

第5章 他の援助機関の動向

サウディ・アラビア農業水資源省への他の援助機関の動向は、農業局に対して国連食糧農業機関（FAO）等の援助があるが、水資源局に対してFAO等の援助は1970年、1980年代にはあったが、最近ない。

第6章 我が国の協力の方向性・可能性

6-1 協力対象地域

サウディ・アラビア農業水資源省の要請により、協力対象地域は更新可能な水資源が比較的多い南西部地域となる（図6-1参照）。

6-2 協力形態

プロジェクト形成調査団とサウディ・アラビア農業水資源省との協議の結果、サウディ・アラビア南西地域の更新可能な水資源利用及び開発マスタープラン作成のための本格調査実施、それとともに水資源関係のシミュレーション、汽水の農業への利用、水資源保全等の技術移転を行うこととなる。

| | | |
|------|--------------------------|---------------------------------|
| 調査項目 | 南西地域の水系調査 | (全水系の既存データ(気象、水文、地質、施設等)を集計する。) |
| | 調査水系の決定 | (農業水資源省と協議し10程度の調査水系を選定する。) |
| | 降雨特性検討 | |
| | 地表流流出解析 | |
| | 現況ワジ道解析 | |
| | 計画ワジ道の検討(施設含む) | |
| | ワジ流域の地質調査 | |
| | ワジ流域の地下水調査 | |
| | 水収支の解明 | |
| | 地下水流の解析 | |
| | 水資源の量的需要 | |
| | 水資源の供給計画 | |
| | 更新可能な水資源の利用と開発のマスタープラン作成 | |

6-3 協力規模

本調査は総括／水資源、水文、河川、ダム、地下水、地質、シミュレーション、施設設計・積算、環境、水需要予測／経済等の技術者で構成する本格調査となる。調査期間は約2年間となる。

6-4 国際機関・他ドナーとの協調

1980年代まではFAO等の国際機関があったが、現在他ドナーは特にない。

6-5 実施手順

2000年中にS/Wミッションを派遣し、2001年4月に本格調査を開始し、2003年3月に終了する。

6-6 我が国の協力の方向性・可能性

本プロジェクト形成調査の結果を受けて、平成12年10月に開発調査の正式要請書が農業水資源省から提出された。本開発調査が採択された際には、平成12年度案件として早期に実施することを検討中である。

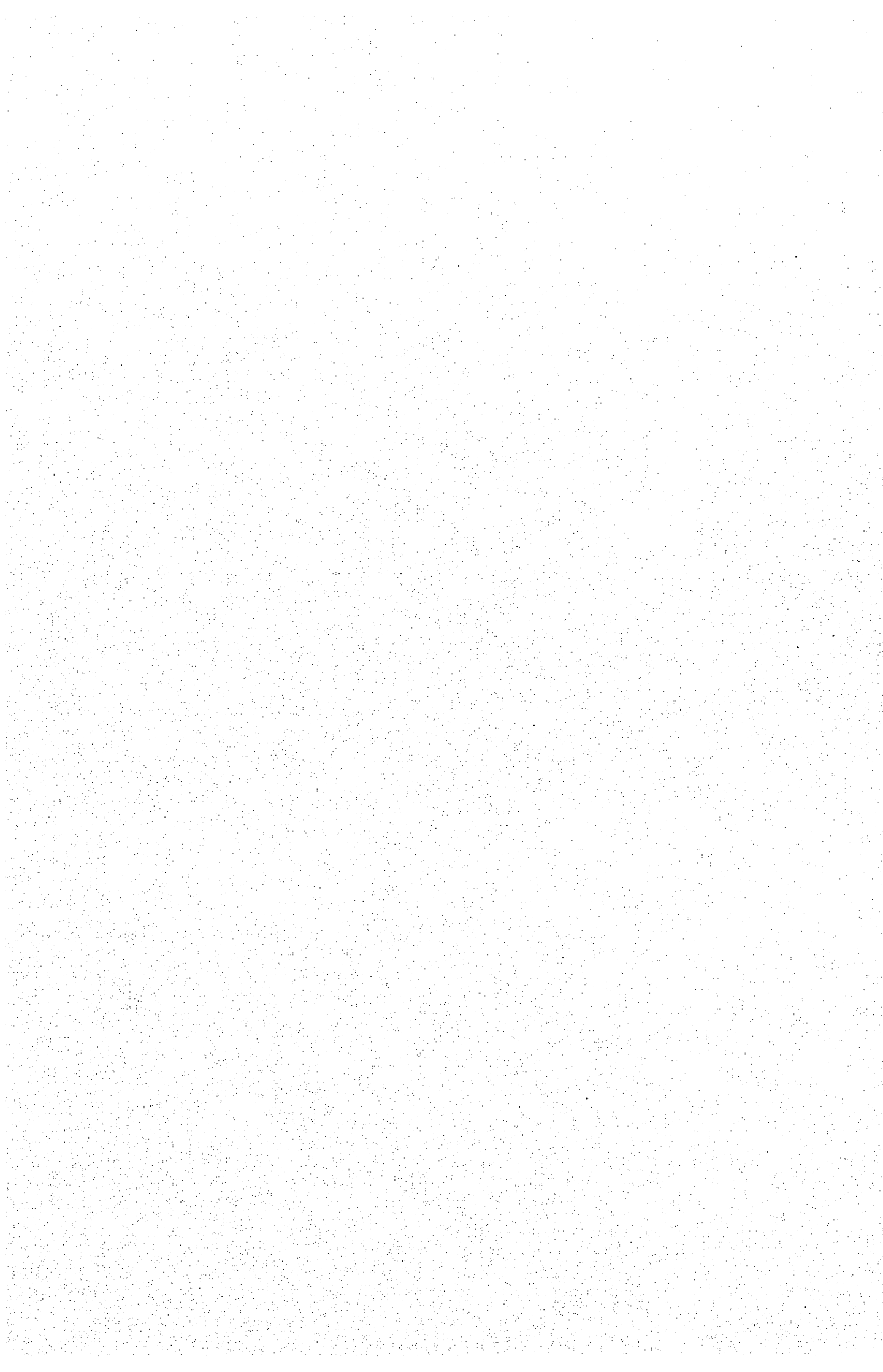
また、農業水資源省から、更なる要望としてあげられた、ワジの水理モデル解析、汽水の農業への利用並びに水資源の保全と管理については、開発調査のセミナー等により技術移転を図ることを検討する。同省は更に「下水の再利用」に係る専門家の派遣を要望しているが、これに関しては、本開発調査とは別に、専門家派遣による対応を検討する。

今回協議においては農業水資源省は日本側の対応につき高く評価するとともに、これまでの海水淡水化及び化石水に依存する当国水資源利用に加え、表流水の利用にも含め、水資源の総合的な対策を真剣に検討する段階に至ったとの認識を示し、このため開発調査の実施のみならず、専門家の派遣による種々の課題への協力及び水資源分野の人材育成について、息の長い総合的な協力を求めるところがあった。従来、化石水の開発や海水淡水化事業に重点を置いてきたサウディアラビアの水資源行政にとって、再生可能な水資源の開発・管理を進めるにあたり、我が国の協力が貢献することは意義あることと考えられる。

本開発調査の成果として想定されるマスタープラン作成の結果、南西地域のどの箇所にもどのような施設を造れば効果的な水資源管理が可能となるかが明確になり、より具体的にいくらのコストで何tの水が利用可能となるかが明確になることが期待される。マスタープランを活用した水資源管理の方策としては、具体的には地下水涵養や森林造成によるウォーターハーベストを想定する。降雨のみられる山岳地域の等高線上に森林を造成すれば、森林が雨水のフィルターとして機能し、雨水から土砂を除去して流出されることが可能となり、飲料水や農業用水への利用が容易になるものと推測される。このような方法によって南西地域に持続可能な水資源管理体制の構築が可能になるものと推測される。

なお、本開発調査の要請元である農業水資源省は、これまで米国と20年以上の密接な協力関係はあるものの、水産分野を除き日本との協力の経験がほとんどなく、今回のような案件形成について、我が国の援助システムの理解が乏しかった旨率直に表明した。今後、実施においても若干

の錯綜はあろうが、地道な協力を展開するなかで信頼関係を築くことは十分可能であると考えられる。



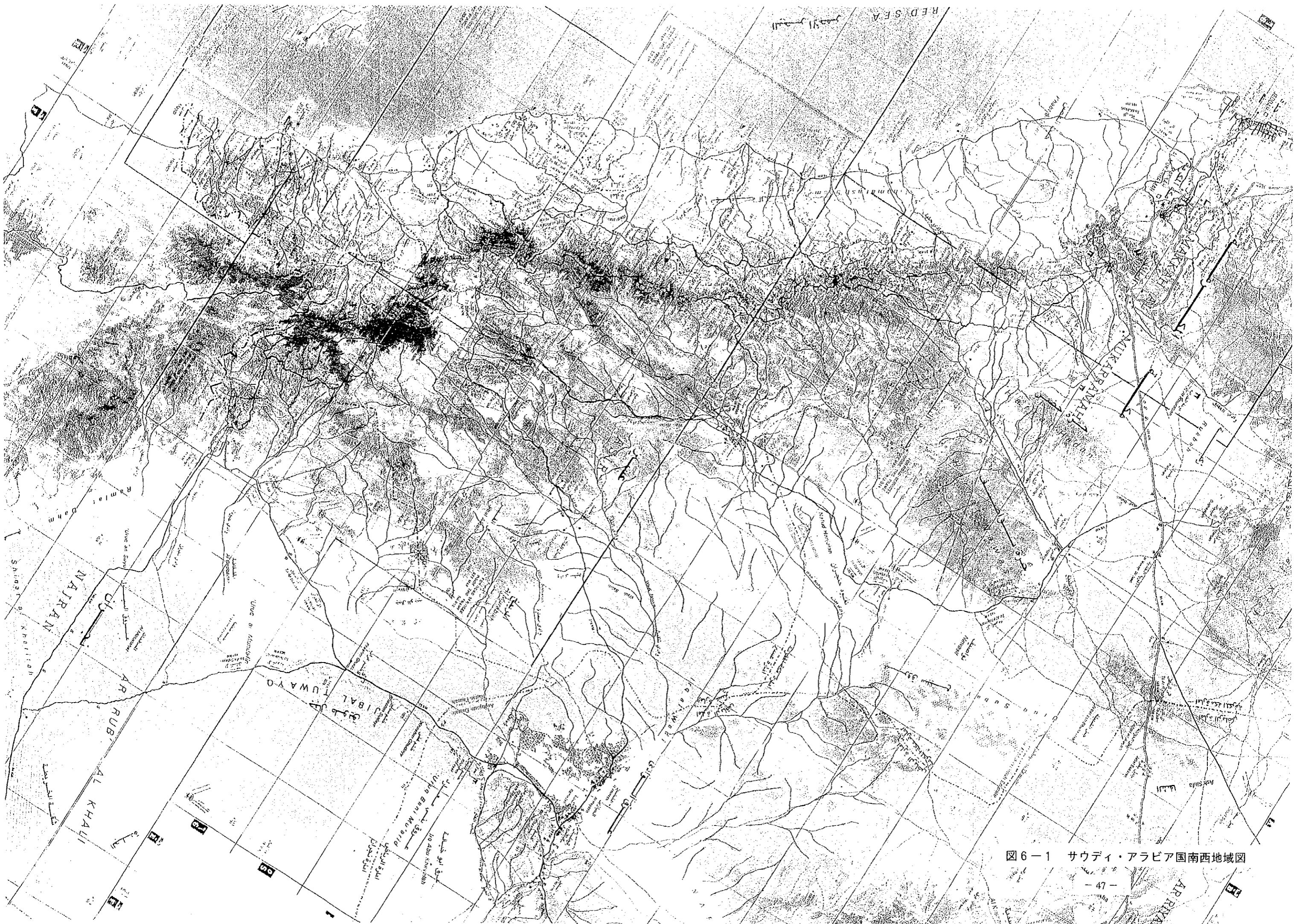


図 6-1 サウディ・アラビア国南西地域図

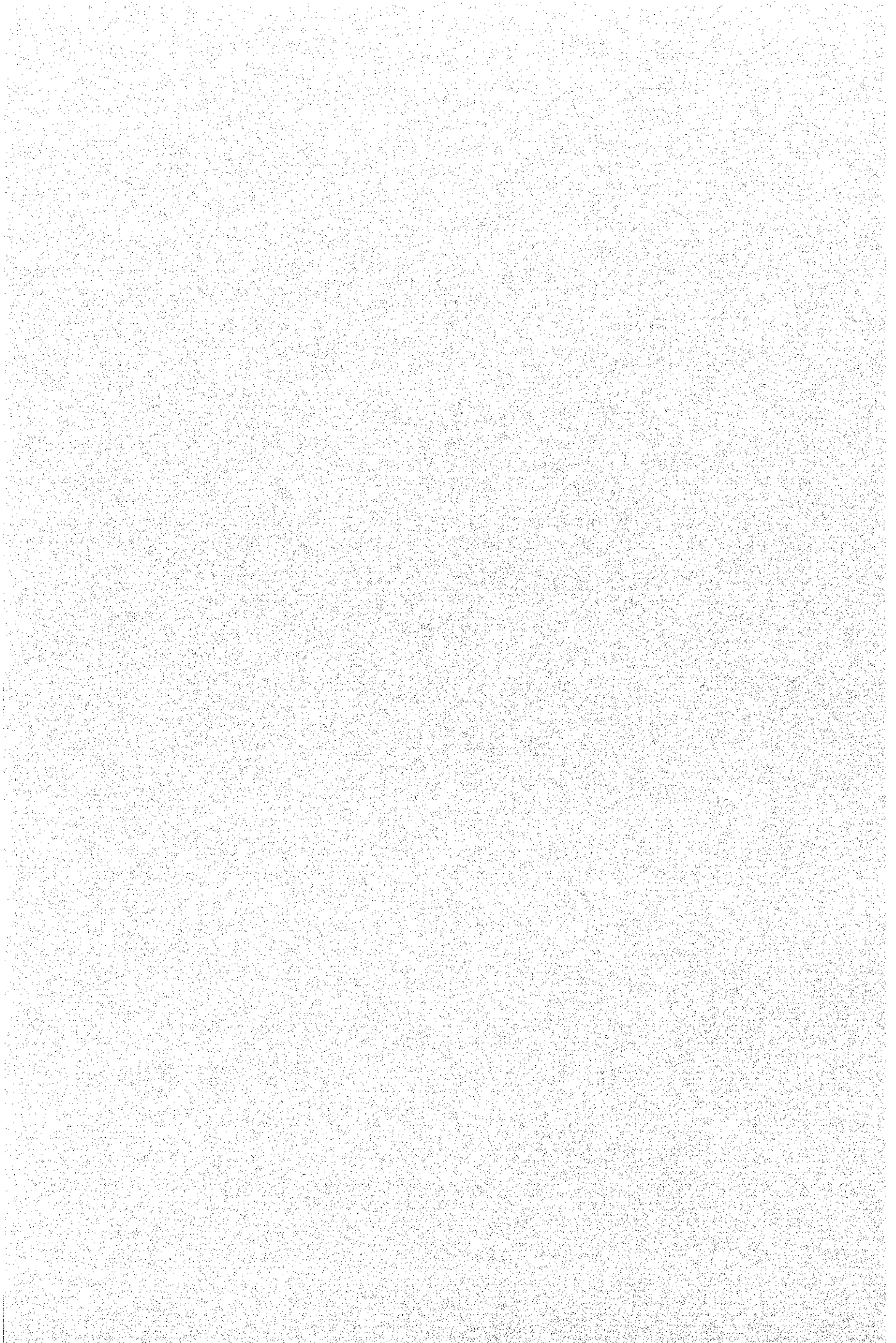
付 属 資 料

資料1 開発調査要請書

資料2 面談者リスト

資料3 収集資料一覧表

資料4 専門家要請背景調査報告書（水資源分野）





تهدي وزارة خارجية المملكة العربية السعودية أطيب تحياتها إلى سفارة اليابان بالرياض .

وبالإشارة إلى زيارة الوفد الياباني الخاص بمجال مصادر المياه للمملكة بتاريخ ١٤٢١/٦/٣ هـ الموافق ١ سبتمبر ٢٠٠٠م المشار إليه في مذكرة السفارة رقم ٢٠٠٠/٤٩٠م وتاريخ ١٣/٥/١٤٢١ هـ الموافق ١٣ أغسطس ٢٠٠٠م والذي تم الاتفاق أثناءها مع الجانب السعودي على حصر أوجه التعاون بين البلدين في هذا المجال من خلال وضع خطة رئيسية لدراسة وتطوير مصادر المياه بالمملكة ، بالإضافة إلى إمكانية إرسال خبراء يابانيين للعمل في وزارة الزراعة والمياه لمدة طويلة في مجالات تقييم آثار إعادة استخدام مياه الصرف الصحي المعالجة على البيئة وكذلك بعض التخصصات التي لا تتوفر لدى وزارة الزراعة والمياه وذلك ضمن برنامج التعاون السعودي - الياباني .

وفي هذا الصدد تود الوزارة أن تبعث لها نسخة من مقترح الدراسة المطلوب تقديمه للحكومة اليابانية الوارد من وزارة الزراعة والمياه ضمن مشروع التعاون المقترح المشار إليه أعلاه والذي سوف تبدأ الدراسة المقترحة في حالة إقرارها في شهر مايو ٢٠٠١م ولمدة سنتين وستتولى الحكومة اليابانية تمويل هذه الدراسة من خلال وكالة التعاون الفني اليابانية (جايكفا) بالتعاون مع الشركات الاستشارية اليابانية المتخصصة تنفيذ هذه الدراسة .

تأمل الوزارة إرسال هذه الدراسة للحكومة اليابانية لإتخاذ ما تراه مناسباً .

وتنتهز الوزارة هذه الفرصة لتعرب لها أطيب تمنياتها ،،،



٥٤٦

٢٠ المرفقات:

التاريخ: ١٤٢١/٧/١٤ هـ الموافق:

٥٤٦
٢٢٤٦

رقم:

Kingdom of Saudi Arabia
Ministry of Foreign Affairs

(1/15 記)

Ref.: 96/33/75896

Date: 09/10/2000

The Ministry of Foreign Affairs presents its compliments to the Embassy of Japan in Riyadh.

The Ministry has the honour to refer to the visit by Japanese delegation specialised in the Water Resources in the Kingdom, to the Kingdom, on 1st of September 2000 as mentioned in the Embassy's Note No. 490/2000 dated 13 August 2000. During the mentioned visit both sides agreed that the Kingdom will prepare a master plan on the renewable water resource development in the Kingdom. Also, to dispatch Japanese Experts to work with the Ministry of Agriculture and Water for long term in the field of evaluating the results of using the renewable water resources on the environment and other specialities are not available in the Ministry of Water and Agriculture.

In this regard, the Ministry would like to attach herewith a copy of the proposed study requested by the Japanese Government from the Ministry of Agriculture and Water. In case of approving the proposed study we will start carrying it on May 2001 for two years. The Japanese Government will finance it through JICA in co-operation with the Japanese Consulting Companies specialised in executing this study.

Kindly hand this study to the Japanese Government to take the required procedures.

The Ministry avails itself of this opportunity to renew to the Embassy the assurances of its highest consideration.

APPLICATION FORM FOR JAPAN'S DEVELOPMENT STUDY

Date of entry: month September year 2000

Applicant: the Government of the Kingdom of Saudi Arabia

1. PROJECT DIGEST

(1) **Project Title:** Master Plan on Renewable Water Resource Development in South West Region in the Kingdom of Saudi Arabia

(2) **Location :** South West Region of Saudi Arabia (Refer to Annex-1 location map of the Study Area" attached)

(3) **Implementing Agency**

Name of the Agency: The Ministry of Agriculture and Water, Water Sector

Number of Staff of the Agency: as of year 2000

Staff 6330

Other Employees 2650

Budget allocated to the Agency: Water Sector

| | <u>1997</u> | <u>1998</u> | <u>1999</u> |
|---------------------------------|-------------|-------------|-------------|
| Total Budget (Billion Riyals) | 1.333 | 1.217 | 1.262 |

(4) **Justification of the Project**

- **Present conditions of the sector:**

In the environmental and climatic conditions of the Kingdom of Saudi Arabia, the water is the most important of all natural resources and the scarcity of potable water is one of main constraints on socio-economic development. Under these conditions, the development of water resources is determined by a complex pattern of demand and supply relationship. Population growth, rising living standard and economic development determine, in general, the volume of water demand. While, the availability, quality and cost of water influence both the potentials for growth and the nature and scope of long term economic development. The water resources in the Kingdom can be divided into four categories; surface water, groundwater, desalinated seawater and reclaimed wastewater. Surface water takes major place in the west and southwest of the Kingdom where periodic rainfall is sufficient to produce runoff. There are two types of groundwater aquifers in the Kingdom; shallow renewable aquifers which include the alluvial and unconfined part of shallow formation and non-renewable deep confined aquifers. The renewable aquifers where groundwater is stored in the alluvial sediment of wadis, the fractured and weathered crystalline rocks below them and carbonate and basaltic aquifers, and, non-renewable aquifers where groundwater is stored in the older sediment rock areas in 16 principal and secondary aquifers which receive only limited recharge. According to 2000 (1419/20) estimates, surface water and shallow groundwater supply only 8,000 million cubic meters per

annum (MCM/a) or 39 % of total water demand (20,740 MCM/a) of the Kingdom, while non-renewable groundwater supplies of 11,769 MCM/a or some 57% of total water needs. Desalinated seawater has reached an advantage stage of development in the Kingdom which now has the largest desalination plants in the world. This source, however, supplies only 791 MCM/a or 4% current water needs. The reclaimed wastewater is still in its early stage of development and supplies only 180 MCM/a or 0.9% current water needs. The water balance of the Kingdom as of 1419/20 was as shown in Table-1 below.

- Sectoral development policy of the national/local government:

The overall development strategy of the water sector in the Seventh Development Plan (2000-2005) sets forth as below:

The main objectives for the water development include;

- (a) To continue with the supply of potable water in sufficient quantities and good quality.
- (b) To consider water as a basic factor and an important determinant in assessing the economic efficiency of the public and private projects.
- (c) To conserve water resources and rationalize water consumption.
- (d) To increase the role of the private sector in management, operation and maintenance of water facilities.

The following policies will be adopted to achieve above objectives;

- (a) To review the existing policies of the agriculture and water sectors and to regulate water consumption priorities.
- (b) To reconsider the administrative organization of the water sector and consolidate all agencies responsible for management of this sector into a sole autonomous agency.
- (c) To support a computerized central data base covering all aspects of water affairs.
- (d) To expand and upgrade the hydrological and hydrogeological monitoring network.
- (e) To expand application of advanced methods and technologies for conservation of water and improvement of utilization efficiency, in cooperation with the Saudi research agencies.
- (f) To develop and support renewable surface and ground water resources by utilizing (rain) precipitated and runoff water, and supporting dams construction program.
- (g) To update the detailed hydrogeological studies and to update the national water plan .
- (h) To improve the collection system of water fees.
- (i) To enhance the role of the private sector in the field of water services.
- (j) To develop the non-conventional water resources, including construction of desalination plants and pertinent facilities in order to support other sources of water as well as implementation of projects for re-use of reclaimed waste water and agricultural

drainage water.

(k) To develop Saudi manpower in water sector. The targeted national water balance in the Seventh Plan period is shown in Table-1 below:

Table-1 Targeted National Water Balance in the Seventh Development Plan

(Unit: MCM/a)

| | 1420/21 (2000) | 1424/25 (2005) | Average annual growth rate (%) |
|--|-------------------|-------------------|-----------------------------------|
| Water Demand: | | | |
| - Municipal and Industrial | 2,200 | 2,630 | 3.9 |
| - Agriculture | 18,540 | 19,850 | 1.4 |
| Total | 20,740 | 22,480 | 1.7 |
| Available Water Resources: | | | |
| - Renewable Water (surface water and shallow groundwater) | 8,000 | 8,000 | 0.0 |
| - Non-renewable groundwater | 11,769 | 13,120 | 2.3 |
| - Desalinated Seawater | 791 | 1,050 | 6.5 |
| - Reclaimed Wastewater | 180 | 310 | 14.4 |
| Total | 20,740 | 22,480 | 1.7 |

- Problem to be solved in the sector:

While the Government has achieved the substantial progress to satisfy the water needs of the Kingdom through past five year development plans, the continuing rapid increase in water consumption raises the following key policy issues for the further development of the water sector in the current Seventh Development Plan period (2000-2005) and beyond;

(a) the hydrological and hydro-geological studies needed to support and update the water database have not been implemented, and the National Water Plan has still not been updated and finalized;

(b) to effectively plan and manage water at the national, provincial, district and community level, and to utilize funds most effectively, trained professional and technical staff must be developed in sufficient numbers.

- Outline of the Project:

The objectives of the project are to formulate a master plan on renewable water resource development in south west region in the Kingdom of Saudi Arabia, and to carry out technology transfer to Saudi counterpart personnel in the course of the study.

- Purpose (short-term objective) of the Project:

- To assess the existing water facilities by means of review of the existing hydro-geological information and geophysical sounding conducted through the Study,
- To assess the water resources in alluvial and related aquifers by means of hydrological model simulation of wadi basins where the existing records on rainfall, wadi runoff, hydro-graph and groundwater draft are available,
- To formulate plan, design of facilities and estimate of project cost of water development for domestic and irrigation water supplies,
- To examine the project feasibility in terms of technology, environmental impact, economy, finance and others; and
- To transfer technology on investigation and assessment of water resources, planning and design of underground water storage, recharge reinforcing, prevention of seawater intrusion schemes to Saudi counterpart personnel.
- To transfer technology on data collection of hydro-metrology network, hydraulic mathematical modeling and simulation technique and provision of water management topics such as agricultural use of brackish water, water conservation technique, groundwater pollution, etc.

- Goal (long-term objective) of the Project:

To formulate plans and implement projects of renewable water development in the study area and other basins applying the underground water recharge and rainfall-runoff relationship.

- Prospective beneficiaries:

The population of prospective beneficiaries in the project area is as below;

Table-2. Population of Province

| Province | Population (As of 2000) |
|-----------------------|--------------------------------|
| Macca (southern area) | 1,885,401 |
| AL Bahah | 532,848 |
| Asir | 1,123,597 |
| Jizan | 349,008 |
| Najran | 296,791 |
| Total | 4,187,645 |

- The Project's priority in the National Development Plan/Public investment program:

The Government has placed the water sector as one of the key issues of the Seventh Plan along with other specific sectors in science and technology, information, environment and development. In the Sixth Plan, the Government deems the electricity

and water is one of most priority sub-sectors allocating some SR 83 billion of the investment financing requirement, the second largest investment next to the government services sub-sector; and constitutes 46 % of SR 181 billion for the producing sector; or 18 % of SR 472 billion for the total investment. As is already stated in the previous section, the study and development of renewable water resources are one of most priority policies of the water sector in the Seventh Plan and Previous Plan.

(5) Desirable or Scheduled time of the commencement of the Project:
year 2

(6) Expected funding source and/or assistance (including external origin) for the Project:
SAUDI GOVERNMENT

(7) Other relevant Projects, if any:

- Representative basins study for wadis: Yiba, Habawnah, Tabalah, Liyyah and Lith (1988)
- Studies of water resources in Al Baha region (1984)
- Operation and maintenance drinking water in the western province (1976)
- Water and agricultural development survey for Aria II and III (1969)

2. Terms of Reference of the proposed Study:

(1) Necessity/Justification of the Study:

The objectives of the Study are,

- To assess the existing water facilities by means of review of the existing hydrogeological information and geophysical sounding conducted through the Study,
- To assess the water resources in alluvial and related aquifers by means of hydrological model simulation of wadi basins where the existing records on rainfall, wadi runoff, hydrograph and groundwater draft are available,
- To formulate plan, design of facilities and estimate of project cost of water development for domestic and irrigation water supplies by means of underground storage, recharge reinforcing and prevention of seawater intrusion technologies,
- To examine the project feasibility in terms of technology, environmental impact, economy, finance and others; and
- To formulate improvement plan of hydro-meteorological system.
- To transfer technology on investigation and assessment of water resources, planning and design of underground water storage, recharge reinforcing, prevention of seawater intrusion schemes to Saudi counterpart personnel.
- To transfer technology on hydraulic mathematical modeling and simulation technique and provision of water management topics such as agricultural use of brackish water, water conservation technique, groundwater pollution, etc.

(2) Necessity/Justification of the Japanese Technical Cooperation:

As a part of cooperation between the Saudi and Japanese Governments.

(3) Objective of the Study:

- To formulate a Master Plan on Renewable Water Resource Development and Utilization in South west Region in the Kingdom of Saudi Arabia, and
- To carry out technology transfer to Saudi counterpart personal in the course of the Study.

(4) Area to be covered by the Study:

The Study will cover the South West region of Saudi Arabia.

(5) Scope of the Study:

In order to achieve the objectives mentioned above, the study will cover the following items.

1. Phase I Basic Study:

- (1) Data collection, review and analysis of the present conditions through existing data, and previous studies:

- 1-1) National and regional socio-economic data and information
- 1-2) Agricultural and water resources sector policy and administration including existing projects
- 1-3) Meteorological and hydrogeological data and information
- 1-4) Soil, geological and hydrogeological data and maps
- 1-5) Topographical data and maps
- 1-6) Current land use and water
- 1-7) Current hydro-meteorological monitoring system
- 1-8) Previous studies and research activities
- 1-9) Other related data and information

(2) Field survey:

- 2-1) Topography
- 2-2) Regional socio-economic activities and environmental condition
- 2-3) Water and land use
- 2-4) Wadi condition
- 2-5) Water resources structures, facilities and well
- 2-6) Hydro-meteorological station
- 2-7) Water quality

2. Phase II Formation of the Master Plan

- 1) Water demand and projection
 - 1-1) Future socio-economic framework
 - 1-2) Future agricultural, domestic water and other use
- 2) Water resources potential analysis
 - 2-1) Preparation of analytical methods and models
 - 2-2) Hydrological and runoff analysis
 - 2-3) Water harvesting and recharge
 - 2-4) Hydrogeological analysis
 - 2-5) Computing of water balance
- 3) Basic strategy and criteria for water resources utilization
- 4) Formulation of the Master Plan
 - 4-1) Regional water resources development and management plan
 - 4-2) Financial and economic aspect
 - 4-3) Social impact and initial environment examination
 - 4-4) Improvement plan of hydro-meteorological system

5) Implementation plan of alternative scenarios of development plan

(6) Study Schedule:

The study will be conducted within 18-24 months starting from January, 2001

(7) Expected Major Outputs the Study:

The expected major outputs of the Study are to be the study report and its appendices, which indicate a master plan of assessment and development of renewable water resources in the study forms.

(8) Possibility to be implemented/ Expected funding resource:

(9) Request of the Study to other donor agencies, if any:

(10) Other relevant information

3. Facilities and information for the Study :

3-1) Assignment of Counterpart Personnel of the Implementing Agency for the Study:

The Ministry will assign a liaison officer in the main Ministry and an appropriate number of technical staff as the counterpart personnel of the experts of Japanese Study Team.

3-2) Available data, information, documents, maps, etc. related to the study:

- Topographic maps scaled in 1/500,000, 1/250,000 and 1/50,000,
- Geological maps scaled in 1/250,000,
- Aero-photographs and satellite images,
- Hydro-meteorological records, 1985 onward,
- Hydrogeological and groundwater records inclusive of test-well, groundwater hydrograph and groundwater model analysis in some selected basins,
- Hydro-meteorological study report for some selected basins inclusive of rainfall and wadi runoff analysis,
- Socio-economic data; and
- Others.

3-3) Information on the security conditions in the study area:

The security conditions are fairly good over the Kingdom.

4. Global Issues (Environment, Women in Development, poverty, etc.)

(4-1) Environment components (such as pollution control, water supply, sewage, environmental management, forestry, biodiversity) of the project, if any.

The project aims to increase water resources and to mitigate groundwater drawdown, and all the necessary facilities and structures are to be constructed. Any major negative impact on socio-economic and natural environment is, therefore, anticipated.

(4-2) Anticipated environmental impacts (both natural and social) by the Project, if any. The major negative impacts are to be vested water right in the lower reach of the facility/structure. The noise and waste during facility construction are to be environmental component.

(4-3) Women as main beneficiaries or not.
Women are not only the main beneficiaries but both genders.

(4-4) Project components which require special consideration for women (such as gender difference, women specific role, women's participation), if any.
Any specific consideration for women is not included in the project components.

(4-5) Anticipated impacts on women caused by Project, if any.
Specific impacts on all genders are involved in the project.

(4-6) Poverty alleviation components of the Project, if any.

(4-7) Any constraints against the low-income people caused by the Project.
The project to mitigate the gap between rich and poor regions.

5. Undertaking of the Government of the Kingdom of Saudi Arabia :

In order to facilitate a smooth and efficient conduct of the Study, the Government of the Kingdom of Saudi Arabia shall take necessary measures;

(5-1) to secure the safety of the Study Team,

(5-2) to permit the members of the Study Team to enter, leave and sojourn in Saudi Arabia in connection with their assignment therein, and exempt them from foreign registration requirements and consular fees,

(5-3) to exempt the Study Team from taxes, duties and any other charges on equipment, machinery and other materials brought into and out of Saudi Arabia for the conduct of the Study,

(5-4) to exempt the Study Team from income tax and charges of any kind imposed on or in connection with any emoluments or allowances paid to the members of the Study Team for their services in connection with the implementation of the Study,

(5-5) to provide necessary facilities to the Study Team for remittance as well as utilization of the funds introduced in Saudi Arabia from Japan in connection with the implementation of the Study,

(5-6) to secure permission or entry into private properties or restricted areas for the

conduct of the Study,

(5-7) to secure the permission for the Study to take relevant data, documents and necessary materials related to the Study out of Saudi Arabia to Japan; and

(5-8) to provide medical services to any member of the Study Team as needed, and the expenses of the services will be chargeable to him.

6. The Government of the kingdom of Saudi Arabia shall bear claims, if any arise against members of the Japanese Study Team resulting from, occurring in the course of or otherwise connected with the discharge of their duties in the implementation of the Study, except when such claims arise from gross negligence or willful misconduct on the part of the Study Team.

7. The Ministry of Agriculture and Water, the Government of the Kingdom of Saudi Arabia shall act as counterpart agency to the Japanese Study Team and also the coordinating body in relation with other governmental and non-governmental organizations concerned for the smooth implementation of the Study.

8. The Ministry of Agriculture and Water, the Government of the Kingdom of Saudi Arabia will, as the executing agency of the project, take responsibilities that may arise from the projects of the Study.

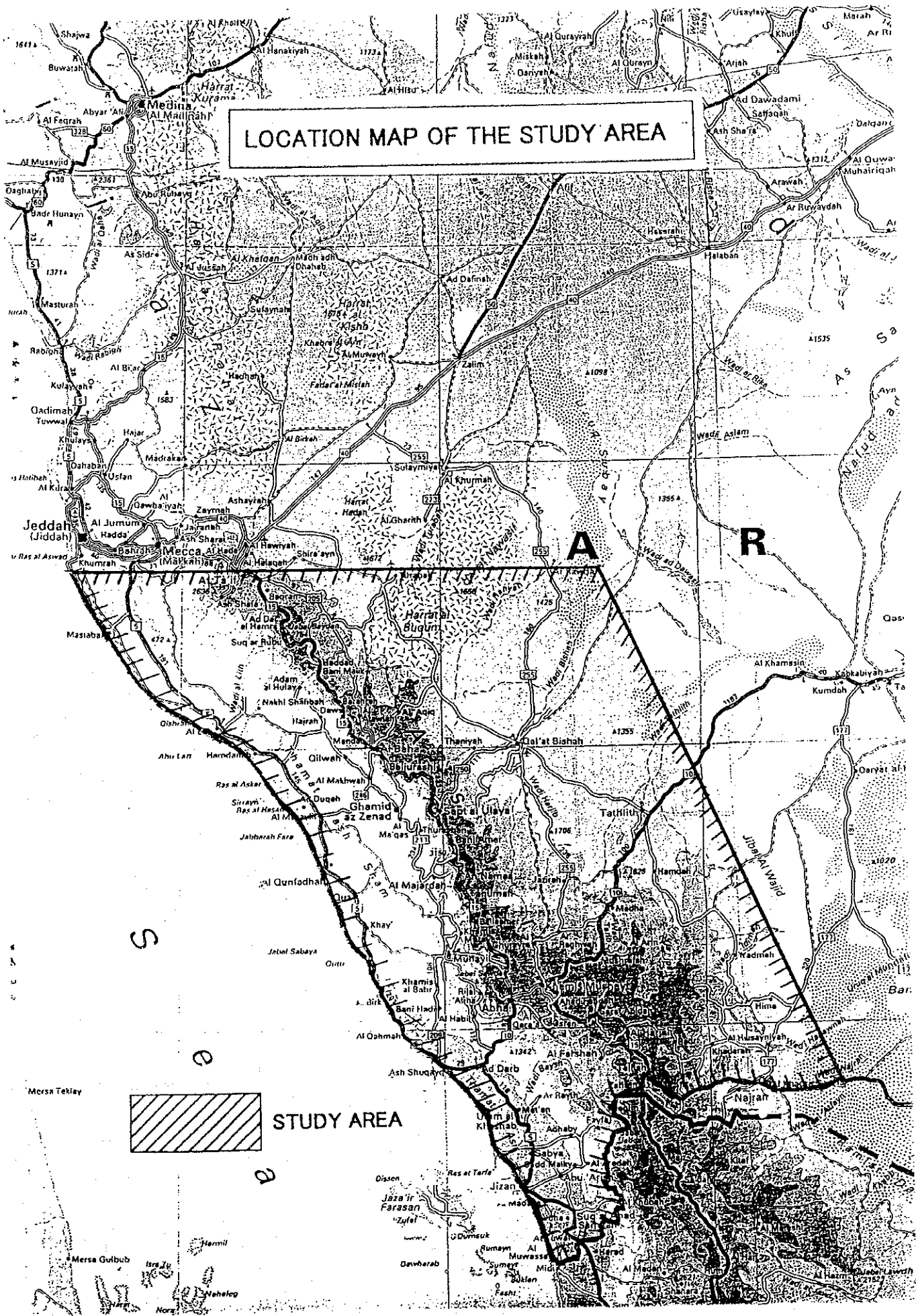
The Government of the Kingdom of Saudi Arabia assures that the matters referred in this form will be ensured for a smooth conduct of the Development study by the Japanese Study Team.

Signed: _____

Title: _____

On behalf of the Government of _____

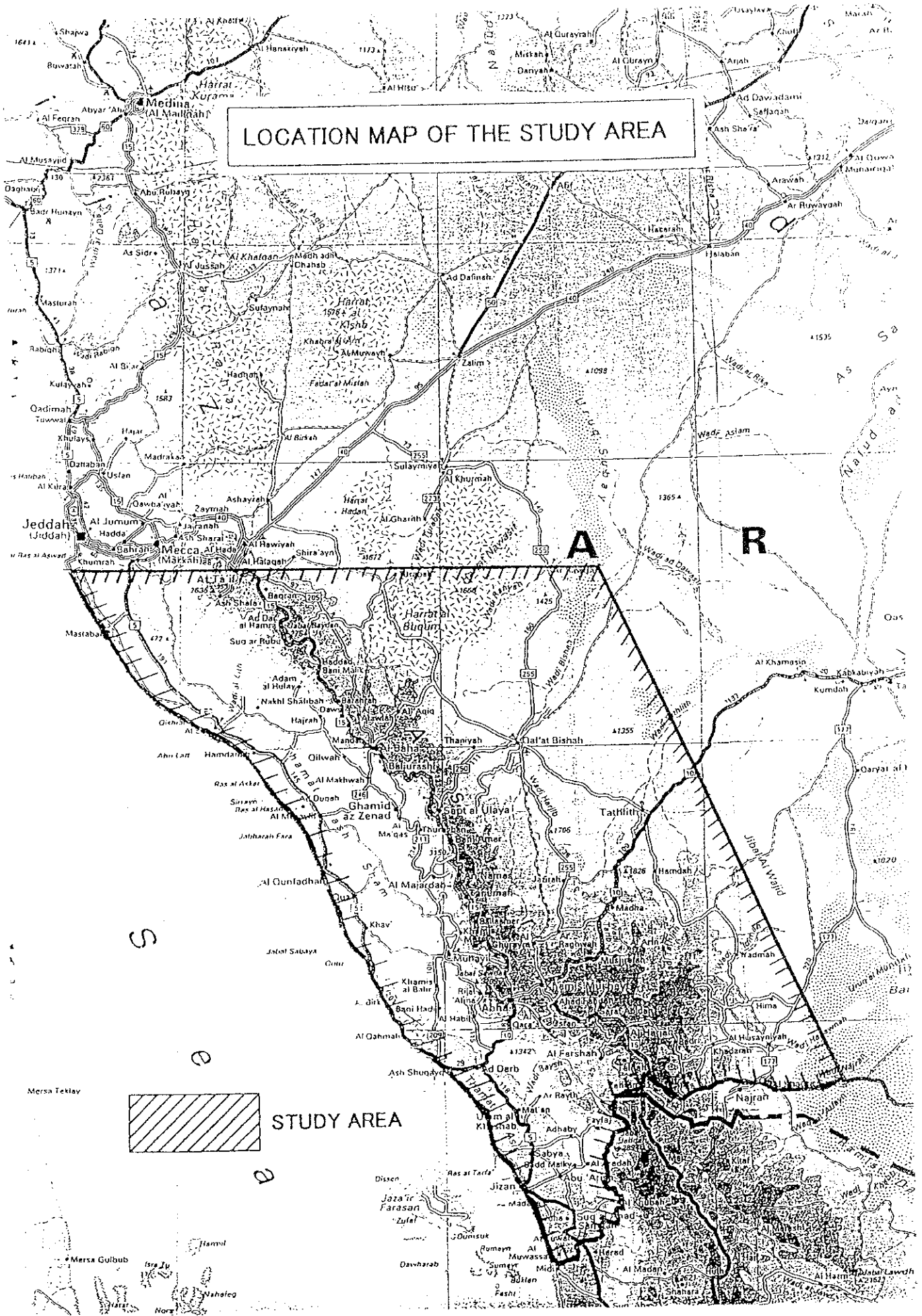
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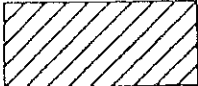
LOCATION MAP OF THE STUDY AREA



STUDY AREA



LOCATION MAP OF THE STUDY AREA



STUDY AREA