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**APPLICATION FOR THE  
TECHNICAL COOPERATION (DEVELOPMENT STUDY)  
BY THE GOVERNMENT OF THE ISLAMIC REPUBLIC OF IRAN**

**1. Project Digest**

**1.1 Project Title**

The Study on Water Management in the Western Area of the Capital Tehran and Ghazvin plain through Taleghan Water Diversion Scheme.

**1.2 Location**

The study area covers the Tehran Western Capital Area, Ghazvin plain, Taleghan, River and Alamut River basin.

**1.3 implementing Agency**

- (1) Responsible Agency : Ministry of Energy, the Islamic Republic of Iran.
- (2) Executing Agency : The Tehran Regional Water Board (TRWB) in collaboration with the other agencies concerned.

**1.4 Justification of the Project.**

**1.4.1 Background.**

The Capital Tehran is located at the southern skirt of the Alborz Mountains, which run east-westwardly at the northern border of the country. In recent years, population growth of the Capital area has been very rapid causing serious problem in securing sufficient water supply to meet the municipal water demand since the area is located in the semi-arid zone having annual rainfall less than 300 mm, the available water resources are very scarce.

In order to cope with the increased demand of water supply, the Government has constructed three storage dams; on the Karaj river at the west, on the Jajrud and Lar rivers at the east of the Capital area. However, continuous increase of the population in the Capital area and suburbs which has exceeded 10 million at present has caused the existing water resources not sustainable to the water demand of the area in future.

For improvement of the above situation, the Government of Iran proposed construction of the Taleghan dam at the upper reach of the Taleghan river and the water diversion plan to divert the Taleghan river water to the western outskirts of the Capital Tehran.

Construction of the diversion pipeline is being under implementation but construction of the dam has not yet started due to some revisions which should be carried out to the dam foundation design.

The Taleghan river at the dam site has about 450 MCM annual runoff in average year according to the FS Report for the Taleghan Multipurpose Water Development Project in 1967. Out of the total 450 MCM annual runoff, 150 MCM has been diverted for use of the Ghazvin plain while the remaining 300 MCM is currently released to the downstream Shahrud river. Construction of Taleghan dam will make use of these 300 MCM available for the western Capital area and Ghazvin plain. However in the long term, more water resources shall be required to meet increased demand of water for the Capital area. To shift a portion of water allocated to the Ghazvin plain for use of the Capital area could be one of the alternative solution but it may affect current water use in the northern Ghazvin plain, because the existing wells in the plain are old and inefficient. To seek for new water resources possibly from the Alamut and the Shahrud rivers as replacement shall be necessary in order to stabilize water use in the Ghazvin plain.

Accordingly, it is deemed that not only the study for construction of the major water diversion structures, but also preparation of the rehabilitation and improvement plan of the existing wells, formation of the water utilization and allocation plan among the western Capital area, and the Ghazvin plain and conducting master plan study on the Alamut water diversion to the north Ghazvin plain are necessary for the proposed water diversion scheme. Furthermore, improvement and strengthening of water resources monitoring and management system to promote efficient utilization of limited water resources shall be carried out at the same time.

In view of the above mentioned, TRWB is seeking international assistance for conducting the captioned study to avail early solution of the water supply problem of the Capital Tehran area and Ghazvin plain.

#### 1.4.2 Water Demand Tendency

According to the Master Plan for Long Term Water Supply to Tehran revised in 1998 water demand projection for Tehran, Karaj and Ghazvin municipalities and surrounding agricultural lands at the target year of 2021 can be summarized as follows. Though the estimated figures are in need of further confirmation, yet judged from the fact that the population of the Capital and surrounding area has reached to about 10 million in 1998, water supply 1,000 MCM from all possible sources including surface water and ground water has to be secured based on the estimation of raw water of 300 l/day per capita.

### Water Demand Projection (at 2021) unit : MCM

	Total Area in km <sup>2</sup>	Domestic Industry	Agricultural	Future Development	Total	Population in mill.
Tehran & Suburb	12000	1214	4427	3127	6641	15
Ghazvin Plain	4000	168	5109	3820	5277	1.4

Since the Capital Tehran is demarcated at the north by the steep slopes of Alborz Mountains, at the east by Jajrud river and undulate gully terrain and at the south by severe weather conditioned desert area, further development of the residential area seems to concentrate more at the western suburb of the Capital area. Also a new town center of the Capital Tehran is now under construction at Hashergerd which is located at about 70 km west of the Tehran City. Therefore, it is easily predicted that future urbanization will be proceeded more rapidly at the western suburb of the Capital area.

#### 1.4.3 Water Resources Potential

At present, water supply to the Capital Tehran relies mostly on the Karaj river (Karaj dam), the Jajrud river (Larian dam), the Lar river (Lar dam) and the ground water etc. Potential amount of supply from these water sources can be summarized as shown in the following table which indicates only about 40% of the proposed water demand. Even for the estimated current water demand of 1,000 MCM, the available supply can meet only about 80% of the demand. Therefore, development of new water resources is urgently required.

#### Water Supply in the Capital Tehran Area. Unit : MCM

Proposed Water Demand	Karaj River	Jajrud River	Lar River	Kordan River	Ground Water	Total
1,650	300	180	100	-	300	880

Note : The proposed water demand is set at the target year of 2021 and the figures are based on the master plan report of the Long Term Water Supply to Tehran.

The following are current situation and prospective development potential of water resources prevailing in the river basins surrounding the Capital Tehran, in the Taleghan river basin as well as in the nearby river basins.

#### 1.4.3.1 Water Resources Development Situation in the Areas Surrounding the Capital Tehran.

#### (1) Karaj River Basin.

The Karaj river is originated in the northern outskirts of the Tehran City runs south-westwardly to detour the city area and flows southwardly at the eastern vicinity of the Karaj City and finally empties in to the Qom salt lake. The amount of water utilized from this river for urban area of the Capital Tehran and agriculture in the Karaj plain is estimated at about 380 MCM annually. As the draw-down of the ground water level at the southern Karaj plain is becoming more serious in recent years, water resources development in this river basin seems to reach the maximum extent.

#### (2) Jajrud River Basin

The Jajrud river is originated in the north-eastern area of the Tehran City flowing southwardly at about 10-30 km east of the Capital area and finally emptying in to the Varamin Plain. The annual runoff at the Latian dam site is about 300 MCM, out of which 180 MCM has been used for the Capital Tehran. Considering agricultural water demand of the Varamin plain, water resources utilization in this river basin seems to be rather tight.

#### (3) Lar-Haraz River Basin

The Lar river is originated at the southern foothills of the Mt. Damavand of the Alborz Mountains and joins with the Haraz river at about 15 km downstream of the Lar dam site and finally empties in to the Caspian Sea. The Lar dam has started storage of water since 1979 but the leakage through the dam has been found serious. At present, water in this river is being diverted to the Capital Tehran via Latian Dam on Jajrud river for about 100 MCM per annum. Stabilization of water from this river basin will be more essential in future.

Based on the above observation, development of the potential water resource in the Capital Tehran and surrounding areas seems to reach to the upper limit at present. Development of new water resources in future shall focus on the river basins other than the above mentioned.

#### 1.4.3.3 Water Resources Development in the Taleghan River Basin.

The Taleghan river is originated at the north-western area of the Karaj river basin. By collecting melting snow water from the Mt. Alam-Kuh and the southern slopes of the mountainous ridges, the Taleghan river runs northwardly across the Taleghan valley and joins with the Alamut river to become the Shahrud river and then the Sefidrud river to empty into the Caspian Sea.

In 1970 decade, both the Sangban and the Ziaran diversion dams together with the Taleghan tunnel were completed and started supply of water for about 150 MCM per annum to the Ghazvin plain. Also according to the Taleghan Multipurpose Water Development Project, by construction of the proposed Taleghan dam, the ultimate supply capacity of the river for irrigation of the Ghazvin plain will reach to

270 MCM. However due to various constraints, the proposed scheme was not materialized. At present, due to change of water use condition, the government considers to divert 150 MCM water out of the available 450 MCM for use of water supply to the Capital Tehran area. The plan is being put for further planning and implementation.

Furthermore, the Alamut river of the Taleghan river basin which has an annual runoff of about 320 MCM can be considered as one of the promising potential water resources for new development.

Aside from the above mentioned, the government ever considered several trans basin schemes including trans-basin diversion from the Chalus river, from the Do-hezar river and from the Sardab river, all of them emptying in to the Caspian Sea to the Capital Tehran area via the Taleghan river.

However, all of these schemes are not feasible due either to long diversion tunnel resulting in high cost against the developed amount or to unstable intake of water because of possible freezing of water due to high altitude of the intake site which is located at about 2,500m MSL.

In addition to the above surface water, the study to utilize ground water resources and reutilization of the treated wastewater shall be conducted well.

#### 1.4.4 Water Resources Development Concept and Water Management Plan

##### 1.4.4.1 Water Resources Development Concept

As the major water resources existing in the vicinity areas of the Capital Tehran such as the Karaj, Jajrud, and Lar river basins have almost been developed to the maximum, new water resources development in future could rely only on the Taleghan and Alamut river basins.

The potential amount of water could be developed for use is about 450 MCM for the Taleghan river basins and about 200 MCM for the Alamut river basin. Particularly for the Taleghan river basin, the feasibility study on the Taleghan Multipurpose Water Development Project had been carried out in 1967 based on which the stage I project including construction of Sangban diversion dam, Taleghan tunnel and Ziaran diversion dam was completed in 1974 for supply of the Ghazvin plain. Therefore, by proper utilization of these existing facilities in addition to the construction of the Taleghan dam, supply of water to relieve urgent demand in the Capital Tehran area could be efficiently achieved in the shortest time.

Accordingly, it is rather promising if construction of the Taleghan dam can be pushed ahead and the regulated flow can be diverted to the Ziaran river via the Taleghan tunnel and further to the Karaj area by conveyance pipeline which is currently under construction. The conveyed water from the Taleghan dam merged

with the excess water from the Karaj dam can be further delivered to the Capital Tehran area.

For the Almut river basin, a storage dam can be constructed at the downstream reach from which a diversion tunnel can be constructed in order to convey the stored water to the Ghazvin plain via Taleghan river. By this arrangement, the irrigation water currently supplied from the Sanghan diversion dam can be shifted to the Capital Tehran area for use of the urban area. If the diversion of the Taleghan water is defined as the 1st stage water resources development project for the Capital Tehran area, development of the Almut river water resources will be the 2nd stage project. This however is only a conceptual idea, more concrete development plan of the Almut river basin shall be proposed after careful study conducted in the future.

#### 1.4.4.2 Water Resources Management Plan

In order to effectively and properly utilize the limited amount of water resources, correct assessment of the surface and ground water potential together with smooth operation of the major water use facilities such as dam and intake etc are the most important. However, strengthening water operation and management system including provision of meteorological and hydrological observation stations and other water management facilities shall be required.

Meantime, in the northern Ghazvin plain, irrigation for the farm land has been practiced by the water from wells and Taleghan canal. In 1970, there were about 600 deep wells under operation. (Average depth 160 m and annual yield 300 MCN). However many of them had been decrepit and not functioning well. Therefore, in parallel to shifting of the Taleghan water to the Capital Tehran area, improvement and rehabilitation of these deep wells shall be carried out in order to stabilize irrigation water supply to the Ghazvin area. Furthermore, for prevention of over drawing of the ground water proper watching and monitoring in the extensive area are also necessary.

#### 1.4.5 Outline of the Project

In view of the above consideration, it is proposed that the feasibility study on the water utilization and management plan in the western area of the Capital Tehran and the Ghazvin plain, the facility plan of the Taleghan and Almut dams and water diversion facilities and the water resources management system and rehabilitation plan shall be carried out as soon as possible. The proposed study consists of the following four major components.

##### (1) Water Utilization and Management Plan for the Western Area of the Capital Tehran and Ghazvin Plain

This study intends to review and establish proper water utilization and allocation plan among the water users in the western area of the Capital Tehran and Ghazvin plain in order to satisfy the growing demands of water in the capital area. The study shall



cover at least the following items which shall be conducted based on the available data and information provided by TRWB.

- Review of the existing water resources development and utilization plans.
- Assessment of surface and ground water resources potential in the relevant river basins area.
- Assessment of the domestic and industrial water demand for the Capital Tehran area and the Karaj and Ghazvin plains together with their future projection.
- Assessment of the available amount of water to be newly developed.
- Water balance study for the overall project area.
- Preparation of water utilization and management plan covering the whole project area.

## (2) Complementary Study on the Taleghan Dam Plan

Construction of the Taleghan dam was originally proposed in 1967 as the stage III project of the Taleghan Multipurpose Water Development Project because the agricultural water use in the Ghazvin plain at the initial stage of the development might be rather limited. As supply of water to the Capital Tehran area becomes more urgent and water resources development and utilization must be maximized, the original dam operation and dimensions were further revised to cope with the current requirement and based on this revision, the construction design of the dam was prepared. Due to some complexity of the dam geology involved, the construction design should be reviewed.

## (3) Preparation of Water Resources Management Plan and Existing Project Facility Rehabilitation Plan.

In order to achieve effective and efficient utilization of the limited water resources, strengthening water operation and management together with introduction of proper monitoring system will be necessary following the establishment of proper water allocation plan. This however, shall be carried out in parallel with the rehabilitation of the existing project facilities. Major work items to be carried out under this component covers the following.

- Conducting inventory survey on the existing project facilities including among others the existing irrigation wells in the northern Ghazvin area.
- Study and propose to introduce surface and ground water monitoring system.
- Study and propose water management and control system.
- Propose rehabilitation plan for the existing water use facilities.
- Propose establishment and strengthening for water management system.
- Establishment of water users' cooperatives and provision of training program.
- Conduct cost recovery study and prepare water fee collection plan.

#### (4) Formulation of the Basic Plan For the Alarnut River Water Diversion Scheme.

As the 2nd stage project of the water resources development for the Capital Tehran area, the water diversion scheme from the Alarnut river to the Ghazvin plain shall be conducted on the master plan level in parallel with the Taleghan water diversion plan. Major study items under this component will include the following :

- Conduct hydrological analysis of th river.
- Study on the proposed water demand in the northern Ghazvin plain.
- Conduct topo-survey.
- Study on the proposed project components, facility plan and cost estimate.
- Prepare preliminary project implementation plan.
- Conduct initial environment examination.
- Conduct project evaluation.

#### 1.4.6 Priority of the Project

The Capital Tehran is the political, commercial and economic center of the country wherein about one fifth of the country's total population are living at present. Shortage of water supply in the capital area has brought about not only difficulties to the city dwellers but also constraints in various economic activities. In view of such urgency of the problem, the government intends to divert available water from the only possible source of the Taleghan river to relieve the water use difficulty in the water shortage stricken capital area and started construction of the diversion pipeline. On the other hand recent development of agricultural activities in Ghazvin plain have caused serious shortage of water for irrigation.

The proposed study is therefore, sharing the highest priority in terms of early completion of the water diversion scheme for the Capital Tehran area and Ghazvin plain.

#### 1.4.7 Program Objectives

The proposed study is aimed to provide rational and practical water allocation plan to support the proposed water diversion scheme from the Taleghan river to the western area of the Capital Tehran and Ghazvin plain, to examine and suggest the facility layout and design plan to available water diversion, to confirm possibility of further development of water resources in the surrounding river basins and to draw-up water management, monitoring and rehabilitation plan for the existing and newly constructed project facilities in order to facilitate future operation and management.

#### 1.4.8 Prospective Beneficiaries

Diversion of water to the Capital Tehran area can provide urban dwellers with more sustainable supply of water while study on the development potential of the nearby river basins can lead to develop irrigated agriculture in those areas where current supply of water will be shifted to the capital area in further future.

#### 1.4.9 Desired or Scheduled Commencement of the Study

The study which is consisting of four major components is expected to take about 18 month to complete. As supply of water from the Taleghan river is urgently required, the study shall be commenced the soonest possible.

#### 1.4.10 Expected Funding Source

Due to budgetary constraint of the government of the Islamic Republic of Iran it is expected that the study shall be carried out by the assistance of JICA of Japan through technical cooperation program agreed by both governments.

## 2. Terms of Reference for the Proposed Study

### 2.1 Objectives and Necessity of the Study

#### 2.1.1 Objectives

The objectives of study is to prepare a rational and practical water allocation plan for effective and efficient utilization of the limited water resources to support the proposed water diversion scheme from the Taleghan river to the western area of the Capital Tehran and Ghazvin plain, to examine and suggest the facility layout and design plan to avail water diversion, to conduct master plan study on the water diversion plan from the Almut river to the northern Ghazvin plain and to draw-up water management, monitoring and rehabilitation plan for the existing and newly constructed project facilities so as to facilitate future operation and management...

#### 2.1.2 Necessity of the Study

Since water resources development potential of the river basins surrounding the Capital Tehran area has almost been utilized to the maximum extend so that development of new water resources to cope with increasing demand of water in the capital area shall rely on the other river basins having possibility of supply. To divert current excess flow in the Taleghan river to the Capital Tehran area and Ghazvin plain via Sangban diversion dam and Taleghan tunnel has been considered as one of the most promising plan for this purpose. However such a diversion plan will affect present water use in the Ghazvin area as well as the irrigation water use in the downstream of the existing Sangban diversion dam.

Moreover, as water supply potential is rather limited and increase in water demand is still continued and rather substantial, more comprehensive study on the water resources potential in the Capital Tehran and surrounding areas and preparation of water allocation and utilization plan conformable to future medium and long term demands in these areas shall be necessary in order to assure sustainability of water supply to the Capital and surrounding areas.

Diversion of water from the Taleghan river via existing Sangban diversion dam and Taleghan tunnel to the Capital Tehran area requires careful revision of new reservoir dam design based on the geotechnical conditions of the dam site which is the prerequisite for proper justification of current construction of the diversion pipeline.

In parallel to the diversion of Taleghan water to the western area of the Capital Tehran, study for development of the Almut river water resources shall be conducted and current deep well utilization status in the north Ghazvin plain shall be investigated so that the agricultural water management in the Ghazvin area can be promoted to the best conditions.

In view of the above mentioned, the captioned study is necessary and be conducted at soonest in order to relieve the water shortage problem of the Capital and surrounding area as well as Ghazvin plain.

## 2.2 Necessity and Justification of Japanese Technical Cooperation

Japan International Cooperation Agency has implemented many water resources development and supply projects for the capital and major urban areas in various countries wherein the water demand is increasing rapidly and water supply potential is rather limited. Such an experience will be the most applicable to the Capital Tehran area.

Furthermore, the Japanese Government has many information and data relevant to water demand and supply potential in the Capital Tehran and Ghazvin region through past undertaking of the study on the Taleghan multi-purpose water development project in 1967. Since the proposed water diversion scheme has been formulated based on the concept of the Taleghan river water development, the project information and data used in the former study are very useful and important for the forthcoming study.

It is therefore necessary and justifiable for the Government of Iran to request for JICA's assistance in conducting the captioned study through technical cooperation by the Japanese Government.

## 2.3 Study Area

The study area covers the western area of the Capital Tehran, Ghazvin plain and the Taleghan and Alamut river basins.

## 2.4 Scope of the Study

The scope of the study will consist of the study on the water utilization and management plan in the western area of the Capital Tehran and the Ghazvin plain, the facility plan of the Taleghan and Alamut dams and water diversion facilities and the water resources management system and rehabilitation plan of the existing and newly constructed project facilities. The detailed scope of the study can be described in four major components as follows :

### (1) Water Utilization and Management Plan for the Western Area of the Capital Tehran and Ghazvin Plain

#### a) Collection and Review of Data and Information including :

- Existing water resources development and utilization plans
- Potential surface water resources
- Potential ground water resources
- Population growth and distribution
- Urban and industrial development

- Agricultural policy and development plan
- b) Estimate and Projection of Water Demand in the Study Area including :

- Estimate and projection of urban and industrial water demand
- Estimate and projection of irrigation water demand

- c) Water Balance and Allocation Plan, including :

- Existing and proposed water development
- Total available amount of water by development
- Water balance study
- Water allocation plan based on the result of water balance study
- Other replacement compensation plans of water use

## **(2) Complementary Study of the Taleghan Dam Design**

- a) Collection of Data and Information Required for the Facility Plan, including :

- Reviewing existing Taleghan dam design
- Geological survey data at the dam site
- Other engineering data and information such as supply of construction materials

- b) Preparation of Implementation Program Including construction method and disbursement schedule.

- c) Conducting environmental impact assessment and preparation of impact mitigation plan if necessary.

## **(3) Preparation of Water Resources Management Plan and Existing Project Facility Rehabilitation Plan.**

- a) Conducting Inventory survey on the existing project facilities including existing irrigation wells in the northern Ghazvin area.
- b) Study and Propose Surface and Ground Water Monitoring and Control System Plan.
- c) Study and Propose Data Management Plan.
- d) Study and Propose Water Management Institution Plan.
- e) Study and Propose Water Users' Training Plan.
- f) Study and Propose Water Management Facilities and Equipment Plan.
- g) Propose Rehabilitation Plan for the Existing Water Use Facilities.
- h) Conduct Cost Recovery Study and Prepare Water Fee Collection Plan.
- i) Preparation of Implementation Program.

#### (4) Formulation of the Basic Plan for the Alamut River Water Diversion Scheme.

##### a) Conducting data Collection and Analysis, including :

- Hydrological and meteorological data collection and analysis of the Alamut river;
- Topographic information of the river and along the diversion route; and
- Study and analysis of water demand in the northern Ghazvin plain.

##### b) Conducting Project Facilities Study on Master Plan Level, including :

- Dam construction plan;
- Water diversion facility plan;
- Cost estimate of the project facilities; and
- Conduct initial environment examination on the proposed facility plan.

##### c) Preparation of Preliminary Project Implementation Plan, including :

- Project implementation plan; and
- Project evaluation.

#### 2.5 Study Schedule

The proposed study will be carried out in 18-months period in accordance with the preliminary work schedule as shown in the attached bar chart.

#### 2.6 Reports

The following reports will be prepared during the course of study:

- Inception report
- Progress report
- Interim report
- Draft final report
- Final report

### 3. Undertakings of the Government of the Islamic Republic of Iran

#### 3.1 Necessary Measures to be Undertaken by the Government of the Islamic Republic of Iran

In order to facilitate smooth implementation of the study, the Government of the Islamic Republic of Iran shall take the following necessary measures.

- (1) To secure safety of the Study Team in Iran
- (2) To permit the members of the Study Team to enter, leave and sojourn in Iran for the duration of their assignment therein and exempt them from foreign registration requirements and consular fees
- (3) To exempt the member of the Study Team from taxes, duties, fees and any charges on equipment, machinery and other materials brought into Iran for conduct of the Study
- (4) To exempt the members of the Study Team from income tax and charges of any kind of levies imposed on or in connection with any emoluments or allowance paid to the members of the Study Team for their services in connection with implementation of the Study
- (5) To provide necessary facilities to the Study Team for remittances as well as utilization of the funds introduced into Iran from Japan in connection with implementation of the Study
- (6) To secure permission for entry into private properties or restricted areas for implementation of the study
- (7) To secure permission for the Study Team to take all data and documents (including photographs and maps) related to the Study out of Iran to Japan
- (8) To provide medical services as needed. However, the expenses will be chargeable on the members of the Study Team

#### 3.2 Liability

The Government of the Islamic Republic of the Iran shall bear claims, if any arises, against the members of the 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 members of the Study Team.

#### 3.3 Counterpart

The Tehran Regional Water Board shall act as the counterpart agency to the Study Team and also as the coordinating body in relation with other governmental and non-governmental organizations concerned for smooth implementation of the Study.



### 3.4 Obligations of Counterpart Agency

The Tehran Regional Water Board in cooperation with the other organizations concerned shall provide, by its own expenses, the Study Team with the following services :

- (1) Available data and information related to the Study;
- (2) Necessary number of counterpart personnel;
- (3) Suitable office space with necessary office equipment in Tehran and project site; and
- (4) Credentials or identification cards.

#### 4. Undertaking of JICA

For implementation of the Study, JICA shall take the following measures :

- (1) To dispatch with its own expenses, the Study Team to Iran
- (2) To pursue technological transfer to the Iranian counterpart personnel during the course of the Study
- (3) To recruit with its own expenses, number of local consultants in various fields to assist the study Team in conducting the Study
- (4) To conduct topographical and geological survey at the proposed dam site
- (5) Other field expenses required for conducting the Study such as hiring cost for the vehicles and laborers, cost for data printing and purchasing and telecommunication costs etc.

## 5. Consultation






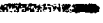
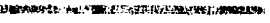
JICA and the Tehran Regional Water Board shall consult with each other with respect to any matter that may arise from or in connection with the study.

The Government of the Islamic Republic of Iran assured that the matters referred in this form will be ensured for a smooth conduct of the Development Study by the Japanese Study Team.

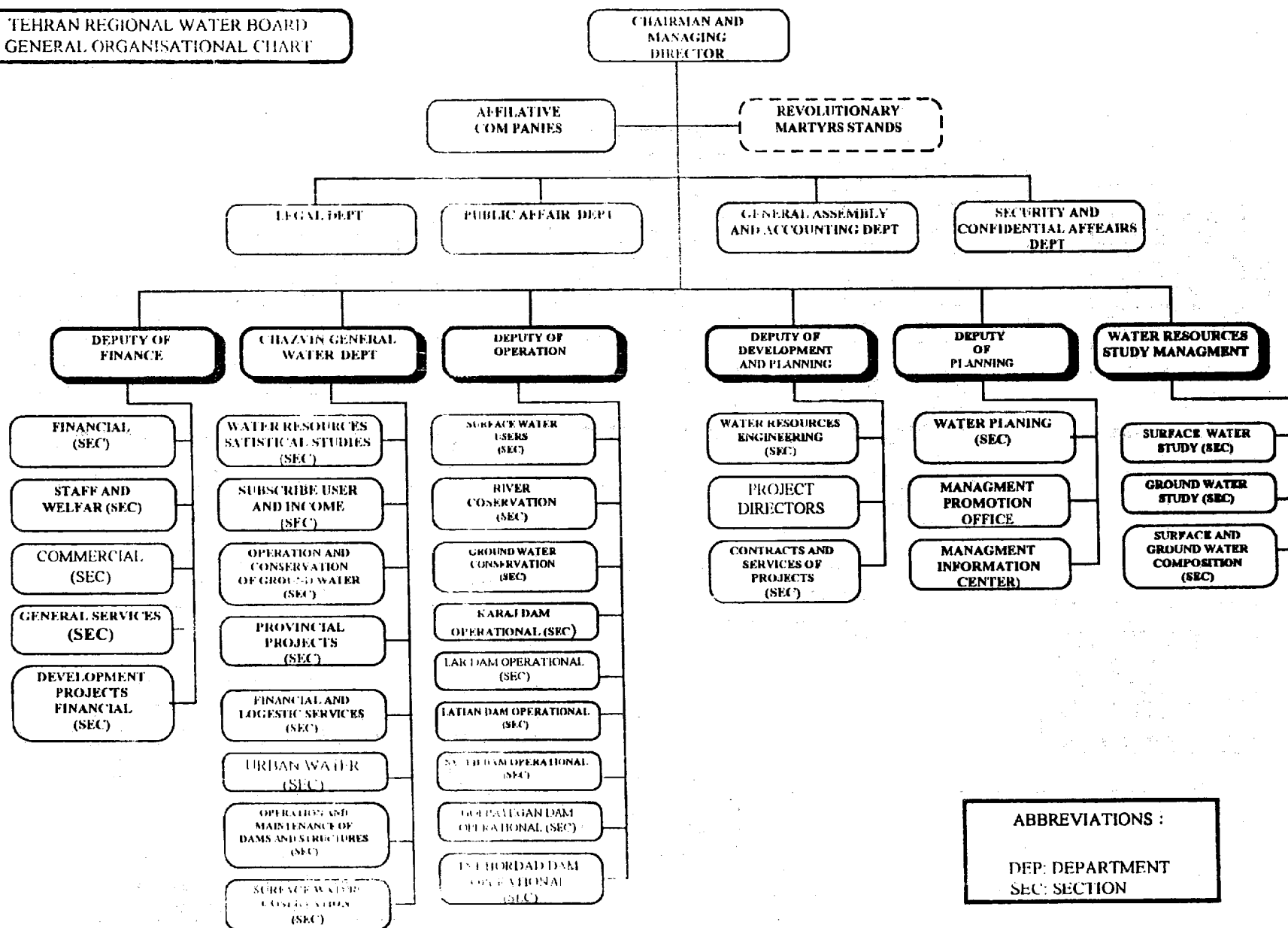
Rassul Zargar  
Deputy Minister of Energy  
on behalf of the Government of  
Islamic Republic of Iran

Date :

## PROPOSED STUDY SCHEDULE

WORK ITEMS	FIRST YEAR		SECOND YEAR	
	May - Oct	Nov - Apr	May - Oct	Nov - Apr
1. Water Utilization & Management Plan				
2. Complementary Study of the Taleghan Dam Design				
3. Preparation of Water Management Plan & Facility Rehabilitation Plan				
4. Basic Plan for Alamut River Water Diversion Scheme				

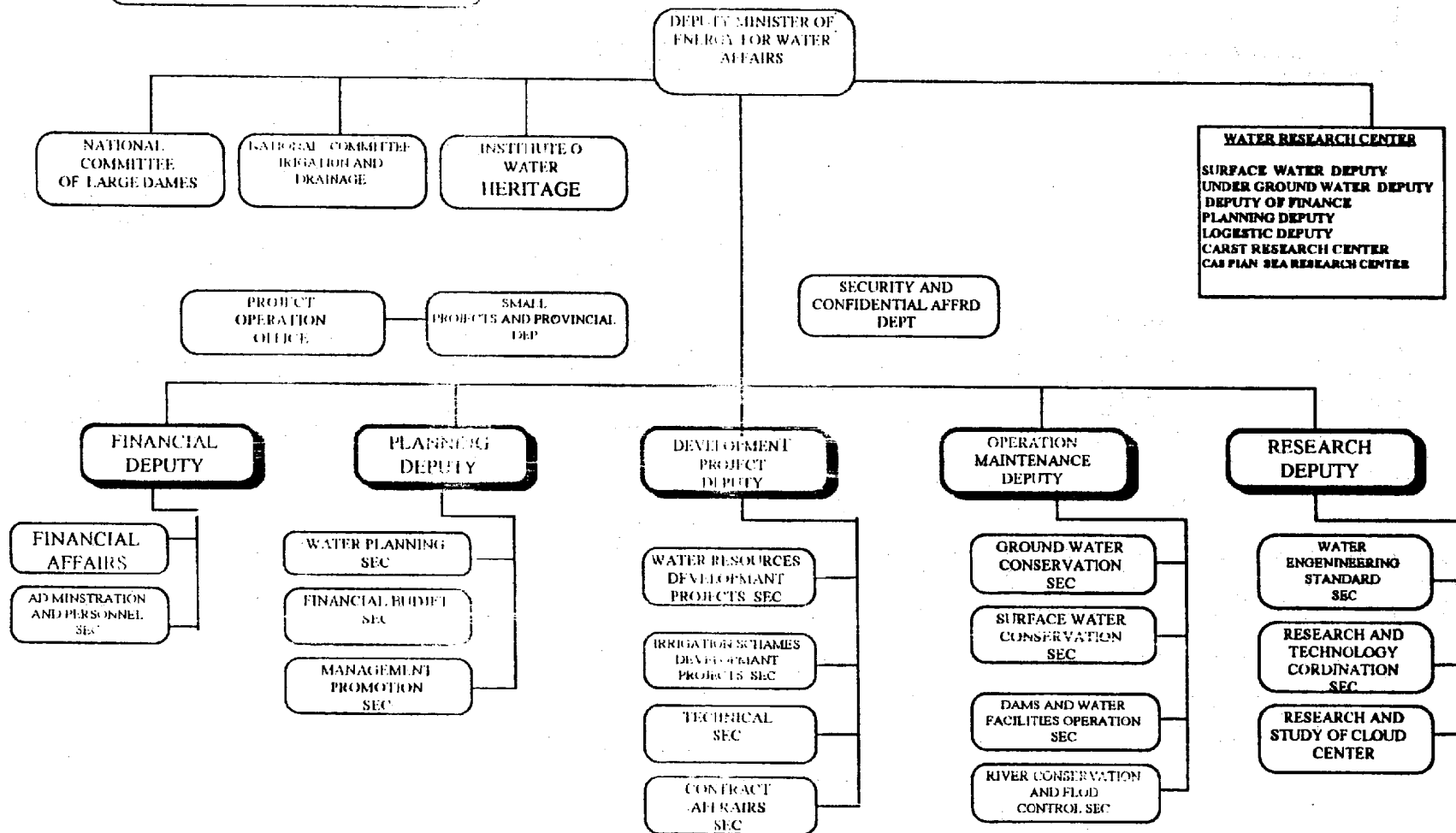
**TEHRAN REGIONAL WATER BOARD  
GENERAL ORGANISATIONAL CHART**

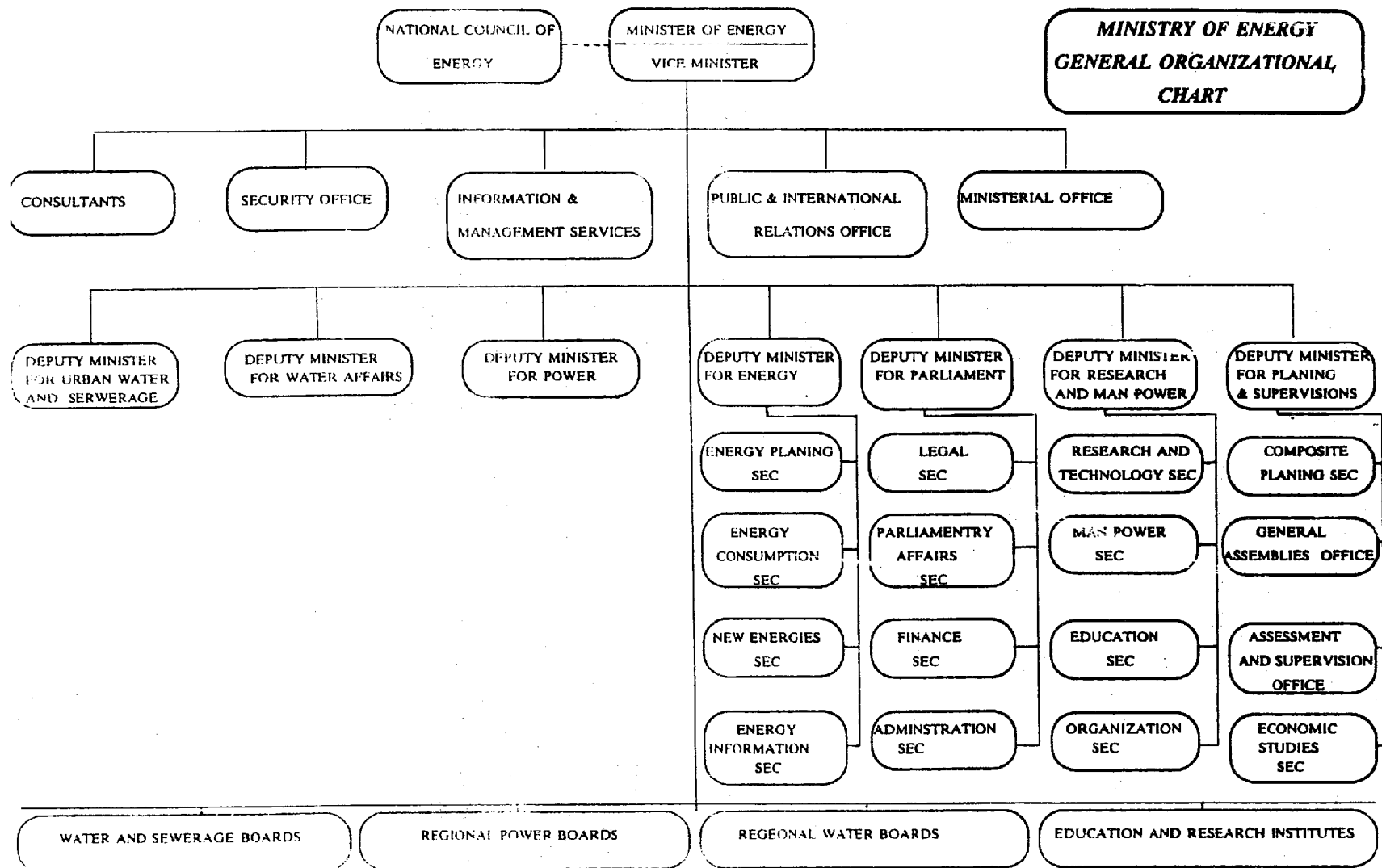


**ABBREVIATIONS :**

DEP: DEPARTMENT  
SEC: SECTION

# **WATER AFFAIRS ORGANIZATIONAL CHART**

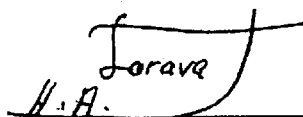




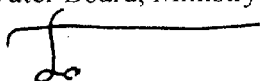
SCOPE OF WORK  
FOR  
THE STUDY  
ON  
WATER MANAGEMENT  
IN  
THE WESTERN AREA OF THE CAPITAL TEHRAN  
IN  
THE ISLAMIC REPUBLIC OF IRAN

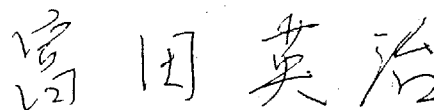
AGREED UPON BETWEEN  
MINISTRY OF ENERGY  
AND  
JAPAN INTERNATIONAL COOPERATION AGENCY

Tehran, 22 December, 1999

  
H.A.

Mr. Hossein Ali TARA VAT  
Managing Director of Tehran Regional  
Water Board, Ministry of Energy



  
Eiji

Mr. Eiji TOMIDA  
Team Leader,  
Preparatory Study Team  
Japan International Cooperation Agency  
(JICA)



## I. INTRODUCTION

In response to the request of the Government of the Islamic Republic of Iran (hereinafter referred to as "the Government of Iran"), the Government of Japan has decided to conduct the study on water management in the western area of the Capital Tehran in the Islamic Republic of Iran (hereinafter referred to as "the Study") in accordance with relevant laws and regulations in force in Japan.

Accordingly, the Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for official implementation of technical cooperation programs of the Government of Japan, will undertake the Study in close cooperation with the authorities concerned of the Ministry of Energy, Tehran Regional Water Board (hereinafter referred to as "TRWB").

The present document sets forth the scope of work with regard to the Study.

## II. OBJECTIVES OF THE STUDY

The objectives of the Study are:

1. To prepare a rational and practical water management plan for effective and efficient utilization of the limited water resources,
2. To carry out technology transfer to the counterpart personnel in the course of the Study.

## III. STUDY AREA

The study area shall cover the western area of the Capital Tehran, Taleghan and Alamut river basin and the Ghazvin plain.



#### IV. SCOPE OF THE STUDY

In order to achieve the above objectives, the Study will cover the following items:

##### Phase I. Basic Survey

1. Collection and review of existing data and information
  - (1) Natural Conditions
  - (2) Existing water resources development and utilization plans
  - (3) Potential water resources (surface and ground)
  - (4) Population growth and distribution
  - (5) Urban, agricultural and industrial development
  - (6) Basic Maps
  - (7) Existing laws, regulations technical standards related to Water Resource Development
  - (8) Environmental aspects
  - (9) Other data/information related to the Study
2. Field Survey
  - (1) Topography and geology
  - (2) Present condition of river basins
  - (3) Present situation of water utilization
  - (4) Present condition of water supply facilities
  - (5) Land use
  - (6) Socio-economic conditions
  - (7) Other surveys related to the Study

##### Phase II. Water Management Plan

1. Confirmation of Socio-economical framework
2. Estimate and Projection of water Demand in the Study Area (urban, agricultural and industrial)
3. Water Balance and Allocation Plan
  - (1) Existing and proposed water development
  - (2) Total available amount of water by development
  - (3) Water balance study
  - (4) Water allocation plan based on the result of water balance study
  - (5) Other replacement/compensation plans of water use
4. Surface and ground water monitoring and control system plan
5. Water management facility and equipment plan
6. Initial environment examination (IEE)
7. Water management institution plan



## 8. Selection of priority project

### Phase III. Pre-Feasibility Study for Priority Project

1. Supplementary data collection and field study
2. Basic design for facility construction and rehabilitation
3. Cost estimate of the project facilities
4. Project implementation plan
5. Project evaluation
  - (1) Financial analysis
  - (2) Economic analysis
  - (3) Social analysis
6. Environmental Impact Assessment (EIA)

## V. SCHEDULE OF THE STUDY

The Study will be carried out in accordance with the attached tentative schedule as shown in Appendix.

## VI. REPORTS

JICA shall prepare and submit the following reports in English to TRWB.

### 1. Inception Report:

Twenty (20) copies at the commencement of the first work in Iran.

### 2. Interim Report:

Twenty (20) copies at the commencement of the second work in Iran.

### 3. Progress Report:

Twenty (20) copies at the end of the second work in Iran.

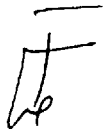
### 4. Draft Final Report:

Twenty (20) copies at the first of the third work in Iran.

TRWB shall submit its comments within one (1) month after the receipt of the Draft Final Report.

### 5. Final Report:

Twenty (20) copies within one (1) month after receipt of the comments on the Draft Final Report.



## VII. UNDERTAKINGS OF IRANIAN SIDE

1. To facilitate smooth implementation of the Study, the Government of Iran shall take necessary measures:
  - (1) To secure the safety of the Japanese Study Team,
  - (2) To permit the members of the Japanese Study Team to enter, leave and sojourn in Iran for the duration of their assignment therein, and exempt them from alien registration requirements and consular fees,
  - (3) To exempt the members of the Japanese Study Team from taxes, duties and any other charges on equipment, machinery and other materials brought into and out of Iran for the conduct of the Study,
  - (4) To exempt the members of the Japanese 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 Japanese Study Team for their services in connection with the implementation of the Study,
  - (5) To provide necessary facilities to the Japanese Study Team for remittance as well as utilization of funds introduced into Iran from Japan in connection with the implementation of the Study,
  - (6) To secure permission for entry into private properties for the implementation of the Study,
  - (7) To secure permission for the Japanese Study Team to take all data and documents related to the Study out of Iran to Japan, and
  - (8) To provide medical services as needed. Its expenses will be chargeable on the members of the Japanese Study Team.
2. The Government of Iran shall bear claims, if any arises, against the 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 members of the Japanese Study Team.
3. TRWB shall act as a counterpart agency to the Japanese Study Team and also as a



coordinating body in relation with other governmental and non-governmental organizations concerned for the smooth implementation of the Study.

4. TRWB shall, at its own expense, provide the Japanese Study Team with the followings, in cooperation with other organizations concerned:
- (1) Available data (including photographs and maps) and information related to the Study,
  - (2) Counterpart personnel,
  - (3) Suitable office space with necessary equipment and furniture, and
  - (4) Credentials or identification cards.

#### VIII. UNDERTAKINGS OF JAPANESE SIDE

For the implementation of the Study, JICA shall take the following measures:

1. To dispatch, at its own expense, the Japanese Study Team to Iran.
2. To pursue technology transfer to the Iranian counterpart personnel in the course of the Study.

#### IX. CONSULTATION

JICA and TRWB shall consult with each other in respect of any matter that may arise from or in connection with the Study.



TENTATIVE SCHEDULE

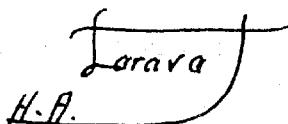
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Work in Iran																		
Work in Japan																		
Report																		

IC/R :Inception Report  
 IT/R :Interim Report  
 P/R :Progress Report  
 DF/R :Draft Final Report  
 F/R :Final Report

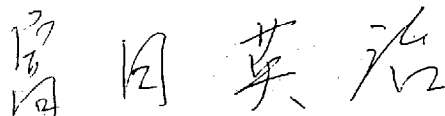
MINUTE OF MEETING  
FOR  
THE STUDY  
ON  
WATER MANAGEMENT  
IN  
THE WESTERN AREA OF THE CAPITAL TEHRAN  
IN  
THE ISLAMIC REPUBLIC OF IRAN

AGREED UPON BETWEEN  
MINISTRY OF ENERGY  
AND  
JAPAN INTERNATIONAL COOPERATION AGENCY

Tehran, 22 December, 1999

  
H.A.

Mr. Hossein Ali TARAVAT  
Managing Director of Tehran Regional  
Water Board, Ministry of Energy



Mr. Eiji TOMIDA  
Team Leader,  
Preparatory Study Team  
Japan International Cooperation Agency  
(JICA)

In response to the request of the Government of the Islamic Republic of Iran (hereinafter referred to as "the Government of Iran"), the Government of Japan has decided to conduct the study on water management in the western area of the Capital Tehran in the Islamic Republic of Iran (hereinafter referred to as "the Study") through the Japan International Cooperation Agency (hereinafter referred to as "JICA").

The Japanese Preparatory Team (hereinafter referred to as "the Team"), headed by Mr. Eiji TOMIDA, visited the Government of Iran and carried out field surveys of the study area and had a series of meetings with the Tehran Regional Water Board, Ministry of Energy (hereinafter referred to as "TRWB") and other authorities concerned of the Government of Iran from December 12th to December 22th, 1999. The list of attendants is shown in Annex.

The draft S/W (scope of work) proposed by the Team was discussed in detail between TRWB and the Team and both sides agreed to adopt the S/W with the following understandings.

## **I TARGET YEAR**

Both sides agreed that the target year for the Study would be set in the year 2021.

## **II SCOPE OF THE STUDY**

1. Both sides agreed to conduct the Pre-feasibility Study of which main part is Alamut River Water Diversion Scheme.
2. Both sides agreed to justify the necessity and the effectiveness of the Talegan dam construction in the Water Resources Management Plan on the basis of the existing study.
3. Both sides agreed to make use of experience and capability of local consultant in order to execute the Study smoothly.

## **III REPORTS**

As for the Final Report, both sides agreed to make it open to the public in accordance with the relevant laws and regulations in force in each country.

## **IV UNDERTAKING OF TRWB**

1. The Team requested that TRWB coordinate with other ministries and organizations concerned such as the Ministry of Agriculture, EIA Bureau, Water and Sewerage Board to get maximum cooperation from these organizations as well as to avoid any duplicated works. The Team also suggested to establish a steering committee to achieve the above mentioned coordination. TRWB agreed to this point and promised to set up the committee and invite representatives





from relevant ministries and organizations for the smooth implementation of the Study.

2. The Team requested that TRWB provide full and free access to the necessary data/documents for the implementation of the Study. TRWB accepted it.
3. The Team requested that TRWB provide the Team with the Greater Tehran Water Master Plan which is under preparation by TRWB as soon as it is completed. TRWB accepted it.
4. The Team requested that TRWB provide suitable office space in Tehran with necessary furniture and telephone. TRWB accepted it.  
Telecommunication fee in the office, however, will be paid by the Team.

## **V UNDERTAKING OF JICA**

1. TRWB requested counterpart training in Japan as many as possible and the Team replied to convey this request to JICA H.Q.
2. TRWB requested that JICA holds a seminar in Iran as a part of technology transfer in the course of the Study (at the time of the submission of the Draft Final Report) and the Team replied to convey the request to JICA H.Q.
3. TRWB requested that JICA would pay for necessary expenses for conducting the Study such as hiring cost for the vehicles, due to procurement limitation by Iranian regulation. The Team replied to convey this request to JICA H.Q.

## **VI OTHERS**

The Team explained JICA's Development Study Program and TRWB understood the Program.



## ANNEX

### LIST OF PARTICIPANT

#### (Iranian Side)

Ministry of Energy

Mr. Rassul ZARGAR

Deputy Minister for Water Affairs

TRWB (Tehran Regional Water Board, Ministry of Energy)

Mr. Hossein Ali TARAVAT

Managing Director

Mr. Shariya RAHMANI

Deputy Director for Construction Affairs

Mr. Ali Akbar SHAFIEI

Director of Talegan Dam Project

Mr. Mohammad Ali KESHAWARZ

Senior Expert

Mr. Mahmoud ASKARI

Senior Expert

Ministry of Foreign Affairs

Mr. Mesbah ANSARI

Japan Desk

#### (Japanese Side)

Embassy of Japan

Mr. Hiroshi AZUMA

Minister Counsellor

Mr. Jiro OKUYAMA

Counsellor

Mr. Masakazu FUJIKANE

Second Secretary

Preparatory Study Team

Mr. Eiji TOMIDA

Team Leader

Mr. Shinichi SHIBUYA

Water Resources Development

Mr. Sota SEKINE

Study Planning



## 2. 各分野の現状と課題

### 2-1 テヘラン首都圏における水資源について

1998年に検討された「テヘラン上水長期計画マスタープラン」によれば、テヘラン市、カラジ市、カズウイン市とこれらの周辺農地における2021年を目標年次とした水需要予測は以下の通りである。これらの数値については、現在TRWBにおいて詳細な検討が行われているところであるが、テヘラン及びその周辺部における人口は現在、約1,000万人に達していることから、粗用水原単位を300lit./dayと仮定したとすると、上水だけでも表流水・地下水合わせて約1,000MCMの水量が必要といえる。

水需要予測（2021年）					単位：MCM	
	面積 (km <sup>2</sup> )	都市工業	農業	新規開発	合計	人口（百万人）
テヘラン周辺部	12,000	2,214	4,427	3,127	6,641	1.5
カズウイン平野	4,000	168	5,109	3,820	5,277	1.4

なお、テヘラン市を中心とする首都圏は、北部をエルブールス山脈の急峻な斜面に遮られており、東部はジャジルド川をはじめとする起伏に富んだ溪谷が形成されている。さらに南部は気候条件の厳しい砂漠地帯が広がっているため、居住地区は西へ向かって展開する傾向にある。このような中、テヘラン市北西約30 kmに位置するカラジ市では、1986年には約28万人であった人口が1995年には約120万人まで急速に増加している。また、テヘラン西約70 kmに位置するハシュケでは、現在、テヘラン首都圏の中核となる新都市が建設中であり、今後もテヘラン西部地域が拡大・発展して行くであろう事は容易に予想される。

現在、テヘラン首都圏への給水は、主としてカラジ川（カラジダム）、ジャジルド川（ラティアンダム）、ラール川（ラールダム）及び地下水等に依存している。これら水圏からの給水量は各々以下の通りであるが、これは全体として計画給水量の35%にすぎない。また、現状においても約1,000MCMの水量が必要と推定されるのに対して、給水可能な水量はその60%に満たない。このため、新規の水源開発が切望されている。

テヘラン首都圏における上水の水の給水状況					単位：MCM	
計画給水量	カラジ川	ジャジルド川	ラール川	コルガン川	地下水等	合計
1,650	300	180	100	—	300	880

注) 計画給水量は2021年を目標年次とし、「テヘラン上水長期計画マスタープラン報告書」による。

以下、テヘラン首都圏周辺流域および隣接流域について水資源開発の現状と開発の可能性を展望することとする。

## 2-2 テヘラン首都圏周辺の水資源開発状況

### 2-2-1 テヘラン東部地域における水資源開発の概況

テヘラン東部地域には、ジャジールド川流域、ラール・ハラズ川流域等があり、テヘラン首都圏の標高の高い地域に給水を行っている。

テヘラン首都圏東部地域における水資源開発は、以下に示すとおり、すでに限界に達しているものと考えられ、これらの水系とは別の流域で新規に水資源を開発するとともに、既存施設の運用合理化を検討していく必要がある。

#### (1) ジャジールド川流域

ジャジールド川はテヘラン北東部に源流を持ち、テヘラン東方 10~30km を南に流下しワラミン平野に流入する。ラティアンダム地点における年間流量は約 300MCM であるが、テヘランへは約 250MCM を導水しており、ワラミン平野における農業用水としての利用を考慮すると水資源は極めて逼迫しているものとする。

#### (2) ラール・ハラズ川流域

ラール川はエスブルース山脈の最高峰であるダマヴァンド山南斜面を主水源として、ヤジールド川流域に隣接して東流し、ラールダム約 15 km 下流でハラズ川と合流してカスピ海に流入する。ラールダムは 1979 年に貯水を開始したが、漏水が著しく、当初の計画通りの貯水池運用ができていないが、流域変更によりジャジールド川のラティアンダムを経て、テヘランへは年間約 100MCM の導水を行っている。現在、貯水池効率の改善のための検討ならびに事業の実施が行われており、ラティアンダムを経由せずに直接テヘランに導水する水路の建設と、ラールダム地点での取水時数高以下の貯水を揚水する施設を建設中である。

### 2-2-2 テヘラン西部地域における水資源開発の概況

テヘラン西部地域においては、カラジ川流域ならびにタレガン川流域において水資源開発が行われており、これら用水は、カラジ平野、カズウイン平野における灌漑用水、ならびにテヘラン首都圏の標高の低い地域の都市用水として利用されている。

テヘラン西部地域では、タレガン川流域において多目的ダム計画があるなど、今後のテヘラン首都圏域への水供給のための開発可能性の高い地域といえる。

## 2-3 テヘラン西部地域における水資源開発について

### 2-3-1 カラジ川流域における水資源開発について

カラジ川はテヘラン北方に源を発し、テヘラン北西を大きく迂回しながらカラジ市東を南流してクム塩湖に流入している。カラジ川の年間平均総流出量は 472MCM であり、1961 年にはカラジダム（ダム高 180m、アーチダム）が建設され、テヘラン都市圏への上水として年間 340MCM を、カラジ平野への農業用水として年間 130MCM を供給している。また、カラジダムでは年間 150 百万 kwh の発電も行われている。

なお、昨今カラジ平野南部においては、地下水位の低下が深刻化しており、カラジ川流域における水資源開発は限界に達しているものと判断される。

### 2-3-2 タレガン川流域における水資源開発について

タレガン川はカラジ川流域の西北部を水源とし、アラムクー山などの南斜面の融雪水を集めてタレガン渓谷を北西へ流れ、アラムート川と合流し、シャルード川、さらにはセフィールド川となってカスピ海に流入する。

現在、1970年代に完成したサングバン、ジアラン両取水堰とこれを結ぶタレガントンネルにより、カズウィン平野に年間約250MCMの灌漑用水を供給している。一方、タレガン川の水資源開発の第二期事業として位置づけられていたタレガン多目的水開発プロジェクトでは、タレガン川本川にダムを建設して、最終的に約450MCMの灌漑用水をカズウィン平野に供給する計画であった。しかし、テヘラン首都圏で水需要が逼迫している現状から、灌漑用水の一部をテヘラン首都圏の都市用水に振り向けることとし、すでにジアラン取水堰の上流に貯水池の建設を進めるとともに、この貯水池からテヘラン首都圏へ導水する導水路（管路）の建設に着手している。

また、タレガンダム本体については、イラン国政府によりフィージビリティ調査が行われ、現在、建設に向けて入札の準備が行われているところである。

タレガンダムの開発可能水量は約450MCMであり、このうち約200MCMをテヘラン首都圏へ安定的に給水することが可能と考えられている。

タレガンダムにより開発された水は、既設のタレガントンネルを利用してジアラン川へ導水し、さらに導水パイプラインによりカラジダム余剰水とともにタレガンダムから転換可能な水量をテヘラン首都圏へ導水する事としており、既存施設を有機的に活用できるという点からも、タレガン川流域におけるプロジェクトは極めて有効なものであり、テヘラン首都圏域へ用水を供給する事業としてもっともプライオリティーが高いプロジェクトといえる。

### 2-3-3 アラムート川流域における水資源開発の可能性について

「テヘラン上水長期マスタープラン」によれば、2021年を目標年次とした水需要に対しては、タレガンダムによる水資源開発のみではその需要に対応することができず、その不足分に対応する水供給施設の建設が必要とされており、タレガン川流域の北方のアラムート川流域における水資源開発が位置づけられている。

タレガン川の下流でシャルド川に合流する右支川アラムート川は、年間流量が約320MCMであることから、新規水源開発の可能性が大いに期待されている。TRWBでは、アラムート川流域における水資源開発施設の建設について机上における検討を実施している。この検討によれば、アラムート川下流にダムを建設し、導水トンネルによりダムからシャルド川を経由してガズウィン平野へ導水する案があげられている。この導水により、タレガンダムからの灌漑用水をさらにテヘラン首都圏への上工水に転換することが期待されており、アラムート川流域における水資源開発は、テヘラン首都圏供給のためのタレガンダム計画に次ぐプロジェクトと言える。

「テヘラン上水長期マスタープラン」は極めて一般的な検討であることから、今後は様々な代替案も含めた詳細な検討が必要である。また、検討に当たっては、現地の地形・地質等の条件にかかる調査・検討は言うまでもないが、アラムート川における水資源開発施設の建設適地は、導水先であるガズウィン平野の標高と同程度のところにあり、施設計画の検討に当たっては、導水の可能性についての十分な検討が必要である。

### 2-3-4 その他流域における水資源開発について

タレガン川、アラムート川以外にもイラン政府は過去にチャールス水系、サルダブ水系、ドヘザロ水系などから流域変更によりタレガン川水系を経由してテヘランへ導水する計画を検討しているが、導水路延長が長く開発水量に対して建設費がかさむことや取水地点の標高が概ね2,500mと極めて高く氷結により安定取水が困難であることなどの理由により計画を見合わせ

ている。

なお、その他、表流水ばかりでなく地下水や污水处理後の再利用水についても利用の可能性を検討する必要があるものと考えられる。

### 2-3-5 カズウィン平野における水管理について

カズウィン平野における灌漑は、1970年代に完成したサングバン、ジアラン量取水堰により、タレガン川より年間約250MCMの用水が灌漑されているほか、1970年代後半に建設された約600本の深井戸（平均深度160m、年間300MCM）からの取水によりまかなわれている。

カズウィン平野には約60,000haの農地があるものの、灌漑用水の不足により、もっとも状況の厳しい夏期においては10,000haの農地にしか灌漑ができない状況にあるといわれている。

また、カズウィン平野では、井戸が老朽化し、機能が低下するとともに、地下水の低下が進行している。

このため、地下水涵養のために、8つの地下水供給施設（地下浸透池；各地下水供給施設あたり4～5の浸透池から構成される）が設置され、地下水の涵養に努めているところであるが、地下水位の低下の問題は解消しておらず、今後、地下水資源の枯渇を防止するために、カズウィン平野における地下水涵養機構の解明を進め、さらに有効な手法による地下水涵養や、過剰な地下水の汲み上げが発生しないよう、地下水利用の規制や、広域にわたる地下水状況の監視など、地下水の水資源管理を強化していくことが必要と考えられる。

今後、タレガンダム開発水等をテヘラン首都圏へ円滑に送水していくためにも、カズウィン平野の灌漑用水の確保は喫緊の課題であるといえる。

### 2-4 まとめ

テヘラン周辺の主要な水源であるカラジ、ジャジルード、ラール・ハラズ流域における新規水開発はすでに限界に近づいており、今後、期待できるのはテヘラン西部地域に存するタレガン、アラムート川流域における水資源開発である。

テヘラン西部地域における水資源開発の可能性を考えた場合、当面、タレガンダム建設が喫緊の課題であるが、さらなる水資源の開発・有効活用のために、アラムート川流域における水資源開発、ならびにカズウィン平野における水資源の保全と管理が重要である。

またあわせて、限られた水資源を有効かつ適正に活用するためには、表流水、地下水資源の賦存量の把握、ダム等基幹水利施設の円滑な運用が重要である。しかし、ダムなど基幹水利施設の運営・管理は管理・観測施設の不備や技術者の不足などから極めて不満足な状況にある。このため、気象・水文観測所を含めた水管理システムの導入と管理体制の強化が急務となっている。