
STRATEGIES FOR ASSISTING THE MARSH DWELLERS AND RESTORING THE MARSHLANDS IN SOUTHERN IRAQ

INTERIM STATUS REPORT



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Report Preparation

This interim status report was prepared by Peter Reiss, team leader, Development Alternatives, Inc.; Curtis Richardson, Duke University Wetland Center; Azzam Alwash, Iraq Foundation; and Douglas Pool, International Resources Group.

Cover Photographs

Upper left: Marsh dwellers living in the interior of Hammar marsh
Upper right: Natural Hawizeh marsh looking eastward to Iran
Lower left: Drained Central marsh
Lower right: Guesthouse interior in Al Chibayish in Hammar marsh

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Executive Summary

Background. In little more than a decade, Saddam Hussein's regime systematically destroyed one of the world's largest wetlands ecosystems. The area was once famous for its biodiversity and cultural richness. The period from 1991 to 1997 was marked by engineering programs which drained the marshes by more than 80 percent. By 1999, the drainage of the marshes was largely over. Over the past two years, the remaining wetlands have decreased in size by half. By March 2003, roughly seven percent of the original marshlands remained.

There is recent reflooding in small enclaves throughout the marshes. This water appears to be from a combination of heavier than usual snows in the north, the deliberate destruction of structures by people in the area, the opening of gates by local government officers, and the release of water by Iran to the east.

Program Objectives. The overall objectives of the 12-month program are to:

- Construct an environmental, social, and economic baseline of the remaining and former marshlands;
- Assist the marsh dwellers, who require economic opportunities and viable social institutions;
- Improve the management of existing and newly reflooded marshlands and explore options to expand the restoration activities through pilot project interventions; and
- Develop and reach a broad internal and international consensus on a long-term comprehensive restoration strategy.

Program Approach. The major elements of the program's approach are the following:

- Implementation in partnership with the Ministry of Water Resources and U.S. oversight from the Coalition Provisional Authority;
- Integrated economic development and ecosystem marsh management;
- Program implementation through priority restoration and economic assistance pilot projects;
- Systematic data collection and monitoring; and
- Development of local capacity in the Ministry of Water Resources and universities in marshland management and restoration.

U.S. Government Agency and International Donor Participation. The U.S. Agency for International Development (USAID) is leading an interagency effort with the U.S. State Department's Bureau for Oceans and International Environmental and Scientific Affairs

(OES) to develop an action plan for marshland restoration. USAID works closely with other government entities through the Interagency Marshlands Subgroup. The subgroup includes representatives from the State Department, Army Corps of Engineers (USACE), US Geological Survey, Environmental Protection Agency, Fish and Wildlife Services, and other agencies.

It is an aim of the U.S. government to internationalize the program, recognizing that the program's ultimate success depends on both Iraqi and international participation and consensus. Thus far, Great Britain, Australia, Denmark, Canada, and Italy have committed to or are considering participating in marshland efforts, although discussions are ongoing.

On the multilateral side, the Secretariat of the Ramsar Convention on Wetlands, which draws upon a roster of internationally recognized experts in wetlands and marshlands, is a source of technical support. United Nations and other international agencies that have shown an interest in becoming involved in as yet to be determined roles include: the World Health Organization, United Nations Environmental Programme (UNEP), and the International Organization for Migration. IUCN, the World Conservation Union, has also expressed an interest, particularly in working on water flow issues with other countries in the region.

June Scoping Trip. To prepare for the long-term program, a team carried out a rapid assessment of the marshlands. Team members included a social scientist, wetlands ecologist, agricultural specialist, and geotechnical engineer. They were joined on the field visits by national and district officers from the Ministry of Water Resources and staff of the Marine Science Center at the University of Basra, and the AMAR International Charitable Foundation, which provides primary health care to marsh dwellers in Iran and Iraq. While in the southern marshes, the scoping team:

- *Extensively visited the existing, reflooded, and drained marshes on the ground and in helicopter flyovers.* It is probably accurate to say that this scoping team was the first scientific/development effort in the Iraq marshlands for at least two decades and the first to begin the systematic canvassing of the region. Previously, all information about the draining of the marshes and its impact was gleaned through remote sensing photography, never on the ground and analyzed from a distance. The team found several areas of healthy regrowth of reeds and other freshwater vegetation and wildlife, and others with serious salinity and only salt plants. Early concerns about endangered seed banks because of highly saline water and soils may be less serious than anticipated, but further investigation is required.
- *Collected soil and water samples from the natural and reflooded marshes.* The team collected roughly 60 water and 20 soil samples in the natural, drained, and reflooded marshes. The samples are being analyzed along a full range of parameters, including salinity, toxicity, pesticides, heavy metals, and water vector diseases. The team also did immediate data analyses on salinity, conductivity, TDS, dissolved oxygen, and pH. An interesting finding was that salinity was far lower than had been anticipated. Most of the water was 1.0 part per thousand or less salinity, rather than the 3-5 expected. This level will support new freshwater plant growth. However, one site was 17.5, half of

seawater, in a reflooded area of high soil salinity, no vegetative growth, and no flowing water.

- *Met with marsh dwellers to assess social and economic conditions.* The team visited a wide range of tribesmen and women throughout the marshes from the traditional floating islands populations to rice growers living on the periphery. Many told horrific stories of repeated displacement, persecution, and destruction, eking out a minimal existence on wheat growing and government handouts of basic foodstuffs. Others have lived stably on the edges of the marshes, returning to fishing and reed collecting when the waters came two months ago. Initial conversations reveal diverse economic niches of the marsh dwellers. In general, they suffer from an absence of public health services and lack clean drinking water. Many are drinking untreated water directly out of the marshes. Both illness and malnutrition are endemic.
- *Involved scientists from the University of Basra.* The previous regime systematically destroyed an independent, intellectual community in the country. The research centers and universities acted as Ba'athist havens. The Marine Science Center is now a shell of what it once was: a well-know, highly regarded institution. Staff have been isolated from new developments in their fields for the past 20 years and lack any knowledge of environmental science and wetlands ecology, but they are well trained in their narrow technical fields. They are eager to participate in the program, which can offer training and research opportunities. The center was badly looted, although some faculty were able to hide equipment in their homes before the war ended. Ba'athist leaders are still a campus presence and of continuing importance, despite first-time elections for university leadership positions. We expect that the center and other research entities will serve as partners on the program so that skills are transferred and wetlands management and restoration approaches can be institutionalized in Iraq.
- *Established working relationships with national and district level Ministry of Water Resources officers and obtained some flow data.* The team worked closely with Ministry of Water Resources officers at the national and district levels. Both accompanied the team during its visits, collecting data, conducting interviews and discussing program options actively. We see this as the first step toward their full participation. The team was able to collect some flow data during the visit from one district office. Visits to the district Ministry of Water Resources (formerly the Ministry of Irrigation) offices in Al Amarah and Al Nasriyah indicate the need for different strategies for partnering. The Al Amarah office had been entirely stripped, while the Al Nasriyah office was completely intact, due to the quick thinking and effective actions of its director. As such, they are likely to play different program roles, at least in the short run.

Marshlands Restoration Program. The program will be carried out in close partnership with the Ministry of Water Resources. The findings of the assessment are being incorporated into the overall design of the next year's restoration program. Components of that program are likely to include:

- Pilot restoration projects – identifying current stages of restoration, monitoring progress, identifying possible new sites, consulting with local stakeholders, implementing, and monitoring;

- Social and economic assistance to marsh dwellers – introducing in quick order carefully targeted interventions to improve the lives of people in the marshes through agricultural improvements, credit, better drinking water and health care, and employment opportunities;
- Data collection and monitoring – carrying out systematic data collection in the marshes both on-the-ground and through state-of-the-art remote sensing analysis;
- Hydrologic and hydro-period modeling – designing and developing models to forecast water flows in the Tigris-Euphrates watersheds and the flow of water within the marshes; and
- Capacity building in marshland management – developing understanding of and skills in marshlands management primarily in the Ministry of Water Resources and in other government agencies, universities, and research centers.

FORWARD's Approach to the Program. The restoration of Iraq's marshlands has been treated by some as a largely technical problem which can be addressed by specialized expertise. FORWARD's perspective is that the resolution of this complex set of issues, like other water-related issues, requires an exploration and vetting of the diverse views of a broad range of parties, which would otherwise impede reaching and honoring agreements over implementation. Even the development of a wetlands database, which some treat as a straightforward effort, involves competing and entrenched interests which can discourage cooperation and collaboration by the many stakeholders. Traditional technical efforts rarely seek to build consensus among these competing interests and instead try to persuade on the basis of the technical solution's logic. As a result, they too often fail or are unsustainable.

FORWARD, a collaborative planning and consensus building program for the Bureau for Asia and the Near East, has over the past seven years addressed longstanding water policy and implementation issues in the Middle East. It brings to this marshlands rehabilitation program experience with successful interventions in demanding situations in Lebanon, West Bank/Gaza, Jordan, Egypt, and Morocco and an awareness of the need for reaching agreement among the stakeholders who will be most affected. In Iraq, they include new ministries emerging from the ruins of old institutions, new local government entities that will be operating in an uncharted civil setting, universities and research centers that were perversely politicized and denied resources, local stakeholders who were the victims of persecution and genocide and remain scattered across many countries, and a general population with whom they must compete for scarce water resources. Outside Iraq, there are various international donors and agencies, humanitarian groups, environmental organizations, Iraqi refugee communities, and an oil industry, all seeking to advance their own agendas.

Next Steps. Program milestones during the next four months will include:

- Preparation for demographic census and public health survey in the marshlands in July and August. The first census in the area since 1947 which ought to produce an accurate assessment of the population and its health status.
- Commencement of modeling efforts in August and September. Meetings are being held with the Army Corps of Engineers and other potential entities to assist in the development of an hydrologic model for the basin and an hydraulic model for the marshes.
- Preparation of publications and press conferences in August and September. Members of the scoping trip team will prepare a presentation for the press and an article for publication in a respected scientific journal.
- Development of methodology for systematic analysis in September and October. Plans made for detailed soil and water sampling in the marshes based on analyses of samples from scoping trip.
- Second field trip in October. An enlarged team will spend the latter half of October in the marshlands continuing data collection and preparing the action plan.
- Action Plan developed in November. Development of a rolling plan with detailed tasks, technical assistance and budget for the life of the program.
- Pilot projects start-up in November and December. Following approval by the CPA, Ministry of Water Resources, and the Interagency Marshlands Subgroup, implementation will begin.

1. Introduction

Background

In little more than a decade, Saddam Hussein's regime systematically destroyed one of the world's largest wetlands ecosystems. This environmental disaster, perpetrated in the roughly 20,000 square kilometer marshlands of southern Iraq, has been compared in scale to the drying up of the Aral Sea in Central Asia and the deforestation of the Amazon. The area was once famous for its biodiversity and cultural richness. The marshes were the permanent habitat for millions of birds and a flyway for billions more migrating between Siberia and Africa. Sixty-six bird species may now be at risk. Other populations are thought to be in serious decline. Coastal fisheries in the Persian Gulf used the marshlands for spawning migrations, and they served as nursery grounds for shrimp and fish. Now fish catches have been significantly decreased. The marshlands also once served as a natural filter for waste and other pollutants in the Tigris and Euphrates rivers, protecting the gulf which has now become noticeably degraded along the coast of Kuwait.

The indigenous marsh dwellers already have a special place in the anthropological and travel literature for their alluring way of life, living in harmony with the environment on man-made reed islands and along the periphery of the marshes in relative isolation. They may have numbered a half a million in the 1950s and a quarter of a million in the early 1990s. In 1991, a populist Shi'a uprising at the end of the Gulf War brought down the full and brutal weight of the Baghdad regime. The military raided settlements, killed tens of thousands of Marsh Arabs – although the actual number may be higher, burned settlements, and killed livestock, destroying the core of the local economy.

The period from 1991 to 1997 was marked by engineering programs which drained the marshes through the construction of manmade rivers and canals of massive proportions and overblown names. They diverted water from the marshes to irrigate vast areas for uneconomical and unsustainable wheat production, fill huge depressions or ponds to evaporate, or drain into the Shatt Al Arab. Despite a crushing international trade embargo, a disproportionate share of the country's limited resources was channeled into these works. By 1999, the drainage of the marshes was largely over. The only remaining marsh of any note was the northern portion of Hawizeh which straddles the Iran-Iraq border. The other two marshes, Hammar and Central to the west, were totally desiccated.

At the beginning of 2003, only seven percent of the original marshlands remained. However, there has been some recent reflooding in small enclaves throughout the marshes. This water appears to be from a combination of heavier than usual snows in the north, the decision by the Saddam Hussein regime to flood the region to slow the coalition invasion in March, the deliberate destruction of structures by people in the area after the war, the opening of gates by local government officers, and the release of water by Iran to the east.

Program Objectives

The objectives of the 12-month program are to:

- Construct an accurate environmental, social, and economic baseline of the remaining and former marshlands to plan interventions and measure their success;
- Assist with the repatriation and resettlement of marshland dwellers in the region, who will require viable economic opportunities and social institutions that are fair and equitable and give them a voice;
- Improve the management of existing marshlands and explore options to restore adjacent drained marshes; and
- Develop and reach a broad consensus on a long-term comprehensive wetland restoration strategy integrated with a regional social and economic development program.

Elements of the Program Approach

The major elements of the program's approach are the following:

- Integrated economic development and ecosystem marsh management;
- Program implementation through priority restoration pilot projects;
- Systematic data collection and monitoring; and
- Development of local capacity in government and universities in marshland management and restoration.

U.S. Agency and International Donor Participation

In the highly dynamic, post-war situation, the U.S. Agency for International Development is leading an interagency effort with the U.S. State Department's Bureau for Oceans and International Environmental and Scientific Affairs (OES) to develop an action plan for marshland restoration. USAID and State/OES work closely with other government entities through the Interagency Marshlands Subgroup, the first of many anticipated special task forces addressing major environmental issues in Iraq. The subgroup includes representatives from the State Department, Army Corps of Engineers, U.S. Geological Survey, Environmental Protection Agency, Fish and Wildlife Service, and other agencies. The subgroup meets regularly to explore technical issues, review donor participation, and monitor progress.

It is an aim of the U.S. government to internationalize the program, recognizing that the program's ultimate success depends on both Iraqi and international participation and consensus. Thus far, the following bilateral donors have expressed an interest in supporting or directly participating in the program:

- Great Britain – fund a technical expert on the second field trip to the marshlands in October through UNEP;
- Australia – provide technical experts on marshlands and agricultural soil salinity problems and develop desalination strategies through the Commonwealth Scientific and Industrial Research Organization (CSIRO), a recognized leader in the field;
- Denmark – fund a river navigation strategy which will be carried out in parallel with the development of a hydroperiod model of the marshlands by the DHI (Danish Hydraulics Institute);
- Canada – will provide technical expertise in biological monitoring and wildlife conservation to the second field visit and work in partnership in program design as the lead into a larger funded program; and
- Italy – fund modeling, water budgeting, and environmental assessments through the Iraq Foundation for a long-term program design.

On the multilateral side, we have engaged the Secretariat of the Ramsar Convention on Wetlands, which draws upon a roster of internationally recognized experts in wetlands and marshlands for technical support. United Nations and other international agencies that have shown an interest in becoming involved in as yet to be determined roles include: the World Health Organization, the United Nations Environmental Programme (UNEP), and the International Organization for Migration (IOM). The World Conservation Union (IUCN) has also expressed an interest in participating, particularly in working on water flow issues with other countries in the region.

FORWARD's Approach to the Program

The rehabilitation of Iraq's marshlands has been treated by some as a largely technical problem which can be addressed by specialized expertise. FORWARD's perspective is that the resolution of this complex set of issues, like other water-related issues, requires an exploration and vetting of the diverse views of a broad range of parties, which would otherwise impede reaching and honoring agreements over implementation. Even the development of a wetlands database, which some treat as a straightforward effort, involves competing and entrenched interests which can discourage cooperation and collaboration by the many stakeholders. Traditional technical efforts rarely seek to build consensus among these competing interests and instead try to persuade on the basis of the technical solution's logic. As a result, they too often fail or are unsustainable.

FORWARD, a collaborative planning and consensus building program for the Bureau for Asia and the Near East, has over the past seven years addressed longstanding water policy and implementation issues in the Middle East. It brings to this marshlands rehabilitation program experience with successful interventions in demanding situations in Lebanon, West Bank/Gaza, Jordan, Egypt, and Morocco and an awareness of the need for reaching agreement among the stakeholders who will be most affected. In Iraq, they include new ministries emerging from the ruins of old institutions, new local government entities that will

be operating in an uncharted civil setting, universities and research centers that were perversely politicized and denied resources, local stakeholders who were the victims of persecution and genocide and remain scattered across many countries, and a general population with whom they must compete for scarce water resources. Outside Iraq, there are various international donors and agencies, humanitarian groups, environmental organizations, Iraqi refugee communities, and an oil industry, all seeking to advance their own agendas.

The successful design and implementation of the Iraq marshlands management and rehabilitation program must incorporate:

- An understanding of the core parties involved;
- A description of their interests and goals that need to be satisfied if agreements are to be reached;
- An identification of current positions;
- An assessment of the parties' willingness to take part constructively;
- The identification of how all parties can profit;
- A characterization of where there is already agreement or "common ground";
- A reframing of the remaining differences needing resolution to make the terms of engagement acceptable to all parties;
- Institutionally and politically appropriate ways of integrating these considerations with the technical approach; and
- Regular monitoring to permit constant revision and improvement of plans as interests change and new information emerges.

The marshlands rehabilitation is a complicated multi-party collaborative planning effort requiring stakeholders to articulate their individual interests and concerns as a first step in reaching consensus around common goals and strategies. No one should underestimate the difficulty in achieving this as the remaining marshlands face increasingly rapid total collapse. Still, this approach, which merges technical expertise with a collaborative process, has a far greater likelihood of success than one which is primarily technically driven.

2. Scoping Trip

Background

Implementation of the program was initiated with the fielding of a small technical team to carry out a rapid assessment of the current situation in the marshlands from June 15-28, 2003. This visit to the marshlands in southern Iraq was the first on-the-ground scientific assessment in two decades. Their goals were to begin data collection to develop a rolling action plan for the program and to set the stage for a larger and longer visit by a technical team in September and October. The team determined logistical needs and started to identify Iraqi counterparts and potential local team members for the evolving program.

Objectives of the Scoping Trip

In anticipation of the long-term program, the objectives of the visit were to:

- Collect information on environmental, institutional, social, and economic conditions in the marshlands to be used to develop a detailed action plan for the program;
- Make initial contacts with key stakeholders, particularly the marsh dwellers, to understand their priorities, concerns, most recent actions, and determine their willingness to take part;
- Determine the availability of water resources and other data and the impact of looting and burning on facilities, libraries, research centers, and other institutions that could participate in the program;
- Identify potential Iraqi team members and determine their capacity to contribute to the program and their technical requirements; and
- Better understand the working and logistical requirements for carrying out the program over the coming year.

Team Members

The scoping team members included:

- Peter Reiss, social scientist and team leader, Development Alternatives, Inc.;
- Curtis Richardson, wetland ecologist, Duke University Wetland Center;
- Azzam Alwash, geotechnical engineer, Iraq Foundation;
- Doug Pool, natural resources specialist, International Resources Group;

- Hassan Janabi, advisor to the Coalition Provisional Authority, working with the US Army Corps of Engineers and the Ministry of Water Resources;
- Eng. Jassim Mohammed Dowage, an engineer with the Ministry of Water Resources' Baghdad office; and
- Eng. Samira Abd Al Shibeeb, an engineer in the Ministry of Water Resources' Basra office.

They were joined on the field visits by representatives of Assisting Marsh Arabs and Refugees International Charitable Foundation (AMAR), and the Marine Science Center at the University of Basra. They included:

- Baroness Emma Nicholson, AMAR chairman;
- Dr. Ali Al Muthanna, AMAR program manager in southern Iraq;
- Dr. Malik Hassan, director of the Marine Science Center, University of Basra; and
- Aimen Abd Al Lateed Al Rubaie, staff member of the Marine Science Center, University of Basra.

Fieldwork Approach

The team visited the entire marsh area, examining reference, drained, and reflooded areas in Hawizeh, Central, and Hammar marshes. They visited the major drainage structures – Glory River, Main Outfall Drain or Third River, Mother of Battles River, and Loyalty to the Leader Canal and sites of recent destruction by marsh dwellers, including a destroyed dam on the Old Euphrates, to the east of Hammar Lake. The team made every effort to document the current conditions in photographs and soil and water sampling, tying the sites to GPS readings, whenever possible. Water and soil samples were collected during the visit and taken back to the U.S. for analysis at the Duke University Wetland Center and other specialized laboratories. The team is also assessing laboratories in Kuwait and Amman as options for future analytical work. Transportation included car travel on well maintained highways and roads, motor and pole-driven boats, and a helicopter provided by the Royal Air Force in Basra for flights over Central Marsh as far north as As-Sannaf above Al Amarah and as far south as Umm Qasr on the Persian Gulf.

The team held many meetings with marsh dwellers, both tribal elders and tribes people throughout the area, representing populations that had been repeatedly displaced to new settlements, moved to urban areas, or remained in place despite the general social upheavals and frequent wars. Usually these meetings were held in the reed guest houses (*mudhif*) which are in greater number throughout the area than were expected. There was restricted access to women, but one meeting inside the marsh did permit a lengthy conversation with two elderly female dwellers who told of repeated, forced moves and violent attacks on family members over a decade.

Team members established a base in Basra, where services exist in a relatively stable and safe environment. They visited Baghdad for two days near the end of the stay in order to debrief the Coalition Provisional Authority (CPA) and the Ministry of Water Resources.

Recent visitors to the marshes had described the people there as living in despair and highly suspicious of outsiders after years of assaults and depravation. The area was characterized as being very unsafe with roaming, armed gangs and unexploded ordnance. While many rural areas in the south are victimized by uncontrolled gangs and looters, the team was warmly welcomed by people within and on the periphery of the marshes. In the south, they never experienced hostility or suspicions. On the contrary, the team was constantly approached by people seeking its help in providing medical services, employment, or compensation for past grievances.

With one day's exception, they team remained together during their time in Iraq, since logistics and safety were ever-present considerations and serious limiting factors. Still, team members could make field visits without military protection. On most days, the team, including MWR staff, traveled throughout the marshes unprotected and never felt threatened. However, a team member who went into the marshes one day with AMAR was accompanied by a number of local, heavily armed bodyguards supplied by the town council, who were watchful during meetings and vigilant during photo taking. Travel to major cities – between Kuwait and Basra and from Baghdad to the Kuwait border – was in convoy, but we learned that traveling with military in the marshes would have seriously impeded the work.

The team worked closely with the AMAR, a British NGO, which has established a permanent presence in the marshlands and surrounding areas. During the past 12 years, AMAR has been the most important provider of primary health care and education to 100,000 southern Iraqi refugees in Iran. The AMAR program manager visited settlements throughout the marshes to inform people of our visit and request their assistance during the first half of June. Team members accompanied AMAR staff now carrying out an extensive demographic and public health survey and providing primary health care to marsh dwellers.

Daily Schedule in Iraq

Although team members did not all arrive or leave the region together, they followed this daily schedule during the scoping visit while in Iraq (Figure 1):

- June 15 – arrival in Kuwait
- June 16 – visit to Kuwait Environmental Public Authority and readying to Iraq entry
- June 17 – arrival in Basra and visit to eastern tail of Hammar Marsh and Lake Hammar through boat trip on Old Euphrates branch
- June 18 – visit to (1) Hawizeh Marsh or (2) to University of Basra
- June 19 – visit to (1) Hammar Marsh or (2) Shatt Al Arab and Umm Qasr
- June 20 – helicopter flyover and visit to Marine Science Center
- June 21 – visit to Al Amarah Marsh, As-Sannaf, and MWR Al Amarah district officer
- June 22 – visit to western end of Hammar Marsh
- June 23 – meeting at MWR Al Nasiriyah district office and travel to Baghdad
- June 24 – debriefing to CPA and Ministry of Water Resources

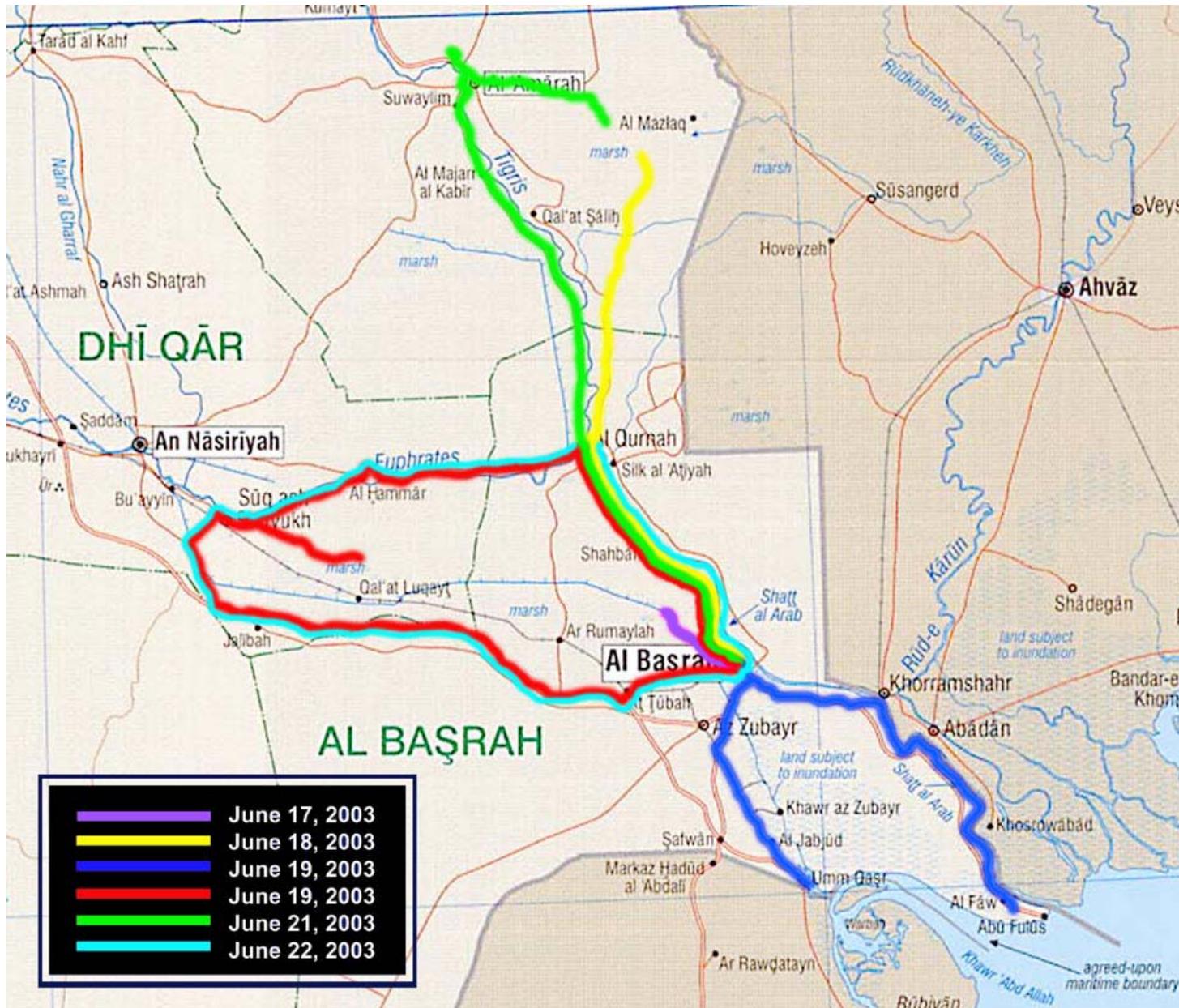
- June 25 – (1) return to Basra or (2) visit to MWR Baghdad headquarters
- June 26 – travel to Kuwait or Amman

Accomplishments of the Trip

Despite the security and communications concerns, the team's work exceeded expectations during the ten days in Iraq. It began its work with nearly a clean slate. There was virtually no scientific database covering the past 30 years in the marshes. The few studies during the previous regime were politically motivated to give credence to the repressive actions. No social or economic information appear to exist for half a century. During the scoping trip, the team:

- *Extensively visited the existing, reflooded, and drained marshes on the ground and in helicopter flyovers.* It is probably accurate to say that this scoping team was the first scientific/development effort in the Iraq marshlands for at least two decades and the first to begin the systematic canvassing of the region. Previously, all information about the draining of the marshes and its impact was gleaned through remote sensing photography, never on the ground and analyzed from a distance. The team found several areas of healthy regrowth of reeds and other freshwater vegetation and wildlife, and others with serious salinity and only salt plants. Early concerns about endangered seed banks because of highly saline water and soils may be less serious than anticipated, but further investigation is required.
- *Collected soil and water samples from the natural and reflooded marshes.* The team collected approximately 60 marsh and drinking water and 20 soil samples in the three marshes in existing and reflooded sites and in the drained marshes. The samples are being analyzed for a full range of parameters, including salinity, toxicity, pesticides, heavy metals, and water vector diseases. The team also did immediate data analyses on salinity, conductivity, total dissolved solids, dissolved oxygen, and pH. An interesting finding was that salinity was far lower than had been anticipated. The salinity of most of the water was 1.0 part per thousand (PPT) or less, rather than the 3.0-5.0 ppt expected. This level will support new freshwater plant growth. However, one site was 17.5 ppt, half of seawater, in a reflooded area of high soil salinity, virtually no vegetative growth, and no flowing water.
- *Met with marsh dwellers to assess social and economic conditions.* The team visited a wide range of tribesmen and women throughout the marshes from the traditional floating islands populations to rice growers living on the periphery. Many told horrific stories of

Figure 1
Daily Route of the Team during the Scoping Trip



repeated displacement, persecution, and destruction, eking out a minimal existence on wheat-growing and government handouts of basic foodstuffs. Others lived stably on the edges of the marshes, even during the entire time they were drained. Some never exploited the marshes directly, despite their proximity. Others had a mixed economy, and returned to the marshes, using boats for fishing and reed collecting when the waters came two months ago. Initial conversations reveal diverse economic niches of the marsh dwellers. In general, they suffer from an absence of public health services and lack clean drinking water. Many are drinking untreated water directly out of the marshes. Both illness and malnutrition are endemic.

- *Involved scientists from the University of Basra.* The previous regime systematically destroyed an independent, intellectual community in the country. The research centers and universities acted as Baathist havens. The Marine Science Center is now a shell of the well-known, highly regarded institution it once was. Staff have been isolated from new developments in their fields for the past 20 years and lack any knowledge of environmental science and wetlands ecology, but they are well trained in their narrow technical fields. They are eager to participate in the program, which can offer training and research opportunities. The center was badly looted, although some faculty were able to hide equipment in their homes before the war ended. Baathist leaders are still a campus presence and of continuing importance, despite first-time elections for university leadership positions. We expect that the center and other research entities will serve as partners on the program so that skills are transferred and wetlands management approaches can be institutionalized in Iraq.
- *Established working relationships with national and district level Ministry of Water Resources officers and obtained some flow data.* The team worked closely with Ministry of Water Resources officers at the national and district levels. Both accompanied the team during its visits, collecting data, conducting interviews, and discussing program options actively. We see this as the first step toward their full participation. The team was able to collect some flow data during the visit from one district office. Visits to the district MWR offices in Al Amarah and Al Nasiriyah indicate the need for different strategies for partnering. The Al Amarah office had been entirely stripped, while the Al Nasiriyah office was completely intact, due to the quick thinking and effective actions of its director. As such, they are likely to play different program roles, at least in the short run.

3. Preliminary Findings and Conclusions

Marshlands Status: Vegetation, Soil and Water

Approximately 60 water and 20 soil samples were taken along with field measurements at 36 sites for salinity, conductivity, pH, water temperature, total dissolved solids, and redox and oxygen to assess the ecological and biogeochemical status of marshes that had remained flooded, were recently flooded or were totally drained and dried out since the early 1990s. Samples were also taken at selected locations along the Tigris and Euphrates rivers, the Shatt al Arab and selected canals in order to determine current water quality conditions as well as assess the nutrient and chemical status of waters that are flowing to either the Persian Gulf or in some cases into the marshes. In addition, drinking water samples were taken at selected locations including in the marsh Arab villages to determine the quality of water that people were drinking. The laboratory methods being used in the ongoing analyses to determine the quantity of nutrients, (nitrogen, magnesium, sodium, potassium, phosphorus, calcium, etc.) pesticides and organics, as well as metals (beryllium, aluminum, vanadium, chromium, manganese, iron, nickel, copper, arsenic, selenium, rubidium, molybdenum strontium, cadmium, antimony, barium, lead, thorium, and uranium) are discussed in Appendix B. An overview of the ecological status of the marshes and preliminary results on some water quality and soil parameters follows.

Natural Remaining Marshes

The team noted that narrow strips of marshes existed along the floodplains of a number of branches of the Euphrates, in the center and eastern end of the Hammar marsh (Figure 2), and some areas of the Tigris. The dominant vegetation in these areas was reed grass (*Phragmites australis*), but surprisingly little cattail (*Typha angustata*) was noted along the main water bodies as well in the Hawizeh, the largest remaining tract of natural marshes in southern Iraq (Figure 3). A quantitative analysis of the vegetation will confirm the current



Figure 2. Tamarix, cattail and reed grass deep inside Hammar marsh where marsh dwellers live



Figure 3. Old and new growth reeds in Hawizeh marsh, facing Iran 30 kilometers to the east

plant community structure in each area. Reed grass was being harvested in a number of the marshes and along the rivers. Hawizeh was dominated by reed grass and large areas of open water. Water depth in the marsh proper was approximately 75-100 centimeters. The reed grass appeared to be in excellent health and was nearly three meters in height in places. These areas were currently being used by the local population for fishing and the grazing water buffalo. In several recently flooded areas of Hawizeh, the reed grass was much lower in height and was found in much lower densities. Duckweed (*Lemna* spp.) was also found along the shore in the Hawizeh. The salinity and pH in the natural marsh averaged 0.870 ppt and 7.6, respectively. Oxygen values averaged 7.7mg/L. Soils in the wetland averaged 35 percent soil moisture and only ten percent organic matter in the upper ten centimeters

Reflooded Marsh Areas

A small number of former marsh areas have been reflooded due to the release of water by local districts or breaks in the dikes surrounding the marsh areas (Figures 4 and 5). Most of the areas which had recently released water were dominated by Athel tree (*Tamarix aphylla*) with little evidence of marsh plant regeneration. This is probably because a number of these areas were only reflooded this spring for the first time in nearly ten years. The salinity and pH in one newly reflooded marsh along the eastern end of the Hammar averaged 0.963 ppt and 7.0, respectively. Oxygen values averaged 7 mg/L.



Figure 4. On the edge of Hawizeh marsh where reflooding has led to new reed growth



Figure 5. In As-Sannaf marsh with no outflow water salinity is half of seawater

Drained Marsh Areas

Large portions of Hawizeh marsh, almost all of Central marsh, and the majority of the Hammar marsh have been drained (Figures 6 and 7). The vegetation in these areas now consists mostly of *Tamarix*, *Acacia* spp., and other desert or saline tolerant species. The soils in the area are mostly clays and silts, which have been dried for nearly a decade and had on average a soil moisture content of only three percent. It is not clear whether any of the native seed bank of marsh species has survived the extended drought. The potential

for natural regeneration of native marsh species in these areas is unknown at this time and requires more systematic investigation.



Figure 6. Central Marsh is largely desiccated and the terrain is littered with unexploded ordnance



Figure 7. In Hawizeh, a dike built by the army in 1984 has drained much of the western parts

Preliminary Conclusions

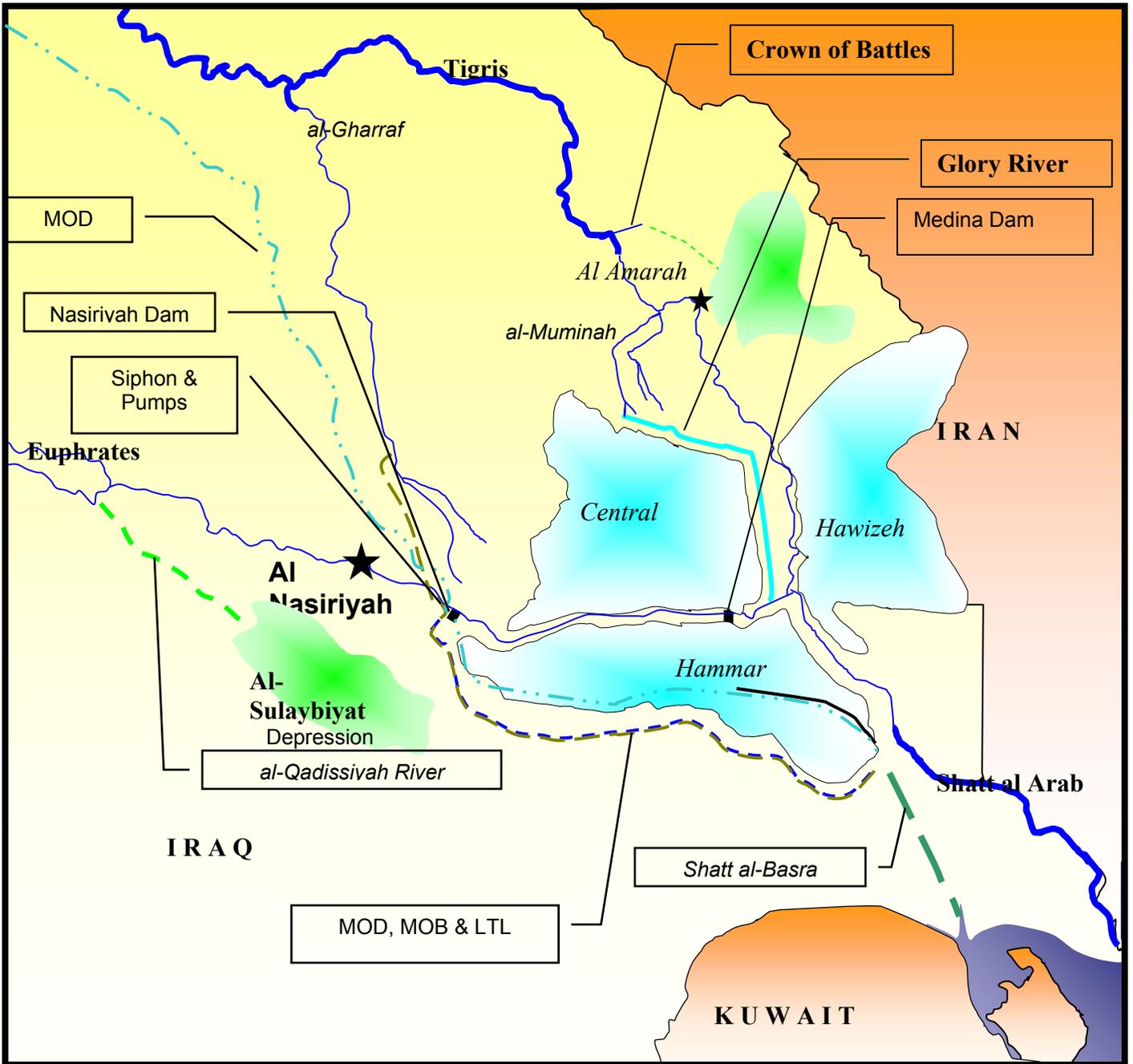
The major, preliminary conclusions on the status of the marshes are as follows:

- Some portions of Hawizeh and Hammar marsh still retain native vegetation and good water quality. These regions may be a seed source and faunal population base for restoring the drained marshes. By contrast, Central marsh has suffered massive drainage, and little wetland remains.
- Vast areas of former marsh are now barren or are sparsely covered with Tamarix and other desert species. Dust storms are now prevalent in the former marsh areas.
- Larger than expected quantities of water were present in southern Iraq, and some of the formerly drained wetlands have recently been reflooded.

Water Resources: Drainage Structures and Flow Data

During the past twenty years, much of what was known about the drainage structures came from analyses of remote sensing photographs. The previously inaccessible area has been the battleground for three major wars and for a massive drainage effort which the Saddam Hussein regime characterized as the physical infrastructure for an irrigation network. The scoping team has made the first on-the-ground assessment of this massive drainage system to date (Figure 8). While much remains to be done to expand our understanding of the network, the following assessment has both technical and historical value.

Figure 8
Major Drainage Structures in the Iraq Marshlands



Flows in Tigris and Euphrates Rivers

Despite serious concerns that government records had been destroyed or looted, the team secured daily flow data from January 1998 through June 2003 for the Euphrates flow in Nasriyah through the Ministry of Water Resources's district office. Flows in the Euphrates vary seasonally and annually, ranging from a high of 99 cubic meters per second (CMS) in January 1998 to a low of 10 CMS in November 2001. The current flows are around 50 to 57 CMS. Attempts to find similar data for the Tigris were unsuccessful. The team was given contradictory reports about the availability of data from the district office in Al Amarah which had been stripped of all furniture and equipment.

Euphrates River Structures

Main Outfall Drain (MOD). Work on this canal (Figure 8) was started in 1953 to intercept saline water that had been used for irrigation in the central Euphrates valley and direct the flow toward the Persian Gulf. The canal was also to provide a navigable connection to the gulf through a lock structure south of Basra. The MOD has three major sections: the northern section which starts north of Baghdad and flows south toward Damj marsh north of Nasiriyah; the central section from the lower end of Damj marsh and flows southeast to the pump/siphon stations east of Nasiriyah; and the southern section from the Euphrates (where the siphon system outlets), flowing south of Hammar marsh and ending at Shatt al Basra.

The southern section, dubbed the Third River or Saddam's River, has a capacity of 120 CMS when the siphon pumps are not in operation. When the pumps operate, the flow can be as much as 200 CMS. The MOD appears to be connected to the Euphrates through an emergency relief outlet which is intended to redirect the water to the Euphrates in case the MOD is breached or if the gates and/or pumps become dysfunctional. Salinity of the water varies seasonally, although the team could not locate historical records for documentation.

Mother of Battles River (MOB). To redirect the water coming from the Euphrates River, the Mother of Battles River (Figure 9) was excavated parallel to the MOD. This canal runs for about 100 kilometers and discharges into the southeastern portion of Hammar Lake, north of the Rumayllah oil field. The water is mixed with the MOD, which then is directed into Shatt al Basra. The maximum capacity of the MOB varies from 400 to 600 CMS. The

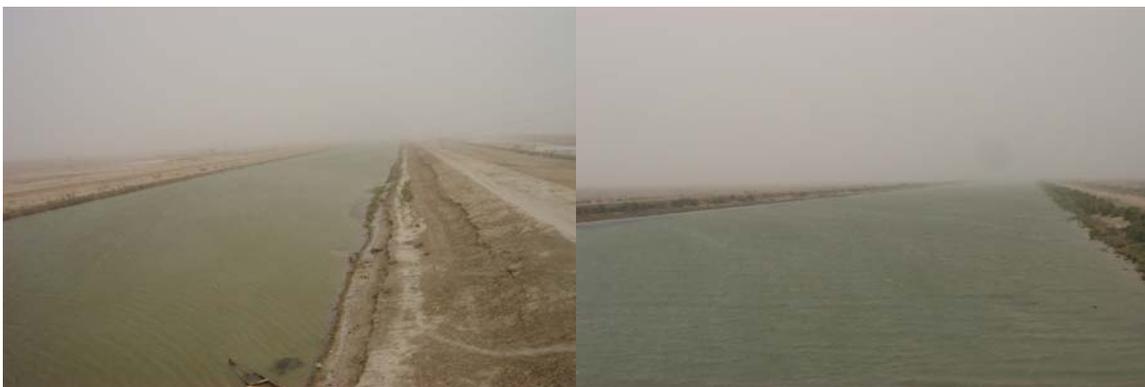


Figure 9. Main Outfall Drain

Figure 10. Mother of Battles River

team observed that the inlet to the MOB is blocked. Despite that, there is water in the MOB downstream of the intake to allow for the construction of a regulator with a capacity of 200 CMS. Construction of the regulator structure was halted due to payment issues after the war.

Loyalty to the Leader Canal. The canal (Figure 11) carries water from the tail end of Shatt Al Gharraff below the Euphrates through some mechanism, delivering it to Basra in a concrete lined elevated canal. The water in Al Gharraf is diverted from the Tigris near Kut. The capacity of the canal is on the order of 100 CMS, however, more than 60 percent of the water in the canal is being wasted since the filtering capacity of plants in Basra lack adequate electricity. The water is diverted to Shatt al Basra and eventually into the Gulf. The canal is not operating at full capacity at this point.

Al Qadissiyah River. The Al Qadissiyah River directs water from the Euphrates upstream of Samawa into a dead end depression called Al Sulaybiyat. The river was designed to reduce the flow in the Euphrates during construction of some of the regulators and siphon systems. The river is dry, since no water has been allowed since 1997. Al Sulaihiyat is reportedly a salt marsh, but, the team did not visit the area to verify.

Euphrates levees. Embankments have been built on both sides of the Euphrates, increasing the capacity of the river canal to carry water above its historic capacity. Previously, water would flow into Central and Hammar marshes when flows exceed capacity. The embankments were elevated three meters above the level of water flows in the river itself.

Nasiriyah Dam. This dam/sluice gate was built to regulate the flow of the Euphrates and direct water into the MOB. The team was not able to visit the dam during this visit.



Figure 11. Loyalty to the Leader Canal



Figure 12. Glory River from a Royal Air Force helicopter

Tigris River Structures

Earth embankments and flow regulators. Earthen embankments ranging from 6 to 18 kilometers in length were built along seven different Tigris irrigation distributaries to prevent overtopping of the embankments. The irrigation canals are Adel and Wadiyah which

bifurcate from Majar Al Kabir; Keffah and Charamkhiya which bifurcate from Shatt Al Muminah; and the Masbah, Hadam and Um Jaddi which receive their waters from Butayrah, which, in turn, bifurcates from Al Muminah. The headwaters of some of these distributaries are controlled by sluice gates or flow regulators to control the amount of in-flow. It appears that there has been no dredging for several years, and the regulators are not effective in distributing water in low flow seasons. Furthermore, the team noted several breaches in the embankments. The breaks were probably made by the local population for their water buffalo.

Glory River. The outflow of the roughly 40 distributaries discharging from the right bank of the Tigris north of Qalat Saleh is captured through an east-west canal, called the Glory River (Figure 12), located along the northern boundary of the now-drained Central Marsh. The Glory River is between one and two kilometers wide and appears to be an excavated structure several meters deep, with some levees close to the headwaters at the terminus of Hadam and Butayrah. The canal is contained by earthen dikes up to six meters high, measuring in width from nine meters at the top to 35 meters at the base.

Prosperity River. The east-west canal ends at a north-south canal called the Prosperity River, which is two kilometers wide and terminates at the Euphrates. There is no control structure at the outlet, and the canal is reportedly influenced by tidal flows. Tidal effects are measured to 15 kilometers upstream from the Euphrates. Tidal fluctuations are on the order of 35 centimeters. The canal is defined by two embankments with an internal ditch, located 170 meters east of the west embankment. The internal ditch is 70 to 80 meters at the top, 60 to 65 meters at the base, and 1 to 1.5 meters deep. Irrigation distribution canals start at the Glory River and end at the Crown of Roads, also known as 316 Kilometer Road.

Crown of Battles River. This canal was excavated on the east side of the Tigris River, north of Kumayt, to divert water from the Tigris into Al Sannaf marsh, which is connected to Hawizeh marsh. Al Sannaf is a seasonal marsh and is very salty. Al Sannaf takes uncontrolled flows from the mountains in Iran, in the past, was an expansion area for Hawizeh when there was uncontrolled flow from Karkheh River. The capacity of the Crown of Battles is 400 CMS, and the spillway inlet has an eight meter elevation. There is a gate on the inlet, which is not operating. Water is directed into the Crown of Battles to prevent flooding Central marsh. It appears that that the capacity of the Glory River is not adequate to handle water from Tigris. If water is pushed into the distributaries of Tigris below the intake for Crown of Rivers, the embankments of the distributaries or the Glory River can be breached. Due to the silting of Majar al Kabir and Musharah canals, water cannot be discharged into Hawizeh to prevent the flooding of Amarah.

Shatt Al Basra Structures

Lock and regulator structures. The lock on the Shatt Al Basra apparently has not been operating since the Gulf War. The gates of the regulator were fixed and were operating until the end of March when the lock was looted of equipment, including electrical wiring. Currently, two of the gates are permanently open, and salt water was observed to be flowing upstream during the visit.

Preliminary Conclusions

The major, preliminary conclusions on the drainage structures and water data are as follows:

- More on-the-ground investigation and discussions with MWR district offices are needed to understand the drainage system and develop a precise inventory of all structures.
- Locating flow and other water data in government offices and private collections has been frustrating and will not be easy. Data are probably available, but people are reluctant or fearful to provide it.

Marsh Dwellers: Identity, Settlement, and Rights

The marsh dwellers of southern Iraq have been a source of interest in travelers' accounts, starting with the seminal writings of Wilfred Thesiger in the 1950s. Evidence of this isolated society appears on 5,000 year old Sumerian clay tablets with images of reed buildings and boats exactly like those still built today. For much of the historical period, the marsh dwellers were not interfered with by far-flung or local governments. The marshes themselves were long-established areas of refuge for rebels to the prevailing government, as well as by the people who plied the waters, living on small islands or in settlements on the periphery. It was only after World War I, with the fall of the Ottoman Empire, that an Iraqi administration first entered the area establishing police stations and schools.

As recently as the 1970s, there was a limited government presence in the marshlands. The Iran-Iraq War of the 1980s brought the Saddam Hussein regime in full military strength, and the displacement of tribes closest to the border began. Marsh dwellers were moved in Hawizeh in 1984 so that a dike for gun emplacements and a large army base could be built. The dike effectively drained large areas of the marsh and started the people on a series of forced moves over the succeeding 15 years. It was also the most sustained contact with the government to date. The marsh dwellers were said to have strongly supported the Iraq government during that war. The situation became more unstable with the Gulf War, and there are reports that both marsh dwellers and outsiders escaped into the marshes for refuge, this time earning the wrath of the army.

Following the Gulf War, the Shi'a population rebelled against the regime in February 1991 after active outside encouragement, apparently taking control of most of the south. In March, the government brought in tanks and helicopters and regained control through the brutal killing of 100,000 or more people and the wholesale destruction of cities and towns. The drainage of the marshes was then put into high gear, becoming one of the highest government priorities, despite the huge investment required. The period also marked an expanded effort to force the marsh dwellers into internal displacement or foreign exile. Roughly 100,000 southern Iraqis are in border refugee camps in Iran; an uncertain number are in Saudi Arabia. No one is certain how many marsh dwellers live within the former or still existing marshlands, but estimates suggest 100,00 to 150,000. Other marsh dwellers have moved farther outside the area, usually the cities in the south.

Given the social upheaval during the past 20 years, intensifying over the last 12, the team was particularly interested in better understanding the extent to which this treatment was uniform across the marshes, the degree of displacement and social disorder, and strategies for economic assistance in such a war-torn environment.

Diversity within the Marsh Dweller Population

Within and on the margins of the marshes are a diverse group of people. Some are the Marsh Arabs who members of nine major indigenous tribes. Initial findings of a demographic census and public health survey, now being conducted by AMAR for this FORWARD activity, indicate that there are roughly 85,000 people who are Marsh dwellers still living in or residing on the margins of the marshes. This number is roughly double what people generally have believed to still be in the area and a third of population 20 years ago. In addition to the Marsh Arabs there are people, not members of those nine tribes, who live on the periphery of the marshes who exploit it directly or indirectly. Through AMAR, FORWARD will soon be carrying out a survey of people living on the periphery of the marshlands, who are not members of the major tribes and whom we do not consider to be marsh dwellers.

There are four major patterns of settlement and economic exploitation for the people living in or near the marshes. These differences have important implications for deciding who are to be the beneficiaries of the marshlands program. The following distinctions are not ethnic or linguistic, although tribal identify is an important factor. They represent different patterns of exploitation for those who are living in marsh or on its periphery, or were forced into internal or external exile:

1. Marsh Arabs living inside the marshes in close to the traditional patterns, having a long history of living on small, isolated islands. Prior to the visit, many wondered if the people of the marshes still survived, given the deliberate and systematic efforts of the Saddam Hussein regime to destroy their society. There are marsh dwellers still residing in the interior of Hammar marsh in small communities. This is an area written about the earlier



Figure 13. Inside the marshes, people suffer from malnutrition and many water-borne diseases in relative isolation



Figure 14. In Hammar marsh, the vegetation is largely salt bush, suggesting recent reflooding since the end of the war

travelers' accounts. The one settlement visited was called Al bu Ajaj in Al Chibayish (Figures 13 and 14). At the end of a narrow spit of land going directly into Hammar, it took another 45 minutes by boat to reach the settlement of roughly a hundred people. Much of the vegetation on the banks was salt bush with new patches of freshwater reeds, suggesting a recent reflooding of the area which had never been entirely drained. They were first displaced in 1991 and moved as a group eight times in nine years, only to be brought back by the army to within a kilometer of where they began. They spoke of burned houses and killed livestock. They now live in both reed and unbaked mud brick houses and have boats for fishing, water buffalo for a major part of their diet, and scratch out some agriculture. The people are suffering from malnutrition and water-borne diseases and drinking untreated and unfiltered water directly out of the marsh. They have neither schools nor any primary health care. The population was young; only one older man was present in the guesthouse during the meeting.

2. Marsh Arabs who had lived in the marshes but were displaced to drained areas on the margins of the present marshes. Displaced dwellers were moved between six and sixteen times during a nine year period. We met no group that was moved after 1999-2000, and many were brought back in the end near to where they began. It may be that forced displacement occurred during the years of drainage (Figure 15), ceasing when the major infrastructure construction was completed, but this is unconfirmed. It might explain why many displaced people were finally resettled near their original homesteads, but it does not explain why people were shifted so many times during those nine years. Among the early displaced people were the dwellers in Turaba in Hawizeh marsh on the Iran border, who were relocated in 1984 when the army built a dike and large base on their village site (Figure 16). Many more were displaced in 1991 after the Shi'a uprising. One finds clusters of small mounds throughout the three marshes attesting to former villages, some still with destroyed cement and brick buildings and lopped off palm trees, others entirely vacant, having likely had reed houses. The tribe in Turaba has 9 sub-tribes, only five of which still remain in the area. They and the later displaced groups live on desiccated marsh,



Figure 15. At the tail end of Hammar marsh, dwellers were forcibly moved to new locations, their houses destroyed, and palm trees cut.



Figure 16. Many displaced marsh dwellers now live in new settlements on the margins of the marsh without basic health and social services

often near a canal or drain, using it to grow wheat for subsistence with some for sale at a severely deflated price (25 percent of the production cost). They lived primarily on monthly government allocations of flour, rice, sugar, dried beans, and oil. These people used to boat, fish, care for water buffalo, hunt game birds, and collect reeds for fodder and construction, but they were restricted from access to the marsh for the nearly 20 years. They are slowly returning to marsh use, and the team found boatmen fishing with nets and others taking their livestock to the reopened marsh. This was an area of natural, continuing marsh. Other displaced populations are in Central and Hammar marshes, living under similar circumstances. In Al Chibayish, the largest town in the marshes, the roughly 5,000 residents have begun fishing and continue to make mats as a major source of income.

3. People living stably on the edge of newly reflooded marshes with a mixed economy.

Along the periphery of Hammar marsh are villages of people who have historically lived in cement-surfaced brick houses (Figure 17). These people were never displaced during the Saddam Hussein regime. They practiced a mixed economy, working in agriculture with palm trees intercropped with other crops, growing wheat, and tending sheep and goats. They also exploited the marshes with boats: fishing, collecting reeds, and birding. Those activities ceased with the drainage of the marsh in 1991, but they quickly returned to marsh activities in mid-April with the reflooding (Figure 18). It appears that these people are not members of the nine major tribes.

4. People living stably on the edge of the newly reflooded marshes who never exploited the marsh as part of their economy.

Also along the western periphery of Hammar marsh are villages which were equally stable historically, its residents not having been displaced during the years of drainage (Figure 19). Here, the people grew palms, intercropped with winter wheat and summer rice. This season is the first time in 12 years that they have been able to grow rice, a good income earner, because of the reflooding of Hammar (Figure 20). These people have never exploited the marshes, except by drawing its water for field crops.



Figure 17. A village in western Hammar marsh again practicing a mixed economy of agriculture and marsh exploitation



Figure 18. People from the village returned to the marshes after 12 years, following the reflooding in mid-April

They do not have boats, fish, hunt, collect reeds, or make mats. In some villages, one finds the traditional reed guesthouses (*mudhif*); in others, guests are greeted in large brick

additions to houses with external entrances (*diwaniya*). These latter are not associated with the marsh dwellers and suggest that these villagers are not a part of that population. It appears that they too are not members of the nine major tribes.

A fifth type of residential and exploitation pattern also exists for marsh dwellers who have forcibly or voluntarily left the marshlands:

5. Marsh dwellers who were internally displaced and live in the towns and cities not working in agriculture or marsh-related occupations. A number of sub-tribes and individual marsh dwellers voluntarily left the marshes for cities and towns in the south. Others are said to be in Najaf and Baghdad or might have moved to the north as part of an Arabization of the Kurdish north. We do not know how many are in this category. People we met in Basra had moved from Hammar marsh in 1991 and were working in occupations removed from the marshes, with the apparent exception of a sheikh who was a prominent importer of nylon nets from Thailand, which are widely used in the marshes by fisherman. They would consider returning to the marshes, where they spoke of large landholdings with orchards of date palms, but they demanded compensation for past mistreatment, new seed varieties, and a reliable water supply.



Figure 19. In Hammar, the village's economy centers on agriculture, never having exploited the adjacent marsh

Figure 20. With the reflooding, rice is cultivated for the first time in 12 years on the western periphery of Hammar marsh

Territorial and Land Rights

In the settled villages along the marsh edges, people hold papers indicating ownership of land. In the marshes with floating islands and waterways used for hunting and fishing, the areas were held first in the name of a tribe, but within those tribal territory, each sub-tribe had its own area for members of that group. Members of other tribes and sub-tribes did not enter. No specific rights were accorded to groups below the sub-tribe. In the era of major irrigation infrastructure for wheat, the areas were government developed and operated. We believe that the land was not individually owned.

Public Health Conditions and Concerns

People in the marshlands suffer from an absence of primary health care, malnutrition, and unacceptable drinking water (Figure 21). Nor are there non-polluting options for wastewater and solid wastes. There are no government services. People suffer from schistosomiasis, worms, and cholera. AMAR open its first clinic in Hawizeh marsh in al Turaba in late June (Figure 22) and plans another in Hammar in the coming months. The clinic is staffed with a midwife, pediatrician, specialists, nurses, and a pharmacist dispensing a good supply of medicines. Clean drinking water is a problem throughout the area. Some people purchase tanker water, having some access to treated water, but those within the marshes drink directly from the untreated source. Drinking water quality was consistently mentioned by people as their first priority. The second was most often mosquitoes which plagued people throughout the marshes. The mosquito problem may have been worsened by the reflooding of the marshes which do not have adequate fish in number to eat the larvae.



Figure 21. A government health clinic in Hammar marsh, ill-equipped and unvisited by the local population



Figure 22. A health clinic in Hawizeh marsh established in late June by AMAR with hundreds seeking help daily

Preliminary Conclusions

The major, preliminary conclusions on the status of marsh dwellers are as follows:

- Despite their ethnic homogeneity, there are a number of distinct patterns of economic exploitation of the marsh dwellers, both voluntary and involuntary. The most surprising pattern is by those living on the periphery: some practiced a mixed economy of agriculture and marsh use, while others only practiced agriculture, despite their physical proximity.
- The worst physical displacement, entailing serial moves over more than a decade, was suffered by the Marsh Arabs who were living inside the marshes on the floating islands. They were forcibly moved to other locations in the drained marshes, often not far from their original sites. Forced moves stopped or decreased in frequency in 1999-2000. It appears that while all Marsh Arabs were repeatedly displaced, marsh dwellers living on the periphery of the marshes were rarely, if ever, displaced.

- Although there has been considerable physical and social upheaval during the past twenty years in the marshes, there is also a remarkable degree of social continuity, given that tribes or sub-tribes usually moved as a group from location to location by the government. The key role of tribal elders has remained largely intact. Guesthouses are still found within the area, with new ones being built. The houses, which reflected tribal politics, have more recently been adopted by local Shi'a social service organizations as centers for their support activities.
- With the reflooding of areas of the marshes, people often moved quickly to re-exploit the areas, taking up boating, fishing, and reed harvesting where sufficient reeds were available.
- People in the marshes are requesting clean drinking water, mosquito control, employment opportunities, health care, and improved security. Many internally displaced people and external refugees are expected to return to the marshes in the coming months and years. They ask for social services that have never been accessible to them in the past but ought to be expected of any representative civil society in the future.

Economic Assistance: Local Economy and Opportunities

The marshlands witnessed massive government investment over the past two decades to first drain the area and second develop an irrigation infrastructure for the uneconomic cultivation of wheat. But there has been no investment to improve the lives of the local population for decades. All government policies and actions were directed toward making the people more subservient to and dependent upon the ruling clique. As a result, there is little economic opportunity within the marshes and on their periphery. The large numbers of displaced people were almost wholly dependent on monthly food allocations. Even those people who were not displaced and depended on wheat growing sold their harvests at a crippling loss to the government. The traditional economic pursuits, including commercial fishing and birding were brought to a standstill. Mat-making continued in the larger towns of Al Chibayish and Hammar City, but was severely undermined by the drying of the marshes.

Today, economic activity in the marshlands revolves around subsistence and limited market wheat-growing. Agricultural activity in the region is largely a monoculture, although there are a few pockets of wider cultivation that were noted by the team:

- Date palm orchards are in the villages without displacement along the periphery of the marshes.
- Vegetables, including okra and maize, and melons are grown on the banks of the Euphrates River, controlled by sub-tribe members.
- Occasionally, tomato plants were seen.

Fruit and vegetable stalls in the open-air markets in the larger towns sell eggplants, potatoes, watermelons, pears, apples and grapes, but none was seen growing in the visits to the marsh villages (Figure 23). This does not rule out the possibility, but the absence of variety in crops grown was rather startling. The affect of an almost total reliance on wheat-growing was observed on the ground and in a Royal Air Force helicopter provided to the team (Figure 24). Vast areas of the drained marshes have been turned into fields for wheat-growing, only to become highly saline from poor water management and bad drainage. Many of the fields throughout the area are abandoned and covered with a salt crust. The wheat cultivation may have been motivated more by an effort to cloak the persecution the marsh dwellers and the destruction of the ecosystem to the world with the veneer of food security through irrigation development. The team visited the area soon after the wheat harvest and postharvest activities, so it difficult to assess the agricultural technologies, but there were few tractors and no irrigation water-saving devices. Surface flood irrigation appears to be the common way of applying water to fields.



Figure 23. With the exception of the tomatoes, the products being sold at this Al Chibayish market stall are not grown locally



Figure 24. Drained Central marsh turned into land for irrigated wheat, now heavily saline from poor water management

Animals were found throughout the area, usually small herds of water buffalo, but sheep and goats were often noted. Water buffalo provide the main share of protein in people's diet through yoghurt and cheese. The extent to which meat is a part of the diet is not yet clear, although we would expect that it is a relatively small.

Fishing was once a flourishing industry in Al Chibayish in Hammar marsh. Tribesmen said that until 1991, four truckloads of fish were sent daily to cities to the north. With the drying of the marshes, the trade ceased. Fish were originally caught with tridents, but dwellers also used nets, although the size of the holes decreased as the catches worsened. Eventually, some people used mesh or cloth from which nothing escaped. Others used poison. There was no mention of the Saddam Hussein's regime having poisoned the waters to kill the livestock and fish, but the issue warrants further investigation. With the reflooding of the Hawizeh and Hammar marshes particularly, people have returned to their boats to fish, usually with nylon nets (Figure 25). The catches seen by the team were disappointing in number and size (Figure 26). Throughout the visit, team members did not see any fish longer than about six inches, and it shares a concern that the present fishing

practice, growing out the people's delight that the waters have returned and the need for food and income, will lead to overfishing and deplete the fragile fish stocks.



Figure 25. A fisherman in the recently reflooded Hawizeh marsh now open to displaced dwellers forcibly relocated nearby



Figure 26. Catches since reflooding are small in number and in size – fishing may be endangering the fragile stocks

The team was also struck by the absence of local crafts or industry, with the exception of mat-making which has historically been an important income source for marsh dwellers. Mats made in the marshlands were sold through Iraq (Figures 27 and 28). There appear to be no cottage industries in the form of pottery, woodworking, weaving, or metalwork. It is as though the local economy has no indigenous underpinning or that its core has been entirely destroyed.



Figure 27. Reeds used for mat-making are also trucked outside the marshes for construction



Figure 28. Crudely made mats are still woven in the marshlands for floor covering and house construction

Preliminary Conclusions

The major, preliminary conclusions concerning the local economic and opportunities for recovery are as follows:

- After twenty years of almost continuous wars, sanctions, and persecution of the local people, the area is bereft of a stable economy and desirable employment opportunities.
- The previous regime's aggressive policies regarding unsustainable wheat-growing as a monoculture has undermined the region's economic base and made that huge investment into a catastrophe for the people.
- Marsh-related and agricultural activities will probably not provide an adequate economic base to this savaged area.

4. Capacity Building in Marshlands Management

The fields of marshlands management and restoration are unknown in Iraq's professional and scientific communities today. It is probably accurate to posit that environmental science is not understood as well. During the past twenty years, Iraq has been a closed society with little intellectual interaction with the West. Few new ideas penetrated a security wall. On the other hand, Iraqi professionals in the government have proven themselves to be effective construction engineers as they mastered and applied techniques to drain and destroy the marshes over a decade. An essential challenge to this program, and to the wider efforts of the Provisional Coalition Authority, is to transform a record of destruction into a springboard for creation and rejuvenation.

A fundamental change in thinking matched by concrete actions will be accomplished, in part, by providing opportunities to Iraqis in government, universities, and research centers to learn about and adopt marshlands management approaches through short courses, international study tours, and complementary laboratory work. Given its limited scope and funding, this program cannot undertake ambitious long-term institution building. However, the program can build skills in Iraqi professionals by bringing them directly into the planning and implementation of its many activities.

The following are initial observations of potential partner institutions:

Ministry of Water Resources and Other Government Entities

The prime beneficiary of capacity building activities is the Ministry of Water Resources. Although it was not able to visit its headquarters in Baghdad, the team did visit the Ministry of Water Resources district offices in Al Amarah and Al Nasiriyah to assess their interest in the marshlands program, review their activities, determine their data holdings, and assess their facilities. Directors of the two offices and staff also accompanied the team on field visits to Al Sannaf and Central marshes and a regulator structure and embankments along the Euphrates. The team found very different situations at the two district offices. In Al Amarah, the office had been thoroughly stripped by looters. All equipment was lost, all furniture removed, and even outlets and floor tiles were taken (Figure 29). Staff were standing in hallways in clusters or sitting on blankets on the floor. No work appeared to be being done in the offices.

In contrast, in Al Nasiriyah, the quick-thinking director anticipated the looting and hired armed bodyguards and closed the gates into the facility. As a result, looters never entered and nothing was taken (Figure 30). Staff were seen working at computers, and operations seemed surprisingly normal. The Al Nasiriya office also supplied the only flow data the team received. Following the war, elders of a marsh tribe from the area that had been displaced approached the director of the Al Nasiriya office, asking for releases of water into a drained marsh, saying they would return if water were supplied. The director opened gates and reflooded the area.

In Baghdad, the team was not able to visit the Ministry of Water Resources headquarters which was badly looted and burned. Nor was it able to secure flow data. The team will pursue this data investigation on the second trip.



Figure 29. Ministry of Water Resources district office in Al Amarah which was heavily looted following the war in April – wires were ripped from walls and tiles removed from the floors



Figure 30. Ministry of Water Resources district office in Nasiriyah which retained all its facilities due to the quick action of the director who hired armed guards to repel looters

Universities and Research Centers

During the scoping trip, the team visited the University of Basra's Faculties of Science Engineering and the Marine Science Center to establish contact and to assess their capacity to participate in the program. The faculties offer degree programs for undergraduate and graduate students. The center operates under the auspices of the Faculty of Science and does not award degrees. Center faculty work with graduate students from Basra and other universities on research projects in five technical fields: marine biology, marine chemistry, physical oceanography of estuarine and coastal waters, marine geology, and marine vertebra (Figure 31). As has been widely reported, the faculty in the university, as in other Iraqi universities, was well-trained in their narrow disciplines and had active careers until the Iran-Iraq War. The center published *Marina Mesopotamia*, a serious academic journal that was disseminated through the region. Several faculty members were trained in Europe, including Britain and France.

The Iran-Iraq War isolated the academic community at the university in 1984, Basra being in the frontline of the continuous battles. For the past 20 years, faculty have not been trained or traveled overseas for conferences. Virtually all outside links stopped. Hence, the faculty know little to nothing about advances in their fields during the last two decades. They lack an understanding of comprehensive environmental science and have no knowledge of marshlands ecology and management; nor are they aware of current restoration approaches.

After the Gulf War, the center was further singled out at the university for reduced support. It received little research funding, and faculty received salaries which were lower than their counterparts in departments. Research was tightly controlled and carried out to support government policies. For example, the center was told to do an environmental impact of the

Main Outfall Drain which would show that there was no negative effect. Faculty members submitted raw data, too fearful to conduct an analysis and write results. Students' research at the university was expected to support the government. One student, whose thesis which reflected badly on the drainage programs, was shouted down by faculty members during his defense and never received the degree. Others were forced to rewrite their work. The physical conditions were largely the same in the faculties and the center. Their facilities, libraries, and laboratories are dated, suffering from isolation and government neglect from the Iran-Iraq War, worsening still more during the years of sanctions. Annual budgets covered salaries and utilities. Little was given for equipment, furniture, and supplies.

There was extensive looting after the last war and buildings were destroyed, equipment looted, and furniture stolen. While the team visited, looters were cutting down and carting away trees on campus. Some hid small equipment in their homes or behind laboratory walls. Most laboratories had little left besides tables fixed to the floor, glass beakers and bottles, or government-supplied furniture which the faculty noted was too undesirable even for the looters. Center vehicles were stolen, and the marine research vessel was taken. In the engineering faculty little remains there too. Only six computers are in the computer center.



Figure 31. Faculty members of the Marine Science Center have been isolated professionally from new advances in their fields for nearly 20 years



Figure 32. Laboratories at the center were badly looted while a former Baathist leader at the university continues to play a prominent role

Following the war, a new director of the center was elected by faculty, for the first time in its history. The previous director, founder of the center, attended and actively participated in meetings with the team. Only later did the team learn that he, perfectly fluent in elegant and witty English – having received his doctorate in Wales – had also been a leader of the Baath Party on campus, who acceded to every demand from Baghdad (Figure 32). The vetting of staff in government and universities promises to be a long and confusing process and could pose credibility problems for this program.

5. Components of the Marshlands Program

Based on the scoping visit, the initial design of the program is clearer. At this point in our understanding of the situation, components of the proposed 12-month program are likely to include the following:

Pilot Restoration Projects

In the fall, soon after the submission of a detailed action plan, on the ground marshlands restoration projects will commence. Based on visits to the marshes, the team identified four pilot projects that might profitably be implemented. The process for carrying out pilot projects will be identifying current stages of restoration, monitoring progress, identifying possible new sites, consulting with local stakeholders, implementing, and monitoring. A number of institutions, including Duke University, the Iraq Foundation, and the Commonwealth Scientific and Industrial Research Organization are likely to be involved. Potential pilot projects include:

- Reflooding drained areas near existing marshes to use seed sources and native species for marshland reclamation (e.g. Hawizeh and Central marshes near Glory River);
- Managing high salinity irrigation waters (e.g. Main Outfall Drain diversion);
- Constructing wastewater treatment wetlands to improve sewage treatment in small villages; and
- Constructing potable water treatment systems using reed beds in the poorest areas, since freshwater marsh plants provide excellent natural filtration and purification.

Social and Economic Assistance

No recent demographic survey exists during this period of social upheaval, so little is known about the remaining and returning populations. Social and economic conditions in the marshes are now dire. Public health services are largely absent, and schools are non-existent or terribly substandard. Malnutrition is widespread. Farmers have been growing wheat in a monoculture pattern and are barely living at a subsistence level, but rice is quickly returning after a 12 year hiatus. Opportunities may exist for introducing new high-value varieties for local and national markets, although credit and other services are likely needed. Other employment options may be introduced. Commercial fishing, once a highly prosperous endeavor, no longer exists since the newly returned fish are small and may be overfished, undermining fish stock regeneration. This program component will introduce, in quick order, carefully targeted interventions to improve the lives of people in the marshes, helping them to help themselves. Proposed interventions include:

- Supporting a demographic and public health survey presently being conducted by the AMAR throughout the marshes to better understand the beneficiaries;

- Carrying out an assessment of land tenure leading to a cadastral survey;
- Initiating interventions in agriculture, water management, and other areas; and
- Identifying other employment options, including fish farming.

Data Collection and Monitoring

A program of this complexity and magnitude will require an accurate database. Iraq requires a database on the marshlands for program planning, monitoring, and assessment and for policy reform. This component will carry out systematic data collection in the marshes both on the ground and through state-of-the-art remote sensing analysis. Potential activities include:

- Remote sensing and soil mapping of the entire marshlands;
- Systematic water and soil sampling and analysis, narrowed by the exhaustive analysis presently being carried out;
- Ecological analysis of the existing Hawizeh marsh through a flora and fauna survey;
- Monitoring new water flow into newly re-flooded marshes to assess biotic response and water quality (e.g., Hammar Marsh near Karmat 'Ali);
- Ecological comparison and contrasting of fish and wildlife populations to determine the degree of marsh reestablishment in the natural and newly flooded marshes; and
- Create water holding ponds to divert and hold toxic or poor quality water.

Hydrologic and Hydroperiod Modeling

Serious, widespread planning for the marshlands must be grounded in an understanding of water availability and allocations within the basin. This component addresses the questions of how much water is in the river systems in Iraq and how it is to be applied within the marshes. Activities include:

- Development of a hydrologic model of the entire basin by the US Army Corps of Engineers; and
- Development of a corresponding hydrodynamic or hydroperiod model of Hammar and Hawizeh marshes.

Capacity Building in Marshland Management

The program will look beyond marshlands restoration and development assistance focusing on developing understanding of and skills in marshlands management in government agencies, universities, and research centers. Possible activities include:

- Study tours and short courses. As a way of jumpstarting the program, a group of Iraqi scientists and officials will be given a marshlands ecology short-course at Duke University, a partner in the program, and a visit to the Everglades. Other visits may be undertaken as deemed necessary and useful.
- Training. Short courses will be designed to be carried out in Iraq on marshlands management and laboratory analysis.
- Equipping laboratories for water and soil analyses. A select number of laboratories will be given equipment to carry out soil and water analyses to support the program. The program will assess existing laboratories in universities and research centers to determine which are the most appropriate partners for program.

6. Challenges Facing Program Design and Implementation

The scoping trip was particularly useful in highlighting challenges that must be addressed in the design and implementation of the marshlands program. The current deterioration of the situation in Basra over the past days reveals additional challenges to be faced. Among the most serious are the following, although others are certain to emerge in the coming weeks:

Designate the Ministry of Water Resources as the Primary Partner for the Program

This program will be carried out in close partnership with the Ministry of Water Resources (formerly the Ministry of Irrigation). Program design and implementation will be done in collaboration with ministry management and technical staff with decision-making responsibility, as well as participation in capacity-building efforts.

Ensure the a Role of the Coalition Provision Authority as the Lead US Entity

Operationally and practically, the Coalition Provisional Authority will play the role as lead US entity for the program and with the Government of Iraq in program direction and oversight. This direction will need to be closely coordinated with US-based entities that are most closely involved in the program, USAID and the Department of State.

Identify the Voices of the Marsh Dwellers

With the change in regime, a number of NGOs and other entities have quickly entered southern Iraq, sometimes claiming to speak for the marsh dwellers. These groups are well meaning, and some have long-term relationships with marsh dwellers who remained in Iraq and others who chose to leave or were forced into exile during the past troubled decade. While these groups can be very useful points of entry into the larger marsh dweller community, given their credibility, this program will need to develop strategies for public participation, public awareness, and public decision-making in its development and activities. In the end, the marsh dwellers must speak for themselves, displaying all the internal differences of opinion that enrich open dialog, debate, and consensus. The program will need to work with the widest range of stakeholders in creative and purposeful venues throughout its life, building the blocks of civil society.

Pursue Donor and United Nations Partnerships

During and since the return of the scoping trip team, a number of donors, including members of the Coalition of the Willing, have begun to make financial commitments for carrying out programs related to marshland restoration and humanitarian assistance. These include:

- Great Britain which has committed to funding half of a three-month environmental assessment by UNEP in Iraq;

- Italy which has signed a memorandum of understanding with Iraq Foundation for 1.2 million euros to carry out modeling and water resources project identification for six months, perhaps leading to a larger project;
- Australia which has recently issued a competitive tender for a national agricultural development project;
- Canada which has allocated C\$300 million for projects in Iraq, some environmental;
- United Nations Environmental Programme which will undertake an environmental assessment of hotspots, capacity-building, and natural resources and biodiversity; and
- International Organization of Migration, already established in Basra, which is seeking additional assistance for emergency and mid-term assistance to marsh dwellers.

There is an obvious need to coordinate these efforts with the US program, at a minimum, and act in partnership whenever possible. The program, with the support and participation of USAID and the Department of State, has already established strong links with the Iraq Foundation and has opened lines of communication with the other donors and agencies, as well. These relations must be strengthened and regularized for best results.

Ensure Coordination of Modeling and Pilot Project Efforts

Following on this donor coordination, the program will need to ensure the coordination of different groups now likely to be involved in the development of hydrologic and hydrodynamic models, whether funded through US or other donor sources, including the US Army Corps of Engineers, the Danish Hydraulic Institute, Iraq Foundation, and Exponent. How this coordination and reasonable division of responsibilities among them to support this marshlands program. Discussions to date with the different parties indicate strong good will in carrying out the process without duplication and mutual support.

Provide for Team Security

During their two weeks in Iraq during the latter half of June, the team experienced relative calm and were not threatened, disturbed, or assaulted. Recent events in Basra, particularly, indicate, at least a temporary, worsening of the situation. While the present riots and violence may abate, it is clear that the next team will need to proceed under greater protection and probably with less freedom. CPA, USAID, and DAI are all, in different ways, responsible for the safety of the team members. The logistical challenges will increase considerably and careful preplanning will need to be carried out to ensure as much as possible their safety and productivity in Iraq.

7. Immediate Program Tasks

The following are descriptions of proposed activities to be carried out between now and the end of October or through completion of the Action Plan:

Marshlands Data Collection and Analysis

- *Initiating soil mapping.* State-of-the-art techniques for mapping soils on large scales using remote sensing photography will be incorporated into the program. During the next months, it is necessary to explore this new technology with the university practitioners and shape their efforts to fit program requirements. This approach is expected to reduce the extent of on-the-ground soil sampling over the southern marshes.
- *Continued systematic soil and water sampling.* The Duke Wetland Center will take the lead in carrying systematic soil and water sampling in the marshes, following on its work during the scoping trip. It is presently completing comprehensive analyses of 60 water and 16 soil samples, which will be used to determine the extent of sampling and analyses required in the second phase. Based on the laboratory findings, the program will develop a methodology for the fall visit.
- *Development of designs for pilot restoration projects.* Four pilot restoration projects have already been identified for potential implementation. During the coming months, the program will develop more detailed designs of each project, including budget and levels of effort. During the second trip, the team will find specific locations for these projects.

Data Flow Collection and Structural Inventory

- *Continue flow data collection.* During the scoping visit, the team was marginally successful finding flow data. Only the MWR district office in Al Nasiriyah supplied the information. Attempts in Baghdad and Al Amarah were inconclusive. During the second trip, the team will continue the search.
- *Continued structural inventory.* The team visited many of the major drainage structures in the south in June. During the second trip, team members will continue the inventory.

Model Design and Development

- *Development of hydrologic and reservoir models.* During the period, the program will launch a modeling effort with the US Army Corps of Engineers' Institute for Water Resources in the Davis, California Hydrologic Engineering Center using HEC-ResSim reservoir simulation software for the Tigris Euphrates watersheds for water control management restoration. The work will focus on significant data preparation, research on reservoir system physical features, and determination of operational goals.
- *Training in HEC models for Ministry of Water Resources engineers in US.* Two Iraqi engineers from the Ministry of Water Resources office in Baghdad spend two months at

the HEC in Davis to assist in the construction of a water management model and be trained in the use of the HEC-ResSim reservoir simulation model software. It is also advantageous to work closely with the Iraq Foundation which recently received a \$1.2 million grant from the Italian Government for environmental assessments, in part for marshlands modeling.

- *Development of hydrodynamic/hydroperiod model.* The program will include a component to develop a hydraulic model to forecast the flow of water in the marshes. Further effort will be made to identify appropriate candidates for the work.

Marsh Dwellers Surveying and Interviews

- *Completion of demographic and public health survey.* The program will provide support to AMAR to complete its demographic census and public health survey of people living in and on the periphery of the marshes. Funding is provided for data entry and analysis and for medicine to distribute to villagers as they participate in the survey, as part of AMAR's primary care initiatives.
- *Interviews with marsh dwellers.* In-depth interviews with marsh dwellers will continue during the second trip to further clarify local organization, modes of exploitation, land use patterns, and preferences for future stability and resettlement. During the scoping trip, AMAR was exceedingly useful in providing links to the local population, given the degree of confidence they have.

Employment Opportunities

- *Design of irrigated agriculture interventions.* Experts in irrigated agriculture will explore opportunities for improving cultivation, inputs, and credit in initiatives to be carried out under the program.
- *Investigation and design initiatives for local employment generation.* The team on the second visit will explore options for job creation and income generation outside irrigation agriculture in complementary post-harvest and other activities, including fish farming. These specific efforts will be incorporated into the rolling action plan.

Capacity Building in Marshlands Management

- *Design of short course and study tour in wetlands restoration.* The Duke Wetland Center will design and conduct a one week course to be given on campus and a study tour of the Everglades for December 2003 or January 2004. Participants will include officers of the Ministry of Water Resources, researchers from the Marine Science Center, and from other appropriate entities. The objective of this first effort is to instill an understanding of wetland restoration and wetland management in experts in Iraq who will take responsibility in the future.

8. Next Steps

The following steps will be carried out in program planning and implementation. These initial steps have been endorsed by the Interagency Marshlands Subgroup.

August and September: Demographic Census and Public Health Survey in the Marshlands

The marshlands program will provide support for a demographic census and public health survey throughout the marshes to determine the population and status of the population. This is probably the first serious assessment of the population since 1947 when a census was carried out by the Iraqi government. AMAR has already initiated the survey, collecting data at the same time that it provides medical services in the villages. DAI submitted a subcontract to USAID for the completion of the survey, data entry and analysis, and incorporation of the data into a geographic information system.

August and September: Modeling Efforts

Meetings are already being held with the Army Corps of Engineers and the Danish Hydraulics Institute to evaluate proposals they submitted. Development Alternatives, Inc., the prime contractor of the Water IQC, has prepared and submitted a subcontract with USACE to USAID for approval to cover the costs for international travel and local expenses for Ahmad Ibrahim Fadhel and Moaid Kadhum Mamoud, both chief engineers in the Ministry of Water Resources' Baghdad office, to receive training at the US Army Corps of Engineers (USACE) office in Davis, California which is the Hydrologic Engineering Center for two months. This visit will be the initial phase of a water control management restoration project using HEC-ResSim reservoir simulation software for the Tigris and Euphrates watersheds in Iraq. The two Iraqi engineers will travel for collaboration on technical information in reservoir operations from their experience, to assist in the construction of the water management model, and to be trained in the use of the HEC-ResSim reservoir simulation model software.

August and September: Publications and Press Conference

As the first scientific and development assistance team on the ground in the marshlands since the end of the war, it is critical that the first publication for wide dissemination be produced under this program as the baseline. Members of the scoping trip team will prepare an article for publication in a respected scientific journal. In addition, under the leadership of USAID and State/OES, the team will hold a press conference to present the findings and conclusions of the trip and the initial program framework. The session will be led by Andrew Natsios, Administrator of USAID, and John Turner, Assistant Secretary of State for Oceans and International Environmental and Scientific Affairs.

September and October: Development of Methodology for Systematic Soil and Water Sampling

The team will develop instruments, data collection plans, and sampling methodologies for the coming year. These methodologies include developing plans for a state-of-the-art approach to soil mapping using remote sensing images, confirmed by on-the-ground soil sampling and conducting water sampling. Analyses being made currently at the laboratories at Duke University ought to better inform the program about what future tests are needed and with what degree of accuracy.

October: Second Field Trip to the Marshlands

An enlarged team will spend the second half of October in the marshlands to continue data collection and prepare for the action plan. The objectives of the trip are to:

- Assess the changes in the marshes between June and September/October to determine the extent of marsh reestablishment;
- Establish a marsh baseline by carrying out a detailed assessment of Hawizeh marsh with regard to vegetation, soil, water, and biota;
- Identify sites for restoration pilot projects and monitoring projects;
- Identify interventions for economic assistance through improvements in irrigated agriculture and new employment opportunities, including fish farming; and
- Assess waste and drinking water systems in order to introduce low cost wetlands treatment systems.

The technical team is likely to include some or all of the following kinds of experts:

- Social scientist/team leader
- Program design/logistics expert
- Agronomist/agribusiness/off-farm employment expert
- Agricultural economist/rural credit/social safety net expert
- Wetland/soil and water ecologist
- Fish and wildlife wetland ecologist
- Constructed wetlands expert
- Saline agriculture expert
- Marine science experts (Iraqi)
- Public health/water borne diseases expert

November: Action Plan Development

The team will submit a “rolling” action plan to the Interagency Marshlands Subgroup and other interested parties for review. The plan serves as the basis for the program and will identify specific tasks, a timeframe, and a detailed budget. It will also contain recommended sites for the pilot projects.

November and December: Pilot Restoration and Economic Assistance Projects Start Up

With approval of the action plan, implementation will begin with pilot restoration and monitoring projects and initial interventions in economic assistance.

APPENDICES

A. Acronyms and Terms

AMAR	Assisting Marsh Arab Refugees International Charitable Foundation
CMS	Cubic meters per second
CPA	Coalition Provisional Authority
CSIRO	Commonwealth Scientific and Industrial Research Organization
DAI	Development Alternatives, Inc.
DHI	Danish Hydraulics Institute
DO	Dissolved oxygen
<i>diwaniya</i>	guesthouse
HEC	Hydrologic Engineering Center
IOM	International Organization of Migration
IUCN	World Conservation Union
MOB	Mother of Battles Canal
MOD	Main Outfall Drain
MOI	Ministry of Irrigation
<i>mudhif</i>	guesthouse for marsh dwellers
MWR	Ministry of Water Resources
OES	Bureau for Oceans and International Environmental and Scientific Affairs
PPT	Parts per thousand
TDS	Total dissolved solids
USACE	US Army Corps of Engineers
USAID	US Agency for International Development
YSI	Yellow Springs Instrument

B. Water and Soil Sampling Methods

Approximately 60 water, 16 soil, and 2 plant composite plant samples (*Phragmites*) were collected from June 17 to June 23, 2003 at a variety of locations within southern Iraq. After cataloging and recording the appropriate volume or weight of each sample, the Duke Wetland Center in Durham, North Carolina carried out a wide range of tests to determine characteristics unique to the Iraq marshes, as well as to determine current soil and water quality. Some tests were outsourced to another laboratory nearby. In addition, field data were collected at the water sampling sites at the time of the water sample collection.

The following soil sample tests and methods were used at Duke Wetland Center:

- pH – paste method – 50 percent air dried sample in deionized water
- Loss on ignition – combustion for four hours at 450°C
- Wet/Dry ratio – dry for 24 hours at 105°C
- Total Phosphorous – nitric acid/perchloric acid digestion, then automated P analysis with Murphy-Riley (1962) method
- Nitrogen extraction – 2M KCl extraction of N compounds (nitrate and ammonia) with analysis with automated cadmium reduction method (nitrate) and automated indophenol blue method (ammonia)
- Microbial Biomass – chloroform fumigation followed by extraction with 0.5M K₂SO₄. The extractant is analyzed for organic C by automated combustion.

Approximately 50 grams of each soil sample are to be analyzed by Prism Laboratories, Charlotte, N.C. for the following organic analysis:

- PAH analysis EPA method 8270 extraction and analysis by GC/MS
- Organochlorine pesticides EPA method 8081 extraction and analysis by GC/MS

The following water sample tests and methods at the Duke Wetland Center:

- Ammonia – automated indophenol blue method
- Nitrate/nitrite – automated ion chromatography with Dionex ion chromatograph
- Total nitrogen – alkaline persulfate digestion with automated cadmium reduction method
- Ortho-phosphate – Murphy-Riley ascorbic acid reduction method (1962) with high sensitivity spectrophotometer analysis
- Total phosphate – acid persulfate digestion with Murphy-Riley method and high sensitivity spectrophotometer analysis
- Dissolved organic carbon – filtration with automated combustion analysis (CO² determination)
- Anion analysis – automated ion chromatography with Dionex chromatograph
- Dissolved metal analysis – filtration followed by automated ICP/MS analysis with HP 4500 ICP/MS

Approximately 10 ml of each water sample will be analyzed by Prism Laboratories for PCB's and pesticides by EPA method 608 with gas chromatography.

We recognize that the sensitivity of the analysis will be lower than usual because of limited sample size.

At the time of water sampling in the field readings were recorded for 36 sites for the following parameters with YSI model 556MPS portable probe with recording station:

- Temperature
- Conductivity
- Salinity
- Total dissolved solids
- Dissolved oxygen
- pH
- Oxidative/reductive potential

These analyses were done by specific probes calibrated before analysis. The data were recorded electronically and transferred to a computer for later retrieval.

C. USAID-Funded Reconstruction Activities in Iraq

Current USAID-funded reconstruction activities implemented throughout Iraq with particular relevance to the marshlands restoration and management initiative include:

Primary and Secondary Education: Assistance will target increased enrollment and improved quality of primary and secondary education, including ensuring classrooms have sufficient material by start of new school year (i.e., desks, computers, pencils, paper); facilitation of community involvement and other social mobilization to retain students; and development of baseline indicators.

Local Governance: Assistance will strengthen management skills and capacity of local administrations and civic institutions to improve delivery of essential municipal services such as water, health, public sanitation and economic governance; includes training programs in communications, conflict resolution, leadership skills and political analysis.

Capital Construction: Provides for emergency repair or rehabilitation of power generation facilities, electrical grids, municipal water systems, sewage systems, airport facilities, the dredging, repair and upgrading of the Umm Qasr seaport and reconstruction of hospitals, schools, ministry buildings, irrigation structures and transportation links.

Public Health: Provides for: supporting a reformed Iraqi Ministry of Health (MOH) at the national, regional and local levels; delivering health services; providing medical equipment and supplies; training and recruiting health staff; providing health education and information; and determining the specific needs of the health sector and vulnerable populations such as women and children.

Agriculture Reconstruction and Development: The objectives is expand agriculture productivity, rehabilitate key agroecosystems, and restore the capacity of small and medium agro-enterprises to produce, process, and market agricultural goods and services.

Community Action Program: Promotion of diverse and representative citizen participation in and among communities throughout Iraq.

Health, Water, Sanitation Services: Grant provides for restoration/provision of basic health services to the most vulnerable populations, focusing on women and children; support for primary health care services; fund essential medicines, vaccines and micronutrients; establishment a rapid referral and response system for the most serious cases; and publishing and distribution relevant health education materials and nutritional assessments.

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