Project Commissioned by the Ministry of Health, Labour and Welfare

Project to Provide Planning Guidance

for the Water Supply Project

-FY2014-

Bhaktapur Water Supply Improvement Project

in the Federal Democratic Republic of Nepal

Study Report

March 2015

Consortium for the Project to Provide Planning Guidance
for the Water Supply Project -FY2014-
HAZAMA ANDO CORPORATION and NJS CONSULTANTS Co., Ltd.

Bhaktapur Water Supply Improvement Project in the Federal Democratic Republic of Nepal Study Report Table of Contents

Summary

☆ Summary

1. Overview

1.1 Background

[Project Development Plan for Nepal by the Ministry of Foreign Affairs]

A basic policy of the Federal Democratic Republic of Nepal (hereafter called "Nepal") is to "Support sustainable and balanced economic growth with the aim of escaping from the group of least developed countries", under which is laid out the goal of "developing the social environment and infrastructure for sustainable and balanced economic growth". The city environment is rapidly deteriorating because of the inflow of population especially into the metropolitan area and its environs, the main regional cities, etc., causing the water supply service conditions faced by residents to grow worse year by year. The problems with the maintenance of water purification facilities and the water quality control system may make it impossible to supply safe water in compliance with the drinking water quality standards, so that water-borne diseases including diarrhea due to insanitary water account for a high percentage of infant deaths. (Source: Drinking water problems in Nepal) This being the case, the vigorous promotion of a clean water supply and sewerage projects in Nepal is an urgent issue.

[Water Supply and Sewerage Projects as Basic Social Infrastructure Development]

As mentioned above, the water supply-demand gap is serious in the Kathmandu Valley which is the center of administrative, industrial, social and economic activities, and forms a bottleneck against the sustainable and balance economic growth of Nepal.

Kathmandu Upatyaka Khanepani Limited (KUKL) has the objective of supplying water to the Kathmandu Valley and operates an intermittent water supply by limiting the days and times when water supply is made available to each of the water supply areas, in order to distribute clean water from meager water sources to users in the service areas. There are many areas in which the water service can be used for only a few hours a week.

Many users draw the service water by means of private pumps and collect it in storage tanks in order to secure a better supply of water. However, their actions cause the water pressure to drop leading to negative pressure on high ground, which prevents poor groups with no pumps and storage tanks from accessing the service water, and causes contaminants to enter the water pipes.

1.2 Outline of the Project

The aim of this Project is to carry out field surveys to monitor in detail the present status of the Water Supply Improvement Project in Bhaktapur Municipality that have been requested by KUKL, and to provide KUKL with guidance to ensure that the Project be implemented in the

most effective manner, with the possibility of this being an ODA project also taken into consideration.

Bhaktapur Municipality is one of the municipalities forming the greater metropolitan area of Kathmandu. Located at the eastern end of the Kathmandu Valley, 12km east of Kathmandu Metropolitan City, it is a city populated predominantly by the ancient Newar people. Bhaktapur Municipality is also a tourist city, a World Cultural Heritage site and an important city for the acquisition of foreign currencies in Nepal.

The Municipality is worried about the increasing population and the insufficiency of water sources, and the related agencies of Nepal strongly desire the implementation of this Project.

2. Water Supply Projects and Problems in Nepal

2.1 Present Status of Water Service Field (at the National Level)

Nepal is an Asian country with a population of 26,490,000 (2011 population census) and a land area of 147,000km^2. It borders two countries, the People's Republic of China and India. It is one of the poorest countries in Asia, with a GNI of approximately 730 US dollars per capita (2013, World Bank).

The Government of Nepal has taken up the improvement of the living environment of the citizens and the relief of the poor as important policies, giving priority in the water service field to the improvement of water supply and sewerage systems and to the provision of a safe water supply, and aiming to provide the poor with an improved water supply service.

For one of the Millennium Development Goals, "Ensuring environmental sustainability", the target is to "halve, by 2015, the proportion of the population without sustainable access to safe drinking water and basic sanitation". In Nepal, it will be difficult for this target to be attained.

Japan has provided assistance for improvement and new construction of many water supply facilities and treatment plants in the Kathmandu Valley and the major regional cities of Nepal, and has dispatched water policy advisers mainly under grant aid. According to JICA data, "with regard to the treatment capacity of treatment plants in the Kathmandu Valley, as of 2009 approximately 52% of the facilities in the Kathmandu Valley had been constructed with the assistance of Japan." The Melamchi Water Supply Project, the E/N for which was signed at the end of 2000, was implemented as a loan assistance project to take in water from the Melamchi River located northeast of the Kathmandu Valley and convey the water to Kathmandu Municipality. The loan assistance provides the funds to construct the treatment plants and access roads for that project. The water conveyance tunnel work was executed as one of the assistance components by the Asian Development Bank (ADB). The tunnel work in

Phase 1 that was planned to be completed in 2007 is still under construction, and the feasibility of the Phase 2 and Phase 3 works to extend the tunnel by 10km is also uncertain. In addition, the increase in population has been more rapid than expected and even with the completion of the Phase 3 work, water shortages will be a concern.

It is unlikely that the millennium development goal will be attained at the national level, but the Government will make continued efforts to implement the projects. This proposed Project will also be helpful in attaining the goal.

2. 2 Problems in Water Service Projects (at the National Level)

The penetration rate of water services above the basic level (minimum necessary water supply level) was 83.59% in Nepal in 2014, not so higher than the 2010 figure of 80.4%. The penetration rate of water services at a high quality level (good water quality) is 15.3%. On the other hand, the penetration rate for sewerage services (using permanent sanitary toilet facilities) was 70.28% in 2014, much higher than the 2010 figure of 43.3%.

However, the water supply facilities have not been appropriately operated or maintained and are out of order and obsolete. The water supply is intermittent and contaminated water may flow into the water pipes, creating a high risk of water pollution. There is no clear division of responsibilities or roles for the operation and maintenance of water supply facilities by the relevant agencies; the budget and personnel are also insufficient because budgets and personnel are not allotted appropriately and no financial plans are drawn up.

2.3 Present Status of Water Service Projects in Bhaktapur Municipality

The present status of the water service projects in Bhaktapur Municipality is described below.

1) Overview of Water Supply Facilities

Bhaktapur Municipality has a population of 81,748 (2011 population census) and the population requiring a water supply, including the mobile population such as tourists and foreigners, is approximately 92,680 (estimated by the Study Team). There are 10,049 water taps (KUKL document). The area of Bhaktapur Municipality is 6,884km^2 (KUKL document) and the area of the district to which the Bansbari Water Treatment Plant distributes water is approx. 4.98km^2 (estimated by the Study Team). Figure 2.1 shows a map of Kathmandu Municipality and the location of Bhaktapur Municipality.

The districts in Bhaktapur Municipality to which water is supplied are shown in Figure 2.2. The red eastern district is the district to which water is supplied from the Bansbari Water Treatment Plant, while the western district is supplied with water from the Manohara Water Treatment Plant (constructed in 2004) through the Bode Distribution Reservoir.

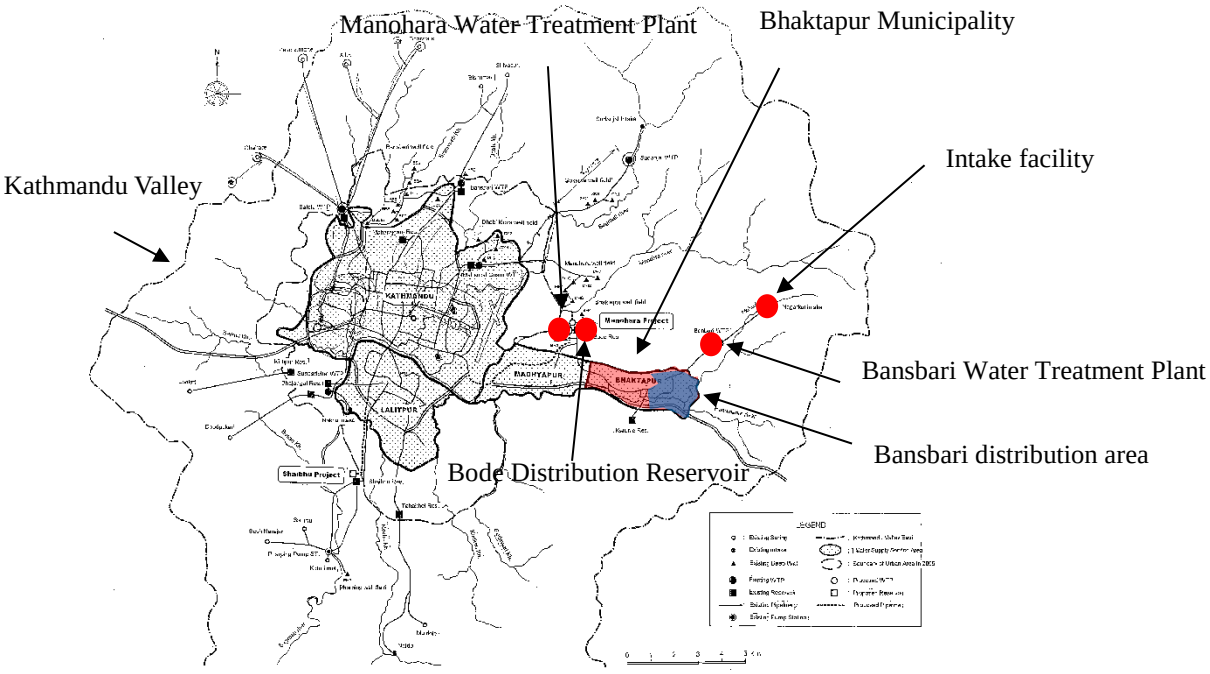


Figure 2.1 Location Map of Kathmandu Valley and Bhaktapur Municipality

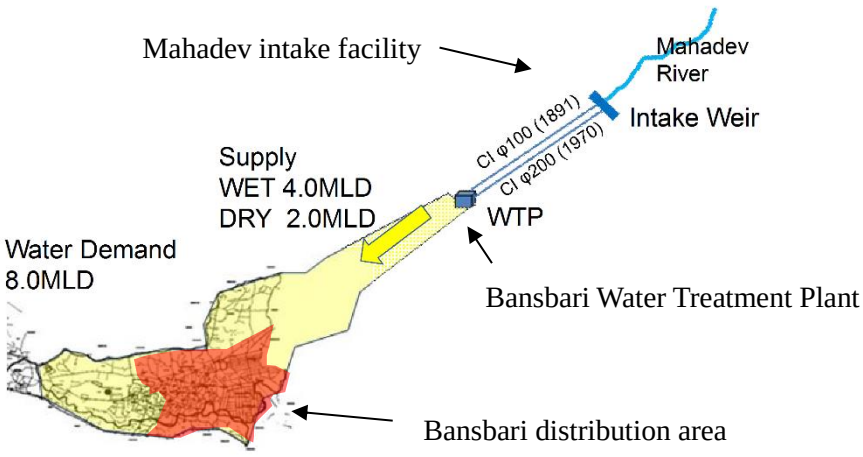


Figure 2.2 Water Supply Facilities and Water Distribution Area in Bhaktapur Municipality

2) Water Sources and Water Conveyance

The water source for the Bansbari distribution area in Bhaktapur Municipality is the Mahadev River, on which an intake weir is installed with two water conveyance pipes (with an approx. length of 3,118m each) laid. One is a cast-iron pipe of 100mm diameter installed in 1896, a very old pipe that has been in place for 119 years. The other is a cast-iron pipe of 200mm diameter constructed in 1971 (in place now for 44 years).

For the water conveyance, the gravity flow system is used and the height difference between the intake weir and the water treatment plant is approx. 56m, with undulations on the way.

3) Water Treatment

The current capacity of the Bansbari Water Treatment Plant is 4,000m^3/day. The water is flocculated in the flocculation basin, settled in the horizontal-flow sedimentation basin and then put into rapid sand filtration. After that, chlorination is added in the treatment/distribution reservoir prior to distribution. There is no cleaning or draining of the rapid filtration facility or the sludge sediment treating facility. Figure 2.3 shows the water treatment process.

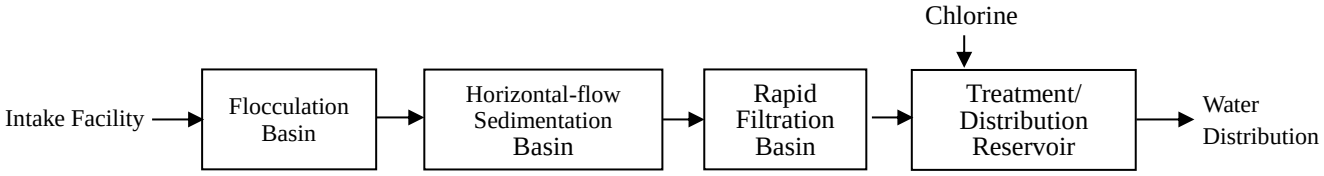


Figure 2.3 Treatment Process at the Present Bansbari Water Treatment Plant

The Bansbari Water Treatment Plant was constructed in 1975, and 40 years have elapsed since its construction. As the chlorination facility is not working, a temporary chlorination facility is provided at the inflow section of the distribution reservoir. Assuming that the durable period of civil work facilities is 50 years, this plant is at the stage where its reconstruction or renewal needs to be planned. No independent power generator is installed despite the long periods of power failure. Therefore, the inability to backwash the rapid filtration basin poses a problem in operation and maintenance.

A well has been constructed in the treatment plant, but its intake capacity is low – approx. 500m^3/day – and it cannot be operated in the event of a power failure. The water contains underground silt and the well can be used only as an auxiliary water source.

4) Water Conveyance and Distribution

Water is distributed to Bhaktapur Municipality from the treatment/distribution reservoir in

the Bansbari Water Treatment Plant. Along the way, no distribution reservoir or overhead tank is provided, and water is distributed via the gravity flow system. The existing distribution pipeline is 50 – 200mm in diameter and its total length is 50km. It is a very old pipeline, laid in 1984 (with the exception of the section of the conveyance pipeline into the city area).

The volume of water distributed from the Bansbari Water Treatment Plant averages 2,897m^3/day with a maximum of 5,760m^3/day and a minimum of 136m^3/day, according to the records on the distribution reservoir in the plant (for the period October 2013 to January 2015). The conveyance capacity of the pipelines (of 100mm and 200mm diameter) is estimated to be approx. 4,000m^3/day and the monthly average distribution volume is deemed to be low.

2.4 Problems with the Drinking Water Supply

The water supply in Bhaktapur Municipality is intermittent. The city area is divided into 3 blocks, each of which is provided with water for about 1 to 3 hours once every 3 days. According to the estimate made by the Study Team, the daily maximum water demand in Bhaktapur Municipality was 13,400m^3/day in 2012. As shown in Figure 2.4, the water supply volume in the dry season was about 1,000m^3/day, a shortfall of some 12,000m^3/day.

The residents make up for the shortage of service water through the use of tanker supply water and well water. The charge for tanker supply water is NRs 343 to 399/m^3, making it more expensive than the service water. (For reference, the service water charge is NRs 32/m^3 for home use (with a 1/2 inch diameter tap) and NRs 71/m^3 for other use (with a 3/4 inch diameter tap). Source: KUKL 6th Anniversary Report.) The volume of well water is insufficient and the quality deteriorates in the dry season. The residents worry about the acquisition of drinking water. KUKL has suspended the connection of new water taps because the water supply capacity is insufficient.

The water quality tests made in this Study showed that the quality of water treated in the Bansbari Water Treatment Plant was compliant with the drinking water quality standards of Nepal. If the turbidity of the source water rises, there will be an increase in the incidence of water-borne infectious diseases in the rainy season. In the future, it will be necessary to carry out water quality tests during the rainy season.

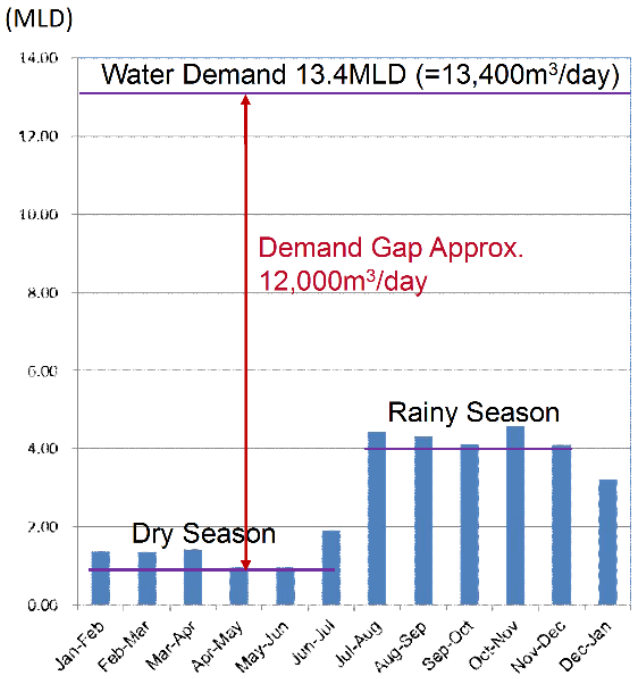


Figure 2.4 Water Demand and Supply in Bhaktapur Municipality

2.5 Urgency and Priority in Nepal with regard to this Project

Water demand in the Kathmandu Valley based on the 2011 population census was in excess of 400MLD (1,000m^3/day), but the water supply capacity of KUKL is only 100MLD because of the shortage of water sources. The "Melamchi Water Supply Project" is being implemented in Phases 1, 2 and 3, with the aim of developing 170MLD (510MLD in total) of water sources. As described previously, however, it is a fact that the progress of Phase 1 has been delayed, so that there is no prospect that Phases 2 and 3 can be completed. Figure 2.5 shows the water demand prediction for the Kathmandu Valley and the water supply volumes assuming that the "Melamchi Water Supply Project" is completed in the shortest period up to Phase 3. On the basis of this prediction, even if Phase 3 is completed in 2028 and a water supply of 510MLD is realized, it cannot be denied that before long demand may well outstrip supply once more.

In the "Melamchi Water Supply Project", higher priority will be given to providing a water supply to homes from the western side, and it will be a considerable time before water sources are allotted to Bhaktapur. KUKL is concerned at the possibility that in the end no water will reach Bhaktapur, and has given the highest priority to the dam construction proposed in this Project. Mr. Ishwori, Acting Secretary of the Water and Energy Commission Secretariat, (who

participated in JICA group training – Water supply management administration and water supply project operation (B) in 2013), made the same remark, from which it can be assumed that the Government of Nepal considers water source development to be important.

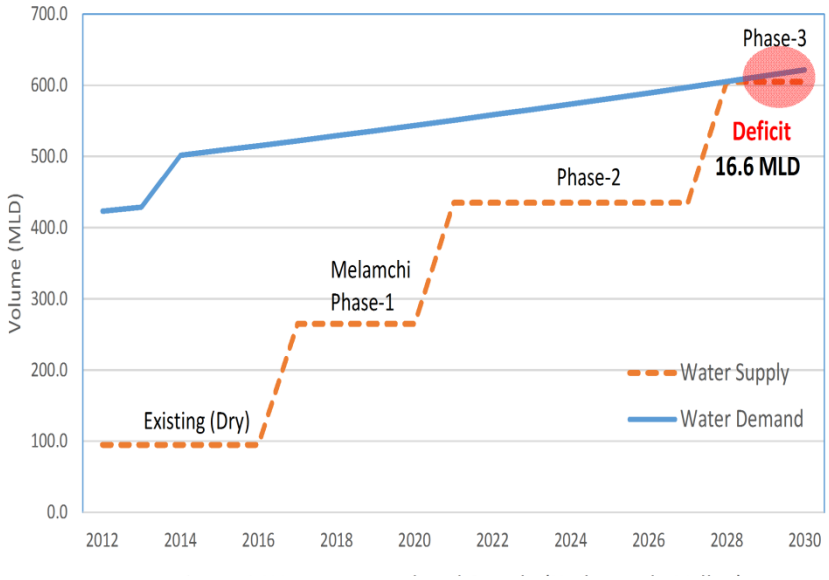


Figure 2.5 Comparison of Water Demand and Supply in the Kathmandu Valley

2.6 Comparison of Candidate Projects

The Melamchi Water Supply Project has the objective of improving the service water supply and sanitation conditions in the Kathmandu Valley. The total project cost for Phase 1 amounts to 31.7 billion USD, and the main items of the project are the construction of the tunnel (3m diameter) with a total length of approx. 27km, the improvement of the water distribution pipeline network and the construction of the water treatment plant/service reservoir.

The Melamchi Water Supply Project will be implemented in 3 phases to supply a total water volume of 510MLD, of which 17MLD will be distributed to Madhyapur Municipality and Bhaktapur Municipality. Regarding the conveyance pipeline for 17MLD water, application has been made to ADB, which is unlikely to cover the Project completely; but it is expected that the schedule for implementation of the Project will be made clear. 17MLD is the water volume to be conveyed in the final instance, not the water volume to be secured before completion of the Project. On the other hand, the water distribution volume per capita will be very different, as shown in Table 2.1 in accordance with the evaluation of the 2030 distribution volumes from the Melamchi Water Supply Project only, following the completion of that Project.

In view of the fact that Bhaktapur Municipality, and the Bansbari distribution district in

particular, is located at the eastern end of the project area, it cannot be expected that the priority of that distribution district within the Melamchi Project is high.

Table 2.1 Comparison of Water Supply Volumes per Capita after Completion of the Melamchi Water Supply Project (2030)

	Population	Distributed Water Volume [1)]	Water Volume per Capita
Kathmandu Valley	3.35 million	510MLD	152L/capita/day
Kathmandu Municipality [2)]	3.13 million	493MLD	158L/capita/day
Madhyapur/Bhaktapur	0.22 million	17MLD	77L/capita/day

Source: Estimate by the Study Team

1) Water distribution volume from the Melamchi Water Supply Project only
2) The population projected for 2030, excluding the populations of Madhyapur and Bhaktapur from the total population of the Kathmandu Valley.

3. Details of the Project

In this Project, water source development is important. The water source development and Bansbari Water Treatment Plant construction plan is summarized in Table 3.1.

Table 3.1 Water Source Development and Treatment Plant Construction

	Intake Volume [1)]		Intake Facility	Conveyance Pipeline	Capacity of Treatment Plant	Water Demand[3)] (Maximum daily volume)
	Rainy Season	Dry Season				
Present (2012)	Mahadev River 4MLD	Mahadev River 2MLD	Mahadev River intake weir	CI φ100 x 1 CI φ200 x 1	4MLD (Existing)	13.4MLD
Target year (2030)	Mahadev River: 4MLD Dam: 4MLD Total: 8MLD	Mahadev River: 2MLD Dam[2)]: 3MLD Total: 5MLD	Mahadev River intake weir Dam (new)	Dam – Intake weir DCIP ND300 x 1 Intake weir – Treatment plant HDPE OD225 x 2	8MLD (New) (4MLD x 2 systems)	16.1MLD

1) Water from the Bode wells is distributed to the western area of Bhaktapur Municipality, not including the Bansbari distribution district.
2) The dam will be of a multi-purpose type, providing water supply source, irrigation and micro-hydropower generation (60kW).
3) Water demand in the Bansbari distribution district (eastern side)

An overview of the Bhaktapur Water Supply Improvement Project is shown in Figure 3.1.

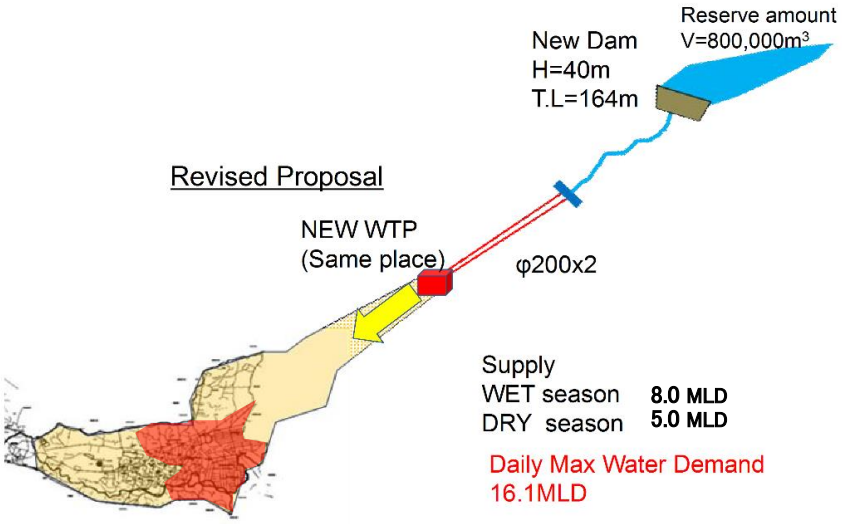


Figure 3.1 Bhaktapur Water Supply Improvement Project

Table 3.2 Proposed Water Supply Facilities

No.	Facility	Scale, Quantity, Dimensions	Remarks
1	Dam	Width 164m x height 40m	Reservoir capacity: 800,000m^3
2	Intake Tower	Diameter 10m x height 27m	Constructed in dam (fixed)
3	Conveyance Pipelines	Dam – existing intake weir: Pipe diameter 300mm x 1,016m Existing intake weir – treatment plant: Outer diameter 225mm x 3,118m x 2 pcs	Pipe material: DCIP Pile material: HDPE
4	Water Treatment Plant (Phase 1)	Treatment capacity: 4,000m^3/day	Treatment flow is shown in Figure 3.2 and specifications in Table 3.3.
5	Water Treatment Plant (Phase 2)	Treatment capacity: 4,000m^3/day	

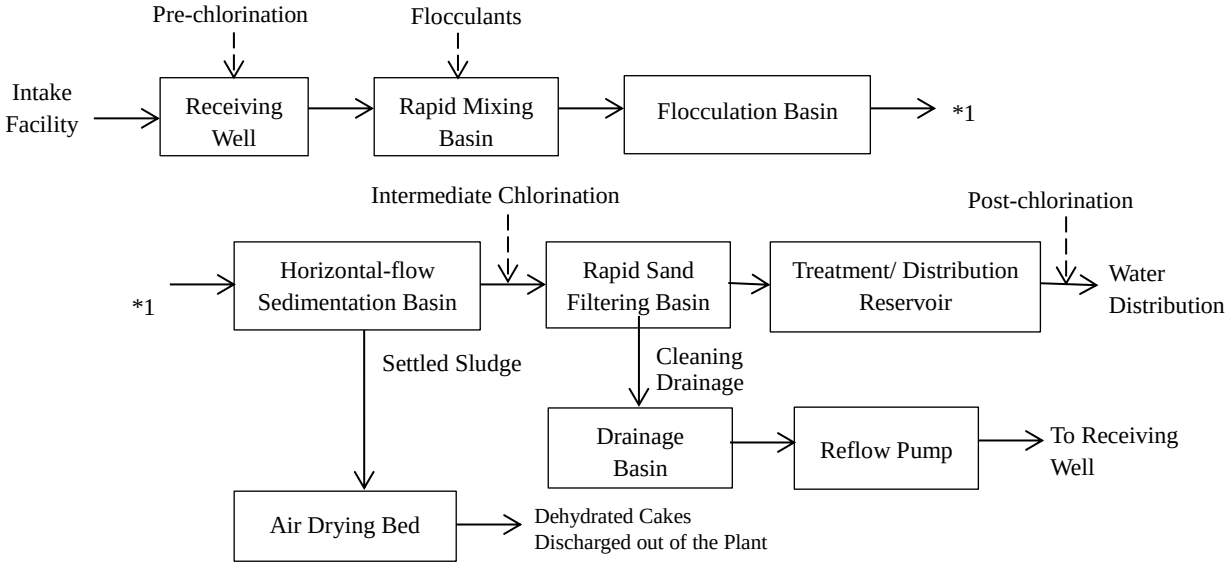


Figure 3.2 Treatment Flow at the New Bansbari Water Treatment Plant

Table 3.3 Specifications of the New Bansbari Water Treatment Plant

Facility	Number of Basins	Dimensions	Real Capacity
Receiving well	2	1.2mW × 2.6mL × 3.0mD	9.36m^3/well
Rapid mixing basin	2	1.7mW × 1.7mL × 1.6mD	4.62m^3/basin
Flocculation basin	2	6.0mW × 6.4mL × 1.6mD	61.4m^3/basin
Horizontal-flow chemical sedimentation basin	2	5.5mW × 18.5mL × 3.0mD	Required channel cross section 7.65m^2
Rapid sand filtering basin	4 (1 reserve)	2.6mW × 3.8mL	Filtering speed 150m/day
Drainage basin and Reflow pump	1	5.0m ×5.0m × 3.0m	74.1m^3
Air drying bed	2	12.0mW × 6.0mL × 1.0mD	Required area 70.9m^2
Treatment/Distribution reservoir	2	15.2mW × 30.0mL × 4.88mD	2,225m^3/basin

[Specifications of the Bansbari Water Treatment Plant with a supply capacity of 4,000m^3/day]

4. Conclusion

Country Assistance Policy for Nepal by the Ministry of Foreign Affairs of Japan (April 2012) defines “social and economic infrastructure development” as a development issue in one of the priority assistance areas: “Building social infrastructure and institutions for balanced and sustainable economic growth”, and indicates the policy for dealing with the improvement of the urban environment, including the water supply. This Project is in line with that policy.

This Project will construct a dam in the vicinity of Bhaktapur Municipality in the

Kathmandu Valley in order to acquire a greater water volume, and will construct water supply facilities to improve the water service through an increase in the water supply and improved water quality, thereby contributing to the improvement of the living environment for the citizens of the Municipality.

☆ Basic Indicators

Table-1 Main Economic Indicators

Indicator		2011	1990
Population (millions)		27.16	18.11
Average life expectancy at birth (years)		67.55	55.04
GNI	Total (million dollars)	19,082.82	3,640.23
	Per person (dollars)	610	220
Real economic growth rate (%)		3.9	4.6
Current account balance (million dollars)		288.61	-
Unemployment rate (%)		-	-
External debt balance (million dollars)		3,956.12	1,626.89
Foreign trade amount Note 1)	Exports (million dollars)	1,862.45	-
	Imports (million dollars)	6,447.27	-
	Foreign trade balance (million dollars)	-4,584.82	-
Government budget (income) (million NPR)		203,582.87	8,733.80
Fiscal balance (million NPR)		-13,676.52	-
Fiscal balance (rate to GDP, %)		-1.0	-
Debt (rate to GNI, %)		15.3	-
Debt balance (rate to exports, %)		129.9	-
Debt service rate (DSR) (rate to GNI, %)		1.1	1.9
Government expenditure on education (rate to GDP, %)		―	-
Government expenditure on public health (rate to GDP, %)		2.1	―
Military expenditure (rate to GDP, %)		1.4	1.1
Total amount of aid receipts (Net expenditure, million dollars)		892.32	422.84
Area ($1000km^2$) Note 2)		147.18	
Category	DAC	Least developing countries (LDC)	
	World Bank, etc.	i / low-income country	
Status of formulation of Poverty Reduction Strategy Papers (PRSP)		PRSP formulated (November 2003)	
Other important development plans		3-year plan (Nov. 2010 – Oct. 2012)	

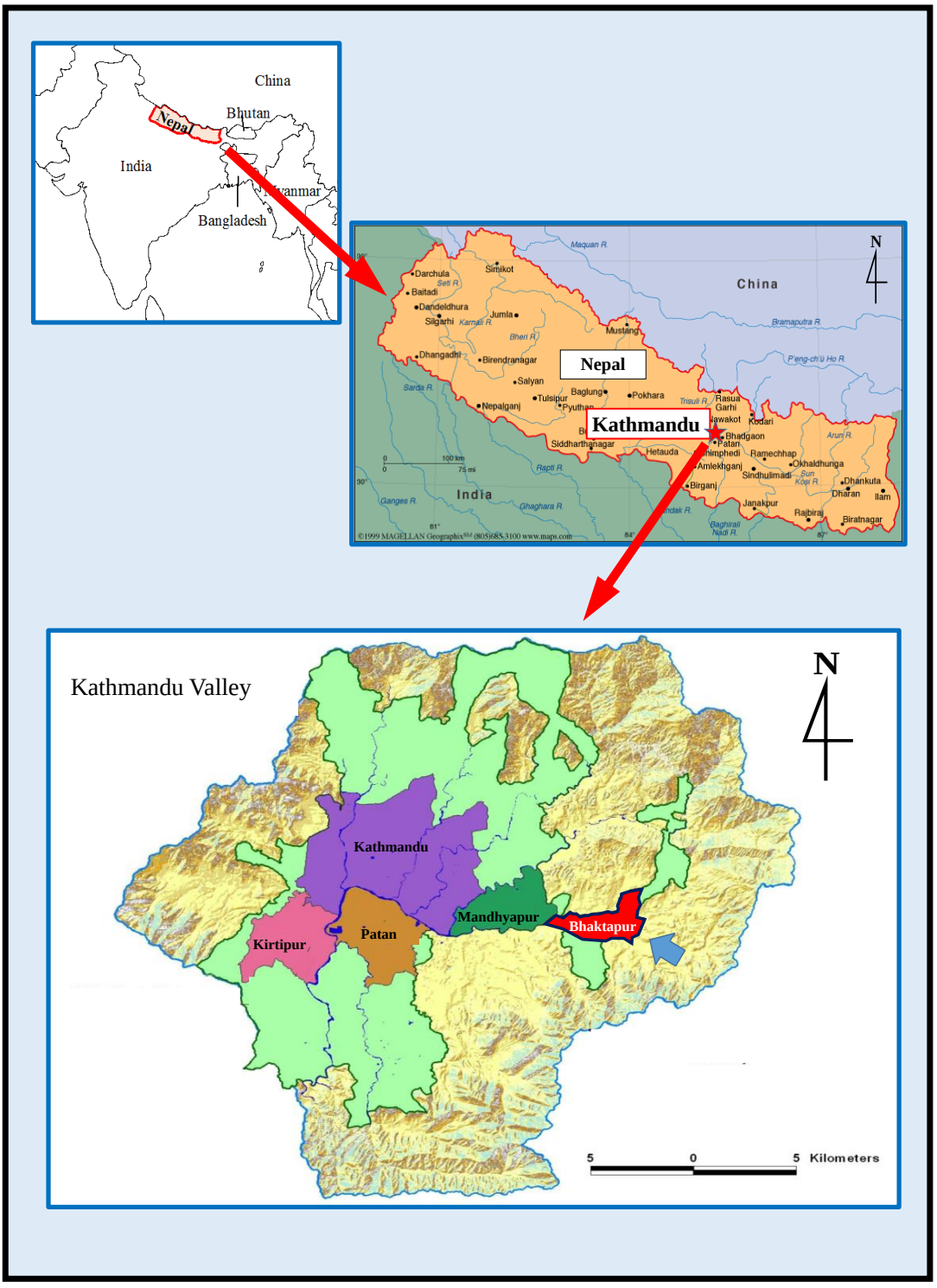
Note 1: The trade amounts are FOB prices for export and import.
2: The area indicates the total “surface area” (including lakes).
Source: Japan ODA Country Data Book, Ministry of Foreign Affairs

Table-2 Main Development Indicators

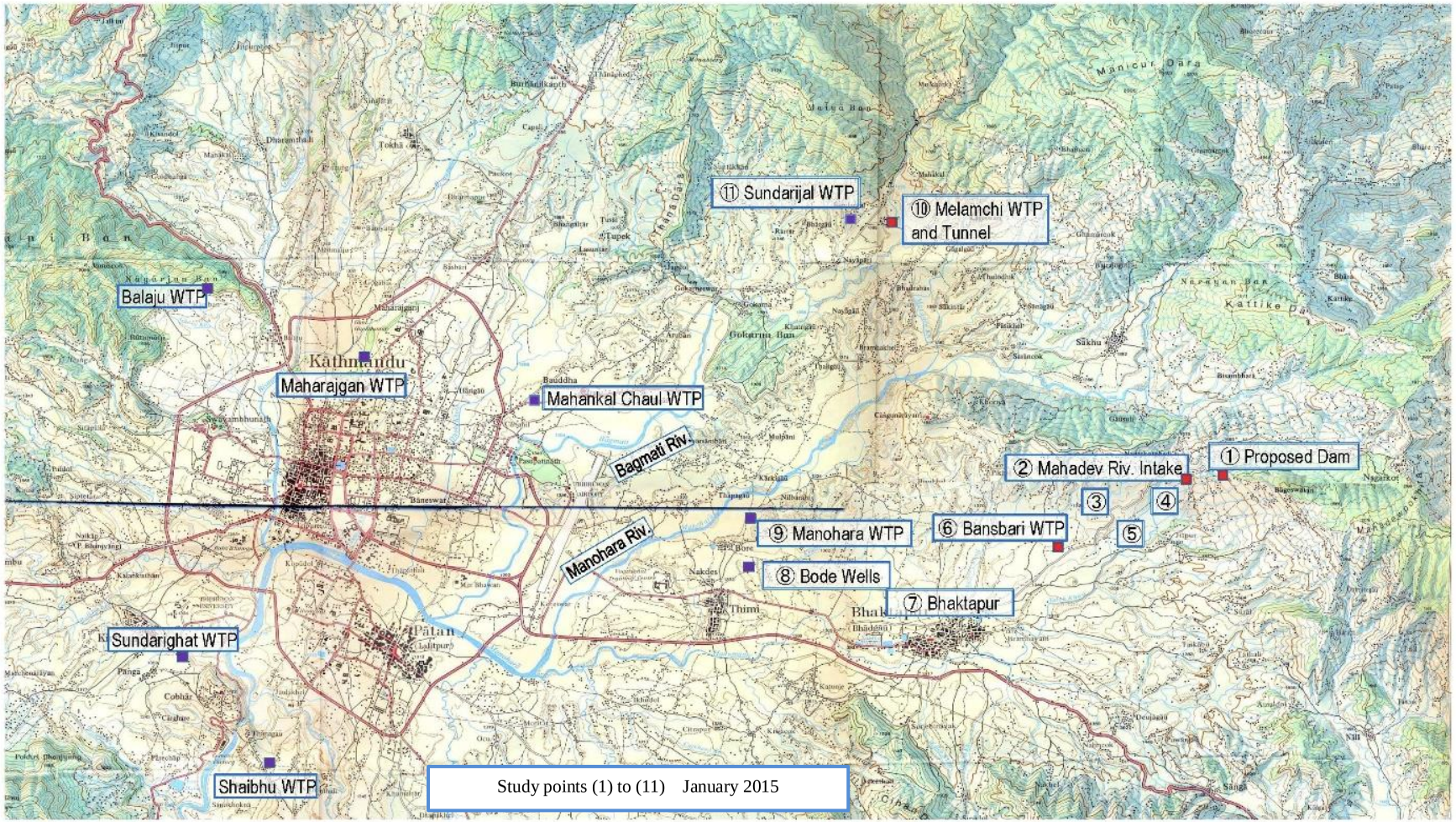
Development Indicator			Latest Year	1990
Eradicate extreme poverty and hunger	Proportion of population living on less than 1.25 dollars/day (%)		24.8 (2010)	-
	Proportion of population living on less than 2 dollars/day (%)		57.3 (2010)	-
	Income or consumption share held by lowest 20% (%)		8.3 (2010)	-
	Under-5 malnutrition rate (low body weight) (%)		29.1 (2011)	-
Achieve universal primary education	Adult (over 15 years old) literacy rate (%)		60.3 (2010)	-
	Net school attendance rate in primary education (%)		-	-
Promote gender equality and empowerment of women	Ratio of female students to male students (in primary education) (%)		-	60.3
	Female literacy rate (15 – 24 years old) (%)		78.4 (2010)	-
	Male literacy rate (15 – 24 years old) (%)		87.6 (2010)	-
Reduce child mortality	Number of infant deaths (per 1000 births)		33.6 (2012)	98.5
	Estimated under-5 deaths (per 1000 births)		41.6 (2012)	141.9
Improve maternal health	Maternal mortality (per 100 thousand women) (persons)		170 (2010)	770
Combat HIV/AIDS, malaria and other diseases	Adult (15 – 49 years old) HIV infection rate (%)		0.3 (2011)	0.1
	Number of tubercular patients (per 100 thousand persons) (persons)		163 (2011)	163
	Reported number of malaria patients (incl. estimated number)		71,752 (2011)	-
Ensure environmental sustainability	Proportion of population with access to improved services	Water (%)	87.6 (2011)	66.9
		Sanitary facilities (%)	35.4 (2011)	6.7
Global partnership for development	External debt stocks to exports of goods and services (%)		9.5 (2011)	15.2

Source: Japan ODA Country Data Book, Ministry of Foreign Affairs

☆ Location Map



Location Map for Target Sites



Study Location Map

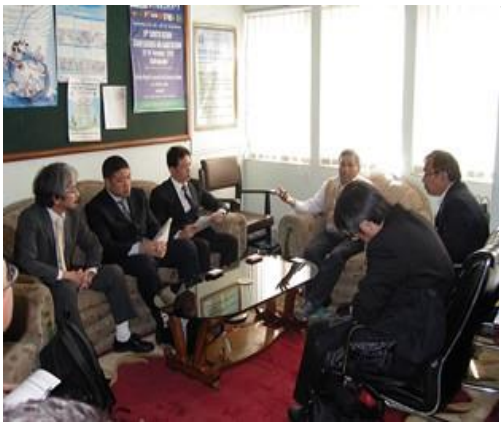
☆ Collection of Photographs

[Collection 1] Visits to Related Agencies

Discussions at JICA Nepal Office

Kathmandu Upatyaka Khanepani Limited (KUKL) (Kathmandu Valley Water Supply, Ltd.), Kathmandu Central Office

Meeting between Kathmandu Valley Water Supply Management Board (KVWSMB) and KUKL



Meeting with Ministry of Urban Development (MoUD)

Meeting with Bhaktapur Municipality Office

Study Report Meeting at JICA Nepal Office

[Collection 2] Planned Dam Site on the Mahadev River (1) and Existing Intake Weir (2)

Distant view of planned dam site

The planned construction site is on an upstream section of the Mahadev River which is a branch of the Bagmati River and designated part of the Bageswari conservation forest zone. The area is not a private area, but state-owned land.

Planned dam site Dike zone

The dam will have a dike height of 40m, a dike top length of 164m, and a total reservoir capacity of 800,000m^3. This will be a multi-purpose dam that will be used not only as a water supply source, but also for micro-hydropower generation and irrigation.

Mahadev River intake weir viewed from a point downstream

It is expected to intake 2.0MLD in the dry season and 4.0MLD in the rainy season. The elevation is 1,420.2m and the difference in elevation from the Bansbari Water Treatment Plant is approx. 56.4m.

Mahadev River intake weir viewed from a point upstream

The intake weir is 12.8m in length with a height of 2.4m. The study in January 2015 showed no overflow from the dike.

Meeting with KUKL engineers at the site

The structure of the intake weir, the intake chamber (position of the water conveyance pipe), etc. were checked. The sampling tests at the planned dam construction site showed that the water complied with the drinking water quality standards in all the items except the number of colitis germ legions, colon bacilli and residual chlorine.

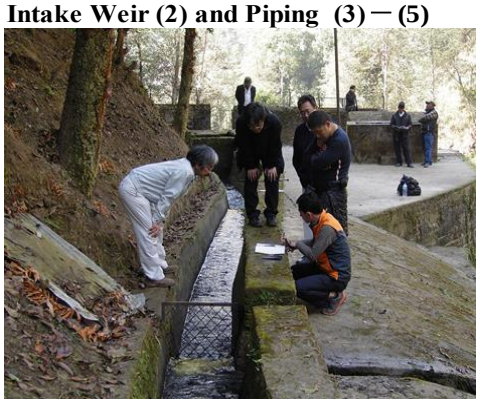
Water channel alongside the intake weir on the Mahadev River

There are few suspended solids in the dry season. The flow was measured using the float measurement method.

[Collection 3] Survey of Mahadev River Existing Intake Weir (2) and Piping (3) – (5)

Simple flow measurement in intake weir channel

The flow in the water channel is approx. 4,800m^3/day, and the flow over the weir is approx. 400m^3/day, a total of approx. 5,200m^3/day (as measured on January 16, 2015). The flow is at its lowest in March and April.



Simple flow measurement in intake weir channel

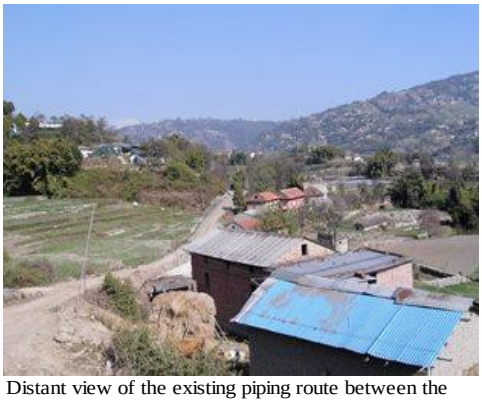
The volume distributed from the Bansbari Water Treatment Plant on the day of the survey was 2,640m^3/day. It is thought that the volume is affected by the flow capacity of the conveyance pipe and leakage.

Existing piping route between the intake weir and the water treatment plant

Two conveyance pipes are in place. One pipe is a cast-iron pipe 100mm in diameter which was laid in 1896, or 119 years ago. The other is a cast-iron pipe 200mm in diameter which was laid in 1971, or 44 years ago.
Each pipe is 3,118m long.

Point where the existing pipes cross over a small river

The two conveyance pipes have been relocated beneath the road beside the bridge. The pipes shown in the photo are not used at present.



Distant view of the existing piping route between the intake weir and the water treatment plant

There is one large bend in the conveyance route. The residents along the route take water directly from the conveyance pipe. The water is not purified but meters are installed at some points and the residents pay water charges.

[Collection 4] Mahadev River Existing Water Treatment Plant (Bansbari Water Treatment Plant) (6)

Bansbari Water Treatment Plant Treatment and distribution reservoir

The plant was constructed in 1975, 40 years ago. It has a treatment capacity of 4,000m^3/day, and uses the rapid sand filtering method. As the chlorination facility is out of order, a temporary chlorification facility has been installed at the inflow section from the treatment reservoir.
The older parts of the plant were constructed 100 years or more ago.

Bansbari Water Treatment Plant Treatment and distribution reservoir

The capacity of the distribution reservoir is 2,400m^3 and the distributed volume averages 2,897m^3/day: maximum 5,760m^3/day, minimum 136m^3/day.

(Data validity: October 2013 to January 2015)

Bansbari Water Treatment Plant Filtering reservoir

At the time of the survey, reverse cleaning of the sand filter was impossible because of a power failure. The rapid sand filter has no treatment facility for cleaning drainage and sludge settling.

Bansbari Water Treatment Plant Settling reservoir and flow

The water treatment process is: Flocculation basin → Horizontal settling basin → Rapid filtering basin → Treatment and distribution reservoir (chlorification) →Water distribution

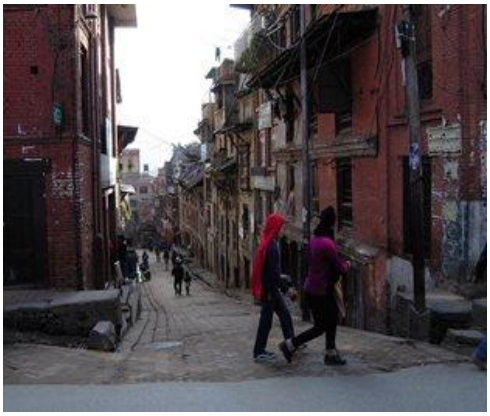
Public water tap in the vicinity of the Bansbari Water Treatment Plant

The quality of the service water distributed from the Bansbari Water Treatment Plant complies with all 27 items of the drinking water quality standards of Nepal.

Simple water quality testing

A simple water quality test was carried out at the site. The free residual chlorine concentration that was measured at the water tap using the Pack Test® was 5mg/L in the vicinity of the water treatment plant and 2mg/L in the city.

[Collection 5] Central Area of Bhaktapur Municipality (7)



Road in the central area of Bhaktapur Municipality

Bhaktapur is an ancient city which was the capital city during the Malla Dynasty.

Historical buildings in the central area of Bhaktapur Municipality

There are a number of Newar buildings including the old royal palace and temples, which are popular with tourists and registered as a World Cultural Heritage.

Stone water tap in the old palace

This was used as a public water place in the past.

One of the many ponds in the municipality

The public water places are open to ordinary citizens and are used as meeting places.

Public water tap in Bhaktapur Municipality

There are 203 public water taps in Bhaktapur Municipality. People stand in line to draw water in the daytime.

[Collection 6] Water Intake from Well Existing Distribution Reservoir (Bode) (8), etc.

One well in the Bode group

Well pump installed on the premises of the Bode Distribution Reservoir

Bode Distribution Reservoir

The capacity of the distribution reservoir is 1,000m^3. Water is conveyed from the Manohara Water Treatment Plant and is distributed to Madhyapur and Bhaktapur.

A water tap at a private house; the water is supplied from Bode

The quality of water conveyed from the Manohara Water Treatment Plant via the Bode Distribution Reservoir complies with all 27 items of the drinking water standards of Nepal.

Small scale water treatment plant in the city (Jagati Water Treatment Plant)

The distribution reservoir has a capacity of 100m^3.

☆ Abbreviations

Abbreviation	Standard Nomenclature
ADB	Asian Development Bank
BDS	Bulk Distribution System
DAC	Development Assistance Committee
DCIP	Ductile Cast Iron Pipe
DNI	Distribution Network Improvement
DWSS	Department of Water Supply and Sewerage
E/N	Exchange of Notes
EIA	Environmental Impact Assessment
F/S	Feasibility Study
FINNIDA	Finnish Ministry of Foreign Affairs, Department for International Development Cooperation
GDP	Gross Domestic Product
GNI	Gross National Income
HDPE	High Density Polyethylene
IEE	Initial Environmental Examination
JICA	Japan International Cooperation Agency
KUKL	Kathmandu Upatyaka Khanepani Limited
KVWSMB	Kathmandu Valley Water Supply Management Board
LDC	Least Developed Countries
MLD	Million Litter Per Day
MoUD	Ministry of Urban Development
ND	Nominal Diameter
NGO	Non-Governmental Organization
NRs	Nepal Rupee
NTA	Nepal Telecommunications Authority
OD	Outside Diameter
ODA	Official Development Assistance
O&M	Operation and Maintenance
SR	Service Reservoirs
USD	United States Dollar
UNICEF	United Nations International Children's Emergency Fund
WB	World Bank
WHO	World Health Organization
WSTFC	Water Supply Tariff Fixation Commission
WTP	Water Treatment Plant

Main Report

Chapter 1. Introduction

1.1 Overview

(1) Background

[Project Development Plan for Nepal by the Ministry of Foreign Affairs]

A basic policy of the Federal Democratic Republic of Nepal (hereafter called "Nepal") is to "Support sustainable and balanced economic growth with the aim of escaping from the group of least developed countries", under which is laid out the goal of "developing the social environment and infrastructure for sustainable and balanced economic growth". The city environment is rapidly deteriorating because of the inflow of population especially into the metropolitan area and its environs, the main regional cities, etc., causing the water supply service conditions faced by residents to grow worse year by year. The problems with the maintenance of water purification facilities and the water quality control system may make it impossible to supply safe water in compliance with the drinking water quality standards, so that water-borne diseases including diarrhea due to insanitary water account for a high percentage of infant deaths. (Source: Drinking water problems in Nepal) This being the case, the vigorous promotion of a clean water supply and sewerage projects in Nepal is an urgent issue.

[Water Supply and Sewerage Projects as Basic Social Infrastructure Development]

As mentioned above, the water supply-demand gap is serious in the Kathmandu Valley which is the center of administrative, industrial, social and economic activities, and forms a bottleneck against the sustainable and balance economic growth of Nepal.

Kathmandu Upatyaka Khanepani Limited (KUKL) has the objective of supplying water to the Kathmandu Valley and operates an intermittent water supply by limiting the days and times when water supply is made available to each of the water supply areas, in order to distribute clean water from meager water sources to users in the service areas. There are many areas in which the water service can be used for only a few hours a week.

Many users draw the service water by means of private pumps and collect it in storage tanks in order to secure a better supply of water. However, their actions cause the water pressure to drop leading to negative pressure on high ground, which prevents poor groups with no pumps and storage tanks from accessing the service water, and causes contaminants to enter the water pipes.

(2) Outline of the Project

The aim of this Project is to carry out field surveys to monitor in detail the present status of the Water Supply Improvement Project in Bhaktapur Municipality that have been requested by KUKL, and to provide KUKL with guidance to ensure that the Project be implemented in the most effective manner, with the possibility of this being an ODA project also taken into consideration.

Bhaktapur Municipality is one of the municipalities forming the greater metropolitan area of Kathmandu. Located at the eastern end of the Kathmandu Valley, 12km east of Kathmandu Metropolitan City, it is a city

populated predominantly by the ancient Newar people. Bhaktapur Municipality is also a tourist city, a World Cultural Heritage site and an important city for the acquisition of foreign currencies in Nepal.

The Municipality is worried about the increasing population and the insufficiency of water sources, and the related agencies of Nepal strongly desire the implementation of this Project.

1.2 Processes and Methodology

1.2.1 Overall Study Schedule

The period of the study was January 11 to 20, 2015 (10 days). (For details, see Appendix-1 Schedule of Guidance Work in Nepal.)

1.2.2 Visits to Target Sites and Agencies of Nepal

The Study Team visited the Ministry of Urban Development (MoUD) and KUKL to undertake interviews, collect data and conduct the field surveys, to gain an understanding of the present condition and state of use of the existing water supply facilities, to check the preparatory conditions and issues in the implementation of this Project, and to analyze the effects and external factors of this Project. The staff of the Kathmandu Valley Water Supply Management Board (KVWSMB), a decision-making agency in implementing this Project, participated in the meeting with KUKL. The Study Team visited Bhaktapur Municipality Office to confirm the progress, present status and projected development of the projects currently in implementation. Further, the Team visited the Embassy of Japan in Nepal and the JICA Nepal Office to provide an explanation of this Study and carry out an exchange of opinions.

1.3 Study Team Members

	Name	Function	Affiliation
Team Leader	Shumei Tanaka	Supervision	International Division, Hazama Ando Corporation
Team member	Daigo Takeda	Overall plan	International Cooperation Office, International Affairs Division, Minister's Secretariat, Ministry of Health, Labour and Welfare
Team member	Yuji Kubo	Overall plan	International Cooperation Office, International Affairs Division, Minister's Secretariat, Ministry of Health, Labour and Welfare
Team member	Noboru Ozaki	Expert adviser	Waterworks and Sewerage Bureau, Sakai City
Team member	Satoru Oniki	Water supply facility plan	NJS Consultants Co., Ltd.
Team member	Kiyoshi Hirose	Work coordination	International Division, Hazama Ando Corporation
Team member	Kenichi Kinoshita	Water supply facility plan	International Division, Hazama Ando Corporation
(Work coordination in Nepal)			
	D.P. Basyal		Nepal Representative Office, International Division, Hazama Ando Corporation

Chapter 2. Grasp of Existing Circumstances for the Project

2.1 Water Supply Projects and Problems in Nepal

2.1.1 Present Status of Water Service Field (at the National Level)

Nepal is an Asian country with a population of 26,490,000 (2011 population census) and a land area of 147,000km^2. It borders two countries, the People's Republic of China and India. It is one of the poorest countries in Asia, with a GNI of approximately 730 US dollars per capita (2013, World Bank).

The Government of Nepal has taken up the improvement of the living environment of the citizens and the relief of the poor as important policies, giving priority in the water service field to the improvement of water supply and sewerage systems and to the provision of a safe water supply, and aiming to provide the poor with an improved water supply service.

For one of the Millennium Development Goals, "Ensuring environmental sustainability", the target is to "halve, by 2015, the proportion of the population without sustainable access to safe drinking water and basic sanitation". In Nepal, it will be difficult for this target to be attained.

Japan has provided assistance for improvement and new construction of many water supply facilities and treatment plants in the Kathmandu Valley and the major regional cities of Nepal, and has dispatched water policy advisers mainly under grant aid. According to JICA data, "with regard to the treatment capacity of treatment plants in the Kathmandu Valley, as of 2009 approximately 52% of the facilities in the Kathmandu Valley had been constructed with the assistance of Japan." The Melamchi Water Supply Project, the E/N for which was signed at the end of 2000, was implemented as a loan assistance project to take in water from the Melamchi River located northeast of the Kathmandu Valley and convey the water to Kathmandu Municipality. The loan assistance provides the funds to construct the treatment plants and access roads for that project. The water conveyance tunnel work was executed as one of the assistance components by the Asian Development Bank (ADB). The tunnel work in Phase 1 that was planned to be completed in 2007 is still under construction, and the feasibility of the Phase 2 and Phase 3 works to extend the tunnel by 10km is also uncertain. In addition, the increase in population has been more rapid than expected and even with the completion of the Phase 3 work, water shortages will be a concern.

It is unlikely that the millennium development goal will be attained at the national level, but the Government will make continued efforts to implement the projects. This proposed Project will also be helpful in attaining the goal.

2.1.2 Problems in Water Service Projects (at the National Level)

The penetration rate of water services above the basic level (minimum necessary water supply level) was 83.59% in Nepal in 2014, not so higher than the 2010 figure of 80.4%. The penetration rate of water services at a high quality level (good water quality) is 15.3%. On the other hand, the penetration rate for sewerage services (using permanent sanitary toilet facilities) was 70.28% in 2014, much higher than the 2010 figure of 43.3%.

However, the water supply facilities have not been appropriately operated or maintained and are out of

order and obsolete. The water supply is intermittent and contaminated water may flow into the water pipes, creating a high risk of water pollution. There is no clear division of responsibilities or roles for the operation and maintenance of water supply facilities by the relevant agencies; the budget and personnel are also insufficient because budgets and personnel are not allotted appropriately and no financial plans are drawn up.

The problems relating to the water service projects in Nepal are summarized in Table 2.1.1.

Table 2.1.1 Problems in Water Service Projects

Item	Problem	Problem Level			Description
		L	M	H	
System and Organization	The institutional definition of the water service projects is unclear.	○			There are established organizations and systems.
	There is no apparent will for self-supporting endeavor.		○		Budget and personnel assignment planning is needed.
	The organizations to implement projects are not set up.	○			There are organizations throughout the country.
	The number of engineers is insufficient compared with the number of water service facilities to be developed.			○	The number of water service engineers is insufficient.
	The policy decision division and the working division are separated due to privatization.		○		Two agencies, KVWSMB and KUKL exist.
Planning and Coordination	No high-level plans (such as master plan) are provided.	○			High-level plans such as the National Water Plan have been established.
	There is no coordination between the recipient country and the international organization.	○			The assistance was provided under grant aid and loan fund, and there is coordination.
	There is no balance between water service facilities (in terms of water quantity and level of progress)			○	There are huge differences between the urban areas and the rural areas.
	There is no balance between related fields (water resources, sewerage and urban plans).			○	The sewerage facilities and conservation of water sources (groundwater) are problems remaining to be solved.
Management and Finance	Funding is insufficient for the size of the projects.			○	A sufficient budget has not been acquired. The time of completion of the Melamchi Water Supply Project remains undetermined.
	There is no established policy or system of water charge collection.	○			The charging and collection systems are in place.
	Independent profitability is not maintained.		○		This problem is recognized by KUKL.
	The repair costs are not provided for.		○		The facilities are obsolete and being renewed.
	The purchase cost of chemicals has not been acquired.	○			The chemicals are in stock and there is no large problem.
Operation and Maintenance	There are no established operating and maintenance standards.			○	Manuals need to be prepared and promoted.
	Facilities are not maintained in an appropriate manner.			○	Systematic operation and maintenance is necessary.
	The number of engineers is insufficient compared with the amount of maintenance necessary.			○	The number of skilled engineers is insufficient.
Technology	There are no established design standards.	○			The design standards have been established.
	The technologies in use are not appropriate.	○			The necessary technology is applied to varying conditions.
	The engineering level is inappropriate for the level of development required.			○	The necessary engineers and skills are lacking.
	The engineering level is inappropriate for the level of operation and maintenance required.			○	The necessary engineers and skills are lacking.
Others	Transfer of water service project to municipalities/business entities		○		Inexperienced business entities cannot undertake the appropriate management and O&M.

2.1.3 Problems with Sanitation and Water-borne Infectious Diseases (at the National Level)

The water-borne diseases leading to death include diarrhea, intestinal parasites, gastrointestinal disorder, typhoid and jaundice. In particular, every year 22% of children who die under the age of 5 die due to water-borne diseases. In 2005 13,000 children died from water-borne diseases. (Source: Drinking water problems in Nepal)

In 2011 child mortality per 1,000 was 16 times higher than in Japan. The comparison of child mortality in Nepal and Japan is shown in Table 2.1.2.

Table 2.1.2 Child Mortality (per 1,000)

Year	Nepal	Japan	Japan/Nepal
1990	135	6	22.5
2000	38	5	7.6
2011	48	3	16.0

Source: WHO, Levels and trends in child mortality report, 2012.

2.1.4 Present Status of Water Service Projects in Bhaktapur Municipality

The present status of the water service projects in Bhaktapur Municipality is described below.

1) Overview of Water Supply Facilities

Bhaktapur Municipality has a population of 81,748 (2011 population census) and the population requiring a water supply, including the mobile population such as tourists and foreigners, is approximately 92,680 (estimated by the Study Team). There are 10,049 water taps (KUKL document). The area of Bhaktapur Municipality is 6,884km^2 (KUKL document) and the area of the district to which the Bansbari Water Treatment Plant distributes water is approx. 4.98km^2 (estimated by the Study Team). Figure 2.1.1 shows a map of Kathmandu Municipality and the location of Bhaktapur Municipality.

The districts in Bhaktapur Municipality to which water is supplied are shown in Figure 2.1.2. The red eastern district is the district to which water is supplied from the Bansbari Water Treatment Plant, while the western district is supplied with water from the Manohara Water Treatment Plant (constructed in 2004) through the Bode Distribution Reservoir.

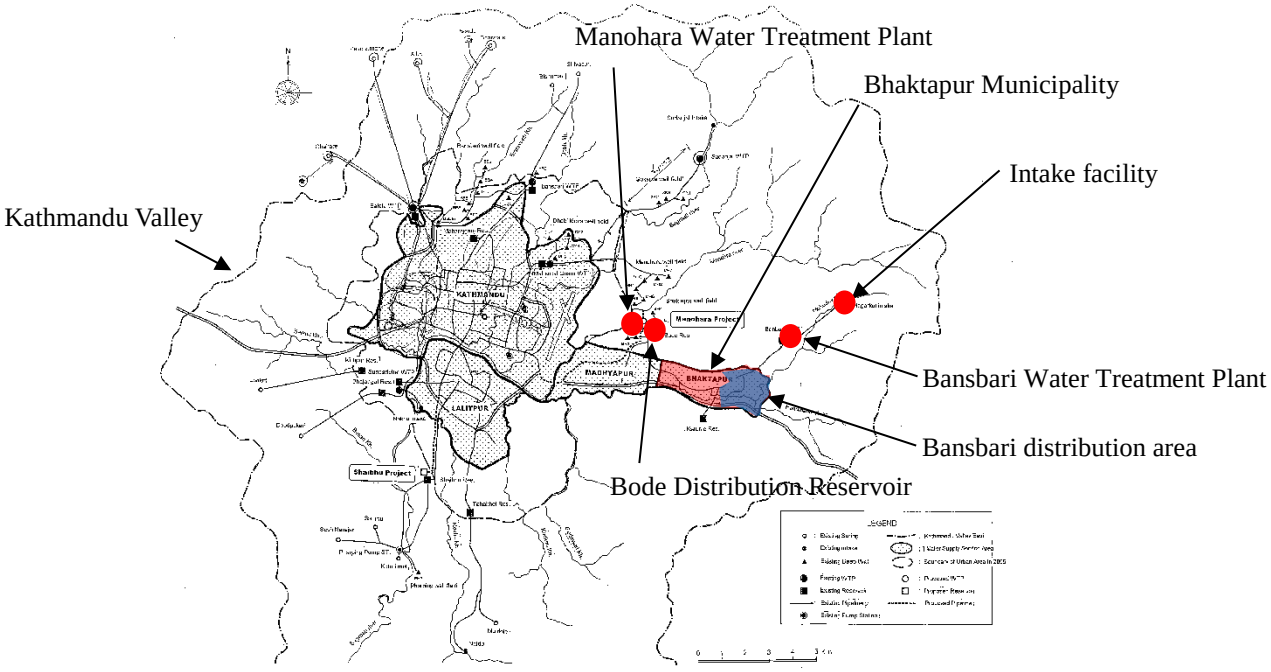


Figure 2.1.1 Location Map of Kathmandu Valley and Bhaktapur Municipality

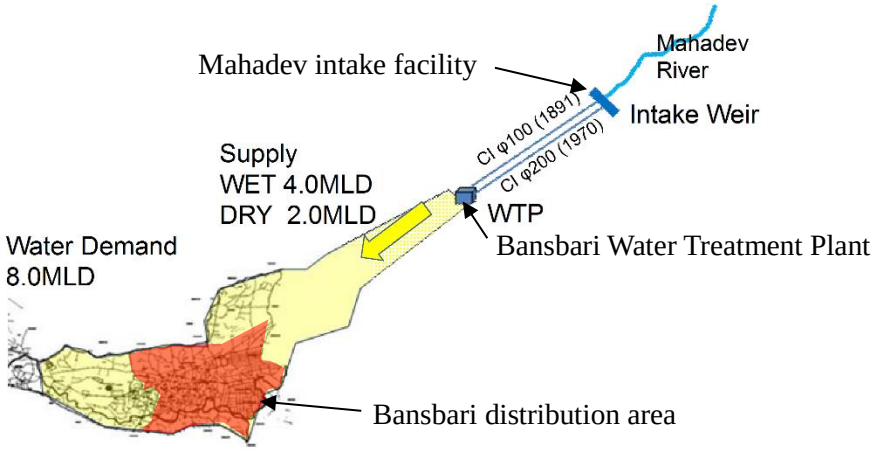


Figure 2.1.2 Water Supply Facilities and Water Distribution Area in Bhaktapur Municipality

2) Water Sources and Water Conveyance

The water source for the Bansbari distribution area in Bhaktapur Municipality is the Mahadev River, on which an intake weir is installed with two water conveyance pipes (with an approx. length of 3,118m each) laid. One is a cast-iron pipe of 100mm diameter installed in 1896, a very old pipe that has been in place for 119 years. The other is a cast-iron pipe of 200mm diameter constructed in 1971 (in place now for 44 years).

For the water conveyance, the gravity flow system is used and the height difference between the intake weir and the water treatment plant is approx. 56m, with undulations on the way. In the plan, air vent valves and drainage facilities were used, but not all facilities were confirmed on site. It is

necessary to investigate in detail whether those facilities are functioning. From the two conveyance pipelines, the raw water (unpurified, non-disinfected water) is drawn out by local residents along the way. During the study period, no raw water reached the treatment plant from the 100mm-diameter pipeline. KUKL tolerated this state of affairs out of consideration for residents living upstream of the treatment plant. Figure 2.1.3 shows the location map and the longitudinal profile including the intake work, conveyance pipelines and water treatment plant.

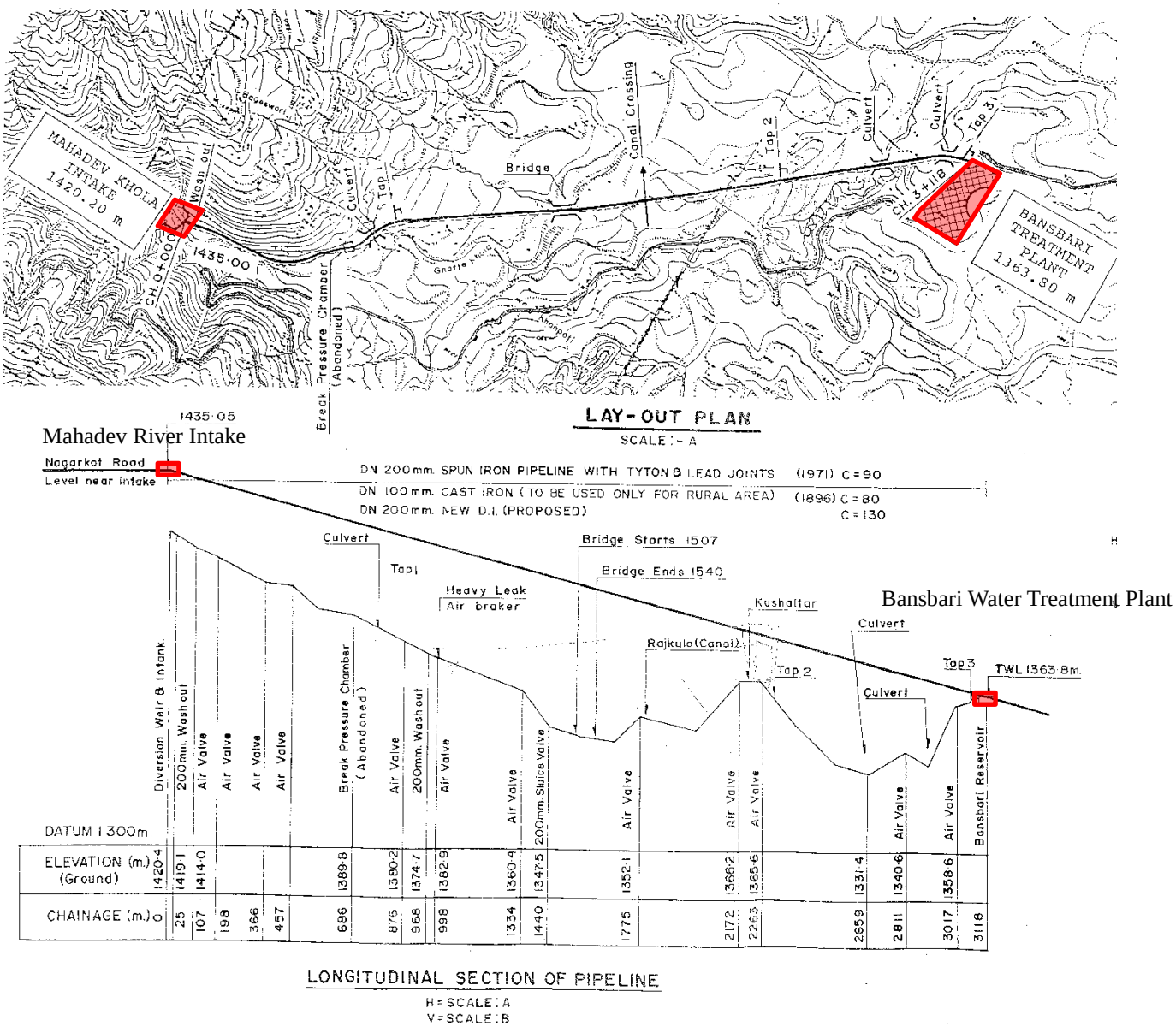


Figure 2.1.3 Location Map and Longitudinal Profile of Intake Facility, Conveyance Pipelines and Water Treatment Plant

3) Water Treatment

The current capacity of the Bansbari Water Treatment Plant is 4,000m^3/day. The water is

flocculated in the flocculation basin, settled in the horizontal-flow sedimentation basin and then put into rapid sand filtration. After that, chlorination is added in the treatment/distribution reservoir prior to distribution. There is no cleaning or draining of the rapid filtration facility or the sludge sediment treating facility. Figure 2.1.4 shows the water treatment process.

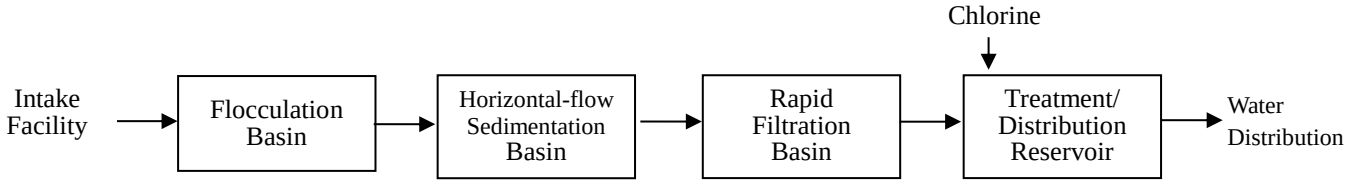


Figure 2.1.4 Treatment Process at the Present Bansbari Water Treatment Plant

The Bansbari Water Treatment Plant was constructed in 1975, and 40 years have elapsed since its construction. As the chlorination facility is not working, a temporary chlorination facility is provided at the inflow section of the distribution reservoir. Assuming that the durable period of civil work facilities is 50 years, this plant is at the stage where its reconstruction or renewal needs to be planned. No independent power generator is installed despite the long periods of power failure. Therefore, the inability to backwash the rapid filtration basin poses a problem in operation and maintenance.

A well has been constructed in the treatment plant, but its intake capacity is low – approx. 500m^3/day – and it cannot be operated in the event of a power failure. The water contains underground silt and the well can be used only as an auxiliary water source.

4) Water Conveyance and Distribution

Water is distributed to Bhaktapur Municipality from the treatment/distribution reservoir in the Bansbari Water Treatment Plant. Along the way, no distribution reservoir or overhead tank is provided, and water is distributed via the gravity flow system. The existing distribution pipeline is 50 – 200mm in diameter and its total length is 50km. It is a very old pipeline, laid in 1984 (with the exception of the section of the conveyance pipeline into the city area).

The volume of water distributed from the Bansbari Water Treatment Plant averages 2,897m^3/day with a maximum of 5,760m^3/day and a minimum of 136m^3/day, according to the records on the distribution reservoir in the plant (for the period October 2013 to January 2015). The conveyance capacity of the pipelines (of 100mm and 200mm diameter) is estimated to be approx. 4,000m^3/day and the monthly average distribution volume is deemed to be low.

5) Financial Problems

The billing, collection and operating expenditure of water charges that KUKL made for the period from fiscal 2007/2008 to fiscal 2013/2014 is shown in Figure 2.1.5. Expenditure exceeded the charges collected and KUKL had an overall deficit. The collections and expenditure in the Bhaktapur District

controlled by KUKL are shown in Table 2.1.3 and Table 2.1.4, respectively. Performance in 2009/2010 resulted in a deficit of approx. 1,616 thousand rupees (NRs) (=15,359 – 13,743) (approx. 1,939 thousand yen).

The collection of water charges (via water meters) provided the highest single income, 51.7% of the total. Staff salaries accounted for 39.4% of operating expenditure.

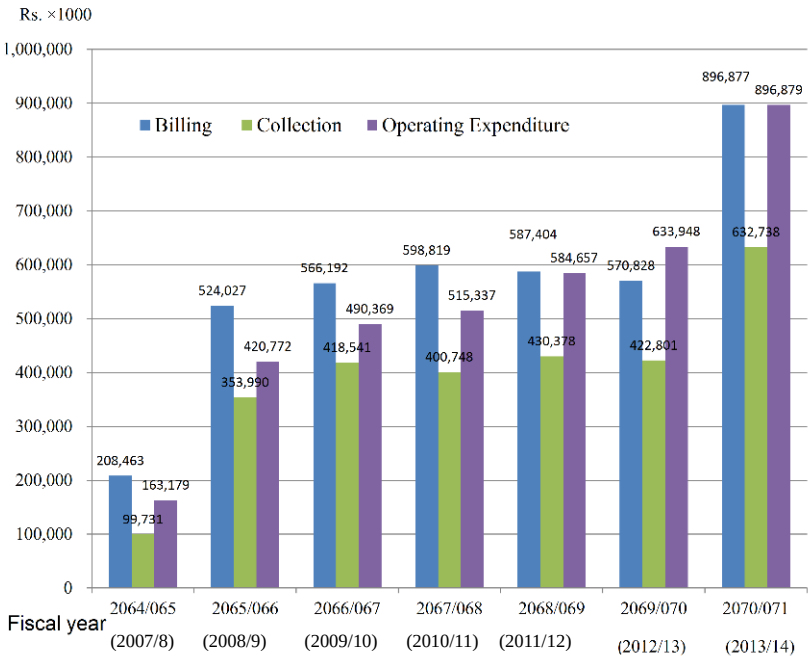


Figure 2.1.5 Changes in Collection and Operating Expenditure of KUKL

Table 2.1.3 Collections from Bhaktapur District

NRs in 000

No.	Details	Bhaktapur	
		2009/2010	2010/2011
		Revised	Proposed
2	Private Connection Metered	7,100	7,240
3	Private Connection UnMetered	1,800	1,800
4	Government Connection Metered	950	950
5	Government Connection UnMetered	397	397
6	Public Stand Post	-	-
7	Sewerage	2,600	2,635
8	Water Sale (Tanker)	-	-
	Total Water & Sewerage Billing	**12,847**	**13,022**
9	Rebate (-)	140	140
	Net Water & Sewerage Billing (A)	**12,707**	**12,882**
10	Extra Billing	400	400
11	Maintenance Charge	-	-
12	New Connection Charge	550	495
13	Miscellaneous Income	86	-
14	Store Sale	-	-
15	Interest Received	-	-
	Total Other Income (B)	**1,036**	**895**
	Grand Total (A+B)	**13,743**	**13,777**

Table 2.1.4 Expenditure in Bhaktapur District

NRs. in 000

Code No.	Details	Bhaktapur	
		2009/2010	2010/2011
		Actual	Proposed
1	Salary	6,052	6,295
2	Allowance	495	300
3	Overtime allowance	600	700
5	Leave salary	321	400
9	Medical Allowance	321	400
10	Dress Allowance	65	90
11	Pump & Machinery Repair	300	375
12	Chemicals (Including Lab)	265	300
13	Fuel for Vehicles	340	375
14	Fue for Other Purposes	10	10
15	Electricity)Power)	500	800
16	Vehicle & Equipment Maintena	230	275
17	Building Maintenance	250	400
21	Printing and Staionaery	450	540
23	Newspapers	10	10
24	Service	200	230
27	Contingency Expenses	100	125
33	Perishable Goods	150	175
35	System Maintenance	4,700	2,500
35 a	Labor Fee		1,980
TOTAL		**15,359**	**16,280**

2.1.5 Problems with the Drinking Water Supply

The water supply in Bhaktapur Municipality is intermittent. The city area is divided into 3 blocks, each of which is provided with water for about 1 to 3 hours once every 3 days. According to the estimate made by the Study Team, the daily maximum water demand in Bhaktapur Municipality was 13,400m^3/day in 2012. As shown in Figure 2.1.6, the water supply volume in the dry season was about 1,000m^3/day, a shortfall of some 12,000m^3/day.

The residents make up for the shortage of service water through the use of tanker supply water and well water. The charge for tanker supply water is NRs 343 to 399/m^3, making it more expensive than the service water. (For reference, the service water charge is NRs 32/m^3 for home use (with a 1/2 inch diameter tap) and NRs 71/m^3 for other use (with a 3/4 inch diameter tap). Source: KUKL 6th Anniversary Report.) The volume of well water is insufficient and the quality deteriorates in the dry season. The residents worry about the acquisition of drinking water. KUKL has suspended the connection of new water taps because the water supply capacity is insufficient.

The water quality tests made in this Study showed that the quality of water treated in the Bansbari Water Treatment Plant was compliant with the drinking water quality standards of Nepal. If the turbidity of the source water rises, there will be an increase in the incidence of water-borne infectious diseases in the rainy season. In the future, it will be necessary to carry out water quality tests during the rainy season.

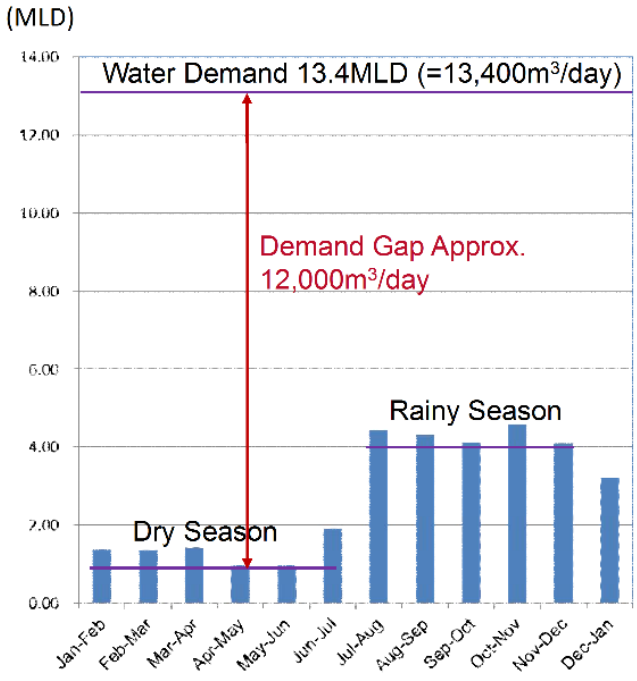


Figure 2.1.6 Water Demand and Supply in Bhaktapur Municipality

2.1.6 Problems with Sanitation and Water-borne Infectious Diseases (Kathmandu Valley)

In the Kathmandu Valley, the urban environment is rapidly deteriorating due to the inflow of population. Among other problems, the condition of the water supply to residents is getting worse year by year. Problems related to the operation and maintenance of treatment facilities and the water quality control system may prevent the provision of a sufficient supply of safe water satisfying the drinking water quality standards, leading to water-borne infectious diseases as described in Section 2.1.3.

In research carried out in Kathmandu Municipality, protozoa were detected in 49.5% of the water samples (97 samples in total) from the outlet of the water treatment plant and water taps. The classification of species showed 43.3% giardia, 19.6% cryptosporidium and 2.1% cyclospora. Such protozoa were detected more from the water taps in Kathmandu Municipality than the outlet of the water treatment plant and increased noticeably in the distribution systems. It was reported[1] that free residual chlorine was detected in 50.0% of the treated water in Kathmandu Municipality, but in only 3.6% of water from the water taps, and that the water distribution system was poorly disinfected.

The above report suggests that the water treatment plants are not disinfected properly and that chlorine may be depleted in the distribution pipeline network, causing the service water to become contaminated.

In this Study, no data on infectious diseases in Bhaktapur Municipality was obtained. The simple water quality analysis (Pack Test®) that was carried out on the free residual chlorine concentration at water supply taps showed that the concentration was 5mg/L or more in the Bansbari Water Treatment Plant and 2mg/L or more at water taps in the Municipality, which was compliant with the drinking water quality standards of Nepal. (See Figure 2.1.7 and Table 2.1.5.) No water-borne infectious diseases were confirmed in Bhaktapur Municipality.

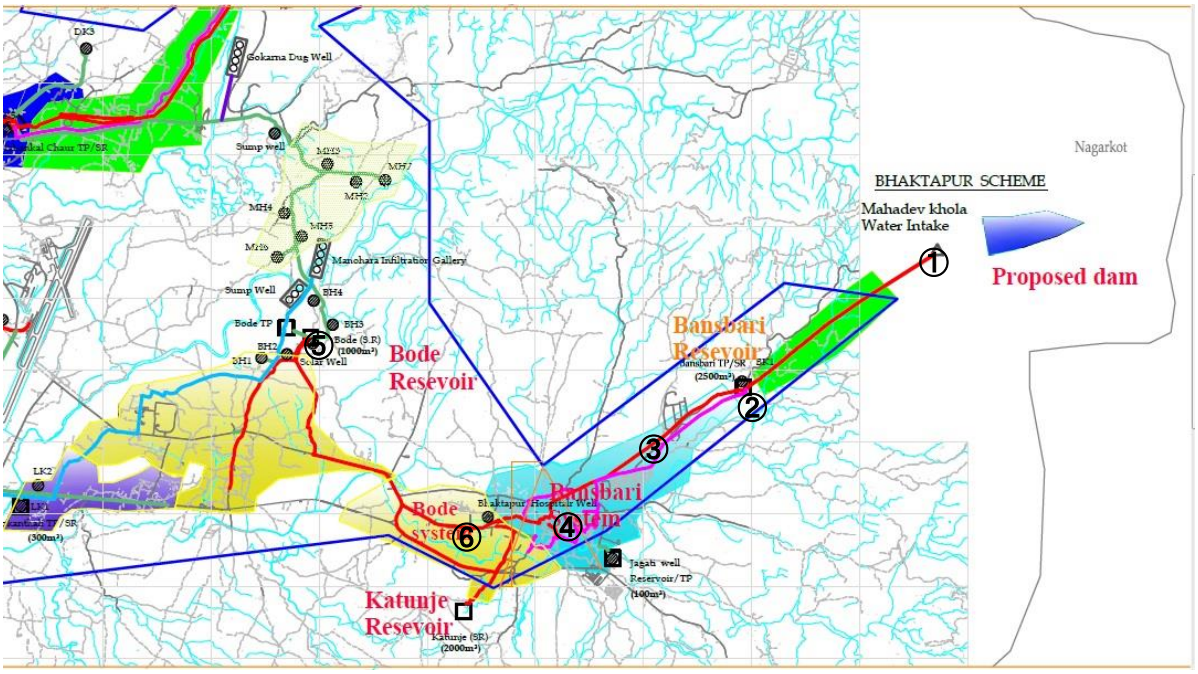


Figure 2.1.7 Water Sampling Points

[1] "Relationship between contamination of tap-water and protozoa-related diarrhea in developing countries" Kimura and Uga, Modern Media Vol. 52, No. 12, 2006

Table 2.1.5 Results of Water Quality Tests at Sampling Points

Parameters	Units	NDWQS	Result					
			Date: 14/01/2015 -20/01/2015 No.1668-1669 /071/072	Date:16/01/2015 -20/01/2015 No.1672-1673 /071/072	Date: 14/01/2015 -20/01/2015 No.1668-1669 /071/072	Date:16/01/2015 -20/01/2015 No.1675-1676 /071/072	Date:16/01/2015 -20/01/2015 No.1672-1673 /071/072	Date:16/01/2015 -20/01/2015 No.1675-1676 /071/072
			① Dam Site Near Nagarkot (1668)	② Water Treatment Plant (WTP) Bansbari haktapur (1672)	③ Tap Water Bhaktapur (1669)	④ Tap Water Bansbari, Bhaktapur Maha-Laxmisthan (1675)	⑤ Thimi Reservoir, Bode (1673)	⑥ Tap Water (Bode Salaghari) (1676)
PHYSICAL								
Colour	Hazen	5(15)	<5.0	10.0	10.0	10.0	5.0	<5.0
Turbidity	NTU	5(10)	<1.0	1.0	3.0	2.0	<1.0	<1.0
Conductivity	µS/cm	1500	26.0	56.0	51.0	53.0	120.0	125.0
pH	-	6.5-8.5*	6.5	7.1	6.9	6.9	6.5	6.5
Total Dissolved Solid	mg/L	1000	13.0	28.0	26.0	2.9	60.0	70.0
Taste	TFN	Not Objectionable	N.O.	N.O.	N.O.	N.O.	N.O.	N.O.
Odor	TON	Not Objectionable	N.O.	N.O.	N.O.	N.O.	N.O.	N.O.
CHEMICAL								
Iron	mg/L	0.3(3)	<0.01	0.24	0.24	0.22	0.06	0.07
Manganese	mg/L	0.2	0.05	0.04	0.08	<0.01	<0.001	0.12
Arsenic	mg/L	0.05	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Cadmium	mg/L	0.003	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Chromium	mg/L	0.05	<0.01	<0.01	<0.01	0.01	<0.01	<0.01
Cyanide	mg/L	0.07	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Lead	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Ammonia	mg/L	1.5	0.03	0.16	0.11	0.03	1.7	1.2
Chloride	mg/L	250	2.0	5.0	3.0	3.0	5.9	5.9
Sulfate	mg/L	250	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Nitrate	mg/L	50	0.27	0.04	0.12	1.6	3.8	37.5
Copper	mg/L	1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total Hardness	mg/L as CaCO3	500	20.0	30.0	28.0	32.0	44.0	50.0
Calcium	mg/L	200	4.8	8.8	6.4	8.0	12.0	13.6
Zinc	mg/L	3	0.09	0.01	<0.01	0.01	0.02	0.02
Mercury	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Aluminium	mg/L	0.2	<0.01	0.03	0.03	0.04	0.10	0.12
Fluoride	mg/L	0.5-1.5*	0.43	0.73	0.77	0.79	0.89	0.86
BIOLOGICAL								
Coliforms	CFU/100ml	Nil	70.0	Nil	Nil	Nil	Nil	Nil
E.Coli	CFU/100ml	Nil	34.0	Nil	Nil	Nil	Nil	Nil

NDWQS: National Drinking Water Quality Standard, 2062(Nepal)

*These values show lower and upper limits, () Values in the parenthesis refers the acceptable values only when alternative is not available

2.1.7 Others

The Bhaktapur Municipality Office has been developing housing districts, and the development of two districts has been completed. The construction of another two districts is planned. It is also expected that the water supply districts will be expanded and the population will increase substantially. Bhaktapur Municipality is a tourist city near to Kathmandu and is a World Cultural Heritage Site. The water consumption volume is high and the Municipality attracts many tourists. Therefore, the acquisition of water sources and a safe, stable water supply is of paramount importance.

2.2 Related Projects

2.2.1 Overview of Development Projects

MoUD is promoting the provision of a fair water service in order to improve public health, stimulate economic growth, and enhance environmental protection and the effects of individual schemes. In formulating the framework for policies and regulations, there is a need for better performance and transparent procedures and for those policies and regulations to be enacted through the participation of people in a wide range of sectors including the public and private sectors, civil society and users in the service field. (Excerpt from "National Urban Water Supply and Sanitation Sector Policy (Draft, February 2009)")

Under this policy, various types of assistance have been provided in the water supply and sewerage sector of Nepal, including the "Small Towns Water Supply and Sanitation Sector Project" for which ADB is the main donor, as well as development assistance for drinking water projects by international organizations such as WHO and UNICEF, and donors in other countries.

2.2.2 High-Level Plans and Projects Relevant to this Project

Nepal has formulated the "National Water Plan – Nepal (2002 – 2027)" which sets goals for 2017 and 2027.

[By 2017]

1) 100% of the population has access to water supply.
2) 27% of the population has medium or high water supply service level.
3) 100% of the population has access to basic sanitation facilities.

[By 2027]

50% of the population has medium or high water supply service level.

The water supply and sanitation programs are focused on enhancing the water supply and sewerage penetration rates on a basic level in the next 5 years. Further, in 10 years, the existing water supply and sanitation facilities will be improved to ensure that 100% of the population has access to such facilities. With regard to health improvement, all citizens will be able to receive appropriate water supply and sanitation services by 2025. To this purpose, the following 6 programs are planned:

1) Accelerated Stand-Alone Sanitation Improvement Program (ASASIP)
2) Rural Water Supply and Sanitation Program (RWSSP)
3) Small Towns Water Supply and Sanitation Program (STWSSP)
4) Kathmandu Valley Water Supply and Sanitation Program (KVWSSP)
5) Major Towns Water Supply and Sanitation Program (MTWSSP)
6) Water Supply and Sanitation Institutional Strengthening Program (WSSISP)

2.2.3 Urgency and Priority in Nepal with regard to this Project

Water demand in the Kathmandu Valley based on the 2011 population census was in excess of 400MLD (1,000m^3/day), but the water supply capacity of KUKL is only 100MLD because of the shortage of water sources. The "Melamchi Water Supply Project" is being implemented in Phases 1, 2 and 3, with the aim of developing 170MLD (510MLD in total) of water sources. As described previously, however, it is a fact that the progress of Phase 1 has been delayed, so that there is no prospect that Phases 2 and 3 can be completed. Figure 2.2.1 shows the water demand prediction for the Kathmandu Valley and the water supply volumes assuming that the "Melamchi Water Supply Project" is completed in the shortest period up to Phase 3. On the basis of this prediction, even if Phase 3 is completed in 2028 and a water supply of 510MLD is realized, it cannot be denied that before long demand may well outstrip supply once more.

In the "Melamchi Water Supply Project", higher priority will be given to providing a water supply to homes from the western side, and it will be a considerable time before water sources are allotted to Bhaktapur. KUKL is concerned at the possibility that in the end no water will reach Bhaktapur, and has given the highest priority to the dam construction proposed in this Project. Mr. Ishwori, Acting Secretary of the Water and Energy Commission Secretariat, (who participated in JICA group training – Water supply management administration and water supply project operation (B) in 2013), made the same remark, from which it can be assumed that the Government of Nepal considers water source development to be important.

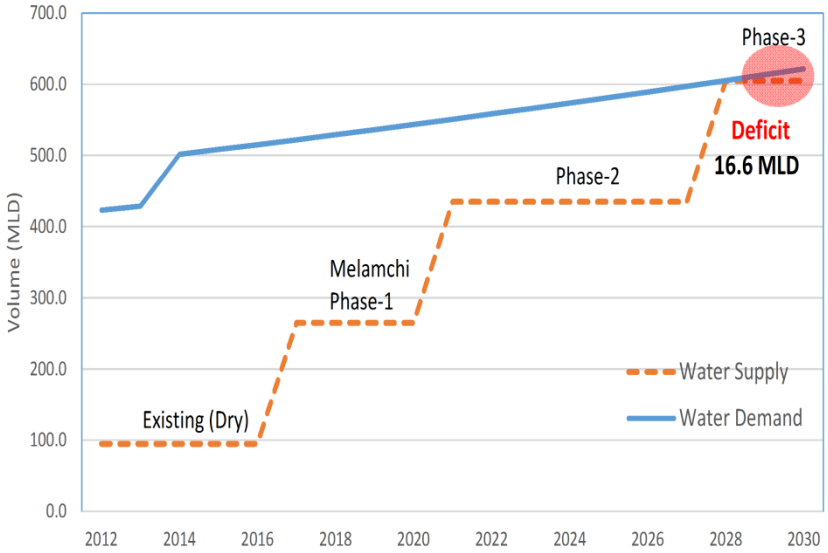


Figure 2.2.1 Comparison of Water Demand and Supply in the Kathmandu Valley

2.2.4 Comparison of Candidate Projects

The Melamchi Water Supply Project has the objective of improving the service water supply and sanitation conditions in the Kathmandu Valley. The total project cost for Phase 1 amounts to 31.7 billion USD, and the main items of the project are the construction of the tunnel (3m diameter) with a total length of approx. 27km, the improvement of the water distribution pipeline network and the construction of the water treatment plant/service reservoir.

The Melamchi Water Supply Project will be implemented in 3 phases to supply a total water volume of 510MLD, of which 17MLD will be distributed to Madhyapur Municipality and Bhaktapur Municipality. Regarding the conveyance pipeline for 17MLD water, application has been made to ADB, which is unlikely to cover the Project completely; but it is expected that the schedule for implementation of the Project will be made clear. 17MLD is the water volume to be conveyed in the final instance, not the water volume to be secured before completion of the Project. On the other hand, the water distribution volume per capita will be very different, as shown in Table 2.2.1 in accordance with the evaluation of the 2030 distribution volumes from the Melamchi Water Supply Project only, following the completion of that Project.

In view of the fact that Bhaktapur Municipality, and the Bansbari distribution district in particular, is located at the eastern end of the project area, it cannot be expected that the priority of that distribution district within the Melamchi Project is high.

Table 2.2.1 Comparison of Water Supply Volumes per Capita after Completion of the Melamchi Water Supply Project (2030)

	Population	Distributed Water Volume [1)]	Water Volume per Capita
Kathmandu Valley	3.35 million	510MLD	152L/capita/day
Kathmandu Municipality [2)]	3.13 million	493MLD	158L/capita/day
Madhyapur/Bhaktapur	0.22 million	17MLD	77L/capita/day

Source: Estimate by the Study Team

1) Water distribution volume from the Melamchi Water Supply Project only
2) The population projected for 2030, excluding the populations of Madhyapur and Bhaktapur from the total population of the Kathmandu Valley.

The target districts and the water distribution volumes of the Melamchi Water Supply Project are shown in Figure 2.2.2.

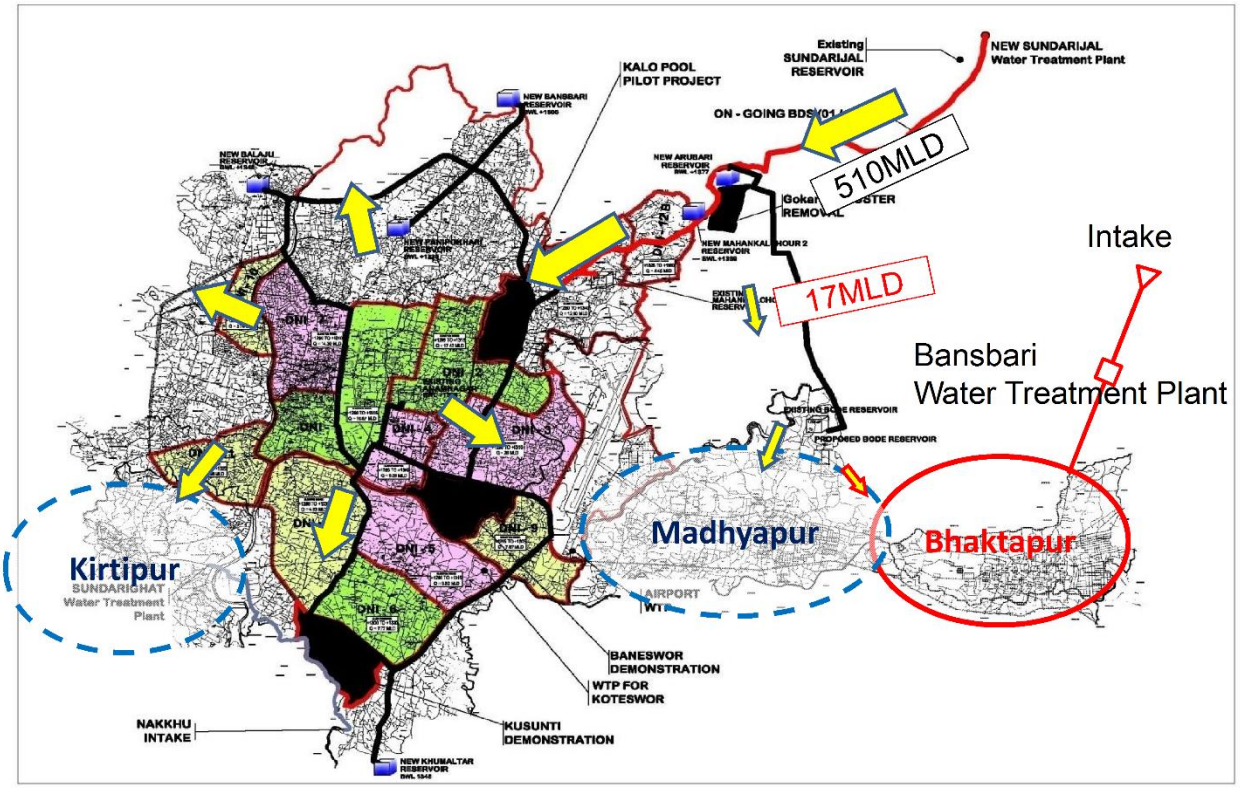


Figure 2.2.2 Melamchi Water Supply Districts and Water Distribution Volumes

The shortest schedule (draft) up to Phase 3 of the Melamchi Water Supply Project as simulated by the Study Team is shown in Figure 2.2.3.

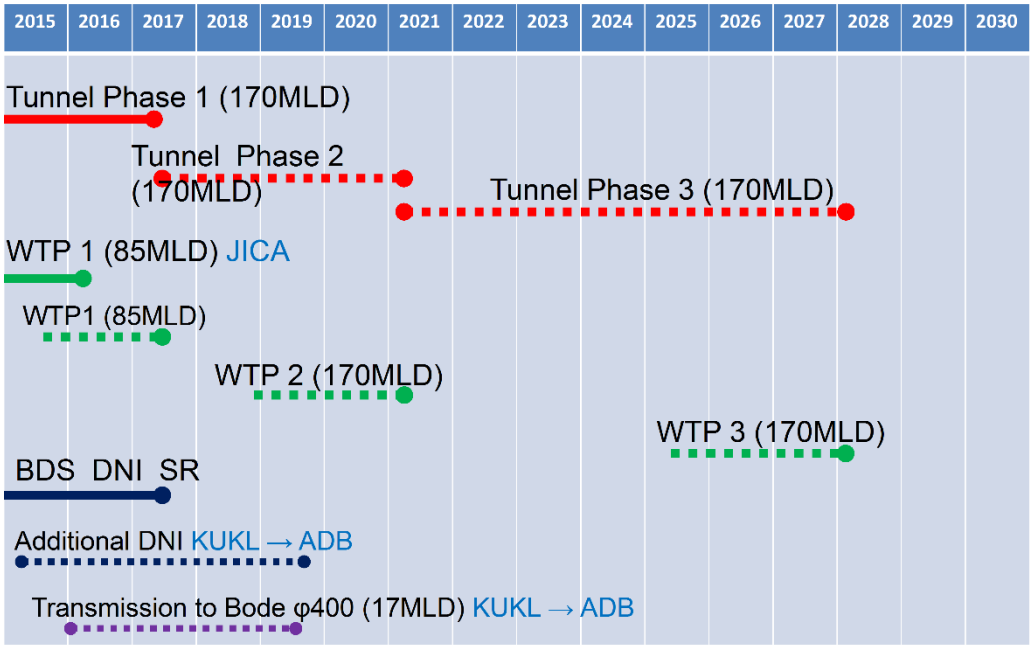


Figure 2.2.3 Melamchi Water Supply Project Schedule (Draft)

2.2.5 Information on Other Related Fields

The Incorporated Administrative Agency Japan Water Agency implemented an assistance project for formulation of the programs necessary for enhancement of water security in the Kathmandu Valley as part of a technical assistance project by ADB in 2012, in which the Agency recommended that the construction of a dam as proposed in this Project would be an effective means of supplying water to the areas with the most urgent need, because surface water sources within the Valley are limited due to the rapid increase in population and housing land development. Since the water sources for supplying water to the Valley will be insufficient even after the completion of the Melamchi Water Supply Project, the possibility of dam construction in the southern area of the Valley was suggested as a long-term prospect following the completion of the Project.

2.3 Responsible Agencies and Implementing Agency

2.3.1 Related Agencies

The counterpart agencies for this Study include the Ministry of Urban Development (MoUD), the Kathmandu Valley Water Supply Management Board (KVWSMB), and Kathmandu Upatyaka Khanepani Limited (KUKL). In particular, KUKL has responsibility for Bhaktapur Municipality and undertakes the operation and maintenance of the municipality water supply facilities. The Department of Water Supply and Sewerage (DWSS) of the MoUD is responsible for the management and supervision of the water supply and sewerage facilities in the medium- and small-sized regional cities and the areas around the Kathmandu Valley,

but in this Project the Bhaktapur District falls outside its jurisdiction.

Bhaktapur Municipality is also considered one of the important organizations promoting this Study.

2.3.2 Organization of Implementing Agencies

The organizational charts of MoUD, KUKL and Bhaktapur Municipality Office are shown below. The Water Supply and Environment Division of MoUD is responsible for the management and supervision of water supply and sewerage projects.

(1) Ministry of Urban Development (MoUD) (Central Government)

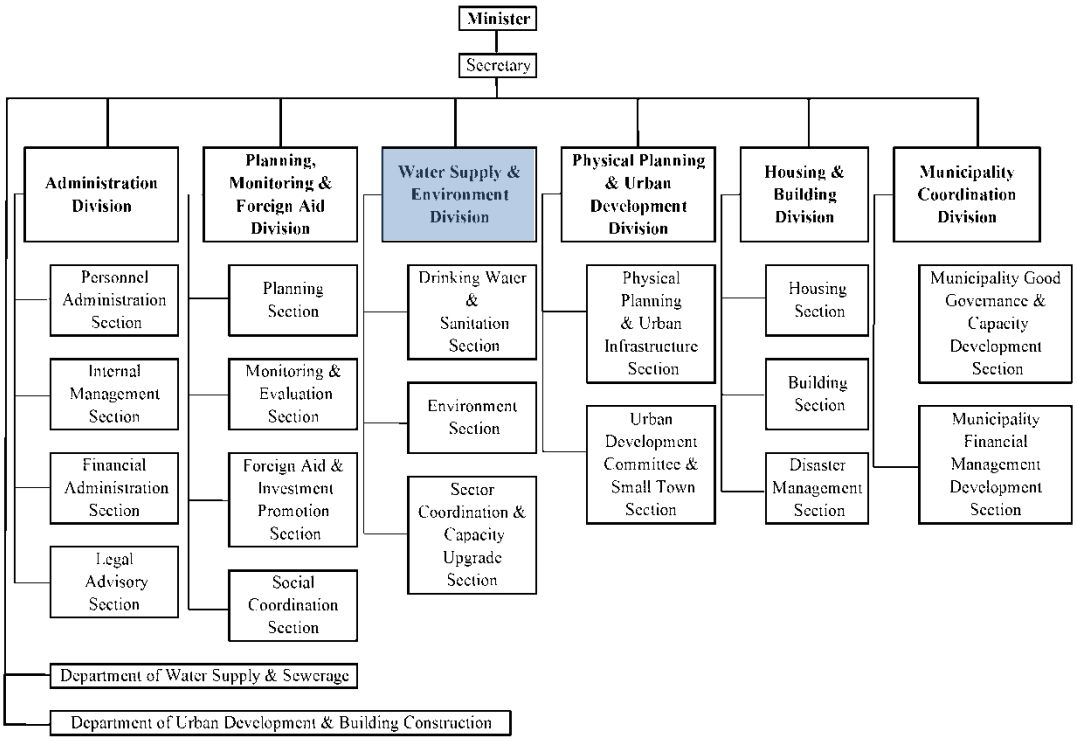


Figure 2.3.1 Organizational Chart of MoUD

(2) Kathmandu Upatyaka Khanepani Limited (KUKL)

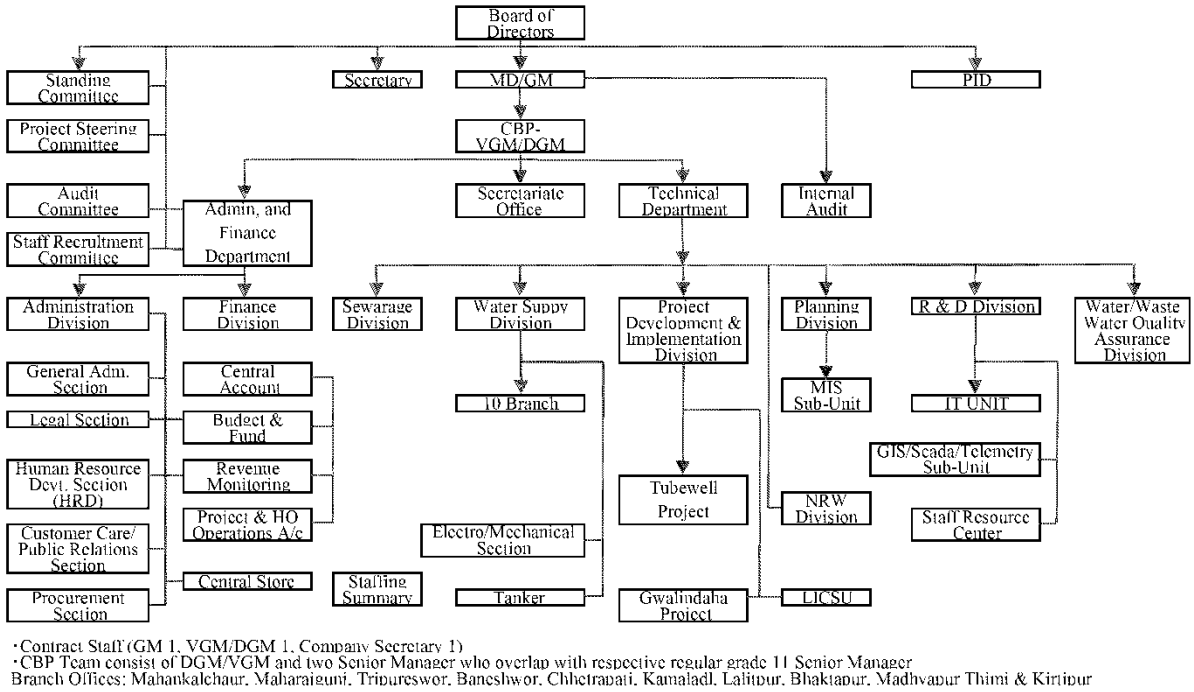


Figure 2.3.2 Organizational Chart of KUKL

(3) Bhaktapur Municipality Office

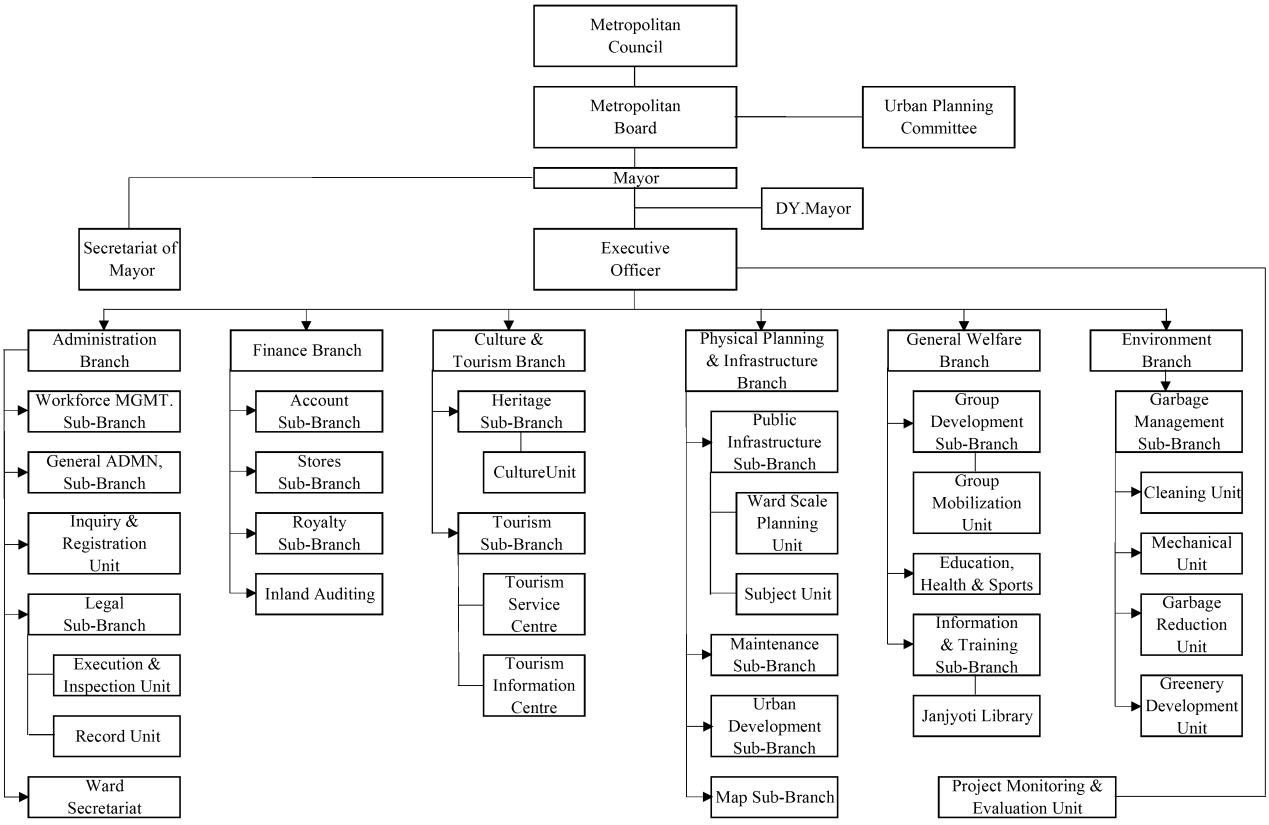


Figure 2.3.3 Organizational Chart of Bhaktapur Municipality Office

2.3.3 Services of Implementing Agencies

(1) Ministry of Urban Development (MoUD) (Central Government)

MoUD is a government agency in charge of housing, urban development, water supply and sewerage, and other projects. The organization in charge of the water supply and sewerage projects is the Water Supply and Environment Division, and its main functions are as follows:

- Formulation of comprehensive plans for drinking water supply and implementation of programs
- Determination of policies for drinking water supply projects, financial measures, training of relevant staff and guidance of relevant public corporations

(2) Kathmandu Upatyaka Khanepani Limited (KUKL)

KUKL is a public corporation registered in accordance with Nepalese Government Ordinance No. 2063. KUKL is responsible for the operation and maintenance of the water supply and sewerage facilities in the Kathmandu Valley and is commissioned by the Kathmandu Valley Water Supply Management Board (KVWSMB) to operate and maintain the facilities.

The staff consists of 823 regular employees, 56 contract employees and 240 daily laborers, totaling 1,119 persons (as of December 2014, KUKL document).

(3) Kathmandu Valley Water Supply Management Board (KVWSMB)

KVWSMB is the owner of the water supply and sewerage facilities in the Kathmandu Valley. KVWSMB commissions KUKL to operate and maintain the water supply and sanitation facilities in the Kathmandu Valley and is responsible for the formulation of policies and supervision of those facilities.

KUKL has entered into an agreement with KVWSMB to operate and maintain the water supply and sewerage facilities (for a period of 30 years). KUKL is obligated to pay an operating license fee to KVWSMB. The Water Supply Tariff Fixation Commission (WSTFC) is the agency which determines water supply charges and has the function of protecting the rights of consumers. Figure 2.3.4 shows the relationship between KUKL, KVWSMB and WSTFC.

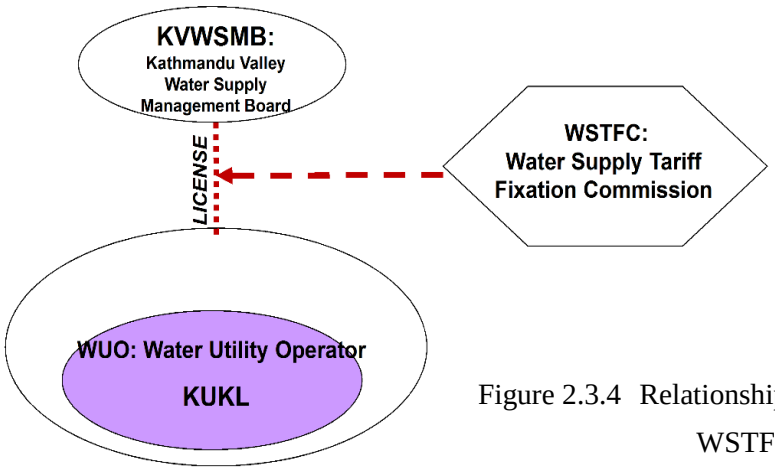


Figure 2.3.4 Relationship between KUKL, KVWSMB and WSTFC (Source: KUKL document)

(4) Bhaktapur Municipality Office

Bhaktapur Municipality Office is not an agency concerned with water supply facilities; KUKL undertakes the operation and maintenance of water service facilities in the Municipality. The main functions of the Municipality Office are to receive residents' complaints relating to the water supply facilities, to discover any failures or malfunctions of the facilities, and to submit reports on the same to KUKL.

2.4 History of Cooperation Projects by Japan

2.4.1 History of Financial Cooperation

The relationship between Nepal and Japan and the records of financial aid to Nepal are shown in Table 2.4.1.

Figure 2.4.1 General Grant Aids to Nepal (related to water supply), since 1976 (Amount: E/N based)

No.	Year	Project Name	Amount
1	1976	Project for the Execution of Water Supply System of Tansen (Water Supply Facilities Construction)	500 million yen
2	1980	Rural Domestic-use Water Supply Project (Equipment Provision)	600 million yen
3	1982	Rural Water Supply Project (Equipment Provision)	400 million yen
4	1983	Rural Domestic-use Water Supply Project (Equipment Provision)	600 million yen
5	1988 to 1991	Project for the Water Supplies to Urban and Semi-urban Centers (Construction of water supply facilities in 9 cities)	4,333 million yen
6	1992 to 1994	Project for Improvement of Kathmandu Water Supply Facilities Phase 1 (Construction of water supply facilities including Mahankal Chaur Water Treatment Plant and improvement of quality of groundwater source for Kathmandu Municipality)	3,372 million yen
7	2001 to 2003	Project for Improvement of Kathmandu Water Supply Facilities Phase 2 (Construction of water supply facilities including Manohara Water Treatment Plant and improvement of quality of groundwater source for Kathmandu Municipality)	2,244 million yen
8	2004	Project for Improvement of Kathmandu Water Supply Facilities Phase 3 (Construction of water supply facilities with an expanded distribution reservoir for Kathmandu Municipality)	277 million yen
9	2006 to 2007	Project for the Improvement of Water Supply Facilities in Urban and Semi-urban Centers (Construction of water supply facilities in 3 cities)	1,124 million yen

The assistance projects for Nepal by water supply utilities in Japan have been implemented mainly through JICA training programs for trainees invited to Japan, but if the stability of the government continues, it is expected that the number of assistance projects in Nepal will certainly increase in the future.

2.4.2 History of Technical Cooperation

Technical cooperation projects are implemented to support developing countries in their programs to promote human resource development, R&D, the spread of technology and the system-building needed for the economic and social development of the country in question, through the dispatch of experts, provision of necessary equipment and training of personnel in Japan or a third country, in order to enhance the

problem-solving capacity and independence of the developing countries. The technical cooperation projects for Nepal implemented by Japan are shown in Table 2.4.2.

Table 2.4.2 Technical Cooperation Projects and Periods of Implementation

Name of Project	Project Period
Water Policy Advisor	Oct. 2003 – Oct. 2005
Water Policy Advisor	Feb. 2006 – Feb. 2008
Project for Strengthening the Monitoring and Evaluation System	Oct. 2006 – Dec. 2009
Promotion of Quality Cocoon Production and Processing Project	Dec. 2006 – Nov. 2011
Support for Improvement of Primary School Management (SISM)	Feb. 2008 – Feb. 2011
Advisor on Water Supply Management	Jun. 2008 – Jun. 2010
School Health and Nutrition Project	Jun. 2008 – May 2012
Gender Mainstreaming and Social Inclusion Project	Feb. 2009 – Jan. 2014
Participatory Watershed Management and Local Governance Project	Jul. 2009 – Jul. 2014
Project for Capacity Development on Water Supply in Semi-urban Areas	Jan. 2010 – Sep. 2013
Strengthening Community Mediation Capacity for Peaceful and Harmonious Society Project	Jan. 2010 – Sep. 2013
Project for Promoting Peace Building and Democratization through the Capacity Development of the Media Sector	Nov. 2010 – Oct. 2013
Project for Strengthening the Monitoring and Evaluation System Phase 2	Nov. 2011 – May 2015
Project for the Operation and Maintenance of Sindhuli Road	Dec. 2011 – Dec. 2015

Source: Japan ODA Country Data Book, Ministry of Foreign Affairs

* The water policy advisor was recommended by Ministry of Health, Labour and Welfare.

2.4.3 Opinions of the Nepalese Government and Agencies with regard to this Project

The water supply facility development in the Kathmandu Valley for which KUKL is responsible is an issue of great urgency for KUKL, and KUKL responded to our Study, stating that they "would afford the guidance work team every cooperation". In addition to KUKL, the agencies concerned in water supply facility development (MoUD, KVWSMB and Bhaktapur Municipality Office) are also working toward the early development of the water supply facility, and the ODA (loan-based aid, grant aid or technical cooperation) of Japan is also included in the scope of this Project.

In addition, Mr. Ishwori, the Acting Secretary of Water and Energy Commission Secretariat (as mentioned in 2.2.3) who has detailed knowledge of this Project has stated: "We want to bring it about by all means. If necessary, the Nepalese side will share the study costs and other costs."

2.5 History of Cooperation by Third Countries/International Organizations

[Move in and Linkage with JICA Projects]

JICA is considering the Water Supply Improvement Project in Pokhara Municipality as its next water supply project in Nepal. This Project is a candidate project to follow that project.

[Moves by and Coordination with Other Donors]

Assistance projects for water supply facility development are also being implemented by donors other than Japan, but those projects are coordinated so as not to duplicate the project content.

The main donors include ADB, the World Bank (WB) and the Finnish Ministry of Foreign Affairs, Department for International Development Cooperation (FINNIDA).

Projects by ADB and WB are of the residents' participation type (community sharing in part of the

project) and target regional areas. The ADB projects focus on the improvement of existing facilities, rather than facility expansion based on predictions of future water demand. Such projects are implemented on the condition that approx. 20% of the project cost is shared by the residents, with ADB providing assistance both in tangible and intangible aspects in all processes, including construction.

2.5.1 Performance and Type of Assistance Projects related to this Project

According to the interview held with KUKL, a distribution pipeline improvement project in the Kathmandu Valley ("Distribution Network Improvement (DNI) and Bulk Distribution System (BDS) with Service Reservoirs (SR)") is being implemented by ADB, looking forward to the future completion of the Melamchi Water Supply Project. In the DNI project, the volume of water to be supplied to the distribution areas in Madhyapur Municipality and Bhaktapur Municipality is 17MLD. How much of this volume will be supplied to the Bhaktapur Municipality area is unclear, but the allotted volume is very low considering that the total volume of water supplied in the entire Melamchi Water Supply Project (Phase 1 – Phase 3) will be 510MLD. It is obvious that the main target supply areas in that project are Kathmandu Municipality and its environs.

2.5.2 Request for this Project and Result

For this Project, "Bhaktapur Municipality Water Supply Improvement Project", no request has been made by the Government of Nepal or by KUKL, but in February 2012 the Japan Water Agency produced a report on "Supporting Investment in Water Security in River Basins (Financed by the Japan Special Fund)" which included a description of the study of water resource development in the Kathmandu Valley and a recommendation for dam construction in the Mahadev River.

2.5.3 Integrity of this Project with the Assistance Policy of Japan (including Country Assistance Policy, Expanded Partnership Initiative for Water and Sanitation, and Report on Review Meeting on the Evaluation of International Cooperation Projects (in Water Supply Field))

Under the heading "Building social infrastructure and institutions for balanced and sustainable economic growth" (one of three priority assistance areas), the Country Assistance Policy for Nepal states: "Delays in constructing infrastructure for transportation, combined with inferior urban environments caused by the deteriorating shortage of electricity and water supplies over a period of years, has posed a serious, adverse effect on the daily lives of people. In order to directly improve the living standard of people, Japan supports the building of social infrastructure and institutions relating to transportation, with due attention to the environment and disaster prevention." This Project as proposed properly complies with the above assistance policy.

2.5.4 Need to Link the Project to Cooperation by Third Countries/International Organizations

As described in 2.5.1 above, a Water Supply Facility Development Project in the Kathmandu Valley is being implemented by another international organization concurrently with the progress of the Melamchi

Water Supply Project. Continued attention needs to be paid to the progress of that Project and other related projects.

2.5.5 Reasons for this Project not to be implemented by a Third Country/International Organization

The Government of Nepal has made the improvement of the people's living environment and the reduction of poverty an important policy item, and is giving priority to the development of the water supply and sewerage system, with the aim of providing a stable supply of safe water to all. The relevant agencies of Japan (such as the Japan Water Agency and the Ministry of Health, Labour and Welfare) are studying the Project proposed in this Study ahead of other potential donors.

2.5.6 Other Considerations

Under review is assistance for the development of water supply facilities in the Kathmandu Valley, but the development of sewerage facilities also needs consideration because the shortage of sewerage treatment capacity and the inadequate sewerage pipeline network is causing serious deterioration of the water environment. At present, there are five sewerage treatment plants in the Kathmandu Valley, of which four plants are not currently in operation. ADB is providing the assistance to recondition those plants.

Chapter 3. Matters Relating to Plans and Projects Requiring Guidance

3.1 Efforts to Ameliorate Problems

3.1.1 Relevance of Water Utility Problems (National Level) to this Project

One of the problems that the water supply utilities face at the national level is the large regional differences in the level of the water service. In the Kathmandu Valley, the water demand is rising rapidly along with the rapid increase in population, but a sufficient volume of water cannot be acquired from usable water sources, and the water supply is available in most areas of Kathmandu Municipality for only a limited number of hours every other day or even every other week. According to a KUKL document (fiscal 2013/2014), the total capacity of the water treatment plants in the Kathmandu Valley is 117,000m^3/day while the water demand is 360,000m^3/day, a shortage of 243,000m^3/day. Thus, the water shortage in the Kathmandu Valley is a very serious problem.

On the other hand, the development of water sources by the Melamchi Water Supply Project is in progress, but KUKL is concerned about the timing and possibility of the allotment of a water source to Bhaktapur Municipality, and about excess demand after completion of the Melamchi Water Supply Project.

KUKL's water supply business is also in a severe condition financially, and it is trying as hard as possible to cover the maintenance cost of existing facilities through the collection of water charges. However expenditure exceeds the collection revenue and KUKL cannot at present afford to take drastic measures to improve or recondition the water supply facilities.

To resolve these problems, this Project will contribute to the acquisition of water sources and the improvement of facilities, and will provide an effective solution to the problems that KUKL faces.

3.1.2 Present Status of the Water Supply Business, Problems with the Drinking Water Supply and Connection to this Project

(1) Present Situation and Problems

In Bhaktapur Municipality, water is currently distributed from the Bansbari Water Treatment Plant to the eastern area where 75% of the population lives and from the Manohara Water Treatment Plant to the western area. The water source for the Bansbari Water Treatment Plant is the surface flow water from the Mahadev River. The water supply is made available twice every 3 days during the rainy season and once every 3 days during the dry season. The water supply is available for 1 to 3 hours each time and the eastern area suffers from a chronic water shortage. The western area of the city on the other hand is supplied with water from the Manohara Water Treatment Plant and the Bode deep well group, which uses as its water source shallow wells in the Manohara River that were constructed with grant aid from Japan. However, 80% of the water from those sources is supplied to Kathmandu Municipality and Madhyapur Municipality. The remaining western area is supplied with water only once every 4 days and like the eastern area it also suffers from a chronic water shortage.

Therefore, the residents store water in plastic containers when the water supply is available and use it only for washing foods and tableware. For washing clothes and other items, they draw water from shallow

wells in the vicinity and store it in tanks, but they are forced to purchase bottled water for drinking. This Project will help alleviate these serious water supply conditions and will play an important role in supporting the development of the urban infrastructure in the metropolitan city which is a world-famous tourist destination.

(2) Source Water Volume

At present, in the dry season all the water volume of the Mahadev River is taken and the volume available for supply is dependent upon the river water volume. In this Project, a dam will be constructed to store excess water in the rainy season, thus ensuring a water source to increase the water supply during the dry season.

(3) Conveyance Pipelines

The intake water volume in the rainy season is limited by the capacity of the conveyance pipeline. Therefore, the conveyance pipes need to be replaced with pipes of a larger diameter in order to increase the intake water volume.

(4) Water Treatment Facilities

The existing Bansbari Water Treatment Plant is of the rapid sand filtering type, but is not provided with chemical feed equipment. The elapse of over 40 years since its construction means that it is outmoded and unable to supply water with a stable quality. In this Project, it is recommended that a new treatment plant with a planned intake capacity be constructed, on the condition that the existing facilities are dismantled.

3.1.3 Scope of Cooperation

The intent of this Project is to construct a dam and water supply facilities for the purpose of boosting treatment capacity and improving water quality in order to acquire stable water sources in the dry season, and its scope of cooperation will cover all processes from the basic design/detailed design to construction of facilities.

However, the dam to be constructed will be a multi-purpose dam to be used not only to supply service water but also for irrigation. As the processes from design to construction will require many years and a high project cost, the Project will be divided into two parts, namely, dam construction and water supply facility construction.

Construction of the water supply facility construction will be accompanied by an upgrading of the facility operation and maintenance capacity of the relevant staff.

3.1.4 Form of Cooperation

For the water supply facilities, it is intended that the project for construction of facilities and Soft Component/technical cooperation be implemented under grant aid by the Government of Japan. For the dam construction, the provision of loan fund aid by the Government of Japan or implementation of the project

through the assistance of ADB or WB, which are involved in water service development projects in Nepal, will be considered.

3.1.5 Implementation Period

The very limited availability of the water supply in Bhaktapur Municipality, only a few hours every three days, gives this Project a high level of urgency, but from the study and design process to the completion of the Project will take a long time. On the other hand, the construction of water supply facilities requires a basic plan for dam construction. Thus it is necessary that the dam construction project be started simultaneously with or prior to the design of the water supply facilities.

3.1.6 Other Items

The dam construction is planned to be multi-purpose; not only used for service water but also for irrigation and hydropower generation. Therefore, the agencies concerned with rivers, agriculture, electricity and water service will be involved in the dam construction project and coordination between the relevant agencies will be required in the implementation of the project. As the dam construction will involve a long construction period and high construction costs, a preliminary study must be carried out. For this purpose, a Master Plan for water resource development in the Kathmandu Valley must be formulated so that the Government of Nepal can recognize and accept the rationality of the dam construction on the Mahadev River.

3.2 Objectives of the Project

3.2.1 Short-term Objectives

One of the short-term objectives of the Project is to replace the obsolete conveyance pipes in order to enhance their water conveyance capacity and enable the distribution of more treated water. Another objective is to upgrade equipment which may be lowering the functionality of the Bansbari Water Treatment Plant, thus improving and stabilizing the supply water quality.

3.2.2 Middle- and Long-term Objectives

In Bhaktapur Municipality, it is foreseen that the water demand will grow as the population increases. The planned target year is set at 2030, by which time it is expected that the planned population will be 111,300 and the planned maximum daily supply (water demand) will be 20.7MLD, of which 16.1MLD will be supplied from the Bansbari Water Treatment Plant to its distribution area. Figure 3.2.1 shows the predicted water demand (maximum daily supply) in Bhaktapur Municipality and in the area of the Municipality supplied by the Bansbari Water Treatment Plant. The middle- and long-term objectives will be covered by dam construction, intake facility construction, replacement of conveyance pipes, construction of treatment plants and expansion of the distribution pipelines.

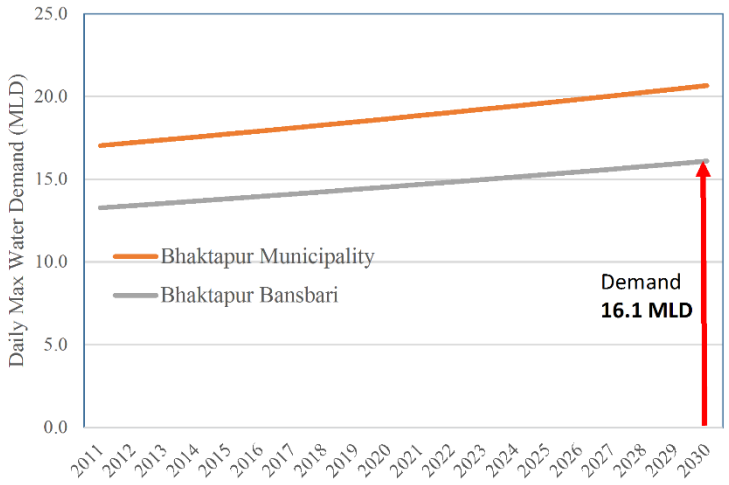


Figure 3.2.1 Predicted Water Demand in Bhaktapur Municipality and Bansbari Distribution District

3.3 Details of the Project

3.3.1 Overview of the Project

In this Project, water source development is important. The water source development and Bansbari Water Treatment Plant construction plan is summarized in Table 3.3.1.

Table 3.3.1 Water Source Development and Treatment Plant Construction

	Intake Volume [1]		Intake Facility	Conveyance Pipeline	Capacity of Treatment Plant	Water Demand[3] (Maximum daily volume)
	Rainy Season	Dry Season				
Present (2012)	Mahadev River 4MLD	Mahadev River 2MLD	Mahadev River intake weir	CI φ100 x 1 CI φ200 x 1	4MLD (Existing)	13.4MLD
Target year (2030)	Mahadev River: 4MLD Dam: 4MLD Total: 8MLD	Mahadev River: 2MLD Dam[2]: 3MLD Total: 5MLD	Mahadev River intake weir Dam (new)	Dam – Intake weir DCIP ND300 x 1 Intake weir – Treatment plant HDPE OD225 x 2	8MLD (New) (4MLD x 2 systems)	16.1MLD

1) Water from the Bode wells is distributed to the western area of Bhaktapur Municipality, not including the Bansbari distribution district.
2) The dam will be of a multi-purpose type, providing water supply source, irrigation and micro-hydropower generation (60kW).
3) Water demand in the Bansbari distribution district (eastern side)

An overview of the Bhaktapur Water Supply Improvement Project is shown in Figure 3.3.1.

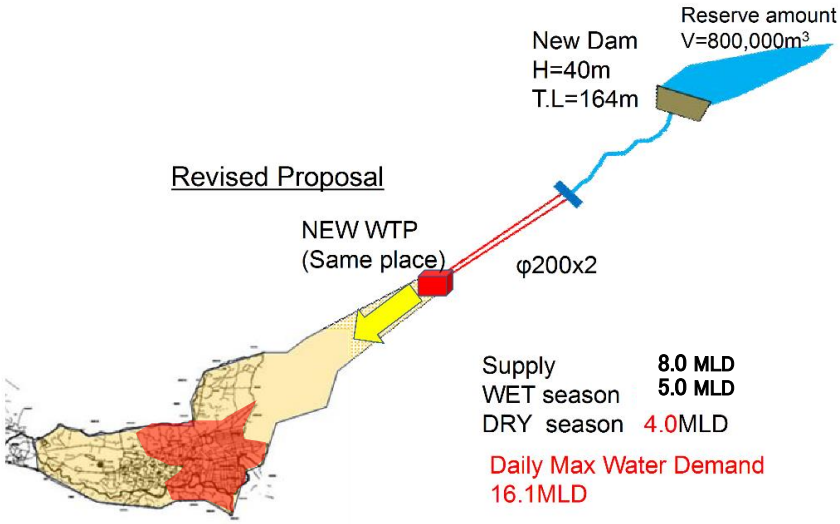


Figure 3.3.1 Bhaktapur Water Supply Improvement Project

3.3.2 Details, Scale and Quantities of the Project

The water supply facilities in the Bhaktapur Water Supply Improvement Project are shown in Table 3.3.2.

Table 3.3.2 Proposed Water Supply Facilities

No.	Facility	Scale, Quantity, Dimensions	Remarks
1	Dam	Width 164m x height 40m	Reservoir capacity: 800,000m^3
2	Intake Tower	Diameter 10m x height 27m	Constructed in dam (fixed)
3	Conveyance Pipelines	Dam – existing intake weir: Pipe diameter 300mm x 1,016m Existing intake weir – treatment plant: Outer diameter 225mm x 3,118m x 2 pcs	Pipe material: DCIP Pile material: HDPE
4	Water Treatment Plant (Phase 1)	Treatment capacity: 4,000m^3/day	Treatment flow is shown in Figure 3.3.4 and specifications in Table 3.3.3.
5	Water Treatment Plant (Phase 2)	Treatment capacity: 4,000m^3/day	

(1) Intake Tower

The intake tower is of a fixed type to be constructed at the dam reservoir. A feature of the fixed type intake tower is that the planned intake volume can be obtained stably in a reservoir that has large water-level fluctuations. The selective water intake is controlled by gate operation, ensuring the intake of relatively good raw water. Figure 3.3.2 and Figure 3.3.3 show the planned position and structure respectively of the intake tower.

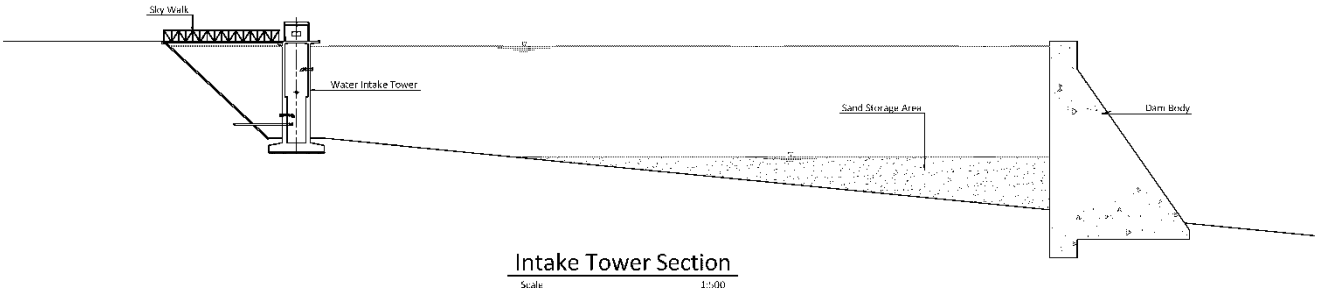


Figure 3.3.2 Planned Positions of Intake Tower and Dam

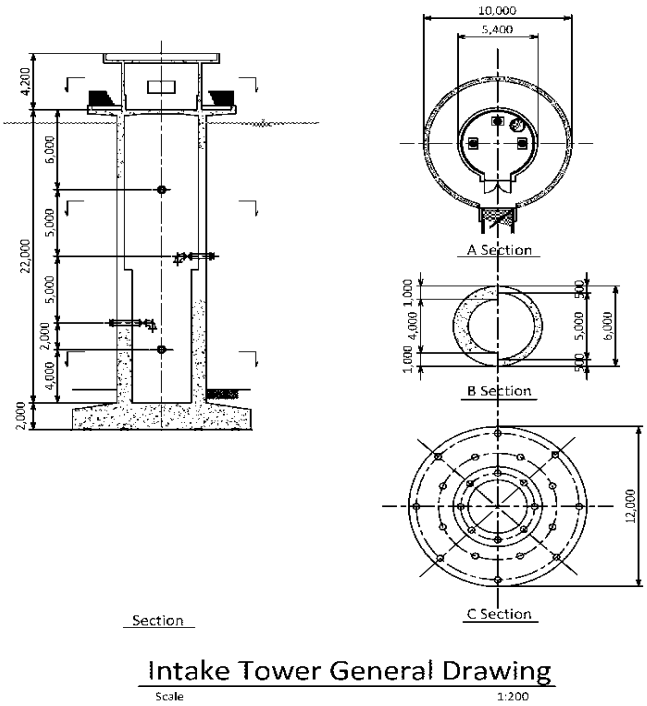


Figure 3.3.3 Planned Structure of Intake Tower

(2) Conveyance Pipelines

The pipeline from the intake tower (dam) to the existing intake weir is one single-thread pipeline 300mm in diameter (DCIP material) and 1,016m in length. From the existing intake weir to the treatment plant, two 2-thread pipelines 225mm in diameter (HDPE material) and 3,118m in length are to be used.

(3) Plan for Expansion of Bansbari Water Treatment Plant

1) Outline of Treatment Plant

- Treatment system: Rapid sand filtering
- Wastewater treatment system: Closed system (Cleaning drainage to be returned to the receiving well)
- Planned intake volume: 4,000m^3/day each in Phase 1 and Phase 2
- Treated loss: 10%

- Planned treated volume: 4,000m^3/day each in Phase 1 and Phase 2 (= 166.7 m^3/h = 2.78 m^3/min)

2) Overview of Treatment Flow

(a) Water treatment Flow

A maximum of 8,800m^3/day raw water will be taken in from the intake tower that is to be constructed in the dam, and conveyed to the receiving well in the Bansbari Water Treatment Plant. The flocculants are added and rapidly mixed in the rapid mixing basin. The flocs aggregated in the flocculation basin are settled in the horizontal-flow sedimentation basin. After that, the water undergoes rapid sand filtering.

Chlorine is prepared for dosing as an oxidant in the receiving well and in the settled water and it is added for post-chlorination to adjust the residual chlorine in the finished water.

(b) Wastewater Treatment Flow

In this Project, a closed system will be adopted to make effective use of the scarce water resource. After the rapid sand filtering the cleaning drainage is received in the drainage basin and 100% of the cleaning drainage is returned to the receiving well. The settled sludge is drained to the air-drying bed and the dried sludge is transported outside of the plant.

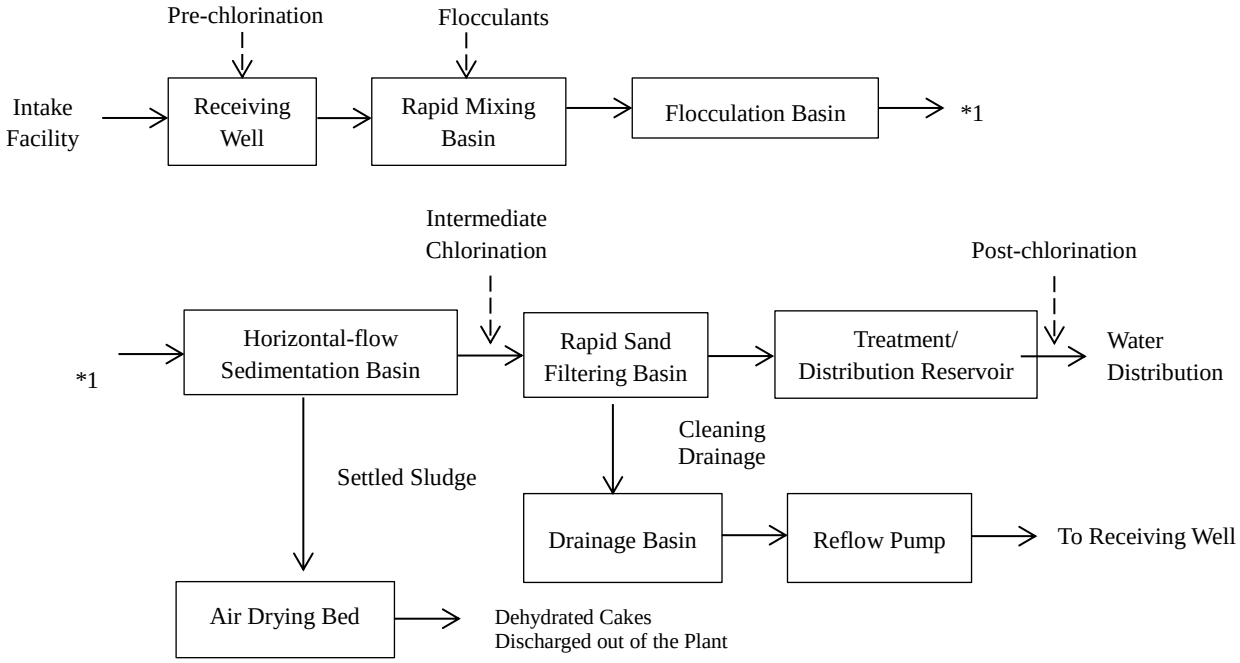


Figure 3.3.4 Treatment Flow at the New Bansbari Water Treatment Plant

3) Treatment Plant Expansion Plan

In the expansion plan for the Bansbari Water Treatment Plant, treatment capacity will be increased to 8,000m^3/day and the construction will be carried out in 2 phases. In Phase 1, the treatment capacity will be 4,000m^3/day. The expansion plan proposes the following conditions:

1. The existing treatment plant will be operated without stopping the water supply service for the construction of the expansion facilities.
2. For this purpose, adjacent land will be purchased for the expansion. As the surrounding land is farming land, there will be no need for the resettlement of residents. The cost of land acquisition will be borne by the Government of Nepal.
3. In Phase 1, a treatment plant with a treatment capacity of 4,000m^3/day will be constructed on the adjacent land.
4. In Phase 2, the existing treatment facilities will be pulled down and a new treatment plant with a treatment capacity of 4,000m^3/day will be constructed.

The layout of the water treatment plant to be constructed in Phase 1 and Phase 2 respectively is shown in Figure 3.3.5 and Figure 3.3 6 below.

Figure 3.3.5 Expansion of Bansbari Water Treatment Plant (Phase-1 Work)

Figure 3.3.6 Expansion of Bansbari Water Treatment Plant (Phase-2 Work)

4) Plant Specifications

The specifications of the Bansbari Water Treatment Plant with a supply capacity of 4,000m^3/day are shown in Table 3.3.3.

Table 3.3.3 Specifications of the New Bansbari Water Treatment Plant

Facility	Number of Basins	Dimensions	Real Capacity
Receiving well	2	1.2mW × 2.6mL × 3.0mD	9.36m^3/well
Rapid mixing basin	2	1.7mW × 1.7mL × 1.6mD	4.62m^3/basin
Flocculation basin	2	6.0mW × 6.4mL × 1.6mD	61.4m^3/basin
Horizontal-flow chemical sedimentation basin	2	5.5mW × 18.5mL × 3.0mD	Required channel cross section 7.65m^2
Rapid sand filtering basin	4 (1 reserve)	2.6mW × 3.8mL	Filtering speed 150m/day
Drainage basin and Reflow pump	1	5.0m ×5.0m × 3.0m	74.1m^3
Air drying bed	2	12.0mW × 6.0mL × 1.0mD	Required area 70.9m^2
Treatment/Distribution reservoir	2	15.2mW × 30.0mL × 4.88mD	2,225m^3/basin

3.3.3 Dispatch of Experts and Equipment to be Provided

After completion of the Project, the water supply facilities and in particular the water treatment plant will need to be properly operated and maintained. Thus it will be necessary to provide technical cooperation assistance to enable KUKL to operate and maintain the facilities and expand its management capacity. The items of technical assistance that are planned are operation and maintenance of the water treatment plant, expansion of water utility management capacity, activities to inform residents of water charges and the reduction of non-revenue water, and the dispatch of the relevant experts is proposed.

The existing water treatment plant is not provided with the water quality testing equipment needed for operation and maintenance of the plant and for water quality control. Therefore, it is also planned to provide the water quality testing equipment necessary for the proper operation of the treatment plant. The testing equipment will have the capacity to measure the minimum necessary indicators (pH, chromaticity, turbidity, residual chlorine, etc.).

3.3.4 Estimated Project Cost

The costs that have been estimated by the Nepalese side are the costs of dam construction and micro-hydropower generation only; the project cost of the water supply facilities including the treatment plant was not estimated. Therefore, the Study Team defined the scope of the Project and made an estimate of the project cost, as shown in Table 3.3.4. In this Project, the construction work for the water treatment plant will be executed in 2 phases. The estimated project costs for Phase 1 and Phase 2 are shown in Table 3.3.5 and Table 3.3.6 respectively. These costs do not include the cost of land acquisition.

Table 3.3.4 Project Cost Estimate for Bhaktapur Water Supply Facilities

	Description	Estimated Work Cost	
		(Thousand yen)	(USD)
Phase 1	Supply capacity: 4,000m^3/day Including dam, intake work, conveyance facilities, water treatment plant	4,299,000	35,899,000
Phase 2	Supply capacity: 4,000m^3/day Including water conveyance facilities and treatment plant	852,700	7,123,000
Total		5,151,700	43,022,000

1US$ = 119.78 yen (as of March 4, 2015)

Table 3.3.5 Project Cost Estimate for Phase-1 Bhaktapur Water Supply Facilities

Name of Facility	Specifications	Quantity	Estimated Work Cost	
			(Thousand yen)	(USD)
Dam	162mW × 40mH	1	3,402,000	28,403,000
Micro-hydropower generator	60kW	1 set	45,000	376,000
Intake tower	φ6.0m × 28mH	1	80,000	668,000
Conveyance pipeline 1	(Dam – Intake weir) DCIP ND300 × 1 pc	1,016m	46,000	385,000
Conveyance pipeline 2	(Intake weir – Treatment plant) HDPE OD225 × 2 pcs	3,118m	37,000	309,000
Receiving well	1.2mW × 2.6mH × 3.0mD	2 units	4,500	38,000
Chemical sedimentation basin	Rapid mixing basin: 1.7mW × 1.7mL × 1.6mD Flocculation basin: 6.0mW × 6.4mL ×1.6mD Sedimentation basin: 5.5mW × 18.5mL ×3.0mD	2 units 2 units 2 units	45,000	376,000
Rapid filtering basin	5.0m × 5.0m × 3.0m	4 units	54,000	451,000
Drainage basin	5.0m × 5.0m × 3.0m	1 unit	8,500	71,000
Air drying bed	12.0m × 6.0mL × 1.0mD	2 units	25,000	209,000
In-plant connection pipes		1 set	24,000	201,000
Machinery and equipment	Flush mixer, sedimentation desludging equipment, filtering equipment, chemical feed equipment, etc.	1 set	350,000	2,923,000
Electric/measuring equipment	Central monitoring, flow meter, water-level meter, etc.	1 set	130,000	1,086,000
Management building	Management room, electric room, chemical feed equipment room	1 bldg	35,000	293,000
Plant Incidentals	In-plant roads, rainwater drainage facilities, etc.	1 set	10,000	84,000
Water quality testing equipment		1 set	3,000	26,000
Total			4,299,000	35,899,000

Table 3.3.6 Project Cost Estimate for Phase-2 Bhaktapur Water Supply Facilities

Name of Facility	Specifications	Quantity	Estimated Work Cost	
			(Thousand yen)	(USD)
Conveyance pipeline 3	φ200	2,500m	37,000	309,000
Chemical sedimentation basin	Rapid mixing basin: 1.7mW × 1.7mL × 1.6mD Flocculation basin: 6.0mW × 6.4mL × 1.6mD Sedimentation basin: 5.5mW × 18.5mL × 3.0mD	2 units 2 units 2 units	45,000	376,000
Rapid filtering basin	5.0mW × 5.0mL × 3.0mD	4 units	54,000	451,000
Drainage basin	5.0mW × 5.0mL × 3.0mD	1 unit	8,500	71,000
Treatment/distribution reservoir	15.2mW × 30.0mL × 4.88mD	2 units	164,000	1,370,000
In-plant connection pipes		1 unit	25,000	209,000
Machinery and equipment	Flush mixer, sedimentation basin desludging equipment, filtering equipment, chemical feed equipment, etc.	1 set	350,000	2,923,000
Electric/measuring equipment	Central monitoring, flow meter, water-level meter, etc.	1 set	130,000	1,086,000
Plant Incidentals	In-plant roads, rainwater drainage facilities, etc.	1 set	8,000	67,000
Dismantling of existing structures	Existing water treatment plant	1,200m^2	31,200	261,000
Total			852,700	7,123,000

3.3.5 Other Items

The dam construction work is planned for Phase 1, but the construction work will require a detailed study and coordination with the relevant agencies, and it is expected that completion of the work will require many years. Therefore, the construction work could be completed during the Phase-2 period. A detailed study will also be required before the implementation of the Project, and it is anticipated that construction costs will increase due to price rises in the future.

The construction work of the water supply facilities will require the Nepalese side to take responsibility for the formulation of the master plan for dam construction, in order to deepen the understanding of the residents and to enable take quick action to be taken in response to any situations that may arise.

3.4 Site Conditions

3.4.1 Location (Land Acquisition, Land Use, Facilities as Sources of Pollution)

The planned construction site of the dam reservoir is located at a point upstream on the Mahadev River, which is a tributary of the Bagmati River. The planned site is in the Bageswari Reserve Forest area, where there will be no problem such as the resettlement of residents. It is planned to construct the new water treatment plant on the premises of the existing treatment plant or close by, but there is a need to undertake a detailed study and to review the land use conditions at the planned site. Also, surveys need to be conducted on sources of pollution in the future.

3.4.2 Natural Conditions

The Kathmandu Valley is located in a region affected by monsoons and has a subtropical climate with a clearly-defined rainy season. Approx. 80% of the annual precipitation falls during the rainy season (June to September). The amount of rainfall varies depending upon the altitude; the annual rainfall is 1,900mm on the flat land of the Valley (varying from about 1,000mm to 2,000mm), and between about 1,500mm to 3,300mm in the mountainous areas.

During the dry season (October to May), the driest month is November; there are three or fewer rainy days from November to January.

The planned construction area is located in the valley south of the access road to Nagarkot Hill Station. (Nagarkot is a famous tourist spot with a spectacular view of the Himalayas and the Kathmandu Valley.)

3.4.3 Access

Bhaktapur Municipality is the city where the Bhaktapur District Office is located. The city is located 12km east of Kathmandu Metropolitan City, at the eastern end of the Kathmandu Valley. The road connecting Kathmandu and Bhaktapur was constructed through a grant aid project of the Government of Japan which was completed in 2011 (widening of the road from 2 lanes to 4) and helped ease the chronic traffic congestion in the metropolitan area. The tourist road to Nagarkot (a 2-lane paved road) provides easy access from the city area of Bhaktapur Municipality to the planned dam construction site.

3.4.4 Electricity and Means of Communications

[Electricity]

Nepal is undergoing rapid urbanization and the supply of electricity cannot keep up with demand, resulting in a chronic electricity shortage. As Nepal relies mainly on hydropower generation for its electricity, there tend to be fewer hours of power failure during the rainy season, but the problem of power shortage is a major obstacle in the planning of construction projects and in the progress of construction works. For these reasons it is desirable that the power supply situation will be improved in Nepal in the future.

[Means of Communications]

In Nepal, the portable phone market is growing. As of June 15, 2013 the total number of subscribers was 18,933,229 and the penetration rate had reached 71.46%, or 21.26% higher than what it was at the end of 2011 (50.2%). The fixed-line telephone market, however, is small. According to a report by the Nepal Telecommunications Authority (NTA), as of June 2013 the total number of fixed-line telephone subscribers was 850,610 and the penetration rate was only 3.21%. (Source: ITU-World Telecommunication/ICT Indicators Database, June 2013)

3.4.5 Safety

The security situation in Nepal is shown in Figure 3.4.1 (based on the Ministry of Foreign Affairs Overseas Safety Website).

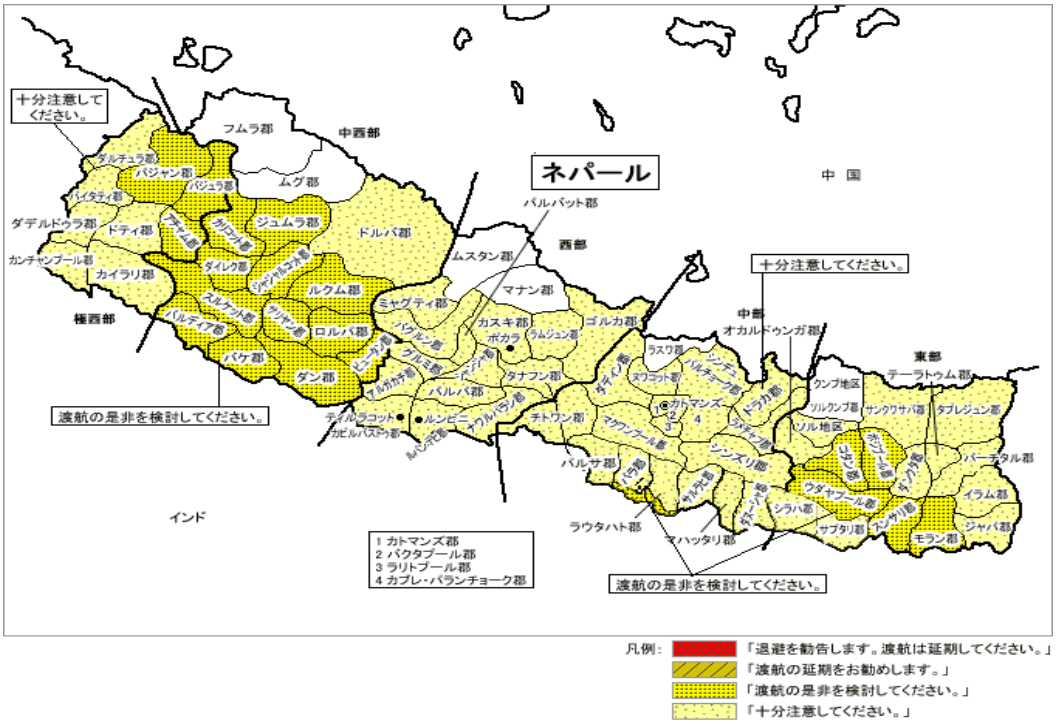


Figure 3.4.1 Safety Information for Nepal, by District

3.4.6 Other Items

[Sewerage Development Situation]

The development of the sewerage system in the Kathmandu Valley is an issue as urgent as the development of the water supply. The “Kathmandu Valley Waste Water Management Project” (ADB Loan No. 3000) (from the start of the 1st stage in 2014 to the end of the 2nd stage in 2018) is progressing as a development project funded by an ADB loan.

Chapter 4. Guidance Project, and Effects and Impacts of the Project

4.1 Effects of the Project

4.1.1 Degree of Resolution of Problems in the Water Service Field

The degree of resolution of problems in the water service field to be expected from the implementation of the Project on the scale planned in 3.3.1 is shown in Table 4.1.1.

Table 4.1.1 Degree of Resolution of Problems from Project Implementation (Bhaktapur Municipality)

No.	Indicator	Unit	Before Implementation (2013)	After Completion (2030)	Remarks
1	Resident population	Persons	83,600	101,300	Bhaktapur Municipality
2	Mobile population	Persons	10,000	10,000	Interview at Bhaktapur Municipality Office
3	Population served by water supply	Persons	93,600	111,300	Water service access rate 100%
4	Penetration rate	%	-	100%	No data available for 2013
5	Total number of households with water supply	Households	9,846	11,699	45 taps for public agencies 9,801 taps for private households (2013)
6	Number of households with water supply (with water meters)	Households	9,356	11,128	34 taps for public agencies 9,322 taps for private households (2013)
7	Public water taps	Points	203	0	
8	Water distribution capacity per day	m^3/day	4,000	8,000	Capacity of Bansbari Water Treatment Plant
9	Daily average water distribution volume	m^3/day	2,897	7,273	According to the water distribution data 2013 – 14
10	Daily maximum water service volume	m^3/day	5,760	8,000	Data for November 27, 2013
11	Daily average water supply volume	m^3/day	-	5,818	No data; assuming a leakage rate of 20%
12	Daily maximum water supply volume	m^3/day	-	6,400	No data; assuming a leakage rate of 20%
13	Non-revenue water rate	%	49	20	From Table 5.3.1
14	Number of staff members	persons	56 (1,119)	-	( ) denotes the total number of KUKL staff members

4.1.2 Degree of Resolution of Problems with the Drinking Water Supply

As described in 2.1.5 “Problems with Drinking Water Supply”, the water supply shortfall (= Daily maximum water demand – Distribution volume (in the dry season)) in the Bansbari distribution area is approx. 12,000m^3/day. It is predicted that in 2030, water demand will reach 16,100m^3/day (daily maximum demand). The construction of the dam, conveyance pipelines and treatment plant will provide a daily maximum water distribution volume of 8,000m^3/day, a substantial improvement. However, it is predicted that there will continue to be a water supply shortfall of approx. 8,100m^3/day. To solve this problem, it is desirable that water be obtained from the Bode Distribution Reservoir, that is, that water from the Melamchi

Water Supply Project be secured.

4.1.3 Degree of Resolution of Problems relating to Sanitation-related and Water-borne Infectious Diseases

The water quality of the treated water from the Bansbari Water Treatment Plant satisfies all 27 indicators of the drinking water quality standards of Nepal, as shown in Table 2.1.5. In the simple quality test (Pack Test®), it was confirmed that the free residual chlorine concentration was 2mg/L (drinking water quality standard: 0.1 to 0.2mg/L) in water from the water taps in the Bansbari distribution area. As this survey was carried out in the dry season, there is a need for a water quality survey to be carried out in the rainy season, when there is an increase in water-borne infectious diseases.

The amelioration of the water supply shortfall through the expansion and renewal of the water supply facilities will allow households using well water for drinking to have the opportunity to access drinking water that satisfies with the water quality standards. It may be expected that the reduction in the use of suction-pumped water will reduce water pollution in the distribution pipelines. For this reason, this Project as proposed will help improve the situation with regard to water-borne infectious diseases.

4.1.4 Other Items

In order to close the water shortage gap, it is certainly necessary to secure the water sources and to improve water treatment capacity; but unless the amount of non-revenue water is reduced, it will be impossible for the effects of this Project to be fully realized. Measures should be taken to reduce the amount of leakage through the replacement of the old pipes in the Bansbari distribution area.

4.2 Impacts from the Implementation of the Project

4.2.1 Political Impact

Bhaktapur Municipality, the target project area, is part of the Kathmandu Metropolitan Area which includes Kathmandu Municipality and others. A Project in an area with metropolitan functions has significant political impact. In Nepal, the concentration of population in the Kathmandu Valley will grow markedly, and the status of Bhaktapur Municipality will become more and more important.

In the field of water supply and sewerage, well-balanced development with no gaps between areas of the Valley is desired. If this Project is implemented, it will have a significant political impact on these areas.

4.2.2 Social Impact

From the viewpoint of national policies, the development of the water supply and sewerage field is an issue of the utmost importance in the basic infrastructure sector as well as in the field of transport. Water in particular is a theme directly associated with health and sanitation and has a very important social impact.

4.2.3 Economic Impact

The Kathmandu Valley is the center of the economy of Nepal and attracts goods transported by land as well as air cargo. Goods to support Nepal flow daily into this area from India, China and elsewhere.

In addition to the resident population, the area has a large mobile (non-resident) population made up of people staying or visiting on business or for tourism. The development of water supply facilities in Kathmandu will attract both "persons" and "goods" and will have a significant economic impact.

4.2.4 Technical Impact

The water service projects in Nepal involve facilities which have a long history of development and are still in operation despite being past their functional life. Therefore, if new technology is introduced, it will be necessary to upkeep the operating technology of the current systems while the maintenance personnel will have to deal precisely with both the new and old systems. It is important, therefore, that in addition to the construction of facilities, education and technology transfer in the Soft Component field be implemented.

This Project can cover the elements sufficiently to provide technical impact.

4.2.5 Diplomatic and Publicity Impact

Japan and Nepal have traditionally maintained a friendly relationship and implemented official development assistance (ODA) programs in a variety of fields. The implementation of the proposed Project as an assistance project relating to water will have a significant diplomatic and publicity impact.

4.2.6 Other Items

This proposed Project is a water supply project for the Kathmandu Valley, and is an important project closely related to the Melamchi Water Supply Project currently in progress. It may be an option for the scope of work to be split up (for example into two works, "water source development and intake" and "water treatment and water conveyance/distribution") in cooperation with a donor from another country.

Chapter 5. Matters relating to Relevance of Project Requiring Guidance

5.1 Results of Comparative Analysis against Main Alternative Projects

There is no alternative project to this Project as proposed.

5.2 Organizational Relevance and Sustainability of the Project

The capacity of KUKL as a management, construction, operation and maintenance organization is shown in Table 5.2.1 to Table 5.2.4; the evaluation criteria are given as "High: 3, Medium: 2 and Low: 1".

5.2.1 Organizational Management Capacity

Table 5.2.1 Organizational Management Capacity (KUKL)

Issue	Criteria (High⇔Low)			Description
	3	2	1	
Organizational strength				
• Dependence on higher agencies and superiors		○		
• Demoralization	○			
Attitude of top officials				
• Accurate grasp of the problems	○			Recognition of the dilapidated state of the facilities and the shortage of revenue, budget and personnel.
• Vision for the future		○		Dependence on JICA and other donors (WB and ADB) to implement the water service project.
• Will to undertake self-help efforts		○		
Authority to operate independently				Multiple stakeholders and related agencies are involved in the water service business.
• Authority to form an organization		○		
• Authority to employ and appoint staff members.			○	Shortage of staff, especially young staff members
• Authority to conclude contracts		○		
• Authority to decide income and expenditure through independent accounting			○	Deficits are covered through governmental subsidies.
Establishment of an organization to manage water service users				
• User information management		○		Manual information management needs to be computerized
• Billing and collection management		○		Managed manually since the water charge billing system broke down in 2009.
Organization in place to manage accounting information and draw up the budget, accounts and long-term plan				
• Budget, accounts and long-term plan		○		Income is less than expenditure and the accounts have been in deficit since 2012.
• Materials management		○		KVWSMB is the owner of the water supply and sewerage facilities in the Kathmandu Valley and has commissioned their operation and maintenance to KUKL, but it remains responsible for policy formulation and supervision.
• Assets (land, facilities and buildings)		○		
Organization in place to manage personnel	○			Perception of the number of staff members and the organization of personnel.

5.2.2 Organizational Construction Capacity

Table 5.2.2 Organizational Construction Capacity (KUKL)

Issue	Criteria (High⇔Low)			Description
	3	2	1	
A department in place to control construction work		○		There is a Project Control Department, but it does not supervise construction work.
Does the department have an influential voice and authority?	○			
Reliance on donor countries for construction work		○		Projects tend to be implemented on the initiative of the donor countries.
A positive willingness to participate in planning, design and construction work	○			
Accumulation of experience in similar projects implemented so far		○		There is no systematic accumulation of knowledge, expertise and technologies.

5.2.3 Organizational Operation and Maintenance Capacity

Table 5.2.3 Organizational Operation & Maintenance Capacity (KUKL)

Issue	Criteria (High⇔Low)			Description
	3	2	1	
A department in place to control maintenance management	○			KUKL is the operation and maintenance company for water service facilities, and the department is established and functioning.
Does the department have an influential voice and authority?	○			
A center for the storage and supply of equipment and materials	○			
Equipment and materials stored and supplied coherently		○		
A center for the control of repair works and repair shops		○		There are 10 branches, which do not undertake repairs.
Accumulation of experience in similar projects implemented so far		○		There is no systematic accumulation of knowledge, expertise and technologies.

5.2.4 Relations with Local Residents

It is essential that the residents along the conveyance pipelines in the basin downstream of the dam construction site and upstream of the Bansbari Water Treatment Plant understand this Project. As these areas are outside the distribution district of the Bansbari Water Treatment Plant and are not provided with water supply facilities, the residents draw the raw water from the conveyance pipelines and use spring water for domestic use. To help these residents, measures such as the construction of a dam to improve the water environment in the dry season and the expansion of the distribution district to these areas are under consideration.

5.2.5 Other Items

If the scale of the treatment plant is expanded, it is necessary to confirm with the Nepalese side the importance of securing the required number of operators for the treatment plant and educating them.

5.3 Financial Relevance and Sustainability in Project Implementation

5.3.1 Financial Source for the Cost to be borne by the Nepalese Side

For the dam construction, it is considered that the part of the cost to be borne by the Nepalese side may be raised through loans from the Government of Japan and other donors, but it is assumed that the procurement of construction land will be paid for out of the government budget of Nepal.

5.3.2 Present Status of Water Service Project Indicators

The indicators in 2013 based on the data collected from KUKL are shown in Table 5.3.1.

Table 5.3.1 Water Service Project Indicators

No.	Water Service Project Indicators (2013)	Calculation Method	Unit	Indictor Value
1	Effective water rate:	Yearly total effective water volume/Yearly total water supply volume	%	51.0
2	Supply cost:	Yearly total water charge/Yearly total revenue water volume	USD/m^3	0.31
3	Water supply cost:	Yearly total water supply cost/Yearly total revenue water volume	USD/m^3	0.42
4	Water supply population per staff member:	Water supply population/Number of staff members	persons	1,935
5	Effective water volume per staff member:	Yearly total effective water volume/Number of staff members	m^3/year	19,921

Note: Presumed values in the table above
Yearly total revenue water volume: 22,676,742m^3 (Loss: 40%, uncollected charge: 15%)
Yearly total water supply volume: 44,464,200m^3
Yearly total water charge: NRs. 672,659,000 (75% of the cost)
Yearly total water supply cost: NRs. 896,879,000 (2013)
Water supply population: 2,160,000 persons (2013)
Number of staff members: 1,116 persons (2013)
Currency exchange rate: Taken as 94.38 NRs/USD.

5.3.3 Change in Financial Balance

KUKL has been in financial deficit since its establishment in 2008 as shown in 2.1.4 5) and the facility rental fee to be paid to KVWSMB has been deferred. The main reason for the deficit lies in the difference between billing and the collection of water charges.

5.3.4 Prospect for Financial Balance

KUKL is working on the following programs to establish a sound financial balance:

- Examination of the condition of all water taps and meters;
- Computerization of the billing system;

- Review of the water charging system;
- Reduction of leakage through the replacement of old pipes

KUKL has requested loans from ADB and WB to cover the cost of the above programs.

KUKL has made an application for a review of the water charging system, but has not yet acquired permission from WSTFC. The proposed Project is intended to increase the water supply volume and is expected to improve the financial balance.

5.3.5 Other Items

The micro-hydropower generation project will help ameliorate the power shortage which is as important an issue in Nepal as the water supply facility development.

5.4 Technical Relevance and Sustainability in Project Implementation

5.4.1 Compatibility with the Technical Level of Nepal

The water supply facilities planned in this Project include a water storage reservoir (dam), a water treatment plant, a water distribution reservoir and pipelines. Nepal has past experience in project implementation and the items to be managed in this Project are not largely different. This Project is fully feasible given the technical level of Nepal and there is no special problem.

5.4.2 Personnel Recruitment and Assignment

If this Project is implemented and the facilities are completed, it will be essential to improve the capacity of staff and increase the number of personnel employed in system operation and maintenance. KUKL is in charge of operation and maintenance activities in facilities in the Kathmandu Valley at present, and it is expected that in the future the staff in charge of these activities will be able to carry out the work.

5.4.3 Operation and Maintenance of Facilities/Equipment

Conventional procedures will continue to be used in the maintenance of facilities and equipment. Should a new method of system management be required, technology transfer to KUKL is planned as the Soft Component.

5.4.4 Other Items

While assistance with respect to tangible aspect is to be provided, it is desirable that the technical cooperation project be implemented as the Soft Component *i.e.* assistance with respect to intangible aspect, to enable the sustainable management, operation and maintenance of the water supply facilities. In particular, it will be necessary to operate and maintain the treatment plant, enhance the water supply utility management, take measures against leakage and educate the residents.

5.5 Environmental Considerations

5.5.1 Expected Environmental Impacts

The planned dam construction site is located in an environment protection area and requires an environmental impact study and environmental impact assessment as stipulated by the applicable laws and relevant government agencies. The items of natural environment that need to be considered during the construction works and operation of the facilities include the ecological system of fauna and flora, pollution and contamination of the air, water, soil and river bed, noise, vibration and waste. The social and environmental impacts including resettlement of residents and compensation for acquisition of farmland are not an issue, but it will be necessary to take into consideration the function of irrigation water channels in the design of the dam because there is an intake gate downstream of the dam.

5.5.2 Environmental Impact Assessment

Following is a summary of the survey items used to determine the environmental and social impact levels for the Project.

Item 1: Details of the Project

1.1 Does the project come under following sectors?

■ Yes □ No

If yes, please mark corresponding items.

□ Mining development □ Industrial development
□ Power generation (incl. geothermal power)
■ Hydropower generation, dams, reservoirs □ River and erosion control
□ Power transmission lines, transformer lines, power supply lines
□ Roads, railways and bridges □ Airports □ Ports and harbors
■ Water supply, sewage and wastewater treatment
□ Waste treatment and disposal
□ Agriculture (involving large-scale land-cleaning or irrigation)
□ Forestry □ Fishery □ Tourism

1.2 Are any of the following elements planned or foreseen in the Project?

■ Yes □ No

If yes, please mark corresponding items.

□ Large-scale involuntary resettlement of residents: (Scale: households persons)

□ Large-scale groundwater pumping (Scale: m^3/year)

■ Large-scale land reclamation, land development and land-cleaning (Scale: ha)

■ Large-scale logging (Scale: ha)

1.3 Project Overview

As described in Chapter 3 of this Report.

1.4 How was the necessity of the Project confirmed?

The necessity of the Project was confirmed through a field survey and interviews with the relevant agencies. Details are given in 2.1.4 "Present Status of Water Service Projects in Bhaktapur Municipality".

1.5 Did the proponent consider alternatives before request?

□ Yes

■ No

1.6 Did the proponent have meetings with the related stakeholders before request?

■ Yes (at the time of F/S) □ No

If yes, please mark the corresponding stakeholders.

□ Administrative body ■ Local residents □ NGO □ Others

Item 2: Is the project a new one or an on-going one? In the case of an on-going one, have you received strong complaints etc. from local residents?

□ New ■ On-going (there are complaints) □ On-going (there are no complaints)

Item 3: Names of laws or guidelines for environmental impact assessment

Is Environmental Impact Assessment (EIA) including Initial Environmental Examination (IEE) required for the project according to a law or guidelines in Nepal?

□ Required only IEE

■ Required both IEE and EIA

□ Required only EIA (The preliminary diagnostic report was prepared at the time of F/S.)

□ Others

Item 4: If the environmental impact assessment has been made, was the Project examined and approved in accordance with the legal system of Nepal?

□ Approved (without a supplementary condition)
□ Approved (with a supplementary condition)
□ Under appraisal ■ Not yet started an appraisal process
□ Other (The sewerage project has been approved.)

Item 5: Are following areas located inside or around the project site?

■ Yes □ No

If yes, please mark corresponding items.

■ National parks, protected areas designated by the government and areas being considered for national parks or protected areas
■ Virgin forests, tropical forests
□ Ecological important habitat areas (coral reef, mangrove wetland, tidal flats)
□ Habitat of valuable species protected by domestic laws or international treaties
□ Likely salts cumulus or soil erosion areas on a massive scale
□ Remarkable desertification trend areas
□ Archaeological, historical or cultural valuable areas
□ Living areas of ethnic minorities, indigenous people or nomads with a traditional lifestyle, or areas of special social value

Item 6: Will the project have any impact on the environment or society?

■ Yes □ No □ Not identified

Item 7: Please mark related environmental and social impacts, and describe their outlines.

□ Air pollution □ Involuntary resettlement of residents
□ Water pollution □ Local economy such as employment and livelihood etc.
□ Soil pollution ■ Land use and utilization of local resources
□ Waste
□ Social capital or social institutions such as decision-making organizations
□ Noise and vibration □ Ground subsidence
□ Existing social infrastructures and services □ Offensive odors

□ The poor, indigenous people and/or ethnic minorities ■ Geographical features
□ Maldistribution of benefit and damage □ Bottom sediment
□ Local conflict of interests □ Biota and ecosystem
□ Gender ■ Water usage
□ Children's rights □ Accidents
□ Cultural heritage □ Global warming
□ Infectious diseases such as HIV/AIDS, etc. □ Others

[Outline of related environmental and social impacts]

Item 8: Information disclosure and meetings with stakeholders

If the environmental and social considerations are required, does the proponent agree on information disclosure and meetings with stakeholders in accordance with JICA Guidelines for Environmental and Social Considerations?

■ Yes □ No

5.5.3 Other Items

The guidelines for environmental and social considerations by the Government of Nepal state that an environmental impact assessment (EIA) shall be made should any of the items in Table 5.5.1 be applicable. No. 2, No. 3, No. 5, No. 8 and No.11 are applicable to this Project, thus making an EIA necessary.

Table 5.5.1 Standards for Environmental Impact Assessment in Nepal

No.	Applicable Item	Applicability
1	Collection of rain-water in an area of more than two thousand hectares and use of water sources (springs/wetlands) located within the same area. (For a rain-water collection area of 2,000ha or more, with a water source from a spring/marsh)	No
2	Surface water sources with more than 1 cft. safe yield, and the use of it in its entire part during the dry season. (Surface flow water with a safety volume of 28.32L or more, all or part of which is used in the dry season.)	Yes
3	Water processing at the rate of more than twenty five liters per second. (Treated water volume of 25L/sec (= 2,160m^3/day) or more)	Yes
4	Reaching of more than fifty per cent of the total aquifer for the development of underground water sources. (Pumped water of 50% or more from the aquifer in groundwater source development)	No
5	Construction of more than 1km-long water tunnel. (Construction of water tunnel of more than 1km long)	No
6	Displacement of more than one hundred persons for the operation of a water supply scheme. (The water supply project requires the resettlement of more than 100 persons.)	No
7	Settlement of more than fifty persons on the upper reaches of the water sources. (There is a village with a population of more than 50 persons on the upper reaches of the water sources.)	No
8	Supply of drinking water to a population of more than twenty thousand. (Water supply population of more than 2,000.)	Yes
9	Supply of drinking water to a population of more than one hundred thousand upon connecting of new sources. (More than 100 thousand persons are supplied with water from new sources.)	No
10	Over-mining of biologically or chemically polluted point and nonpoint sources or underground water sources that may be affected by them. (There is mining of a point source/non-point source of biological or chemical pollution, or a groundwater source affected by those sources.)	No
11	Operation of a multi-purpose project relating to sources of drinking water which consumes the sources at the rate of more 25 liters per second. (Multi-purpose project related to a drinking water source with a flow of 25L/sec or more.)	Yes

Source: Environmental Protection Rules, 2054 (1997), Nepal

Chapter 6. Conclusion

6.1 Particulars

None

6.2 Precautions for Implementation of Cooperation Project

In the water supply field, at present, ADB is implementing assistance projects for the construction of water supply facilities in the Kathmandu Valley, sector reform, the improvement of water supply and sewerage facilities in regional city areas and improvement of the urban environment. WB is implementing a rural water supply and sanitation improvement project.

This Project as proposed will be a large-scale project to implement both the construction of a dam and the improvement of water supply facilities. A project of this scale cannot be covered solely by the grant aid of the Government of Japan, but loan-based financial cooperation is kept in mind. Therefore, it is necessary to pay attention to the actions of the above donors, in particular, to the progress of the Melamchi Water Supply Project and the related water supply improvement works, and to promote the formation of the project from a long-term, comprehensive viewpoint.

6.3 Conclusion

Country Assistance Policy for Nepal by the Ministry of Foreign Affairs of Japan (April 2012) defines "social and economic infrastructure development" as a development issue in one of the priority assistance areas: "Building social infrastructure and institutions for balanced and sustainable economic growth", and indicates the policy for dealing with the improvement of the urban environment, including the water supply. This Project is in line with that policy.

This Project will construct a dam in the vicinity of Bhaktapur Municipality in the Kathmandu Valley in order to acquire a greater water volume, and will construct water supply facilities to improve the water service through an increase in the water supply and improved water quality, thereby contributing to the improvement of the living environment for the citizens of the Municipality.

This Project proposes the construction of the following facilities:

(1) Dam (164mW x 40mH, with water storage of 800,000m^3)
(2) Intake tower (10m diameter x 27mH, constructed in the dam (fixed type))
(3) Water conveyance pipelines (Dam – existing intake weir: pipe diameter 300mm x 1,016m long, pipe material: DCIP; existing intake weir – treatment plant: outer diameter 225mm x 3,118m long x 2 lines, pipe material: HDPE)
(4) Water treatment plant (Phase 1: treatment capacity of 4,000m^3/day; Phase 2: treatment capacity of 4,000m^3/day)

6.4 Comments

There is a definite necessity for the urgent implementation of this Project; the Project will not only affect the target city, but will also be beneficial to the development of the surrounding areas (in the Kathmandu Valley). Thus, it is deemed that the relevance of the Project is high.

An important issue is where the water source to improve the serious water shortage in the Kathmandu Valley is to be sought. The Melamchi Water Supply Project that is seeking a water source outside the Kathmandu Valley is now in progress, but it has also been recommended that a potential water source be created in the Valley through the construction of a dam. (Study report by Japan Water Agency (2012) et al.)

This Study is based on the latter recommendation and the effectiveness of a water source in the Valley.

For the water supply facility construction part of the Project, it is considered that the facility construction should be implemented under grant aid by the Government of Japan and that the Soft Component and technical cooperation should be provided. It is to be hoped that a basic study will be undertaken in the future in order to enhance the reliability of the Project. It is considered however that the construction of a dam the main purpose of which is to secure a stable water source in the dry season will be implemented through loan-based aid (ODA loan) by the Government of Japan or with the assistance of ADB or WB, which are involved in water service improvement projects in Nepal.

The completion of the Melamchi Water Supply Project is expected to substantially improve the water shortage situation in the Kathmandu Valley. However, the increase in water supply from the Melamchi Water Supply Project will not be enough to meet the total water demand in the Kathmandu Valley. As indicated by the results of this Study, it is feared that it will not be possible to meet future water demand even with the addition to the existing water supply of the water supply from the Melamchi Project.

In considering a stable water supply for the Kathmandu Valley, it is necessary to complementing the Melamchi Water Supply Project through the rehabilitation of existing facilities and the development of a water source in the Valley. This Study is intended to examine a project to make effective use of the source water volume through the rehabilitation of existing facilities and the construction of a dam to increase the water supply volume in the dry season. The Project under examination is deemed to be a significant project to complement the Melamchi Water Supply Project.

After completion of the Melamchi Water Supply Project, KUKL will be a business entity providing a 24-hour water supply service to a water supply population of more than 3 million. Along with the increase in the water supply, KUKL will face the challenge of providing increased and more complex services. To make the effects of the project sustainable, KUKL must be helped to succeed in their efforts. The technical cooperation project, the necessity of which is pointed out in this Study, is expected to support the efforts of KUKL.

Appendices

Appendices

Appendices

資料-1 現地指導作業日程

日数	月／日	用　　務	宿 泊 地
1	1/11(日)	成田発 → バンコク着	バンコク泊
2	1/12(月)	バンコク発 → カトマンズ着 15:00 大使館 表敬訪問、 16:00 JICA ネパール事務所 表敬訪問	カトマンズ泊
3	1/13(火)	09:30 カトマンズ盆地水道供給管理委員会(KVWSMB) および カトマンズ盆地水道会社(KUKL) 本部 打ち合わせ 11:00 都市開発省 訪問 12:30 カトマンズ盆地水道会社(KUKL)本部 打ち合わせ	カトマンズ泊
4	1/14(水)	09:30 バクタプール バンスバリ浄水場 現地調査(概要)・・・・・・・・・・・⑥ 10:00 マハデブ川 ダム新設予定地 現地調査・・・・・・・・・・・・・・・・・・・① 12:30 マハデブ川 既設取水堰 現地調査 ・・・・・・・・・・・・・・・・・・・・② 16:20 バクタプール市役所 訪問	カトマンズ泊
5	1/15(木)	10:00 バクタプール バンスバリ浄水場 現地調査(詳細) 11:30 マハデブ川 既設取水堰からバンスバリ浄水場まで 既設配管 ルート現地調査・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・③④⑤ 15:00 ボーデ配水池 現地調査・・・・・・・・・・・・・・・・・・・・・・・・・・・⑧ マノハラ浄水場 視察・・・・・・・・・・・・・・・・・・・・・・・・・・・・・・⑨	カトマンズ泊
6	1/16(金)	10:00 バクタプール市内 既設配水池(カトゥンジェ配水池)現地調査・・⑦ 11:00 マハデブ川 既設取水堰 現地調査(簡易流量測定)および バンスバリ浄水場 現地調査(簡易流量測定) 14:00 バクタプール市内 民家水栓、公共水栓 水質調査 同市内 小規模浄水場(ジャガティ浄水場) 現地調査	カトマンズ泊
7	1/17(土)	10:30 スンダリジャル浄水場、発電施設 視察・・・・・・・・・・・・・・・・・・・・⑪ 11:30 メラムチ浄水場建設 現場視察 および導水路トンネル坑口部 遠望・・・・・・・・・・・・・・・・・・・・・・⑩ 15:30 マハデブ川 既設取水堰近傍にて新規浄水場建設地点検討 既設配管ルート上にて新規配水池建設地点検討	カトマンズ泊
8	1/18(日)	10:00 資料整理、中間報告書作成 13:30 カトマンズ盆地水道会社(KUKL) 本部 打ち合わせ	カトマンズ泊
9	1/19(月)	9:00 JICA ネパール事務所にて 大使館および JICA へ調査報告 カトマンズ発 → バンコク着、 バンコク発 →	機中泊
10	1/20(火)	→ 成田着	

※ 上表内の番号①～⑪は、要約に添付した「調査位置図」の①～⑪に対応する。

資料-2 面会者リスト

所属	名前	役職	
		和名	英語名
在ネパール日本国大使館	小川　正史	特命全権大使	Ambassador Extraordinary and Plenipotentiary
	星野　久史	一等書記官	First Secretary
	横井　英治	二等書記官	Second Secretary
JICA ネパール事務所	藤井　智	次長	Senior Representative
	有馬　朋宏	所員	Representative
	緒方　隆二	水道政策専門家	Water Policy Advisor
都市開発省	Mr. Ram Chandra Devkota	担当次官	Joint Secretary, Water and Environment Division, Ministry of Urban Development
カトマンズ盆地水道供給管理委員会	Mr. Sanjeev Bickram Rana	常任理事	Executive Director, Kathmandu Valley Water Supply Management Board (KVWSMB)
カトマンズ盆地水道会社	Mr.Chandra Lal Nakarmi	部長	General Manager Kathmandu Upatyaka Khanepani Ltd. (KUKL)
〃	Mr. Tilak Mohan Bhandari	技術マネージャー	Manager Kathmandu Upatyaka Khanepani Ltd. (KUKL)
〃	Mr.Gyanendra Bdr. Karki	チーフ	Chief, Water Quality Section Kathmandu Upatyaka Khanepani Ltd. (KUKL)
バクタプール市役所	Mr. Ram Mani Bhattarai	市長	Executive Officer Bhaktapur Municipality

資料-3 収集資料一覧

(1) カトマンズ盆地水道公社 『6周年 記念レポート 2013年』
SIXTH ANNIVERSARY REPORT 2013年
KATHMANDU UPATYAKA KHANEPANI LIMITED (KUKL)

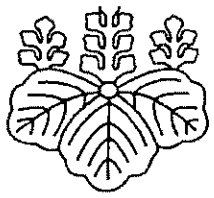
(2) カトマンズ盆地水道公社 『カトマンズ盆地内の水供給の現況』
CURRENT STATUS OF WATER SUPPLY IN KATHMANDU VALLEY
(Presented by Mr.Tilak Mohan Bhadari, KUKL)

(3) カトマンズ盆地水道公社 『マハデブ川 表流水水源開発計画』
MAHADEV KHOLA RAIN WATER HARVESTING PROJECT
(Presented by Mr.Tilak Mohan Bhadari, KUKL)

(4) 水資源機構 『カトマンズ盆地 表流水による安定した水供給計画に対する投資』
SUPPORTING INVESTMENTS IN WATER SECURITY IN RIVER BASINS
(Financed by the Japan Special Fund)
SUPPLEMENTARY STUDY 1, SURFACE WATER DEVELOPMENT IN THE KATHMANDU VALLEY, JUNE2012, by JAPAN WATER AGENCY (JWA)

資料-4 調査団派遣通知レター

Ministry of Health, Labour and Welfare
Japanese Government
1-2-2, Kasumigaseki,
Chiyoda-ku, Tokyo 100-8916
Tel + 81-3-5253-1111



日本国厚生労働省
〒100-8916
東京都千代田区
霞が関1-2-2
電話 03-5253-1111

January 6, 2015

Mr. Ram Chandra Devkota
Joint Secretary
Water and Environment Division
Ministry of Urban Development
Singha Durbar, Kathmandu
Federal Democratic Republic of Nepal

Subject: Request for acceptance of a survey team of the "Water Supply Project Formation Program" by the Ministry of Health, Labour and Welfare of Japan

Dear Mr. Ram Chandra Devkota:

I am writing to you to seek a possibility of your arrangements for an on-site survey.

The Ministry of Health, Labour and Welfare of Japan (MHLW) has a program the "Water Supply Project Formation Program" to encourage international cooperation in the field of water supply. This program aims to support formulation of a water supply improvement plan through discussions and on-site surveys together with water supply authorities in a country which has challenges to be addressed on their water supply.
This year, the MHLW commissioned the program to a joint venture (JV) consisting of the Hazama Ando Corporation and the NJS Consultants Co., Ltd.
The JV proposed an idea for water supply improvement in Bhaktapur, and they are going to dispatch the survey team from January 12 to 19, 2015. Details of the survey are shown in the enclosed document.

It is highly appreciated if you could kindly accept the survey team, and coordinate visits and consultations with institutions concerned.
I thank you for your consideration and I look forward to hearing from you soon.

Sincerely yours,

日下英司

Mr. Eiji HINOSHITA
Director, International Cooperation Office, International Affairs Division
Minister's secretariat, Ministry of Health, Labour, and Welfare

Enclosure: Schedule and Members
Copy submitted to:

- Mr. Chandra Lal Nakarmi, Act. General Manager, Kathmandu Upatyaka Khanepani Limited
- Mr. Sanjeev Bikram Rana, Executive Director, Kathmandu Valley Water Supply Management Board
- Mr. Ram Mani Bhattari, CEO of Bhaktapur Manucipality

Schedule of the survey

January 2015	
Date	Activity
1st day (11th Sun)	Move from Japan to Kathmandu
2nd day (12th Mon)	12:45 Arrival in Kathmandu 15:00 Visit to Japanese embassy 16:30 Visit to JICA
3rd day (13th Tue)	Visit to KUKL (Consultation on the survey and data collection) Visit to Bhaktapur City Hall (Data collection and discussion)
4th day (14th Wed)	On-site survey and data collection on intake facilities and water treatment facilities
5th day (15th Thu)	On-site survey and data collection on water sources
6th day (16th Fri)	On-site survey and data collection on distribution facilities
7th day (17th Sat)	On-site survey and data collection on the Melamchi Project etc.
8th day (18th Sun)	Team meeting
9th day (19th Mon)	9:00 Report to the Japanese embassy and Jlca (at JICA office) 13:50 Leave for Japan
10th day (20th Tue)	Arrival in Japan

Name List of the Study Team

Name	Position, Affiliation
Mr. Shumei TANAKA (Team Leader)	General Manager, Civil Engineering Department, International Division Hazama Ando Corporation
Mr. Daigo TAKEDA	Assistant Director, International Cooperation Office, Minister's Secretariat, Ministry of Health, Labour and Welfare
Mr. Yuuji KUBO	Section Chief, International Cooperation Office, Minister's Secretariat, Ministry of Health, Labour and Welfare
Mr. Noboru OZAKI	Senior staff Sakai City Waterworks and Sewerage Bureau
Mr. Satoru ONIKI	Deputy Director Environmental System Department NJS Consultants Co., Ltd.
Mr. Kiyoshi HIROSE	Manager Business Development Department, International Division Hazama Ando Corporation
Mr. Kenichi KINOSHITA	Manager Business Development Department, International Division Hazama Ando Corporation

ネパール国
バクタプール上水道改善計画

【経緯】

かねてより、安藤ハザマはKUKLよりバクタプールにおける
水道施設改善について相談を受けていた。
今般、『厚生労働省水道プロジェクト計画作成指導事業』
を活用し、現地調査をすることとした。

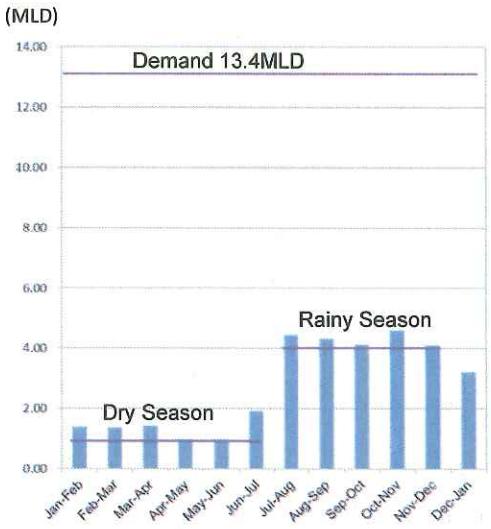
【目的】

バクタプール水道事業における水源不足の解決

Survey Schedule

Jan 11	Sun	Arrival in Katmandu
Jan 12	Mon	AM Arrival in Katmandu 15:00 Visit to the Japanese Embassy 16:30 Visit to the JICA
Jan 13	Tue	Discussion with KUKL and KVWSMB Discussion with Joint secretary / MoUD
Jan 14	Wed	On-site survey
Jan 15	Thu	On-site survey
Jan 16	Fri	On-site survey
Jan 17	Sat	On-site survey Team meeting
Jan 18	Sun	Discussion with KUKL Team meeting
Jan 19	Mon	9:00 Report to EoJ and JICA Leave to Japan
Jan 20	Tue	Arrival in Japan

Monthly Water Production (Bansbari WTP)



2days alternative

- Rainy Season : 2 time/day
- Dry Season : 1 time/day
  (1-3hr/time)

Water Supply Improvement in Bhaktapur

Original Condition

Supply
WET 4.0MLD
DRY 2.0MLD

Water Demand
8.0MLD

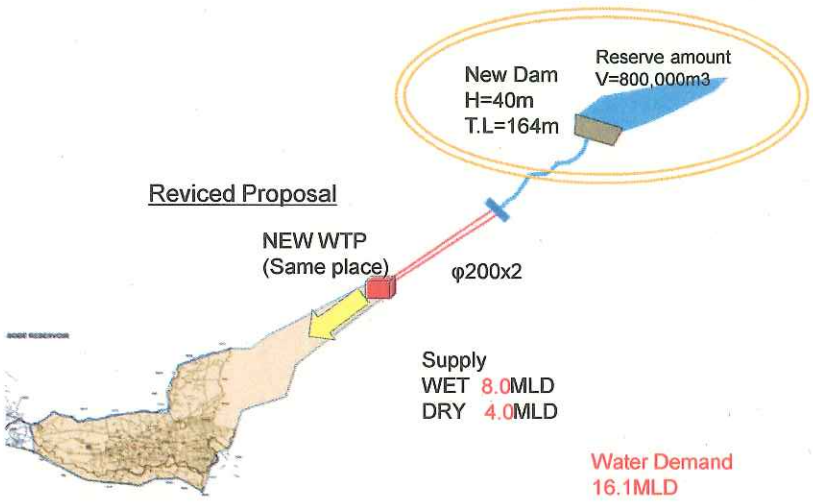
Target year	: 2011 -> 2030
Population	: 70,000 -> 111,000
Unit demand	: 90ltr/cap -> 135ltr/cap
Loss	: 10% -> 20%
Variation	: 1.2 -> 1.1

Reviced Condition

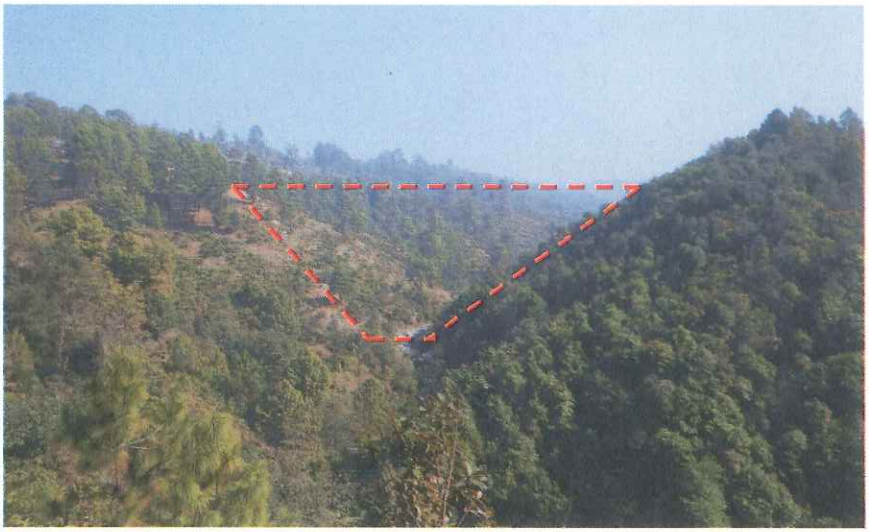
Water Demand
16.1MLD

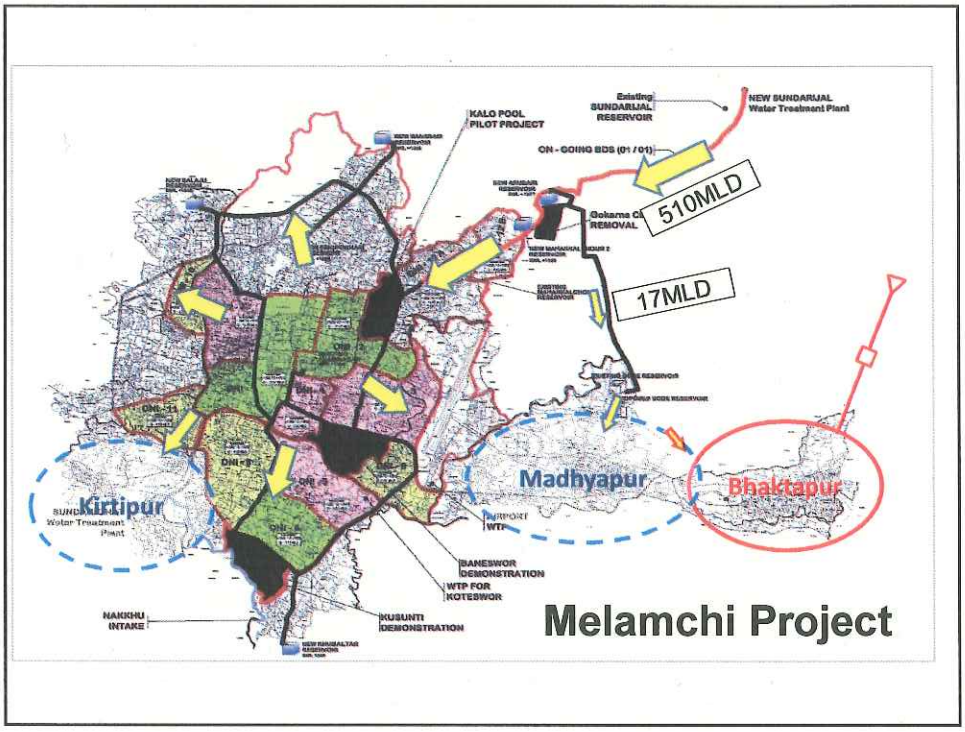
Supply
WET 4.0MLD
DRY 1.0MLD

Water Supply Improvement in Bhaktapur



Proposed Dam Site





Prospective Schedule of Melamchi Project

2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030

Tunnel Phase 1 (170MLD)

Tunnel Phase 2 (170MLD)

Tunnel Phase 3 (170MLD)

WTP 1 (85MLD)

JICA

WTP 2 (85MLD)

WTP 2 (170MLD)

WTP 3 (170MLD)

BDS DNI SR

Additional DNI KUKL → ADB

Transmission to Bode φ400 (17MLD) KUKL → ADB

Figure 1 Water Demand and Supply (Kathmandu Valley)

今後の課題

1. ダム計画の精査

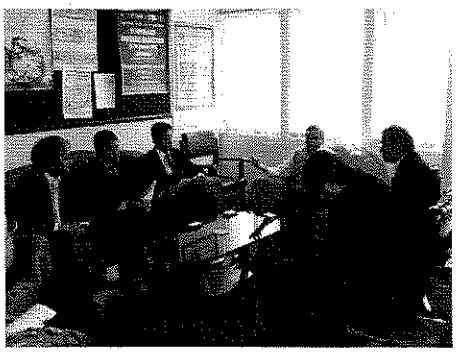
2. 雨期の原水水質（濁度）の評価

3. メラムチ給水事業からの受水可能量の確定

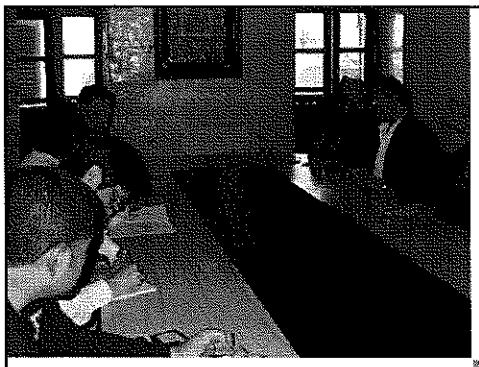
ネパール国JICA事務所での協議

KUKLカトマンズ本部

KVWSMBおよびKUKLとの会合



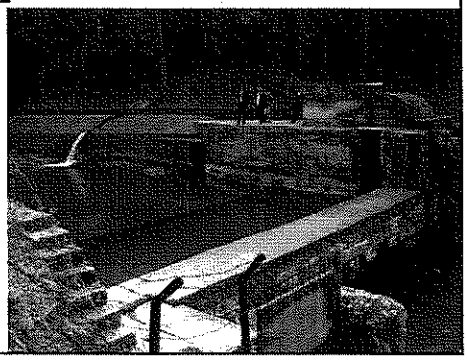
都市開発省との会合



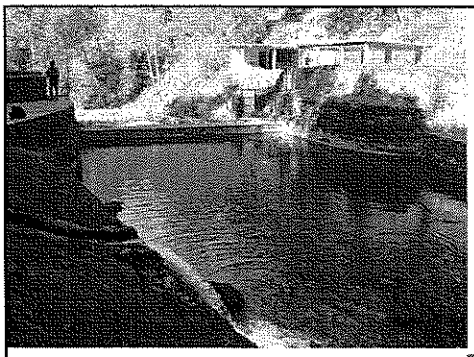
バクタプール市役所との会合

マハデブ川　ダム予定地　遠望

ダム予定地　堤体部

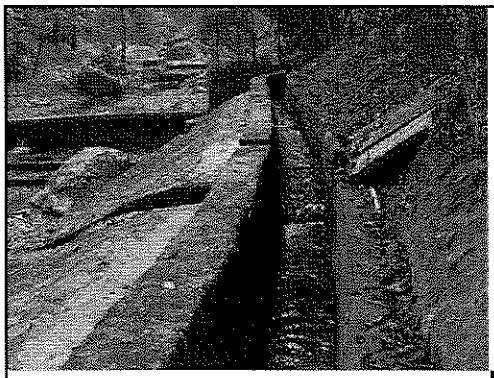


マハデブ川　取水堰を　下流から見る。



マハデブ川　取水堰を　上流から見る。

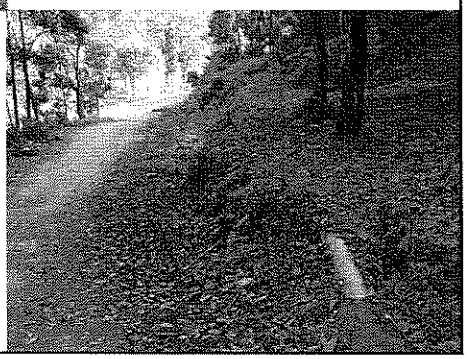
KUKL技術者との現場での打ち合わせ



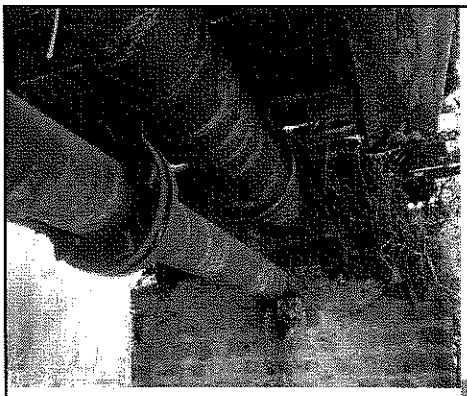
マハデブ川　取水堰横の水路

水路での簡易流量測定

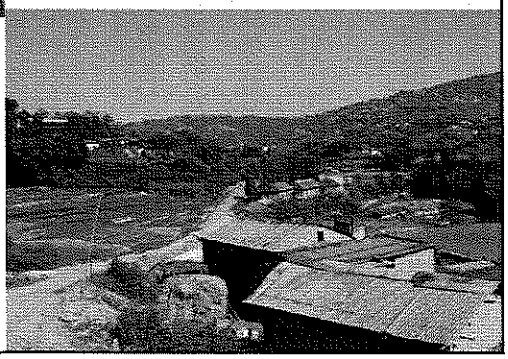
取水堰近傍　新規浄水場建設地点
候補地



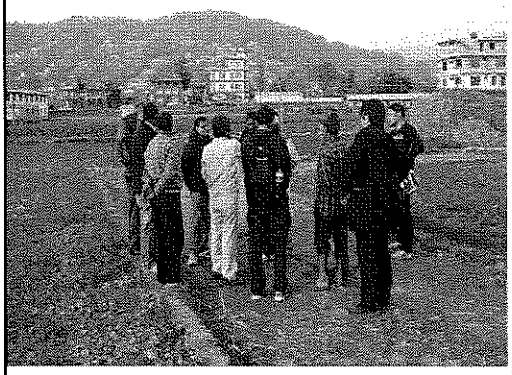
取水堰～浄水場間の既設配管ルート



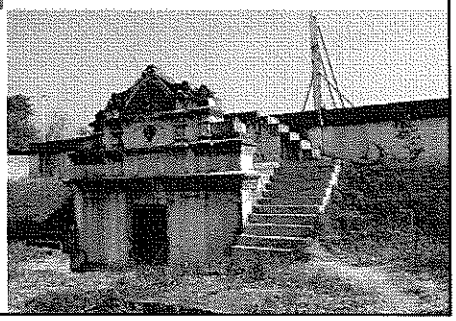
既設配管の小河川横断地点



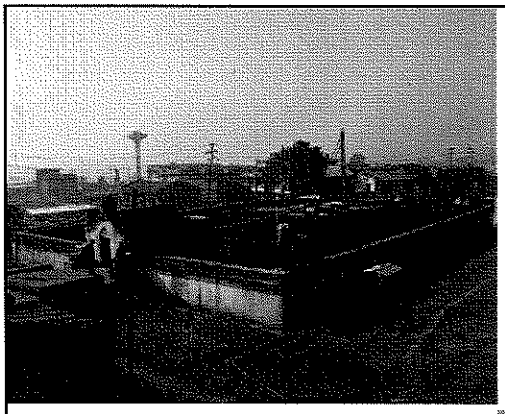
取水堰～浄水場間の既設配管ルート
遠望



配管ルート上の新規配水池建設
地点　候補地

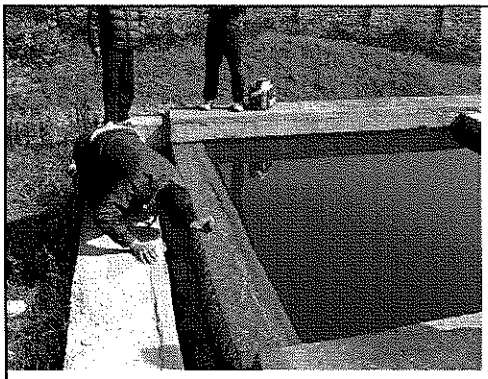


マハデブ川　バンスバリ浄水場　正面



バンスバリ浄水場　全景

バンスバリ浄水場　ろ過池



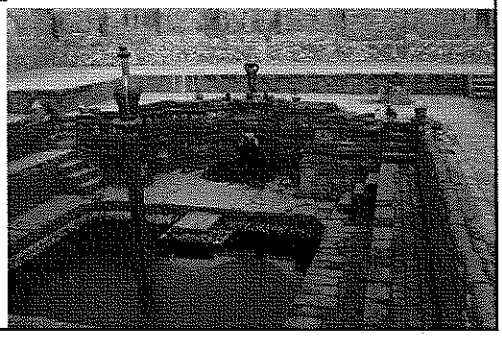
バンスバリ浄水場　沈殿池　流量測定

バンスバリ浄水場　直近の公共水栓

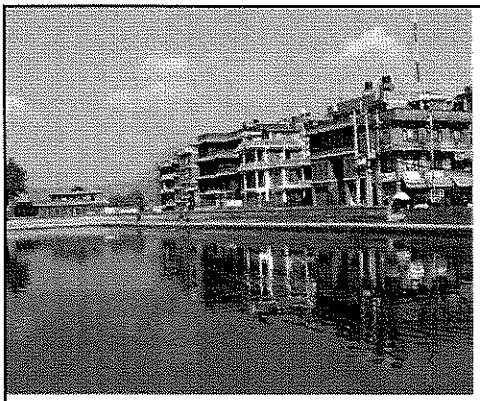
簡易水質検査状況

バクタプール市内中心部　道路

市中心部の歴史的建造物群

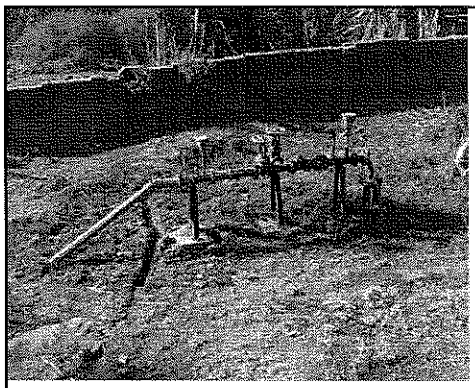


旧宮殿内の石造りの水栓

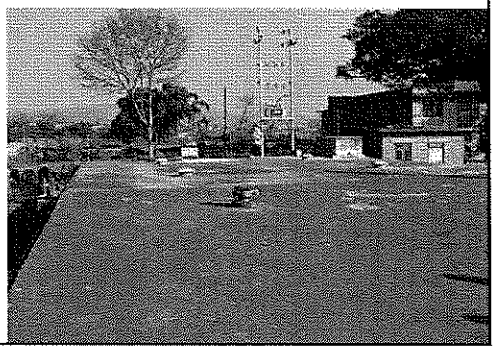


市内に数多くある池のひとつ

バクタプール市内の公共水栓

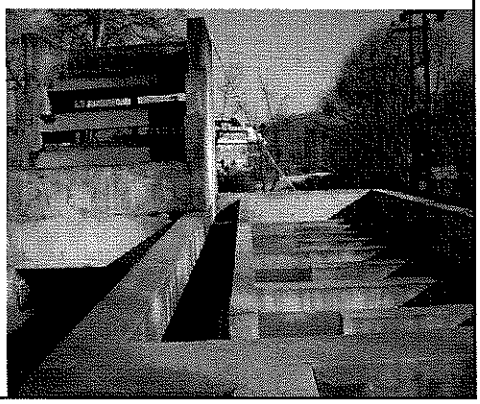


ボーデの井戸群のひとつ

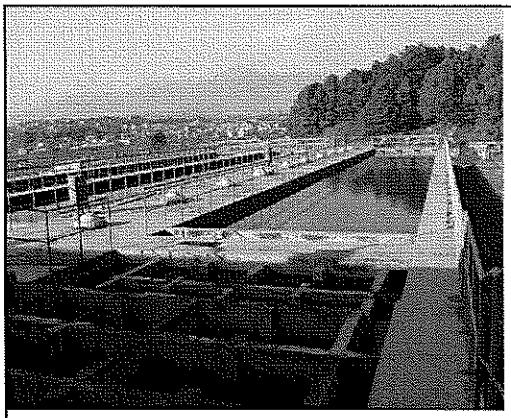


ボーデの配水池

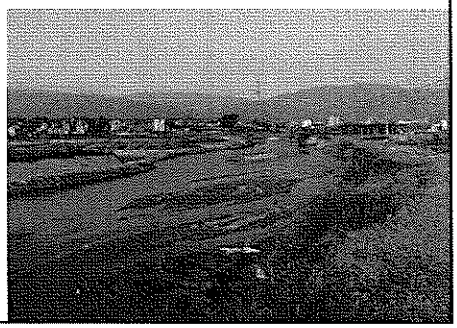
民家の蛇口　ボーデからの供給水



市内の小規模浄水場（ジャガティ浄水場）

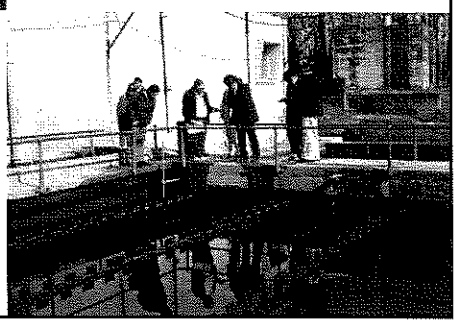


マノハラ浄水場　全景

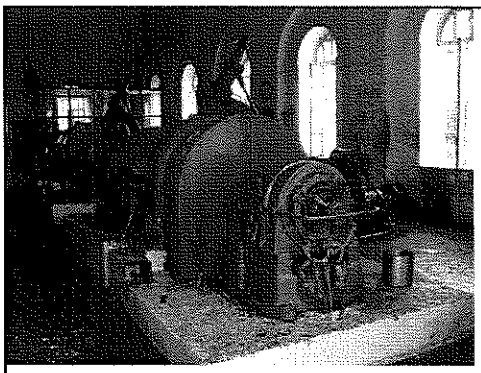


マノハラ川　取水地点の河川状況

マノハラ川の取水施設

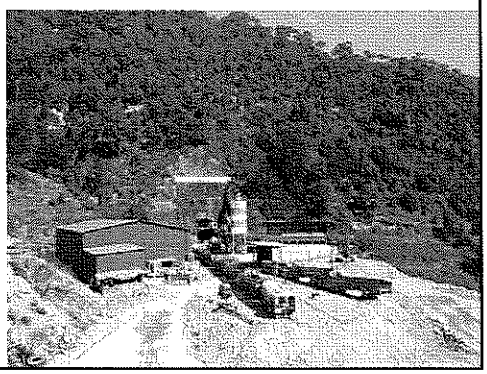


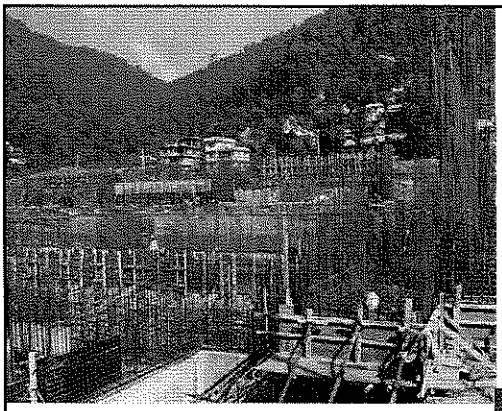
スンダリジャール浄水場内



スンダリジャール発電所

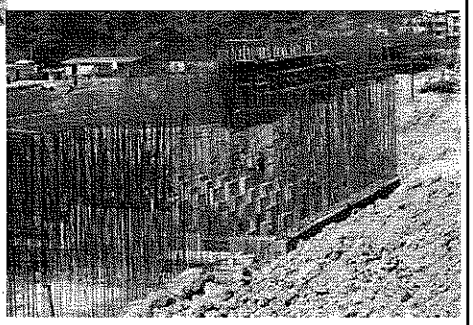
メラムチ浄水　導水トンネル坑口

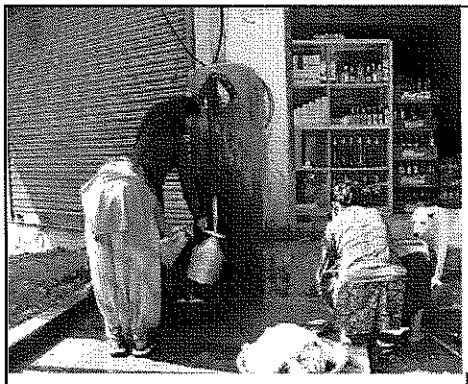




メラムチ浄水場　建設状況

メラムチ浄水場　建設状況





浄水場近傍の公共水栓

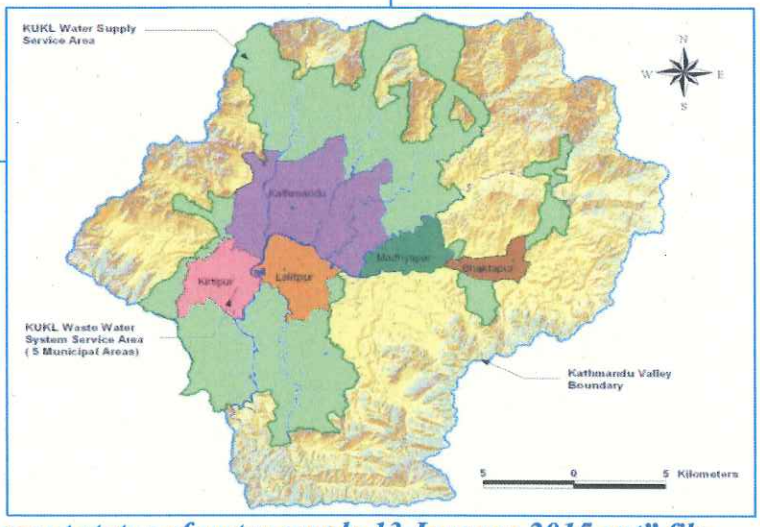
河川での洗濯、水浴

QUESTIONNAIRE ON PRESENT SITUATION OF THE WATER SUPPLY AND MANAGEMENT AND STAFF ALLOCATION

1. What is the name of your city?

Service area of KUKL is five municipalities of Kathmandu valley with adjoining villages. Five municipalities are: Kathmandu Metropolitan city, Lalitpur sub-metropolitan city, Bhaktapur Municiplaty, Madhyapur Thimi Municipality, Kirtipur Municipality.
Service area map is shown in Power point.(below)

Sevice area : five municipalities and adjoining villages.
1. Kathmandu
2. Lalitpur
3. Bhaktapur
4. Madhyapur
5. Kirtipur



"current status of water supply 13 January 2015.ppt" file

2. What is the official title of your body?

Kathmandu Upatyaka Khanepani Limited

3. When was your body established, and when did your body start to supply water?

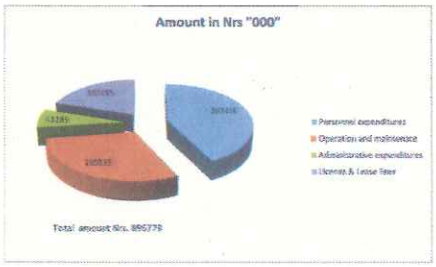
Public Water Supply System started in 1893.
Name of Organization was Pani Adda and Pani Goswara (1893 to 1973)
Water Supply and Sewerage Board (1973 to August1984)
Water Supply and Sewerage Corporation (August1984 to March 1990)
Nepal Water Supply Corporation (March 1990 to Feb 2008)
Kathmandu Upatyaka Khanepani Limited (Feb 13, 2008 to ..)

4. What is the type of your management?

Public Private Partnership (PPP model)
The shareholding structure of the company are

Government	***30%***
Municipalities	***50%***
Private Sector	***15%***
Employees Trust	***5%***

5. What is the proportion of annual revenue and expenditure? (Last five year)
(Hard copies of Financial status has been already provided during your visit.)



"KUKL Sixth Anniversary Report"

3.8 Financial Situation

A) Operating Income (Billing and Collection) Amount in USD

Heads	FY 2011/012	FY 2012/013
Billing from Water and Sewerage	5,496,747.37	5,392,452.63
Other Income	593,178.95	500,231.58
Total Billing	**6,089,926.32**	**5,892,684.21**
Cash Collection	**4,530,463.16**	**4,452,294.74**

Operating Expenditure Amount i

Heads	FY 2011/012	FY 2012/013
Personnel Expenditure	3,147,936.84	3,106,494.74
Quality Control	101,726.32	89,978.95
Electricity and Fuel	832,863.16	1,059,578.95
System Maintenance	807,021.05	787,673.68
Administrative Expenses	368,452.63	401,357.89
Lease, License, TFC Fee	891,673.68	1,706,147.37
Total Expenditure	**6,149,673.68**	**7,151,231.58**

"Presentation to Guest.ppt" file

KATHMANDU UPATYAKA KHANEPANI LIMITED
Estimated Cash Flow Analysis for FY 2066/67
NRs in 000

S. No.	Details	Total 2065/66 Approved	Total 2065/66 Revised	Total 2066/67 Proposed	If Increased by 25%
1	Private Connection Metered	199128	176914	198750	222535
2	Private Connection UnMetered	49683	45412	52318	59337
3	Government Connection Metered	12515	11377	13386	15234
4	Government Connection UnMeter	6835	5324	6734	7618
5	Public Stand Post	0	0	14208	17761
6	Sewerage	70393	62399	74280	84391
7	Water Sale (Tanker)	15750	15000	11060	13825
	Total Water & Sewerage Billing	354304	310426	370736	420701
8	Rebate (-)	5831	6270	6275	6275
	Net Water & Sewerage Billing (	348473	304156	364461	414426
9	Extra Billing	8636	17940	18010	18010
10	Maintenance Charge	1400	1848	1330	1330
11	New Connection Charge	11109	9977	7417	7417
12	Miscellaneous Income	1100	1661	1485	1485
13	Store Sale	0	0	0	0
14	Interest Received	335	3000	4000	4000
	Total Other Income (B)	22580	34426	32242	32242
	Grand Total (A+B)	371053	338582	396703	446668

KATHMANDU UPATYAKA KHANEPANI LIMITED
Estimated Revenue (Billing)
FY 2066/67 FY 2066/67
NRs. In Thousands

S. No.	Details	Total 2065/66 Approved	Total 2065/66 Revised	Total 2066/67 Proposed	If Increased by 25%
2	Private Connection Metered	284468	249489	254326	317908
3	Private Connection UnMetered	70976	67814	67814	84768
4	Government Connection Metered	17876	16967	17410	21763
5	Government Connection UnMetered	9764	8705	8706	10883
6	Public Stand Post	14208	14208	14208	17761
7	Sewerage	100562	95142	96447	120559
8	Water Sale (Tanker)	15750	15750	15800	19750
	Total Water & Sewerage Billing	513604	468075	474711	593389
9	Rebate (-)	5831	6270	6275	6275
	Net Water & Sewerage Billing (A)	507773	461805	468436	587114
10	Extra Billing	8636	17940	18010	18010
11	Maintenance Charge	1400	1848	1330	1330
12	New Connection Charge	11109	9977	7417	7417
13	Miscellaneous Income	1100	1661	1485	1485
14	Store Sale	0	0	0	0
15	Interest Received	2335	3000	4000	4000
	Total Other Income (B)	24580	34426	32242	32242
	Grand Total (A+B)	532353	496231	500678	619356

KATHMANDU UPATYAKA KHANEPANI LIMITED
Budgeting Expenditure
FY 2066/67
NRs. in 000

Code No.	Details	Total 2065/66 Approved	Total 2065/66 Actual	Total 2066/67 Proposed
01	Salary	145065	142439	154925
02	Allowance	19000	12220	20740
03	Overtime allowance	10785	9818	12280
04	Travelling allowance	500	0	500
05	Leave salary	7765	9223	15580
07	Insurance	2500	2750	7500
08	Gratuity	0	5000	10000
09	Medical Allowance	8025	10538	15955
10	Dress Allowance	1870	1557	2020
11	Pump & Machinery Repair	12413	7898	12080
12	Chemicals (Including Lab)	12640	10441	12220
13	Fuel for Vehicles	24735	23357	25680
14	Fue for Other Purposes	295	234	330
15	Electricity)Power)	69600	60605	67980
16	Vehicle & Equipment Mair	14015	12428	16460
17	Building Maintenance	4380	3328	4425
20	Audit Fees	500	500	500
21	Printing and Staionaery	6620	7363	8250
22	Advertisement	6500	4100	2000
23	Newspapers	300	154	305
24	Service	6405	7119	9125
25	House Rent	2865	2293	1810
26	Board Expenses	1500	1500	2000
27	Contingency Expenses	5585	4637	3385
29	Incidental Expenses	2500	0	0
33	Perishable Goods	2985	2738	3240
34	Training & Research	3000	1000	1000
35	System Maintenance	119547	85356	77380
35 a	Labor Fee	0	0	26065
35 b	License Fee	11275	10000	11000
35 c	Lease & TFC Fee	22058	23404	24000
	TOTAL	525228	461999.75	548735

"Financial st.66t.xls" file

6. How many number of employees? In addition, what are their job description?
Please write down the number of employee of each branch offices respectively (including treatment plant, service office and others)

(Unit : Person)

Department	*Maharaiqunq Branch Office*:
Smallest unit in department	*Store Unit*
Description of job:	Number of employee
1. Administration	*15*
2. Revenue/counter	*19*
3. Account	*2*
4. Meter readinq	*23*
5. Procurement	*3*
6. Store	*2*
7. Treatment plant	*28*
8. Production/distribution/supervision & maintenance	*61*
9. Others	*4*
Total	*159*

(Unit : Person)

Department	Administration Division*Maharaiqunq Branch Office*:
Smallest unit in department	Leoal Section*Store Unit*
Description of job:	Number of employee
1. Administration division chief	*1*
2. Human resource development section	*8*
3. Legal section	*1*
4. General administration section	*4*
5. Public relation section	*5*
6. Store section	*7*
7. Procurement section	*2*
8. Others (drivers and securitv)	*9*
Total	*37*

Number of employee in your entire water business enterprise.

Kathmandu Uptyaka Kanepani Limited
Number of Employees Permanent

Month : End of Pasuh 2071

S.No.	Description	Total
1	Officer level	145
2	Non officer level	675
	Total	820
1	Technical Staffs	325
2	Administrative Staffs	380
3	Finacial Staffs	115
	Total	820

"Organization chart", "Number of Employees Permanent" are showed in attached Annex 【1】

7. Where is your service area and how large (Km^2) is it?

See no.5

8. What is the population of the area, the population served and other statistics of your water supply?

Item	Example	
Population (A)	*2,700,000*	
Population served (B)	*2,160,000*	
Rate of service pervasion (A/B)	*100 %*	
Maximum daily supply (m^3/day)	*144,000*	
Average daily supply (C)(m^3/day)	*116,000*	
Accounted - for water (D)(m^3/day)	*69600*	
Accounted – for water as percent of total (D/C)	*60 %*	

9. What are the number of your customer and annual water consumption?

Subject	No. of Customer (Tap)		Water consumption	Example	
	Customer	Tap	(m^3/day)	No. of customer	Water consumption (m^3/day)
Domestic					
Commercial					
Common tap					
Industrial					
Others (....)					
Total		*194718*	*116,000*	*2,160,000*	*116,000*

Number of connection and category is given in "MIS report 2070-071.xls No-conn sheet"

Kathmandu Upatyaka Khanepani Limited

Technical Department

No. of Connection and Catagory

Fiscal year 2070/2071 (2013/2014)

S.No.	Branch	Govt. Connection (Metered)	Private Connection (metered)	Govt. Connection (Nonmetered)	Private Connection (Non metered)	Standpost	Total
1	Tripureshwor	192	18,618	110	1,709	137	20,766
2	Chhetrapati	42	12,199	9	1,464	180	13,894
3	Maharajgung	53	29,811	51	1,116	173	31,204
4	Mahankalchaur	74	27,218	46	3,864	137	31,339
5	Baneshwor	138	24,805	21	800	32	25,796
6	Kamaladi	143	5,533	30	214	20	5,940
7	Lalitpur		35,443	28	3,907	314	39,692
8	Bhaktapur	34	9,902	11	346	203	10,496
9	Thimi	18	7,937	7			7,962
10	Kritipur	10	7,569		50		7,629
	Total	704	179,035	313	13,470	1,196	194,718

"MIS report 2070-071.xls"

10. What are the type and the intake capacity of your water source?

Unit:m^3/day

Type of source		No. of source	Intake capacity	Depth(m)
Surface water	River with intake weir	*26*	*133000*	-
	Impounding Reservoir			-
Underground water	Shallow well			
	Deep well	*59*	*40000*	
Others (.....)				
Total				

11. How many treatment plants do you have? What kind of treatment process do you use? Please attach flow chart of treatment plants.

Number of treatment plant	*21*

Name of Plant: ***Bode Manohara Treatment Plant***			
Area of the sate (m^2)			
Capacity (m^3/day) : 21.7 MLD			
Sedimentation basin	No. of basin	*3*	
	Type		
	Dimension (1 unit) W×L× H (m)	*7×46.1×2.8 m*	
	Capacity (m^3/day)	*21,700*	
Filtration basin	No. of basin		
	Type	*Gravity*	
	Dimension (1 unit) W×L× H (m)	*3.15×7.2*	
	Filtration rate (m/day)	*120~137*	
	Capacity (m^3/day)	*21,700*	
Chemical	Type of coagulant (Powder or liquid)	***Poly aluminum chloride***	
	Type of chlorine agent (Liquid, gas or powder)	***Bleaching powder***	
	Others (....)	***Sodium hydroxide***	
Others			

Example for the flow chart of treatment plant is showed in attached Annex 【2】.

Flow chart and design criteria is given in Bode Manohara Treatment power point

12. What kind of the sludge treatment plant is there? Please write it if any.
Sludge drying bed

13. To what extent do you use instrumentation control in your facilities (intake, treatment plant, pumping plant etc.)?
Mostly manual

14. What is the total capacity of reservoirs to distribute water?

Supply zone (Purification plant)	Number of distribution reservoir	Total capacity (m^3)
Bhaktapur Bansbari	*1*	*2500*
Bhaktapur Jagati	*1*	*100*
Katunje Reservoir	*1*	*2000*
Bode Manohara	*2*	*2000*
Lokanthali	*2*	*300*
Mahankalchaur	*3*	*9000*
Kathmadu Bansbari	*1*	*2000*
Balaju	*1*	*4500*
Maharajgunj	*1*	*7000*
Minbhawan overhead resevoir	*1*	*3000*
Anamnagar over head reservoir	*1*	*2700*
Sinamangal	*1*	*50*
Sainbu	*2*	*5400*
Tahakhel	*2*	*1000*
Bagedhara	*1*	*200*
Balkumari	*1*	*50*
Jwagal	*1*	*100*
Bhajagal	*1*	*850*
Sundarighat	*1*	*800*
Balkhu	*1*	*60*
Kuleswor	*3*	*170*
Lagan	*1*	*100*
Sipradi	*2*	*150*
Kalanki	*1*	*50*
Total		

15. Do you introduce the advanced treatment system for water purification? If you do it, what kind of the advanced treatment system do you utilize? (e.g. : Activated carbon, aeration, ozonaization, biological treatment, etc.)
Biological treatment plant at two places Mahankalchaur and Bansbari for ammonia removal.

16. What kinds of pump are there on your water supply? Please fill it up if any.

Tube- and Shallow Wells

No.	Name of Source	~ Year of Constr.	Discharge Q mld		Feeding to	Remarks [ex.: pump capacity installed, Technical Documents of wells, Problems, etc.]	Pump rcommended	
			Rainy S.	Dry S.			Q (lit/min)	H (m)
	MAHANKAL CHAUR Branch							
1	Dhobi Khola well field DK1 (NW)	1984			Abandoned			
2	DK2 (NW)	1984			Abandoned			
3	DK3	1984	0.32	0.32	Local area	Q = 500 lit/min, H = 60 m , About 12 hrs operation	500	60
4	DK4 (NW)	1984			Abandoned			
5	DK5	1984		0.76	Mahankal treatment	Q = 700 lit/min, H = 45 m	700	60
6	Gokarna well field GK1	1983		1.44	" " "	Q = 1200 lit/min , H = 80 m	1200	80
7	GK2	1985		1.2	" " "	Q = 1000 lit/min, H = 80 m	1000	80
8	GK3	1985		0.72	" " "	Q = 700 lit/min, H = 75 m	700	75
9	GK4 (NW)	1984			Abandoned			
10	GK5 (NW)	1984			Abandoned			
11	Manohara well field MH2 (NW)	1984						
12	MH3	1984	29	0.72	Local & treatment	Q=700 lit/min, H= 90 m, (20 hrs. in dry & 8 hours in wet)	700	90
13	MH4	1985	0.58	1.44	" " "	Q=1200 lit/min, H= 100 m " "	1200	100
14	MH5	1985	0.5	1.26	" " "	Q=1050, H=100 m, " "	1050	100
15	MH6	1985	0.34	0.84	" " "	Q=900, H=100 m " "	900	100
16	MH7 (NW)	1985			" " "	Q= 350 lit/min, H = 100m No transformer	350	100
17	Shanker Park	2058	0.76	1.08	Local area	Q=900 m, H=110m (20 hrs. in dry & 14 hrs. in wet)	900	110
	TRIPURESHWOR System							
18	Kalimati	2053				Abandoned from2058		
19	Kuleshwor	2056	0.28	0.28	Kuleswor Sump well	Q=600 lit/min, H=70m (12 hrs. operation)	600	70
20	Lagan Tole	2056	0.28	0.28	0.28	Q=300 lit/min, H=80 m (12 hrs. in operation)	300	80
21	Kalanki (Shipradi)	2057	0.3	0.3	Kal. Treat. Plant	Q= 300 lit/min, H = 65 (20 hrs. operation in dry & wet)	300	65
22	Tahachal (MC College)	2058	0.43	0.43	T.P. Local area	Q= 600 lit/min, H=80 m (12 in dry & wet)	600	80
23	Tripureshwor	2059	0.25	0.25	T.P. Local area	Q= 300 lit/min, H = 65m (14 hrs. in wet & dry)	300	65
24	Solar well (Sundarighat) (NW)	1990				Low discharge & silt		
	BANESHWOR Branch							
25	Sina Mangal	2000	0.36	0.36	T.P. local	Q= 600lit/min, H= 65m (10 hrs in operation in dry & wet)	600	65
26	Airport	2065	0.58	0.58	Local	Q= 800 lit/min, H= 85 m, 12 hrs in dry & wet	800	85
	CHHETRAPATI Branch							
27	Sitapaila			0..10		Q= 150 lit/min, H= 70m, 12 hrs in dry & wet	150	70
28	Ikhapokhari	2065			Local	Q= 1050 lit/min, H =90	1050	90
29	Damaichaghat Kankeswori	2065			Local	Q= 1050 lit/min, H = 80m	1050	90
	MAHARAJGUNJ Branch							
30	Bansbari well field BB0	1972	0.31	0.8	Local & B.T.P.	Q=700 lit/min, H=110m, 20 hrs. in dry I & 8 hrs. in wet	800	110
31	BB1	RHP2054		0.38	B.T.P.	Q=500 lit/min, H=150 m, 16 hrs. in dry season	500	150
32	BB2	RHP2058	0.48	0.96	Local	Q=900 lit/min, H=100 m, 16 hrs in dry & 8 hrs in wet	900	110
33	BB3	1984/2062	0.48	0.76	Local & B.T.P.	Q= 600 lit/min, H= 110 m, 16 hrs in dry & 10 hrs in wet	800	110
34	BB4	1985/2004	0.48	0.76	Locall & B.T.P.	Q= 800 lit/min, H= 110 m, 16 hrs. in dry & 10 hrs in wet	800	110
35	BB5	1984/2062	0.72	1.1	Local & B.T.P.	Q=1200 lit/min, H=110 m, 16hrs in dry & 10 hrs in wet	1200	110
36	BB6	1984/	0.2	0.2	Local & B.T.P.	Q=300 lit/min, H =110 m, 16hrs in dry & 10 hrs in wet	300	110
37	BB7	1985/2004	0.6	0.96	Local & B.T.P.	35 HP, 16hrs operation in dry & 10 hrs in wet		
38/	BB8 (NW)	1984						
39	BB9	2054		0.2	Local	Q= 300 lit/min, H=90 m,10 HP, 16 hrs. in dry	400	90
40	BBWT Plant	2063		1	B.W.T.P.	Q= 900 lit/min, H= 80 m, 25 HP, 16 hrs in dry	900	80
41	Mahadev Khola well field MK1	2056/57	0.58	0.58	Local & B.W.T.P	Q=800 lit/min, H= 110, 16 hrs in dry & wet	800	110
42	MK2 (NW)	2056//57			Not in operation			
43	MK3	2057/58	1.25	1.25	Local & B.W.T.P	Q= 1300 lit/min, H=110 m, 16 hrs in dry & wet	1400	140
44	MK4	2057/58	1.54	1.54	Local & B.W.T.P	Q=1600 lit/min, H = 110 m, 16 hrs in dry & wet	1600	140
45	MK5 (NW)	2057/58				Not in operation		
46	Baniyatar 1	2057/58	0.29	0.58	Local	Q= 700 lit/min, H= 80 m, 12 hrs in wet	700	80
47	Baniyatar 2	2061				Not in operation due to silt pumping		
48	Chakrapath (NW)	1972/56/57				Not in Operation		
49	Samudayik (Bus Park)	2062/63	0.54	0.96	Local & B.W.T.P	Q=1000 lit/min, H= 110 m, 16 hrs in dry & 9 hrs in wet	1000	110
50	Pig forming	2063			Local only	Not in operation, Q= 700 lit/min, H = 70 m	700	70
51	Baluwapati (NW)	2062	0.54	0.96	Local Area	Q=1000 lit/min, H= 110 m, 16 hrs in dry & 9 hrs in wet	1000	110
52	Maharajgunj Office	2062		0.96	M.Reservoir	Q=1000 lit/min, H = 80 m, 16 hrs in dry	1000	80
53	Sangle Khola (NW)	2062			Balaju T. P.	(To be operated) Q= 1000 lit/min, H =110 m	1000	110
54	Ratna Park	2058/59		0.67	Local	Q= 700 lit/min, H= 80 m, 16 hrs in dry only	700	80
	LALITPUR Branch							
55	Pharping 1	1976		0.96	Sainbu	Q=1000 lit/min, H= 80 m, 16 hrs in dry only	800	70
56	Pharping 2	1977		0.96	Sainbu	Q=1000 lit/min, H= 80 m, 16 hrs in dry only	800	70
57	Jwagal (Kuondol)	2059	0.29	0.29	Local	Q= 400 lit/min, H = 60 m, 12 hrs in dry & wet	400	60
58	Balkumari	2062	0.86	0.86	Local	Q= 1200 lit/min, H =60 m, 12 hrs in dry &wet	1000	90
	MADHYAPUR THIMI Branch							
59	BH1 (NW)	1984				Abandoned		
60	BH2 (NW)	1976		0.58	Bode treatment	Q= 600 lit/min H= 75 m, 16 hrs. in dry only	600	75
61	BH3	1985	1.2	1.2	" "	Q =1000 lit/min, H =70 m, 20 hrs. in dry & wet	1000	70
62	BH4	1985	1.2	1.2	" "	Q =1000 lit/min, H =70 m, 20 hrs. in dry & wet	1000	70
63	Solar well (NW)	1995				Not in operation		
64	Dug Well	2063	1.2	1.2	" "	Q =1000 lit/min, H =70 m, 20 hrs. in dry & wet	1000	70
65	WTP Bode	2063	1.2	1.2	" "	Q =1000 lit/min, H =70 m, 20 hrs. in dry & wet	1000	70
66	Lokanthali 1	1997	0.72	0.72	Lo. Treatment plant	Q =1000 lit/min, H =70 m, 12 hrs. in dry & wet	1000	70
67	Lokanthali 2 (NW)	2000				Abandoned		
68	Jadibudi, JICA well (NW)	1990				Not on use		
	BHAKTAPUR Branch							
69	Bansbari	2052		0.29	B. B. W.T.P.	Q= 300 lit/mi, H= 70 m, 16 hrs in dry only	300	70
70	Jagati well	2057	0.29	0.29	J.W.T.P. for Local	Q= 300 lit/min, H = 90 m, 16 hrs in dry & wet	300	90
	KIRTIPUR Branch							
71	Tyangala Phat	2065				Not yet connected , Q= 150 lit/min (2.5 lit/sec) H= 100 m	150	100

"Type of pumps and capacity.xksl"

List of Distribution pumps

S. No.	Installation point / Location	Brief description of the Equipment (pump / switch board)	Head in meters	Discharge Lpm	Power Kw / H.P	No. of Equipments	Remarks (replacement, new installation, urgent etc)
1	Pharping H. S. Pump Station	Volute Pump EBARA Co. Japan	175 175	1735 2750	125 H.P. 200 H.P.	2 3	Replacement, urgent Replacement, urgent
2	Sundarighat Pump Station	Centrigugal Pump, Ritz Germany Hawkor Sinddley, England (motor)	60	1100	22 Kw	3	Replacement, urgent
3	Kalimati Pump Station	Centrigugal Pump, Ritz Germany Hawkor Sinddley, England (motor)	60	1100	22 Kw	1	Replacement, urgent
4	Kuleswor Pump Station	Centrigugal Pump, Ritz Germany Hawkor Sinddley, England (motor)	60	1100	22 Kw	2	Replacement, urgent
5	Bhanjangal Pump Station	Centrigugal Pump, Ritz Germany Hawkor Sinddley, England (motor)	60	1100	22 Kw	2	Replacement, urgent
6	Balkhu, Gyangkhel Pump St.	Centrifugal Pump, Kirloskar India	70	500	25 H.P.	1	New Installation
7	Nagrajun Palace, Balaju	Centrifugal Type, Grundfos Co.	140	200	50 H.P.	2	Replacement, urgent
8	Kalanki Treatment Plant	Centrifugal pump, Kirloskar India	75	350	12.5 H.P	1	Replacement
9	Sim Jhowalhiti, Kirtipur	Centrigugal, Kirlosker India	140	800	35 H.P.	2	Replacement
10	Bungamati P.Station, Lalitpur	Vertical Grubdfos CR 60 / 80 model	83.2	1150	22 Kw	1	New as spare pump
11	Muldole Pump Station, Lalitpur	Vertical Grubdfos CR 60 / 80 model	83.2	1150	22 Kw	2	New as spare pump
12	Dhobighat Pump St., Lalitpur	Centrigugal Pump, Ritz Germany	60	600	20 H.P.	1	Replacement
13	Pulchowk Pump St., Lalitpur	Centrigugal Pump, Ritz Germany	60	600	20 H.P.	2	Replacement
14	Maharajgung Reservoir Site	Centrigugal Pump, Ritz Germany	85	700	30 H.P.	2	Replacement
15	Mulpani Solid Waste Site	Centrigugal, Kirlosker India	120	600	40 H.P.	1	Replacement, urgent
16	Sundarijal Reservoir Site	Centrifugal Booster Pump, KSB	28	4000	30 H.P.	1	Replacement, urgent
17	Sundarijal Reservoir Site	Centrifugal Backwash Pump, KSB	20	500	10 H.P.	2	Replacement, urgent
18	Gokarneswor Pump, Gokarna	Centrifugal, Kirloskar India	90	300	20 H.P.	1	Replacement
19	Bode Dogwell Site	Dewatering Submerssible, Japan Dewatering Submerssible, India	33 33	2050 1500	27 Kw 21 Kw	4 4	Replacement, urgent Replacement, urgent
20	Lokanthali Treatment Plant	Centrifugal Pump, Kiloskar, India	80	1400	30 H.P.	2	Repalcement, urgent
					Total	42	

"Type of pumps and capacity.xksl"

17. How much do you use electricity in your facility?

Energy consumption at each pumping station is attached here with.

Place	of electricity (kW / year)
Intake facility	
Treatment plant	
Transmission and distributior	
Others (....)	

No Answer

18. What is the total length of distribution pipe? In addition, what kind of material do you use?

Length of distribution main and transmission main is available in KUKL sixth Anniversary Report.

5.2 WATER DISTRIBUTION MAINS

SN	PROJECT	SIZE (mm)	MATERIAL	AGE (yrs)	APPROXIMATE LENGTH (KM)
1	BASE	50-600	CI, GI, Steel, PVC	Up to 115	300
2	FIRST PROJECT (IDA)	100-400	CI, GI	40	120
3	SECOND PROJECT (IDA)	100-400	CI,GI, DI	35	150
4	THIRD PROJECT (IDA)	100-300	DI,GI	25	150
5	NWSC	75-300	DI,GI	21	345
6	KUKL	50-150	CI,GI	3	75
7	PID	90-350	DI, UPVC	3	126
	TOTAL				1266

5.3 WATER TRANSMISSION MAINS

SN	PROJECT	SIZE (mm)	MATERIAL	AGE (yrs)	APPROXIMATE LENGTH (KM)
1	BALAJU	100-400	CI, AC, Steel, DI, PVC	Up to 82	45
2	BANSBARI/MAHARAJGUNJ	100-400	CI,DI,PVC	Up to 120	70
3	SUNDARIJAL	100-600	CI,DI,HDPE	Up to 46	62
4	PHARPING	200-500	CI,Steel,DI	Up to 36	29
5	KIRTIPUR	100-200	CI,PVC	Up to 117	38
6	NAKHU	200-300	PVC	Up to 21	14
7	BHAKTAPUR	100-400	CI,DI,	Up to 116	10
8	CHAPAGAON	125-200	CI,DI,HDPE	Up to 35	20
9	BODE	100-350	CI,DI,PVC	Up to 46	16
10	OTHERS	50-100	CI,GI,PVC	.....	10
	TOTAL				314

"KUKL Sixth Anniversary Report"

19. What is the total length of service pipes? In addition, what kind of materials do you use?

(Less than 50 mm in diameter)

Materials	Total length (m)
Steel pipe	*No*
Lead pipe	*No*
Plastic pipe	*No*
Copper pipe	*No*
Total	

20. What is the leakage rate? What kind of measures for leakage prevention does you introduces?

About 36 to 40 % Nonrevenue water including Physical loss.

At present only visible leakages are repaired

21. Is there any standard on the water quality for drinking that you had to be subject? In addition, what is the name of it? Would you give us your quality standard, in addition, analysis data (some example, dry and rainy season)? Please add frequency of analysis.

NATIONAL DRINKING WATER QUALITY STANDARDS-2062

NATIONAL DRINKING WATER QUALITY STANDARDS-2062

S No	Category	Parameters	Units	Concentration Limits	Remark
1	Physical	Turbidity	NTU	5(10)	
2		pH		6.5-8.5*	
3		Color	TCU	5(15)	
4		Taste & Odor		Non-Objectional	
5		TDS	mg/L	1000	
6		Electrical Conductivity (EC)	µS/cm	1500	
7	Chemical	Iron	mg/L	0.3(3)	
8		Manganese	mg/L	0.2	
9		Arsenic	mg/L	0.05	
10		Cadmium	mg/L	0.003	
11		Chromium	mg/L	0.05	
12		Cyanide	mg/L	0.07	
13		Fluoride	mg/L	0.5-1.5*	
14		Lead	mg/L	0.01	
15		Ammonia	mg/L	1.5	
16		Chloride	mg/L	250	
17		Sulphate	mg/L	250	
18		Nitrate	mg/L	50	
19		Copper	mg/L	1	
20		Total Hardness	mg/L as CaCO3	500	
21		Calcium	mg/L	200	
22		Zinc	mg/L	3	
23		Mercury	mg/L	0.001	
24		Aluminum	mg/L	0.2	
25		Residual Chlorine	mg/L	0.1-0.2*	In system using chlorination
26	Microbiological	E. Coli	MPN/100ml	0	
27		Total Coliforms	MPN/100ml	0 in 95% Samples	

"KUKL Sixth Anniversary Report"

Item	Raw water		Finished water		Tap water	
	No. of sample	Frequency	No. of sample	Frequency	No. of sample	Frequency
As per KUKL analysis report	10	W	10	D	1	D

Raw water analysis report has been sent separately. => Q22

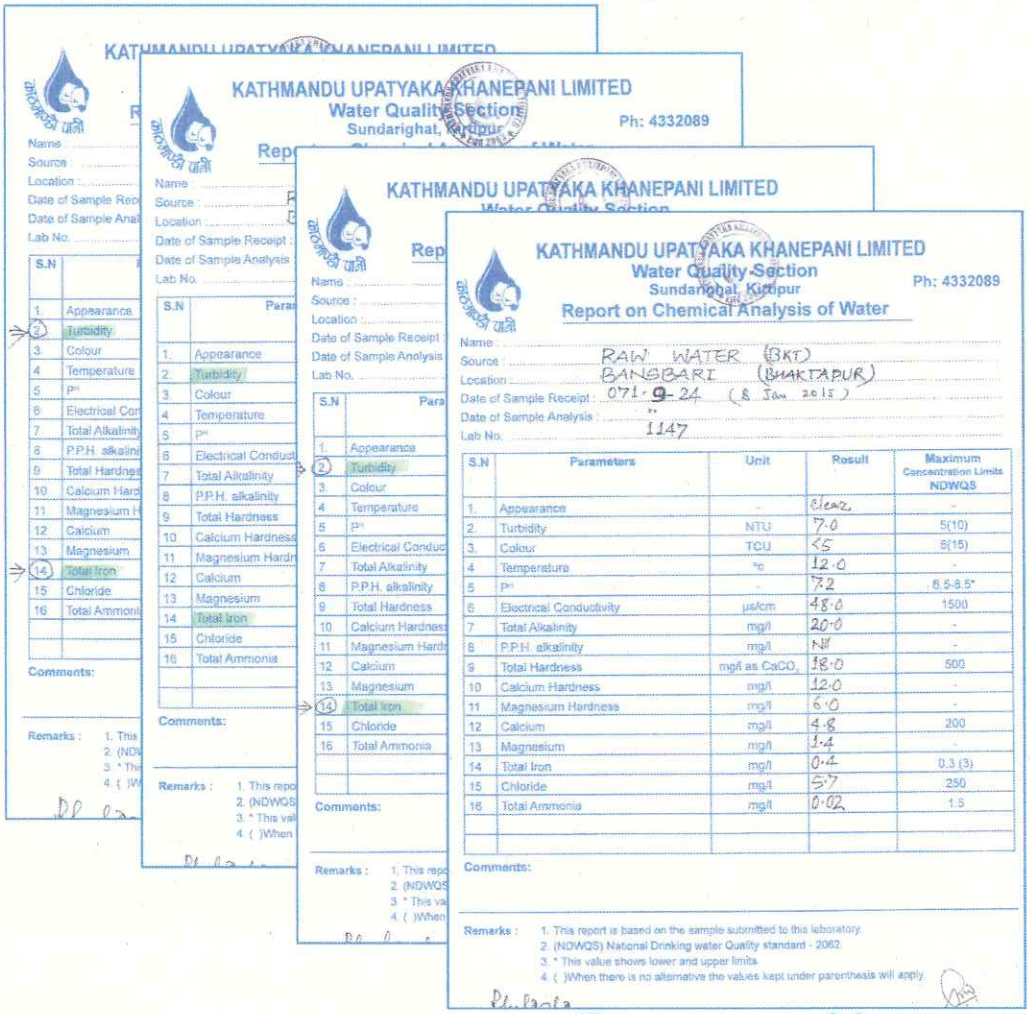
Some report of water treatment plant will sent separately => Q22

Frequency of your water quality analysis: D; Daily, W; Weekly, M; Monthly, O: Others

22. How do you examine and analyze the quality of water? What kind of water analysis equipment do you have?

Water analysis reports of different month will be sent separately.

(Bansbari Raw Water : 05.Jul, 17.Jul, 19.Aug 2014, 08.Jan 2015)



KATHMANDU UPATYAKA KHANEPANI LIMITED
Water Quality Section
Sundarighat, Kirtipur
Ph: 4332089

Report on Chemical Analysis of Water

Name :
Source : RAW WATER (BKT)
Location : BANSBARI (BHAKTAPUR)
Date of Sample Receipt : 071-9-24 (8 Jan 2015)
Date of Sample Analysis : "
Lab No. : 1147

S.N	Parameters	Unit	Result	Maximum Concentration Limits NDWQS
1.	Appearance	-	Clear.	-
2.	Turbidity	NTU	7.0	5(10)
3.	Colour	TCU	<5	5(15)
4	Temperature	°c	12.0	-
5	P^H	-	7.2	6.5-8.5*
6	Electrical Conductivity	µs/cm	48.0	1500
7	Total Alkalinity	mg/l	20.0	-
8	P.P.H. alkalinity	mg/l	Nil	-
9	Total Hardness	mg/l as CaCO3	18.0	500
10	Calcium Hardness	mg/l	12.0	-
11	Magnesium Hardness	mg/l	6.0	-
12	Calcium	mg/l	4.8	200
13	Magnesium	mg/l	1.4	-
14	Total Iron	mg/l	0.4	0.3 (3)
15	Chloride	mg/l	5.7	250
16	Total Ammonia	mg/l	0.02	1.5

Comments:

Remarks : 1. This report is based on the sample submitted to this laboratory.
2. (NDWQS) National Drinking water Quality standard - 2062.
3. * This value shows lower and upper limits.
4. ( )When there is no alternative the values kept under parenthesis will apply.

Pl. Panta

"Raw water report & human reource.pdf"

(WTP, TAP : 2013.07 - 08)

KATHMANDU UPATYAKA KHANEPANI LIMITED
Water / Sewerage Quality Assurance Division , KIRTIPUR
Laboratory Record Of Chemical & Bacteriological Analysis Of Water
(Result Expressed as mg/l)

S.No.	Date	Location	Branch	Sample taken	Turbidity	Colour	P^H	E.C.	Total Alkalinity	Total Hardness	Total Iron	Total Ammonia	Chloride	F.R.C.	Total Golifroms	Remarks
					(NTU)	(TCU)		µs/cm							100/ml	
NDWQS					5 (10)	5 (15)	6.5-8.5	1500		500	0.3 (3)	1.5	250	0.1-0.2	0 in 95% Samples	
1	2070-04-01	Bhainshe Pati Supply	Jawalakhel	Reservoir	Clear/<5	<5	7.8	254	124	130	0.1	0.02	7.68	0.5	Nil	satisfactory
2	2070-04-02	Nakhhu	Jawalakhel	Customer Tap	Clear/<5	<5	7.8	256	126	130	0.1	0.02	7.68	0.2	Nil	satisfactory
3	2070-04-02	Old Baneshwor	Baneshwor	Customer Tap	Clear/<5	<5	6.9	40	20	16	0.3	0.02	5.76	0.05	Nil	satisfactory
4	2070-04-02	Bansbari Treated	Maharajgung	Water T.Plant	Clear/<5	<5	7.1	48	22	18	0.1	0.02	5.76	0.6	Nil	satisfactory
5	2070-04-02	Dilibazar height Marga	Baneshwor	Customer Tap	Clear/<5	<5	7.1	36	18	16	0.3	0.02	5.76	0.05	Nil	satisfactory
6	2070-04-03	Pipal Bot	Maharajgung	Customer Tap	Clear/<5	<5	7.3	36	18	12	0.1	0.02	5.76	0.3	Nil	satisfactory
7	2070-04-03	Chakrapath	Maharajgung	Customer Tap	Clear/<5	<5	7.4	34	16	12	0.1	0.02	5.76	0.3	Nil	satisfactory
8	2070-04-03	N.G Bazar	Maharajgung	Customer Tap	Clear/<5	<5	7.5	32	14	12	0.1	0.02	5.76	0.2	Nil	satisfactory
9	2070-04-04	Bansbari Treated	Maharajgung	Water T.Plant	Clear/<5	<5	7.4	50	24	18	0.1	0.02	5.76	0.5	Nil	satisfactory
10		Manikalchaur			Clear/<5	<5						0.02	5.76		Nil	

"Lab2070 Shrawn Monthly Report.xls"
"Lab2070 Bhadra Monthly Report.xls"
"Asoj 2070 W.T.P Wabside.xls"
"Kirtik 2070 W.T.P wabside.xls"

23. Would you give us your water rate schedule?

Water tariff is given in power point presentation

Present Tariff Structure

Pipe Size (inch)	(A) Metered Connections)			Unmetered Connections In N.Rs.
	Minimum consumtion In (ltrs)	Minimum rate In N.Rs.	Excess consumption per 1000 ltrs in N. Rs.	
1/2	10,000	100	32	785
¾	27,000	1910	71	4595
1/	56,000	3960	71	9540
1 1/2	155,000	10950	71	26280
2	320,000	22600	71	54255
3	881,000	62240	71	149415
4	1,810,000	127865	31	306880
Public stand post				1188
Tanker sale	5,000	1995		
	6,000	2300		
	8,000	2860		
	9,000	3155		
	10,000	3435		

Nptr:: Sewerage charge 50 % of water bill
1 USD= N. Rs. 99.00

"current status of water supply 13 January 2015.ppt" file

24. What system is used to calculate the water rate?

Cost recovery

25. Do you utilize water meters? If you do it, how often do you read water meters in a year?

Every month

26. What is the billing period?

(Every month)

27. How do you collect water charges?

Meter reader visit the customer every month and left the water bill and customer pay at KUKL counter.

28. What is the major problem to be solved now and in the future?

Existing Challenges & Issues:

- **Water supply is intermittent one to three hours in three alternate day in wet season and nine alternate day in dry seasons**
- **Gap between Water demand & water production is very high**
- **Lack of water supply in many area due to unplanned distribution net work**
- **There is no separate transmission & distribution line**
- **Most of the distribution lines are under sized and very long**
- **Leakage in pipeline is very high due to very old distribution net work**
- **limited and scattered water sources in the valley**
- **surface sources dry up during dry season**
- **Leakage and wastage is about 40 %**

"current status of water supply 13 January 2015.ppt" file

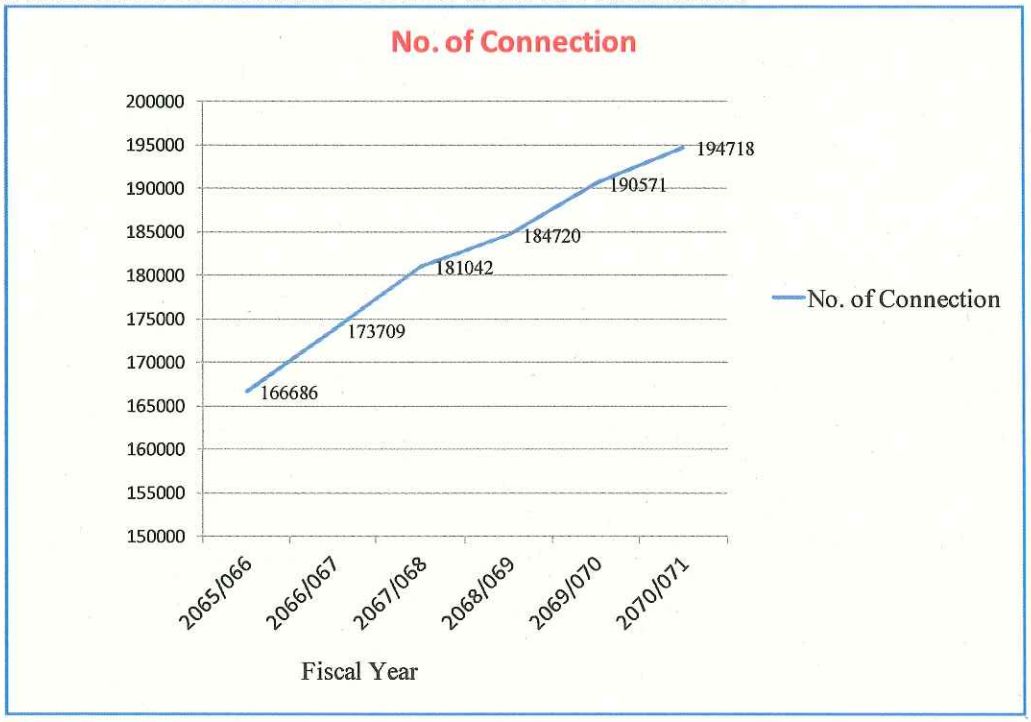
29. Do you have the master plan and estimate the future demand? If you have, please give us one copy of it.

No

30. What is the number of construction works per annum which includes new pipe laying, replacement and repairing as to distribution pipe over than 50mm in diameter? In addition, what is their total length per annum?

No Answer

31. What is the number of construction works of service installation?



"current status of water supply 13 January 2015.ppt" file

32. How many customers (taps) with meter do you have?

Kathmandu Upatyaka Khanepani Limited

Technical Department

No. of Connection and Catagory

Fiscal year 2070/2071

S.No.	Branch	Govt. Connection (Metered)	Private Connection (metered)	Govt. Connection (Nonmetered)	Private Connection (Non metered)	Standpost	Total
1	Tripureshwor	192	18618	110	1709	137	20766
2	Chhetrapati	42	12199	9	1464	180	13894
3	Maharajgung	53	29811	51	1116	173	31204
4	Mahankalchaur	74	27218	46	3864	137	31339
5	Baneshwor	138	24805	21	800	32	25796
6	Kamaladi	143	5533	30	214	20	5940
7	Lalitpur		35443	28	3907	314	39692
8	Bhaktapur	34	9902	11	346	203	10496
9	Thimi	18	7937	7			7962
10	Kritipur	10	7569		50		7629
	Total	704	179035	313	13470	1196	194718

"MIS report 2070-071.xls"

33. How many times unscheduled interruptions greater than 12 hours?
(12 hours water unavailable due to failure or under-sizing of water business enterprise's infrastructure, source failure, service reservoir depletion and bursts. Scheduled maintenance, damages to utility by 3rd parties and power failure at facilities excluded.)

No Answer

34. How many pipeline breakages per annum are there in your water business enterprise?

Kathmandu Upatyaka Khanepani Limited
Technical Department
Branch Activities
Fiscal year 2070/2071

SN	Month	Injection Points Installed (No)	Tank Installed (No)	Leak Identified (No)	Leak Repaired (No)	Pipe Repaired (M)	Connection Changed (No)	New Consumer (No)	New Meter Installed (No)	Meter Repaired (No)
1	Srawan	0	0	514	485	2	62	212	1574	385
2	Bhadra	0	0	429	414	50	112	276	1149	486
3	Aswin	0	0	428	418	28	190	477	744	314
4	Kartik	0	0	514	477	45	85	246	488	248
5	Magsir	5	0	450	425	63	111	357	561	229
6	Paush	1	0	441	437	150	155	446	672	252
7	Magh	2	0	486	455	0	124	328	437	237
8	Falgun	3	0	467	433	24	78	331	438	292
9	Chaitra	3	0	386	367	0	55	413	316	253
10	Baishak	5	0	409	368	0	65	305	322	254
11	Jestha	6	0	475	438	0	155	227	350	382
12	Ashad	5	2	410	375	0	156	285	266	449
	Total	**30**	**2**	**5409**	**5092**	**362**	**1348**	**3903**	**7317**	**3781**

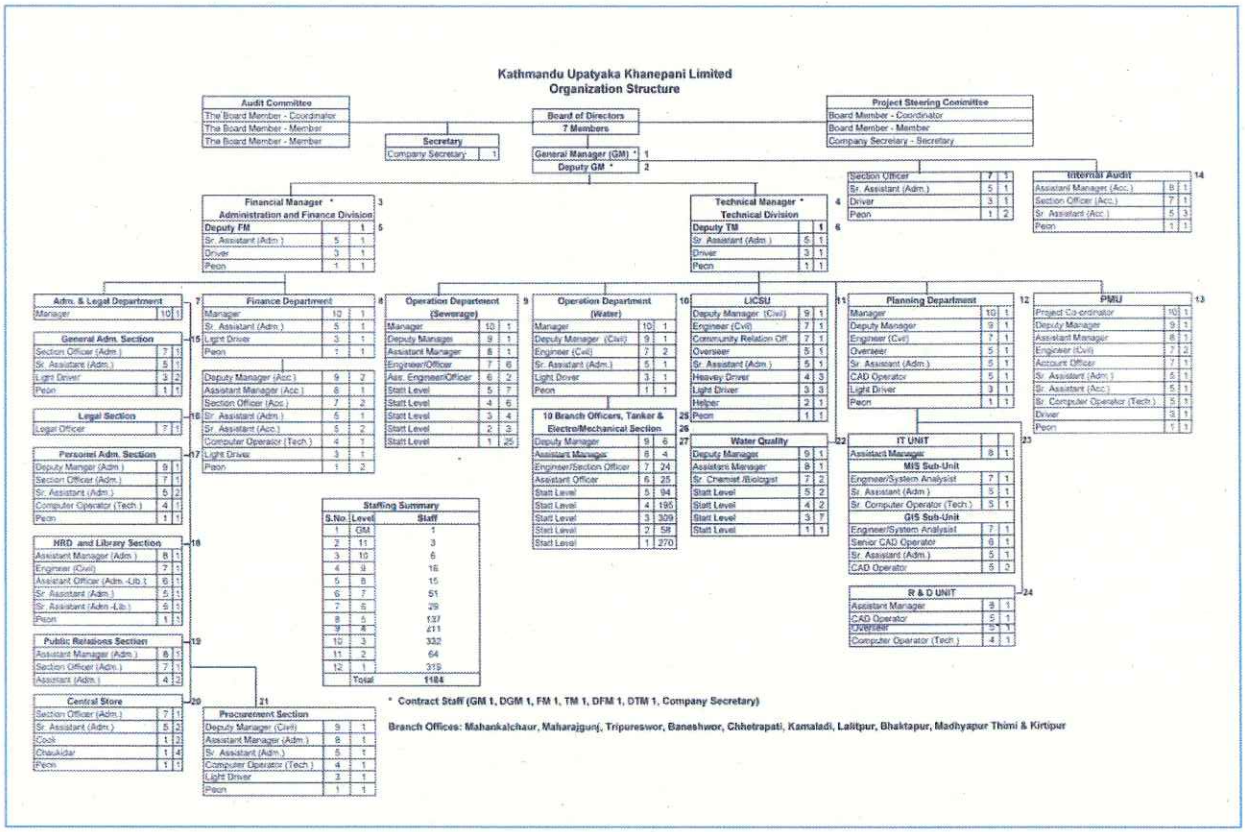
"MIS report 2070-071.xls"

35. How many percent of water quality test of tap water that do not conform to your drinking water quality standard are there?

Name of you	
Title of you	
Address	
Telephone	
Facsimile	

No Answer

Annex 【1】 Organization Chart



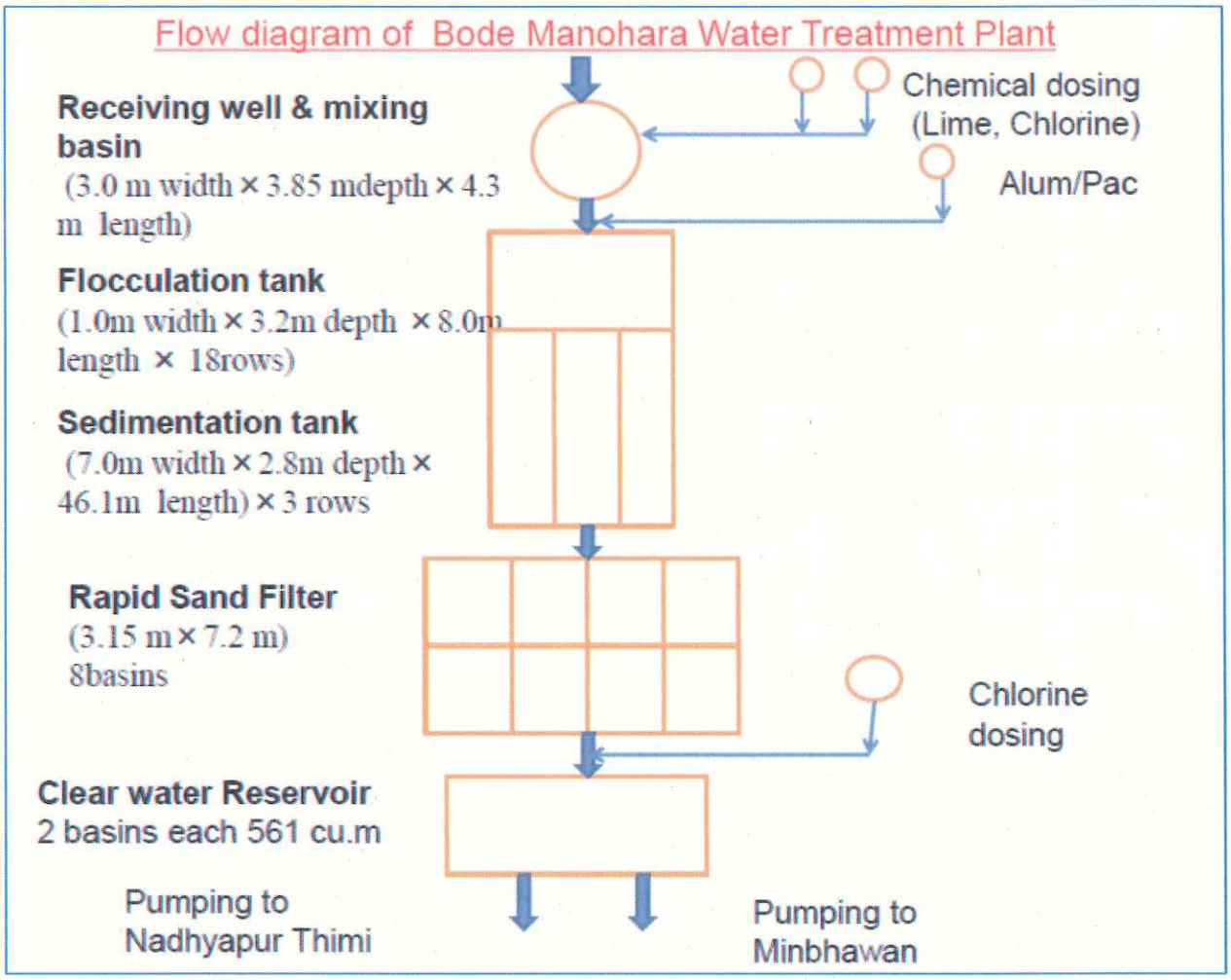
"current status of water supply 13 January 2015.ppt" file
"KUKL Sixth Anniversary Report"

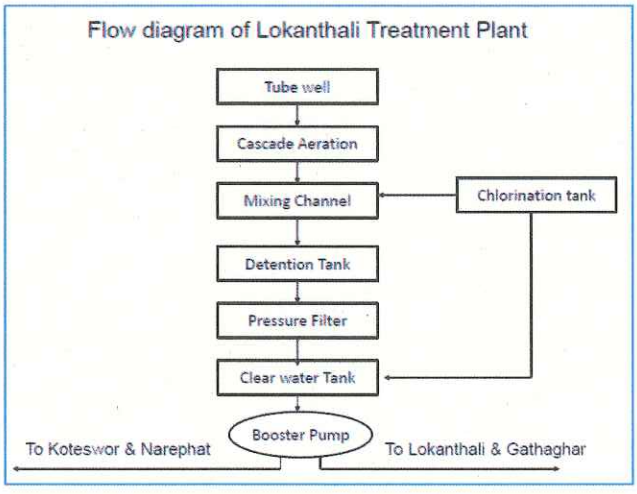
Kathmandu Uptyaka Kanepani Limited
Human Resource Development Section
Number of employees

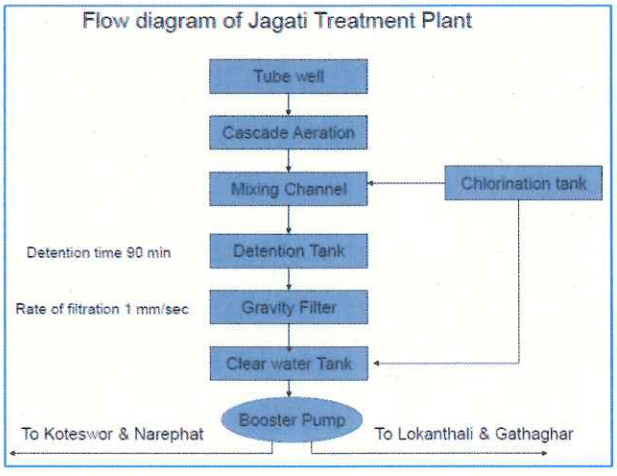
Month : End of Pasuh 2071

S.No.	Section/Branch	Permanent Staff	Contract	Daily Wages	Total Staff
1	Head Office + PID	96	1	1	98
2	Tripureswor	54	7	20	81
3	Thimi	36	1	15	52
4	Tanker	30		11	41
5	Sewrage Dept.	38	1		39
6	Electromechanical	30	1	4	35
7	Maharajgunj	112	4	36	152
8	Mahankalchaur	99	9	34	142
9	Kirtipur	33	2	16	51
10	Kamaladi	23	1	4	28
11	Chhetrapati	34	3	12	49
12	Bhaktapur	33	3	20	56
13	Baneswor	71	14	9	94
14	Lalitpur	113	8	54	175
15	Tubewell Project	6			6
16	Central Lab	6	1	3	10
17	Gwalindaha W.S.Project	3		1	4
18	LICSU	3			3
	Total	820	56	240	1116

Annex 【2】 Example for Flow chart of Treatment plant







"Bode Manohara Water treatment.ppt"

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Water

SAVE WATER

Engineering & Training Centre (P.) Ltd.

Tel : 977-1-4475674
Fax No: 977-1-4479642

Laboratory, R & D on Total Water Management, Treatment & Consultancy

LABORATORY ANALYSIS REPORT

Name of Sender: Hazama Ando Corporation / NJS Consultants JV — **Analyzed date : 14/01/2015- 20/01/2015**
Sample No: 1668 - 1669/071/072 — **No. of Samples: 02**
Date of Receipt: 14/01/2015 — **Report: Part I of II**
Sampled by : Client

Parameters	Units	WHO GV	NDWQS	Result		Instruments / Methods used
				Dam Site Near Nagarkot (1668)	Tap Water Bhaktapur (1669)	
PHYSICAL						
Colour	Hazen	15	5 (15)	<5.0	10.0	2120 B, APHA, 21ST EDITION
Turbidity	NTU	5	5 (10)	<1.0	3.0	2130 B, APHA, 21ST EDITION
Conductivity	µS/cm	-	1500	26.0	51.0	2510 B, APHA, 21ST EDITION
pH	-	6.5 -	6.5-8.5*	6.5	6.9	4500-H^+ B, APHA, 21ST EDITION
Total Dissolved Solid	mg/l	1000	1000	13.0	26.0	2540 C., APHA, 21ST EDITION
Taste	TFN	-	Not Objectionable	N.O.	N.O.	2160. APHA, 21ST EDITION
Odor	TON	-	Not Objectionable	N.O.	N.O.	2160 B, APHA, 21ST EDITION
CHEMICAL						
Iron	mg/l	0.3	0.3 (3)	<0.01	0.24	3111 B, APHA, 21ST EDITION
Manganese	mg/l	0.4	0.2	0.05	0.08	3111 B. APHA, 21ST EDITION
Arsenic	mg/l	0.01	0.05	< 0.005	< 0.005	3114 C,APHA, 21ST EDITION
Cadmium	mg/l	0.003	0.003	<0.01	<0.01	3111 B., APHA, 21ST EDITION
Chromium	mg/l	0.05	0.05	<0.01	<0.01	3111 B. APHA, 21ST EDITION
Cyanide	mg/l	0.07	0.07	<0.05	<0.05	4500-CN E. APHA, 21ST EDITION
Lead	mg/l	0.01	0.01	<0.01	<0.01	3111 B. APHA, 21ST EDITION
Ammonia	mg/l	1.5	1.5	0.03	0.11	4500-NH_3 C., APHA, 17TH EDITION
Chloride	mg/l	250	250	2.0	3.0	4500-Cl^- B, APHA, 21ST EDITION
Sulfate	mg/l	-	250	<5.0	<5.0	4500-SO4. APHA, 21ST EDITION
Nitrate	mg/l	50	50	0.27	0.12	4500-NO3- B., APHA, 21ST EDITION
Copper	mg/l	2	1	<0.01	<0.01	3111 B., APHA, 21ST EDITION
Total Hardness	mg/l as $CaCO_3$	500	500	20.0	28.0	2340 C, APHA, 21ST EDITION
Calcium	mg/l	-	200	4.8	6.4	3500 - Ca B. APHA, 21ST EDITION

WHO GV: World Health Organization Guideline Value, 2006 Update, NDWQS: National Drinking Water Quality Standard, 2062 (Nepal),
* These values show lower and upper limits, () Values in the parenthesis refers the acceptable values only when alternative is not available.

Analyzed by

Checked by

Nepal Laboratory Accreditation Scheme

Authorized Signature

Note: 1. The result refer only to the parameters tested of the samples provided to our laboratory or collected by us for analysis as specified. Endorsement of the product is neither inferred nor implied.
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Fax No: 977-1-4479642

Laboratory, R & D on Total Water Management, Treatment & Consultancy

WATER ENGINEERING & TRAINING CENTER (P.) LTD. DILLIBAZAR 2048

LABORATORY ANALYSIS REPORT

Name of Sender: Hazama Ando Corporation
Sample No: 1668 - 1669/071/072
Date of Receipt: 14/01/2015
Sampled by : Client

Analyzed date : 14/01/2015 - 20/01/2015
No. of Samples: 02
Report: Part II of II

Parameters	Units	WHO GV	NDWQS	Result		Instruments / Methods used
				Dam Site Nagarkot 1668	Tap Water Bhaktapur 1669	
Zinc	mg/l	-	3	0.09	<0.01	3111 B., APHA, 21ST EDITION
Mercury	mg/l	0.001	0.001	<0.001	<0.001	3112 B., APHA, 21ST EDITION
Aluminium	mg/l	-	0.2	<0.01	0.03	3500-Al B. APHA, 21ST EDITION
Residual Chlorine	mg/l	0.5	0.1-0.2*	Nil	Nil	4500-Cl G. APHA, 21ST EDITION
Fluoride	mg/l	1.5	0.5-1.5*	0.43	0.77	4500F- D. APHA, 21ST EDITION
BIOLOGICAL						
Coliforms	CFU/100ml	Nil	Nil	70	Nil	9222 B, APHA, 21ST EDITION
E. Coli	CFU/100ml	Nil	Nil	34	Nil	9222 D., APHA, 21ST EDITION

Comment:
Sample 1668: Biologically unsatisfactory.
Sample 1669: Tested parameters are within NDWQS guideline value.

Analyzed by

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Nepal Laboratory Accreditation Scheme Accredited Laboratory

Authorized Signature

Note: 1. The result refer only to the parameters tested of the samples provided to our laboratory or collected by us for analysis as specified. Endorsement of the product is neither inferred nor implied.
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Tel : 977-1-4475674
Fax No: 977-1-4479642

Laboratory, R & D on Total Water Management, Treatment & Consultancy

LABORATORY ANALYSIS REPORT

Name of Sender: Hazama Ando Corporation / NJS Consultants JV — **Analyzed date : 16/01/2015- 20/01/2015**
Sample No: 1672 - 1673/071/072 — **No. of Samples: 02**
Date of Receipt: 16/01/2015 — **Report: Part I of II**
Sampled by : Client

Parameters	Units	WHO GV	NDWQS	Result		Instruments / Methods used
				Water Treatment Plant (WTP) Bansbari Bhaktapur (1672)	Thimi Reservoir, Bode (1673)	
PHYSICAL						
Colour	Hazen	15	5 (15)	10.0	5.0	2120 B, APHA, 21ST EDITION
Turbidity	NTU	5	5 (10)	1.0	<1.0	2130 B, APHA, 21ST EDITION
Conductivity	µS/cm	-	1500	56.0	120.0	2510 B, APHA, 21ST EDITION
pH	-	6.5 -	6.5-8.5*	7.1	6.5	4500-H^+ B, APHA, 21ST EDITION
Total Dissolved Solid	mg/l	1000	1000	28.0	60.0	2540 C., APHA, 21ST EDITION
Taste	TFN	-	Not Objectionable	N.O.	N.O.	2160. APHA, 21ST EDITION
Odor	TON	-	Not Objectionable	N.O.	N.O.	2160 B, APHA, 21ST EDITION
CHEMICAL						
Iron	mg/l	0.3	0.3 (3)	0.24	0.06	3111 B, APHA, 21ST EDITION
Manganese	mg/l	0.4	0.2	0.04	<0.001	3111 B. APHA, 21ST EDITION
Arsenic	mg/l	0.01	0.05	< 0.005	< 0.005	3114 C,APHA, 21ST EDITION
Cadmium	mg/l	0.003	0.003	<0.01	<0.01	3111 B., APHA, 21ST EDITION
Chromium	mg/l	0.05	0.05	<0.01	<0.01	3111 B. APHA, 21ST EDITION
Cyanide	mg/l	0.07	0.07	<0.05	<0.05	4500-CN E. APHA, 21ST EDITION
Lead	mg/l	0.01	0.01	<0.01	<0.01	3111 B. APHA, 21ST EDITION
Ammonia	mg/l	1.5	1.5	0.16	1.7	4500-NH_3 C., APHA, 17TH EDITION
Chloride	mg/l	250	250	5.0	5.9	4500-Cl^- B, APHA, 21ST EDITION
Sulfate	mg/l	-	250	<5.0	<5.0	4500-SO4. APHA, 21ST EDITION
Nitrate	mg/l	50	50	0.04	3.8	4500-NO3- B., APHA, 21ST EDITION
Copper	mg/l	2	1	<0.01	<0.01	3111 B., APHA, 21ST EDITION
Total Hardness	mg/l as $CaCO_3$	500	500	30.0	44.0	2340 C, APHA, 21ST EDITION
Calcium	mg/l	-	200	8.8	12.0	3500 - Ca B. APHA, 21ST EDITION

WHO GV: World Health Organization Guideline Value, 2006 Update, NDWQS: National Drinking Water Quality Standard, 2062 (Nepal),
* These values show lower and upper limits, () Values in the parenthesis refers the acceptable values only when alternative is not available.

Analyzed by

Checked by

Authorized Signature

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Nepal Laboratory Accreditation Scheme — Accredited Laboratory No. 08/065-66

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Water

Engineering & Training Centre (P.) Ltd.

Tel : 977-1-4475674
Fax No: 977-1-4479642

Laboratory, R & D on Total Water Management, Treatment & Consultancy

WATER ENGINEERING & TRAINING CENTER (P.) LTD. DILLIBAZAR 2048

LABORATORY ANALYSIS REPORT

Name of Sender: Hazama Ando Corporation / NJS consultants JV
Sample No: 1672 - 1673/071/072
Date of Receipt: 15/01/2015
Sampled by : Client

Analyzed date : 15/01/2015 - 20/01/2015
No. of Samples: 02
Report: Part II of II

Parameters	Units	WHO GV	NDWQS	Result		Instruments / Methods used
				Water Treatment Plant (WTP) Bansbari Bhaktapur (1672)	Thimi Reservoir, Bode (1673)	
Zinc	mg/l	-	3	0.01	0.02	3111 B., APHA, 21ST EDITION
Mercury	mg/l	0.001	0.001	<0.001	<0.001	3112 B., APHA, 21ST EDITION
Aluminium	mg/l	-	0.2	0.03	0.10	3500-Al B. APHA, 21ST EDITION
Residual Chlorine	mg/l	0.5	0.1-0.2*	Nil	Nil	4500-Cl G. APHA, 21ST EDITION
Fluoride	mg/l	1.5	0.5-1.5*	0.73	0.89	4500F- D. APHA, 21ST EDITION
BIOLOGICAL						
Coliforms	CFU/100ml	Nil	Nil	Nil	Nil	9222 B, APHA, 21ST EDITION
E. Coli	CFU/100ml	Nil	Nil	Nil	Nil	9222 D., APHA, 21ST EDITION

Comments:

Sample 1672: All the tested parameters are within the NDWQS guideline value.

Sample 1673: Ammonia content exceeded the NDWQS guideline value.

Nepal Laboratory Accreditation Scheme — Accredited Laboratory No. 08/065-66

Analyzed by *Checked by* *Authorized Signature*

Note: 1. The result refer only to the parameters tested of the samples provided to our laboratory or collected by us for analysis as specified. Endorsement of the product is neither inferred nor implied.
2. Any duplication of this report can not be used as evidence in the court of law and should not be used in any advertising media without prior written permission to us.
3. The total liability of our company for the product is limited to the invoiced amount only.

VAT/PAN No.: 300124309
Regd. No. 5180/052/053

"Training For Success"

Water

Engineering & Training Centre (P.) Ltd.

Tel : 977-1-4475674
Fax No: 977-1-4479642

Laboratory, R & D on Total Water Management, Treatment & Consultancy

LABORATORY ANALYSIS REPORT

Name of Sender: Hazama Ando Corporation / NJS Consultants JV — **Analyzed date : 16/01/2015- 20/01/2015**
Sample No: 1675 - 1676/071/072 — **No. of Samples: 02**
Date of Receipt: 16/01/2015 — **Report: Part I of II**
Sampled by : Client

Parameters	Units	WHO GV	NDWQS	Result		Instruments / Methods used
				Tap Water Bansbari, Bhaktapur Maha-Laxmisthan (1675)	Tap Water (Bode Salaghari) (1676)	
PHYSICAL						
Colour	Hazen	15	5 (15)	10.0	<5.0	2120 B, APHA, 21ST EDITION
Turbidity	NTU	5	5 (10)	2.0	<1.0	2130 B, APHA, 21ST EDITION
Conductivity	µS/cm	-	1500	53.0	125.0	2510 B, APHA, 21ST EDITION
pH	-	6.5 -	6.5-8.5*	6.9	6.5	4500-H^+ B, APHA, 21ST EDITION
Total Dissolved Solid	mg/l	1000	1000	29.0	70.0	2540 C., APHA, 21ST EDITION
Taste	TFN	-	Not Objectionable	N.O.	N.O.	2160. APHA, 21ST EDITION
Odor	TON	-	Not Objectionable	N.O.	N.O.	2160 B, APHA, 21ST EDITION
CHEMICAL						
Iron	mg/l	0.3	0.3 (3)	0.22	0.07	3111 B, APHA, 21ST EDITION
Manganese	mg/l	0.4	0.2	<0.01	0.12	3111 B. APHA, 21ST EDITION
Arsenic	mg/l	0.01	0.05	< 0.005	< 0.005	3114 C,APHA, 21ST EDITION
Cadmium	mg/l	0.003	0.003	<0.01	<0.01	3111 B., APHA, 21ST EDITION
Chromium	mg/l	0.05	0.05	0.01	<0.01	3111 B. APHA, 21ST EDITION
Cyanide	mg/l	0.07	0.07	<0.05	<0.05	4500-CN E. APHA, 21ST EDITION
Lead	mg/l	0.01	0.01	<0.01	<0.01	3111 B. APHA, 21ST EDITION
Ammonia	mg/l	1.5	1.5	0.03	1.2	4500-NH_3 C., APHA, 17TH EDITION
Chloride	mg/l	250	250	3.0	5.9	4500-Cl^- B, APHA, 21ST EDITION
Sulfate	mg/l	-	250	<5.0	<5.0	4500-SO4. APHA, 21ST EDITION
Nitrate	mg/l	50	50	1.6	37.5	4500-NO3- B., APHA, 21ST EDITION
Copper	mg/l	2	1	<0.01	<0.01	3111 B., APHA, 21ST EDITION
Total Hardness	mg/l as $CaCO_3$	500	500	32.0	50.0	2340 C, APHA, 21ST EDITION
Calcium	mg/l	-	200	8.0	13.6	3500 - Ca B. APHA, 21ST EDITION

WHO GV: World Health Organization Guideline Value, 2006 Update, NDWQS: National Drinking Water Quality Standard, 2062 (Nepal),
* These values show lower and upper limits, () Values in the parenthesis refers the acceptable values only when alternative is not available.

Analyzed by *Checked by* *Authorized Signature*

Nepal Laboratory Accreditation Scheme

Note: 1. The result refer only to the parameters tested of the samples provided to our laboratory or collected by us for analysis as specified. Endorsement of the product is neither inferred nor implied.
2. Any duplication of this report can not be used as evidence in the court of law and should not be used in any advertising media without prior written permission to us.
3. The total liability of our company for the product is limited to the invoiced amount only.

VAT/PAN No.: 300124309
Regd. No. 5180/052/053

"Training For Success"

Water

SAVE WATER

Engineering & Training Centre (P.) Ltd.

Laboratory, R & D on Total Water Management, Treatment & Consultancy

Tel : 977-1-4475674
Fax No: 977-1-4479642

WATER ENGINEERING & TRAINING CENTER (P.) LTD. DILLIBAZAR 2048

LABORATORY ANALYSIS REPORT

Name of Sender: Hazama Ando Corporation
Sample No: 1675 - 1676/071/072
Date of Receipt: 16/01/2015
Sampled by : Client

Analyzed date : 16/01/2015 - 20/01/2015
No. of Samples: 02
Report: Part II of II

Parameters	Units	WHO GV	NDWQS	Result		Instruments / Methods used
				Tap Water Bansbari, Bhaktapur Maha-Laxmisthan (1675)	Tap Water Bode Salaghari (1676)	
Zinc	mg/l	-	3	0.01	0.02	3111 B., APHA, 21ST EDITION
Mercury	mg/l	0.001	0.001	<0.001	<0.001	3112 B., APHA, 21ST EDITION
Aluminium	mg/l	-	0.2	0.04	0.12	3500-Al B. APHA, 21ST EDITION
Residual Chlorine	mg/l	0.5	0.1-0.2*	Nil	Nil	4500-Cl G. APHA, 21ST EDITION
Fluoride	mg/l	1.5	0.5-1.5*	0.79	0.86	4500F- D. APHA, 21ST EDITION
BIOLOGICAL						
Coliforms	CFU/100ml	Nil	Nil	Nil	Nil	9222 B, APHA, 21ST EDITION
E. Coli	CFU/100ml	Nil	Nil	Nil	Nil	9222 D., APHA, 21ST EDITION

Comment:

Sample 1675: Tested parameters in the sample water are within NDWQS guideline value.

Sample 1676: Tested parameters in the sample water are within NDWQS guideline value.

Nepal Laboratory Accreditation Scheme Accredited Laboratory No. NAMSS-66

Analyzed by

Checked by

Authorized Signature

Note: 1. The result refer only to the parameters tested of the samples provided to our laboratory or collected by us for analysis as specified. Endorsement of the product is neither inferred nor implied.
2. Any duplication of this report can not be used as evidence in the court of law and should not be used in any advertising media without prior written permission to us.
3. The total liability of our company for the product is limited to the invoiced amount only.

KATHMANDU UPATYAKA KHANEPANI LIMITED
Water Quality Section
Sundarimat, Kirtipur

Ph: 4332089

Report on Chemical Analysis of Water

Name : .....

Source : D.M. WATER

Location : .....

Date of Sample Receipt : 2071-10-2 / 16 JAN 2015

Date of Sample Analysis : " 144 M

Lab No. .....

S.N	Parameters	Unit	Result	Maximum Concentration Limits NDWQS
1.	Appearance	-	Clear	-
2.	Turbidity	NTU	<5	5(10)
3.	Colour	TCU	<5	5(15)
4	Temperature	°c	12°c	-
5	P^H	-	6.9	6.5-8.5*
6	Electrical Conductivity	µs/cm	45.0	1500
7	Total Alkalinity	mg/l	20.0	-
8	P.P.H. alkalinity	mg/l	Nil	-
9	Total Hardness	mg/l as $CaCO_3$	10.0	500
10	Calcium Hardness	mg/l	6.0	-
11	Magnesium Hardness	mg/l	4.0	-
12	Calcium	mg/l	2.4	200
13	Magnesium	mg/l	0.97	-
14	Total Iron	mg/l	0.1	0.3 (3)
15	Chloride	mg/l	3.8	250
16	Total Ammonia	mg/l	0.02	1.5

Comments:

Remarks :
1. This report is based on the sample submitted to this laboratory.
2. (NDWQS) National Drinking water Quality standard - 2062.
3. * This value shows lower and upper limits.
4. ( )When there is no alternative the values kept under parenthesis will apply.

Analyst 071-10-4

Water Quality Section

Chief
Water Quality Section
Date : 18th Jan. 2015

KATHMANDU UPATYAKA KHANEPANI LIMITED
Water Quality Section
Sundarighat, Kirtipur

Ph: 4332089

Report on Chemical Analysis of Water

Name : .....

Source : TAP WATER

Location : .....

Date of Sample Receipt : 071-10-2 / 16 JAN 2015

Date of Sample Analysis : " 145 M

Lab No. .....

S.N	Parameters	Unit	Result	Maximum Concentration Limits NDWQS
1.	Appearance	-	Clear	-
2.	Turbidity	NTU	<5	5(10)
3.	Colour	TCU	<5	5(15)
4	Temperature	°c	12°c	-
5	PH	-	7.1	6.5-8.5*
6	Electrical Conductivity	µs/cm	72.0	1500
7	Total Alkalinity	mg/l	32.0	-
8	P.P.H. alkalinity	mg/l	Nil	-
9	Total Hardness	mg/l as $CaCO_3$	26.0	500
10	Calcium Hardness	mg/l	16.0	-
11	Magnesium Hardness	mg/l	10.0	-
12	Calcium	mg/l	6.4	200
13	Magnesium	mg/l	2.4	-
14	Total Iron	mg/l	0.3	0.3 (3)
15	Chloride	mg/l	5.7	250
16	Total Ammonia	mg/l	0.02	1.5

Comments:

Remarks :
1. This report is based on the sample submitted to this laboratory.
2. (NDWQS) National Drinking water Quality standard - 2062.
3. * This value shows lower and upper limits.
4. ( )When there is no alternative the values kept under parenthesis will apply.

Analyst: 071-10-4

Water Quality Section

Chief
Water Quality Section
Date : 18th Jan, 2015

KATHMANDU UPATYAKA KHANEPANI LIMITED
Water Quality Section
Sundarighat, Kirtipur

Ph: 4332089

Report on Chemical Analysis of Water

Name : .....

Source : WTP- 1/15

Location : .....

Date of Sample Receipt : 071-10-2 / 16 JAN 2015

Date of Sample Analysis : " "

Lab No. 146 M

S.N	Parameters	Unit	Result	Maximum Concentration Limits NDWQS
1.	Appearance	-	Clear	-
2.	Turbidity	NTU	5.0	5(10)
3.	Colour	TCU	<5	5(15)
4	Temperature	°c	12°c	-
5	PH	-	7.3	6.5-8.5*
6	Electrical Conductivity	µs/cm	79.0	1500
7	Total Alkalinity	mg/l	34.0	-
8	P.P.H. alkalinity	mg/l	Nil	-
9	Total Hardness	mg/l as $CaCO_3$	30.0	500
10	Calcium Hardness	mg/l	20.0	-
11	Magnesium Hardness	mg/l	10.0	-
12	Calcium	mg/l	8.0	200
13	Magnesium	mg/l	2.4	-
14	Total Iron	mg/l	0.5	0.3 (3)
15	Chloride	mg/l	5.7	250
16	Total Ammonia	mg/l	0.02	1.5

Comments:

Remarks :
1. This report is based on the sample submitted to this laboratory.
2. (NDWQS) National Drinking water Quality standard - 2062.
3. * This value shows lower and upper limits.
4. ( )When there is no alternative the values kept under parenthesis will apply.

Analyst 071-10-4
Water Quality Section

Chief
Water Quality Section
Date : 18th Jan. 2015

KATHMANDU UPATYAKA KHANEPANI LIMITED

Water Quality Section

Sundarighat, Kirtipur

Ph: 4332089

Report on Chemical Analysis of Water

Name : .....

Source : THIMI RESERVOIR - 1/15

Location : .....

Date of Sample Receipt : 071-10-2 / 16 JAN 2015

Date of Sample Analysis : " 14 " JAN

Lab No. 147 M

S.N	Parameters	Unit	Result	Maximum Concentration Limits NDWQS
1.	Appearance	-	Clear	-
2.	Turbidity	NTU	<5	5(10)
3.	Colour	TCU	<5	5(15)
4	Temperature	°C	12°C	-
5	PH	-	6.8	6.5-8.5*
6	Electrical Conductivity	µs/cm	151.0	1500
7	Total Alkalinity	mg/l	64.0	-
8	P.P.H. alkalinity	mg/l	Nil	-
9	Total Hardness	mg/l as $CaCO_3$	50.0	500
10	Calcium Hardness	mg/l	30.0	-
11	Magnesium Hardness	mg/l	20.0	-
12	Calcium	mg/l	12.0	200
13	Magnesium	mg/l	4.8	-
14	Total Iron	mg/l	0.3	0.3 (3)
15	Chloride	mg/l	11.5	250
16	Total Ammonia	mg/l	1.8	1.5

Comments:

Remarks :
1. This report is based on the sample submitted to this laboratory.
2. (NDWQS) National Drinking water Quality standard - 2062.
3. *This value shows lower and upper limits.
4. ( )When there is no alternative the values kept under parenthesis will apply.

Analyst 071-10-4

Plant Officer

Water Quality Section

Chief

Water Quality Section

Date : 16 Jan 2015

KATHMANDU UPATYAKA KHANEPANI LIMITED
Water Quality Section
Sundarighat, Kirtipur

Ph: 4332089

Report on Chemical Analysis of Water

Name : TAP WATER

Source : KHARIPATI

Location : 071-10-4 / 18 JAN 2015

Date of Sample Receipt : "

Date of Sample Analysis : 148 M

Lab No.

S.N	Parameters	Unit	Result	Maximum Concentration Limits NDWQS
1.	Appearance	-	Clear	-
2.	Turbidity	NTU	<5	5(10)
3.	Colour	TCU	<5	5(15)
4	Temperature	°c	13°c	-
5	PH	-	7.2	6.5-8.5*
6	Electrical Conductivity	µs/cm	80.0	1500
7	Total Alkalinity	mg/l	32.0	-
8	P.P.H. alkalinity	mg/l	Nil	-
9	Total Hardness	mg/l as $CaCO_3$	28.0	500
10	Calcium Hardness	mg/l	18.0	-
11	Magnesium Hardness	mg/l	10.0	-
12	Calcium	mg/l	7.2	200
13	Magnesium	mg/l	2.4	-
14	Total Iron	mg/l	0.3	0.3 (3)
15	Chloride	mg/l	7.6	250
16	Total Ammonia	mg/l	0.02	1.5

Comments:

Remarks :
1. This report is based on the sample submitted to this laboratory.
2. (NDWQS) National Drinking water Quality standard - 2062.
3. * This value shows lower and upper limits.
4. ( )When there is no alternative the values kept under parenthesis will apply.

Analyst
Water Quality Section

Chief
Water Quality Section
Date : 18th Jan. 2015

KATHMANDU UPATYAKA KHANEPANI LIMITED
Water Quality Section
Sundarighat, Kirtipur

Ph: 4332089

Report on Chemical Analysis of Water

Name : .....

Source : TAP WATER

Location : SALLAGHARI - BODE WATER

Date of Sample Receipt : 071-10-4 / 18 JAN 2015

Date of Sample Analysis : " 19 M

Lab No. .....

S.N	Parameters	Unit	Result	Maximum Concentration Limits NDWQS
1.	Appearance	-	Clear	-
2.	Turbidity	NTU	<5	5(10)
3.	Colour	TCU	<5	5(15)
4	Temperature	°c	13°c	-
5	PH	-	6.7	6.5-8.5*
6	Electrical Conductivity	µs/cm	162.0	1500
7	Total Alkalinity	mg/l	66.0	-
8	P.P.H. alkalinity	mg/l	Nil	-
9	Total Hardness	mg/l as $CaCO_3$	50.0	500
10	Calcium Hardness	mg/l	30.0	-
11	Magnesium Hardness	mg/l	20.0	-
12	Calcium	mg/l	12.0	200
13	Magnesium	mg/l	4.8	-
14	Total Iron	mg/l	0.5	0.3 (3)
15	Chloride	mg/l	13.4	250
16	Total Ammonia	mg/l	2.0	1.5

Comments:

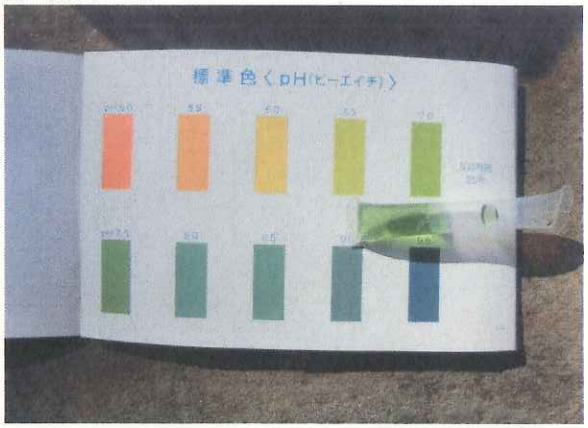
Remarks :
1. This report is based on the sample submitted to this laboratory.
2. (NDWQS) National Drinking water Quality standard - 2062.
3. * This value shows lower and upper limits.
4. ( )When there is no alternative the values kept under parenthesis will apply.

Analyst
Water Quality Section

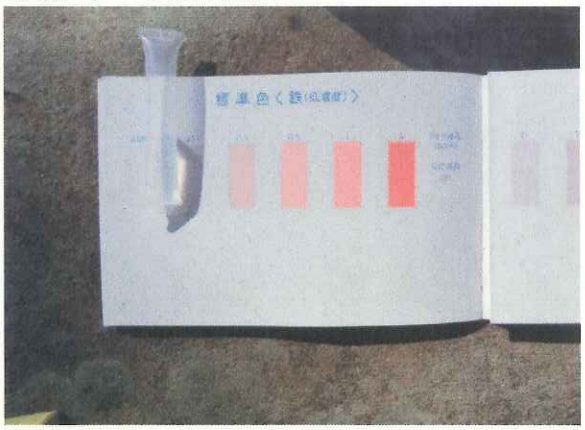
Chief
Water Quality Section
Date 19 Jan 2015

Location : Proposed Dam Site 2　　Date:　January 14, 2015

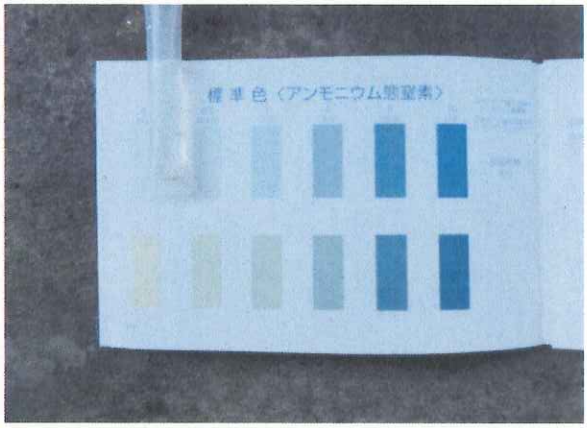
① pH :　7



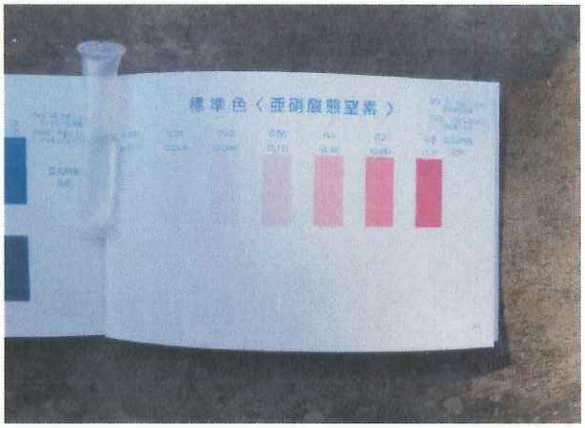
② 鉄 :　< 0.05 mg/L



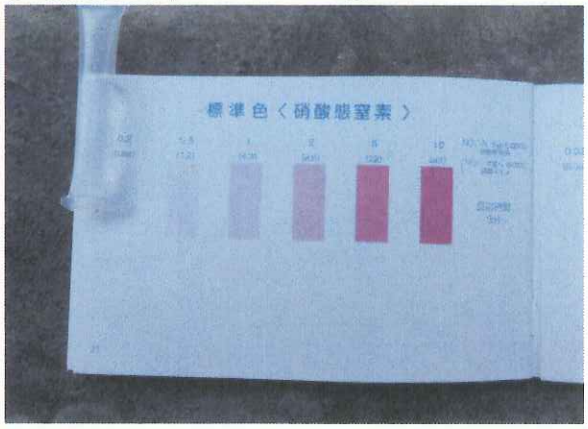
③ アンモニウム態窒素 :　< 0.2 mg/L



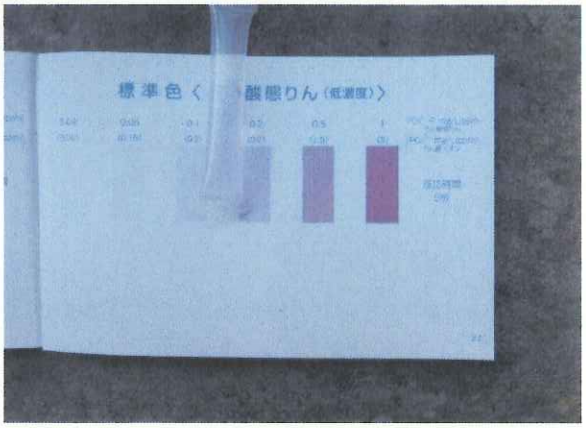
④ 亜硝酸態窒素 :　< 0.005 mg/L



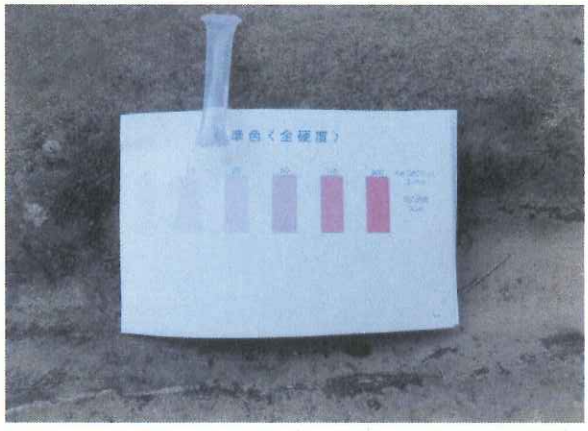
⑤ 硝酸態窒素 :　< 0.2 mg/L



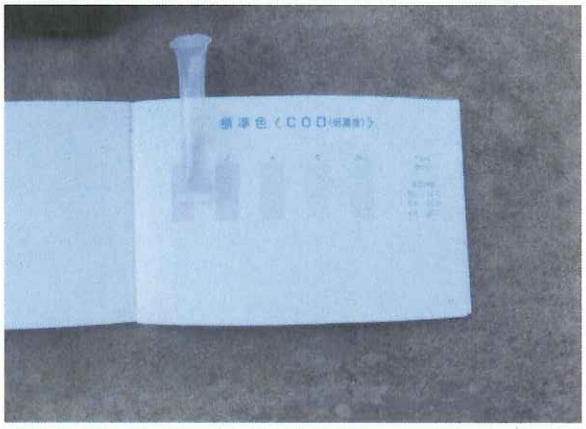
⑥ りん酸態りん :　0.1 mg/L



⑦ 全硬度 :　20 mg/L

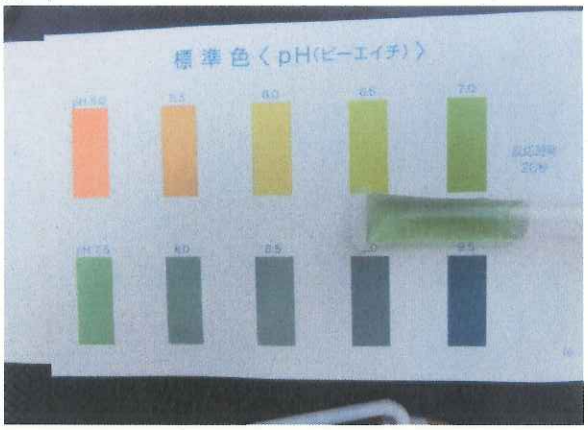


⑧ COD :　2 mg/L



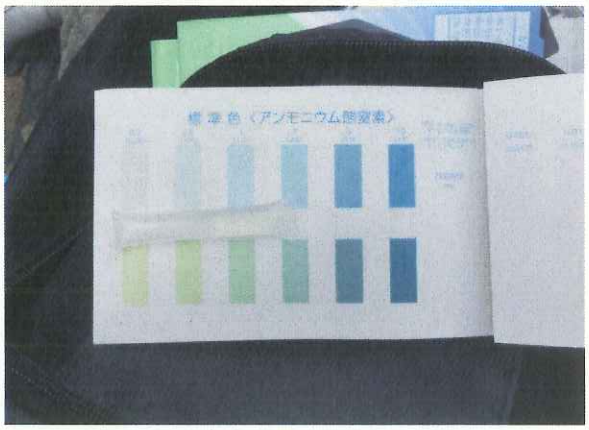
Location : Existing Intake Site　　Date: January 14, 2015

① pH : 7

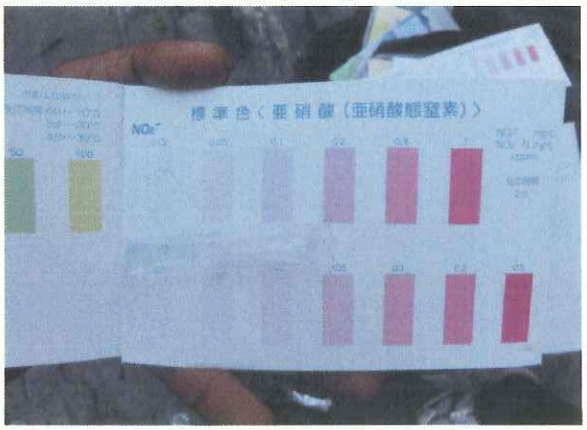


② 鉄 : 〈0.05 mg/L

③ アンモニウム態窒素 : 〈0.2 mg/L

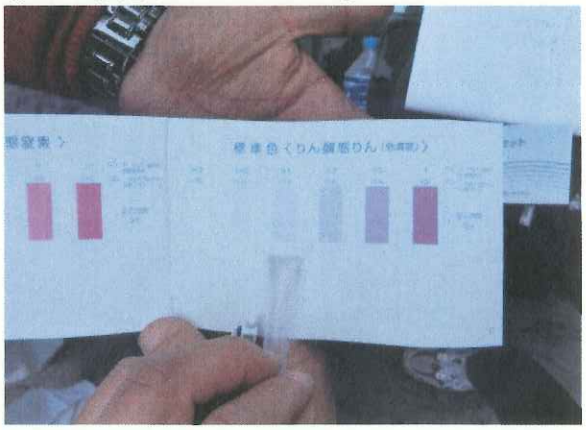


④ 亜硝酸態窒素 : 〈0.005 mg/L

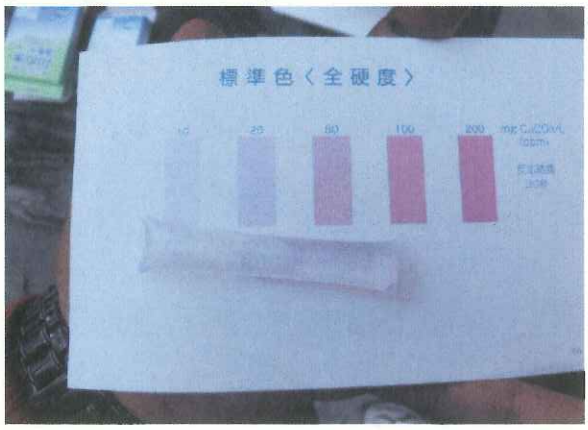


⑤ 硝酸態窒素 : 〈0.2 mg/L

⑥ りん酸態りん : 0.1 mg/L



⑦ 全硬度 : 20 mg/L

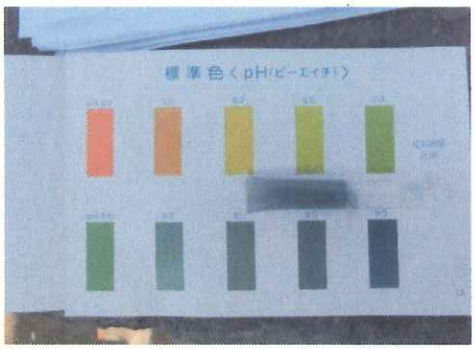


⑧ COD : 0-5 mg/L

c

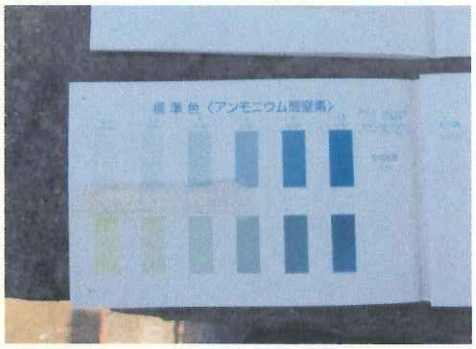
Location: Bansbari WTP　　Date: January 15, 2015

① pH :　9

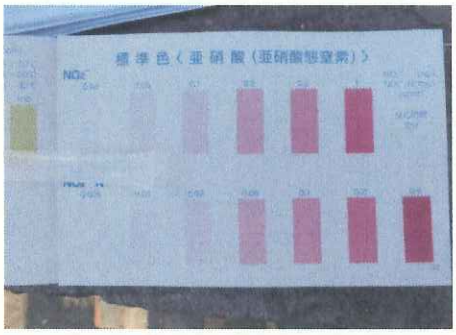


② 鉄 :　< 0.0 5mg/L

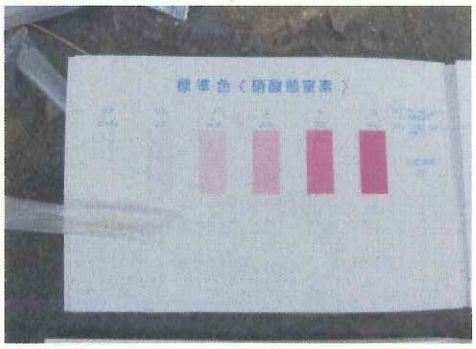
③ アンモニウム態窒素 :　< 0.2 mg/L



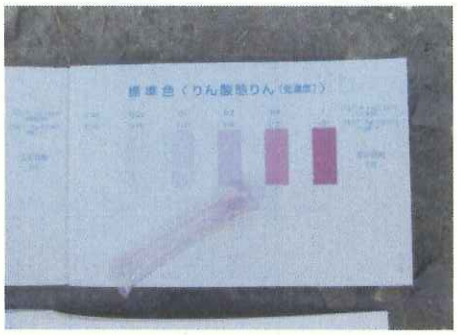
④ 亜硝酸態窒素 :　< 0.005 mg/L



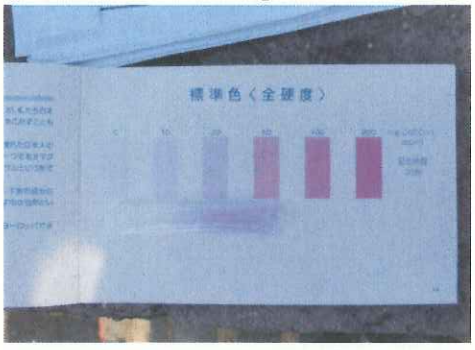
⑤ 硝酸態窒素 :　< 0.2 mg/L



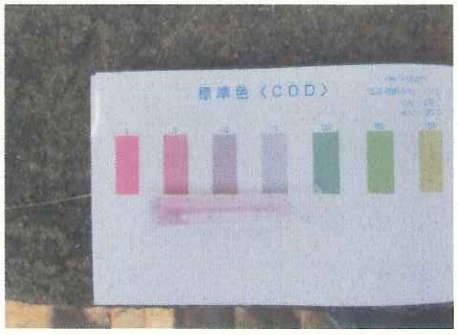
⑥ りん酸態りん :　< 0.2 mg/L



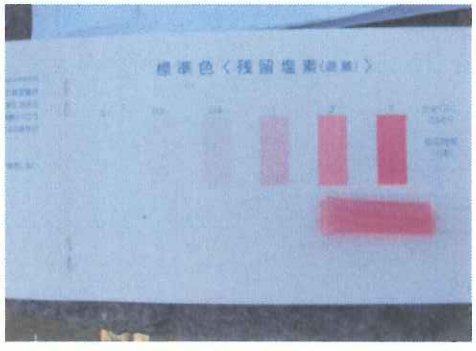
⑦ 全硬度 :　20 mg/L



⑧ COD :　5 mg/L

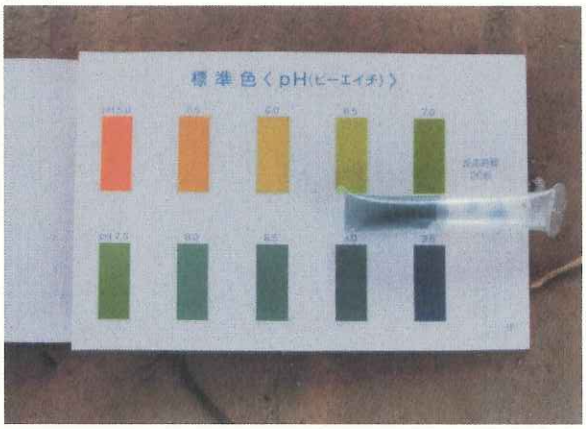


⑦ 残留塩素 :　5 mg/L

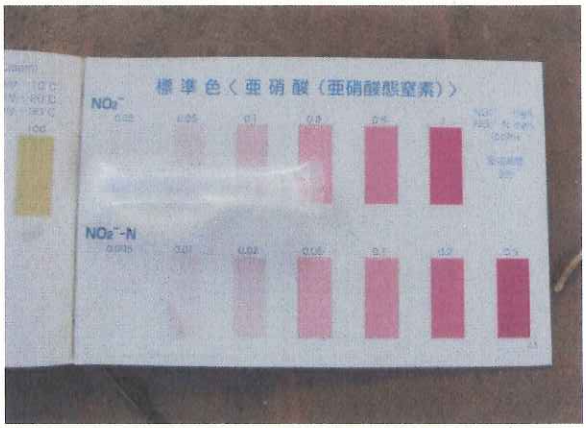


Location: **Tap Water near Transmission**　　Date: Janary 15, 2015

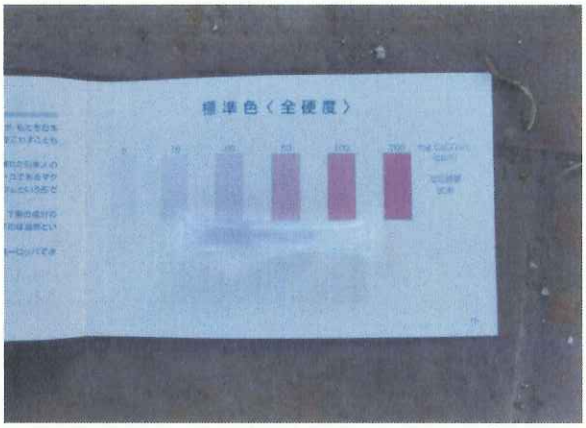
① pH :　9



② 亜硝酸態窒素 :　< 0.005 mg/L

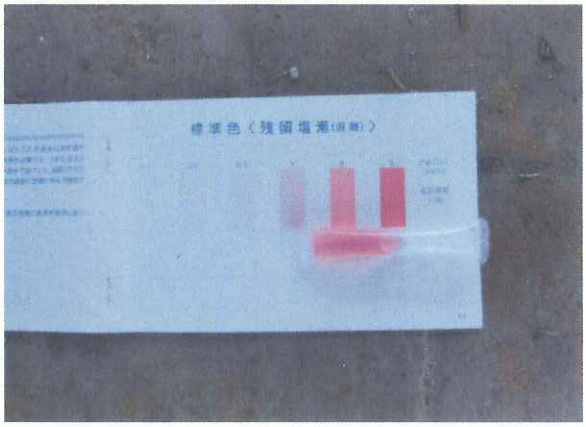


③ 全硬度 :　20 mg/L



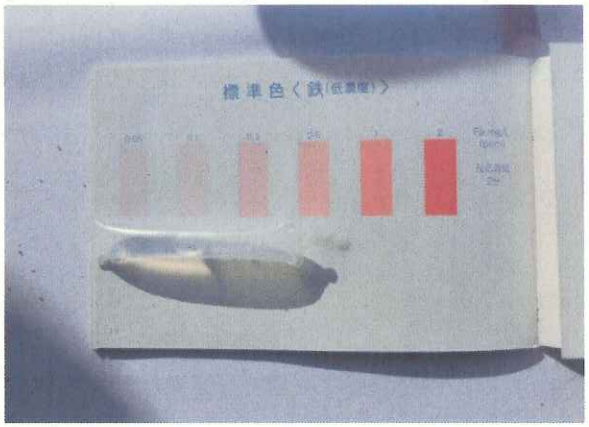
④ COD :　5 mg/L

⑤ 残留塩素 :　2 mg/L

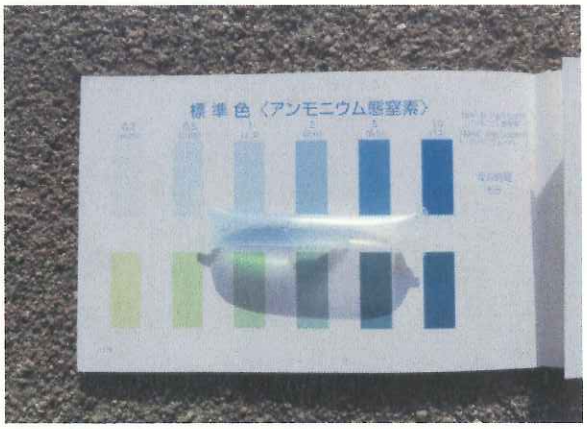


Location: Timi Reservoir　　Date: Janary 15, 2015

① 鉄 ： ＜0.05 mg/L

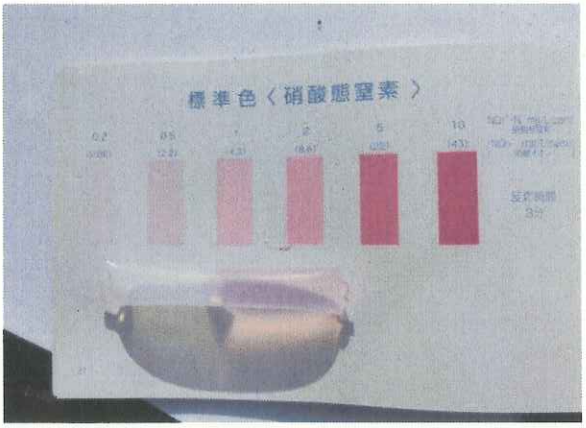


② アンモニウム態窒素 ： 1.0 mg/L



③ 亜硝酸態窒素 ： ＜0.005 mg/L

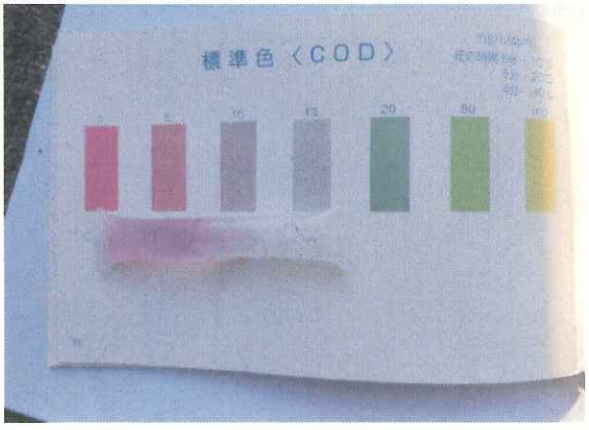
④ 硝酸態窒素 ： 0.5 mg/L



⑤ りん酸態りん ： 0.1 mg/L

⑥ 全硬度 ： 20 mg/L

⑦ COD ： 5 mg/L



⑧ 残留塩素 ： ＜0.1 mg/L

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