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ESTABLISHMENT OF A GROUNDWATER MONITORING AND ENFORCEMENT DIRECTORATE AT THE WATER AUTHORITY OF JORDAN

FINAL REPORT: PROJECT COMPLETION

NOVEMBER 2006

This publication was produced for review by the United States Agency for International Development and the Water Authority of Jordan. It was prepared by ARD, Inc. in cooperation with IdRC, Engicon and Uhl & Associates.

PREFACE

ARD wishes to express our deepest gratitude to everyone who contributed to the success of the Groundwater Monitoring and Enforcement Directorate (GMED) project and to acknowledge those individuals responsible for the achievements reported herein:

- Water Authority of Jordan (WAJ) – Engineer Munther Kaleifat, Dr. Khair Al Hadidi, Samir Sukkar, Zuhair Hayasat, Abdul Halim Awad, and the Groundwater Basins Monitoring Sector (GBMS) Center and regional office personnel;
- Ministry of Water and Irrigation (MWI) – Suzan Taha, Ibtisam Saleh;
- United States Agency for International Development (USAID) – Ramzi Sabella, Jim Franckiewicz, Ziad Abd-Rabu;
- United States Geological Survey (USGS) – Dr. Bill Steinkampf;
- *Deutsche Gesellschaft für Technische Zusammenarbeit GmbH* (GTZ) - Dr. Philipp Magiera, Hussein Hamdan;
- ARD/Amman – Dr. Kamel Radaideh, Raed Nimri, Maysa Al Oran, Mrawan Raggad, Dawoud Saeed, Mohammad Al-Howary, Saleem Al Kharabsheh, and Mustafa Al Hmoud;
- ARD/US – Dr. Hammond Murray-Rust, Robert Kirkman, David Smith, Pam Doran and the home office support staff; and
- Subcontractors:
  - Engicon - Amer Batikhi, Nadia Ghandour, Basel Shomali, Dr. Omar Joudeh;
  - IdRC – Dr. Tarek Tarawneh, Dr. Amer Jabarin, Dr. Rasheed Al Hamoud, Waleed Haddadin; and
  - Uhl & Associates – Dr. Vince Uhl, Jim Horvath.

The results of your combined efforts exceeded all expected outcomes. The new Groundwater Basins Monitoring Sector at WAJ has had a very strong and positive start. We all hope that the people of Jordan will benefit.

Howard Sokoloff
Chief of Party – GMED Project

Submitted by the ARD Water IQC Consortium, under
USAID Contract No. LAG-I-00-99-00018-00, Task No. 812

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DECEMBER 2006

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ACRONYMS AND ABBREVIATIONS

APR	Annual Progress Report
BMFO	Bulk Meter Flow and Operations (GTZ-sponsored data management program for MWI)
CIS	Customer Information System
DC	Data Collection
DM	Data Management
DVD	Data Verification Division
FAS	Finance and Accounting System
GBMS	Groundwater Basins Monitoring Sector
GIS	Geographic Information System
GMED	Groundwater Monitoring and Enforcement Directorate
GPS	Global Positioning System
GTZ	*Deutsche Gesellschaft für Technische Zusammenarbeit GmbH*
IT	Information Technology
MOU	Memorandum of Understanding
MPR	Monthly Progress Report
O&M	Operation and Maintenance
OJT	On-the-Job Training
PSC	Project Steering Committee
QA/QC	Quality Assurance/Quality Control
QPR	Quarterly Progress Report
ROI	Return on Investment
SA	Systems Administration
SAP	Sustainability Action Plan
SOP	Standard Operating Procedures
USAID	United States Agency for International Development
USGS	United States Geological Survey
WAJ	Water Authority of Jordan
WIS	Water Information System

1.0 INTRODUCTION

1.1 PROJECT DESCRIPTION

After the ratification of Groundwater By-law 85/2002, the Government of Jordan decided to enhance the Water Authority of Jordan (WAJ) operations to improve compliance and monitoring of groundwater resources. WAJ decided to merge the Groundwater Basins and Licensing Unit and the Water Security and Protection Unit into one Directorate reporting directly to the Secretary General of WAJ.

It was envisioned that this new directorate would also be clearly linked to the billing and collection functions related to groundwater abstractions of the Water Subscribers Department. In addition, the link to the Water Resources Planning Directorate and the Water Information System (WIS) at the Ministry of Water and Irrigation (MWI) would be enhanced to provide improved groundwater abstraction data flow, accuracy and coordination.

It was intended that this reorganization would create a specialized body within WAJ to implement By-law 85/2002, thus providing a "one-stop shop" for groundwater users, and facilitating WAJ staff operations. Under this new organization, WAJ field offices would have a stronger connection to and support from the center to expedite operations and reduce inefficiencies.

ARD, Inc. was awarded a 24-month USAID contract to manage and implement the project for *Establishment of a Groundwater Monitoring and Enforcement Directorate (GMED) at the Water Authority of Jordan*. The GMED Project objectives are summarized below.

On 2 December 2004, the ARD team initiated project activities in Amman, Jordan. During December 2004, the project office was established, the GMED Project Steering Committee formed, and the project Work Plan for Year 1 was presented and approved by USAID, MWI and WAJ. In October 2005, the project Work Plan for Year 2 was approved by USAID and WAJ.

This *Final Report* provides a detailed summary of progress and end-of-contract outcomes for all project activities and deliverables contained in the approved GMED project Work Plan for Years 1 and 2 (see Appendix A).

This report also provides "lessons learned" that may be useful in the planning of similar future projects as well as sections summarizing project administration, financial management, and performance indicator tracking.

1.2 PROJECT OBJECTIVES

- Institutional strengthening: Establishment of Groundwater Basins Monitoring Sector (GBMS). Initially the project title was "Establishment of a Groundwater Monitoring and Enforcement Directorate" (GMED). However, during implementation WAJ indicated that they would prefer to have the title of the new Directorate to be the "Groundwater Basins Monitoring Sector" (GBMS). From a contractual perspective the acronym GMED was maintained, but for purposes of implementation within WAJ the acronym GBMS is used. There was no change in purpose as a result of this name change.

- Performance improvement: By-law 85 enforcement instructions.
- Capacity building: Training WAJ technical and field staff; transferring three trained junior staff from the GMED Project to GBMS/WAJ positions responsible for the new GBMS Data Management System.
- Quality assurance: Verification and analysis of abstraction data.
- Decision and enforcement support: Data management system.
- Work process improvement: Standard Operating Procedures—data management, data collection, operations and maintenance (O&M), and systems administration.
- Equipment and logistics support: Computers, water meters and monitoring equipment, mobile workshops, vehicles, and office equipment and furniture.
- GBMS sustainability: Planning and financial alternatives.

1.3 MAJOR ACCOMPLISHMENTS – FINAL STATUS

Technical – As shown in the table below, all project deliverables as defined in the approved Revised Work Plan – Detailed Year 1 and 2 (see Appendix B) for the GMED Project were completed on schedule and approved by USAID and WAJ.

Table 1.1. Major GMED Project Activities and Accomplishments

Major Accomplishments - Year 1 January – December 2005	Major Accomplishments - Year 2 January - November 2006
Task 1. GMED Organization Development	
• GMED organization chart (functional) - Dec 2004 • Assessment of 8 regional offices – Mar 2005 • Groundwater Basins Monitoring Sector (GBMS) organization and staffing, final – Mar 2005 • GBMS organization established – Jun 2005	• GBMS Long-term Staffing Plan – Jan 2006 • Hiring of Administrator/data-entry position for each regional office – completed by WAJ • Junior ARD staff (3) transferred to Data Verification Division, GBMS; employment by WAJ underway - Nov 2006
Task 2. Improved Groundwater By-Law 85/2002 Enforcement	
• Instructions for effective enforcement of By-law 85/2002 – Mar 2005	• Selected By-law instructions presented as Conditionalities for USAID Grant - 2006 • SOPs to assess By-law implementation, final - Aug 2006
Task 3. Procurement	
• Final approved procurement specifications – Oct 2005 • Procurement Report (Draft) – Mar 2005	• All commodities delivered • Support for vehicle distribution – central and regional offices • Assistance to WAJ in the inventory and distribution of various GBMS technical equipment – May 2006 • Procurement Report – Sep 2006
Task 4. Data Management Systems Development and Implementation	
• Assessment of GMED and WAJ Data Management Systems – Mar 2005 • Pilot GBMS Data Management System – Aug 2005 • Computers and connectivity operational for regional offices - Dec 2005	• GBMS MS-SQL Server established – Jan 2006 • GBMS Data Management System tested and accepted by WAJ and MWI, complete - Jun 2006 • Troubleshooting Checklist – Jul 2006 • Bulk Meter Flow and Operations (BMFO) implementation - Sep 2006 • Interim implementation solution – Sep 2006 • Follow-up data management implementation

Major Accomplishments - Year 1 January – December 2005	Major Accomplishments - Year 2 January - November 2006
	support – Nov 2006
Task 5. Standard Operating Procedures (SOP) and Training	
Development: • Data management, data collection, O&M – ongoing *Training:* • Basic computer training – Oct 2005 • Data Management System SOP training – Nov 2005 *Junior Hydrologist/Agronomist Trainees:* • Recruitment and hiring – Oct 2005 • Training program – ongoing	*Development:* • Data management, data collection and O&M SOPs – Oct 2006 *Training:* • O&M SOP training (Uhl and Associates), complete - Apr 2006 • Data collection SOP OJT training, complete - Sep 2006 • Training Report, complete - Sep 2006 *Junior Hydrologist/Agronomist Trainees:* • Formal training program, complete - Jun 2006 • USGS Groundwater Flow Systems Analysis and Modeling – Aug 2006 • OJT complete - Sep 2006 • MS Access® OJT – Nov 2006
Task 6. Groundwater Outreach	
• Groundwater Issues Awareness and Education Workshop – Sep 2005	• None planned
Task 7. Assessment of By-Law 85/2002 Implementation in a Pilot Basin	
• Impact Assessment Workshop and Plan – Nov 2005 • Impact Assessment Field Implementation – ongoing	• Indirect data secured from WIS/MWI - Mar 2006 • Field data collection (74 wells), complete - Apr 2006 • Trend and frequency analysis, complete, - Jun 2006 • Draft impact assessment, complete - Jun 2006 • Final impact assessment and SOPs, complete - Sep 2006
Task 8. GBMS Sustainability	
• Draft Action Plan for GBMS sustainability – Sep 2005 • Sustainability Action Plan (SAP) Workshop – Oct 2005 • Draft GBMS financial sustainability alternatives – Oct 2005	• Field interviews with GBMS/central and regional offices, complete - Jun 2006 • Final Sustainability Action Plan, complete - Aug 2006 • Sustainability Action Plan SOPs, complete - Sep 2006 • Financial data collection and analysis, complete - Jul 2006 • Final Report on Financial Sustainability and Opportunities for MOUs and Contracts, complete - Sep 2006
Task 9. Project Work Plans and Progress Reports	
• Revised Work Plan Year 1- Dec 2004 • Revised Work Plan Year 2 – Oct 2005	• All reports – submitted
Task 10. Project Final Activities	
• No activities planned for Year 1	• Final Workshop – Nov 2006 • Final Report – Nov 2006
Task 11. Well Data Verification and Labeling	
• None planned	• Well Data Coordination Plan – Jan 2006

Major Accomplishments - Year 1 January – December 2005	Major Accomplishments - Year 2 January - November 2006
	• Well data verification SOPs and training – Mar 2006 • Well data verification and field labeling at regional offices (8), complete - Aug 2006 • Wells data quality assurance/quality control (QA/QC), complete - Sep 2006

1.4 PERFORMANCE INDICATORS

The table below shows the final status in the achievement of specific indicators and measures established by USAID, in coordination with WAJ, to monitor and assess the planned impacts of the GMED Project activities and inputs, and targeted WAJ performance results.

Table 1.2. GMED Performance Indicators (Final Status) – December 2006

Indicator	Year	Target	Final End-of-Project Status
1. Number of groundwater and watershed protection activities completed	2005	1. 710 new water meters for wells procured.	COMPLETE – meters, spares delivered, Sep 2005
		2. 6 mobile workshops for water meter maintenance and repair procured.	COMPLETE - delivered, Jan 2006; equipped and allocated to regional offices, May 2006
		3. Procedure for groundwater data collection, validation/verification, and storage (methodology, equipment, quality control, and quality assurance) established.	COMPLETE – delivered, Oct 2006; SOP training, Oct 2005 through Oct 2006
	2006	1. Instructions for the implementation of groundwater By-law enforcement prepared.	COMPLETE - By-law report including recommended instructions submitted Mar 2005; SOPs for By-law assessment final, Aug 2006
		2. *USGS Indicator.*	*N/A*
		3. Groundwater data collection and quality expanded to majority of private wells.	COMPLETE – delivered, Sep 2006 (all private wells data updated and verified)
		4. *USGS Indicator.*	*N/A*
		5. 335 water meters installed on water wells (by WAJ).	142 installed through Sep 2006 by WAJ
		6. Groundwater Monitoring and Enforcement Directorate at the Water Authority of Jordan (WAJ) established.	COMPLETE – **Groundwater Basins Monitoring Sector** established at WAJ, Jun 2005
7 Number of water sector staff trained	2007	1. 3 junior staff.	UNDERWAY - transfer to GBMS/WAJ, ongoing in Nov 2006 (Hired by ARD, Oct 2005; formal training program complete, Jun 2006; SOP and MS Access OJT complete, Sep 2006)
		2. 375 water meters installed (by WAJ).	*N/A*

2.0 TECHNICAL ACTIVITIES

2.1 TASK 1: GMED ORGANIZATION DEVELOPMENT

2.1.1 Subtask 1.1: Assess GMED Organizational Structure

Task Complete – Deliverable Report: *GMED Organization Chart and Staffing Requirements – Functional*. The GMED project team conducted a detailed organizational needs assessment of the existing institutional structures within WAJ responsible for enforcement of By-law 85/2002 for Groundwater Control in December 2004.

This process included the development of a mission (summarized below) and vision statement for the proposed new organizational element to be established within WAJ and having responsibility for By-law implementation. Key organizational responsibilities were arrayed in various arrangements for MWI, WAJ and USAID consideration. A final "functional" organizational chart was selected by MWI and WAJ, and was found to be appropriate by USAID.

GBMS Mission

Statute:	Enforce *Groundwater Control By-law/85*
Services:	Well Licensing & Monitoring Meter Reading & Maintenance Bill Delivery & Collection Violations Reporting, Action, and Follow Up Water Utilization Advisory
Systems:	Data Management & Collection Well Licensing & Enforcement Meters Installation & Maintenance Quality Control
Support:	Appropriate Staff; Adequate Resources

This approved functional organization and the findings from the assessment of the eight WAJ regional offices were used as the basis for finalizing the structure and staffing of the new groundwater organizational element within WAJ to be known as the Groundwater Basins Monitoring Sector (GBMS).

2.1.2 Subtask 1.2: Assess WAJ Regional Offices

Task Complete – Deliverable Report: *Assessment of WAJ Regional Office Operations*. This field assessment required that a GMED project team visit each of the eight GBMS regional offices.

At each regional office, the team assessed the current status of management, operations, and overall performance. In addition, the team determined the specific needs for human resources as well as commodities required to more effectively enforce By-law 85/2002 including computers, communications, vehicles, and related meter installation and maintenance equipment.

2.1.3 Subtask 1.3: Finalize GMED Organization

Task Complete – Deliverable Report (March 2005): *Groundwater Basins Monitoring Sector (GBMS) Organization and Staffing – Final*. This report contained detailed statements of departmental responsibilities, staffing levels and job descriptions including job/task responsibilities and qualifications criteria.

The GBMS organization structure and staffing was approved and implemented by MWI and WAJ in June 2005 (see Figure 2.1).

During Quarter 1 of Year 2, the GMED project assisted GBMS/WAJ in preparing a Long-term Staffing Plan for the prioritization of hiring additional new staff recommended in the GBMS Organization and Staffing Report. In accordance with the staffing plan, during Quarter 2, WAJ hired eight new administrators to be assigned to each GBMS regional office.

In November 2006, significant vacancies remained within the GBMS organization structure. Filling these vacancies is essential for the GBMS to fully achieve its mission and improve implementation and enforcement of the By-law 85/2002 for Groundwater Control. WAJ leadership should continue to support the full staffing of the GBMS organization and monitor impact of enhanced human resources on By-law enforcement.

2.2 TASK 2: IMPROVED GROUNDWATER BY-LAW 85/2002 ENFORCEMENT

2.2.1 Subtask 2.1: Review By-Law 85/2002

Task Complete – Deliverable Report (March 2005): *Improved Enforcement of Law 18/1988 and WAJ By-Law 85/2005 – Review of required instructions and amendments*. This report provided an extensive review of the operational implementation of the By-law and identified numerous instructions and actions that could be implemented to clarify, strengthen, and improve enforcement of specific By-law articles.

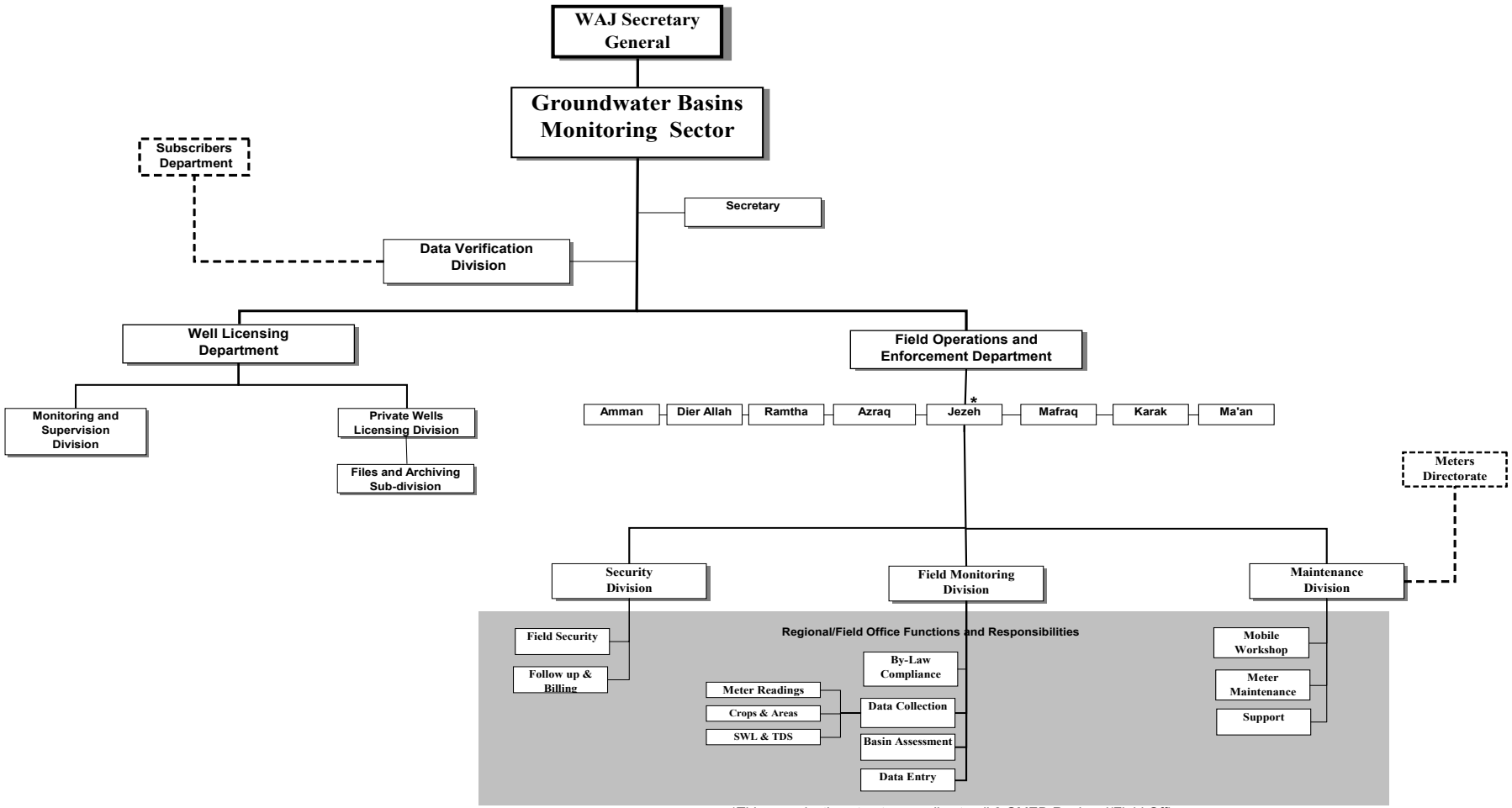
Key among these recommended measures were new instructions related to Article 4, which empowers the Government of Jordan to set limits on groundwater abstraction.

In March 2005, WAJ responded to the report by indicating their agreement with most of the recommended new instructions. The project replied with a suggested *Action Plan for New By-law Instructions Development and Implementation* which listed the top priority actions for WAJ and MWI to undertake to initiate the process, secure governmental approval, and proceed with enforcement. WAJ agreed to establish a working group to review the Action Plan and the project provided a schedule for the selection, development, and adoption of new instructions.

In July 2005, WAJ established a working group to review the By-law Action Plan. During August and September, GBMS and the project agreed upon a set of new instructions and drafted the basic content. Many of the related groundwater issues were and remain under study by high levels within the Jordanian government.

As of November 2006, no action had been taken by WAJ to implement any of the recommended instructions contained in the GMED deliverable report and little progress had been made by the WAJ By-law Action Plan working group.

Figure 2.1. Groundwater Basins Monitoring Sector (GBMS) – Approved Organization Structure



*This organization structure applies to all 8 GMED Regional/Field Offices.

Over the course of the GMED project, MWI had four different ministers. These frequent leadership changes made it particularly difficult for WAJ to move forward with any new significant By-law instructions, as these require review and approval by senior MWI and WAJ decision makers.

The overall impact of the GMED project on the operational/field level of the GBMS will result in some limited improvement in By-law enforcement. The introduction of standard operating procedures at the GBMS will lead to greater efficiency, but the extent to which these tactical measures will result in improved By-law enforcement (further resulting in reduced consumption of groundwater from the private wells under GBMS jurisdiction) remains unclear. WAJ should monitor improvements closely and attempt to replicate successes.

In an attempt to leverage decisive Jordanian governmental action, the 2006 USAID Grant Conditionalities incorporated a number of the new high-impact By-law 85/2002 instructions recommended by the GMED project. USAID will track the impact of these measures on groundwater abstraction in the future.

2.2.2 Subtask 2.2: Support to Assess By-Law Implementation

During Quarter 1 of Year 2, based on the By-law Action Plan, a set of proposed conditionalities related to the By-law were prepared in coordination with USAID.

To effectively accommodate the process above, in May 2006, *SOPs to Assess By-law Implementation* were drafted and submitted to WAJ for review in June 2006.

Task Complete – Deliverable Report (August 2006): *SOPs to Assess By-law Implementation - Final*. These SOPs provide methods for the monitoring, tracking, and reporting of progress if and when MWI and WAJ take action to implement any new By-law instructions.

2.3 TASK 3: PROCUREMENT

2.3.1 Subtask 3.1: Update Procurement Specifications

Task Complete - final procurement specifications for all commodities.

During Quarter 4 of Year 1, final agreement was reached with WAJ regarding specifications for all commodities to be procured by the GMED project amounting to approximately US $1.5 million. This performance-based process was fully documented and signed. WAJ approvals for all commodities including quantities and specifications are contained in the Procurement Report.

GMED Performance-based Procurement

Data Management: Server, computers, printers, basic software.

Communications: Fax machines, phone systems, mobile telephones.

Enforcement: GPS units, digital cameras, vehicles.

Water Monitoring: Water meters, spare parts, water quality kits, M-scopes.

Operations & Maintenance: Meter testing devices, fully equipped mobile workshops.

Administration: Office furniture and equipment.

2.3.2 Subtask 3.2: Procure GMED Equipment

Table 2.1. Procurement Status (September 2006)

Commodity – US Procurement	Qnt	Specs	Quotes	WAJ	USAID	Award	Delivery	Handover	Distributed	Documented
Desktop Computer – PC System	12	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Printer	8	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Server	1	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Date Management Software – Access	0	n/a	Provided by WAJ							
UPS	0	Deleted by WAJ								
Digital Cameras	8	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Water Meters (various sizes)	710	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Water Meter Spare Parts (sets of various sizes)	206	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Water Quality Kits	12	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Water Level – m-Scopes	12	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Meter Testing Device & Batteries	3	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mobile Workshop – Vehicle, Toolbox, Shell	6	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mobile Workshop – Tools & Equipment Sets	6	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pickups	12	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SUV 4X4	2	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Portable Generators for Mobile Workshops	6	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Portable Compressors for Mobile Workshops	6	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Local Procurement										
GPS	8	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fax	8	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mobile Phones	10	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Regional Office Furniture	8	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Telephone Sets	16	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Document Trays	16	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Power Extensions	16	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Binding Machine	1	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vertical Blinds	16	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Garbage Bins	24	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Water Cooler	8	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Task Complete – early in 2005, the GMED project obtained a Source and Origin Waiver from USAID for local procurement of selected commodities. ARD provided substantial and efficient home office support to expedite the procurement and timely delivery of items coming from the USA. Local procurement of items such as telephone sets and office furniture was completed by GMED project local administrative staff.

Based on completed commodity delivery and distribution of items as planned throughout GBMS (central and regional offices), the *Final Procurement Report* was delivered in September 2006 as a complete record of the entire procurement activity.

The GMED project Office Manager coordinated with the WAJ warehouse and each GBMS facility (central; eight regional offices) to finalize the inventory, labeling, and documentation of commodity distribution.

As per USAID request, the *Final Procurement Report* includes ***Certificates of Receipt*** from all GBMS units that received commodities via the project. This ensures that commodities have been allocated in accordance with USAID directives to restrict all commodity distribution to the GBMS only.

As part of GMED project MOD 3, the following items were also procured for the GBMS/WAJ:

- Flash Drives 512 K – Quantity: 8 (1 per GBMS regional office); and
- Modems – Quantity: 2 (Azraq and Dier Alla regional offices to facilitate dial-up Internet communication until improved connectivity is available).

USAID and the project requested and received a *Water Meters Installation Plan and Projection* from GBMS showing where and when the 710 water meters procured by the project would be installed. Actual meter installation—a WAJ responsibility as per project design agreement—and projections of demand are shown below.

Table 2.2. SENSUS Meters Installation Report

No.	Regional Office	Actual Sept 2006	Projected 2006	Projected 2007	total
1	Amman-Zarqa	12	4	93	109
2	Jezah	33	3	26	62
3	Ramtha	7	3	10	20
4	Azraq	18	15	85	118
5	Ma`an	8	3	23	34
6	Karak	16	2	12	30
7	Mafraq	14	5	55	74
8	Deir Allah	34	10	60	104
	Total	142	45	364	551

Overall accuracy of projections is dependent upon difficulty in estimating number of meters to be replaced. Projections also rely on expectation that Licenses will be obtained

2.4 TASK 4: DATA MANAGEMENT SYSTEMS DEVELOPMENT AND IMPLEMENTATION

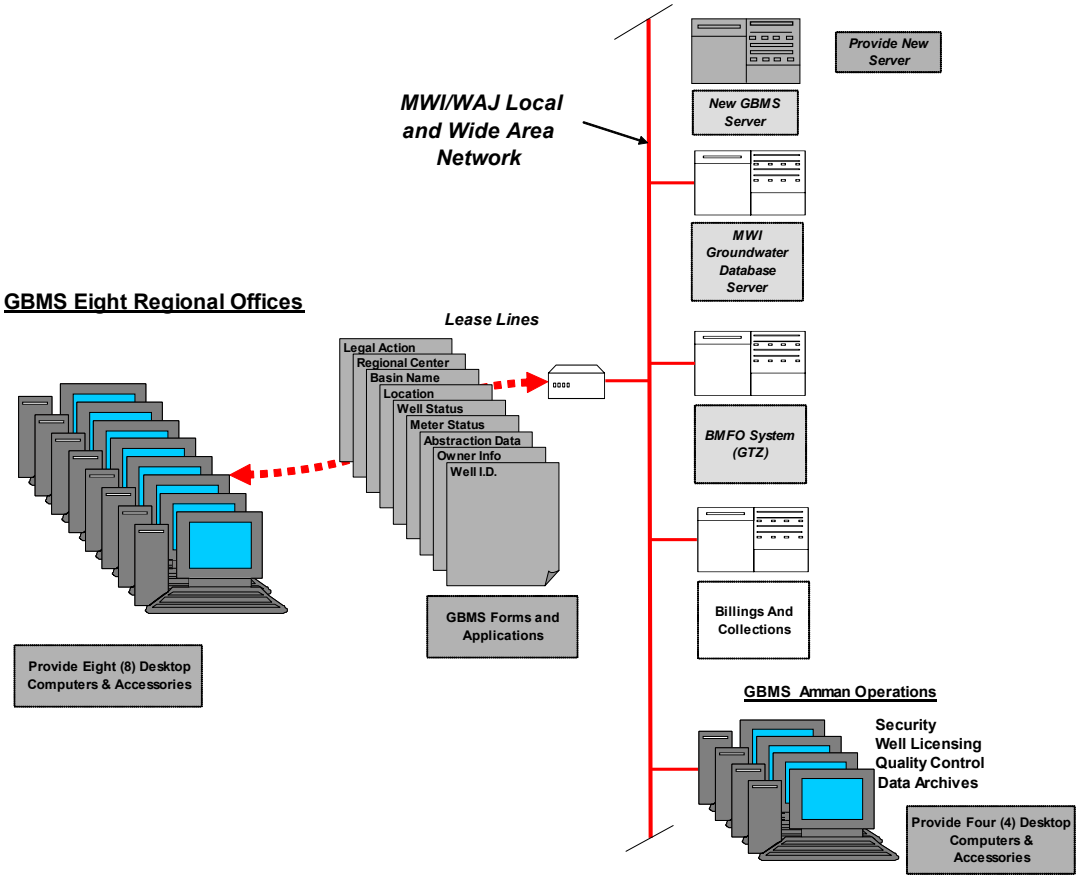
2.4.1 Subtask 4.1: Assess GMED and WAJ Data Management Systems

Task Complete – Deliverable Report: *Assessment of WAJ Data Management System and GMED Plan*. This task was conducted by the GMED project with major input from Engicon in close coordination with the MWI Water Resources Planning Department, the WAJ Information Technology (IT) Department, and GTZ—a donor conducting similar activities within MWI for public wells.

The Data Management System recommended by the GMED project was based in part upon the GTZ model known as the Bulk Meter Flow Operations (BMFO) in use by MWI and WAJ for publicly owned groundwater wells. However, the design of the BMFO system did not easily support the specific needs of data collection, entry and transfer between WAJ Regional Offices and GBMS. Care was taken to incorporate the same data requirements in the Data Management System as used for the BMFO to ensure that data used in both systems was fully compatible. GMED developed an interface that allowed transfer of information between the two systems while still maintaining the integrity of both systems.

The recommended GMED Data Management System (shown in Figure 2.2) also complied with design criteria agreed with MWI and WAJ emphasizing: prohibition of any data duplication, limitations on access and data entry, related database security issues, and appropriate operations and quality control procedures.

Figure 2.2. GMED Data Management System



2.4.2 Subtask 4.2: Implement Pilot System - Regional Office (1)

Task Complete – the GBMS Data Management System including Access®, BMFO and Water Information System integration was successfully pilot tested in August 2005 at the GBMS Amman/Zarqa regional office.

2.4.3 Subtask 4.3: Implement GBMS Server

Task Complete - the Blade Server requested by WAJ was delivered in October 2005. It was configured by the project and WAJ to host the GBMS Access database and communicate with the BMFO and WIS. At that time, efficiency of data transfer became an operational issue. Due to the design criteria set by MWI, particularly the requirement that to avoid data duplication, the GBMS system was required to up- and down-load large amounts of data for each data entry transaction. It was decided to enhance data transfer speed by converting from the original Access database to MS SQL Server. During Year 2, Quarter 1, the conversion was successfully completed; the pilot GBMS database was installed and was fully operational.

2.4.4 Subtask 4.4: Expand Systems Improvements to All GBMS Sites

Task Complete – during Quarter 2 of Year 2, the Data Management System was successfully expanded to all GBMS/WAJ units (central and regional offices). At the time of project completion, two regional offices (Dier Alla, Azraq) were operating on a dial-up basis with modems provided by the GMED project due to limitations of Internet service providers in those geographic areas.

2.4.5 Subtask 4.5: Integrate and Optimize GMED Systems

Task Complete – during Quarter 2 of Year 2, the GBMS database, BMFO, and WIS components were integrated into a seamless Data Management System. Numerous meetings were held with WIS/MWI and GTZ personnel to ensure effective integration. System performance was optimized as connectivity issues were solved and the new Blade Server was fully implemented. Conversion of the original Access database to MS SQL Server software improved transfer speeds and contributed to improved, if not ideal, system optimization.

In June 2006, the GMED project finalized all issues raised by the MWI/WAJ System Acceptance Committee, including a revised solution to the ensure system security.

As required during the remainder of Year 2, the project provided follow-up support to ensure:

- All computer/electronic equipment was operational; and
- Routine data collection and reporting was conducted in GBMS central and regional offices.

A GBMS System Implementation Team was created with managerial oversight from WAJ, MWI, the project, and USAID to ensure that all implementation requirements were addressed efficiently so that the GBMS system would remain operational and sustainable. This team met twice in June 2006. It was further agreed that a set of Data Management System Administration SOPs would be added to the data management package to fully document processes, roles, and responsibilities.

All deliverables associated with Task 4, Data Management System Development, were completed in June 2006. In August 2006, the project conducted a final demonstration intended to fully familiarize the WAJ IT department with the system and to clarify sustainability and connectivity requirements.

At the time of project completion, the entire GBMS Data Management System was on-line and operational. Issues pertaining to the speed of data transfer due to the limitations of the WAJ network were resolved by implementing a file separation approach which reduces the amount of data to be up-/down-loaded with each transaction. In addition, a Data Management System Troubleshooting Procedure and Checklist was developed and implemented with the WAJ IT group to further ensure system sustainability.

2.5 TASK 5 STANDARD OPERATING PROCEDURES (SOP) AND TRAINING

2.5.1 Subtask 5.1: Develop SOPs for All Major GMED Activities

Task Complete – in October 2006, the project, with major inputs from Engicon, completed the intensive and laborious process of documenting all new and recommended *GBMS Data Management, Data Collection, Operations and Maintenance (O&M), and System Administration SOPs* in both English and Arabic, as well as SOPs developed for other tasks including the Assessment of By-law Implementation, Impact Assessment, Sustainability Tracking, and Well Data Verification. These were delivered in the form of a *GBMS SOP Manual* (hard copy and electronic CD versions) as per the agreed GBMS SOP Development and Implementation Plan below:

GBMS Standard Operating Procedures (SOP)

Data Management SOPs (DM)

1. Well Licensing
2. Legal and Follow-up
3. Data Control and Transfer
    - 3.1 Data Entry, Processing and Retrieval
    - 3.2 Initial Data Validation QAQC – Regional
    - 3.3 Operation Off Line (without Internet Connection)
    - 3.4 Well Licenses and Well Data Archives (Non-AJ Wells)
    - 3.5 Data Transfer: GBMS Central/Regional
WAJ Subscribers Department
WIS/MWI
    - 3.6 Back-up Procedures
4. Billing
5. Preliminary Basin Evaluation

Data Collection SOPs (DC)

1. Groundwater Abstraction - Meter Reading
2. Groundwater Abstraction – Estimation
    - 2.1 Historic
    - 2.2 Crop-based
3. Other Groundwater Measurements
    - 3.1 Field Measurement of Water Salinity (TDS)
    - 3.2 Field Measurement of Static Water Level (SWL using m-scope)

Operation and Maintenance SOPs (O&M)

1. Maintenance Management
2. Meter Installation and Replacement
3. Meter Testing (Controlotron device)
4. Meter Maintenance

Systems Administration SOPs (SA)

1. GBMS Program Modification
2. GBMS System O&M

2.5.2 Subtask 5.2: Plan and Implement Training - Data Managers

Task Complete - in September 2005, two data management training activities were planned and developed. A basic computer training course was developed for selected GBMS staff that required fundamental computer training.

In addition, a training program was developed for data managers at GBMS/central and the GBMS regional offices on data control and transfer SOPs and the GBMS Data Management System User Manuals.

The two-day basic computer training course was conducted in October 2005 and the three-day data control and transfer SOP training program in November 2005.

2.5.3 Subtask 5.3: Plan and Implement Training - Regional Offices

Task Complete – during Years 1 and 2, the data control and transfer SOP training program was conducted for regional office personnel, and extensive on-site follow-on application training was conducted by GMED junior hydrologist/agronomist staff in conjunction with system setup and data entry at each regional office.

In April 2006, the GMED project completed O&M SOP development and training. ARD subcontractor, Uhl and Associates, prepared the O&M SOPs in English for various technical tasks and the water meters and equipment procured by the GMED project. These materials were translated to Arabic by GMED project local staff and formal two-day training sessions were conducted for regional office technical personnel by American instructor-experts (Uhl and Associates) and a GMED technical team.

In October 2006, an extensive on-the-job training (OJT) program for GBMS data collection SOPs was completed.

The GMED project comprehensive *GBMS Training Report* (see Appendix C) lists all formal training and workshop activities conducted by the project.

2.5.4 Subtask 5.4: Plan and Implement Training - 3 Junior Staff

This staff was recruited and hired to begin ARD employment and orientation in October 2005. The associated Specialist Training Plan was submitted in August, approved in September, and implemented in November 2005. It was modified as shown below for better coordination with the ongoing Data Management System implementation, project workshop, and SOP training.

In addition to these structured activities, junior staff attended all SOP training and project workshops. This program was also supplemented by OJT and participation in various project tasks including data entry at regional offices, sustainability planning, and impact assessment.

As reported above, during Quarter 1 of Year 2, the junior staff was physically transferred to begin work at the Data Verification Division (DVD) of GBMS. In addition, USAID requested that WAJ begin the process to transfer them from ARD to full-time WAJ positions by November 2006.

In June 2006, the formal specialist training program presented by Dr. Omar Joudeh of Engicon was completed and a training report was submitted in July 2006.

In November 2006, as part of MOD 3, this group received structured OJT sessions in MS Access software. In November 2006, the process to transfer the three trained ARD junior staff members to WAJ employment in the GBMS DVD remained underway.

Table 2.3. Training Program for Junior Hydrologists/Agronomists (GMED/WAJ)

Workshops Contents/ Training Themes	Starting Date	Type of Training & Duration in hrs	
		Lectures	Practical applications
Workshop No. 1: Groundwater occurrence, properties and control:	27-Nov-05		
Geology & Hydrology of Jordan		2	2
GW occurrence in different rock types		2	
Hydrolgeologicel properties of water bearing formations.		2	
Hydrogeologic classification of rock units/ formations.		2	
Types of aquifers.		2	
Groundwater quality and properties.		2	2
Field visit			6
Totals		**12**	**10**
Workshop No. 2: Groundwater Flow	**01-Jan-06**		
Hydraulic properties of aquifers.		3	1
Well testing,		3	1
Groundwater recharge and discharge.		3	1
Pumping tests design, implementation and analyses (field visit).		2	3
Totals		**11**	**6**
Workshop No. 3: Groundwater Investigations and surveys:	**01-Feb-05**		
Reconnaissance Surveys		4	
Data collection		4	
Groudwater monitoring.		4	2
Totals		**12**	**2**
Workshop No. 4: Well drilling and well design:	**14-Apr-06**		
Well drilling methods,		4	
Types of wells & locating appropriate sites		2	
Well design		2	2
Drilling supervision,		2	
Well dvelopment.		2	
Well completion	**19-Apr-06**	2	
Totals		**14**	**2**
Workshop No. 5: Groundwater Investigations and surveys:			
Reconnaissance Surveys	**22-Apr-06**	4	
Data collection		2	
Groudwater monitoring,		2	
Planning field programs.		2	
Data Analysis & presentation	**27-Apr-06**	2	2
Totals		**12**	**2**
Workshop No. 6: Groundwater management:			
Aquifer and basin yield concepts.	**18-Jun-06**	2	
The role of inegration in groundwater monitoring		2	
Applied techniques in water management.:		2	
Application of groundwater modeling in groundwater basin evaluation			
TWODAN analytical model		4	4
Winflow analtical model	**22-Jun-06**	4	4
Totals		**14**	**8**
Grand total		**75**	**30**

2.6 TASK 6: GROUNDWATER OUTREACH

2.6.1 Subtask 6.1: Plan and Conduct Groundwater Awareness Workshop

Task Complete - this workshop was planned and developed in July and August and successfully conducted on 6 September 2005 for approximately 60 participants from WAJ, MWI, the Ministry of Agriculture, Ministry of Environment, Jordan Valley Authority, as well as donors and projects.

The workshop focused on introducing the mission, functions, and services of the new Groundwater Basins Monitoring Sector to internal stakeholders. A *Groundwater Issues and Awareness Workshop Report* was submitted in September 2005 summarizing the workshop event.

2.7 TASK 7 ASSESSMENT OF BY-LAW IMPLEMENTATION IN PILOT REGION

2.7.1 Subtask 7.1: Plan and Implement Pilot Impact Assessment

Task Complete – Deliverable Report (June 2006): *Trend & Frequency Analysis for the Pilot Impact Assessment of the Amman/Zarqa Basin*. This was followed by delivery of the *Draft Impact Assessment* also in June 2006. In September 2006, the project delivered the *Final Impact Assessment*.

Preliminary planning and coordination for this task was initiated in August 2005 by Dr. Amer Jabarin of IdRC, and discussions were held with WAJ and USAID in September to address critical planning issues, particularly selection of the regional and overall purpose of the assessment. It was agreed that a user-friendly survey approach which could be replicated in the future by WAJ regional offices would be pilot tested in the Amman/Zarqa basin.

On 29 November 2005, the *Impact Assessment Planning Workshop* by Dr. Tarek Tarawneh of IdRC was successfully conducted for MWI, WAJ, and GBMS staff.

An *Impact Assessment Workshop and Plan – Report* was submitted as per the GMED work plan in November 2005. The plan incorporated workshop input and set out the methodology and schedule for the task. It was confirmed at the workshop to select the Amman-Zarqa Basin as the pilot with participation from the Amman, Mafraq, and Ramtha regional offices. This deliverable also contains a summary of the workshop proceedings.

The project completed the following related activities:

- Sample (74 wells) finalized with input from regional offices;
- Coordination with WIS/MWI to receive the ‘indirect data’;
- Coordination with WAJ to plan collection of ‘direct data’ in the field;
- Completion of field interviews (74 wells) with WAJ participation;
- Preliminary findings as requested by USAID;
- *Trend and frequency analysis* submitted in June 2006;
- *Draft Impact Assessment* submitted in June 2006; and
- *Final Impact Assessment* submitted in September 2006.

2.7.2 Subtask 7.2: Support WAJ in Assessment of By-Law Implementation

Task Complete – the *Final Impact Assessment* delivered in September 2006 also contains a set of five *SOPs for Assessing Impact at Other Basins* to identify the results and the effectiveness of By-law 85/2002 implementation. These SOPs include:

- IA 1 – Planning and Preparation,
- IA 2 – Data Collection,
- IA 3 – Data Entry and Reduction,
- IA 4 – Data Analysis, and
- IA 5 – Reporting and Follow-up.

Detailed results of Task 7 were presented as part of the GMED project final workshop in November 2006.

2.8 TASK 8: GMED SUSTAINABILITY

2.8.1 Subtask 8.1: Implement Sustainability Approach

Task Complete – Deliverable Report (August 2006): *Sustainability Action Plan (SAP) Final Report*. The related *SAP Monitoring and Evaluation SOPs* were delivered in September 2006.

During the summer of 2005, the project conducted an extensive review of the most current donor literature concerning project sustainability and, based on this research, developed a Sustainability Action Plan (SAP) approach. This SAP approach was presented to USAID and WAJ in July 2005 by Dr. Tarek Tarawneh of IdRC. It was agreed that the proposed SAP methodology would be adopted as the approved planning approach.

In September 2005, as per approved work plan, the *Draft Action Plan for GBMS Sustainability* was submitted. In October 2005, the project assisted WAJ to establish an SAP team (GBMS/central and regional office managers) and conducted a workshop to finalize the SAP on 17 October 2005. This SAP activity and workshop examined how GBMS can be successfully sustained beyond the project life, and addressed limited proposals for necessary adjustments in the project work plan for Year 2. A *Sustainability Action Plan (SAP) Workshop - Report* was submitted in October 2005.

During Quarter 1 of Year 2, the SAP interview format was finalized and interviews were conducted with Dr. Khair Al Hadidi, Samir Socour and regional office representatives. A variety of good points were raised including the need for a lawyer within the GBMS to follow up on all legal cases and the need for a higher quality of technical staff.

In Quarter 2 of Year 2, all SAP interviews were completed for GBMS central and regional office functions.

2.8.2 Subtask 8.2: Financial Sustainability

Task Complete – Deliverable Report (September 2006): *Financial Sustainability Alternatives - Final* including opportunities for Memoranda of Understanding (MOUs) and contracts.

Upon completion of the GBMS SAP and as per approved work plan, the project drafted the GBMS Financial Sustainability Alternatives in October 2006. This task was intended to assist WAJ is exploring financial options and opportunities to reduce the operating costs of the GBMS by using various private sector participation alternatives including management contracts and outsourcing.

The approach of this financial study was based on the World Bank Private Sector Participant Handbook for the Water Sector and data collected by Dr. Rasheed Al Hamoud of IdRC. A draft of the *GBMS Financial Sustainability Alternatives - Report* was submitted in October 2005.

In December 2005, the project formally requested a set of financial data from WAJ necessary to complete this task.

The financial data for estimating GBMS operating costs and for By-law tariff-related revenues was received from WAJ and was analyzed in July 2006. Findings showed that the revenues generated by the By-law far exceed the GBMS operating costs. Revenue data related to GBMS fees was also analyzed.

The *Financial Sustainability and Opportunities for MOUs and Contracts Final Report* was delivered in September 2006 by Dr. Tarek Tarawneh of IdRC. This report contained a description of financial sustainability alternatives as well as measures taken by the Government of Jordan (to date) and of various private sector participation options that could serve as a basis for future GBMS financial planning.

Detailed results of Task 8 were presented as part of the GMED project final workshop in November 2006.

2.9 TASK 9: PROJECT WORK PLANS AND PROGRESS REPORTS

2.9.1 Subtask 9.1: Update Work Plans

Task Complete – Deliverable Work Plan (December 2004): *Revised GMED Project Work Plan – Year 1*. It was presented to the Project Steering Committee (PSC) on 10 January 2005, updated, and subsequently accepted by WAJ and approved by USAID.

The work plan was implemented during 2005 and was used as the primary progress monitoring benchmark.

In October 2005, the *Revised GMED Project Work Plan – Year 2* was submitted to USAID for review. Approval was received in December 2005.

This plan was used as the primary progress monitoring benchmark for Year 2.

2.9.2 Subtask 9.2: Periodic Progress Reporting

Progress Reports:

- *Monthly Progress Reports* (MPR) – all submitted on time for Year 1 and 2.
- *Quarterly Progress Reports* (QPR) – all submitted on time for Year 1 and 2.
- *Annual Progress Report* (APR) – Year 1 – submitted in December 2005.

2.10 TASK 10: PROJECT FINAL ACTIVITIES

2.10.1 Subtask 10.1: Project Completion

Task Complete:

- GMED Final Workshop conducted on 13 November 2006 for approximately 50 participants. *GMED Project Final Workshop Report* submitted in November 2006.
- *GMED Project Final Report* was submitted in November 2006.

2.11 TASK 11: WELL DATA VERIFICATION AND LABELING

2.11.1 Subtask 11.1: Well Data Coordination Plan

Task Complete - the *Well Data Coordination Plan* was submitted January 2006.

2.11.2 Subtask 11.2: Well Data Verification Procedures and Training

Task Complete – a pilot program was completed at Jezah regional office in March. *Well Data Verification Procedures* were delivered to GBMS/WAJ in March 2006. Well Data Verification SOP training for all regional offices was conducted at the Jezah regional office on 20 March 2006.

2.11.3 Subtask 11.3: GBMS/Central and Field Support and Follow Up

Task Complete – in August 2006, field activities were completed for all eight regional offices. Data QA/QC, revision and entry on the WIS Oracle® database and the BMFO was completed in October 2006.

2.11.4 Subtask 11.4: Well Data Verification Report

Task Complete – Deliverable Report (September 2006): *Well Data Verification Report*.

Table 2.4. Well Data Verification and Labeling – Breakdown by GBMS Regional Office

GBMS Regional Office	Surveyed Wells
Karak	111
Azraq	169
Jezah	436
Ma'an	222
Ramtha	176
Amman-Zarqa	339
Mafraq	360
Deir Allah	193
Total	**2006**

2.12 CHALLENGES, ISSUES AND LESSONS LEARNED

2.12.1 Twenty-four Month Project Design

The GMED project has been described as complex, comprehensive, compressed, ambitious, and input versus results driven. As most experienced capacity-building experts would predict, given the range and depth of the GMED project scope of work—at best, two years might be adequate to complete and deliver the many inputs designated for this project. Securing real and sustainable institutional change and measurable performance improvement are objectives that would typically require an extended timeframe.

This is the case with the GMED project. Although the project delivered all of its programmed products and services as per the approved work plans, these efforts are best described as inputs that along with nurturing support and ongoing training, enable targeted change and performance results. The GMED project, while fully adhering to and efficiently completing its contractual obligations, was not positioned

to secure the real and sustainable institutional change and measurable performance improvement that is needed by the GBMS.

The primary lesson to be learned from an activity like the GMED project is that real permanent institutional capacity building requires not only a commitment of resources but also a commitment of time.

Speaking specifically about the GMED project, the addition of a third year, programmed in the middle of the project would have provided the duration required to allow the automated data collection and management systems to take root within the newly formed organization. This is also applicable to the many other activities conducted by the project for which SOPs were delivered. Although GBMS staff did receive training on these SOPs, the time simply was not programmed to make these changes a part of GBMS routine.

MWI, WAJ and USAID still have an opportunity to assist GBMS to take full advantage of the inputs provided by the GMED project by moving quickly to develop and implement a second stage of GBMS capacity-building support which would build on the strong foundation now in place and support real change. If such an effort were to be planned, it is highly recommended that the scope not be less than an additional 24 months in duration and include the development of strong financial management systems within the GBMS as described in the Task 8 – GBMS Sustainability deliverables.

2.12.2 Supportive Environment and Leadership Commitment

Successful capacity building can not occur in a vacuum. The goals for change must be understood and supported if there are to be any important outcomes and results. In the case of the GMED project, the underlying political will and actions required from the highest levels of the Government of Jordan to establish an environment supportive of the GBMS goals was not forthcoming. Without this supportive political environment, MWI, WAJ and GBMS efforts to rapidly achieve the controversial changes that would result in substantial reductions in groundwater abstraction were destined to yield very limited results.

The key variable in successful change management is leadership. In many ways, the specific successes of the GMED project can be linked to the commitment and energy demonstrated by the MWI, WAJ, and GBMS leadership. The degree to which these leaders championed the GBMS vision and demonstrated proactive ownership of the GMED project work plan and schedule correlates directly with the achievement of many ambitious goals. The project leveraged every opportunity to support GBMS leadership in pursuit of work plan completion and true institutional change.

From the outset, the GMED project was working with the serious disadvantages caused by lack of a supportive political environment and high-level leadership commitment to change. The policy issues underpinning the full implementation of the GBMS mission were neither effectively addressed prior to project startup (during design and negotiation with the Government of Jordan), nor were they included for intensive attention as part of the GMED scope of work. As a result, all parties involved found themselves powerless to effect real change and help in any significant ways to solve Jordan's groundwater crisis.

The lesson to be learned is that project objectives should be carefully considered and adequate political support and leadership commitment at all levels should be either secured as a pre-condition or adequate resources should be allocated to address the issue of building and obtaining support and commitment within the project design. Unfortunately, securing the political will for change can be highly elusive. In the case of the GMED project, four different Ministers of Water and Irrigation held office during the brief 24-month duration of the activity. Such instability is extremely difficult to overcome regardless of the measures taken to plan a project and develop a scope that addresses adequate political support and leadership commitment.

In the end, it must be recognized that capacity building of this type operates within a realm of ambiguity and resistance that can not always be managed to achieve the projected ends. The donor, partner institution, and contractor must be realistic given such circumstances. This does not, however, relieve any of these players from seriously attempting to influence decision makers and establish an environment conducive to achieving results.

In the case of the GMED project, emphasis shifted from making great strides in the implementation of new instructions to improve enforcement of By-law 85/2002, to a focus on what could be done to facilitate improvement of responsibilities at the GBMS operational level. In this context, the project was highly successful.

In a further attempt to manage the circumstance and leverage decisive Jordanian governmental action, the 2006 USAID Grant Conditionalities incorporated a number of the new high-impact By-law 85/2002 instructions recommended by the GMED project. USAID will track the impact of these measures on groundwater abstraction in the future.

2.12.3 Project Work Plans

From project startup, the ARD Chief of Party advocated and adhered to a "Plan the Work; Work the Plan" approach which served well in the intensive deliverables and procurement environment of the GMED project. The project work plans provided a critical and central set of controls utilized by all involved parties to coordinate efforts, stay on track and deliver on time.

The GMED project has proven the value of these plans and an approach that ensures their utmost application. WAJ, USAID, and ARD have all learned the lesson that project management is made transparent, accountable, and effective when such plans are well done and utilized as dynamic tools for coordination and control.

2.12.4 GBMS Management and Sustainability

The deliverables associated with *Task 8 – GBMS Sustainability* provide a detailed accounting and prioritization of the various requirements necessary for the new GBMS to sustain delivery of its mission after the project. Many of these requirements are summarized here as representing significant challenges for WAJ and the GBMS as they move forward to build upon the GMED project foundation.

Leadership and Management Development – The emphasis of the GMED project was at the operational level of the new GBMS organization. Systems, SOPs, training, and commodities procurement were primarily targeted at improving performance at the GBMS regional offices.

Significant management development needs exist at the senior level/GBMS central and middle level/GBMS regional level offices of the GBMS organization. These needs were not addressed by the GMED scope of work. Real progress in improving GBMS performance will not occur without addressing these management needs.

As well as assistance to establish productive strategic links with MWI and the achievement of the National Water Master Plan, the GBMS management team requires support in implementing a tailored performance management system to monitor, report, and follow up on GBMS indicators and targets.

Leadership and management skills training, particularly planning and budgeting, would contribute greatly to achieving the full benefit of investments at the operational level and to sustaining improved performance.

Improved communication and coordination among GBMS and its internal partners at WAJ and MWI; its external stakeholders at the Ministry of Agriculture, Ministry of Environment, and Jordan Valley Authority, and with donors and projects requires serious team-building attention.

Finally, it can be said with assurance that the GBMS management team will face great difficulties and will need further capacity-building assistance and support to secure the MWI and WAJ commitments and resources identified by GMED project *Task 8 – GBMS Sustainability*. Much of the discussion at the *GMED Project Final Workshop* in November 2005 raised issues related to these needs and comments have been incorporated below.

Strengthening By-Law 85 – With results from the GMED pilot impact assessment (Task 7), MWI and WAJ should be assisted in replicating the assessment in all regions and conducting a professional analysis of the results to determine how the By-law can be strengthened, and to take the necessary actions to realize improvements.

Specialized capacity-building assistance is required at the WAJ Legal Department to improve management and overall performance in By-law issues. This focused attention should include clarifying and strengthening the GBMS role in more effective By-law monitoring and enforcement. In addition, the By-law needs to be strengthened to include collections authority.

Outreach/Advisory Services – The role of the GBMS field units regarding assistance to farmers in improved water use methods remains vague. The GBMS regional offices staff is perfectly positioned to coordinate and deliver advisory services in conjunction with the Ministry of Agriculture; however, assistance is required to design and implement this outreach program.

Systems and SOP Development – The systems implemented via the GMED project to improve GBMS performance are primarily internal. As other systems within WAJ including the FAS (Finance and Accounting System), the CIS (Customer Information System)—particularly the billing component, and the GIS (Geographic Information System) at MWI come on line, the GBMS will require assistance to establish effective communications, electronic links, and standard operating procedures. The GBMS mission is geo-based and as such, specific emphasis should be placed on assisting the GBMS to take full advantage of the GIS capabilities within MWI. In addition, as the GBMS Data Management System is new, it will require attention and support until it is completely reliable.

Performance-based Budgeting and Procurement for Results – As the GBMS matures as a well-managed unit, resources should be linked to performance results and performance-based decision making with regard to resource allocations. The GBMS will require assistance to reach this level of performance management and the installation of a cost center/performance-based budgeting approach. A good example is the provision of additional water meters; however, this input should be based on a Return on Investment (ROI) assessment that the GBMS conducts itself as part of a performance-based budgeting system. The establishment of a special fund should be instituted to cover the depreciation of water meters and the other assets/equipment, such as computers, provided to the GBMS by the GMED project so that WAJ can maintain and replace these commodities from groundwater revenues.

USAID encouraged MWI and WAJ to establish the GBMS and has provided targeted assistance primarily at the operational level of the new GBMS organization. If USAID is contemplating continued assistance and support to this nascent organization, USAID can, at minimum, plan that assistance to address the following activities needed by the GBMS to fully accomplish its mission:

- Conducting a policy support awareness program for improved By-law 8/2002 enforcement directed at winning the backing of high-level decision makers;
- Improving senior and middle level GBMS management skills;
- Establishing a performance management and performance-based budgeting system;

- Establishing a strong commercial/financial management system including funds for agricultural incentive to reduce groundwater consumption and utilization of outsourcing options;
- Improving participation and awareness of stakeholders, well owners and the public; replicating Impact Assessments in all eight regional offices;
- Conducting ongoing farmer advisory services and regional socioeconomic impact assessments;
- Securing much needed resources and autonomy in spite of the GBMS revenue generation potential (GBMS warehouse and separate billing unit);
- Hiring and training staff for new positions with the GBMS, especially the regional offices;
- Maintaining computers and O&M equipment; introducing new systems (GIS) and technology as required; implementing links from GBMS to new MWI and WAJ systems; and
- Institutionalizing the systems and SOPs developed and delivered during the GMED project.

Junior Staff Transfer – At the end of the GMED project, efficient and successful transfer of the three junior staff trained by ARD to WAJ permanent employment remained a major concern. As this matter was documented by official signed agreement between MWI and USAID, it is being directly addressed by them.

A failure on the part of WAJ to hire the three trained staff will have a major negative impact on all system implementation and sustainability introduced by the GMED project. These two professional hydro-geologists and one agronomist, to be permanently assigned to the GBMS Data Verification Division, represent the only personnel within WAJ who are fully knowledgeable and skilled to operate, maintain, and sustain the GBMS Data Management System.

This trained team of junior staff is the keystone for the future success of the By-law 85/2002 enforcement improvement program initiated by USAID via the GMED project. They represent a significant investment in terms of training and OJT experience. Failure to hire this staff will have dire consequences on overall GBMS performance.

It is strongly recommended that USAID use the full power of its good offices to ensure that the junior staff is hired by WAJ. USAID must view anything less than permanent positions for the three junior staff as a deficiency to be seriously considered by USAID in its future dealings with MWI and WAJ.

The lesson to be learned by this circumstance is that any action by the Government of Jordan to employ project staff based on prior agreement between USAID and that partner institution should include coordination with the human resources officials within that organization to ensure a smooth, legal, and timely transition of staff to the assigned governmental positions.

3.0 PROJECT MANAGEMENT, FINANCE, AND ADMINISTRATION

3.1 ADMINISTRATION AND PLANNING

3.1.1 Contract Modifications (3) Summary

MOD	SOW Summary
1	Budget realignment to apply savings from procurement (water meters) to enhanced staffing (Robert Kirkman; Dr. Kamel Al-Radaideh) and additional limited procurement of ARD office equipment and vehicles
2	Labor realignment to increase number and duration of Robert Kirkman's assignments to support Task 4. Data Management System and Task 5. SOPs and Training
3	Budget and labor realignment to accommodate demobilization of Howard Sokoloff/COP in Oct 2006; assignments for Hammond Murray-Rust and a closeout administrator (Peter LaRosa); additional procurement (flash-drives, modems) and MS Access on-the-job training activity for junior staff

3.1.2 Staffing Summary

Long-Term Employees - US

Name	Position	Date of Hire	Date of Completion
Howard Sokoloff	Chief of Party	2 Dec. 2004	1 Dec. 2006

Short-Term Consultants – US

Name	Position	Date of Hire	Date of Completion
Hammond Murray-Rust	Senior Technical Advisor	2 Dec. 2004	1 Dec. 2006 intermittent
Carrie Conway	Start-up Coordinator	2 Dec. 2004	15 Jan. 2005
David Smith	Legal/Policy Advisor	24 Feb. 2005	4 Mar. 2006
Robert Kirkman	Systems/SOP Specialist	2 Dec. 2004	1 Dec. 2006 intermittent
Vincent Uhl	SOP Training Expert	15 Aug. 2006	4 Sept. 2006
Jim Horvath	SOP Training Expert	16 Apr. 2006	29 Apr. 2006
Marc Companion	Project Manager	1 Sept. 2006	1 Dec. 2006
Pam Doran	Procurement Specialist	2 Dec. 2004	1 Dec. 2006 intermittent
Peter LaRosa	Close-out Coordinator	1 Nov. 2006	30 Nov. 2006
Ruzan Aghazadyan	Project Manager	22 Mar. 2006	31 Aug. 2006
Jen Ward	Project Manager	2 Dec. 2004	21 Mar. 2006

Long-Term Employees – Local

Name	Position	Date of Hire	Date of Completion
Tarek Tarawneh	Director	1 Feb. 2005	1 Dec. 2006 intermittent
Maysa'a Al Oran	Office Manager	25 Jan. 2005	30 Nov. 2006
Raed Nimri	Technical Coordinator	1 Feb. 2005	30 Nov. 2006
Marwan Al Raggad	Trainee	2 Oct. 2005	30 Nov. 2006
Dawoud Iseed	Trainee	2 Oct. 2005	30 Nov. 2006
Mohammad Al Hawari	Trainee	2 Oct. 2005	30 Nov. 2006
Saleem Al Kharabshe	Driver	14 Fe. 2005	30 Nov. 2006
Mustafa Al Hmoud	Driver	26 Dec. 2005	30 Nov. 2006

Short-Term Consultants - Local

Name	Position	Date of Hire	Date of Completion
Kamel Al Radaideh	Senior Policy Expert	3 Jan. 2005	30 Nov. 2006 intermittent
Raed Nimri	Technical Coordinator	2 Dec. 2004	31 Jan. 2005

3.1.3 Financial Summary

Contract Value	**$3,316,110**
US Personnel	$680,252
Local Personnel	$232,387
Subcontracts	$261,985
Travel & Transportation	$137,342
Equipment	$1,492,641
Allowances	$109,565
Other Direct Costs	$110,720
Total Direct Costs	**$3,024,892**

APPENDICES

APPENDIX A. LIST OF PROJECT DELIVERABLES – MILESTONES AND REPORTS

Deliverable	Complete
GMED Organization Chart and Staffing Requirements – Functional	Jan 2005
Assessment of 8 Regional Offices – Report	Jun 2005
GBMS Organization and Staffing – Final	Jun 2005
GMED Organization Established and Functional	Jun 2005
Instructions for Effective Enforcement of By-law 85/2002 (Article 44)	May 2005
SOPs to Assess By-law Implementation	Aug 2006
Procurement Report – Working Version	Mar 2005
Procurement Report – Final	Sep 2006
Mobilization and Installation of Equipment	June 2006
Assessment of GMED and WAJ Data Management Systems - Report	Apr 2005
Established GBMS Data Management System	June 2006
Routine Data Collection & Reporting - Regional Centers to GBMS	Nov 2006
Data Management SOPs: Licensing, Abstraction, Billing; QA/QC	Oct 2006
Data Collection SOPs: Meter Reading, Water Quality, Abstraction, etc.	Oct 2006
O&M SOPs: Meters, Monitoring Equipment, Mobile Workshops	Oct 2006
Final Report - GBMS SOPs for All Activities	Sep 2006
Data Management SOP Training - WAJ/GMED Data Managers	Nov 2005
Data Collection SOP Training (Hydro-geologists, 8 Offices - OJT)	Oct 2006
O&M SOP OJT - Meters, Equipment, Workshops (Technicians, 8 Offices)	Apr 2006
Junior Engineers Recruitment and Hiring	Sep 2005
Junior Engineer Training Program	June 2006
Transfer Junior Engineers to WAJ/GBMS - Underway	Nov 2006
Groundwater Issues Awareness and Education Workshop (1)	Sep 2005
Impact Assessment Workshop and Plan	Nov 2005
Impact Assessment - Trend and Frequency Analysis	June 2006
Impact Assessment Report (Study 1, 2, 3)	Sep 2006
SOPs to Assess By-Law Implementation in Other Basins	Sep 2006
Draft Action Plan for GBMS Sustainability	Sep 2005
Sustainability Action Plan Workshop	Oct 2005
Final Action Plan Report for GBMS Sustainability after Project	Aug 2006
Sustainability Monitoring & Evaluation Procedures	Sep 2006
First Draft Report - GME Program Financial Sustainability Alternatives	Oct 2005
Final Report - GME Program Financial Sustainability Alternatives	Sep 2006
Opportunities for MOUs & Contracts identified for WAJ Activities	Sep 2006
Well Data Coordination Plan	Jan 2006
Well Data Verification Procedures and Training	Mar 2006
Delivery of Well Labeling Equipment and Materials	Mar 2006

Deliverable	Complete
Well Data Verification Report	Sep 2005
Revised Work plan - Year 1	Jan 2005
Revised Work plan - Year 2	Dec 2005
Annual Report - Year 1	Dec 2005
Final Project Workshop	Nov 2006
Final Report	Nov 2006

APPENDIX B. GMED PROJECT TIMELINE

Appendix B
GMED Project Timeline - Detailed Year 1 and Year 2
Establishment of GBMS at WAJ
= Year 2 Changes

#	Task	Subtask	Result/Deliverable	Start	Phase I			Phase II									Phase III										Exit	
					Q1			Q2			Q3			Q4			Q1			Q2			Q3					
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
				2004	2005												2006											
				Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	
1	GBMS organization development	1.1 Assess GMED organization structure	GBMS Organization Chart and Staffing Requirements - Functional																									
		1.2 Assess WAJ regional offices	Assessment of 8 Regional Offices - Report																									
		1.3 Finalize GBMS organization	GBMS Organization and Staffing - Final																									
			GBMS Organization Established																									
2	Improved groundwater by-law 85/2002 enforcement	2.1 Review by-law 85/2002	Instructions for Effective Enforcement of By-law 85/2002 (Article 44)																									
		2.2 Support to assess by-law implementation	SOPs to Assess By-law Implementation																									
3	Procurement	3.1 Update procurement specifications	Final Procurement Specifications																									
		3.2 Procure GBMS equipment	Procurement Plan & Schedule																									
			Procurement Process																									
			Procurement Report																									
			Mobilization and Installation of Equipment																									
4	Data management systems development and implementation	4.1 Assess GMED and WAJ data management systems	Identify Data Requirements: Dictionary, Sources, Input & Reporting Forms																									
			Assessment of GMED and WAJ Data Management Systems - Report																									
		4.2 Implement pilot system - regional office (1)	Equipment Prepared - Computers, GPS, Digital Cameras, Phones/Faxes																									
			Data and Forms Loaded; Equipment Distributed																									
			Pilot Training Program - Automated Data Collection/Reporting																									
		4.3 Implement GBMS server	GBMS Server Installed and Prepared																									
			Data and Forms Loaded																									
			Automation Training of GBMS Server Staff																									
		4.4 Expand systems improvements to all GBMS sites	Equipment Prepared - Computers, GPS, Digital Cameras, Phones/Faxes																									
			Data and Forms Loaded; Equipment Distributed																									
			Automated Systems Training for All GBMS Staff																									
			Follow-up Implementation Support																									
		4.5 Integrate and optimize GBMS systems	Established GBMS Data Management System																									
			Routine Data Collection & Reporting - Regional Centers to GBMS																									
5	Standard operating procedures (SOP) and training	5.1 Develop SOPs for all major GBMS activities	Data Management SOPs: Licensing, Abstraction, Billing; QA/QC																									
			Data Collection SOPs: Meter Reading, Water Quality, Abstraction, etc.																									
			O&M SOPs: Meters, Monitoring Equipment, Mobile Workshops																									
			Final Report - GBMS SOPs for All Activities																									
		5.2 Plan and implement training - Data Managers	Data Management SOP Training - WAJ/GBMS Data Managers																									
		5.3 Plan and implement training - Regional Offices	Data Collection SOP Training (Hydrogeologists, 8 Offices)																									
			O&M SOP OJT - Meters, Equipment, Workshops (Technicians, 8 Offices)																									
			Final Report - GBMS SOP Training Completion																									
		5.4 Plan and implement training - 3 junior engineers	Junior Engineers Recruitment and Hiring																									
			Junior Engineer Training Program																									
			Transfer Junior Engineers to WAJ/GBMS Complete																									
6	Groundwater outreach	6.1 Plan and conduct Groundwater Awareness Workshop	Groundwater Issues Awareness and Education Workshop (1)																									
7	Assessment of by-law implementation in pilot region	7.1 Plan and implement pilot impact assessment	Impact Assessment Workshop and Plan																									
			Impact Assessment Implementation/Data Collection (Direct/Indirect)																									
			Trend and Frequency Analyses																									
			Draft Report - Impact Assessment Studies (3); Recommendations																									
			Final Report - Impact Assessment Studies (3); Recommendations																									
		7.2 Support WAJ in assessment of by-law implementation	SOPs to Assess By-Law Implementation in Other Basins																									
8	GBMS sustainability	8.1 Implement sustainability approach	Draft Action Plan for GBMS Sustainability																									
			Action Plan Workshop																									
			Final Action Plan Report for GBMS Sustainability after Project																									
			Sustainability Monitoring & Evaluation Procedures																									
		8.2 Financial sustainability	First Draft Report - GME Program Financial Sustainability Alternatives																									
			Final Report - GME Program Financial Sustainability Alternatives																									
			Opportunities for MOUs & Contracts identified for WAJ Activities																									
9	Project work plans and progress reports	9.1 Update work plans	Revised Work plan - Year 1	X																								
			Revised Work plan - Year 2												X													
		9.2 Periodic progress reporting	Monthly Report		X	X		X	X		X	X		X	X		X	X		X	X		X	X		X		
			Quarterly Report				X			X			X						X				X			X		
			Annual Report - Year 1													X												
10	Project final activities	10.1 Project completion	Final Project Workshop																								X	
			Final Report																									X
11	Well Data Verification and Labeling	11.1 Well Data Coordination	Well Data Coordination Plan																									
		11.2 Well Data Verification Procedures and Training	Well Data Verification Procedures and Training																									
		11.3 GBMS/Central and Field Support and Follow-up	Labeling Equipment and Materials																									
		11.4 Well Data Verification Report	Well Data Verification Report																									

APPENDIX C. GMED SOP TRAINING

Appendix C - GMED Project - Final Report - SOP Training Completion, Sept 2006

Training Program Name	Field of Study	Date(s)	Training Type	Facility	Cost			Trainee Information			
					Instruction	Travel	Trainee	Group Name	# of Male	# of Female	Total
GMED Project Orientation	Groundwater Monitoring & Enforcement	27-Jan-05	Workshop	Hotel	$212.57	0	0	GBMS Central & Regional Office Staff	16	0	16
GBMS Regional Office Assessment & Data Management System Requirements	Groundwater Monitoring & Enforcement	24-Mar-05	Workshop	Hotel	$481.00	0	0	GBMS Central & Regional Office Staff	17	0	17
GBMS Organization Structure & SOP Approach	Groundwater Monitoring & Enforcement	16-Jun-05	Workshop	Hotel	$513.33	0	0	GBMS Central & Regional Office Staff	17	0	17
Groundwater Issues and Awareness	Stakeholder Outreach	6-Sep-05	Workshop	Hotel	$3,642.49	0	0	GBMS Stakeholders	45	5	50
GBMS Sustainability Action Plan	Sustainability Planning	17-Oct-05	Workshop	Hotel	$709.73	0	0	GBMS Central & Regional Office Staff	17	0	17
Basic Computer Training	MS Office	3, 4 Oct 2005	Course	WAJ/MWI	$36.53	0	0	GBMS Regional Office Staff	3	0	3
GBMS Data Mangement System SOPs	Data Management SOPs	8, 9, 16 Nov 2005	Course and Application	WAJ/MWI	$37.58	0	0	GBMS Central & Regional Office Staff	15	0	15
GBMS Impact Assessment	Impact Assessment in Pilot Basin	29-Nov-05	Workshop	Hotel	$797.08	0	0	GBMS Central & Regional Office Staff	16	1	17
Well Data Verification and Labeling	Record-keeping and well labeling	20-Mar-06	Course and Application	Jezeh Regional Office	$362.32	0	0	GBMS Regional Office Staff	32	0	32
Water Meters Operation and Maintenance SOPs	Technical O&M SOPs	24, 25; 26, 27 April 2006	Course and Application	WAJ Meters Directorate	$913.14	0	0	GBMS Regional Office Staff	44	0	44
	Data Collection SOPs	Oct/Nov 2006	On-Job-Training	GBMS Regional Offices (8)	n/a	0	0	GBMS Regional Office Staff	16		16
Junior Staff Training	Groundwater Occurrence, Properties & Control	27-Nov-05	Course and Application	GMED Project Office				GMED Project Junior Trainee Staff	3	0	3
	Groundwater Flow	2-Jan-06	Course and Application	GMED Project Office				GMED Project Junior Trainee Staff	3	0	3
	Groundwater Investigations and Surveys - Part 1	1-Feb-06	Course and Application	GMED Project Office				GMED Project Junior Trainee Staff	3	0	3
	Well Design and Drilling	14, 19 Apr 2006	Course and Application	GMED Project Office				GMED Project Junior Trainee Staff	3	0	3
	Groundwater Investigations and Surveys - Part 2	22, 27 Apr 2006	Course and Application	GMED Project Office				GMED Project Junior Trainee Staff	3	0	3
	Groundwater Management	18, 22 Jun 2006	Course and Application	GMED Project Office	$5,967.00	0	0	GMED Project Junior Trainee Staff	3	0	3
	Goundwater Flow Systems Analysis and Modeling - USGS	20 - 31 Aug 2006 (10 days)	Course and Application	MWI	0	0	0	GMED Project Junior Trainee Staff	3	0	3

APPENDIX D. GMED PROJECT PHOTOS

EVENTS

During Year 1 of the GMED project, a series of workshops and meetings were conducted with GBMS/WAJ and other key stakeholders to kickoff tasks and coordinate activities. A selection of these events is shown below.

PROCUREMENT

The GMED project had a substantial procurement task to deliver a wide variety of commodities to strengthen the GBMS and contribute to improved enforcement of By-law 85/2002. Some of the major items delivered in Year 1 are pictured below.

DATA MANAGEMENT

Task 4 – Data Management was a central focus of Year 1 of the GMED project. A few of the many data management activities conducted by the project as part of system planning, testing, training, and implementation are shown below along with the Blade Server procured to host the GBMS system at WAJ.

NEW METER INSTALLATION

Pictured below is the installation of the first of 710 US water meters procured by the GMED project for WAJ to improve groundwater monitoring. This installation was performed by the Jezah regional office. The GBMS plans to install at least 335 meters in 2006 and the remainder in 2007.

U.S. Agency for International Development/Amman
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