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The Hashemite Kingdom of Jordan

Ministry of Water and Irrigation

Water Quality Improvement and Conservation Project

Springs Monitoring Plan

Science Applications International Corp
WAJ Surface Water Basins Division

Development Alternatives Inc

USAID

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Prepared by Science Applications International Corporation and
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1 Introduction

The Ministry of Water and Irrigation (Ministry) is responsible at the national level for administering water policy and managing water resources in Jordan A major component of the Water Quality Improvement and Conservation (WQIC) Project is to assist the Ministry in establishing a national water monitoring program for collecting surface and ground water resources and quality data and information The monitoring program also includes the monitoring of springs and hydrometeorologic variables (rainfall and evaporation) This comprehensive and integrated monitoring program is essential to the improvement of the Kingdom's national water resources assessment, management, conservation, and planning It also will help identify additional sources of water (recharge, water harvesting) and improve water quality

This document presents the details for the springs monitoring program It discusses the objectives of the monitoring program, an assessment of the existing program, and the upgrade and extension of the springs monitoring network, types of data to be collected by the program, the uses of the data, specific monitoring stations, and the frequency of monitoring and sample collection

2 0 Monitoring Program Objectives

2 1 Overview

In Jordan, springs historically have played an important role in the settlement pattern, where they served as a local source of domestic water supply and irrigation In addition, thermal springs have long been used for their therapeutic value Being a convenient source of water and a significant component of the national water resources, a number of springs have been further developed by the Water Authority of Jordan (WAJ) to provide domestic water supply for several modern cities and towns Meanwhile, numerous rural communities rely on springs for domestic water supply and farming Two thermal springs, namely Hammamat Ma'in and Mukheiba have been developed by the Ministry of Tourism as resorts for tourism and therapy

Increased demand to satisfy the water supply requirements of a growing population, rapid expansion of urban areas, and industrialization, coupled with a highly variable rainfall, have resulted in the decline of the available spring water quantity and the deterioration of the water quality of a number of springs Several springs have dried-up due to over-abstraction of the ground water aquifer from which they emerge Bacteriological contamination has affected some of the major domestic water supply springs, such as Deek, Teis, Qairawan, Qantara, Ruseifa, and Wadi Es Sir, due to domestic waste water infiltration from housing areas upgradient of these springs

The decrease of water quantity and the contamination of springs does not only present an additional stress on the limited national water resources and on the preservation of the environment, it also imposes additional financial expenses by requiring more expensive water supply alternatives such as ground water production wells, surface water reservoirs (storage dams), treatment of brackish water, and desalination There is an urgent need for the conservation and protection of this valuable national resource (springs), which has proven to be a convenient and cost effective water supply, or in the case of thermal springs has potential health and tourist value

The conservation and the protection of spring water quantity and quality require the availability of an integrated national water resources monitoring network (especially rainfall, surface water, ground water, spring discharge, and water quality) in order to fully understand how the water quantity and quality of springs vary during a year and over a period of years This document focuses on the springs monitoring program The ground water and surface water monitoring programs were developed in earlier studies

2 2 Program Objectives

Objectives

The principal goal for the program is to monitor the water quantity and quality of the springs in order to achieve the following objectives

1) Obtain a realistic assessment of the water quantity of the springs and evaluate its temporal variability
2) Evaluate the behavior of the water quality of springs, especially those used for domestic water supply, tourism, and irrigation
3) Design and operate domestic water supply stations fed by spring discharges
4) Design and operate irrigation distribution systems fed by spring discharges
5) Provide data for the enhancement of existing thermal resorts and the development of new thermal spring stations for tourism and therapy
6) Identify the sources of water quality deterioration of contaminated springs in order to identify and execute the appropriate remedial measures
7) Understand the relationship between the temporal variability of rainfall and the fluctuation of the water quality and quantity of springs
8) Monitor the effect of current ground water abstraction on the water quality and quantity of springs
9) Monitor the effect of ground water and surface water (construction of dams) development on the water quality and quantity of springs
10) Design aquifer protection zones in the vicinity of important springs
11) Establish decision rules for water supply management under drought conditions
12) Provide data for the exploitation of brackish springs in the Ghor area

13) Provide data for the sustainable management of the water quantity and quality of the springs

Data Requirements

The basic data and information required to achieve the above objectives are mainly discharge (flow), water quality, and temperature (for hot or thermal springs) data Spring discharge data may be required on a weekly, monthly, or seasonal basis depending on the water use (domestic supply, irrigation, thermal resorts), the magnitude of discharge, and the temporal variability of the flows Basic water chemistry and microbiological data requirements depend on the water use and on the type of development in the vicinity of the springs (residential or industrial) The general classes of water quality parameters are identified in Section 3 0 Temperature data is only applicable to hot springs for the design and operation of thermal resorts

The discharge data obtained by the springs monitoring program will be analyzed and evaluated using a variety of standard techniques and tools These practices generally are applicable and consistent world-wide and frequently have been formalized by the United States Geological Survey, the World Meteorological Organization, the International Organization for Standardization (ISO), or other professional organizations Section 12 0 in the Water Monitoring System Procedures document (Volume 2, Appendix A of the Water Monitoring System Upgrade Plan) (MWI, 1995b) includes a detailed list of technical references for evaluating and analyzing flow data

Water quality data collected by this program will be evaluated in part against various established water quality standards or criteria These standards/criteria include Jordanian water quality standards for various uses, World Health Organization guidelines, and possibly other international standards, as appropriate and necessary

Decision Rules

The use of spring waters is dictated mainly by the type of water use (domestic, irrigation, tourism, and industry), water requirements, water availability, and water quality Decision rules need to be developed for the management of spring waters The monitoring program

should help establish a set of water supply rules which take into account the variability of water quantity and quality and the trend of water demand (short, medium, and long term) These rules should define the water allocation priority for water use sectors and include the management of spring waters, under drought conditions Water quality data also will help establish decision rules for water allocation for different water use sectors, according to the Jordanian Standards

Data Quality

Data Quality Objectives (DQOs) are qualitative and quantitative statements specified to ensure that data of known reliability are obtained from a monitoring program In addition, the identification of monitoring requirements involves specifying the data measurement techniques/methods, monitoring station design, number of stations, data measurement frequency, types of data to be measured, and the level of quality control required As data needs are established or refined, logistical planning can be conducted to ensure that data are acquired expeditiously and cost effectively Data quality objectives constantly must be re-evaluated and refined as new information is obtained

Data quality is the degree of certainty of data with respect to precision, accuracy, reproducibility, comparability, and completeness Several levels of qualitative and quantitative specificity have been defined for data quality Two Data Quality Levels (DQLs) have been identified for the springs monitoring program The two DQLs are defined as follows

> Level I -- **Field Measurements** This level includes data which generally can be quickly obtained from field measurement activities Data measurement typically involves use of portable or transportable instruments or collection of discharge data at stations with natural controls where the flow path may shift after floods (i e , for springs discharging in wadis) and therefore reduce the expected accuracy of the discharge information Level I data are used for on-site screening, baseline data development, and rapid field determination of the general characterization of the discharge and water quality conditions associated with springs

Level II -- **Flow Control Structures Measurements or Laboratory Analytical Data** This level provides data of greater completeness and reproducibility from stations located at flow control structures, including properly installed portable or permanent weirs Flow control structures are engineered devices to provide a high level of reliability and reproducibility in the data measured Typically the data are obtained at a rate slower than provided by Level I However, the data present a more complete description of the hydrologic processes at a station For water quality data, standardized testing procedures equivalent to those used for international testing, potentially including the United States Environmental Protection Agency procedures for water and wastewater, are used

Level I data will consist of field measurements such as water level or stage, discharge, water velocity, cross-sectional area, travel distance, and related hydraulic parameters Level II data typically will consist of water level or stage controlled by weirs or stable natural controls Discharge data will be expected to be of good accuracy as determined from weirs and current meters Record stations with natural controls may be at Level I because of shifting in the configuration of the control which may occur during flood events, resulting in discharge data of lesser accuracy Concerning water quality, Level I data will consist of field measurements of spring water quality parameters such as pH, temperature, specific conductance, turbidity, and dissolved oxygen Level II data will consist of results of analyses of spring water samples for the substances discussed in Section 3 0 of this document

The quality assurance/quality control objectives for all measurements include representativeness, completeness, comparability, precision, and accuracy The definition of these terms and the criteria used for their evaluation are listed below

Representativeness

Data measured or samples collected during performance of the tasks for this program must be representative of the discharge and water quality of the spring under investigation and must be obtained using accepted and valid techniques Any variations in measurement techniques, required field conditions, or environmental conditions should be noted in the field log book

Any observable parameter variations, matrix differences, and environmental conditions likewise will be noted in the field log book

Completeness CompletenessCompletenessCompleteness

The completeness of the data set for a particular water quantity or water quality need will be assessed by comparison of the amount of data required with the amount of data obtained Loss of data due to equipment or station malfunction should be documented Quality control data, as appropriate, will be recorded and if data are rejected on the basis of quality control results, the reason for data rejection and corrective action taken should be documented in the analytical report

Comparability

Consistency in the acquisition, measurement, or analysis of data is necessary for the comparison of results to be meaningful To achieve optimum comparability, acceptable methods for the measurement and analysis of data as described in the protocols presented in the Water Monitoring System Upgrade Plan Appendix A (Volume 2 - Water Monitoring System Procedures), (MWI, 1995b) should be closely followed

Precision and Accuracy

Precision refers to the reproducibility of a measurement method when it is repeated in a homogeneous environment regardless of whether or not the observed values are representative of the true values Precision can be expressed by standard deviation Accuracy refers to the agreement between the value of a parameter measured by a method and the actual value of the parameter

Precision and accuracy of data may be enhanced by using calibrated instrumentation, proper measurement techniques for given discharge and water quality conditions, and by repeating measurements

3 0 Monitoring Network Evaluation and Upgrade

3 1 Status of Existing Monitoring System

Spring discharge measurements started in 1937 covering a limited number of springs Most of the existing spring monitoring network was established in the early 1960's Additional springs were added to the network in the early 1970's and again in the 1980's The monitoring network has included more than 880 springs (Rakad, 1989) This number has been reduced to approximately 700 springs (Rakad, 1997) About 220 springs are monitored on a monthly basis for water discharge data purposes Another 60 springs are monitored on a seasonal basis, and 426 springs are monitored on an annual basis

Water quality monitoring started in the early 1980's A water sample is collected from each spring on a yearly basis for geochemical analysis which includes TDS, electrical conductivity, pH, Ca, Mg, Na, K, Cl, CO_3, HCO_3, SO4, and NO_3 Microbiological samples generally have not been collected because the multi-day sampling trips could affect the integrity of the samples (MWI, 1995a), and temperature data are not collected even for the hot springs

The existing Springs Monitoring Program has encountered few problems over the last several years which have affected the collection of water quantity and water quality information (MWI, 1995a) A main problem has been the limited staff resources to conduct monitoring of the springs At one time there were seven staff dedicated to monitor nearly all springs on a regular basis Now there are only two technicians to monitor the springs throughout the country resulting in a reduction of monitoring sites and of measurement frequency Several springs which were monitored on a monthly basis are now monitored only on a quarterly or yearly basis Moreover, equipment and supplies are needed to conduct the required monitoring of the springs The staff and resources requirements are being addressed through the overall water monitoring system negotiations

Another major problem, already stated in Section 2 0 of this report, consists of the decrease of discharge or a dry-up of numerous springs as a result of ground water over-abstraction The latest survey (Raked 1989) identified 90 dry springs These springs ceased flowing in

the late 1980's Other important springs, such as those of the Azraq pools, stopped flowing during the 1990's and El Birkatein spring, which has been part of the waterworks of Jerash since Roman times, became intermittent (flows only during wet seasons) in late 1996 In addition, bacteriological contamination has affected a number of significant domestic water supply springs such as Qantara, Ruseifa, Wadi Es Sir, Deek, Teis, and Qairawan which also has been of importance since the Roman era

3 2 Springs Monitoring Parameters and Frequency

Springs monitoring consists of measuring the discharge and the water quality The discharge is obtained either by the velocity cross-section method using a current meter or by stage-discharge method using portable or permanent weirs, and occasionally by the volumetric method It is important to note that water originating as springs should not be counted twice in Jordan water budget (i e , as springs, and as a contributor to a downstream surface water station) (MWI, 1995a)

Spring discharges are measured on a monthly, seasonal (quarterly), or annual basis Monthly measurements are recommended for major springs which have an average annual discharge of a least 25 m^3/hr and for all springs developed for domestic water supply The monthly discharge monitoring frequency for domestic water supply springs needs to be upgraded to a weekly basis, when the monitoring program will be fully staffed, in order to develop adequate decision rules for the supply management of spring waters, especially under drought conditions (see decision rules in Section 2 2) Also, it is important to note that hourly pumping rate data are currently recorded for springs which are exploited by WAJ The weekly monitoring of these springs can be done by the operators of the WAJ pumping stations under supervision of spring monitoring personnel

The seasonal discharge monitoring will include springs which have an average annual discharge less than 25 m^3/hr but at least equal to 15 m^3/hr, excluding those used for domestic water supply The rest of the springs will be monitored on a biannual basis (one measurement during the winter and the other during the summer) Biannual monitoring will provide a broad estimate of the total annual spring discharge This estimate can be considered as acceptable because the total discharge of all springs which have an average

discharge of less than 15 m^3/hr represents only a very small component of the national water resources and monitoring these springs at a higher frequency is not cost effective

The annual monitoring will be limited to springs which are currently dry or reduced to seepage and may resume flowing during wet years It will be used as a qualitative indicator which helps in deciding whether to discontinue the monitoring of these springs or resume data collection on a biannual or seasonal basis depending on the amount of discharge during wet years On the other hand, annual monitoring is not valid for the assessment of springs water resources because a single annual measurement does not give a realistic estimate of the total annual discharge Therefore, it is recommended to upgrade the monitoring frequency of springs which currently are observed on an annual basis to a biannual or seasonal basis for the first 5 years, according to the importance of the spring Then the monitoring frequency could be increased possibly to seasonal or monthly depending on the value of the average discharge during these first 5 years

An examination of springs records indicates that a number of them have experienced a significant decrease in their discharge due to ground water over-abstraction Also, it is important to note that Ain Wadi Kufrein spring discharge declined due to the decrease of the recharge downstream of the new Kufrein dam On the other hand, future artificial recharge dams may lead to an increase of flows from the springs which are in the vicinity of these dams The average annual yield of these springs should be re-estimated in order to reflect their new average annual yield, and the frequency of the monitoring should be changed accordingly For the springs which recently have been affected by ground water over-exploitation, judgment is used to select a new monitoring frequency

Springs water quality monitoring will be conducted in accordance with the general categories outlined in Tables 2, 4, 6, 8, 10, and 12 Table 13 lists the monitoring frequency and the specific water quality parameters associated with the general categories specified in the latter tables

Because monitoring trips have been of several days duration, it has not been feasible to collect water quality samples Holding times for the samples typically are exceeded Microbiological samples generally have not been collected because the multi-day trips could

affect the integrity of the samples (MWI, 1995a) This problem can be solved by planning daily transportation of samples from regional offices, as done in other countries

3 3 Evaluation and Upgrade of the Monitoring Network

An evaluation of the springs monitoring network included visiting the major springs in the country Approximately 130 springs, which have an average annual discharge greater or equal to 25 m^3/hr, were visited 18 in the Jordan River basin, 7 in Yarmouk basin, 26 in Zarqa Basin, 38 in the Rift Side Wadi basins, 26 in the Dead Sea basins, 2 in Wadi Mujib basin, 4 in Wadi Hasa basin, 8 in Wadi Araba North, and one in Wadi Araba South The locations of these springs are illustrated in Figures 1 to 3 For each one of them, the field visit focused on the following items

1) Monitoring status which indicates whether the station is active, inactive or new, and whether the monitoring frequency is monthly, seasonal (quarterly), biannual or annual
2) Rationale for station location which gives the reason for the monitoring (i e , high flow, used for domestic water supply and irrigation)
3) Data collected which includes the type of monitored parameters (i e , water quantity and water quality)
4) Physical Description of Station which defines the hydraulic condition of the monitoring site and evaluates its adequacy for current meter or weir measurement
5) Direction to location which gives an approximate description on how to reach the monitoring site
6) Proposed Action for Monitoring System which gives specific recommendations about the monitoring frequency, upgrade or discontinuation of a station, establishment of a new site, installation of monitoring equipment (weir, staff gauge), water quality monitoring, treatment of bacteriological contamination, etc
7) Other Observations includes UTM coordinates, temperature and electrical conductivity values as well as any other relevant remark

A field visit report was prepared for each visited site A Water Monitoring Station Field Review Form is presented in Appendix A The field data are complemented by an examination of the observed spring discharge records in order to identify the status of the

current discharge of each of these springs The discharge status is classified in four categories

1 Normal spring flows continuously and its discharge varies according to the natural variability of rainfall
2 Declined spring flows continuously, but its discharge has declined due to ground water over-abstraction
3 Intermittent spring flows only during part of the year
4 Dry spring ceased flowing

Tables 1, 3, 5, 7, 9, and 11 show the average, minimum, maximum discharge, and the status for the major springs in the Jordan River basin, Yarmouk River basin, Zarqa River basin, Rift Side Wadis basins, Dead Sea basins, and Wadi Mujib-Hasa-Wadi Araba basins, respectively

The springs monitoring network evaluation and upgrade for each of the above regions is reported hereafter

Jordan River Basin

There are 18 major springs in the Jordan River basin (Table 1) Tabqat Fahil is the most important spring in the basin, it has an average annual discharge of 1057 4 m^3/hr Eleven (11) springs, including Tabqat Fahil, have normal discharge, six (6) springs have experienced a flow decrease and their discharge has dropped during the last few years to less than 25 m^3/hr Sa'ada spring is currently intermittent Abu Fahal spring is proposed as a new monitoring station to be monitored on a monthly basis Tabqat Fahal is the only spring which is developed by WAJ for domestic water supply (Table 2), it also is partly used for irrigation The rest of the springs, with the exception of El Hujeijeh which is partly used for domestic water supply but is not developed, are exploited for irrigation purposes

The discharge of the 11 "normal" springs should continue to be monitored on a monthly basis The discharge monitoring frequency of five (5) of the six (6) "declined" springs needs to be changed from monthly to seasonal Batta spring will continue to be observed on a biannual basis Two permanent weirs need to be installed for Tabqat Fahil to measure the

total discharge of the spring (see Appendix A for details) Another permanent weir is proposed for Abu Ziad spring

The proposed springs water quality monitoring for Jordan River Basin will be conducted in accordance with the general categories of water quality parameters listed in Table 2 These categories are associated with the water use and the type of spring For springs used for irrigation purposes, category Irrigation Water 3 corresponds to the monthly monitored springs and category Irrigation Water 4 corresponds to the seasonal and biannual springs Category Drinking Water 1 is recommended for domestic water supply springs Table 13 lists the specific chemicals and the monitoring frequency associated with the general parameter categories specified in Table 2

Yarmouk River Basin

Only four (4) of the seven (7) major springs in the Yarmouk River basin have normal or natural discharge (Table 3) Qweilbeh spring became intermittent and the Um El Forat and Bir Sarayah springs have dried up Hammamat Mukheiba thermal spring is the most important spring in the basin with an average annual discharge of 1639 0 m^3/hr It is currently used for tourism, therapy, and irrigation The Rahoub spring is the only spring in the basin developed by WAJ for domestic water supply (Table 4) However, it has been recently polluted by bacteriological contamination due to seepage of effluents possibly from an upstream poultry farm (see Appendix A for details) Qweilbeh is partially developed by local inhabitants for water supply and irrigation, but its reservoir and canal require rehabilitation The two other flowing springs namely El Balad Aqraba and El Adaseyyeh are used for irrigation

Monthly discharge monitoring should continue for Qweilbeh, El Balad Aqraba, Hammamat Mukheiba, and El Adaseyyeh It is recommended to install a permanent weir at El Adaseyyeh station Biannual discharge monitoring for Rahoub sprig needs to be upgraded to monthly monitoring due to its significant discharge

The proposed springs water quality monitoring in the Yarmouk River basin will be conducted in accordance with the general categories of water quality parameters listed in Table 4 These

general categories are associated with the water use and the type of spring For the springs used for irrigation purposes, category Irrigation Water 3 corresponds to the monthly monitored springs Drinking Water 1 is recommended for domestic water supply springs, and Thermal 1 for the hot springs Table 13 lists the specific chemicals and the monitoring frequency associated with the general parameter categories specified in Table 4

It is recommended to treat the bacteriologic contamination in Rahoub spring water

Zarqa River Basin

Twenty (20) of the twenty six (26) major springs in the Zarqa River basin still have normal flow (Table 5) Two springs, including Sukhnah which was the most important spring in the basin (average annual discharge of 564 m^3/hr), dried up Three (3) of the Four (4) springs which have experienced a discharge decrease, became intermittent Eight (8) springs have been developed by WAJ for domestic water supply, six (6) of these springs are partly used for irrigation (Table 6) Ruseifa, Qairwan,Teis and Deek have bacteriological contamination The remainder of the springs (16) are being exploited for irrigation purposes

The discharge from eighteen (18) of the "normal" springs should continue to be monitored on a monthly basis At Ras Al Ain spring biannual monitoring needs to be reactivated and upgraded to monthly monitoring It is recommended to upgrade the monitoring at Nimra and Ain Wadi Rumeimin springs to monthly monitoring and at Ain Wadi Jebarat spring to seasonal monitoring El Shawahid and El Birkatein need to be downgraded to seasonal and biannual monitoring, respectively An annual visit, for the next five years, during the wet season, is proposed for Sukhneh and Bisass El Room springs in order to check whether they will resume flowing or not (see section 3 2) Flow records reported in the database for Deek and Teis springs are doubtful because both springs are diverted (piped) to a common reservoir and it is not currently possible to measure the discharge from each of these springs Therefore, it is recommended to install a flow meter at each of Deek and Teis WAJ pipes in order to measure the discharge of these springs

The proposed springs water quality monitoring in the Zaqra River basin will be conducted in accordance with the general categories of water quality parameters listed in Table 6 These general categories are associated with the water use and the type of spring For springs used

for irrigation purposes, category Irrigation Water 3 corresponds to the monthly monitored springs and category Irrigation Water 4 corresponds to the seasonal and biannual springs Drinking Water 1 is recommended for domestic water supply springs Table 13 lists the specific chemicals and the monitoring frequency associated with the general parameter categories specified in Table 6

It is recommended to treat all the domestic water supply springs which have bacteriological contamination

Rift Side Wadi Basins

Thirty (30) of the thirty eight (38) major springs in the Rift Side Wadis basins have normal discharge and three (3) are intermittent (Table 7) Two (2) springs have dried up and three (3) have experienced a decrease in their discharge Eleven (11) springs have been developed by WAJ for domestic water supply , nine (9) of these are partly used for irrigation Two (2) springs, namely El Qantara and Wadi Es Sir, have documented bacteriological contamination, and five (5) others also may have documented bacteriological contamination The remainder of the springs (25) are being exploited for irrigation purposes

The discharge of twenty seven (27) springs will continue to be monitored on a monthly basis (Table 8) A new monitoring site was selected for Essabrah spring which needs to be reactivated and upgraded to seasonal monitoring It is recommended to upgrade El Buheira and Fawwar springs to monthly monitoring, and the Shunah North and Kursi springs to seasonal monitoring Birkit El Himma at Ain Janna, Abo El Jood Ain Janna, and El Khandaq springs need to be upgraded to biannual monitoring Ain Wadi Kufrein spring should be reactivated and downgraded to seasonal monitoring Two permanent weirs need to be installed, one at Mbeirdeh spring and one at Sumiya spring (see Appendix A for details)

The proposed springs water quality monitoring in the Rift Side Basins will be conducted in accordance with the general categories of water quality parameters listed in Table 8 These general categories are associated with the water use and the type of spring For springs used for irrigation purposes, category Irrigation Water 3 corresponds to the monthly monitored springs and category Irrigation Water 4 corresponds to the seasonal and biannual springs Drinking Water 1 is recommended for domestic water supply springs Table 13 lists the

specific chemicals and the monitoring frequency associated with the general parameter categories specified in Table 8

It is recommended to treat all the domestic water supply springs which have bacteriological contamination

Dead Sea Basins

Most of the major springs in the Dead Sea basins have maintained their normal flow regime (Table 9) Only one spring (Sikkin) has dried up and and another (Marwaha Kabireh) has "declined" in discharge The Dead Sea basins include the majority of the hot or thermal springs in the country These springs are located in the Wadi Zarqa Ma'in basin and in the Zara area along the Dead Sea The most important springs in Wadi Zarqa Ma'in are Ma'in East, Esh Shallal, Hammam Amir, and El Magara These springs have been developed by the Ma'in thermal station for tourism and therapy

Esh Shallal and Hammam Amir springs are monitored on a monthly basis (Table 10), but their permanent weirs need to be rehabilitated El Magara spring will continue to be monitored on a monthly basis Ma'in East is a new spring located east of Esh Shallal It was identified during the field trip and is proposed as a new monthly monitoring station (see Appendix A) A high flow, which originates from springs upstream of Wadi Zarqa Ma'in, was identified during the field visit A new monthly monitoring station was selected to measure this flow (refer to Appendix A for details) All the Wadi Zarqa Ma'in springs waters flow toward the Dead Sea where they are monitored on a monthly basis at the Wadi Zarqa Ma'in station near the Dead Sea The existing Wadi Zarqa Ma'in surface water gauge, near the Dead Sea, needs to be relocated in order to record all the latter springs discharge, the baseflow and flood flow

Most of the Zara springs flow to the Dead Sea and have not been developed Five (5) major Zara springs, namely Zara No 1, Zara No 2, Zara No 4, Zara No 7, and Zara No 8, currently are monitored on a monthly basis Two (2) other non-monitored major springs were identified during the field visit A monthly monitoring site was selected for each of them These springs are presented in Table 9 as Zara E and Zara F, and are described in Appendix A It also was found that Zara No 2, Zara No 4, Zara No 5 (low discharge), and Zara No 6

(low discharge) originate from a common spring A monthly monitoring site was selected for this spring, which was named Zara B as described in Appendix A Therefore, it is recommended to discontinue the monitoring at Zara No 2, Zara No 4, Zara No 5, and Zara No 6 For convenience, it is suggested to rename Zara No 1, Zara No 7, Zara No 8, and Zara No 9 (low discharge) as Zara A, Zara C, Zara D, and Zara G

Thirteen (13) of the ordinary major springs are used for irrigation (Table 10), two (2) other springs, namely Sarah and Zara 8, have been used for domestic water supply by WAJ and the Ministry of Defense camp, respectively Both springs also are partly exploited for irrigation Fifteen springs will continue to be monitored on a monthly basis The monthly monitoring site for Suweima spring will be relocated, details about the new site are given in Appendix A Wadi Issal, Al Odheima at Suweima, and Seil El Buleideh springs need to be reactivated to monthly monitoring Marwaha Kabireh spring needs to be downgraded to biannual monitoring An annual visit, for the next five (5) years, during the wet season, is suggested for Sikkin spring in order to check whether it will resume flowing or not (see Section 3 2)

The proposed springs water quality monitoring in the Dead Sea basins will be conducted in accordance with the general categories of water quality parameters listed in Table 10 These general categories are associated with the water use and the type of spring For the springs used for irrigation purposes, category Irrigation Water 3 corresponds to the monthly monitored springs and category Irrigation Water 4 corresponds to the seasonal and biannual springs Drinking Water 1 is recommended for domestic water supply springs, and Thermal 1 for the hot springs Table 13 lists the specific chemicals and the monitoring frequency associated with the general parameter categories specified in Table 10

Wadi Mujib, Hasa, and Wadi Araba Basins

Wadi Mujib basin has two (2) major springs namely Wadi Haidan and Lajjun The high average annual discharge of 1704 1 m^3/hr for Wadi Haidan (Table 11) is most likely the average of the accumulation of discharge from several springs along the wadi Both springs have natural or normal discharges which are used for irrigation purposes, and monthly discharge monitoring of these springs should continue The proposed water quality monitoring for the two springs will be conducted in accordance with the Irrigation Water 3

general category (Table 12) Table 13 lists the specific chemicals and the monitoring frequency associated with this category

Wadi Hasa basin has four (4) major springs Bir Al Harir, Mugheisel Kabeira, and Hammam Burbata springs have natural or normal discharge and Wadi Hasa at Tannour spring is intermittent (refer to details in Appendix A) The average annual discharge 97 2 m^3/hr at Hammam Burbata spring is not realistic An examination of the monthly records indicates that discharge measurements made prior to November 1986 most likely were taken at Seil Hasa and assigned to Hammam Burbata Bir El Harir spring has been developed by WAJ for domestic water supply Hammam Burbata spring is used for therapy and irrigation Mugheisel Kabeira and Wadi Hasa at Tannour springs are exploited for irrigation purposes It is recommended to rectify the Hammam Burbata spring records and to continue monthly monitoring for all four (4) springs (Table 12) The proposed water quality monitoring parameter categories (Table 12) are Irrigation Water 3 for Mugheisel Kabeira and Wadi Hasa at Tannour, Drinking Water 1 for Bir Al Harir, and Thermal 1 for Hammam Burbata Table 13 lists the specific chemicals and the monitoring frequency associated with these categories

Wadi Araba North basin has eight (8) major springs El Heesha spring is intermittent while the rest of the springs have normal or natural discharge (Table 11) Wadi Feifa and Wadi Fidan discharges are most likely the accumulation of discharge of several springs along each wadi Gharandal spring has been developed by Gharandal Municipality for domestic water supply Hammamat Afra spring is being developed for tourism, therapy, and part of its water is used for irrigation purposes The rest of the springs are exploited for irrigation purposes It is recommended to upgrade the discharge monitoring to biannual for El Heesha spring and to monthly for Wadi Umrug spring Monthly monitoring should be reactivated at Wadi Khanzira spring Monthly monitoring needs to continue for the rest of the springs (Table 12) The proposed water quality monitoring general categories (Table 12) are Drinking Water 1 for Gharandal, Thermal 1 for Hammamat Afra, Irrigation Water 4 for El Heesha, and Irrigation Water 3 for the rest of the springs Table 13 lists the specific chemicals and the monitoring frequency associated with these categories

Wadi Araba South basin has only one major spring in Wadi Dathna (Table 11) Wadi Dathna spring has only three (3) annual records (1973, 1977, and 1981) Based on the field

visit, this spring is judged to have normal or natural flow and is proposed to be reactivated as a monthly monitoring station Its water is being used for drinking by the Potassium Co (Table 12) and its water quality needs to be monitored according to the specifications of the Drinking Water 1 category (Table 13)

3 4 Hydrologic Measurements, Sampling, and Quality Assurance Protocols

Consistent hydrologic measurements, sampling, quality assurance, and data management protocols will be followed throughout the monitoring program to ensure that the data and associated analyses provide an accurate representation of the springs water resources throughout the basins These procedures are similar to those for surface water monitoring and are presented in detail in the Water Monitoring System Upgrade Plan Appendix A (Volume 2) (MWI, 1995b) and include

(i) Surface water resources measurement procedures (Section 10 0),
(ii) Surface water sample collection (Section 6 0),
(iii) Sample preservation and shipment (Section 2 0),
(iv) Chain-of-custody control (Section 2 0),
(v) Quality assurance (Section 2 0), and
(vi) Data management (Section 3 0)

Data Measurement

Springs water resources data measurement is similar to that of surface water resources Data will be obtained in accordance with internationally accepted procedures Section 10 0 of the Water Monitoring System Upgrade Plan Appendix A (Volume 2 - Water Monitoring System Procedures) presents detailed descriptions of data measurement techniques and procedures to be followed for the springs or surface water resources monitoring program Primarily, water level (height for weir measurement method), water velocity, and cross-sectional area data will be measured and recorded in the field

Section 5 0 of the Water Monitoring System Upgrade Plan Appendix A (Volume 2 - Water Monitoring System Procedures) presents general information for planning a water measurement event

Sample Collection

Springs water samples will be obtained in accordance with internationally accepted procedures Samples will be handled and transported with full chain-of-custody Section 6 0 of the Water Monitoring System Upgrade Plan Appendix A (Volume 2 - Water Monitoring System Procedures) presents detailed descriptions of the sampling procedures to be followed for the surface water monitoring program Specific conductance, temperature, and pH will be analyzed and recorded in the field Table 14 presents a generic summary of information relating to container type and volume, preservation technique, and holding time for chemical parameters for which samples will be collected

Section 4 0 of the Water Monitoring System Upgrade Plan Appendix A (Volume 2 - Water Monitoring System Procedures) presents general practices and procedures for field operations to ensure collection of representative data and samples Section 5 0 of the Water Monitoring System Upgrade Plan Appendix A (Volume 2 - Water Monitoring System Procedures) presents general information for planning a water quality sampling event

Quality Assurance

Quality assurance protocols for the monitoring program are presented in Section 2 4 of the Water Monitoring System Upgrade Plan Appendix A (Volume 2 - Water Monitoring System Procedures) These protocols describe the system to promote collection of representative and defensible data, use of field instrumentation, equipment calibration, sample documentation and record keeping requirements, and quality control samples Use of field logs and field report forms is specified to maintain proper sample documentation Section 10 0 of the Water Monitoring System Upgrade Plan Appendix A (Volume 2 - Water Monitoring System Procedures) provides general information about use of field instrumentation, equipment calibration, data documentation and record keeping requirements Use of field logs and field report forms is specified to maintain proper documentation of measurement data

Quality control samples shall be collected in accordance with the quality assurance guidelines described in Section 2 4 of the Water Monitoring System Upgrade Plan Appendix A (Volume 2 - Water Monitoring System Procedures) Field, equipment, and trip blanks and duplicate samples will be used to provide field quality assurance for springs water samples A

minimum of one field blank and one equipment blank will be collected each day springs water samples are obtained for chemical analysis One duplicate sample will be collected for every 10 samples or a minimum of one each day springs samples are collected A minimum of one trip blank shall be obtained each day samples are collected for analysis of volatile organic compounds

Sample Analysis

Samples will be analyzed for the specific list of parameters according to the master categorization and schedule presented in Tables 2, 4, 6, 8, 10, 12, and 13 Parameters include microbiological indices, general water quality constituents, typical water quality nutrients, metals, general organic constituents, and special organic constituents Analyses of samples will be performed by the Central Laboratory of the Water Authority of Jordan within the Ministry of Water and Irrigation Surface water samples will be analyzed following established international procedures such as USEPA procedures

Data Management

Data management protocols for the monitoring program are presented in Section 3 0 of the Water Monitoring System Upgrade Plan Appendix A (Volume 2 - Water Monitoring System Procedures) These protocols provide guidance on data management responsibilities of monitoring personnel and for recording and maintenance of data obtained from the monitoring program

4 0 Data Evaluation

Data, including quality control data, recorded and collected by the monitoring team will be reviewed for reasonableness and general consistency with water resources conditions in the basins and recent data trends Significant discrepancies will be discussed with the monitoring team and laboratory, as appropriate, to determine if unusual conditions occurred during the measurement or sampling event or if recording errors or laboratory reporting errors may exist After review, field data and laboratory data will be evaluated using appropriate techniques by the analysis function in accordance with established organizational procedures The data will be checked and then will be entered into a computerized water resources database Data entered into the computerized database will be checked again for entry and keying errors consistent with data management and database management procedures established for the overall monitoring program Original field forms and computer entry forms will be maintained in the project files

The analyzed data and resulting discharge and related information also will be evaluated with respect to the program objectives and decision statements outlined in Section 2 2 The decision statements establish the basic water resources management objectives for the program Data evaluation techniques and tools for purposes of evaluating the water resources data are not recommended in this document Such tools or techniques are readily available depending on specific needs and may become appropriate as the monitoring program and water resources database develop and as water management requirements change

Water quality data will be reviewed with respect to Jordanian and international (e g , WHO and USEPA) water quality standards These standards provide the bases for the acceptable use of water The data also will be evaluated with respect to the program objectives and decision statements outlined in Section 2 2 The decision statements establish the basic water quality management objectives for the program As noted in Section 2 2, no decision rules have been defined for the water quality monitoring program Data evaluation techniques and tools for purposes of evaluating the water quality data are not recommended in this document Such tools or techniques are available and may be appropriate as the monitoring program and water quality database develop and as water management requirements change

5 0 References

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TABLES

Table 1 Discharge of Major Springs in Jordan River Basin

STA_IDN	NAME	PGE	PGN	AVG_DISCHARGE M^3/HOUR	MIN_DISCHARGE M^3/HOUR	MAX_DISCHARGE M^3/HOUR	DISCHARGE CURRENT STATUS
AB0504	DOQA	206 600	223 000	49 7	5 6	238 0	Declined
AB0510	WADI TAIYIBA	213 000	216 000	63 7	6 2	371 0	Normal
AB0512	TELL EL ARBA IN	205 400	214 000	25 1	2 2	92 5	Declined
AB0522	ABU ZIAD	211 300	212 800	154 7	24 5	420 0	Normal
AB0526	EL BEIDA	209 200	212 400	137 5	55 1	262 0	Normal
AB0538	BATTA	205 400	207 300	61 5	2 6	191 0	Declined
AB0540	GHANNAM	205 400	206 500	33 3	1 4	252 0	Declined
AB0542	TABQAT FAHIL	208 000	206 250	1057 4	487 0	2255 0	Normal
AB0548	SA ADA	205 400	204 550	35 7	0 0	200 0	Declined Intermittent
AB0558	SHARHABEEL	204 700	200 000	105 0	12 1	225 0	Normal
AB0570	EL HUJEIJEH	207 400	194 200	33 1	12 4	64 4	Normal
AB0578	EL SULEIKHAT	207 800	193 000	64 9	24 4	170 0	Normal
AB0586	UM BEIRREH	204 400	189 300	113 7	22 1	275 0	Normal
AB0592	SA DIYA	204 600	186 300	641 3	15 8	1638 0	Normal
AB0601	AIN EL BUWEIB	206 500	182 800	84 0	20 9	378 0	Normal
AB0603	NUKHEIL	206 200	181 200	99 2	37 5	151 0	Normal
AB0699	AIN AMRA AT KURAIYMA	204 430	190 075	53 4	16 3	140 0	Declined
Ababuf	ABU FALAH	205 000	183 000				New

The data presented in this table are obtained from the Foxpr Database They have not been rigously validated and should not be accepted as accurate

Table 2 Proposed Monitoring Action, Major Springs in Jordan River Basin

STA_IDN	NAME	WATER USE	MONITORING STATUS	PROPOSED ACTION	WATER QUALITY MONITORING	COMMENTS
AB0504	DOQA	Irrigation	Monthly	Change to Seasonal	Irrigation Water 4	
AB0510	WADI TAIYIBA	Irrigation	Monthly	Continue Monthly	Irrigation Water 3	
AB0512	TELL EL ARBA IN	Irrigation	Monthly	Change to Seasonal	Irrigation Water 4	
AB0522	ABU ZIAD	Irrigation	Monthly	Continue Monthly	Irrigation Water 3	Install weir
AB0526	EL BEIDA	Irrigation	Monthly	Continue Monthly	Irrigation Water 3	
AB0538	BATTA	Irrigation	Bi-annual	Continue Bi-annual	Irrigation Water 4	
AB0540	GHANNAM	Irrigation	Monthly	Change to Seasonal	Irrigation Water 4	
AB0542	TABQAT FAHIL	Domestic W Supply Irrigation	Monthly	Continue Monthly	Drinking Water 1	Install two weirs
AB0548	SA ADA	Irrigation	Monthly	Change to Seasonal	Irrigation Water 4	
AB0558	SHARHABEEL	Irrigation	Monthly	Continue Monthly	Irrigation Water 3	
AB0570	EL HUJEIJEH	Irrigation Domestic W Supply	Monthly	Continue Monthly	Drinking Water 1	Local supply not developed
AB0578	EL SULEIKHAT	Irrigation	Monthly	Continue Monthly	Irrigation Water 3	
AB0586	UM BEIRREH	Irrigation	Monthly	Continue Monthly	Irrigation Water 3	
AB0592	SA DIYA	Irrigation	Monthly	Continue Monthly	Irrigation Water 3	
AB0601	AIN EL BUWEIB	Irrigation	Monthly	Continue Monthly	Irrigation Water 3	
AB0603	NUKHEIL	Irrigation	Monthly	Continue Monthly	Irrigation Water 3	
AB0699	AIN-AMRA AT KURAIYMA	Irrigation	Monthly	Continue Monthly	Irrigation Water 3	
Ababuf	ABU FALAH	Irrigation	New	Start Monthly	Irrigation Water 3	

Table 3 Discharge of Major Springs in Yarmouk River Basin

STA_IDN	NAME	PGE	PGN	AVG_DISCHARGE M^3/HOUR	MIN_DISCHARGE M^3/HOUR	MAX_DISCHARGE M^3/HOUR	DISCHARGE CURRENT STATUS
AD0530	UM EL FORAT	236 600	224 000	33 7	1 0	152 3	Dry
AD0536	RAHOUB	237 600	223 600	34 6	1 8	61 9	Normal
AD0580	QWEILBEH	231 600	231 200	35 5	0 0	144 0	Intermittent
AD0600	EL BALAD AQRABA	225 200	236 300	31 5	11 3	155 0	Normal
AD0670	HAMMAMAT MUKHEIBA	214 500	234 500	1639 0	100 4	3060 0	Normal
AD0696	BIR SARAYA	213 100	232 100	25 1	18 2	36 0	Dry
AD0740	EL ADASEYYEH	207 900	230 000	191 6	6 9	766 0	Normal

The data presented in this table are obtained from th the Foxpro Database They have not been rigously validated and should not be accepted as accurate

Table 4 Proposed Monitoring Action, Major Springs in Yarmouk River Basin

STA_IDN	NAME	WATER USE	MONITORING STATUS	PROPOSED ACTION	WATER QUALITY MONITORING	COMMENTS
AD0530	UM EL FORAT		Bi annual Inactive	Discontinue		Inactive since Dec 1993
AD0536	RAHOUB	Domestic W Supply	Bi Annual	Upgrade to monthly	Drinking Water 1	Bacteriological Contamination
AD0580	QWEILBEH	Domestic W Supply Irrigation	Monthly	Continue monthly	Drinking Water 1	Rehabilitate reservoir and Canal
AD0600	EL BALAD AQRABA	Irrigation	Monthly	Continue monthly	Irrigation Water 3	
AD0670	HAMMAMAT MUKHEIBA	Tourism Therapy Irrigation	Monthly	Continue monthly	Thermal 1	
AD0696	BIR SARAYA		Annual Inactive	Discontinue		Inactive since Sep 1980
AD0740	EL ADASEYYEH	Irrigation	Monthly	Continue monthly	Irrigation Water 3	Install weir

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Table 5 Discharge of Major Springs in Zarqa River Basin

STA_IDN	NAME	PGE	PGN	AVG_DISCHARGE M^3/HOUR	MIN_DISCHARGE M^3/HOUR	MAX_DISCHARGE M^3/HOUR	DISCHARGE CURRENT STATUS
AL0501	RAS EL AIN	237 000	150 500	412 4	6 2	2820 0	Normal
AL0514	AIN ZARBI	243 400	158 800	61 3	2 0	948 0	Normal
AL0515	RUSEIFA	246 600	158 610	263 6	4 3	1771 0	Normal
AL0522	SUKHNEH	250 500	171 000	564 0	0 0	1300 0	Dry
AL0528	NIMRA	248 000	172 800	161 4	0 0	511 0	Declined Intermittent
AL0546	EL KHALLA	245 800	172 600	28 2	5 6	74 4	Normal
AL0552	KHUREISAN	244 850	179 450	60 2	13 2	170 0	Normal
AL0597	WADI EL KARIM	244 530	180 720	46 2	2 6	353 0	Normal
AL0600	QUNAYYAH	244 300	182 300	377 1	74 5	2142 0	Normal
AL0630	MAGHASIL	229 300	191 700	45 2	0 2	757 0	Normal
AL0648	FAWWAR	230 900	190 900	47 5	1 0	611 0	Normal
AL0664	BISASS EL ROOM	234 100	191 600	48 7	0 0	222 0	Dry
AL0666	EL SHAWAHID	233 950	190 600	44 9	0 0	162 6	Declined Intermittent
AL0668	EL BIRKATEIN	234 300	189 800	98 0	0 0	619 0	Declined Intermittent
AL0672	EL QAIRAWAN	234 500	188 000	148 1	60 0	359 0	Normal
AL0674	AIN WADI JEBARAT	234 400	187 600	27 6	0 4	114 0	Declined
AL0716	EL TANNOUR	237 200	183 550	105 3	3 1	356 0	Normal
AL0748	ABU GHADIR	227 550	187 150	63 2	9 6	341 4	Normal
AL0758	TEIS	229 900	186 300	123 6	23 2	511 0	Normal
AL0760	DEEK	229 850	186 050	91 7	2 3	289 0	Normal
AL0822	RAS EL MAI	229 700	174 650	44 0	8 2	271 0	Normal
AL0864	UM EDDANANIR	226 850	166 500	28 3	10 3	98 3	Normal
AL0875	AIN WADI RUMEIMIN	225 600	167 300	128 4	43 1	298 0	Normal
AL0876	AIN W RUMEIMIN/SIYAGHA	225 600	167 300	93 7	22 1	295 0	Normal
AL0878	RAHIB	225 600	167 700	77 9	3 8	648 0	Normal
AL0918	SULEIHI	228 700	169 750	39 5	7 1	205 0	Normal

The data presented in this table are obtained from the the Foxpro Database They have not been rigously validated and should not be accepted as accurate

Table 6 Proposed Monitoring Action, Major Springs in Zarqa River Basin

NAME	WATER USE	MONITORING STATUS	PROPOSED ACTION	WATER QUALITY MONITORING	COMMENTS
RAS EL AIN	Domestic W Supply	Inactive Bi annual	Reactivate monthly	Drinking Water 1	Inactive since April 1984
AIN ZARBI	Irrigation	Monthly	Continue monthly	Irrigation Water 3	
RUSEIFA	Irrigation	Monthly	Continue monthly	Irrigation Water 3	Bacteriological Contamination
SUKHNEH		Monthly	Change to annual		
NIMRA	Irrigation	Seasonal	Upgrade to monthly	Irrigation Water 3	
EL KHALLA	Irrigation	Monthly	Continue monthly	Irrigation Water 3	
KHUREISAN	Irrigation	Monthly	Continue monthly	Irrigation Water 3	
WADI EL KARIM	Irrigation	Monthly	Continue monthly	Irrigation Water 3	
QUNAYYAH	Domestic W Supply Irrigation	Monthly	Continue monthly	Drinking Water 1	
MAGHASIL	Domestic W Supply	Monthly	Continue monthly	Drinking Water 1	Used by Air Forces
FAWWAR	Irrigation	Monthly	Continue monthly	Irrigation Water 3	
BISASS EL ROOM		Monthly	Change to annual		
EL SHAWAHID	Irrigation	Monthly	Change to bi annual	Irrigation Water 4	
EL BIRKATEIN	Irrigation	Monthly	Change to seasonal	Irrigation Water 4	Possible Bact Contamination
EL QAIRAWAN	Domestic W Supply Irrigation	Monthly	Continue monthly	Drinking Water 1	Bacteriological Contamination
AIN WADI JEBARAT	Irrigation	Annual	Upgrade to seasonal	Irrigation Water 4	
EL TANNOUR	Irrigation	Monthly	Continue monthly	Irrigation Water 3	
ABU GHADIR	Domestic W Supply Irrigation	Monthly	Continue monthly	Drinking Water 1	
TEIS	Domestic W Supply Irrigation	Monthly	Continue monthly	Drinking Water 1	Bacteriological Contamination
DEEK	Domestic W Supply Irrigation	Monthly	Continue monthly	Drinking Water 1	Bacteriological Contamination
RAS EL MAI	Irrigation	Monthly	Continue monthly	Irrigation Water 3	
UM EDDANANIR	Irrigation	Monthly	Continue monthly	Irrigation Water 3	
AIN WADI RUMEIMIN	Irrigation	Annual	Upgrade to monthly	Irrigation Water 3	
AIN W RUMEIMIN/SIYAGHA	Irrigation	Monthly	Continue monthly	Irrigation Water 3	
RAHIB	Domestic W Supply Irrigation	Monthly	Continue monthly	Drinking Water 1	
SULEIHI	Irrigation	Monthly	Continue monthly	Irrigation Water 3	

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Table 7 Discharge of Major Springs in Rift Side Wadis Basins

STA_IDN	NAME	PGE	PGN	AVG_DISCHARGE M^3/HOUR	MIN_DISCHARGE M^3/HOUR	MAX_DISCHARGE M^3/HOUR	DISCHARGE CURRENT STATUS
AE0540	AIN WADI ARAB	216 100	226 100	54 3	0 0	191 0	Dry
AE0542	BESSAS WADI ARAB	216 300	225 900	569 0	0 0	2020 0	Dry
AE0576	SHUNEH NORTH	212 000	224 000	25 2	4 5	76 7	Normal
AH0506	RASUN	222 000	202 000	94 0	7 1	954 0	Normal
AH0510	TANNUR	220 500	201 500	273 4	57 9	1490 0	Normal
AH0512	BEIDA	220 500	201 800	115 2	19 0	894 0	Normal
AH0516	URJAN FOUQA	220 400	200 500	61 3	5 9	954 0	Normal
AJ0516	EL BALAD (AJLUN)	220 900	193 400	43 7	0 5	280 0	Normal
AJ0520	EL QANTARA	220 100	192 100	135 2	12 1	336 0	Normal
AJ0540	BASSET JATTA	219 700	191 500	30 1	5 6	71 0	Normal
AJ0568	EL BIRKEH	213 000	186 900	38 7	6 2	116 0	Normal
AJ0580	ZUGAIG	210 560	200 430	224 9	62 5	1259 0	Normal
AJ0581	BIRKIT EL HIMMA AT AIN JANNA	222 260	193 200	115 2	0 0	630 0	Intermittent
AJ0582	ABO EL JOOD AIN JANNA	221 770	194 660	91 5	0 0	365 0	Intermittent
AK0516	EL BUHEIRA	220 300	184 300	30 2	1 6	82 5	Normal
AK0520	FAWWAR	217 900	184 300	124 3	13 9	641 0	Normal
AK0521	AIN UM QASIM	213 660	183 640	33 3	10 3	75 6	Normal
AM0502	EL KHANDAQ	218 700	160 600	49 6	0 0	196 0	Declined Intermittent
AM0504	JADOUR TAHTA	219 200	160 000	45 4	2 0	281 0	Normal
AM0512	HAZZIR	219 600	158 400	102 1	10 1	332 0	Normal
AM0526	AL AZRAQ (FUHEIS)	222 050	158 810	239 9	50 0	718 0	Normal
AM0528	SHORE AI	221 050	157 750	177 9	60 1	3091 0	Normal
AM0530	BAQOURIYYEH	219 400	155 300	402 9	61 0	948 0	Normal
AM0532	ESSABRAH	218 600	154 800	66 8	12 8	145 0	Normal
AM0534	MAHIS	222 700	155 000	39 8	15 9	116 9	Normal
AN0502	BAHHATH	226 300	146 000	427 8	2 4	1693 0	Normal
AN0532	KURSI	227 500	151 700	86 4	0 0	250 0	Intermittent
AN0534	WADI ES SIR	227 200	151 400	386 0	40 3	2950 0	Normal
AN0536	KHEIL	227 200	151 400	67 3	7 5	209 0	Normal
AN0542	DEIR EL FOUQA	225 000	149 200	59 6	1 1	270 0	Normal
AN0544	DEIR EL TAHTA	224 300	148 800	97 5	14 7	170 0	Normal
AN0554	TARABIL	222 800	148 100	37 4	3 6	152 0	Normal
AN0566	AIN WADI KUFREIN	222 000	143 100	80 7	0 0	328 0	Declined Intermittent
AP0506	FARIA	225 600	138 400	235 7	8 6	986 0	Normal
AP0508	AIN WADI HISBAN	225 400	138 300	172 4	1 2	846 0	Declined
AP0510	KDEESHAH	225 300	138 200	59 5	6 2	173 0	Normal
AP0518	MBEIRDEH	223 200	136 300	157 1	22 2	321 0	Normal
AP0520	SUMIYA	223 200	136 200	67 2	5 6	158 0	Normal

The data presented in this table are obtained from the Fox the Foxpr Database They have not been rigously validated and should not be accepted as accurate

Table 8 Proposed Monitoring Action Major Springs in Rift Side Wadis Basins

STA_IDN	NAME	WATER USE	MONITORING STATUS	PROPOSED ACTION	WATER QUALITY MONITORING	COMMENTS
AE0540	AIN WADI ARAB		Inactive Annual	Discontinue		
AE0542	BESSAS WADI ARAB		Inactive Annual	Discontinue		
AE0576	SHUNEH NORTH	Irrigation	Annual	Upgrade to seasonal	Irrigation Water 4	
AH0506	RASUN	Domestic W Supply Irrigation	Monthly	Continue monthly	Drinking Water 1	
AH0510	TANNUR	Domestic W Supply Irrigation	Monthly	Continue monthly	Drinking Water 1	
AH0512	BEIDA	Irrigation	Monthly	Continue monthly	Irrigation Water 3	
AH0516	URJAN FOUQA	Irrigation	Monthly	Continue monthly	Irrigation Water 3	
AJ0516	EL BALAD (AJLUN)	Irrigation	Monthly	Continue monthly	Irrigation Water 3	
AJ0520	EL QANTARA	Domestic W Supply Irrigation	Monthly	Continue monthly	Drinking Water 1	Bacteriological Contamination
AJ0540	BASSET JATTA	Irrigation	Monthly	Continue monthly	Irrigation Water 3	
AJ0568	EL BIRKEH	Irrigation	Monthly	Continue monthly	Irrigation Water 3	
AJ0580	ZUGAIG	Domestic W Supply Irrigation	Monthly	Continue monthly	Drinking Water 1	
AJ0581	BIRKIT EL HIMMA AT AIN JANNA	Irrigation	Annual	Upgrade to bi annual	Irrigation Water 4	
AJ0582	ABO EL JOOD AIN JANNA	Irrigation	Annual	Upgrade to bi annual	Irrigation Water 4	
AK0516	EL BUHEIRA	Irrigation	Annual	Upgrade to monthly	Irrigation Water 3	
AK0520	FAWWAR	Irrigation	Annual	Upgrade to monthly	Irrigation Water 3	
AK0521	AIN UM QASIM	Domestic W Supply Irrigation	Monthly	Continue monthly	Drinking Water 1	
AM0502	EL KHANDAQ	Irrigation	Annual	Upgrade to bi annual	Irrigation Water 4	
AM0504	JADOUR TAHTA	Irrigation	Monthly	Continue monthly	Irrigation Water 3	
AM0512	HAZZIR	Domestic W Supply Irrigation	Monthly	Continue monthly	Drinking Water 1	
AM0526	AL AZRAQ (FUHEIS)	Domestic W Supply	Monthly	Continue monthly	Drinking Water 1	
AM0528	SHORE AI	Domestic W Supply	Monthly	Continue monthly	Drinking Water 1	
AM0530	BAQOURIYYEH	Domestic W Supply Irrigation	Monthly	Continue monthly	Drinking Water 1	
AM0532	ESSABRAH	Irrigation	Inactive Annual	Reactivate monthly	Irrigation Water 3	New monitoring site (see Appendix A)
AM0534	MAHIS	Domestic W Supply Irrigation	Monthly	Continue monthly	Drinking Water 1	
AN0502	BAHHATH	Irrigation	Monthly	Continue monthly	Irrigation Water 3	
AN0532	KURSI	Irrigation	Annual	Upgrade to seasonal	Irrigation Water 4	Possible Bacteriological Contamination
AN0534	WADI ES SIR	Domestic W Supply Irrigation	Monthly	Continue monthly	Drinking Water 1	Bacteriological Contamination
AN0536	KHEIL	Irrigation	Monthly	Continue monthly	Irrigation Water 3	Possible Bacteriological Contamination
AN0542	DEIR EL FOUQA	Irrigation	Monthly	Continue monthly	Irrigation Water 3	Possible Bacteriological Contamination
AN0544	DEIR EL TAHTA	Irrigation	Monthly	Continue monthly	Irrigation Water 3	Possible Bacteriological Contamination
AN0554	TARABIL	Irrigation	Monthly	Continue monthly	Irrigation Water 3	Possible Bacteriological Contamination
AN0566	AIN WADI KUFREIN	Irrigation	Inactive Monthly	Reactivate seasonal	Irrigation Water 4	Inactive since 1995
AP0506	FARIA	Irrigation	Monthly	Continue monthly	Irrigation Water 3	
AP0508	AIN WADI HISBAN	Irrigation	Monthly	Continue monthly	Irrigation Water 3	
AP0510	KDEESHAH	Irrigation	Monthly	Continue monthly	Irrigation Water 3	
AP0518	MBEIRDEH	Irrigation	Monthly	Continue monthly	Irrigation Water 3	Install weir
AP0520	SUMIYA	Irrigation	Monthly	Continue monthly	Irrigation Water 3	Install weir

Table 9 Discharge of Major Springs in Dead Sea Basins

STA_IDN	NAME	PGE	PGN	AVG_DISCHARGE M^3/HOUR	MIN_DISCHARGE M^3/HOUR	MAX_DISCHARGE M^3/HOUR	DISCHARGE CURRENT STATUS
CA0502	EL HADEITHEH	201 700	78 500	1096 9	677 0	1770 0	Normal
CA0520	ZARA NO 1	203 650	112 250	521 1	176 0	1088 0	Normal
CA0522	ZARA NO 2	203 450	112 050	38 1	13 2	60 1	Normal
CA0526	ZARA NO 4	203 250	111 650	53 7	7 1	177 6	Normal
CAZB	ZARA B	204 310	111 840				New
CA0532	ZARA NO 7	204 000	100 250	176 2	44 9	275 0	Normal
CA0534	ZARA NO 8	204 300	99 850	89 4	21 2	140 0	Normal
CAZE	ZARA E	203 200	106 700				New
CAZF	ZARA F	203 300	105 900				New
CA0622	HIRREH	213 200	130 400	38 1	13 1	65 5	Normal
CA0638	SUWEIMA	207 100	131 000	115 3	12 1	391 0	Normal
CA0654	RAS EL MAY MAIN	203 950	111 850	63 6	15 8	229 0	Normal
CA0672	MARWAHA KABIREH	201 000	77 000	37 9	9 3	88 6	Declined
CA0674	SIKKIN	200 500	75 400	181 8	0 0	374 0	Dry
CA0686	W ZARQA MAIN	207 100	113 700	1908 1	1036 0	3335 0	Normal
CA0688	ESH SHALLAL	209 600	112 600	279 0	182 0	569 0	Normal
CA0690	HAMMAM AMIR	207 300	113 200	60 0	20 1	109 0	Normal
CA0692	EL MAGARA	207 100	113 300	35 2	7 1	83 2	Normal
CAMEast	MA IN EAST	209 900	112 900				New
CAWest	MA IN UPSTREAM	209 700	112 500				New
CA0706	W ISSAL	201 000	66 800	109 5	47 2	177 0	Normal
CA0778	EL FARA'A	218 900	78 300	112 7	50 8	204 0	Normal
CA0840	W NUMERIA	200 300	60 300	118 4	27 0	196 0	Normal
CA0841	AL ODHEIMA AT SUWEIMAH	209 150	132 250	41 8	22 6	76 7	Normal
CE0502	SEIL EL-BULEIDEH	203 000	74 800	339 0	1 0	907 0	Normal
CE0540	SARAH	216 300	76 300	562 9	200 0	2664 0	Normal
CE0644	W THRA'A	204 800	72 400	137 0	48 0	217 0	Normal
CE0648	HAMMAM WEIDA A	206 250	72 000	27 3	11 3	55 9	Normal

The data presented in this table are obtained from the the Foxpr Database They have not been rigously validated and should not be accepted as accurate
Zara 7 and Zara 8 coordinates do not represent the geographic location of these springs

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Table 10 Propopsed Monitoring Action Major Springs in Dead Sea Basins

STA_IDN	NAME	WATER USE	MONITORING STATUS	PROPOSED ACTION	WATER QUALITY MONTORING	COMMENTS
CA0502	EL HADEITHEH	Irrigation	Monthly	Continue monthly	Irrigation Water 3	
CA0520	ZARA NO 1	Flow to Dead Sea	Monthly	Continue monthly	Thermal 1	T 39 5 degrees C
CA0522	ZARA NO 2	Flow to Dead Sea	Monthly	Discontinue		
CA0526	ZARA NO 4	Flow to Dead Sea	Monthly	Discontinue		
CAZB	ZARA B	Irrigation Flow to Dead Sea	New	Start monthly	Thermal 1	T 54 degrees C groups Zara 2 4 5 6
CA0532	ZARA NO 7	Flow to Dead Sea	Monthly	Continue monthly	Thermal 1	T 29 degrees C
CA0534	ZARA NO 8	Irrigation MOD Water Supply	Monthly	Continue monthly	Thermal 1	T 54 5 degrees C
CAZE	ZARA E	Flow to Dead Sea	New	Start monthly	Thermal 1	T 31 degrees C
CAZF	ZARA F	Flow to Dead Sea	New	Start monthly	Thermal 1	T 30 degrees C
CA0622	HIRREH	Irrigation	Monthly	Continue monthly	Irrigation Water 3	
CA0638	SUWEIMA	Irrigation	Monthly	Start monthly (new site)	Irrigation Water 3	new site was selected
CA0654	RAS EL MAY MAIN	Irrigation	Monthly	Continue monthly	Irrigation Water 3	
CA0672	MARWAHA KABIREH	Irrigation	Monthly	Change to bi annual	Irrigation Water 4	
CA0674	SIKKIN		Inactive annual	Reactivate annual		
CA0686	W ZARQA MAIN	Flow to Dead Sea	Monthly	Continue monthly	Thermal 1	T 31 3 degrees C (see Field Review Form)
CA0688	ESH SHALLAL	Tourism Therapy	Monthly	Continue monthly	Thermal 1	T 57 degrees C Rehabilitate weir
CA0690	HAMMAM AMIR	Tourism Therapy	Monthly	Continue monthly	Thermal 1	T 47 3 degrees C Rehabilitate weir
CA0692	EL MAGARA	Tourism Therapy	Monthly	Continue monthly	Thermal 1	T 50 3 degrees C
CAMEast	MA IN EAST	Tourism Therapy	New	Start monthly	Thermal 1	T 55 degrees C
CAWest	MA IN UPSTREAM	Flow to Dead Sea	New	Start monthly	Thermal 1	T 34 2 degrees C
CA0706	W ISSAL	Irrigation	Inactive monthly	Reactivate monthly	Irrigation Water 3	
CA0778	EL FARA A	Irrigation	Monthly	Continue monthly	Irrigation Water 3	
CA0840	W NUMERIA	Irrigation	Inactive monthly	Reactivate monthly	Irrigation Water 3	
CA0841	AL ODHEIMA AT SUWEIMAH	Irrigation	Monthly	Continue monthly	Irrigation Water 3	
CE0502	SEIL EL BULEIDEH	Irrigation	Inactive monthly	Reactivate monthly	Irrigation Water 3	
CE0540	SARAH	Domestic W Supply Irrigation	Monthly	Continue monthly	Drinking Water 1	
CE0644	W THRA A	Irrigation	Monthly	Continue monthly	Irrigation Water 3	
CE0648	HAMMAM WEIDA A	Irrigation	Monthly	Continue monthly	Irrigation Water 3	

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Table11 Discharge of Major Springs in Wadi Mujib, Hasa, and Wadi Araba Basins

STA_IDN	NAME	PGE	PGN	AVG_DISCHARGE M^3/HOUR	MIN_DISCHARGE M^3/HOUR	MAX_DISCHARGE M^3/HOUR	DISCHARGE CURRENT STATUS
Wadi Mujib							
CD0540	W HAIDAN	219 300	108 000	1704 1	58 0	4540 0	Normal
CD0564	LAJJUN	232 200	72 100	42 9	16 7	119 0	Normal
Wadi Hasa							
CF0560	BIR EL-HARIR	214 600	20 600	48 6	10 0	110 0	Normal
CF0600	MUGHEISEL KABEIRA	224 300	42 600	52 3	20 0	96 6	Normal
CF0620	HAMMAM BURBATA	214 000	43 750	97 2			Normal
CF0621	W HASA AT TANNOUR	220 400	41 700	40 2	0 0	308 0	Intermittent
Wadi Araba North							
DA0546	EL-HEESHA	194 200	49 800	52 1	0 0	191 0	Intermittent
DA0556	W UMRUG	194 500	35 500	32 1	8 6	54 0	Normal
DB0502	W FEIFA	194 900	38 000	413 9	234 0	652 0	Normal
DB0616	HAMMAMAT AFRA	209 200	41 550	332 7	144 0	997 0	Normal
DC0502	W KHANZIRA	191 500	32 200	142 9	79 2	177 0	Normal
DC0562	GHARANDAL	212 700	14 100	29 0	5 6	182 0	Normal
DE0502	W FIDAN	187 500	8 100	91 2	36 0	145 0	Normal
DG0540	MUSA	197 700	970 600	24 8	10 3	54 5	Normal
Wadi Araba South							
EA0546	W DATHNAH	201 000	2 770	40 4	31 3	49 8	Normal

The data presented in this table are obtained from the the Foxpr Database They have not been rigously validated and should not be accepted as accurate

Table 12 Propopsed Monitoring Action, Major Springs in Wadi Mujib Hasa and Wadi Araba Basins

STA_IDN	NAME	WATER USE	MONITORING STATUS	PROPOSED ACTION	WATER QUALITY MONITORING	COMMENTS
Wadi Mujib						
CD0540	W HAIDAN	Irrigation	Monthly	Continue monthly	Irrigation Water 3	
CD0564	LAJJUN	Irrigation	Monthly	Continue monthly	Irrigation Water 3	
Wadi Hasa						
CF0560	BIR EL HARIR	Domestic w Supply	Monthly	Continue Monthly	Drinking Water 1	
CF0600	MUGHEISEL KABEIRA	Irrigation	Monthly	Continue Monthly	Irrigation Water 3	
CF0620	HAMMAM BURBATA	Therapy Irrigation	Monthly	Continue Monthly	Thermal 1	T 40° C Correct records (see filed review form)
CF0621	W HASA AT TANNOUR	Irrigation	Monthly	Continue Monthly	Irrigation Water 3	
Wadi Araba North						
DA0546	EL HEESHA	Irrigation (mixed)	Annual	Upgrade to bi annual	Irrigation Water 4	
DA0556	W UMRUG	Irrigation	Annual	Upgrade to monthly	Irrigation Water 3	
DB0502	W FEIFA	Irrigation	Monthly	Continue monthly	Irrigation Water 3	
DB0616	HAMMAMAT AFRA	Tourism Therapy Irrigation	Monthly	Continue monthly	Thermal 1	
DC0502	W KHANZIRA	Irrigation	Inactive monthly	Reactivate monthly	Irrigation Water 3	Inactive since 1985
DC0562	GHARANDAL	Domestic w supply Irrigation	Monthly	Continue monthly	Drinking Water 1	
DE0502	W FIDAN	Irrigation	Monthly	Continue monthly	Irrigation Water 3	
DG0540	MUSA	Irrigation	Monthly	Continue monthly	Irrigation Water 3	
Wadi Araba South						
EA0546	W DATHNAH	Potassium Co	Inactive annual	Reactivate to monthy	Drinking Water 1	only 3 records (1973 1977 1981)

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Table 13 General Classes of Parameters for Spring Water Quality Monitoring Program

<u>Category 1-</u> <u>**Drinking Water Chemical Parameter Suites**</u> (springs supplying water for municipal uses)

Subcategory Drinking Water 1 -

- Monthly Parameters
  - Biological - total coliform, fecal coliform
  - General - (TDS, electrical conductivity, pH, temperature, SO_4, Cl, CO_3, HCO_3, NO_3)

- Quarterly Parameters
  - Misc - Bromide, fluoride
  - Metals - B, Ca, Cd, Cr, Cu, Fe, K, Mg, Mn, Na, Ni, Zn

- Semi-annual Parameters
  - Pesticides (e g , USEPA Method 8080)
  - Herbicides (e g , USEPA Method 8150)

- Annual Parameters
  - Volatile Organic Compounds (e g , USEPA Method 8240)
  - Special Metals - As, Hg, Pb, Se
  - Semi-volatile Organic Compounds (e g , USEPA Method 8270)
  - Cyanide and Sulfur, as required

Subcategory Drinking Water 2 -

- Monthly Parameters
  - Biological - total coliform, fecal coliform
  - General - (TDS, electrical conductivity, pH, temperature, SO_4, Cl, CO_3, HCO_3, NO_3)
- Quarterly Parameters
  - No quarterly monitoring proposed

- Semi-annual Parameters
  - Metals - B, Ca, Cd, Cr, Cu, Fe, Mg, Mn, Na, Ni, Zn

- Annual Parameters
  - Special Metals - As, Hg, Pb, Se
  - Pesticides (e g , USEPA Method 8080)
  - Herbicides (e g , USEPA Method 8150)
  - Misc - Bromide, fluoride

Table 13 General Classes of Parameters for Springs Water Quality Monitoring Program (cont'd)

Category 2 - Irrigation Water Chemical Parameter Suites (springs supplying water for irrigation uses)

Subcategory Irrigation Water 1 -

- Twice Monthly Parameters
  - Electrical conductivity, pH
- Semi-annual Parameters (April, October)
  - Ca, Mg, K, Na, Cl, SO_4, CO_3, HCO_3, NO_3

Subcategory Irrigation Water 2 -

- Twice Daily Parameters
  - Electrical conductivity, pH, TDS
- Weekly Parameters
  - Na, Cl, B
- Semi-annual Parameters (April, October)
  - Ca, Mg, K, Na, Cl, SO_4, CO_3, HCO_3, NO_3

Subcategory Irrigation Water 3 -

- Monthly Parameters
  - Electrical conductivity, pH
- Semi-annual Parameters (April, October)
  - Ca, Mg, K, Na, Cl, SO_4, CO_3, HCO_3, NO_3

Subcategory Irrigation Water 4 -

- Semi-annual Parameters(April, October)
  - Electrical conductivity, pH
- Semi-annual Parameters (April, October)
  - Ca, Mg, K, Na, Cl, SO_4, CO_3, HCO_3, NO_3

Category 3 - Thermal Water Chemical Parameter Suites (thermal springs)

Subcategory Thermal 1 -

- Quarterly Parameters
  - General - (TDS, electrical conductivity, pH, temperature, Ca, Mg, K, Na, Cl, SO_4, CO_3, HCO_3)
  - Biological - total coliform, fecal coliform

- Annual Parameters
  - General Metals - B, Ca, Cd, Cr, Cu, Fe, Mg, Mn, Na, Ni, Zn
  - Special Metals - As, Hg, Pb, Se
  - General - NO_3

Table 14 Water Quality Monitoring Parameters and Sampling and Preservation Procedures

Parameter	Container	Preservative	Holding Time	Sample Type	Ref
Water Low to Medium Concentration Samples					
Alkalinity	500 ml or 1 liter polyethylene[3] with polyethylene or polyethylene lined closure	Cool 4°C	14 days	G or C	C
Acidity	500 ml or 1 liter polyethylene[3] with polyethylene or polyethylene lined closure	Cool 4°C	14 days	G or C	C
Bacteriological	250 ml glass with glass closure or plastic capable of being autoclaved	Cool 4 C	6 hours	G	C
Static Bioassay	1 gal amber glass (not solvent rinsed)	Cool 4°C	48 hours	G or C	D
Biochemical Oxygen Demand (BOD)	1/2 gal polyethylene[3] with polyethylene closure	Cool 4 C	48 hours	G or C	C
Chlorine	500 ml or 1 liter polyethylene[3] with polyethylene or polyethylene lined closure	None	28 days	G or C	C
Chlorine Residual	In situ beaker or bucket	None	Analyze Immediately	G	C
Conductivity	500 ml or 1 liter polyethylene[3] with polyethylene or polyethylene lined closure	Cool 4°C	28 days (determine on site if possible)	G or C	C
Chromium Hexavalent	1 liter polyethylene with Polyethylene closure	Cool 4°C	24 hours	G	C
Cyanide	500 ml or 1 liter polyethylene[3] with polyethylene or polyethylene lined closure	Ascorbic acid[4,5] Sodium Hydroxide pH >12 Cool 4°C	14 days	G	C
Dissolved Oxygen (Probe)	In situ beaker or bucked	None	Determine on site	G	C
Dissolved Oxygen (Winkler)	300 ml glass BOD bottle (store in dark if possible)	Fix on site	8 hours (determine on site	G	C
EP Toxicity	1 gal glass (amber) with Teflon© liner	Cool 4°C	Not Specified	G or C	B
TCLP Extractable Organics (VOA)	3 40 ml VOA containers with Teflon© lined Septum sealed caps	None	28 days[2]	G	

Table 14 Water Quality Monitoring Parameters and Sampling and Preservation Procedures (cont d)

Parameter	Container	Preservative	Holding Time	Sample Type	Ref
Water Low to Medium Concentration Samples (continued)					
TCLP Extractable Organics Herbicides and Pesticide/PCBs	1 gal amber glass with Teflon© liner		None	54 days[2]	G or C	-
TCLP Metals except Mercury	1 gal amber glass with Teflon© liner		None	360 days[2]	G or C	-
TCLP Mercury	Samples will be taken from TCLP Metals container		None	56 days[2]	G or C	-
	Permissible					
Fluoride	1 liter polyethylene[3] or 1/2 gal polyethylene with polyethylene or polyethylene lined closure		None	28 days	G or C	C
Hardness	500 ml or 1 liter polyethylene with polyethylene or polyethylene lined closure		50% Nitric Acid[4] pH <2	6 months	G or C	C
TSS	500 ml or 1 liter polyethylene[3] with polyethylene or polyethylene lined closure		Cool 4 C	48 hours	G or C	C
Metals	1 liter polyethylene with polyethylene lined closure		50% Nitric Acid[4] pH <2	6 months	G or C	C
Metals Dissolved	1 liter polyethylene with polyethylene lined closure		Filter on site[4] 50% Nitric Acid pH <2	6 months	G	C
Nutrients[6]	1 liter polyethylene or 1/2 gal polyethylene with polyethylene or polyethylene lined closure		50% Sulfuric Acid[4] pH <2 Cool 4°C	28 days	G or C	C
Oil and Grease	1 liter widemouth glass with Teflon© lined cap		50% Sulfuric Acid[4] pH <2 Cool 4°C	28 days	G	C
Organic Compounds Extractable and Pesticide Scan						
No Residual Chlorine Present	1 gal amber glass or 2 5 gal amber glass with Teflon© lined cap		Cool 4°C	47 days[7]	G or C	A or C
Residual Chlorine Present	1 gal amber glass or 2 5 gal amber glass with Teflon© lined cap		Add 3 mls 10% Sodium Thiosulfate per gallon cool 4°C	47 days[7]	G or C	A or C
Organic Compounds Purgeable (VOA)						

Table 14 Water Quality Monitoring Parameters and Sampling and Preservation Procedures (cont d)

Parameter	Container	Preservative	Holding Time	Type	Ref
Water Low to Medium Concentration Samples (continued)					
No Residual chlorine Present	3 40 ml vials with Teflon© lined septum sealed caps		4 drops 1+1 HCl Cool 4°C	14 days	G	A or C
No Residual Chlorine Present	3 40 ml vials with Teflon© lined septum sealed caps		Cool 4 C	7 days	G	
A or C					
Residual Chlorine Present	3 40 ml vials with Teflon© lined septum sealed caps		Footnote 8	14 days	G	A or C
Organic Compounds Specified and Pesticides (Non Priority Pollutants such as Herbicides	1 gal glass (amber) or 2 5 gal glass (amber) with Teflon© lined closure		Footnote 9	47 days[7]	G or C	A or C
Organic Halides Total (TOX)	250 ml amber glass with Teflon© lined septum closure		Cool 4°C	H_2SO_4 to pH <2	28 days	G	A or E
pH	In situ beaker or bucket		None	Analyze Immediately	G	C
Phenols	1 liter amber glass with Teflon©lined closure		50% H_2SO_4 ph <2 Cool 4°C	28 days	G	C
Phosphate Ortho	500 ml or 1 liter polyethylene with polyethylene or polyethylene lined closure		Filter on site Cool 4°C	48 hours	G	C
Phosphorus Total Dissolved	500 ml or 1 liter polyethylene with polyethylene or polyethylene lined closure		Filter on site 50% H_2SO_4 pH <2 Cool 4°C	28 days	G	C
Solids Settleable	1/2 gal polyethylene with polyethylene closure		Cool 4°C	48 hours	G or C	C
Solids (Total and Suspended etc)	500 ml or 1 liter polyethylene[3] with polyethylene or polyethylene lined closure		Cool 4°C	7 days	G or C	C
Sulfates	500 ml or 1 liter polyethylene[3] with polyethylene or polyethylene lined closure		Cool 4°C	28 days	G or C	C
Sulfides	500 ml or 1 liter polyethylene[3] with polyethylene or polyethylene lined closure		2 ml Zinc Acetate[4] Conc NaOH to pH >9 Cool 4°C	7 days	G	C
Temperature	In situ beaker or bucket		None	Determine on site	G	C
Turbidity	500 ml or 1 liter polyethylene[3] with polyethylene or polyethylene lined closure		Cool 4°C	48 hours	G or C	C

Table 14 Water Quality Monitoring Parameters and Sampling and Preservation Procedures (cont'd)

Abbreviations

G = Grab
C = Composite
ASAP = As Soon As Possible
NS = Not Specified

Footnotes

1 The TCLP method requires the leaching of 25 grams of solid for volatile organics and 100 gram of solids for all other parameters If the sample is low in solids additional sample containers may be required to provide sufficient sample for the TCLP leach extraction

2 These are total holding times for TCLP that cover sampling through analysis The holding times are broken down as follows TCLP volatile organics 14 days from collection to TCLP extraction plus 14 days from leach extraction to analysis extractible organics pesticides & herbicides 7 days from collection to TCLP extraction plus 7 days to solvent extraction of leachate plus 40 days to analysis of extract mercury 28 days from collection to TCLP extraction plus 28 days to analysis metals except mercury 180 days from collection to TCLP extraction plus 180 days to analysis

3 Use indicated container for single parameter requests or 1/2 gallon polyethylene container for multiple parameter requests except those including BOD Use a 1 gallon polyethylene container for multiple parameter requests which include BOD

4 Must be preserved in the field at time of collection

5 Use ascorbic acid only if the sample contains residual chlorine Test a drop of sample with potassium iodide starch test paper a blue color indicates need for treatment Add ascorbic acid a few crystals at a time until a drop of sample produces no color on the indicator paper Then add an additional 0 6 g of ascorbic acid for each liter of sample volume

6 May include nitrogen series (ammonia total Kjeldahl nitrogen nitrate nitrite) total phosphorus chemical oxygen demand and total organic carbon

7 Samples must be extracted within seven days and extract must be analyzed within 40 days

References

1 USEPA Test Methods for Evaluating Solid Waste SW 846 3rd Edition Office of Solid Waste and Emergency Response Washington DC November 1986

2 40 CFR Part 136 Federal Register Vol 49 No 209 October 26 1984

3 USEPA Region IV 1991 Environmental Compliance Branch Standard Operating Procedures and Quality Assurance Manual Athens Georgia

FIGURES

Figure 1 Important Springs in Northern Jordan (Discharge >25 m^3/hour)

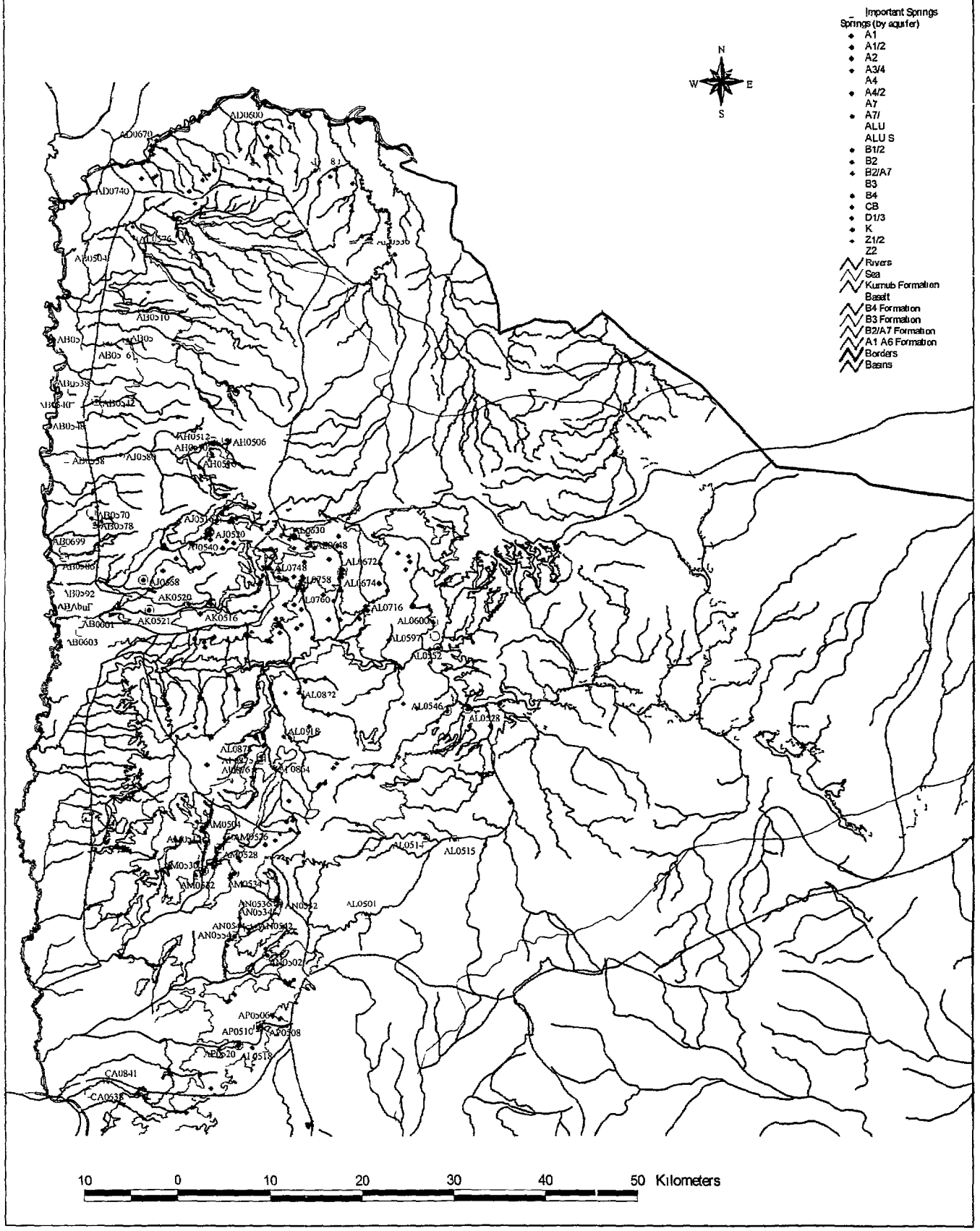


Figure 2. Important Springs in Central Jordan (Discharge >25 m^3/hour)

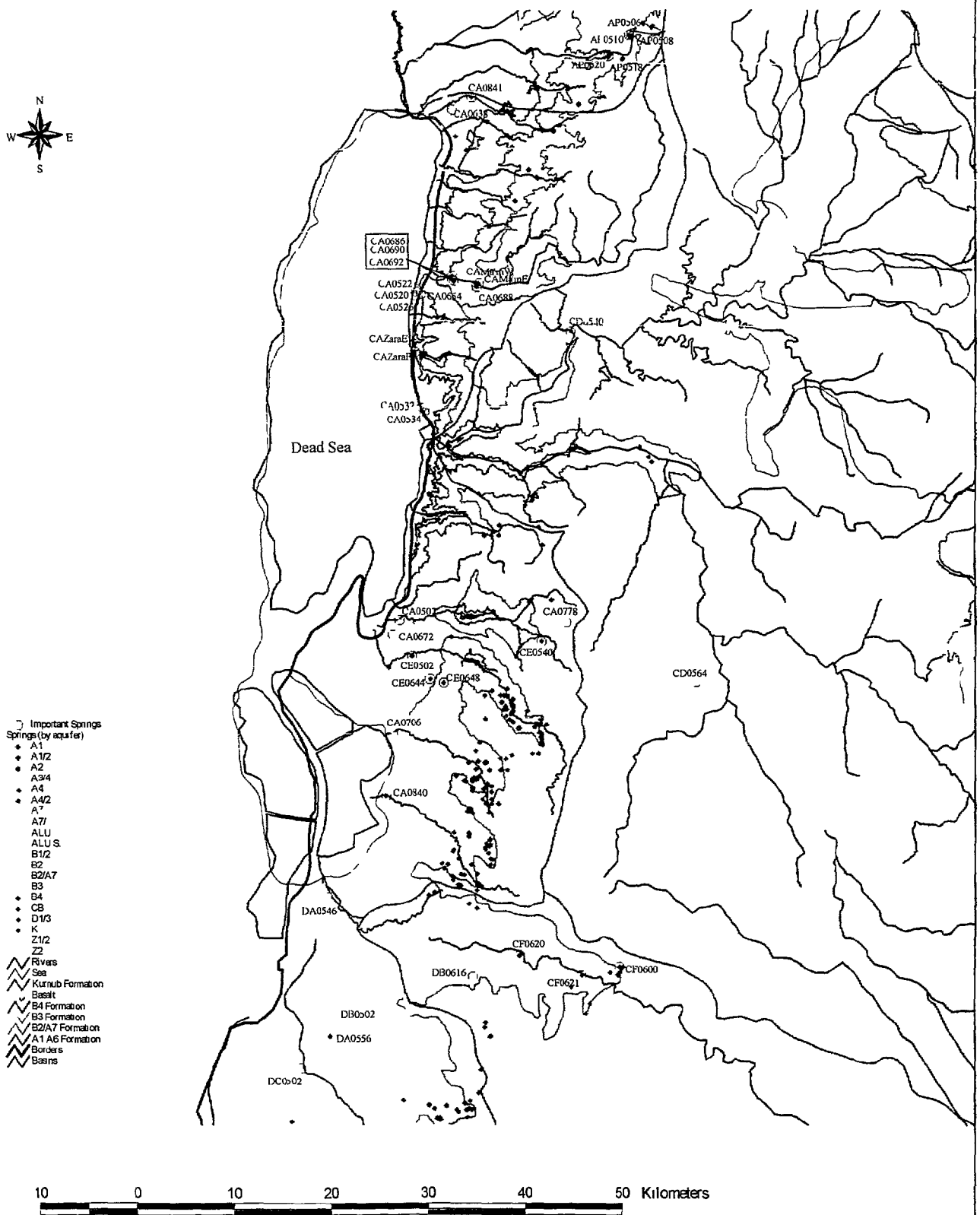
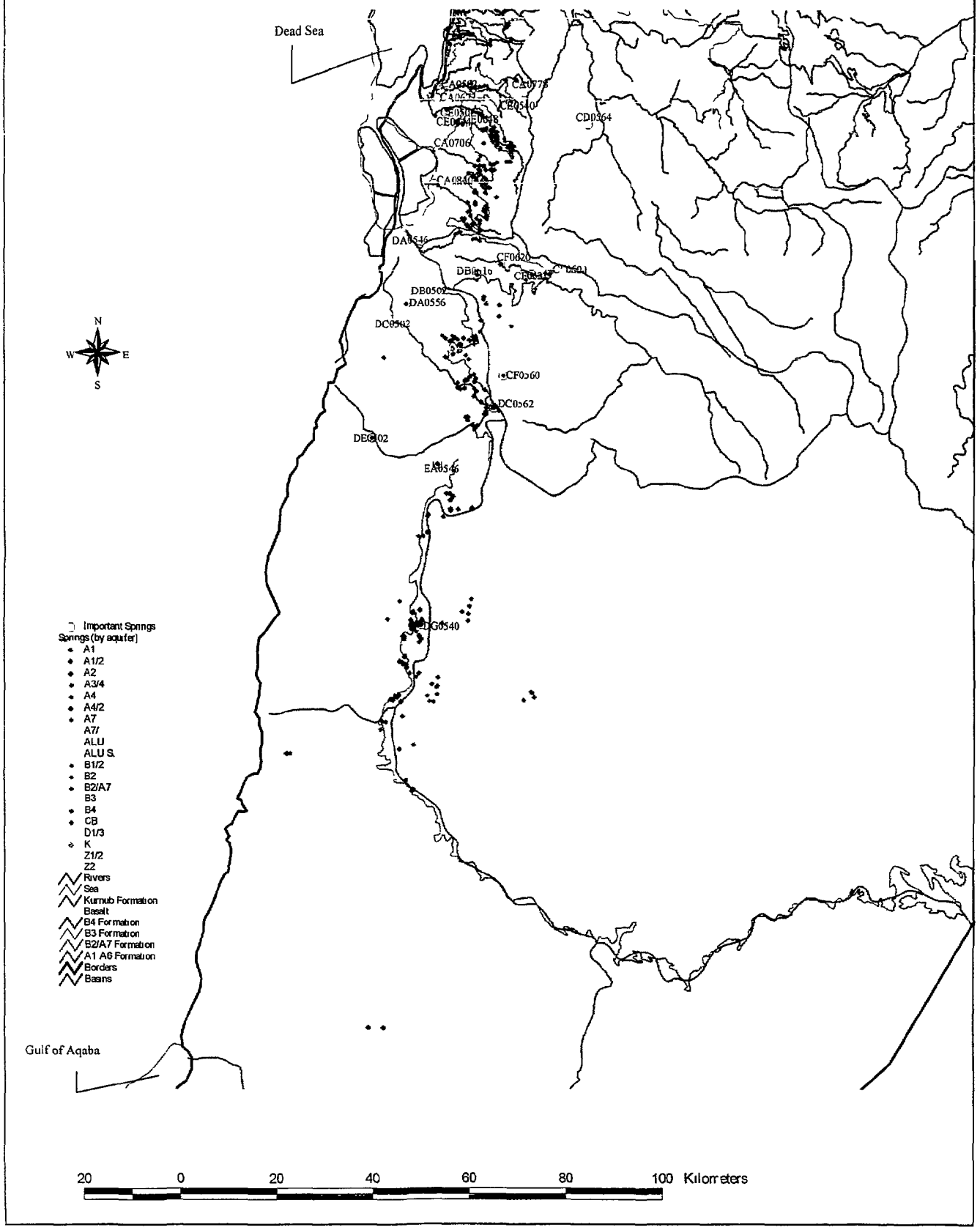


Figure 3 Important Springs in Southern Jordan (Discharge >25 m^3/hour)



APPENDIC A

Jordan River Basin

Author/Date Rola Abu Nahleh (02/12/97) Editor/Date Rania Shahin (07/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	30 November, 1997
Weather Conditions	Partly cloudy
1 Station Identification	
Name	Doqa
ID Number	AB 0504
Basin	Jordan River
Aquifer	
Status	Active / monthly
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

Significant intermittent discharge used for irrigation

Data Collected

Discharge and water quality (geochemistry)

4 Physical Description of Station

Spring discharges in a dirt channel, which is suitable for weir or current meter measurement

5 Directions to Location of Station

West of Shuneh Town in Khaled Rabi's farm

6 Proposed Action for Water Monitoring System Station

Change to seasonal or bi-annual, if discharge continues to decline

7 Other Observations

Flow records show a sign of decline of the discharge since April 1994

Global position system UTM coordinates 7-42-962E and 36-09-690N Temperature 23°C, Brackish water

2

Author/Date Rania Shahin (30/11/97) Editor/Date Rania Shahin (03/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	25 November 1997
Weather Conditions	Partly Cloudy
1 Station Identification	
Name	Wadi Tayyiba
ID Number	AB 0510
Basin	Jordan River
Aquifer	
Status	Active / Monthly
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

Significant flow used for irrigation

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Springs discharge towards Wadi Tayyiba Control channel is suitable for portable weir or current meter measurement

5 Directions to Location of Station

Around 5 km East of Tayyiba Village, near Mohammed Al Ali's house

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring

7 Other Observations

Global position system UTM coordinates 7-50-287E and 36-03-070N Temperature 22 degrees C and EC 830 micro S/cm

Author/Date Rola Abu Nahleh (02/12/97) Editor/Date Rania Shahin (06/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	30 November, 1997
Weather Conditions	Partly cloudy
1 Station Identification	
Name	Tell El Arba'in
ID Number	AB 0512
Basin	Jordan River
Aquifer	
Status	Active / monthly
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

Significant flow used for irrigation

Data Collected

Discharge and water quality (geochemistry)

4 Physical Description of Station

Spring discharges in a dirt channel, which is adequate for current meter or weir measurement

5 Directions to Location of Station

West of the Municipality of Sheikh Hasin Town, West of Saleh El Ghool's farm

6 Proposed Action for Water Monitoring System Station

Change to seasonal monitoring

7 Other Observations

Flow records show a discharge decline since late 1968

Global position system UTM coordinates 7-93-968E and 36-00-686N Temperature 23°C

Author/Date Rola Abu Nahleh (02/12/97) Editor/Date Rola Abu Nahleh (06/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	6 November, 1997
Weather Conditions	Partly cloudy

1 Station Identification

Name	Abu Ziad
ID Number	AB 0522
Basin	Jordan River
Aquifer	
Status	Active / monthly

2 Station Type

- ☐ Ground Water
- ☒ Springs
- ☐ Surface Water
- ☐ Other

Other

3 Station Purpose

- ☒ Water Resources
- ☒ Water Quality

Rationale for Station / Location

High flow used for irrigation

Data Collected

Discharge and water quality (geochemistry)

4 Physical Description of Station

Spring discharges in Wadi Abu Ziad Flows are measured by portable weir or current meter Ideal channel control section was select for installation of a permanent weir (see UTM coordinates) in the vicinity of current monitoring site

5 Directions to Location of Station

2 1 km east of El Beida spring, in Wadi Abu Ziad

6 Proposed Action for Water Monitoring System Station

Install a permanent weir (see UTM coordinates) and continue monthly monitoring

7 Other Observations

Global position system UTM coordinates 7-48-472E and 36-00-010N Temperature 25°C and EC 660 micro s / cm

Author/Date Rola Abu Nahleh (02/12/97) Editor/Date Rola Abu Nahleh (06/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	6 November, 1997
Weather Conditions	Partly cloudy

1 Station Identification

Name	El Beida
ID Number	AB 0526
Basin	Jordan River
Aquifer	
Status	Active / monthly

2 Station Type

- ☐ Ground Water
- ☒ Springs
- ☐ Surface Water
- ☐ Other

Other

3 Station Purpose

- ☒ Water Resources
- ☒ Water Quality

Rationale for Station / Location

High flow used for irrigation

Data Collected

Discharge and water quality (geochemistry)

4 Physical Description of Station

Spring discharges in Wadi Abu Ziad Monitoring in a control channel suitable for current meter measurement

5 Directions to Location of Station

Deir Abu Sad road, 2,5 km from junction of Deir Abu Said road and Esh Shouna, Esh Shamaliya road

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring

7 Other Observations

Global position system UTM coordinates 7-46-760E and 35-99-430N Temperature 23°C

Author/Date Rola Abu Nahleh (02/12/97) Editor/Date Rania Shahin (06/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	30 November, 1997
Weather Conditions	Partly cloudy

1 Station Identification

Name	Batta
ID Number	AB 0538
Basin	Jordan River
Aquifer	
Status	Active / bi-annual

2 Station Type

- ☐ Ground Water
- ☒ Springs
- ☐ Surface Water
- ☐ Other

Other

3 Station Purpose

- ☒ Water Resources
- ☒ Water Quality

Rationale for Station / Location

Significant flow used for irrigation

Data Collected

Discharge and water quality (geochemistry)

4 Physical Description of Station

Spring discharges in the Wadi Control channel is suitable for weir or current meter measurement

5 Directions to Location of Station

North of Mashari' Town, near Mahmoud El Ghazzawi's farm

6 Proposed Action for Water Monitoring System Station

Continue bi-annual monitoring

7 Other Observations

Global position system UTM coordinates 7-42-803E and 35-94-422N Temperature 24°C

Author/Date Rola Abu Nahleh (02/12/97) Editor/Date Rania Shahin (06/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	30 November, 1997
Weather Conditions	Partly cloudy

1 Station Identification

Name	Ghannam
ID Number	AB 0540
Basin	Jordan River
Aquifer	
Status	Active / monthly

2 Station Type

- ☐ Ground Water
- ☒ Springs
- ☐ Surface Water
- ☐ Other

Other

3 Station Purpose

- ☒ Water Resources
- ☒ Water Quality

Rationale for Station / Location

Significant flow used for irrigation

Data Collected

Discharge and water quality (geochemistry)

4 Physical Description of Station

Spring discharges in a dirt channel, which is adequate for weir or current meter measurement

5 Directions to Location of Station

West of El Mashari' Town, near Mohammed Taha Mahmoud's farm

6 Proposed Action for Water Monitoring System Station

Change to seasonal monitoring

7 Other Observations

Flow records show a discharge decline since 1967

Global position system UTM coordinates 7-43-162E and 35-93-980N Temperature 23°C

Author/Date Rola Abu Nahleh (12/02/97) Editor/Date Rania Shahin (01/14/98)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	6 November, 1997
Weather Conditions	Clear sky
1 Station Identification	
Name	Tabqat Fahil
ID Number	AB 0542
Basin	Jordan River
Aquifer	
Status	Active / monthly
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

High flow used for domestic water supply of three towns Mashari Tabqat Fahil and Shouna Shamaliya, and for irrigation

Data Collected

Discharge and water quality (geochemistry)

4 Physical Description of Station

Three nearby spring sources which discharge in two main channels prior to diversion for water supply and irrigation Two new monitoring sites are selected North Site near Pella in Northern Channel and South Site , South of Pella A permanent weir is suggested for each site

5 Directions to Location of Station

At Pella Roman Town east of Tabqat Fahil village

6 Proposed Action for Water Monitoring System Station

Install two permanent weirs at above sites and continue monthly or preferably weekly monitoring by

Tabqat Fahil WAJ station operator

7 Other Observations

Global position system UTM coordinates North site 7-45-801E and 35-93-272N

South site 7-45-793E and 35-93-173N Temperature 24 5°C

Author/Date Rola Abu Nahleh (02/12/97) Editor/Date Rola Abu Nahleh (07/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	30 November, 1997
Weather Conditions	Partly cloudy

1 Station Identification

Name	Sa'ada
ID Number	AB 0548
Basin	Jordan River
Aquifer	
Status	Active / monthly

2 Station Type

- ☐ Ground Water
- ☒ Springs
- ☐ Surface Water
- ☐ Other

Other

3 Station Purpose

- ☒ Water Resources
- ☒ Water Quality

Rationale for Station / Location

Significant flow used for irrigation

Data Collected

Discharge and water quality (geochemistry)

4 Physical Description of Station

Spring discharges in a concrete canal, which is suitable for weir or current meter measurement

5 Directions to Location of Station

west of Mashari's town, near Ahmad Ibrahim Suleiman's farm

6 Proposed Action for Water Monitoring System Station

Change to seasonal monitoring

7 Other Observations

Flow records show a discharge decline since 1960

Global position system UTM coordinates 7-42-985E and 35-91-922N Temperature 22°C

Author/Date Rola Abu Nahleh (02/12/97) Editor/Date Rola Abu Nahleh (06/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	6 November, 1997
Weather Conditions	Clear sky

1 Station Identification

Name	Sharhabeel
ID Number	AB 0558
Basin	Jordan River
Aquifer	
Status	Active / monthly

2 Station Type

- ☐ Ground Water
- ☒ Springs
- ☐ Surface Water
- ☐ Other

Other

3 Station Purpose

- ☒ Water Resources
- ☒ Water Quality

Rationale for Station / Location

Significant flow used for irrigation

Data Collected

Discharge and water quality (geochemistry)

4 Physical Description of Station

Spring discharges in a dirt channel, which is suitable for portable weir at current meter measurement

5 Directions to Location of Station

Around 2 0 km West of El Rayan village, at Abdelkader Bdah's farm

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring

7 Other Observations

Global position system UTM coordinates 7-42-542E and 35-86-728N

Temperature 24 7°C

Author/Date Rola Abu Nahleh (02/12/97) Editor/Date Rola Abu Nahleh (06/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	5 November, 1997
Weather Conditions	Cloudy

1 Station Identification

Name	El Hujeijeh
ID Number	AB 0570
Basin	Jordan River
Aquifer	
Status	Active / monthly

2 Station Type

- ☐ Ground Water
- ☒ Springs
- ☐ Surface Water
- ☐ Other

Other

3 Station Purpose

- ☒ Water Resources
- ☒ Water Quality

Rationale for Station / Location

Significant flow for irrigation and local domestic water supply (not developed)

Data Collected

Discharge and water quality (geochemistry)

4 Physical Description of Station

Spring discharges in an open channel, which is suitable for portable weir and current meter measurement

5 Directions to Location of Station

East of El Hujeijeh village

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring

7 Other Observations

Global position system UTM coordinates 7-45-343E and 35-81-220N Temperature 24°C and EC 650 micro s/ cm

Author/Date Rola Abu Nahleh (02/12/97) Editor/Date Rola Abu Nahleh (06/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	5 November, 1997
Weather Conditions	

1 Station Identification

Name	El Suleikhat
ID Number	AB 0578
Basin	Jordan River
Aquifer	
Status	Active / monthly

2 Station Type

- ☐ Ground Water
- ☒ Springs
- ☐ Surface Water
- ☐ Other

Other

3 Station Purpose

- ☒ Water Resources
- ☒ Water Quality

Rationale for Station / Location

Significant flow used for irrigation

Data Collected

Discharge and water quality (geochemistry)

4 Physical Description of Station

Spring discharges in an irrigation canal, which is suitable for portable weir at current meter measurement

5 Directions to Location of Station

A Suleikhat village, near Faiz Abu Samara's house

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring

7 Other Observations

Global position system UTM coordinates 7-45-068E and 35-79-934N

Temperature 23 3°C and EC 590 micro s/ cm

Author/Date Rola Abu Nahleh (02/12/97) Editor/Date Rola Abu Nahleh (06/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	5 November, 1997
Weather Conditions	Cloudy

1 Station Identification

Name	Um Beirreh
ID Number	AB 0586
Basin	Jordan River
Aquifer	
Status	Active / monthly

2 Station Type

- ☐ Ground Water
- ☒ Springs
- ☐ Surface Water
- ☐ Other

Other

3 Station Purpose

- ☒ Water Resources
- ☒ Water Quality

Rationale for Station / Location

High flow used for irrigation

Data Collected

Discharge and water quality (geochemistry)

4 Physical Description of Station

Spring discharges in two diversion channels, which are adequate for current meter measurement

5 Directions to Location of Station

West of Abu Sidou village, East of Jordan River Military Road or Zaur Road

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring

7 Other Observations

Global position system UTM coordinates 7-42-368E and 35-76-261N

Temperature 25 4°C

Author/Date Rola Abu Nahleh (02/12/97) Editor/Date Rola Abu Nahleh (02/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	5 November, 1997
Weather Conditions	Cloudy

1 Station Identification

Name	Sa'diya
ID Number	AB 0592
Basin	Jordan River
Aquifer	
Status	Active / monthly

2 Station Type

- ☐ Ground Water
- ☒ Springs
- ☐ Surface Water
- ☐ Other

Other

3 Station Purpose

- ☒ Water Resources
- ☒ Water Quality

Rationale for Station / Location

High flow used for irrigation

Data Collected

Discharge and water quality (geochemistry)

4 Physical Description of Station

A small part of the spring discharge is diverted to nearby farms, the rest flows towards Wadi Kufranja, effluent of Jordan River The flow is monitored in suitable sites irrigation canal and Wadi Kufranja using current meter

5 Directions to Location of Station

West of Kraima town, in Ba'ara's farm

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring

7 Other Observations

Global position system UTM coordinates 7-42-585E and 35-73-146N Temperature 24°C

Author/Date Rola Abu Nahleh (02/12/97) Editor/Date Rola Abu Nahleh (06/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	5 November, 1997
Weather Conditions	Clear Sky

1 Station Identification

Name	Ain El Buweib
ID Number	AB 0601
Basin	Jordan River
Aquifer	
Status	Active / monthly

2 Station Type

- ☐ Ground Water
- ☒ Springs
- ☐ Surface Water
- ☐ Other

Other

3 Station Purpose

- ☒ Water Resources
- ☒ Water Quality

Rationale for Station / Location

Significant flow used for irrigation

Data Collected

Discharge and water quality (geochemistry)

4 Physical Description of Station

Spring discharge flows in Wadi El Buweib, effluent of Jordan River The flow course , and subsequently the monitoring site, change according to flood events Monitoring site is selected by the observer to allow adequate current meter measurement Sites are generally in the vicinity of the spring

5 Directions to Location of Station

Wadi El Buweib near Fuad Salama's farm

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring

7 Other Observations

Global position system UTM coordinates 7-43-957E and 35-69-698N Temperature 24°C

Author/Date Rola Abu Nahleh (12/02/97) Editor/Date Rola Abu Nahleh (12/07/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	05 November 1997
Weather Conditions	Partly cloudy
1 Station Identification	
Name	Nukheil (El Buweih)
ID Number	AB 0603
Basin	Jordan River
Aquifer	
Status	Active / monthly
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

Significant flow used for irrigation

Data Collected

Discharge and water quality (geochemistry)

4 Physical Description of Station

Spring discharges at two points Flow is diverted to an open channel, which is adequate for weir or current meter measurement

5 Directions to Location of Station

3km west of Abu Abeida site at Abu Abdallah Essatari's farm

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring

7 Other Observations

Global position system UTM coordinates 7-44-025E and 35-67-930N Temperature 24°C

Author/Date Rola Abu Nahleh (02/12/97) Editor/Date Rola Abu Nahleh (07/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	30 November, 1997
Weather Conditions	Partly cloudy

1 Station Identification

Name	Ain Amra at Kuraiyma
ID Number	AB 0699
Basin	Jordan River
Aquifer	
Status	Active / monthly

2 Station Type

- ☐ Ground Water
- ☒ Springs
- ☐ Surface Water
- ☐ Other

Other

3 Station Purpose

- ☒ Water Resources
- ☒ Water Quality

Rationale for Station / Location

Significant discharge used for for irrigation

Data Collected

Discharge and water quality (geochemistry)

4 Physical Description of Station

Spring discharges in a dirt channel, which is adequate for weir or current meter measurement

5 Directions to Location of Station

North of Um Beirreh spring in Mohammed Abu Saleem's farm

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring

7 Other Observations

Flow records show a discharge decline since late 1991, but average flow is still greater than 25m^3/hr

Global position system UTM coordinates 7-42-469E and 35-76-458N Temperature 23^{0}C

Author/Date Rola Abu Nahleh (02/12/97) Editor/Date Dario Dal Santo (03/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	5 November, 1997
Weather Conditions	Cloudy and rainy

1 Station Identification

Name	Abu Falah
ID Number	NA
Basin	Jordan River
Aquifer	
Status	New / monthly

2 Station Type

- ☐ Ground Water
- ☒ Springs
- ☐ Surface Water
- ☐ Other

Other

3 Station Purpose

- ☒ Water Resources
- ☒ Water Quality

Rationale for Station / Location

Significant flow (brackish) used for irrigation and domestic water supply (not developed) for Abu Falah Village

Data Collected

New site

4 Physical Description of Station

Discharge of three nearby springs are diverted to an irrigation channel, west of military road or zaur road The selected monitoring site (see UTM coordianates) is suitable for current meter measurement

5 Directions to Location of Station

North of Abu Falah village, few meters West of Jordan River Military road or Zaur road, at Abu Nawaf's farm

6 Proposed Action for Water Monitoring System Station

Start monthly monitoring at new site

7 Other Observations

Global position system UTM coordinates 7-42-620E and 35-719-096N

Yarmouk River Basin

Author/Date Rania Shahin (30/11/97) Editor/Date Rania Shahin (03/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	25 November 1997
Weather Conditions	Light rain, Partly Cloudy
1 Station Identification	
Name	El Balad Aqraba
ID Number	AD 0600
Basin	Yarmouk
Aquifer	
Status	Active / Monthly
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

Significant flow used for irrigation

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Spring discharges into a concrete channel, which is suitable for portable weir or current meter measurement

5 Directions to Location of Station

West of Aqraba Village near the Ministry of Agriculture horticulture nursery

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring

7 Other Observations

Global position system UTM coordinates 7-62-322E and 36-23-862N Temperature 23 degrees C and Ec 830 micro S/cm

Author/Date Rania Shahin (11/30/97) Editor/Date Rola Abu Nahleh (12/06/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	6 November 1997
Weather Conditions	Partly Cloudy
1 Station Identification	
Name	Hammamat Mukheiba
ID Number	AD 0670
Basin	Yarmouk
Aquifer	
Status	Active / Monthly
2 Station Type	__ Ground Water __ Springs __ Surface Water __ Other

Other

3 Station Purpose	__ Water Resources __ Water Quality

Rationale for Station / Location

High flow used for tourism therapy and irrigation Around 50% of the water is used for irrigation in Mukheiba area The rest flows to Jordan River

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Spring source is transformed to a swimming pool with an outlet which diverts the water to local irrigation and to Jordan River Monitoring site is the diversion canal which is suitable for current meter measurement

5 Directions to Location of Station

Mukheiba Thermal resort station

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring Take temperature reading and carry out geochemistry and microbiological

Author/Date Rania Shahin (30/11/97) Editor/Date Rania Shahin (06/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	30 November 1997
Weather Conditions	Partly Cloudy

1 Station Identification

Name	Um El Forat
ID Number	AD 0530
Basin	Yarmouk
Aquifer	
Status	Inactive / Bi-annual

2 Station Type

- ☐ Ground Water
- ☒ Springs
- ☐ Surface Water
- ☐ Other

Other

3 Station Purpose

- ☒ Water Resources
- ☒ Water Quality

Rationale for Station / Location

Use to have significant flow used for irrigation It ceased flowing due to groundwater abstraction and is currently used as a well Station has been inactive since December 1993

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Used as a well

5 Directions to Location of Station

In Malka Village

6 Proposed Action for Water Monitoring System Station

Discontinue monitoring

7 Other Observations

Global position system UTM coordinates 7-58-345E and 36-16-936N

Temperature 21°C and Ec 730 micro S/cm

Author/Date Rania Shahin (11/30/97) Editor/Date Rania Shahin (01/14/98)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	25 November 1997
Weather Conditions	Partly Cloudy
1 Station Identification	
Name	Rahoub
ID Number	AD 0536
Basin	Yarmouk
Aquifer	
Status	Active / Bi-annual
2 Station Type	☐ Ground Water ☑ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☑ Water Resources ☑ Water Quality

Rationale for Station / Location

Significant flow used to be exploited for domestic water supply by WAJ Now spring is contaminated by effluent from Poultry farm

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Spring discharge is currently entirely diverted to Wadi Rahoub for irrigation Monitoring can be made either near spring source or near confluence with Wadi Rahoub Flow measurement is possible by portable weir or current meter method

5 Directions to Location of Station

Rahoub WAJ station Wadi Rahoub

6 Proposed Action for Water Monitoring System Station

Upgrade to monthly monitoring Treat contaminated water

7 Other Observations

Author/Date Rania Shahin (30/11/97) Editor/Date Rola Abu Nahleh (06/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	25 November 1997
Weather Conditions	Partly Cloudy

1 Station Identification

Name	Qweilbeh
ID Number	AD 0580
Basin	Yarmouk
Aquifer	
Status	Active / Monthly

2 Station Type

- ☐ Ground Water
- ☒ Springs
- ☐ Surface Water
- ☐ Other

Other

3 Station Purpose

- ☒ Water Resources
- ☒ Water Quality

Rationale for Station / Location

Significant discharge used for water supply (Tankers) and irrigation

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Spring discharges into a covered concrete reservoir (leaking) then diverts through concrete canal for irrigation and water supply by Tankers The canal is damaged and not adequate for monitoring

5 Directions to Location of Station

Hartha-Kharja road, in Qweilbeh area, 1 2 km North of Kharja Village

6 Proposed Action for Water Monitoring System Station

Rehabilitate reservoir and canal to avoid water losses and insure adequate monitoring, continue monthly monitoring

7 Other Observations

Global position system UTM coordinates 7-68-839E and 36-18-580N

Temperature 20° C and Ec 490 micro S/cm

Author/Date Rania Shahin (30/11/97) Editor/Date Rania Shahin (03/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	25 November 1997
Weather Conditions	Light rain Partly Cloudy
1 Station Identification	
Name	El Balad Aqraba
ID Number	AD 0600
Basin	Yarmouk
Aquifer	
Status	Active / Monthly
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

Significant flow used for irrigation

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Spring discharges into a concrete channel which is suitable for portable weir or current meter measurement

5 Directions to Location of Station

West of Aqraba Village, near the Ministry of Agriculture horticulture nursery

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring

7 Other Observations

Global position system UTM coordinates 7-62-322E and 36-23-862N Temperature 23 degrees C and Ec 830 micro S/cm

Author/Date Rania Shahin (11/30/97) Editor/Date Rola Abu Nahleh (12/06/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	6 November 1997
Weather Conditions	Partly Cloudy
1 Station Identification	
Name	Hammamat Mukheiba
ID Number	AD 0670
Basin	Yarmouk
Aquifer	
Status	Active / Monthly
2 Station Type	☐ Ground Water ☐ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☐ Water Resources ☐ Water Quality

Rationale for Station / Location

High flow used for tourism therapy and irrigation Around 50% of the water is used for irrigation in Mukheiba area The rest flows to Jordan River

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Spring source is transformed to a swimming pool with an outlet which diverts the water to local irrigation and to Jordan River Monitoring site is the diversion canal which is suitable for current meter measurement

5 Directions to Location of Station

Mukheiba Thermal resort station

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring Take temperature reading and carry out geochemistry and microbiological

analysis on routine basis

7 Other Observations

Global position system UTM coordinates 7-51-426E & 36-21-749N Temperature 34° C

Author/Date Rania Shahin (30/11/97) Editor/Date Rania Shahin (07/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	30 November 1997
Weather Conditions	Partly Cloudy
1 Station Identification	
Name	Bir Saraya
ID Number	AD 0696
Basin	Yarmouk
Aquifer	
Status	Inactive / Annual
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

Use to have significant flow It ceased flowing and is currently used as a well Station has been inactive since late 1980

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Used as a well

5 Directions to Location of Station

South of Um Batimah Village in Mohammad Miqbel's farm

6 Proposed Action for Water Monitoring System Station

Discontinue monitoring

7 Other Observations

Temperature 19°C and Ec 620 micro S/cm

Author/Date Rania Shahin (30/11/97) Editor/Date Rola Abu Nahleh (06/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	6 November 1997
Weather Conditions	Partly Cloudy
1 Station Identification	
Name	El Adaseyyeh
ID Number	AD 0740
Basin	Yarmouk
Aquifer	
Status	Active / Monthly
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

Significant flow used for irrigation

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Spring discharges in an irrigation channel The monitoring is done at a uniform control channel 300 m West of spring Current meter measurements are used to estimate the flow A permanent rectangular weir is preferable

5 Directions to Location of Station

Around 1250 meters West of El Adaseyyeh Military checkpoint

6 Proposed Action for Water Monitoring System Station

Install a permanent weir Continue monthly monitoring

7 Other Observations

Global position system UTM coordinates 7-44-699E and 36-16-933N Temperature 23°C and Ec 1325 micro S/cm

Zarqa River Basin

Author/Date Rania Shahin (11/30/97) Editor/Date Rania Shahin (12/08/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	30 November 1997
Weather Conditions	Partly Cloudy
1 Station Identification	
Name	Ras El Ain
ID Number	AL 0501
Basin	Zarqa
Aquifer	
Status	Inactive / Bi-annual
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☐ Water Quality

Rationale for Station / Location

High flow used for domestic water supply (WAJ)

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Spring discharge is diverted to WAJ pumping station

5 Directions to Location of Station

North of Ennafaq WAJ pumping station Ras El Ain area in Amman

6 Proposed Action for Water Monitoring System Station

Reactivate station upgrade to monthly monitoring Check and monitor bacteriological contamination

7 Other Observations

Global position system UTM coordinates 7-76-018E and 35-38-115N

Author/Date Rania Shahin (30/11/97) Editor/Date Rania Shahin (03/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	23 November 1997
Weather Conditions	Clear Sky

1 Station Identification

Name	Ain Zarbi
ID Number	AL 0514
Basin	Zarqa
Aquifer	
Status	Active / Monthly

2 Station Type

- ☐ Ground Water
- ☒ Springs
- ☐ Surface Water
- ☐ Other

Other

3 Station Purpose

- ☒ Water Resources
- ☒ Water Quality

Rationale for Station / Location

Significant intermittent flow used for irrigation

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Spring discharges in dirt channel, which is suitable for portable weir or current meter measurement

Spring dries up during dry years

5 Directions to Location of Station

Near Sweileh-Yajouz road, at Hammouda's farm

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring Change to seasonal monitory if flow continues to decline

7 Other Observations

Flow declined during the last 5 to 6 years because of groundwater obstruction from new WAJ wells, in the area

Global position system UTM coordinates 7-83-164E and 35-46-480N Temperature 17 degrees C and Ec 790 micro S/cm

Author/Date Rania Shahin (30/11/97) Editor/Date Rania Shahin (09/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	23 November 1997
Weather Conditions	Clear Sky
1 Station Identification	
Name	Ruseifa
ID Number	AL 0515
Basin	Zarqa
Aquifer	
Status	Active / Monthly
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

High flow used for irrigation Water is effected by bacteriological contamination

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Spring discharges in Wadi Ruseifa Site is adequate for current meter measurement

5 Directions to Location of Station

In Ruseifa Town, in Wadi Ruseifa, near Yeast factory

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring Treat and monitor bacteriological contamination

7 Other Observations

During winter the Ain Ghazala wastewater treatment plant overflows in Wadi Ruseifa upstream of the spring Temperature 20° C

Author/Date Rania Shahin (30/11/97) Editor/Date Rania Shahin (08/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	23 November 1997
Weather Conditions	Clear Sky
1 Station Identification	
Name	Sukhneh
ID Number	AL 0522
Basin	Zarqa
Aquifer	
Status	Active / Monthly
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

Use to have significant intermittent flow used for irrigation Now ceased flowing because of groundwater overabstraction in the area

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Non flowing spring, used as a well

5 Directions to Location of Station

Near Sukhneh roundabout, at Abu Iyad's construction block plant

6 Proposed Action for Water Monitoring System Station

Annual visit during wet season In case of significant flow, continue monitoring on a bi-annual basis, otherwise, stop monitoring

7 Other Observations

Author/Date Rania Shahin (11/30/97) Editor/Date Rania Shahin (12/08/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	23 November 1997
Weather Conditions	Clear Sky
1 Station Identification	
Name	Nimra
ID Number	AL 0528
Basin	Zarqa
Aquifer	
Status	Active / Seasonal
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

Significant flow used for irrigation

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Spring discharges in a channel which flows towards Seyl Zarqa with a control section suitable for current meter measurement

5 Directions to Location of Station

North of Douqara Village at Wirr's farm near Seyl Zarqa

6 Proposed Action for Water Monitoring System Station

Upgrade to monthly monitoring

7 Other Observations

Temperature 24 degrees C

Author/Date Rania Shahin (30/11/97) Editor/Date Rania Shahin (03/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	24 November 1997
Weather Conditions	Clear Sky

1 Station Identification

Name	El Khalla
ID Number	AL 0546
Basin	Zarqa
Aquifer	
Status	Active / Monthly

2 Station Type

- ☐ Ground Water
- ☒ Springs
- ☐ Surface Water
- ☐ Other

Other

3 Station Purpose

- ☒ Water Resources
- ☒ Water Quality

Rationale for Station / Location

Significant flow used for irrigation

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Spring discharges in two channels, which are suitable for portable weir or current meter measurement

5 Directions to Location of Station

Sukhneh-Jerash road at Beerein crossing in Wadi Beerein

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring

7 Other Observations

Temperature 21 degrees C

85A

Author/Date Rania Shahin (30/11/97) Editor/Date Rania Shahin (03/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	23 November 1997
Weather Conditions	Clear Sky

1 Station Identification

Name	Khureisan
ID Number	AL 0552
Basin	Zarqa
Aquifer	
Status	Active / Monthly

2 Station Type

- ☐ Ground Water
- ☒ Springs
- ☐ Surface Water
- ☐ Other

Other

3 Station Purpose

- ☒ Water Resources
- ☒ Water Quality

Rationale for Station / Location

Significant flow used for irrigation

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Spring discharges at two points Measurements need to be taken near the two discharge points The channel which connects the flow of the two discharges is not adequate for measurement

5 Directions to Location of Station

Near Sukhneh-Qunayyah road, North of Khureisan Primary School

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring

7 Other Observations

Temperature 21 degrees C

Author/Date Rania Shahin (30/11/97) Editor/Date Rania Shahin (03/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	23 November 1997
Weather Conditions	Clear Sky
1 Station Identification	
Name	Wadi El Karim
ID Number	AL 0597
Basin	Zarqa
Aquifer	
Status	Active / Monthly
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

Significant flow used for irrigation

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Spring discharges in a channel, which is suitable for portable weir or current meter measurement

5 Directions to Location of Station

At El Karim Village

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring

7 Other Observations

Global position system UTM coordinates 7-82-180E and 35-71-360N Temperature 23 degrees C and Ec 730 micro S/cm

Author/Date Rania Shahin (30/11/97) Editor/Date Rania Shahin (03/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	23 November 1997
Weather Conditions	Clear Sky

1 Station Identification

Name	Qunayyah
ID Number	AL 0600
Basin	Zarqa
Aquifer	
Status	Active / Monthly

2 Station Type

- ☐ Ground Water
- ☒ Springs
- ☐ Surface Water
- ☐ Other

Other

3 Station Purpose

- ☒ Water Resources
- ☒ Water Quality

Rationale for Station / Location

High flow used for domestic water supply and irrigation

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Part of spring discharge is diverted to WAJ pumping station The rest flows in an irrigation channel, which is adequate for current meter measurement

5 Directions to Location of Station

Qunayyah WAJ pumping station

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring

7 Other Observations

Global position system UTM coordinates 7-82-500E and 35-70-090N Temperature 23 degrees C and Ec 690 micro S/cm

Author/Date Rania Shahin (11/30/97) Editor/Date Rola Abu Nahleh (12/06/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	24 November 1997
Weather Conditions	Partly Cloudy
1 Station Identification	
Name	Maghasil
ID Number	AL 0630
Basin	Zarqa
Aquifer	
Status	Active / Monthly
2 Station Type	☐ Ground Water ☑ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☑ Water Resources ☑ Water Quality

Rationale for Station / Location

Moderate flow used for drinking water supply (Air Force), but declined (appr 5 m^3/hr during visit) because of groundwater abstraction West of the spring

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Spring discharges into a small basin and diverted to a pumping station through a concrete canal

Measurement can be taken at source by volumetric method or at canal by portable weir

5 Directions to Location of Station

In Soaf Village at Air Force pumping station

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring

7 Other Observations

Global position system UTM coordinates 7-67-357E and 35-79-132N Temperature 18° C and Ec 560 micro S/cm

Author/Date Rania Shahin (30/11/97) Editor/Date Rola Abu Nahleh (06/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	24 November 1997
Weather Conditions	Partly Cloudy

1 Station Identification

Name	Fawwar
ID Number	AL 0648
Basin	Zarqa
Aquifer	
Status	Active / Monthly

2 Station Type

- ☐ Ground Water
- ☒ Springs
- ☐ Surface Water
- ☐ Other

Other

3 Station Purpose

- ☒ Water Resources
- ☒ Water Quality

Rationale for Station / Location

Significant flow used for irrigation

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Spring discharges into a channel, suitable for portable weir and current meter measurement

5 Directions to Location of Station

East of Soof Town near agricultural road

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring

7 Other Observations

Global position system UTM coordinates 7-68-443E and 35-78-606N Temperature 18° C and Ec 800 micro S/cm

Author/Date Dario Dal_Santo (05/14/95) Editor/Date Rania Shahin (01/14/98)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	24 November, 1997
Weather Conditions	Clear sky
1 Station Identification	
Name	Bisass El Room
ID Number	AL 0664
Basin	Zarqa
Aquifer	
Status	Active / Monthly
2 Station Type	☐ Ground Water ☑ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

Use to have significant flow used for irrigation declined to intermittent then dried up during the last few months

Data Collected

Discharge and water quality (geochemistry)

4 Physical Description of Station

Dry

5 Directions to Location of Station

East of Mukhayyam Soof near Ajoor club

6 Proposed Action for Water Monitoring System Station

Change to annual monitoring

7 Other Observations

Global position system UTM coordinates 7-72-112E and 35-78-450N

Author/Date Dario Dal_Santo (14/05/95) Editor/Date Rania Shahin (07/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	24 November, 1997
Weather Conditions	Clear sky

1 Station Identification

Name	El Shawahid
ID Number	AL 0666
Basin	Zarqa
Aquifer	
Status	Active / monthly

2 Station Type

- ☐ Ground Water
- ☒ Springs
- ☐ Surface Water
- ☐ Other

Other

3 Station Purpose

- ☒ Water Resources
- ☒ Water Quality

Rationale for Station / Location

Use to have significant flow which is used for irrigation It ceased flowing (only seepage) and used as a well to pump water for irrigation

Data Collected

Discharge and water quality (geochemistry)

4 Physical Description of Station

Spring is transformed to a seepage

5 Directions to Location of Station

South of Mukhayyam Soof, near a construction block plant

6 Proposed Action for Water Monitoring System Station

Change to bi-annual monitoring Check and monitor biological contimination

7 Other Observations

Global position system UTM coordinates 7-71-668E and 35-77-945N

Author/Date Dario Dal_Santo (14/05/95) Editor/Date Rania Shahin (07/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	24 November, 1997
Weather Conditions	Clear sky

1 Station Identification

Name	El Birkatein
ID Number	AL 0668
Basin	Zarqa
Aquifer	
Status	Active / Monthly

2 Station Type

- ☐ Ground Water
- ☒ Springs
- ☐ Surface Water
- ☐ Other

Other

3 Station Purpose

- ☒ Water Resources
- ☒ Water Quality

Rationale for Station / Location

Use to have high flow (125 8m^3/hr average) Now dry because of ground water overabstraction in Shawahid area Bacteriological contamination is possible

Data Collected

Discharge and water quality (geochemistry)

4 Physical Description of Station

Spring use to discharge into interconnected pools which were part of the Roman water works for the ancient city of Jerash Now only stagnant water in both pools

5 Directions to Location of Station

North of Jerash archeologic site

6 Proposed Action for Water Monitoring System Station

Change to seasonal monitoring Check and monitor bacteriological contamination

7 Other Observations

Global position system UTM coordinates 7-72-435E and 35-77-230N

Author/Date Dario Dal_Santo (14/05/95) Editor/Date Rola Abu Nahleh (06/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	23 November, 1997
Weather Conditions	Clear sky

1 Station Identification

Name	El Qairawan
ID Number	AL 0672
Basin	Zarqa
Aquifer	
Status	Active / monthly

2 Station Type

- ☐ Ground Water
- ☒ Springs
- ☐ Surface Water
- ☐ Other

Other

3 Station Purpose

- ☒ Water Resources
- ☒ Water Quality

Rationale for Station / Location

High flow used the domestic water supply (WAJ) and irrigation Water is currently affected by bacteriological contamination

Data Collected

Discharge and water quality (geochemistry)

4 Physical Description of Station

Spring discharge is collected into a large deepened pool which has been enclosed in a structure associated with the WAJ pumping station The domestic water supply is pumped from this pool through two large diameter pipes The excess water is diverted through two concrete irrigation canals, which are suitable for current meter measurement

5 Directions to Location of Station

In Jerash across the street from the Ya Hala restaurant and immediately north east of the Jerash archaeological site

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring Monitor and treat bacteriological contamination

7 Other Observations

95

Global position system UTM coordinates 7-72-700E and 35-75-376N Temperature 20^{0}C and EC 730 micro s/cm

96

Author/Date Dario Dal_Santo (05/14/95) Editor/Date Rania Shahin (12/07/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	24 November, 1997
Weather Conditions	Clear sky
1 Station Identification	
Name	Ain Wadi Jebarat
ID Number	AL 0674
Basin	Zarqa
Aquifer	
Status	Active / annual
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

Significant flow which is mixed downstream of spring with Jerash sewage plant discharge, and used along Wadi Jebarat for irrigation

Data Collected

Discharge and water quality (geochemistry)

4 Physical Description of Station

Spring discharges into a concrete canal which is adequate for portable weir or current meter measurement the canal discharges the spring flow in Wadi Jabarat

5 Directions to Location of Station

South of Jerash town, near Rawdha restaurant in Mohammed Nour's farm

6 Proposed Action for Water Monitoring System Station

Upgrade to seasonal monitoring

7 Other Observations

Global position system UTM coordinates 7-72-375E and 35-73-216N Temperature 20°C

98

Author/Date Dario Dal_Santo (14/05/95) Editor/Date Rola Abu Nahleh (06/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	23 November, 1997
Weather Conditions	Clear sky

1 Station Identification

Name	El Tannour
ID Number	AL 0716
Basin	Zarqa
Aquifer	
Status	Active / monthly

2 Station Type

- ☐ Ground Water
- ☒ Springs
- ☐ Surface Water
- ☐ Other

Other

3 Station Purpose

- ☒ Water Resources
- ☒ Water Quality

Rationale for Station / Location

Significant flow used for irrigation

Data Collected

Discharge and water quality (geochemistry)

4 Physical Description of Station

Spring discharges in two concrete channels, which are ideal for current meter and weir measurement

5 Directions to Location of Station

Near Wadi El Riashi, West of El Riashi Primary School

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring

7 Other Observations

Global position system UTM coordinates 7-75-600E and 35-71-190N Temperature 22°C and EC 950 micro s/cm

Author/Date Dario Dal_Santo (14/05/95) Editor/Date Rola Abu Nahleh (06/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	23 November, 1997
Weather Conditions	Clear sky

1 Station Identification

Name	Abu Ghadir
ID Number	AL 0748
Basin	Zarqa
Aquifer	
Status	Active / monthly

2 Station Type

- ☐ Ground Water
- ☒ Springs
- ☐ Surface Water
- ☐ Other

Other

3 Station Purpose

- ☒ Water Resources
- ☒ Water Quality

Rationale for Station / Location

Significant flow used for domestic water supply (WAJ) and irrigation

Data Collected

Discharge and water quality (geochemistry)

4 Physical Description of Station

Spring discharges is collected into a reservoir, a large portion is piped to WAJ pumping station and the rest flows into an irrigation channel, which is adequate for portable weir or current meter measurement

5 Directions to Location of Station

WAJ pumping station, West of Nahla village

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring Rehabilitation WAJ reservoir (leaking)

7 Other Observations

Global position system UTM coordinates 7-65-877E and 35-74-520N Temperature 18°C and EC 760 micro s/cm

100

Author/Date Dario Dal_Santo (14/05/95) Editor/Date Rola Abu Nahleh (06/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	23 November, 1997
Weather Conditions	Clear sky

1 Station Identification

Name	Teis
ID Number	AL 0758
Basin	Zarqa
Aquifer	
Status	Active / monthly

2 Station Type

- ☐ Ground Water
- ☒ Springs
- ☐ Surface Water
- ☐ Other

Other

3 Station Purpose

- ☒ Water Resources
- ☒ Water Quality

Rationale for Station / Location

High flow used mainly for domestic water supply (WAJ), a portion of the discharge is used for irrigation

Water is affected by bacteriological contamination

Data Collected

Discharge and water quality (geochemistry)

4 Physical Description of Station

Discharge from Deek and Teis (adjacent to Deek) springs is collected in concrete reservoirs which have been built over the springs From these reservoirs, the water is piped to the WAJ pumping station Some flow discharges into the wadi for irrigation, through a concrete channel which is suitable for portable weir or current meter measurement

5 Directions to Location of Station

North of Deek - Teis WAJ station, adjacent to Deek spring

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring Install flow meter at the WAJ pipe coming from each spring (Deek and Teis) because the current measurement of domestic water supply from each spring is not obvious

Monitor bacteriological contamination and treat it

7 Other Observations

101

Global position system UTM coordinates 7-68-008E and 35-73-600N Temperature 22°C and EC 660 micro s/cm

102

Author/Date Dario Dal_Santo (14/05/95) Editor/Date Rola Abu Nahleh (06/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	23 November, 1997
Weather Conditions	Clear sky

1 Station Identification

Name	Deek
ID Number	AL 0760
Basin	Zarqa
Aquifer	
Status	Active / monthly

2 Station Type

- ☐ Ground Water
- ☒ Springs
- ☐ Surface Water
- ☐ Other

Other

3 Station Purpose

- ☒ Water Resources
- ☒ Water Quality

Rationale for Station / Location

High flow used mainly for domestic water supply (WAJ), a portion of the discharge is used for irrigation

Water is affected by bacteriological contamination

Data Collected

Discharge and water quality (geochemistry)

4 Physical Description of Station

Discharge from Deek and Teis (adjacent to Deek) springs is collected in concrete reservoirs which have been built over the springs From these reservoirs, the water is piped to the WAJ pumping station Some flow discharges into the wadi for irrigation, through a concrete channel which is suitable for portable weir or current meter measurement

5 Directions to Location of Station

Deek - Teis WAJ pumping station, at the intersection of Wadi Nahla and the road going eastward toward Mukhayyam Ghazza

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring Install flow meter at the WAJ pipe coming from each spring (Deek and Teis) because the current measurement of domestic water supply from each spring is not obvious

Monitor and treat bacteriological contamination

7 Other Observations

Temperature 22^{0}C and EC 580 micro s/cm

Author/Date Dario Dal_Santo (14/05/95) Editor/Date Rola Abu Nahleh (06/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	25 November, 1997
Weather Conditions	Partly cloudy
1 Station Identification	
Name	Ras El Mai
ID Number	AL 0822
Basin	Zarqa
Aquifer	
Status	Active / monthly
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

Significant flow used for irrigation

Data Collected

Discharge and water quality (geochemistry)

4 Physical Description of Station

Spring discharges in an open channel, which is suitable for portable weir or current meter measurement

5 Directions to Location of Station

Near Jerash - Amman road, East of El Manqal restaurant, El Rummen area, in Wadi Rummen

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring

7 Other Observations

Global position system UTM coordinates 7-68-528E and 35-61-861N Temperature 19°C

105

Author/Date Rania Shahin (30/11/97) Editor/Date Rania Shahin (06/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	29 November 1997
Weather Conditions	Partly Cloudy

1 Station Identification

Name	Um Eddananir
ID Number	AL 0864
Basin	Zarqa
Aquifer	
Status	Active / Monthly

2 Station Type

- ☐ Ground Water
- ☒ Springs
- ☐ Surface Water
- ☐ Other

Other

3 Station Purpose

- ☒ Water Resources
- ☒ Water Quality

Rationale for Station / Location

Significant flow used for irrigation

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Spring discharges in the Wadi channel, which is adequate for current meter or weir measurement

5 Directions to Location of Station

Baqa'a-Rumeimin road, around 2 3 km from Satellite station, West of Ayed El Faouri's farm, in Wadi Rumeimin

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring

7 Other Observations

Global position system UTM coordinates 7-65-941E and 35-53-507N Temperature 21°C and Ec 470 micro S/cm

Author/Date Dario Dal_Santo (05/14/95) Editor/Date Rania Shahin (12/08/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	29 November, 1997
Weather Conditions	Partly Cloudy

1 Station Identification

Name	Ain Wadi Rumeimin
ID Number	AL 0875
Basin	Zarqa
Aquifer	
Status	Active / Annual

2 Station Type

- ☐ Ground Water
- ☒ Springs
- ☐ Surface Water
- ☐ Other

Other

3 Station Purpose

- ☒ Water Resources
- ☒ Water Quality

Rationale for Station / Location

High flow used for irrigation

Data Collected

Discharge and water quality (geochemistry)

4 Physical Description of Station

Spring discharges in an open channel flowing towards Wadi Rumeimin Control section is suitable for current meter measurement

5 Directions to Location of Station

Esh Shallal Es Siyahi road near Salah Mari's farm in Wadi Rumeimin

6 Proposed Action for Water Monitoring System Station

Upgrade to monthly monitoring

7 Other Observations

Global position system UTM coordinates 7-64-598E and 35-57-934N Temperature 16°C and EC 830

micro s/cm

Author/Date Rania Shahin (30/11/97) Editor/Date Rania Shahin (06/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	29 November 1997
Weather Conditions	Partly Cloudy

1 Station Identification

Name	Ain W Rumeimin / Siyagha
ID Number	AL 0876
Basin	Zarqa
Aquifer	
Status	Active / Monthly

2 Station Type

- ☐ Ground Water
- ☒ Springs
- ☐ Surface Water
- ☐ Other

Other

3 Station Purpose

- ☒ Water Resources
- ☒ Water Quality

Rationale for Station / Location

High flow used for irrigation

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Spring discharges in a concrete canal, which is suitable for current meter or weir measurement

5 Directions to Location of Station

Near Sayegh Horticulture nursery, south of Rahib WAJ station, in Wadi Rumeimin

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring

7 Other Observations

Global position system UTM coordinates 7-64-090E and 35-54-817N Temperature 20°C and Ec 610 micro S/cm

Author/Date Dario Dal_Santo (14/05/95) Editor/Date Rola Abu Nahleh (06/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	29 November, 1997
Weather Conditions	Partly Cloudy
1 Station Identification	
Name	Rahib
ID Number	AL 0878
Basin	Zarqa
Aquifer	
Status	Active / monthly
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

Significant flow used for domestic water supply (WAJ) and irrigation

Data Collected

Discharge and water quality (geochemistry)

4 Physical Description of Station

Part of spring discharge is pumped by WAJ station, the rest flows towards the wadi in a control channel which is suitable for current meter or weir measurement

5 Directions to Location of Station

Rahib WAJ station, north of Ain Wadi Rumeimin spring

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring Check and monitor bacteriological contamination

7 Other Observations

Global position system UTM coordinates 7-64-171E and 35-54-881N Temperature 20°C and EC 750 micro s/cm

Author/Date Rania Shahin (11/30/97) Editor/Date Rola Abu Nahleh (12/07/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	30 November 1997
Weather Conditions	Partly Cloudy
1 Station Identification	
Name	Suleihi
ID Number	AL 0918
Basin	Zarqa
Aquifer	
Status	Active / Monthly
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☐ Water Resources ☒ Water Quality

Rationale for Station / Location

Significant flow used for irrigation

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Spring discharges in a concrete canal, which is suitable for weir or current meter measurement

5 Directions to Location of Station

In Suleihi town west of the post office

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring

7 Other Observations

Global position system UTM coordinates 7-67-219E and 35-57-210N Temperature 20° C

Rift Side Wadıs Basıns

Author/Date Rania Shahin (30/11/97) Editor/Date Rania Shahin (06/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	29 November 1997
Weather Conditions	Partly Cloudy
1 Station Identification	
Name	Ain Wadi Arab
ID Number	AE 0540
Basin	Rift Side Wadis
Aquifer	
Status	Inactive / Annual
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

Use to have significant flow which is used for irrigation It dried up due to groundwater abstraction

Station has been inactive since 1996

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Dry

5 Directions to Location of Station

6 Proposed Action for Water Monitoring System Station

Discontinue monitoring

7 Other Observations

Flow records show zero flow in 1994 and in 1995

Global position system UTM coordinates 7-50-670E and 36-13-650N

Author/Date Rola Abu Nahleh (12/03/97) Editor/Date Rania Shahin (12/09/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	30 November, 1997
Weather Conditions	Partly Cloudy
1 Station Identification	
Name	Shuneh North
ID Number	AE 0576
Basin	Rift Side Wadis
Aquifer	
Status	Active / Annual
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

Significant intermittent flow used for irrigation

Data Collected

Discharge and water quality (geochemistry)

4 Physical Description of Station

Spring discharges in a dirt channel which is suitable for current meter or weir measurement

5 Directions to Location of Station

Near JVA station Shumah North

6 Proposed Action for Water Monitoring System Station

Upgrade to seasonal monitoring

7 Other Observations

Global position system UTM coordinates 7-45-252E and 36-10-981N Temperature 23°C

Author/Date Rola Abu Nahleh (03/12/97) Editor/Date Rola Abu Nahleh (06/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	25 November, 1997
Weather Conditions	Partly Cloudy
1 Station Identification	
Name	Rasun
ID Number	AH 0506
Basin	Rift Side Wadis
Aquifer	
Status	Active / monthly
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

High flow mainly used for domestic water supply (WAJ), a small portion of the flow is used for irrigation

Data Collected

Discharge and water quality (geochemistry)

4 Physical Description of Station

Most of the spring disharge is diverted into WAJ pumping stations, the rest flow in an open channel, which is suitable for portable weir measurement

5 Directions to Location of Station

WAJ Rasun station, East of Rasun Town

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring

7 Other Observations

Global position system UTM coordinates 7-60-160E and 35-87-366N Temperature 19°C and EC 720 micro s/cm

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Author/Date Rola Abu Nahleh (03/12/97) Editor/Date Rola Abu Nahleh (06/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	25 November 1997
Weather Conditions	Partly Cloudy

1 Station Identification

Name	Tannur
ID Number	AH 0510
Basin	Rift Side Wadis
Aquifer	
Status	Active / monthly

2 Station Type

- ☐ Ground Water
- ☒ Springs
- ☐ Surface Water
- ☐ Other

Other

3 Station Purpose

- ☒ Water Resources
- ☒ Water Quality

Rationale for Station / Location

High flow mainly used for domestic water supply (WAJ), the rest is used for irrigation

Data Collected

Discharge and water quality (geochemistry)

4 Physical Description of Station

Most of the spring disharge is diverted into WAJ pumping stations, the rest flows into a concrete canal, which is adequate for portable weir or current meter measurement

5 Directions to Location of Station

Tannur WAJ station, at Wadi Urjan

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring

7 Other Observations

Global position system UTM coordinates 7-58-218E and 35-88-877N Temperature 18^{0}C and EC 670 micro s/cm

Author/Date Rola Abu Nahleh (03/12/97) Editor/Date Rola Abu Nahleh (06/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	25 November, 1997
Weather Conditions	Partly Cloudy
1 Station Identification	
Name	Beida
ID Number	AH 0512
Basin	Rift Side Wadis
Aquifer	
Status	Active / monthly
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

High flow used for irrigation

Data Collected

Discharge and water quality (geochemistry)

4 Physical Description of Station

Spring discharges from two sources in two open channels, one concrete channel and one dirt channels Both are suitable for portable weir or current meter measurement

5 Directions to Location of Station

East of Tannur WAJ station

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring

7 Other Observations

Global position system UTM coordinates 7-58-295E and 35-89-018N Temperature 19°C and EC 750 micro s/cm

Author/Date Rola Abu Nahleh (03/12/97) Editor/Date Rola Abu Nahleh (06/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	25 November, 1997
Weather Conditions	Partly Cloudy
1 Station Identification	
Name	Urjan Fouqa
ID Number	AH 0516
Basin	Rift Side Wadis
Aquifer	
Status	Active / monthly
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

Significant flow used for irrigation

Data Collected

Discharge and water quality (geochemistry)

4 Physical Description of Station

Spring discharges in two open channels, which are suitable for portable weir or current meter measurement

5 Directions to Location of Station

East of Urjan Town, near Hussein Salem Ezzawahra's house

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring

7 Other Observations

Global position system UTM coordinates 7-57-615E and 35-87-707N Temperature 19°C and EC 630 micro s/cm

Author/Date Rola Abu Nahleh (03/12/97) Editor/Date Rola Abu Nahleh (06/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	24 November, 1997
Weather Conditions	Partly Cloudy

1 Station Identification

Name	El Balad Ajlun
ID Number	AJ 0516
Basin	Rift Side Wadis
Aquifer	
Status	Active / monthly

2 Station Type

- ☐ Ground Water
- ☒ Springs
- ☐ Surface Water
- ☐ Other

Other

3 Station Purpose

- ☒ Water Resources
- ☒ Water Quality

Rationale for Station / Location

Significant flow used for irrigation

Data Collected

Discharge and water quality (geochemistry)

4 Physical Description of Station

Spring discharges into a concrete canal, which is adequate for portable weir or current meter measurement

5 Directions to Location of Station

East of Ajlun bus station, at Ajlun city

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring

7 Other Observations

Spring is affected by bacteriological contamination Global position system UTM coordinates 7-58-810E and 35-80-364N Temperature 19°C and EC 650 micro s/cm

Author/Date Rola Abu Nahleh (03/12/97) Editor/Date Rola Abu Nahleh (06/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	24 November, 1997
Weather Conditions	Partly Cloudy

1 Station Identification

Name	El Qantara
ID Number	AJ 0520
Basin	Rift Side Wadis
Aquifer	
Status	Active / monthly

2 Station Type

- ☐ Ground Water
- ☒ Springs
- ☐ Surface Water
- ☐ Other

Other

3 Station Purpose

- ☒ Water Resources
- ☒ Water Quality

Rationale for Station / Location

Significant flow used for domestic water supply and irrigation

Data Collected

Discharge and water quality (geochemistry)

4 Physical Description of Station

Most spring discharges is diverted to WAJ pumping station and the rest flows towards wadi Ajlun in an open channel,which is suitable for current meter measurement

5 Directions to Location of Station

WAJ pumping station southwest of Ajlun city

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring station Treat bacteriological automation

7 Other Observations

WAJ stopped pumping since 27 July 1997 due to bacteriological contamination Global position system UTM coordinates 7-58-102E and 35-79-577N Temperature 18°C and EC 700 micro s/cm

Author/Date Rola Abu Nahleh (03/12/97) Editor/Date Rola Abu Nahleh (03/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	24 November, 1997
Weather Conditions	Partly Cloudy
1 Station Identification	
Name	Basset Jatta
ID Number	AJ 0540
Basin	Rift Side Wadis
Aquifer	
Status	Active / monthly
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

Significant flow used for irrigation

Data Collected

Discharge and water quality (geochemistry)

4 Physical Description of Station

Spring discharges into an open channel which flows toward Wadi Ajlun Monitoring control channel is suitable for portable weir or current meter measurement

5 Directions to Location of Station

West of Ajlun City, Wadi Ajlun, downstream of El Qantara spring

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring

7 Other Observations

Global position system UTM coordinates 7-57-582E and 35-78-812N Temperature 17°C and EC 730 micro s/cm

Author/Date Rola Abu Nahleh (03/12/97) Editor/Date Rola Abu Nahleh (03/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	24 November, 1997
Weather Conditions	Partly Cloudy

1 Station Identification

Name	El Birkeh
ID Number	AJ 0568
Basin	Rift Side Wadis
Aquifer	
Status	Active / monthly

2 Station Type

- ☐ Ground Water
- ☒ Springs
- ☐ Surface Water
- ☐ Other

Other

3 Station Purpose

- ☒ Water Resources
- ☒ Water Quality

Rationale for Station / Location

Significant flow used for irrigation

Data Collected

Discharge and water quality (geochemistry)

4 Physical Description of Station

Spring discharge is diverted in two concrete channels, which are adequate for portable weir or current meter measurement

5 Directions to Location of Station

Near Kufrinja - Ghor road, at Ahmed Innab's farm

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring

7 Other Observations

Global position system UTM coordinates 7-51-046E and 35-74-094N Temperature 22°C and EC 740 micro s/cm

Author/Date Rola Abu Nahleh (03/12/97) Editor/Date Rola Abu Nahleh (06/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	6 November, 1997
Weather Conditions	Clear Sky

1 Station Identification

Name	Zugaig
ID Number	AJ 0580
Basin	Rift Side Wadis
Aquifer	
Status	Active / monthly

2 Station Type

- ☐ Ground Water
- ☒ Springs
- ☐ Surface Water
- ☐ Other

Other

3 Station Purpose

- ☒ Water Resources
- ☒ Water Quality

Rationale for Station / Location

High flow used for domestic water supply (WAJ) and irrigation

Data Collected

Discharge and water quality (geochemistry)

4 Physical Description of Station

Spring discharge is piped to WAJ pumping station, excess water is diverted to WAdi Halawa for irrigation The excess water is measured by current meter method

5 Directions to Location of Station

At Zugaig WAJ station, in Wadi Halawa, West of Halawa village

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring

7 Other Observations

The excess water is contaminated by motor oil leakage at WAJ station Global position system UTM coordinates 7-48-102E and 35-87-619N Temperature 22 6°C and EC 690 micro s/cm

Author/Date Rola Abu Nahleh (12/03/97) Editor/Date Rania Shahin (12/09/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	24 November, 1997
Weather Conditions	
1 Station Identification	
Name	Birkit El Himma at Ain Janna
ID Number	AJ 0581
Basin	Rift Side Wadis
Aquifer	
Status	Active / annual
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

Use to have high flow declined sharply to insignificant flow (seepage)

Data Collected

Discharge and water quality (geochemistry)

4 Physical Description of Station

Use to flow in an open channel towards wadi Kufrinja

5 Directions to Location of Station

East WAJ pumping station East of Ajlun city

6 Proposed Action for Water Monitoring System Station

Upgrade to bi-annual monitoring

7 Other Observations

Global position system UTM coordinates 7-60-152E and 35-80-660N

Author/Date Rola Abu Nahleh (12/03/97) Editor/Date Rania Shahin (12/09/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	24 November, 1997
Weather Conditions	Partly Cloudy
1 Station Identification	
Name	Abu El Jood at Ain Janna
ID Number	AJ 0582
Basin	Rift Side Wadis
Aquifer	
Status	Active / annual
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

Use to have sugnificant flow declined sharply since 1993 (seepage)

Data Collected

Discharge and water quality (geochemistry)

4 Physical Description of Station

5 Directions to Location of Station

Near Amira Aisha Bint El Hussein Primary School, around 1km north west of Birkit El Himma at Ain Janna

6 Proposed Action for Water Monitoring System Station

Upgrade to bi-annual monitoring

7 Other Observations

Global position system UTM coordinates 7-59-180E and 35-81-437N

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Author/Date Rola Abu Nahleh (12/03/97) Editor/Date Rania Shahin (12/06/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	24 November 1997
Weather Conditions	Partly cloudy
1 Station Identification	
Name	El Buheira
ID Number	AK 0516
Basin	Rift Side Wadis
Aquifer	
Status	Active / annual
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

Significant flow (around 30m^3/hr during visit) used for irrigation

Data Collected

Discharge and water quality (geochemistry)

4 Physical Description of Station

Spring discharges in Wadi Rajib near road crossing Flow channel adequate for portable weir or current meter measurement

5 Directions to Location of Station

East of Rajeb town, in Wadi Rajeb at road crossing

6 Proposed Action for Water Monitoring System Station

Upgrade to monthly monitoring

7 Other Observations

Global position system UTM coordinates 7-58-310E and 35-71-65N Temperature 18°C and EC 620

micro s/cm

Author/Date Rola Abu Nahleh (12/03/97) Editor/Date Rania Shahin (12/07/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	24 November 1997
Weather Conditions	Clear sky
1 Station Identification	
Name	Fawwar
ID Number	AK 0520
Basin	Rift Side Wadis
Aquifer	
Status	Active / annual
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

High flow used for irrigation

Data Collected

Discharge and water quality (geochemistry)

4 Physical Description of Station

Spring discharges in Wadi Rajeb through a dirt channel which is suitable for portable weir or current meter measurement

5 Directions to Location of Station

In Wadi Rajeb, near Sami Said's farm

6 Proposed Action for Water Monitoring System Station

Upgrade to monthly monitoring

7 Other Observations

Flow records show a sign of discharge decline but average flow is still greater than 25 m^3/hr

Global position system UTM coordinates 7-51-856E and 35-70-511N Temperature 20°C and EC 850 micro s/cm

Author/Date Rola Abu Nahleh (12/03/97) Editor/Date Rania Shahin (01/22/98)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	24 November 1997
Weather Conditions	Clear sky
1 Station Identification	
Name	Ain Um Qasim
ID Number	AK 0521
Basin	Rift Side Wadis
Aquifer	
Status	Active / monthly
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

Significant flow used for domestic water supply (WAJ) and irrigation

Data Collected

Discharge and water quality (geochemistry)

4 Physical Description of Station

Most of the spring disharge is pumped by WAJ, the rest is diverted to Wadi Rajeb for irrigation Control channel is adequate for measuring the water flowing towards Wadi Rajeb by portable weir or current meter

5 Directions to Location of Station

Um Qasim WAJ pumping station

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring

7 Other Observations

Global position system UTM coordinates 7-51-916E and 35-70-770N Temperature 24°C and EC 740 micro s/cm

Author/Date Rania Shahin (11/30/97) Editor/Date Rania Shahin (12/09/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	29 November 1997
Weather Conditions	Partly Cloudy
1 Station Identification	
Name	El Khandaq
ID Number	AM 0502
Basin	Rift Side Wadis
Aquifer	
Status	Active / Annual
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

Use to have significant flow It is currently dry due to groundwater abstraction

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Dry

5 Directions to Location of Station

Opposite to Police Directorate, in Salt city

6 Proposed Action for Water Monitoring System Station

Upgrade to bi-annual monitoring

7 Other Observations

Global position system UTM coordinates 7-57-338E and 35-47-973N

Author/Date Rania Shahin (01/12/97) Editor/Date Rania Shahin (06/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	3 November 1997
Weather Conditions	Partly Cloudy

1 Station Identification

Name	Jadour Tahta
ID Number	AM 0504
Basin	Rift Side Wadis
Aquifer	
Status	Active / Monthly

2 Station Type

- ☐ Ground Water
- ☒ Springs
- ☐ Surface Water
- ☐ Other

Other

3 Station Purpose

- ☒ Water Resources
- ☒ Water Quality

Rationale for Station / Location

Significant flow used for irrigation Water is affected by bacteriological contamination

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Spring discharges in two channels, which are adequate for current meter or portable weir measurement

5 Directions to Location of Station

Salt town entrance, coming from Wadi Shue'ib, near Municipal Market

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring Assess and treat bacteriological contamination

7 Other Observations

Global position system UTM coordinates 7-58-140E and 35-47-370N

Temperature 20° C

Author/Date Rania Shahin (01/12/97) Editor/Date Rola Abu Nahleh (06/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	3 November 1997
Weather Conditions	Partly Cloudy

1 Station Identification

Name	Hazzir
ID Number	AM 0512
Basin	Rift Side Wadis
Aquifer	
Status	Active / Monthly

2 Station Type

- ☐ Ground Water
- ☒ Springs
- ☐ Surface Water
- ☐ Other

Other

3 Station Purpose

- ☒ Water Resources
- ☒ Water Quality

Rationale for Station / Location

Significant flow used for domestic water supply (WAJ) and irrigation

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Part of the discharge is piped, at source, to WAJ pumping station and the rest flows to Wadi Shue'ib The current monitoring site is not adequate A permanent weir is more suitable for measuring the discharge to the Wadi

5 Directions to Location of Station

Hazzir WAJ pumping station, near Wadi Shue'ib Rest House

6 Proposed Action for Water Monitoring System Station

Install a permanent weir to measure discharge to Wadi Shue'ib Check bacteriological contamination Continue monthly monitoring

7 Other Observations

Global position system UTM coordinates 7-58-247E and 35-45-624N

Temperature 20° C

Author/Date Rola Abu Nahleh (03/12/97) Editor/Date Rania Shahin (06/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	29 November, 1997
Weather Conditions	Partly Cloudy

1 Station Identification

Name	Al Azraq (Fuheis)
ID Number	AM 0526
Basin	Rift Side Wadis
Aquifer	
Status	Active / monthly

2 Station Type

- ☐ Ground Water
- ☒ Springs
- ☐ Surface Water
- ☐ Other

Other

3 Station Purpose

- ☒ Water Resources
- ☒ Water Quality

Rationale for Station / Location

High flow used for domestic water supply (WAJ)

Data Collected

Discharge and water quality (geochemistry)

4 Physical Description of Station

Spring discharge is intercepted by WAJ pumping station Excess flows in a channel, which is adequate for current meter measurement

5 Directions to Location of Station

Salt-Fuheis road, Fuheis WAJ station

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring Check and monitor bacteriological contamination

7 Other Observations

Global position system UTM coordinates 7-60-937E and 35-46-111N Temperature 20°C and EC 500 micro s/cm

Author/Date Rania Shahin (01/12/97) Editor/Date Rola Abu Nahleh (06/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	5 November 1997
Weather Conditions	Partly Cloudy, Windy

1 Station Identification

Name	Shore'a
ID Number	AM 0528
Basin	Rift Side Wadis
Aquifer	
Status	Active / Monthly

2 Station Type

- ☐ Ground Water
- ☒ Springs
- ☐ Surface Water
- ☐ Other

Other

3 Station Purpose

- ☒ Water Resources
- ☒ Water Quality

Rationale for Station / Location

High discharge used mainly for domestic water supply (WAJ), excess water, mainly during winter and spring, flows to Wadi Shue'ib

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Spring discharge is piped to WAJ pumping station Excess water is measured in open channel, near spring source The monitoring site is suitable for current meter and portable weir measurement

5 Directions to Location of Station

3 4 km South east of salt sewage treatment plant, in Wadi Shue'ib

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring Carry out bacteriological contamination analysis, in addition, to routine water quality monitoring

7 Other Observations

Global position system UTM coordinates 7-59-870E and 35-45-020N Temperature 19°C and Ec 520 micro S/cm

Author/Date Rania Shahin (12/01/97) Editor/Date Rola Abu Nahleh (12/06/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	3 November 1997
Weather Conditions	Partly Cloudy
1 Station Identification	
Name	Baqouriyyeh
ID Number	AM 0530
Basin	Rift Side Wadis
Aquifer	
Status	Active / Monthly
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

High discharge used for domestic water supply (WAJ) and irrigation

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Part of the spring discharge is piped to WAJ pumping station and the rest is diverted to two channels, an irrigation channel and a channel flowing in Wadi Shue'ib Current meter method is used to measure the flow at both channels

5 Directions to Location of Station

Baqouriyyeh WAJ pumping station

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring Install a permanent weir near spring source to measure all the flow in excess to piped flow (WAJ Station)

7 Other Observations

Global position system UTM coordinates 7-58-126E and 35-42-300N

Temperature 22 6° C and Ec 650 micro S/cm

Author/Date Rania Shahin (12/01/97) Editor/Date Rania Shahin (01/14/98)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	3 November 1997
Weather Conditions	Partly Cloudy
1 Station Identification	
Name	Essabrah
ID Number	AM 0532
Basin	Rift Side Wadis
Aquifer	
Status	Inactive / Annual
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

Significant flow used for irrigation

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Spring discharge is collected in a basin connected to a concrete canal flowing towards Wadi Shue'ib The discharge is estimated as the difference between the Wadi Shue'ib flows downstream and upstream of the spring

5 Directions to Location of Station

Wadi Shue'ib around 800 m from Petrol station Wadi Shue'ib-Salt road

6 Proposed Action for Water Monitoring System Station

Reactivate and upgrade to monthly monitoring A new monitoring site was selected to measure the discharge at concrete canal near the spring source prior to diversion in Wadi Shue'ib

7 Other Observations

Only 4 scattered records during the 1985-95 period

Global position system UTM coordinates of new site 7-58-103E and 35-41-602N Temperature 22 5° C and Ec 770 micro S/cm

Author/Date Rola Abu Nahleh (03/12/97) Editor/Date Rola Abu Nahleh (06/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	29 November, 1997
Weather Conditions	Partly Cloudy

1 Station Identification

Name	Mahis
ID Number	AM 0534
Basin	Rift Side Wadis
Aquifer	
Status	Active / monthly

2 Station Type

- ☐ Ground Water
- ☒ Springs
- ☐ Surface Water
- ☐ Other

Other

3 Station Purpose

- ☒ Water Resources
- ☒ Water Quality

Rationale for Station / Location

Significant flow used for domestic water supply (WAJ) and irrigation

Data Collected

Discharge and water quality (geochemistry)

4 Physical Description of Station

Spring discharge is diverted to WAJ pumping station The excess flows in a concrete canal, which is suitable for weir or current meter measurement

5 Directions to Location of Station

In Mahis Town, El Madaris road, at WAJ pumping station

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring Check and monitor bacteriological contamination

7 Other Observations

Global position system UTM coordinates 7-61-594E and 35-42-390N Temperature 19°C and EC 640 micro s/cm

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Author/Date Rania Shahin (30/11/97) Editor/Date Rola Abu Nahleh (06/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	1 November 1997
Weather Conditions	Clear Sky

1 Station Identification

Name	Bahhath
ID Number	AN 0502
Basin	Rift Side Wadis
Aquifer	
Status	Active / Monthly

2 Station Type

- ☐ Ground Water
- ☒ Springs
- ☐ Surface Water
- ☐ Other

Other

3 Station Purpose

- ☒ Water Resources
- ☒ Water Quality

Rationale for Station / Location

High flow used for irrigation

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Spring discharges into three channels, which are monitored at three near by sites adequate for current meter measurement

5 Directions to Location of Station

From Tarabil spring, take Wadi El Shita road towards Marj El Hamam until Wadi El Shita's Primary School Take first right to El Bahhath road

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring

7 Other Observations

Global position system UTM coordinates 7-65-200E and 35-33-244N Temperature 20^0 C and Ec 610 micro S/cm

Author/Date Rania Shahin (11/30/97) Editor/Date Rania Shahin (01/14/98)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	1 November 1997
Weather Conditions	Clear Sky
1 Station Identification	
Name	Kursi
ID Number	AN 0532
Basin	Rift Side Wadis
Aquifer	
Status	Active / Annual
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

Intermittent but has significant discharge during the winter used for irrigation of seasonal crops No flow (dry) during visit

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Current site is not adequate for flow measurement A new site is selected downstream of road crossing around 30m downstream of existing site

5 Directions to Location of Station

Around 400 meters east of Wadi Es Sir WAJ station, in Wadi Es Sir

6 Proposed Action for Water Monitoring System Station

Relocate monitoring site as described above Remove weed from new site Upgrade monitoring to seasonal (4 times a year) Assess bacteriological contamination

7 Other Observations

Global position system UTM coordinates for the new site 7-66-460E and 35-39-160N

Author/Date Rania Shahin (30/11/97) Editor/Date Rola Abu Nahleh (06/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	1 November 1997
Weather Conditions	Clear Sky

1 Station Identification

Name	Wadi Es Sir
ID Number	AN 0534
Basin	Rift Side Wadis
Aquifer	
Status	Active / Monthly

2 Station Type

- ☐ Ground Water
- ☒ Springs
- ☐ Surface Water
- ☐ Other

Other

3 Station Purpose

- ☒ Water Resources
- ☒ Water Quality

Rationale for Station / Location

High flow previously used mainly for domestic water supply The residual discharges, in excess to WAJ pumping is used for irrigation WAJ stopped the exploitation of this spring due to bacteriological contamination

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Large diameter pipe for water supply and two open channels (one concrete and one natural) for the excess discharge Total discharge consists of water supply intake, obtained from WAJ station operator, and current meter measurement from open channels

5 Directions to Location of Station

Es Sir WAJ pumping station in Wadi Es Sir

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring at the site Treat and monitor bacteriological contamination

7 Other Observations

Global position system UTM coordinates 7-66-038E and 35-38-729N

Temperature 18 8° C and EC 730 micro S/cm

Author/Date Rania Shahin (30/11/97) Editor/Date Rola Abu Nahleh (06/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	1 November 1997
Weather Conditions	Clear Sky

1 Station Identification

Name	Kheil
ID Number	AN 0536
Basin	Rift Side Wadis
Aquifer	
Status	Active / Monthly

2 Station Type

- ☐ Ground Water
- ☒ Springs
- ☐ Surface Water
- ☐ Other

Other

3 Station Purpose

- ☒ Water Resources
- ☒ Water Quality

Rationale for Station / Location

Significant discharge used for irrigation

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Spring flows from source to a natural channel in Wadi Es Sir The monitoring site is adequate for portable weir or current meter measurement

5 Directions to Location of Station

Around 3 km south of Es Sir spring, in Wadi Es Sir

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring at site Assess and monitor bacteriological contamination

7 Other Observations

Global position system UTM coordinates 7-66-153E and 35-35-727N

Temperature 18 7°C and Ec 700 micro S/cm

Author/Date Rania Shahin (30/11/97) Editor/Date Rola Abu Nahleh (06/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	1 November 1997
Weather Conditions	Clear Sky

1 Station Identification

Name	Deir El Fouqa
ID Number	AN 0542
Basin	Rift Side Wadis
Aquifer	
Status	Active / Monthly

2 Station Type

- ☐ Ground Water
- ☒ Springs
- ☐ Surface Water
- ☐ Other

Other

3 Station Purpose

- ☒ Water Resources
- ☒ Water Quality

Rationale for Station / Location

Significant intermittent flow used for irrigation The flows are highly variable, ranging from zero during dry years to 270 m^3/hr during wet years

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Monitoring site in open natural channel Natural vegetation (weed) must be removed to insure accurate current meter water measurement

5 Directions to Location of Station

Around 2 km south west of Es Sir spring, in Wadi Es Sir

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring Remove weed prior to current meter measurement Assess and monitor bacteriological contamination

7 Other Observations

Global position system UTM coordinates 7-64-390E and 35-36-915N Temperature 19° C and Ec 740 micro S/cm

Author/Date Rania Shahin (11/30/97) Editor/Date Rola Abu Nahleh (12/06/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	1 November 1997
Weather Conditions	Clear Sky
1 Station Identification	
Name	Deir El Tahta
ID Number	AN 0544
Basin	Rift Side Wadis
Aquifer	
Status	Active / Monthly
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

Significant flow used for irrigation

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Monitoring site in natural channel which needs to be cleared from vegetation (weed) prior to current meter measurement Additional flow discharge occurs along the wadi reach between Deir El Fouqa and Deir El Tahta

5 Directions to Location of Station

Around 200 m downstream of Deir El Fouqa in Wadi Es Sir

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring Remove weed prior to current water measurement Measure discharges occurring between Deir El Fouqa and Deir El Tahta Assess and monitor bacteriological contamination

7 Other Observations

Global position system UTM coordinates 7-64-182E & 35-36-745N Temperature 19°C & Ec 730 micro S/cm

Author/Date Rania Shahin (30/11/97) Editor/Date Rola Abu Nahleh (06/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	1 November 1997
Weather Conditions	Clear Sky
1 Station Identification	
Name	Tarabil
ID Number	AN 0554
Basin	Rift Side Wadis
Aquifer	
Status	Active / Monthly
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

Significant flow used for irrigation

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

No adequate site for direct measurement of discharge Spring flows are estimated by subtracting the discharge measured upstream of spring from the discharge measured downstream of Tarabil The two monitoring sites are adequate for current meter measurement

5 Directions to Location of Station

Around 3 5 km southwest of Es Sir spring, in Wadi Es Sir

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring Assess and monitor bacteriological contamination

7 Other Observations

Global position system UTM coordinates 7-61-780E and 35-38-280N

Temperature 19 8° C and Ec 0 80 micro S/cm

Author/Date Rania Shahin (11/30/97) Editor/Date Rania Shahin (12/09/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	3 November 1997
Weather Conditions	Partly Cloudy
1 Station Identification	
Name	Ain Wadi Kufrein
ID Number	AN 0566
Basin	Rift Side Wadis
Aquifer	
Status	Inactive / Monthly
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

Use to have high flow for irrigation It has declined sharply due to groundwater abstraction

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Spring discharges in Wadi Kufrein Flows are measured by weir or current meter method

5 Directions to Location of Station

Downstream of Kufrein dam

6 Proposed Action for Water Monitoring System Station

Reactivate to seasonal monitoring

7 Other Observations

Author/Date Rania Shahin (30/11/97) Editor/Date Rola Abu Nahleh (06/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	2 November 1997
Weather Conditions	Partly Cloudy

1 Station Identification

Name	Faria
ID Number	AP 0506
Basin	Rift Side Wadis
Aquifer	
Status	Active / Monthly

2 Station Type

- ☐ Ground Water
- ☒ Springs
- ☐ Surface Water
- ☐ Other

Other

3 Station Purpose

- ☒ Water Resources
- ☒ Water Quality

Rationale for Station / Location

Significant flow used for irrigation

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Spring discharges in two irrigation canals and a natural channel which flows towards Wadi Hisban The canals and the natural channel are suitable for current meter measurement and portable weir (during low flows) Flows in natural channel can also be monitored at road crossing near Kdeeshah spring

5 Directions to Location of Station

Around 350 meters north west of Kdeeshah spring

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring

7 Other Observations

Global Position System UTM coordinates 7-64-800E and 35-25-770N

Temperature 19 8^{0} C and Ec 550 micro S/cm

Author/Date Rania Shahin (01/12/97) Editor/Date Rola Abu Nahleh (06/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	2 November 1997
Weather Conditions	Partly Cloudy

1 Station Identification

Name	Ain Wadi Hisban
ID Number	AP 0508
Basin	Rift Side Wadis
Aquifer	
Status	Active / Monthly

2 Station Type

- ☐ Ground Water
- ☒ Springs
- ☐ Surface Water
- ☐ Other

Other

3 Station Purpose

- ☒ Water Resources
- ☒ Water Quality

Rationale for Station / Location

Significant flow used for irrigation Records show a discharge decrease during the last few years

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Spring discharges in a natural channel, which is suitable for current meter measurement

5 Directions to Location of Station

East of seyl Hisban Village, upwadi from Faria spring

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring

7 Other Observations

Global position system UTM coordinates 7-64-847E and 35-25-779N Temperature 20^0 C and Ec 580 micro S/cm

Author/Date Rania Shahin (01/12/97) Editor/Date Rola Abu Nahleh (06/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	2 November 1997
Weather Conditions	Partly Cloudy

1 Station Identification

Name	Kdeeshah
ID Number	AP 0510
Basin	Rift Side Wadis
Aquifer	
Status	Active / Monthly

2 Station Type

- ☐ Ground Water
- ☒ Springs
- ☐ Surface Water
- ☐ Other

Other

3 Station Purpose

- ☒ Water Resources
- ☒ Water Quality

Rationale for Station / Location

Significant flow used for irrigation

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Spring discharges in a natural channel, in Wadi Hisban Monitoring site is adequate for portable weir measurement during low flows and current water measurement at medium and high flows

5 Directions to Location of Station

East of seyl Hisban Village, near Mohammed El Fuqara's home

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring

7 Other Observations

Global position system UTM coordinates 7-64-446E and 35-25-544N

Temperature 19 9^{0} C and Ec 530 micro S/cm

Author/Date Rania Shahin (12/01/97) Editor/Date Rola Abu Nahleh (12/06/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	2 November 1997
Weather Conditions	Partly Cloudy
1 Station Identification	
Name	Mbeirdah
ID Number	AP 0518
Basin	Rift Side Wadis
Aquifer	
Status	Active / Monthly
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

High flow used for irrigation

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Current monitoring location is adequate only for low flows

5 Directions to Location of Station

West of seyl Hisban Village, around 300 meters north west of Sumiya spring, at Al Ballbisi's farm

6 Proposed Action for Water Monitoring System Station

Install permanent weir, near spring source to measure all flow ranges Continue monthly monitoring

7 Other Observations

Global position system UTM coordinates 7-62-200E and 35-23-633N Temperature 20°C and Ec 620 micro S/cm

Author/Date Rania Shahin (01/12/97) Editor/Date Rola Abu Nahleh (06/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	2 November 1997
Weather Conditions	Partly Cloudy
1 Station Identification	
Name	Sumiya
ID Number	AP 0520
Basin	Rift Side Wadis
Aquifer	
Status	Active / Monthly
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

Significant flow used for irrigation

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Site is not adequate for current meter measurement, but satisfactory for portable weir

5 Directions to Location of Station

West of seyl Hisban Village, near Al Ballbisi's farm

6 Proposed Action for Water Monitoring System Station

Continue monitoring at the site Construct a permanent weir near the source pool area

7 Other Observations

Global position system UTM coordinates 7-62-280E and 35-23-345N

Temperature 21 8° C and Ec 590 micro S/cm

Dead Sea Basins

Author/Date Rania Shahin (01/12/97) Editor/Date Rania Shahin (09/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	15 November 1997
Weather Conditions	Clear Sky
1 Station Identification	
Name	El Hadeitheh
ID Number	CA 0502
Basin	Dead Sea
Aquifer	
Status	Active / Monthly
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

Very high flow (appr 800m^3/hr during visit), developed by JVA for irrigation

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

JVA spring diversion station, concrete open channel, ideal for current meter measurement

5 Directions to Location of Station

300 meters East of Dead Sea, Aqaba road, at Wadi El Hadeitheh

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring

7 Other Observations

Global position system UTM coordinates 7-41-665E and 34-65-310N Temperature 28 degrees C

Author/Date Rania Shahin (01/12/97) Editor/Date Rania Shahin (08/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	3 November 1997
Weather Conditions	Clear Sky
1 Station Identification	
Name	Zara 1
ID Number	CA 0520
Basin	Dead Sea
Aquifer	
Status	Active / Monthly
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

High thermal discharge flowing to the Dead Sea

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Spring discharges into a wadi channel which flows to the Dead Sea Flow control channel is adequate for current meter measurement

5 Directions to Location of Station

1 3km south of Dead Sea Hotel, few meters up Wadi of Dead Sea - Aqaba road culvert

6 Proposed Action for Water Monitoring System Station

Name to be changed from Zara 1 to Zara A Continue monthly monitoring Take temperature readings, geochemistry and bacteriological data on routine basis

7 Other Observations

Global position system UTM coordinates 7-43-127E and 34-99-110N

Temperature 39 5° C

Author/Date Rania Shahin (12/01/97) Editor/Date Rania Shahin (12/08/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	3 November 1997
Weather Conditions	Clear Sky
1 Station Identification	
Name	Zara B
ID Number	NA
Basin	Dead Sea
Aquifer	
Status	New / Monthly
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

High thermal flow partially used for irrigation the rest discharges into the Dead Sea

Data Collected

None

4 Physical Description of Station

Zara No 2 Zara No 4 Zara No 5 and Zara No 6 were found to originate from a common spring This spring discharges into a channel which is suitable for current meter measurement Zara B is the name which is assigned to this spring

5 Directions to Location of Station

Southeast of H H Princess Basma a farm east of Dead Sea - Aqaba road

6 Proposed Action for Water Monitoring System Station

Discontinue monitoring at Zara No 2 Zara No 4 Zara No 5 and Zara No 6 Start monthly monitoring at Zara B Take temperature geochemistry and bacteriological data on routine basis

7 Other Observations

Global position system UTM coordinates 7-43-776E and 34-98-724N

Temperature 54° C

Author/Date Rania Shahin (01/12/97) Editor/Date Rola Abu Nahleh (07/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	3 November 1997
Weather Conditions	Clear Sky
1 Station Identification	
Name	Zara 7
ID Number	CA 0532
Basin	Dead Sea
Aquifer	
Status	Active / Monthly
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

High discharge flowing to the Dead Sea

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Spring discharges in Wadi Abu Khsheiba Control channel adequate for current meter measurement

5 Directions to Location of Station

In Wadi Abu Khsheiba, near Dead Sea - Aqaba road

6 Proposed Action for Water Monitoring System Station

Name to be changed from Zara 7 to Zara C Continue monthly monitoring

7 Other Observations

Global position system UTM coordinates 7-42-545E and 34-96 - 572N

Temperature 29° C

Author/Date Rania Shahin (01/12/97) Editor/Date Rania Shahin (08/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	3 November 1997
Weather Conditions	Clear Sky
1 Station Identification	
Name	Zara 8
ID Number	CA 0534
Basin	Dead Sea
Aquifer	
Status	Active / Monthly
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

Significant discharge partially used for irrigation, domestic water supply (Ministry of Defence), the rest flows to Dead Sea

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Spring discharges into a channel (near spring source), which is suitable for current meter measurement

5 Directions to Location of Station

East of Dead Sea - Aqaba road, east of Munir Sakhtian's farm

6 Proposed Action for Water Monitoring System Station

Change the name from Zara 8 to Zara D Continue monthly monitoring Take temperature readings, geochemistry and bacteriological data

7 Other Observations

Global position system UTM coordinates of new site 7-43-117E and 34-96 - 027N

Temperature 54 5° C

Author/Date Rania Shahin (01/12/97) Editor/Date Rania Shahin (08/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	15 November 1997
Weather Conditions	Clear Sky

1 Station Identification

Name	Zara E
ID Number	NE
Basin	Dead Sea
Aquifer	
Status	New / Monthly

2 Station Type

- ☐ Ground Water
- ☒ Springs
- ☐ Surface Water
- ☐ Other

Other

3 Station Purpose

- ☒ Water Resources
- ☒ Water Quality

Rationale for Station / Location

Significant flow to the Dead Sea

Data Collected

None

4 Physical Description of Station

Spring discharges in Wadi channel towards the Dead Sea Monitoring site, upstream of Dead Sea - Aqaba, is adequate for current meter measurement

5 Directions to Location of Station

Around 2 5km South of Munir Sakhtian's farm, upstream of Dead Sea - Aqaba road

6 Proposed Action for Water Monitoring System Station

Start monthly monitoring Take temperature readings, geochemistry and bacteriological data on routine basis

7 Other Observations

Global position system UTM coordinates of new site 7-42-647E and 34-93 - 570N

Temperature 31° C

Author/Date Rania Shahin (01/12/97) Editor/Date Rania Shahin (08/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	15 November 1997
Weather Conditions	Clear Sky

1 Station Identification

Name	Zara F
ID Number	New
Basin	Dead Sea
Aquifer	
Status	New / Monthly

2 Station Type

- ☐ Ground Water
- ☒ Springs
- ☐ Surface Water
- ☐ Other

Other

3 Station Purpose

- ☒ Water Resources
- ☒ Water Quality

Rationale for Station / Location

Significant discharge flowing towards the Dead Sea

Data Collected

None

4 Physical Description of Station

Spring discharges into a Wadi channel, which is suitable for portable weir or current meter measurement

5 Directions to Location of Station

Near Dead Sea - Aqaba road, upstraem of the bridge, 3 3km south of Munir Sakhtian's farm

6 Proposed Action for Water Monitoring System Station

Start monthly monitoring take temperature readings, geochemostry and bacteriological data

7 Other Observations

Global position system UTM coordinates of new site 7-42-776E and 34-92 -855N

Temperature 30^0 C

Author/Date Rania Shahin (01/12/97) Editor/Date Rola Abu Nahleh (06/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	3 November 1997
Weather Conditions	Clear Sky

1 Station Identification

Name	Hirreh
ID Number	CA 0622
Basin	Dead Sea
Aquifer	
Status	Active / Monthly

2 Station Type

- ☐ Ground Water
- ☒ Springs
- ☐ Surface Water
- ☐ Other

Other

3 Station Purpose

- ☒ Water Resources
- ☒ Water Quality

Rationale for Station / Location

Significant flow used for irrigation

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Spring discharge intercepted by irrigation canal, adequate for current meter and weir measurement

5 Directions to Location of Station

East of Suweima Village downstream of Al Odheima spring, near Mohammed Harb Al Masanda's farm

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring Change the name of Hirreh No 1 to Hirreh

7 Other Observations

Database shows Hirreh No 1 and Hirreh No 2 This site correspond to Hirreh No 1 Hirreh No 2 data consist of 7 sporadic measurements taken during the September 1960 and January 1985 period with two measurements duplicated in Hirreh No 1 According to the field visit of 3 November 1997 there is only one significant spring in the area

Global position system UTM coordinates 7-49-527E and 35-18-878N Temperature 26^{0} C

Author/Date Rania Shahin (01/12/97) Editor/Date Rania Shahin (01/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	3 November 1997
Weather Conditions	Clear Sky

1 Station Identification

Name	Suweima
ID Number	CA 0638
Basin	Dead Sea
Aquifer	
Status	Active / Monthly

2 Station Type

- ☐ Ground Water
- ☒ Springs
- ☐ Surface Water
- ☐ Other

Other

3 Station Purpose

- ☒ Water Resources
- ☒ Water Quality

Rationale for Station / Location

High flow used for irrigation

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Spring discharge intercepted by concrete canal which is connected to a dirt channel Old site at dirt channel was relocated to concrete canal near the spring source

5 Directions to Location of Station

Suweima Village East of Mosque

6 Proposed Action for Water Monitoring System Station

Start monthly monitoring at new selected site

7 Other Observations

Global position system UTM coordinates of the new site 7-46-650E and 35-18-022N Temperature 27 2 degrees C and Ec 3654 micro S/cm

Author/Date Rania Shahin (01/12/97) Editor/Date Rola Abu Nahleh (06/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	2 November 1997
Weather Conditions	Partly Cloudy

1 Station Identification

Name	Ras El May Ma'in
ID Number	CA 0654
Basin	Dead Sea
Aquifer	
Status	Active / Monthly

2 Station Type

- ☐ Ground Water
- ☒ Springs
- ☐ Surface Water
- ☐ Other

Other

3 Station Purpose

- ☒ Water Resources
- ☒ Water Quality

Rationale for Station / Location

Significant flow used for irrigation

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Spring discharges in two channels, which are suitable for portable weir and current meter measurement

5 Directions to Location of Station

Around 11 km west of Main Police station, near Mohammed Amin Lejfrerat's farm

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring

7 Other Observations

Global position system UTM coordinates 7-56-312E and 35-04-442N Temperature 29°C and Ec 700 micro S/cm

Author/Date Rania Shahin (01/12/97) Editor/Date Rania Shahin (10/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	15 November 1997
Weather Conditions	Clear Sky
1 Station Identification	
Name	Marwaha Kabireh
ID Number	CA 0672
Basin	Dead Sea
Aquifer	
Status	Active / Monthly
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

Use to have significant flow (average of 37 9 m^3/hr) which is used for irrigation The discharge has declined (appr 8m^3/hr during visit) due to groundwater abstraction in the well field of SAFI Potassium Co

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Spring discharges in Wadi El Hadeitheh, control channel satisfactory for medium to high flow measurement During low flows current meter measurements are not applicable and portably weir measurements are marginal

5 Directions to Location of Station

At El Hadeitheh Village, in Wadi El Hadeitheh, at Dead Sea - Aqaba bridge

6 Proposed Action for Water Monitoring System Station

Change monitoring frequency to bi-annual

7 Other Observations

Author/Date Rania Shahin (01/12/97) Editor/Date Rania Shahin (08/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	15 November 1997
Weather Conditions	Clear Sky
1 Station Identification	
Name	Sikkin
ID Number	CA 0674
Basin	Dead Sea
Aquifer	
Status	Inactive / Annual
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

Use to have significant flow, it is currently dry due to groundwater abstraction in the well field of Safi Potassium Co

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Dry

5 Directions to Location of Station

6 Proposed Action for Water Monitoring System Station

Visit site on a yearly basis in winter period to check possibility of discharge during wet years

7 Other Observations

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Author/Date Rania Shahin (01/12/97) Editor/Date Rola Abu Nahleh (06/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	2 November 1997
Weather Conditions	Cloudy
1 Station Identification	
Name	W Zarqa Ma'in
ID Number	CA 0686
Basin	Dead Sea
Aquifer	
Status	Active / Monthly
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

Monitor flood flows, baseflow, and Wadi Ma'in springs which flow towards the Dead Sea

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

The continuos record gauge downstream of Wadi Ma'in records only medium to high flow stages Spring flows are measured separately in the lower Wadi bed A new site was selected in order to record all the surface water and spring flows

5 Directions to Location of Station

Wadi Ma'in near Ghor-Aqaba highway

6 Proposed Action for Water Monitoring System Station

Relocate existing continuous Wadi flow gauge in order to record spring flows, baseflow and flood flows, few meters upstream of old site

7 Other Observations

Do not count spring flow, which was monitored in Ma'in Thermal springs complex, as an additional downstream resource

Global position system UTM coordinates of proposed site 7-43-497E and 35-00-999N Temperature 31 3° C

Author/Date Rania Shahin (12/01/97) Editor/Date Rania Shahin (01/21/98)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	2 November 1997
Weather Conditions	Cloudy
1 Station Identification	
Name	Ma'in Upstream
ID Number	
Basin	Dead Sea
Aquifer	
Status	New
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

High discharge upstream of Ma'in hot springs

Data Collected

New site

4 Physical Description of Station

High discharge in Wadi Ma'in from springs flowing from the upstream of the Wadi Flows are estimated at 300 to 400 m^3/hr (during visit) Ideal site for current meter measurement was selected few meters east of Ma'in road culverts

5 Directions to Location of Station

Few meters East of Wadi Main road culverts in Wadi Main, near main entrance inside the Ma'in Thermal springs complex

6 Proposed Action for Water Monitoring System Station

Start monthly monitoring of discharge Take temperature readings geochemistry and bacteriological data

on routine basis

7 Other Observations

Global position system UTM coordinates 7-47-745E & 34-99-877N Temperature 34 2^0 C

Author/Date Rania Shahin (01/12/97) Editor/Date Rola Abu Nahleh (06/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	2 November 1997
Weather Conditions	Cloudy

1 Station Identification

Name	Ma'in East
ID Number	
Basin	Dead Sea
Aquifer	
Status	New

2 Station Type

- ☐ Ground Water
- ☒ Springs
- ☐ Surface Water
- ☐ Other

Other

3 Station Purpose

- ☒ Water Resources
- ☒ Water Quality

Rationale for Station / Location

Thermal spring (high discharge) used for tourism and therapy

Data Collected

New site

4 Physical Description of Station

Spring discharge is intercepted by two concrete channels, which are adequate for current meter measurement or permanent weir

5 Directions to Location of Station

East of Esh Shallal spring, north of staff housing unit, inside the Ma'in Thermal springs complex, west of the entrance

6 Proposed Action for Water Monitoring System Station

Start monthly monitoring of discharge at new selected sites in both channels Take temperature readings, geochemistry and bacteriological data on routine basis

7 Other Observations

Global position system UTM coordinates 7-47-946E and 35-00-205N

Temperature 55° C

Author/Date Rania Shahin (01/12/97) Editor/Date Rola Abu Nahleh (06/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	2 November 1997
Weather Conditions	Cloudy
1 Station Identification	
Name	Esh Shallal
ID Number	CA 0688
Basin	Dead Sea
Aquifer	
Status	Active / Monthly
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

Thermal spring used for tourism and therapy

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Flows are intercepted by concrete canal which feeds the famous Main Largest Hot Water falls (wet falls) Flows are currently measured by current meter, upstream of a broken old rectangular weir

5 Directions to Location of Station

Main Thermal station, on hill north of Ishtar Hotel, inside of Ma'in Thermal springs complex

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring and rehabilitate the permanent weir Take temperature readings, geochemistry and bacteriological data on routine basis

7 Other Observations

Global position system UTM coordinates 7-47-440E and 35-00-193N Temperature 57° C and Ec 2010 micro S/cm

Author/Date Rania Shahin (01/12/97) Editor/Date Rola Abu Nahleh (06/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	2 November 1997
Weather Conditions	Cloudy
1 Station Identification	
Name	Hammam Amir
ID Number	CA 0690
Basin	Dead Sea
Aquifer	
Status	Active / Monthly
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

Thermal spring used for tourism and therapy

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Flows are intercepted by a concrete canal which has a broken weir Discharge measurements are done by current meter, downstream of weir

5 Directions to Location of Station

West of Esh Shallal, on the hill north of the Mosque, inside of Ma'in Thermal springs complex

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring and rehabilitate the permanent weir Take temperature readings, geochemistry and bacteriological data on routine basis

7 Other Observations

Global position system UTM coordinates 7-46-987E and 35-00-155N

Temperature 47 3^{0} C and Ec 1992 micro S/cm

Author/Date Rania Shahin (01/12/97) Editor/Date Rola Abu Nahleh (06/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	2 November 1997
Weather Conditions	Cloudy

1 Station Identification

Name	El Magara
ID Number	CA 0692
Basin	Dead Sea
Aquifer	
Status	Active / Monthly

2 Station Type

- ☐ Ground Water
- ☒ Springs
- ☐ Surface Water
- ☐ Other

Other

3 Station Purpose

- ☒ Water Resources
- ☒ Water Quality

Rationale for Station / Location

Thermal spring used for tourism and therapy

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Spring discharges in two points, one currently monitored and the other not monitored The site used to monitor the first source is not adequate because of obstruction by construction A new site was selected, at around 6 meters from current site, to measure both discharges

5 Directions to Location of Station

Near bathing area, behind the mosque, in the Ma'in Thermal springs complex

6 Proposed Action for Water Monitoring System Station

Discontinue monitoring at current site Continue monthly monitoring at new selected site Take temperature readings, geochemistry and bacteriological data on routine basis

7 Other Observations

Global position system UTM coordinates of new site 7-47-038E and 35-00-140N Temperature 50 3 ^{0}C and Ec 2022 micro S/cm

Author/Date Rania Shahin (01/12/97) Editor/Date Rania Shahin (08/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	17 November 1997
Weather Conditions	Clear Sky
1 Station Identification	
Name	W Issal
ID Number	CA 0706
Basin	Dead Sea
Aquifer	
Status	Inactive / Monthly
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

High flow used for irrigation

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Spring discharges in Wadi Issal, flow path variable with floods Flow is measured by current meter method

5 Directions to Location of Station

Around 2 km North of Ghor Issal Salt Plant East of Heidar El Majali's farm, 1 km East of Ghor-Aqaba Road

6 Proposed Action for Water Monitoring System Station

Resume monthly monitoring

7 Other Observations

According to flow records the monitoring stopped in late 1985

Global position system UTM coordinates 7-42-111E and 34-53-915N Temperature 24 degrees C

Author/Date Rania Shahin (01/12/97) Editor/Date Rola Abu Nahleh (06/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	16 November 1997
Weather Conditions	Clear Sky

1 Station Identification

Name	El Fara'a
ID Number	CA 0778
Basin	Dead Sea
Aquifer	
Status	Active / Monthly

2 Station Type

- ☐ Ground Water
- ☒ Springs
- ☐ Surface Water
- ☐ Other

Other

3 Station Purpose

- ☒ Water Resources
- ☒ Water Quality

Rationale for Station / Location

Significant discharge used for irrigation

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Spring discharges in three irrigation canals, which are suitable for current meter or portable weir measurement A monitoring site is selected for each canal (see coordinates)

5 Directions to Location of Station

Site I At Jamil La'wiset's farm

Site II At Aoud El Ma'itah's farm

Site III At Qacem El Ma'itah's farm

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring

7 Other Observations

Global position system UTM coordinates

Site I 7-56-309E and 34-63-984N

Site II 7-54-465E and 34-63-633N

Site III 7-56-201E and 34-64-250N

Temperature 20 6 degrees C and Ec 600 micro S/cm

Author/Date Rania Shahin (01/12/97) Editor/Date Rania Shahin (01/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	3 November 1997
Weather Conditions	Clear Sky

1 Station Identification

Name	El Odheima at Suweima
ID Number	CA 0841
Basin	Dead Sea
Aquifer	
Status	Active / Monthly

2 Station Type

- ☐ Ground Water
- ☒ Springs
- ☐ Surface Water
- ☐ Other

Other

3 Station Purpose

- ☒ Water Resources
- ☒ Water Quality

Rationale for Station / Location

Significant flow used for irrigation

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Spring discharge is intercepted by an irrigation channel, adequate for current meter and weir measurement

5 Directions to Location of Station

Around 1 km West of Hirreh spring, south of JVA well

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring

7 Other Observations

Global position system UTM coordinates 7-48-433E and 35-19-377N Temperature 26 5 degrees C and Ec 2714 micro S/cm

Author/Date Rania Shahin (01/12/97) Editor/Date Rola Abu Nahleh (06/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	17 November 1997
Weather Conditions	Clear Sky
1 Station Identification	
Name	Seil El Buleideh
ID Number	CE 0502
Basin	Dead Sea
Aquifer	
Status	Inactive / Monthly
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

High flow used for irrigation

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Spring discharges in Wadi El Buleideh, flow path varies with floods Flow is measured by current meter method

5 Directions to Location of Station

4 5 km, East of Hadeethah Primary School

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring

7 Other Observations

According to flow records the monitoring stopped in late 1987

Global position system UTM coordinates 7-44-295E and 34-65-493N Temperature 23°C

Author/Date Rania Shahin (01/12/97) Editor/Date Rola Abu Nahleh (06/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	16 November 1997
Weather Conditions	Clear Sky
1 Station Identification	
Name	Sarah
ID Number	CE 0540
Basin	Dead Sea
Aquifer	
Status	Active / Monthly
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

High flow used for domestic water supply (WAJ) and irrigation

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Part of the discharge is piped to WAJ pumping station, the rest flows in Wadi channel (used downstream for irrigation) A channel control section, around 100 meters of spring source, is suitable for current meter measurement of the latter flows

5 Directions to Location of Station

Around 3 km West of Karak, near Karak-Ghor El Mazara' road, north of Ain Sarah recreation park

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring Assess and monitor bacteriological contamination

7 Other Observations

Global position system UTM coordinates 7-56-928E and 34-54-550N Temperature 20^{0}C and Ec 780 micro S/cm

185

Author/Date Rania Shahin (01/12/97) Editor/Date Rola Abu Nahleh (06/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	15 November 1997
Weather Conditions	Clear Sky
1 Station Identification	
Name	Wadi Thra'a
ID Number	CE 0644
Basin	Dead Sea
Aquifer	
Status	Active / Monthly
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

Significant discharge flowing into Wadi Thra'a and diverted with that of Hammam Weida'a spring in an irrigation canal

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Spring discharges in Wadi Thra'a Flow is measured in a suitable control channel prior to confluence with Hammam Weida'a flow

5 Directions to Location of Station

2 8 km East of Potassium Village Ghor El Mazara'-Karak road, in Wadi Thra'a

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring Take current meter measurement at irrigation canal to verify accuracy of flow estimates at both Hammam Weida'a and Wadi Thra'a springs

7 Other Observations

Global position system UTM coordinates 7-46-140E and 34-59-070N Temperature 23° C and Ec 860 micro S/cm

Author/Date Rania Shahin (01/12/97) Editor/Date Rola Abu Nahleh (06/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	15 November 1997
Weather Conditions	Clear Sky

1 Station Identification

Name	Hammam Weida'a
ID Number	CE 0648
Basin	Dead Sea
Aquifer	
Status	Active / Monthly

2 Station Type

- ☐ Ground Water
- ☒ Springs
- ☐ Surface Water
- ☐ Other

Other

3 Station Purpose

- ☒ Water Resources
- ☒ Water Quality

Rationale for Station / Location

Significant discharge flowing into Wadi Thra'a and diverted with that of Wadi Thra'a spring in an irrigation canal

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Spring discharges in Wadi Thra'a Flow is measured by current meter in a suitable site, near spring source

5 Directions to Location of Station

2 8 km East of Potassium Village, Ghor El Mazara'-Karak road, in Wadi Thra'a

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring Take current meter measurement at irrigation canal to verify accuracy of flow estimates at both Hammam Weida'a and Wadi Thra'a springs

7 Other Observations

Global position system UTM coordinates 7-46-140E and 34-59-070N Temperature 32° C (warm spring) and Ec 690 micro S/cm (near source)

Wadi Mujib, Hasa and Wadi Araba Basins

Author/Date Rania Shahin (30/11/97) Editor/Date Rania Shahin (07/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	30 November 1997
Weather Conditions	Partly Cloudy
1 Station Identification	
Name	W Haidan
ID Number	CD 0540
Basin	Wadi Mujib
Aquifer	
Status	Active / Monthly
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

Significant flow used for irrigation

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Spring discharges in the Wadi channel, which is adequate for current meter or weir measurement

5 Directions to Location of Station

18 km West of El Wala Bridge, in Ibrahim Mustapha El Hawejreh's farm, Mada Governorate

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring

7 Other Observations

Global position system UTM coordinates 7-55-676E and 34-88-961N Temperature 18°C

Author/Date Rania Shahin (01/12/97) Editor/Date Rania Shahin (07/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	16 November 1997
Weather Conditions	Clear Sky
1 Station Identification	
Name	Lajjun
ID Number	CD 0564
Basin	Wadi Mujib
Aquifer	
Status	Active / Monthly
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

Significant flow used for irrigation

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Spring discharges in an irrigation canal, which is adequate for current meter or weir measurement

5 Directions to Location of Station

6 5 km East of Jdeida town, in Wadi Lajjun near spring source

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring

7 Other Observations

Global position system UTM coordinates 7-72-833E and 34-59-571N Temperature 23°C

Author/Date Rania Shahin (01/12/97) Editor/Date Rania Shahin (07/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	18 November 1997
Weather Conditions	Clear Sky
1 Station Identification	
Name	Bir El Harir
ID Number	CF 0560
Basin	Wadi Hasa
Aquifer	
Status	Active / Monthly
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

Significant flow for water supply (WAJ)

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Spring discharge is collected at source, in a concrete basin, and pumped by WAJ Flow measurement (hourly pumping rate) is recorded by WAJ operator In case of basin overflow the additional discharge is measured by portable weir

5 Directions to Location of Station

WAJ pumping station at Bir El Harir

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring

7 Other Observations

Global position system UTM coordinates 7-55-788E and 34-08-349N Temperature 17 4 degrees C and Ec 480 micro S/cm

Author/Date Rania Shahin (01/12/97) Editor/Date Rania Shahin (06/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	16 November 1997
Weather Conditions	Clear Sky
1 Station Identification	
Name	Mugheisel
ID Number	CF 0600
Basin	Wadi Hasa
Aquifer	
Status	Active / Monthly
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

Significant flow used for irrigation

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Part of the flow is piped for irrigation, the rest flows in the Wadi for irrigation of downstream farms The flow at pipe is measured by volumetric method and that of the Wadi is measured in a control channel by current meter method

5 Directions to Location of Station

In El Eina Village, at the Mosque

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring

7 Other Observations

Global position system UTM coordinates 7-65-047E and 34-29-600N Temperature 24^{0} C and Ec 530 micro S/cm

Author/Date Rania Shahin (01/12/97) Editor/Date Rola Abu Nahleh (06/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	18 November 1997
Weather Conditions	Clear Sky
1 Station Identification	
Name	Hammam Burbata
ID Number	CF 0620
Basin	Wadi Hasa
Aquifer	
Status	Active / Monthly
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

Hot spring having moderate flow (appr 15 m^3/hr during visit), used for therapy and irrigation

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Spring discharges in a channel, which flows towards Seyl El Hasa Wadi Adequate site for portable weir measurement near confluence with Seyl El Hasa

5 Directions to Location of Station

Near Burbata Primary School, near Wadi Seyl El Hasa

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring at new site Disregard data prior to November 1986

7 Other Observations

Database shows an average of 97 2 m^3/hr for this spring This is not possible An analysis of monthly data indicates that the measurements prior to November 1986 are most likely taken at Seyl El Hasa and assigned to Hammam Burbata Temperature 40 degrees C and Ec 580 micro S/cm

Author/Date Rania Shahin (12/01/97) Editor/Date Rania Shahin (12/08/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	16 November 1997
Weather Conditions	Clear Sky
1 Station Identification	
Name	W Hasa At Tannour
ID Number	CF 0621
Basin	Wadi Hasa
Aquifer	
Status	Active / Monthly
2 Station Type	☐ Ground Water ☑ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

Use to have significant intermittent flow (average 40 2 m^3/hr) used for irrigation it is currently dry

Flow records indicate that it dried up 5 times during 1985 / 86 but had high flow in February May, June and July 1996 May flow only during wet seasons

Data Collected

Discharge and water quality (Geochemistry)

4 Physical Description of Station

Currently dry

5 Directions to Location of Station

Not Visited

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring

7 Other Observations

Author/Date Rola Abu Nahleh (12/02/97) Editor/Date Rania Shahin (12/08/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	17 November 1997
Weather Conditions	Clear Sky
1 Station Identification	
Name	El Heesha
ID Number	DA 0546
Basin	Wadi Araba - North
Aquifer	
Status	Active / Annual
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

Use to have significant flow (brackish) Flow is almost stagnant It may flow during winter

Data Collected

Discharge and water quality (geochemistry)

4 Physical Description of Station

Spring discharges in a dirt channel Almost stagnant flow

5 Directions to Location of Station

In Heesha area, in Fadhel Eid Towihan's farm

6 Proposed Action for Water Monitoring System Station

Upgrade monitoring to bi-annual (winter and summer)

7 Other Observations

Global position system UTM coordinates 7-33-405E and 34-35-972N Temperature 26°C

Author/Date Rola Abu Nahleh (12/02/97) Editor/Date Rania Shahin (12/08/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	17 November, 1997
Weather Conditions	Clear Sky
1 Station Identification	
Name	W Umrug
ID Number	DA 0556
Basin	Wadi Araba - North
Aquifer	
Status	Active / Annual
2 Station Type	☐ Ground Water ☑ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

Significant flow used for irrigation

Data Collected

Discharge and water quality (geochemistry)

4 Physical Description of Station

Site needs to be relocated due to new upstream diversion which took place after the construction of Tafila-Ghor road

5 Directions to Location of Station

In Wadi Umrug, east of Ma moura village 1km east of Ghor-Aqaba road (current site)

6 Proposed Action for Water Monitoring System Station

Upgrade to monthly monitoring relocate monitoring site

7 Other Observations

Global position system UTM coordinates 7-35-934E and 34-22-194N Temperature 21°C and EC 590

micro s/cm

Author/Date Rola Abu Nahleh (02/12/97) Editor/Date Dario Dal Santo (03/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	17 November, 1997
Weather Conditions	Clear Sky

1 Station Identification

Name	W Feifa
ID Number	DB 0502
Basin	Wadi Araba - North
Aquifer	
Status	Active / Monthly

2 Station Type

- ☐ Ground Water
- ☒ Springs
- ☐ Surface Water
- ☐ Other

Other

3 Station Purpose

- ☒ Water Resources
- ☒ Water Quality

Rationale for Station / Location

High flow, developed by JVA for irrigation

Data Collected

Discharge and water quality (geochemistry)

4 Physical Description of Station

Spring discharge diverted to JVA irrigation canal, control canal flowing towards two flow gates, ideal for current meter measurement

5 Directions to Location of Station

1 9 km east of Feifa village, at JVA spring diversion, few meters upstream of Wadi Feifa gauging station

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring

7 Other Observations

Global position system UTM coordinates 7-36-476E and 34-24-805N Temperature 25°C and EC 680 microS/cm

Author/Date Rola Abu Nahleh (02/12/97) Editor/Date Dario Dal Santo (03/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	16 November, 1997
Weather Conditions	

1 Station Identification

Name	Hammamat Afra
ID Number	DB 0616
Basin	Wadi Araba - North
Aquifer	
Status	Active/ monthly

2 Station Type

- ☐ Ground Water
- ☒ Springs
- ☐ Surface Water
- ☐ Other

Other

3 Station Purpose

- ☒ Water Resources
- ☒ Water Quality

Rationale for Station / Location

High flow (appr 100m^3/hr during visit), used for irrigation and being developed for tourism

Data Collected

Discharge and water quality

4 Physical Description of Station

Spring currently discharges in Wadi Afra Flow control channel changes according to floods The discharge can be adequately measured by current meter

5 Directions to Location of Station

In Wadi Afra thermal spring resort

6 Proposed Action for Water Monitoring System Station

Continue monthly measurement

7 Other Observations

Flow measurement conditions may improve after completion of spring development

Temperature 46^{0}C and EC 580 micro s/cm

Author/Date Rola Abu Nahleh (02/12/97) Editor/Date Rania Shahin (06/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	17 November, 1997
Weather Conditions	Clear Sky

1 Station Identification

Name	W Khanzira
ID Number	DC 0502
Basin	Wadi Araba - North
Aquifer	
Status	Inactive / Monthly

2 Station Type

- ☐ Ground Water
- ☒ Springs
- ☐ Surface Water
- ☐ Other

Other

3 Station Purpose

- ☒ Water Resources
- ☒ Water Quality

Rationale for Station / Location

High flow developed for irrigation Station inactive since April 1985 High flow during visit

Data Collected

Discharge and water quality (geochemistry)

4 Physical Description of Station

Most of the spring discharge is diverted to an irrigation canal, the rest flows in Wadi Khanzira A new channel control section, prior to diversion, is selected for current meter measurement

5 Directions to Location of Station

2 4km east of Ghor- Aqaba road in Wadi Khanzira

6 Proposed Action for Water Monitoring System Station

Resume monthly monitoring at the new monitoring site (see coordinates below)

7 Other Observations

Global position system UTM coordinates 7-32-730E and 34-18-970N Temperature 22°C

Author/Date Rola Abu Nahleh (02/12/97) Editor/Date Dario Dal Santo (03/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	18 November, 1997
Weather Conditions	Clear Sky
1 Station Identification	
Name	Gharandal
ID Number	DC 0562
Basin	Wadi Araba - North
Aquifer	
Status	Active / Monthly
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

Significant flow used for domestic water supply (the Gharandal Municipality) and irrigation

Data Collected

Discharge and water quality (geochemistry)

4 Physical Description of Station

Spring discharge is piped to the Gharandal Municipality pumping station and excess water flows to an irrigation canal, which is suitable for weir or current meter measurement

5 Directions to Location of Station

At the Gharandal Municipality water pumping station, in Gharandal Village, near mosque

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring

7 Other Observations

Global position system UTM coordinates 7-54-240E and 34-01-300N Temperature 17°C and EC 510 micro s/cm

Author/Date Rola Abu Nahleh (02/12/97) Editor/Date Dario Dal Santo (03/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	19 November, 1997
Weather Conditions	Partly Cloudy
1 Station Identification	
Name	W Fidan
ID Number	DE 0502
Basin	Wadi Araba - North
Aquifer	
Status	Active / Monthly
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

High discharge flowing from wadi bed outcrop, used for irrigation

Data Collected

Discharge and water quality (geochemistry)

4 Physical Description of Station

Flow discharges from wadi bed outcrop, in two main locations Measurements are taken at both sites by current meter method Flow path may change with flood

5 Directions to Location of Station

North West of Greigra village, in Wadi Fidan

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring

7 Other Observations

Wadi Fidan is locally known as Wadi Afran Global position system UTM coordinates 7-29-820E and 33-93-560N Temperature 27^{0}C

Author/Date Rola Abu Nahleh (02/12/97) Editor/Date Dario Dal Santo (03/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
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Date of Time of Visit	19 November, 1997
Weather Conditions	Clear sky
1 Station Identification	
Name	Musa
ID Number	DG 0540
Basin	Wadi Araba - North
Aquifer	
Status	Active / Monthly
2 Station Type	☐ Ground Water ☒ Springs ☐ Surface Water ☐ Other

Other

3 Station Purpose	☒ Water Resources ☒ Water Quality

Rationale for Station / Location

Significant discharge used for irrigation

Data Collected

Discharge and water quality (geochemistry)

4 Physical Description of Station

Spring discharge is collected in a concrete basin and diverted to a concrete canal, which is suitable for current meter or portable weir measurement

5 Directions to Location of Station

Entrance of Wadi Musa Town opposite of post office and Musa Spring Hotel

6 Proposed Action for Water Monitoring System Station

Continue monthly monitoring

7 Other Observations

Global position system UTM coordinates 7-39-990E and 33-57-317N Temperature 17°C and EC 540 micro s/cm

Author/Date Rola Abu Nahleh (02/12/97) Editor/Date Rania Shahin (08/12/97)

Water Monitoring Station Field Review

Water Quality Improvement and Conservation Project
Ministry of Water And Irrigation

Date of Time of Visit	17 November, 1997
Weather Conditions	Clear sky

1 Station Identification

Name	W Dathnah
ID Number	EA 0546
Basin	Wadi Araba - South
Aquifer	
Status	Inactive / Annual

2 Station Type

- ☐ Ground Water
- ☒ Springs
- ☐ Surface Water
- ☐ Other

Other

3 Station Purpose

- ☒ Water Resources
- ☒ Water Quality

Rationale for Station / Location

Significant flow used by the Potassium Co

Data Collected

Discharge and water quality (geochemistry)

4 Physical Description of Station

Spring discharges in the Potassium Co diversion canal, which is adequate for current meter or portable weir measurement

5 Directions to Location of Station

200 meters East of the gate to Potassium Exploration site, upstream of Ghor-Aqaba road, in Wadi Dathnoh

6 Proposed Action for Water Monitoring System Station

Reactivate to monthly monitoring

7 Other Observations