

UNEP in Iraq

Post-Conflict Assessment, Clean-up and Reconstruction

United Nations Environment Programme

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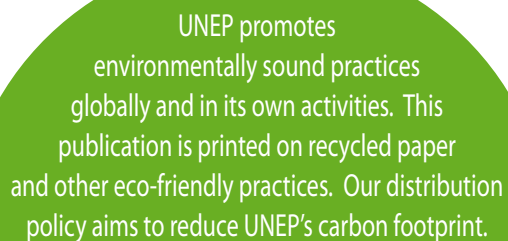
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1 Introduction

The United Nations Environment Programme (UNEP) is the specialized body within the United Nations organization (UN) with a specific mandate to address environmental concerns. In 1999, UNEP established the Balkans Task Force to study the environmental consequences of the conflict in Kosovo. Since then, UNEP has undertaken post-conflict environmental assessments in Serbia, Montenegro, Macedonia, Albania, Afghanistan, Liberia, the Occupied Palestinian Territories, Lebanon and Sudan.

In February 2003, as the coalition forces planned their invasion of Iraq, UNEP initiated a desk-based environmental surveillance to monitor the conflict as it occurred. This resulted in the publication of the *Desk Study on the Environment in Iraq* in April 2003. Since then, UNEP has undertaken a number of follow-up activities in Iraq.

1.1 Objectives of this Report

A wide range of activities were carried out by UNEP in Iraq between 2003 and 2006, primarily through the Post-Conflict and Disaster Management Branch (PCDMB) based in Geneva, Switzerland, and the International Environmental Technology Centre (IETC) based in Osaka and Shiga, Japan. Many activities continued into 2007 and beyond.

This report is an up-to-date compilation of the various activities undertaken by UNEP in Iraq between 2003 and 2006. Its objectives are the following:

1. To provide a complete description of the various activities undertaken by UNEP in Iraq between 2003 and 2006;
2. To make an objective assessment of the impacts of UNEP's intervention; and
3. To document the lessons learned by UNEP in implementing activities in a complex situation such as Iraq.

1.2 UNEP Activities in Iraq 2003-2006

UNEP was active in Iraq even before the 2003 conflict, but attention was particularly focused

on the environmental situation during the conflict and ensuing reconstruction period, and the establishment of the Ministry of Environment (MoEN) provided UNEP with a key counterpart institution in its capacity-building efforts.

To support the Ministry of Environment in Iraq in developing capacity for environmental governance, and to address some of the key priority environmental management issues, UNEP's interventions had the following key objectives:

1. Assess the existing environmental issues in Iraq that require focused attention from the ministry and support from the international community;
2. Assess the existing capacity within the Ministry of Environment and other ministries to address those environmental priorities;
3. Undertake field-based assessments of environmental contamination caused by conflict and by industrial activities;
4. Support the sustainable management of the Iraqi marshlands;
5. Re-link Iraq to regional and multilateral institutions dealing with environmental issues;
6. Re-establish cooperation between Iraq and its neighbours on issues relating to the environment;
7. Strengthen the institutional capacity of the ministry for environmental monitoring and information management;
8. Strengthen the institutional capacity in Iraq for responding to environmental emergencies; and
9. Mainstream environmental concerns into other activities undertaken by the United Nations in Iraq.

From February 2003, UNEP intervened in the following key areas:

1. Desk study on the Environment in Iraq (February-April 2003);

2. Post-conflict needs assessment (June-October 2003);
3. Capacity-building activities (March 2004-September 2006);
4. Environmental site assessments (July 2004-November 2005);
5. Institutional capacity assessment (January-December 2005);
6. Clean-up of contaminated sites (November 2005-December 2006);
7. Environmental mainstreaming within the UN Programme for Iraq (2005-2006);
8. Support to environmental management of the Iraqi marshlands (July 2004-continuing), including:
 - Strategy development and coordination;
 - Baseline data collection and analysis;
 - Capacity-building;
 - Pilot project implementation in drinking water provision, sanitation and wetland restoration; and
 - Awareness-raising;
9. Activities related to depleted uranium (June 2005-continuing).

The activities in each of these areas which ranged from training, the provision equipment and assistance to information management. Activities were planned and implemented with a view to helping Iraq recover from the damage its environment incurred through conflict, as well as to setting a basis for sustainable development.

When UNEP designed its Iraq programme in 2003, the assumption was that the security situation would gradually improve, allowing UNEP to establish a field office in Baghdad and deploy international teams within the country. However, the deteriorating security situation in Iraq prevented UNEP from fielding international staff there. Instead, a range of innovative solutions had to be put in place to deliver the project. A significant part of the project was implemented by providing adequate

training and equipment to Iraqi counterparts from government ministries. Substantial efforts also went into on-the-ground implementation of pilot projects. Capacity-building activities were undertaken from neighbouring countries such as Jordan, Syria, Egypt and Bahrain – and when required, from Switzerland, Kenya and Japan. For the marshlands project, training activities inside Iraq were carried out in cooperation with relevant ministries and local universities. To facilitate constant dialogue and domestic implementation, the marshlands project also appointed a National Coordinator and established a coordination mechanism with national, governorate and local institutions. Finally, international contractors working with local employees undertook the clean-up and hardware installation activities.

1.3 Other Publications from the Iraq Project

A series of individual reports were prepared during the course of the project.

1. *Desk Study on the Environment in Iraq* (2003);
2. *Environment in Iraq, Progress Report* (2003);
3. *Assessment of Environmental Hot-Spots in Iraq* (2005);
4. *Capacity-Building for Assessment of Depleted Uranium* (2008);
5. Reports on the Iraqi marshlands, including:
 - a. *Report of the UNEP Roundtable on Iraqi Marshland Management* (September 2004);
 - b. *Environmental Management of the Iraqi Marshlands: Phytotechnology for Wetland Management* (English and Arabic, 2005);
 - c. *Environmental Management of the Iraqi Marshlands: Water Quality Management – A Training Kit* (English and Arabic, 2005);
 - d. *Environmental Management of the Iraqi Marshlands: Sustainable Sanitation – A Training Kit* (English and Arabic, 2005);

- e. *Environmental Management of the Iraqi Marshlands: Community Level Initiatives – A Training Kit* (English and Arabic, 2005);
- f. *Environmental Management of the Iraqi Marshlands: ESTs for Drinking Water Provision – A Training Kit* (English and Arabic, 2005);
- g. *Environmental Management of the Iraqi Marshlands: EST Assessment Methodology and Implementation – A Training Kit* (English and Arabic, 2005);
- h. *Environmental Management of the Iraqi Marshlands: Wetland Management – A Training Kit* (English and Arabic, 2005);
- i. *Environmental Management of the Iraqi Marshlands: IWRM Policy Integration – A Training Kit* (English and Arabic, 2005);
- j. *Environmental Management of the Iraqi Marshlands: Marshland Information Network – A Training Kit* (English and Arabic, 2005);
- k. *Environmental Management of the Iraqi Marshlands: Wetland Remote Sensing – A Training Kit* (English and Arabic, 2005);
- l. *Back to Life* (information tool in English, Arabic and Japanese, 2005, 2006)

The present document draws from the activities reported on in earlier publications. Each of the reports listed above was reviewed with an eye to identifying how the individual activities contributed to UNEP's overall objectives of intervention. Such an analysis was not possible at the time the activities were undertaken. This current report, therefore, provides a significant insight into the overall success of UNEP's intervention in Iraq.

1.4 Funding for the Iraq Projects

The total cost of the original UNEP environmental assessment programme in 2003-04 was approximately USD 2.5 million. The UK Government agreed to fund 50 percent of the total amount (GBP 717,146/approximately USD 1.2 million), while the Government of Germany agreed to fund EUR 100,000 (approximately USD 122,000) towards capacity-building activities related to disaster management.

In July 2004, the Government of Japan (through the Iraq Trust Fund) supported UNEP's continued involvement in Iraq in two areas: USD 4.7 million was provided in support of the entire capacity-building related activities, while USD 11 million was granted for activities relating to the restoration and management of the Iraqi marshlands. In addition, the UK and Italian Governments made allocations to support donor coordination for the Iraqi marshlands in 2005.

In September 2005, the Iraq Trust Fund provided further support of USD 905,000 for the clean-up of two severely contaminated sites.

In 2006, the Government of Italy and the Government of Japan made additional bilateral allocations of approximately USD 880,000 and USD 1 million to continue the Iraqi marshlands project into its second phase. In 2007, the Government of Japan pledged approximately USD 900,000 for the third phase of the marshlands project towards 2008.

1.5 Key Partners for the Iraq Project

A number of institutional partnerships were forged throughout the implementation of the project. Key partners were:

1. The Iraqi Ministry of Environment (MoEn);
2. The Iraqi Ministry of Water Resources (MOWR);
3. The Centre for the Restoration of Iraqi Marshlands (CRIM); and
4. The United Nations Office of Project Services (UNOPS).

In addition, the Iraqi marshlands project has cooperated extensively with local community groups, non-governmental organizations (NGOs) and Iraqi universities.

1.6 Security Situation in Iraq during 2003-2006

The security situation in Iraq changed considerably during the period of implementation of UNEP projects. In July-August 2003, it was possible to obtain security clearances to travel into the country. After the bombing of the UN office and

consequent loss of staff members, however, the UN decided to withdraw from Iraq.

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

1. Terrorism claimed lives of some Iraqi government officials associated with the project, while others resigned from their positions citing security concerns. The focal point for the marshlands project and other high-level officials within the Ministry of Municipalities and Public Works were killed in terrorist attacks that targeted the Deputy Prime Minister inside the ministry premises in early 2007. Such loss of human life is tragic and devastating, and destroys the much-needed human and institutional capital to rebuild Iraq. UNEP operations were put on hold while the ministry regrouped and appointed new personnel. While activities were continued with new resolve, such violent loss of dedicated individuals and colleagues inevitably had psychological impacts on personnel associated with the project.
 2. Implementation of field activities incurred delays due to security problems. Work hours were often shortened to enable personnel movement during safer time periods. Border closings, curfews and other restrictions also impeded the movement of equipment into Iraq and impacted personnel movement for installation.
 3. Some projects had to be modified and adapted in design and delivery to minimize time and efforts inside Iraq. For example, to shorten the time needed for installation, water treatment equipment was delivered in prefabricated containers that were then installed in the field to minimize further need for shelter constructions and security provisions. All meetings and training that required participation of international staff had to be undertaken outside Iraq. As operations progressed into 2005 and 2006, even road travel between Baghdad and Amman became dangerous. The unit cost of delivery of training increased substantially, resulting in a proportional reduction in the total number of people who could be trained for some projects, while other projects shortened the number of training days by concentrating lectures and scheduling for longer training hours per day.
 4. UNEP experts could not travel to Iraq to supervise the national experts undertaking various assessment activities. This however, may have had a positive outcome as it led to national experts 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 projects.
 6. The completion of various tasks in and around the Baghdad area could not be verified, even for contractual purposes. Exemptions had to be made in regards to this.
 7. Installation and commissioning of some equipment took a disproportionate amount of time, due to the difficulty experienced by some suppliers' technicians in gaining access to ministry premises.
- Working under such difficult security conditions, it is a testament to the dedication of the Iraqi nationals involved, and the flexibility of the project management team, that the project achieved all of its stated objectives.

2 Country Background

2.1 Orientation

This chapter presents the basic geographical, geo-political and socio-economic background information to provide a context for the environmental issues discussed in the subsequent chapters. This information is not intended to be fully

comprehensive, but sources are given for readers wishing to obtain further details.

Iraq currently has 18 provinces or governorates. Since 1970, three of the northern governorates (Dahuk, Sulaymaniyah and Erbil) have been officially designated as a Kurdish autonomous region, with a separate elected legislature. This region came under UN and coalition protection after the 1990-1991 Gulf War, to prevent the Iraqi regime from taking military action against the Kurds.

MAP 1: Iraq and Neighbouring Region



THE BOUNDARIES AND NAMES SHOWN AND THE DESIGNATIONS USED ON THIS MAP DO NOT IMPLY OFFICIAL ENDORSEMENT OR ACCEPTANCE BY THE UNITED NATIONS.

MAP 2: Elevations and Principal Geographical Regions in Iraq³



THE BOUNDARIES AND NAMES SHOWN AND THE DESIGNATIONS USED ON THIS MAP DO NOT IMPLY OFFICIAL ENDORSEMENT OR ACCEPTANCE BY THE UNITED NATIONS.

2.2 Geographical Features

Iraq covers an area in excess of 430,000 square kilometres, with the precise figure varying from one source to another and depending, for instance, on whether both land and water areas are included. Iraq's Gulf coastline is just 58km in length.

Four main geographical zones have been recognized.^{1, 2} These are described briefly as:

- a. **Desert plateau:** Approximately 40 percent of Iraqi territory. A broad, stony plain with scattered stretches -of sand, lying west and southwest of the Euphrates River and sparsely inhabited by pastoral nomads. A network of seasonal watercourses (or wadis) runs from the border to the Euphrates River.
- b. **Northeastern highlands:** Covering approximately 20 percent of Iraqi territory. This region extends south of a line between Mosul to Kirkuk towards

the borders with Turkey and Iran, where mountain ranges reach up to 3,600m in altitude.

- c. **Uplands region:** About 10 percent of Iraq. A transitional area between the highlands and the desert plateau, located between the Tigris north of Samarra and the Euphrates north of Hit, and forming part of a larger natural area that extends into Syria and Turkey. Much of this zone may be classified as desert because watercourses flow in deeply cut valleys, making irrigation far more difficult than in the alluvial plain.
- d. **Alluvial plain:** Approximately 30 percent of Iraq. Formed by the combined deltas of the Tigris and Euphrates Rivers. This region begins north of Baghdad and extends to the Persian Gulf. The once-extensive wetlands of the region have been decimated by damming and diversion of the Euphrates in Turkey and Syria, and by large-scale drainage works carried out by the Iraqi regime in the wake of the 1991 Gulf War.



Aerial survey near Baghdad in August 2003



Children playing at the Ouireej site

2.3 Land Cover and Land Use

The desert plateau provides the country's main rangeland grazing, as well as limited dry land cultivation. The uplands and mountains yield acorns, almonds, walnuts and pine nuts, with additional grazing and dry land cultivation. Irrigated agriculture occurs mainly in the alluvial plain.⁴ It is estimated that about 11.5 million hectares (approximately one quarter of the country's total area) are cultivable. However, due to soil degradation, the practice of leaving fallow land, and the unstable political situation of recent years, it is estimated that only 3-5 million hectares are currently cultivated annually.⁵

Iraq's principal crops include dates, wheat, barley, maize, rice and cotton, as well as a wide variety of fruit and vegetables. Other plants are grown for forestry, medicinal and ornamental purposes.⁶

2.4 Population Overview

The estimated population of Iraq in July 2006 was 26,783,383⁷ with a national average population

density of 51 persons per square kilometre.⁸ However, actual density varies from 5 inhabitants/km² in the western desert province of Al-Anbar (Anwar) province, to more than 170 inhabitants/km² in the fertile lowlands of Babil (Babylon). Approximately 75 percent of the population is concentrated in urban centres. Average population growth was estimated at 3.6 percent in the period 1980-90, but emigration of foreign workers and severe economic hardship have reduced the rate since 1990,⁹ with estimated growth of 2.82 percent in 2002. In the same year, the infant mortality rate was estimated at 57.61 deaths/1,000 live births, with life expectancy at birth of 67.38 years. Women were expected to bear an average of 4.63 children.¹⁰

2.5 Overview of Key Environmental Issues

Water Resources

Precipitation in Iraq is limited and the majority of the country is arid to semi-arid. Annual precipitation in the northern hills and mountain ranges varies from



Stream draining sewage and contaminated by metal water

300-1000mm, while in the extreme south and west it is in the order of 100-200mm, and highly irregular. The central alluvial plain relies substantially upon the flow of the Tigris and Euphrates Rivers and their tributaries.

Catchments and groundwater recharge zones are concentrated in the north and east of Iraq and the neighbouring countries. In the more arid hilly areas to the east, networks of wadis provide isolated areas with significant recharge. Evaporation rates in the arid areas are much higher than precipitation and natural recharge rates, resulting in natural salinization of groundwater.

Both surface water and groundwater are heavily extracted, with most urban centres serviced by river water extraction and purification plants. In rural areas, village wells and springs are the predominant water sources.

Obtaining and maintaining the necessary quantity and quality of water represents a significant

problem for Iraq. Root causes of the problem include international capture of upstream water, pollution, salinization, wastage and leakage.

Extensive dam projects since 1950 in Iraq, Iran and Turkey have resulted in a significant reduction in annual flows of the Tigris and Euphrates Rivers, permanently changing the riverine and wetland ecology. Excessive river water abstraction and several millennia of irrigation have resulted in chronic salinity problems for much of the alluvial plain, putting many traditional well fields effectively out of use. Surface water quality in central and southern Iraq is generally poor in terms of potability due to high suspended and dissolved solids and sewage contamination.

Environmental and Population Vulnerability

The importance of hazardous waste and land contamination issues on a particular site is strongly

linked to its surroundings and in particular to the vulnerability of the local natural environment and population. Assessing these factors on a national scale can help to identify important areas and topics for assessment.

For the natural environment, the indicators of importance are biodiversity and sensitivity to degradation. In general, the industrial areas in Iraq are sited in heavily developed regions of low biodiversity and sensitivity. Biodiversity is particularly low in the central plain and the Baghdad region due to a history of sustained agricultural activity and the population density in the riverine areas.

The most significant environmental receptors – vulnerable people or environments – are the Tigris and Euphrates River systems and the underground water aquifers. In the south of Iraq the most important areas are: the Iraqi marshlands in southern Iraq, the riparian zones, the estuarine Shatt Al-Arab and the coastal mudflats.

For the population, the pattern of land use in Iraq indicates that the human health issues for contaminated land and hazardous waste are similar to those observed worldwide. Potential

pathways to exposure from toxic chemicals on such sites include direct contact (a risk for site workers or trespassers) from blown dust and contaminated drinking water.

The most important sources of drinking water are the Tigris and Euphrates River systems, with dozens of large-scale municipal supply river water intakes located in the central plain region. Much of the developed central plain has saline or polluted groundwater, which prevents its use. Shallow village wells are however still widely used in rural areas, even if saline.

An issue particular to Iraq is the continued looting and lack of security on many derelict and abandoned industrial sites. This implies that the risk to the public from direct contact with hazardous chemicals and wastes left on such sites is particularly high.

Based on this broad assessment of vulnerability to contaminated land in Iraq, human health risks appear to be the predominant issue. The vulnerability of the surface water and groundwater resources to pollution is a critical and joint human health/environmental concern. Other environmental risks, though far from negligible, are of less concern.



Garbage dump in a street of Baghdad



The Al Qadisiya site is unsecured, contains quantities of highly toxic chemicals and has been demolished in an uncontrolled manner, resulting in severe human and environmental hazards

Industrial Development

Contaminated sites and hazardous waste arise principally from industrial sites. An understanding of the history and status of Iraqi industry can therefore assist in the direction of efforts to identify and assess contamination and hazardous waste issues.

Iraq's industrial development has had a turbulent history, with periods of rapid growth and decline. Development began at the start of the twentieth century with the commencement of significant oil production near Kirkuk and Basra. This growth, however, was largely limited to the oil industry and related services, and most of the equipment was imported.

Broader industrial development began in the 1970s when the Iraqi Government started a development programme largely funded from oil export revenues. The focus was on medium technology industries such as textiles, food production and construction materials and heavy industry including iron, steel and basic petrochemicals. Higher technology goods were, and still are, largely imported.

The minerals industry grew gradually with a focus on sulphur, phosphate and potash, including post-processing of ores to produce sulphuric acid, alum and fertilisers. At its peak in the 1980s, Iraq was one of the world's largest producers of fertiliser.

From the 1970s, Iraq developed a domestic arms industry that produced the full range of low to medium technology goods, such as explosives, small arms and artillery munitions as well as higher-grade items such as missiles.

Oil was discovered in commercial quantities in Iraq in 1927, but production was relatively limited until the 1970s. Following nationalization in 1972 and the rise in oil prices, oil production rose rapidly. By 1979 oil production represented 63 percent of Iraq's gross domestic product (GDP). Peak production of 3.7 million barrels per day (bpd) was achieved in 1979, compared to a low of 1.5 million bpd in 2002 and the current rate (June 2005) of approximately 1.9 million bpd.

Most industrial development in Iraq was based upon a nationalized system with central government ownership and direction of industries. The internal market was tightly controlled and uncompetitive: uneconomic industries were commonly underwritten and subsidised with funds from oil exports. This system deteriorated and then largely collapsed in the period from 1980 to 2003, due a combination of inherent inefficiencies and external events. As of mid 2003, there were 45 major state-owned enterprises, many effectively derelict.

The Iran-Iraq war from 1980 to 1988 led to the diversion of funds to the arms industry and drained

the national treasury. Industries that were previously highly subsidised began a slow but near terminal decline. Production levels dropped, new capital projects were limited and existing plants began to degrade due to limited maintenance and a lack of imported spare parts.

The 1991 Gulf War dealt an immediate blow to the Iraqi economy and the subsequent programme of UN sanctions accelerated the process of industrial decay. Imports of key spare parts and source chemicals were effectively cut off and the local market for goods became depressed.

Many plants continued to operate on a limited basis, dismantling their own equipment for spare parts and devising alternative solutions for missing parts and chemicals. This process was particularly pronounced in the arms industry, which in many cases reverted to older technology, e.g. for explosives production, which could be produced using domestic goods and services.

UN sanctions, which were in place from 1990 to 2003, the 1990 conflict, and other problems either curtailed or prevented the export of minerals and finished materials. As a result, large stockpiles of unsold material built up at some mining and mineral processing sites. As an example, up to 500,000 tonnes of sulphur were stockpiled at the Al Mishraq mining complex pending export.

Irrespective of the production levels and economic conditions, state-owned industrial companies employed very large workforces, which were largely retained at least up until 2003. Many of the management and technical staff were highly qualified, with particular expertise in science and engineering.

The arms industry in Iraq declined from sanctions with respect to the procurement and manufacturing of more advanced weaponry and some explosives, although the overall volume of production remained high. The US military estimates the cache of stockpiled munitions in Iraq prior to the 2003 conflict to be between 600,000 and 1 million tonnes. Environmental issues associated with munitions disposal are therefore potentially significant in Iraq.

The environmental performance of Iraqi industry pre-2003 is poorly documented and many records were lost from 2003 onwards. In general, however, the environmental performance of industry in Iraq can be classed as poor and in line with basic international standards from the 1960s to the early 1980s when most of the plants were constructed.

Discharges to air, water and soil were largely uncontrolled, with the exception of major plants discharging chemical effluents to the rivers. In such cases, modern (1970-90s) water treatment plants were installed and their effectiveness monitored.



Al Mishraq sulphur mining and acid complex



Inspection of a demolition site

Hazardous Waste Management Issues

The issues of hazardous waste management and contaminated land are commonly linked in two ways:

- Poor management of hazardous materials and wastes is a common cause of land contamination (e.g. by the dumping of waste on site);
- Remediation of contaminated land commonly results in the generation of hazardous wastes, which then require proper management, including an appropriate treatment or disposal route.

A third link is also apparent in Iraq. Previously sound sites have been extensively damaged by looting and in the process, the chemicals previously stored on site have been dumped on site, thereby creating hazardous waste and leading to land contamination.

From the evidence available, it appears that hazardous waste management in Iraqi industry was particularly poor, with many industries disposing of waste on site in an uncontrolled manner. The predominance of large, state-owned industries and military priorities meant that external accountability for waste management was limited. In the Al-Qaa Qaa explosives manufacturing site for example, flammable wastes were burned in the open, non-flammable wastes were dumped on site and liquid wastes were dumped into large unlined evaporation ponds.

With respect to hazardous waste treatment and disposal, at present there is no national or regional facility. The most common solution for major facilities such as refineries, mines or factory complexes is unlined pits located on site.

Municipal waste management included the use of local and regional landfills – essentially uncontrolled dumpsites. In some cases, hazardous wastes from industry were also disposed at such sites.

Aid initiatives since 2003 have undertaken the upgrade of Iraq's waste management facilities to modern standards. A modern municipal landfill has been constructed on the southwestern outskirts of Baghdad and a second facility is under construction in the north of Baghdad.

However, as of June 2005, based on public domain information, there are no firm plans for the construction of facilities for the treatment and disposal of hazardous waste, although the World Bank has generated proposals on this topic. The lack of an appropriate central waste facility in Iraq is a serious constraint for the management of contaminated land and hazardous waste.

Ecosystem Degradation of the Mesopotamian Marshes

The wetlands in the middle and lower basin of the Tigris and Euphrates Rivers in Iraq were, until recently, the most extensive wetland ecosystem in the Middle East. In their lower courses the rivers created a vast network of wetlands – the Mesopotamian marshes – covering up to 20,000km². These comprised a complex of interconnected shallow freshwater lakes, marshes and seasonally inundated floodplains

extending from the region of Basra in the east, to within 150km of Baghdad in the west.

Massive drainage works in southern Iraq in the late 1980s and early 1990s, together with the effects of major upstream damming, devastated the wetlands so that only minor and fragmented parcels remained as the former regime collapsed in 2003. Satellite images have shown that massive loss and degradation has taken place, with the greatest change occurring between 1991-1995. The central and Al-Hammar marshlands had been almost completely destroyed, with approximately 95 percent of their cover transformed into bare land and salt crusts. The water-filtering role of the marshland had ceased and the remaining drainage canals carried polluted irrigation waste water directly toward the Gulf, with potentially harmful impacts on local fish resources.¹¹

The entire marsh Arab community suffered huge social and economic upheaval as a result of the marshlands' destruction, with about 40,000 people forced to flee to southwest Iran.¹² The re-flooding of the dried marshland areas started in 2003, when local residents opened the floodgates and broke the banks to let water back into some marshes.



Heavy metals waste at Al Qadissiya. This demolished site represents a severe risk to human health, due to the cyanide contained in hazardous waste

The impact on biodiversity has also been catastrophic. Prominent losses include extinction of the endemic smooth-coated otter (*Lutra perspicillata*), and the probable disappearance of two waterbirds: the African darter (*Anhinga rufa*) and the sacred ibis (*Ibis Threskiornis aethiopicus*) from the Middle East. A further 66 bird species are considered to be at risk. A wide-range of migratory aquatic species were affected, including penaeid shrimp that migrate between the Gulf and nursery grounds in the marshlands, causing serious economic consequences for coastal fisheries.

In 2003, the United Nations-World Bank *Needs Assessment Initiative for the Reconstruction of Iraq* (as summarized in section 4 of this document) identified the extensive damage to the Iraqi marshland and the accompanying displacement of the indigenous population as one of the country's major environmental and humanitarian disasters. In particular, critical and priority problems for the area included the marshland degradation, lack of drinking water and lack of sanitation. These problems have posed a significant threat to human health and the livelihood of the indigenous population, as well as to the ecosystem.

Biodiversity

Protected areas

The UNEP-World Conservation Monitoring Centre (WCMC) *Protected Areas Virtual Database* lists just eight small protected areas (none bigger than 110ha) in Iraq.¹³ None of these qualifies for inclusion in the official *UN List of Protected Areas* maintained by UNEP-WCMC, which only covers sites of more than 1,000ha.

The majority of sites important for biodiversity conservation have no protected area status, although many have been recommended for designation. For example, BirdLife International has recognised a total of 42 sites as Important Bird Areas (IBAs). These cover a total area of 35,000km², or about 8 percent of the country's surface area.¹⁴ However, none benefit from any legal protection from a biodiversity perspective and many of the wetlands, in particular, are critically threatened by flood control, irrigation and drainage projects being carried out in Iraq and in neighbouring countries.

Species

The UNEP-WCMC *Species Database* lists 73 terrestrial mammal species, plus a further three species

known to be extinct. Of these, the Eurasian otter (*Lutra lutra*), and three bat species are listed as vulnerable.¹⁵

A large number of reptiles are found in Iraq, but information on their distribution and conservation status is limited. The International Union for Conservation of Nature and Natural Resources' (IUCN) *Red List 2002*, ranked the Euphrates soft-shelled turtle (*Rafetus euphraticus*) as endangered, and the common tortoise (*Testudo graeca*) as vulnerable.

Over 400 species of birds have been recorded in the northern Gulf Region (comprising Kuwait, Iraq, eastern Saudi Arabia and western Iran). Among the species occurring in Iraq, the white-headed duck (*Oxyura leucocephala*) is listed as endangered in the 2002 *IUCN Red List*, while the socotra cormorant (*Phalacrocorax nigrogularis*), marbled teal (*Marmaronetta angustirostris*), greater spotted eagle (*Aquila clanga*), imperial eagle (*Aquila heliaca*), lesser kestrel (*Falco naumanni*), corncrake (*Crex crex*) and the sociable lapwing (*Vanellus gregarius*) are listed as vulnerable. A further nine species are listed as conservation-dependent, or near threatened.^{16,17} The region is especially important as part of the intercontinental flyways used by huge numbers of birds, and a great variety of species, moving between Africa and Eurasia. It is estimated that some two to three billion migrants move south across Arabia each autumn.^{18,19}

In a generally arid to semi-arid region, Iraq's wetlands are of immense importance for the maintenance of biodiversity. Until their virtual disappearance, the Iraqi marshes were of global conservation value. In central and northern Iraq, most of the natural freshwater lakes and marshes have long since been drained for agricultural purposes, although significant remnants still survive in the Haweija (Huweiija) marshes in the Little Zab Valley, and around Baquba in the Diyala Valley. The valleys of the Tigris and Euphrates themselves have been extensively modified for agricultural purposes. Most of the original riverine forest which once lined the banks of these two rivers has been replaced by orchards and other cultivated land, although some significant stands of forest still exist, especially on small islands. The surviving patches of forest provide an important breeding habitat for a wide variety of birds, notably regional specialities such as the grey hypocolius (*Hypocolius ampelinus*), Iraq babbler (*Turdoides altirostris*) and dead sea sparrow (*Passer moabiticus*), and are used as staging

areas by large numbers of migratory passerines. Other important natural wetlands in central Iraq include two large brackish to saline lakes – Shari Lake to the east of the Tigris, north of Samarra, and Haur Al-Shubaicha on the plains to the east of the Tigris, southeast of Baghdad.²⁰

BirdLife International has submitted a dossier of information to UNEP and to permanent members of the UN Security Council detailing the organization's fears concerning the possible impacts of the current conflict on birds and biodiversity in general.

There is very limited information available on fish diversity in Iraq. The World Resources Institute states that the combined Euphrates and Tigris watershed supports 71 native fish species, plus a further 21 introduced species of which 28 are endemic to the basin, though none of these is indicated as being under threat.²¹

2.6 Institutional Structures for Environmental Governance

The Iraqi Ministry of Environment (MoEn) was established in 2003. In contrast with other countries in the Middle East, however, Iraq had a well-developed system of environmental governance and monitoring prior to the formal constitution of the ministry. A Human Environment Directorate was created under the Ministry of Health in 1972, after the United Nations Conference on the Human Environment. This was followed in 1986 by the enactment of a law establishing an Environment Protection Centre (EPC) within the Health Ministry. With the introduction of the Environment Protection and Improvement Law in 1997, the EPC was transformed into the Environment Protection and Improvement Directorate (EPID). The law was then amended in September 2001, extending the mandate and responsibilities of EPID to address broader environmental issues. At that time, EPID was designated as an independent body and formally dissociated from the Ministry of Health.

An Environment Protection and Improvement Council (EPIC), consisting of various governmental and non-governmental representatives and experts, was set up within this new institutional framework. Its principal duties were to:

- Create an overall environmental policy framework;

- Review EPID's work plan, at both national and governorate levels;
- Approve environmental quality standards;
- Serve as an intra-governmental coordination body;
- Deliver decisions, including sanctions for environmental offences; and
- Formulate Iraq's position in regional and international environmental negotiations and consider accession to international agreements.

The Council's decisions had to be endorsed by the Cabinet (Council of Ministers), which was the ultimate political and legislative decision-maker on environmental matters. The new law also allowed for the constitution of environmental councils and EPID branches in the fifteen governorates under the control of the central government in Baghdad.²²

Finally, the Environment Protection and Improvement Law established EPID's budgetary and technical independence. Despite these legislative and structural changes however, EPID continued to receive administrative support from the Ministry of Health, of which it was widely regarded to be an integral part. Accordingly, in the administrative vacuum created by the 2003 conflict, and in the absence of a functional Environment Council, EPID was initially re-integrated for administrative and budgetary purposes into the Ministry of Health.

In mid-August 2003, EPID staff relocated from the Ministry of Health to the Department of Environmental Laboratories building in Baghdad. The Directorate's operations, though, were seriously curtailed by the limited office space available. As a result, its immediate concern was to identify or construct a new building. Moreover, EPID's capacity was critically degraded, as most laboratories in Baghdad were looted after the conflict. Throughout the country, the remaining equipment was old, and reagents were in short supply. The need to rebuild Iraq's environmental monitoring capacity by reconstructing and re-equipping laboratories was clearly urgent.

On 1 September 2003, the Iraqi Governing Council (IGC) announced its Cabinet, which included the appointment of a Minister of Environment, Mr. Abdul-Rahman Sidiq Kareem. In parallel, the Governing

Council developed and submitted a proposal for an institutional structure for a new Environment Ministry. Under this proposal, the existing Environment Protection and Improvement Directorate formed the core of the ministry, which integrated all EPID departments and centres except for the National Centre for Occupational Health and Safety, which was reassigned to the Ministry of Labour and Social Affairs. Under the Minister, two under-secretaries were responsible for the technical and administrative portfolios, respectively. The Ministry of Finance opened a new account (in US dollars and Iraqi dinar), to which EPID assets held under the Ministry of Health were to be transferred.

The Ministry of Environment (MoEn) was officially created by a resolution passed by the Iraqi Governing Council and signed by Coalition Provisional Authority (CPA) Administrator – Ambassador L. Paul Bremer, on 3 September 2003.

The resolution known as CPA Order #44 gave MoEn the mandate to protect and conserve Iraq's environment, as well as protect the residents of Iraq from environmental pollutants and environmental risks to human health. The Order further stated that MoEn was responsible for integrating environmental concerns in other sectors such as economic development, energy, transportation, agriculture, industry and trade. Other duties included the development of environmental policies and programmes, as well as the creation and enforcement of environmental standards.

Finally, the CPA Order abolished the Environment Protection and Improvement Council connected with

the previous regime's Council of Ministers. Instead, it set up a consultative body composed of representatives of other ministries to coordinate policies and programmes affecting the environment.

After the United States' handover of sovereignty in June 2004, Ms. Mishkat Al-Moumin was appointed as the new Minister of Environment. One year later, on 3 May 2005, when the IGC was replaced by the Iraqi Transitional Government, Mrs. Narmin Othman was sworn in as Minister of Environment. HE Othman was reconfirmed as Minister of Environment on 21 May 2006.

2.7 Participation in International Organizations/Agreements

Iraq belongs to the following international organizations: the United Nations and some of its specialized agencies, including the World Bank (WB), the International Monetary Fund (IMF), and International Atomic Energy Agency (IAEA). It is also a member of the Organization of the Islamic Conference (OIC), Arab League, Organization of Petroleum Exporting Countries (OPEC), Organization of Arab Petroleum Exporting Countries (OAPEC), International Telecommunications Satellite Consortium (INTELSAT), International Police (INTERPOL), G-19, and G-77. Iraq is also party to a range of international treaties. Those more recent agreements which have most environmental relevance are listed in Table 2. Iraq, however, is not a party to any of the conventions dealing with desertification, wetlands, biological diversity, climate change or migratory species.

Table 1: International Conventions and Agreements to which Iraq is Party

Title	Entry into force
Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare	08.09.1931
International Plant Protection Convention	01.07.1954
Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and under Water	30.11.1954
Treaty on the Non-Proliferation of Nuclear Weapons	05.03.1970
Agreement for the Establishment of the Arab Centre for the Study of Dry and Barren Land	25.01.1971
Treaty on the Prohibition of the Emplacement of Nuclear Weapons and other Weapons of Mass Destruction on the Sea-Bed and the Ocean Floor and in the Subsoil thereof	13.09.1972
Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on their Destruction	19.06.1991
Convention concerning the Protection of the World Cultural and Natural Heritage	17.12.1975
Protocol Concerning Regional Cooperation in Combating Pollution by Oil and other Harmful Substances in Cases of Emergency	01.07.1979
Kuwait Regional Convention for Cooperation on the Protection of the Marine Environment from Pollution	01.07.1979
Convention on Early Notification of a Nuclear Accident	21.08.1988
Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency	21.08.1988
Protocol concerning Marine Pollution resulting from Exploration and Exploitation of the Continental Shelf	17.02.1990
Protocol for the Protection of the Marine Environment against Pollution from Land-Based Sources	No date provided

3 UNEP Desk Study on the Environment in Iraq

3.1 Background

In early 2003, as the invasion of Iraq by the coalition forces became imminent, UNEP set up a team of experts to monitor environmental impacts related to the conflict. The team conducted regular surveillance of conflict-related news feeds and, placing this against the backdrop of the environmental situation in Iraq, prepared a series of situation reports on environmental issues associated with the conflict. A roundtable was organized in Geneva, with the participation of experts from around the world who were interested and concerned about the environmental impacts associated with the conflict. These activities resulted in the publication of the *Desk Study on the Environment in Iraq*, in April 2003, and the *Environment in Iraq UNEP Progress Report*, in October 2003. Both reports outlined the key chronic environmental problems faced by the country, as well the environmental threats posed by the various military conflicts.

3.2 Key Activities and Outcomes

The following are the key findings on the environmental situation in Iraq in 2003:

Pollution Associated with Disruption of Power Supply

- Baghdad, Basra and other cities experienced extended power cuts, with serious impacts on the already inadequate water distribution and sanitation systems that were subject to further degradation during the conflict. Millions of civilians were deprived of basic services. The risk of disease epidemics was most likely elevated, and the pollution burden of the Tigris River was increased.

Oil Well Fires in Southern Iraq and Oil-filled Trenches around Baghdad

- Reports of oil wells having been deliberately set on fire in the Rumeila oilfield of southern Iraq began to emerge on 20 March, and a

thick haze of dark smoke could be seen from Kuwait City the following day. Pentagon officials indicated that the fires were at wellheads, rather than oil-filled trenches. Initial reports of up to 30 fires were later scaled back to nine. On 25 March, Reuters stated that three of the fires had been extinguished, while on 27 March the Associated Press reported 'as many as five fires were still burning', although a spokesperson for the Kuwaiti oil industry said that only three fires remained. Specialist contractors from Canada and the US were preparing to tackle these sites. British forces cast doubt on initial claims that many of the wellheads had been sabotaged, reporting only very limited evidence of tampering. Only two fires were still burning on 3 April and these were reportedly close to being extinguished.²³

- Oil-filled trenches close to Baghdad were set alight in an attempt to reduce visibility and impede coalition weapons. These fires, together with fires at targeted sites, generated large quantities of dense black smoke containing a range of toxic substances with potential health risks for local people. The trenches also caused soil pollution and threatened to contaminate groundwater bodies and drinking water supplies.
- As the number, extent and intensity of oil fires (whether from wells or trenches) were far smaller than during the 1991 Gulf War, it could be expected that damage to the environment and/or human health was comparatively less serious. However, further studies were needed to confirm this tentative conclusion.

Targeting of Industrial Sites

- The intense coalition bombardment was thought to have included the targeting of industrial sites, especially those with potential dual uses, such as fertiliser and pharmaceutical facilities. These sites were potential sources of air, soil and water pollution, with possible attendant risks for human health.
- On 29 March, a coalition air strike on a missile factory close to Al-Rasheed water treatment plant caused damage to buildings within the treatment plant compound.

Targeting of Military Sites

- The Al-Kindi rocket and missile development site located at Mosul, near the Tigris River some 400km north of Baghdad, was targeted by a coalition air strike on 30 March.³⁰ The site had been visited by IAEA and UNMOVIC inspectors on four occasions between December 2002 and February 2003.
- On 3 April, the Pentagon reported dropping precision-guided bomb on a surface-to-air missile factory in the southwestern outskirts of Baghdad.

Physical Degradation of Ecosystems

- The movement of thousands of military vehicles, intensive fighting and air bombardments caused widespread and locally severe degradation of fragile desert ecosystems which could take many decades to recover.

Depleted Uranium

- Depleted uranium (DU), a by-product of the process that enriches natural uranium ore for use as fuel in nuclear reactors and nuclear weapons, has both defensive and offensive

military applications.³² Its high density makes it suitable as a component of armour plating (e.g. for part of the turrets of US Abrams M1 main battle tanks), as well as for piercing armour plating. DU munitions are currently manufactured for use by aircraft (including helicopters) and tanks.

- Many Iraqi tanks and armoured personnel carriers (APCs) were targeted during the conflict by US A10 Thunderbolt ('warthog' or 'tankbuster') aircraft, used throughout the military campaign. A10s are equipped with missiles, as well as guns that fire rounds of depleted uranium. Television pictures broadcast by western media on 8 April showed A10 aircraft attacking both the Planning and Information Ministries in Baghdad. Expert observers considered that DU munitions were used in these attacks. In other incidents, US Abrams tanks are known to have caught fire.
- DU was reportedly used extensively in the vicinity of Basra during the 1991 Gulf War, so it is likely that future field investigations would detect sites where DU contamination was present from two conflicts – 12 years apart. DU was also used in Kuwait in 1991 and IAEA conducted a study of affected sites in 2002, although the results of that study are not yet publicly available.



In June 2003, looting of the Al Mishraq complex caused a massive sulphur stockpile fire, causing regional scale damage to human health and crops



The site of Khan Dhari used to be the Iraq central refinery chemicals warehouse facility. It now represents a moderate risk to the health of site workers, and as such is unfit for normal use

Impacts Due to Looting and Other Acts of Vandalism

One of the distinguishing features of the 2003 conflict was the looting that followed the collapse of the regime. Looting was both widespread and indiscriminate and many of the facilities were burnt down during or after being looted. This resulted in environmental damage in many cases.

The Al-Mishraq Sulphur State Company, located 30km south of Mosul, conducted sulphur mining and comprised a sulphuric acid and an aluminium sulphate plant, as well as supporting infrastructure. Mining of sulphur began at Al-Mishraq in 1972, and by 1988 production capacity was about 1.25 million tonnes per year. The sulphur was mainly stored in loose stockpiles. On 26 June 2003, it was reported that the Al-Mishraq sulphur plant was burning and emitting a huge plume of gas over Iraq and other Middle Eastern countries. It was not yet known whether this was an act of sabotage or caused by an accident in the production process. Although not confirmed by laboratory analysis, it was likely that the visible plume was generated by the reaction of the primary combustion product (sulphur dioxide) with sunlight, oxygen, dust particles and water in the air, to form a mixture of sulphate (SO₄-2), aerosols (tiny particles

and droplets), sulphuric acid (H₂SO₄) and other oxidized sulphur by-products. On the basis of satellite images, the fire took place at the mining and milling area. Though the extent of the plume appeared to peak between 29 June-1 July 2003, it was reported that the fire had been extinguished by 25 July using bulldozers, fire trucks and other fire fighting equipment. It was also reported that the mounds of elemental sulphur had turned molten in the intensity of the fire and had threatened to impact the Tigris River.

According to local media reports, the persistent plume caused significant environmental impacts as well as health impacts among the local population, such as respiratory distress and skin irritations. The UNEP Fact Finding Mission of July 2003 confirmed the concerns of local people regarding the ongoing sulphur burning at the Al-Mishraq plant. Local experts estimated that approximately 0.5 million tonnes of sulphur (0.5 to 1 million tonnes according to Ministry of Industry and Minerals) were destroyed during the approximate one month that the fire burned, affecting a wide area extending from Al-Sharqat to Mosul and Erbil. In addition, the impact of contaminated firewater and potential run-off into the Tigris had not been determined.

Midland (Al-Doura) Refinery Stores

The Al-Doura refinery warehouses near Abu Gharaib, 35km west of Baghdad, were one of the largest stores of chemicals in the country. The looting and ransacking of the refinery warehouses after the 2003 conflict caused a major environmental disaster. Over 5,000 tonnes of chemicals, including highly hazardous materials, particularly tetra ethylene lead (TEL) and furfural, were spilled, burnt or stolen. Burning of the chemicals reportedly generated white toxic fumes affecting a radius of 2-3km around the storage facility, with neighbouring villages also reportedly affected. The entire area was assumed to be heavily contaminated with a variety of hazardous chemicals. The risk of groundwater pollution was also high, given the permeable nature of the sandy soils in the area. A detailed inventory of the chemicals and quantities destroyed or stolen was made available to UNEP.

Sabotage of Oil Pipelines

During 2003, a number of oil pipelines were sabotaged all over Iraq. The damage resulted in temporary halts to oil exports and significant local environmental damage. A review of different information sources indicated that the oil pipeline system was subject to at least nine attacks between 12 June-16 October 2003, resulting in further oil fires and spillages.

The oil pipeline explosions identified included the following:

- **12 June** – 15km from Mosul, 2 blasts;
- **21 June** – Same pipeline (near Hit), 140km northwest of Baghdad;
- **24 June** – Barwanah, 250km northwest of Baghdad;
- **26 June** – Near Al-Fatha (near Tigris);
- **15 August** – Kirkuk-Ceyhan pipeline (near Bayi);
- **17 August** – 2km from Kirkuk-Ceyhan pipeline (near Bayi),
- **30 August** – Bayi;
- **18 September** – Kirkuk-Ceyhan pipeline, 9km north of Bayi;
- **16 October** – Near Al-Hadithah, 200km northwest of Baghdad.

Uncontrolled Dumping of Municipal Waste

The 2003 war led to occasional uncontrolled dumping of municipal waste into the streets, due to the failure of collection systems, looting or restrictions. In addition, the conflict generated large volumes of demolition waste from bomb-damaged buildings (potentially impacted by depleted uranium and asbestos) and military hardware (vehicles, unexploded ordnance, and depleted uranium). It was reported that emergency waste collection initiated by the CPA in the period April to August 2003 resulted in the removal of more than 1 million m³ of waste from the streets and neighbourhoods of Baghdad. The main Baghdad landfill, Al-Amariy, is located in a shallow aquifer area. Some 3,000 garbage pickers lived off of it. The CPA undertook training of the landfill engineer in pollution control techniques, and opened three new temporary landfills. The newly developed Awarisch landfill in southwestern Baghdad contains over 10,000 damaged or destroyed military vehicles (tanks, armoured personnel carriers, trucks, Scud launchers) and includes a small recycling facility. A photo-essay report by the International Rescue Committee (IRC) indicated that this landfill might not be secure, with children recycling aluminium and other valuable metals from the tanks.



Dump site near Baghdad

4 UNDG's Assessment of Needs

4.1 Background

After the fall of the regime in April 2003, a comprehensive assessment of needs was initiated for Iraq. The assessment was compiled on the basis of discussions between the UN, the World Bank and the IMF from a technical meeting held on 24 June 2003 and subsequent consultations with the Coalition Provisional Authority (CPA). Fourteen priority sectors were identified for the needs assessments, and in addition, human rights, gender, environment and institutional capacity were identified as crosscutting themes. UNEP was designated as the lead agency for the environment.

UNEP undertook the following activities in support of the needs assessment:

- **Assignment of UNEP Technical Experts:** Technical experts within UNEP were designated as focal points for each United Nations Development Group (UNDG) sector, in order to provide technical assistance to task managers.
- **Issues Screening Checklists:** UNEP provided all task managers with sector-specific environmental issues checklists to be used during the assessment process.
- **Fact-finding Missions:** UNEP conducted two fact-finding missions to Iraq (8-28 July and 8-27 August). The missions aimed to collect firsthand information on environmental needs; to meet with key Iraqi environmental stakeholders (Ministries, University/Research Institutes, members of the Governing Council, and the CPA); and to work with available UNDG task managers.
- **External Stakeholders Workshop:** UNEP conducted an external stakeholders workshop (roundtable) in Geneva, where environmental needs in Iraq were discussed with several UN agencies, international environmental NGOs and donors interested in Iraqi environmental issues.

4.2 Key Activities and Outcomes

UNEP identified five primary sectors as priority areas for 2004, from an environmental point of view. These were:

- Health (Primarily due to environment health interactions, but also because EPID administratively worked within the Ministry of Health);
- Agriculture, water resources and food security;
- Water supply and sanitation;
- Investment climate and state-owned enterprises; and
- Governance and Rule of Law.

UNEP also identified six secondary sectors where relevant inputs could be provided:

- Electricity;
- Livelihoods and employment generation;
- Housing;
- Mine action;
- Education; and
- Transport and Telecommunications.

Key environmental needs were identified for each of the above listed primary and secondary sectors, and where possible, detailed cost estimates for specific remedial or improvement actions were included. UNEP also reviewed all other sectoral papers and provided suggestions for the incorporation of environmental issues. All elements of UNEP's input are captured in the present review paper.

4.3 Environmental Needs Assessment – Synthesis of 2004 Priorities

Environmental Priorities for 2004

1. **Strengthening environmental governance at the national, governorate and local levels:** A new Ministry of Environment had been established with the existing EPID as the core of the new ministry. Environmental units also existed in at least three other ministries (agriculture, industries, oil). During UNEP's interaction with the Iraqi environmental administration at the national and governorate level, it became obvious that there existed a relatively sophisticated administrative structure and staffing to monitor and manage environmental issues. The challenge facing the Iraqi administration and the international

community was to enhance the capacity and skills of the environmental administration by training them on environmental best practices and providing them with sufficient equipment, operating budgets and guidelines to initiate environmental monitoring, clean-up and conduct proactive environmental assessment and management.

2. Assessment of environmental threats to human health:

Due to two decades of conflict and inadequate environmental management, Iraq had a number of environmental hotspots that were potentially posing grave risks to human and environmental health. These environmental hotspots included: areas chronically contaminated by pollution and toxic materials; areas targeted during conflicts; areas where during the looting and burning of industrial facilities hazardous materials had been released; areas contaminated by illegal dumping of hazardous wastes and sewage; and areas impacted by depleted uranium and other ammunition. An immediate assessment was needed to identify the location of hotspots and provide recommendations for risk reduction and remediation.

3. Emergency clean-up of environmental hotspots:

Several sites were identified that posed such extreme health and environmental risks as to require emergency clean-up measures. It was therefore recommended that an emergency clean-up fund be created during 2004 to provide for immediate risk-reduction measures, including: access restrictions, signs, monitoring, packing of wastes, and clean-up. The fund was also important to facilitate the privatization of state-owned enterprises that had serious environmental problems.

4. Assessment of environmental threats to human livelihoods:

Iraq's natural resource base was severely degraded by overexploitation and mismanagement in the latter part of the 20th century. As a result, serious degradation of waters, forests, soils and biodiversity resources was found to be threatening human livelihoods and ecosystem services. An immediate assessment was needed to identify the existing levels of natural resource degradation and to

provide recommendations for rehabilitation, recovery and sustainable use. In particular, urgent attention was needed to develop an integrated strategy for the environmental, economic and social recovery of the Iraqi marshlands.

5. Interim Environmental Impact Assessment:

In order to fully integrate environmental considerations into the reconstruction and development process, it was recommended that a strategic environmental assessment of the national development plan be carried out. In addition, the findings showed that all proposed projects should be subject to interim environmental impact assessments, while all existing industrial locations, municipal facilities and waste disposal areas should undergo an environmental impact assessment/environmental due diligence review. The environmental impact assessment process should result in the issuing of an environmental permit for all activities, and follow-up monitoring should be conducted to ensure compliance.

6. Environmental Awareness-raising:

Environmental awareness-raising was considered integral to ensuring sustainable improvements in environmental quality and in preventing immediate danger to populations from exposure to risks from hazardous materials and toxic contamination of air, soil and water resources. It was recommended that during 2004, awareness-raising be conducted through the use of TV and radio campaigns, followed by efforts to integrate environmental issues into educational curriculum at the national and local levels.

7. Promoting National Civil Society Organizations and Engaging the International Community:

During the past 20 years there had been limited activity of environmental civil society organizations (CSOs), as well as poor participation in regional environmental cooperation and international environmental agreements. During 2004, groundwork needed to be undertaken to strengthen the Iraqi civil society organizations working in the area of environment. Regional and international environmental cooperation also needed to

be revitalised, including the ratification and implementation of multilateral environmental agreements.

Environmental Priorities for 2005-2008

- 1. Establishing Modern Environmental Infrastructure:** Effective implementation of environmental regulations requires the establishing of modern environmental infrastructure, such as: national/regional hazardous waste management facilities; waste oil recycling plants; and combined effluent treatment facilities for industrial complexes. In addition, the requirement is for the facilitation of cleaner production technologies, for upgrading individual treatment unit and for promoting recycling.
- 2. Environmental Laws and Procedures:** While the short-term objective of environmental laws is to support the reconstruction efforts, thereby eliminating environmental threats to human health and avoiding overexploitation of environmental resources, the long-term objective of environmental management will be to promote sustainable development. This will require modern environmental laws that will integrate social, environmental and economic inputs together into the decision-making process; provide public access to environmental information; and make use of economic instruments. The country should embark on a strategy for introduction of ISO 14001, lifecycle analyses, environmental taxes, differential fuel pricing etc.
- 3. Environmental Information System:** Iraq has lagged behind its neighbours in terms of environmental information systems development and application of remote sensing for integrated environmental management. Establishing a national databank of environmental information and creating in-country expertise for remote sensing environmental analyses will be areas to be addressed in the medium term.
- 4. Accessing International Environmental Funding Opportunities:** A number of international funding mechanisms have evolved in the past decade to support environmental projects. These include the Global Environmental Facility (GEF), opportunities for emission trading, and the clean development mechanism. Efforts must be initiated to provide assistance to Iraq's environmental recovery through multilateral and other funding mechanisms. These mechanisms will also be important sources of funding for non-governmental organizations.

5 Environmental Site Assessment

5.1 Background

As described in previous sections, it was evident that years of conflict and routine industrial activities had resulted in a large number of chemically contaminated sites in Iraq. The Environmental Site Assessment (ESA) project was scoped to include both policy and site-specific activities, but did not attempt to identify or address all of the potentially contaminated sites in Iraq. Instead, efforts were concentrated on capacity-building at the government level for the management of such sites. At the same time, site-specific work was conducted in areas with urgent short-term problems, so as to ensure that the project delivered immediate practical benefits.

5.2 Key Activities and Outcomes

The Environmental Site Assessment project was compiled of the following key activities:

1. Provision of ESA assessment training;
2. Selection of a list of high-priority contaminated sites;
3. Provision of ESA equipment;
4. Provision of information technology (IT) and document-based assessment support tools;
5. Field surveys of the contaminated sites;
6. Provision of laboratory analytical services; and
7. Interpretation and reporting of results on assessment of selected sites.

Specific capacity-building work was concentrated in activities 2 to 4, although the theme of capacity-building was central to the project and extended to all activities.

5.3 National Partners

The new Iraq MoEn was the national partner for the project. The MoEn evolved from the Environmental Protection and Improvement Directorate within the Ministry of Health. The MoEn's 700 staff are mainly

based in Baghdad, with 15 offices located in the governorates.

MoEn formed a dedicated project team, consisting of a project manager, five site assessment managers, and technical support staff. Critical fieldwork activities such as site reconnaissance, sampling and mapping were managed and carried out by local MoEn staff, who are to be commended for their efforts in the face of security risks and other problems.

The Iraqi security situation presented significant challenges to the project over the period 2004-2005. These were overcome by tailoring the project to the Iraqi environment, as well as through the efforts of MoEn staff.

The UNEP Post-Conflict and Disaster Management Branch (PCDMB) has significant experience in the assessment and remediation of chemically contaminated sites in post-conflict countries, which is usually carried out as part of a larger country-specific package of environmental assessment, capacity-building and assistance.

The usual UNEP methodology for such assessments is to work on location with a team of international experts, partnering with local and government scientists who provide local knowledge, expertise and resources. This approach not only ensures the highest possible technical standards, but also helps to build local capacity and ownership of the issues that arise from the assessments.

In the case of Iraq, the prevailing security situation during 2003-2005 made this approach unworkable. UNEP therefore developed an alternative approach based on capacity-building in the MoEn, so as to enable them to carry out the fieldwork and assessment activities themselves.

UNEP experts initially provided intensive training and equipment to the MoEn teams, and thereafter worked closely with the same staff for the duration of the project. For the priority site assessment, significant work (such as laboratory analysis, map and report compilation) was completed outside Iraq by UNEP experts, consultants and contractors, with UNEP providing oversight and quality control.

Fieldwork activities such as site reconnaissance, sampling and mapping were managed and carried out by MoEn staff. Technical staff from other ministries – Oil, Agriculture and the ex-Ministry of Military Industrialisation (MIC) – were able to assist on three of the five sites.

This partnership approach can be considered to have been successful, as the technical objectives were achieved and the practical capacity of the MoEn in the field of contaminated land and site assessment was significantly increased.

5.4 Training

The provision of training to the Iraqi MoEn and other government staff was one of the largest components of the assessment project. The training covered theory, planning, methods and tools, and focused on the specialist skills required for site assessment together with an introduction to the broader subjects of contaminated land and hazardous waste management.

The training was provided as a series of technical workshops, which brought together international experts and Iraqi delegates under the umbrella of UN management.

The workshops were designed to follow the normal sequence of site assessment activities. This was done to enable the Iraqi MoEn teams to absorb and apply the learning from each workshop in actual site assessment work as the programme progressed. Progress on each site and proposed future actions were discussed at each successive workshop.

The MoEn selected training workshop attendees and project participants. For security reasons the workshops were held outside Iraq – in Amman, Jordan and Spiez, Switzerland. The training workshops comprised:

1. **Environmental site assessment workshop** – A broad introduction with detailed training in the first stages of site assessment. Held 4-7 October 2004 in Amman, Jordan.
2. **Environmental assessment planning workshop** – An introduction to the planning and management of site assessment projects. Held 21-22 November 2004 in Amman, Jordan.
3. **Environmental sampling workshop** – Detailed hands-on skills training in site assessment equipment and techniques. Held 12-14 December 2004 in Spiez, Switzerland (at Spiez Laboratory, the Swiss civil protection facility).



Workshop conducted in Geneva for Iraqi environmental experts

4. **Field sampling preparation workshop** – A meeting that drew on learning from earlier workshops to develop detailed plans for each site. Held 16-17 March 2005 in Amman, Jordan.
5. **Interpretation, risk assessment and remediation workshop** – A detailed review of the field and laboratory results obtained, combined with training in data interpretation, reporting, risk assessment, remediation and hazardous waste management. Held 22-24 August 2005 in Amman, Jordan.

5.5 Site Assessment Activities

Site selection for priority assessment was led by the Ministry of the Environment, with UNEP in an advisory role. An initial list of over 50 sites covering all of the above-listed sectors was developed by UNEP and presented to the MoEn for review and discussion. The UNEP-MoEn review covered issues such as the magnitude of the threat; internal resource constraints; suitability for capacity-building work; site ownership; and access, transport logistics and site security.

The final result was a list of five sites, each of which underwent a detailed assessment in the course of the project. The sites were:

- **Al-Qadissiya** – A destroyed small arms, metal plating and annealing (metal treatment) works;
- **Al-Suwaira** – A pesticides warehouse complex;
- **Khan Dhari** – A refinery chemicals warehouse;
- **Al-Mishraq** – A sulphur mining and acid complex; and
- **Ouireej** – A scrap yard containing conflict-damaged military and civilian vehicles.

Al-Qadissiya

This former small arms manufacturing site was located 30km south of Baghdad. It formerly contained extensive electroplating and metalworking plants. The site was unsecured, contained large quantities of highly toxic chemicals and had been demolished in an uncontrolled manner, resulting in severe human and environmental hazards.

Al-Suwaira

Al-Suwaira was a warehouse complex located 50km southeast of Baghdad, where the Ministry of Agriculture stored insecticides, pesticides and fungicides. The stores held a large quantity of obsolete and highly toxic methyl mercury pesticides. The stores were comprehensively looted in 2003, resulting in the loss and spillage of virtually all stored pesticides.

Khan Dhari

The chemical warehouses for the Al-Doura Refinery were located in Khan Dhari district, near Abu Ghraib, 35km west of Baghdad. This site was the Iraq central refinery chemicals warehouse facility administered by the Midlands (Al-Doura) Refinery Company. The site was looted and burnt down in 2003, resulting in a major toxic chemicals spill and a fire.

Al-Mishraq

Al-Mishraq was a large state-owned sulphur mine and acid manufacturing complex located 53km south of the city of Mosul. In June 2003, looting led to a massive sulphur stockpile fire, causing regional-scale damage to human health and crops. Thirty years of operation had also resulted in extensive local ground contamination, subsidence and erosion.

Ouireej

Ouireej was the location of a large stockyard 15km south of Baghdad where both civilian and military vehicles and equipment had been dumped and were being scrapped in an uncontrolled manner, resulting in localized contamination.

Main Findings

The main findings for the five priority sites were:

Al-Qadissiya metal plating facility: This demolished site represented a **severe** risk to human health, due to hazardous waste containing cyanide.

Al-Suwaira pesticides warehouse complex: The site represented a **low** human health risk, but only because security prevented access to the contaminated warehouses. The warehouses were unsafe to use or even enter.

Khan Dhari petrochemicals warehouse site: Large parts of the site represented a **moderate** risk to the health of site workers. The site was therefore considered unfit for normal use.

Al-Mishraq sulphur mining complex: Surface water and groundwater pollution from the Al-Mishraq site was significant at the time of its operation but had largely ceased at the time of the assessment. Preliminary work in relation to the 2003 sulphur fire indicated that permanent effects on the environment were localized and limited. The site thus represented a **low** risk to human health and the environment, which was principally due to acidic surface water ponds.

Ouireej military scrap yard site: The site represented a **moderate** risk to human health, principally to site workers but also to site residents. The mixing of civilian and military scrapping activities increased the scale of the problem.

General Findings

In addition to the specific findings for the five assessed sites, the project uncovered a range of more general problems in Iraq related to land contamination and hazardous wastes.

Given the current security situation in Iraq and the wide range of development priorities, UNEP's recommendations on land contamination or hazardous waste management needed to be realistic in scale. Recommendations would also have limited value in the absence of a robust mechanism to implement them. Therefore, not all findings were accompanied by specific recommendations.

UNEP's recommendations were presented in a concise format including a summary, a nominated responsible party, outlined scope of work, estimated time and costs. More detailed explanations of the recommendations, including cross-linkages, prioritization and the underlying

rationale could be requested directly from UNEP.

The general findings were:

- **Priority site identification and corrective action.** The serious problem of highly hazardous wastes on derelict industrial and military sites needed to be addressed with a programme of site identification, rapid assessment, local capacity-building and appropriate corrective action.
- **Hazardous waste facilities.** A central hazardous waste management facility for Iraq was needed to enable proposed work and avoid future problems.
- **Oil industry sites.** Oil industry sites and ongoing pipeline breaks were undoubtedly a major source of contamination and hazardous waste and needed addressing in the medium to long term by the oil industry.
- **Mining industry sites.** Mining industry sites had caused land degradation and in some cases extensive water pollution. Most sites contained large quantities of mining waste that included hazardous compounds. Costly intervention measures would probably not be justified unless the mines restart or are permanently closed.
- **Military scrap yards.** The military scrap industry was an ongoing preventable source of human health and environmental hazards that could benefit from some simple reforms.
- **Munitions disposal sites.** Munitions disposal work was believed to be creating new contaminated sites, which needed to be drawn into the larger programme of priority site management.
- **Policy and legislation.** In the longer term, national strategies, policies, legislation and enforcement were needed for hazardous waste management and contaminated land.

6 Institutional Capacity Assessment

6.1 Background

The United Nations Environment Programme undertook a first needs assessment for the environment sector in Iraq between July and September 2003. A team of experts visited the Environment Protection and Improvement Directorate in July 2003 and reported the following:

“A new Ministry of Environment has been established with the existing EPID as the core of the new Ministry. Environmental units also exist in at least three other ministries (agriculture, industries, oil). During our interaction with the Iraqi environmental administration at the national and governorate level, it became obvious that there exists a relatively sophisticated administrative structure and staffing to monitor and manage environmental issues. The challenge facing the Iraqi administration and the international community is to enhance the capacity and skills of the environmental administration by training them on environmental best practices and providing them with sufficient equipment, operating budgets and guidelines to initiate environmental monitoring, clean-up and conduct proactive environmental assessment and management”.

In July 2004, UNEP succeeded in securing USD 4.7 million to help meet the immediate capacity-

building needs of the Iraqi Ministry of Environment. This project had three components:

1. To upgrade the MoEn's physical infrastructure (laboratory/information centre etc);
2. To strengthen its human capacity (through classroom training and field assessments); and
3. To carry out an institutional capacity assessment.

Ideally, the institutional capacity assessment (ICA) should have preceded the other two activities, as input from it could have been used as a basis for targeted action on both physical and human capacity-building. However, because the political timetable for transition in Iraq resulted in frequent changes at the ministerial level, the project was implemented differently – it was considered more appropriate to conduct a systematic assessment of the Ministry of Environment after it had been in existence for at least a year and had been given the opportunity to develop experience and maturity. It was also felt that any recommendations for follow-up would be of better value once the MoEn had been in place for a full four-year term. The institutional capacity assessment was therefore only initiated in August 2005, after the human capacity element of the project had to a large extent been completed. Given that the needs of the new ministry were enormous – requiring several years and a substantial budget to be met – the fact that the ICA was not undertaken before did not actually affect the ministry's most important capacity-building needs.



Field sampling preparation workshop held in Amman in March 2005



Interpretation, risk assessment and remediation workshop conducted in Amman in August 2005

6.2 Key Activities and Outcomes

1. To assess the context in which the MoEn operates, which was determined by the legislative framework that provided its mandate and by the country's general political situation. Iraq's commitments to regional and international treaties and organizations constituted additional constraints.
2. To inventory the organization's current resources by gathering information on the human, infrastructural and financial resources of the MoEn.
3. To assess procedures and priorities by acquiring information on the current operational practices of the ministry, its institutional linkages and technical challenges.
4. To develop recommendations to assist the MoEn to successfully carry out its mandate.

At the time of the assessment, the Ministry of Environment was faced with several challenges. As Iraq continues to move towards a more decentralized federal political system and a more market-oriented economy, the MoEn would need to keep adjusting to this rapidly changing political and economic environment for a number of years. At the same time, as Iraq rejoined the international community, it would be both more involved and more accountable in the international environmental arena. It was therefore likely that the

new system the MoEn would operate in would be one in which the rule of law, as well as new standards of transparency and accountability, would be upheld. An increase in public participation was also to be expected, although achieving this would require environmental awareness-raising.

A brief discussion of the MoEn's main challenges follows.

Decentralization

More focus was needed on building capacity in the regions, as departmental structures regarding equipment, staff, budgets and institutions required strengthening. The shift towards decentralisation could not only be seen as an opportunity to address the immediate needs of the population more directly, but also, according to the more holistic approach on which modern environmental management is based, as an opportunity for positive environmental actions in one governorate to impact on others – just as Iraq's overall environmental actions could affect the region and even the world as a whole.

Market Economy

The move towards a market economy would require the Ministry of Environment to develop strong working relationships with the private sector, and to use economic instruments and incentives to achieve environmental goals. The ministry could also emphasize and support the development of environmental equipment, goods and services in the private sector.

Rule of Law

A large share of the international assistance provided to Iraq was allocated to stabilization. Facilitating the application of the rule of law was an important part of this effort – i.e. for strengthening the judiciary and the enforcement authorities, and increasing the quality of the legal system (laws, regulations, jurisprudence, etc.). The Ministry of Environment was already working to harmonize environmental law with the new Constitution, and to strengthen the law in terms of international best practice. The next phase would involve developing standards for enforcement and inter-ministerial collaboration on environmental legal tools. Defining advocacy for the environment as a human right, and developing public participation/claims mechanisms would also be important.

International Context

At the time of the assessment, Iraq's accession to several international environmental agreements is imminent. Accession would allow Iraq to benefit from the financial and technical assistance provided by a variety of convention secretariats, and by the Global Environment Facility. It would also require Iraq to harmonize its own laws with the provisions of the MEAs to which it had become party.

Awareness-raising

The lack of public awareness on environmental issues and on the specific role of the MoEn, as well as the lack of active civil society environmental organizations, were major challenges that could be addressed in a variety of ways. Media such as television, radio, newspapers and the Internet could be used to reach out to the public and private sectors at large. Educational initiatives could also be carried out through environmental awareness programmes and courses at educational and religious institutions. Collaborating with civil society was deemed a priority for the Ministry of Environment.

6.3 Recommendations

Although it had been a challenging period for the Iraqi Ministry of Environment, it was testimony to the strength of the core of the organization that it had withstood this challenge. Not only had the ministry continued to function amid political and security uncertainties, it had also succeeded in implementing national and international projects during this transition period, demonstrating the high level of the technical competence of its staff.

In order to be effective as an institution in the longer term, a ministry's mandate must be explicitly stated in the appropriate legal framework. The CPA Order provided an unambiguous mandate for the Ministry of Environment to take ownership of all conservation and protection-related environmental issues. Also, the constitutional provisions on the environment provided a strong political and legal base for the ministry to operate. Moreover, the MoEn was in the process of drafting a new framework environmental law, which was expected to further clarify its role and responsibilities.

The Ministry of Environment faced two main challenges in carrying out its mandate. First, it had

to prevail in Iraq's changing political context. The MoEn was a relatively new ministry whose mandate could be aligned or shared with the Ministries of Municipalities, Public Works, Water Resources and Health, which were all firmly established organizations with significantly higher staff numbers and operational budgets.

The MoEn's second challenge was to increase public awareness of its role as a normative agency, distinct from implementing ministries such as the Ministry of Municipalities. The MoEn had to find ways and means to use its mandate to guide larger ministries with implementation responsibilities to undertake actions that lead to environmental improvements.

Based on this Institutional Capacity Assessment, UNEP recommended the following actions:

1. The ministry's three core functions (law/policy-making, law enforcement and environmental monitoring) should be clearly segregated and staff deployed in these three areas.
2. The new framework environmental law should be adopted as soon as possible, so as to provide an administrative tool for MoEn staff to enforce environmental norms. Additional rules, regulations and standards should be developed once the framework law is put into place.
3. Environmental concerns should be prioritised and resources deployed to address the most serious challenges.
4. The constitutional emphasis on decentralization should be taken into account in the final organogram.
5. Some of the MoEn's expertise (e.g. in environmental impact assessment, environmental monitoring etc.) should be made available as a 'service function', with a view to developing these services into independent profit centres at a later date.
6. The ministry should consider partnerships with civil society to strengthen environmental governance, but retain its independence.
7. The MoEn should identify the potential emergency situations in which environmental concerns are involved (e.g. oil spills), and develop the expertise and systems to react appropriately.

7 Capacity-Building for Environmental Governance

7.1 Background

It was evident during the initial site visits undertaken that there were large number of qualified professionals in the Environmental Protection and Improvement Department (which became the Ministry of Environment). However, due to a poor economic situation and UN sanctions they had not been able to keep up-to-date with developments in the field. Capacity-building for the staff was therefore considered a key requirement to enable the MoEn to assess and manage environmental issues in Iraq.

7.2 Key Activities and Outcomes

UNEP therefore initiated capacity-building activities for the Iraqi Ministry of Environment in March 2004. Capacity-building activities involved the following:

1. Training and technical assistance to the Ministry of Environment;
2. Strengthening analytical capability by providing lab and field equipment;

3. Strengthening information management by providing computers and books; and
4. Strengthening international integration by facilitating participation in regional and international meetings.

7.3 Training Events

A series of training events were undertaken throughout 2004-2006, primarily focusing on staff from the MoEn. However, staff from other ministries (Water Resources, Municipalities, Agriculture, Industries, Justice etc.) were also invited to participate, as appropriate.

The key training events were:

- environmental emergencies response,
- environmental inspection and control,
- environmental impact assessment,
- multilateral environmental agreements,
- environmental law,
- oil spill related environmental emergencies response,
- biodiversity and natural resources management, and
- office management.



Interpretation, risk assessment and remediation workshop conducted in Amman in August 2005

7.4 Technical Assistance on Environmental Law

In response to a request from the Iraqi MoEn, UNEP met on 15 February 2005 with the Minister of Environment, to discuss the development of an environmental framework law and environment article for the Constitution. UNEP brought three legal advisors from the IUCN Environmental Law Centre (Beveridge and Diamond), as well as their own UNEP legal expert to this meeting.

Immediately following up on the recommendations of the ministerial consultation, UNEP organized a technical workshop on environmental law development and enforcement, which was held in Amman from 7-10 March 2005. This workshop was organized in cooperation with United Nations Institute for Training and Research (UNITAR). Training was provided to 20 officials from a number of ministries on environmental law, compliance and enforcement. The course identified a continued need for training specifically in the areas of: economic instruments, public participation, access to information, access to justice, non-governmental organizations and civil society role in environmental monitoring/compliance and enforcement, human rights and the environment.

After the workshops and consultative meetings, the Deputy Minister of Environment took an active role in helping to develop an environmental law. After the Deputy Minister was replaced, however, the MoEn decided to create a drafting committee, and requested assistance from UNEP. Subsequently, during January-February 2006, UNEP sent an environmental law expert, Mr. Sami Shubber, to work jointly with MoEn staff to expedite the development of Iraqi environmental law. The committee for the redrafting of the environmental law consisted of ten members: three lawyers from the ministry, five technicians, a secretary, the UNEP consultant as advisor, with a senior staff member from the MoEn serving as the Chairman.

Under this committee, a first draft text was prepared and submitted by the Minister of the Environment for review by other key ministries and stakeholders. A second draft was then later prepared and submitted to the Ministerial Council for review and



Laboratory training conducted in Switzerland for Iraqi environmental experts, December 2004

endorsement. UNEP's assistance in support of Iraqi environmental law development was finalized in March 2006.

7.5 Strengthening Analytical Capabilities

In order to strengthen environmental analytical capabilities in Iraq, the MoEn was provided with modern analytical equipment. This included portable equipment for fieldwork and high sensitivity equipment for laboratory work. The detailed list of equipment provided to the Laboratory is given in Appendix II.

7.6 Environmental Information Centre

UNEP assisted MoEn with the establishment of an Environmental Information Centre within the Ministry of Environment. Training was provided to four members of ministry staff at UNEP HQ in Nairobi during October 2005. Additional training for a further four ministry staff members took place during May 2006. Specific computer equipment configured with library software, furniture, and 1,500 publications (both UNEP and non-UNEP publications) were provided to the ministry. Subscriptions to international online research databases were also delivered.

8 Hazardous Waste Collection and Storage

8.1 Background

Under the guidance of UNEP, Iraqi teams conducted site assessments of five sites. The Iraq MoEn and UNEP jointly selected the teams. Of the five sites investigated, three were found to contain significant quantities of highly hazardous waste chemicals. The worst site – Al-Qadissiya – contained pure sodium cyanide, a toxin with a lethal dose by ingestion of less than 1 gramme. The site had been successively looted and demolished, resulting in the deposition of piles of cyanide on open ground. Al-Qadissiya was unfenced, unguarded and located in a semi-built up area south of Baghdad. Trespassers, including children, had been seen on the site and looters were noted stripping metal from cyanide-containing reaction vessels. A second site – Al-Suwaira – contained remaining old pesticides in a Ministry of Agriculture warehouse. The project thus focused on the removal of the public health hazard posed by hazardous substances found on these two sites.

8.2 Key Activities and Outcomes

1. Collection and containment of cyanide and other toxic wastes from the derelict Al-Qadissiya metal treatment works site and Al-Suwaira warehouses.
2. On-site secure storage sites designed and created for storage of hazardous waste from Al-Qadissiya and Al-Suwaira.

Al-Qadissiya Site

All the identified chemicals were collected and stored in steel barrels. All were identified, labelled, and appropriately stored.

Table 2: Material Collected at Al Qadissiya Site

Contents	No. of drums
Sodium Cyanide	150
Hexavalent Chromium Salt	228
Sodium Hydroxide	68
* Asbestos	100 bags plugging the store entrance.



Iraqi experts taking part in a hazardous waste collection and storage project at Al Qadissiya

Asbestos

Asbestos was packed into plastic bags and then placed inside another layer of plastic bags. The bags were sewn tight with a special sewing machine and stacked in the passageways and entrance, to prevent access to the drums.

Samples were taken of all chemicals and all the drums and bags were clearly labelled.

Liquids

The contaminated liquids inside the plating basins were pumped out, placed into jerrycans, and stored inside the Al-Qadissiya store. 220 jerrycans were filled with a mixture of Hexavalent Chromium Salt and Cyanide Salt. It is worth noting that the summer heat evaporated a large portion of the liquids before the cans were filled.

Contaminated Soil and Debris

A hangar was constructed with concrete floors, closed walls and a sealed roof, covering a total area of 360m². The hangar was used to store the following:

- contaminated soil and concrete that the chemicals had been laying on top of;
- The emptied storage containers and drums;
- The chemical wash tanks;
- The Cyanide Salt annealing vessel with solidified chemicals; and
- The contaminated concrete and debris found near the plating basins.

Al-Suwaira Site

Pesticide residue from the warehouse was collected in plastic bags and sealed inside storage drums.

The drums were clearly labelled to indicate that the contents were: 'toxic, environmentally hazardous, not to be touched, and flammable'. Each drum was numbered serially and the samples taken from each drum were cross-referenced with the same serial number. A total of 149 barrels was filled. The drums were then stored at the end of the warehouse and enclosed by warning tape.

Site-Cleaning Process

After the pesticide residue had been collected, the Al-Suwaira warehouse was cleaned in the following manner:

- The ceiling was thoroughly scrubbed, hoovered and washed with water jets;
- Damage to the walls, window and doors were repaired and holes filled. The walls were also cleaned, hoovered and washed by water jetting;
- Pesticides were collected from the floor, which was then thoroughly washed and hoovered before cleaning the walls and ceiling. Once the walls and ceiling were cleaned, the floor-cleaning process was repeated for a second time. Afterwards, a special concrete-polishing machine was used to strip and remove any stains and discolouration from the surface of the floor concrete;
- Once cleaned, the warehouse was then washed with warm soap solution and hypochlorite solution and then cleaned and washed a second time to reach a satisfactory state;
- Manholes in the floor were cleaned and new covers installed; and
- The outside of the warehouse was also cleaned and washed.

Table 3: Material Collected at Al Suwaira Site

Item	Serial No.	Contents	No. of drums
1	1-90	Hazardous waste such as soil, dust, bird guano mixed with Chlorophenyl Mercury	90
2	91-117	Chlorophenyl Mercury	27
3	118-148	Calcium Cyanide	31
4	149	Seeds	1
Total			149

9 Environmental Diplomacy and Mainstreaming

9.1 Background

The years of conflict that Iraq went through under the former regime meant that it had become isolated from its neighbours, regional organizations and multilateral institutions in all spheres – including that of the environment. Prior to the period of conflict (1980), Iraq was a signatory to most international conventions and an active member of regional organizations. One of the activities that UNEP focused on after the change of the regime was to help Iraq's current regime re-link with its neighbours, regional organizations and the international community.

Another activity performed by UNEP during the period 2003-2006 was that of mainstreaming environmental concerns within the UN family. Indeed, in the period immediately after the conflict, while the UN was one of the key players in undertaking projects in Iraq, there was no system for screening the environmental impact of its projects. UNEP therefore established a system to ensure that no environmental damage would be caused by the UN's intervention in Iraq.

9.2 Iran-Iraq Dialogue on the Mesopotamian Marshlands

The Al-Hawizeh marshland straddles both Iran and Iraq, so that the two countries are hydrologically and ecologically interdependent. During the previous Iraqi regime, when engineering projects were initiated in Iraq to drain the wetlands, counter measures were taken in Iran to build a dyke to protect the local hydrological regime. The net effect of these measures was to bisect the Al-Hawizeh marshland, with the result that it is consequently one of the remaining undisturbed parts of the Mesopotamian marshlands.

In 2004, UNEP brought together experts from both Iran and Iraq to discuss ways in which the two countries could collaborate on the issue of the Mesopotamian marshlands. This was the first time in 29 years that the two countries had met face-to-face to discuss the issue. The result at the meeting's end was an agreement to share information on the issues and to continue the dialogue.

In 2005, UNEP, in association with the Regional Organization for Protection of the Marine Environment, organized a high-level conference on the *Restoration of the Mesopotamian Marshlands* in Manama (Bahrain). The meeting was well attended by representatives of most governments of the region, by UN agencies, the World Bank and a number of NGOs.

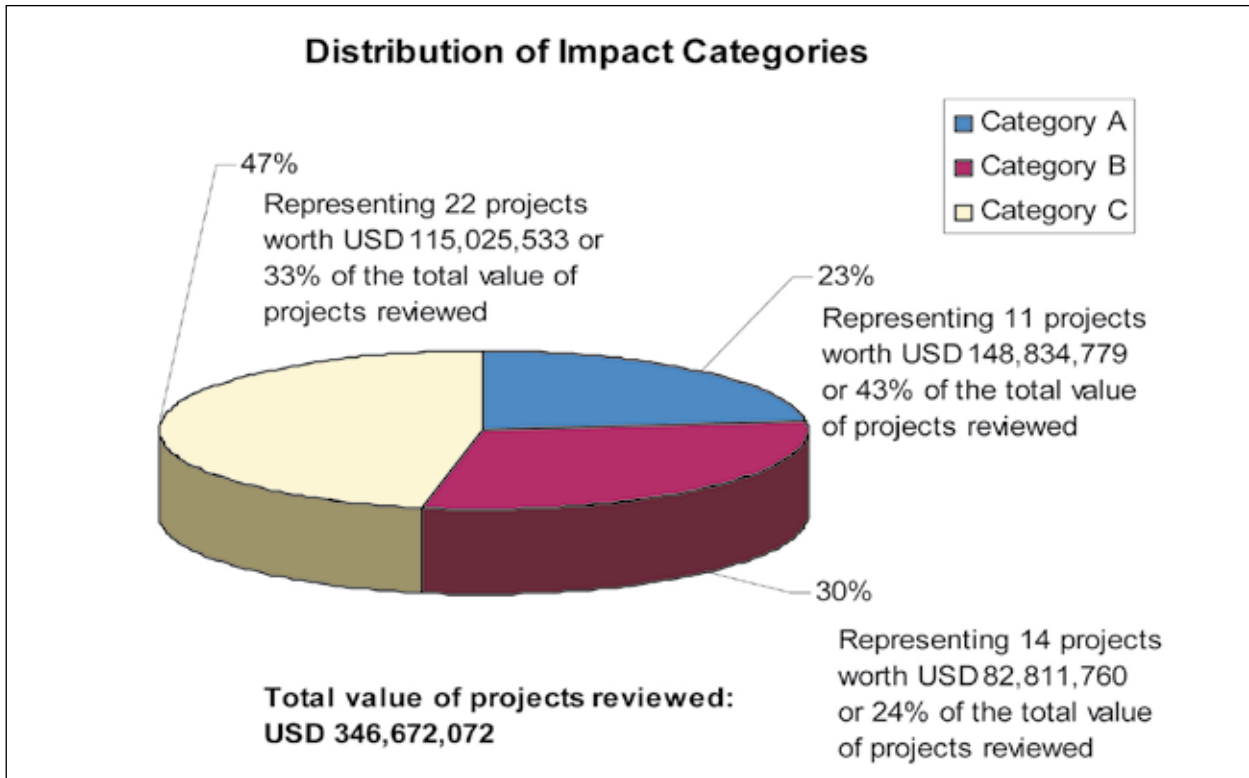
9.3 Re-linking Iraq to the Regional Organization for Protection of Marine Environment

Iraq was one of the founding members of the Regional Organization for Protection of the Environment (ROPME). However, the membership of Iraq was suspended after the invasion of Kuwait. In 2005, UNEP initiated a process by which representatives from ROPME and officials of the Ministry of Environment were brought together in Geneva to discuss Iraq's return to ROPME. This was followed by Iraq's participation in various ROPME events as an observer. By 2006, the member countries of ROPME agreed to allow Iraq to take its chair in ROPME as a full member.

9.4 Re-linking Iraq to the Ramsar Convention

Though Iraq was party to the Ramsar convention and host to one of the key wetlands of international importance, the Al-Hawizeh marshland was never declared a Ramsar site. In 2005, UNEP initiated action to classify as such. UNEP undertook the technical preparation for the act and encouraged the Ministry of Environment to take the necessary political action within Iraq to declare Al-Hawizeh a Ramsar site. At the 9th Meeting of the Conference of the Contracting Parties to the Convention on Wetlands held at Kampala, Uganda on 8-15 November 2005, Iraq made a statement noting that it was attending COP9 as an observer but would soon accede to the convention and participate at COP10 as a contracting party. The eastern part of the famous Mesopotamian marshes would be submitted as the country's first Ramsar site. Iraq considered its presence at COP9 to be an indicator of reintegration within the international community after decades of tragic circumstances.

Figure 1 : Distribution of Impact Categories



9.5 Capacity-Building for Engaging other Multilateral Systems

As part of its overall capacity-building activities in Iraq, UNEP conducted a workshop on Multilateral Environmental Agreements for officials from the Government of Iraq, at which information on both 'green' agreements (Convention on Biodiversity, Convention on International Trade in Endangered Species of Wild Fauna and Flora) and 'brown' agreements (Basel Convention, Rotterdam Convention) was provided. Officials were also given training on procedures for participation in these conventions and negotiation strategies. UNEP has since facilitated the attendance of Iraq in a number of events associated with these conventions.

9.6 Environmental Mainstreaming

Between 2004 and 2006, UNEP was a resident agency in Amman, Jordan, along with other members of the UN country team that was assisting Iraq. The overall size of the UN Iraq Trust Fund (ITF) exceeded USD 600 million and a large number of projects was undertaken by various UN agencies in Iraq. During the screening process to identify new projects for ITF support, it became evident that there was no systematic manner in which

environmental concerns, if any, were being identified and addressed. UNEP thus established a Project Environmental Review (PER) methodology and offered its services to all other resident agencies to undertake environmental screening of all projects carried out by the UN in Iraq.

Based on the findings of the PER, approximately 23 percent of reviewed projects were classified as impact category A (potentially significant); 30 percent were classified as category B (potentially moderate); and 47 percent were classified as category C (insignificant impacts). In total 53 percent of the projects reviewed (representing 67 percent of the total value of projects reviewed) had potential impacts.

PER also found that for more than half of the projects reviewed, the three most common environmental impacts related to the protection of water quality and quantity, the safe disposal of solid waste, and the sustainable use of biodiversity. Potential impacts in the areas of air quality and groundwater quality were also identified in more than 30 percent of cases.

A guidance note on undertaking project environmental review was also prepared as part of the mainstreaming exercise.

10 Capacity Building for Depleted Uranium

10.1 Background

The 1991 Gulf War was the first conflict in which depleted uranium (DU) munitions were used extensively. More recently, the use of DU munitions during major combat was confirmed during the 2003 conflict in Iraq. No comprehensive DU assessments had been successfully undertaken in Iraq, however. The absence of rigorous scientific assessments had led to speculation, and there was a high potential for inaccurate DU risk perceptions by the general public and the Iraqi authorities.

Within the Ministry of Environment (MoEn), the Radiation Protection Centre (RPC) was charged with all aspects related to radiation protection in Iraq. The RPC would thus become the key organization to take charge of DU assessments in the country and for continuous interaction with UNEP. However, the scientific ability of the RPC to plan and execute a thorough DU assessment was hampered by the lack of latest knowledge on DU (both of state-of-the-art field techniques, and a lack of the necessary field and laboratory

equipment). It was recognized at an early stage that local experts required both training and equipment relevant to environmental assessments in general, and to DU assessments specifically. UNEP decided to put together a capacity-building programme for the RPC and key staff from related agencies (such as the Ministry of Health) to address these knowledge and resource gaps.

10.2 Key Activities and Outcomes

UNEP's capacity-building process in Iraq for environmental laboratory, fieldwork and depleted uranium included the following activities:

- Training workshops on DU, environmental site assessments and sample analyses;
- Selection and procurement of field monitoring equipment and laboratory analytical instruments;
- Definition of the scope of the DU assessment project and provision of the relevant information tools in the form of site assessment packages, in order to facilitate good quality deliverables by the local experts;



Workshop on depleted uranium (DU) field measurement techniques, reconnaissance, sampling, and selection of site clean-up measures

- Provision of logistical support for data and sample transfers between Iraq and UNEP; and
- Interaction with the local experts throughout the DU assessment project.

Through this capacity-building process, Iraq's Ministry of Environment, and its Radiation Protection Centre now have well trained and experienced field staff, a set of field monitoring equipment, and a host of technical resource materials.

Their site assessment work was a large project with complex logistical constraints. Much thought and effort from both UNEP and the RPC was pooled to design a solid and realistic process in order to ensure successful completion of the work. The RPC gained experience in creating, managing and coordinating multidisciplinary teams of trained staff in various parts of the country for environmental and DU assessments, which could be extended to other, non DU-related, issues in the field of radiation assessment and protection.

An additional achievement of this capacity-building process was a strengthened partnership between UNEP, the Iraqi MoEn and its Radiation Protection Centre. It also demonstrated good international cooperation with UN partner agencies, in particular IAEA and WHO. Indeed, in each step of the programme, UNEP shared its latest findings with both agencies through a series of regular meetings. In addition, WHO and IAEA actively participated in the seminars and workshops organized by UNEP.

This experience also exposed some potential areas of improvement, especially in institutional strengthening. The RPC have an excellent infrastructure, which was built under a WHO programme directly after the 2003 war. However, the centre needs to acquire both basic and state-of-the-art equipment for its laboratories, and provide adequate training and refresher courses to its laboratory technicians.

11 Iraqi Marshlands Project

11.1 Background

Since 2004, UNEP has been implementing a large-scale integrated project for the sustainable management and restoration of the Iraqi marshlands. UNEP's marshlands initiatives are expected to continue into 2008, as requested by the Iraqi institutions and supported with findings from donors.

The Iraqi marshlands constitute the largest wetland ecosystem in the Middle East, with environmental and socio-cultural significance. By the time the former Iraqi regime collapsed in 2003, these marshlands – with their rich biodiversity and unique cultural heritage – had been almost entirely destroyed. In 2001, UNEP alerted the international community to the marshlands' destruction when it released satellite images showing that 90 percent of the marshlands had already been lost. Experts feared that the marshlands' ecosystems would be completely lost within three to five years unless urgent action was taken. UNEP has continued to be the leading agency reporting on the condition of the marshlands.

Extensive ecological damage to this area, with the accompanying displacement of much of the indigenous population, was identified as one of the country's major environmental and humanitarian disasters by the United Nations Environment Programme (UNEP) and the United Nations–World Bank *Needs Assessment Initiative for the Reconstruction of Iraq* in 2003. Critical problems and associated priority needs for the Iraqi marshlands identified by the Iraqi authorities and the UN assessments included, among others, the following:

Marshland degradation: While the re-flooding of dried areas started in 2003, the level of such re-flooding showed varying degrees of ecosystem recovery. Marsh water was suspected to be contaminated with pesticides by 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, impacting vegetative and fish recovery. Water quality and

marshland management was an urgent priority to protect human health and livelihood, and to preserve biodiversity and the ecosystems.

Lack of drinking water: The 2003 UN interagency assessment and a public health survey by the United States Agency for International Development (US AID) found that the provision of safe drinking water was the critical priority for the residents of the Iraqi marshlands.³³ 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.³⁴

Lack of sanitation: Assessments found that most settlements lacked basic sanitation systems, and 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 a critical necessity for public health. In addition, the return of displaced persons to the marshland area continued to place an increasing burden on the provision of drinking water and sanitation.

The Iraqi authorities recognized the above issues as priorities, and identified the management of the marshlands, provision of water and sanitation, and capacity-building as priorities for Iraq 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 provision of technologies, equipment, and training. To respond to such requests and prioritization, the Government of Japan made contributions to the UN Iraq Trust Fund, and earmarked funds for the Iraqi marshlands management and restoration. In addition,

within the UN Iraq Trust Fund framework, the need for coordination of activities and strategy formulation for longer-term marshland management had been identified.

Additional assistance has been provided to UNEP, on a bilateral basis, by the Governments of Italy and Japan.

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 that are suitable for immediate provision of drinking water and sanitation as well as wetland management, and to implement them on a pilot basis; and

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-sectorial dialogue.

Project Phases

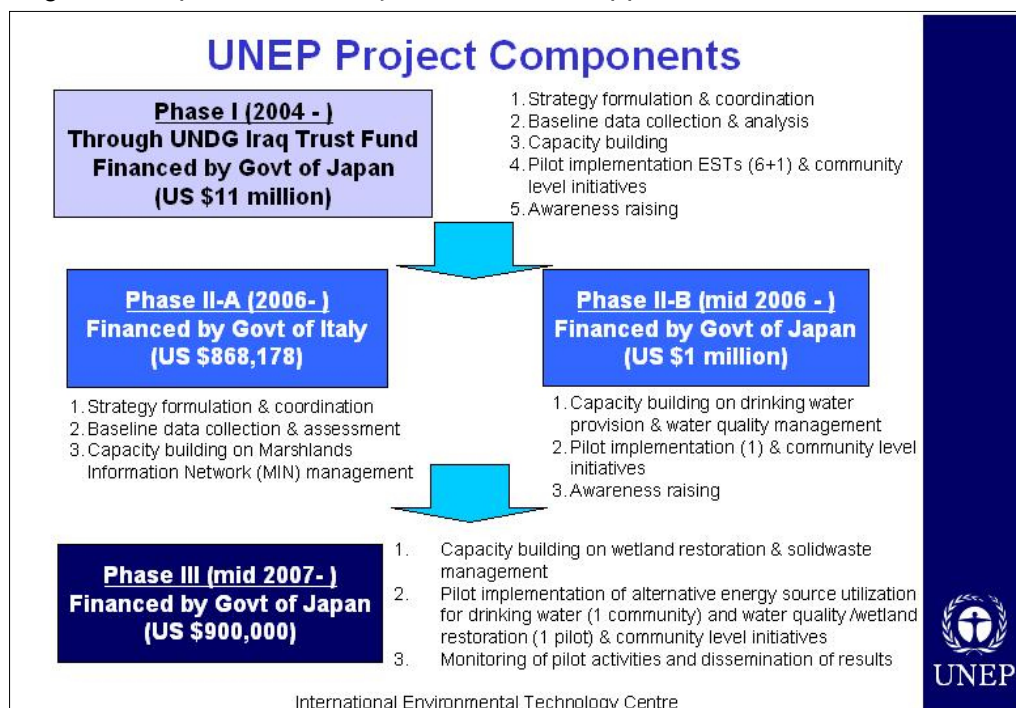
This project has received support from various donors and has been organized into phases, as described in this section and shown in the figure below.

Phase I

Phase I of the marshlands project was implemented within the framework of the UNDG Iraq Trust Fund. The Government of Japan provided USD 11 million to support this phase. Work during Phase I focused on:

- Safe drinking water provision, utilizing environmentally sound technologies;
- Sanitation and wastewater treatment demonstrations;
- Wetland and water quality management;
- Targeted capacity-building;
- Community level initiatives for marshland management; and
- Support for data collection and analysis.

Figure 2: Iraqi Marshlands Project Phases and Supported Activities



Phase II

Phase II has been running in parallel with Phase I and building on its success. Funding from the Governments of Italy and Japan supports this second phase. Planning for Phase II was carried out with the MoEn, MOWR, and MMPW.

Phase II-A: strategy formulation and coordination; baseline data collection and assessment; capacity-building

Activities supported by funding from the Government of Italy include:

- Coordinated data collection and analysis of water, environmental and socio-economic parameters;
- Expanded use of the MIN to share and manage data; and
- Provision of additional hardware, software and training.

Phase II-B: drinking water provision and water quality management; pilot implementation and community level awareness; awareness raising

Activities supported by funding from the Government of Japan include:

- A pilot project for drinking water provision in another community;
- An additional training course;
- An international workshop on Iraqi marshlands management;
- Continued initiatives at local community level; and
- The update of awareness-raising materials.

Project Implementation Structure

The International Environmental Technology Centre (IETC), part of UNEP's Division of Technology, Industry and Economics (UNEP DTIE) and located in Japan, is carrying out project implementation. The project maintained the following adaptation of implementation and monitoring mechanisms to ensure Iraqi involvement and ownership:

- **Activity implementation in communities that are endorsed by local, governorate, and national institutions:** The primary mode of project operations

has been that the project implements activities in communities only when (a) there is demonstrated demand and support for interventions from the community leaders; (b) there exists a clear pledge of security provision by the local communities; and (c) all stakeholders, including ministries, governorates and local communities, endorse implementation. By including the provision of security and local commitment to assist in implementation in the selection criteria for pilot communities, the project has successfully minimized the security and staff constraints. The sense of ownership and responsibility among the local communities is also more assured.

- **Engagement of National Coordinator:** The continued engagement of the national coordinator inside Iraq has been a crucial factor to facilitate the successful implementation of this project. The national coordinator has maintained constant dialogue with local community groups, contractors, and ministries inside Iraq to monitor progress, share information on the project implementation, and to solicit dialogue with partners to facilitate action. Whenever the security situation allows, the national coordinator has travelled to the southern governorates to meet and follow up on activities with local partners.
- **Use of contractors with experience delivering in Iraq:** 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 and logistical challenges.
- **Engagement of Iraqi institutions for activities:** Whenever possible, the project has utilized Iraqi institutions (government agencies, universities, local groups, and NGOs) to carry out activities, such as water quality monitoring, secondary training, and field assessments. Also, the Iraqi institutions are notified whenever the expression of interest, request for proposals, and other public procurement notices are made public.

In recognition of such efforts for local coordination and the actual results on the ground, the Iraqi Minister of Environment and other donors have identified the marshlands project as a model case of cooperation and sustainable development.

Summary of Project Benefits

The following benefits of the marshlands project have been identified:

- ESTs are being introduced and implemented, making use of Iraqi expertise.
 - Up to 22,000 people in six pilot communities (Al-Kirmashiya, Badir Al-Rumaidh, Al-Masahab, Al-Jeweber, Al-Hadam, and Al-Sewelmat) have access to safe drinking water supplied by common distribution taps from Phase I of the project. By the middle of 2006, 23 kilometres of water distribution pipes and 127 common distribution taps had been installed. Phase II-B is supporting drinking water provision in another community for 3,000 people.
 - Partly because drinking water was made available through this project, people are returning to pilot site areas. As stability returns, possibilities for finding employment and rebuilding life in the marsh ecosystem are increasing.
 - A sanitation system utilizing constructed wetlands is serving approximately 170 inhabitants, who face health hazards from discharges of untreated wastewater to a nearby canal.
 - Wetland rehabilitation and reconstruction initiatives are being implemented in cooperation with the Centre for the Restoration of Iraqi Marshlands, of the Ministry of Water Resources (MOWR).
- Input is being provided for a long-term management plan to benefit people and ecosystems in southern Iraq. This includes:
 - Experience with suitable management options;
 - Recognition of local communities as stakeholders;
 - Assessment of policy and institutional needs;
 - Identification of (and engagement with) evolving and emerging Iraqi institutions associated with marshlands management; and

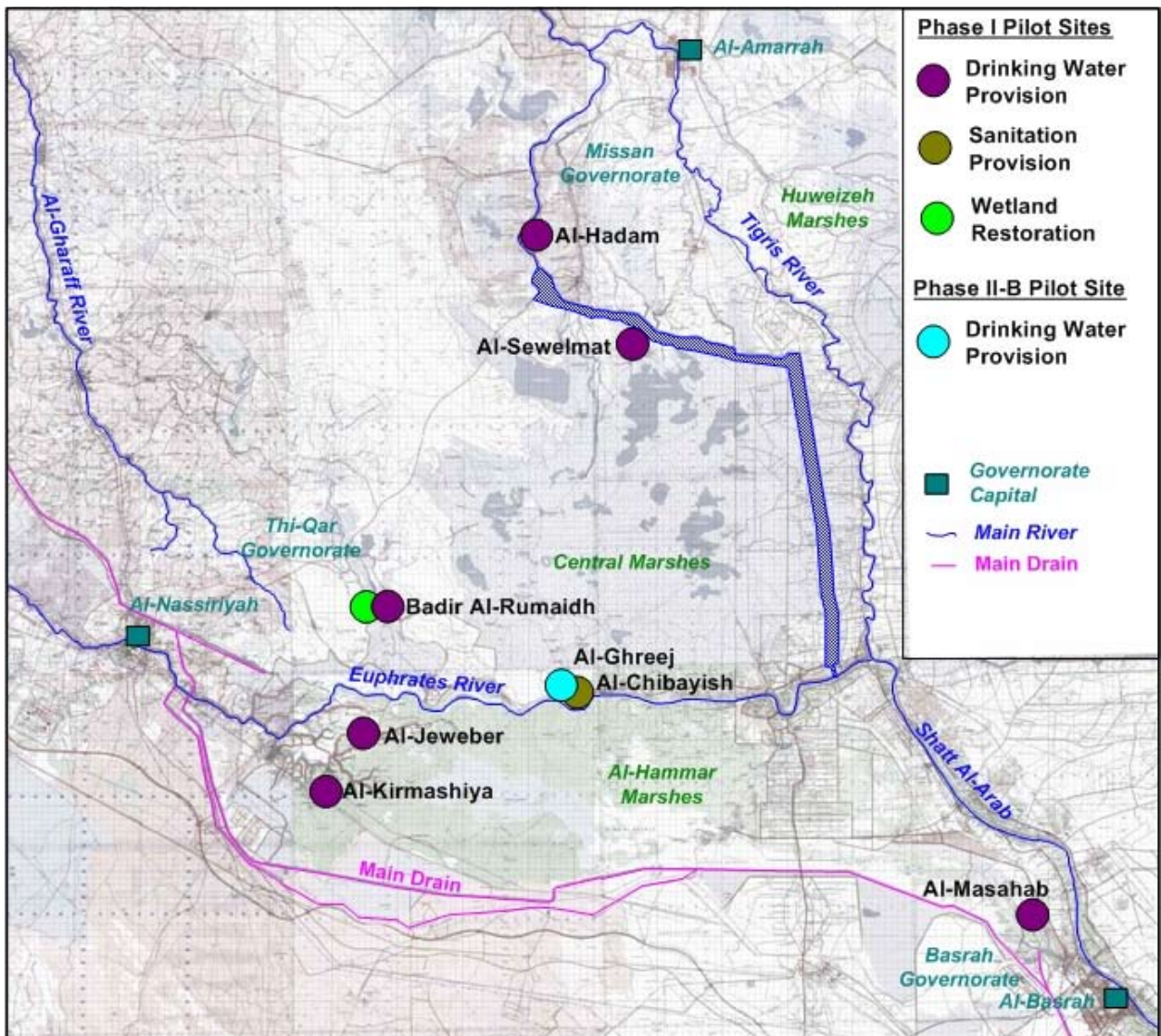
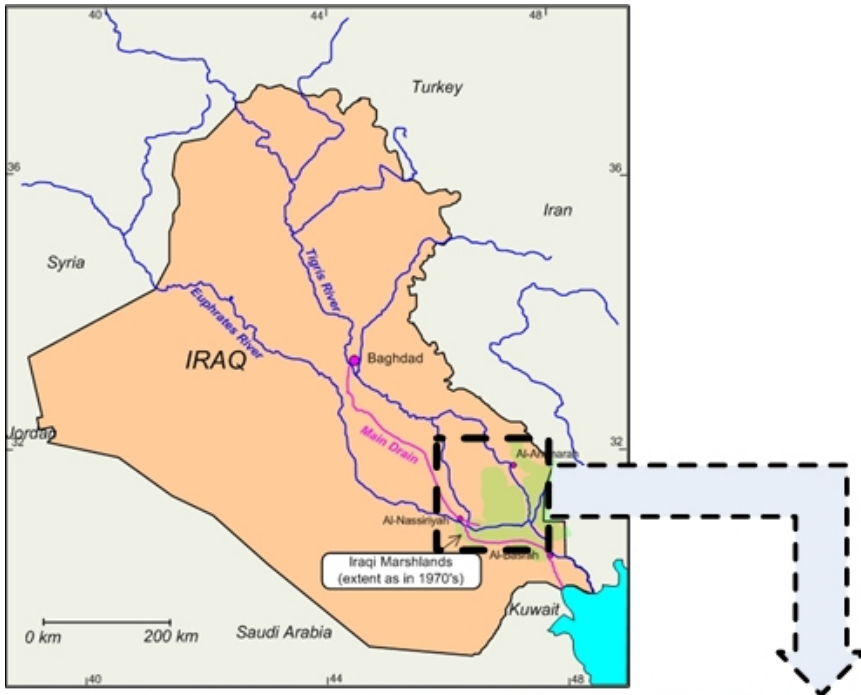
- Provision of analysed data, gathered through water quality testing, satellite image analysis and remote sensing.
- The capacity and knowledge of Iraqi decision-makers, technical experts, and community members are being enhanced. Policy and institutional elements, technical knowledge, community engagement, and analytical methods are among the aspects being addressed.
- Employment opportunities related to assessment, pilot applications, awareness-raising and monitoring are being developed at professional and community levels.
- Coordination of donor-supported activities and domestically led activities inside the marshlands is being facilitated to foster coordination and cooperation while minimizing waste.

11.2 Pilot Projects on Drinking Water, Sanitation and Wetland Rehabilitation

A. Drinking Water Provision in Six Communities

Access to safe drinking water remains the number one priority for residents of small communities in the marshlands who have returned to the region after being displaced for more than a decade. Many residents in the small communities have re-established their livelihoods through traditional activities such as agriculture, fishing, animal-rearing, harvesting reeds or making reed products. These activities are small-scale and the residents tend to live 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 securing safe drinking water has become increasingly difficult, especially for small communities. One of the main challenges addressed by the environmental management of Iraqi marshlands is to ensure the communities a safe drinking water supply, provided in an environmentally sound manner. Groundwork in the form of pilot projects on drinking water provision is implemented to address this challenge.

MAP 3: Pilot Project Sites for Drinking Water Provision



The main objectives of the pilot projects on drinking water provision are to identify and evaluate ESTs through field implementation, while providing immediate relief to the residents in the community where pilot projects are being implemented.

Pilot Sites

In February 2005, a technical meeting was organized with the objective of discussing priority sites identified by Iraqi institutions for interventions to provide water, sanitation, marshland management and to reach consensus on five to six candidate sites to be considered by UNEP for pilot implementation for Phase I. Participants included representatives from MoEn, MMPW, MOWR, Marsh Arab Forum (MAF) and the Iraq Foundation. In addition, relevant UN agencies participated including FAO, UNESCO, UNHCR, UNICEF, and WHO, as well as the Italian Ministry of Environment.

The selection process for the Phase I candidate sites for pilot implementation was based on the following criteria:

1. Soliciting proposals from the MoEn, MMPW, MOWR, and MAF, with fact sheets on each candidate site;
2. Applying technical selection 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; and
5. Reaching consensus based on discussion.

The ministries and Marsh Arab Forum presented 18 candidate sites, followed by clarification on 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. After an in-depth discussion, the group reached consensus on six candidate sites: Al-Kirmashiya, Badir Al-Rumaidh, Al-Masahab, Al-Jeweber, Al-Hadam and Al-Sewelmat. Their locations are shown in Map 3 on previous page. In Badir Al-Rumaidh, an existing and broken-down water treatment system was available for rehabilitation.



Access points and common taps installed at all six pilot sites



Access points and common taps installed at all six pilot sites

The representatives of local communities pledged to facilitate access and provide security provisions for pilot implementation. For Phase II-B, UNEP has requested the Iraqi institutions to jointly nominate a community for the drinking water project. Based on the Iraqi nomination, Al-Ghreej village in Thi-Qar Governorate, with a population of approximately 3,000, has been selected for pilot implementation of drinking water utilizing ESTs.

Implementation

Contracts for procurement of goods and services for the pilot project on drinking water provision and sanitation provision were administered by the UNOPS Office in Amman, Jordan under the supervision and coordination of UNEP-DTIE-IETC. In Iraq, the MoEn is the coordinating ministry for the UNEP's project (including pilot projects). Activities for the pilot projects were also conducted through the Ministry of Water Resources (MOWR) and Ministry of Municipalities and Public Works (MMPW). As the public water supply in Iraq is entrusted to MMPW, close coordination was maintained with MMPW in the implementation of pilot project.

UNOPS was responsible for contracting services for the field assessment, design, construction and

commissioning of facilities, as well as contracting the supply, delivery, installation and construction of water supply treatment and distribution facilities.

For Phase I, the supply of clean drinking water commenced in early January 2006 in five sites, following the delivery of EST equipment. At Badir Al-Rumaidh, an existing non-operational water treatment unit was rehabilitated and put back into operation. Distribution pipelines and common water taps were installed in all six villages to improve the access to safe water.

Implementation Achievements

- Installation of water treatment units at five villages (to a total nominal daily capacity of 750 m³/d for new installation) using packaged low-pressure reverse osmosis treatment system – together with the rehabilitation of an existing conventional water treatment plant, which can serve a total population of 15,000-22,000.
- Installation of a water distribution pipeline measuring a total length of 23.01km, with 127 common water distribution points in six villages.

- Training of local residents to operate the water treatment plants.
- The project supported the operation and maintenance for a one-year period following installation. The total cost for implementing Phase I (EST equipment and water supply for six sites) is USD \$4.68 million.
- Arrangements to hand over the facilities to MMPW have been completed. For Phase II-B, similar arrangements for operations and maintenance as well as hand over are planned for 2008.

ESTs for drinking water provision

Waters sources:

Surface water from the marshlands canals and rivers showed brackish water (total dissolved solids in the range of 1,000 to 5,000 mg/L), thereby necessitating the application of technologies for the removal of dissolved salts. This salt-removal process, desalination, is best achieved small-scale by using reverse osmosis membranes.

Conventional water treatment involves the separation of solids by sedimentation to remove suspended solids that can be settled by gravity, also by filtration aided by chemical coagulation to remove both suspended and colloidal solids.

Comparing the costs of the two treatments, the water production costs are higher for membrane filtration due to the energy required to overcome osmotic pressure caused by dissolved salts, and the cost of equipment. Further, chemical pre-treatment and post-treatment are necessary to prevent fouling of filters and to prevent damage to membranes. The actual operating costs of these processes are also dependent on the raw water quality.

Water supply planning:

Planning of the water supply system was based on the following criteria:

- Per capita water supply of 50 litres per day (L/d). Uncertainties regarding the number of families expected to return to communities, due to the restoration of the provision of basic services, has been incorporated in the planning. The facilities have been designed to address the needs of a larger population with a minimum supply of 20 L/d;
- Long-term water supply target of 160 L/capita day);
- Modular design of intake and water treatment facilities for expansion considering long-term water supply target;
- Distribution system was designed by taking into account of long-term target;

Figure 3: Raw Water Quality in the Pilot Sites

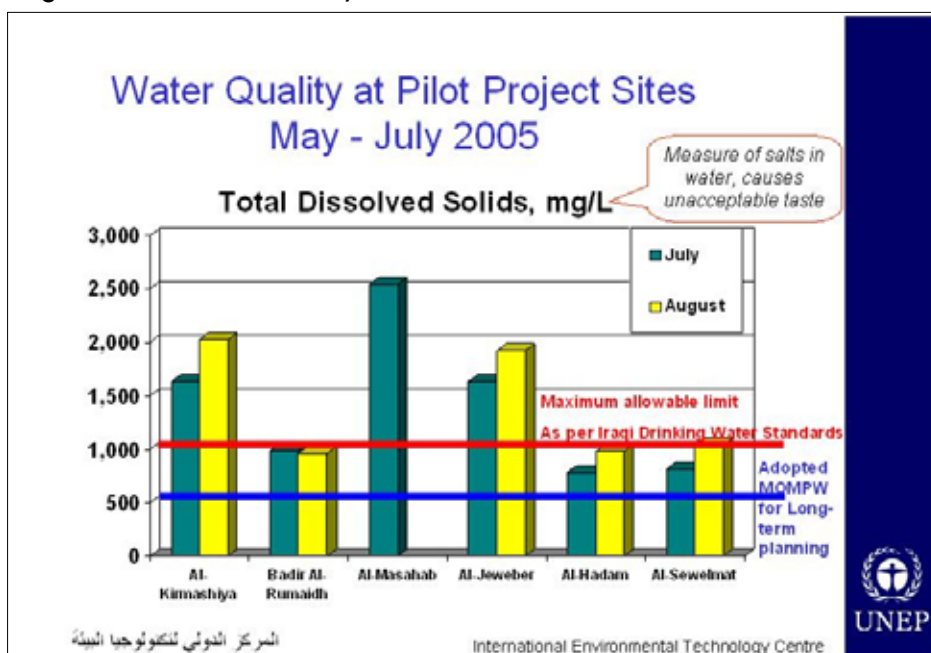
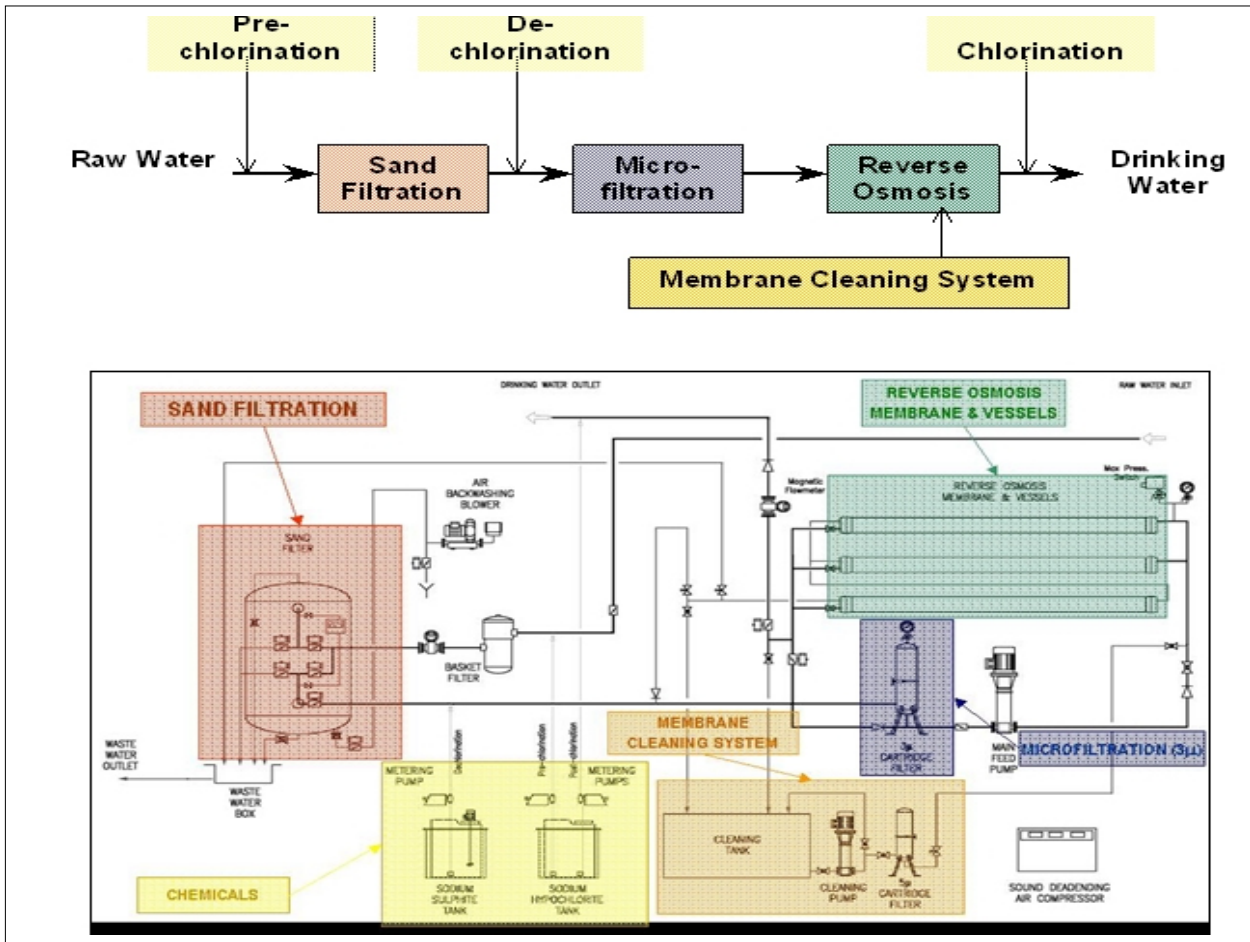


Figure 4: Schematic of Packaged Low-pressure Reverse Osmosis Technology



- Water quality to meet the Iraqi drinking water standards and WHO drinking water guidelines.

A preliminary analysis of the applicability of dual water supply system indicated that the topographic and settlement pattern were not favourable to adopt such a system. The dual water supply system takes into consideration the fact that certain water uses (such as washing, flushing etc.) does not need the high standards of treatment required for drinking and cooking. Within each community, comparisons were made among the single water treatment plant to supply the entire community – versus – multiple, smaller-sized treatment plants distributed throughout the community. Also, alternative treatment processes available for desalination were considered, such as reverse osmosis process and thermal distillation.

Water supply system:

Components of the water supply system that were selected for implementation in five of the communities consisted of:

1. Direct withdrawal of water from rivers and canals of the marshes;
2. Water treatment using packaged low-pressure reverse osmosis process consisting of the following unit processes:
 - Pre-chlorination (with sodium hypochlorite, NaOCl),
 - Pressurized sand filtration,
 - Dechlorination (with sodium sulphite, Na₂SO₃),
 - 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.

The distribution network can be extended when funds become available.

Table 4: Outline of completed facilities for drinking water provision

Pilot Project Site	Al-Kirmashiya	Badir Al-Rumaidh	Al-Masahab	Al-Jeweber	Al-Hadam	Al- Sewelmat
Estimated population	1,500	3,000	2,000	2,500	2,500	3,500
Target service population	2,000	3,100	2,200	4,500	4,600	5,700
Water source	Al-Kirmashiya River, Euphrates River system	Gharraf River, Tigris River system	Al-Hammar Lake, Shatt Al-Arab system	Garmat Hassan River, Euphrates System	Al-Hadam River, Tigris River system	Glory River, Tigris 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	Packaged low-pressure reverse osmosis (RO) process	Packaged low-pressure reverse osmosis (RO) process
Treatment Capacity	100 m ³ /d	1,650 m ³ /d (estimated)	150 m ³ /d	200 m ³ /d	100 m ³ /d	200 m ³ /d
Length of distribution pipeline	3,416 m	4,050 m	3,711 m	4,068 m	4,040 m	3,725 m
Water distrib. method (Number of water taps)	Common water taps along the road at approximately 200 m to 500 m intervals.					
	13	26	17	18	25	28

Completed facilities and their transfer to Iraqi authorities:

An outline of the completed facilities is shown in Table 5 above, and some of the facilities are depicted on the next page.

Technical dossiers containing all the relevant data needed for the operation and maintenance of the plants, including plant specifications, operation and maintenance manuals, and as-built drawings on each of the facilities were provided to the Water Directorate of MMPW. The dossiers will enable MMPW to continue the operations and maintenance of the facilities at a working level.

Two sets of documents were provided to MMPW for each of the five drinking water supply facilities using packaged low-pressure reverse osmosis technology at: Al-Kirmashiya, Al-Masahab, Al-Jeweber, Al-Hadam and Al-Sewelmat. Documents in Set 1 provide an overall description of the water supply system including plant specifications, inventory and the as-built drawings. Documents in Set 2 provide information from the manufacturers of the water treatment equipment on the operation and maintenance of the water supply system.

Relevant information was also included within the technical dossiers for Badir Al-Rumaidh, where

the existing water treatment unit was rehabilitated and water treatment process is based on the conventional flocculation and sedimentation using compact units.

Set 1: Overall water supply system data

1. Plant specifications and inventory:
 - a. Description of the water treatment plant and detailed description of water treatment and distribution unit,
 - b. Equipment data sheets for water treatment and distribution units.
2. As-built drawings of drinking water supply facilities:
 - a. Water treatment and distribution system – general plan,
 - b. Water intake and water treatment plant – plan views, sections, foundations and structural drawings,
 - c. Water treatment and distribution system – P&I diagram,
 - d. Water treatment and distribution system – electrical flow chart,

- e. Water treatment and distribution system – piping arrangement for container 1,
- f. Water treatment and distribution system – mechanical arrangement for container 2, 3 & 4.

Set 2: Manufacturers information for water treatment equipment

Operation and maintenance manuals, information on sources of spare-parts and chemicals, and personnel requirements for operation and maintenance:

Section A: Installation instructions and general description,

Section B: Start up procedure,

Section C: Drawings and electrical schemes,

Section D: Machinery manuals,

Section E: Additional items and spare parts.

Similar arrangements are planned for Phase II-B, to take place in 2008.



The water plant facility at Al-Kirmashiya



The water plant facility at Al-Masahab



The water plant facility at Al-Jeweber

Monitoring and Evaluation

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 organization through a series of four site visits to each pilot community from February to July 2006. 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 at the original locations of their roots, in turn resulting in an increased number of livestock, active production and supply of dairy products, reed related crafts, and other commodities for the main urban market enters, thus, adding to the income generation, employment, and generally, the prosperity of the community.”

ESTs Assessment

An assessment of environmental soundness of the ESTs applied in the provision of drinking water in the six pilot sites is one of the key outcomes for wider implementation

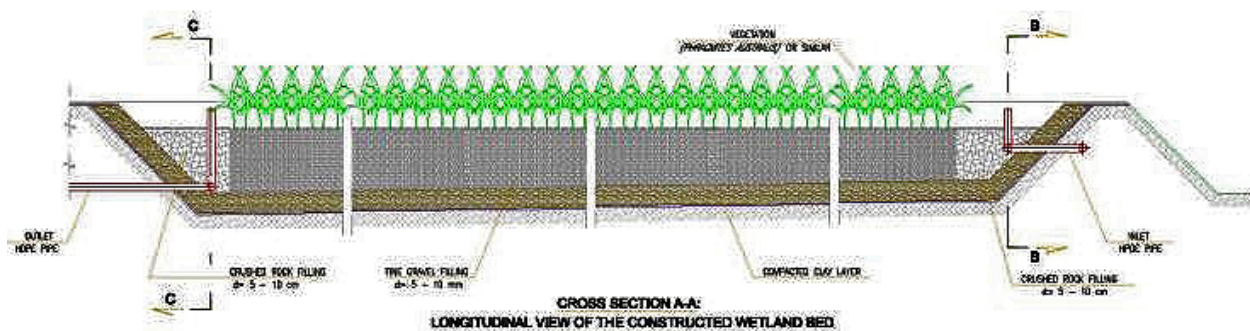
of the technologies within the marshlands, and in the formulation of marshland management plans. Data on the operation of the six marshlands’ plants are currently being analysed in order to provide necessary information.

B. Sanitation Pilot Project

A demonstration system for sanitation was constructed to serve a small community in Al-Chibayish in the Thi-Qar Governorate. The facility implements an EST called “constructed wetlands” and serves approximately 170 inhabitants who face potential health hazards from untreated wastewater discharged into a nearby canal. The facility is designed with a surface area of 540 m², utilizing the sub-surface flow type constructed wetlands in which water flows through gravel beds that are planted with reeds. Organic nutrients and pollutants in the wastewater are removed through biochemical processes in the root zone of the reed plants as well as through the uptake of the plants. Reed stems from nearby marshes were used for planting. Construction of the facility was completed by the end of December 2006 and is now in operation.

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 the community residents. Such support is considered as one of the important criteria 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 is therefore expected to generate relevant data and management experience for wider implementation within the marshlands and beyond.

Figure 5: Schematic of the constructed wetland in Al-Chibayish



C. Marshland Rehabilitation and Management Project

With the consent of the line Ministry (MoEn), the project has reached an agreement with MOWR to carry out field assessments, design, and construction supervision of phytotechnology applications for wetland rehabilitation. The field implementation work for this pilot component was outlined in a *Memorandum of Understanding* signed between UNEP and MOWR/CRIM. Through a field assessment, together with the recommendations to be provided by a meeting of experts, it was agreed to select two of the four sites for groundwork whereby technological approaches such as re-flooding, planting, building and/or restoration of canals etc., may be put into practice to rehabilitate degraded or destructed wetlands in the sites.

To inform the design and assessment of artificial constructed wetlands and wetland rehabilitation/reconstruction, two numerical models were prepared. One is for wastewater treatment (Sub-Surface Flow (SubWeT) and Surface Flow (SufWet), and another one for Wetland Rehabilitation and Reconstruction (WetRestore). To complement the models, the *Handbook on Phytotechnology for Water Quality Improvement and Wetland Management Through Modelling Applications* was also produced with complementary information from the technical workshop aimed to capacitate experts from MOWR, MoEn, MOMPW, and the Iraq Foundation on the use these tools (Amman, Jordan in May 2005).

Through the field assessment, four potential sites have been selected and subsequent assessments by MOWR-CRIM have identified one site for on-the-ground rehabilitation work.

CRIM have been conducting work for re-flooding, planting, building and or restoration of canals plus other technical approaches.

As marshland rehabilitation requires a longer-term horizon for continued management, MOWR-CRIM is expected to continue with the activities related to wetland rehabilitation and reconstruction. Additional marshland management work is expected to take place during Phase III in 2007 and 2008.

D. Lessons learned

The main lessons learned from this project thus far, include the following:

- 1. Recognize the urgency and high expectations for basic services from the local residents:** The overwhelming and priority need for the local residents has been the restoration of basic services. However, previous data collection and assessment work, while necessary, had not improved the situation on the ground. Such delay in the relief provision by Iraqi and international institutions, both perceived and real, created anxiety and high expectations among the local residents when the UNEP project commenced. Until the drinking water facilities were put into operation, issues impacting project implementation, such as border closings and curfews, among others, created anxiety and wariness among the local residents. Recognition of such urgency and importance of striving for timely completion of projects when responding to urgent basic human needs, like the provision of drinking water, cannot be overemphasized.
- 2. Address potential for local-level competition through dialogue and project endorsement at the community/governorate level:** As the project progressed, expectations of the residents became higher and articulated, in part, due to community rivalry. Implementation and continued operation of the facilities constructed under this project have experienced a delicate balancing act, as the communities and tribes tended to compete for the limited resources available. Examples include competition among the tribes for the employment opportunities available for the operation of water treatment plants, strong requests for additional layout of water distribution pipelines, and difficulty in reaching agreement for the selection of households for sanitation demonstration. Such competition had a tendency to undermine the key benefit of access to safe drinking water. The project's policy and practice of involving various stakeholders, such as representatives of the Marsh Arab Forum and the governorates, have helped to resolve most of these issues that occurred during implementation. Additional measures have also become necessary to

address security problems, i.e. construction of concrete block walls around the water treatment units instead of wire-mesh fencing. While changing expectations cannot be avoided completely, “endorsement of projects at governorate and community level in addition to the line ministry for supporting projects” is effective and crucial in resolving such situations.

3. Accommodate procurement and tender process in Arabic:

There had been delays in the procurement and tender process, due to limited interests and poor response received to the procurement notice posted in the UNDG Iraqi Trust fund website. Some Iraqi institutions, particularly at the governorate and local levels, have complained about the lack of Arabic information on the procurement, which they stated was a limiting factor for some Iraqi contractors to either apply, or to provide more thorough information to support their applications. The accommodation of the Arabic language in the procurement and tender process is strongly encouraged to increase the participation of qualified vendors and service providers.

4. Facilitate interactions among local communities and national ministries:

The project has continued to involve local communities, governorates, and national ministries in various activities, including the decision of where to carry out pilot projects, how to divide responsibilities for plant operations, and how to develop a longer-term plan for marshland management. In various meetings and training sessions, the participants often 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 realise such interactions has been greatly appreciated. Such dialogue is necessary, as each institution has different priorities and responsibilities, as well as distinct insight and resources to offer. Also, there is a need to diminish mistrust and unrealistic expectations placed on other stakeholders, which can only be achieved through direct interactions and dialogue. UNEP will continue to use this model of promoting dialogue and interactions.

5. Incorporate measures to lesson project impacts from governmental changes:

Transfer of facilities to MMPW encountered delays due to the late appointment of the new Minister of MMPW, following the December 2005 elections. As the project included a one-year period of operation and management of the facilities by the contractor following start-up of operation, such provision has, to a certain extent, offset situations that could have occurred due to delay in transfer.

6. Improve awareness about the need to improve sanitation through a demonstration facility:

Difficulties and delays were encountered in implementing the sanitation system for demonstration due to security concerns in one of the six sites. Implementing sanitation systems for demonstration involved working with individual households in a cluster within the community. Consent on the selection of the cluster could not be obtained. While sanitation conditions within the six communities are in need of improvement, convincing the communities on the need to improve sanitation remains a challenge that needs to be addressed in the future.

7. Understand administrative requirements of partner institutions:

The project experienced significant delay in the transfer of funds within one of the line ministries (MOWR to CRIM) as the implementing body to undertake the project. This was due to the lack of effective mechanisms for expeditious internal fund transfer. Although the funds were not made available to CRIM, CRIM nevertheless undertook the initial field assessment using its own scarce funds, allowing for the identification of the potential sites. This was done despite security problems in the region and uncertainties about the project implementation. To ensure the efficient implementation of the project, it is crucial to know the existing ministerial policies and regulations to release funds for activities from external sources in a timely manner. There is a need to strongly interact with high-level authorities in the line ministries to approve and execute such fund release in line with the policies and regulations of the receiving institution.

11.3 Capacity Building and Awareness Raising

Identifying and implementing technical and policy responses for sustainable marshland management requires adequate human and institutional capacity. To help address this necessity, the project has been providing capacity building opportunities in multiple areas that are deemed necessary to develop a crosscutting response to sustainable marshland management.

For each training programme, the project has selected participants from key government agencies, governorates, and representatives of communities, with profiles of suitable candidates to suit the training objectives and contents.

Courses were designed using the 'train the trainers' model. In this way, participants were able to impart knowledge acquired to their colleagues, and organize secondary training courses. UNEP has provided support for such secondary training courses inside Iraq, including provision of training materials and funding for course organization. Training manuals were prepared in Arabic and

English. The training manuals are published in hard copy versions and are also freely available to download in either language at:

<http://marshlands.unep.or.jp>

Training outside Iraq

Courses with international lecturers and relevant case studies were organized outside Iraq. Some courses emphasized policy-making and management, while others mainly provided technical aspects.

Courses consisted of lectures, demonstrations, and group exercises conducted in both English and Arabic. Participants took an active part in discussions and other activities. Most courses included site visits. For example, during a course on wetland management organized in Cairo, there was a field trip to Egypt's Lake Manzala, 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 learned about EST options for household sanitation.



Visit to a wastewater treatment plant



Visit to a reverse osmosis plant

The approximate 300 training course participants included nominated officials from the Iraqi MoEn, MOWR, and MMPW, together with representatives from the southern governorates, marshlands communities, and academic institutions.

Policy and Institutional Training

Sound environmental management of marshlands requires policy and institutional frameworks that incorporate water and wetland management, based on the integrated water resource management (IWRM) approach. The relevant Iraqi authorities, decision-makers within communities, and NGOs have limited understanding of such frameworks or how to formulate practical policies and strategies. Initiatives for marshland management must also be anchored in local communities. To address this need, the project conducted the following training courses under Phase I and Phase II:

1. **Water Quality Management:** Provided participants with relevant policy and institutional information on how to manage water quality, including: standard setting, monitoring, enforcement and management plan development. Held 6-17 December 2004 in Shiga, Japan, in partnership with International Lake Environment Committee (ILEC), WHO-Iraq, UNEP GEMS-Water, and Shiga Prefecture.
2. **Integrated Water Resource Management (IWRM): Policy and Integration:** Improved the understanding and capacity of national experts, government officials, and local authorities to work with IWRM concepts, principles, and applications. Held 4-9 April 2005 in Amman, Jordan, in partnership with American University of Beirut and UN Economic and Social Commission for Western Asia (UN ESCWA).
3. **Community Level Initiatives:** Addressed ways to raise public awareness of marshlands environmental issues and how to engage and support communities. Participants included community leaders and officials involved in community outreach. Held 11-16 June 2005, in Alexandria, Egypt, in partnership with UNEP Regional Office for West Asia, Centre for Environment and Development for the Arab Region and Europe (CEDARE).

4. Wetland Management: Examined policy and management topics for sound wetland management including institutional, legal, conservation, socio-economic and economic elements, basin-level management and community participation. Held 19-26 June 2005, in Cairo, Egypt, in partnership with Cairo University, Secretariat of the Ramsar Convention, Wetlands International, and International Agricultural Centre.

Technical training

Identification, implementation and management of EST options to provide water, sanitation, and marshland water quality management require specific skills development. These were addressed in the following training programmes:

1. Sustainable Sanitation: Provided practical technical information prior to 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. Held 6-17 December 2004 in Shiga, Japan, in

partnership with the Global Environment Centre Foundation (GEC), Osaka City and Prefecture, and Japan International Cooperation Agency Osaka International Centre.

2. Phytotechnologies for Wetland Management: Provided technical guidance on the use of plants and vegetation to manage wetlands conditions and water quality, in preparation for the pilot implementation of this technology in the marshland communities for water quality management and sanitation. Held 6-16 December 2004 in Cairo, Egypt, in partnership with Cairo University.

3. ESTs for Drinking Water Provision: An introduction to the applications of ESTs for safe drinking water, responding to the need to equip Iraqi engineers, public officials, and other stakeholders with adequate knowledge and tools to implement appropriate ESTs. Held 16-27 May 2005 in Osaka and Shiga, Japan, in partnership with the Global Environment Centre Foundation (GEC), Osaka City, and Maibara City.



Community-level initiatives training

4. **EST Assessment Methodology and Implementation:** Capacitated national experts, government officials, and local authorities on protocol for pilot assessment and evaluations to assess the suitability of the EST options from various angles. These included technical suitability, environmental impacts, community acceptance, maintenance needs, and ease of operations. Held 1-3 December 2005 in Damascus, Syria, in partnership with UNEP Regional Office for West Asia and Arab Centre for the Studies of Arid Zones & Dry Land (ACSAD).
5. **Drinking Water Provision with Environmentally Sound Technologies (ESTs) and Water Quality Management:** 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. Held 6-15 December 2006 in Shiga, Japan, in partnership with the Global Environment Centre Foundation (GEC) as part of Phase II-B activities.

The project has also conducted study tours to provide opportunities to examine first-hand various community level actions and capacity building activities, and EST applications.

Data Management training

The project also supported the following data management training:

1. **Application of Remote Sensing and GIS for Marshland Assessment and Monitoring:** Taught participants how to provide timely information on restoration activities using remotely sensed satellite imagery. Highlighted the benefits of this approach to monitoring, assessing and empirically quantifying changes on a near real-time basis include cost effectiveness, a global perspective, and repeatable and systematic survey methods. Held 6-10 February 2005 in Amman, Jordan, in partnership with International Institute for Geo-Information Science and Earth Observation (ITC), and UNEP Post Conflict Branch.
2. **Marshland Information Network (MIN):** Taught information managers, IT officers, technical editors and engineers to use

the EST system developed by IETC. Each organization represented created its own website, which can now be used for information sharing through the MIN. Held 27-31 March 2005 in Amman, Jordan.

3. **Marshlands Information Network (MIN):** Additional technical information to IT managers and data analysts as part of Phase II-A. Held April 2006 in Bahrain, in partnership with UNEP Regional Office for West Asia.
4. **Advanced Marshlands Information Network (MIN):** Training and technical meeting provided training 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 marshlands. Held 27-30 June 2006 in Shiga, Japan, as part of Phase II-A.

Training Inside Iraq

The project has also organized six training courses inside Iraq, in cooperation with the Ministry of Environment (MoEn), the Ministry of Water Resources (MOWR), and the Universities of Basra and Thi-Qar. UNEP has provided financial support as well as the training materials in Arabic and English to enable successful replication of training courses inside Iraq. Persons that have participated in the project training courses held outside Iraq have helped to organize and deliver lectures.

These courses support Iraqi institutions in increasing their internal capacity to organize and deliver such training programmes with multiplier effects. Some courses also provided a first-hand opportunity for participants to visit the actual sites of the pilot project implementation. As of the end of 2006, over 100 Iraqis have participated in training courses held inside Iraq.

International Workshop on Iraqi Marshland Management

This workshop was organized to take stock of the conditions of the Iraqi marshlands from an environmental, water resource and socio-

economic perspective. Also to analyze 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. Held 8 December 2006 in Kyoto, Japan.

Communication Booklet

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 is available as hard copy and an electronic copy.

Supporting Production of BBC 'Eden Reborn'

Utilizing extensive film footage collected during Phase I, the project has supported the production of a documentary for international broadcast on the BBC, as part of the Earth Report series by TVE – as well as a short Video News Release for distribution to international news broadcasts. The BBC Earth Report on the Iraqi marshlands was broadcast around the world, starting in November 2006.

Main Findings

The project took care to organize targeted training to correspond with 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, and/or analyse various tasks undertaken within the project framework.

The Iraqi side also raised concerns that too many meetings and training programmes were organized with little visible change inside Iraq, or opportunities 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.

Analysis of participant evaluations has shown that suitable capacity building initiatives were found to have the following components: (1) contain a large proportion of case studies and hands-on exercises and less direct lectures; (2) should

provide additional training in response to interest in learning more about the subject; and (3) be longer in duration, preferably at least 2 weeks.

Lessons Learned

- Efforts should be made to use Arabic training materials and lectures to improve learning. It is especially required for training targeting local level officials and communities.
- Using trained personnel to organize training inside Iraq is particularly effective in allowing UNEP to reach a larger number of participants in need of practical knowledge about marshland management.
- Unless specifically requested as a priority with clear explanations, stand-alone training programmes (i.e. training when there are no potential opportunities available to apply the newly gained knowledge in the near future) should be avoided.

11.4 Community Level Initiatives in Three Governorates

Background

Meaningful improvement of the marshlands must include community support and initiatives, as communities and residents must be an integral part of marshland management framework. UNEP therefore introduced small-scale community level initiatives in the three southern governorates of Basra, Thi-Qar, and Missan during Phase I. Based on proposals submitted by each governorate; the following initiatives have been carried out with UNEP support. Additional community level initiatives are being implemented in 2007, as supported by Phases II and III.

Key Activities and Outcomes

Basra governorate

The environmental awareness campaign for Marsh Arabs that launched in Basra, consisted of ten public meetings focussing 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 (Basra division) in collaboration with the University of Basra, religious leaders, tribal chiefs, and local organizations. Basra's Governing Council provided oversight and support where necessary.

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 Basra, in order to fully engage the community from different angles (e.g. religious, scientific, political). The common goal, to convey a coherent message that the 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 organizations with which they could work in the future.

Thi-Qar governorate

The Marsh Arab Council of Thi-Qar undertook an 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). The use of poison as a means of fishing is widespread within the marshlands, as a large numbers of fish can be killed cheaply and quickly utilizing this method. However, since poison is a pollutant it poses 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 MoEn sought the assistance of the newly trained tribal chiefs and religious leaders to help explain the adverse affects associated with fishing by poison to local fishermen and their families. The overall rationale behind the campaign was to begin to create an atmosphere in which using poison for fishing will become unacceptable within marshlands society and eventually lead to the elimination of this practice.

Missan governorate

The initiative to develop an understanding among marshland residents in Missan on the importance of the marshland ecosystem had two components:

- The first was a project for religious leaders, consisting of an intensive five-day course in which participants were exposed to the environmental problems facing the marshlands. Issues addressed included the adverse affects on human health that fishing with poison inflicts and the damage caused by dumping waste directly into the marshes. The goal of the course was to make religious leaders aware of the environmental problems that can be improved through behavioural changes. Religious leaders were targeted as their daily interaction with the larger community could help spread environmental issues to a wider audience.
- The second was a training course for young people, on the importance of the marshlands environment. The purpose of this course was 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. As needed, the Missan Governing Council provided oversight and support.

In Phase II, UNEP is conducting community level initiatives related to women, health, and the marshland environment, in partnership with an NGO and Basra University. Practical sessions and hand-on demonstrations of marshland management and sanitation practices have been organized in 15 communities in the marshlands, with follow-up visits by Iraqi advisors.

Lesson Learned

Small projects at the local level make big impacts. While these community level activities were carried out with modest budgets and are both labour and time-intensive to administer, they generated a significant and visible positive impacts within the communities, as well as fostering a better understanding and support for larger project components (particularly the water and sanitation provision). In addition, as these community initiatives were targeted to build better awareness about marsh environment among the

local population, they are also contributing to the longer-term goal of this project (i.e. marshland management and local sustainability). With this lesson learned, UNEP plans to continue including similar local initiatives for future projects.

11.5 Data and Information Management

Background

The project supported various data and information management activities under Phase I and Phase II, to address the need for objective and reliable data as well as management systems. Specifically, Phase I has established the Marshland 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. Phase II-A supported the expansion of this 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.

The Marshlands Information Network (MIN)

The MIN is solving the problem of limited availability of environmental and social information about the marshlands. It provides a forum for information and data sharing. Network users may include: officials from the MoEn, MOWR, MMPW; experts including those involved with academic institutions; representatives of the southern governorates; and individual communities. All institutions taking part in the marshlands' restoration and management have access to this cost-effective, Internet-based tool through a version of the Environmentally Sound Technology Information System (ESTIS) in Arabic. ESTIS is an innovative, multi-language e-service developed by IETC in 2003.

To facilitate active engagement of local stakeholders and data sharing/management, Phase I has provided MIN server equipment in five locations – four in the MoEn offices in Baghdad, Basra, Missan and Thi-Qar, and one in the Centre for Restoration of Iraqi Marshlands (CRIM) of the Ministry of Water Resources.

Under Phase II-A, the project has established additional MIN nodes at key Iraqi institutions, such as MMPW and Thi-Qar University. For more information, see:

http://www.estis.net/communities/min_eng/

The Iraqi Marshlands Observation System (IMOS)

The Iraqi Marshlands Observation System (IMOS) monitors the extent and distribution of re-flooding developments and associated changes in vegetation cover. Systematic assessment of ongoing changes is essential to obtain a better understanding of the dynamics and, ultimately, the level of success of the wetland recovery process. The IMOS is a pragmatic decision-making support tool that assists stakeholders in modifying and adapting restoration plans in a timely manner, based on valid scientific information.

In the spring of 2006, UNEP organized a two-week training and handover workshop in Geneva, to transfer scientific knowledge obtained using the IMOS to partner organizations in Iraq. These included the Centre for the Restoration of the Iraq Marshlands within the Ministry of Water Resources, and Nature Iraq/Iraq Foundation.

The purpose of the handover 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. For more information on the IMOS, see <http://imos.grid.unep.ch>.

Water Quality and Biodiversity Monitoring

The Water Quality Monitoring Programme has been implemented to collect and analyze baseline data for environmental conditions within the Iraqi marshlands, especially in communities selected for pilot water and sanitation implementation of water and sanitation provision. The work was implemented through a Memorandum of Understanding (MOU) with the Ministry of Environment, Iraq. MoEn collaborated with Ministry



Water quality field survey

of Water Resources, Marsh Arab Forum and Nature Iraq/Iraq Foundation in the execution of the work. Sampling surveys were conducted five times during April 2005 to December 2005.

In all samples collected, the presence of high levels of total dissolved solids (TDS) and fecal coliform was reported. The concentrations of these pollutants were above the drinking water quality limits, indicating the necessity to treat the marshland water for human consumption. As such, efforts to provide treatment facilities for drinking water provision in the marshlands are recommended in order to protect human health.

Trace pollutants including PAHs, pesticides and heavy metals in the water samples were found to be within the WHO and US Environmental Protection Agency water quality limits for use as raw water source. No radiation was detected in the samples collected.

The diversity and richness of phytoplankton, fish, macrophytes and macrobenthos populations showed an increasing trend between May 2005 and September 2005 in all sites, indicating an

increase of biological communities. While longer-term monitoring and analysis is necessary to determine the level of recovery of the marshlands, these results give an encouraging snapshot of the environmental conditions of the area, and may be indicative of the recovery and improvement of biological communities of the Iraqi marshlands. Heavy metals contents of the sediment samples collected were found to be within acceptable limits of the European Union soil standards for heavy metals (EC Directive 86/278/EC). The concentrations of pesticides and PAHs were detected at low levels. No radiation was detected in the samples collected.

This extensive analysis was carried out during a relatively short period, and may form a basis for improvement of subsequent monitoring and for the monitoring of ecosystem recovery of marshlands. As the marshlands re-flooding and re-vegetation conditions continue to change, periodical monitoring of water quality and biodiversity is recommended to assess the conditions and the trends of marshland ecosystem recovery, and to protect the health of marshland residents who have returned to these villages.

Cooperation with the Government of Iraq in data sharing and management

Phase II-A of this project has supported data collection and assessments and efforts to convert existing data and results that are relevant for marshland management by the Iraqi partner institutions as follows:

- MoEn: water quality and biodiversity data,
- MOWR: hydraulic and hydrological data,
- MMPW: land use, demographic, other related data.

In June 2006, as a Phase II-A activity, IETC organized a meeting with technical experts from the Iraqi MoEn, MOWR and MMPW. The meeting's overall purpose was:

- To assist Iraqi ministries in effectively analysing, presenting, and sharing available data using the Marshlands Information Network (MIN);
- To develop a strategy for initial data collection efforts concerning basic demographic and socio-economic data and solid waste management in the marshlands.

At the meeting, Iraqi officials, in collaboration with IETC staff, accomplished the following:

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

UNEP and each ministry subsequently signed a Memorandum of Understanding to carry out the data analysis work and to manage the MIN sites with additional data. The ministries have uploaded numerous reports and analyses, which were previously

unavailable for review. For example, MOWR has made available various reports on project field surveys, such as historical changes using remote sensing, report of Al-Huwaizeh marsh restoration, and updates on the re-flooding of the marshes.

Under Phase II-A, the project also commissioned two surveys at the community level: A survey to collect data on demographic and socioeconomic conditions, and a solid waste management survey. The surveys were carried out by the University of Thi-Qar using UNEP's guidance and advice from MMPW. They were designed to fill the gaps in data availability for community-level living conditions and waste management practices.

In addition, the project has 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 that are in use, and to evaluate their compatibility and comparability. The analyses formulated recommendations on how to share data based on a three-tier data system. The project has also explored the feasibility of integrating the MIN platform with the web-based GIS system, which is being established at the Iraqi ministries with bilateral support from the Government of Italy.

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

Lessons Learned

Basic data and scientific analysis are still lacking and are important for sound policy and strategy formulation. It is necessary to collect and analyse

basic scientific and technical data to evaluate marshland conditions, and formulate policies and strategies to mitigate negative conditions. UNEP has carried out water quality and biodiversity analysis, assessment of re-flooding and vegetative recovery, and has supported an information system to share such data and analytical tools. While such activities are time-consuming and are sometimes perceived as outside the agency's local implementation track record, the project has taken the strategy to allocate adequate resources and time to undertake them, and publicly share the information.

Based on such data and analysis, UNEP and other initiatives are able to more accurately identify: (a) ecologically sensitive areas that may merit further protection, (b) areas where the recovery is robust enough to be considered further for resettlement, (c) degrees of fluctuations in water quality and other indicators that may inform what

types of technological interventions are necessary to provide clean water and sanitation, (d) begin to analyze scenarios of environmental and socio-economic response to policy interventions (i.e. how realistic it is to expect vegetative and biodiversity recovery in certain areas where an agency may be considering to re-establish basic services; what measures may be considered further to achieve a certain level of water quality in a location; and what level of population can be served by such interventions, etc.).

The importance of such analysis cannot be overemphasized for the sustainability and medium to longer-term fulfilment of development goals of Iraq and its people. Failure to support such activities, or not requiring more thorough analysis for individual projects, may ultimately undermine the soundness of many fast-track and short-term interventions that are taking place or planned for the future.

12 Project Achievements

The United Nations Environment Programme has been active on projects relating to Iraq since March 2003. 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.

In terms of tangible outputs delivered by UNEP projects and their impact on the environment in Iraq, the following are worth mentioning:

1. The Iraqi Ministry of Environment, which in 2003 was a young organization whose staff had mostly not been exposed to international best practices on environmental governance, is now fully linked to external peer groups by individual and institutional contacts. The ministry has also established cooperation and coordination on a range of topics with other relevant national ministries, governorates, and local institutions. Such development was made possible by the series of targeted training programmes which reached approximately 800 representatives from the Ministry of Environment, Ministry of Water Resources, Ministry of Municipalities and Public Works, as well as governorates and local communities on a range of environmental topics such as environmental impact assessment, biodiversity management and emergency response, water quality management, wetland management, sustainable sanitation, integrated water resource management, and community level initiatives.
2. The Government of Iraq is also now institutionally linked to counterpart institutions in Iran, ROPME, UNEP and number of international organizations and conventions.
3. Immediate relief has been provided to vulnerable populations living in environmentally sensitive areas – up to 22,000 people in the Iraqi marshlands now have access to safe drinking water, using environmentally sound technologies, and suitable approaches for sanitation and marshland management options have been demonstrated.
4. Community groups have been empowered and recognized as legitimate stakeholders in environmental management. Community-level initiatives for marshland management have been conceptualized, developed, and implemented with UNEP support.
5. A modern environmental information centre has been set up and staff trained on gathering, classifying and distributing environmental information. Consequently the ministry staff and other interested parties in Iraq have access to up-to-date information on the environment through textbooks as well as international databases.
6. The Marshland Information Network has been established among the Iraqi ministries, governorates, local groups, academia, and international organizations – enabling the exchange of data and analysis, and facilitating communication to move towards the development of a marshland management plan.
7. Objective data on various aspects of marshlands conditions (such as water quality and biodiversity, vegetative and water cover, socio-economic and demographic surveys) have been collected and analysed within the framework of the marshland conditions. Such work, largely carried out by Iraqi partner institutions is useful to inform sound management decision-making based on scientific analysis.
8. A donor coordination mechanism was established and endorsed by Iraqi and international institutions involved in marshland management. UNEP was selected as a liaison to facilitate coordination.
9. Work is in final stages for setting up a modern environmental analytical laboratory in Iraq and training staff on modern analytical techniques.
10. Assistance was provided for development of a new Framework Environmental Law. A draft is now available and when this is processed through the legislative system, Iraq will have a modern environmental legislation, among the best in the region.

11. With equipment, protocols and training provided by UNEP, officials of the Ministry of Environment and other institutions in Iraq were able to undertake field assessments at a number of contaminated sites. This has provided specific information on contamination of those sites as well as experience to the staff in continuing with such investigation at many more such sites in Iraq.
12. Based on the results obtained on site assessment, two site clean-up projects were initiated. The clean-up project minimized the immediate danger to public health from the two locations and provided training to local employees on undertaking environmental clean-up.
13. The entire project was undertaken with careful planning on health, safety and security. This, on one hand, ensured that there were no health, safety or security incident during the implementation of the training, and on the other, introduced Iraqi officials to best international practices on health and safety.
14. UNEP initiatives, particularly on the Iraqi marshlands, generated significant press coverage and good news about Iraqi reconstruction. Through extensive coverage by the BBC – Earth Report and other major media coverage, UNEP raised international awareness on the Iraqi environment and efforts to promote sustainable development initiatives even under difficult conditions.
15. The UNEP approach was recognized and supported by Iraqi institutions and communities. Local communities have officially commended UNEP as one of the only international organizations that have made a difference on the ground and improved the lives of the people. The Ministry of Environment has also recognized the Iraqi marshlands project as a model case of technical cooperation.

Appendix I: List of References and Internet Sources

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- 3) http://www.globalsecurity.org/military/world/iraq/images/iraq_usmc-book_topo-map.jpg
- 4) <http://www.fao.org/ag/agl/aglw/aquastat/countries/iraq/index.stm>
- 5) UNEP. 1991. *A Rapid Assessment of the Impacts of the Iraq-Kuwait Conflict on Terrestrial Ecosystems*
- 6) <http://www.fao.org/WAICENT/FAOINFO/AGRICULT/AGP/AGPS/Pgrfa/pdf/iraq.pdf>
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- 11) (Partow, 2001)
- 12) (AMAR, 2001; UNCHR, 1996)
- 13) <http://www.unep-wcmc.org/cgi-bin/padb.p>
- 14) http://www.birdlife.net/news/iraq_iba_chapter.pdf
- 15) UNEP. 1991. *A Rapid Assessment of the Impacts of the Iraq-Kuwait Conflict on Terrestrial Ecosystems*.
- 16) <http://www.redlist.org/>
- 17) <http://www.birdlife.org/species/index.cfm?GeoRecID=102>
- 18) <http://www.wetlands.org/inventory&/MiddleEastDir/IRAQ1.htm>
- 19) UNEP. 1991. *A Rapid Assessment of the Impacts of the Iraq-Kuwait Conflict on Terrestrial Ecosystems*.
- 20) <http://www.wetlands.org/inventory&/MiddleEastDir/IRAQ1.htm>
- 21) http://pdf.wri.org/watersheds_europe_p2_62.pdf
- 22) This did not include the Kurdish region, autonomous since 1991. In the three northern provinces of the Kurdistan Regional Government, environmental matters were dealt with by the Ministry of Health and Social Affairs.
- 23) <http://www.washingtonpost.com/wp-dyn/articles/A15118-2003Apr2.html>
- 24) http://www.defenselink.mil/news/Mar2003/t03312003_t0331asd.html
- 25) For background information on UNEP's work on depleted uranium, see:
<http://postconflict.unep.ch/activities.htm> - du
- 33) (United Nations, 2003)
- 34) (US AID, 2004)

Appendix II: List of equipment provided

A.1 Portable Equipment Procured for Iraq Ministry of Environment

Equipment Details	Ref. No.	Qty. Purchased
Interface meter	004/04	3
Standard dipmeter		5
Bailer Box(24)		9
Auger set	008/04	2
Single Edelman auger		10
Packing		1
Troll 9000	005/04	3
P/h ORP sensor		3
Conductivity sensor		3
Dissolved oxygen sensor		3
Quick Cal kit		3
Troll Quick connect cable		3
Rugged reader		3
Win Situ software		3
Hard carry case		3
Field test kits		
Contents are filed.		
PID analyser	009/04	2
PID analyser		2
PID analyser		2
Landfill gas analyser	010/04	2
GA 2000 Intrinsically safe infra redgas analyser		2
GA 4.1 Inlet port filter		2
GA 4.2 Inline water trap		2
Hard disk		1
PC		1
Computer accessories(six each)		1
Iraq map	003/04	1
Plan(map) printouts	001/04	30
Sony DSC-P73		6
Laptops		6
Software		6
Camcorders		5
GPS		5
Data show type	011/04	1
Hard hat		11
Safety goggles		11
Safety shoes		11
Safety gloves		11
Coveralls		11

A.2 Major Laboratory Equipment

Major Equipment Items for Iraq Laboratory				
Item	No.	Analysis/ Parameters	Detection Limits Soil	
1	ICP OES with ultra sonic nebuliser	1	Metals - Al, As, Be, Cd, Cr, Cu, Ca, Mg, Mn, Fe, Ni, Pb, Se, Si, Zn, Hg, Sn, Na, K, Co	Between 0.5 - 5 mg/kg
2	MSD plus liquid injector	1	PAHs PCBs Pesticides Chlorophenols	10 ug/kg 10 ug/kg 10 ug/kg 10 ug/kg
3	MSD plus headspace unit	1	BTEX Volatile chlorinated Volatile aromatics GRO SVOCs	1 ug/kg Between 10 and 1000 ug/kg
4	GC system plus liquid injector and FID	1	TPH (speciated)	1 mg/kg
5	HPLC system, plus detectors (different for different analyses)	1	Amides, nitriles Explosives Phenols	10 mg/kg Various 100 ug/kg

A.3 Minor Equipment Items for Iraq Laboratory

	Item	No.	Purpose
1	Infra red spectrophotometer	1	TPH screen
2	Hotplate	2	Acid digestion for metals analysis
3	4 place balance	1	Analytical balance for preparing standards
4	Ultra sonic bath	1	Solvent extraction of soils
5	Small lower temp hotplate and evaporating lines plus pump (Mini vap)	1	Reducing solvent volume
6	Filter papers	1000	Removing suspended solids
7	Potentiometer plus electrodes:	1	Anion analysis
	cyanide, fluoride, nitrite, sulphide, ammonia	10	Two of each
8	Fume hood plus:	2	Safety of staff
	filters for solvents	2	
	filters for acids	2	
9	Water purification system (basic)	1	Removing ions from tap water
10	Water purification system (high purity)	1	Removing ions from tap water
10	Flame photometer	1	Analysis of Na and K
11	COD apparatus	1	Analysis of COD on waters
12	Cool boxes and ice packs	50	Cooling and storing samples
13	Certified Reference Materials for:		
14	Soil - metals		Validating methods
	Soil - PCBs		Validating methods
	Soil - EPH		Validating methods
	Soil - pesticides		Validating methods
	Soil - PAHs		Validating methods
	Soil - cyanide		Validating methods
	Liquid standards for -		
15	- metals	2	Calibrating instruments
	- VOCs		Calibrating instruments
	- PCBs		Calibrating instruments
	- EPH		Calibrating instruments
	- pesticides		Calibrating instruments
	- PAHs		Calibrating instruments
	- cyanide		Calibrating instruments
	Centrifuge - up to 3600 rpm plus accessories		Separating solids Rotor, buckets etc
16	Gastight syringes for GC and GCMS	10	Measuring small volumes for injection
17	Refrigerators	6	Storing samples and standards
18	40 ml vials for volatile sampling	1000	Sampling waters for VOCs
19	Misc sampling bottles (1 year)		Sampling
20	Vials for GC and GCMS system		Crimp capped vials
21	Solvents for extraction DCM	50	2.5 l winchesters
22	Solvents for extraction hexane	50	2.5 l winchesters
23	Misc glassware		Sample prep
24	Misc chemicals/consumables		Analysis
25	Inverted microscopes	2	Bacteriological work
26	Hydrogen gas generator	1	Instrument carrier gas

A.4 Equipment Items under Iraqi Marshlands Project

List of portable water quality measuring equipment transferred to the Ministry of Environment

	Item	No.	Purpose
1	Troll 9000	3	Water quality monitoring of marshlands
	pH sensor	3	Water quality monitoring of marshlands
	ORP sensor	3	Water quality monitoring of marshlands
	Conductivity sensor	3	Water quality monitoring of marshlands
	Dissolved oxygen sensor	3	Water quality monitoring of marshlands
	Quick Cal kit	3	Water quality monitoring of marshlands
	Troll Quick connect cable	3	Water quality monitoring of marshlands
	Rugged reader	3	Water quality monitoring of marshlands
	Hard carry case	3	Water quality monitoring of marshlands

List of facilities to be transferred to the Ministry of Municipalities and Public Works

- Al-Kirmashiya (ةيش امركلأ) – Thi-Qar Governorate
- Badir Al-Rumaidh (ضي مرلأ رذب) – Thi-Qar Governorate
- Al-Masahab (ب ح س ملأ) – Basrah Governorate
- Al-Jeweber (ر ب ي و ج لآ) – Thi-Qar Governorate
- Al-Hadam (م اد ملأ) – Missan Governorate
- Al-Sewelmat (ت ام ل ي و س لآ) – Missan Governorate

Name of Community	Al-Kirmashiya	Badir Al-Rumaidh ^{*1}	Al-Masahab	Al-Jeweber	Al-Hadam	Al-Sewelmat
Capacity of water treatment plant	100 m ³ /d	1,650 m ³ /d (estimate)	150 m ³ /d	200 m ³ /d	100 m ³ /d	200 m ³ /d
Water treatment equipment	Packaged low-pressure reverse osmosis (RO) process equipment	Conventional sedimentation/ filtration (Existing compact unit)	Packaged low-pressure reverse osmosis (RO) process equipment	Packaged low-pressure reverse osmosis (RO) process equipment	Packaged low-pressure reverse osmosis (RO) process equipment	Packaged low-pressure reverse osmosis (RO) process equipment
Water source	Al-Kirmashiya River, Euphrates River system	Gharraf River, Tigris River system	Al-Hammar Lake, Shatt Al-Arab system	Garmat Hassan River, Euphrates System	Al-Hadam River, Tigris River system	Glory River, Tigris River system
Length of distribution pipeline	3.7 km	3.9 km	3.9 km	3.9 km	3.9 km	3.7 km
Common taps for water distribution	Total of 86 common water collection points.					

Note *1 : Existing compact unit was rehabilitated under this project.

List of Marshland Information Network related equipment transferred to the Ministry of Environment

Items	Location				Total Quantity
	Baghdad	Basrah	Missan	Thi-Qar	
Rack 15U (60x80x140) (WxDxH)	1	1	1	1	4
Server hp DL 360 or equivalent, with HP ILO advanced pack	1	1	1	1	4
Desktop Computer HP Compaq 2200	2	2	2	2	8
UPS 600 VA	2	2	2	2	8
Laser Printer hp 1320n	2	2	2	2	8
Monitor TFT 17"	2	2	2	2	8
MS Office Pro	2	2	2	2	8
1M UTP, RJ45 cable	3	3	3	3	12
3M UTP, RJ45 cable	3	3	3	3	12
Switch Hub 3 Com 8 Ports	1	1	1	1	4
Windows Server 2000 St Ed 5 User	1	1	1	1	4
UPS 1000VA	1	1	1	1	4
MS SQL Server 2000	1	1	1	1	4
Firewall CISCO 515E, 50 user	1	1	1	1	4
Generator 10 KVA	1	1	1	1	4
Air con 2 ton	1	1	1	1	4
Internet hardware – satellite dish	1	1	1	1	4

List of Marshland Information Network related equipment transferred to the Ministry of Water Resources

Items	Total Quantity
Rack 15U (60x80x140) (WxDxH)	1
Server hp DL 360 or equivalent, with HP ILO advanced pack	1
Desktop Computer HP Compaq 2200	2
UPS 600 VA	2
Laser Printer hp 1320n	2
Monitor TFT 17"	2
MS Office Pro	2
1M UTP, RJ45 cable	3
3M UTP, RJ45 cable	3
Switch Hub 3 Com 8 Ports	1
Windows Server 2000 St Ed 5 User	1
UPS 1000VA	1
MS SQL Server 2000	1
Firewall CISCO 515E, 50 user	1
Generator 10 KVA	1
Air con 2 ton	1
Internet hardware – satellite dish	1

Appendix III: Training received by MoEn since 2003

SL #	Topic	When	Where	Provided by
1	Environmental emergencies	March 2004	Amman	UNEP
2	Environmental inspection	May 2004	Geneva	UNEP/PCDMB
3	Environmental laboratory	June 2004	Spiez	UNEP/PCDMB
4	Environmental impact assessment	September 2004	Tunis	UNEP/PCDMB
5	Environmental site assessment	October 2004	Amman	UNEP/PCDMB
6	Field planning and health & safety	November 2004	Amman	UNEP/PCDMB
7	Sampling and analyses	December 2004	Geneva	UNEP/PCDMB
8	Environmental impact assessment	January 2005	Amman	UNEP/PCDMB
9	Environmental law	March 2005	Amman	UNEP/PCDMB
10	Depleted uranium	June 2005	Amman	UNEP/PCDMB
11	Multilateral Environmental Agreements (MEAs)	July 2005	Amman	UNEP/PCDMB
12	Oil spill management	June 2005	Aqaba	UNEP/PCDMB
13	Management of biodiversity	September 2005	Jordan	UNEP/PCDMB
14	Depleted uranium fieldwork	August 2005	Geneva	UNEP/PCDMB
15	Environmental Information Management	December 2005	Nairobi	UNEP/PCDMB
16	Site risk assessment	September 2005	Amman	UNEP/PCDMB
17	Office management	June 2005	Amman	UNEP/PCDMB
18	Environmental information management	March 2006	Nairobi	UNEP/DCPI

Training under Iraqi Marshlands Project

Training outside Iraq

SL #	Topic	When	Where	Provided by
1	Sustainable sanitation	Dec 2004	Osaka	UNEP DTIE IETC, in partnership with Global Environment Centre Foundation (GEC)
2	Water quality management	Dec 2004	Shiga	UNEP DTIE IETC, in partnership with International Lake Environment Committee (ILEC)
3	Phytotechnologies for wetland management	Dec 2004	Cairo	UNEP DTIE IETC, in partnership with Cairo University
4	Application of remote sensing and GIS for marshland assessment and monitoring	Feb 2005	Amman	UNEP DTIE IETC, in partnership with UNEP PcoB, International Institute for Geoinformaiton Science and Earth Observation
5	Marshlands Information Network (MIN)	Feb 2005	Amman	UNEP DTIE IETC
6	Integrated Water Resources Management (IWRM): policy and integration	Apr 2005	Amman	UNEP DTIE IETC, in partnership with American University in Beirut
7	ESTs for drinking water provision	May 2005	Osaka / Shiga	UNEP DTIE IETC in partnership with GEC
8	Community-level initiatives	Jun 2005	Alexandria	UNEP DTIE IETC, in partnership with UNEP-ROWA, CEDARE
9	Wetland management	Jun 2005	Cairo	UNEP DTIE IETC, in partnership with Cairo University, Secretariat of RAMSAR Convention, Wetlands International, and International Agricultural Centre of the Netherlands
10	EST assessment methodology	Dec 2005	Damascus	UNEP DTIE IETC, in partnership with UNEP-ROWA / ACSAD
11	Marshlands Information Network (MIN)	April 2006	Manama	UNEP DTIE IETC in partnership with UNEP- ROWA
12	Drinking water provision with environmentally sound technologies and water quality management	Dec 2006	Shiga	UNEP DTIE IETC in partnership with GEC

Secondary training inside Iraq

SL #	Topic	When	Where	Provided by
1	Phytotechnology	Dec 2005	Basrah	University of Basrah
2	Water quality management	Dec 2005	Baghdad	Ministry of Water Resources
3	Marshland Information Network (MIN)	Dec 2005	Baghdad	Ministry of Environment
4	Marshland Information Network (MIN)	Sept 2006	Thi Qar	Thi-Qar University

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American University of Beirut

University of Basra

University of Thi-Qar

Secretariat for Ramsar Convention

Wetland International

Centre for Environment and Development for the Arab Region and Europe (CEDARE)

International Agricultural Centre

Arab Centre for the Studies of Arid Zones & Dry Land (ACSAD)

Iraq Foundation

Nature Iraq

Women and Environment Organization, Iraq

Marsh Arab Forum

Further information

Further technical information may be obtained from the UNEP Post-Conflict and Disaster Management Branch website at: <http://postconflict.unep.ch> or by Email: postconflict@unep.ch



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