

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

MINISTRY OF INFRASTRUCTURE DEVELOPMENT (MID)

THE GOVERNMENT OF MONGOLIA

**THE STUDY
ON
GROUNDWATER DEVELOPMENT
FOR
ALTAI CITY
IN
MONGOLIA**

**FINAL REPORT
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PACIFIC CONSULTANTS INTERNATIONAL
MITSUI MINERAL DEVELOPMENT ENGINEERING CO., LTD.

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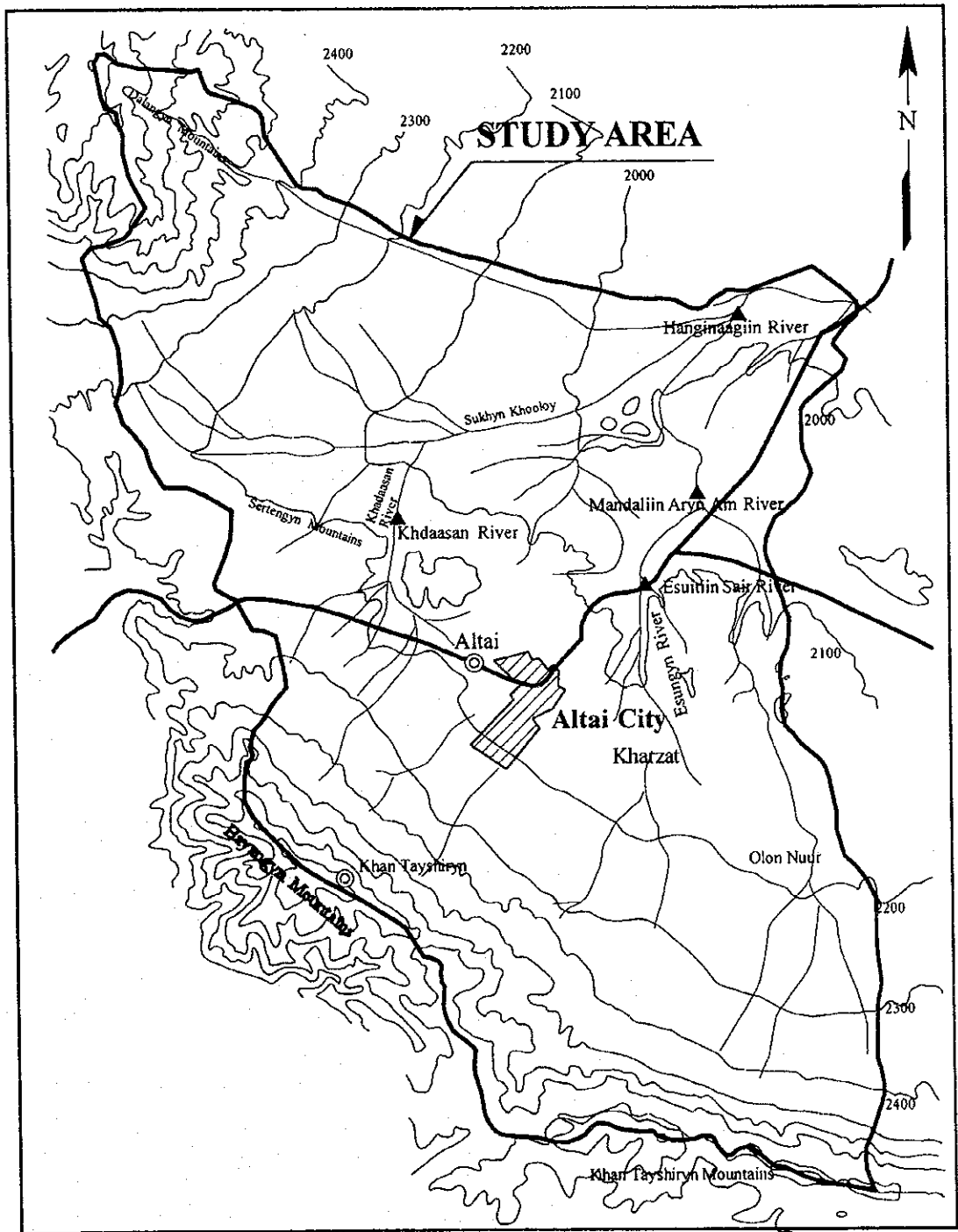
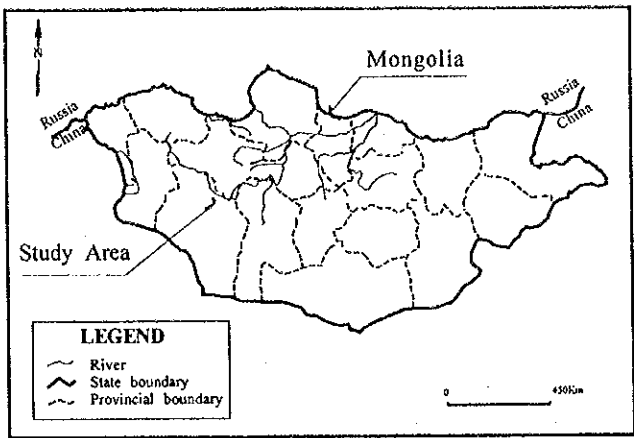
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In this report, project costs are estimated based on December 1998 prices with an exchange rate of US\$ 1 = Mongolian Tugrug 890 (US\$ 1 = Yen 117.5).



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Study Area

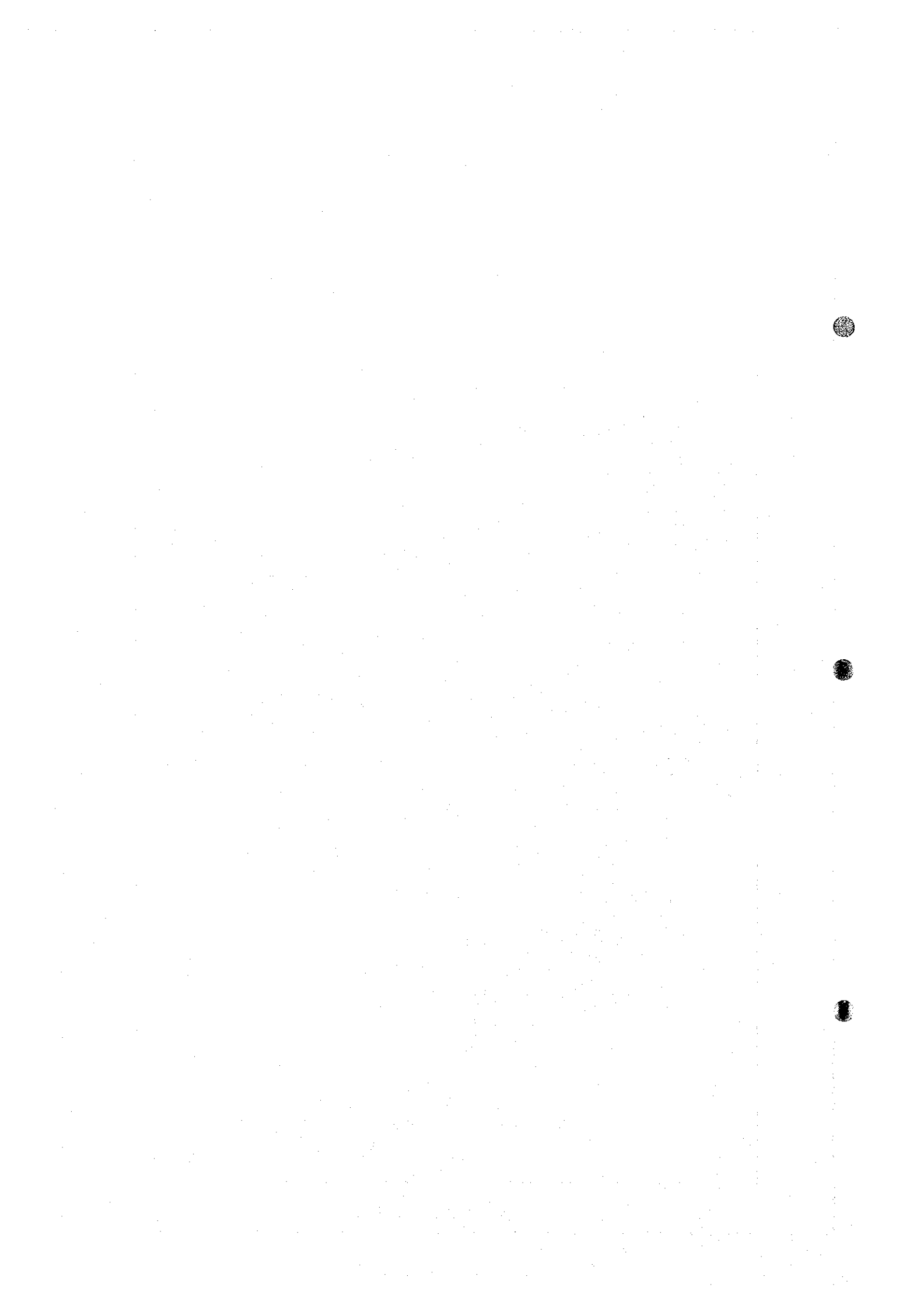


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Abbreviations

ADB	Asian Development Bank
APSD	Altai Public Service Department
ASL	Above Sea Level
AWSD	Altai City Water Supply Department
B/C	Benefit - Cost Ratio
BOD	Biochemical Oxygen Demand
CCT	Computer Compatible Tape
CHC	Communal Heating Center
CITES	Convention International Trade in Endangered Species of Wild Fauna and Flora
CMEA	Council for Mutual Economic Assistance
COD	Chemical Oxygen Demand
DPT	Diphtheria Pertussis Tetanus
DTH	Down The Hall (rotary percussion drilling)
EC	Electric Conductivity
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
EM	Electro Magnetic
FIRR	Financial Internal Rate of Return
G. L.	Ground Level
GDP	Gross Domestic Product
GIAUS	Governmental Implementation Agency of Urban Services
GPS	Global Positioning System
GRDP	Gross Regional Domestic Product
I.D.	Inside Diameter
IEE	Initial Environmental Examination
IMR	Infant Mortality Rate
IUCN	Red list of world Conservation Union
JICA	Japan International Cooperation Agency
l/c/d	liter Per Capita Per Day
l/d/c	Liter per Day per Capita
LEIAC	Licensed Environmental Impact Assessment Company
M/P	Master Plan
MAI	Ministry of Agriculture and Industry
MID	Ministry of Infrastructure Development
MLH	Mongolian Law on Hunting
MLNP	Mongolian Law on Natural Plants
MMR	Maternal Mortality Rate

Abbreviations

MNE	Ministry of Nature and Environment
MSS	Multi Spectrum Scanner
MW	Mega Watt
NDB	National Development Board
NPV	Net Present Value
O/M	Operation and Maintenance
ORS	Oral Rehydration Solution
/c/d	Per Capita Per Day
P.W.L.	Pumping Water Level
S.W.L.	Static Water Level
SP	Spontaneous Potential
SPR	Single Point Resistivity
SS	Suspension Solid
TM	Thematic Mapper
UNDP	United Nations Development Program
UNICE	United Nations Children's Fund
VES	Vertical Electric Sounding
VLF	Very Low Frequency (electromagnetic survey)
WHO	World Health Organization
WWTP	Wastewater Treatment Plant

I INTRODUCTION



I INTRODUCTION

1 BACKGROUND OF THE STUDY

The Government of Mongolia established "the Regional Development Plan of Western Five Provinces" including Gobi-Altai Aimag in 1993. The Government of Mongolia also adopted the Decree 119 of some measures on development of Gobi-Altai province in July 5, 1995. It is reported in the development plans that the shortage of water quantity and bad water quality had restricted the development of western part of Mongolia and Gobi-Altai province. Consequently, the improvement of quantity and quality of water in Altai city which is the capital and center of Gobi-Altai province, shall be given priority to promote the development.

Recently, Altai city has frequently encountered the suspension of water supply due to the superannuated water supply facilities and exhausted groundwater resources.

Altai city requested to improve the water supply facilities to the Ministry of Infrastructure Development. But, the central government could not cope with the improvement of water supply facilities in Altai city due to the shortage of budget and manpower.

Accordingly, the Government of Mongolia requested the technical assistance from Japanese Government in the formulation of a master plan for the water resources development and a feasibility study of high priority project for Altai city.

In response to the request of the Government of Mongolia, the Government of Japan decided to conduct the Study on Groundwater Development for Altai City (hereinafter referred to as "the Study") in accordance with the relevant laws and regulations in force in Japan. In May 1996, the Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched a mission headed by Mr. Makoto AOKI to Mongolia for the preliminary survey as well as discussions on the scope of work for the Study. The scope of work was agreed upon between the Government of Mongolia and JICA mission on May 18, 1996.

JICA, the official agency responsible for the implementation of the technical cooperation programs of the Government of Japan, will undertake the study in close cooperation with the authorities concerned of Mongolia.

Ministry of Infrastructure Development and Gobi-Altai Governor's Office act as counterpart agency to the Japanese Study Team and also as coordinating body in

relation with other organizations for smooth implementation of the Study.

In September 1996, Pacific Consultants International in association with Mitsui Mineral Development Engineering Co., LTD. (hereinafter referred to as "the Study Team") was appointed by JICA to conduct the Study. And in the same month, JICA dispatched the Study Team headed by Mr. Teruo TAHARA to conduct the first field survey in Mongolia.

Since September 1996 to February 1999, JICA Study Team has conducted the Study.

Flow Chart of the Study is shown in Figure 1.1

2 OBJECTIVES OF THE STUDY

The objectives of the Study are :

- (1) to formulate a master plan on water resources development (focusing on groundwater) and improvement of water supply system for Altai City for the target year of 2015,
- (2) to conduct a feasibility study for the priority project identified in the master plan for the target year of 2005, and
- (3) to pursue the technology transfer to the counterpart personnel in the course of the Study.

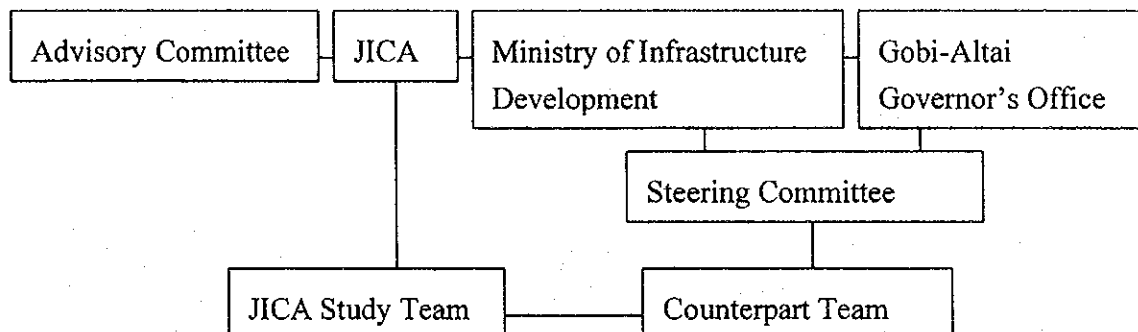
3 STUDY AREA

The Study area covers an area of about 600 km² as shown in Figure 1.2. The detailed groundwater development study covered the area of "Kharzat" and "Sukhyn Khooloy" as shown in Figure 1.2. Tsagaantokhoy and Taishyr along the Zavkhan river were also investigated as alternative water sources by reviewing previous studies.

4 STUDY ORGANIZATION

4.1 GENERAL ORGANIZATION

A general organization for the Study is described below.



4.2 JAPANESE ORGANIZATION

The official agency of Japanese side to execute the Study is JICA. JICA organized an advisory committee to ensure the smooth and appropriate execution of the Study. The Study Team consists of 11 members and Advisory Committee consists of three members as follows.

JICA Advisory Committee

1	Specialist on water resources, JICA	Dr. Yuji MARUO
2	Officer, Ministry of Foreign Affairs	Mr. Takaaki ANDO
3	Project coordinator	Mr. UEKI (former) / Mr. SEKINE (present)

JICA Study Team

1	Team leader, Groundwater planner	Mr. Teruo TAHARA
2	Hydrogeologist 1, Hydrologist	Dr. Katsuhito YOSHIDA
3	Hydrogeologist 2	Mr. Yusuke OSHIKA
4	Water supply planner	Mr. Nobuyuki GONOHE (former) Mr. Susumu SAKAGUCHI (present)
5	Environmental expert Water quality analyst	Dr. Kazuhiko IKEDA
6	Geophysical expert 1	Dr. Takashi OHYA
7	Geophysical expert 1	Mr. Hiroyuki ITOGA
8	Drilling expert	Mr. Takashi SUZUKI
9	Planner / Economist	Mr. Haruo YAMANE
10	Public health expert	Mr. Eimitsu USUDA
11	Coordinator	Mr. Youji. SAKAKIBARA / Mr. Naoki YASUDA

4.3 MONGOLIAN ORGANIZATION

Ministry of Infrastructure Development (MID) and Gobi-Altai Governor's Office (GAGO) acted as the counterpart agency to the Study Team and provided necessary counterpart staff. Mongolian Counterparts conducted the Study together with members of the Study Team. Good relationship and cooperation between Study Team and Mongolian counterparts had made good results overcoming the obstacles of language. Mongolian Steering Committee set up on September 1996 and Mongolian counterpart are listed in the following table.

Mongolian Counterpart

June 19, 1998

1	Team leader	U. BORCHULUUN, Officer, Department of Strategy Planning and Policy, MAI
2	Deputy team leader	R. DAGVADORJ, Director, Water Supply Company, Gobi-Altai province (Gobi – Altai Water Development Company)
3	Hydrogeologist	D. TSERENJAV, Senior research fellow in charge of Water Resources and Water Supply, Geoecology Institute
4	Hydrogeologist	R. BATTUMUR, Mineral Resources Department, MAI
5	Hydrologist	T. BAAST, Research Fellow, Geoecology Institute
6	Water supply planner	D. MYAGMAR, Senior officer, Department of Urban Development, Housing and Public Services, MID
7	Water supply planner	O. TSEDENDAMBA, Governmental Implementation Agency of Urban Services (GIAUS), MID
8	Water supply planner	D. MUNKHBAATAR, Senior officer, GIAUS, MID
9	Water supply planner	G. HURELHUU, Chief engineer, Public Service Department in Altai City (APSD)
10	Environmental expert	S. BARHAA, Officer, GAGO, State Inspector for Nature and Environment Control
11	Environmental expert	D.DORJ, Research fellow, Geoecology Institute
12	Drilling expert	Sh. YADMAA, (Gobi – Altai Water Development Company)
13	Planner / Economist	Ts. NERZEDGARAM, Chief, Statistical Division, GGO
14	Public health expert	S. BATCHIMEG, Hygiene inspector
15	Public health expert	D. GOMBOSUREN, Director, Social Health Care Center, Gobi Altai Province

Member of Mongolian Steering Committee

June 19, 1998

1	Chairman	Ts. DAMIRAN, Secretary of State, MID
2	Vice chairman	B. BATJAV, General Director, Department of Urban Development, Housing and Public Services, MID
3	Member	N. JANCHIVDORJ, Governor, Gobi Altai province
4	Member	B. JIGJID, Director General, GIAUS, MID
5	Member	Ts. SUKHBAATAR, Director, Department of Economic Cooperation, MID
6	Member	M. SAIJAA, Director, National Center of Hygiene, Epidemics and Virology (regulation agency)
7	Member	Ts. DAVAASUREN, Officer, Division of Foreign Relations, Ministry of Finance
8	Member	N. TEMUUJIN, Officer, Department of Foreign Relations and International Cooperation, Ministry of External Relations
9	Member	D. GANTIGMAA, Officer, Regulation Department on the Policy Implementation, Ministry of Nature and Environment
10	Member	S. CHULUUNKHUAYG, Scientific Secretary, Geoecology Institute
11	Member	B. BATMUNKH, Officer in charge of irrigation, Strategy and Planning Policy Department, MAI
12	Member	A. BUZMAA, Senior officer, Strategy Management and Planning Department, Ministry of Health and Social Welfare
13	Member	D. MYAGMAR, Officer, Department of Urban Development, Housing and Public Services, MID

5 REPORT

The Study reports are prepared as follows :

- Main report,
- Supporting report,
- Executive summary report,
- Data book, and
- Mongolian summary report.

Main Report

The main report presents the summarized results of the Study. It mainly consists of three part as follows :

- ① a description for the background information of the present social and natural conditions of Gobi-Altai province and Altai city,
- ② a description for the master plan study of the long term development plan,

and

- ③ a description for the feasibility study of the priority project.

Supporting Report (this Report)

The supporting report describes the details of the same contents presented in the main report.

Executive Summary Report

The summary report presents the summary of the Study.

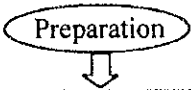
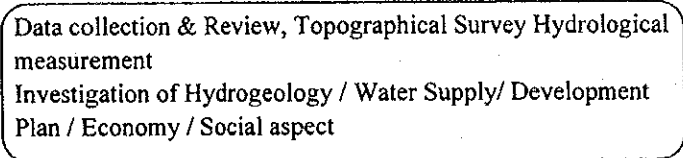
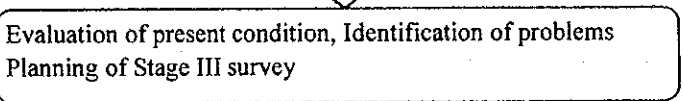
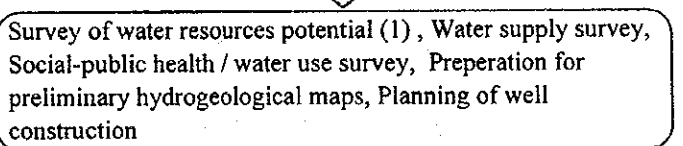
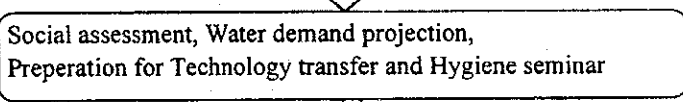
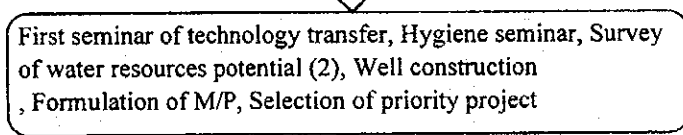
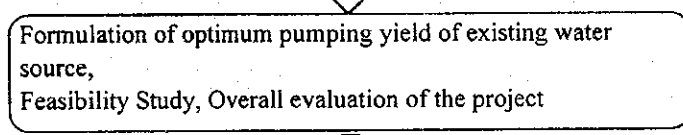
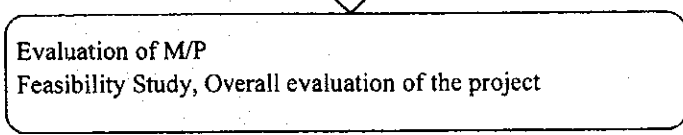
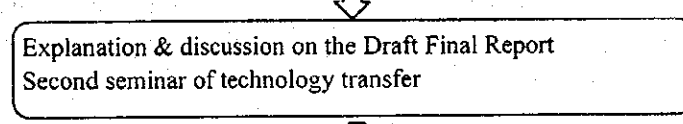
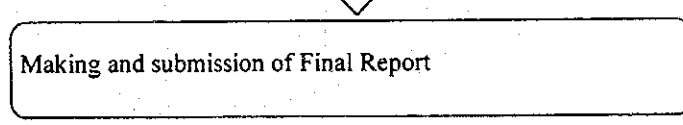
Data Book

The data book contains a basic data and information utilized and collected in the Study.

Mongolian Summary Report

The Mongolian summary report presents the summary of the Study in Mongolia.

Figure 1.1 Flow Chart of the Study

Period	Phase	Stage	Components	Report
Sep. '96				
Nov. '96	Basic Study	Stage I		Inception Progress (1)
		Stage II		Interim (1)
Feb. '97				
June '97	Master Plan Study (M/P)	Stage III		Progress (2)
Aug. '97		Stage IV		Interim (2)
Sep. '97		Stage V		
May '98		Stage VI		Progress (3)
Nov. '98				
Jan. '99	Feasibility Study			
Feb. '99		Stage VII		Draft Final
Mar. '99		Stage VIII		Final

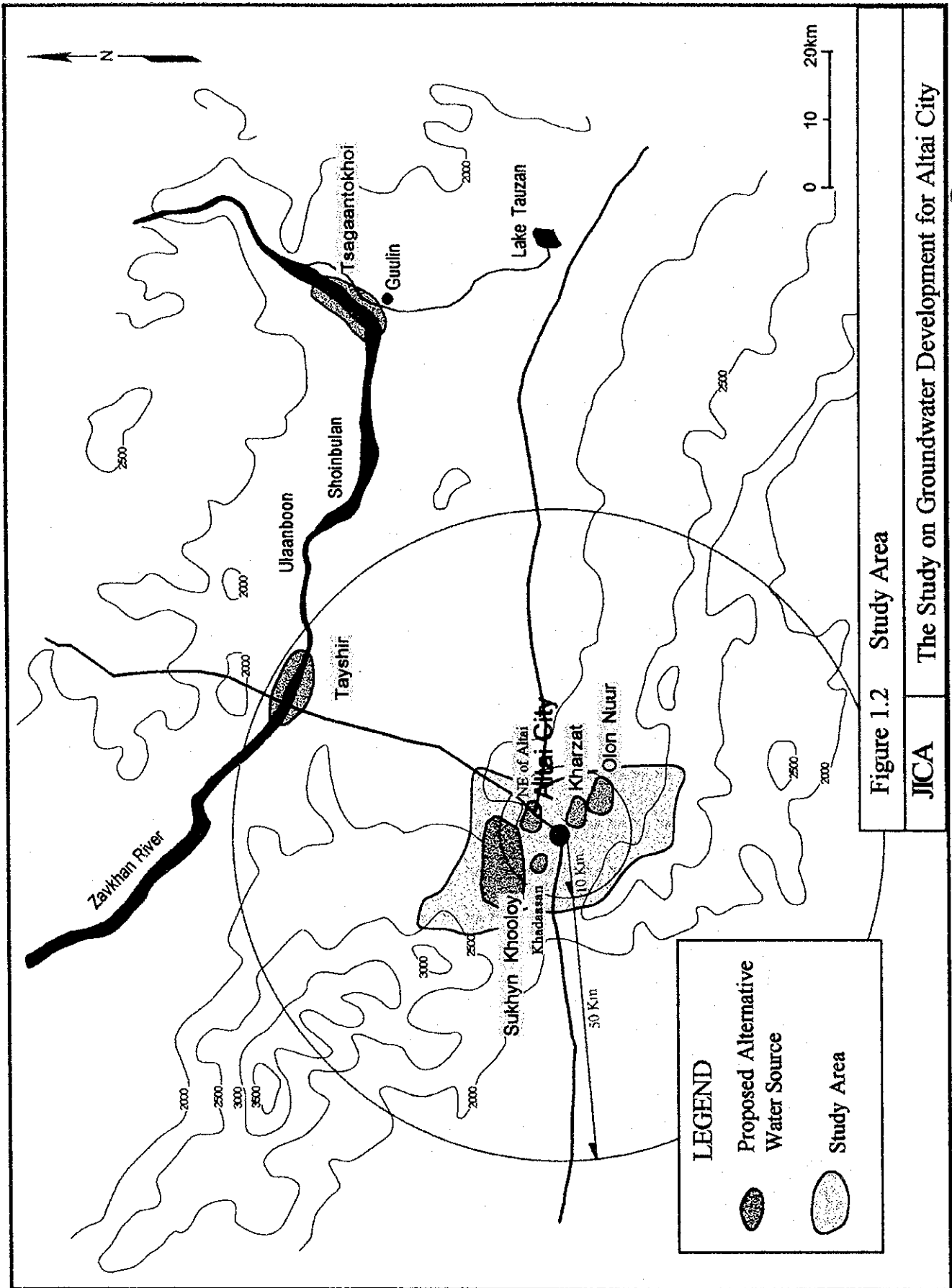


Figure 1.2 Study Area

JICA

The Study on Groundwater Development for Altai City

II PRESENT CONDITIONS



II PRESENT CONDITIONS

1 SOCIAL SECTOR SOCIETY AND HYGIENE

1.1 OBJECTIVES AND SCOPE OF WORK

The objectives and scope of work for social sector and hygiene education are:

- 1) to grasp issues on socioeconomic profile, water consumption pattern, willingness to pay for improved water supply, and knowledge about hygiene among the residents of Altai City, and then incorporate them into planning process,
- 2) to conduct hygiene education based on the prepared plan and educational materials in the course of the Study,
- 3) to disseminate major findings, methodology of social survey, and significance of social analysis to Mongolian counterparts and related personnel through a seminar,
- 4) to conduct social analysis in order to extract social issues and integrate them into master plan / proposed projects, and
- 5) to conduct a supplementary study regarding the people's view on the quality of water.

1.2 GENERAL VIEW

This section is to provide general view and background information of Altai City focusing on social infrastructure and social services including background information related to water supply and hygiene. The data and information for the Altai City were collected from Gobi-Altai Governors Office, Esunbulag District Office and the Gobi-Altai Province Social Health Center in the first fieldwork. The outcome of direct observation and group interview were also integrated into this section. For the purpose of comparison and complementing the lack of data, necessary data and information from national level were extracted from various reports produced by UNICEF, UNDP, and Ministry of Health and Social Service.

1.2.1 Social Structure

(1) Altai City

Altai City is located at 1,000 km southwest of Ulaanbaatar which is the nation's capital. The city is surrounded by small mountains and hills with short grasses. The altitude is 2,200 meters above sea level. The winter temperature marks -40 Celsius with occasional blizzard. The summer is rainy. The fall and spring are very windy.

Officially, Altai City has been placed under the administration of Esunbulag District, Gobi-Altai Province since April 1996. Altai-City was composed of four bags (No.1 - No.4) formerly, and later two more bags (division), Rashaant and Naran, were attached to Esunbulag District. The word "Altai City" used here stands for the former definition, in other words, it is focusing on the population of about twenty thousand in the four district.

The city is not only the administrative capital of Gobi-Altai Province but also a social, economic, and logistical center for both nomadic and sedentary life. Furthermore, the city is expected to be the base for future economic development of western territories.

The city can be divided into two areas based on the characteristic of dwelling pattern and infrastructure, the central area and ger area. The central area comprises various administrative offices for public services, commercial and industrial buildings, and one to three story residential apartment buildings. The ger area, surrounding the central build-up area, consists of three masses in the north, the southeast, and the southwest. It is estimated that more than 3,000 households dwell in this area. The central area constitutes hospital, post office, shops, museum, theater hall, library, kindergartens, schools, and heating facilities. Most of those building were constructed in the 1950's and 1960's while only a few building were constructed during the past five years. Transportation center, oil storage facilities, and power generation plant are placed adjacent to the central area but segregated from the residential area.

The town is compact enough to walk across but it takes 50-60 minutes to get to the edge of the southwest ger area from the Governor's office that is recognized as the center of the city. There used to be bus transportation service before the political and economic reform.

(2) Religion and Ethnic Group

Although the freedom of religion is guaranteed by the 1960 Constitution during social regime, it is in the 1990's that Tibetan form of Buddhism started coming back with its social value in Mongolia. The people in Altai City rebuilt Dashpeljeelen temple at the foot of monumental hill, Jargalant, in 1990, transferring its original location from the suburb of the Altai City. On the other hand, the people in Altai City are almost all Khalkh which are the largest ethnic group in Mongolia. However, neither the religion nor the ethnicity contribute social disparity which is sometimes the issue in other areas.

1.2.2 Media, Education and Social Service

(1) Media

Media and communication are still undertaken by state enterprises in Gobi-Altai Province. TV station with 10 staff members provide its local broadcasting service for 3 hours on every Monday evening and radio broadcasting for 30 minutes on every Monday morning. The number of TV set and radio are quite high with the ratio of 1 to 25 for TV set and 1 to 24 for radio respectively.

The weekly newspaper used to be published by the Governor's office so that the people could have access to necessary information for their local life. But, the newspaper office was shutdown due to the budgetary constraints and shortage of paper. The people only can read newspaper from shops and post office, which are transported by air plane for three times a week. This has lead to less accessibility to the information.

A movie theater used to operates 2-3 evening per week and concerts, dramas and dances were being performed for the people. The Province cultural center leads professional guidance for this purpose.

(2) Education

Mongolia literacy rate is remarkably high at a reported 98% for men and 96% for women with age 10 years or above. The enrollment and retention rates at the primary education was over 95% in 1990. Over three-quarters of the young people are

reported to have completed at least eight years of schooling. This is a considerable achievement in a country with a substantial nomadic population that required residential schools and boarding facilities for education of their children. However, due to the current economic crisis and the consequent shortage of financial resources for education programs, enrollment in primary and middle schools is dropping rapidly and drop-out rate is rising in all regions of the country. 1995 UNICEF report (An Analysis of the Situation of Children and Women - Mongolia, 1995) indicated the increase of drop out could be attributed to the followings.

- ① Demand for labor of children at home resulting from the dissolution of the livestock cooperative and privatization of herds
- ② Withdrawal of free boarding facilities for children
- ③ Inability of poor family
- ④ Skepticism about the relevance of education
- ⑤ Deteriorating quality of education service
- ⑥ Low salaries for teachers coupled with chances of more remunerative jobs in other fields is causing a higher attrition rate for teaching
- ⑦ Non availability of text book

In Altai-City, 6 schools engage in primary (1st -8th grade) and middle (9th-10th grade) school education. Four of them can be categorized under the middle schools of which three accommodate 1st -10th graders and the other one hold for 5th -10th grade. The remaining two are primary schools of which the one accommodates for 1st -8th graders and the other one takes 1st-4th graders. Three of the six schools were established in 1990's, the rest started teaching before 1980. Only one school is capable of boarding service.

According to the Population and Development Report, 1995, in the Gobi-Altai Province, 338 cases of children never attend primary school and 1,076 cases of drop out, with the age 8-15, were reported by the census of October-November, 1994. In 1995, 3,179 pupils enrolled in primary education (1st -8th grade) in Altai-City out of 3,852 of relevant age group (8-15 years of age), which is 83% of relevant age. However, the data state that only 60-70% of children actually attend classes of the relevant grades with respect to their age.

Number of enrolled pupils of 1st – 8th grade and relevant age group (8-15 years old)

	Boys	Girls	Total
Number of relevant age group	1,906	1,946	3,852
Number of pupils enrolled primary schools	1,575	1,624	3,179
% of enrolled pupils to the relevant age group	83%	83%	83%

Source: Gobi-Altai Governor's Office

According to the hearing from Esunbulag's school No.3, which has been upgraded to 1-10th grade school from 1-8th grade school recently, there were 30 cases of pupils having left school in 1994-95 but this trend is getting better by the effort of teachers and parents consultation, which has lead only 4 cases of quitting school in 1995-96.

Meanwhile, 42 women were numbered as illiteracy in which 65 people were categorized into this group in Altai-City.

(3) Social Service

The system of social service that had evolved prior to 1990 was considered to be quite adequate, providing pensions for the elderly and disabled as well as extensive benefits, including maternity leave and various child - related allowances. Social Security Supply office, Esunbulag District is the peripheral functioning office of social service with its own budget.

The table shows the type of current social benefits provided, amount of money allocated to each type and the number of beneficiaries during the first 9 months of 1996.

Social Security provided at Esunbulag Social Security Office, by the first 9 months of 1996

Category	Subject	Amount of compensation / benefit from January 96 to September 96 (Tg.)	Number of beneficiaries from January 96 to September 96
I	Pension, Support for widowed, Disabled	124,048,000	2,912
II	Salary compensation during hospitalizing, Funeral Expenditure	5,08,000	212
III	Unemployed	The law will be in force on 1997	-
IV	Compensation for industrial [workmen] accidents.	-	-

Source: hearing from Social Security Supply Office Esunbulag Office

Health Insurance covers 98% of people in the country. Salaried workers pay a half of the premium while the government funds the other half according to salary scale. In

case of Esunbulag District, 1,961 people were eligible for being paid by health insurance during the first 9 months of 1996 and Tg4,118,000 were paid for medical care from Social Security Delivery Supply office. However, disbursement of money covered by state budget tends to be delayed.

For working women, kindergartens take care of their children aged 3-7 years old with sharing 50% of its necessary cost. For the family who can't pay for the fee, day-care service is available to 7 years old limiting only 3 hours.

1.2.3 Women in Society

Mongolian women traditionally have had relatively higher social positions and greater autonomy than women in the Islamic societies of inner Asia or in East Asia. Women herded and milked cattle, and they routinely managed the household if widowed or if their husbands were absent due to military service or caravan work. Furthermore, the social regime brought women into public life giving them legal right to education, free medical care, equal pay for work, ownership and inheritance, decisions for marriage etc. According to the previous UNICEF report, as of April 1994, women make up 49% of the national workhorse, 64% in trade and supply, and over 70% in education, health and social sectors. Women's high level of enrollment in higher education reflected the female predominance in medicine, nursing, teaching as professional child care. However, once in the labor force they suffered the familial double burden of house work and child care on top of a day's work for wages. If women continue to live in the traditional setting, they would be in much stronger influence from the nomadic life.

The group interview and discussion held at Altai City indicate (Refer to Appendix 1 Group Discussion in Data Book) that women who live in ger area categorize family jobs depend on whether the activity is done outdoors or indoors. For instance, the ger group put walking and milking cattle as boys' regular work and taking care of babies and making milk products as girls' regular work while apartment group put homework and playing as children's regular work.

1.2.4 Dwelling and Community

About one fifths of people live in flats (apartments) linked to centrally organized piped

heating and water supply, while the rest live in traditional round felt tents called ger. Other dwelling style are wooden flats and single brick house to four story apartment, which are seen both in apartment area and ger area.

Living condition is not the same even among apartment dwellers in Altai-City. Comparably newly built apartments are usually equipped with electricity, telephone, piped water supply, central heating system, and flush toilet. However, some poor families who live in one room of old flat, usually widowed, unemployed, or elderly pensioner, dwell without water supply and toilet facilities. People live in those circumstance have to fetch water from neighboring apartment .

Ger is usually enclosed by wooden fence to ward off winter blizzard and spring storm. Many families keep a dog and even feed cattle in their plot. Electricity is supplied to those gers with unreliable power line. Refrigerator, motorbike, and television are seen in some ger.

For the people in Altai City, fuel is also one of the essential resources to survive in the winter season. Some people go for collecting animal dung for fuel in winter as wood and coal are expensive for their income.

A difference compared with large city like Ulaanbaatar is that there might be some support from relatives in country side in terms of food and goods.

Two women organizations are active in the city. Women Association has 10,000 members in Gobi-Altai Province and organize a course on health education, cooking, sewing etc. Liberal Women's Brain Pool was established three years ago, and now has 300 members. The organization promotes women education, home-economy, and support social status of women through political commitment.

1.2.5 Health and Hygiene

(1) Health System and Infrastructure

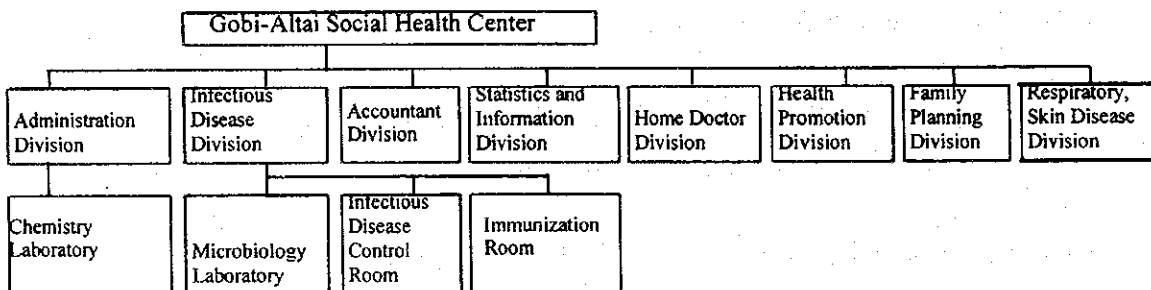
The health care system consists of five referral levels in Mongolia.

1. Rural health care is obtained through field units from which care goes out to nomadic people.

2. Village centers, comprising small sub-district level medical units (10-15 beds), are serviced by 2-3 sub-district physician.
3. Inter-village hospitals provide services for 2-3 Villages (40-100 beds) and are staffed by plural health professionals.
4. Provincial hospitals (250-450 beds) give more specialized services.
5. The tertiary health care is only available in the capital city of Ulaanbaatar with full medical and surgical specialties.

Altai City accommodates Altai College of Medicine and Gobi-Altai Province hospital. The college is one of the four medical colleges in Mongolia and produces 120-170 students for nurse and bag-physician. The hospital provides curative service to the entire population of Province. Gobi-Altai Social Health Center is responsible for public health service to the people in the Province including primary health care in Altai-City. Seventy staff members are engaged in the service at this institution as shown below. The Center also conducts water analysis and hygiene education.

Organizational Chart of Gobi-Altai Social Health Center



(1) Health Status

Infant mortality rate (IMR: No. of infant death per 1000 live births) of Altai City was estimated at 52.7, very close to the mean of Gobi-Altai Province(51.4), but higher than the National mean(44.6) in 1995. There were 2 cases of maternal deaths out of 503 births in Altai City in 1995. Therefore, estimated maternal mortality rate (MMR: No. of mother death per 100,000 live births) is 400.(See the Table below)

Selected Health Indicators for Altai City, Gobi-Altai Province, and the Country

	Infant Mortality Rate (per 1000 live births)	Under 5 Mortality Rate (per 1000 live births)	Maternal Mortality Rate (per 100,000 live births)	Life Expectancy (male / female)
Altai City	52.7**	-	400***	-
Gobi-Altai Province	51.4	66	-	-
National	44.6	62	215*	63/65*

* Source: UNICEF Report 1994

** Source: Gobi-Altai Province Social Health Center

*** Estimated

Immunization coverage rate of all vaccination (Measles -89%, Tuberculosis-89%, DPT-81%, and Polio-80) was 80% in 1995, but decreased from 88% of 1990. The ranking of infant death by causes in Altai City shows a quite similar pattern to the National one(See table below).

Infant death by causes, 1995

Causes of death	National			Altai-city		
	No. of cases	%	Rank	No. of cases	%	Rank
Respiratory disease	1242	51.6%	1	7	17.9%	1
Perinatal conditions	391	16.2%	2	6	15.4%	2
Digestive system diseases	188	7.8%	3	5	12.8%	4
Infectious and parasite diseases	160	6.6%	4	5	12.8%	4
Neurological diseases and the disease of sense	86	3.6%	5	6	15.4%	2
Diseases of blood circulatory system	79	3.3%	6	2	5.1%	7
Accidents, trauma, poisoning	76	3.2%	7	2	5.1%	7
Unknown syndrome	59	2.5%	8	0	0.0%	-
Congenital malformations	57	2.4%	9	3	7.7%	6
Diseases of blood and blood forming organs	20	0.8%	10	2	5.1%	7
Others	50	2.1%	-	1	2.6%	10
Total	2408	100.0%		39	100.0%	

Source: Social Health Center / Ministry of Health and Social Service

According to the Social Health Center, the ranking of adult death by cause in Altai City indicates that 80% of the death can be attributed to disease of blood circulatory system (31.9%, 30 cases) malignant neoplasm (16.8%, 19 cases), respiratory infectious disease (16.0%, 18 cases), and infection of digestive system (15%, 17 cases) in 1995.

(2) Water Related Disease

Virus hepatitis (A), dysentery, and scabies categorized under the water-borne disease and water-washed disease (Bradley, 1974) are common in Altai City. All of those are reported during the past 12 months in Altai City (Refer to Appendix 2 Reported Infectious Disease in Data Book).

While diarrhea cases are usually not reported for official recording, WHO and Ministry of Health and Social Service Study indicate the prevalence of diarrhea and attribution of child death to diarrhea. The group interview and discussion from women of Altai-City also disclosed the frequent use of Oral Rehydration Salts (ORS), which hint the high prevalence of contaminated water. Further more, according to the hearing from one of 3 pharmacy shop in the City, 10 - 20 pack of ORS in average are sold every day.

According to the director of the Social Health Center(as of 1997), calcium and magnesium imbalance (When the amount of calcium is less than the amount of magnesium) would account for certain chronic diseases such as liver cirrhosis and renal calculus. He mentioned that continuous intake of those imbalance minerals in drinking water would lead to the diseases. Meanwhile, a doctor of the hospital pointed out over-take of Sodium which people put in local tea in the form of sodium chloride, increase the prevalence of certain chronic disease, such as high blood pressure in Altai City (Refer to Section 1.8)

(3) Hygiene and Sanitary Practice

Those living in the ger areas rely principally on water delivery by water-wagon. Acute shortages in fuel and spare parts for the wagons makes it difficult to supply them with as much as 40 liters of water. As a result, people get only 5 to 10 liters per person per day, instead of 40 liters recommended by national hygiene services.

For those families living in apartment blocks, with flush toilets connected to a municipal sewage system, sanitary conditions are better than those who live in ger areas.

In ger areas, people dig two holes with a depth of 1.5 meters at one corner of their plot and use one for latrine, the other for waste disposal. A pit latrine usually has a wooded housing on top. It is obscure how many people practice anal cleaning. However, some people use waste paper for that purpose.

There is one public shower facility which opens on Saturdays and Sundays from 10:00 - 18:00. Although it covers the entire city less and less people are using it every year, ranging from 2 to 70 visits per day.

(4) Water Delivery

The survey revealed that carrying water containers from a water-wagon delivery point to ger plot is mainly women and children's work. They bring various kinds of container of 10 - 60 liter volume with or without a lid and carry them in their hands in helping each other. They don't use a wheel carrier which is seen in Ulaanbaatar. In most cases, they make two round trips so the volume of water becomes 80-100 liter in total. The water delivery service is available only every other day due to the limited manpower and water facilities.

(5) Hygiene Education

Primary and middle school curriculums do not included health and hygiene practice education. Physical exercise and biology might be relevant subjects but they only give physical check up on weight, breast size, height, blood pressure, and breathing capacity. Although some health education programs are being prepared for schools with the joint cooperation of Ministry of Education, Ministry of Health and Social Service. However, it is anticipated that the shortage of supplies such as soap, towel, and toilet paper will make it difficult to conduct hygiene education since some students live in ger area without those supplies. In addition, like District's No3 school where water flush toilets are available on every floor but most of them are out of service with lack of taps and spare parts.

At the college of medicine, public health has become one of the emphasized subjects to 2-3rd students, being taught 8 hours per week by 2 instructors. However, textbook for public health is not available

(6) Support from international agency

UNDP / World Bank / Swedish Government support national hygiene education program through their Water Supply and Sanitation Technical Assistance and Capacity Building. In this project, two education materials were developed: a printed ring file and 20 minutes videotape. The project team also provided hygiene education

training to 3-5 health staffs from three villages of Gobi-Altai Province including Altai City with distribution of 5 copies of the material for each village. The first training session was held in Ulaanbaatar, then the second session was implemented at Dund-Gobi Province.

1.3 PLAN AND DESIGN OF SOCIAL SURVEY

Two major components were planned and carried out in the development study. One was a social survey through household interviews and group discussion on water-use and knowledge on hygiene and sanitation among the residents and the institutions. The survey was expected to provide information and data for social analysis. A local contractor under the supervision of the Study Team undertook the actual field interviews.

The other item was a preparation of hygiene education program that was first implemented in 1998. The work includes a supplementary study on the people's view on the quality of water. In addition, the present hygiene education policies and programs in public sector, water usage and hygiene practice, possibility of participatory planning for hygiene education program, assessment of organizational capability on hygiene education were included. The preparation of educational materials was contracted out to a local consultant.

1.4 HOUSEHOLD SURVEY

One of the JICA Study Team members, who was responsible for social survey prepared the operational plan together with the design of questionnaires for households and institution survey prior to the second field survey. The fieldwork of the survey was contracted out to a local consultant within the framework of the operational plan (Refer to Appendix 3 Plan of Operation in Data Book). The questionnaires were adapted to the situation of Altai City and to the project needs, then those were translated, revised and pre-tested through the contractor in Ulaanbaatar under the supervision of JICA Study Team. Besides those prepared questionnaires, additional qualitative approach was used as well.

Prior to the field survey in Altai City, the JICA Study Team requested for cooperation and support from the Governor of Gobi-Altai Province, Usunbulag District

Administration Office, and the leaders of 4 targeted districts. Messages calling for cooperation from the citizens was also broadcast through radio and TV.

1.4.1 Sampling Scheme

Samples were supposed to be taken from both the household with piped water supply and the non-piped households that is not connected to piped water supply. As some households in ger area live in brick apartment or wooden house without piped water supply, random sampling method was applied for the sampling of household survey with the help of Eusunbulag District Administration Office. 200 samples were randomly drawn out from a list of 1,251 households submitted by 4 district leaders (bag leader).

As for the institution survey, 20 institutions were listed and all of them were surveyed. They were chosen by the counter-parts according to water consumption level and public importance .

1.4.2 Questionnaire

The questionnaire prepared for household survey consists of 117 questions regarding socioeconomic profile, water consumption pattern, and willingness to pay for improved services, perception on the current service and knowledge about hygiene. A draft of questionnaire was produced prior to the second field survey based on the information collected from the first field survey.

Some of the questions in the questionnaire were designed to ask the same issue from a different angle so that some discrepancies can be identified and possibly corrected (Refer to Appendix 4 Revised Questionnaire for Household Survey - English version in Data Book).

The questionnaire prepared for institution was used for interviewing with those in charge of institutions. Some institutions were visited again so that raised questions were clarified (Refer to Appendix 5 Prepared Questionnaire for Institutions – English version in Data Book).

Those prepared questionnaires were translated into Mongolian and tested with the

dwellers of both apartment and ger in Ulaanbaatar to assess or find out cultural bias, logical error, wrong-translation, and timing. From the response of this pre-testing, some questions were revised and then the necessary number of the questionnaire were printed (Refer to Appendix 6 Questionnaire for Household Survey - Mongolian version and Appendix 7 Prepared Questionnaire for Institutions - Mongolian version of the Data Book).

1.4.3 Training of Supervisor and Interviewers

One of the objectives in the plan of operation is to supervise the local contractor (Supervisor of the field survey team) so that they properly follow the schedule along with the plan. The person responsible for social survey of the JICA Study Team took a role of editor, who finally judged the validity of the answers. The local contractor recruited six field interviewers. They were all female students or graduates of Medical College in Altai City. The training of interviewers took two days using the prepared training sheets (Refer to Appendix 8 Training Sheet for Household Survey - English version and Appendix 9 Training Sheet for Household Survey - Mongolian version of the Data Book). The training also included discussion and role-plays using Training Sheet.

1.4.4 Fieldwork

The fieldwork was conducted from 25 June to 3 July 1997 covering all four districts in Altai City. Every interviewer was responsible for visiting 30 - 35 households on average during the above period. The filled questionnaires were taken to the supervisor to be checked for a discrepancy or unanswered questions before taken to the editor. The editor corrected data if there was any obvious discrepancy in the answers. Respondents were limited to the adult of 18 years or older, preferably female.

1.4.5 Quality Control and Data Analysis

After the completion of the fieldwork, the team consisting of the editor, the supervisor and the interviewers had a review meeting on the whole process of sampling, training, and fieldwork. The identified issues are as follows.

- 1) Although there were minor errors on Q68, Q103 and Q114 in the questionnaire, they were well recognized and well measured by the interviewers.
- 2) A few respondents were reluctant to answer the questions about the family's income
- 3) The samples were taken from the prepared list in which the district leaders drew spontaneously 2-3 households by every street from the original book of households' registration. In this sense, the sample selection did not follow perfectly randomization though, the team judged that the samples would represent the population with a meaningful degree.

The survey data were entered into a database for a required analysis. Excel spreadsheet was also employed to analyze data.

1.5 RESULT AND FINDINGS

1.5.1 Household Survey

The counting of the respondents to the specific question and some basic statistics are presented in the summed up result of household survey (Refer to Appendix 10 Summed up result of Household Survey of the Data Book).

The following are the findings from the result.

(1) Sample Distribution

A total number of 197 households responded to the interview in which the survey team visited 213 out of 3,516 households (As of December 1996) from 24 June to 30 June 1997. 124 out of 197 household in a traditional ger and 73 households dwell in brick apartment or wooden flat. The locations of sampled households are shown in the location map (Refer to Appendix 11 Location of Samples of the Data Book)

Thirty-seven (37) out of 73 non-ger dwellers were residents of apartment with piped water supply (hereinafter: piped households). In other words, 160 households including 124 ger dwellers out of 197 sampled households depend on water wagons for the delivery of the water (hereafter: non-piped households).

Cross table for settlement pattern by different source

Settlement pattern	Number of samples with household survey*	Number of households (as of December 1996)	Population (as of December 1996)	APSD served population
Apartment (Assumed as piped water supply)	37(19%)	441(13%)	2,253(13%)	1,985
Traditional ger or others (non-piped)	160(81%)	3,075(87%)	15,713(87%)	(4,650?)
Total	197(100%)	3,516(100%)	17,966(100%)	-

* June 1997

(2) Characteristics of Respondents / Households

The average age of respondents is 38 years. 53% of them went to school for more than 10 years and 65% of the respondents were female.

The average number of family member with the sampled households is 5.11 while 11% of respondents mentioned the residence of visitors in their houses.

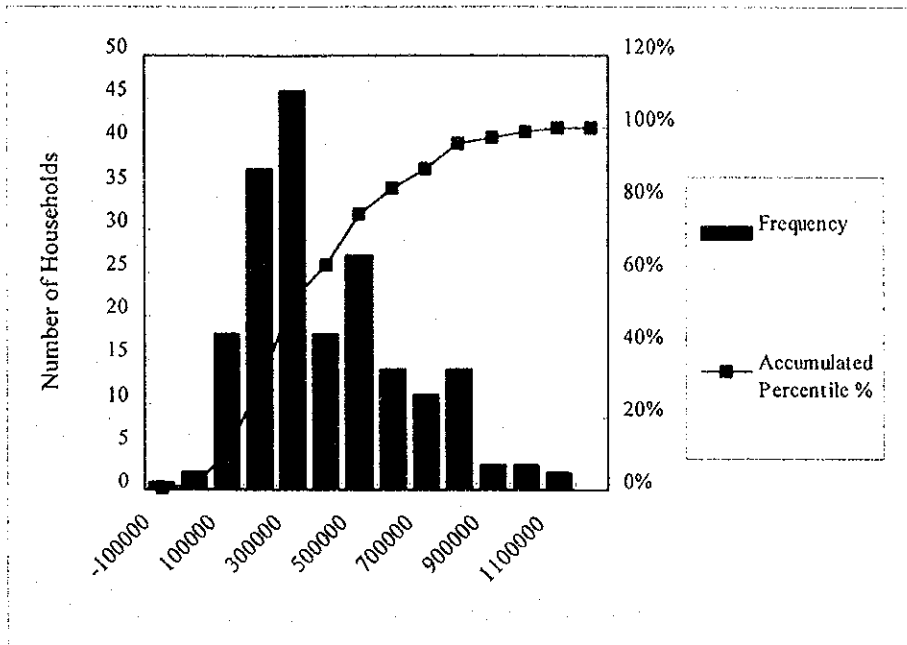
The sampled households are mostly male-headed and have been living in their dwelling site for 15 years on average although two (2) households stay in their dwelling site temporarily.

Fifteen (15) out of the 197 sampled households keep livestock. Six (6) of them keep their livestock in their plot and at least three (3) households give livestock paid-water.

(3) Socioeconomic Profile

The main source of income for the sampled households is regular and temporary work (74%) and pension (29%) or both. In addition, 8% of the households borrow money and 12% of them get financial or material support from relatives or friends for their living.

The median of the total income of all the sampled households in the last 12 months is Tg299,940. In other words, 50% of the sampled households earned less than Tg299,940 in the past 12 months. There were a few households with debt. The distribution of the income and the numbers of households are shown below.

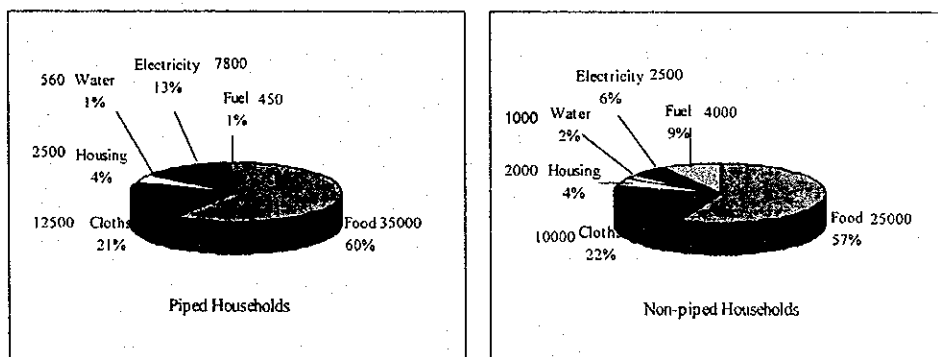


The distribution of households by income

With regard to the expenditure, 50% of households spend more than Tg 47,920. If this were simply multiplied by 12 months, the median annual expenditure would be Tg575, 040, which exceed the estimated annual income of Tg 299,940 by the amount of Tg 275,100. In this regard, it seems that the respondents tend to give excessive estimations of the expenditures.

The category under which they spent most of the income were food and clothing followed by fuel. The majority of respondents think that the autumn (October - December) and the winter (January - March) are the highest spending seasons.

The following are the figures of the median monthly expenses for the specific categories from both piped households and non-piped households.



Monthly expenses (proportion of expenses) by categories with non-piped households and non-piped households

The non-piped households spend Tg 1,000 (2% of monthly expenditure)¹ for water out of Tg 44,500 on the other hand, the piped households spend Tg 560 (1% of monthly expenditure) out of Tg 58,810. As all the piped households dwell in apartments, they are required to pay for heating from 1 October to 1 May of the following year. Those who live in apartments were estimated to spend Tg5,000 per month for heating.

(4) Water Usage and Service

The piped households have 1.91 taps on average besides flush toilet, bath tub and shower. In the 197 sample households, three (3) households share a tub with others. They use water most in the evening.

Fourteen (14) out of the 37 piped households are not satisfied with the current service of water supply as shown in the following Table. They put reason that the water sometimes stops as the first place, the quality of water is not good, and facilities are deteriorating as the second and the third places respectively.

In spite of the above fact, they want authorities to improve the quality of water at first, then availability of the water next for priority. There was no respondent who selected the tariff level as a problem.

Satisfaction of the service among piped households

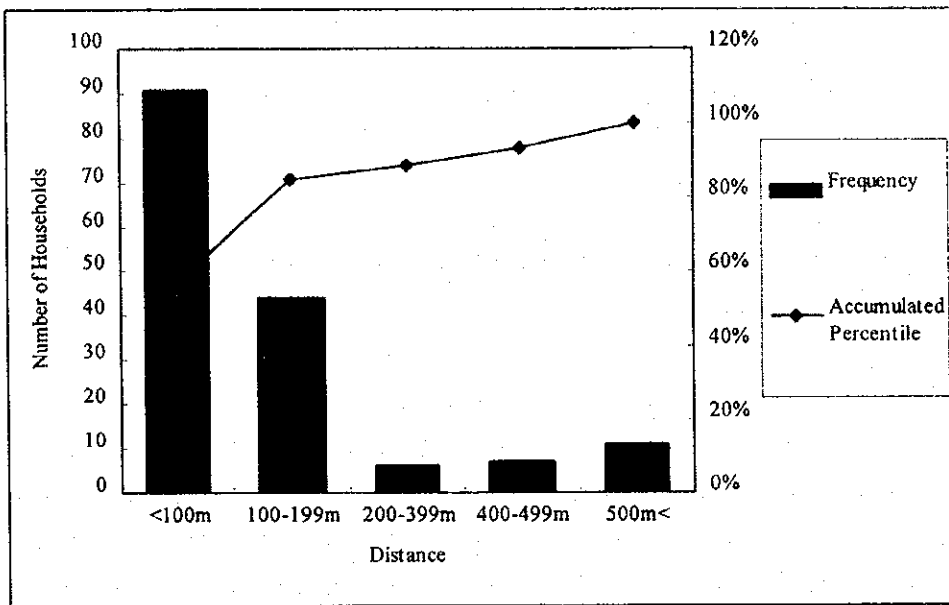
50	Are you satisfied with the existing service on water supply?	<input type="checkbox"/> Yes 1 <input type="checkbox"/> Don't know 2 <input type="checkbox"/> No 3 <div style="text-align: right;">Null 1</div>	19 3 14 1	
Total / No. respondents			37	
51	If "No" in the above question, in what respect are you not satisfied? You can select more than one.	<input type="checkbox"/> Sometimes water stops coming / <input type="checkbox"/> Water quality is not good <input type="checkbox"/> Facilities are deteriorating <input type="checkbox"/> Volume of running water is not enough <input type="checkbox"/> Water tariff is too expensive <input type="checkbox"/> Others (specify)	<div style="border-bottom: 1px solid black; display: flex; justify-content: space-between; font-size: small;"> "Yes" count % </div> 11 79% 8 57% 8 57% 2 14% 0 1 7%	
No. respondents to the above question			14	

Household Survey June 1997

¹ expressed as median which is expected to represent the average most properly in this area

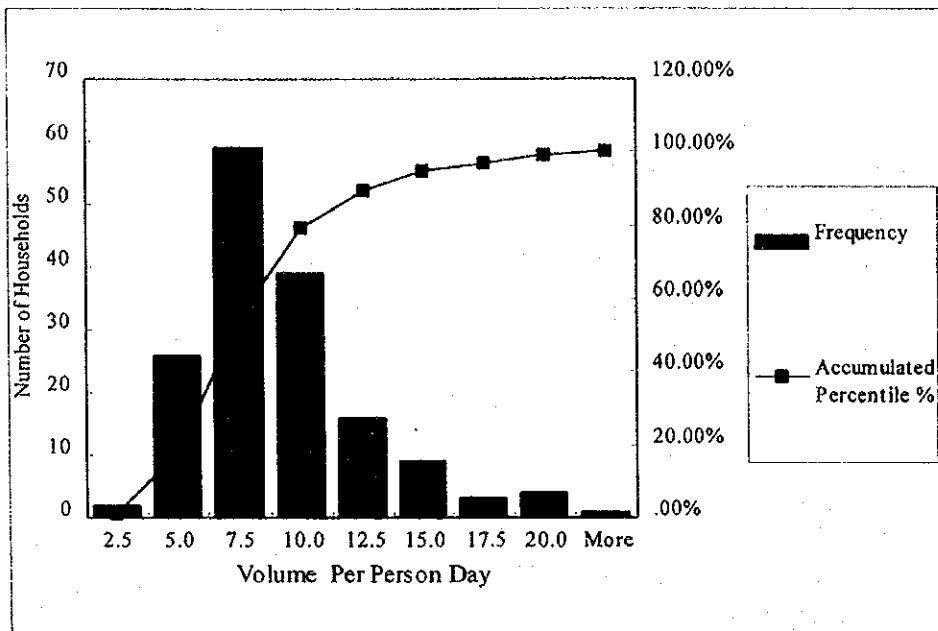
answer to the question of “up to what level of water tariff they would be ready to pay if the condition is improved and managed by means of cost sharing”.

Regarding the water delivery service by water wagon, 85% of the non-piped households have access to the water within 200m, although 7% of them have to walk more than 500 m to fetch water. The average non-piped household carries 80.3 liters of water every other day and it takes 10.5 minutes for them to complete the workload by two persons (See the following figure).



Distribution of non-households for distance to track delivery points

The following histogram shows the frequency distribution of the 128 non-piped households for the volume of water consumption per person per day. The average volume of water used in a day per person was 8.6 l/c/d or 7.9 - 9.3 l/c/d with 95% confidence. However, 27% or 31 out of 160 non-piped households think that they do not get enough water for their requirement.



Distribution of non-piped households for the volume of water consumption per day per person

Fifty-three (53)% of the non-piped households are not satisfied with the existing way of getting water as shown in Table below. The answer that the water is not available whenever they want was placed at the top (94%). The answers that the quality of water is bad (65%) and the water delivery points are too far have come to the second and the third respectively. Furthermore, they prefer a yard connection (71%) to a public kiosk (26%) if the service would be strengthened.

Satisfaction of the service among the non-piped households

68	Are you satisfied with the existing way of getting water ?	<input type="checkbox"/> Yes 1 <input type="checkbox"/> Not sure 2 <input type="checkbox"/> No 3 <div style="text-align: right;">Null</div>	71	44%
		Total / No. respondents	160	100%
<hr/>				
69	If "No" in the question above, answer the following questions What will be the source of water you want most and why?	<input type="checkbox"/> House Connection 1 <input type="checkbox"/> Yard Connection 2 <input type="checkbox"/> Public kiosk 3 <input type="checkbox"/> Other (specify) 3	<div style="text-align: right;">"Yes" count</div> 2 57 21 0	<div style="text-align: right;">%</div> 3% 71% 26%
		Total / No. respondents	80	100%
<hr/>				
70	Because	<input type="checkbox"/> Water is not available whenever you want <input type="checkbox"/> Number of truck service is not sufficient <input type="checkbox"/> Water delivery point is too far <input type="checkbox"/> Water quality is not good <input type="checkbox"/> Water tariff is too expensive <input type="checkbox"/> Fetching water is burden of family's work <input type="checkbox"/> Other (specify)	<div style="text-align: right;">"Yes" count</div> 75 29 41 52 33 38 1	<div style="text-align: right;">%</div> 94% 36% 51% 65% 41% 48% 1%
		No. respondents to the above question	80	

Household Survey June 1997

While 91 out of 160 non-piped households wish to receive piped water and accept paying the tariff of piped water supply, only 2 households actually answered that they would pay for the present level of tariff for piped water supply. As a matter of fact, the rest or 89 households answered they prefer the present tariff level of wagon delivery to the tariff of piped water supply. They would be ready to pay even for doubled level of the present tariff for the wagon delivery. However this means that they would like to maintain the current tariff level since the tariff of wagon delivery was doubled in 1997 as it has been doubled almost every year in the past (See Table below).

Willingness to pay among the non-piped households that prefer upgrading of the service

74	<p>In the future, water tariff for piped water supply likely to be raised to cover cost for improving and maintaining the system in good condition. In this event, up to how much would you be ready to pay for piped water supply service. Suppose a situation in which you will get water in sufficient amount and good quality.</p> <p>Please answer "yes" (meaning you are ready to pay) or "No" (meaning you are not ready to pay) to the tariff levels given by the interviewer.</p>	<p>Present tariff level</p> <p><input type="checkbox"/> Maximum</p> <p><input type="checkbox"/> Minimum</p> <p><input type="checkbox"/> Average</p> <p><input type="checkbox"/> Median</p> <p><input type="checkbox"/> % increase of the median</p>	<p>1 Tg/l</p> <p>10 Tg/l</p> <p>1 Tg/l</p> <p>2.9 Tg/l</p> <p>2 Tg/l</p> <hr/> <p>100%</p>
No. respondents to the above question			89

Sixty-nine (69) out of 160 non-piped households are not interested in piped water supply. They would like to reserve or reduce the current tariff level of wagon delivery even if the service would not improve. In fact 50% of this group answered that the current tariff should be reduced (See Table below).

Willingness to pay among the non-piped households that are not interested in upgrading the service

75	<p>If you wish to continue get water from water truck ser and to solve the problems mentioned in Q70, cost sha is needed to keep the syste good condition.</p> <p>Suppose a situation in which you will get water in sufficient amount and good quality, up to what level of water tariff would you ready to pay? Please answer "yes" (meaning you are ready to pay) or "No" (meaning you are not ready to pay) to the tariff levels given by the interviewer.</p>	<p>Present tariff level</p> <p><input type="checkbox"/> Maximum</p> <p><input type="checkbox"/> Minimum</p> <p><input type="checkbox"/> Median</p> <p><input type="checkbox"/> Average</p> <p><input type="checkbox"/> % increase of the median</p>	<p>1 Tg/l</p> <p>12 Tg/l</p> <p>0.25 Tg/l</p> <p>1 Tg/l</p> <p>2.3 Tg/l</p> <hr/> <p>0%</p>
No. respondents to the above question			69

(5) Water Consumption Pattern

The average consumption of water for drinking and cooking of all the sampled

households was 4.0 l/c/d and the one for personal hygiene and laundry was 5.8 l/d/c. While a few households use most of the water for livestock, 95% of households use most of the water for daily life as such drinking and personal hygiene.

(6) Health and Hygiene

Thirty (30) % of the sampled households own or share a flush toilet and the rest use traditional pit toilet. The interviewer observed that 68% of homes were heavily infested with flies.

Ninety two (92) % of the respondents have heard about disease that can be transmitted through contaminated water. Within two weeks before the beginning of the survey, 21 persons of 16 households had diarrhea and 2 of them consulted with a doctor. However, there was no peculiar geographical pattern of diarrhea cases within sampled households (Refer to Appendix 12 Prevalence of Diarrhea in the Past Two Weeks in the Data Book)

Most of respondents know about Hepatitis A, Dysentery and Scabies. Nine (9) households had a patient of Hepatitis A within 2 years before the survey.

In twenty-four (24)% of the households, there is at least one member who had participated in health or hygiene education in the past.

1.5.2 Analytical Statistics of Household Survey

Analytical statistics was applied to see if there was a difference in answers among the social groups. Seven characteristics were tested to the following social groups using t-test and chi-square test. It should be noted that all the data collected are based on the respondent's perceptions but not an objective measurement.

(1) The Piped Households and the Non-piped Households

Despite the piped households consume 200 liters l/c/d on average², they perceive that they consume less amount of water for drinking and washing than the amount the non-piped household perceive. For instance, the average amount of water they think they use for drinking and cooking among the piped households is 14.4 liters per household per day. It is significantly lower than 21.7 liters per household per day of the non-

² The estimation was made through the measurement. See chapter 6 Water Supply System.

piped households ($t = -3.56, P < 5.6 \times 10^{-4}$).

In addition, when the consumption of water is converted to individual consumption volume, the average consumption of the water for hygiene and laundry of the piped households is 5.45 l/c/d and significantly lower than 6.70 l/c/d of the non-piped households ($t = -1.859, P = 0.06$). It was assumed that the piped households don't care much about how much water they use since they can get the water whenever they want. Contrary, the non-piped households are always required to calculate how much water is left till the next delivery. There was no significant difference between the two means of households' composition.

Since the water tariff is set by different standard among the piped and non-piped, percentage of increase to the present tariff level was used for the comparison of the willingness to pay. The average percentage of increase to the present tariff of which the piped households approved is 35% and significantly lower than the 163% of which the non-piped households approved ($t = -4.43, P < 1.53 \times 10^{-5}$).

It is noted that the ratio of respondents with more than 10 years education in the piped households is significantly higher than in the non-piped households.

The piped household vs. non-piped households

	Piped households		Non-piped households		t-value	P-value	χ^2	df
	mean _i	N _i	mean _j	N _j				
Household income*	559,154	37	329,063	158	1.73	0.08	-	194
No. of household's members	5.2	37	5.1	159	0.39	0.69	-	195
Volume of water used by per day per capita	-	-	8.6	160	-	-	-	-
% of increase with the present tariff	35%	35	163%	157	-3.56	5.6×10^{-4}	-	191
Volume of water used for drinking and cooking	14.4	37	21.7	159	-4.43	1.53×10^{-5}	-	195
Volume of water used for personal hygiene and laundry	26.5	37	30.4	159	-1.42	0.155	-	195
No. of households that have diarrhea	3	37	13	159	-	-	0.00057	1
No. of respondents with higher education	29	37	72	156	-	-	12.45	1
No. of households that has health or hygiene education	13	37	33	156	-	-	3.22	1

(2) Lower Income and Higher Income

In order to divide all the households into lower income group and higher income group, the following classification was applied to the grouping.

First, all the households are put in order of the "income divided by the number of adults (15-60 years) in the households". Lower income group is defined as the lowest quarter. The rest three-quarters are put under the higher income group.

The average percentage of increase to the preset water tariff of which the piped households approved is 80% and it is significantly lower than the 161% for the higher income group ($t=-2.49$, $P<0.01$).

It is noted that the proportion of respondents with more than 10 years education in the lower income group is significantly lower than that in the higher income group. Furthermore, the number of household's member in the lower income group is 6.3 and significantly larger than the 4.7 of the higher income group ($t=5.47$, $P<1.35 \times 10^{-7}$).

Lower income households vs. higher income households

	Lower Income		Higher Income		t-value	P-value	X ²	df
	mean _i	N _i	mean _j	N _j				
Household income*	213,688	105	516,523	91	-	-	-	-
No. of household's members	5.8	106	4.3	91	5.71	4.18×10^{-8}	-	195
Volume of water used by per day per capita	7.9	91	9.3	69	-2.1	0.035	-	158
% of increase with the present tariff	148%	105	131%	88	0.55	0.57	-	191
Volume of water used for drinking and cooking	22.3	106	18.1	91	3.11	0.02	-	195
Volume of water used for personal hygiene and laundry	28.6	106	30.9	91	-1.099	0.27	-	195
No. of households that have diarrhea	10	106	6	91	-	-	0.529	1
No. of respondents with higher education	43	15	59	89	-	-	12.4	1
No. of households that has health or hygiene education	23	105	24	89	-	-	0.67	1

(3) Unemployed and Employed

The comparison based on employment status was also tested. The volume of water used for drinking and cooking in a household was compared. Household with at least a member of family works regularly or temporarily uses 29.1 liters per a household. It is significantly lower than the 35.5 liters per a household of which the source of income is only from pension ($t=-2.12$, $P=0.04$).

Employed vs. Pensioners

	Regular & Temporary Work		Pension only		t-value	P-value	X ²	df
	mean _i	N _i	mean _j	N _j				
Household income*	361,694	144	383,259	34	-0.47	0.64	-	176
No. of household's members	5.1	145	5.2	34	-0.34	0.73	-	177
Volume of water used by per day per capita	8.5	116	9.8	28	-1.38	0.17	-	143
% of increase with the present tariff	152%	139	132%	34	0.51	0.61	-	171
Volume of water used for drinking and cooking	20.2	145	22.1	34	-1.04	0.3	-	177
Volume of water used for personal hygiene and laundry	29.1	145	35.3	34	-2.12	0.04	-	177
No. of households that have diarrhea	12	145	1	34	-	-	1.16	1
No. of respondents with higher education	72	142	23	34	-	-	3.17	1
No. of households that has health or hygiene education	29	142	16	34	-	-	10.22	1

Within the non-piped households, the volume of water used by a household whose source of income come from regular and temporary work is 8.5 l/c/d and significantly higher than the 6.4 l/c/d of the households which do not have the source of income (t=2.16, P=0.03).

Employed vs. Unemployed

	Regular & Temporary Work		Unemployed		t-value	P-value	X ²	df
	mean _i	N _i	mean _j	N _j				
Household income*	361,694	144	252,022	18	1.86	0.06	-	160
No. of household's members	5.1	145	5.4	18	-1.059	0.55	-	160
Volume of water used by per day per capita	8.5	116	6.4	16	2.16	0.033	-	130
% of increase with the present tariff	152%	139	60%	34	1.66	0.98	-	155
Volume of water used for drinking and cooking	20.2	145	18.6	18	0.76	0.44	-	162
Volume of water used for personal hygiene and laundry	29.1	145	23.2	18	1.7	0.09	-	162
No. of households that have diarrhea	12	145	3	18	-	-	1.34	1
No. of respondents with higher education	72	142	7	18	-	-	0.89	1

Reference only: the distribution does not follow Gaussian distribution

(4) From the Notes and Comments on Questionnaire

The interviewers made some useful notes during the household survey.

While some households are ready to pay for 10 times higher tariff to the present one with improved water supply, the poor households opposed to the increase of water tariff and even expected it to be lowered up to one fourth of the current level.

Part of the income was not calculated properly due to its provision in terms of labor or

livestock property outside of the city.

1.5.3 Institution Survey

The result of the interviews was presented in the summary table (Refer to Appendix 13 Institution Result: Summary table of Institution Survey in the Data Book).

The public institutions where many people gather or stay in are usually the largest water consumers. The hospital is ranked as the largest consumer among the institutions. They consume 4,900 m³ of water per month for laundry and cooking. The middle school and Medical College are also large consumers.

Among the private companies, the Ilch-Altai Heating Center and the Mandal service Company consume more than 4,000 m³ per month for heating and producing liquor respectively.

The large consumers tend to be unsatisfied with the existing service. The hospital marked 4 out of 5 reasons for dissatisfaction with the water supply. The Ilch-Altai Heating Center and the Governor's Office marked 4 and 3 respectively.

The institutions approved only marginal increase of tariff level regardless of their levels of satisfaction with the current service.

1.6 DISSEMINATION SEMINAR FOR SOCIAL SURVEY

In order to introduce the major findings in social sector and the survey approach applied to the Study, a technical seminar was held in Ulaanbaatar inviting the Mongolian counterparts and related personnel. The summary of the presentation is as follows.

Social survey is a process for comprehensive collection of data and information about the people living in a specific area. The methods used are questionnaires and other qualitative and quantitative research techniques through fieldwork. In the course of the Study, household survey and group discussions were applied to assess the people's need asking such as knowledge and practice on hygiene, volume of water for use, household income and so on.

Social survey consists of a plan and design, fieldwork, data analysis, and reporting of findings. The household survey conducted in the Study area also follow the process of social survey applying similar techniques such as a

workflow, questionnaire, cross-tabulated table, and statistics.

In the household survey, a total number of 197 sample households responded to the interview and 160 samples including 124 traditional ger dwellers were households without the connection of piped water supply (hereafter: non-piped). The rest or 37 samples were of the households living in apartments with piped water supply (hereafter: piped).

The survey revealed that the non-piped dwellers consume 8.6 liter of water per person per day (l/c/d) on average. On the contrary, the apartment dwellers consume 220 l/c/d.

The volume of 8.6 l/c/d of the non-piped households is much less than the volume of 40 l/c/d which is recommended by the Ministry of Health and UNICEF. In addition, it seems that lower income dwellers consume less volume of water, which is very close to the minimum requirement for keeping human life. Non-piped dwellers are obliged to spend twice more for water to the proportion of monthly expenses and pay for much higher unit price.

There are also disparities in terms of the proportion of monthly expense on water as well as the substantial amount of money spent on unit water between the piped households and the non-piped households.

Social analysis is to utilize the collected information through the survey and apply skill of social science for development purpose such as forecasting negative and positive impacts on beneficiaries, increasing capacity for project implementation and so on.

As an area of social analysis with priority in the Study, the following social disparities between the non-piped households and the piped households should be rectified:

- the volume of water consumption,
- the unit water price, and
- the burden of work for fetching water.

Around 50 people from various Ministries including academic institutes and civil service agencies attended the seminar.