No.

BASIC DESIGN STUDY REPORT
ON
THE PROJECT FOR
WATER POLLUTION MONITORING SYSTEM
IN
THE HASHEMITE KINGDOM OF JORDAN

MARCH, 2002

JAPAN INTERNATIONAL COOPERATION AGENCY

YACHIYO ENGINEERING CO., LTD.

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PREFACE

In response to a request from the Hashemite Kingdom of Jordan, the Government of Japan decided to conduct a basic design study on the Project for Water Pollution Monitoring System in the Hashemite Kingdom of Jordan and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Jordan a study team from November 16 to December 18, 1999.

The team held discussions with the officials concerned of the Government of Jordan, and conducted a field study at the study area. After the team returned to Japan, further studies were made. Then, a mission was sent to Jordan in order to execute the Implementation Review Study and discuss a draft basic design, and as this result, the present report was finalized.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Hashemite Kingdom of Jordan for their close cooperation extended to the teams.

March, 2002

Takao Kawakami
President
Japan International Cooperation Agency

March, 2002

LETTER OF TRANSMITTAL

We are pleased to submit to you the implementation review study report on the Project for Water Pollution Monitoring System in the Hashemite Kingdom of Jordan.

This study was conducted by Yachiyo Engineering Co., Ltd., under a contract to JICA, during the period from January 5 to January 25, 2002. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Jordan and formulated the most appropriate basic design for the project under Japan's grant aid scheme.

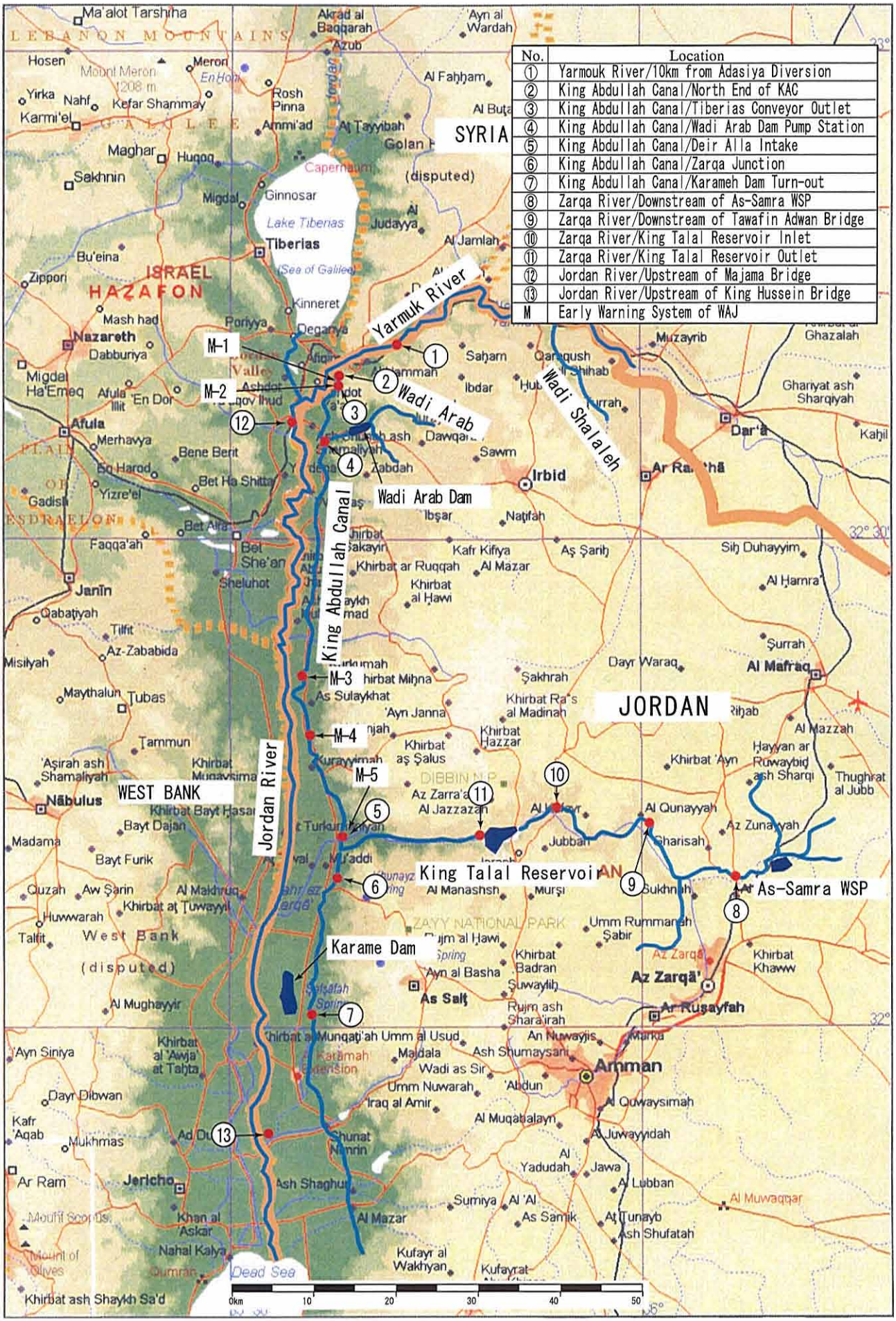
Finally, we hope that this report will contribute to further promotion of the project.

Very truly yours,

Masahiro Takeuchi

Project Manager,
Implementation Review Study Team on the
Project for Water Pollution Monitoring System
in the Hashemite Kingdom of Jordan

Yachiyo Engineering Co., Ltd.



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ABBREVIATIONS

CUEP	Central Unit for Environmental Pollution Monitoring
DCC	Diral Control Center
E/N	Exchange of Notes
ERC	Environmental Research Center
EWS	Early Warning System
GCEP	General Corporation for Environmental Protection
GDP	Gross Domestic Product
HCST	The Higher Council for Science and Technology
IMF	International Monetary Fund
JD	Jordanian Dinar
JIS	Japanese Industrial Standards
JICA	Japan International Cooperation Agency
JVA	Jordan Valley Authority
KAC	King Abdullah Canal
M/D	Minutes of Discussion
MWI	Ministry of Water and Irrigation
NEPRAMS	National Environmental Pollution Research and Monitoring System
NIC	National Information Center
NIS	National Information System
RSS	Royal Scientific Society
WAJ	Water Authority of Jordan
WSP	Wastewater Stabilization Pond
WTP	Water Treatment Plant

SUMMARY

SUMMARY

The Hashemite Kingdom of Jordan (hereinafter referred to as Jordan) is a country situated in latitude 29 to 33 degrees N and longitude 34 to 39 degrees E, with its land area of about 89,000 km^2, about one-fourth as large as Japan, and its population of about 4.7 million (as of 2000). Approximately 80% of the land is desert; in particular, the eastern area is an uninhabited desert.

Manufacturing industries in Jordan are inactive except for the phosphate rock mining and 62% of the employee population is engaged in services. The foreign currency income depends mainly on tourist industry and money transfer from Jordanian workers in other countries. While the GDP per head is US$1,553 (as of 1998), the economy of Jordan is as weak as can be heavily influenced by the political and economical conditions of the surrounding countries, for most of the consumption goods and investment goods count on import, employment chances depend on the Gulf countries, and its political activities are closely connected with Palestine. At present, according to the structural adjustment program initiated by the IMF, the country aims to rebuild its finance through decreased expenditures and increased revenue and conducts economical measures, such as relaxation of restraint and privatization of business, in line with the liberalization policy.

Jordan is now in its 5-year Socio-economic Development Plan for a period from 1999 to 2003. One of the national goals in the environmental sector, mentioned in this 5-year plan, is to preserve environment by applying an appropriate international standard by the target year 2003. The most important goal in the environmental sector is set to the technical and administrative improvement, including the enhancement of the environmental monitoring capacity in the environmental sector. Accordingly, it can be said that this Project is in well harmonization with the above plan.

In Jordan, the Environmental Protection Law was enacted in 1995 and, in order to put a unified control over the environmental administrations, the General Corporation for Environmental Protection (GCEP) was established under the jurisdiction of the Ministry of Municipal and Rural Affairs and the Environment and the Environmental Council as an environmental policy decisive agency was established as well. However, since GCEP is not staffed with competent technical division, technical study on the environmental standard is done by the Higher Council for Science and Technology (HCST). HCST, which is the highest-level scientific and technical research agency in Jordan, carries out environmental measurements on an entrustment from ministries, agencies and enterprises.

Demand for water in Jordan has been increasing rapidly in recent years in line with sudden increase in the population caused by the return of migrant workers following the Gulf War and recent high rate of population increase (averaged rate of increase from 1980 to 1999 : 4.1 %). Meanwhile, in addition to the shortage of water sources, there has been a problem of water pollution of the major water sources (Yarmouk River, King Abdullah Canal, Zarqa River, and Jordan River) in the northern area of Jordan, caused by the inflow of agricultural and industrial waste water into the water system and the inflow of insufficiently treated drain water into the water system due to major deficiencies in the capacity of sewage treatment facilities.

However, it is difficult to take effective water quality preventive measures because, in addition to a fact that continuous water quality monitoring stations are deficient in major water sources all over the country, the analyzing capacity and analytical data accuracy are insufficient in the water quality laboratories, who carry out the intermittent monitoring, due to deterioration of chemical analyzing equipment, shortage of the number of equipment compared to the number of specimens requiring analysis, and deficiency of micro-chemical analyzing equipment with high accuracy. Moreover, since each water quality test laboratory carries out the analysis of different water source or facility independently and, as a result, the analytical data are utilized only within each related agency, and not placed under a unified control and compilation, there is no such system where the nation-wide monitoring data is reflected promptly in the environmental administration.

In September 1997, under an advice of the Japanese experts for establishing an environmental monitoring system, HCST organized a committee comprising 26 bodies, including related ministries and agencies, universities, laboratories, private enterprises, etc., and initiated a study for establishing a national environmental monitoring system, covering not only the water pollution but also air pollution and soil pollution.

Based on the result of the study, the Government of Jordan requested the Government of Japan for a grant aid needed for establishing an environmental monitoring center in the three fields; water pollution, air pollution, and soil pollution. The request, however, was for too magnificent a plan covering the whole fields of the environment and the plan was not feasible as it was, because, for example, the role of GCEP and jurisdiction of the monitoring center who plays the major role in the monitoring activities were not clear and the responsibility sharing was not clear among too many ministries and agencies that were supposed to be given equipment and apparatuses under the aid.

Meanwhile, there arose a problem in the summer of 1998 that a lot of algae grew in the rivers serving as the water source of the drinking water for the city area and the quality of the drinking water was deteriorated. Since, with this as a turning point, the Government of

Jordan expressed their recognition that it would be possible to carry out the construction of the water quality monitoring system first as an urgent issue and then to make improvement in the other fields requesting for the cooperation of other donors, the Government of Japan conducted a preliminary survey in April 1999 to collect information on the modified portion of the request.

Besides, concerning the jurisdiction issue of the monitoring center, a new law was supposed to be legislated so that a Central Unit for Environmental Pollution Monitoring (CUEP) for operating the center be established inside HCST and that the Ministry of Municipal and Rural Affairs and the Environment, GCEP, and other related ministries and agencies take part in the Managing Board for National Environmental Pollution Research and Monitoring System (NEPRAMS), the controlling body of CUEP. Since this made the Japanese side understand that the precondition for carrying out the project was met, the Government of Japan conducted a basic design study for a period from November 15 to December 19, 1999. However, since the Government of Jordan did not take necessary actions in connection to the organization and system, the survey was interrupted.

Later on, as the Government of Jordan added to their environmental pollution monitoring system regulations an objective that the monitoring data be utilized for their environmental administration, the Japanese Government came to an understanding that the precondition of the project be finally met and conducted a implementation review study for a period from January 4 to January 26, 2002 so as to confirm the implementing organization on the Jordanian side and modifications to the result of the basic design study.

Through the consultation with relevant persons of Jordan and the site survey, the delegation of the study have become aware of the water pollution monitoring condition in Jordan and confirmed a need for improving the water pollution monitoring system on the major water sources in the northern area of Jordan, such as Yarmouk River, King Abdullah Canal, and Jordan River, including the project site. In addition, it is also confirmed that, since suitable protective measures of the water sources from contamination cannot be taken because of deficient water pollution monitoring system, the inhabitants in the project site are exposed to a threat of contaminated water sources.

As a result of the implementation review study, two items were excluded from the list of equipment requested previously because Water Authority of Jordan (WAJ) Laboratory had already purchased them. On the contrary, the civil work for installing the monitoring stations has been included in the scope of cooperation by the Japanese side because civil works in rivers and construction of a jetty are necessary for monitoring and accordingly, design and construction as well as alignment with precision equipment are needed, corresponding to the specific conditions at each of the 13 monitoring stations.

The basic concept of this Project is to extend a grant aid for the installation of monitoring stations (at 13 points) in Jordan, procurement of the chemical analysis equipment for intermittent monitoring (for three major laboratories), procurement of the equipment and apparatuses for telemetry system (for data communication between the monitoring center and each monitoring station, GCEP and Environmental Research Center), execution of the civil work relating to the installation of the monitoring stations, and for the introduction of the soft components for acquiring knowledge on the handling, maintenance and operation of the equipment and apparatuses to be procured so as to help Jordan to implement the water pollution monitoring plan that aims to prevent water pollution through the improvement of the environmental monitoring system in the northern area of Jordan and prompt reflection of the measurement result in the environmental administration.

This Project has been so formed, based on a policy of strengthening the chemical analysis equipment to enhance the water quality analyzing capacity in the continuous monitoring and the intermittent monitoring in the northern area, as to establish a water quality monitoring system of the major water sources that serve for about three millions of the inhabitants in the northern area of Jordan, centering at the metropolitan area of Amman.

The Project scheme formulated by the basic design study team, upon their return to Japan, on the basis of the result of the site survey and consultation with the Jordanian side is as follows:

Outline of the Project

① Procurement of the equipment for monitoring station	・ Monitoring stations: for 13 points ・ Spare parts (for two-year operation)
② Procurement of the chemical analysis equipment for intermittent monitoring	・ WAJ Laboratory : 1 set ・ JVA Laboratory : 1 set ・ ERC Laboratory : 1 set ・ Spare parts for the above (for two-year operation)
③ Procurement of the equipment for telemetry system	・ Monitoring Center : 1 set ・ Equipment for data transfer from ERC Laboratory to the Monitoring Center : 1 set ・ Equipment for data transfer from the Monitoring Center to GCEP : 1 set
④ Installation of the equipment in ① to ③ above and civil work for the installation of the equipment in ③ above	
⑤ Soft component	Guidance on the operation and maintenance of the equipment to be procured ・ Guidance on the operation of the monitoring system ・ Guidance on the maintenance of the monitoring station ・ Technical guidance on the telemetry system and data processing ・ Guidance on the maintenance of the chemical analysis equipment

(Note) WAJ : Water Authority of Jordan JVA : Jordan Valley Authority
ERC : Environmental Research Center GCEP : General Corporation for Environmental Protection

The implementation agency of the Project on the Jordan side is the Higher Council for Science and Technology (HCST) and the operation and maintenance after the Project is to be taken charge by the Central Unit for Environmental Pollution Monitoring (CUEP), which will be established, in the course of the Project, inside the Royal Scientific Society (RSS) under the jurisdiction of HCST. While the operation and maintenance cost is expected to be around 6% of the HCST's annual budget, no problem is foreseen in securing necessary budget since it has already been approved that the operation and maintenance cost be included in the budget items of HCST. The staff of CUEP can be secured by relocating the staff members of the Environmental Research Center, most authoritative research center in Jordan, located inside RSS.

When the Project is to be implemented with a Grant Aid of Japan, the estimated project cost of the Jordanian portion is JD311,000. The total construction and procurement period of the Project is expected to be 11.5 months including the detailed design.

As a result of the Project, in which the monitoring stations will be installed at the major water sources in the northern area of Jordan (benefiting population: 3 million, as of 2001) centering at the metropolitan area of Amman, the center of the governmental and economical activities of Jordan, and the telemetry system for data transmission will be prepared, changes in the water quality in major water sources can be monitored continuously and hence a remedial system for coping with abnormal water quality is ensured. In addition, since the chemical analysis equipment at major water quality laboratories is strengthened, the number of measuring points and analytical data increases and the reliability of the data improves, and besides, a system for checking micro pollutant that cannot be detected through conventional chemical analysis is prepared.

Furthermore, the following indirect effects are expected.

- Utilization of the monitoring data in the environmental administration eliminates anxiety about the quality of the drinking water sources for about three millions of inhabitants in the northern area of Jordan, including the metropolitan area of Amman, and also about crops in the Jordan Valley.
- Provision of a system for checking micro pollutant enables to take practical measures for improving the water quality, resulting in increased safety of the water for drinking and irrigation.
- Unified control, compilation and analysis of the water quality data from each related agency at the Monitoring Center enables to plan out effective water pollution preventive measures on a nation-wide basis.

Since this Project is expected to produce a lot of effects but also to contribute greatly to the improvement of the fundamental living conditions of the inhabitants as explained above, the appropriateness of extending a grant aid of the Government of Japan to the intended activities under cooperation is hereby confirmed.

For more effective and efficient implementation of the Project, it is important for the Jordanian side to ensure to carry out the works within their supply scope, in the course of the Project execution, including installation of power cables into each monitoring station and construction of communication facilities and also to fulfill the requirement for securing the maintenance personnel after the Project execution and ensuring the budget.

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Letter of Transmittal
Location Map
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CHAPTER 1 BACKGROUND OF THE PROJECT

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In Jordan, the Environmental Protection Law was enacted in 1995. Under this, in order to achieve unified supervision of environmental administration, the General Corporation of Environmental Protection (GCEP) was set up under the Ministry of Municipal and Rural Affairs and the Environment, and the Environment Council was established to act as the executive agency on environmental policy. However, since the GCEP does not have a technical department, it is the Higher Council for Science and Technology (HCST) that carries out technical examination of environmental standards. HCST is the highest-ranking science and technology research agency in Jordan and it implements environmental measurements at the request of government agencies and private corporations, etc.

In September 1997, based on the advice of environmental monitoring system formation experts from Japan, HCST organized a committee composed of 26 agencies including government agencies, universities, research agencies and private corporations, etc. and conducted examination into the construction of a national environmental monitoring system.

Based on these results, the Government of Jordan in August 1998 issued a request to the Government of Japan for the provision of grant aid necessary for the construction of an environmental monitoring center covering the three sectors of water pollution, air pollution and soil pollution. However, the said request was for a broad project covering all environmental sectors and it could not easily be implemented in its original form for the following reasons: 1) it did not clarify the status of GCEP or the monitoring center, which plays the focal role in monitoring work, and 2) since numerous agencies were targeted for equipment supply, the whereabouts of responsibility were unclear, and so forth.

However, following the incident in the summer of 1998 when major growth of algae occurred in rivers in the capital region and potable water quality deteriorated, the Government of Jordan indicated the possibility of first building the water monitoring system as an emergency item and expanding this to other areas while seeking the cooperation of donors. In response, the Government of Japan implemented a preliminary survey and collected information of the revised portions of the request in April 1999.

Moreover, concerning status of the monitoring center, since it was considered that the conditions for project implementation were finalized with the establishment of the Central Unit for Environmental Pollution (CUEP) within HCST and participation of the Ministry of Municipal and Rural Affairs and the Environment, GCEP and related government agencies in the Managing Board of NEPRAMS (superior agency to CUEP) following new legislation, the

Government of Japan implemented the basic design study in November 1999. However, because the Jordanian government did not take the necessary organizational and institutional measures at this time, the study was suspended.

Following this, it was once more deemed that conditions for project implementation were ready when environmental pollution monitoring system rules were amended to include the use of monitoring data in environmental administration. The Government of Japan subsequently conducted an implementation review study with the goals of confirming the implementation setup of the Jordanian side and revisions made after the basic design study.

Table 1-1 Contents of the Request

①	Supply of monitoring station equipment ・Monitoring stations: 13 sites ・Spare parts (for 2-year operation)
②	Supply of chemical analysis equipment for intermittent monitoring ・WAJ laboratory: 1 lot ・JVA laboratory: 1 lot ・ERC laboratory: 1 lot ・Spare parts for the above (for 2-year operation)
③	Supply of telemetry system equipment ・Monitoring Center: 1 lot ・Equipment for transferring data from ERC laboratory to the Monitoring Center: 1 lot ・Equipment for transferring data from the Monitoring Center to GCEP: 1 lot
④	Installation works of equipment for items ① to ③ and civil works for item ①
⑤	Soft component (guidance on initial operation and maintenance of equipment)

(Note) WAJ : Water Authority of Jordan
JVA : Jordan Valley Authority
ERC : Environmental Research Center of the Royal Scientific Society (ERC)
GCEP : General Corporation of Environmental Protection

CHAPTER 2 CONTENTS OF THE PROJECT

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2-1 Basic Concept of the Project

(1) Overall goal and project purpose

The water quality deteriorated in the summer of 1998 when a lot of algae grew in King Abdullah Canal, serving as a major water source. With this as a turning point, it has been an important issue in Jordan to improve the monitoring system not only for the quantitative management of limited water sources but also for qualitative management such as water pollution prevention.

In their 5-year Socio-economic Development Plan currently under way, environmental preservation and enhanced environmental monitoring system is included as one of the priority goals.

This Project aims to improve the environmental monitoring system in the water quality field in relation to the enhancement of the environmental monitoring system set as a supreme goal as above.

(2) Outline of the Project

In order to achieve the above goal, this Project is to install monitoring stations for continuous water quality monitoring at 13 points of locations, most effective for monitoring water pollution, on the major water sources in Jordan, i.e. Yarmouk River, Jordan River, King Abdullah Canal, and Zarqa River, and to strengthen the chemical analysis equipment in the three major laboratories (EAJ Lab., JVA Lab. and ERC Lab.) that have been carrying out the intermittent water quality monitoring on a nation-wide basis, and also to build a telemetry system containing, at its center, a Monitoring Center for unified control of the monitoring data from those laboratories.

Besides, for smooth operation and maintenance after the implementation of the Project, soft components are to be introduced to provide guidance on the handling, maintenance and operation of the equipment and apparatuses to be prepared.

As a result of these measures, continuous water quality monitoring of the water can be achieved, water quality monitoring system can be strengthened, monitoring data can be reflected in the environmental administration on a nation-wide basis, and water pollution can be prevented.

2-2 Basic Design of the Requested Japanese Assistance

2-2-1 Design Policy

(1) Concept Regarding Natural Conditions

Continuous water quality monitoring equipment (monitoring units) will be installed at the monitoring stations in the Project, however, since these equipment will be placed outdoors and will be exposed to the natural conditions, consideration shall be given to the following points in planning.

1) Concerning temperature and humidity

Temperatures in the Jordan Valley which includes the Canal and Jordan River, etc. reach as high as 50℃. Accordingly, the monitoring units which comprise measurement equipment and telemetry system-related equipment shall be designed with a heat insulating structure that gives ample consideration to temperature and humidity conditions from the viewpoint of equipment protection, and air conditioning equipment shall also be installed.

2) Concerning rainfall conditions

Annual average rainfall ranges from 400 mm in the mountain belt to 200 mm in the Jordan Valley, and most rainfall is concentrated during the rainy season from October to April.

Following three days of continuous torrential rain during the Implementation Review Study period (January 5 to January 25, 2002), the Study Team surveyed carried out a site survey in order to investigate the level of increase in river water level. Moreover, upon surveying records of past water levels from related agencies, the Team selected monitoring unit installation sites that would not be affected by increase in the water level.

(2) Concept Regarding Social Conditions

1) Education level, etc.

When setting the Project equipment grades, it is necessary to give consideration to the following social conditions.

① The education level in Jordan is particularly high even among Middle and Near East countries, and many of the staff at government agencies and the water quality laboratories targeted for supply of chemical analysis equipment have

received education at universities in Europe and America and have acquired doctor's or master's degrees.

② Jordan frequently stages international conferences and forums of global scale, and it plays a central role in the field of education and culture in the Middle and Near East.

③ Employees at HCST (the implementing agency) and other environment-related agencies are endowed with ample know-how of information equipment and chemical analysis equipment and possess much information concerning the latest technology.

④ The main water testing laboratory possesses sophisticated chemical analysis equipment almost on a par with that found in Europe and America, and the operation and management level is also high.

2) Customs, Festivals, etc.

94% of the population of Jordan is Moslems, so holidays and working hours, etc. are set based on Islamic customs including Ramadan. Accordingly, concerning the equipment installation part of the Project implementation schedule, it is necessary to take local customs regarding holidays and working hours, etc. into account. Friday is normally a holiday in Jordan, and many agencies and corporations have also recently made Saturday a holiday and are adopting a five-day week. Moreover, festivals or national holidays fall on 16 days throughout the year.

Table 2.2.1-1 Festivals in Jordan (in 2002)

Date	Festival
January 1	New Year's Day
January 31	Birthday of King Abdullah
February 22-25	Hajji Holidays
March 15	Islamic New Year
May 1	May Day
May 25	Independence Day /Birthday of Mohammed
October 4	Ascension of Mohammed
November 14	Birthday of King Hussein
December 6-9	Ramadan Holidays
December 25	Christmas

(3) Concept Regarding the Equipment Supply Situation

Since none of the equipment planned under the Project is produced or can be procured in Jordan, it shall either be procured from Japan or a third country. Therefore, the monitoring stations and telemetry system for data communication and control, which have a complicated equipment composition, shall be procured from Japan, while third

country procurement shall be considered regarding some of the chemical analysis equipment for intermittent monitoring.

Incidentally, concerning the after-sales service setup for chemical analysis equipment, this should not be a problem because many European and American products are available locally.

(4) Concept Regarding Utilization of Local Contractors and Materials

1) Utilization of local contractors

Since none of the equipment planned under the Project is produced or can be procured in Jordan, it shall either be procured from Japan or a third country. However, concerning civil engineering works, inland transportation of procured equipment and installation works required for establishing the monitoring stations, since there are no items of major scale, utilization of local contractors is possible.

2) Utilization of local materials

Since the construction materials such as cement, aggregate, reinforcing bars, piping, etc. for monitoring station installation (to be implemented by the Japanese side), and the power cables and telephone lines, etc. to the monitoring stations (to be carried out by the Jordanian side) are standard items, it is possible to make use of local materials.

(5) Concept Regarding Operation and Maintenance Capacity of the Implementing Agency

The Project implementing agency is HCST. It is planned to consign the operation and maintenance of monitoring stations and the Monitoring Center to CUEP to be established in the Royal Scientific Society (RSS), which is the subordinate agency of HCST. It is planned to staff CUEP mainly by transferring personnel from the laboratory of the Environmental Research Center (ERC), which is a subordinate agency of RSS. Since the said laboratory already implements relatively high level water quality analysis and implements maintenance of equipment that is linked to the planned Project equipment, it is thought that no problem exists regarding operation and maintenance capacity in the Project.

(6) Concept Regarding Setting of the Supply Scope and Grade of Equipment

The following basic concept shall be followed in setting the supply scope and grade of equipment.

1) Concept regarding scope of equipment supply

Monitoring station equipment, chemical analysis apparatus, and the telemetry system equipment shall be procured. Moreover, since the installation and trial running adjustment of equipment are important for realizing the required functions, installation and trial running adjustment shall be included in the scope of cooperation.

Concerning the monitoring stations, it is necessary to carry out monitoring unit foundation works, river improvement works for sampling, and jetty construction, etc. Moreover, since design, execution and equipment adjustments suited to unique conditions at each of the 13 sites will be required, these works shall also be included in the scope of cooperation.

2) Concept regarding setting of equipment grades

In setting the grades (specifications) of equipment, consideration shall be given to the following points:

① Natural conditions in Jordan;

② Water quality analysis concentrations that are required;

③ Grades of existing equipment owned by related agencies;

④ Operating and maintenance capacity of related agencies.

(7) Concept Regarding Implementation Schedule

Following the exchange of notes (E/N), the project shall be implemented within a single accounting year over a period of 11.5 months, breaking down as approximately 0.8 months for final confirmation of the equipment plan contents and civil engineering facilities detailed design, 1.2 months for tender and contract work, and 9.5 months for plant fabrication, transportation, civil engineering works, equipment installation, trial operation and adjustments, and soft components, etc.

2-2-2 Basic Plan

2-2-2-1 Overall Plan

As was mentioned earlier (Section 2-1), the Project is made up of three equipment components: ① continuous water quality monitoring facilities, ② chemical analysis equipment for intermittent monitoring, and ③ telemetry system.

In compiling the basic design for these equipments, ample consideration shall be given to the following points.

(1) Integrated control of measured data at the monitoring stations and at each laboratory

Water quality monitoring in the environmental field in Jordan is performed by carrying out the efficiently integrated control of measured data for general water quality parameters from continuous monitoring equipment to be supplied under the Project, and intermittent measured data for chemical analysis currently carried out in the water quality laboratories of related authorities. In other words, since intermittent measured data entails far more parameters and measurement points than measured data of designated parameters in continuous water quality monitoring system, the collection and control of these data are also important.

Accordingly, concerning the automatic accumulation of data by continuous monitoring and the input of the analysis results for intermittent measurement data from the laboratories of related agencies, it is necessary to build a system that will permanently and definitely carry out such work.

(2) Avoidance of overlapping and sharing of data from related agencies

In Jordan, various water quality analyses are currently being conducted by related agencies. In the Project, by carrying out neutral analysis monitoring from the viewpoint of environmental waste quality monitoring and sharing the data of related agencies, it shall be planned so that economic and effective monitoring is possible.

Incidentally, the data of related agencies are as follows:

- Analysis data from the Jordan Water Authority (WAJ) laboratory and from the early warning system for raw water quality monitoring at Zai Water Treatment Plant
- Data from the Jordan Valley Development Authority (JVA) laboratory and Diral Control Center (DCC)
- Analysis data from the Environmental Research Center (ERC) laboratory
- Water quality analysis data and research findings from university agencies

(3) Effective utilization of collected data by the National Information Center (NIC) network

A network has been set up by the National Information Center (NIC) in Jordan and, concerning the utilization of collected data, it is possible to simply build a system which makes it possible to directly use data in environmental administration and to utilize government agencies including universities. In the Project, too, consideration shall be given to NIC connections and the provision of data via the NIC and Internet.

2-2-2-2 Plan for Continuous Water Quality Monitoring Stations

(1) Layout Plan

The results of examining 13 monitoring station locations are listed in Table 2.2.2.2-1

Table 2.2.2.2-1 Examination Results for Monitoring Station Locations

No.	Source／Location	Examination Results
①	Yarmouk River 10km from Adasiya Diversion	The Yarmouk River is one of the main surface water sources and the main source of King Abdullah Canal (KAC). Therefore, it is important to do a monitoring at the upstream of Adasiya diversion. So a location approximately 10 km upstream of Adasiya diversion was selected because it is found that extension of power and telephone lines is possible and an access road already exists here.
②	King Abdullah Canal North End of KAC	Yarmouk River is the main water source of Jordan, while KAC is an important source for irrigation and drinking water. Therefore, in order to gauge a water quality at the canal start point, it is necessary to carry out monitoring at the point of canal divergence.
③	King Abdullah Canal Tiberias Conveyor Outlet	Water from lake Tiberias is conveyed to KAC by pipeline, and it is necessary to gauge water quality at the outlet point to the canal.
④	King Abdullah Canal Wadi Arab Dam Pump Station	In order to regulate the water flow in the canal, water is pumped to Wadi Arab Dam according to water conditions in the canal. Accordingly, since it is thought that changes may occur in water quality as a result of convection in the dam, monitoring shall be carried out at the pump station intake where back flowing water from the dam converges.
⑤	King Abdullah Canal Deir Alla Intake	Since water from the canal is pumped to Zai WTP from this point and is supplied to approximately 40% of the population of Amman City as public water supply, it is necessary to gauge the water quality.
⑥	King Abdullah Canal Zarqa Junction	Water from Zarqa River enters the canal via King Talal Dam. Since water following convergence is used for irrigation and is thought to have a major impact on the environment, water quality measurement at this point carries greater importance in terms of environmental monitoring.
⑦	King Abdullah Canal Karameh Dam Turn-out	Because flow in the canal is also adjusted in Karameh Dam and changes in water quality can be considered as a result of convection in the dam, it is necessary to monitor water quality here.
⑧	Zarqa River Downstream of As-Samra WSP	As-Samra Water Stabilization Pond is the largest treatment facility in the Amman metropolitan region, and treated effluent from here is utilized for irrigation in the Jordan Valley. Therefore, since it is forecast that treated effluent will have an impact on the environment, a monitoring station shall be established downstream of the plant outlet. Concerning the exact sampling site, the Jordanian side proposed inside the WSP, however, because the purpose of monitoring in the Project is environmental preservation, the discharge destination of Wadi Dulayl was deemed to be appropriate.
⑨	Zarqa River Downstream of Tawafin Adwan Bridge	Monitoring stations No.⑧ (As-Samra WSP outlet) and No.⑩ (King Talal Reservoir Inlet) on Zarqa River are separated by more than 30 km and, since waste water from the industrial belt flows into the river along this section, the implementation of measurement at this point is significant from the viewpoint of environmental monitoring.
⑩	Zarqa River King Talal Reservoir inlet	Most of the water flowing into King Talal Dam is treated effluent from As-Samra WSP, however, since the dam is approximately 30 km away from the treatment plant and there is some minor inflow of water along the way, monitoring shall also be carried out at this point just before the dam.
⑪	Zarqa River King Talal Reservoir outlet	Since it is considered that there is a change in water quality from the water detention at the dam, a monitoring at the place just down from the dam outlet is needed.
⑫	Jordan River Upstream of Majama Bridge	Environmental improvement of Jordan River is a vital issue facing the region including Israel and Palestine. In addition to carrying out environmental monitoring at the furthest downstream point of the river, it is important to do the same at the furthest upstream point, too.
⑬	Jordan River Upstream of King Hussein Bridge	It is necessary to gauge water quality at this point because environmental impact is large here and this is the point just before water flows into the Dead Sea.
--	As-Samra WSP inlet	Wastewater is transferred through pipeline, so that it does not have an influence to the environment. Therefore, this point was not adopted as the monitoring point.
--	Zai WTP outlet	Environmental administration side has an obligation to monitor the water quality of public water body such as rivers, etc., but not for drinking water. Water quality of drinking water is monitored by the Ministry of Water and Irrigation and the Ministry of Health in accordance with the drinking water standard. Therefore, this point was not adopted as the monitoring point.

The coordinates of 13 monitoring stations are shown in Table 2.2.2.2-2 and the detailed locations of each station are shown in Annex-6.

Table 2.2.2.2-2 Detailed Locations for Monitoring Station

No.	Area	Location	N. Latitude			E. Longitude		
			Degree	Minute	Second	Degree	Minute	Second
①	Yarmouk River	10km from Adasiya Diversion	32	42	49.7	35	42	23.0
②	King Abdullah Canal	North End of KAC	32	40	45.2	35	37	43.0
③	King Abdullah Canal	Tiberias Conveyor Outlet	32	39	58.9	35	37	15.3
④	King Abdullah Canal	Wadi Arab Dam Pump Station	32	36	20.0	35	36	17.9
⑤	King Abdullah Canal	Deir Alla Intake	32	11	8.6	35	37	21.4
⑥	King Abdullah Canal	Zarqa Junction	32	8	36.7	35	36	38.0
⑦	King Abdullah Canal	Karameh Dam Turn-out	32	0	8.4	35	35	9.8
⑧	Zarqa River	Downstream of As-Samra WSP	32	8	38.9	36	6	26.2
⑨	Zarqa River	Downstream of Tawafin Adwan Bridge	32	12	13.7	35	59	9.3
⑩	Zarqa River	King Talal Reservoir inlet	32	12	54.5	35	52	13.5
⑪	Zarqa River	King Talal Reservoir outlet	32	11	27.5	35	47	35.6
⑫	Jordan River	Upstream of Majama Bridge	32	37	29.7	35	33	46.7
⑬	Jordan River	Upstream of King Hussein Bridge	31	52	29.4	35	32	28.6

Relations between 13 monitoring stations and main water sources are shown in Fig. 2.2.2.2-1.

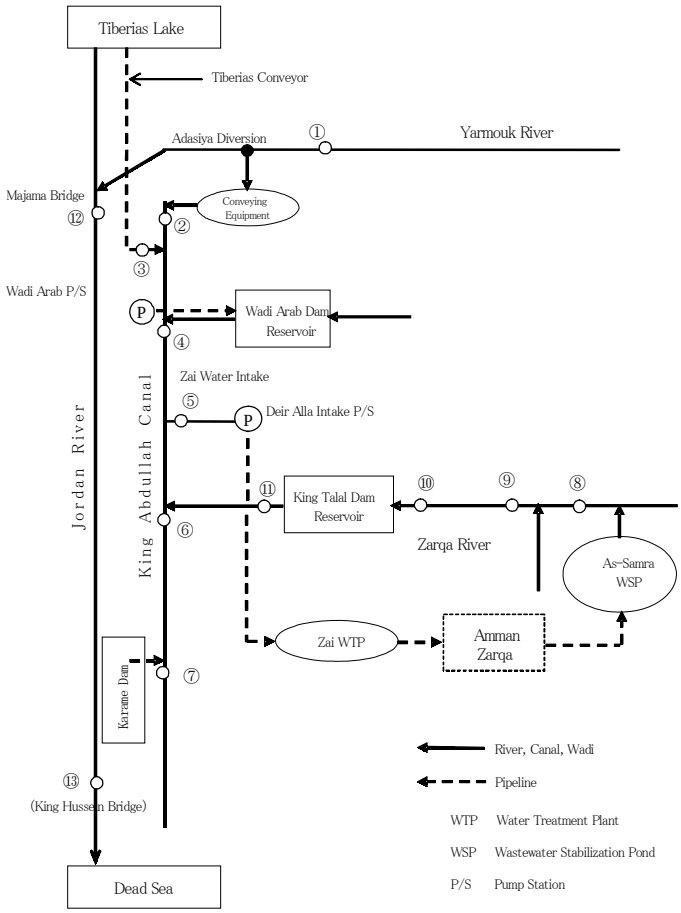


Fig. 2.2.2.2-1 Relations between 13 Monitoring Stations and Main Water Sources

(2) Parameters of the Continuous Monitoring

The following eight parameters shall be adopted as the water quality monitoring items at the monitoring stations:

- Temperature
- pH (hydrogen ion concentration)
- DO (dissolved oxygen)
- EC (electric conductivity)
- TB (turbidity)
- COD (chemical oxygen demand)
- T-N (total nitrogen)
- T-P (total phosphorous)

Reasons for the adoption of these parameters are as follows:

1) Temperature, pH, DO, EC, TB

These items are basic parameters for determining the state of water quality. Moreover, since measurement of these items is relatively easy, they shall be adopted as continuous monitoring parameters at all measurement points.

2) COD

Together with BOD, COD is the most common indicator of organic pollution. Because the level of organic pollution is the most important element in determining various methods of water utilization, this shall be adopted at all measurement points.

Moreover, there are two methods for directly analyzing COD - these are the potassium permanganate method, which is prescribed in Japanese environmental standards and effluent standards, and the potassium dichromate method, which is generally adopted in overseas countries including Jordan. However, as methods for conducting continuous monitoring, since maintenance for the above-mentioned methods is difficult and problems exist in treating organic waste water, etc., the conversion method by ultraviolet photometry (UV method), which involves easy maintenance and does not use reagents, etc. shall be adopted. The absorbance obtained from the UV method is converted into COD value.

3) T-N, T-P

T-N and T-P are used in Japan as indicators to monitor the possibility of eutrophication occurring in closed water areas.

Eutrophication leads to the abnormal growth of phytoplankton in extremely closed water areas such as lakes and marshes and bays, thus hindering water usage. It is generally known that nitrogen or phosphorous are the first biological elements to become deficient in the growth of phytoplankton, and it is these two elements which determine the speed of phytoplankton growth.

In Jordan, abnormal growth of algae became a problem in the source of drinking water (King Abdullah Canal) in 1998, and it is thought that this was caused by conditions similar to those of a closed water body because flow was obstructed by the establishment of water flow control gates along the canal. Accordingly, on this canal used as a source for drinking water, monitoring of these two eutrophication items is necessary.

4) Utilization of water quality data from Early Warning System of WAJ

The Early Warning System (EWS) for monitoring raw water at Zai Water Treatment Plant has been constructed by Norwegian assistance in 2000. The monitoring points of EWS overlap with this Project at Tiberias conveyor outlet (No.③) and Deir Alla intake (No.⑤). However, as a result of the site survey, it was found that the monitoring data from EWS are not reliable because some of the measuring equipments are not in a good condition and the measured values are not stable. Therefore, water quality monitoring shall be done at the above-mentioned points (No.③ and ⑤) in this Project. The monitoring data from EWS shall be supplied by off-line (CD-Rom or FD) and utilized in the monitoring system to be established in the Project.

At the monitoring points of No.③ and ⑤, T-P and T-N, which are the parameters for eutrophication, shall be measured in addition to the parameters measured by EWS (water temperature, pH, OD, EC and TB).

5) Utilization of water flow data from Diral Control Center of JVA

Flow data is considered to be important in terms of gauging total pollution load. However, when it comes to carrying out measurement in natural rivers with minor flow, the only method is to construct a full-scale channel structure. The Jordanian side has not prepared any specific implementation method.

Meanwhile, it was found in the field survey that JVA (manager of King Abdullah Canal) carries out detailed control of flow in King Abdullah Canal at Diral. Therefore, flow data shall be supplied by off-line (CD-Rom or FD) and utilized in the monitoring system to be established in the Project.

6) Request for additional parameters

In the final stage of the field survey, the Jordanian side made a request for addition of the following parameters as continuous monitoring items. However, the necessity of the additional parameters could not be confirmed due to them being special items and lacking in data, it was decided not to adopt these parameters.

- Cyanide
- Hydrocarbon
- Ammonia
- Nitrate
- Chlorophyll
- Heavy metals

The above results of examination are indicated in Table 2.2.2.2-3 as the measurement parameters.

Table 2.2.2.2-3 Parameters of Water Quality Monitoring

No.	Area	Location	Source for	Parameters of Water Quality Monitoring							
				(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
①	Yarmouk River	10km from Adasiya Diversion	Drinking	○	○	○	○	○	○	○	○
②	KAC	North End of KAC	Drinking	○	○	○	○	○	○	○	○
③	KAC	Tiberias Conveyor Outlet	Drinking	○	○	○	○	○	○	○	○
④	KAC	Wadi Arab Dam Pump Station	Drinking	○	○	○	○	○	○	○	○
⑤	KAC	Deir Alla Intake	Drinking	○	○	○	○	○	○	○	○
⑥	KAC	Zarqa Junction	Irrigation	○	○	○	○	○	○	○	○
⑦	KAC	Karameh Dam Turn-out	Irrigation	○	○	○	○	○	○	○	○
⑧	Zarqa River	Downstream of As-Samra WSP	Irrigation	○	○	○	○	○	○	○	○
⑨	Zarqa River	Downstream of Tawafin Adwan Bridge	Irrigation	○	○	○	○	○	○	×	×
⑩	Zarqa River	King Talal Reservoir inlet	Irrigation	○	○	○	○	○	○	○	○
⑪	Zarqa River	King Talal Reservoir outlet	Irrigation	○	○	○	○	○	○	×	×
⑫	Jordan River	Upstream of Majama Bridge	Irrigation	○	○	○	○	○	○	○	○
⑬	Jordan River	Upstream of King Hussein Bridge	Irrigation	○	○	○	○	○	○	×	×

○: Applicable
×: Not applicable
(a): Temperature, (b): pH, (c): DO, (d): EC, (e): TB, (f): COD, (g): T-N, (h): T-P

(3) Current Water Quality Conditions in the Target Area

Average water quality values in the target area are as shown in Table 2.2.2.2-4. Equipment design shall be conducted based on these figures.

Table 2.2.2.2-4 Average Water Quality in the Project Target Area

No.	Parameter	Unit	Sampling Location			
			Jordan River King Hussein Bridge	As-Samra WTP Outlet	Yarmouk River Tunnel Outlet	Junction with Canal
1	pH	–	8.15	7.87	8.13	8.04
2	DO	mg/L	–	5.2	8.23	8.50
3	TM	℃	–	20.5	23.20	21.9
4	EC	μS/cm	6,270	2,539	1,007	1,691
5	TDS	mg/L	–	1,232	597	991
6	TSS	mg/L	–	109	44	43
7	BOD5	mg/L	2.9	118	3	11
8	COD	mg/L	48.5	310	10	27
9	T-P	mg/L	–	19.4	0.70	4.3
10	T-N	mg/L	–	89	4.24	15.39
11	Cl	mg/L	–	374	126	282

Source: JVA Laboratory, Jordan Valley and ERC (Environment Research Center), Amman

(4) Equipment Detailed Design

Assuming that attainment of stable operation in the Project facilities is the most important issue, design that takes the following points into account shall be adopted.

1) Sampling method

Concerning sampling from rivers, in consideration of the fact that river depth and width will grow during the rainy season, submersible pumps shall be used for sampling.

As for sampling from the canal, since there is little fluctuation in water level, ordinary centrifugal pumps shall be installed on adjoining weirs to enable simple inspections and maintenance.

2) Consideration for flood times

Monitoring units containing the measurement instruments for river monitoring shall be installed at positions higher than the design water level at flood time. By doing this, flood damage will be prevented. Meanwhile, concerning sampling piping connected to pumps and the monitoring units, since it is uneconomical to implement flood countermeasures, these items shall be considered as expendable items.

3) Monitoring units

Monitoring units will contain the various measurement instruments, power receiving and control equipment, telemetry equipment and air conditioning equipment, etc. for preserving the equipment monitoring environment. These items shall all be planned for supply inside containers.

4) COD meter type

Concerning the COD measurement method, the UV method shall be adopted because this entails a simple mechanism which makes maintenance easy and enables equipment to be installed in the unmanned monitoring stations that are found in Jordan.

5) Pure water supply for T-P and T-N measurement

Pure water for diluting and washing is required in T-P and T-N measurement. In Japan, ordinary tap water is supplied to monitoring stations and converted to pure water in water purifying apparatus.

However, because it is very difficult to extend public water supply lines to the monitoring stations in the Project and it is desirable to reduce the number of inspection and maintenance items at stations, etc., the necessary pure water shall be prepared at the maintenance agency and supplied to the monitoring stations in regular deliveries.

6) Type of measurement instruments, etc.

Models shall be selected according to the degree of change in the quality of target water. Moreover, concerning the washing of detection parts, air bubbling shall be adopted in the absence of public water supply.

7) Civil works for installation of monitoring station

Concerning the civil works related to the installation of monitoring station (structure construction in the river for installation of submersible pumps, river bottom dredging, erection of a jetty, etc.), because these are strongly linked to monitoring station functions, detailed design according to site conditions and the execution shall be carried out by the Japanese side.

8) Technical guidance and training

Since the water quality monitoring (including T-P and T-N analysis) stations are the first of their kind in Jordan and their operation and maintenance require special

know-how, it is essential that technical guidance and training be carried out by experts.

Based on above mentioned design, the layout of monitoring equipment is shown in the basic design drawing No. WPM-M-01 and the monitoring system diagram is shown in WPM-M-02.

Also main specifications of monitoring station equipment are shown in Table 2.2.2.2-5.

Table 2.2.2.2-5 Main Specifications of Monitoring Station Equipment

Item	Specification
1. Monitoring Unit	
(1) Thermometer	
-Type	Platinum resistance thermometer
-Measuring range	0～40℃
(2) pH Meter	
-Type	Glass electrode
-Measuring range	2～12
(3) DO Meter	
-Type	Polarographic or galvanic membrane electrode
-Measuring range	0～20mg/l
(4) Conductivity Meter	
-Type	AC dual electrode
-Measuring range	0～10,000 μ S/cm
(5) TB Meter	
-Type	Transmitted light, scattered light comparative measurement or scattering light
-Measuring range	0～200mg/l
(6) COD Analyzer	
-Type	UV Spectrophotometer
-Measuring range	0～500mg/l
(7) T-N Analyzer	
-Type	UV Spectrophotometer
-Measuring range	0～200mg/l
(8) T-P Analyzer	
-Type	Molybdenum blue absorption photometry
-Measuring range	0～50mg/l
2. Sampling Equipment	
(1)Sampling pump	
-Type	Centrifugal suction pump for canal Submergible pump for river
-Flow rate	approx.60 l/min
-Head	5～10 meter
-Motor	approx. 0.4kW
(2) Axially equipment	
-Piping	Sampling pip, Drain pipe
-Suction filter	Stainless screen
-Pump maintenance device	Hand winch

2-2-2-3 Plan for Chemical Analysis Equipment for Intermittent Monitoring

(1) Outline of Target Water Quality Laboratories

There are three main water quality laboratories doing measurement survey in the main water sources in Jordan as follows.

- Water Authority of Jordan (WAJ) Laboratory
- Jordan River Authority (JVA) Laboratory
- Environment Research Center (ERC) Laboratory

The surveying areas in which above each laboratory is doing measurement activities are as shown in Table 2.2.2.3-1.

Table 2.2.2.3-1 Water Quality Surveying Areas for Target Laboratories

Name of Laboratory	Location for Intermittent Water Quality Monitoring
WAJ Laboratory	Water quality analysis ・Water treatment plant (raw water and purified water) ・Pump station ・Water reservoir ・Wastewater treatment plant (treated water)
JVA Laboratory	Water sources in Jordan Valley ・Jordan River ・King Abdullah Canal (KAC) ・Yarmouk River
ERC Laboratory	Zarqa River basin ・Zarqa River ・King Talal reservoir ・Wadis flowing into Zarqa River

1) WAJ Laboratory

WAJ Laboratory is located in Amman City; it is composed of seven sections, but it is only the following three sections that are targeted for development.

Analytical Chemistry Section

The Analytical Chemistry Section carries out analysis of surface water, groundwater and drinking water, and it possesses three laboratories.

- The organic substances laboratory possesses analytical equipment composed of a GC, GC-MS and TOC meter, and it mainly carries out analysis of organic chlorine solvents, trihalo-methane, agricultural chemicals, odorous substances, and so on.
- The inorganic water chemistry laboratory uses a spectrophotometer and ion chromatograph, etc. to mainly perform analysis of inorganic ions.
- The inorganic heavy metals laboratory possesses ICP-AES, atomic absorption spectrophotometer and spectrophotometer, etc. and conducts analysis of heavy metals.

Wastewater Chemistry Section

The Wastewater Chemistry Section conducts monitoring of industrial waste water and sewage treatment plants and carries out analysis of organic pollution and heavy metals, etc.

Microbiology Section

The Microbiology Section carries out analysis of total coliform count and general bacteria, etc.

WAJ Laboratory has the highest equipment and staff levels of the three target laboratories, however, it is a medium scale facility when compared to private sector laboratories in Japan, and it is not capable of monitoring the whole of Jordan.

2) JVA Laboratory

JVA Laboratory is located in the Jordan Valley region. In geographical terms, it is anticipated that this laboratory will play the most mobile role in water quality monitoring.

This laboratory carries out inspections of soil, crops, and water quality in response to environmental problems in the agricultural sector. However, the laboratory setup is divided into chemical analysis (manual analysis such as titration, etc.), equipment analysis, and biological analysis groups, but the laboratory is not divided according to the analysis targets (soil, crops, water quality).

It can be said that this situation arises because this laboratory is not as organized as the WAJ laboratory due to the small scale of equipment and staff. Moreover, the machinery room of the analysis room is weak and is considered to be unsuitable for installation of an atomic absorption spectrophotometer. A proper machinery room will need to be prepared when procuring the equipment.

3) ERC Laboratory of Royal Scientific Society (RSS)

The ERC Laboratory is located in Amman City and is the most authoritative research center in Jordan. The organization relating to research consists of the Air Division and Water Quality Division, and both are endowed with ample staff and size.

Moreover, this laboratory is a subordinate organization of Royal Scientific Society (RSS) and it has been consigned by the Environmental Management Board, which is the operating agency for the water monitoring system envisaged by the Project in Jordan, to be in charge of continuous monitoring.

(2) Main Analysis Equipment Owned by the Target Laboratories

Table 2.2.2.3-2 to 2.2.2.3-4 shows the existing quantity and conditions (as of 1998) of main chemical analysis equipment owned by each laboratory.

Table 2.2.2.3-2 Current Conditions of Main Equipment owned by WAJ Laboratory

Equipment Name	Abbreviation	Owned Qt'y	Condition of Equipment		
			A	B	C
Spectrophotometric analysis	SP	3	1	2	
Flame photometer	FP	1		1	
Atomic absorption analysis (flame)	AAS	3	1	1	1
Atomic absorption analysis (flame less)	FLAAS	1		1	
Mercury atomic absorption		1			1
ICP emission analysis	ICP-AES	1	1		
Gas chromatogram	GC	2		2	
Gas chromatogram mass analysis	GC-MS	2		2	
Ion chromatogram	IC	1		1	
Total organic carbon meter	TOC	1		1	
Optical microscope		1			1

A: In operation, B: Not working sometimes, C: Out of order

Table 2.2.2.3-3 Current Conditions of Main Equipment owned by JVA Laboratory

Equipment Name	Abbreviation	Owned Qt'y	Condition of Equipment		
			A	B	C
Spectrophotometric analysis	SP	2	1	1	
Flame photometer	FP	1	1		
Atomic absorption analysis (flame)	AAS	2		1	1
Atomic absorption analysis (flame less)	FLAAS	1		1	
Gas chromatogram	GC	1	1		
Ion chromatogram	IC	1			1

Table 2.2.2.3-4 Current Conditions of Main Equipment owned by ERC Laboratory

Equipment Name	Abbreviation	Owned Qt'y	Condition of Equipment		
			A	B	C
Spectrophotometric analysis	SP	2	2		
Flame photometer	FP	1	1		
Atomic absorption analysis (flame)	AAS	1	1		
Gas chromatogram	GC	4	4		
Ion chromatogram	IC	2	1	1	
High speed liquid chromatogram	HPLC	1	1		
Total organic carbon meter	TOC	1	1		

(3) Examination of Appropriateness of the Request Contents

1) Contents of the Requested Equipment

The requested chemical analysis equipments for intermittent monitoring requested are as indicated in Table 2.2.2.3-5.

Table 2.2.2.3-5 List of Requested Equipments

Classi-fication	Ref. No.	Equipment Name	Qty	Purpose of Use	Sample No./month	Reason for Request
WAJ Lab.	W-1	High speed liquid chromatograph	1	Analysis of agricultural chemicals	20	New
	W-2	Flow injection analyzer	1	Simultaneous analysis of large samples of metals in minute quantities	400	New
	W-3	Electrochemical detector	2	Cyanide and mercury detector	80	New
	W-4	Spectrophotometer	1	Analysis of inorganic elements, etc.	600	New
	W-5	Ion chromatograph (IC)	1	Analysis of inorganic ions	150	Additional
	W-6	pH meter, DO meter, thermometer, residual chlorine meter, turbidity meter	6 sets	Hand held simple analysis (combined unit type)	300	New
	W-7	ICP-MS	1	Analysis of heavy metals		New
	--	IC auto-sampler	1	Auto-sampler for IC		New
	--	Atomic absorption spectrophotometer	1	Analysis of heavy metals, etc.	150	Renewal
	--	Optical microscope (with monitor)	1	Analysis of bacteria	100	Renewal
JVA Lab.	J-1	ICP-AES	1	Analysis of heavy metals	500	New
	J-2	Automatic titration system for COD	1	Upgrading of analysis efficiency	250	New
	J-3	Automatic titration system for BOD	1	Upgrading of analysis efficiency	250	New
	J-4	Draft chamber for organic substances	1	Laboratory development		New
	J-5	Draft chamber for strong acid	1	Laboratory development		New
	J-6	Hand held analysis system	1	Simple field analysis		New
	J-7	Micro-Kjeldal digestion system	1	Pretreatment of nitrogen samples		New
	J-8	Pure water equipment	1			New
	J-9	Water distillation apparatus with deionizer	1	Manufacture of pure water for analysis		New
	--	Ion chromatograph (IC)	1	Measurement of shadow ion		Renewal
	--	4WD pickup truck	2	For sampling		Additional
ERC Lab.	E-1	ICP-MS	1	Analysis of minute quantities of metals, etc.	150	New
	E-2	Mercury analyzer (gold amalgam method)	1	Analysis of mercury	150	New
	E-3	Fluorescent microscope	1	Analysis of bacteria	75	New
	E-4	Automatic titration system	1	Automatic titration of BOD, COD	150	New
	E-5	Autoclave	1	Sterilization		New
	E-6	Six-way filtration system	1	Shortening of filtration time during bacteria inspection	150	New
	E-7	Microwave digestion system	1	Pretreatment of samples		New
	E-8	Distillated water equipment	1			New

2) Concept for Examining Appropriateness

Examination of the appropriateness of requested equipment shall be conducted with equipment divided into analysis equipment and auxiliary equipment for analysis. The

following standards shall be adopted for examining the appropriateness of analysis equipment.

① Is it appropriate analysis equipment with respect to the necessary analysis parameters?
② Can appropriate accuracy be secured with respect to the necessary analysis parameters?
③ Is appropriate treatment capacity (quantity of equipment) secured with respect to the necessary numbers of samples?
④ Have staff capable of handling the equipment been secured?
⑤ Can the necessary budget for operation and maintenance be secured?

The results of compiling the equipment supply concept at each laboratory according to each parameter classification are given in Table 2.2.2.3-6.

Moreover, concerning the auxiliary equipment for analysis, judgment shall be made according to necessity with respect to each analysis and usefulness concerning satisfaction of the required treatment capacity.

Table 2.2.2.3-6 Basic Concept of Chemical Analysis Equipment Supply

Classi-fication	Representative Indices	Main Analysis Methods	Analysis Frequency	Necessary Accuracy (mg/l)	Concept
General pollution indices	BOD, COD, SS, DO	Chemical analysis : electrode gauge, titration, etc.	1 sample / 3 days ~ month per site	> 1	Since the number of samples is the most common and manual analysis is the main method, auxiliary equipment shall be introduced to raise treatment capacity according to need.
	Nitrogen, phosphorous, etc.	Equipment analysis: SP, IC, etc.	1 sample / half a week ~ month per sit	>0.01	Samples are relatively common for this parameter, which is necessary for monitoring odor in drinking water. Necessary analysis equipment, and also auxiliary equipment for improving treatment capacity, shall be introduced.
Inorganic substances	Positive ions: Na, Ca, Mg, etc.	Equipment analysis: AAS, IC, etc.	1 sample/7 days ~ month per site	> 10	This parameter is important concerning the general quality of drinking water, and equipment shall be bolstered to enable the necessary number of samples to be treated.
	Negative ion: SO_4, Cl, etc.	Equipment analysis: SP, IC, etc.	1 sample / month per site	> 0.01	This parameter is important concerning the general quality of drinking water, and equipment shall be bolstered to enable the necessary number of samples to be treated.
	Cd, Cr, Hg, etc.	Equipment analysis: SP, AAS, FLAS, ICP, etc.	1 sample / month ~ half a year per site	> 0.0001	Since this is an important parameter for securing safety of drinking water and a lot of samples are required, equipment shall be supplied to secure the necessary analysis items and analysis accuracy. Moreover, concerning analysis accuracy, in consideration of work efficiency, equipment performance which does not require thickening work shall be secured as much as possible.
Organic chemical substances	Trihalo-methane, chlorine organic solvents, etc.	Equipment analysis: GC, GC-MS, etc.	1 sample / month ~ half a year per site	> 0.000001	The number of required samples is relatively small, however, since this parameter is important in terms of managing drinking water quality, equipment supply shall be carried out to secure the necessary analysis parameters and accuracy.
	Churam, cimazine, etc.	Equipment analysis: GC, GC-MS, HPLC, etc.	2~4 samples / year per site	> 0.000001	The number of required samples is relatively small. However, since this parameter is important in terms of managing drinking water quality, equipment supply shall be carried out to secure the necessary analysis parameters and accuracy.

3) Examination Concerning Chemical Analysis Equipment

① Examination Concept

In the intermittent water quality monitoring by laboratories, it is hoped that measurements will be conducted at many locations which cannot be covered by the monitoring stations, and that detailed parameters required for examining causes and countermeasures for pollution are measured.

Table 2.2.2.3-7 shows the analysis equipment and water quality parameters that are adopted in JIS (Japan Industrial Standards) with respect to the items designated in Japanese environmental standards and drinking water standards (standards concerning the required properties of public water supply). However, the relationships indicated in the table do not restrict the analysis method and there are other possible parameters and equipment relationships, however, the relationship between necessary equipment and necessary accuracy can be gauged.

From this relationship, concerning the equipment stated in this table, it is necessary to supply the quantities that enable the quantities of samples to be processed.

Moreover, concerning the analysis accuracy, a minimum level of 1/10 the figure indicated as the reference value is required. However, generally speaking, various thickening work has been standardized as pretreatment, and analysis of concentration from numerous orders is possible with the equipment capacity. Judging from staff levels at each laboratory, it is necessary to procure high accuracy equipment which enables pretreatment to be minimized and to raise analysis capacity. Concerning the appropriateness of equipment, the equipment capacity and necessary analysis accuracy shall be directly compared.

The requested analysis equipment is compiled in outline form in Table 2.2.2.3-8. The analysis accuracy and treatment capacity shown in the table are rough figures, and the appropriateness of supply shall be examined based on totals for all three laboratories.

Table 2.2.2.3-7 Outline of Analysis Methods Used in Chemical Analysis Equipment (1/2)

Classification	Substance Name	Standard Value (mg/l)	Name of Equipment								
			SP	AAS	FL AAS	ICP-AES	ICP-MS	GC	GC-MS	IC	HPLC
Inorganic substances	Sodium	200		●		●	○			●	
	Ammonium	0.1	●							●	
	Nitrate nitrogen	0.1	●							●	
	Nitrite nitrogen	0.1	●							●	
	Total cyanide	0.01	●							●	
	Chlorine ion	200								●	
	Fluoride	0.8	●							●	
	Phosphorous	0.005	●							●	
Heavy metals	Cadmium	0.01		●	●	●	●				
	Lead	0.01		●	●	●	●			○	
	Hexagonal chrome	0.05		●	●	●	●				
	Arsenic	0.01	●	●	●	●	○				
	Total mercury	0.0005	●	●		○	○				
	Selenium	0.01		●		●	○				
	Zinc	1		●	●	●	●				
	Iron	0.3		●	●	●	○				
	Copper	1	●	●	●	●	●				
	Manganese	0.05	●	●	●	●	●				
	Nickel	0.01	●	●		●	○				
	Antimony	0.002	○	●		○	○				
	Molybdenum	0.07	●	●		●	○				
	Boron	0.2	●	○		●	●				
Organic chemicals	Alkali mercury	ND	●	●				●			
	PCB	ND	○					●	○		
	dichloromethane	0.02	○					●	●		
	Carbon tetrachloride	0.002	○					●	●		
	1, 2 dichloroethane	0.004	○					●	●		
	1, 1 dichloroethylene	0.02	○					●	●		
	1, 2 dichloroethane	0.04	○					●	●		
	1, 1, 1 trichloroethane	1	○					●	●		
	1, 1, 2 trichloroethane	0.006	○					●	●		
	Trichloroethylene	0.03	○					●	●		
	Tetrachloroethylene	0.01	○					●	●		
	1, 3 dichloropropane	0.002	○					●	●		
	Benzene	0.01	○					●	●		
	Chloroform	0.06	○					●	●		
	Trans 1, 2 dichloroethylene	0.04	○					●	●		
	1, 2 dichloropropane	0.06	○					●	●		
	p-dichlorobenzene	0.3	○					●	●		
	Toluene	0.6	○					●	●		
	Xylene	0.4	○					●	●		
	Diethyl hexyl phthalate	0.06	○					●	●		
	Negative ion surface active agent	0.2	●								○
	Phenol	0.005	●						○		
	PCDDs	1pg/l						○	●		

Classification	Substance Name	Standard Value (mg/l)	Name of Equipment								
			SP	AAS	FL AAS	ICP-AES	ICP-MS	GC	GC-MS	IC	HPLC
Agricultural chemicals	Churam	0.003						●	●		
	Cimazin	0.02						●	●		
	Tiobencalve	0.008						●	●		
	Isokisation	0.005						●	●		
	Diajinon	0.003						●	●		
	MEP	0.04						●	●		
	Isoprotioran	0.04						●	●		
	Oxine copper	0.04	●								●
	TPN	0.008						●	●		
	Propizamid	0.006						●	●		
	EPN	0.01						●	●		
	DDVP	0.02						●	●		
	BPMC							●	●		
	IBP	0.008						●	●		
Other	CNP	0.005						●	●		
	Total nitrogen	0.1	●								
	Organic nitrogen	0.1	●								

Mark ● shows the method with which the parameter can be measured and that is adopted in JIS.
Mark ○ shows the method with which the parameter can be measured, but not adopted in JIS
Standard Value means the lowest value in the environmental quality standard, the drinking water quality standards and effluent standards in Japan

Table 2.2.2.3-8 Features of Requested Analysis Equipment

Equipment Name	Abbrevia-tion	Main target Parameters	Guide to Analysis Accuracy (mg/l)	Multi-parameter Sikmultaneous Analysis	Guide to Capacity (samples/day)
Spectrophotometric analysis	SP	Inorganic substances, etc.	> 1	Impossible	10~20
Flame photometer	FP	Heavy metals, etc.	10^{-1}~10	Impossible	Roughly 10
Atomic absorption analysis (flame)	AAS	Inorganic substances, heavy metals, etc.	10^{-1}~10	Impossible	Roughly 10
Atomic absorption analysis (flame less)	FLAAS	Inorganic substances, heavy metals, etc.	10^{-3}~1	Impossible	Roughly 10
Mercury atomic absorption		Mercury	10^{-4}~10^{-1}	Unnecessary	Roughly 10
ICP emission analysis	ICP-AES	Inorganic substances, heavy metals, etc.	10^{-4}~10^{2}	Possible	Roughly 10
ICP mass analysis	ICP-MS	Inorganic substances, heavy metals, etc.	10^{-6}~1	Possible	Roughly 10
Gas chromatogram	GC	Agricultural chemicals, chlorine solvents, etc.	10^{-3}~10^{-1}	Possible	5~10
Gas chromatogram mass analysis	GC-MS	Agricultural chemicals, chlorine solvents, etc.	10^{-6}~	Possible	~5
Ion chromatogram	IC	Inorganic ions, etc.	10^{-3}~	Possible (limited)	5~10
High speed liquid chromatogram	HPLC	Agricultural chemicals, etc.	10^{-3}~	Possible	5~10

② Examination Concerning Parameters and Necessary Accuracy

Upon comparing the owned equipment of the three laboratories as shown in Table 2.2.2.3-2 to 2.2.2.3-4 and the equipment analysis items according to JIS shown in Table 2.2.2.3-7, it can be seen that types of equipment in Jordan are adequate with respect to the target parameters.

Concerning the necessary accuracy, if ICP-MS is not used with respect to heavy metals, there are some items which cannot be measured without thickening. Currently, at laboratories in Japan, application of ICP-MS is advancing, and the supply of ICP-MS to the ERC Laboratory (the highest research authority in Jordan) is considered to be highly significant in terms of raising the level of chemical analysis technology in Jordan and improving efficiency for utilization of human resources.

③ Examination of the Appropriateness of Individual Instruments

As was mentioned above, because the equipment already owned in Jordan is adequate for satisfying the necessary parameters and accuracy, the appropriateness of supply shall be examined individually from the viewpoints of treatment capacity (samples which can be analyzed) regarding the necessary monitoring setup, and the operation and maintenance setup, etc.

The results of examining the above analysis equipment are described in Table 2.2.2.3-9 to 11.

Main specifications for each equipment are shown in Table 2.2.2.3-12 to 14.

Table 2.2.2.3-9 Examination of Appropriateness for Equipment Provision to WAJ Laboratory

No.	Equipment	Quantity		Examination Result
		Request	This Project	
W-1	High speed liquid chromatograph	1	1	This equipment is effective for mainly analyzing the agricultural chemical components, and one unit is possessed by the ERC Laboratory. The area around Jordan's main water source, King Abdullah Canal, is an important farming belt and pollution by agricultural chemicals is a cause for concern. When bolstering the monitoring setup in future, since it is thought that one unit for three laboratories does not provide sufficient processing capacity, equipment supply is deemed to be appropriate.
W-2	Flow injection analyzer	1	1	Since the originally requested flame photometer was purchased in 1999, the above equipment was requested in its place to analyze minute quantities of heavy metals in drinking water. However, in Japan, this equipment is mainly used for measuring large quantities of nitrogen and not heavy metals, and it was not possible to obtain a clear response from the Jordanian side upon inquiring about the analysis method, etc. Therefore, since there is no clear basis for supplying this equipment, it is judged to be inappropriate for supply and shall be omitted from the Project.
W-3	Electrochemical detector	2	2	The original request was for a porarograph to analyze mercury and cyanide, etc., however, since measurement is difficult with this equipment and this is hardly used in the environmental field in Japan today, the request was changed to an electrochemical detector. However, rather than electrochemical detectors, atomic absorption spectrophotometers are mainly used for analysis of mercury. As for analysis of cyanide, electrochemical detectors are used as ion chromatograph detectors and, since the WAJ Laboratory plans to use this equipment for carrying out the efficient measurement of cyanide, etc., the request is deemed to be appropriate.
W-4	Spectrophotometer	1	1	It is scheduled to use this equipment for monitoring nutrients in environmental water and, although three spectrophotometers already exist in this laboratory, it is forecast that the quantity of samples will increase a lot in future. The requested equipment has a wide range of use, requires simple operation, and can measure a lot of parameters. Since the number of samples that can be accepted is limited with the existing equipment, introduction is deemed to be appropriate for raising treatment capacity.
W-5	Ion chromatograph (IC)	1	1	It is scheduled to use this equipment for monitoring ions in waste water. The laboratory already possesses one unit, however, the request was made to deal with future increases in the number of samples. The substances targeted for analysis are inorganic nitrogen and phosphoric acid, which lead to eutrophication, which in turn triggers the currently troublesome smell of mold in drinking water. Ion, which is an important element in

No.	Equipment	Quantity		Examination Result
		Request	This Project	
				determining drinking water quality, is also targeted. This equipment is important for this laboratory, which needs to carry out water quality analysis for the protection of drinking water sources, and when consideration is given to the future increase in samples, supply is deemed to be appropriate. Moreover, auto-samplers necessary for conducting efficient analysis shall be included as auxiliary equipment.
W-6	Field Survey Set (pH, DO, temperature, residual chlorine, turbidity)	6	6	This equipment is necessary for carrying onto sites and evaluating water quality by conducting site measurements. Three sets of equipment with meters contained in cases have been requested and this request is deemed to be appropriate judging from the number of samples.
W-7	ICP-MS	1	1	Since this equipment can simultaneously analyze numerous heavy metal parameters and samples and also has high sensitivity with respect to minute quantities, it has been requested to deal with expansion in minute heavy metals analysis work. Concerning equipment which can analyze minute quantities of heavy metals at the three laboratories, there are only two flameless atomic absorption spectrophotometers, and bolstering can be said to be necessary to deal with future formidable environmental problems and to manage the quality of drinking water. Meanwhile, the WAJ Laboratory is a study and research body which possesses high level analysis technology in Jordan and already has ICP-AES. It was confirmed that they have already prepared the room for this equipment. In view of these points, too, the request for the above equipment is deemed appropriate. Since there is no pure water producing equipment needed for proper operation of this equipment, pure water equipment shall be added as incidental equipment. The Jordanian side has to prepare air-tight room like clean room for this equipment. This equipment is so sophisticated that technical assistance is needed for the proper operation.
--	Auto-sampler for ion chromatograph	1	--	As a result of the field survey, since it was found that this auto-sampler is for the ion chromatograph of W-5, this item shall be deleted and the ion chromatograph shall be provided with an auto-sampler.
--	Atomic absorption spectrophotometer	1	--	WAJ Laboratory has already bought this equipment. Therefore, the request for this item was withdrawn.
--	Optical microscope	1	--	WAJ Laboratory has already bought this equipment. Therefore, the request for this item was withdrawn.

Table 2.2.2.3-10 Examination of Appropriateness for Equipment Provision to JVA Laboratory

No.	Equipment	Quantity		Examination Result
		Request	This Project	
J-1	ICP-AES	1	1	A graphite furnace atomic absorption analysis system was originally requested mainly for analysis of heavy metals, however, in order to deal with increased analysis items in future, since an ICP emission analysis device, which enables simultaneous analysis of numerous heavy metal parameters, is more effective, a revised request was made. As heavy metals analysis equipment, three atomic absorption spectrophotometers are already installed in this laboratory, however, when one considers the current operating rate and bolstering of the future monitoring setup (increase in samples, higher analysis sensitivity), etc. the contents of the request are deemed to be appropriate.
J-2	Automatic titration systems for COD	1	1	The main water quality monitoring work at this laboratory currently consists of survey of general pollution indicators such as BOD and COD. In order to supply the necessary equipment under the Project and respond to the increased analysis load of heavy metals, chlorine solvents, and agricultural chemicals, etc., it is necessary for human sources to shift to chemical analysis work and, since the above titration systems are effective for improving work efficiency in this area, supply is considered to be appropriate.
J-3	Automatic titration systems for BOD	1	1	
J-4	Draft chambers for organic substances	1	1	Ventilation and lighting equipment in the machine room where chemical analysis equipment will be installed in this laboratory is poor. Accordingly, supply of the various equipment is conditional on the laboratory undergoing improvement. Since draft chambers are naturally needed for this reason, the request is considered to be appropriate.
J-5	Draft chambers for strong acids	1	1	
J-6	Hand held analyzers (EC, DO, Temp)	1	1	Since frequent patrols and measurements are necessary, the above hand held equipment is considered necessary.
J-7	Micro-Kjeldahl digestion system	1	1	Nitrogen is an important parameter in water quality monitoring and also requires numerous samples. Therefore, the request for the above equipment needed to perform pretreatment is considered to be appropriate.
J-8	Water distillation apparatus with deionizer	1	1	The existing water distillation apparatus has no ion exchange functions and is unable to manufacture high grade pure water. The request for this equipment is appropriate because it makes the manufacture of high grade pure water possible.
J-9	Gas chromatograph (GC)	1	1	The equipment was requested for making analysis of agricultural chemical components. Since there are some fear against contamination by agricultural chemicals in the agricultural areas of Jordan River areas where the main surface water sources exist, strengthening of analyzing function for agricultural chemicals is one of the important issues. At present, JVA Laboratory only possesses GC (ECD) as agricultural chemical component analysis equipment which can make analysis of the limited chemical items. Therefore, in view of these points, too, the request for the above equipment is deemed appropriate.
--	Ion chromatograph (IC)	1	--	JVA Laboratory has already bought this equipment. Therefore, the request for this item was withdrawn.
--	4WD pickup truck	1	--	JVA Laboratory has 8 pickup trucks, so that it is considered that there is no urgent necessity

Table 2.2.2.3-11 Examination of Appropriateness for Equipment Provision to ERC Laboratory

No.	Equipment	Quantity		Examination Result
		Request	This Project	
E-1	ICP-MS	1	1	Since this equipment can simultaneously analyze numerous heavy metal parameters and samples and also has high sensitivity with respect to minute quantities, it has been requested to deal with expansion in minute heavy metals analysis work. Concerning equipment which can analyze minute quantities of heavy metals at the three laboratories, there are only two flameless atomic absorption spectrophotometers, and bolstering can be said to be necessary to deal with future formidable environmental problems and to manage the quality of drinking water. Meanwhile, the ERC Laboratory plays a core role in water quality analysis within the water quality monitoring setup, and it is also a study and research body which possesses high level analysis technology in Jordan. It was confirmed that they have already prepared the room for this equipment. In view of these points, too, the request for the above equipment is deemed appropriate. Since there is no pure water producing equipment needed for proper operation of this equipment, pure water equipment shall be added as incidental equipment. The Jordanian side has to prepare air-tight room like clean room for this equipment. This equipment is so sophisticated that technical assistance is needed for the proper operation.
E-2	Mercury analyzer (gold amalgam method)	1	1	Mercury analysis requires complex pretreatment, and this equipment is generally used today to automatically perform this and also atomic absorption analysis. Since there is currently only one unit in the WAJ Laboratory, bolstering is deemed to be appropriate.
E-3	Fluorescent microscope	1	1	This equipment was requested for observation of pathogenic bacteria in drinking water and other water sources and, although there are already three microscopes, since the number of samples has increased and there are no fluorescent observation functions, the request is deemed to be appropriate.
E-4	Automatic titration system	1	1	Because automatic titration of manual analysis items such as BOD and COD will improve work efficiency, this request is deemed to be appropriate.
E-5	Autoclave	1	1	Because the autoclave is frequently used for sterilizing BOD and biological sample utensils, it is necessary equipment and the request is deemed to be appropriate.
E-6	Six-way filtration System	1	1	Concerning the six way filtration system too, since the effect in terms of improving the efficiency of manual work is large and it is considered necessary for handling greater numbers of samples in future, the request is deemed to be appropriate.
E-7	Microwave digestion System	1	1	The microwave digestion system has been requested for use in the pretreatment of heavy metal samples. Moreover, since the effect of this equipment in terms of improving the efficiency of manual work is large and it is considered necessary for handling greater numbers of samples in future, the request is deemed to be appropriate.
E-8	Distillated water Equipment	1	1	This equipment is for producing distillated water to supply with 13 monitoring stations. Purchasing the distillated water is not economical because it is rather expensive in the market. Since producing the distillated water in the laboratory is less costly, the request is deemed to be appropriate.

Table 2.2.2.3-12 Main Specifications of Chemical Analysis Equipment at WAJ Laboratory

Ref. No.	Equipment Name	Main Specifications
W-1	High speed liquid chromatograph	Constant flow: 0.001~9.0 ml/min Column: C18 (plural type of chemically modified silica gel columns) Constant pressure: 30 Mpa max. Measurement wavelength: 190 ~ 600nm Injection volume: 0.0001 ~ 0.1 ml Sampler number: 80 samples max.
W-2	Flow injection analyzer	Pumping type : double flanger method Pumping volume : 0 ~2ml or over Detecting method : spectrophotometer type Wavelength : fixed or movable Auto-sampler : not less than 50 samples
W-3	Electrochemical detector	Measurement mode: potential sweeping; DC, SW, DP stripping; potential step, linear sweep coulometry; const. current, const. voltage, potential sweep Flow Cell: DME, HDME
W-4	Spectrophotometer	Photometric system: double beam Wavelength range: 190 ~ 750nm Wavelength scan speed: 50～5000nm/min. Light source: D2 & halogen lamp Photometric system: -0.5 ~ 2Abs
W-5	Ion chromatograph (2-channel)	Flow setting: Max. 9.0 ml/min. or more Maximum pressure: 34.3 Mpa max. Measurement band: 0 ~ 5000 μ S/m Temperature setting range: room temperature +10~90℃ Injection volume: 1 ~ 50 μ l or more Sample number: 80 max.
W-6	Field Survey Set	
W-6-1	pH meter	Display: pH, ORP (mV), temperature (℃), time Measuring range: pH 0 ~ 14, ORP 0-1999mV, temperature –10 ~ 99℃ Resolution: 0.01 pH, 1mV, 0.1℃ Output: more than 10 points, RS-232C or printer
W-6-2	DO meter	Display: DO (mg/l, %), temperature (℃), time Measuring range: 0 ~ 19.99 mg/l, 0 ~ 199%, 0 ~ 45℃ Resolution: 0.01 mg, 1%, 0.1℃ Output: more than 10 points, RS-232C or printer
W-6-3	Thermometer	Range: -200 ~ 300℃ Output: available
W-6-4	Residual chlorine meter	Measuring range: 0 ~ 2.00 mg/l Repeatability: +/- 0.2 mg/l Output: available, RS-232C or printer
W-6-5	Turbidity meter	Measuring method: Scattering light Measuring range: turb.; 0 ~ 200mg/l, temp.; 0 ~ 40℃ Resolution: 1 mg/l, 0.1℃ Output: available, RS-232C or printer
W-7	ICP-MS	Plasma output: more than 1.2 kW (27.12 MHz) Spectrometer mass range: 3 ~ 260amu (quadroupole), Resolution: M/△>2M Dynamic range: 1×10^8 Data control system: RAM>64MB, CPU>Pentium III 400MHz

Table 2.2.2.3-13 Main Specifications of Chemical Analysis Equipment at JVA Laboratory

Ref. No.	Equipment Name	Main Specifications
J-1	ICP-AES	Output: Not less than 1.2kW(27 or 40MHz) Spectrometric method : Monochrometer or Polychrometer Resolution: Not less than 0.01nm Data Processor: CPU; Pentium III, 200MHz or higher, RAM: 32MB or higher
J-2	Automatic titration system for COD	Measurement items: pH, mV, temperature Titration method: end point, set point, pKa, stat titration Discharge Speed: 0.02-50ml/min. Minimum titration volume: 0.001 ml, Sample number: more than 24
J-3	Automatic titration system for BOD	Measurement items: pH, mV, temperature Titration method: end point, set point, pKa, stat titration Discharge Speed: 0.02-50ml/min. Minimum titration volume: 0.001 ml, Sample number: more than 24
J-4	Draft chamber	Active carbon scrubber, Air flow volume: not less than $12m^3$/min. Capacity of working area: Approx. $0.6m^3$ or more
J-5	Draft chamber	Alkali solvent scrubber, Air flow volume: not less than $12m^3$/min. Capacity of working area: Approx. $0.6m^3$ or more
J-6	Field detector set	Measuring items: pH, DO, temperature, conductivity, turbidity, salinity Measuring range: pH 0 ~ 14, 0 ~ 20 mg/l (DO), 0 ~ 40° (temperature), 0 ~ 5 S/m (conductivity), 0 ~ 4% (salinity), 0 ~ 200 mg/l (turbidity) Sensor cable: 25m or longer
J-7	Micro-Kjeldahl digestion system	Digestion tube: more than 250ml, Digestion number: Not less than 20pcs. Distillation sample tube: 500ml, Distillation number: 1 Titrator sample number: not less than 20 samples Data storage: more than 100 data
J-8	Pure water equipment	Collection method: primary; distillation, secondly; ion-exchange Distillation Rage: Not less than 6lit./hr Deionized water flow rate: not less than 1.5 lit./min. Pure water tank: Polyethylene, not less than 100lit.
J-9	GC-MS	Plasma output: more than 1.2 kW (27.12 MHz) Spectrometer mass range: 3 ~ 260amu (quadroupole), Resolution: M/△>2M, Dynamic range: 1×10^8 Data control system: RAM>64MB, CPU>Pentium III 400MHz

Table 2.2.2.3-14 Main Specifications of Chemical Analysis Equipment at ERC Laboratory

Ref. No.	Equipment Name	Main Specifications
E-1	ICP mass spectrometer (ICP-MS)	Plasma output: more than 1.2 kW (27.12 MHz) Spectrometer mass range: 3 ~ 260amu (quadroupole), Resolution: M/△>2M Dynamic range: 1×10^8 Data control system: RAM>64MB, CPU>Pentium III 400MHz
E-2	Mercury analyzer	Method: Gold Amalgam method Treatment: Vapor generation by heating and/or hydride forming Light source: Low pressure mercury discharge lamp, hollow cathode lamp Detector range: more than 0-200mg, Sensitivity: not more than 0.05ppb
E-3	Fluorescent microscope	Optical system: infinity-corrected optical system Eyepiece: 10x , Objective lens: 4x, 10x, 20x, 40x and 100x Condenser: achromatic swing-out condenser Fluorescence attachment: provide, Camera: autofocus 35mm
E-4	Automatic titration system	Measurement items: pH, mV, temperature Titration method: end point, set point, pKa, stat titration Discharge Speed: 0.02-50ml/min. Minimum titration volume: 0.001 ml, Sample number: more than 24
E-5	Autoclave	Capacity of chamber: more than 15 lit., Material of chamber: Stainless steel Temperature range: 105-123℃ or wider, Pressure: not less than 1.6kg/cm2 Timer: Digital, 1-60 min., Safety device: available
E-6	Six way filtration system	Quantity of branch: 6 (stainless steel) Filter holder: Filter size; 47 ϕ mm, volume; 500ml, stainless steel Filtering flask: 5 lit. or more, glass Vacuum pump: pumping speed: more than 30lit/min.
E-7	Microwave digestion system	Output: Not less than 950 W, Frequency: 2450 MHz, Number of Sample: 12 Program: Pressure, temp., time, Vessel volume: not less than 90ml Heat proof/pressure proof: 200℃/1.4MPa or more
E-8	Distillated water equipment	Collection method: primary; distillation Distillation Rage: Not less than 5.0lit./hr Pure water tank: Polyethylene, not less than 100lit.

2-2-2-4 Plan for Telemetry System

(1) Overall System

1) Outline of the System

In the telemetry system, data collected in each monitoring station will be transmitted to the Monitoring Center to be established within RSS. The Monitoring Center will house a computer system composed of work stations and personal computers, etc. linked in a mutual network, and this will enable the collected data to be managed, preserved and analyzed and each item of information to be viewed and printed out.

In order to utilize the monitored data promptly on the environmental administration, telemetry equipment such as a personal computer, modem, etc. shall be installed in the General Corporation for Environmental Protection (GCEP). The computer in GCEP shall be connected with the monitoring center by the leased telephone line so that the collected data can be reported to GCEP.

Moreover, by connecting the Monitoring Center with the National Information Center/National Information System (NIC/NIS), disclosure of information as a web page will be possible on the Internet. Fig. 2.2.2.4-1 shows the overall system composition.

Data provision method from each related authority and facility to the monitoring center for the Project, contents and frequency of the data to be provided, and proposed parameters to be provided from three major laboratories (WAJ, JVA and ERC) are shown in Table 2.2.2.4-1, 2.2.2.4-2 and 2.2.2.4-3 respectively.

Table 2.2.2.4-1 Data Provision Method from Related Authority/Facility to the Monitoring Center

Authority/Facility	Method of Data Provision
Monitoring Stations (13 stations)	By on-line
Early Warning System of WAJ	By off-line
Diral Control Center of JVA	By off-line
WAJ Laboratory	By off-line
JVA Laboratory	By off-line
ERC Laboratory	By on-line

Table 2.2.2.4-2 Contents and Frequency for Data Provision

Authority/Facility	Parameters	Frequency	Media
Monitoring Stations (13 places)	Water Temperature, pH, DO, EC, TB, TOC, T-N, T-P	For T-N and T-P, 4 times/day, hourly for other items	Telephone Line
Early Warning System of WAJ	pH, Water Temperature, EC, TB, Color, BOD, TOC, COD, Ammonia, TSS, DO	Monthly	CD or FD
Diral Control Center of JVA	Water Flow	Daily	CD or FD
WAJ Laboratory	(See Table 5-3)	Monthly	CD or FD
JVA Laboratory	(See Table 5-3)	Monthly	CD or FD
ERC Laboratory	(See Table 5-3)	Monthly	Telephone Line

Table 2.2.2.4-3 Proposed Parameters to be Provided from 3 Major Laboratories

Item	Parameters	Remarks
Basic parameter	Water Temperature, pH, EC, TB, TDS, TSS	Parameters to show the basic characteristic of water.
Organic substance	BOD, COD, DO, FOG	Parameters to show the pollution by the organic substances from domestic or industrial sources.
Coliform group	TCC, TFCC	Parameters to show the pollution by Coliform group.
Eutrophic parameters	T-N, kj-N, NH4-N, NO3-N, NO2-N, T-P, PO4-P, algae, Chlorophyll(a)	Parameters to show the grade of eutrophication and concentration of nitrogen compounds, phosphorus compounds and algae.
Cations	K, Na, Ca, Mg, etc.	Parameters to show the concentration of cations except nitrogen compounds.
Anions	Cl, SO4, HCO3, CO3, etc.	Parameters to show concentration of anions.
Trace Elements	Al, As, Be, Cu, Fe, Li, Mn, Ni, Pb, Se, Cd, Zn, Cr, Hg, V, Co, Mo, etc.	Parameters to show the pollution by the heavy metals mainly from industrial sources.
Pesticides	Thiram, Simazine, etc.	Parameters to show the pollution by chemicals for agriculture.
Volatile organic compound	Cl2=CHCl, Cl2=CCl2, etc.	Parameters to show the pollution by harmful organic substances.
Other chemical substances	Phenol, CN, Cr6+, THM's, etc.	Parameters to show the pollution by domestic or industrial sources, except items shown above.

2) Data Collection

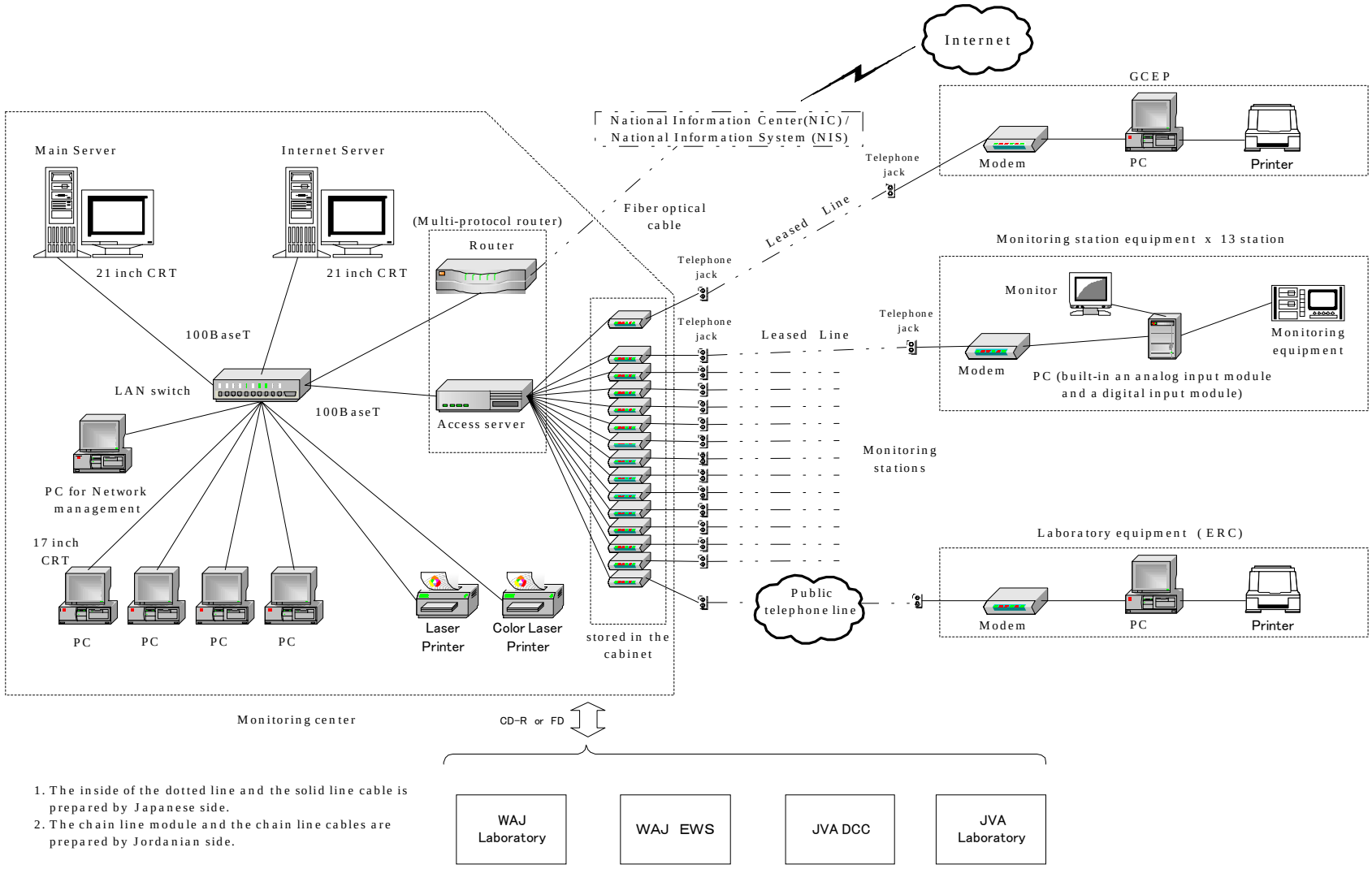
Data collection from the monitoring stations shall be carried out under the following conditions:

- Measurement cycle: once/hour
- Measurement data: 3-8 items (see Table 2.2.2.2-3 Parameters of Water Quality Monitoring).
- Data volume: 2 bytes per measurement item (binary data)

The volume of raw data during communication will, according to the above, be a maximum of 16 bytes per measurement. At times of data communication, in addition to this raw data, the monitoring station ID No., time of data measurement, measurement device and operating conditions of the sampling pump will be transmitted. When these items of data are added, the amount of data transmitted in one batch will be at least 20 bytes. Assuming that communication is conducted at a rate of 9,600 bps (bits per second), the time required for communication of measurement data will be as follows:

100 bytes = 1,000 bits
1000 bits / 9600 bps = 0.104 sec

The time required to transmit measurement data is less than 1 second in the above calculation, however, during actual communication, apart from the time required to communicate the measured data, time is also required to carry out various settings and confirmation between the two modems at the Monitoring Center and monitoring station. Therefore, total communication time between the start and end of each telephone call will be anything above 20 seconds. Concerning the modem speed, the maximum speed of telephone line modems is 56 Kbps, and it is thought that 9,600 bps can be definitely secured even when phone line conditions are poor.



1. The inside of the dotted line and the solid line cable is prepared by Japanese side.
2. The chain line module and the chain line cables are prepared by Jordanian side.

Fig. 2.2.2.4-1 Overall Composition for Telemetry System

3) Data Recording

The amount of data in the case where it is processed and stored on the Monitoring Center server following collection is as follows. Since the amount of data per transmission or per day is small, all measurement data per month from each monitoring station will be stored as a single file on disc. File size in this case will be approximately 10 K-bytes as indicated in the following table.

Files will be binary format and will record each measured data in time series. The time and date of each data will be determined according to their recorded order from the top. For example, data from 15.00 on the 14th day will be recorded from byte 5,232 onwards as shown in the following calculation:

16 bytes ×24 hours ×13 days + 16 bytes ×15 hours = 5,232 bytes

Concerning the station ID and year and month, this will be judged according to the file name. The amount of raw data recorded in this way will be as indicated in Table 2.2.2.4-4.

Table 2.2.2.4-4 Amount of Raw Data (bytes)

	1 Time	1 Day	1 Month	1 Year
Each station	16	384	11,520	140,160
All stations	208	4,992	149,760	1,822,080

These raw data are recorded in binary format and, in cases of conducting screen display or printing out, data base soft will be converted into letters and processed. On the server, in addition to these measurement data (raw data), a file showing the operating conditions of measurement devices and sampling pumps, etc. will be required, but this will entail a far smaller amount of data than that on the measurement data files. In any case, judging from the capacity of computer networks in recent years, it can be said that the system will only handle small amounts of data.

4) Necessary System Capacity

As was mentioned above, the amount of data handled by the system will be small and, when one considers the capacity of communications systems and computer systems today, there is no need for particularly high speed telecommunications systems and computer systems. The system can be sufficiently operated with the standard devices that are available today.

(2) Communication System

1) Means of Communication

The means of communication indicated in Table 2.2.2.4-5 will be used in the telemetry system.

Table 2.2.2.4-5 Means of Communication

Communication Sites	Type
Monitoring stations ↔ Monitoring Center	Leased analog line
ERC Laboratory ↔ Monitoring Center	Public telephone line
Monitoring Center↔GCEP	Leased analog line
Monitoring Center ↔ NIC	Optical fiber cable

2) Capacity of Communication Lines

As was indicated in paragraph 1) above, since the amount of data sent in each transmission from the monitoring stations is small and data is sent just once per hour, general phone lines can amply serve as the communication lines, however, because exclusive lines can be used at a low price in Jordan, exclusive analog lines shall be used. Concerning laboratories and related agencies, since frequency of communications from the stations will be small (roughly once per day), public telephone lines shall be used.

The communication line between GCEP and the monitoring center shall be done by the leased analog line. Concerning communication lines with NIC, high speed optical fiber communication lines will be utilized so that related agencies can view information on the Internet.

(3) Monitoring Center Equipment

1) Computer System Capability

Since the amount of data handled by the system is small and the type of data analysis is not complicated, standard personal computers will be sufficient.

2) Examination Concerning the Request Contents

① Personal Computer (PC)

The request is for one network management personal computer, seven administration personal computers, and six note personal computers. The administration personal computers are for soft corrections and revisions of

readouts, and the note personal computers are for field activities at measurement points.

However, since the outdoor use of personal computers cannot be considered in the Project and use of note personal computers cannot be restricted to the Project, the note personal computers were deemed to be unnecessary. Meanwhile, concerning the administration personal computers, these are necessary for data viewing and work, however, judging from the size of the Monitoring Center, four desk top personal computers and one network management personal computer are deemed to be appropriate.

② Serial Line Printer for the Monitoring Center

A high speed line printer was requested for producing large amounts of readouts, however, this was deemed to be unnecessary for the following reasons:

- The numbers of slips and quantity of printed materials produced every day are minor.
- Because data is disclosed via the Internet, there is little distribution of printed materials to related agencies.
- A feature of this printer is that is uses continuous paper, however, printing speed in page units is not so different from a page printer.
- Printing work can be amply implemented using a laser printer only.

③ Projector

An additional request was made for a frontal type projector which can be connected to a personal computer, however, because the Monitoring Center will host few visitors and meetings, there is no direct need for a projector, and there is a strong possibility that such a device could be used for purposes other than water quality monitoring, supply is considered to be inappropriate.

④ Duplexing of Uninterrupted Power Supply

In view of the frequent power failures in Amman City, a request was made for the duplexing of the uninterrupted power supply, however, since there is no urgency concerning this system, and data can be collected after operation has stopped in the event of power failure, duplexing is considered to be unnecessary.

3) Design Contents of Each Equipment

The design contents of requested equipment for the Monitoring Center are indicated in Table 2.2.2.4-6.

(4) Equipment for Monitoring Stations

1) Monitoring Station Functions

In cases where set period measurement data are stored and regular communications cannot be carried out due to the poor status of telephone lines, PC at the monitoring stations shall be given the capability to send the latest data together with stored data not yet sent after the problem has been resolved.

Moreover, in the event where monitoring stations experience power failure, measurement equipment will not function, but concerning personal computers, it shall be possible to record information using backup from the uninterrupted power supply (UPS).

2) PC

Personal computers with FA specifications, which offer high environmental resistance, shall be used at the monitoring stations. Moreover, for better reliability, the system shall not use a hard disc but a semiconductor disc shall be used for data storage.

3) Design Contents of Each Equipment

The design contents of equipment requested for the monitoring stations are indicated in Table 2.2.2.4-7.

Table 2.2.2.4-6 Telemetry Equipment for Monitoring Center

Requested Item	Quantity		Project Contents
	Request	Project	
Data processor (equivalent to FA3 100)	1 set	1 set	One Internet server and one 21 inch CRT are required for viewing and processing information via the Internet.
Main server (equivalent to UX2000)	1 set	1 set	One main server and one 21 inch CRT are required for collecting, managing, storing and analyzing data.
Personal computer (CPU Pentium)	14 units	5 units	Four PC are sufficient for carrying out viewing of measurement data and analysis results, etc. and for performing water quality monitoring work such as printing, but one network management PC is also required to manage the network in the Monitoring Center. Back-up shall be done by CD-RW.
Laser printer	14 units	2 units	The original request was to connect 14 laser printers to each of 14 PC, however, because the number of PC has been drastically cut and disclosure of data to related agencies will be conducted via the Internet with optical discs used for data backup, printouts will be very few. Therefore, the printers shall also be drastically reduced to one high speed black and white page printer and one color printer.
Leased line rack modem	20 units	14 units	Analog leased line modems for carrying out communications with the stations. Rack-mount type modems shall be adopted and 13 are required in line with the number of stations and 1 modem is required for a PC at GCEP.
Dial-up stand alone modems	10 units	1 unit	One public telephone line modem is required to carry out communications between ERC Laboratory and related agencies. These will be used alternately between five connections.
Multi-protocol router (equivalent to CISCO 4000)	2 units	1 unit	After connecting with NIC by optical fiber cable, one Internet connection router is required to carry out communications for information disclosure on the Internet.
Multi-protocol router (equivalent to CISCO 2500)	1 unit	1 unit	One access route for connecting to analog lines is required to collect and process data from stations, laboratories and related agencies via analog telephone lines.
System line printer	1 unit	–	This was deemed to be unnecessary.
Page printer	2 units	–	These were requested as backup for the above system line printer, however, since the system line printer was deemed to be unnecessary, the page printer is also deemed unnecessary.
LAN, switch, hubs, cable	1 set	1 set	One Ethernet mutual connection switch and server are required for mutually linking devices in the monitoring center to LAN, and one Ethernet cable set is required for mutually connecting the server, each PC and routers.
Uninterrupted power supply (15 KVA*10 min)	1 unit	1 unit	This is required for shutdown work at times of power failure. Backup time is roughly 10 hours.
Lightning arrester	1 set	2 sets	Two sets are required, one each for the power lines and the telephone lines.
Operating console	1 unit	–	Since this is a standard item, it shall be borne by the Jordanian side.
Accessories	1 set	1 set	One tape drive is required for server backup. One MO is required for PC backup.
Software	1 set	1 set	Database management soft and network management software.
Wiring work	1 set	1 set	Laying of network cable within the Monitoring Center shall be borne by the Japanese side. The laying of exclusive analog lines, public telephone lines, optical fiber cables and power lines to the Monitoring Center shall be borne by the Jordanian side.

Table 2.2.2.4-7 Telemetry Equipment for Monitoring Stations

Requested Item	Quantity		Project Contents
	Request	Project	
Data system logger Personal computer (CPU Pentium) Printer	13 sets	13 sets	As items for dealing with the logger, an analog input module and digital input/output module are required. These will be installed inside the PC, which will be an FA type. For higher reliability, the program shall be in ROM format and shall be stored on disc. A semiconductor disc shall be installed for data backup. For maintenance work, a monitor showing the operating conditions of measurement devices shall be installed. No printer is required because conditions can be confirmed on monitor.
Modem interface	13 units	–	Unnecessary because a modem is built into the PC.
Modem, telephone	13 units	13 units	One leased line modem is necessary. Installation of the leased line shall be undertaken by the Jordanian side.
Power supply	13 sets	–	UPS is unnecessary because a set voltage is generated.
UPS	13 units	13 units	UPS is required for backup of the PC power source. Backup time is 10 hours.
Lightning arrester	13 sets	13 sets	One each for the power lines and the telephone lines.
Cable, console	13 sets	13 sets	Cable for connecting the PC and each measurement device is required. A console shall not be installed because room inside the units is small.
Wiring work	13 sets	13 sets	Wiring work inside the monitoring unit shall be undertaken by the Japanese side

Note : The quantity is for 13 statios.

(5) Equipment for ERC Laboratory

Although telemetry equipment for the WAJ, JVA and ERC laboratories was requested, it has been decided to provide the telemetry equipment only to ERC Laboratory as indicated in Table 2.2.2.4-8.

Table 2.2.2.4-8 Telemetry Equipment for ERC Laboratory

Requested Item	Quantity		Project Contents
	Request	Project	
Personal computer Printer	3 sets	1 set	One PC and one ink jet printer are required for transmitting measurement data to the Center.
Modem interface	3 sets	–	Unnecessary because this is already built into the PC.
Modem, telephone	3 sets	1 set	One public telephone line modem is necessary. Installation of the telephone line shall be undertaken by the Jordanian side.
Power supply	3 sets	–	UPS is unnecessary because the scope of equipment power supply is wide.
Lightning arrester	3 sets	1 set	One each is required for the power lines and the telephone lines.
Cable, console	3 sets	1 set	One cable each is required for the printer and modem. A console shall not be placed because it is a standard item.
Wiring work	3 sets	1 set	Laying of telephone lines and power lines to the system shall be undertaken by the Jordanian side.

(6) Equipment for Connection with GCEP

The telemetry equipment such as PC shall be installed in GCEP building in order to connect between GCEP and the monitoring center with leased analog line. The contents of the provided equipment are shown in Table 2.2.2.4-9 below.

Table 2.2.2.4-9 Telemetry Equipment for GCEP

Requested Item	Quantity		Project Contents
	Request	Project	
Personal computer Printer	1 set	1 set	One PC and one ink jet printer are required for transmitting measurement data to the Center.
Modem interface	1 set	1 set	Unnecessary because this is already built into the PC.
Modem, telephone	1 set	1 set	One public telephone line modem is necessary. Installation of the telephone line shall be undertaken by the Jordanian side.
Power supply	1 set	1 set	UPS is unnecessary because the scope of equipment power supply is wide.
Lightning arrester	1 set	1 set	One each is required for the power lines and the telephone lines.
Cable, console	1 set	1 set	One cable each is required for the printer and modem. A console shall not be placed because it is a standard item.
Wiring work	1 set	1 set	Laying of telephone lines and power lines to the system shall be undertaken by the Jordanian side.

(7) Equipment for Connection with DCC

At the early stage of the basic design study of this project, flow data of KAC obtained at Diral Control Center (DCC) of JVA was supposed to be supplied to the Monitoring Center by on-line through the connection between the Monitoring Center and the SCADA system of DCC by public telephone line. However, JVA changed their policy that the flow data is supplied by media such as CD-Rom or FD, not by on-line.

Input of flow data to CD-Rom or FD shall be done by DCC. Therefore, there is no equipment to be provided to DCC under this project.

(8) Equipment for Connection with Zai Water Treatment Plant

At the early stage of the basic design study of this project, monitored water quality data of KAC obtained at the Early Warning System (EWS) of Zai Water Treatment Plant (WTP) of WAJ was supposed to be supplied to the Monitoring Center by on-line through the connection between the Monitoring Center and the SCADA system of EWS by public telephone line. However, WAJ changed their policy that the monitored data is supplied by media such as CD-Rom or FD, not by on-line.

Input of flow data to CD-Rom or FD shall be done by the staff of Zai WTP. Therefore, there is no equipment to be provided to EWS of Zai WTP under this project.

(9) Software

1) Data Base Management

Since there are no related systems of note, system design shall be performed based on the assumption of individual operation.

2) Data Disclosure

Since collected data shall be disclosed as a web site on the Internet and the data adopts a very standard format, it will be possible to utilize data in other systems.

3) Analysis

The data storage and analysis items are as follows:

- Raw data
- Average, maximum, minimum (day, month, year)

4) Display

① Selection screen

As a screen for operating the system, for example, selecting the monitoring station, etc., a simple graphical user interface shall be provided.

② Tables

- Real time data
- Raw data
- Average, maximum, minimum (day, month, year)

③ Trend graphs

- Raw data
- Average, maximum, minimum (day, month, year)

④ Upper and lower limits shall be set for each measurement, and data out of range shall be displayed.

- Monitoring station operating conditions (current conditions and history)
- Alarm information (current conditions and history)

⑤ Printing

(a) Tables

- Real time data
- Raw data
- Average, maximum, minimum (day, month, year)

(b) Trend graphs

- Raw data
- Average, maximum, minimum (day, month, year)

(c) Upper and lower limits shall be set for each measurement, and data out of range shall be displayed.

⑥ Disc File

- Raw data (text file)

⑦ Gauging of Operating Conditions

Operating conditions at the monitoring stations can be gauged at the Monitoring Center at all times. The collected items will be power failure conditions, trouble in submersible pumps, trouble in measurement devices, existence of measurement water, and so on.

⑧ Handling of Power Failure

Design shall be carried out to ensure that overall functions are not hindered even if power failures should occur at the monitoring stations or Monitoring Center, and to allow automatic recovery of systems after power is restored. At the Monitoring Center, system breakdown will be prevented by using UPS for backup power and shutting down the system at times of power failure. As for the monitoring stations, even if functioning should stop at the Monitoring Center, measurement data during this period shall be stored and transmitted en masse after functions have been restored.

⑨ Handling at Times of Telephone Line Failure

The system shall be designed so that, even if trouble should arise on telephone lines, it will be possible to recover measurement data unharmed after normal functions are resumed.

(10) Operation and Maintenance

1) Operation and Maintenance Staff

The monitoring center with 13 monitoring stations shall be operated and maintained by CUEP to be established under RSS. The center will be the It is not necessary to assign special operation and maintenance staff for system and network management. In the event of system breakdowns, existing system staff shall carry out restoration work.

2) Network Management

It shall be given basic network management functions in line with this. Moreover, concerning government networks, NIC conducts integrated operation and management and, since this system will also be directly connected to NIC by leased line, it will be possible for NIC to carry out remote control via this line.

③ Security Control in Line with Internet Connection

Security control arising in line with Internet server installation will mainly be handled by NIC, and basic functions only shall be provided inside the system itself.

④ Consumable Items

Since it is necessary to have a permanent supply of consumable items for the printer, products which can easily be procured in Jordan shall be selected.
Main specification of telemetry system is shown in the Table 2.2.2.4-10.

Table 2.2.2.4-10　Main Specifications for Telemetry Equipment

Equipment	Specifications	Note
Ⅰ Hardware 1. Monitoring stations (1) Personal Computer －Model －CPU －Main memory －Silicon Disk －Analog Input －Digital Input (2) Modem －Speed, etc. (3) Monitor －Size (4) UPS	 Embedded PC IBM7344-TV0 Celeron 400MHz 64M byte 512M byte 12bit isolated input A/D converter 10 kHz conversion speed Isolated input digital input module 56Kbps、 MNP class4, MNP class5 or equivalent Color LCD 12inch、800×600 dot（SVGA） AC 220V，100VA×10min	 This PC will be a highly reliable system capable of continuous operations 24 hours a day. A silicon disk utilizing flash memory will be used for storing accumulated data in place of a hard disk.
2. ERC Laboratory and GCEP (1) Personal Computer －Model －CPU －Main memory －Hard disk (2) Monitor (3) Printer	 Desktop PC Pentium III, 1.0GHz or equivalent 128M byte 10G byte 17inch color CRT A4 size inkjet printer	 CRT and modem are included.
3. Monitoring Center (1) Internet Server (2) Main Server －Type －CPU －Memory －Hard disk －Monitor (3) LAN switch －Network (4) Access Server －Network －Port (5) Multi-protocol Router －Network －Port (6) Modem －Speed, etc.	 UNIX workstation or equivalent IBM RS/6000 Model44P-170 or equivalent Power 3-II, 333MHz or equivalent 512M byte 9.1G byte 21 inch CRT Catalyst 2912 or equivalent 10/100BASE-TX×12port Cisco 2610 100BASE-TX Asynchronous×20port Cisco 2610 100BASE-TX Optical fiber cable, PRI unbalanced Rack mount type 33.6Kbps、MNP class 4, MNP class 5	 The same model shall be used for (1) Internet server and (2) Main server. For leased line:14 units For Dial-up:1 units

Equipment	Specifications	Note
(7) Personal Computer		
－Model	Desktop PC	
－CPU	Pentium III, 1.0GHz	
－Main memory	128M byte	
－Hard disk	10G byte	
－Monitor	17 inch color CRT	
(8) Printer		
1) Laser printer		
－Model	Monochrome Laser printer	
－Size, speed	A3 size, max.32ppm(A4size)	
2) Color printer		
－Model	Color Laser printer	
－Size, speed	A3 size, max.4ppm(color)	
(9) Software		Software to be purchased in the market
－Database management	Orcacle8I Enterprise Edition or equiv.	
－Network management	HP Open-view NNM or equivalent	
(10) UPS	AC220V 3000VA×10min	
Ⅱ Software		Specifications of software to be made especially for monitoring system of this project.
1. Monitoring Station		
(1) Data logging	PC with analog/digital converter will be read the analog data from the continuous measuring devices.	
(2) Data transmitting	Transmission of measurement data will be initiated by Monitoring center via a leased telephone line.	
2. Laboratories		
(1) Data input	Measurement data will be input manually into the PC.	
(2) Data transmitting	Accumulation of data shall be performed via telephone from the Laboratory to the Center.	
3. Monitoring Center		
(1) Data Accumulation	Measurement data from Monitoring Stations will be accumulated by the command from the Center using the telephone line at every 1 hour.	
(2) Data Analysis	Data analysis will be performed automatically on all accumulated data.	
(3) Data display and print	The analyzing data will be able to display and print by table format or trend graph.	
(4) Data Disclosure	The system will have the ability to disclose accumulated data and the results of analysis to related organizations in Web format using the Internet.	

2-2-2-5 Facility Plan for Civil Work

(1) Outline of the facility

While the civil work for installing the monitoring stations at 13 points is different from point to point, it can be summarized as follows.

- Ground leveling at the site
- Banking of the land for the monitoring station
- Foundation of the monitoring unit
- Boundary fence around the monitoring station
- Foundation, embankment, and river-bottom dredging for installing the sampling pump
- Jetty for the sampling pump

Table 2.2.2.5-1 shows the details of the civil work and facilities at each candidate site of the monitoring station.

Table 2.2.2.5-1 Civil Works for Installation of Monitoring Stations

Site No.	Location	Ground leveling	Banking	MU foundation	Boundary fence	Pump foundation	River improvement related to pump foundation	Digging in the river	Jetty
①	10km from Adasiya Diversion	○		○	○	○			○
②	North end of KAC	○		○	○	○			
③	Tiberias conveyor outlet			○		○			
④	Wadi Arab Dam pump station outlet			○		○			
⑤	Deir Alla intake			○		○			
⑥	Zarqa junction	○		○	○	○			
⑦	Karameh Dam turn-out	○	○	○	○	○			
⑧	Downstream of As-Samra WSP	○	○	○	○		○	○	
⑨	Downstream of Tawafin Adwan Bridge	○	○	○	○		○	○	
⑩	King Talal reservoir inlet	○		○				○	
⑪	King Talal reservoir outlet	○	○	○	○		○	○	
⑫	Upstream of Majama Bridge	○	○	○	○			○	
⑬	Upstream of King Hussein Bridge	○	○	○	○		○	○	

Note) MU: monitoring unit

(2) Ground leveling and embankment at the site

The monitoring stations, except for those with Nos. ③, ④ and ⑤ to be installed in the premises of an existing facility such as a pump station, will be installed on a land along a canal or on a riverbed. Since these lands are slightly undulated or covered with rolling stones, ground leveling and embankment are needed.

In addition, for the monitoring stations with Nos. ⑧, ⑨ and ⑬ to be installed on a riverbed, the embankment must be high enough in consideration of possible effect of the rise of the river. Judging from the above, the height of the embankment at each location shall be as shown in Table 2.2.2.5-2.

Table 2.2.2.5-2 Height of Embankment at Each Monitoring Station Site

No.	Site name	Height of embankment (m)	Remarks
⑦	Karameh Dam turn-out	0.3	Too much undulated, so the unevenness is adjusted.
⑧	Downstream of As-Samra WSP	0.6	On the Wadi waterbed, so effect of the rise of the river is considered.
⑨	Downstream of Tawafin Adwan Bridge	0.6	On the Wadi waterbed, so effect of the rise of the river is considered.
⑪	King Talal reservoir outlet	0.3	Too much undulated, so the unevenness is adjusted.
⑫	Upstream of Majama Bridge	0.3	Too much undulated, so the unevenness is adjusted.
⑬	Upstream of King Hussein Bridge	1.5	On an ordinary waterbed, so effect of a flood is considered.

(3) Foundation of the monitoring unit

The monitoring unit, which is a container equipped with monitoring equipment, is transported into the site and installed on the foundation using a crane.

Since the monitoring unit is as light in weight as about 4 ton, the foundation of the unit is a direct foundation supported at two points. Since the unit is about 2.5m wide, the size of the foundation is set to 0.6 m x 0.6m x 3.0m.

The subgrade reaction is 4 ton/(0.6m x 0.3m)=1.1 ton/m^2. Since the subgrade reaction of about 3 to 5 ton/m^2 can be ensured even if the unit is installed directly on the ground or on the bank at the monitoring station site, the safety is secured.

(4) Boundary fence around the monitoring station

The monitoring stations, except for those with Nos. ③, ④ and ⑤ to be installed in the premises of an existing facility, are provided with a fence for protecting the monitoring station equipment from theft. The height of the fence is 1.8m.

(5) Foundation, embankment, and river-bottom dredging for installing the sampling pump

A foundation for installing the sampling pump is constructed. Since the monitoring stations, except for those (with Nos. ② to ⑦) to be installed along King Abdullah Canal, are to be installed on a riverbed, dredging of the river bottom and embankment are needed.

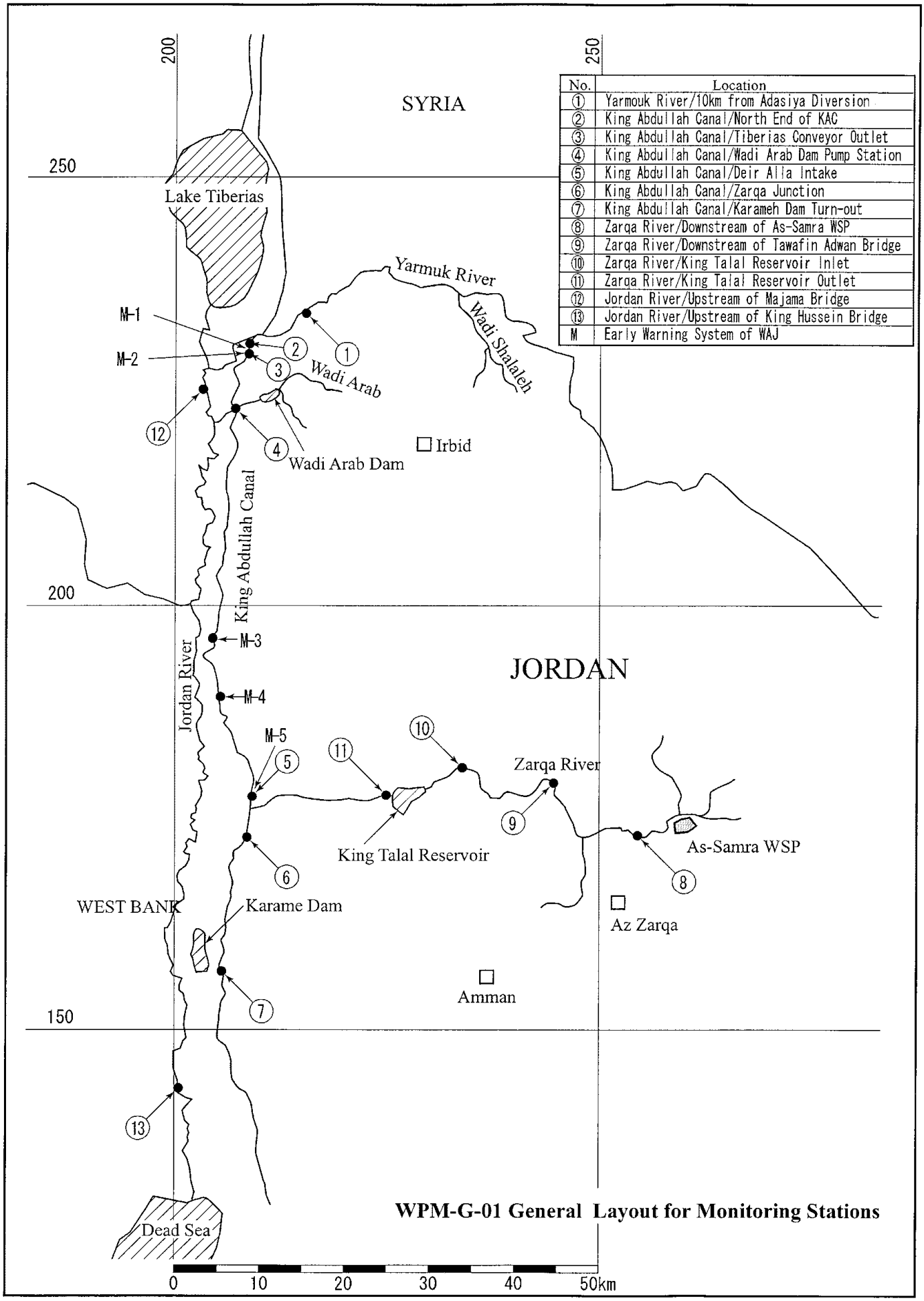
(6) Jetty for the sampling pump

The monitoring station with the site No. ① is to be installed along Yarmouk River, but access to the river is difficult because the riverbank forms a cliff. For this reason, a jetty with steel frame structure, which is generally employed as a flow monitoring station in Jordan, is to be built as the monitoring station. Details are shown in the basic design drawings WPM-C-01-1 and WPM-C-01-2.

2-2-3 Basic Design Drawings

Basic design drawings for the project are listed below.

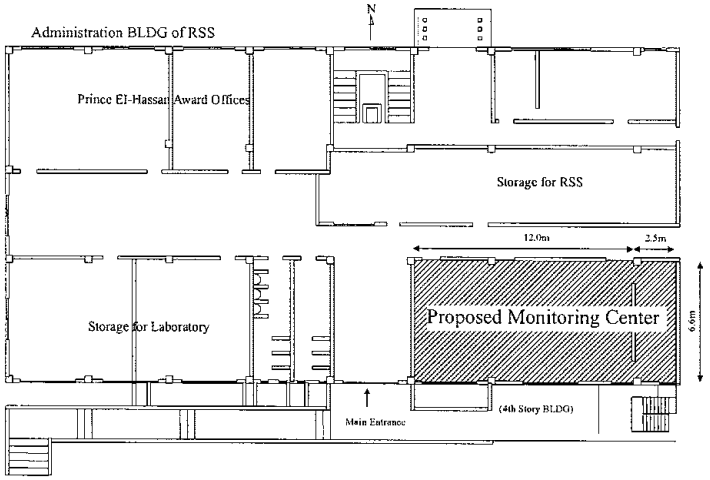
Drawing No.	Drawing Title	
WPM-G-01	General Layout for Monitoring Stations	
WPM-G-02	Location of Monitoring Center and Equipment Layout	
WPM-M-01	Equipment Layout for Monitoring Unit	
WPM-M-02	System Diagram for Monitoring Unit	
WPM-C-01-1	Station No.1	Yarmouk River/10km from Adasiya Diversion－Plan
WPM-C-01-2	Station No.1	Yarmouk River/10km from Adasiya Diversion－Section
WPM-C-02-1	Station No.2	King Abdullah Canal/North Eng of King Abdullah Canal－Plan
WPM-C-02-2	Station No.2	King Abdullah Canal/North Eng of King Abdullah Canal－Section
WPM-C-03-1	Station No.3	King Abdullah Canal /Tiberias Conveyor Outlet－Plan
WPM-C-03-2	Station No.3	King Abdullah Canal /Tiberias Conveyor Outlet－Section
WPM-C-04-1	Station No.4	King Abdullah Canal /Wadi Arab Dam Pump Station－Plan
WPM-C-04-2	Station No.4	King Abdullah Canal /Wadi Arab Dam Pump Station－Section
WPM-C-05-1	Station No.5	King Abdullah Canal /Deir Alla Intake－Plan
WPM-C-05-2	Station No.5	King Abdullah Canal /Deir Alla Intake－Section
WPM-C-06-1	Station No.6	King Abdullah Canal /Zarqa Junction－Plan
WPM-C-06-2	Station No.6	King Abdullah Canal /Zarqa Junction－Section
WPM-C-07-1	Station No.7	King Abdullah Canal /Karame Dam Turn-out－Plan
WPM-C-07-2	Station No.7	King Abdullah Canal /Karame Dam Turn-out－Section
WPM-C-08-1	Station No.8	Zarqa River/Downstream of As-Samra WSP－Plan
WPM-C-08-2	Station No.8	Zarqa River/Downstream of As-Samra WSP－Section
WPM-C-09-1	Station No.9	Zarqa River/Downstream of Tawafin Adwan Bridge－Plan
WPM-C-09-2	Station No.9	Zarqa River/Downstream of Tawafin Adwan Bridge－Section
WPM-C-10-1	Station No.10	Zarqa River/King Talal Reservoir Inlet－Plan
WPM-C-10-2	Station No.10	Zarqa River/King Talal Reservoir Inlet－Section
WPM-C-11-1	Station No.11	Zarqa River/King Talal Revervoir Outlet－Plan
WPM-C-11-2	Station No.11	Zarqa River/King Talal Revervoir Outlet－Section
WPM-C-12-1	Station No.12	Jordan River/Upstream of Majama Bridge－Plan
WPM-C-12-2	Station No.12	Jordan River/Upstream of Majama Bridge－Section
WPM-C-13-1	Station No.13	Jordan River/Upstream of King Hussein Bridge－Plan
WPM-C-13-1	Station No.13	Jordan River/Upstream of King Hussein Bridge－Section
WPM-D-01	Foundation for Monitoring Unit and Pump	
WPM-D-02	Details of Civil Work for Pump Installation（For Stations No.8 & 9）	
WPM-D-03	Details of Civil Work for Pump Installation（For Stations No.11 & 13）	
WPM-D-04	Details of Filtering Screen and Shed for Pump	



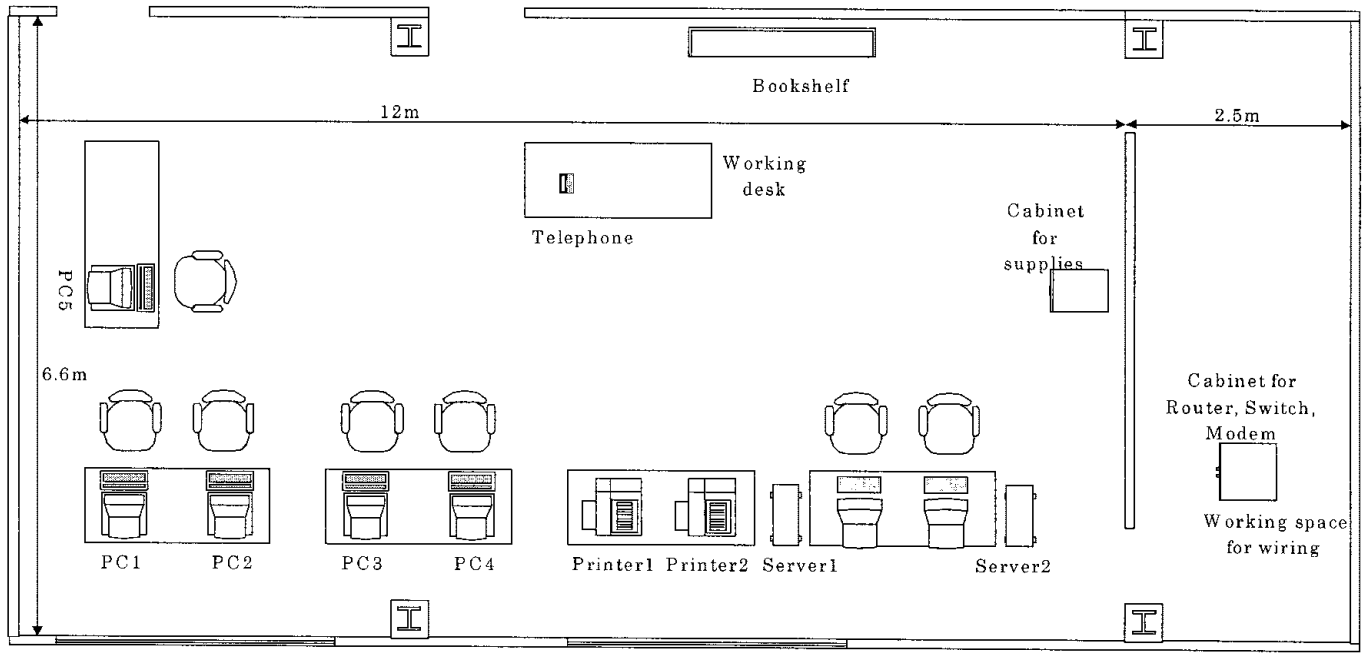
No.	Location
①	Yarmouk River/10km from Adasiya Diversion
②	King Abdullah Canal/North End of KAC
③	King Abdullah Canal/Tiberias Conveyor Outlet
④	King Abdullah Canal/Wadi Arab Dam Pump Station
⑤	King Abdullah Canal/Deir Alla Intake
⑥	King Abdullah Canal/Zarqa Junction
⑦	King Abdullah Canal/Karameh Dam Turn-out
⑧	Zarqa River/Downstream of As-Samra WSP
⑨	Zarqa River/Downstream of Tawafin Adwan Bridge
⑩	Zarqa River/King Talal Reservoir Inlet
⑪	Zarqa River/King Talal Reservoir Outlet
⑫	Jordan River/Upstream of Majama Bridge
⑬	Jordan River/Upstream of King Hussein Bridge
M	Early Warning System of WAJ

WPM-G-01 General Layout for Monitoring Stations

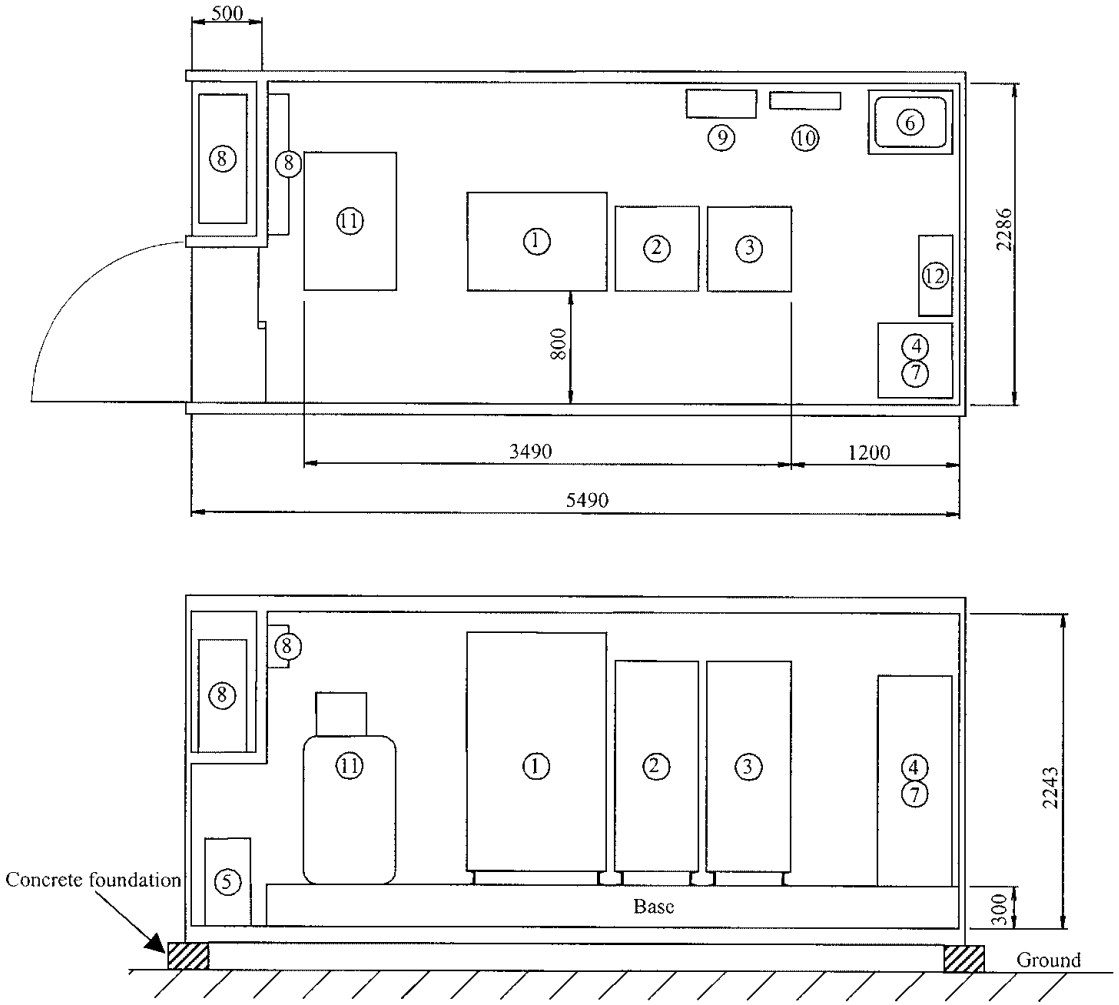
Location of Monitoring Center



Equipment Layout

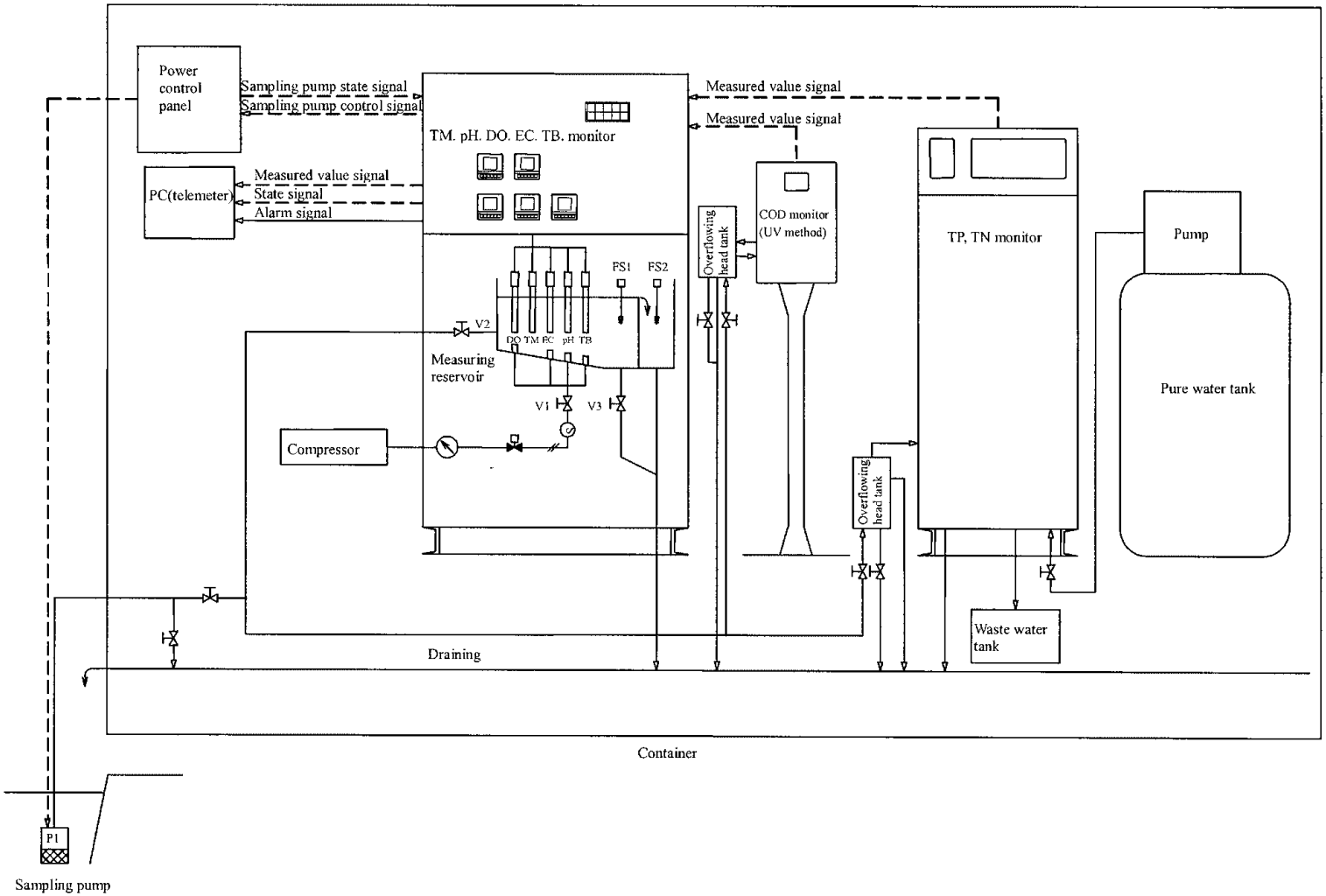


WPM-G-02 Location of Monitoring Center and Equipment Layout



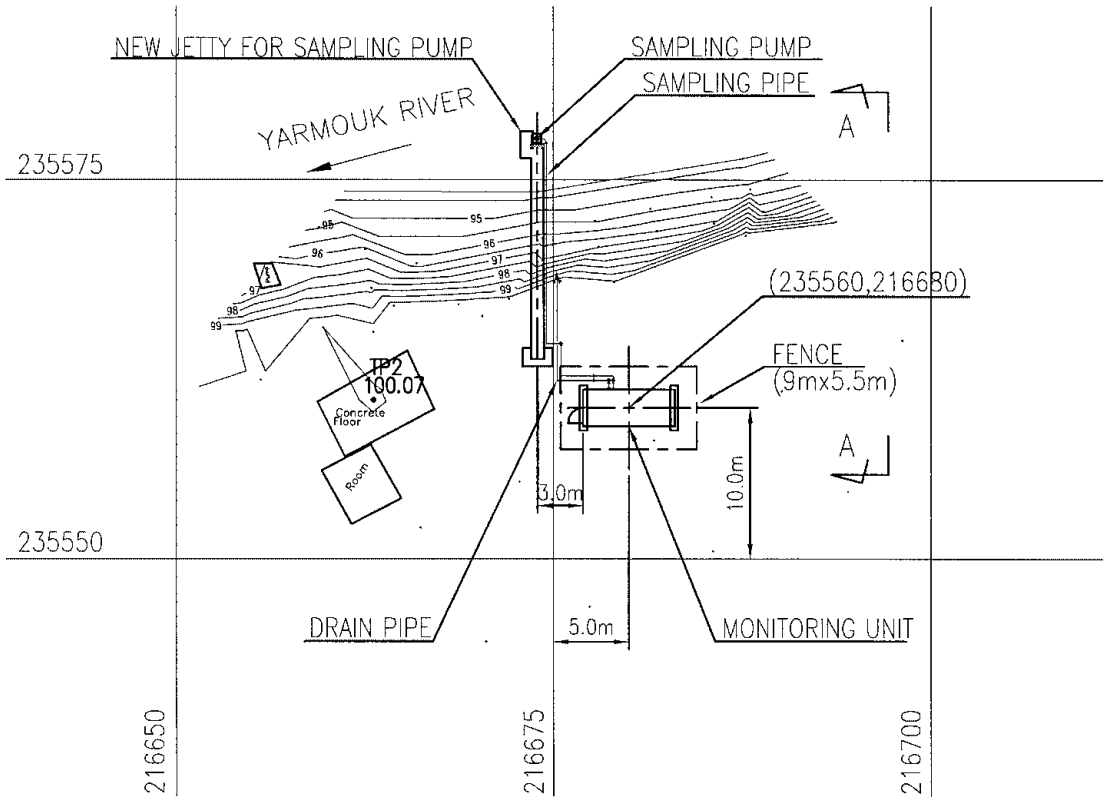
No.	ITEM
1	TM, pH, DO, EC, TB monitor
2	COD monitor(UV method)
3	TP, TN monitor(UV method)
4	Power transformer
5	Compressor
6	Sink
7	PC(telemeter)
8	Air conditioner
9	Power control panel
10	Power distributor
11	Pure water tank
12	Interruptible power system

WPM-M-01 Equipment Layout for Monitoring Unit

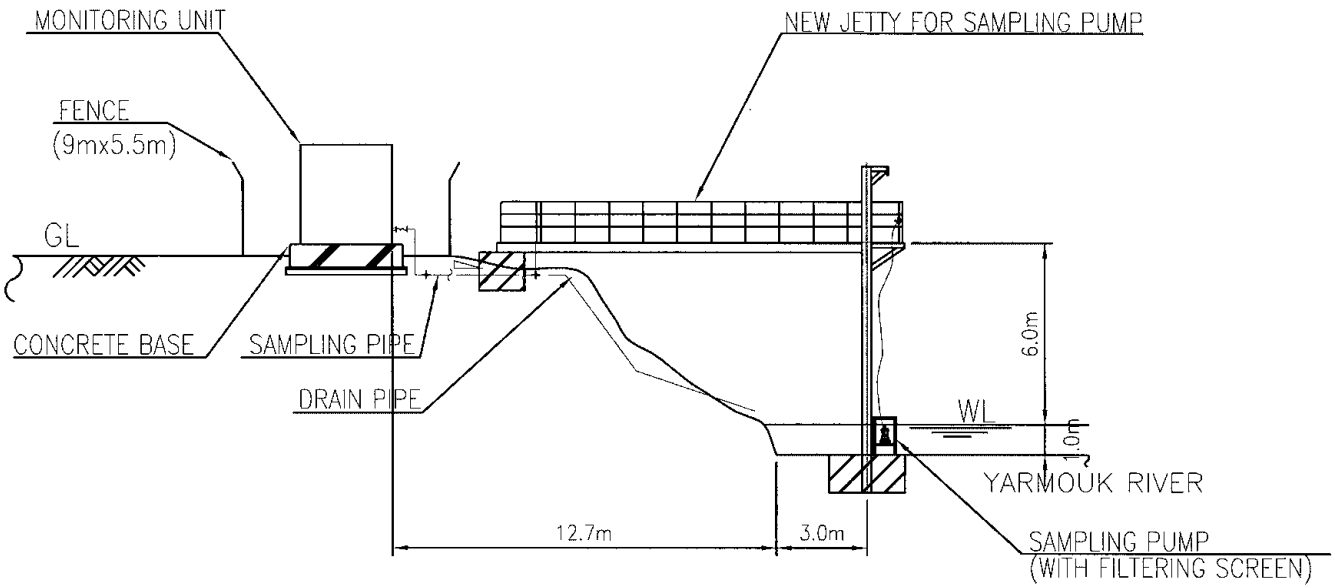


WPM-M-02 System Diagram for Monitoring Unit

LAYOUT OF MONITORING STAITION

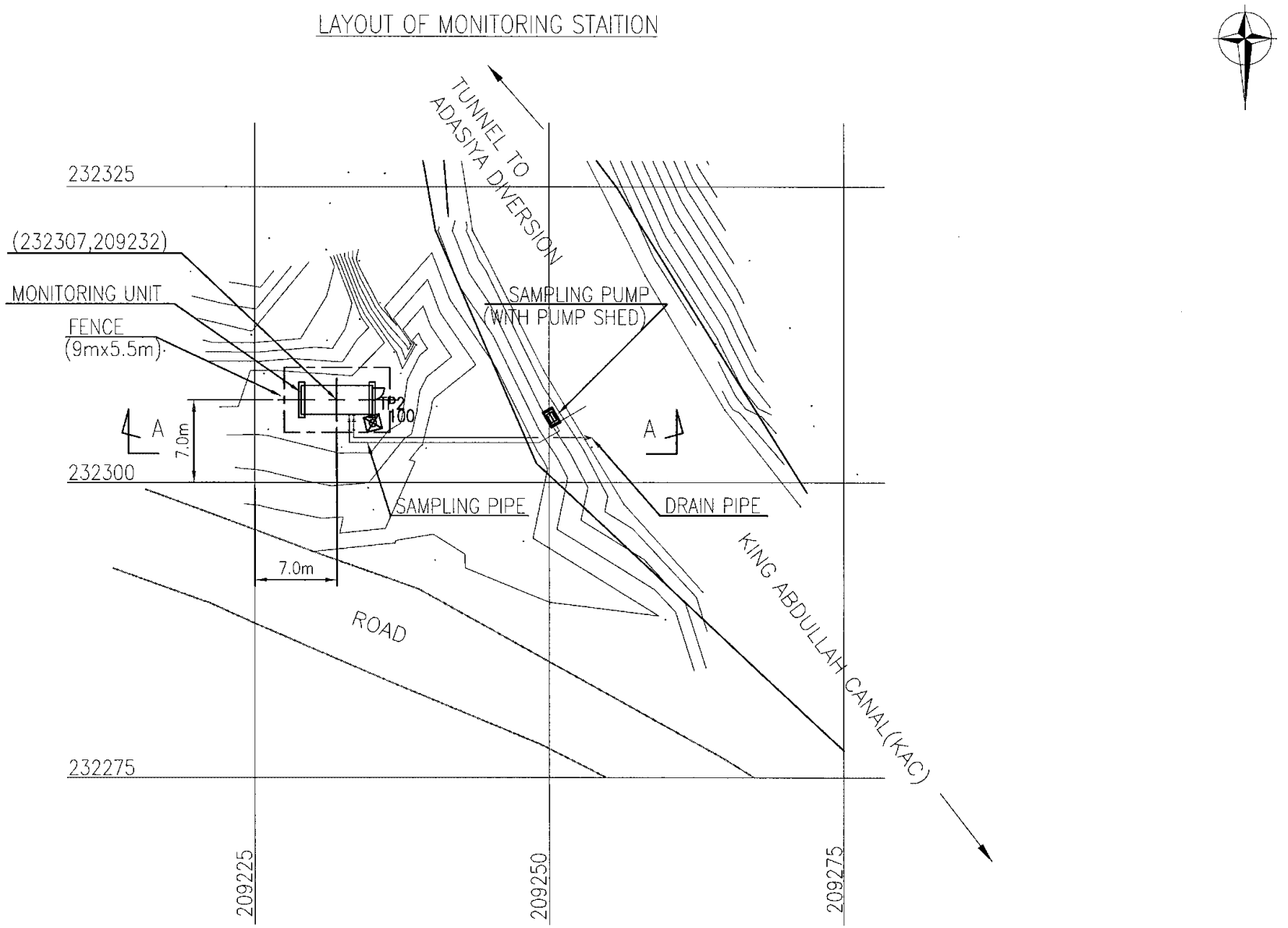


WPM-C-01-1 Station No.1 Yarmouk River/10km from Adasiya Diversion-Plan

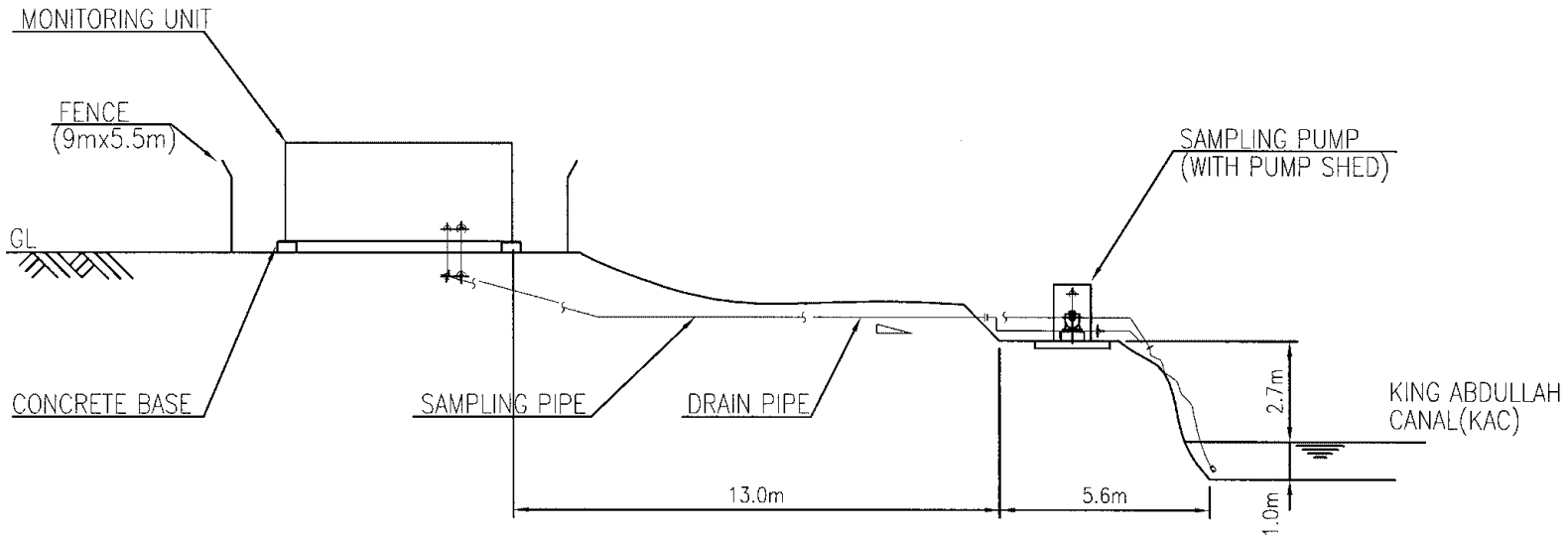


SECTION A–A

WPM-C-01-2 Station No.1 Yarmouk River/10km from Adasiya Diversion-Section

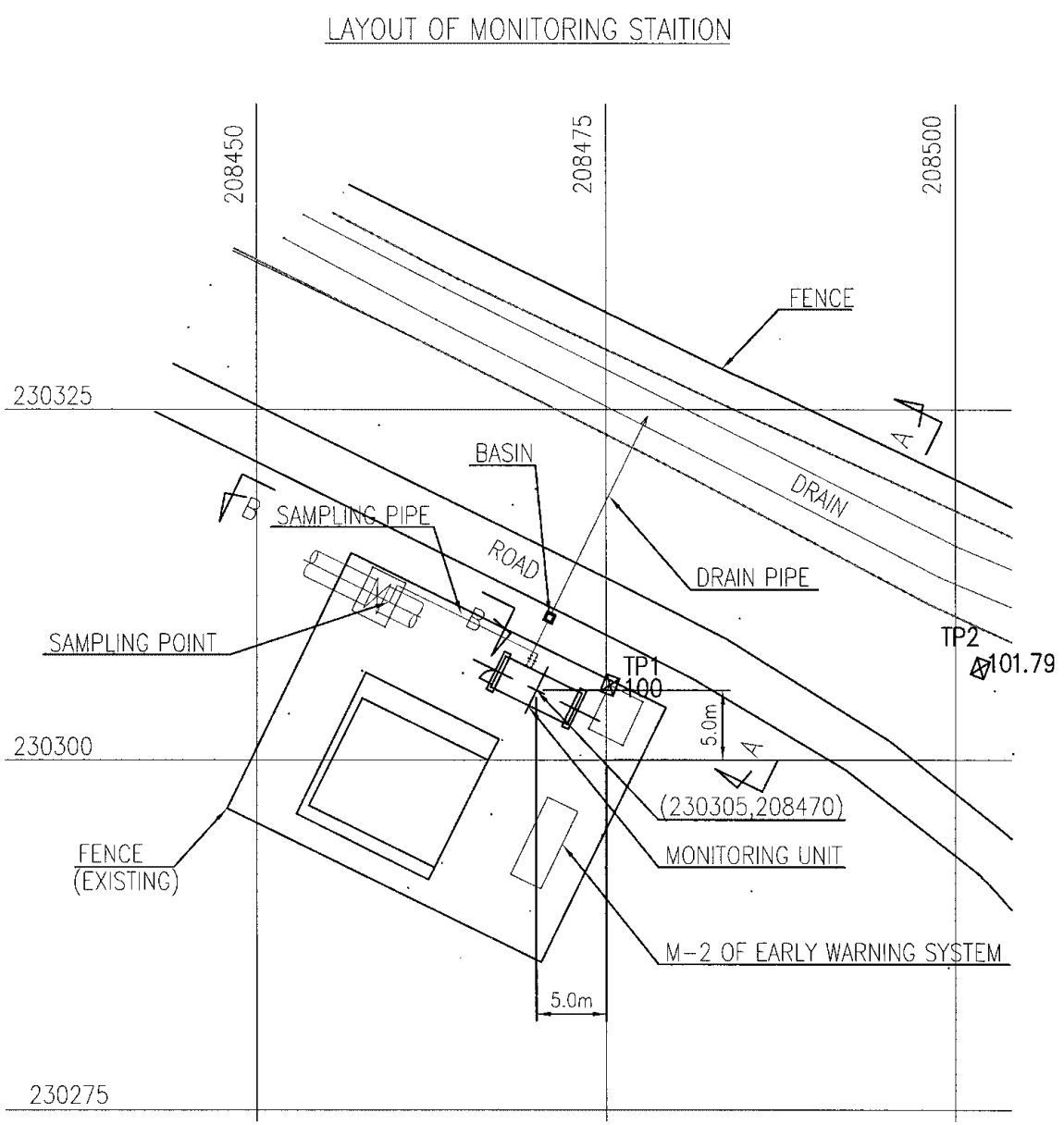


WPM-C-02-1 Station No.2 King Abdullah Canal/North Eng of King Abdullah Canal-Plan

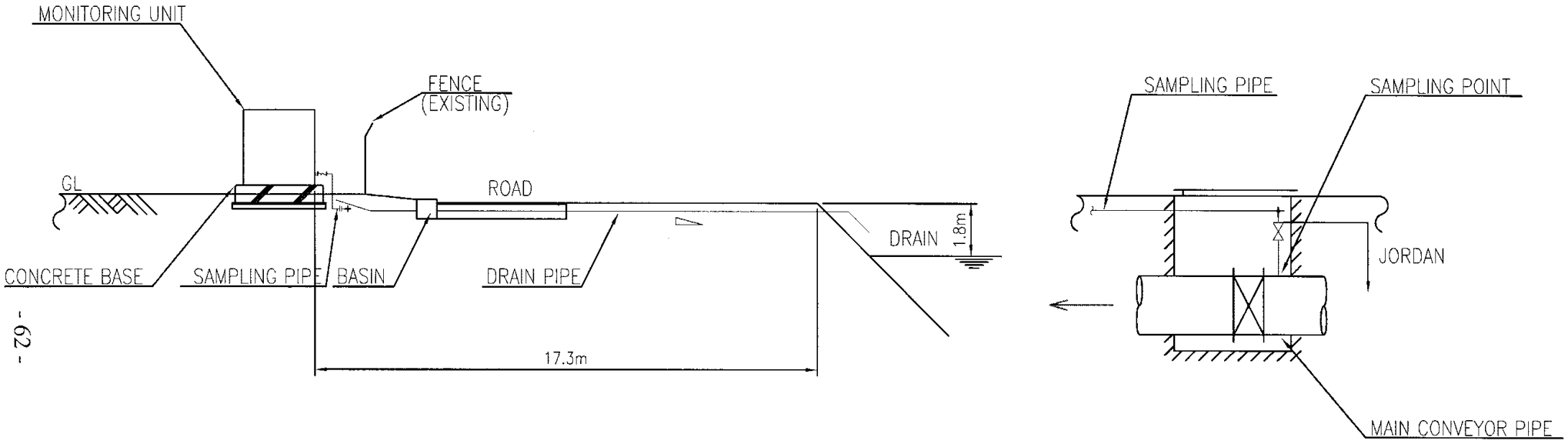


SECTION A–A

WPM-C-02-2 Station No.2 King Abdullah Canal/North Eng of King Abdullah Canal-Section



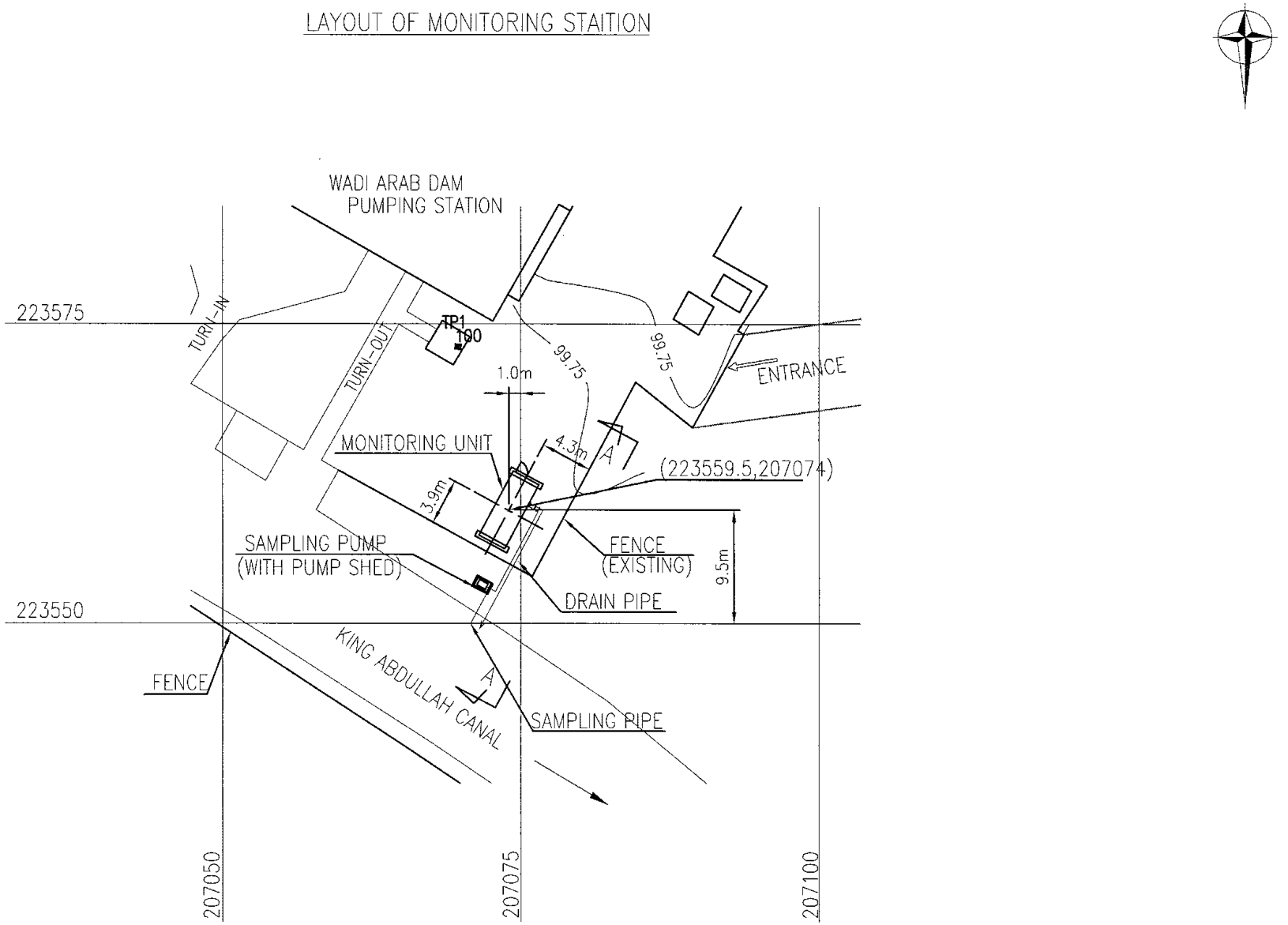
WPM-C-03-1 Station No.3 King Abdullah Canal/Tiberias Conveyor Outlet-Plan



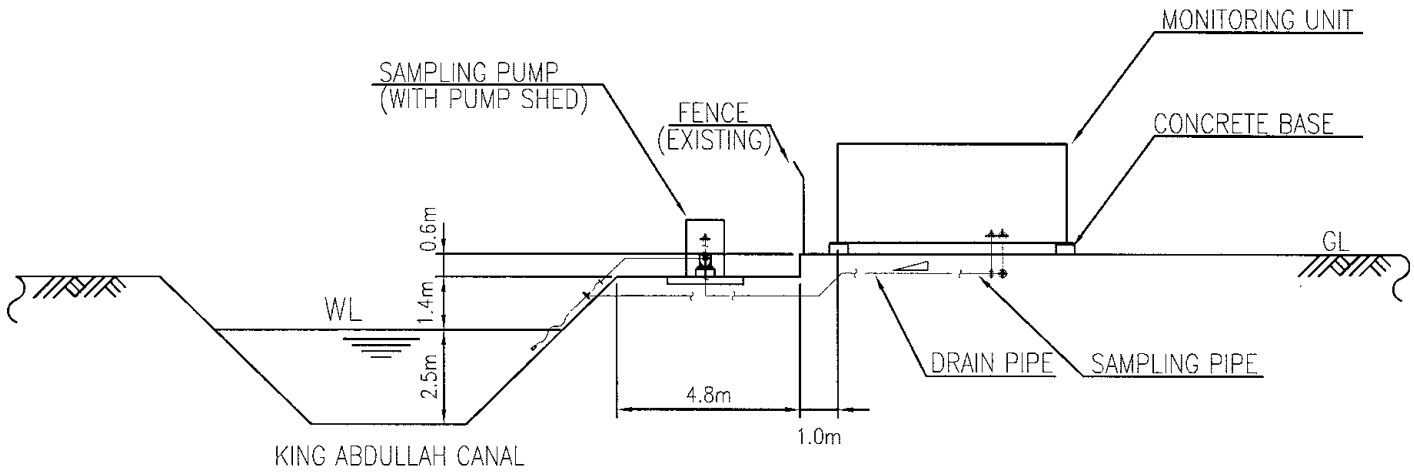
SECTION A–A

SECTION B–B

WPM-C-03-2 Station No.3 King Abdullah Canal/Tiberias Conveyor Outlet-Section

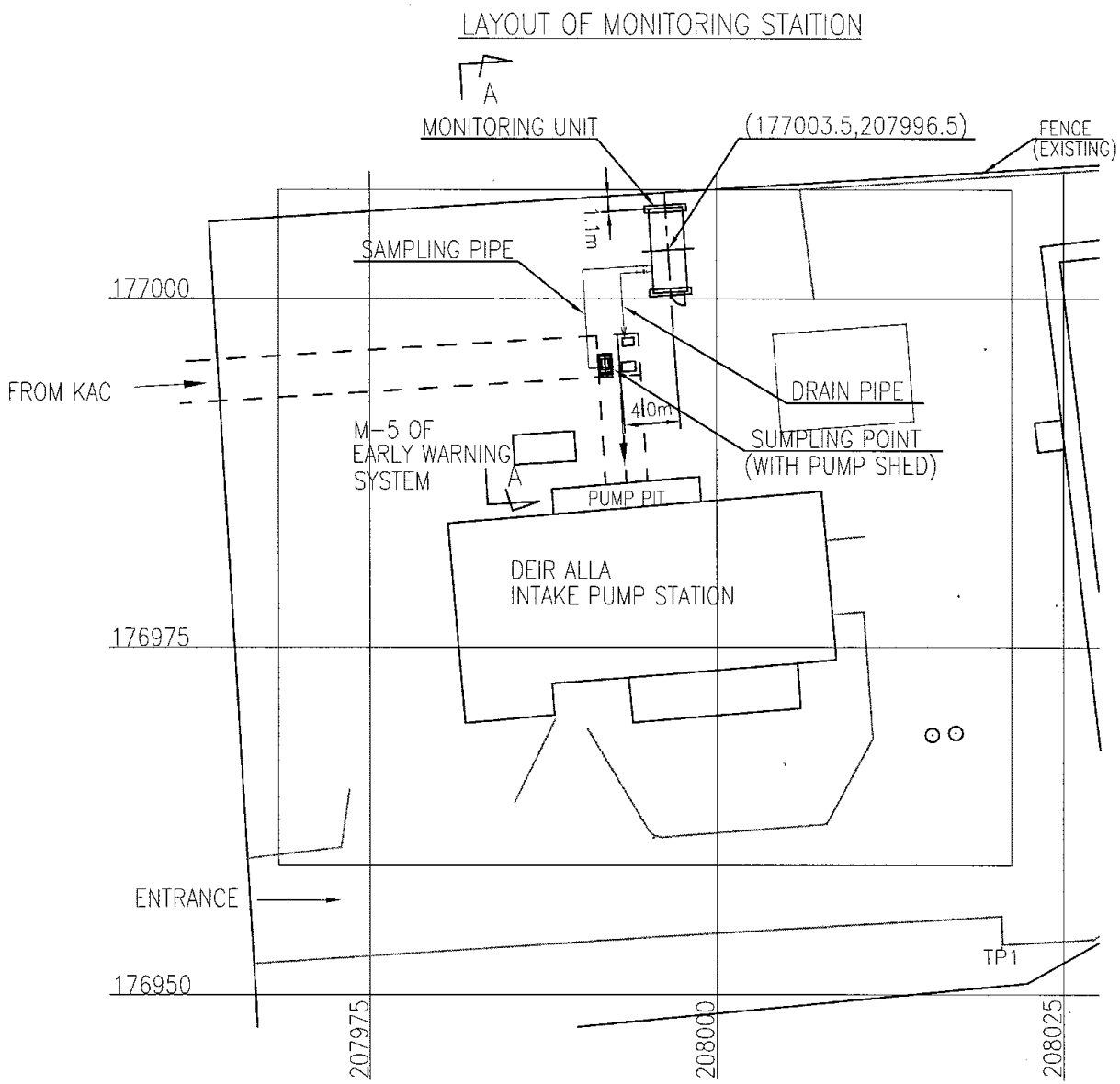


WPM-C-04-1 Station No.4 King Abdullah Canal/Wadi Arab Dam Pump Station-Plan

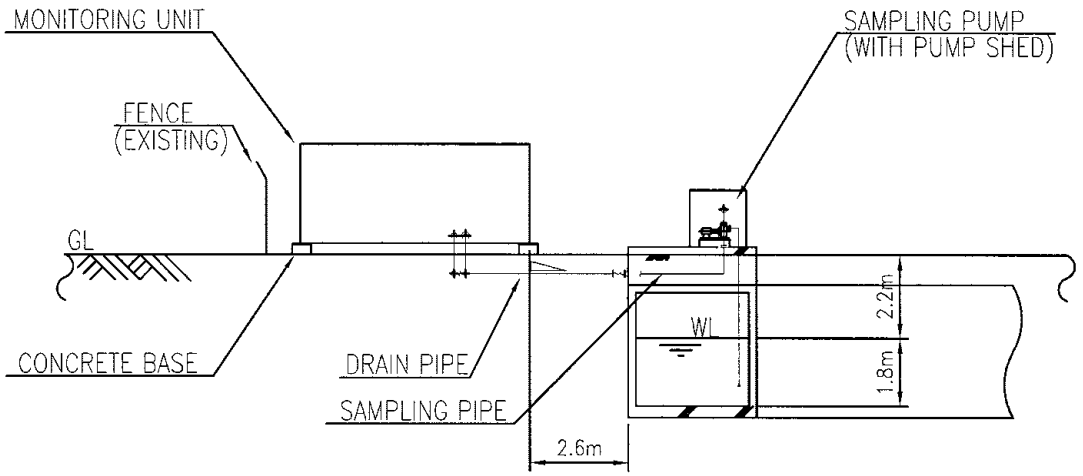


SECTION A--A

WPM-C-04-2 Station No.4 King Abdullah Canal/Wadi Arab Dam Pump Station-Section



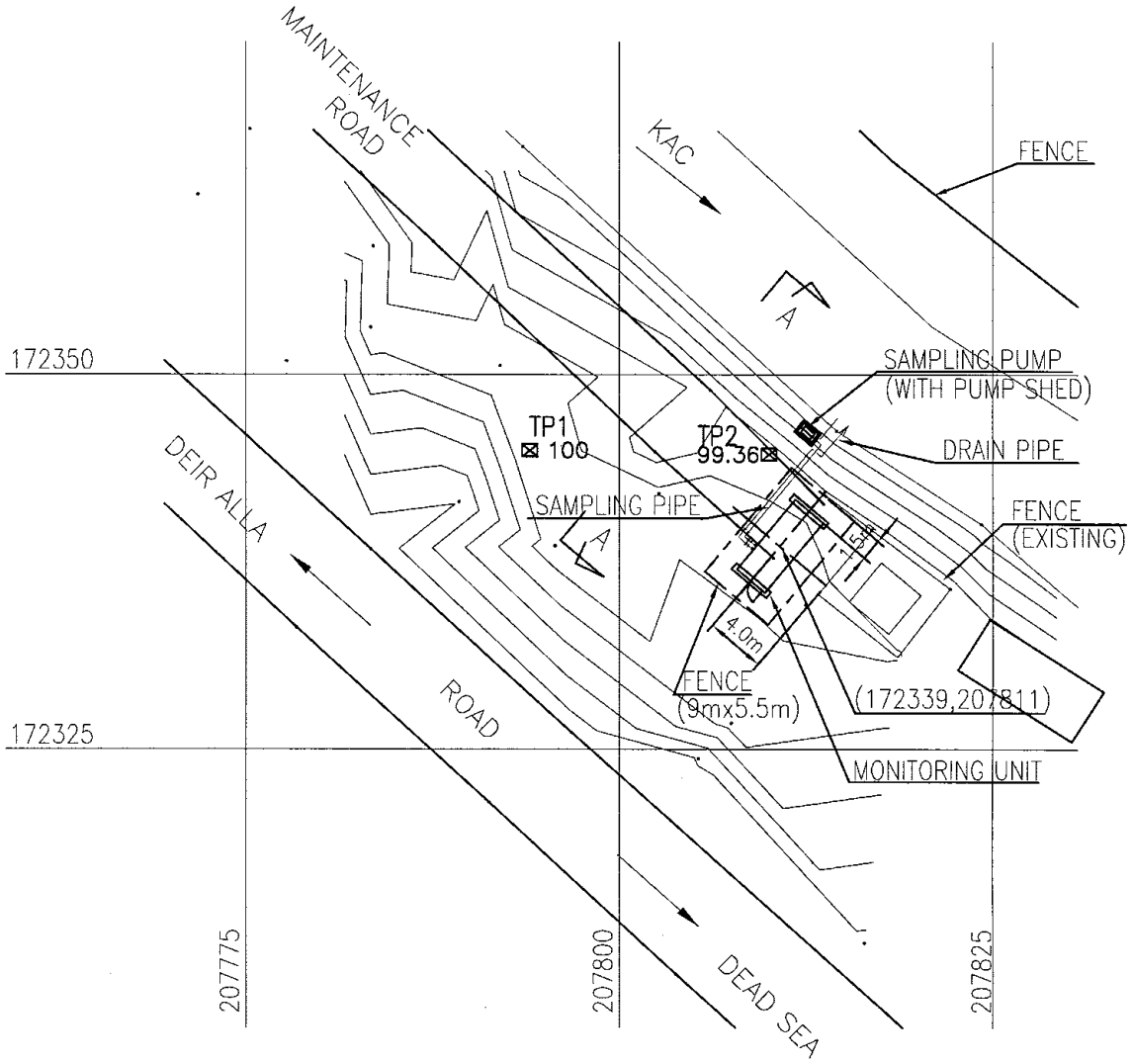
WPM-C-05-1 Station No.5 King Abdullah Canal/Deir Alla Intake-Plan



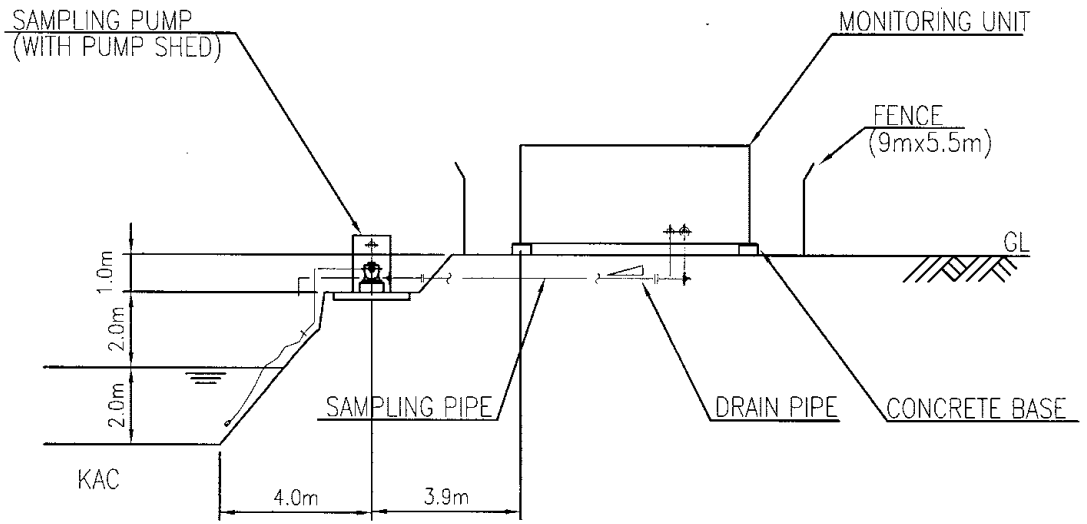
SECTION A–A

WPM-C-05-2 Station No.5 King Abdullah Canal/Deir Alla Intake-Section

LAYOUT OF MONITORING STAITION

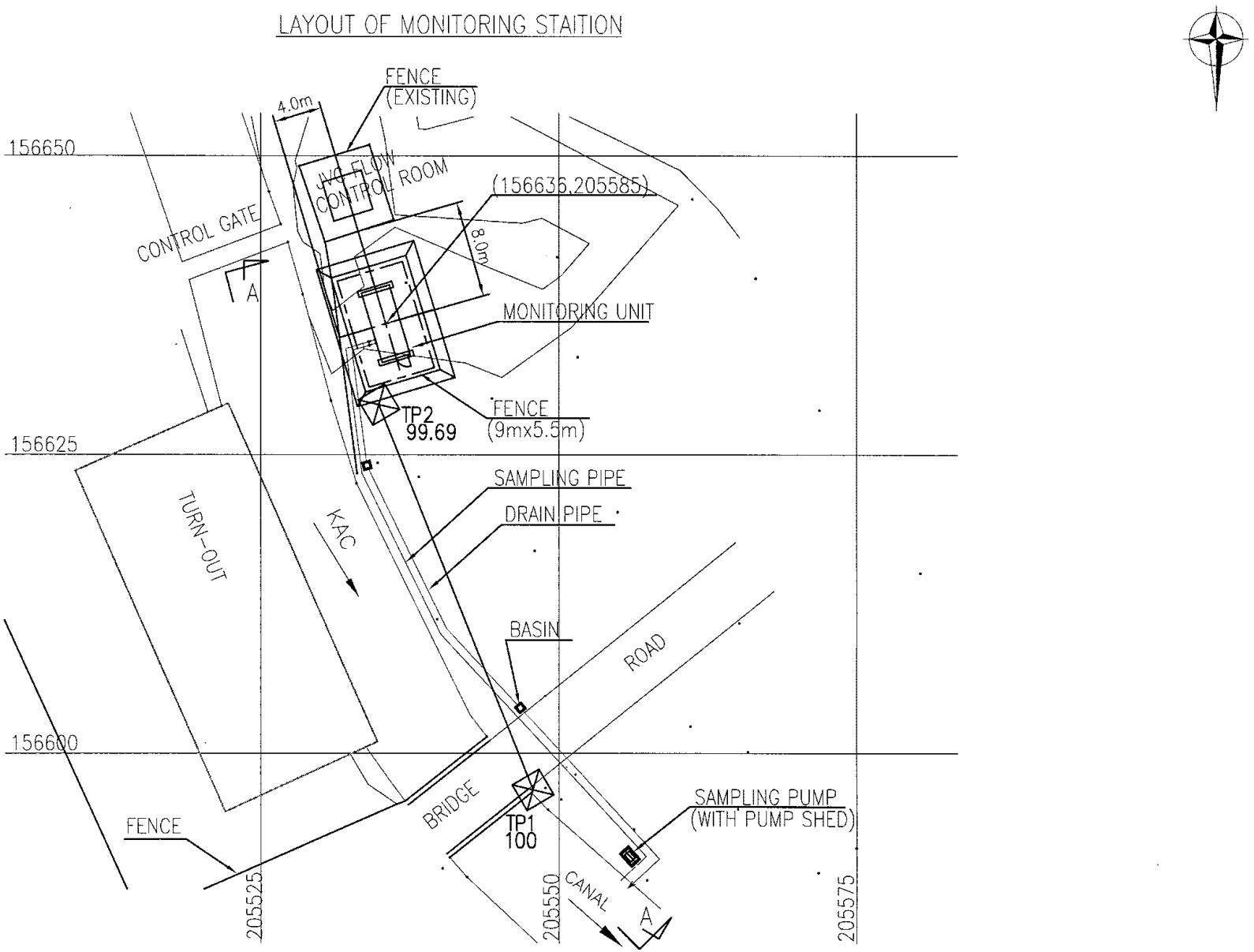


WPM-C-06-1 Station No.6 King Abdullah Canal/Zarqa Junction-Plan

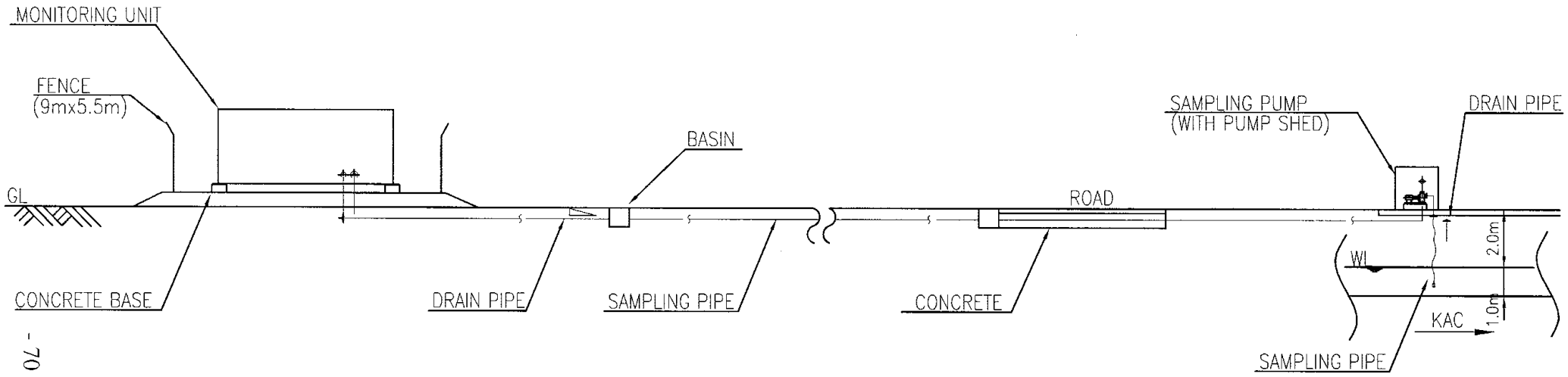


SECTION A–A

WPM-C-06-2 Station No.6 King Abdullah Canal/Zarqa Junction-Section

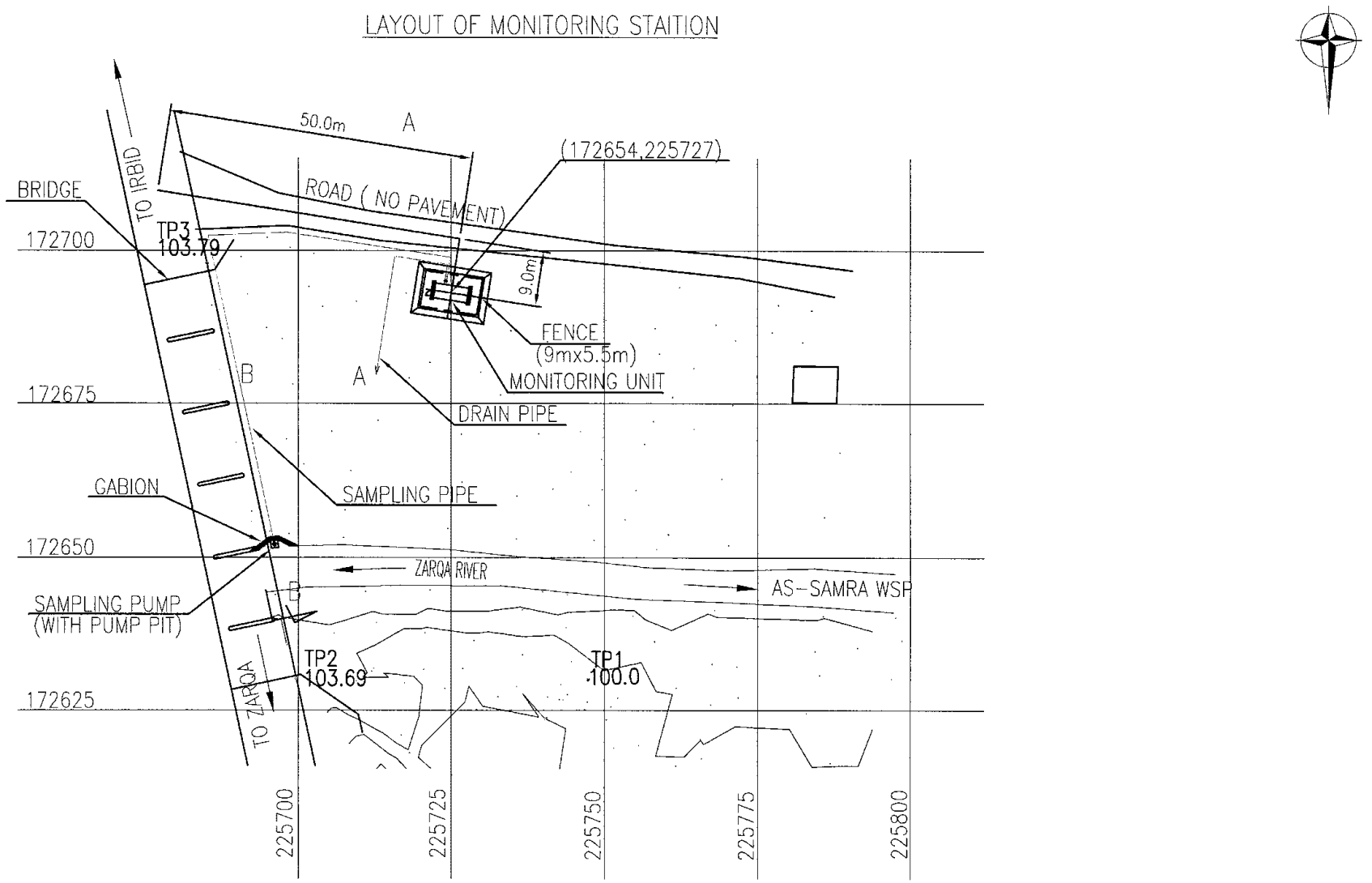


WPM-C-07-1 Station No.7 King Abdullah Canal/Karame Dam Turn-out-Plan

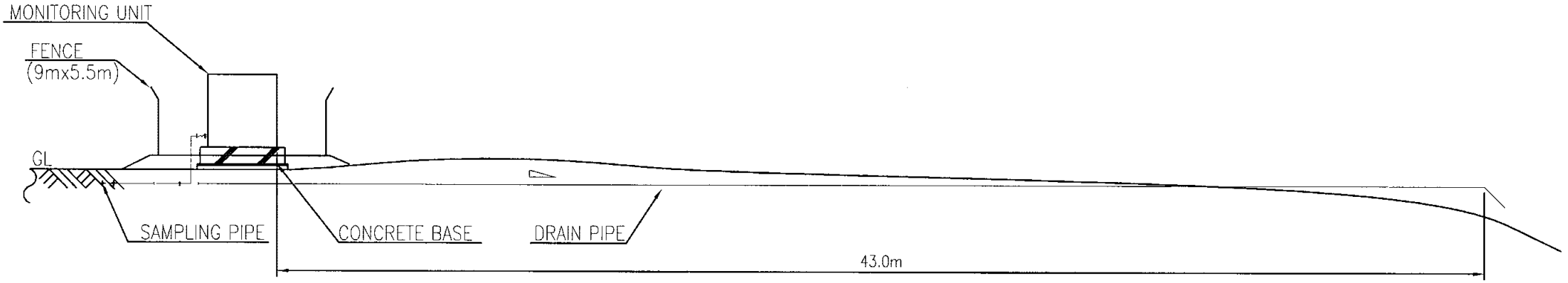


SECTION A–A

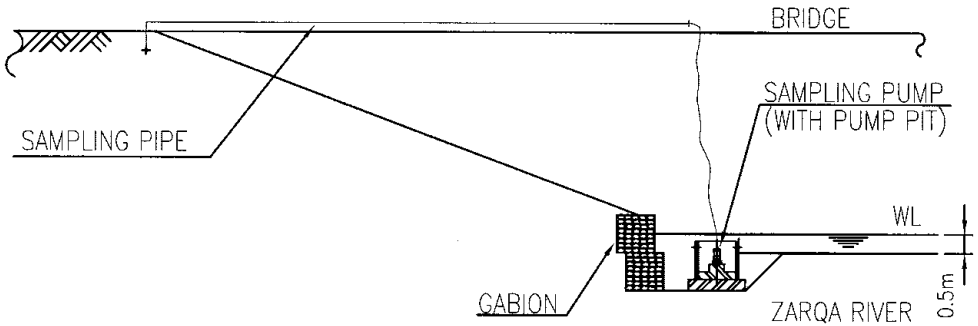
WPM-C-07-2 Station No.7 King Abdullah Canal/Karame Dam Turn-out-Section



WPM-C-08-1 Station No.8 Zarqa River/Downstream of AS-samawa WSP-Plan

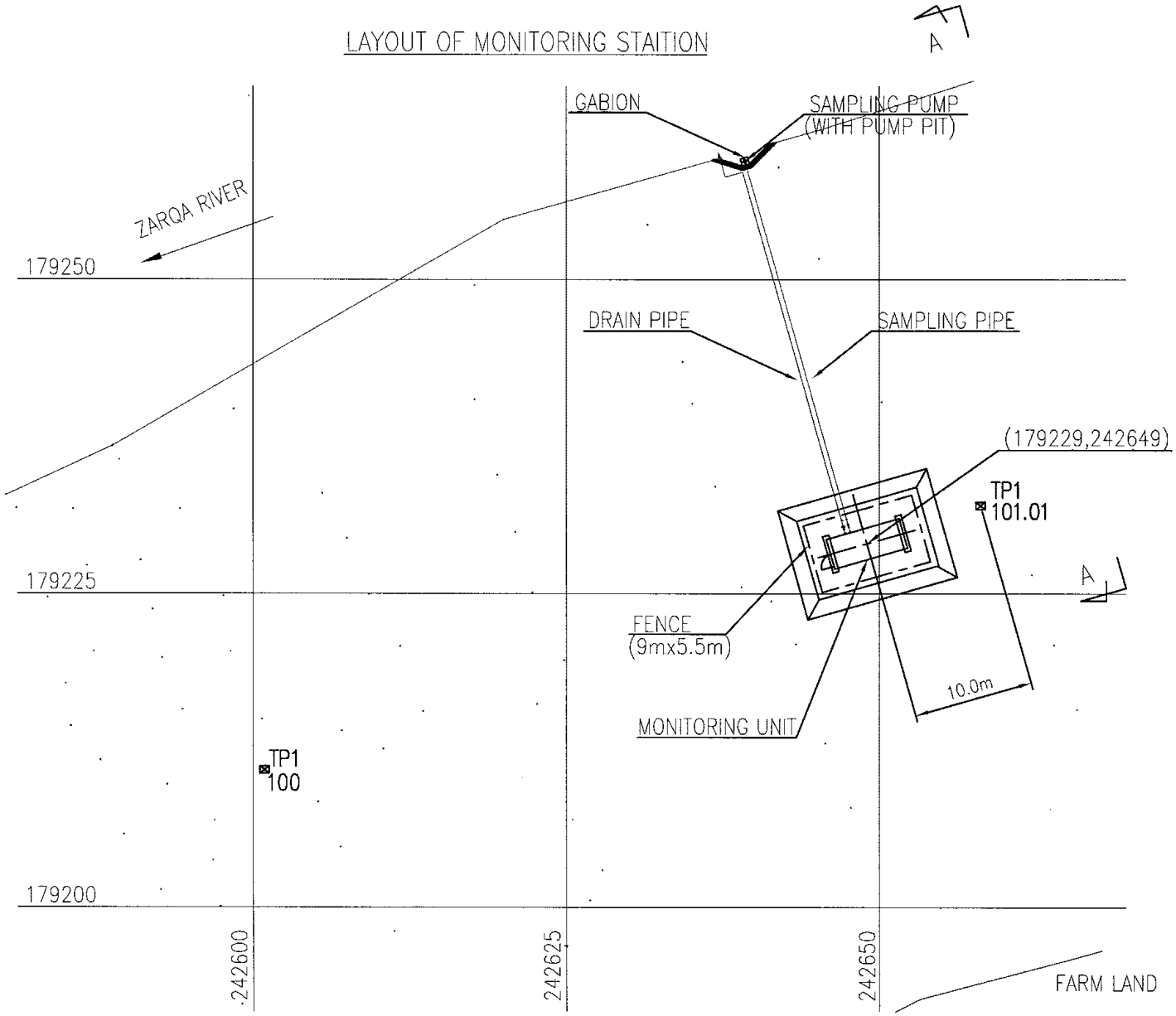


SECTION A–A

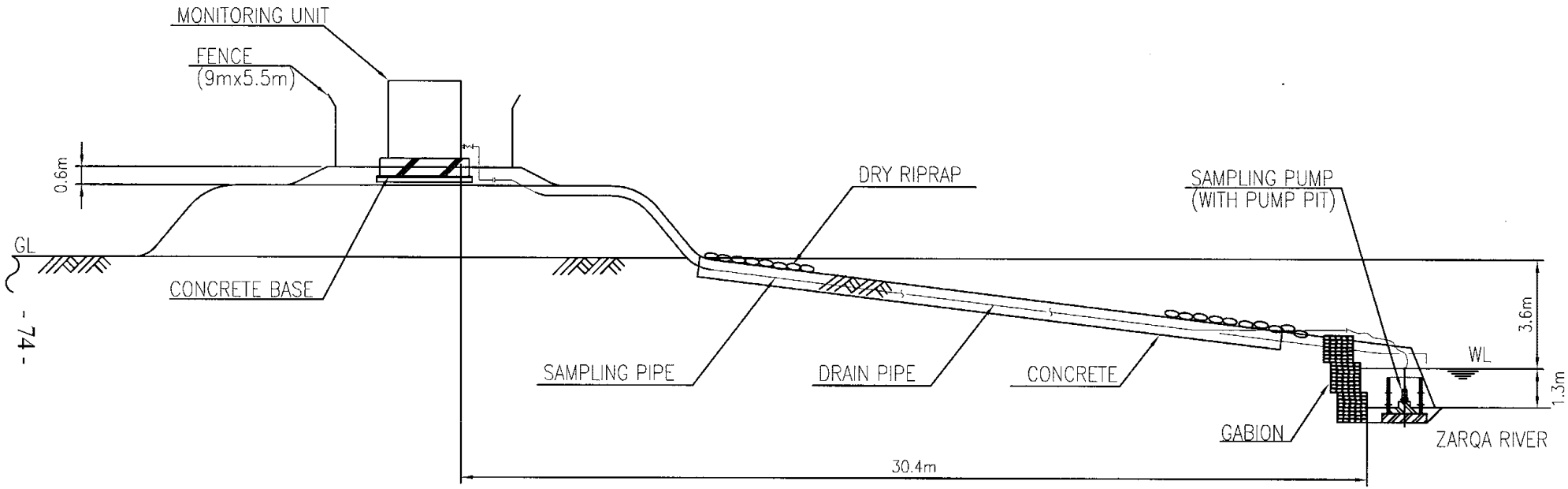


SECTION B–B

WPM-C-08-2 Station No.8 Zarqa River/Downstream of AS-samawa WSP-Section

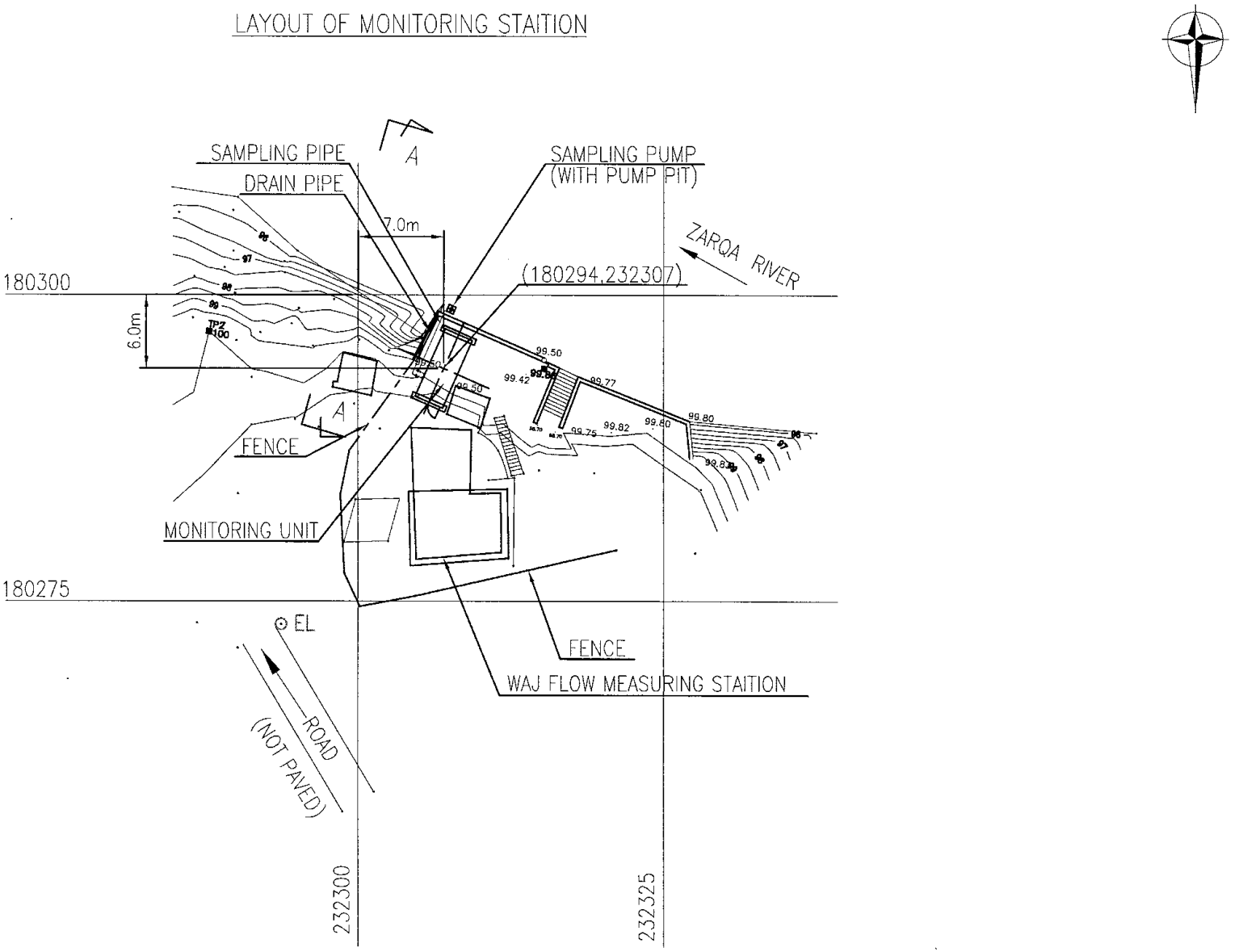


WPM-C-09-1 Station No.9 Zarqa River/Downstream of Tawafin Adwan Bridge-Plan

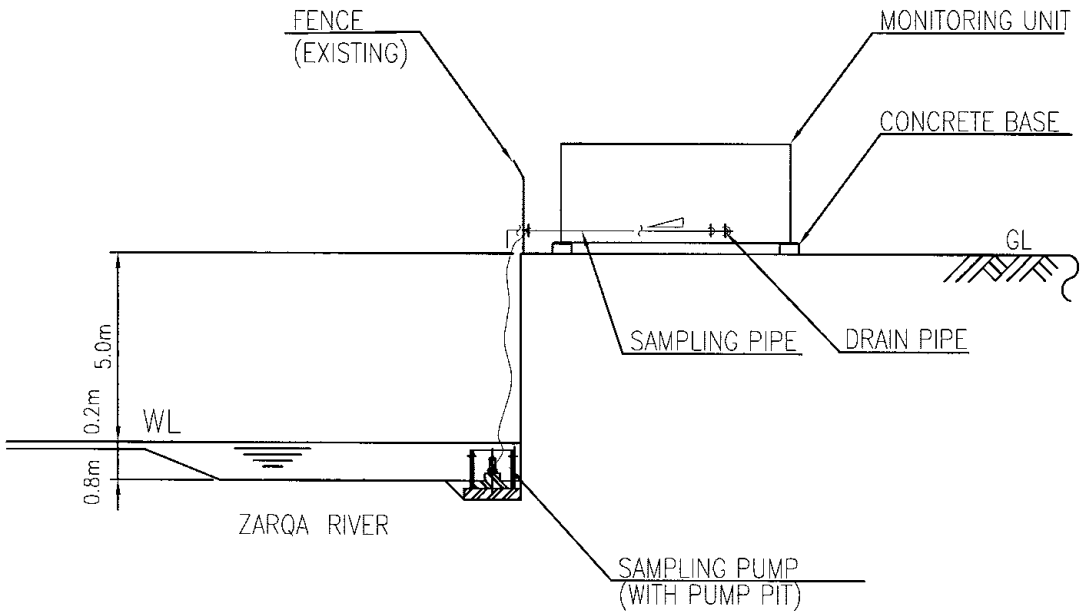


SECTION A–A

WPM-C-09-2 Station No.9 Zarqa River/Downstream of Tawafin Adwan Bridge-Section

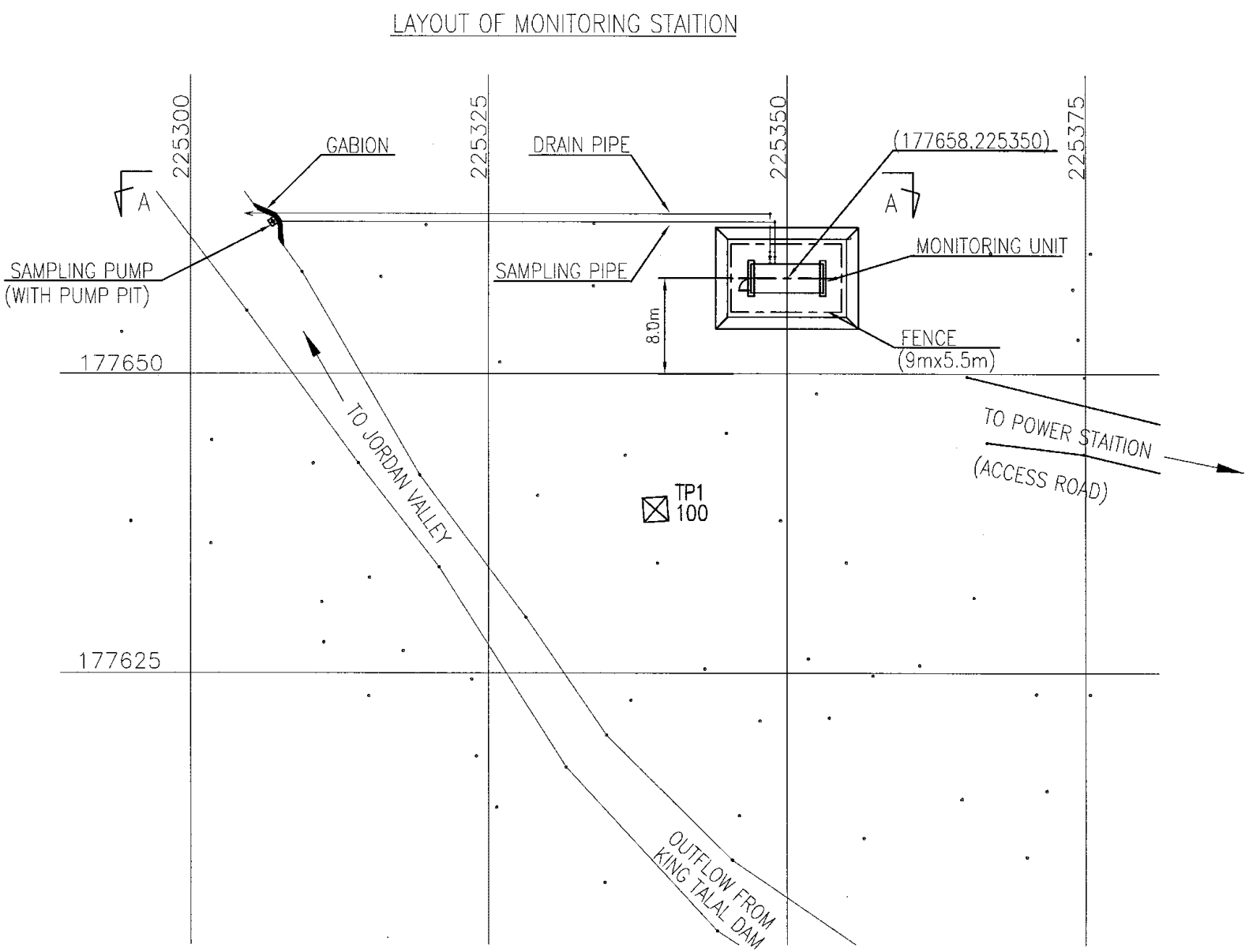


WPM-C-10-1 Station No.10 Zarqa River/King Talal Reservoir Inlet-Plan

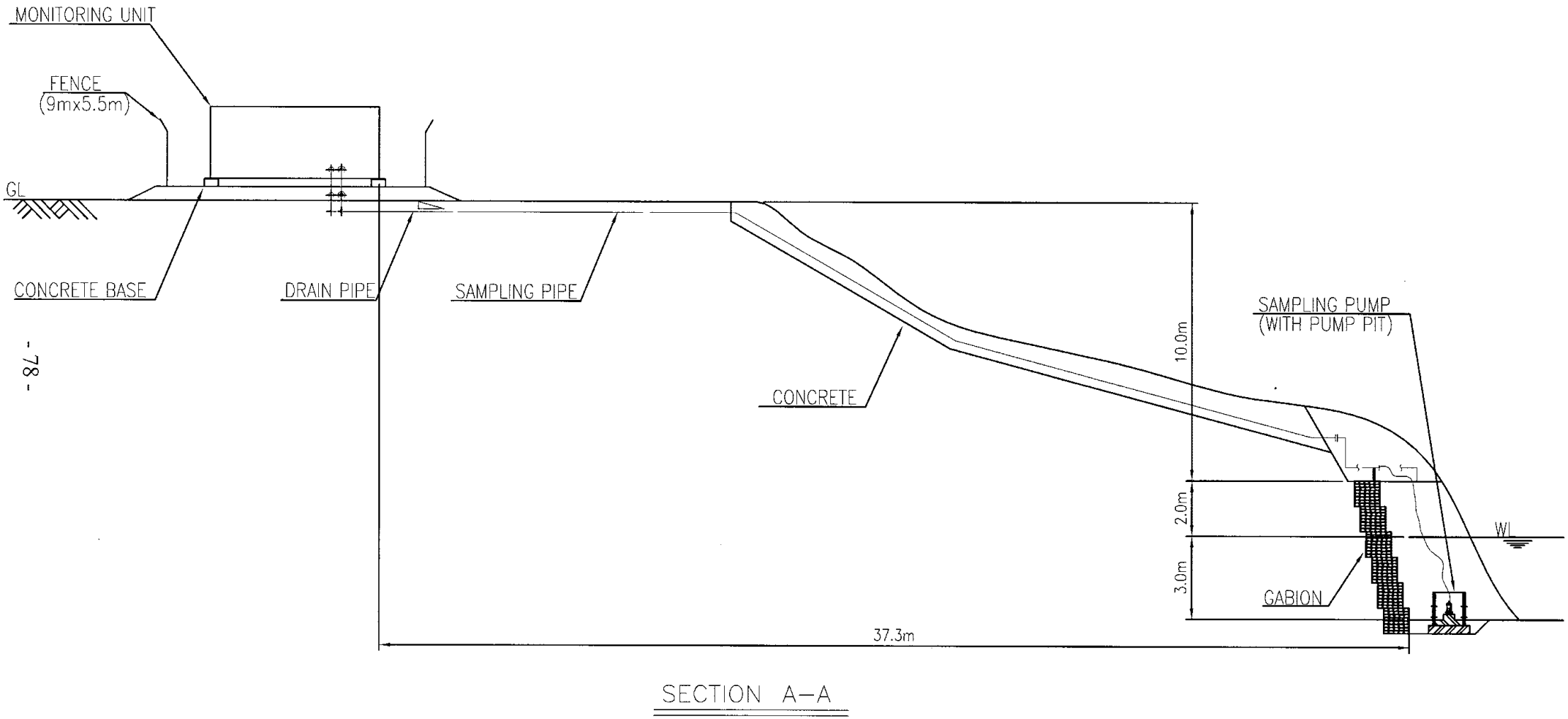


SECTION A–A

WPM-C-10-2 Station No.10 Zarqa River/King Talal Reservoir Inlet-Section

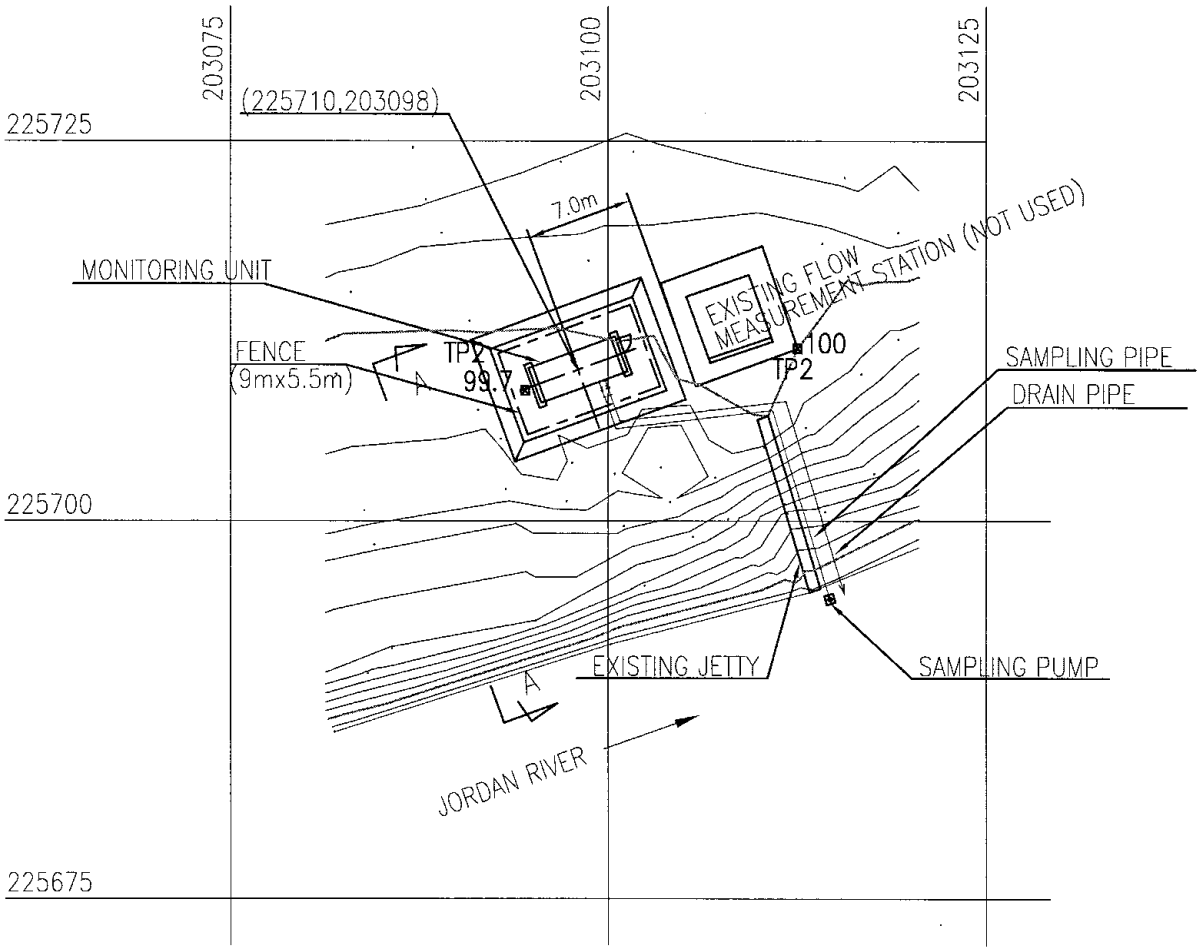


WPM-C-11-1 Station No.11 Zarqa River/King Talal Reservoir Outlet-Plan

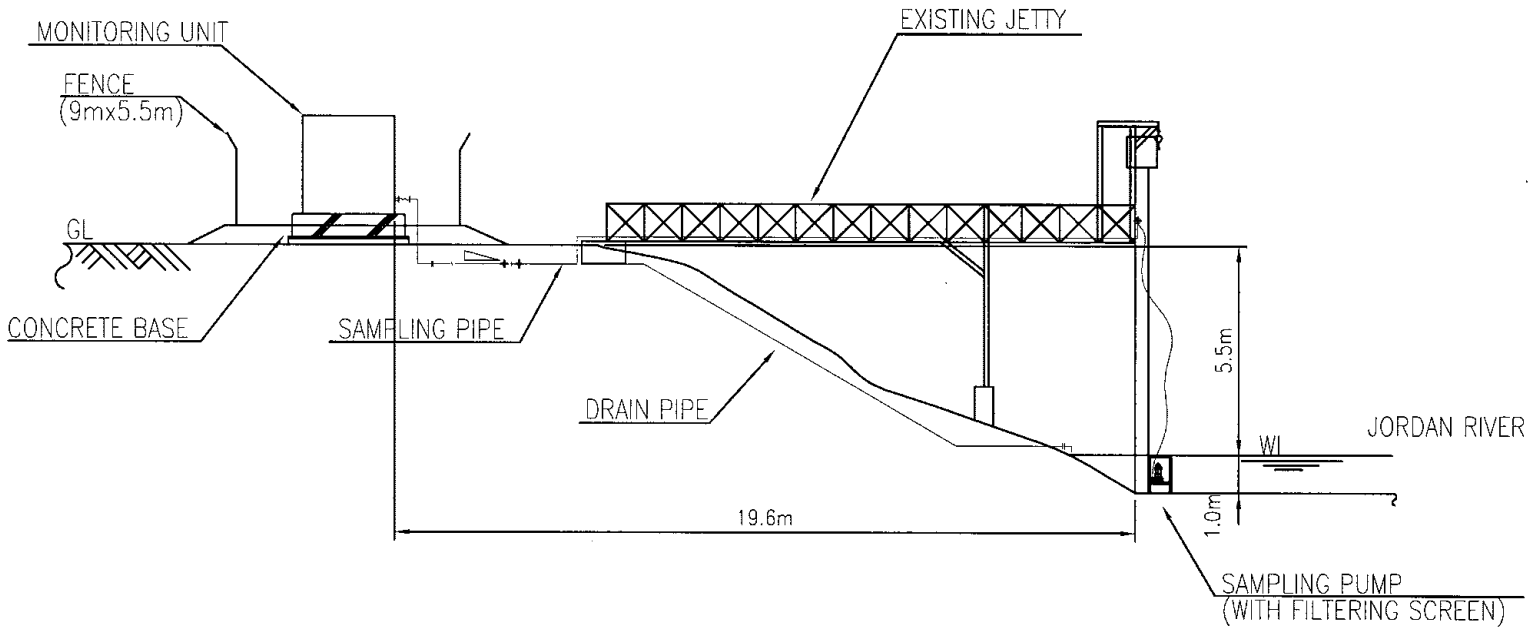


WPM-C-11-2 Station No.11 Zarqa River/King Talal Reservoir Outlet-Section

LAYOUT OF MONITORING STAITION

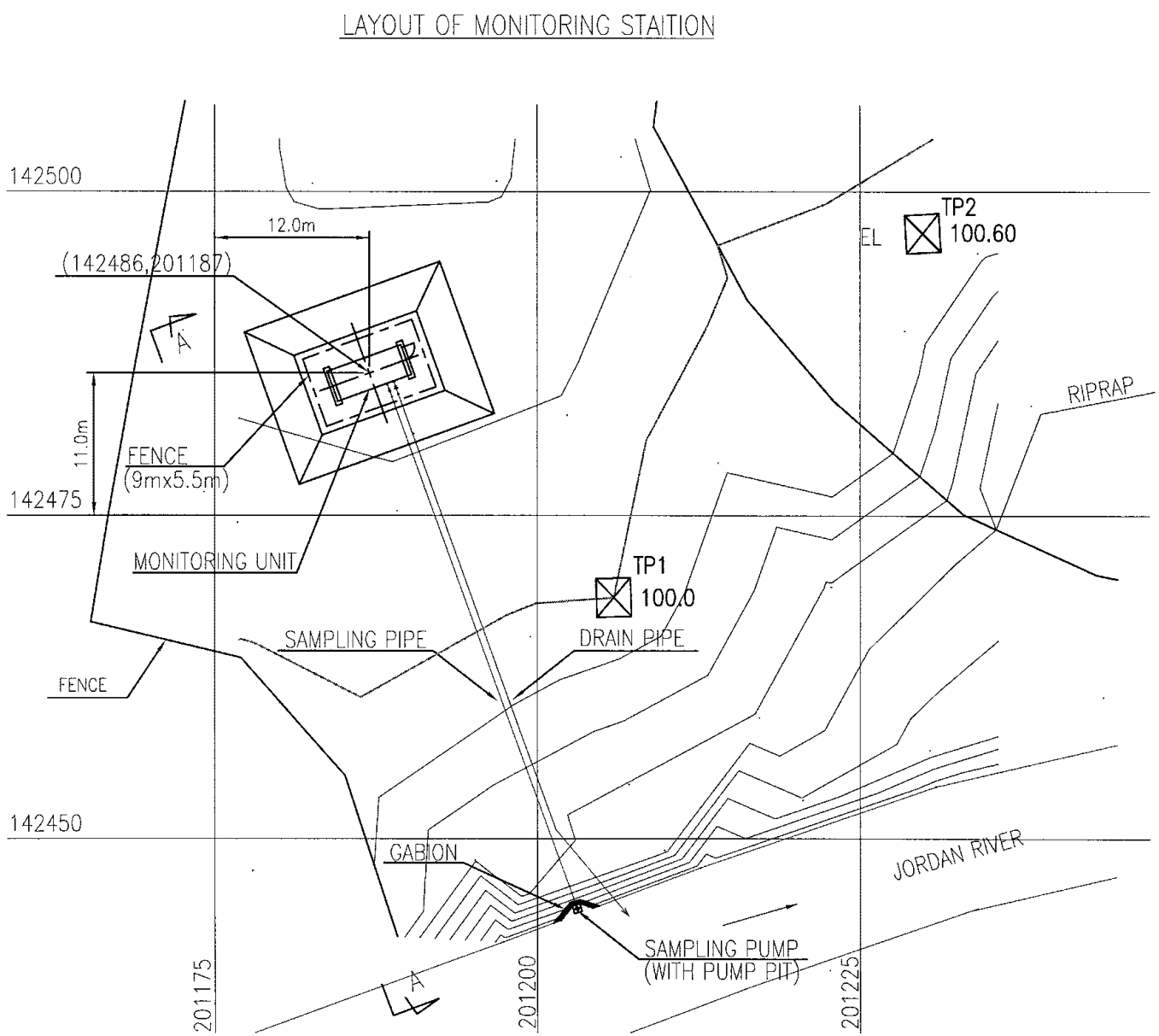


WPM-C-12-1 Station No.12 Jordan River/Upstream of Majama Bridge-Plan

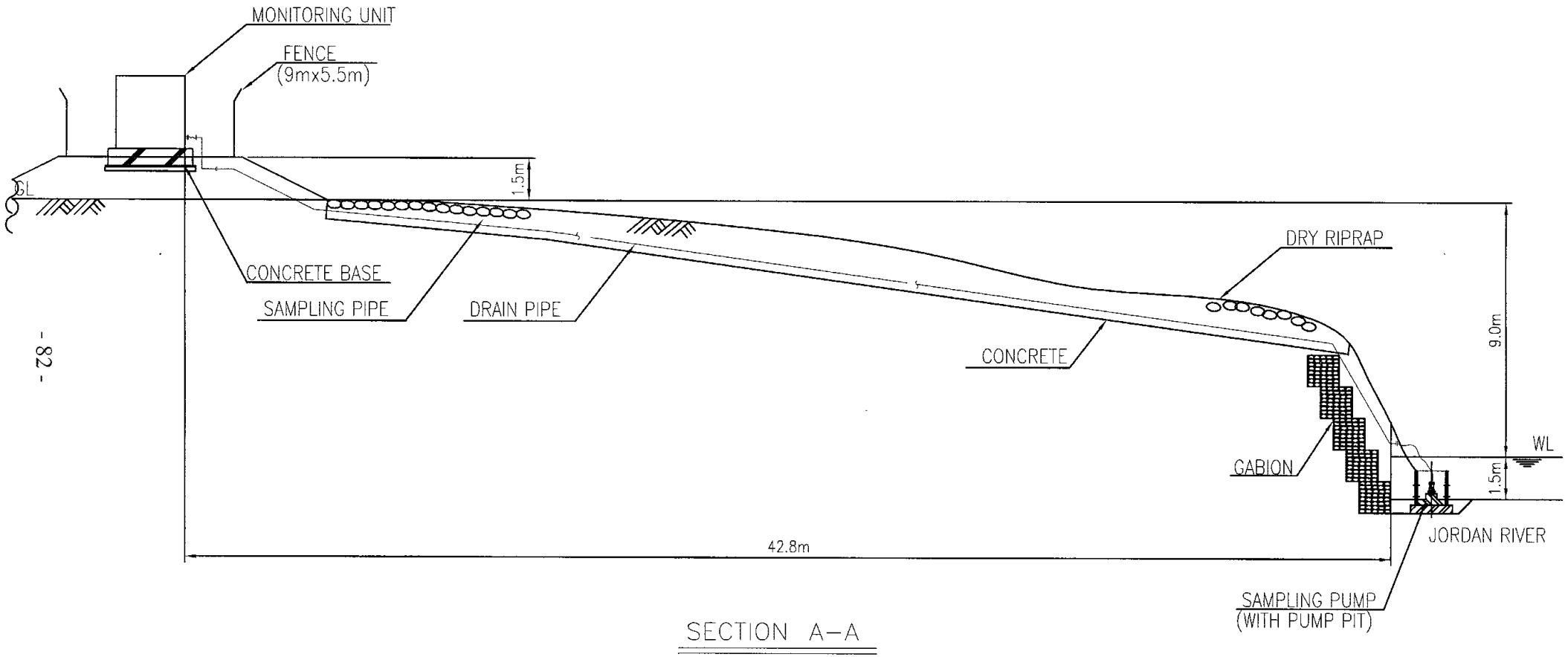


SECTION A–A

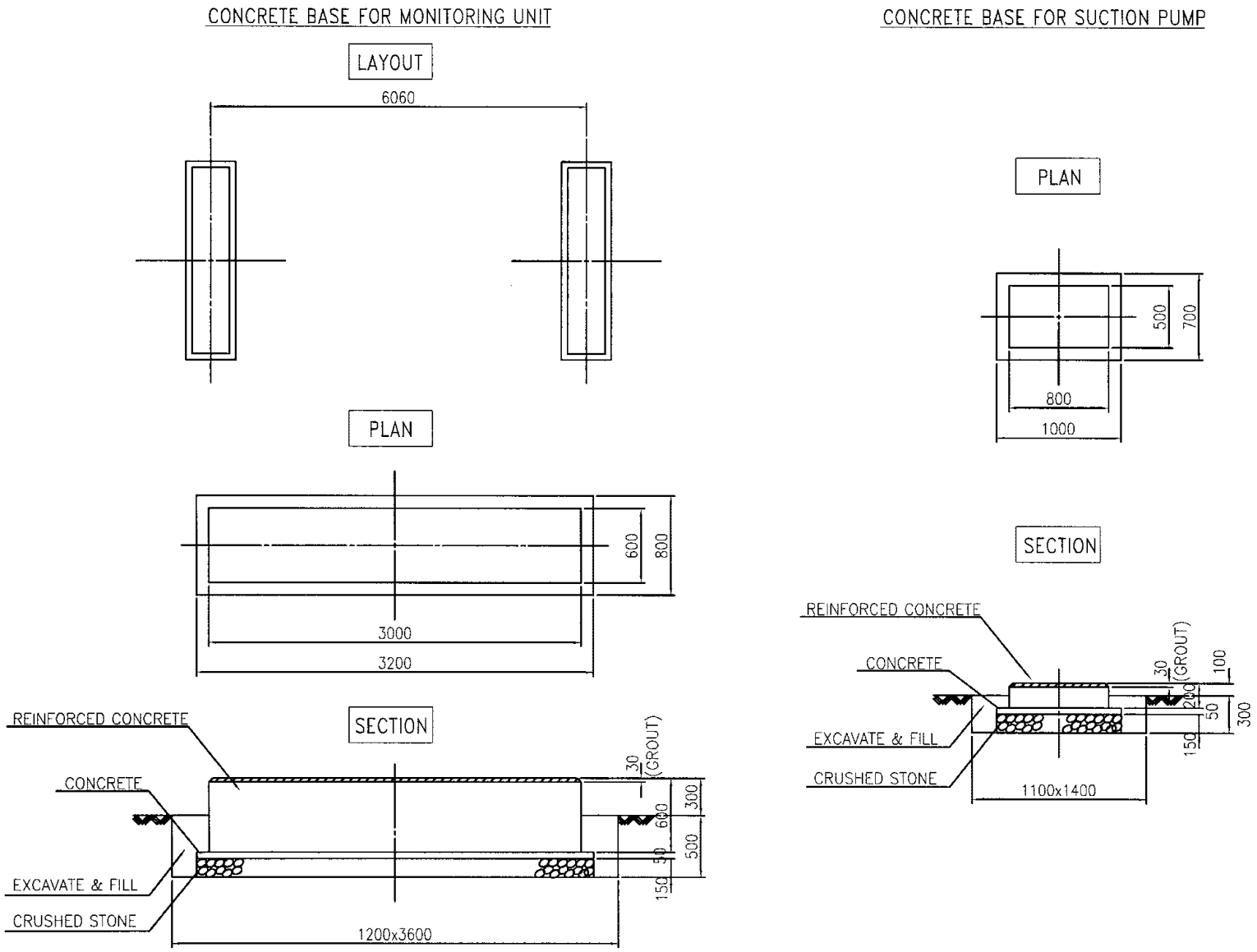
WPM-C-12-2 Station No.12 Jordan River/Upstream of Majama Bridge-Section



WPM-C-13-1 Station No.13 Jordan River/Upstream of King Hussein Bridge-Plan

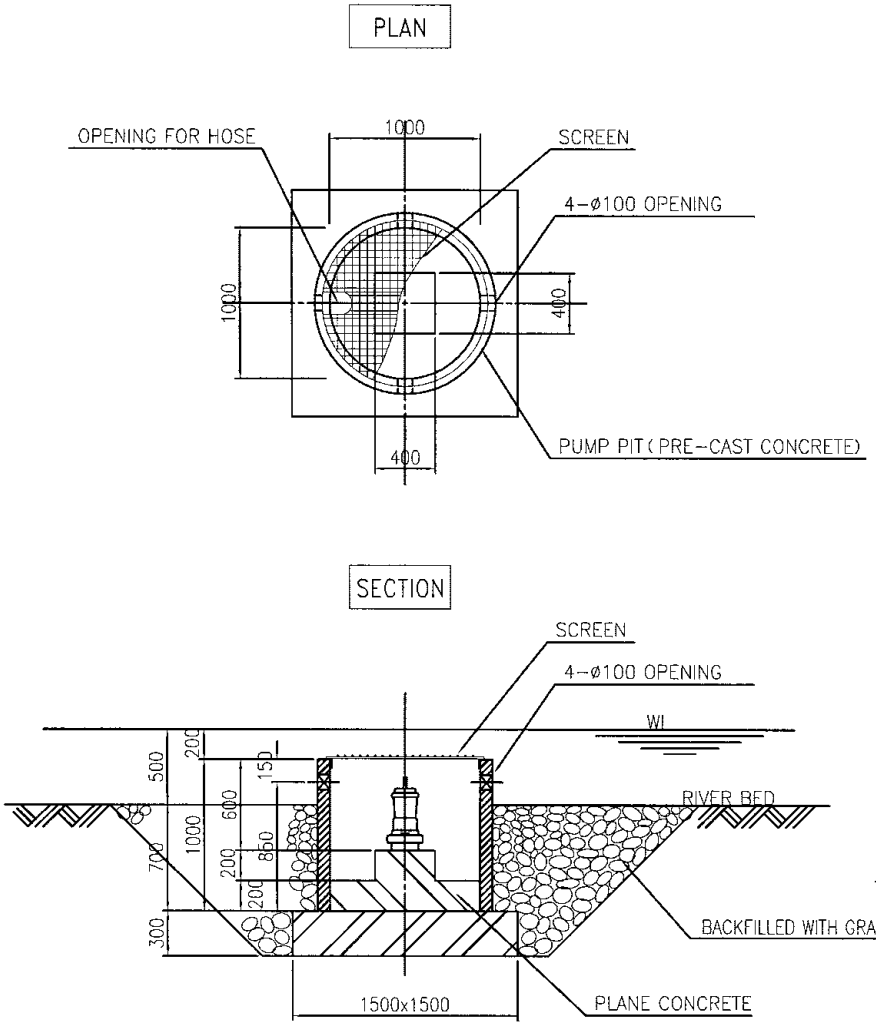


WPM-C-13-2 Station No.13 Jordan River/Upstream of King Hussein Bridge-Section

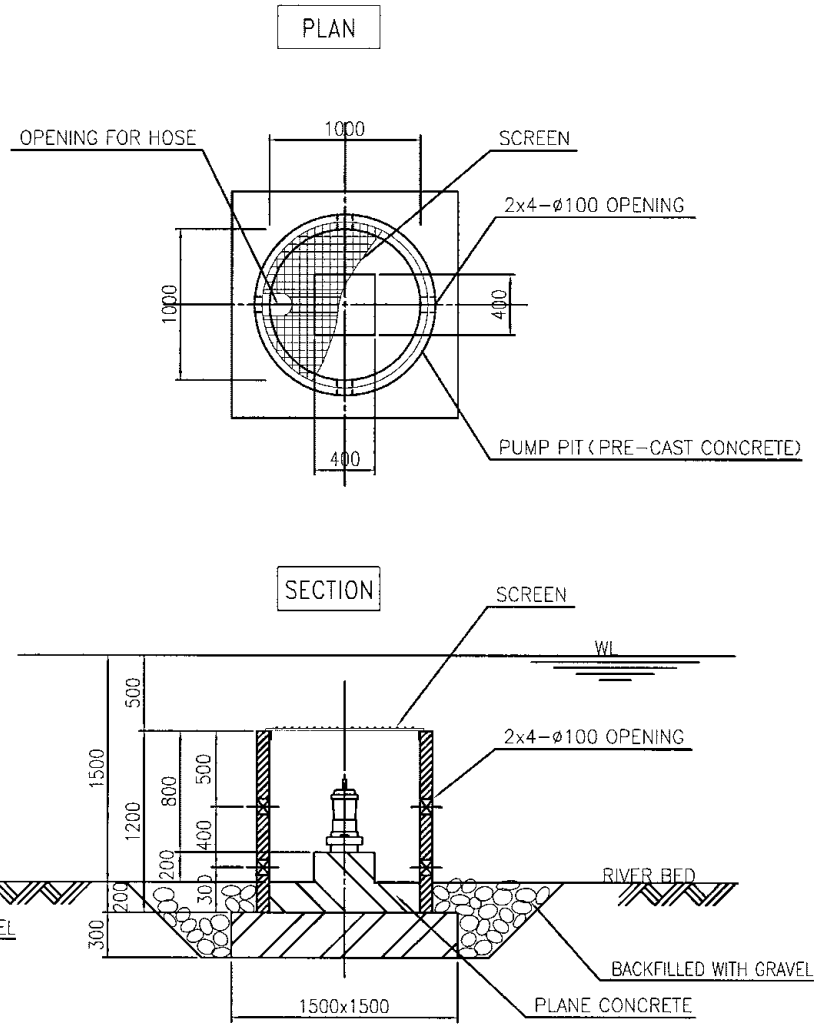


WPM-D-01 Foundation for Monitoring Unit and Pump

NO8. ZARQA RIVER /DOWNSTREAM OF AS-SAMRA WSP
PUMP PIT

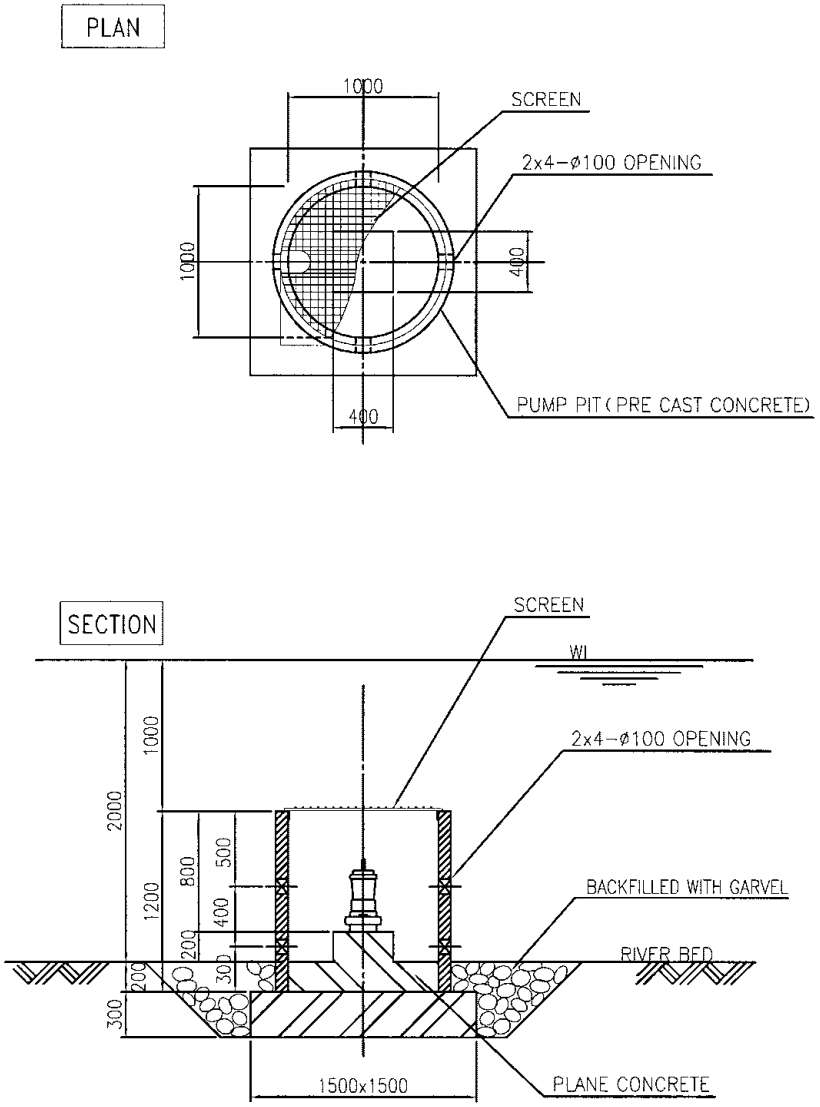


NO9. ZARQA RIVER /DOWNSTREAM OF TAWAFIN ADWAN BURIDGE
PUMP PIT

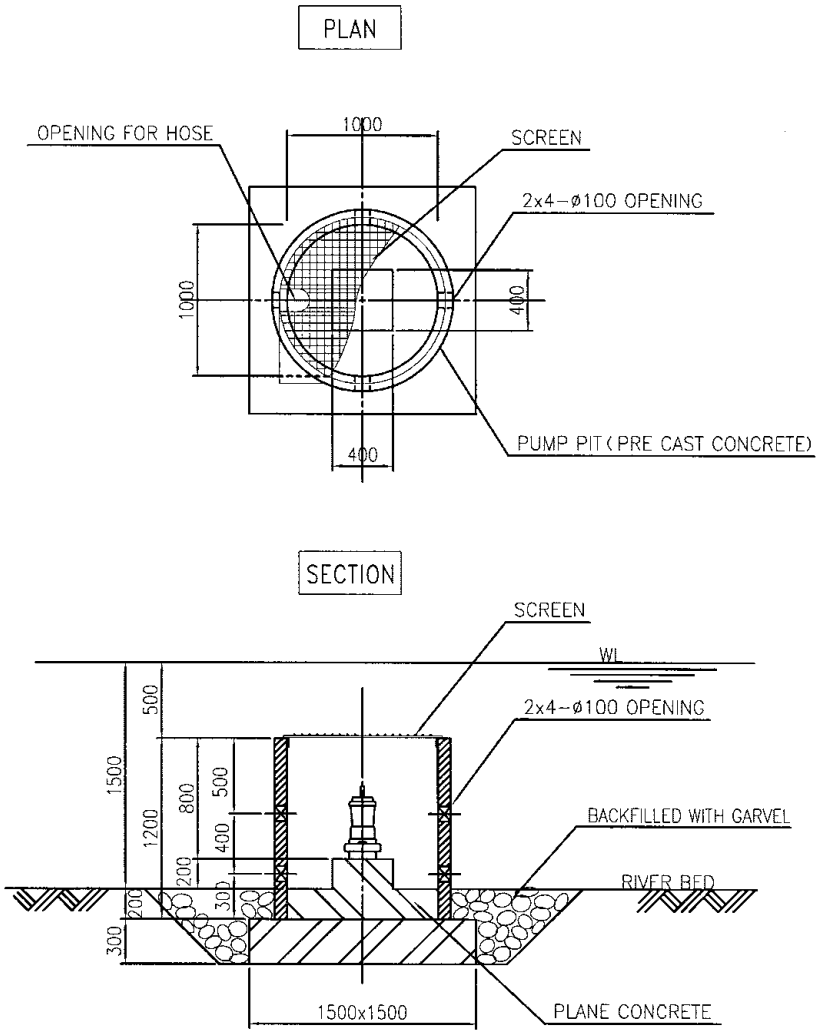


WPM-D-02 Details of Civil Work for Pump Installation (For Stations No.8 & 9)

NO11. ZARQA RIVER /KING TALAL RESERVOIR OUTLET
PUMP PIT

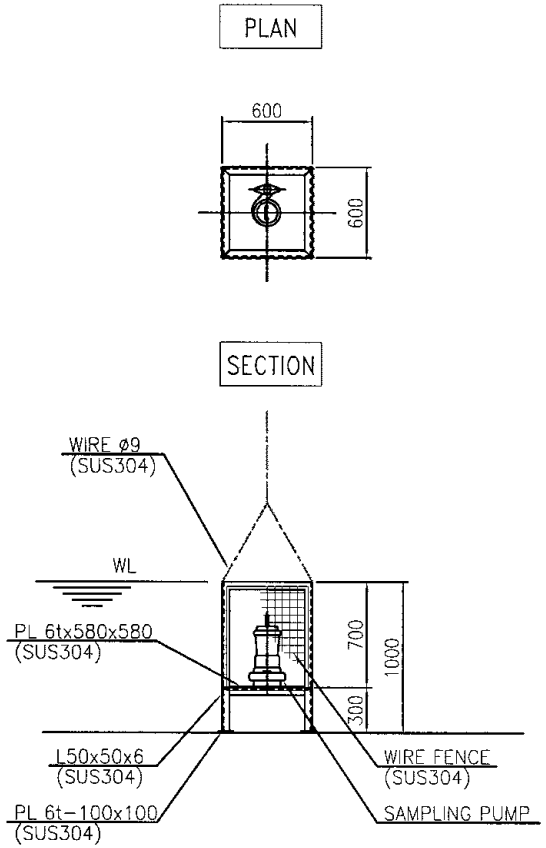


NO13. JORDAN RIVER /UPSTREAM OF KING HUSSEIN BURIDGE
PUMP PIT

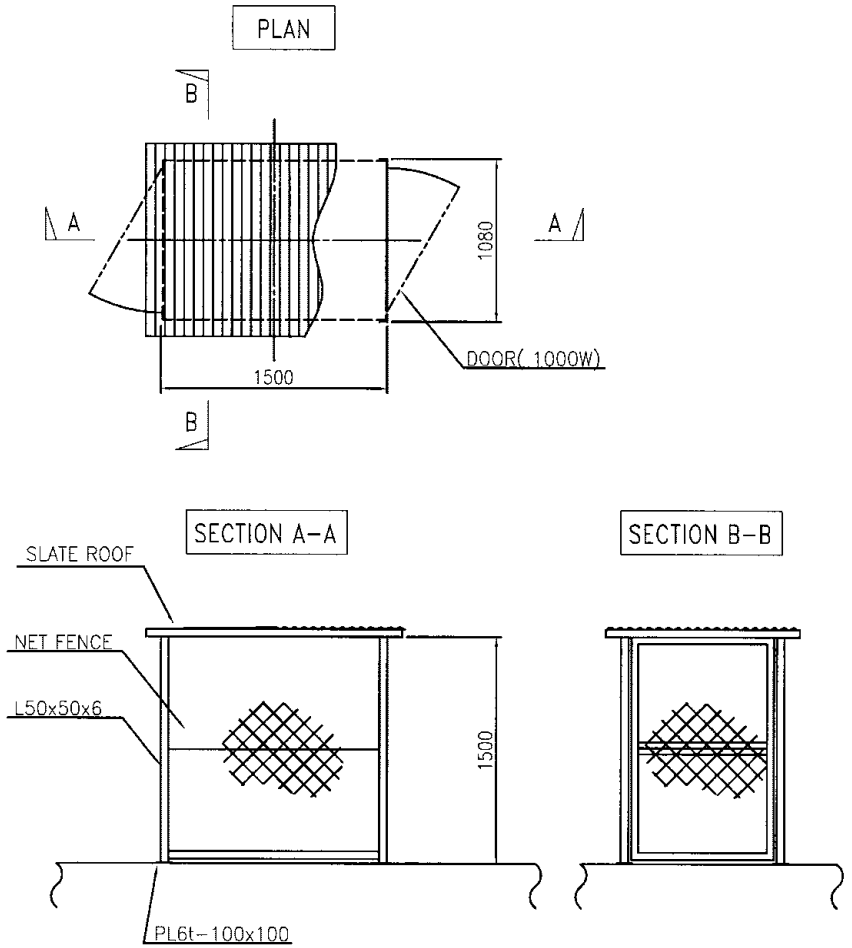


WPM-D-03 Details of Civil Work for Pump Installation (For Stations No.11 & 13)

FILTERING SCREEN



PUMP SHED



WPM-D-04 Details of Filtering Screen and Shed for Pump

2-2-4 Implementation Plan

2-2-4-1 Implementation Policy

Since the Project shall be implemented in accordance with the framework of the Grant Aid Scheme of the Government of Japan, it shall be implemented after receiving the approval of the Government of Japan and the E/N are exchanged between both countries. Following this, the Japanese Consultant shall be selected by the Government of Jordan and implementation design work shall be commenced. Following completion of the tender documents based on the implementation design results, equipment supply shall be carried out by the Japanese Contractor selected in the tender. Basic items and points requiring particular consideration in the event of Project implementation are as follows.

(1) Implementing Body

The implementing agency on the Jordanian side is the Higher Council for Science and Technology (HCST).

In order for the Government of Jordan to maintain close communications and discussions with the Japanese Consultant and Contractor and smoothly advance Project implementation, it is necessary to appoint a person responsible for the Project, and the Head of the Agriculture and Water Sector is set to fill this post.

The above person will need to fully explain the Project contents to related persons and offer guidance to ensure that cooperation is forthcoming with respect to Project advancement.

(2) Consultant

In order to carry out the Project civil engineering works and equipment supply and installation works under the grant aid, the Japanese Consultant shall bind a design supervision contract with the implementing agency on the Jordan side and carry out the implementation design and supply supervision of Project equipment. The Consultant shall also prepare tender documents and carry out tender work on behalf of HCST - the Project implementing body.

(3) Contractor

A Japanese Contractor selected in open tender according to the Grant Aid Scheme of the Government of Japan shall carry out the Project civil engineering works and equipment supply and installation works

Moreover, since it is thought that services such as spare parts supply and breakdown repairs will be required following the equipment supply, it is necessary for the Contractor to pay ample attention to building a setup for coordinating communications following the handing over of equipment.

(4) Necessity for Dispatch of Engineers

The Project consists of equipment supply (continuous monitoring equipment, regular fixed point chemical analysis apparatus, and telemetry system equipment), installation works, and civil engineering works for equipment installation. Accordingly, in order to achieve consistent process control and quality control, etc. from the civil works through to the installation and trial operation of equipment, it will be necessary to perform execution and supply supervision and to have a permanently stationed manager from the Contractor. Moreover, at the installation and trial operation stage of each item of equipment, installation engineers will be required from each maker. Therefore, the following engineers will need to be dispatched from the Contractor:

1) Site manager (1): supervision from civil works through to equipment installation, trial operation, inspection and acceptance, and handing over
2) Administration staff (1): equipment and materials supply, labor control
3) Installation engineers (12): installation guidance and trial operation of equipment
    - Continuous monitoring equipment (3 staff)
    - Chemical analysis apparatus (6 staff)
    - Telemetry system equipment (3 staff)

Concerning guidance on operation and maintenance following the equipment installation, this is handled in the soft component described later (2-2-4-7).

2-2-4-2 Implementation Conditions

(1) Important Points in the Execution Plan

Important points in the execution plan are as follows:

1) Since the civil engineering works period is short at around 7 months and the works are scattered over 13 sites, it is necessary to compile an efficient execution plan.

2) Since the Project area is located along the border with Israel including the basins of the Jordan River and Yarmouk River and is thus strategically important, the Contractor will need to cooperate with the implementing agency (HCST) in quickly completing procedures for obtaining authorization, etc. following the start of works.

(2) Important Points in the Equipment Supply Plan

Important points concerning the equipment supply plan are as follows:

1) Since water quality monitoring equipment is not produced in Jordan, it will need to be procured in Japan or a third country.

2) Regarding transportation and installation works in Jordan, there are no special conditions and using local operators should pose no problem.

2-2-4-3 Scope of Works

The scope of works concerning execution, supply and installation to be undertaken by the Japanese side and the Jordanian side are as indicated in Table 2.2.4.3-1.

Table 2.2.4.3-1 Scope of Works to be done by the Japanese Side and the Jordanian Side

Works Area	Japan	Jordan
1. Continuous water quality monitoring facilities		
(1) Equipment supply	○	–
(2) Spare parts supply (2 year supply)	○	–
(3) Civil engineering works	○	–
(4) Installation works	○	–
(5) Power supply works	–	○
(6) Communications facilities works	–	○
2. Chemical analysis equipment		
(1) Equipment supply	○	–
(2) Spare parts supply (2 year supply)	○	–
(3) Securing of installation space	–	○
(4) Installation works	○	–
(5) Power supply works	–	○
3. Telemetry system equipment		
(1) Equipment supply	○	–
(2) Securing of building for Monitoring Center	–	○
(3) Power and telephone line laying works	–	○
(4) Installation works	○	–
4. Transportation		
(1) Marine transportation	○	–
(2) Internal transportation	○	–

2-2-4-4 Consultant Supervision

Based on the Grant Aid Scheme of the Government of Japan, the Consultant shall ensure smooth work progress by forming a permanent Project Team to carry out implementation design work and consultant supervision work according to the purport of the basic design.

The Consultant shall permanently station one engineer on site during the civil engineering works and equipment installation and trial operation period in order to implement process supervision, quality control and safety control. The said engineer shall manage the civil engineering works, equipment installation, trial operation and maintenance, and handing over inspections carried out by the Contractor, and he shall witness inspections and provide follow-up on items borne by the Jordanian side.

(1) Basic Concept of Consultant Supervision

It is necessary for the Consultant to supervise the progress of works and supply to ensure that the Project is surely and safely implemented within the execution and supply period; and to manage and guide the contractor to ensure that the quality levels and delivery deadlines indicated in the contract are secured and that the works are implemented safely.

The works contents are as indicated in Table 2.2.4.4-1.

Table 2.2.4.4-1 Work Contents of Consultant in the Project

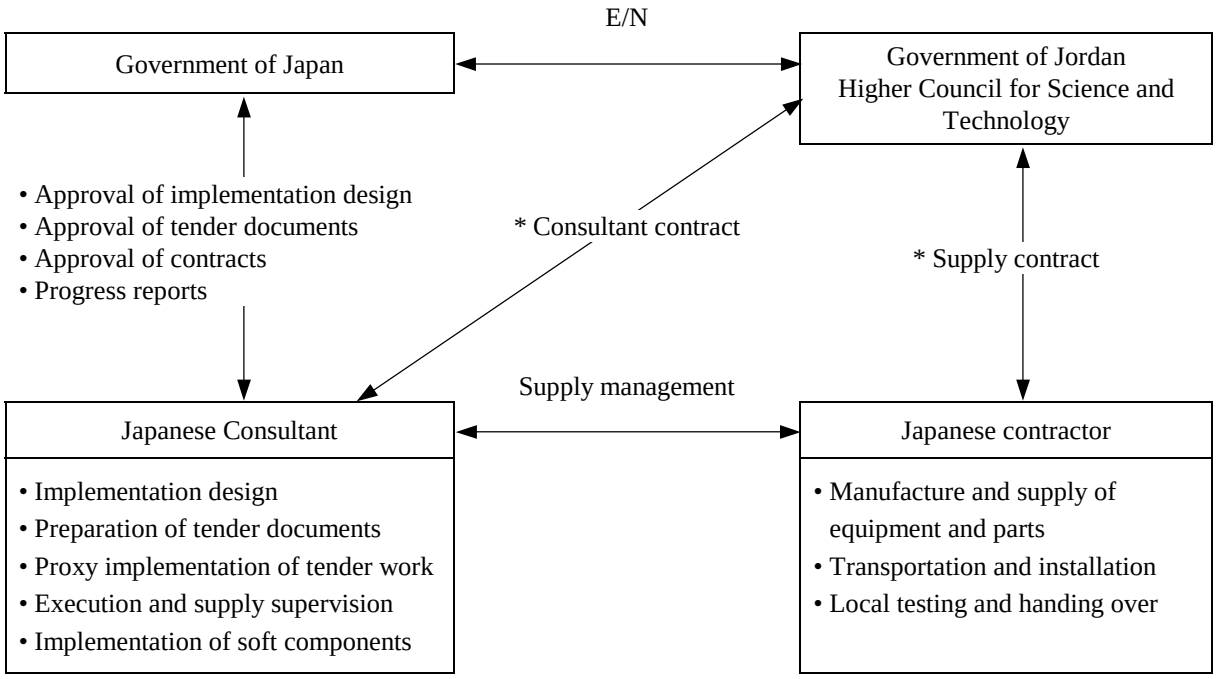
	Work Contents
Before execution and supply	Implementation design study Preparation of tender documents Acting implementation of tender work Evaluation of tender results Assistance of contract work
Execution and supply stage	Execution and supply supervision (including design supervision, installation guidance) Inspection Preparation of progress reports, etc. Implementation of soft components (initial operation guidance of procured equipment)

With regard to schedule control, attention shall be paid to the following items:

1) Regular progress reports regarding equipment fabrication and transportation shall be received from the contractor and schedule control shall be carried out.
2) Guidance shall be provided to ensure that monthly schedule control is carried out for each supplied item and that the contractor adheres to the contract period.
3) Concerning the power supply works and telecommunications facilities works, which are to be undertaken by the Jordanian side, since installation is set to start from January 2003, these shall be completed by the end of December 2002, and regular management guidance shall be provided to ensure that the Jordanian side closely adheres to the works schedule.

(2) Overall Relationship During Consultant Supervision

Fig. 2.2.4.4-1 shows the consultant supervision setup and overall relationship between related agencies during the period of consultant supervision.



* Note : Attestation by the Government of Japan is required for the Consultant contract and the supply contract.

Fig. 2.2.4.4-1 Project Implementation System

2-2-4-5 Quality Control Plan

Supervision based on the following items shall be carried out to make sure that the Contractor secured the facilities and equipment quality indicated in the contract documents (technical specifications, implementation design drawings, etc.). When there is doubt that the quality can be secured, the Contractor shall be asked to make corrections, revisions or repairs.

1) Checking of equipment fabrication drawings and specifications
2) Witnessing of equipment plant inspections and checking of plant inspection results
3) Checking of packing, transportation and site temporary storage methods
4) Checking of equipment working drawings and installation procedures
5) Checking of equipment trial operation, adjustment and inspection procedures
6) Supervision of equipment site installation works and witnessing of trial operation, adjustment and inspection
7) Checking of civil execution drawings and work progress on site

2-2-4-6 Procurement Plan

Because the Project equipment will not be manufactured in Jordan, it will be procured from Japan or a third country.

Therefore, supply sources were determined as shown in Table 2.2.4.6-1 as a result of carrying out comparison from the viewpoints of standards, specifications, quality, production, supply stability, supply time, and price. As for spare parts, these shall be supplied from each equipment supply source.

Table 2.2.4.6-1 Division of Procurement of Materials and Equipment

Equipment	Supply Source		
	Jordan	Japan	Third Country
1. Continuous water quality monitoring facilities (monitoring units)	–	○	–
① Monitoring equipment	–		–
② Civil works for equipment installation:			
- Cement	○	–	–
- Aggregate (sand, gravel)	○	–	–
- Reinforcing bars	○	–	–
- Steel	○	–	–
- Banking materials	○	–	–
- Works machinery	○	–	–
2. Chemical analysis equipment for intermittent monitoring			
High speed liquid chromatograph	–	○	–
Electrochemical detector	–	○	–
Spectrophotometer	–	○	–
Atomic absorption spectrophotometer	–	○	○
Ion chromatograph	–	○	–
Hand held simple analysis meters	–	○	–
Flow injector	–	○	–
ICP emission spectrophotometer	–	○	–
Automatic titration system	–	○	–
Draft chamber	–	○	–
Site detector set	–	○	–
Nitrogen compounds analyzer	–	○	–
Water distillation apparatus	–	○	–
Gas chromatograph mass analyzer	–	○	–
ICP mass spectrophotometer	–	○	–
Mercury analyzer	–	○	–
Fluorescent microscope	–	○	–
Autoclave	–	○	–
Six way filtration system	–	○	–
Microwave digestion system	–	○	○
Water purifying apparatus	–	○	–
3. Telemetry system	–	○	–

2-2-4-7 Implementation Schedule

In the event where the Project is implemented according to the Grant Aid Scheme of the Government of Japan, following the exchange of notes (E/N) between the two countries, work shall pass through the following three stages: ① execution of detailed design and preparation of tender documents, ② tender and contract for equipment procurement and civil works, and ③ execution of equipment procurement and civil works.

(1) Detailed Design Work

Following the E/N, the Japanese Consultant shall immediately bind a consultant agreement with the Jordanian side and start work on the detailed design.

Based on the results of the basic design study and the detailed design study, preparation of the tender documents (specifications and detailed design drawings) shall be carried out. In the initial and final stages of the detailed design, close consultations shall be conducted with the related authorities on the Jordanian side and approval for the tender documents shall be obtained. It is expected that this stage will last 0.8 months.

(2) Tender Opening and Contract Execution

After the detailed design, the tendering work shall be started. Acting on behalf of the Jordanian side, the Consultant shall advertise the tender, distribute tender documents, prepare an addenda, etc. Then, after leaving an enough period for the preparation of tender by the tenderers, the tender will be submitted by the tenderers at the tender opening meeting. Then, the Consultant will examine the submitted tender and open the tender price, and expedite conclusion of the contract between the Jordanian side and the Japanese contractor.

The tender opening will take place in the presence of the concerned parties, and the tenderer who offers the lowest price bid shall be deemed the successful tenderer (providing the contents of its tender are appropriate) and shall bind a contract with the Jordanian side. It is expected that this stage will last 1.2 months from the distribution of tender documents to binding of the contract.

(3) Civil Works and Equipment Supply

Following execution of the contract, verification will be obtained from the Government of Japan and work will start on the civil works and supply. Judging from the scale of the Project, providing that the procurement work proceeds smoothly and the scope of

works of the Jordanian side is executed, it is expected that the civil work period will be 7 months and procurement work period will be 8.5 months.

Moreover, starting with preliminary consultations with the contractor, the Consultant shall conduct guidance and supervision of schedule and quality control during the procurement period, and shall complete work within the period designated in the E/N.

Fig.2.2.4.7-1 shows the expected work implementation schedule.

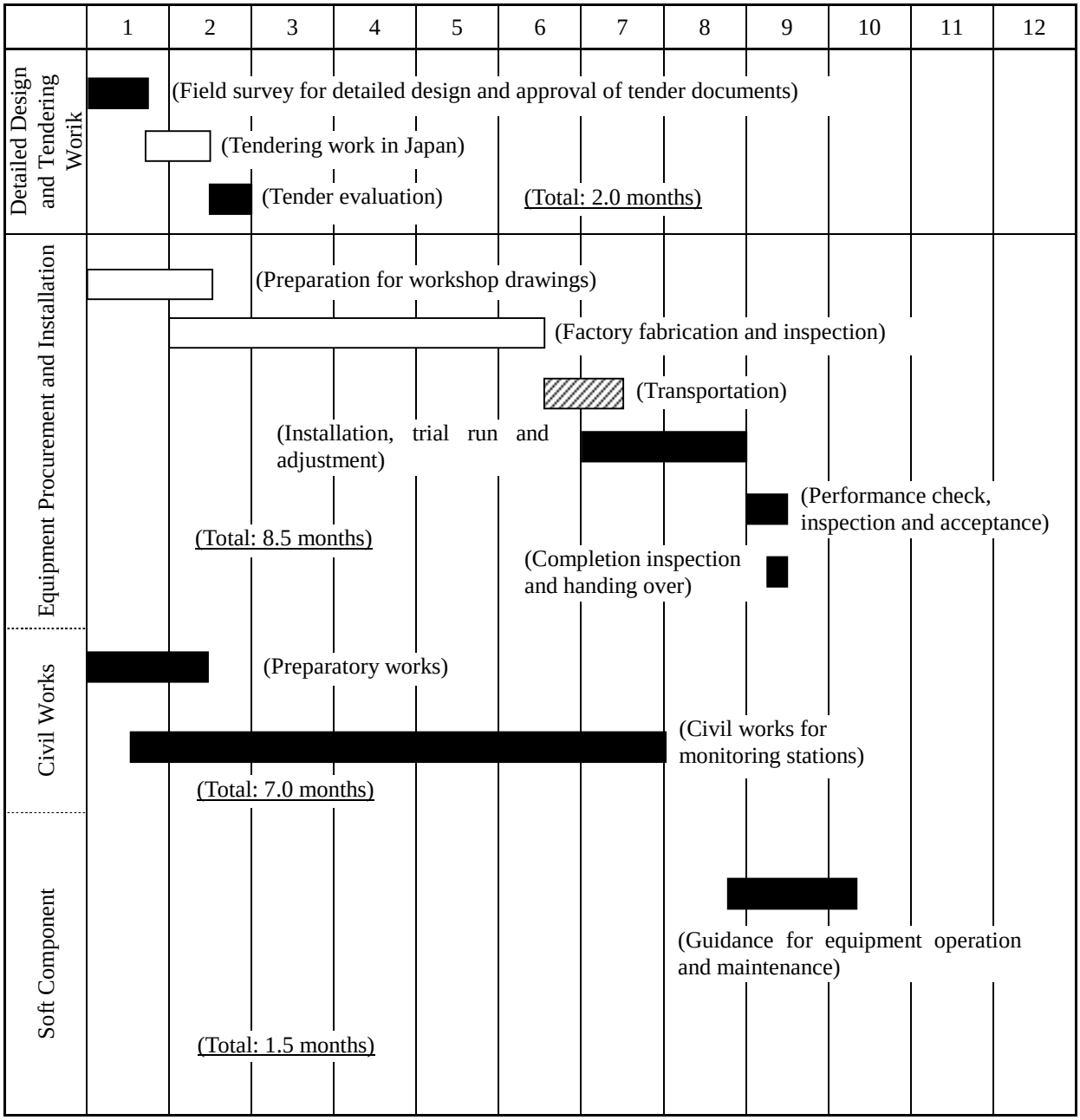


Fig.2.2.4.7-1 Work Implementation Schedule

2-3 Obligation of Recipient Country

2-3-1 Works to be Undertaken by the Jordanian Side

The scope of works to be undertaken by the Jordanian side is as follows.

Before Works Implementation

(1) To provide necessary information and data for the Project

(2) To obtain authorization of use for the monitoring station installation sites prior to the start of works by the Japanese side

(3) To obtain the permission and authorization required for the monitoring station civil engineering works

During Works Implementation

(1) To ensure the swift unloading, customs clearance and tax exemption of equipment and materials required for the Project

(2) To exempt taxes and provide conveniences with respect to necessary equipment and Japanese nationals dispatched for the Project

(3) To exempt customs charges and business tax, etc. with respect to equipment and materials required for the Project

(4) To bear account opening charges and payment commission at a Japanese bank

(5) To bear all other costs required for the Project but not included in the Grant Aid of the Government of Japan

(6) To appoint expert technicians for the transfer of operation and maintenance technology

(7) To provide power supply for each item of equipment supplied under the Project

(8) To execute power supply works for installation of the monitoring stations to be supplied under the Project

(9) To secure space for construction of the Monitoring Center

(10) To prepare installation sites for chemical analysis equipment to be supplied under the Project

(11) To provide power supply for chemical analysis equipment to be supplied under the Project

(12) To supply reagents and pure water, etc. for operating the equipment to be supplied under the Project

(13) To lay the telephone lines required for the telemetry system to be supplied under the Project

(14) To prepare the installation sites for the telemetry system to be supplied under the Project

After Project Implementation

(1) Reflection of monitoring data in environmental administration

(2) Appropriate and effective maintenance of equipment procured under Japan's grant aid

(3) Securing of operation and maintenance personnel and budget

(4) Continued acquisition of fixed point and regular observation water quality data from related agencies

2-3-2 Cost Estimation of Jordanian Side's Obligation

The estimated cost for main items to be done by the Jordanian side is approximately 311,000 JD as shown in Table 2.3.2-1.

Table 2.3.2-1 Estimated Cost for Works to be done by the Jordanian Side

Item	Amount (JD)
Electrical power supply works	224,000
Telephone line works	87,000
Total	311,000

The calculation basis is shown in Appendix-5.

2-4 Project Operation Plan

2-4-1 Operation and Maintenance Organization

The operation and maintenance of the monitoring station of the Project and the Monitoring Center at Amman are taken charge by the Central Unit for Environmental Pollution Monitoring (CUEP) to be established inside RSS. CUEP will be divided into two

departments, Chemical Analysis Department and Maintenance Department, organized with 12 staff members.

Fig. 2.4.1-1 shows the proposed organization chart of CUEP.

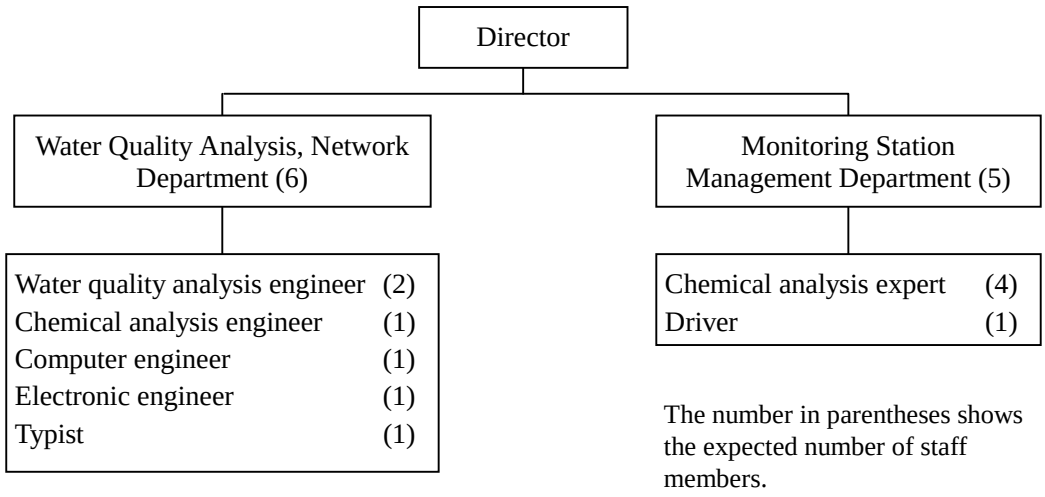


Fig. 2.4.1-1 Proposed Organization Chart of CUEP

2-4-2 Contents of Maintenance Services

The operation of the facility requires supply of chemical agent and water, calibration and maintenance of the measuring instruments, and inspection and cleaning of the sampling system on a weekly basis. For the regular maintenance of 13 monitoring stations situated about 80km, in average, apart from Amman, a staff of two groups each comprising two persons, i.e. four persons in total is needed.

A cycle of patrol inspection of the monitoring stations in a week is as shown in Fig.2.4.2-1.

Table 2.4.2-1 Cycle of Patrol Inspection of the Monitoring Stations

	Sat.	Sun.	Mon.	Tue.	Wed.	Thu.
Group A	①	③	⑤	⑦	⑨	⑫
Group B	②	④	⑥	⑧	⑩,⑪	⑬

① to ⑬ are the station numbers.

2-4-3 Operation and Maintenance Work Items

The following work is necessary in order to maintain normal operation at the monitoring stations:

- Cleaning of sampling pumps and pipes, etc.
- Inspection and adjustment of measuring instruments
- Regeneration of zero points and spans
- Replenishment of reagents and pure water

Detailed operation and maintenance items and work cycles are as indicated in Table 2.4.3-1.

Table 2.4.3-1 Operation and Maintenance Work Plan

Item	Work Contents	Required Time	Work Cycle		
			Once/Week	Once/Month	Once/6 Months
Temperature pH EC DO TB	Sampling pipes washing Inspection and maintenance Regeneration by standard liquid	2	○		
COD (UV method)	Sampling pipes washing Zero point and span regeneration	1	○		
T-N, T-P	Liquid bypass washing Reactor washing Zero point and span regeneration Replenishment of reagents	3	○		
	Inspection and adjustment of heaters Cell inspection	2		○	
	Replenishment of pure water	0.5	○		
	Wastewater treatment	1	○		
Overall inspection of above equipment		5			○
Blending of reagents		7	○		

2-4-4 Operation and Maintenance Cost

(1) Operation and Maintenance Cost

The operation and maintenance cost of the 13 monitoring stations will be as follows.

1) Personnel expenses

a) Personnel: 12 staff (1 station manager, 5 engineers, 4 technicians, 1 typist, 1 operator)

b) Salaries:

Personnel	Unit Rate	Annual Cost
Station manager (1)	15,000 JD/year	15,000 JD/year
Engineers (5)	8,000 JD/year	8,000 x 5 = 40,000 JD/year
Technicians (4)	3,500 JD/year	3,500 x 4 = 14,000 JD/year
Typist (1)	2,500 JD/year	2,500 JD/year
Operator (1)	2,500 JD/year	2,500 JD/year
	Total	74,000 JD/year

2) Utilities costs

a) Electricity

Amount Used	Unit Rate	Cost
3 kW x 24 hrs x 365 days/year x 13 sites = 342,000 kWh/year	0.05 JD/kWh	17,100 JD/year

b) Water (pure water)

Amount Used		Total	Unit Rate	Cost
T-N & T-P (10 sites)	Other (3 sites)			
1.5 liters/time x 4 times/day x 7 days = 50 liters/week/site	5 liters/week/site	(50 x 10 + 5 x 3) x 52 weeks = 30 m^3/year	1.0 JD/m^3	30 JD/year

c) Fuel (diesel oil)

Average Distance	Amount Used	Unit Rate	Cost
80 km from Amman	20,000 liters/year	0.11 JD/liter	2,200 JD/year

d) Telephone Charge

Number of Lines	Charge	Cost
13 lines	300 JD/line/month	300 x 13 x 12 = 46,800 JD/year

Total utilities cost (above a) + b) + c) + d) is 66,130 JD/year.

3) Reagents

Approximately 13,030 JD/year

4) Expendable items and spare parts

Approximately 38,520 JD/year

Therefore, the annual operation and maintenance cost will be as shown in Table 2.4.4-1.

Table 2.4.4-1 Expected Annual Operation and Maintenance Cost

Item	Cost (JD/year)
Personnel expenses	74,000
Utilities costs (electricity, water, fuel, telephones)	66,130
Reagents	13,030
Expendables and spare parts	38,520
Total	191,680

(2) Spare Parts Preparation Plan

1) Spare parts for the Project equipment shall be replaced according to time of operation. Spare parts shall be prepared separately as parts for maintenance and parts necessary over the service life of equipment and in the event of unexpected breakdowns, etc. Concerning the types and quantities of parts, a permanent supply that satisfies the cycles of the aforementioned periodic maintenance plan needs to be kept.

2) In the Project, spare parts shall be supplied for use over on operation time of 2 years. As for additional spare parts after this initial supply, Jordan side will need to raise funds for purchase through its own efforts. It is thought that the cost of this will amount to roughly 5% of the original equipment cost per year.

3) The telemetry system does not need any spare parts in particular.

2-5 Technical Assistance (Soft Component)

(1) Background

There are two major effects that are expected through effective utilization of the equipment to be prepared in the Project.

First, utilization of the continuous monitoring data from the monitoring stations enables to take immediate measures in the case of abnormal water quality due to, for example, illegal inflow of industrial effluent into a water source, and taking concrete measures for improving the water quality increases the safety of the drinking and agricultural water.

Secondly, conducting a unified control and analysis, and reporting the result systematically and promptly, of the continuous monitoring data from the 13 monitoring stations, prepared in the Project, and intermittent water quality monitoring data supplied from related agencies (WAJ, JVA, and ERC Laboratories) enable to make a political judgment on a scientific basis and yet swiftly.

In order to realize the effects of preparing the water quality monitoring equipment as above, the following matters shall be taken charge by the Jordanian side.

1) Ensured operation and maintenance of the monitoring equipment and apparatuses (monitoring station equipment, chemical analysis equipment, and telemetry system apparatuses)
2) Ensured operation and maintenance of the data collection and compilation system using the telemetry system
3) Ensured achievement of data analysis by the Central Unit for Environmental Pollution Monitoring (CUEP)
4) Establishment of an operation system of the water quality data in a policy-forming sector, and improvement and management of an urgent communication system by CUEP in the case of an emergency (abnormal water quality)

In carrying out the above, it is necessary to prepare software environment (or operation and maintenance technique) to be coupled with the hardware environment (or equipment) provided in the Project. Accordingly, it is understood that introducing the technical assistance or so-called soft component into the Project for the purpose of preparing necessary software environment will make it possible to advance the operation of the whole monitoring system and operation and maintenance of individual equipment.

(2) Target

The following three points can be the target of the soft component.

1) Operation and maintenance system of the continuous monitoring system is established.
2) Knowledge on the maintenance of the fixed point, regular chemical analysis equipment, granted in the Project, is acquired.
3) Collection, compilation and analysis system of the data from the monitoring stations and fixed point, regular monitoring data from related agencies is established.

(3) Achievements

The following achievements are expected as a result of introducing the soft component.

1) Technical transfer on the maintenance and operation of the monitoring stations is achieved.
2) Technical transfer on the aggregation and compilation of the collected monitoring data and on the analysis of the data is achieved.
3) Technical transfer on the operation and maintenance of the telemetry system is achieved.
4) Technical transfer on the maintenance of the fixed point, regular chemical analysis equipment is achieved.
5) Technical transfer on the operation of the equipment for a collection and entry system of the fixed point, regular analysis data supplied from each agency is achieved.

(4) Activities

The soft component shall principally be provided by Japanese consultants. In an exception case, where fixed point, regular chemical analysis equipment is procured from a third country and no engineer capable of technical transfer on the operation of the equipment is available in Japan, a competent engineer of the third country shall be selected.

The organizations and activities for the implementation of the soft component are as follows.

1) Guidance on the operation of the monitoring system

An engineer shall be selected for providing a technical guidance on the operation and maintenance of the whole monitoring system to be prepared in the Project. The engineer particularly provides a technical guidance on the compilation and analysis work of the collected data to be taken charge by CUEP, to be installed inside RSS as an operation and maintenance body, and also provides an advice on the preparation work of the report to the Managing Board for NEPRAMS and advice and guidance on the establishment of the maintenance system.

This engineer shall come to the site earlier by one week than other engineers so as to make necessary coordination for the Jordanian side to get ready for the implementation of the soft component.

The dispatching period of the engineer shall be the entire period of the soft component activities, that is, for 1.5 month after the installation of equipment is completed.

a. Technical guidance on the compilation and analysis of the collected data

- To provide a technical guidance on the compilation and analysis work of the measurement data collected by the Monitoring Center from the continuous monitoring stations and intermittent monitoring data from related agencies.
- To provide a technical guidance, concerning the preparation work of the report by CUEP to the Managing Board for NEPRAMS and to related agencies, on the content of data and subjects for review and examination.
- To provide an advice, concerning the water quality analysis data disclosed by CUEP to the public on the Internet via NIC, on the content of data and subjects for review and examination.

b. Advice and guidance on the establishment of the maintenance system

- To review with CUEP the establishment of the maintenance system of the monitoring stations, concerning the most appropriate manner, implementation schedule, etc.

2) Guidance on the maintenance of the monitoring stations

An engineer well acquainted with the maintenance of the monitoring system shall be selected for ensuring thorough activities in maintaining the monitoring station

equipment and cleaning the building inside and outside and also for providing a technical guidance thereon. For providing an on-the-job guidance, the engineer shall assign the activities to the Jordanian side engineers well in line with the working groups to be organized.

The dispatching period of the engineer shall be for 1.25 month after the installation of equipment is completed.

- To provide a technical guidance on the maintenance (washing, cleaning, etc.) of the equipment and building inside and outside.
- To provide a technical guidance on the indicated value correction of the measuring instrument.
- To provide a technical guidance on the supply of chemical agent and pure water to the analysis equipment and on the waste water treatment.
- To provide a technical guidance on the conversion of UV value - COD value of the COD meter (UV meter), and to work jointly for setting the initial conversion coefficient.
- To prepare supplementary explanatory notes, concerning the above contents, to the operation manuals prepared by the equipment manufacturers so as to make the manuals perfect.

3) Technical guidance on the telemetry system/information processing

An engineer in the information processing field shall be selected for realizing technical transfer on the maintenance work of the telemetry system equipment and information processing work in CUEP

The dispatching period of the engineer shall be for 1.25 months after the installation of equipment is completed.

a. Matters concerning the maintenance of the telemetry system

To provide a guidance on the activities concerning the maintenance of the telemetry system equipment in the monitoring stations, and to prepare supplementary explanatory notes to the operation manuals prepared by the equipment manufacturers, considering the specific factors at each location, so as to make the manuals perfect.

b. Matters concerning the information processing

To provide a guidance on the operation of the software (packaged software and batch job software) for supporting CUEP to prepare report documents, and to prepare supplementary explanatory notes to the operation manuals prepared by the equipment manufacturers so as to make the manuals perfect.

4) Guidance on the maintenance of the fixed point, regular chemical analysis equipment

An engineer well acquainted with overall chemical analysis and maintenance of individual equipment shall be selected for providing a technical guidance on the improvement and management of the utility environment for the operation of the equipment in the laboratory and a guidance on the maintenance of individual equipment.

Since pieces of the equipment to be prepared in the Project include the equipment, such as ICP-MS and GC-MS, that requires complicated maintenance procedure or that analyzed super-micro component, a guidance on the maintenance procedure of the equipment is necessary. Because even a small amount of foreign article in an analysis chamber or in dilution water results in a failure of analysis on such equipment that analyzes super-micro component, it is important to prepare suitable utility for the apparatuses in the analysis chamber and auxiliary facilities, and hence guidance and improvement for the purpose are needed.

a. Matters concerning the improvement and management of the utility environment for the operation of the equipment in the laboratory

An engineer well acquainted with overall chemical analysis and operation in analysis chamber shall be selected for achieving the following activities.

The dispatching period of the engineer shall be for 1.0 month after the installation of equipment is completed.

- To evaluate the progress in the preparation of the installation environment (analysis chamber, air-conditioning, etc.) for the precision analysis equipment, which is within the supply scope of the Jordanian side.
- To evaluate the progress in the preparation of the equipment and environment for the supply and storage of the gas, pure water and chemical agent used for the precision equipment.

- To evaluate the progress in the preparation of the installation environment for other pieces of equipment to be granted in the Project.
- To prepare necessary improvement plans based on the result of the above evaluation and, upon consultation with relevant Jordanian personnel, prepare a report concerning improvement measures, schedule, etc.
- To determine the content and procedure of supplying the fixed point, regular chemical analysis data from the laboratories to the water quality monitoring system, and prepare a report.

b. Matters concerning the maintenance of the chemical analysis equipment

Of the pieces of equipment granted in the Project, the following items require advanced maintenance technique and so technical guidance is particularly needed.

(a) ICP-MS
(b) ICP-AES
(c) GC-MS
(d) IC
(e) HPLC

An engineer well acquainted with the operation and handling of the equipment shall be selected for (a) and (b) and another engineer for (c), (d), and (e), and each engineer shall perform the following activities.

- To provide a technical guidance on the maintenance procedure of the equipment at each laboratory and to prepare supplementary explanatory notes to the operation manuals prepared by the equipment manufacturers so as to make the manuals perfect.

(5) Detailed activity plan

Table 2.5-1 shows the expected activity plan for the soft component to be provided by different experts in this Project.

Table 2.5-2 is the execution schedule of each activity.

Table 2.5-1 Detailed Activity Plan

	Classification	Description of activity	Aided object	Necessary period	Apparatus required
1	Guidance on the operation of the monitoring system	(1) Preparation and arrangement prior to the implementation of the soft component (2) Technical guidance on the arrangement and analysis of the collected monitoring data (3) Advice and guidance on the establishment of the maintenance system in CUEP	HCST, CUEP	1 person x 1.5 month	Vehicle - 1
2	Guidance on the maintenance of the monitoring station	Technical guidance on the maintenance of the monitoring station ・ Technical guidance on the maintenance service of equipment ・ Technical guidance on the indicated value correction of measuring instruments ・ Technical guidance on the supply of consumable chemical agent of analyzing equipment ・ Technical guidance on the indicated value correction of COD meter ・ Preparation of supplementary explanatory notes concerning the above	CUEP Monitoring stations at 13 points	1 person x 1.25 month	Vehicle - 2
3	Technical guidance on the telemetry system/information processing	(1) Technical guidance on the maintenance of the telemetry system ・ Guidance on the maintenance service, and preparation of supplementary explanatory notes thereof (2) Technical guidance on the information processing ・ Guidance on the operation of equipment and software, and preparation of supplementary explanatory notes thereof	CUEP Monitoring stations at 13 points GCEP ERC Lab.	1 person x 1.25 month	Vehicle - 1
4	Guidance-A on the maintenance of chemical analysis equipment	Technical guidance on the utility of the laboratory ・ Guidance on the evaluation and improvement of the arrangement condition of the utility for precision analyzing equipment ・ Guidance on the evaluation and improvement of the arrangement condition of the supply and storage equipment for special chemical consumable of precision analyzing equipment ・ Guidance on the evaluation and improvement of the installation environment of other equipment than the above ・ Consultation on the improvement and preparation of report	WAJ Lab. JVA Lab. ERC Lab.	1 person x 1.0 month	Vehicle - 3
5	Guidance-B on the maintenance of chemical analysis equipment	Guidance on the maintenance of chemical analysis equipment (ICP-MS, ICP-AEC) ・ Guidance on the maintenance of the above chemical analysis equipment in each laboratory, and preparation of supplementary explanatory notes thereof		1 person x 1.0 month	Vehicle - 3
6	Guidance-C on the maintenance of chemical analysis equipment	Guidance on the maintenance of chemical analysis equipment (GC-MS, HPLC) ・ Guidance on the maintenance of the above chemical analysis equipment in each laboratory, and preparation of supplementary explanatory notes thereof		1 person x 1.0 month	Vehicle - 3

Table 2.5-2 Execution Schedule of Soft Component of the Project

(Unit: month)

	Personnel classification	Activity		1	2
1	Guidance on the operation of the monitoring system (1 person)	(1) Preparation and arrangement for the implementation of the soft component			
		(2) Technical guidance on the arrangement and analysis of the collected monitoring data			
		(3) Advice and guidance on the establishment of the maintenance system in CUEP			
2	Guidance on the maintenance of the monitoring station (1 person)	Technical guidance on the maintenance of the monitoring station	Guidance on the maintenance of equipment		
			Guidance on the correction of COD meter		
3	Technical guidance on the telemetry system/information processing (1 person)	(1) Technical guidance on the maintenance of the telemetry system			
		(2) Technical guidance on the information processing			
4	Guidance-A on the maintenance of chemical analysis equipment (1 person)	Technical guidance on the utility of the laboratory	Survey of each laboratory		
			Preparation and consultation on improvement plan		
			Report format of fixed point, regular analysis result		
5	Guidance-B on the maintenance of chemical analysis equipment (1 person)	Guidance on the maintenance of chemical analysis equipment (ICP-MS, ICP-AES)	WAJ Lab. (ICP-MS)		
			ERC Lab. (ICP-MS)		
			JVA Lab. (ECP-AES)		
6	Guidance-C on the maintenance of chemical analysis equipment (1 person)	Guidance on the maintenance of chemical analysis equipment (GC-MS, HPLC)	WAJ Lab. (IC)		
			ERC Lab. (HPLC)		
			JVA Lab. (GC-MS)		

CHAPTER 3 PROJECT EVALUATION AND RECOMMENDATIONS

CHAPTER 3 PROJECT EVALUATION AND RECOMMENDATIONS

3-1 Project Effect

The present condition and problems at the Project site, measures to be taken in the Project (intended activities under cooperation), and the Project effects can be summarized as shown in Table 3.1-1.

Table 3.1-1 Present Condition, Problems, Improvement Measures, and Positive Effects Associated with the Project

Present condition and problems	Measures to be taken in the Project (intended activities under cooperation)	Project effects, degree of improvement
1. In the summer of 1998, a lot of algae grew in the King Abdullah Canal, which is a major water resource providing about 30-40% of the water supply to the metropolitan area of Amman, and the quality of the water resource deteriorated, resulting in stoppage of water supply to about two millions of the residents in the metropolitan area.	Monitoring stations are installed at 13 points on the major water resources, including Yarmouk River, Jordan River, King Abdullah Canal, and Zarqa River, so as to continuously monitor the nitrogen and phosphorus concentration, the major factor for eutrophication, and also to continuously monitor the major water quality analysis items, including water temperature, COD, DO, turbidity, and EC.	- Continuous monitoring enables to monitor the changes in the water quality in the major water resources all the time. - Utilization of the monitoring data in the environmental administration eliminates anxiety about the quality of the water resources for drinking and irrigation water of about three millions of inhabitants in the northern area of Amman.
2. Taking appropriate water pollution preventive measures seems difficult at present because the water quality analyzing capacity is insufficient in the public water quality test laboratories due to deterioration of chemical analyzing equipment in their possession, shortage of the number of equipment compared to the number of specimens requiring analysis, and deficiency of micro-chemical analyzing equipment.	In order to improve and strengthen the chemical analyzing capacity of the three major laboratories (WAJ, JVA and ERC Laboratories), equipment for fixed point, regular chemical analysis is procured.	- Strengthening the chemical analysis equipment improves the capacity in analyzing the measured data. - A system for checking pollutants up to 10^{-6}mg/l, such as inorganic substances, heavy metals, agricultural chemicals, chlorine organic solvents that cannot be detected through conventional chemical analysis is prepared, and accordingly, concrete measures can be planned for the improved safety of the water for drinking and irrigation.
3.Since each of the three major water quality test laboratories carries out fixed point, regular water quality monitoring independently without any collaboration among them, there has been no established water quality monitoring system where the monitoring data measured by each laboratory is utilized effectively in the environmental administration.	A Monitoring Center is built inside RSS in the City of Amman, and the 13 monitoring stations, ERC Laboratory and GCEP are connected with each other by telephone lines so as to construct a telemetry system where data communication is available on-line. Data supply from WAF and JVA to the Monitoring Center is done off-line (by means of CD ROM or floppy disk).	- Continuous on-line monitoring of the water pollution in the major water resources enables to take immediate measures for coping with abnormal water quality. - Unified control, compilation and analysis of the water quality data from each related agency at the Monitoring Center enables to plan out effective water pollution preventive measures on a nation-wide basis.

3-2 Recommendations

Matters requiring further improvement and preparation, as well as our recommendations thereon, for the ensured implementation of the Project and sustained operation and maintenance after completion of the Project are as follows,

(1) Carrying out the work within the supply scope of the Jordanian side

For smooth implementation of the Project and accomplishment of the goals, HCST, the implementation body on the Jordanian side should secure the expenses for the installation of power cables into each monitoring stations and construction of the communication facilities, which are included in the supply scope of the Jordanian side and hence are an external-factor risk in the Project, without delay and ensure to carry out the work.

(2) Reflecting the monitoring data in the environmental administration

The operation and maintenance of the monitoring system to be prepared in the Project are taken charge by CUEP, which will be established inside RSS. CUEP then reports the analysis result of the water quality monitoring to the Management Committee of the National Environmental Pollution Research and Monitoring System (NEPRAMS) and the Committee decides water pollution preventive measures. Based on the decision, GCEP, the environmental administrating agency is supposed to carry out the preventive measures in accordance with the Environmental Protection Law.

Because of the above, it is important that the Management Committee of NEPRAMS continues to function efficiently in the future, and accordingly, the related agencies constituting the Management Committee must take positive action so that the Committee's activities are well under way. GCEP, the responsible agency for the environmental administration must secure necessary staff and improve the organization so that the policies on the environmental administration, decided by the Management Committee, can surely be put into practice.

(3) Establishing a maintenance organization soonest and securing the operation and maintenance cost

CUEP, which is supposed to take charge of the operation and maintenance of the monitoring system on the Project, is an established body in a legal sense, for it has already been approved in HCST. It is expected that the staff of CUEP be secured mostly by relocating the staff members of ERC. While the number of staff members is 12 for the time being, securing the necessary staff must be complete by the end of

December 2002, for the installation of the monitoring equipment is scheduled to commence from January 2003.

Beside, while it has already been approved that the operation and maintenance cost of CUEP is included in the annual budget of HCST, HCST must try to secure the operation and maintenance cost for ensuring sustained operation.

(4) Acquiring knowledge on the operation and handling techniques of the equipment to be procured in the Project

The technical level of most of the monitoring equipment, chemical analysis equipment, and telemetry system equipment and apparatuses to be prepared in the Project seems to be about the same as compared to that of the related equipment and apparatuses already employed in Jordan. For some of the equipment and apparatuses, however, guidance to a certain degree is needed because of the differences in operation, handling and maintenance resulting from the latest technical innovation. While the Project introduces software components so as to provide guidance on the operation, handling and maintenance of the equipment and apparatuses, the related agencies must carefully select the staff members who receive the guidance so that the operation and handling of the equipment and apparatuses after installation are smooth.

APPENDICES

APPENDIX-1 : Member List of the Study Team

APPENDIX-2 : Study Schedule

APPENDIX-3 : List of Parties Concerned in the Recipient Country

APPENDIX-4 : Minutes of Discussions

APPENDIX-5 : Cost Estimation Borne by the Recipient Country

APPENDIX-6 : Detailed Location Map for Monitoring Stations

APPENDIX - 1

Member List of the Study Team

Member List of the Study Team

1. Basic Design Study

Name	Work Assignment	Present Position
Mr. Hiromi CHIHARA	Leader	Development Specialist, Institute for International Cooperation JICA
Dr. Yoshio MATSUI	Technical Advisor	Chief Researcher, Water Section, Environmental Science and Research Institute, Nagoya City
Mr. Kenichiro KASAHARA	Planning Management	First Budget Division, Finance and Accounting Department, JICA
Mr. Noboru SAEKI	Chief Consultant/ Environment Monitoring	Yachiyo Engineering Co., Ltd.
Mr. Masahiro TAKEUCHI	Equipment Planning I	Yachiyo Engineering Co., Ltd.
Dr. Mineo TSURUMAKI	Equipment Planning II	Yachiyo Engineering Co., Ltd.
Mr. Yoshihiro OKAZAKI	Network System Planning	Yachiyo Engineering Co., Ltd.
Mr. Kiyoshi SHIMIZU	Cost Estimation/ Procurement Planning	Yachiyo Engineering Co., Ltd.

2. Implementation Review Study

Name	Work Assignment	Present Position
Mr. Satoshi IWAKIRI	Leader	Senior Assistant for Grant Aid, Economic Cooperation Bureau, Ministry of Foreign Affairs
Mr. Shigeru OTAKE	Planning Management	First Project Management Division, Grant Aid Management Department, JICA
Mr. Masahiro TAKEUCHI	Chief Consultant/ Environment Monitoring	Yachiyo Engineering Co., Ltd.
Mr. Kiyoshi SHIMIZU	Procurement Planning/ Cost Estimation	Yachiyo Engineering Co., Ltd.
Mr. Mineo TSURUMAKI	Facility Design	Yachiyo Engineering Co., Ltd.

APPENDIX - 2

Study Schedule

Survey Schedule

1. Basic Design Study

No.	Date	Day of Week	Weather	Place of Stay	Move	Descriptions of Survey
1	'99 11/15	Mon.	Fine	Paris	Government member	Government members (Chihara, Matsui, Kasahara) moved. LV Narita AF275 (12:35) → AR Paris (17:10)
				Abu Dhabi	Consultant member	Consultant members (Saeki, Takeuchi, Tsurumaki, Okazaki) moved. LV Narita CX501 (10:35) → Hong Kong CX731 (14:45/16:30) → AR Dubai (21:15)
2	11/16	Tue.	Fine	Amman	Government member	Government members (Chihara, Matsui, Kasahara) arrived at Amman. LV Paris AF672 (13:15) → AR Amman (19:15)
					Consultant member	Consultant members (Saeki, Takeuchi, Tsurumaki, Okazaki) arrived at Amman. LV Dubai RJ191 (8:30) → AR Amman (9:15) Internal meeting
3	11/17	Wed.	Fine	Amman		Courtesy visit to JICA office Courtesy visit to Japanese Embassy Courtesy visit to the Ministry of Planning; Explanation and consultation on Inception Report (IC/R) Courtesy visit to HCST; Explanation and consultation on IC/R
4	11/18	Thu.	Fine	Amman		Site survey (Muheiba water resource, Yarmouk River branch, Water Quality Monitoring Station aided by Norway, King Abdullah Canal, Wadi Arab Dam, JVA Lab. Diral Control Center, Zai Water Treatment Plant)
5	11/19	Fri.	Fine	Amman		Internal meeting Arrangement of materials
6	11/20	Sat.	Fine	Amman		Courtesy visit and consultation with ERC Lab. Courtesy visit and consultation with the Ministry of Water and Irrigation Courtesy visit and consultation with WAJ Courtesy visit and consultation with JVA Courtesy visit and consultation with RSS Courtesy visit and consultation with HCST
7	11/21	Sun.	Fine	Amman		[Matsui, Kasahara, Takeuchi, Tsurumaki, Okazaki] Courtesy visit and consultation with WAJ Lab. Survey of King Talal Reservoir Survey of As-Samra Sewage Treatment Plant [Chihara Leader, Saeki] Courtesy visit and consultation with USAID
8	11/22	Mon.	Fine	Amman		[Chihara Leader, Matsui, Kasahara, Saeki] Consultation with HCST on the minutes [Takeuchi, Tsurumaki, Okazaki] Survey of Jordan River Survey of Diral Control Center
9	11/23	Tue.	Fine	Amman		Signing of the minutes Report to JICA Office Report to the Embassy
10	11/24	Wed.	Fine	Amman	Government member	[Government members (Chihara, Matsui, Kasahara) left Jordan] LV Amman AF677 (7:20) → AR Paris (11:50) LV Paris JL406 (17:55)
						[Consultant members continued survey] Technical consultation with Diral Control Center (flow data) Technical consultation with JVA Lab. (questionnaire)
11	11/25	Thu.	Fine	Amman	Government member	[Government members (Chihara, Matsui, Kasahara) arrived at Japan (13:45)] Field survey of the monitoring point (2 points on Jordan

No.	Date	Day of Week	Weather	Place of Stay	Move	Descriptions of Survey
						River) Technical consultation with WAJ Lab.
12	11/26	Fri.	Cloudy	Amman		Arrangement and analysis of materials Internal meeting
13	11/27	Sat.	Cloudy with tempora ry rain	Amman		Field survey of the monitoring point (2 points on King Talal Reservoir) Technical consultation with HCST Technical consultation with ERC
14	11/28	Sun.	Rainy, and fine later	Amman		Survey of Zai Water Treatment Plant Survey of the projects aided by other countries Technical consultation with HCST (questionnaire) Survey of the monitoring point (1 point on King Abdullah Canal, 1 point on Zai Water Treatment Plant inlet)
15	11/29	Mon.	Fine	Amman		Technical consultation with HCST Technical consultation with ERC Interim report to JICA Office
16	11/30	Tue.	Fine	Amman	Consultant member	Field survey of the monitoring point (Karameh Dam downstream) [Consultant member, Shimizu left Japan.] LV Narita CX501 (10:35) → Hong Kong CX733 (14:45/16:30) → AR Dubai (0:20)
17	12/1	Wed.	Fine	Amman	Consultant member	[Consultant member, Shimizu arrived at Jordan.] LV Dubai EK903 (6:30) → AR Amman (07:55)
						Technical consultation with JVA Project Division Field survey of the monitoring point (1 point on As-Samra Sewage Treatment Plant downstream) Collection of JVA Lab's answer to the questionnaire
18	12/2	Thu.	Fine	Amman		Technical consultation with WAJ Lab. (answer to the questionnaire) Arrangement and analysis of the survey result Survey of procurement-related matters (agent, transportation agent, etc.)
19	12/3	Fri.	Fine	Amman	Consultant member	[Consultant member, Takeuchi left Jordan.] LV Amman GA972 (14:10) → AR Bahrain (17:30) → LV Bahrain CX730 (23:35)
						Arrangement and analysis of materials; Internal meeting
20	12/4	Sat.	Fine	Amman	Consultant member	[Consultant members, Tsurumaki arrive at Japan.] AR Hong Kong (12:05) → LV Hong Kong CX500 (15:15) → AR Narita (20:00)
						Technical consultation with WAJ Lab. (questionnaire) Technical consultation with HCST (monitoring plan) Technical consultation with JTC (collection of telemetry-related data) Survey of procurement-related matters
21	12/5	Sun.	Fine	Amman		Technical consultation with JVA Lab. (questionnaire) Technical consultation with HCST (telemetry-related) Field survey of the monitoring point Survey of procurement-related matters (agent, transportation agent, etc.) Preparation of Field Report (FL/R)
22	12/6	Mon.	Fine	Amman		Technical consultation with HCST (monitoring plan) Hashemite University (environmental standard) Survey on procurement-related matters (agent, transportation agent, etc.) Preparation of FL/R
23	12/7	Tue.	Fine	Amman		Technical consultation with ERC (questionnaire) Technical consultation with HCST (questionnaire) Preparation of FL/R Survey on procurement-related matters (agent, transportation agent, etc.)
24	12/8	Wed.	Fine	Amman		Survey of the monitoring point (check with related agencies)

No.	Date	Day of Week	Weather	Place of Stay	Move	Descriptions of Survey
						Preparation of FL/R Survey on procurement-related matters (agent, transportation agent, etc.)
25	12/9	Thu.	Fine	Amman	Consultant member	[Consultant member, Okazaki left Jordan.] LV Amman GF972 (14:30) → AR Bahrain (19:45) → LV Bahrain CX730 (23:35) →
						Preparation of FL/R Survey on procurement-related matters (agent, transportation agent, etc.)
26	12/10	Fri.	Fine	Amman	Consultant member	[Consultant member, Okazaki arrived at Japan.] AR Hong Kong (12:05) → LV Hong Kong CX500 (15:15) →AR Narita (20:00)
						Preparation of FL/R
27	12/11	Sat.	Fine	Amman		Survey of the monitoring point (check with related agencies) Preparation of FL/R Survey on procurement-related matters (agent, transportation agent, etc.)
28	12/12	Sun.	Fine	Amman		Submission of FL/R to HCST; Consultation with related agencies Consultation with GCEP Survey on procurement-related matters (agent, transportation agent, etc.)
29	12/13	Mon.	Fine	Amman		Consultation on FL/R with related agencies Consultation with ERC Survey on procurement-related matters (agent, transportation agent, etc.)
30	12/14	Tue.	Fine	Amman		Consultation on FL/R with related agencies Consultation with JVA Lab. Survey of Zai Water Treatment Plant (telemetry-related) Survey on procurement-related matters (agent, transportation agent, etc.)
31	12/15	Wed.	Fine	Amman		Consultation on FL/R with related agencies Consultation with HCST Report to the Embassy
32	12/16	Thu.	Fine	Amman		Report to JICA Additional survey of Zai Water Treatment Plant (technical consultation with Norwegian consultant) Survey on procurement-related matters (agent, transportation agent, etc.)
33	12/17	Fri.	Fine	Amman		Arrangement of materials; Analysis of data obtained Internal meeting
34	12/18	Sat.	Fine	Aircraft	Consultant member	Final consultation on FL/R [Consultant members (Saeki, Takeuchi, Shimizu) left Jordan.] LV Amman EK904 (16:30) → AR Dubai (21:15) → LV Dubai CX750 (23:55)
35	12/19	Sun.	Fine		Consultant member	[Consultant members (Saeki, Takeuchi, Shimizu) arrive at Japan.] AR Hong Kong (15:15) → LV Hong Kong CX508 (16:20) → AR Narita (21:05)

Note) HCST : Higher Council for Science and Technology
GCE P : General Corporation for Environmental Protection
RSS : Royal Scientific Society
ERC : Environmental Research Center
JVA : Jordan Valley Authority
WAJ : Water Authority of Jordan

2. Implementation Review Study

No.	Date	Day of Week	Weather	Place of Stay	Move	Descriptions of Survey
1	'02 1/4	Fri.	Fine	Paris	Consultant member	[Consultant members (Takeuchi, Shimizu, Tsurumaki) left Japan.] LV Narita JL1405 (11:10) → Paris (15:40)
2	1/5	Sat.	Fine	Amman	Consultant member	[Consultant members (Takeuchi, Shimizu, Tsurumaki) arrived at Jordan.] LV Paris RJ116 (15:30) → AR Amman (23:10)
3	1/6	Sun.	Fine	Amman		Courtesy visit to HCST; Explanation on Inception Report (IC/R) Courtesy visit to JICA Office; Explanation of negotiation policy Natural condition survey (topographic survey)
4	1/7	Mon.	Cloudy, and snowy later	Amman		Survey of JVA Lab. Survey of candidate sites No. 1, 2, 3, and 12 of the monitoring stations Natural condition survey (topographic survey)
5	1/8	Tue.	Rainy, and cloudy later	Amman		Consultation with HCST on the minutes Survey on the construction condition Natural condition survey (topographic survey)
6	1/9	Wed.	Rainy	Amman		Survey on the present condition of the early warning system at Zai Water Treatment Plant Consultation with Dillahl Water Control Center (Check of data supply manner) Explanation on DFR to JVA Lab.; Check of requested equipment and apparatuses Survey of candidate sites No. 7, 13 of the monitoring stations Natural condition survey (topographic survey)
7	1/10	Thu.	Fine	Amman		Consultation with HCST (confirmation of data ready) Survey of candidate sites No. 8-11 of the monitoring stations Survey on the construction condition Natural condition survey (topographic survey)
8	1/11	Fri.	Cloudy	Amman		Survey of candidate site No. 10 of the monitoring station Arrangement and analysis of materials
9	1/12	Sat.	Rainy	Amman		Survey of candidate sites No. 7, 13 of the monitoring stations Consultation with HCST Survey on the construction condition Natural condition survey (topographic survey)
10	1/13	Sun.	Rainy	Amman		Consultation with GCEP Consultation with ERC; Explanation on DF/R Consultation with WAJ Lab.; Explanation on DF/R Survey of the WAJ Lab. new building Survey of the candidate site of the Monitoring Center Natural condition survey (topographic survey)
11	1/14	Mon.	Fine	Amman		Consultation with HCST on the minutes Natural condition survey (topographic survey) Survey on the construction condition
12	1/15	Tue.	Cloudy	Amman		Survey on the electric power condition Survey on the present condition of the communication facilities Survey of candidate site No. 10 of the monitoring station Consultation with HCST Natural condition survey (topographic survey)
13	1/16	Wed.	Fine	Amman		Interim report to JICA Office Preparation of Field Report (FL/R) Natural condition survey (topographic survey)
14	1/17	Thu.	Fine	Amman	Consultant member	[Consultant member, Tsurumaki left Jordan.] LV Amman RJ111 (11:15) → AR London (14:45) LV London JL402 (19:00)

No.	Date	Day of Week	Weather	Place of Stay	Move	Descriptions of Survey
						Preparation of FL/R Consultation with HCST on DF/R Survey on the electric power and communication conditions Natural condition survey (topographic survey)
15	1/18	Fri.	Fine	Amman	Consultant member	[Consultant member, Tsurumaki arrived at Japan.] Preparation of FL/R Natural condition survey (topographic survey)
16	1/19	Sat.	Fine	Amman		Preparation of FL/R Survey on the electric power and communication conditions Natural condition survey (topographic survey)
17	1/20	Sun.	Fine	Amman	Government member	[Government members (Iwakiri Leader, Otake) left Japan.] LV Narita JL405 (11:10) → AR Paris (15:40)
						Survey on the electric power and communication conditions Survey of candidate sites No. 8 & 9 of the monitoring stations Preparation of FL/R Natural condition survey (topographic survey)
18	1/21	Mon.	Fine	Amman	Government member	[Government members (Iwakiri Leader, Otake) arrived at Amman.] LV Paris AF672 (19:15) → AR Amman (19:15)
						Preparation of FL/R Internal meeting
19	1/22	Tue.	Fine	Amman		Consultation with JICA Office Courtesy visit to the Japanese Embassy in Jordan Courtesy visit to GCEP, WAJ, JVA, MWI Internal meeting
20	1/23	Wed.	Fine	Amman		Consultation with HCST on the minutes Consultation with HCST on FL/R Consultation with WAJ Lab.
21	1/24	Thu.	Fine	Amman		Signing of the minutes Courtesy visit to the Ministry of Planning Report to JICA Office Courtesy visit to the Japanese Embassy in Jordan
22	1/25	Fri.	Fine	Aircraft	Government member, Consultant member	[Government members (Iwakiri Leader, Otake) and Consultant members (Tekeuchi, Shimizu) left Jordan.] LV Amman AF677 (07:15) → AR Paris (11:50) LV Paris JL406 (18:05) →
23	1/26	Sat.	Fine	Amman	Government member, Consultant member	[Government members (Iwakiri Leader, Otake) and Consultant members (Tekeuchi, Shimizu) arrived at Japan.] AR Narita (13:55)

Note) HCST : Higher Council for Science and Technology
GCE P : General Corporation for Environmental Protection
RSS : Royal Scientific Society
ERC : Environmental Research Center
JVA : Jordan Valley Authority
WAJ : Water Authority of Jordan

APPENDIX - 3

List of Parties Concerned in the Recipient Country

List of Party Concerned in the Recipient Country

1. Basic Design Study

Position and Agency	Name
Higher Council for Sience and Technology (HCST)	
Secretary General	Dr. Munther Al-Masri
Head of Agriculture and Water Sector	Ms. Majeda Al-Assaf
The Royal Scientific Society (RSS)	
Vice President	Dr. Seyfeddin Muaz
Environment Research Center (ERC)	
Director	Dr. Bassam Hayek
Head of Water Section	Dr. Mohamed Y. Saidam
National Information Center (NIC)	
Manager, Communication & Network	Mr. Amjad Al-Ashqar
Ministry of Planning	
Secretary General	Dr. Jamal Salah
Director of Water Environment and Tourism Dept.	Mr. Boulos Kefaya
Director of Multilateral Cooperation Dept.	Dr. Nael T. Al-Hajaj
Director of Information and Computer Dept.	Mr. Munir Asad
Ministry of Municipal, Rural Affairs and the Environment	
Minister	H.E. Tawfeeq Kreishan
General Corporation for Environmental Protection (GCEP)	
Director General	Dr. Suleiman Jafari
Director	Dr. Ahmed Khattab
Ministry of Water and Irrigation	
Secretary General	Dr. Hazem Nasir
Assistant Secretary General	Mr. Fayez Bataineh
Water Authority of Jordan (WAJ)	
[Wastewater Service Operation Section]	
Engineer	Mr. A. A. Matar
[Central Laboratory]	
Director of Central Labs	Mr. Zakaria Tarawneh
Assistant Director of Central Labs	Dr. Nawal Sunna
[Zai Water Treatment Plant]	
Plant Manager	Mr. Saad Abu Hamour
(Norwegian Consultant)	
Technical Manager	Mr. Kjell O. Wesstad
Computer System Engineer	Mr. Oyvind Kleppan
Jordan Valley Authority (JVA)	
Secretary General	Mr. Avedis Serpekian
Director of Planning and Special Projects	Mr. Yousef Hasan Ayadi
Director of North Area Operation Office	Mr. Qais A. Owais
Director of Middle Area Operation Office	Mr. Tayseer M. Ghezawi

Director of South Area Operation Office	Mr. Farook Kanan
Manager of Karama Dam	Mr. Bader Abbadi
[Diral Control Center]	
Head of Contral Systems Division	Mr. Shafiq Al Habash
Instrument Engineer	Mr. Said Ridhi Said
(French Consultant)	
Water Control Engineer	Dr. Franck Sanfilippo
Telecommunication Engineer	Mr. Michel Tuillier
[JVA Laboratory]	
Director	Mr. Hussan Ebbeni
Head of Lab. Division	Mr. Mohammed El-Imamr
Ministry of Tourism and Antiquities	
Secretary General/Head of Multilateral Talk for Environment	Dr. Alia Hatough Bouran
The University of Jordan	
Dean of Fuculty of Agriculture	Dr. Muhammad Shatanawi
Manager, Water& Environment Research Center	Dr. Manar Fayyad
Hashemite University	
Dean of Research & Graduate Studies	Dr. Talal Akasheh
U. S. Agency for International Development (USAID)	
Mission Environment Officer	Mr. Abdullah A. Ahmed Dr. Amal Hijazi Mr. Steve Luxton Dr. Mohamed Chebane
Jordan Telecommunication Company	
Deputy Director General of Operation & Maintenance	Mr. Ahmed H. Bani Hani
Manager of Transmission Dept. North Region	Mr. Ziad Ebbini
JICA Expart	
Environmental Monitoring Adviser	Mr. Yoshiharu Kobayashi
Environmental Monitoring Adviser	Mr. Takashi Yokomizo
Embassy of Japan in Jordan	
Ambassador	Mr. Koichi Matsumoto
First Secretary	Mr. Masaya Tanaka
JICA Jordan Office	
Resident Representative	Mr. Yoshio Yabe
Deputy Resident Representative	Mr. Hiroshi Kurakata
Assistant Resident Representative	Mr. Masaaki Iwai
Research Coordinator	Mr. Adel O. Zureikat
Research Coordinator	Mr. Hani Kurudi

2. Implementation Review Study

Position and Agency	Name
Higher Council for Sience and Technology (HCST)	
Secretary General	Dr. Munther Al-Masri
Head of Agriculture and Water Sector	Ms. Majeda Al-Assaf
Environment Research Center (ERC)	
Director	Dr. Bassam Hayek
Head of Water Section	Dr. Mohamed Y. Saidam
Ministry of Planning	
Minister	Dr. Bassam Awadallar
Director of Bilateral Cooperation Dept.	Dr. Mustafa Al-Saleh
General Corporation for Environmental Protection (GCEP)	
Director General	Mr. Faris Al Junaidi
Ministry of Water and Irrigation	
Secretary General	Dr. Hazem Nasir
Assistant Secretary General	Mr. Fayez Bataineh
Water Authority of Jordan (WAJ)	
[WAJ Laboratory]	
Director of Central Labs	Mr. Zakaria Tarawneh
Assistant Director of Central Labs	Dr. Nawal Sunna
[Zai Water Treatment Plant]	
Early Warning System Engineer	Mrs. Majeda
Jordan Valley Authority (JVA)	
Secretary General	Mr. Avedis Serpekian
Director of Planning and Special Projects	Mr. Yousef Hasan Ayadi
[JVA Laboratory]	
Director	Mr. Hussan Ebbeni
Head of Lab. Division	Mr. Mohammed El-Imamr
[Diral Control Center]	
Head of Contral Systems Division	Mr. Shafiq Al Habash
Jordan Telecommunication Company	
Deputy Director General of Operation & Maintenance	Mr. Ahmed H. Bani Hani
Manager of Transmission Dept. North Region	Mr. Ziad Ebbini
Embassy of Japan in Jordan	
Ambassador	Mr. D2Shintaro Sasaki
Counsellor	Mr. Jun Yoshida
Secondary Secretary)	Mr. Shunichi Kamiya
JICA Jordan Office	
Resident Representative	Mr. Mitsuo Inagaki
Deputy Resident Representative	Mr. Hidenori Kumagai
Assistant Resident Representative	Mr. Tsutomu Kobayashi
Research Coordinator	Mr. Adel O. Zureikat

APPENDIX - 4

Minutes of Discussions

[Basic Design Study]

MINUTES OF DISCUSSIONS
ON
BASIC DESIGN STUDY
ON
THE PROJECT
FOR
IMPROVEMENT OF MONITORING EQUIPMENT FOR WATER POLLUTION
IN
THE HASHEMITE KINGDOM OF JORDAN

Based on the results of the Preliminary Study, the Government of Japan decided to conduct a Basic Design Study on the Project for Improvement of Monitoring Equipment for Water Pollution (hereinafter referred to as "the Project") and entrusted the study to the Japan International Cooperation Agency (hereinafter referred to as "JICA").

JICA sent to the Hashemite Kingdom of Jordan (hereinafter referred to as "Jordan") the Basic Design Study Team (hereinafter referred to as "the Team") which is headed by Mr. Hiromi Chihara, Development Specialist, JICA, and is scheduled to stay in the country from 16th of November to 18th of December, 1999.

The Team held discussions with the officials concerned of the Government of Jordan and conducted a field survey at the study area.

In the course of the discussions and field survey, both parties confirmed the main items described on the attached sheets. The Team will proceed to further works and prepare the Basic Design Study report.

Amman, 23rd of November, 1999

Mr. Hiromi Chihara
Leader
Basic Design Study Team
JICA

Dr. Munther Al-Masri
Secretary General
The Higher Council for Science and Technology

ATTACHMENT

1. Objective of the Project

The objective of the Project is to improve the environmental condition by means of the introduction of monitoring system for water pollution in the Jordan Valley Area and other selected sites.

2. Project Sites

The Project sites are described in Annex-I.

3. Responsible and Implementing Agencies

(1) The responsible and implementing agency is the Higher Council for Science and Technology (HCST).

(2) When the National Center for Environmental Research and Monitoring (NCERM) or the equivalent entity is established under HCST, NCERM or this entity becomes the implementing agency.

4. Items Requested by the Government of Jordan

After discussions with the Team, the items described in Annex-II were finally requested by the Jordanian side. JICA will assess the appropriateness of the request and will recommend to the Government of Japan for approval.

5. Japan's Grant Aid Scheme

(1) The Jordanian side has understood the Japan's Grant Aid Scheme explained by the Team, as described in Annex-III.

(2) The Jordanian side will take the necessary measures, as described in Annex-IV, for the smooth implementation of the Project, as a condition for the Japanese Grant Aid to be implemented.

6. Schedule of the Study

(1) The consultant members of the Team will proceed to further studies in Jordan until 18th of December 1999.

(2) After when the requirements of the Project as stipulated in Paragraph 7.1 of this Minutes of Discussions are met to satisfaction of the Japanese side, JICA will prepare the draft report in English, and dispatch a mission in order to explain its contents.

(3) (i) If the above-mentioned condition is fulfilled not later than the end of January 2000, JICA will dispatch the mission around March 2000.

(ii) In case that the contents of the draft report is accepted in principle by the Government of Jordan, JICA will complete the final report and send it to the Government of Jordan by May 2000.

7. Other Relevant Issues

7.1 Conditions of Project Implementation

(1) Establishment of National Center for Environmental Research and Monitoring (NCERM)

- The Team explained that the establishment of the NCERM by the legislation of By-Law of the NCERM is one of the essential conditions for implementation of the Project.

- The Jordanian side explained up-to-date situation regarding the establishment of the NCERM based on the HCST board meeting held on November 2nd, 1999 as follows;

  For reasons of the overall operational efficiency of HCST organizations, the functions proposed for the NCERM can possibly be attached to the existing RSS (one of the HCST affiliated centers) instead of creating a new center. The final decision on this issue will be taken by the HCST board.

- The Team stressed that any new counterpart entity of the Project shall be lawfully qualified in such a way that the legal aspects of the organization, the role and responsibility of the Management Council and other terms and conditions envisaged for applying to the NCERM shall practically be maintained and redefined by legislative procedures.

- The Jordanian side agreed, with their appreciating the above-mentioned original intent of establishing the NCERM, to submit the institutional plan and the schedule of necessary legal procedure for establishment of the counterpart entity for the Project by the end of January 2000 or sooner.

(2) Importance of utilization of monitored data for environmental protection

The Team further explained the importance of the effective utilization of monitored data for execution of the national environmental protection policy such as by enacting legislation of anti-pollution laws and regulations and through institutional building. The Jordanian side also understood the explanation.

7.2 Technical Discussions

(1) Locations and Parameters of Continuous Monitoring

The Team explained that the locations and parameters of the continuous monitoring stations will be examined considering a common utilization of the existing and/or planned data/information by other organizations and necessity of additional data/information.

As for the monitoring stations of Aqaba, the Jordanian side emphasized the point that it is extremely important to monitor its water quality as requested in the original proposal. The Team replied that since this cooperation intends to focus on the water quality being relevant to the supply to the metropolitan area, these stations would not be considered in the Project.

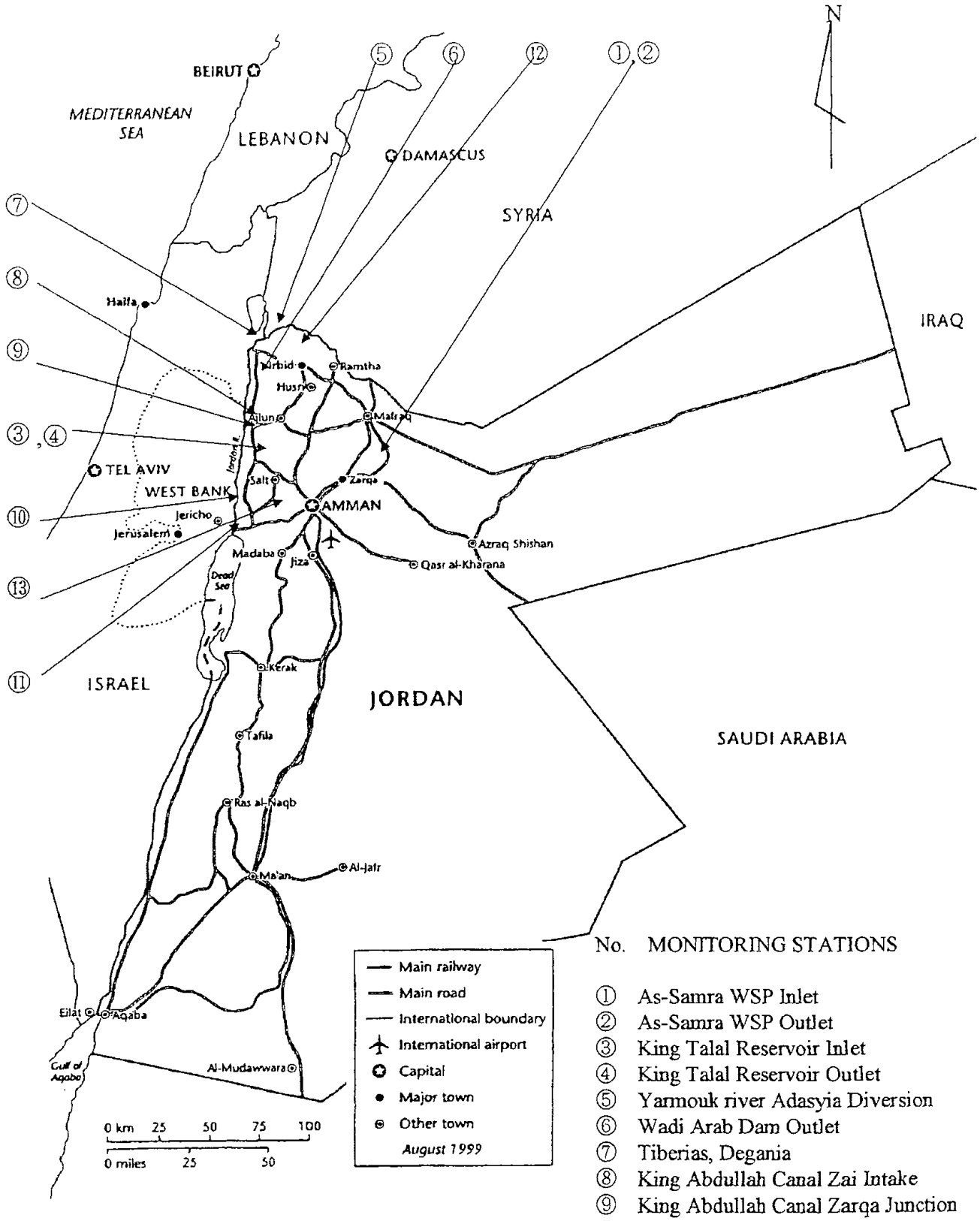
(2) Permissions/Approvals of the Authorities Concerned

The Team pointed out that the Jordanian side will take necessary actions to secure the land acquisition and preparation of the spaces/buildings for the equipment/stations and the permissions/approvals as well from the related authorities for the installation of sampling/measuring devices in the designated river/canal/channel. The Jordanian side explained that these arrangements will be finalized by the end of January 2000 and the results will be reported to JICA Headquarters in writing through JICA Jordan office.

(3) The Work to be done by the Jordanian side

Both parties confirmed that the scope of the Japanese side is to procure the equipment, while the scope of the Jordanian side is to prepare the buildings/spaces for the equipment, to construct the river/canal structures for water sampling and measurements and to install the equipment with associated civil and utility works such as electricity, water, waste disposal, air conditioning and telephone line.

Annex –I



No. MONITORING STATIONS

① As-Samra WSP Inlet
② As-Samra WSP Outlet
③ King Talal Reservoir Inlet
④ King Talal Reservoir Outlet
⑤ Yarmouk river Adasyia Diversion
⑥ Wadi Arab Dam Outlet
⑦ Tiberias, Degania
⑧ King Abdullah Canal Zai Intake
⑨ King Abdullah Canal Zarqa Junction
⑩ King Abdullah Canal Karameh Dam
⑪ Jordan River
⑫ Wadi Shalaleh Treatment Plant Outlet
⑬ Zai Water Treatment Outlet

Location of the Project Sites

Annex – II

Table-1 List of Requested Monitoring Equipment

Station No.	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫	⑬
Location	As-Samra WSP Inlet	As-Samra WSP Outlet	King Talal Reservoir Inlet	King Talal Reservoir Outlet	Yarmouk River Adasyia Diversion	Wadi Arab Dam Outlet	Tiberias, Degania	King Abdullah Canal Zai Intake	King Abdullah Canal Zarqa Junction	King Abdullah Canal Karameh Dam	Jordan River	Wadi Shalaleh Treatment Plant Outlet	Zai Water Treatment Outlet
Thermometer	1	1	1	1	1	1	1	1	1	1	1	1	1
pH Meter	1	1	1	1	1	1	1	1	1	1	1	1	1
DO Meter	1	1	1	1	1	1	1	1	1	1	1	1	1
Conductivity Meter	1	1	1	1	1	1	1	1	1	1	1	1	1
TB Meter					1	1	1	1			1		1
COD Analyzer	1	1	1	1		1	1	1	1	1			1
T-N Analyzer		1		1	1	1	1	1			1	1	
T-P Analyzer		1		1	1	1	1	1			1	1	
Residual Chlorine Analyzer													1
Flow Meter		1	1	1	1	1	1				1	1	1
Sampling Unit		1		1	1	1					1	1	1

Table-2 List of Requested Laboratory Equipment

1. WAJ Labs
   (1) Analytical Chemistry Div./ Organic Lab
   (2) Analytical Chemistry Div./ Inorganic and Hydro Chemistry Lab
   (3) Analytical Chemistry Div./ Inorganic Heavy Metals lab
   (4) Wastewater Chemistry Div.
   (5) Water Quality Monitoring Div.
   (6) Microbiology Lab

No.	Equipment	Purpose	Number
W-(1)-1	HPLC	For the analysis of high molecular weight organic compounds	1
W-(2)-1	Flame Photometer	For the analysis of Na, K, Li	1
-2	Autosampler	For the Ion Chromatograph (Dionex DX-120)	1
W-(3)-1	Porarograph	For the analysis of Hg, CN, Cr+6	1
-2	Spectrophotometer	For the investigation of nutrients	1
W-(4)-1	Flame Atomic Absorption Spectrophotometer	For the determination of Heavy Metals	1
-2	Ion Chromatograph	For the analysis of anions and cations	1
W-(5)-1	pH meter	For the pH measurement	4
-2	DO meter	For the DO measurement	2
-3	Temperature	Temperature measurement	
-4	Residual chlorine meter	Residual chlorine measurement	5
-5	Turbidity meter	Turbidity measurement	1
W-(6)-1	Adsorbent filters holder	For concentrating the sample in the microbiological analysis	3 set
-2	Pressure vessel	ditto	2
-3	Positive pressure source	ditto	1 set
-4	Electronegative virus adsorbent filters	ditto	each 100

2. JVA Lab.

No.	Equipment	Purpose	Number
J-1	Atomic Absorption with Graphite Furnace	For analyzing heavy metals in water and soil	1
J-2	Automatic Titration System	For COD determination	1
J-3	Automatic Titration System	For BOD determination	1
J-4	Draft chamber	For organic substances	1
J-5	Draft chamber	For strong acid	1
J-6	Ion Chromatograph	For anion determination in water and soil	1
J-7	Field combined detectors(EC,DO and TEMP)	For investigation of water quality	1
J-8	Macro-Kjeldahl digestion system	For analysis of nitrogen compound in plant and soil	1
J-9	Water Distillation Apparatus with Deionizer	For chemical analysis	1
J-10	Four wheel pickups	For collecting samples in the remote monitoring sites	2

3. Environmental Research Center

No.	Equipment	Purpose	Number
E-1	ICP-MS	For supplying the demand for the increase of heavy metal analysis	1
E-2	Mercury analyzer (Gold Amalgam Method)	For improvement in the evil practices caused by combined use	1
E-3	Fluorescent Microscope	For diagnosis of pathogenic protozoa such as Giardia cysts and Cryptosporidium cysts in drinking water and other water sources in Jordan.	1 set
E-4	Automatic Titration System	For supplying the demand for increased microbiological test.	1
E-5	Autocrave	ditto	1
E-6	Six way filtration System	ditto	1
E-7	Microwave Digestion System	For monitoring the polluted soil and foods by heavy metals.	1

Table-3 List of Requested Telemetry Equipment

		Monitoring center	Monitoring stations	Laboratories
1	Data Processor	1		
2	Main Server	1		
3	Personal Computer	14	13	3
4	Laser Printer	14	13	3
5	Leased Line Rack Modem	*1		
6	Dial-up Stand alone Modems	*1		
7	Multiprotocol Routers(Large)	2		
8	Multiprotocol Routers(Small)	1		
9	System Line Printer	1		
10	Page Printer	2		
11	LAN Infrastructure	*1		
12	Uninterrupted Power Supply	*1	13	
13	Lightning Arrester	*1	13	
14	Operating Consoles and Desks	*1	13	3
15	Accessories	*1		
16	Software	*1		
17	Wiring Work	*1	13	3
18	Power Supply Unit	*1	13	3
19	Data Logger		13	
20	Modem Interface		13	3
21	Modem & Telephone		13	3

Note) *1 means 1 set.

Annex-III

Japan's Grant Aid Scheme

1. Grant Aid Procedures

(1) Japan's Grant Aid Program is executed through the following procedures.

Application	(Request made by a recipient country)
Study	(Basic Design Study conducted by JICA)
Appraisal & Approval	(Appraisal by the Government of Japan and Approval by Cabinet)
Determination of Implementation	(The Notes exchanged between the Governments of Japan and the recipient country)

(2) Firstly, the application or request for a Grant Aid project submitted by a recipient country is examined by the Government of Japan (the Ministry of Foreign Affairs) to determine whether or not it is eligible for Grant Aid. If the request is deemed appropriate, the Government of Japan assigns JICA (Japan International Cooperation Agency) to conduct a study on the request.
Secondly, JICA conducts the study (Basic Design Study), using (a) Japanese consulting firm(s).
Thirdly, the Government of Japan appraises the project to see whether or not it is suitable for Japan's Grant Aid Program, based on the Basic Design Study report prepared by JICA, and the results are then submitted to the Cabinet for approval.
Fourthly, the project, once approved by the Cabinet, becomes official with the Exchange of Notes signed by the Governments of Japan and the recipient country.
Finally, for the implementation of the project, JICA assists the recipient country in such matters as preparing tenders, contracts and so on.

2. Basic Design Study

(1) Contents of the Study
The aim of the Basic Design Study (hereinafter referred to as "the Study"), conducted by JICA on a requested project (hereinafter referred to as "the Project") is to provide a basic document necessary for the appraisal of the Project by the Japanese Government. The contents of the Study are as follows:

a) Confirmation of the background, objectives, and benefits of the requested project and also institutional capacity of agencies concerned of the recipient country necessary for the Project's implementation.
b) Evaluation of the appropriateness of the Project to be implemented under the Grant Aid Scheme from a technical, social and economic point of view.
c) Confirmation of items agreed on by both parties concerning the basic concept of the Project.
d) Preparation of a basic design of the Project
e) Estimation of costs of the Project

The contents of the original request are not necessarily approved in their initial form as the contents of the Grant Aid project. The Basic Design of the Project is confirmed considering the guidelines of Japan's Grant Aid Scheme.
The Government of Japan requests the Government of the recipient country to take whatever measures are necessary to ensure its self-reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the organization in the recipient country actually implementing the Project. Therefore, the implementation of the Project is confirmed by all relevant organizations of the recipient country through the Minutes of Discussions.

(2) Selection of Consultants

For smooth implementation of the Study, JICA uses (a) registered consultant firm(s). JICA selects (a) firms(s) based on proposals submitted by interested firms. The firm(s) selected carry(ies) out a Basic Design Study and write(s) a report, based upon terms of reference set by JICA.

The consulting firm(s) used for the Study is(are) recommended by JICA to the recipient country to also work on the Project's implementation after the Exchange of Notes, in order to maintain technical consistency.

3. Japan's Grant Aid Scheme

(1) What is Grant Aid?

The Grant Aid Program provides a recipient country with non-reimbursable funds to procure the facilities, equipment and services (engineering services and transportation of the products, etc.) for economic and social development of the country under principles in accordance with the relevant laws and regulations of Japan. Grant Aid is not supplied through the donation of materials as such.

(2) Exchange of Notes (E/N)

Japan's Grant Aid is extended in accordance with the Notes exchanged by the two Governments concerned, in which the objectives of the Project, period of execution, conditions and amount of the Grant Aid, etc., are confirmed.

(3) "The period of the Grant Aid" means the one fiscal year which the Cabinet approves the Project for. Within the fiscal year, all procedures such as exchanging of the Notes, concluding contracts with (a) consultant firm(s) and (a) contractor(s) and final payment to them must be completed.

However in case of delays in delivery, installation or construction due to unforeseen factors such as weather, the period of the Grant Aid can be further extended for a maximum of one fiscal year at most by mutual agreement between the two Governments.

(4) Under the Grant Aid, in principle, Japanese products and services including transport or those of the recipient country are to be purchased.

When the two Governments deem it necessary, the Grant Aid may be used for the purchase of the products or services of a third country.

However the prime contractors, namely, consulting, contracting and procurement firms, are limited to "Japanese nationals". (The term "Japanese nationals" means persons of Japanese nationality or Japanese corporations controlled by persons of Japanese nationality.)

(5) Necessity of "Verification"

The Government of recipient country or its designated authority will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be verified by the Government of Japan. This "Verification" is deemed necessary to secure accountability to Japanese taxpayers.

(6) Undertakings required of the Government of the Recipient Country

In the implementation of the Grant Aid project, the recipient country is required to undertake such necessary measures as the following:

1) To secure land necessary for the sites of the Project and to clear, level and reclaim the land prior to commencement of the construction.
2) To provide facilities for the distribution of electricity, water supply and drainage and other incidental facilities in and around the sites.
3) To secure buildings prior to the procurement in case the installation of the equipment.
4) To ensure all the expenses and prompt execution for unloading, customs clearance at the port of disembarkation and internal transportation of the products purchased under the Grant Aid.
5) To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which will be imposed in the recipient country with respect to the supply of the products and

services under the Verified Contracts.

6) To accord Japanese nationals whose services may be required in connection with the supply of the products and services under the Verified Contracts, such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work.

(7) "Proper Use"

The recipient country is required to maintain and use the facilities constructed and equipment purchased under the Grant Aid properly and effectively and to assign staff necessary for this operation and maintenance as well as to bear all the expenses other than those covered by the Grant Aid.

(8) "Re-export"

The products purchased under the Grant Aid should not be re-exported from the recipient country.

(9) Banking Arrangements (B/A)

1) The Government of the recipient country or its designated authority should open an account in the name of the Government of the recipient country in a bank in Japan (hereinafter referred to as "the Bank"). The Government of Japan will execute the Grant Aid by making payments in Japanese yen to cover the obligations incurred by the Government of the recipient country or its designated authority under the Verified Contracts.

2) The payments will be made when payment requests are presented by the Bank to the Government of Japan under an authorization to pay issued by the Government of the recipient country or its designated authority.

Annex-IV

Necessary measures to be taken by the Hashemite Kingdom of Jordan on condition that Japan's Grant Aid is extended.

1. To secure the land necessary for monitoring stations prior to the commencement of the procurement of the equipment for the Project and provide necessary works for the stations during the execution of the Project.

2. To support prompt execution for customs clearance of the equipment imported to the Jordan under the Grant Aid.

3. To accord Japanese nationals whose services may be required in connection with the supply of products and services under the verified contracts such facilities as may be necessary for their entry into the Jordan and stay therein for the execution of their work.

4. To exempt Japanese nationals from custom duties, internal taxes and other fiscal levies which may be imposed in the Jordan with respect to the supply of the products and services under the verified contracts.

5. To maintain and use the equipment provided under the Grant Aid properly and effectively and to assign the staff necessary for operation and maintenance for the equipment.

6. To bear all the expenses other than those to be borne by the Grant Aid necessary for the execution of the Project.

7. To bear advising commissions for Authorization to Pay and payment commission to a Japanese bank for the banking services based upon the banking arrangement.

MINUTES OF DISCUSSIONS
ON
IMPLEMENTATION REVIEW STUDY
ON
THE PROJECT FOR WATER POLLUTION MONITORING SYSTEM
IN
THE HASHEMITE KINGDOM OF JORDAN

In November 1999, the Japan International Cooperation Agency (JICA) dispatched the Basic Design Study Team on the Project for Water Pollution Monitoring System(hereinafter referred to as "the Project") to the Hashemite Kingdom of Jordan (hereinafter referred to as "Jordan"), and through discussions, field survey, and technical examination of the results in Japan, JICA has prepared the Draft Report of the Basic Design on the Project.

In order to explain and to consult Jordanian side on components of the Outline of the Basic Design, JICA sent to Jordan the Implementation Reviewing Team, which is headed by Mr. Satoshi Iwakiri, Senior Assistant for Grant Aid, Economic Cooperation Bureau, Ministry of Foreign Affairs (hereinafter referred to as "the Team"), and is scheduled to stay in Jordan from January 5 to 25, 2002. The Team held discussions with the officials concerned of the Government of Jordan and conducted a field survey at the study area.

As a result of discussions, both sides confirmed the main items described on the attached sheets.

Amman, January 24, 2002

Mr. Satoshi Iwakiri
Leader
Implementation Review Study Team
Japan International Cooperation Agency

Dr. Munther Al-Masri
Secretary General
The Higher Council for Science and Technology

ATTACHMENT

1. Components of the Outline of the Basic Design

The Jordanian side has agreed and accepted in principle the components of the draft report proposed by the Team.

2. Project site

The Project Site is shown in Annex I.

3. Responsible and Implementing Agency

The Responsible Agency and Implementing Agency of the Project is the Higher Council for Science and Technology (HCST).

4. Items requested by the Jordanian side

After discussion with the Team, the items finally requested by the Jordanian side are shown in Annex II.

Civil work for the installation of the monitoring equipment was requested by the Jordanian side.

Spare parts for two-year operation of the continuous monitoring and chemical analysis equipment were requested by the Jordanian side.

Technical advisors for the smooth operation and proper maintenance of the following equipment to be provided under the Project were also requested to be dispatched to Jordan at the final stage of the Project by the Jordanian side.

- Continuous monitoring equipment
- Chemical analysis equipment
- Telemetry system

However, final items to be constructed and procured under Japan's Grant Aid will

be decided after further studies in Japan.

5. Japan's Grant Aid Scheme

The Jordanian side has understood the system of Japan's Grant Aid Scheme as explained by the Team and will take the necessary measures described in Annex-IV of the Minutes of Discussions signed on the 23rd of November, 1999 by both sides.

6. Further Schedule of the Study

Based on the Minutes of Discussions and technical examination of the study results, JICA will complete the final report and send it to the Government of Jordan around April 2002.

7. Other Relevant Issues

The following were discussed and confirmed by both sides.

(1) Importance of utilization of monitored data for environmental protection

The Team explained the importance of utilization of monitored data for environmental protection.

The Jordanian side explained that the monitored data will be utilized for the environmental protection by the Government of Jordan as follows.

Authorities and institutions concerned

The main authorities and institutions concerned with the data coming out of the Project are:

- The General Corporation for Environment Protection (GCEP)
- Ministry of Water and Irrigation
  - Jordan Valley Authority (JVA)
  - Water Authority of Jordan (WAJ)

- The Royal Scientific Society (RSS)
  - Environmental Research Center (ERC)

Procedure for utilization of monitored data

The procedure for the utilization of the monitored data shall be as follows.

- Central Unit for Environmental Pollution Monitoring (CUEP) is organized and located in RSS to execute operation and maintenance for the water pollution monitoring system consisting of 13 monitoring stations and the monitoring center to be established under the Project.
- CUEP analyzes the water quality data collected in the monitoring center from the monitoring stations and the related authorities/institutions.
- CUEP reports the results of the analysis to the Managing Board of the National Environmental Pollution Research and Monitoring System (NEPRAMS).
- In case that extraordinary change is found in the monitored water quality data, the Managing Board discusses this matter and determines the countermeasures to solve the problem.
- In response to the decision of the Managing Board, GCEP takes necessary actions according to the environmental law.

Managing Board of NEPRAMS

The Managing Board of NEPRAMS is chaired by the Minister of Municipal and Rural Affairs and the Environment. The General Director of the General Corporation for Environment Protection (GCEP) is the deputy chairman of the Managing Board. It consists of the following members.

- Secretary General of the Ministry of Agriculture
- Secretary General of the Ministry of Health and Medical Care
- Secretary General of the Ministry of Water and Irrigation
- Secretary General of the Ministry of Energy and Mineral Resources
- Director General of the General Corporation for Environment Protection
- Secretary General of Jordan Valley Authority
- Secretary General of the Water Authority of Jordan
- Secretary General of the Higher Council for Science and Technology
- President of the Royal Scientific Society

The Managing Board shall be convened periodically or whenever it is needed, especially when an extraordinary situation in the water quality occurs.

Role of GCEP

GCEP is the institution officially in charge of monitoring the environment. It was established according to the law No.12 for the year 1995. This law gives GCEP the authority to implement the environment law and to take necessary measures in case of violation.

Therefore, in order for GCEP to be able to monitor the environment and since it does not have the technical capability to do so, GCEP, since its establishment, has been contracting ERC to carry out this task. Based on the report from ERC, they have been working for water pollution protection.

The Project will give GCEP direct access to the parameters monitored continuously in 13 monitoring stations and intermittently in other locations. This will strengthen its position in inspecting any source of pollution before it starts to threaten any major water source. Therefore, they can take legal actions to prevent that. Eventually, this will contribute a great deal to controlling any pollution source and protecting the environment.

(2) Permission /Approvals of the authorities concerned

The Jordanian side has agreed to obtain the permission and approval necessary for the installation of the monitoring stations by August 2002.

(3) Data Provision from the related authorities for the Project

The Jordanian side explained that the related authorities of Jordan Valley Authority (JVA), Water Authority of Jordan (WAJ) and Environment Research Center (ERC) have already agreed in principal to provide the required data as shown below for the Project and the details of the data provision such as parameters, frequency, media, etc. will be determined by the commencement of the operation of the monitoring system.

WAJ

1. Water quality data measured by Early Warning System at Zai Water Treatment Plant (by off-line)
2. Water quality data measured intermittently in the whole Jordan (by off-line)

JVA

1. Water flow data measured by Dirar Control Center (by off-line)
2. Water quality data measured intermittently in Jordan Valley (by off-line)

ERC

- Water quality data measured intermittently in the whole Jordan (by on-line)

(4) The work to be done by the Jordanian side

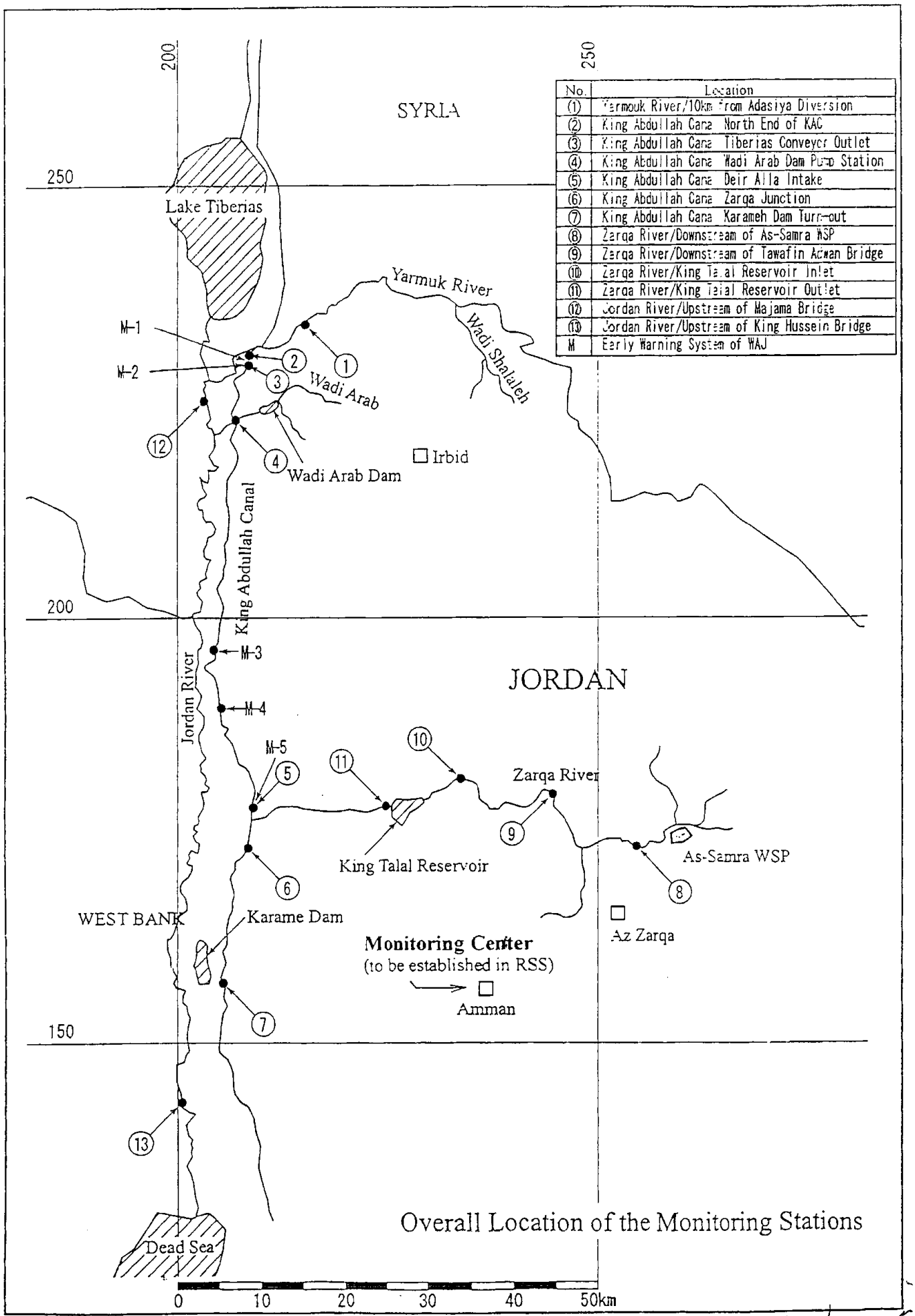
The Jordanian side has agreed to arrange the land acquisition for the monitoring stations by August 2002. The Jordanian side has also agreed to complete the preparation of communication and electrical facilities required for the equipment to be provided under the Project by December 2002.

The Jordanian side explained that, for the land acquisition, the Ministry of Water and Irrigation has already approved the usage of the required land for the monitoring stations in principle.

(5) Operation and Maintenance

The Jordanian side has agreed to secure the necessary staff and budget to execute operation and maintenance of the monitoring equipment to be provided under the Project by January 2003.

The Jordanian side stated that, since the operation and maintenance of the monitoring equipment to be provided under the Project has already been approved by HCST, the necessary staff and budget shall be secured accordingly.



No.	Location
(1)	Yarmouk River/10km from Adasiya Diversion
(2)	King Abdullah Cana North End of KAC
(3)	King Abdullah Cana Tiberias Conveyor Outlet
(4)	King Abdullah Cana Wadi Arab Dam Pump Station
(5)	King Abdullah Cana Deir Alla Intake
(6)	King Abdullah Cana Zarqa Junction
(7)	King Abdullah Cana Karameh Dam Turn-out
(8)	Zarqa River/Downstream of As-Samra WSP
(9)	Zarqa River/Downstream of Tawafin Adwan Bridge
(10)	Zarqa River/King Talal Reservoir Inlet
(11)	Zarqa River/King Talal Reservoir Outlet
(12)	Jordan River/Upstream of Majama Bridge
(13)	Jordan River/Upstream of King Hussein Bridge
M	Early Warning System of WAJ

Overall Location of the Monitoring Stations

Annex II - 1 List of Requested Equipment for Monitoring Station

STN No.	Location	Thermo-meter	pH Meter	DO Meter	EC Meter	TB Meter	COD Meter	T-N Analyzer	T-P Analyzer
①	Yarmouk River/10km from Adasiya Diversion	○	○	○	○	○	○	○	○
②	KAC/North End of KAC	○	○	○	○	○	○	○	○
③	KAC/Tiberias Conveyor Outlet	○	○	○	○	○	○	○	○
④	KAC/Wadi Arab Dam Pump Station	○	○	○	○	○	○	○	○
⑤	KAC/Deir Alla Intake	○	○	○	○	○	○	○	○
⑥	KAC/Zarqa Junction	○	○	○	○	○	○	○	○
⑦	KAC/Karameh Dam Turn-out	○	○	○	○	○	○	○	○
⑧	Zarqa River/Downstream of As-Samra WSP	○	○	○	○	○	○	○	○
⑨	Zarqa River/Downstream of Tawafin Adwan Bridge	○	○	○	○	○	○	×	×
⑩	Zarqa River/King Talal Reservoir Inlet	○	○	○	○	○	○	○	○
⑪	Zarqa River/King Talal Reservoir Outlet	○	○	○	○	○	○	×	×
⑫	Jordan River/Upstream of Majama Bridge	○	○	○	○	○	○	○	○
⑬	Jordan River/Upstream of King Hussein Bridge	○	○	○	○	○	○	×	×

○ Installed in the station

× Not installed in the station

KAC : King Abdullah Canal

Annex II - 2 List of Requested Chemical Analysis Equipment for Laboratories

1. WAJ Laboratory

No.	Equipment	Quantity	Purpose
W-1	High speed liquid chromatograph	1	Analysis of agricultural chemicals, etc
W-2	Flow injector	1	Analysis of alkalinity, acidity, etc
W-3	Electrochemical detector	2	Cyanide and mercury detection
W-4	Spectrophotometer	1	Analysis of inorganic substance
W-5	Ion chromatograph (IC) (with auto sampler)	1	Analysis of inorganic
W-6	Field survey set	6	Detection of pH, DO, temp, chloride,
W-7	ICP- Mass spectrometer (ICP-MS) (with pure water equipment)	1	Analysis of trace heavy metal in drinking water

2. JVA Laboratory

No.	Equipment	Quant	Purpose
J-1	ICP-AES	1	Analysis of heavy metals
J-2	Automatic titration system	1	Analysis of COD
J-3	Automatic titration system	1	Analysis of BOD
J-4	Draft chamber	1	Treatment of organic substances
J-5	Draft chamber	1	Treatment of strong acid
J-6	Hand held analyzer	1	For sample field analysis
J-7	Macro-kjeldahl digestion system	1	Pretreatment of nitrogen samples
J-8	Water distillation	1	Manufacturing of pure water for analysis
J-9	Gas chromatograph with Mass spectrometer (GC-MS) (with pure water equipment)	1	Analysis of agricultural chemicals

3. ERC Laboratory

No.	Equipment	Quantity	Purpose
E-1	ICP-Mass spectrometer (ICP-MS) (with pure water equipment)	1	Analysis of trace heavy metals, etc
E-2	Mercury analyzer (Gold Amalgam Method)	1	Analysis of mercury
E-3	Fluorescent	1	Analysis of bacteria
E-4	Automatic titration system	1	Automatic titration of BOD, COD, etc
E-5	Autoclave	1	For sterilization
E-6	Six way filtration system	1	Shortening of filtration time in bacteria inspection
E-7	Microwave digestion system	1	Pretreatment of sample
E-8	Pure water equipment	1	Production of pure water for the monitoring stations

Annex II - 3 List of Requested Telemetry Equipment for Monitoring Center

Requested Item	Quantity	Description
Data processor	1 set	One Internet server and one 21-inch CRT are required for viewing and processing information via the Internet.
Main server	1 set	One main server and one 21-inch CRT are required for collecting, managing, storing and analyzing data.
Personal computer	5 units	Four (4) PC are sufficient for carrying out viewing of measurement data and analysis results, etc. and for performing water quality monitoring work such as printing, but one network management PC is also required to manage the network in the Monitoring Center.
Laser printer	2 units	One (1) high speed black and white page printer and one(1) color printer are enough for the monitoring center.
Leased line rack modem	14 units	Leased line modems for carrying out communications with the monitoring stations and GCEP. Rack-mount type modems shall be adopted and thirteen (13) are required for the monitoring stations and one (1) is for GCEP.
Dial-up stand alone modems	1 unit	One (1) public telephone line modems is required to carry out communications between the monitoring center and ERC laboratory.
Multi-protocol router Router	1 unit	After connecting with NIC by optical fiber cable, one Internet connection router is required to carry out communications for information disclosure on the Internet.
Multi-protocol router Access server	1 unit	One access server for connecting to analog lines is required to collect and process data from stations, laboratories and related agencies via analog telephone lines.
LAN, switch, hubs, cable	1 set	One Ethernet mutual connection switch and server are required for mutually linking devices in the monitoring center to LAN, and one Ethernet cable set is required for mutually connecting the server, each PC and routers.
Uninterrupted power sup ply	1 unit	This is required for shutdown work at times of power failure. Backup time is roughly 10 hours.
Lightning arrester	2 sets	Two sets are required, one each for the power lines and the telephone lines.
Accessories	1 set	One tape drive is required for server backup. Four (4) internal CD-RW drives are installed in the PC for backup.
Software	1 set	Database management software and network management software are required.
Wiring work	1 set	Laying of network cable within the Monitoring Center shall be borne by the Japanese side. The laying of exclusive analog lines, public telephone lines, optical fiber cables and power lines to the Monitoring Center shall be borne by the Jordanian side.

Annex II - 4 List of Requested Telemetry Equipment for Monitoring Stations

Requested Item	Quantity	Description
Data system logger Personal computer	13 sets	As items for dealing with the logger, a input module and digital input/output module are required. These will be installed inside the PC, which will be an FA type. For higher reliability, the program shall be in ROM format and shall be stored on disc. A semiconductor disc shall be installed for data backup. For maintenance work, a monitor showing the operating conditions of measurement devices shall be installed. No printer is required because conditions can be confirmed on monitor.
Modem, telephone	13 units	One leased line modem is necessary. Installation of the leased line shall be undertaken by the Jordanian side.
UPS	13 units	UPS is required for backup of the PC power source. Backup time is 10 hours.
Lightning arrester	13 sets	One each for the power lines and the telephone lines.
Cable	13 sets	Cable for connecting the PC and each measurement device is required. A console shall not be installed because room inside the units is small. Consoles shall be prepared by the Jordanian side, because there are standard item.
Wiring work	13 sets	Wiring work inside the monitoring unit shall be undertaken by the Japanese side. However laying of telephone lines and power lines to the system shall be undertaken by the Jordanian side

Annex II – 5 List of Requested Telemetry Equipment for ERC Laboratory and GCEP

Requested Item	Quantity	Description
Personal computer Printer	2 sets	Two (2) PC and two (2) ink jet printers are required for transmitting measurement data to the monitoring center.
Modem, telephone	2 sets	One (1) public telephone line modem is necessary for ERC and one (1) leased line modem is necessary for GCEP. Installation of the telephone line shall be undertaken by the Jordanian side.
Lightning arrester	2 sets	Two (2) sets of lightning arrester are required for the power lines and the telephone line protection.
Cable	2 sets	Two (2) sets of cable are required for the printer and modem. Consoles shall be prepared by the Jordanian side, because there are standard item.
Wiring work	2 sets	Wiring work around computer shall be undertaken by the Japanese side. However laying of telephone lines and power lines to the system shall be undertaken by the Jordanian side.

APPENDIX - 5

Cost Estimation Borne by the Recipient Country

Cost Estimation Borne by the Recipient Country

Electrical work and connection work for telephone line for Monitoring Stations to be done by the Jordanian side are estimated to be approx. 311,000 JD as shown below.

1. Electrical Work for Monitoring Stations

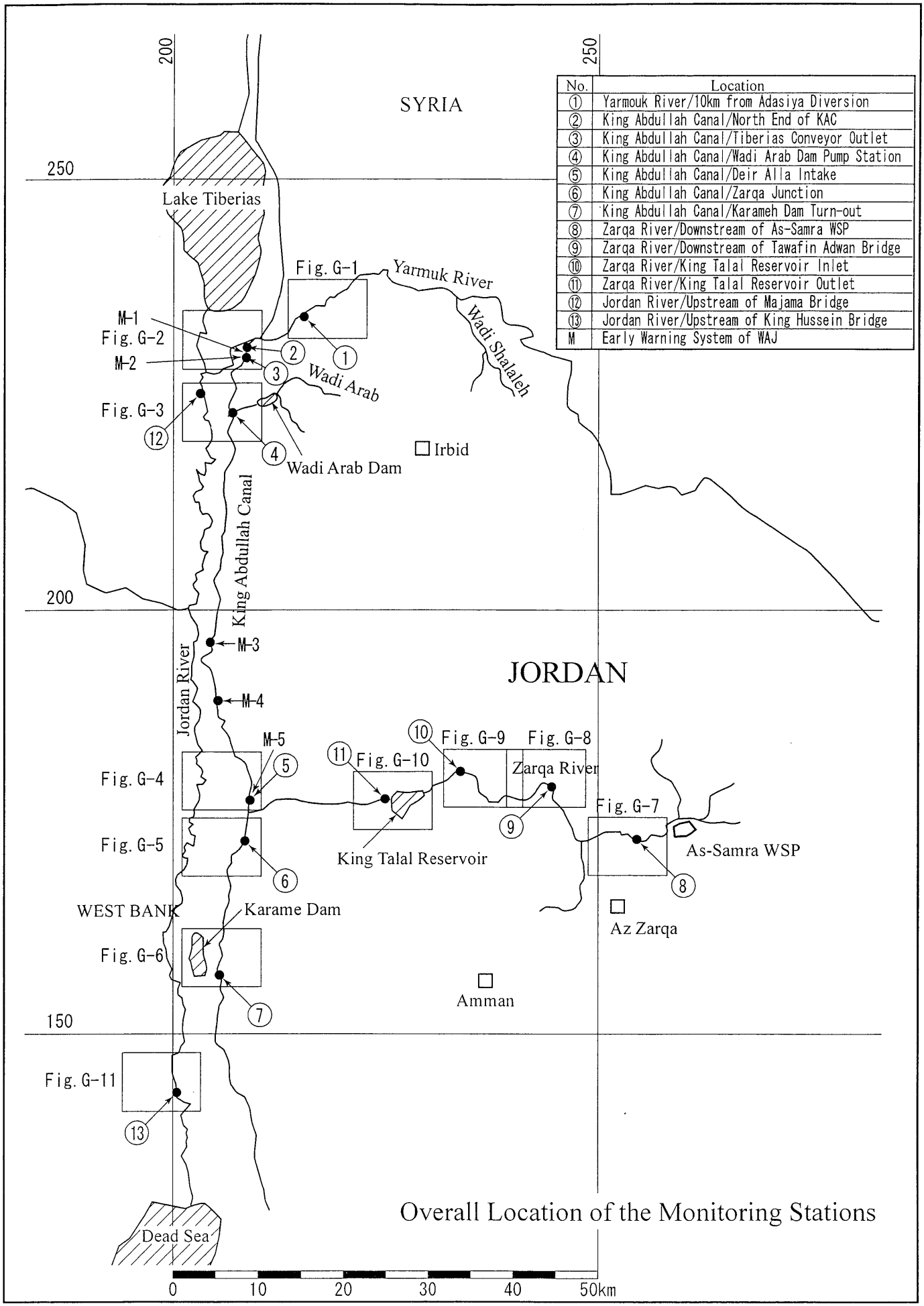
	Distance for Connection (m)	Construction Cost		Total Cost (JD)
		Fixed Cost (JD)	Unit Price (JD/100m)	
MU- 1	300	500	5,500	17,000
MU- 2	1,200	500	5,500	66,500
MU- 3	50	500	5,500	3,250
MU- 4	50	500	5,500	3,250
MU- 5	50	500	5,500	3,250
MU- 6	50	500	5,500	3,250
MU- 7	50	500	5,500	3,250
MU- 8	50	500	5,500	3,250
MU- 9	400	500	5,500	22,500
MU- 10	50	500	5,500	3,250
MU- 11	300	500	5,500	17,000
MU- 12	1,300	500	5,500	72,000
MU- 13	100	500	5,500	6,000
	Total			223,750

2. Connection Work for Telephone Line of Monitoring Stations

	Distance for Connection (m)	Construction Cost		Total Cost (JD)
		Fixed Cost (JD)	Unit Price (JD/100m)	
MU- 1	4,000	700	1,000	40,700
MU- 2	1,200	700	1,000	12,700
MU- 3	50	700	1,000	1,200
MU- 4	50	700	1,000	1,200
MU- 5	50	700	1,000	1,200
MU- 6	50	700	1,000	1,200
MU- 7	50	700	1,000	1,200
MU- 8	50	700	1,000	1,200
MU- 9	400	700	1,000	4,700
MU- 10	50	700	1,000	1,200
MU- 11	300	700	1,000	3,700
MU- 12	1,300	700	1,000	13,700
MU- 13	100	700	1,000	1,700
ERC	50	112	1,000	612
GCEP	50	700	1,000	1,200
	Total			87,412

APPENDIX - 6

Detailed Location Map for Monitoring Stations



No.	Location
①	Yarmouk River/10km from Adasiya Diversion
②	King Abdullah Canal/North End of KAC
③	King Abdullah Canal/Tiberias Conveyor Outlet
④	King Abdullah Canal/Wadi Arab Dam Pump Station
⑤	King Abdullah Canal/Deir Alla Intake
⑥	King Abdullah Canal/Zarqa Junction
⑦	King Abdullah Canal/Karameh Dam Turn-out
⑧	Zarqa River/Downstream of As-Samra WSP
⑨	Zarqa River/Downstream of Tawafin Adwan Bridge
⑩	Zarqa River/King Talal Reservoir Inlet
⑪	Zarqa River/King Talal Reservoir Outlet
⑫	Jordan River/Upstream of Majama Bridge
⑬	Jordan River/Upstream of King Hussein Bridge
M	Early Warning System of WAJ

Overall Location of the Monitoring Stations

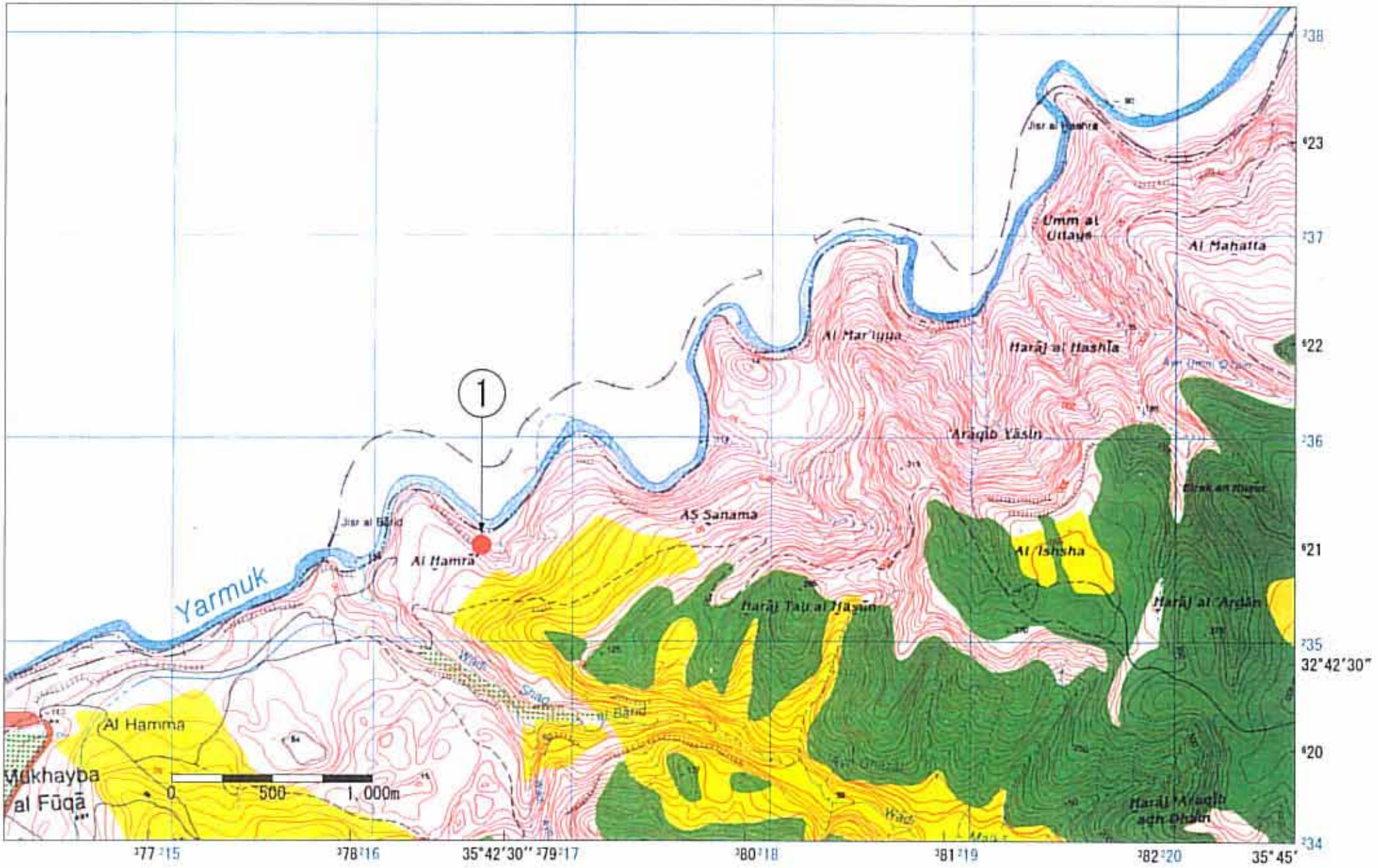


Fig. G-1 ①Yarmouk River/10km from Adasiya Diversion

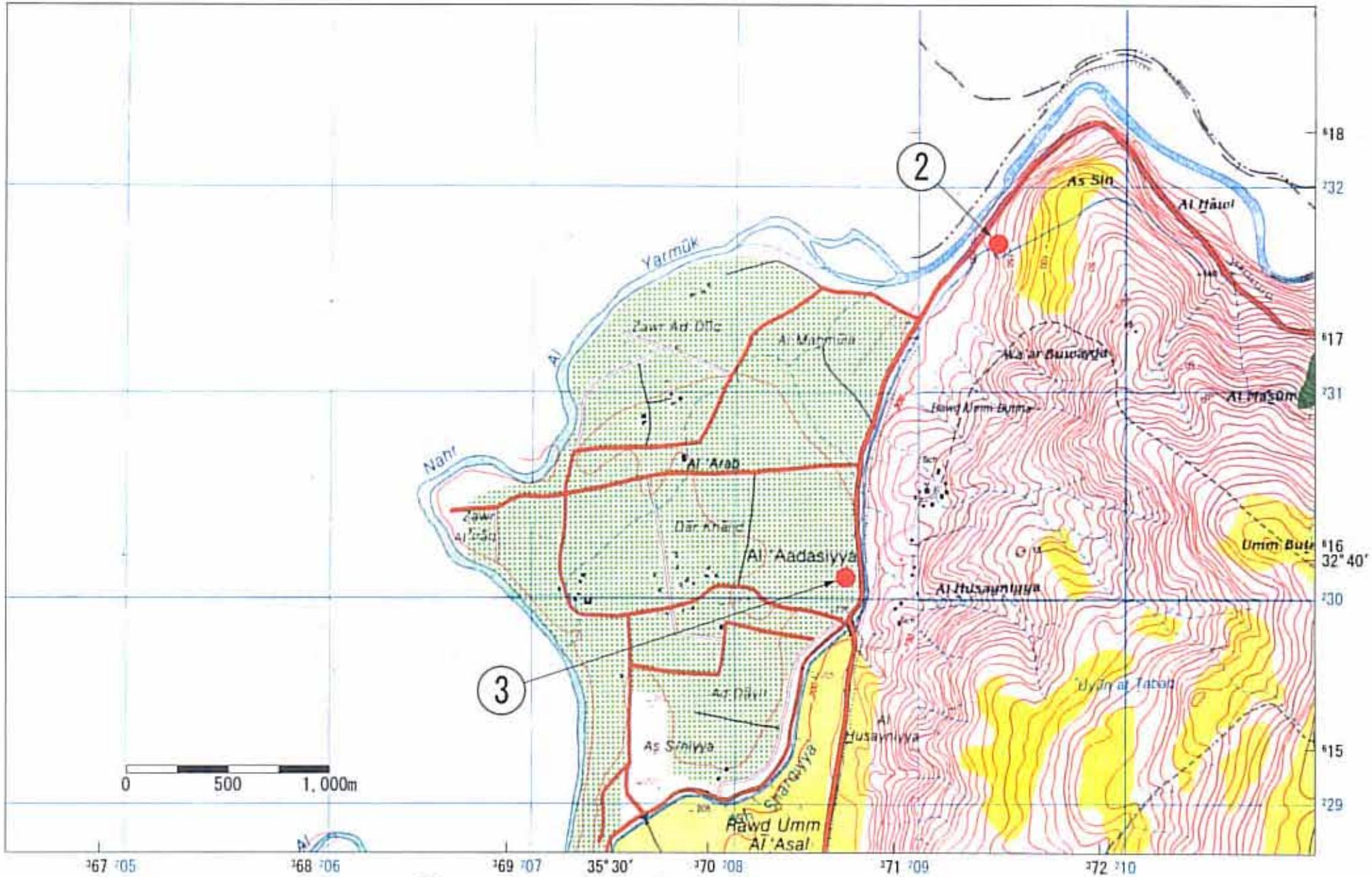


Fig. G-2 ②King Abdullah Canal/North End of KAC
③King Abdullah Canal/Tiberias Conveyor Outlet

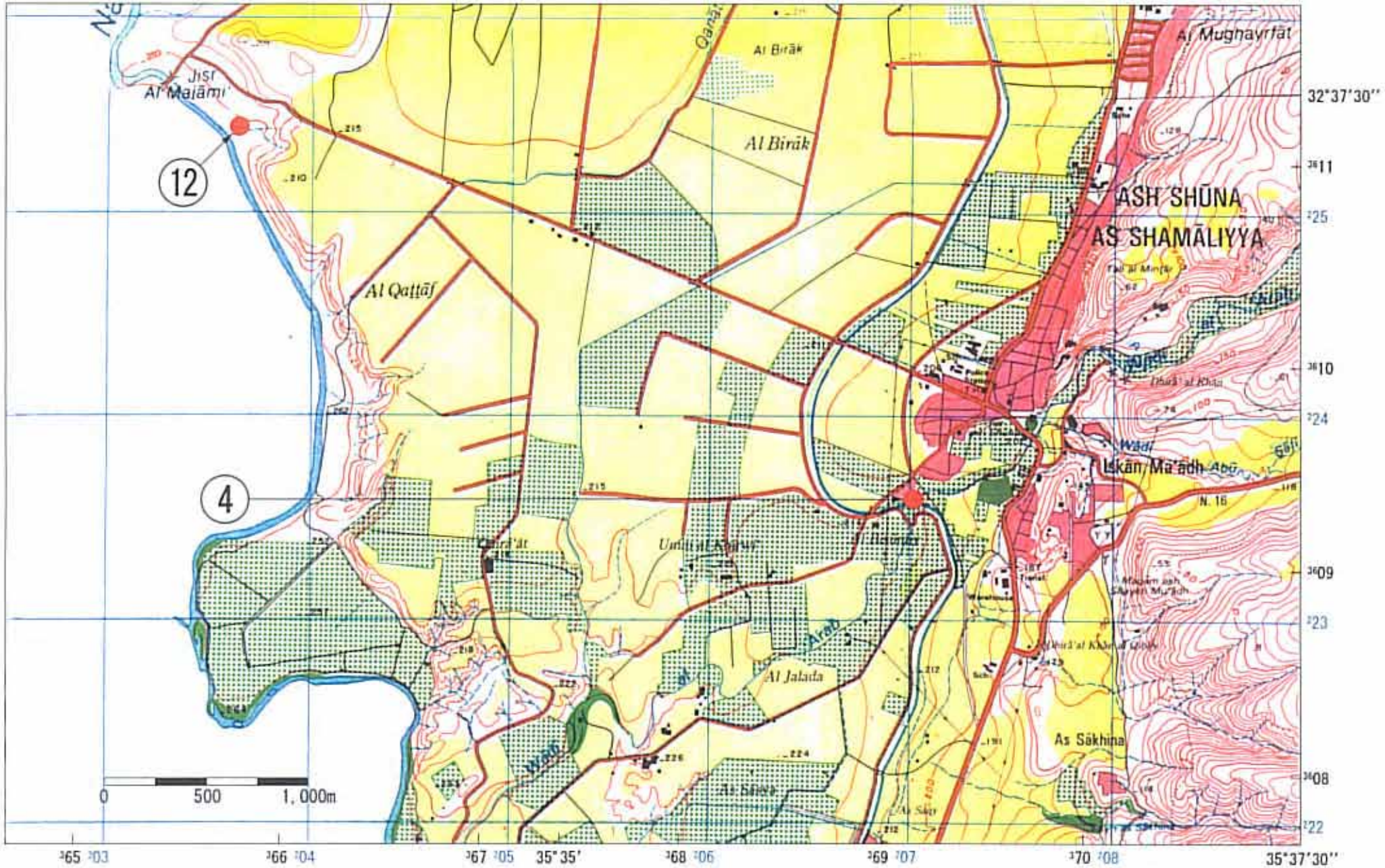


Fig. G-3 ④King Abdullah Canal/Wadi Arab Dam Pump Station
⑫Jordan River/Upstream of Majama Bridge

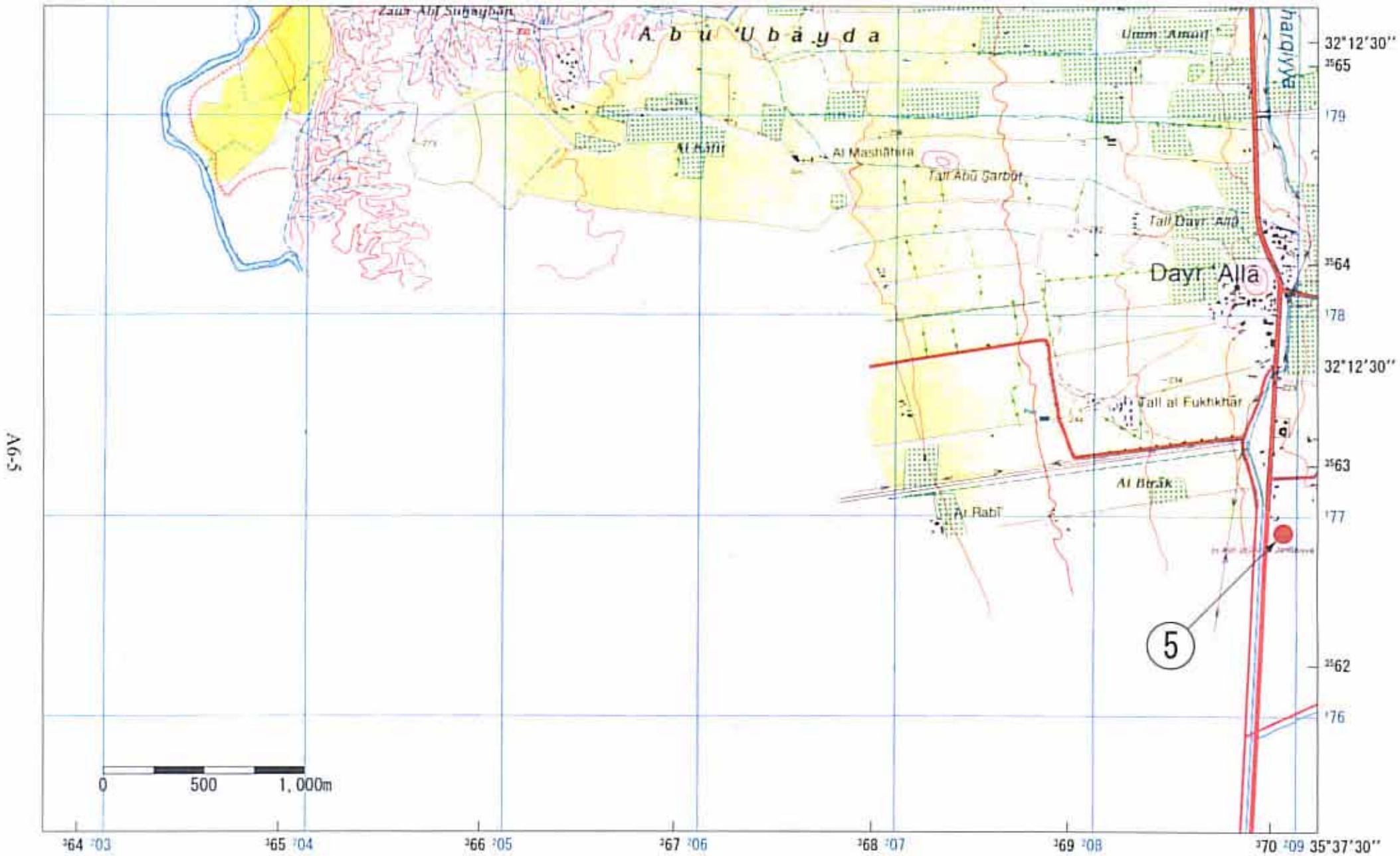


Fig. G-4 ⑤King Abdullah Canal/Deir Alla Intake

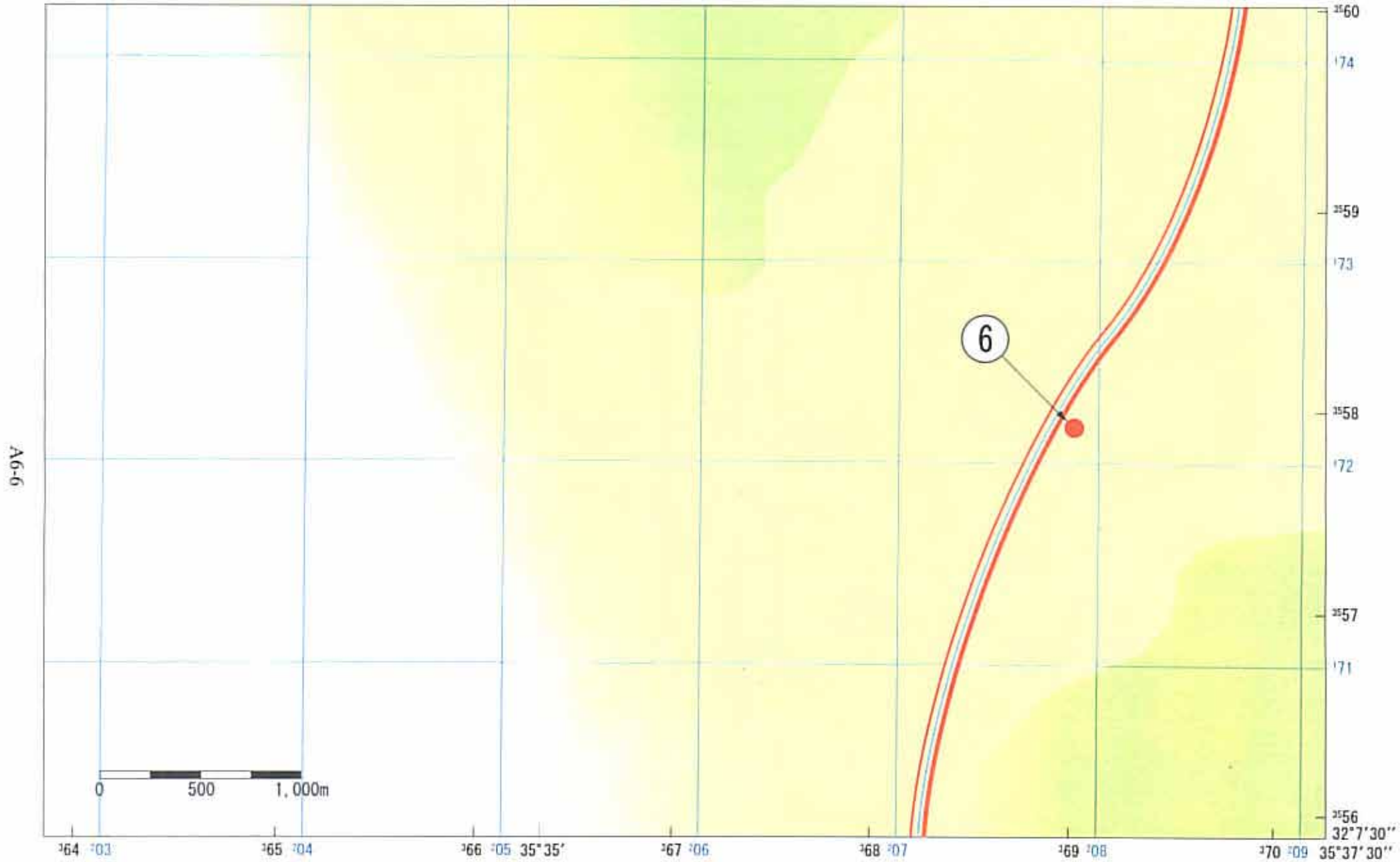
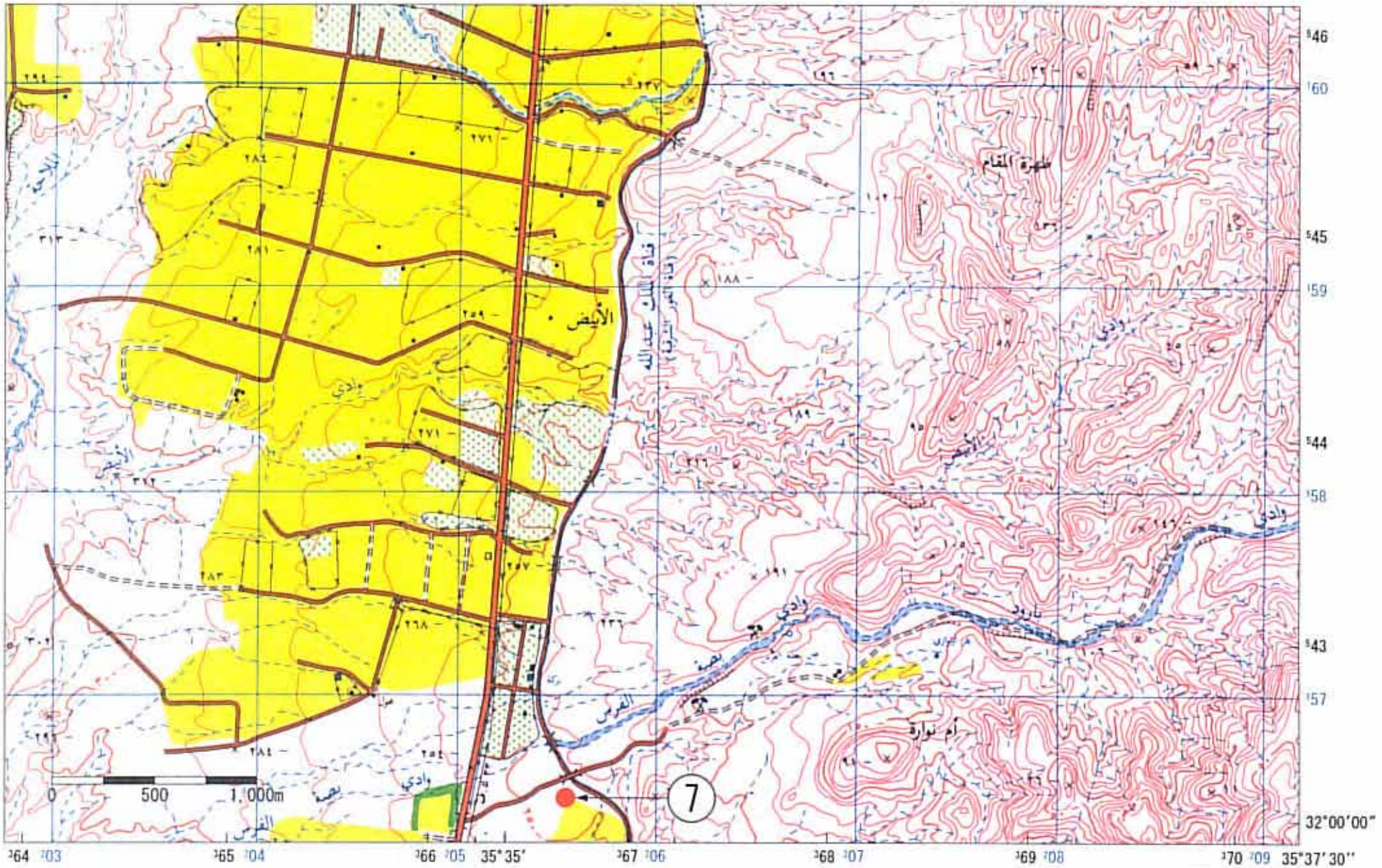
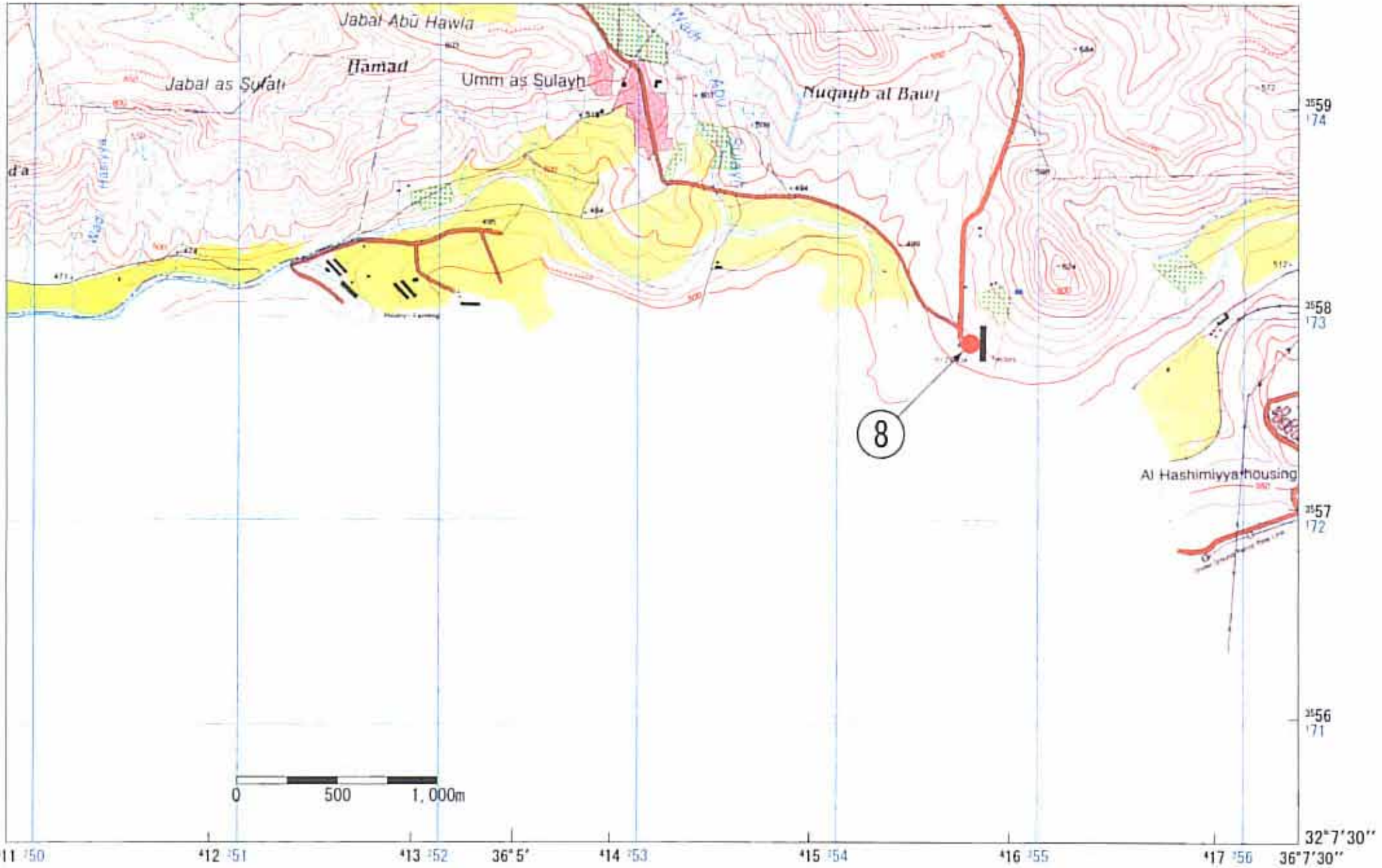


Fig. G-5 ⑥King Abdullah Canal/Zarqa Junction



A6-7

Fig. G-6 ⑦King Abdullah Canal/Karameh Dam Turn-out



A6-8

Fig. G-7 ⑧Zarqa River/Downstream of As-Samra WSP

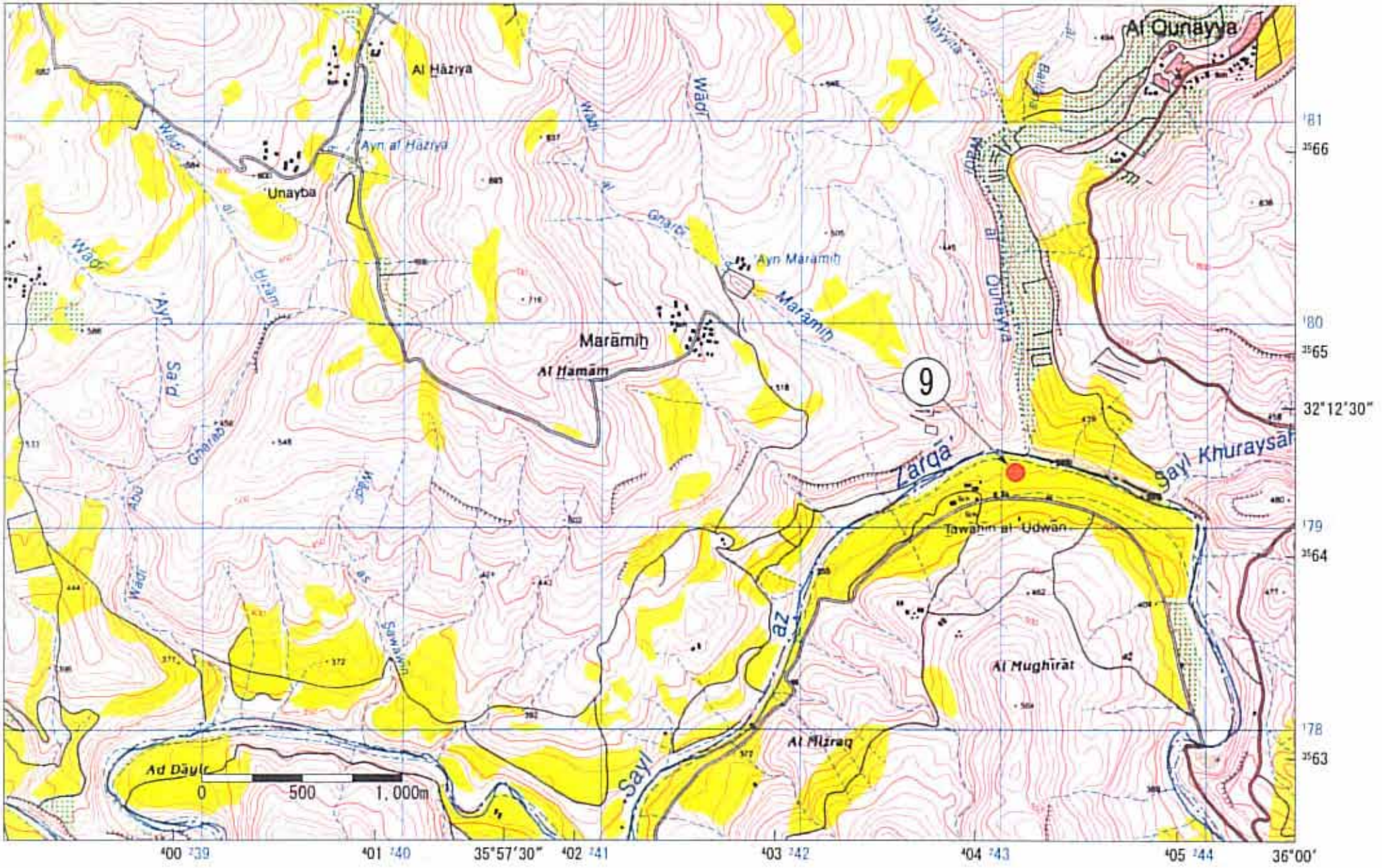


Fig. G-8 ⑨Zarqa River/Downstream of Tawafin Adwan Bridge

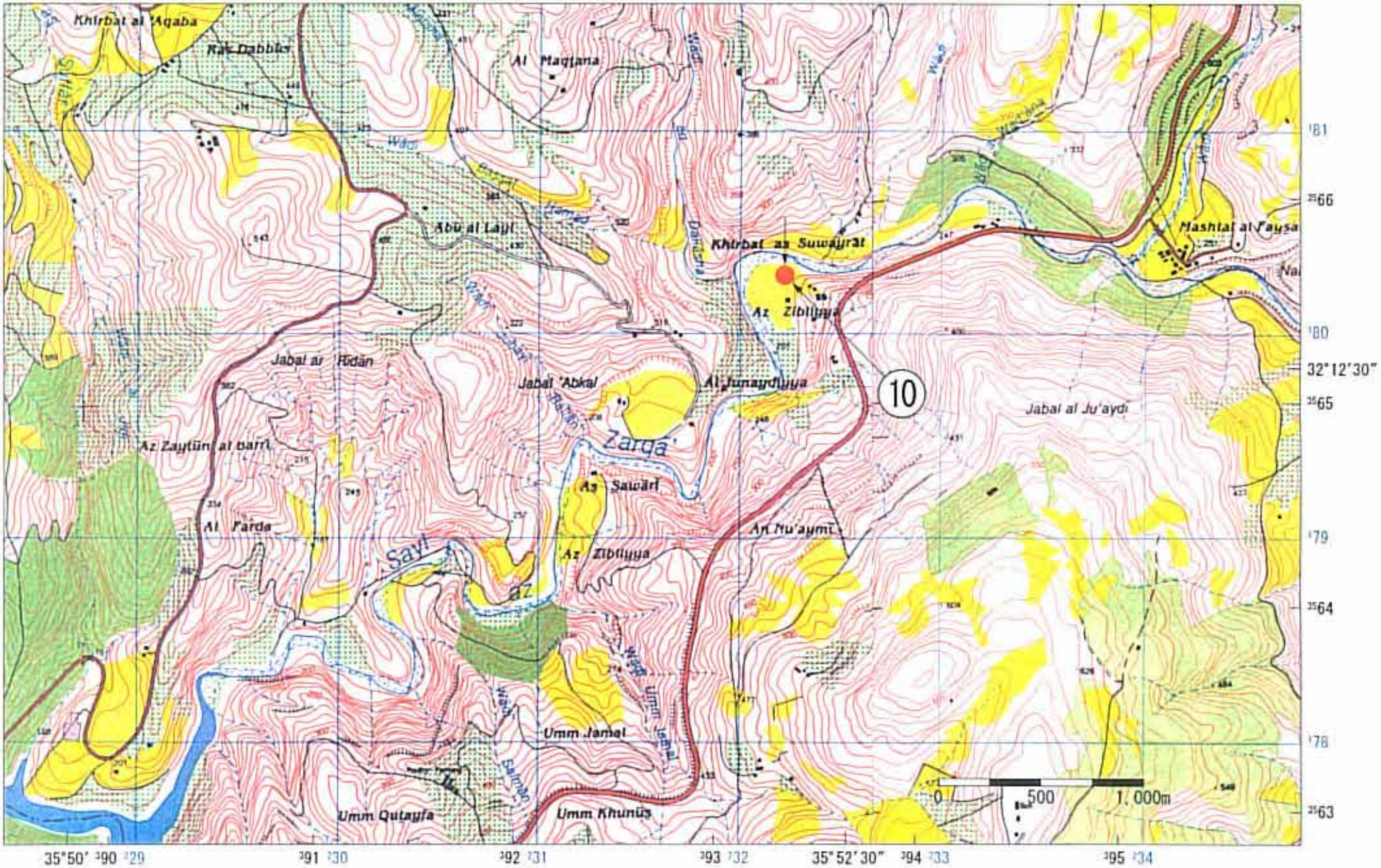


Fig. G-9 ⑩Zarqa River/King Talal Reservoir Inlet

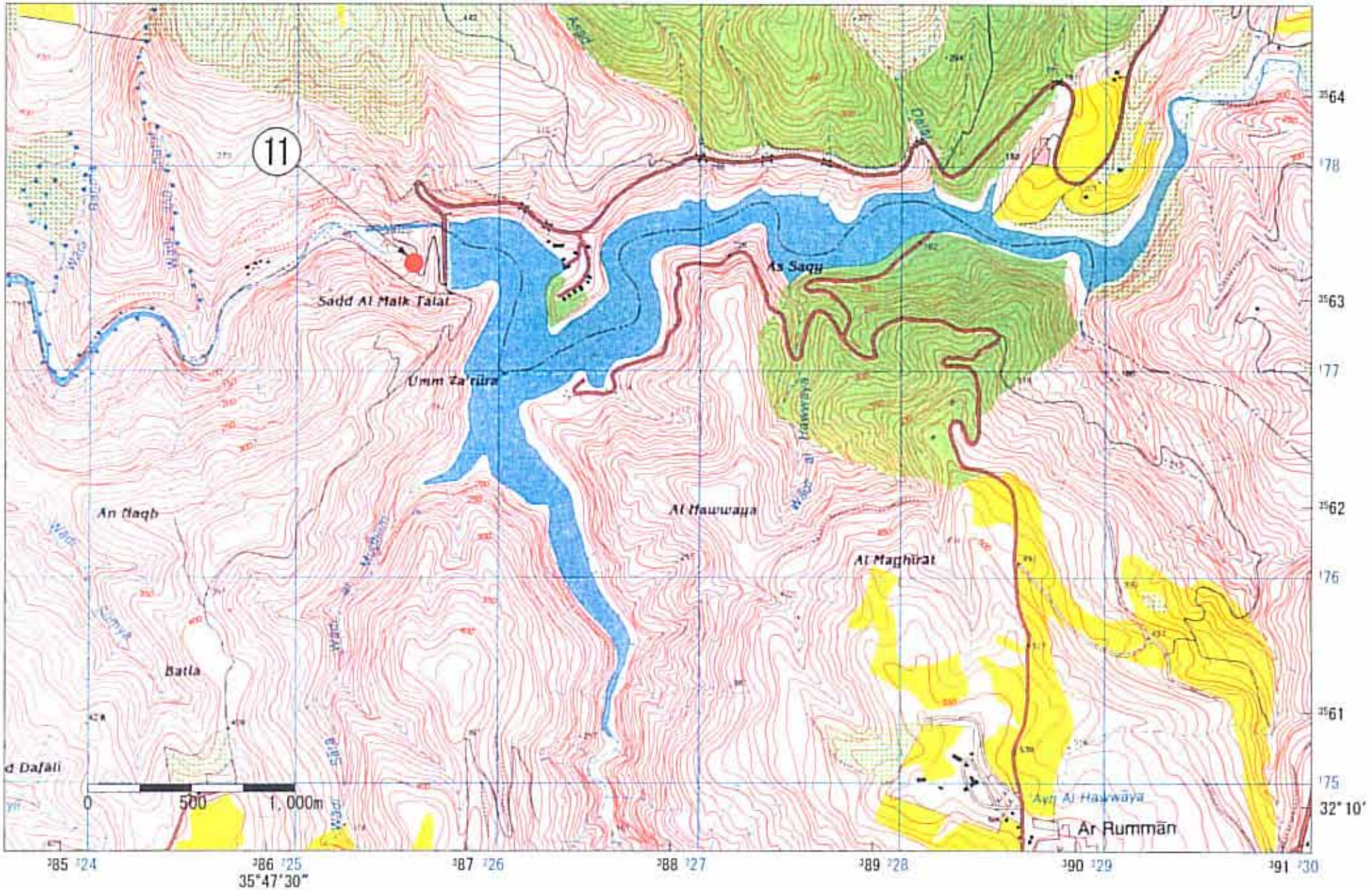


Fig. G-10 ⑪Zarqa River/King Talal Reservoir Outlet

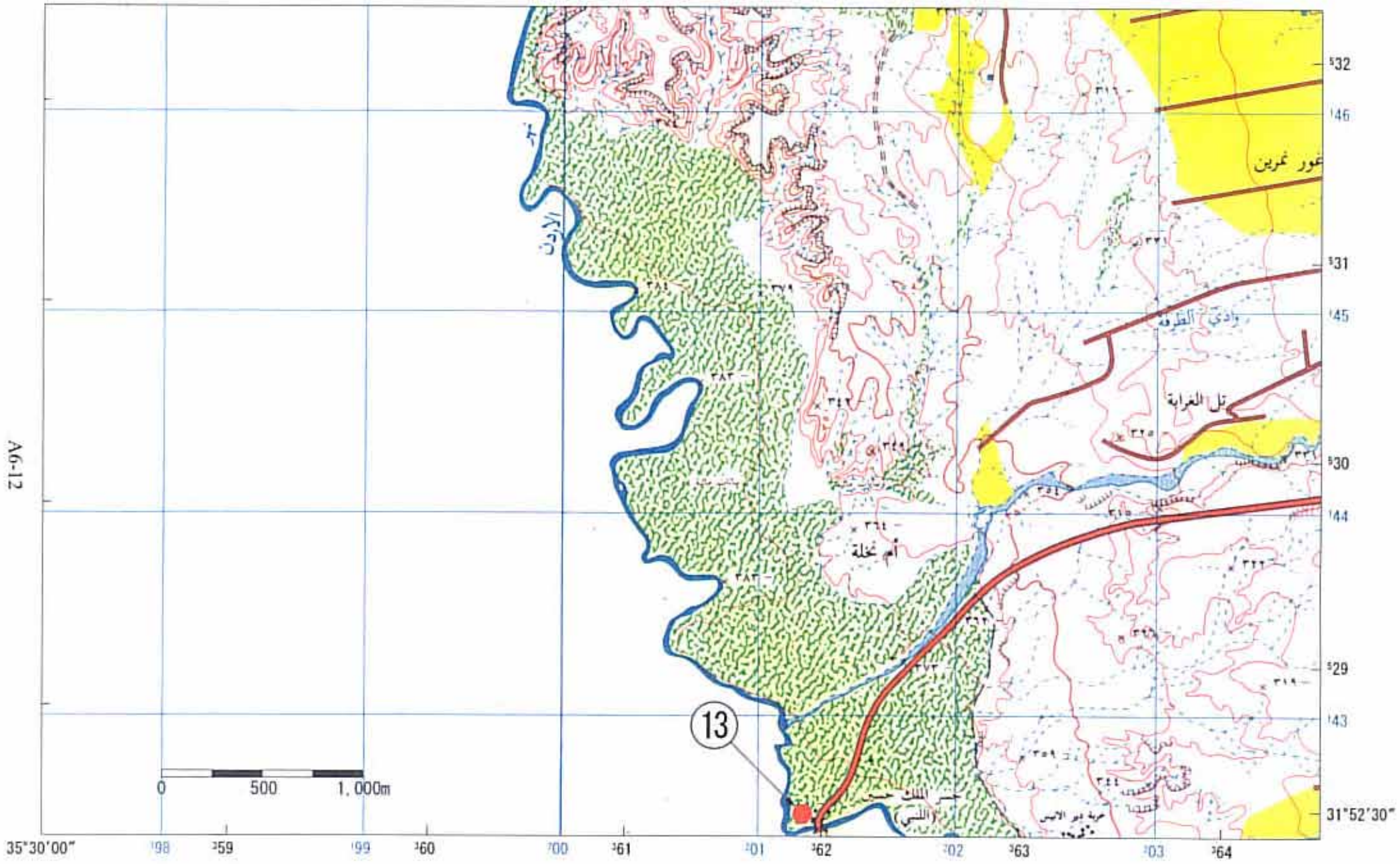


Fig. G-11 ⑬Jordan River/Upstream of King Hussein Bridge