(4) ステアリングコミティミーティング（概略設計調査時）

MINUTES OF MEETING
ON
STEERING COMMITTEE MEETING
OF
THE PREPARATORY SURVEY (BASIC DESIGN)
ON
THE ULAANBAATAR WATER SUPPLY DEVELOPMENT PROJECT
IN
GACHUURT IN MONGOLIA

ULAANBAATAR, October 14, 2009

Mr. B. MUNKHBAATAR
Vice Mayor
Municipality of Ulaanbaatar

for 石井 昌樹 Masaki ISHII
Mr. Yoshiharu Matsumoto
Chief Engineer
JICA Survey Team

Mr. Ts. GANKHUU
UB City Chief Engineer and Director of
Engineering Utilities Department

Mr. B. PUREVJAV Msc
Director
Water Supply and Sewerage Authority of
Ulaanbaatar City

07. 10. 石井

I. General

The meeting for the presentation of the field Survey for the Preparatory Survey (Basic Design) on the Ulaanbaatar Water Supply Development Project in Gachuurt in Mongolia (hereinafter referred to as "the Survey") was held on October 14, 2009 at the Conference Hall, 2nd Floor of Puma Imperial Hotel, Sukhbaatar District, Ulaanbaatar, Mongolia.

The list of attendance is shown in the Attachment.

II. Discussions

First, Director of USUG Mr. B Purevjav Msc. Member of the Steering Committee, called the meeting to order.

Then, Mr. Yoshiharu Matsumoto, the Chief Engineer and Mr. Masaki Ishii, the Deputy Chief Engineer/Facility Designer1 of the Survey Team explained the contents of the presentation material on each expertise field for the Survey. The contents were accepted in principle by the Mongolian side.

In the meeting, the following confirmation and comments on the Survey were made:

1. **Solid waste management**

   The Mongolian side questioned whether the Survey will cover the contents about solid waste management.
   The Survey Team answered that the contents about solid waste management are out of scope.
   The Mongolian side understood.

2. **Water quality of water reserves**

   The Mongolian side questioned whether the water quality of water reserves on current condition is safety for intake.
   The Survey Team answered that the water reserves are designated as the water resource preservation area by Mongolian government, and the water quality is satisfactory.
   The Mongolian side understood.

3. **Water supply facility**

   1) **Drawing of transmission main pipe and collection pipe**

      The Mongolian side commented that the collection pipe and the transmission main pipe at the hillside slope in Gachuurt are seemed to be overlapped and hard to recognize the pipe lines.
      The Survey Team answered that those pipes shall be expressed intelligibly on the

09. 10. 14

drawing.

The Mongolian side understood.

2) **Water sterilization system**

The Mongolian side questioned whether there was any comment from administration of land affairs regarding the method of sterilization for extracted raw ground water on the stakeholder meeting.

The Survey Team answered that there was a comment to discontinue the chlorination equipment for water treatment furthermore and they consider the requirement of higher sterilization system such as ozone treatment or ultra violet treatment system.

The Mongolian side understood.

4. The amount of water supply and demand on this Survey

The Mongolian side questioned whether the amount of estimated water demand and proposed water supply in this Survey cover the whole amount including power plant or others of Ulaanbaatar City.

The Survey Team answered that this Survey investigates about the amount of water supply and demand of the area supplied by USUG, and contains not only drinking water but also industrial factories, public institutions, etc. The Study Team also answered that the water amount by another supplier or organizations is not grasped and it is out of scope.

The Mongolian side understood.

5. Others

The Mongolian side commented that the customs duty of imported materials or machinery from Japan or other countries shall be exempted from taxation, but the circulating materials in Mongolia such as oil under construction shall not be exempted.

The Mongolian side also commented that the customs clearance shall be conducted in Ulaanbaatar, not Zamin-uud.

The Study Team understood.

07. 12. 石井

THE PREPARATORY SURVEY (BASIC DESIGN) ON THE ULAANBAATAR WATER SUPPLY DEVELOPMENT PROJECT IN GACHUURT IN MONGOLIA

Steering Committee Meeting
Conference Hall, Puma Imperial Hotel, Sukhbaatar District, Ulaanbaatar, Mongolia
October 14, 2009 (11:00 AM-13:00 PM)

ATTENDANCE LIST

Name	Position	Dept. / Section
A. Members of the Steering Committee and Invited Officials		
Ts. Gankhuu	General Engineer of the Ulaanbaatar City and Director of Engineering Utilities Section	Ulaanbaatar City, Municipality
B. Purevjav Msc	Director of the Water Supply and Sewerage Authority	USUG, Water Supply and Sewerage Authority
B. Baatarkhuyag	Deputy Director of the Water Supply and Sewerage Authority, General Engineer	USUG, Water Supply and Sewerage Authority
P. Badamdorj	Head of department. Water Authority	The Water Authority
L. Dashdorj	Specialized Inception Agency of the Ulaanbaatar City	Specialized Inception Agency of the Ulaanbaatar City
Ts. Regzmaa	UB city, Municipality	Administration of the Ulaanbaatar city
Mr. Jargal	Engineer of the engineering structure	Administration of the Ulaanbaatar City
N. Bayaraa	Chief of the Water Supply office	USUG, Water Supply office
Sh. Ganzorig	Chief of the Industrial and Technology sector	USUG, Industrial and Technology sector
B. Bazargarid	Chief of the Monitoring and Appraisal sector	USUG, Monitoring and Appraisal sector
B. JICA Mongolian Office		
Ogura Toru	Project Formulation Adviser	JICA
E. Ankhtsetseg	Program Administrative Officer	JICA
C. JICA Sutudy Team		
Yoshiharu Matsumoto	Chief Engineer	JICA Survey Team
Masaki Ishii	Deputy Chief Engineer/Facility Designer 1	JICA Survey Team
Teruo Tahara	Groundwater Development Engineer	JICA Survey Team
Manabu Atsuchi	Water Supply Planner/Mechanical and Electrical Engineer	JICA Survey Team
Hideki Konno	Facility Designer 2/ Coordinator	JICA Survey Team
Bat-Amgalan	Translator	JICA Survey Team
Demuulen	Translator	JICA Survey Team

(5) ステアリングコミティミーティング（補足調査時）

GOVERNOR'S OFFICE
OF ULAANBAATAR MUNICIPALITY

15160 Baga toiruu 15,
Chingeltei duureg, Ulaanbaatar, MONGOLIA
Tel: (976-11) 31-53-47, Fax: (976-11) 32-94-02,
E-mail: UBGVRNR_WR_DV@mongolnet.mn

To: JICA Head
Quarters in Tokyo

Date 11.01.2010
Ref. 3/19

Subject: Mongolian Government Contribution to Ulaanbaatar Water Supply Development project

This is our great pleasure to be informed that project financing has been approved by Japanese government for improving water supply service of Ulaanbaatar city.

We, the Project Steering Committee, generally agree to your idea to implement part of construction work as our contribution, and after studying of your proposal, we are asking following changes for project contents:

1. Considering of cold climate of Ulaanbaatar and insufficient electricity supply, we prefer to construct bigger water reservoir with capacity of 6000m3 (instead of 1050m3) in order to avoid lack of water supply or freezing risk in the pipeline system.
2. All well field work including borehole construction will be done by Japanese financing part. Mongolian side will finance and construct water reservoir with capacity of 6000m3 including valve chambers at the reservoir as a contribution of Mongolian part.
3. All expenses financed by Mongolian side shall not exceed 5% of total amount of the Exchange of Notes.

In addition, we would like to guarantee that during construction period of the project we would finance the work on time and complete work in the same time as scheduled by Japanese side.

We looking forward to considering our suggestions and proceeding to the project implementation.

Copy to: JICA representative office in Ulaanbaatar

Sincerely yours,

Ts.Gankhuu,

Head of Engineering Facilities department
Municipality of Ulaanbaatar

(6) M/D（概略設計概要説明調査時）

MINUTES OF DISCUSSIONS
ON THE PREPARATORY SURVEY (BASIC DESIGN)
ON THE ULAANBAATAR WATER SUPPLY DEVELOPMENT PROJECT IN GACHUURT
IN MONGOLIA
(EXPLANATION ON DRAFT BASIC DESIGN STUDY REPORT)

In August 2009, the Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched the Preparatory Survey for the Basic Design on the Ulaanbaatar Water Supply Development Project in Gachuurt (hereinafter referred to as "the Project") to Mongolia and through discussion, field survey and technical examination of the results in Japan, JICA prepared a draft basic design study report (hereinafter referred to as "the Draft Report").

In order to explain and to consult with Mongolia on the components of the Draft Report, JICA sent the Draft Report Explanation Team (hereinafter referred to as "the Team"), which is headed by Yukio Ishida, Chief Representative, JICA Mongolia Office, from 22nd February to 26th February, 2010.

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

26th February, 2010

Yukio Ishida
Leader
Draft Report Explanation Team
Japan International Cooperation Agency
Japan

Bat-Erdene Jadamba
State Secretary
Finance and Investment Department
Ministry of Road, Transportation, Construction and Urban Development
Mongolia

Munkhbaatar Begzjav
Vice Mayor
Municipality of Ulaanbaatar
Mongolia

Khurenbaatar Baavgai
Director
Department of Development Financing and Cooperation
Ministry of Finance
Mongolia
(Witness)

Purevjav Bat-Ochir
Director
Water Supply and Sewerage Authority of Ulaanbaatar City (USUG) Co., Ltd.
Mongolia

ATTACHMENT

1. Components of the Draft Report

The Mongolian side agreed and accepted in principle the components of the Draft Report explained by the Team. The components of the Project are shown in **Annex-1.**

2. Japan's Grant Aid Scheme

The Mongolian side understood the Japan's Grant Aid Scheme and the necessary measures to be taken by the Government of Mongolia as explained by the Team and described in Annex-4, Annex-5 of the Minutes of Discussions signed by both sides on 7 August, 2009.

3. Schedule of the Study

JICA will complete the final report in accordance with the confirmed items and send it to the Government of Mongolia by April 2010.

4. Other Relevant Issues

The following issues were discussed and confirmed by both sides.

4-1) Project Cost Estimation

The team explained to the Mongolian side the Project Cost Estimation as described in **ANNEX-2.** Both sides agreed that the Project Cost Estimation should never be duplicated or released to any outside parties until signing of all the contract(s) for the Project.

The Mongolian side understood that the Project Cost Estimation is not final and subject to be modified.

4-2) Undertakings and Obligations of the Mongolian Side

In case that the Project would be approved by the government of Japan, the Mongolian side would execute the obligations in pace with the progress of the procurement of materials and equipment, in addition to the major undertakings described in Annex-5 of the Minutes of discussions signed by both sides on August 7, 2009. The list of the obligations is described in **ANNEX-3**. The Mongolian side explained that there would be technical issues to build the bridge by the Mongolian side because they have not enough experiences for construction of similar scale bridges by themselves. The Mongolian side requested Japanese side for some advises on designing and cost estimation of the bridge.

4-2-1) Budget Allocation Schedule

The budget for undertakings and obligations of the Mongolian side (hereinafter referred to as "the Undertakings and Obligations") would be approved and allocated in pace with the progress by Municipality of Ulaanbaatar. The budget for the fences and the electronic equipment would be allocated as the budget for Mongolian fiscal year which coincides with

the term 1 described in the implementation schedule in the Draft Report and the budget for the reservoir would be allocated as budget for Mongolian fiscal year which coincides with the term 2.

4-2-2) Responsible Agencies

The Responsible Agencies are the Ministry of Road, Transportation, Construction and Urban Development and the Municipality of Ulaanbaatar. In case that the Implementing Agency (USUG) could not fulfill the Undertakings and Obligations, both Responsible Agencies (Especially the Municipality of Ulaanbaatar) will fulfill them instead of USUG.

4-2-3) Achievement of the project output

The Mongolian side understood that fulfilling the Undertakings and Obligations by Mongolian side in proper occasion is necessary to achieve the project output. The Mongolian side confirmed to complete works and procedures of the Undertakings and Obligations in the same time as scheduled by Japanese side described in **ANNEX-4**

4-3) Environmental Impact Assessment (EIA)

EIA shall be approved by the Mongolian side before March 8, 2010.

4-4) Monitoring for Environmental and Social Consideration

Monitoring for Environmental and Social Considerations should be conducted by USUG in accordance with the Monitoring Plan. USUG would draft the Monitoring Plan by mid-March, 2010 based on contents of Monitoring Form (Draft) (**ANNEX-5**) made by Japanese side and contents of EIA report made by Mongolian side. The Monitoring Plan and the Monitoring Form would be finalized by agreement between JICA and USUG, by the end of March, 2010.

The results of the Monitoring for Environmental and Social Consideration will be provided to JICA by filling in the Monitoring Form, as part of progress reports during the construction phase and 2 years after completion of the Project.

4-5) Environmental Checklist

The environmental and social considerations including major impacts and mitigation measures for the Project are summarized in the Environmental Checklist, attached as **ANNEX-6**.

4-6) Operation and maintenance of the Project's facilities

JICA requested the Mongolian side for proper operation and maintenance of facilities which would be provided by the Project such as reservoir, pump houses, pipes, etc. JICA suggested that skillful staffs of the USUG who have enough experiences to work in other water supply facilities, should be relocated for the operation of the new facilities.

4-7) Water distribution

It is necessary to assure the water distribution from North East Reservoir to water users for achievement of the project target. In this connection, JICA recommended the Mongolian side to

conduct proper water distribution taking measures for water leakage and replacement of dilapidated pipes.

4-8) Saving water in apart area

In due consideration of water supply in Ulaanbaatar city, it is necessary to save the water usage in apartment area so that water shortage in ger area may be softened. In this connection, JICA recommended Mongolian side to take necessary actions such as installing meters for each user, establishing of adequate water charge system, etc.

4-9) Influence of dam project

Regarding to the future water resources development plan by dam construction, the Mongolian side informed that there exist some preliminary study results, but no clear schedule for the implementation of the further study. JICA requested the Mongolian side to implement groundwater survey carefully when such dam projects would be implemented in the future, since construction of dam may seriously affect to the existing water supply system by groundwater.

ANNEX-1	**Components of the Project**
ANNEX-2	**Project Cost Estimation (CONFIDENTIAL)**
ANNEX-3	**Obligations of the Mongolian side**
ANNEX-4	**Implementation deadlines of Obligations of the Mongolian side**
ANNEX-5	**Monitoring Form (Draft)**
ANNEX-6	**Environmental Checklist**

ANNEX-1 Components of the Project

Requested Items and Survey Results

	Requested Items	Survey Results	
		Japan Side	Mongolia Side
Development Volume	25,200m^3/day	25,200m^3/day	
Production well	21 wells	21 wells	—
Conveyance pipe	Length: 4.8km SP Φ Ave.320mm	Length: 4.3km DCI Φ 150 to 500mm	
Collection pipe	—	Length: 2.8km DCI Φ 150mm	—
Distribution reservoir	Capacity: 8,000m^3	—	Capacity: 6,000m^3
Chlorination unit	1 unit (Cl_2)	1 unit ($CaCl_2O$)	—
Transmission main pipe	Length: 19.5km SP Φ 600mm	Length: 18.8km FRPM Φ 700mm	—
Others	—	—	Fence installation Electric power drawing Bridge for operation and maintenance

Note) SP: Steel pipe, DCI: Ductile Cast Iron, FRPM: Fiberglass Reinforced Plastic Mortar

CONFIDENTIAL

ANNEX-2 Project Cost Estimation (CONFIDENTIAL)

Project Cost Estimation borne by Japan side

Work Item			Estimated Cost (million yen)	
Facilities	Transmission main (L=18.8km)	Pipes		
		Valve chambers		
		Siphons		
		Thrust blocks		
	Conveyance and collection pipes (Conveyance pipe: L=4.3km) (Collection pipes: L=2.8km)	Pipes		
		Valve chambers		
		Siphons		
		Thrust blocks		
	Well pumping stations (21 units)	Wells		
		Pumps		
		Pump house and substructures		
		Electric equipment		
	Chlorination & operation house	Building		
		Sanitation equipment		
		Telemetry system		
		Chlorination system		
		Electric equipment		
Others		Transportation & packing cost, temporary construction cost, etc.		
Detailed design/construction supervision				

Project Cost Estimation borne by Mongolian side

Work Item			Estimated Cost (million yen)	
Facilities	Reservoir ($V=6,000m^3$)	Reservoir	100	150
		Valve room		
		Overflow pipe		
	Others	Electric power supply	50	
		Fences and gates		
		Bridge for operation and maintenance		

ANNEX-3 Obligations of the Mongolian side

The undertakings to the Government of Mongolia for the Project are as follows.

1) Take necessary measures to ensure prompt unloading and customs clearance upon entry into Mongolia and transportation inside Mongolia, for the goods purchased for the implementation of the Project.

2) Take necessary measures to exempt the contractor and the consultant from the customs duty, internal taxes and other fiscal levies imposed in Mongolia for their supply of goods, services, and equipment.

3) Open an account in a designated bank in Japan for the Banking Arrangement (B/A), and issue the Authorization to Pay (A/P). Bear the advising commission of the A/P and payment commissions to the bank.

4) Execute restriction of development activities and necessary negotiations with the landlords for the use of the necessary lands for the construction work.

5) Apply for the construction approval from the authorities concerned for the construction work.

6) Carry out necessary procedures for the Detailed Environmental Impact Assessment (DEIA).

7) Construct the distribution reservoir (6,000m^3 in volume), which Mongolia side is responsible for in construction work excluding the installation of the valves, flow meters, level gauges and piping around the reservoir, in compliance with the overall implementation schedule of the Project.

8) Extend the electric power lines with the necessary capacity to the required locations such as the well pumping stations, distribution reservoir and relevant temporary stock yards. Increase the electric capacity to the required power if the capacity is insufficient.

9) Apply for the permission of the use of frequency band for the telemetry system.

10) Conduct a study along the transmission main pipe route to monitor the ger houses affected by the construction work. Take due process, concurrence and proper compensation for the affected households when temporal relocations and removal of those houses and their properties are necessary.

11) Provide lands for the temporary stock yards for setting-up of the site offices and storage of the construction materials and equipment during the construction work.

12) Install fences and gates in the premises of the distribution reservoir and the well pumping stations.

13) Provide a bridge over Tuul River for the access, operation and maintenance of the Gachuurt water source after the completion of the construction work.

14) Allocate proper security guards for the security of construction work.

15) Conduct environmental and social impact monitoring based on the monitoring plan instructed by the DEIA

16) The transmission main pipe will be connected to the existing inlet pipes (φ500) of the Northeast reservoir. Therefore, repair the reservoir and the existing peripheral pipes in the event of any trouble caused by the discharge, under normal use, to the reservoir.

17) Procure the disinfectant (calcium hypochlorite $CaCl_2O$) for the operation of the chlorination facility.

18) Plan out observation tours for citizens for the advertisement of the Project. In addition, carry out promotion activities by creating project brochures and through the media.

ANNEX-4 Implementation deadlines of Obligations of the Mongolian side

Large item	Small item	Quantity	Implementation deadline (Months after E/N for DD)
EIA procedure	-	Implementation of DEIA and permission for the Project	March 2010
Application for construction permission	-	Application to the City of Ulaanbaatar and permission	12 months
Land acquisition	Base camp and temporary yard	4 sites	16 months
	Transmission main	18.8km	22 months
	Conveyance pipe	4.3km	22 months
	Collection pipes	2.8km	22 months
	Reservoir and chlorination & operation house	1 site	22 months
	Well pumps	21 sites	22 months
Distribution power line installation	Reservoir and chlorination & operation house	1 site	39 months
	Well pumps	21 sites	39 months
Frequency band	Telemetry system	1 set	36 months
Construction	Reservoir	1 site	Budget acquisition : 12 moths Construction : 39 months
	Fence at well pumps	21 sites	51 months
	Access bridge	1 site	On the timing not to hamper operation and maintenance works
Compensation	Temporary removal and restoration of fence on transmission main route	Review before construction commencement	Until construction completion after 23 months
Inspection	Discharging in Gachuurt Reservoir	1 site	47 months
	Discharging in North-East Reservoir	1 site	52 months

Source: JICA Survey Team

ANNEX-5 Monitoring Form (Draft)

MONITORING FORM IN CONSTRUCTION PHASE

Monitoring elements	Suggestion for avoidance and mitigation measures
Temporal relocation of the ger houses and restoration for the temporal removal	* Prior to the commencement of the construction work, USUG and Ulaanbaatar City shall conduct a study along the transmission main pipe route to monitor the ger houses that are to be affected by the construction work. When relocations of those houses are necessary, USUG and Ulaanbaatar City shall follow proper procedure and request the residents to relocate the houses to other areas within the housing lots during the construction work. * During the period of the construction work, USUG and Ulaanbaatar City shall take due process and proper compensation shall be materialized with the affected households for the temporal removal and restoration of private property.
Records of performance	

MONITORING FORM IN CONSTRUCTION PHASE

Monitoring elements	Suggestion for avoidance and mitigation measures
Traffic control	* USUG and Ulaanbaatar City shall inform local residents and businesses of the schedule of construction work and the traffic control plan in due timing. * USUG and Ulaanbaatar City shall set a contact address and locate necessary personnel to receive complaints from affected parties.
Records of performance	

MONITORING FORM IN CONSTRUCTION PHASE

Monitoring elements	Suggestion for avoidance and mitigation measures
Coordination for Tsaiz area and the military bases	* Before the commencement of the construction work, USUG and Ulaanbaatar City shall organize an informational meeting at Tsaiz area with local businesses, bus operators, and other related parties to discuss whether it is necessary to move bus stations or to do night work. * As for the military facilities, USUG and Ulaanbaatar City shall provide sufficient information about the work plan and equipment to be used, and operate construction work according to necessary precautions directed by the military institutions.
Records of performance	

MONITORING FORM IN CONSTRUCTION PHASE

Monitoring elements	Suggestion for avoidance and mitigation measures
Coordination for Gachuurt area	* USUG and Ulaanbaatar City shall organize informational meetings at Gachuurt area before the commencement of the construction work and in due timing as necessary about the work item, schedule and request to the residents. * During the period of the temporal channel closure required for the due construction work, USUG and Ulaanbaatar City shall designate locations to draw water for the affected households. * USUG and Ulaanbaatar City shall consult with the Hotel Mongolia and any other local businesses to be affected during the period of construction and take their requests into considerations in conformity with due regulations.
Records of performance	

MONITORING FORM IN CONSTRUCTION PHASE

Monitoring elements	Suggestion for avoidance and mitigation measures
Groundwater level	* USUG shall monitor, around 9AM everyday, 2 test wells drilled for the JICA basic design survey and 1 well used by the local water service provider at Gachuurt village in static groundwater level. * Recording format is as per attached below.
Records of performance	

Groundwater Level of Observation Wells in Construction Phase

Location: _____

Month: _____

Year: _____

Day	Week	Static groundwater level from zero gauge in meters	Time	Weather	Observer
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
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18					
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20					
21					
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23					
24					
25					
26					
27					
28					
29					
30					
31					
		Mean			
		Max.			
		Min.			

MONITORING FORM IN OPERATION PHASE

Monitoring elements	Suggestion for avoidance and mitigation measures
Restriction of the entry to the facilities	* The bridge and the distribution reservoir at Gachuurt area shall be guarded 24 hours by the military and the entry to the constructed facilities shall be limited to those permitted. * USUG is requested to report the monthly record of the activity, to JICA Mongolia office, every month during first 1 year after the commencement of the operation of the pumps, and submit to the said office the annual results of the activity at the end of the second year.
Records of performance	

MONITORING FORM IN OPERATION PHASE

Monitoring elements	Suggestion for avoidance and mitigation measures
Prevention of accident in the chlorination	* USUG shall properly store and manage the disinfectant for the chlorination work to avoid accidents such as theft and leak to outside. * USUG shall provide the chlorination personnel with proper training and due equipment to prevent any physical damage to their health. * USUG shall properly dispose of the empty containers of the disinfectant. * USUG is requested to report the monthly record of the work on the chlorination, to JICA Mongolia office, every month during first 1 year after the commencement of the operation of the pumps, and submit to the said office the annual results of the work at the end of the second year.
Records of performance	

MONITORING FORM IN OPERATION PHASE

Monitoring elements	Suggestion for avoidance and mitigation measures
Groundwater level	* USUG shall monitor, around 9AM everyday, 2 test wells drilled for the basic design survey and 1 well used by the local water service provider at Gachuurt village in static groundwater level. * USUG shall monitor, everyday, 21 wells constructed by the project in dynamic groundwater level. * USUG is requested to operate the 21 pumps so that the dynamic water levels in the wells can not lower over 2m each from the static water level before the pump operation. * USUG is requested to report the result of the monitoring to JICA Mongolia office every month during first 1 year after the commencement of the operation of the pumps, and submit to the said office the annual monitoring results at the end of the second year. * Recording format is as per attached below.
Records of performance	

Groundwater Level of Observation Wells in Operation Phase

Location: _____

Month: _____

Year: _____

Day	Week	Static groundwater level from zero gauge in meters	Time	Weather	Observer
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
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21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					
		Mean			
		Max.			
		Min.			

Groundwater Level of Wells in Operation Phase

Location: Well No. _____

Month: _____

Year: _____

Day	Week	Groundwater level from zero gauge in meters		Weather	Observer
		Static before operation	Max. dynamic		
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					
		Mean	Mean		
		Max.	Max.		
		Min.	Min.		

MONITORING FORM IN OPERATION PHASE

Monitoring elements	Suggestion for avoidance and mitigation measures
Drinking water quality of the wells	* USUG shall monitor the drinking water quality of the Gachuurt Reservoir and the North East Reservoir, and the raw groundwater quality of the 21 Wells in conformity with the USUG's regulations. * USUG is requested to report the result of the monitoring to JICA Mongolia office every ____ month during first 1 year after the commencement of the operation of the pumps, and submit to the said office the annual monitoring results at the end of the second year. * Recording format is as per attached below.
Records of performance	

Raw Groundwater Quality of Wells in Operation Phase

Location: Well No. _____

Month: _____

Year: _____

No.	Parameters	Units	Allowable figures in Mongolia	Measured values	Sampling date	Testing methods	Testing laboratories
1							
2							
3							
4							
5							
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34							
35							

Drinking Water Quality of Reservoirs in Operation Phase

Location: Gachuurt Reservoir, North East Reservoir

Month: _____

Year: _____

No.	Parameters	Units	Allowable values in Mongolia	Measured values	Sampling date	Testing methods	Testing laboratories
1							
2							
3							
4							
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7							
8							
9							
10							
11							
12							
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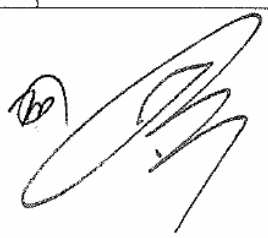
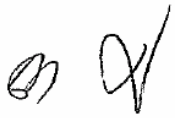
35							

Drinking Water Standards in Mongolia

No.	Parameters	Units	Allowable values in Mongolia	Testing frequency	
				Chlorinated water	Raw water
1	Color	TCU	20	Everyday	2/year
2	Odor	-	2.0	Everyday	2/year
3	Taste	-	2.0	Everyday	2/year
4	Turbidity	NTU	5	Everyday	2/year
5	Conductivity	Ms/sm	-	Everyday	2/year
6	pH	-	6.5-8.5	Everyday	2/year
7	Total coliforms	No.100mL	Not detected	Everyday	2/year
8	General bacteria	No./mL	20	Everyday	2/year
9	Chloride	mg/L	350	1/month	2/year
10	Sulphate	mg/L	500	1/month	2/year
11	Calcium	mg/L	100	1/month	2/year
12	Magnesium	mg/L	30	1/month	2/year
13	Total hardness	mg-evl/L	7	1/month	2/year
14	Dry residuals	mg/L	1000	1/month	2/year
15	Nitrates	mg/L	50	1/month	2/year
16	Iron	mg/L	0.3	1/month	2/year
17	Fluoride	mg/L	0.7-1.5	1/month	2/year
18	Nitrite	mg/L	1.0	1/month	2/year
19	Ammonium	mg/L	1.5	1/month	2/year
20	Sodium	mg/L	200	1/month	2/year
21	Phosphate	mg/L	3.5	1/month	2/year
22	Residual chlorine (free)	mg/L	0.3	1/month	2/year
23	Aluminum	mg/L	0.5	1/3 months	2/year
24	Manganese	mg/L	0.1	1/3 months	2/year
25	Copper	mg/L	1	1/3 months	2/year
26	Zinc	mg/L	5	1/3 months	2/year
27	Silver	mg/L	0.05	1/3 months	2/year
28	Arsenic	mg/L	0.05	1/3 months	2/year
29	Cadmium	mg/L	0.01	1/3 months	2/year
30	Cyanides	mg/L	0.01	1/3 months	2/year
31	Chromium	mg/L	0.05	1/3 months	2/year
32	Molybdenum	mg/L	0.25	1/3 months	2/year
33	Lead	mg/L	0.03	1/3 months	2/year





ANNEX-6 Environmental Checklist: 18. Water Supply (1)

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
1 Permits and Explanation	(1) EIA and Environmental Permits	1. Have EIA reports been officially completed? 2. Have EIA reports been approved by authorities of the host country's government? 3. Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied? 4. In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?	1. Detailed EIA was submitted by Feb. 5, 2010, and was forwarded to the local authority (City of Ulaanbaatar) for review and comment, prior to the official submission to the Ministry of Nature, Environment and Tourism. The EIA procedure is still on-going. 2. The report is expected to be approved by MNET by 4th March 2010. 3. No special condition. 4. No other environmental requirements.
	(2) Explanation to the Public	1. Are contents of the project and the potential impacts adequately explained to the public based on appropriate procedures, including information disclosure? Is understanding obtained from the public? 2. Are proper responses made to comments from the public and regulatory authorities?	1. USUG has organized public consultation meeting twice and stakeholder meeting once to introduce the project outline and collect public and authorities complaints. 2. Suggested complaints and comments will be considered into DEIA report for authorities discussion.
2 Mitigation Measures	(1) Air Quality	1. Is there a possibility that chlorine from chlorine storage facilities and chlorine injection facilities will cause air pollution? Do chlorine concentrations within the working environments comply with the country's occupational health and safety standards?	1. Calcium hypochlorite $Ca(ClO)_2$ will be used to disinfect the raw water in the planned reservoir site. The same material is already used at existing Zavsariin reservoir and no chemical accidents are reported since opening of the facility. USUG has the chemical handling manual for the staff and the staff are trained using this manual. In this project, the same training, management, and operation is expected and the possibility of chemical accident is low.
	(2) Water Quality	1. Do pollutants, such as SS, BOD, COD contained in effluents discharged by the facility operations comply with the country's effluent standards?	1. As USUG described, septic tank will be installed underground and it will be emptied with waste truck when it filled up. Then there is guideline for using waste water storage tank and its padding approved by MNET and MH, MNS 4943:2000 is standard for effluent water from waste water treatment facility.
	(3) Wastes	1. Are wastes, such as sludge generated by the facility operations properly treated and disposed of in accordance with the country's standards?	1. For sludge, see above. Chemical containers shall be stored and disposed to disposal site or washed for reuse.
	(4) Noise and Vibration	1. Do noise and vibrations generated from the facilities, such as pumping stations comply with the country's standards?	1. Proposed facilities will not generate significant noise and vibration.
	(5) Subsidence	1. In the case of extraction of a large volume of groundwater, is there a possibility that the extraction of groundwater will cause subsidence?	1. According to the geological survey results, there is no clay layer in the water source area. Subsidence will be unlikely.
3 Natural Environment	(1) Protected Areas	1. Is the project site located in protected areas designated by the country's laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas?	1. According to guideline for Sanitary areas by MNET and MH (March 2009), it is allowed to construct or build drinking water supply facilities for public use in the special protected and sanitary zone of water reverses and resources. The project will not affect the purpose of the protected area.
3 Natural Environment	(2) Ecosystem	1. Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)? 2. Does the project site encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions? 3. If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem? 4. Is there a possibility that the amount of water (e.g., surface water, groundwater) used by the project will adversely affect aquatic environments, such as rivers? Are adequate measures taken to reduce the impacts on aquatic environments, such as aquatic organisms?	1. The water source area is 45 ha and located in the Sanitary Zone protected for water resource. Out of the 45 ha, 27 ha is grassland area and 18 ha is forest area dominated by poplar and willow. 2. No. 3. No significant ecological impacts are anticipated. 4. No. Tuul River that runs through existing water source area has good amount of water flow. Drawing ground water will not affect surface flow.

ANNEX-6 Environmental Checklist: 18. Water Supply (2)

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
4 Social Environment	(1) Resettlement	1. Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement? 2. Is adequate explanation on relocation and compensation given to affected persons prior to resettlement? 3. Is the resettlement plan, including proper compensation, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement? 4. Does the resettlement plan pay particular attention to vulnerable groups or persons, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples? 5. Are agreements with the affected persons obtained prior to resettlement? 6. Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan? 7. Is a plan developed to monitor the impacts of resettlement?	1. During the construction work of the transmission main pipe, there is no involuntary resettlement.-Only temporal removal of fences shall be required at about 20 households along the pipe route. USUG and other related institutions should keep proposed areas from illegal settlement. 2.USUG organized some meetings with Khoroo governors and land department of Bayanzurkh district. And explained them if the dwellers are affected by the project implementation, they will receive some compensation. 3. Municipality intends to create a relocation plan for those 20 households asked for temporary removal from thier plots with proper compensation and restoration. 4. The resettlement plan will pay attention to vulnerable people on the base of socioeconomic study to be done by MUB. 5. If there is need, agreements will be made between affected dwellers and MUB prior to the resettlement. 6. On the base of cost estimation of the properties, MUB will secure budget for the resettlement. 7. MUB intends to develop a plan to monitor the impacts of the resettlements.
	(2) Living and Livelihood	1. Is there a possibility that the project will adversely affect the living conditions of inhabitants? Are adequate measures considered to reduce the impacts, if necessary? 2. Is there a possibility that the amount of water used (e.g., surface water, groundwater) by the project will adversely affect the existing water uses and water area uses?	1. There may occur some impacts, but it will not be significant. To avoid or minimize the impact, USUG shall inform local residents and businesses about the schedule of construction work and traffic control plan during the construction. USUG shall also conduct sufficient traffic control measures on site. USUG shall plan and coordinate the construction work efficiently to minimize the length of road closure. USUG shall set a contact address and locate necessary personnel to receive complaints from affected parties. 2. No. According to the Water Authority, it is custom in Mongolia to limit the water level change within 2 m during well operation. If the regulation is followed, the project will not affect groundwater level in the surrounding area. USUG shall monitor the groundwater levels at the 2 observation wells drilled by the Project and the existing 1 private kiosk.
	(3) Heritage	1. Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage sites? Are adequate measures considered to protect these sites in accordance with the country's laws?	1. None of cultural heritage and archaeological findings recorded and found in the proposed project area.
	(4) Landscape	1. Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?	1. It is expected that there will be little or no impact on landscape of the project areas as water supply pipelines will be installed underground and the water collection facility and pumping wells will not have significant impact on project area landscape. Restoration plan will be developed and implemented when construction completed.
4 Social Environment	(5) Ethnic Minorities and Indigenous Peoples	1. Does the project comply with the country's laws for rights of ethnic minorities and indigenous peoples? 2. Are considerations given to reduce the impacts on culture and lifestyle of ethnic minorities and indigenous peoples?	1. There is no ethnic minorities and indigenous peoples in the project area. 2. Not applicable.

ANNEX-6 Environmental Checklist: 18. Water Supply (3)

Category	Environmental Item	Main Check Items	Confirmation of Environmental Considerations
5 Others	(1) Impacts during Construction	1. Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)? 2. If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce impacts? 3. If construction activities adversely affect the social environment, are adequate measures considered to reduce impacts? 4. If necessary, is health and safety education (e.g., traffic safety, public health) provided for project personnel, including workers?	1. USUG and contractor shall properly maintain construction vehicles and construction machineries to minimize noise and vibration. To minimize production of turbid water, water channels will be closed by the earth dams during the construction of crossing structures such as distribution pipe. Materials for the earth dam must be chosen carefully among the material available on-site so that minimum amount of clayish soil shall go into the river water. To minimize wastes, dug materials will be used to refill the pipe ditch and construct earth bars over the pipes. 2. If it is necessary to cut trees during the construction work, Populous laurifolia, Salix ledebouriana, Salix pentandra shall be cut above ground level, and their root system shall be dug out, about 6 m diameter maximum. That root system shall be immediately re-planted to nearby grassland for regrowth. Such activity will minimize reduction of tree number. 4. Education related to chemical handling will be provided to the staff at the reservoir by USUG. During construction work, drivers and operators will be instructed by USUG to avoid traffic accidents and other accidents at the construction sites.
	(2) Monitoring	1. Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts? 2. Are the items, methods and frequencies included in the monitoring program judged to be appropriate? 3. Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)? 4. Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?	1. DEIA report should contain Environmental Monitoring Plan and Environmental Protection Plan with respect to Law of DEIA . Project operator is obligated to implement approved EMP and EPP during project operation and have to report EPP and EMP implementation to authorities. 2. Appointed Environmental officer by MNET will judge and review entire DEIA report. 3. Project operator at USUG should implement approved EMP by MNET and project operator can update or enhance EMP under the standard and regulation. 4. Implemented measures and result should be reported end of the each year to MNET.
6 Note	Note on Using Environmental Checklist	1. If necessary, the impacts to transboundary or global issues should be confirmed (e.g., the project includes factors that may cause problems, such as transboundary waste treatment, acid rain, destruction of the ozone layer, or global warming).	1. In Mongolia, as some researchers expect and conclude, global warming will impact and continue in nearest and future. In past 20 years, the impact from global climate change has very clear in Mongolia.

1) Regarding the term "Country's Standards" mentioned in the above table, in the event that environmental standards in the country where the project is located diverge significantly from international standards, appropriate environmental considerations are made, if necessary.
In cases where local environmental regulations are yet to be established in some areas, considerations should be made based on comparisons with appropriate standards of other countries (including Japan' experience).
2) Environmental checklist provides general environmental items to be checked. It may be necessary to add or delete an item taking into account the characteristics of the project and the particular circumstances of the country and locality in which it is located.

Ministry of Natural Environment and Tourism
Ministry of Health

５．事業事前計画表（概略設計時）

事業事前計画表（概略設計時）

１．案件名
モンゴル国　ウランバートル市水供給改善計画
２．要請の背景（協力の必要性・位置付け）
モンゴルの首都ウランバートル市は、地方からの人口流入が顕著で、2000 年代に入ってから年率 4%の人口増加が続いた結果、2008 年には 107 万人に達していると推定されており、モンゴルの人口の 40%が集中している。その結果、都市問題が深刻化しており、特に水供給については 2011 年頃に増え続ける水需要が現在の供給能力を超えることが予測されており、水不足が発生した場合、市民生活や首都機能への影響は非常に大きいと懸念されることから、水道施設の増強が喫緊の課題となっている。 同市の水供給はウランバートル市上下水道公社（USUG）が担っており、我が国の無償資金協力による施設整備等により、給水能力は 24 万m3／日に達している。しかし、人口の約半分を占めるゲル地区[1]は公共水栓や給水車による給水であり、水使用量はわずか 7.2 L／人／日に過ぎない。そのため、世界銀行がゲル地区への配水管の延伸や給水所の増設等を進めている。USUG は各戸給水を行っているアパート地区において、従量制料金制度への移行や節水啓発を行い、水消費を抑制する努力を継続しているが、ゲル地区の給水事情の改善、人口の急増、ゲル地区からアパート地区への人口移動とそれに伴う水消費量の増大等の要因により、水供給能力の拡張が求められている。 USUG は 4 ヶ所の水源地において地下水を揚水して給水しているが、既存水源はいずれも開発余力が残されていないため、既往調査において最適地として提案されている市東部のガチョルト地区において、新規の水源地を開発する必要がある。
３．プロジェクト全体計画概要
（１）プロジェクト全体計画の目標 2014 年に、ウランバートル市の住民への給水が改善される。 直接裨益対象の範囲：ウランバートル市給水区域住民：約 120 万人 **（２）プロジェクト全体計画の成果** ア　ウランバートル市北東に位置するガチョルト地区において日量 2.52 万m3 の水源が開発される。 イ　ガチョルト地区において開発された水がウランバートル市内の北東配水池まで送水される送配水管が整備される。 ウ　北東配水池から住民への給水が行われる。 **（３）プロジェクト全体計画の主要活動** ア　ガチョルト地区における取水施設の整備 イ　ガチョルト地区からウランバートル市内までの送配水管の施設整備及び北東配水池への接続 ウ　北東配水池から住民への給水施設の整備

[1] ゲル地区とは、遊牧民が都市部に流入して生成されたウランバートル市周辺の生活インフラが整っていない地区を指す。

エ　整備された施設の適切な運転維持管理体制が確立する

（4）投入（インプット）

ア　日本側：

施工・調達業者契約認証まで非公表

イ　モンゴル国側：

（ア）本無償資金協力案件実施に関わる負担額：1.50 億円

（イ）本無償資金協力案件対象施設建設後の維持管理費用

（5）実施体制

主管官庁：道路運輸建設都市開発省、ウランバートル市

実施機関：ウランバートル市上下水道公社（USUG）

4．無償資金協力案件の内容

（1） サイト

ウランバートル市（水源開発予定地は東部のガチョルト地区。）

（2） 概要

ア　土木工事、調達機器等の内容

【施設】取水井戸（21 井）（小屋、ポンプ、制御盤等を含む）、集水管・導水管（7.1km）、操作棟（塩素注入及び遠隔操作施設）（1 式）、送配水管（口径 700mm、延長 18.8km）

イ　コンサルティング・サービス/ソフトコンポーネントの内容

詳細設計・施工監理　（ソフトコンポーネントは含まない）

ウ　調達・施工方法

管材、ポンプ、制御盤等の主要建設資機材は本邦調達とし、砂、生コン、鉄筋等現地で容易に入手できる建設資材は現地調達とする。管路敷設にあたっては土被り 3.5m を確保して凍結を防止するなど、寒冷地対策を行う。

（3） 相手国側負担事項

ア　配水池（6,000 ㎥/日規模）、運転維持管理用橋梁の建設

イ　施設建設用地手配

ウ　電力供給

エ　地下水開発に係る許可の取得

オ　環境社会配慮の手続き

カ　免税措置　等

（4） 概略事業費

施工・調達業者契約認証まで非公表

（5） 工期

詳細設計、入札期間を含めて約 54 ヶ月

貧困、ジェンダー、環境及び社会面の配慮

ア　貧困削減促進：本事業の主な給水区域は市北部の貧困層の居住地区であるゲル地区であり、同地区の住民のうち約 39 万人の同住民に裨益すると想定され、貧困削減の促進に資する。

イ　自然環境面：本事業は大規模地下水揚水を伴うものの、運用時には地下水位をモ

ニタリングすると共に、2m 以上の水位低下が生じないよう運転数の調整を行う。また、既存井戸とは水理的に分断されており、水位低下等の影響は限られているため、自然環境への影響は少ないものと考えられる。

ウ　社会環境面：送水管の敷設に際し、移動式住居等の一時的な移動が生じる可能性があるが、モンゴル側が必要な補償を行うとともに、関係機関によるモニタリングが行なわれる。

５．外部要因リスク

特になし。

６．過去の類似案件からの教訓の活用

特になし。

７．プロジェクト全体計画の事後評価に係る提案

（１） プロジェクト全体計画の目標達成を示す成果指標

指標	現状（2009 年）	計画値（2017 年） 【事業完了 3 年後】
給水施設能力	24.00 万 m3／日	26.52 万 m3／日

（２） その他の成果指標

特になし。

（３） 評価のタイミング

2017 年以降（施設完工後 3 年経過後）

以上

６．参考資料／入手資料リスト

調査名　モンゴル国ウランバートル市水供給改善計画準備調査

番号	名　　称	形態 （図書・ビデオ・ 地図・写真等）	オリジナル ・コピー	発行機関	発行年
	質問票の回答				
Annex-A-1	Statistical Handbook of Ulaanbaatar 2006	印刷	コピー	Ulaanbaatar City Government, Department of Statistics	2007
Annex-A-2	Statistical Handbook of Ulaanbaatar 2007	データ	コピー	Ulaanbaatar City Government, Department of Statistics	2008
Annex-A-3	Mongolian Statistical Yearbook 2008	印刷	コピー	National Statistical Office of Mongolia	2009
Annex-A-4	北東配水池図面	印刷	コピー	USUG	1982
Annex-A-5	Hotel Mongolia から市内下水処理場への下水道管図面	データ	コピー	USUG	2007
Annex-A-6	National Bench Mark 情報	データ	コピー	Ulaanbaatar City	-
Annex-A-7	埋設物情報	データ	コピー	Ulaanbaatar City	-
Annex-A-8	上水道管路網図	印刷	コピー	USUG	2009
Annex-A-9	下水道管路網図	印刷	コピー	USUG	2009
Annex-A-10	FASEP project Nr 647; WATER AND WASTE WATER MASTER PLAN OF ULAANBAATAR Development Options Sections 2 : Urban and Population Development, April 2006	データ	コピー	Municipality of Ulaanbaatar, SEURECA	2006.4
	共通資料				
A-1	Main Report of "Household Income and Expenditure Survey/Living Standards Measurement Survey", 2002-2003	印刷	コピー	National Statistical Office of Mongolia	2004
A-2	Poverty Profile in Mongolia - Main Report of "Household Socio-Economic Survey" 2007-2008	印刷	コピー	National Statistical Office of Mongolia	2009
A-3	Urban Services Rehabilitation Project Phase 2 Volume 1 and 2	印刷	コピー	World Bank	1996.10.10
A-4	Borrower's Implementation Completion Report on Ulaanbaatar Services Improvement Project financed by World Bank Credit 2973-MOG	印刷	コピー	World Bank	2004.6
A-5	Preliminary Design Report on Feasibility Study of the Second Ulaanbaatar Services Improvement Project and Preliminary Design of Water Supply Facilities (Project No. TF 051125) - Volume I Main Report	データ	コピー	World Bank	-
A-6	Final Feasibility Study Report on Feasibility Study of the Second	データ	コピー	World Bank	2003.12

番号	名　　称	形態 （図書・ビデオ・ 地図・写真等）	オリジナル ・コピー	発行機関	発行年
	Ulaanbaatar Services Improvement Project and Preliminary Design of Water Supply Facilities (Project No. TF 051125) - Volume II Appendices				
A-7	Draft Report on Feasibility Study of the Second Ulaanbaatar Services Improvement Project and Preliminary Design of Water Supply Facilities (Project No. TF 051125) - Volume II Appendices	データ	コピー	World Bank	2003.10
A-8	Master Plan Report on Water and Waste Water Master Plan of Ulaanbaatar	印刷	コピー	World Bank	2006.9
A-9	Maps on Master Plan Report on Water and Waste Water Master Plan of Ulaanbaatar	印刷・データ	コピー	World Bank	2006.9
A-10	Inception Report on the Second Ulaanbaatar Services Improvement Project (USIP 2) for Project Management and Construction Supervision Consulting Services	印刷	コピー	World Bank	2007.9
A-11	Quarterly Progress Report - 2nd Quarter of 2009 - "Semi Annual Progress Report No.1 of 2009 for USIP 2	印刷	コピー	World Bank	2009.7.31
A-12	Urban cadastre of Mongolia	印刷	コピー	Ministry of construction and urban development	2007
A-13	Water supply outside network and facilities	印刷	コピー	Ministry of construction and urban development	2006
A-14	Norms on construction drawing at seismic zones of Mongolia	印刷	コピー	Ministry of construction and urban development	2006
A-15	Norms on construction drawing at seismic zones of Mongolia (2)	印刷	コピー	Ministry of construction and urban development	2007
A-16	Reinforced concrete pre cast structured	印刷	コピー	Ministry of construction and urban development	2005
A-17	Fire precaution norm of construction designs drawings	印刷	コピー	Ministry of construction and urban development	2002
A-18	Heating supply	印刷	コピー	Ministry of construction and urban development	2005
A-19	Finishing work	印刷	コピー	Ministry of construction and urban development	2005
A-20	Steel structure	印刷	コピー	Ministry of construction and urban development	2007
A-21	Instruction on design drawings for masonry structure	印刷	コピー	National center of construction, urban development and public utilities	2005

番号	名　　称	形態 （図書・ビデオ・ 地図・写真等）	オリジナル ・コピー	発行機関	発行年
A-22	Design and installation of polymeric pipelines for water supply and sewage systems	印刷	コピー	National center of construction, urban development and public utilities	2006
A-23	Heating, ventilation and conditioning	印刷	コピー	Ministry of infrastructure	2002
A-24	Public and civil building	印刷	コピー	Ministry of infrastructure	2003
A-25	Building for administration and utility premises	印刷	コピー	Ministry of infrastructure	2003
A-26	Goals on Promoting Environmentally Sustainable Transport in UB City	印刷	コピー	Capital City governor and Mayor of Ulaanbaatar	-
A-27	Population-Environment dynamics in UB, MONGOLIA	印刷	コピー	豊橋科学技術大学 (Purev-Erdene Ershuu)	-
A-28	JFPR 9106-MON: Community-Driven Development for Urban Poor in Ger Areas	印刷	コピー	ADB	2007.10
A-29	Proposed Loan Mongolia: Urban Development Sector Project	印刷	コピー	ADB	2006.11
A-30	Environmentally Sustainable Transport in UB City Mongolia	印刷	コピー	Capital City governor and Mayor of Ulaanbaatar	-
A-31	モンゴル国ウランバートル市近郊ゲル地域の現状と課題	印刷	コピー	富原崇之 他	-
A-32	モンゴル国ウランバートル市近郊に暮らす遊牧民の生活環境に関する研究	印刷	コピー	日大生産工（川岸梅和 他）	-
A-33	モンゴル・ウランバートル市のゲル集落の拡大	印刷	コピー	宮城教育大学（小金沢孝亜昭 他）	2006
A-34	ウランバートルのゲル地域における住民の意向と日常行動	印刷	コピー	櫛谷桂司 他	2006
A-35	ADB'S Urban Sector Strategy and Program	印刷	コピー	ADB	2008.10
A-36	Mongolia: Urban Development Sector	印刷	コピー	ADB	2008.10
A-37	プロジェクト・サイト及び周辺の状況	印刷	コピー	JICA Survey Team	2006
	公聴会資料				
B-1	Description of the project	印刷	コピー	JICA Survey Team	2009
	ステークホルダー会議関連資料				
C-2	Invitation letter（会議プログラム）	印刷	コピー	USUG	2009
C-3	Scoping and monitoring	印刷	コピー	JICA Survey Team	2009
C-4	施設設計方針（パワーポイント）	印刷	コピー	JICA Survey Team	2009
C-5	Stakeholder Consultation Meeting Attendance Sheet	印刷	コピー	USUG	2009
C-6	Minutes of Stakeholder Consultation Meeting	印刷	コピー	USUG	2009

７．その他の資料・情報

(1) 地下水涵養率の決定

地下水の涵養率(量)の算定には、経験式あるいは水収支から算定する方法が用いられている。本調査に参考になる例としては、アルタイ市の実測に基づく経験式あるいは、本調査地における水収支における例などが参考となる。それらを下表にまとめた。

表 A.1　水収支　諸数値一覧

	降水量	蒸発散量	表面流出率	地下水涵養率	流域の地勢
本調査地の水収支	100% 346mm	60% 計算値*1	18.6% 実測値	11.4%*2 計算値	山地、緩傾斜地。Steppe, Mountain forest steppe, partly Taiga
アルタイ市の例*3	100% 182mm	70% 実測値	14% 計算値	12% 実測値	草原多く、平地～緩傾斜の山地。Step, Mountain forest steppe
Mandal-Gobi*4				0.3-3%	Gobi desert
Gobi-desert*5				2-3%	Gobi desert
ヘルレン*6	地下水涵養は降雨強度の高い雨のみ。				
イラン*7	100% 346mm (1985-2005)	66.2%	24.6%	9.2%	年平均気温: 11.3℃。半乾燥地。山地 69%、平地・丘陵地 31%。Step, Mountain forest steppe
採用値	**100%**	**70%**	**19%**	**9% 損失 2%**	損失は不飽和土の飽和率

*1: ウランバートル市水供給計画調査最終報告書　1995 年 6 月
*2: 地下浸透率
*3: アルタイ市地下水開発計画調査最終報告書　1999 年 3 月
*4: 京大水資源報告　開発氏他　2001 年
*5: Dr. Marinov, Russia
*6: ヘルレン川流域における地下水涵養機構、安部氏（筑波大学）他、2004 年
*7: イラン国セフィードルード川流域総合水資源管理計画調査中間報告書、2008 年 6 月

1) 水収支からの地下浸透率の推定

河川流量及び降水量の資料が整備されているザイサン橋地点で検討する。

降水量は標高によって異なり、標高が高くなるほど降水量は増加することが知られている。調査地内に観測所は少なく特に標高 2000m 以上の山間地には近隣も含めて気象観測所が無いので統計処理が不可能である。従って標高 1500m 以下の降水量は Tahilt 観測上の 237mm、1500-2000m は Terelj 観測所の 323mm の観測値を採用し、2000m 以上は下図を参考に代表高度を 2250m として 577mm を採用した。流域の平均降水量は標高の面積比率から算定すると 367mm で、概ね Terelj 観測所の降水量に近似する。

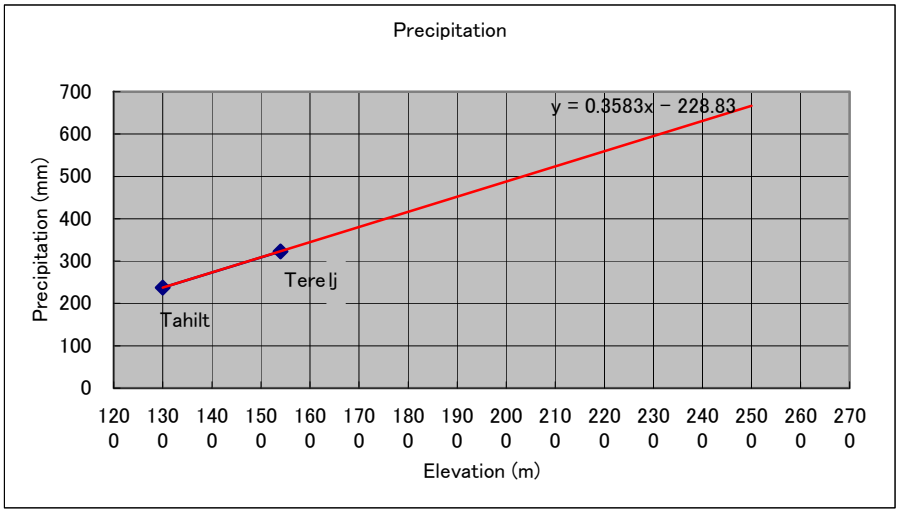


図 A.1　降水量と標高

表 A.2　Zaisan 橋流域の小流域面積と降水量(単位:km^2)

小流域	標高別			合計
	1500m 以下	1500-2000m	2000m 以上 (代表高度 2250m)	
Upper Tuul Sub-basin	0	2,114	626	2,740
Terelj Sub-basin	0	797	542	1,339
Middle Sub-basin	405	1,763	53	1,318
合計 (km^2)	405	4,674	1,221	6,300km^2
比率 (%)	6.4%	74.2%	19.4%	100%
年平均降水量 (mm)1996-2008	237mm	323mm	577mm	366.8mm
河川流量換算 (mil. m^3/year)*	96.0	1,509.7	704.5	2,310

*: 河川流量
1500m 以下:　Q1=0.237 x 405,000,000=95,985,000 m^3/year
1500-2000m　Q2=0.323 x 4,674,000,000=1,509,702,000m^3/year
2000m 以上　Q3=0.577 x 1,221,000,000=704,517,000m^3/year
Q=Q1 + Q2 + Q3 = 2,115,135,000 m3/year =2,310mil m^3/year

これに対して、1996－2008 年の河川流量観測値は 430.75 million m^3/year である。この値は、降水量に対して 18.6%に該当する。蒸発散の観測資料は無いので、アルタイ市の観測値である降水量の約 70%を採用すると、地下浸透率は 11.4%を得る。

これを水収支の式に当てはめると次のようになる。

P:100%=E:70%+D:18.6%+I:11.4%

ここに：P=降水率、E=蒸発散率、D=表面流出率、I=地下浸透率

2) 経験式からの地下水涵養率の推定

本調査地の地形・植生条件に類似したゴビーアルタイ県における実測による降水量観測、河川流量観測及び地下水位観測の結果からゴビ草原における水収支は、次のように算出されている。

P:100%=E:70%＋D:14%＋I:16%
降水率(量)：P=100%（182mm/年）

蒸発散率(量)：E=70%（127.4mm/年）
表面流出率(量)：D=14%（25.5mm/年）
地下浸透率(量)：I=16%（29.1mm/年）
I=地下水涵養量:25.5mm（14%)＋飽和土の飽和:3.6mm（2%）

地下浸透率のうち、約 2%程度は不飽和土の飽和で消費されている。

この場合、地下水涵養率は降雨観測、河川流量観測と地下水位観測を同時並行して行い日雨量が 8mm/day 以上の場合地下水に対する涵養があることを確かめた値で 14%と決定されている。日雨量が 8mm/day 以上ある割合は、合計雨量のうち 25%であった。

本調査対象地域内の日降水量 8mm 以上の資料を次表にまとめた。

表 A.3 日雨量 8mm 以上の雨量と年間降水量(2000-2008)

	Tahilt 観測所（市内）			Terelj 観測所（山間地）		
	日数	合計降水量	年間降水量	日数	合計降水量	年間降水量
年	(日/年)	(mm)	(mm/年)	(日/年)	(mm)	(mm/年)
2000	9	165.9	328.8	9	134.1	280.5
2001	4	71.7	201.1	14	263.8	384.2
2002	7	86.6	190.2	14	182.8	321.6
2003	8	148.3	288.0	14	238.5	372.8
2004	7	123.6	260.7	12	193.3	311.2
2005	6	78.9	193.3	12	242.2	352.9
2006	6	83.7	257.8	9	121.9	264.1
2007	6	91.4	185.7	9	173.8	266.8
2008	7	130.5	228.5	12	209.8	352.2
合計	60	980.6	2,134.1	105	1760.2	2906.3
平均	**6.7**	**109.0**	**237.1**	**11.7**	**195.6**	**322.9**
割合	**-**	**45.9%**	**100%**	**-**	**60.6%**	**100%**
1979-1994	*参考値*	-	*274mm*	-	-	*403mm*

アルタイ市の場合に較べて、日雨量 8mm 以上の降水量の割合は 46-61%と高い。アルタイ市に比較すると地下浸透量は大きいものと推定されるが、地形条件がアルタイ市の場合に較べて急峻で、中間流出が大きいと推定される。地下水涵養率は安全側を採用してアルタイ市の 14%を越えることはないと推定される。さらに、不飽和土の飽和率をアルタイ市の場合と同率の 2%とすることが望ましい。

3) その他の地域の地下水涵養率

イラン国のセフィードルード川流域は年平均降水量が 346mm で半乾燥地に属し、平地・丘陵地が 31%、山地が 69%の割合をなし植生は乏しく、本調査地の地勢に類似している。ここでは MIKE-SHE を使ったシミュレーションを行なっており、水収支は下記のような結果となっている。

P:100%=E:66.2%＋D:24.6%＋地下水涵養率:9.2%

地下水涵養率は、9.2%と決定されている。

4) 地下水涵養率の決定

本調査の水収支から地下浸透率は 11.4%、地形条件が緩いアルタイ市の場合の地下水涵養率

が 14%、地形及び植生の類似したイラン国の例で地下水涵養率が 9.2%であった。本調査の水収支の場合、地下浸透率はのうち降水量が不飽和土の飽和分を差引いて、地下水涵養率を決める必要がある。アルタイ市の事例では降水量のうち地下浸透量が 16%でそのうち地下水涵養率が 14%である。地質条件は両者とも類似しているので不飽和土の飽和率もアルタイ市の例と同率の 2%を採用できる。また、地勢の類似したイラン国の例で正確なシミュレーションを実施して地下水涵養率を 9.2%と定めた例も参考となる。ただし、イラン国の場合、高山を除いて永久凍土層の影響が不明確である。

従って、本計画では本調査地の水収支における地下浸透率から 2%を差引いた 9%を採用することが妥当と判断できる。