Contents

Annex

CHAPTER I
INTRODUCTION

1.1 GENERAL BACKGROUND

Access to safe drinking water supply and sanitation services is fundamental to improving public health and meeting national poverty reduction objectives. As is now widely recognized, lack of access to these essential basic services contributes substantially to the high burden of disease that needlessly foreshortens and impairs the lives of far too many of Nepal's citizens. According to 2002 statistics, about 30 % of the total population of the country still needs to be provided with safe water. Incidence of diseases caused by unsafe water, poor sanitation and lack of personal hygiene, are visible in the people's health profile. Improvement of health requires continuous delivery of safe water, which necessitates that the scheme be properly operated and maintained. The performance of a scheme becomes effective when the users are involved in its management.

The Department of Water Supply and Sewerage (DWSS), established in 1972, is the lead agency for the drinking water supply and sanitation sector of Nepal. It is working towards achieving the sector objective of Government of Nepal which is to achieve 'sustained improvement in health status and productivity for Nepalese people as a whole with particular emphasis on lower income group through the provision of adequate, locally sustainable water supply and sanitation facilities in association with improved personal, household and community hygiene behaviour'.

In line with achieving the above sector objective, Government Nepal has set the goal of providing all the Nepalese people access to drinking water supply and sanitation facilities by the year 2017. This goal has also been acknowledged by the interim constitution of Nepal, by defining access to water as a fundamental right to its citizens.

DWSS programs are now being implemented to provide basic water supply and sanitation access, improved service levels in water supply as defined by the National Urban Water Supply and Sanitation Policy 2009, mitigating climate change effects in water supply and sanitation service delivery, regulation and bench marking of water utilities across the country as well as mass scale promotion of sanitation activities to achieve a complete Open Defecation Free status for the country by 2017 according to the provisions of the National Sanitation Master Plan 2011. DWSS is committed to provide highly professional water and sanitation services that is both efficient and consumer responsive. To achieve the targets mentioned above, DWSS has set forth and adopted some broad objectives such as:

- Provide and ensure safe, convenient and adequate water supply to all Nepalese, with sanitation as an integral component, and with specific focus on disadvantaged groups;
- Reduce the incidence of water-related dieses prevalent in the country; and
- Reduce suffering and drudgery of women and children, traditionally responsible for collecting water and domestic sanitation and hygiene.

(Source: Rural Water Supply and Sanitation Sector policy, 2004)

1.2 OBJECTIVES OF THE PROJECT

The main objective of this study is to support interested potential and qualified user associations/ communities for improvement in the living standard of the people by providing safe, reliable, adequate and sustainable water supply and sanitation services on fast track basis. This project aims to provide improved service level from conventional basic level of service in response to the changes in the living style of the people, on demand and cost sharing basis with cost recovery principle at least to user's side contribution.

Further, this project has following additional objectives:

- Support Water User and Sanitation Association (WUSA) of the selected project to operate and maintain the project on commercial and sustainable manner by enhancing their knowledge, skills, capacity and efficiency.
- Support and involve WUSA and private sector to create enabling environment and opportunities for extension of service area and improve service level in water supply and sanitation sector.
- To raise awareness and trigger the users towards the importance of water quality and sanitation on healthy life.
- To support implementation of Water Safety Plan to meet water quality standards.

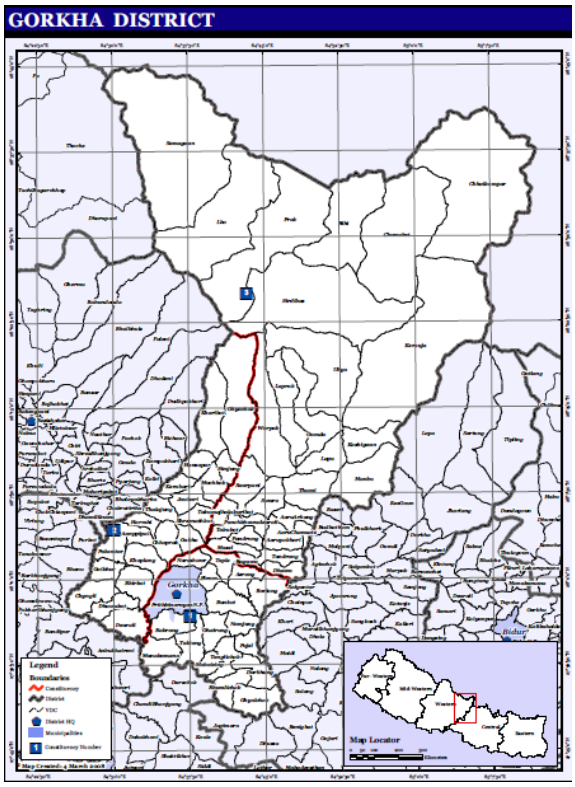
1.3 OBJECTIVES OF THE STUDY

The overall objective of the study is to formulate technically feasible, economically viable, socially acceptable and environmental friendly water supply and sanitation project. Specific objectives are to ascertain population and coverage area, project cost, community contribution, detailed construction works and O&M requirements. Major scope of works is as follows:

- Assessment of existing water supply and sanitation in the area
- Review relevant documents, policies, past projects in the area
- Carry out detailed engineering and socio-economic survey and prepare cost estimate
- Verification of source yield, water quality, intake site, reservoir site, pipe alignment, household numbers
- Assessment of community enthusiasm and affordability to contribute in cash and labor for construction and O&M
- Recommend proper hygiene at personal, household and community level
- Prepare required TOR to carry out Initial
- Environmental Examination (IEE)
- Recommend appropriate Climate Change and Disaster Risk Response Program within the project area

1.4 LOCATION

Gorkha district lies in Gandaki zone and Gorkha Bazaar municipality is the district head-quarter. It lies in the southern part of Gorkha district and is surrounded by Chhoprak, Gakhu, VDC in the north; Deurali, Bakrang, Taklung, Ghairung VDC in the south; Taple, Bunkot VDC in the east; Khoplang, Bhirkot VDC in the west.



1.5 CLIMATE

The climate of the project area is sub-tropical. There are no rain gauge station and climatological station in the project area. The temperature ranges from 8.6 degree to 31° C.

1.6 SERVICE AREA PROFILE

The service area Daraudi Gorkha (Gorkha Brihat Pumping) water supply and sanitation project covers the area of ward no 1-8, 12, 14 and 15 of Gorkha Municipality.

As per the population census 2068 BS (2011AD), the population under Gorkha Municipality is 39172 in total. Out of this 21545 are male and 17627 are female. The annual growth rate of Gorkha District is 1.32% per annum.

The present population in the proposed service area is 16295 in 3259 HHs. The permanent population of the project at the end of design period of 17 years (2 year construction + 15 years project life) is projected as 20826 with annual growth rate 1.32%. The population growth rate percentage is determined based upon population census 2011 AD of the Gorkha district.

1.7 SETTLEMENT PATTERN

Settlement pattern in the service area is heterogeneous. Some areas are settled with houses grouped together and attached with other houses like in urban settlement. This is so with Gorkha main bazzar. The villages newarhatiya, pipal thok, manepani, bindabasini ratmate,kuwapani, have more or less village like settlement with scattered houses far from one another. Mandre dhunga, nareswor, swara, thingure swara, gariri kuwa,Ghalang, Kattel danda and amdanda have group together but not attached with other house. Nareswor, Mandre dhunga, phinam is recently merged in gorkha municipality.

The rate of migration in to the service area from the surroundings and other districts is increasing during last few years.

1.8 MAJOR COMPONENTS

The Daraudi Gorkha (Gorkha Brihat Pumping) water supply project has been formulated to supply required quantity of water to gorkha bazzar and other nearest village which was merged with Gorkha Municipality. The project shall comprise three major components. The first and the most important component shall be the water supply system itself. Similarly installation of sump well could be second and treatment plant could be the third important component of this project. However there are other components such as sanitation facility development for the locals are also equally important for the successful completion of this project.

1.9 INSTITUTIONAL ARRANGEMENT

For the preparation, implementation and operation and maintenance of the project following institutional arrangement shall be made.

1.9.1 ESTABLISHING PROJECT OFFICE

The local division office of DWSS, will be the project office for this project.

1.9.2 WUSC

The project has been conceptualized on community based approach. Community are ready for ~~sharign~~sharing the cost as needed by project. They will also be responsible for operation and management of the system. So their active involvement in the decision making regarding project preparation, implementation and operation and maintenance has to be ensured. In view of this, they will be represented in project related activities by the WUSC. The WUSC will take necessary decision on behalf of the consumers, will mobilize necessary fund and assist DWSS DO in the project implementation and will make all arrangement for the operation and maintenance of the project after its completion.

1.10 ENGINEERING DESIGN

The DWSS DO has recruited Multiscope Consulting Pvt. Ltd., Kathmandu for the preparation of Detailed Engineering survey, Design and study report

As per the terms of reference Issued by DWSS DO Gorkha, the major components of the scope of the consulting services were as follows:

- Determination of water demand of the project area
- Design of required structures/components at the source
- Design of service reservoirs and collection chambers
- Design of a treatment plant
- Transmission mains alignment and design
- Analysis of distribution system and design
- Design of Electrical and Mechanical systems
- Location of major structures/components and community stand posts
- Design/determination of system appurtenances (valves, washouts, flow meters, crossings, etc.)
- Environmental Compliance Measures
- Operation and Maintenance (O&M) Plans

1.10.1 ORGANISATION OF THE STUDY TEAM

The Multiscope Consulting Pvt. Ltd. had mobilised a team of the following experts for the detailed engineering design of the project.

Table 1.1: Composition of Study Team

SN	Name	Designation
1	Laxman K.C	Project Coordinator
2	Krishna Mani Lamichhane	Team Leader
3	Pratap Chhatkuli	Financial Analyst
4	Desh Bhakta Mallik	Socio-economist
5	Hari Darshan Shrestha	Structural engineer
6	Krishna Prasad Timilsina	GIS Expert
7	Kishwor kumar Jha	Contract Document Préparation Expert/ Quantité Surveyor
8	Niranjan Shrestha	Environmental/ Water Quality Management Expert
9	Anjan parajuli	Geo-hydrologist/ Hydrologist
10	Hari Darlami	Mechanical Engineer
11	Guna Raj Ghimire	Water Supply and Sanitation Engineer
12	Kiran Dhaubanjara	Civil Engineer
13	Sujan simkhada	Junior Civil Engineer

1.10.2 METHODOLOGY FOR DETAILED DESIGN REPORT

Multiscope Consulting Pvt. Ltd. has carried out Detail engineering design according to the following methodologies:

- Organization of team and delegation of responsibility
- Collection of secondary data and literature review.
- Development of check list and formats for reporting.
- Submission of inception report.
- Meeting with user community and concern authority;
- Reconnaissance survey with concern authority and user community as well as selection of source and preparation of layout map of project area.
- Detailed survey using total station from source (daraudi river bank).
- .Social economic survey and discharge measurement of local source
- Field report preparation and submissions;

CHAPTER II
EXISTING SYSTEM

2.1 INTERACTION WITH THE LOCAL COMMUNITIES

On Jestha 25- of 2072 a mass meeting was held at water supply and sanitation committee (WUSC) office at Gorkha. The participants of the meeting included official of DDC and WSSDO, WUSC and beneficiaries. The team members interacted with the officials and the general members of WUSC and beneficiaries during field visit. The consultant team highlighted the concept of Daraudi Gorkha (Gorkha Brihat pumping) water supply and sanitation project. They also highlighted the technical, financial aspects and socioeconomic aspects of the project. Discussions on various issues were held during floor discussion session and quarries of the participants were clarified. The team visited existing system including service area, intake, reservoir, etc.

2.2 EXISTING WATER SUPPLY SYSTEM

The locals of the Gorkha Bazaar are getting piped supply water but not adequate. From the field inspection it was found that they are barely get 2 hour supplied water in dry season. It is way beyond for meeting their water demand.
More specifically they are getting water from the following four sources:

- Prithibinarayan sana sahari water supply and sanitation project
- Karnekhola water supply and sanitation project
- Kholkhole laxmi bazzar water supply and sanitation project.
- Hatiya thok pokhar thok water supply and sanitation project
- Tindhara Water Supply and sanitation project

~~Besids~~Besides, there are numerous local ~~sourcces~~sources that can be tapped for water supply system of the Bazaar. The major such sources are summarized below:

S/N	Name of Local source	Discharge lps	Safe yield
1	Chainise Dhara	0.3	0.21
2	Kholkhole,Mathillo	0.2	0.14
3	Kholkhole,Tallo	0.2	0.14
4	Sundhara Bosipani	1	0.70
5	Chhahare Dara	0.3	0.21
6	Padeli Dhara	0.3	0.21
7	Darapani Dhara	0.2	0.14
8	Dhobi Dhara	0.6	0.42
9	Tindhara	0.18	0.13
10	Rotepani	0.1	0.04
11	Sirkhali Dhara	0.1	0.05
	Total discharge	3.4	2.38

Source: field survey 2015

Brief overview of each project are given below:

- **Prithibi Narayan sana sahari water supply and sanitation project:-**
  This is pumped supply system. The source is located at Chankhola. The system has 880 private taps. The water is directly supplied from the reservoir to the individual water taps. The system consists of four circular RCC reservoir of 150 cubic meters, and two 50 cubic meters. Most of the pipes used on this system are High Density Polyethylene (HDEP). However, transmission lines and terrain passing through rocky areas, has used Galvanised Iron (GI). In general, the existing pipe network seems working well.

- **Karne khola water supply and sanitation project:-**
  Karne khola is another source located at Karne Khola. The source is about 500 meter below the RVT. And thus, the locals are ~~sare~~ using pump for lifting water from source to RVT>The system has 420 private taps, four reservoir of 20 cubic meter capacity, one RVT of 25 cubic meter. They used HDPE in most of the cases. ~~However,the~~However, the ~~transmissoin~~transmission line sand the terrain passing through ~~rockey~~rocky areas used GI pipes.

- **Khol khole laxmibazzar water supply project: -** Similarly, kholkhole is also on~~-e~~ of the existing source of water that the local are using for their daily use. This is gravity flow system. The system has covered 500 HH. The major components of the system are: One 80 CUM RCC tank. Most of the pipelines consist of High Density Polyethylene (HDEP) Pipe. However, in rocky terrain galvanised iron (GI) pipe has been used.

- **Hatiya thok pokhar thok water supply and sanitation project:-**
  This is another one system they are using since a long time. The system used both pump and gravity technology. The system cover 160HH. Source of the system is boring. The system consists of one 35 cum RVT and other necessary accessories.

Further to above, the consultants had accomplished the detailed study of the Gorkha Bazaar water supply and sanitation project. Considering the various source alternatives and treatment options.

2.3 CONSUMPTION LEVEL

The present system has been supplying water to Gorkha Bazaar. Having 9,800 people, the average water consumption per capita is 72 litres per day. Some people are also using water from Local spring source for drinking propose. The exact water consumption per capita figures shall be much more than above.

Some households get water from rainwater harvesting. For washing and livestock propose.

2.4 WATER TARIFF

Present water tariff for each tap varies by system, quantity used, by season etc. The details of the existing water tariff of each system are given below:

Kholkhole laxmibazzar wsp		
SN	**In dry season**	
1	Unit	Rate (Rs.)
2	5	120
3	above 6	120+200/unit
4	**In rainy season**	
5	10	120
6	above 11	120+50/unit

Prithibinarayan sana sahari wsp		
SN	Unit	rate
1	1 to 6	RS. 300
2	7 to 10	RS. 450
3	11 to 20	RS. 450+Rs.60/unit
4	21 to 30	RS. 450+Rs.80/unit
5	above 30	RS. 450+Rs.100/unit

Karnekhola wsp		
SN	Unit	rate
1	upto 8	RS. 275
2	8 to 12	RS. 275+Rs.50/unit
3	12 to 16	RS. 275+Rs.90/unit
4	above 16	RS. 275+Rs.100/unit

Hatiyathok pokhar thok wsp		
SN	Unit	rate
1	upto 8	RS. 300
2	8 to 12	RS. 300+Rs.50/unit
3	12 to 16	RS. 300+Rs.90/unit
4	above 16	RS. 300+Rs.100/unit

2.5 EXISTING SANITATION

The sanitation practice is directly related with quantity as well as quality of water supplied. This is also dependent on climatic condition, living standard, culture and awareness of the people in the health and sanitation activities. There is some sewerage system in the proposed service area.

The sanitary condition of the community is fairly satisfactory. All households in the Project area have their own latrine. There is no public toilet in the community. Due to the shortage of water, the latrines do not function properly.

Also there is surface drainage facility to dispose rainwater in main bazaar but there is not available surface drainage facility is village area. And no garbage disposal system exists.

2.6 WILLINGNESS TO CONTRIBUTE FOR WATER SUPPLY SERVICE

The WUSC and beneficiaries expressed their willingness to contribute cash as well as kind in stipulated amount in the project implementation. WUSC has shown strong commitment for the cash collection in time for scheme implementation.

The commitment of the users to the project is evident from the fact that they are paying water tariff regularly. Inspire of this, difficult task for WUSC is to collect water tariff and upfront cash required for the proposed new scheme.

WUSC and communities have strong commitment to collect the require amount in time due to the felt need of water in the service area.

CHAPTER III
DETAILED ENGINEERING DESIGN

3.1 DESIGN STANDARDS

The following design standards have been followed in detailed engineering design of project.

3.1.1 DESIGN PERIOD

The design periods for water supply systems in Nepal vary from 15 - 20 years for rural and semi urban areas. However, an increased design period will have economic and cost implications on the sub-projects. It is envisaged that the construction of the project will be started in 2015 and will be completed in 2017. Thus survey and design year is 2015. Initiation of construction will be done in 2016, base year after the completion of the project will be 2017 and the design year will be 2032. The overall period for project preparation and construction is 2 years.

3.1.2 POPULATION GROWTH RATE

The project area comprises both urban and rural settlement. The annual population growth rate is taken as 1.32. The population growth rate percentage is determined based upon population census 2001 AD and 2011 AD of the Gorkha District. The population growth rate is used for the calculation of the design population.

3.1.3 POPULATION PROJECTRION

The geometrical increase method has been adopted to estimate the design population.

The present population in the proposed service area is 19045 in 3809 HHs. The population of the project at the end of design period of 17 years (2 year construction + 15 years project life) has been calculated and found as 24263 by using geometrical increase method. The rental population is kept constant throughout the project period.

The following formula is used for determining the design population.

$$PN = P\left(1+\frac{R}{100}\right)^{N}$$

Where,

P = Present Population
R = Annual population growth rate in percentage
N = Number of years
PN = Projected population at the end of the N^{th} year.

The annual population growth rate at Gorkha is 1.32%. The project has been designed to serve a base year (2019) population of 19552. By applying the above relation, the design year (2034) population has been found as 24263.

3.1.4 SERVICE LEVEL

The service level should be in accordance with consumer needs, desires and willingness to pay. The tenth plan approach paper also highlights the need for improvement of service level in emerging towns. Service level improvement means essentially providing reliable and efficient supply predominantly through house connections (fully plumbed), yard connections and a few community stand-posts for disadvantaged groups. The design is based on some assumption for each type of connections. The per capita demand of 95 lpcd has been proposed for HH, 3000 lpd, 500 lpb, 80 LPs for hotel and like this for designing the system. Majority of the households will obtain water through private house connections. Main features associated with the improvement on service level are continuous 24 hours supply of treated water to meet GoN water quality standard with a minimum of 5 meter of residual head at connection points in few places. Most of the places the residual head is maintained more than 10m.

3.1.5 WATER DEMAND

Water demand is one of the key factors in the formulation of any water supply project with its implication in project cost. Factors affecting the water demand are personal habits, industrialization and climatic condition, reliability of supply, cost of water and availability of supplementary sources. The water demand is calculated based on the present population, population growth rate, population in rental and the demand of water for other purposes such as hotels, cinema hall, restaurant, schools and government and non-government offices. Hence the total water demand includes domestic, institutional and industrial and fire fighting demand. Per capita water demand figures used in the water demand calculation for various categories of users are presented in Table below

Table: Water Demand

SN	Type of Demand	Recommended Demand
1.	HH connections	95 lpcd
2.	School	10 lpcd
3.	Private office/ governmental office	10 lpcd
4.	Health post	3000 lpd
5.	Cinema hall	5 lpseat
6.	Hotel/ lodges	80 lpseat
7.	Restaurant	5 lpseat

The above recommended figures for various demands are based on the design standard established by the DWSS. Other demands to be considered are leakage and wastage from the system. These have been assumed about 10% of the total demand.

3.1.6 PEAK FACTOR

The peak demand in each pipe has been determined with peak factor 3.

3.1.7 DOMESTIC DEMAND

The daily demand primarily consists of daily house - hold needs i.e. drinking, washing, cooking and hygienic needs. Service connection has been categorized into fully plumbed connection, yard connection and community taps.

Each type has different rate of water consumption. The percentage of the population served by each category has been estimated through socio-economic survey. Rate of consumption per person is based on the design guidelines of DWSS. The rate of consumption has been kept within recommended range of the design guidelines.

Water demand has been based also on the living standard of the people. The change in the types of connection from community taps to yard connection to fully plumbed connection will reflect the increase in the living standard. The percentage of different types of tap connection is based on the present situation of the community.

Domestic water demand is presented in the Table below.

SN	Description	Water demand (lit/ day)	
		Based year 2019	Design year 2034
1	Domestic	1865610	2305023

3.1.8 INSTITUTIONAL DEMAND

Water demand for various types of institution, such as educational, governments, non-government offices and health facilities have been included in the project.

Under the institutional demand, provision has been made for two health posts, two hospital having 65 beds, 24 governmental offices (having 960 staffs), 27 non-governmental offices (486 staffs) and 17 school (having 5509 students). The total institutional demand has been calculated as 108,050 litres per day. The following table shows the pattern of the institutional water demand within his project area.

Table : Pattern of Institutional Water Demand

S/N	Description		Institutional Water Demand		
		Total NO.	Population/ Staff/bed	Water demand	Total Water
				Lpcd/lpbed	demand lit/day
1	School	17	5509	10	55090
3	Gov. offices	24	960	10	9600
4	Non gov. office	27	486	10	4860
5	Health post	2		3000	6000
7	Hospital	2	65	500	32500
Total demand lit/day					108050

The number of students, offices staff etc are kept same as the survey year for throughout the project period. WUSC is committed to collect the water tariff from institutions.

3.1.9 COMMERCIAL DEMAND

Commercial water demand includes the demand for commercial activities such as hotels, restaurants, cinema hall, factories and bank/finance the commercial demand has been estimated according to DWSS guideline. The commercial demand is distributed in distribution line where they are situated. The following table shows the pattern of the commercial water demand.

Table : Pattern of Commercial Water Demand

S/N	Description		Commercial Water Demand		
		Total No.	Staff/ seat	Water demand	Total water demand
				lpcd	lit/day
1	Cinema Hall (seat)	1	200	5	1000
2	Hotel / lodges (seat)	56	840	80	67200
3	Bank and Finance	82	1066	10	10660
Total demand lit/day					78860

There are 1 cinema hall, 56 hotels, and 82 Bank and Financial institutions. The total demand required for commercial use has been found to be 78,860.00 litres per day.

3.1.10 WASTAGE AND LEAKAGE

For the design purpose, 10% of the total demand has been considered for wastage, leakage or uncounted water use as specified in DWSS guidelines. The wastage and leakage during design year is 263,177 litres per day.

3.1.11 TOTAL WATER DEMAND

The total water demand for the project is calculated as 2,894,945 litres per day. But the design pumping water is calculated as 1,954,945 liters per day. The brief summary of water demand for various uses is presented in below table:

SN	Description	Water demand (lit/ day)	
		Based year 2017	Design year 2032
1	Domestic	1865610	2305023
2	Institutional	108050	108050
3	Commercial	78860	78860
4	Leakage and wastage	204334	248275
	Total demand (lit/day)	2247674	2731028

The detail of water demand calculation has been done separately and attach in annex 7.

3.1.12 CONSUMPTION PATTERN

The distribution system capacity to meet design water demand at the desired and time is determined by the service area consumption pattern. The recommended consumption pattern is presented in Table below:

Table: Consumption Pattern

SN	Hours	Percentage of daily demand
1	05:00 – 07:00	25
2	07:00 – 12:00	35
3	12:00 – 17:00	20
4	17:00 – 19:00	20
5	19:00 – 05:00	

3.2 PIPE MATERIALS

The transmission main has been designed using 32mm - 160mm HDPE pipes, 40mm – 75mm PPR Pipe, 65mm – 100mm GI Pipe, 200mm Carbon Steel Pipe. HDPE and PPR pipes have been proposed and designed in the distribution system as per technical requirement and suggestion of the community.

3.2.1 PRESSURE AND VELOCITY

Adequate residual head or pressure should be maintained at all the connection points and service nodes of a water supply system to provide desired water level of service during operation. As per the design guide line the minimum residual head at service node and connection point should be 5m and 10m respectively. Slightly higher residual heads are provided in the design for better service most of the places. In a few places the residual head is below 10m.

The velocity 1.70m/sec is kept in transmission line. Similarly, the minimum self-cleaning velocity has been maintained in distribution system wherever possible. The velocities are non-scoring and are enough for self-cleaning. In some cases the size of the pipe governs the nominal velocity.

3.3 DESIGN APPROACH

3.3.1 GENERAL

The design should be responsive to the demands of consumers for improved water supply and sanitation services. Consumer demand has been indicated by willingness to pay for these services. People receive project assistance to help them build the kind of facilities they desire, and are willing to pay for the facility. This will also have strong bearing on long-term sustainability of the project. Therefore, adequate interaction with the community was made from the very beginning to study completion phase to make important and critical decisions such as use of pipe materials, location of pump site, treatment plant and reservoir site, type of tap connection, location of surface drainage section, location of public latrines etc. At each stage, the design has been carried out in consultation with the community. After submission of draft report, a meeting was organized and their responses have been incorporated in the final report.

3.3.2 SERVICE AREA

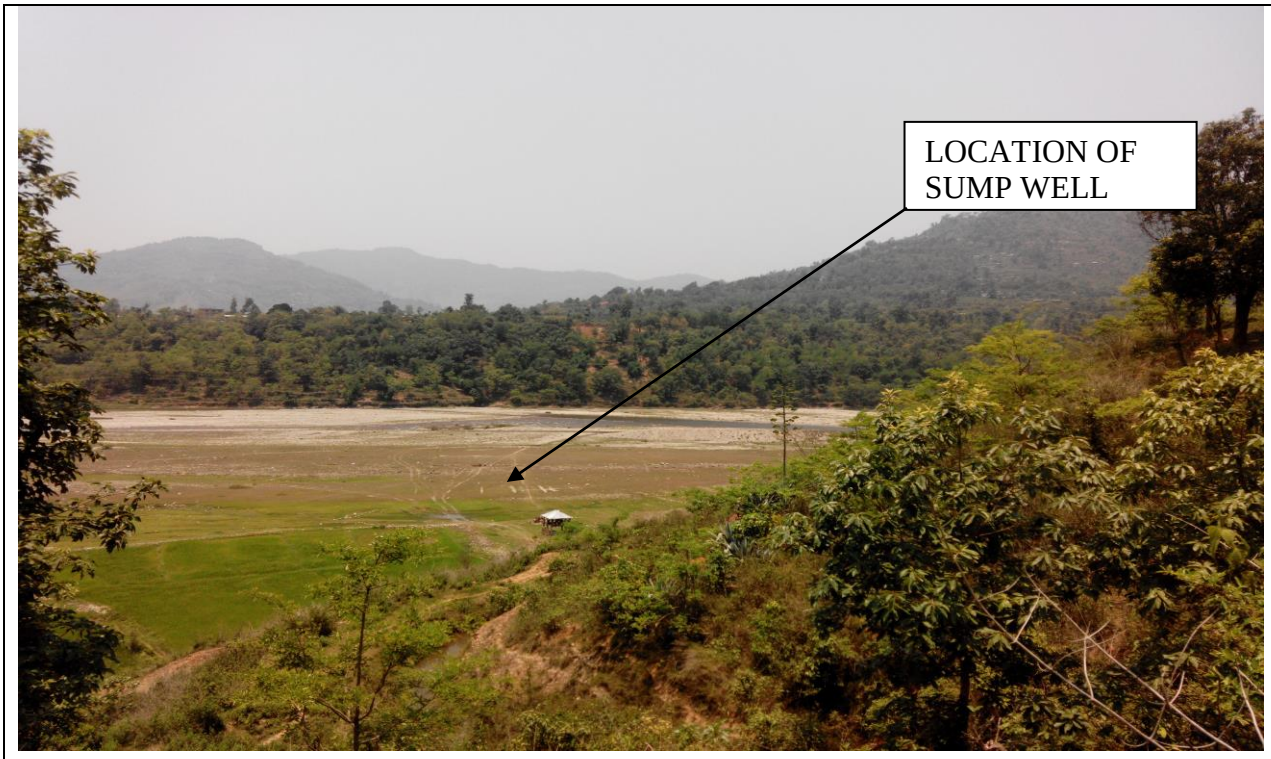
Service area delineation has been made through a long discussion among stakeholders. The service area includes the area covered by the existing system and surrounding area suggested by the WUSC. Finally the following service areas has been delineated in consultation with the concerned stakeholders:

S/N.	Name of Village/Community	Ward No.	HH	Present Pop.
1	Newar Hatiya Phinam	12	33	165
2	Pipal Thok Phinam	12	191	955
3	Gairikuwa Khaphal Ghari	4	106	530
4	Swara	4	97	485
5	Paslang Pasimkali Mandir	4	23	115
6	Mandre Dhunga	5	73	365
7	Simal gairi	6	49	245
8	Aalevanjyang	7	128	640
9	hilepokhari campus	6	132	660
10	Katel danda	8	145	725
11	Nareswor	14,15	749	3745
12	Dumri danda Nagarpalica Office area	6	78	390
13	Tindahra ws covered area	1,3	200	1000
14	Sanusahari wsp covered area	1,2,3,6	1100	5500
15	Karnekhola wsp covered area	1,2,4	420	2100
16	Hatiyathok pokhar thok wsp covered area	1	160	800
17	Aamdanda		125	625
	Total population		3809	19045

3.3.3 Proposed Sources and Intakes PROPOSED SOURCES AND INTAKES

The proposed source is located at Daraudi. It is located at confluence of Bini and Daraundi stream. The ~~dettails~~details of the location are shown in below picture:

The proposed water source/intake is deemed to be technically viable regarding the stability and source discharge. Pumping is necessary to extract the water from sump well/ ground water source.



SOURCE PICTURE

Fig:- location of intake in Google earth map

3.3.4 DESIGN OF ELECTRICAL SYSTEM

The water supply system at Gorkha has proposed sump well with 30 KW pump used for pumping water from source to treatment plant. Then 4 pumps of 51 KW capacity has been proposed for lifting water from treatment plant to reservoir in different stage.

Selection of Transformer and Transformer capacity is given below:

Description	Pumping Station				
	Infiltration Gallery	**Stage I**	**Stage II**	**Stage III**	**Stage IV**
Type of Pumps Submersible Pump (Water cool)	Type of Pumps Submersible Pump (Water cool)	Type of Pumps Submersible Pump (Water cool)	Type of Pumps Submersible Pump (Water cool)	Type of Pumps Submersible Pump (Water cool)	Type of Pumps Submersible Pump (Water cool)
Model of Pumps (Equivalent)	KSB BPHA 333/6C, HBC(small) 413, (30 kW) or equivalent	KSB UPHA 293/15+HBC 683	KSB UPHA 293/15+HBC 683	KSB UPHA 293/15+HBC 683	KSB UPHA 293/15+HBC 683
Capacity kw	30	51	51	51	51
Rating current(amp)	57.74	98.15	98.15	98.15	98.15
Discharge-(Q-m3/hr)	90	40	40	40	32
Efficiency of Pump (%)	60.29	60.22	58.48	58.15	51.14
Gross Head Pumping (mtr.)	**83.13**	**282.28**	**274.15**	**272.59**	**299.64**
No of Pump to use	2	3	3	3	2 (one for standby)

Transformer capacity

Transformer power	No of Transformer
Transformer (200 KVA)	2
Transformer (250 KVA)	1
Transformer (250 KVA)	1
Transformer (315 KVA)	1

3.3.5 TRANSMISSION MAIN

Transmission line is the pipe line length from sump well (intake) to Main Distribution tank. The total actual length of transmission main is about 27.88km. The transmission main has been designed using 32mm - 160mm HDPE pipes, 40mm – 75mm PPR Pipe, 65mm – 100mm GI Pipe, 200mm Carbon Steel Pipe. The water from the sump well shall be pumped and deliver to the sedimentation tank. After sedimentation and filtration, the water shall be disinfected and stored in the storage reservoir. The treated water shall be pumped from storage to another station reservoir.

The transmission pipe line passes through the roads and cultivated land, jungle etc. there are 4 pumping station.

3.3.6 TREATMENT PLANT

There is treatment plant in the existing system. The existing system has been also used Plane sedimentation and disinfection unit. Treatment plant has been proposed beside the pumping station no. II. After test sump well, the water quality shall be tested. Based upon the test result the type treatment process shall be confirmed. However, plain sedimentation, followed by rapid sand filtration and disinfection have been proposed for the treatment process. Chlorination unit is provided before the storage reservoir. This will give adequate detention time. After test sump well the water shall be tested and their results shall be compared with the recommended standard. If the quality of water is good then rapid sand filter shall be removed in the filtration process.

Sedimentation tank has been designed assuming detention time and permissible velocity. An emergency feeder consisting of a solution tank connected to a constant level feeding tank is proposed for the chlorination. After disinfection some part of the lime will be settled at the bottom of the reservoir as residue and removed through washout. The washout pipe will be connected with the drain. The detail design and their sizes of various treatment plant structures are provided in **Volume III**.

3.3.7 SERVICE RESERVOIR

The total storage requirement for the system at the end of the design period shall be about 1665 m^3 distribution reservoir and 2650 m^3 for balancing reservoir. The reservoir size has been optimised.

3.3.8 DISTRIBUTION SYSTEM

Distribution system comprises a pipe network, which is designed by using CBWSS software. CBWSS is software which is used for the analysis of the water supply network. The base demand, elevation of each node, reservoir and distance from node to node are the basic input data. Socio economic survey data is used to determine the nodal/ base demand. The engineering survey data is used for the length of the pipe and elevation of the nodes. The software works for unlimited nodes. The input data should be given directly in the software. The data prepared in excel cannot be browsed in the software is its major limitation. Colebrook-White equation is used in pipe line design. The roughness coefficient used in this equation for the use of DI, GI and HDPE pipes are 130, 120 and 150 respectively. The entire distribution system has been designed by using steel PPR pipe, and HDPE pipe. The minimum pipe size used in the design is 20mm which governs the velocity. In some nodes the residual head is some high to maintain the residual head in the downstream node. The details of distribution line network design of Daraudi Gorkha (Gorkha Brihat Pumping) Water Supply Project and sanitation project are presented in ~~Annes~~Annex.

The flow in each line has been calculated based on the socioeconomic survey data regarding population, institution etc. Control valve has been proposed at suitable junction to regulate the design flow in each pipe line and to stop the flow in the particular area without affecting the other area during repair and maintenance. All distribution line passes along the road network and public

land. The distribution main has been designed with 10% extra pipe length than the actual one. The detail survey was carried out by using Total Station. The bigger dia pipes are used in the design and the chances of the bending in the trench is very less as compared with the smaller dia pipe. Hence the estimated pipe length is taken as 3% more than the surveyed length. The total estimated length of the distribution main is about 20720 m.

3.3.9 HOUSE CONNECTION

As per the WUSC decisions, the household tap shall be connected directly from the distribution main. The average 30m length of 20mm dia. HDEP Pipe has been estimated for each HH. The average 30m length pipe has to be laid in the road and remaining pipe comes in the house compound shall be exposed.

3.3.10 OTHER APPURTENANCES

Primarily appurtenances such as wash out, control valve etc. have been provided as needed.
Control valve has been designed in suitable distribution junction having more than two mains and in required place to regulate the design flow in the main. The design flow is based on design population, institutional and commercial demand and fire fighting. The future demand in the main may fluctuate and the control valve shall be useful to deliver the required flow in pipe line.

CHAPTER IV
FIELD INVESTIGATION

4.1 SOURCES

Field investigation has been carried out for the selection of source, transmission pipeline and distribution line and for different structures required for the scheme. The investigation shows that the proposed intake/ pump house sites are stable. There is no dispute in the pump house sites, pipeline alignment and structure locations. More information on them is as below.

4.1.1 EXISTING SOURCE

The source of the existing water supply system of the Gorkha bazaar is karnekhola,kholkhole and chankhola. The source has about 20 lps discharge. The source is situated in the jungle. The possibility of the human intrusion is very less as the source is far from the settlement. There is a possibility of water becoming turbid during rainy season. The transmission line is passes through the forest.

4.2 WATER QUALITY ASSESSMENT OF THE SOURCES

In general, the water source needs some treatment which shall be tested after test sump well. Based on the filed investigation and the past ~~experinces~~experiences of the designers in the similar other projects, sedimentation followed by rapid sand filtration and disinfection is proposed for water treatment system has been proposed. Daraudi ~~rivier~~river water quality test report area given below.

Government of Nepal
Ministry of Urban Development
Department of Water Supply and Sewerage
Central Drinking Water Quality Testing Laboratory
Panipokhari Kathmandu, Ph:- 014006633

Report of Water Analysis

Lab Id No:-	Date Recieved:- 2072/04/11
Name of project/Person:- Executive consulting engineer's and plannar's pvt	Date of completion:-2072/04/13
Source:-Daraudi, gorkha	
Location:-ktm	Sampled by:-Self

Analytical Information

SN	Parameters	Unit	Method	Result/Observed value	NDWQS
			PHYSICAL		
1	pH		Instrumental	7.6	6.5-8.5
2	Colour	TCU	Instrumental	5	5
3	Taste& odour				Non-Objectionable
4	EC	µS/cm	Instrumental	188	1500
5	TDS		Instrumental	112.8	1000
6	Turbidity	NTU	Nephlometery	**34.31**	5(10)
			CHEMICAL		
7	Ammonia	mg/L	Spectrophotometery	0.5	1.5
8	Total Hardness	mg/L	Titrimetry	140	500
9	Nitrate	mg/L	Spectrophotometery	<5	50
10	Iron	mg/L	AAS	**1.7**	0.3(3)
11	Manganese	mg/L	AAS	0.04	0.2
12	Arsenic	ppb/L	AAS	<5	50
			MICRO-BIOLOGICAL		
13	Total Coliform	CFU/100	MF-method	**15**	0 in 95%
14	Faecal Coliform/E-Coli	CFU/100	MF-method	**3**	0

Remarks:-

ND: Not Detected

Analysed by

Verified by

.

CHAPTER V
SUMMARY OF DESIGN OF WATER SUPPLY SYSTEM

5.1 INTRODUCTION

5.1.1 WATER QUALITY AND TREATMENT REQUIREMENT

The water from ground water source needs some treatment which shall be tested after test boring. However, sedimentation followed by sedimentation, rapid sand filtration and disinfection have been designed for water treatment. It is expected that the proposed treatment process shall meet the WHO standard.

5.1.2 PROJECT COMPONENT

The Daraudi Gorkha (Gorkha Brihat Pumping) Water Supply Project and sanitation project has been designed as a pumping system which will supply water from Daraundi Khola. The water shall be pumped from sump well and goes to the sedimentation, rapid sand filter and stored in the storage reservoir after disinfection. The water shall be pumped again from reservoir to another pumping station reservoir. There are 5 pumping stage. The water goes in the distribution system from uppalokot reservoir by gravity flow.

The major components of the town projects are:

- sump well/ Intake
- Transmission main
- Wash out
- Plain sedimentation tank
- Rapid sand filter
- Chlorination chamber
- water reservoir tank
- Distribution main
- Control valve
- Pump house cum guard quarter
- Pump house
- Boundary wall
- Break pressure tank
- Distribution chamber

5.1.3 SUMP WELL/INTAKE

The use of groundwater source is used for the new water supply system. Two pumps of each 31 KW capacity are proposed to pump the ground water from sump well to plan sedimentation. The well size should be of (4000 mm). The total depth should be about 10 m with maximum screened area and allowing maximum drawdown, the yield of the sump well can be increased to great extent. We except 30 lps discharge from this sump well.

5.1.4 WASHOUT VALVE

Washout valves have been provided at all depressions in the pipeline. The purpose of the valve is to clean the debris collected in the pipeline. Sometimes the valve can also be used for the maintenance of the pipe line without closing the whole distribution system.

5.1.5 PLAIN SEDIMENTATION TANK

Sedimentation is a process of removal of the suspended particles by gravitational settling. Sedimentation tank has been designed to reduce the velocity of water so as to permit suspended solids to settle out of the water by gravity. There is 2 plain sedimentation tank is proposed. Horizontal plain sedimentation tank has been designed by taking the length at three times width and maximum permissible velocity 0.25m/sec. Detention period of 3.5 hours has been provided.

5.1.6 RAPID SAND FILTER

Sedimentation process removes a large proportion of suspended impurities, but do not effectively remove very fine colloidal particles, colour, dissolved minerals and micro-organisms. In order to remove from very fine particles, colour and turbidity a rapid sand filter has been proposed. There is 3 rapid sand filter is proposed. As the name suggests, the rate of filtration of this filter is very high. The depth of the filter media has been kept as 1.75m and the depth of water on it is kept as 2.5m. The rate of filtration is adjusted at 3000 ltr/hr/m^2 area of the filter. The depth of the drain below filter is provided as 0.3m with longitudinal slope 0.5% and lateral slope of 1%. Including 0.42m free board, the total depth of rapid sand filter is 3m.

5.1.7 CHLORINATION

When water comes out from the rapid sand filter plants, it may contain bacteria and other micro – organisms, some of which might be pathogenic. Hence it is necessary to disinfect water to kill bacteria and other micro-organisms, and thus prevent water borne diseases. Disinfection follows filtration. The chlorination is the most commonly used method for disinfection. The chlorine demand is the difference between the amount of chlorine added to water and the quantity of free available chlorine remaining at the end of a specified contact period.

Generally chlorine is applied in the water in the forms chlorine gas. But in remote areas it is applied as bleaching powder which contains 30% chlorine and 70% lime. The dose of the chlorine should be adjusted such that the residual chlorine is about 0.1 to 0.2 ppm before water enters in the distribution system.

5.1.9 RESERVOIR

Reservoir with adequate capacity has been designed to balance the supply and demand. The reservoir capacity is based on the water demand. The maximum water withdrawal occurs at 5 – 7 AM and the minimum withdrawal occurs at 7 PM – 5 AM.

5.1.10 DISTRIBUTION MAIN

The distribution system consists of pipe network designed by preparing the Dead end network system. The hydraulic design has been carried out accordingly. HDPE and PPR pipes have been proposed and designed in the distribution system as per technical requirement and suggestion of the community. The total estimated pipe length of the proposed distribution system is around 9592m.

5.1.11 CONTROL VALVE

The purpose of the control valve is to regulate the required flow in each distribution main from the junction. A control valve is provided in the system where there are more than two branches from one junction.

5.1.12 HOUSEHOLD CONNECTION

The system has been designed for private house connections. The number of connection has been estimated as per socio economic survey. Based upon the survey, it is estimated that about 3259 numbers of tap connections shall be made during construction phase.

5.1.13 PUMP HOUSE AND GENERATOR HOUSE

A pump house cum generator house is designed for pump I, II, III, IV station.

5.1.14 BOUNDARY WALL

Angle post barbed wire fencing above brick masonry wall has been proposed to protect the structures such as pump house, reservoirs and treatment plants.

5.2 PROJECT COST

Rate analysis has been carried out using the rates fixed for Gorkha district for fiscal year 2073 – 2074 as per prevailing norms and practices. Some items having no GoN norms, practical experience has been used. The rates of pipes are taken DWSS DO and fittings are taken from concerned industries. The price includes the cost for delivery up to the site.

5.2.1 CAPITAL COST OF WATER SUPPLY SYSTEM

Sn	Items	Unit	Unit rate	Scheme #1	
				Quantity	Amount (Rs.)
A	**Community Education Awareness Programme**				
1	Pre-construction training	no	37,000.00	4.00	148,000.00
2	Appraisal & community preparation	no	14,000.00	4.00	56,000.00
3	VMWs training	no	16,000.00	16.00	256,000.00
4	Pump operator training	no	20,000.00	12.00	240,000.00
5	Account/meter reader's training	no	20,000.00	8.00	160,000.00
6	Pre-handover training	no	54,000.00	4.00	216,000.00
7	Motivators/volunteers training	no	12,000.00	16.00	192,000.00
8	Post construction activities including Exposure visit to WUC members, Staff salary for one yr etc.	%		100.00	2,500,000.00
	Total A				**3,768,000.00**
B	**General Items**				
	Rental of 4WD Vechicle with driver, fule , lubricant & maintenance cost	Day	8,000.00	180.00	1,440,000.00
	Insurance charges (PS)	%			4,200,000.00
	Submission of complition reoprt with as build drawing (PS)	%			200,000.00
	Land Acquisition	Ropani	4 45 000.00	26	11,570,000.00
	Maintanance cost for Damageing existing structures (PS)	%			2,500,000.00
	Enviromentla management cost (PS)	%			3,000,000.00
	Temporary Services (PS)	%			200,000.00
	Total B:				**23,110,000.00**
C	**Water Supply & Sanitation**				
C1	**Civil Works**				
1	Construction of earthen road	km		2.00	1,552,648.25
2	Infiltration gallery	no	2,608,661.49	2.00	5,217,322.98
3	RCC reservoir - 16 m³ capacity	no	609,214.05	1.00	609,214.05
4	RCC reservoir - 20 m³ capacity	no	678,204.54	2.00	1,356,409.08
5	RCC reservoir - 40 m³ capacity	no		5.00	7,257,771.95

			1,451,554.39		
6	RCC reservoir - 55 m³ capacity	no	1,734,659.08	3.00	5,203,977.24
7	RCC reservoir - 70 m³ capacity	no	2,228,260.81	3.00	6,684,782.43
8	RCC reservoir - 100 m³ capacity	no	2,578,662.92	2.00	5,157,325.84
9	RCC reservoir - 150 m³ capacity	no	2,958,809.67	2.00	5,917,619.34
10	RCC reservoir - 200 m³ capacity	no	3,941,254.65	2.00	7,882,509.30
11	RCC reservoir - 300 m³ capacity	no	5,360,017.87	1.00	5,360,017.87
12	RCC reservoir - 500 m³ capacity	no	6,715,398.60	3.00	20,146,195.80
13	RCC reservoir - 600 m³ capacity	no	7,824,098.63	1.00	7,824,098.63
14	Private tap connection (new)	no	18,984.20	2 000.00	37,968,400.00
15	Tap stand post	no	46,974.95	5.00	234,874.75
16	Air valve chamber	no	15,973.65	22.00	351,420.30
17	Valve chamber	no	34,064.57	15.00	510,968.55
18	Break pressure chamber	no	67,909.62	10.00	679,096.20
19	Distribution chamber-2 chambered	no	111,478.10	4.00	445,912.40
20	Distribution chamber-3 chambered	no	153,168.63	2.00	306,337.26
21	Disinfection chamber	no	24,218.44	1.00	24,218.44
22	Pump operation-cum-chaukidar house	no	1,973,869.73	4.00	7,895,478.92
23	Pump House	no	517,514.46	5.00	2,587,572.30
24	Office Building	no	9,015,992.65	1.00	9,015,992.65
24	Pump casing well	no	102,433.00	11.00	1,126,763.00
25	Electrical transmission work	km		5.40	13,425,801.59
26	Transmission pipeline work	km		34.87	32,747,092.40
27	Distribution pipeline work	km		99.03	11657812.08
28	Laying and Jointing of Distribution Line	Km		99.03	6,435,368.33
29	Pipe line protection work	%		100.00	4,858,142.71
30	Institution latrine- double unit	no	263,447.71	3.00	790,343.13
31	Institution latrine- single unit	no	161,276.66	5.00	806,383.30
32	Supply and Installation of pump	%		100.00	23,526,277.95

			23,526,277.95		
33	Transportation of pipes, fittings, tools	%		100.00	1,334,951.58
34	Cost of Treatment Plant	%		100.00	50,906,394.33
	Sub-Total (C1)				**287,805,494.93**
C2	**Materials & Equipments**				
1	Procurement of pipes	km		138.02	133,727,623.33
2	Procurement of fittings	%		100.00	13,144,654.31
3	Tools & plants	%	1,426,548.22	100.00	1,426,548.22
	Sub-Total (C2)				**148,298,825.86**
	Total C (C1+C2)				**436,104,320.79**
D	**Others**				
	Apparatus and Equipments for laboratory (PS)		1,000,000.00	1	1,000,000.00
	Concret Cube Test/ soil tests (PS)		500.00	500	250,000.00
	Days Works		5 00 000.00	1	500,000.00
	Cost of commissioning of system(1 year - RMO cost)				22,006,489.45
	Total C				**23,756,489.45**
	Total (A+B+C+D)				**486,738,810.24**
E	**Contingencies & overhead**				
1	Contingencies 2.5 % of (A+B)				12,168,470.26
2	Overhead 2.5 % of (A+B)				12,168,470.26
	Total E				24,336,940.52
	Total Cost of Scheme (A+B+C+D+E)				**511,075,750.76**
	Physical contingencies @ 10%				48,673,881.02
	Price escalation contingencies @ 10%				48,673,881.02
	Total Cost of Project(A+B+C+D) :			**Rs. 60 84 23 512.80**	

5.2.2 OPERATION AND MAINTENANCE

The sustainability of the project depends on the adequate and effective operation and maintenance mechanism of the project. After the construction of the project WUSC is the main stakeholder responsible for the operation and maintenance of the system. The project has to raise fund for the operation and maintenance cost, through the collection of tariff against the use of the water from consumers. The major components of the operation and maintenance cost for the proposed system are as follows.

Total water production (at base year) =	2247674	L/day
Total water production (at design year) =	2731028	L/day
a) Cost of electricity		
Capcity and time of pump-run per station:		

	Station	Capcity of pump (kW)	No of pumps to be run at a time	Total capacity (kW)	Time of run at base year (hr)	Power consumed per day at base year (kW-H:Unit)	Time of run at design year (hr)
	Infiltration Galleri	30	2	60	10.02	601.2	12.22
	Station-1	51	3	153	13.35	2042.55	16.29
	Station-2	51	3	153	13.35	2042.55	16.29
	Station-3	51	3	153	13.35	2042.55	16.29
	Station-4	51	1	51	13.10	668.1	15.98
	Total:			**570**	**63.17**	**7396.95**	
						Total energy consumption = **2699886.75**	**unit/year**
				Charge of electricity per unit :	5.20	Rs	1 40 39 411.10	Rs/year
				Demand charge per kW/month	200.00	Rs	13 68 000.00	Rs/year
				Transformer loss @ 3%			4 21 182.33	Rs/year
				Total cost of electricity per year			**1 58 28 593.43**	**Rs**

b) Cost of pump operator/Maintennance worker					
Man power required	**no**	**Salary per month**	**No of man-month**	**Cost per year**	
At 1st station/treatment plant site					
Supervisor/manager	1	30 000.00	13.00	3 90 000.00	
Engineer	1	60 000.00	3.00	1 80 000.00	
Pump operator	1	20 000.00	13.00	2 60 000.00	
Treatment plant operator	1	20 000.00	14.00	2 80 000.00	
WSST	1	20 000.00	13.00	2 60 000.00	
Chaukidar	1	15 000.00	13.00	1 95 000.00	
Meter reader	1	20 000.00	13.00	2 60 000.00	

Administrative/account keeper	1	20 000.00	13.00	2 60 000.00	
At 2nd station					
Pump operator	1	20 000.00	13.00	2 60 000.00	
At 3rd station					
Pump operator	1	20 000.00	13.00	2 60 000.00	
At 4th station					
Pump operator	1	20 000.00	13.00	2 60 000.00	
Miscelleneous(part-time work):					
For service RVT operation	3	20 000.00	12.00	7 20 000.00	
Total cost of manpower per year				**35 85 000.00**	**Rs**
c) Cost of repair/maintenance					
It is assumed this cost will around 1.5 lakh per month:					
hence cost of repair/maintenance per year:				**18 00 000.00**	**Rs**
d) Depriciation cost of pumps, per year					
Depreciation Cost of Pump(life: 8 years)	@ 20% 0f initial cost			5 88 156.95	
Depreciation Cost of Electrical(life: 20 years)	@ 10% 0f initial cost			67 129.01	
			Sub total:	**6 55 285.96**	
Unforseen cost	@ 10% 0f subtotal			65 528.60	
			Total:	7 20 814.56	
Maintenance of electromechanical Equipments	@ 10% 0f total			72 081.46	
			Total cost of depriciation, per year	**7 92 896.02**	
Total cost of operation and maintenance (a+b+c+d):-				**22006489.45**	**Rs**
Cost of operation and maintenance per HH at base year(3809 hh):				**5 777.50**	**Rs/year**
Minimum charge for one household at base year per HH				**481.46**	**Rs/month**
Cost of 1 m^3 of water at base year period:				**26.82**	**Rs/m^3**
Which is a costlier project, but against the scarcity it is quite affordable to people of Gorkha Bazaar.					
Also the cost of manpower may be decreased drastically if WSSDO trains the local human resources.					

CHAPTER VI
SOCIO-ECONOMIC ANALYSIS

6.1 INTRODUCTION

This part of the report presents the socio-economic characteristics of the Gorkha bazzar, of Gorkha district, ~~particularly~~particularly the project area. . The information provided in this report would be the basis for future projects planning, design, monitoring and evaluation. Of the total 3121 households identified as project beneficiaries interview was conducted with 321 households (10 percent). Remaining 1907 households were not available during the data collection. Census beneficiary survey, institutional survey and social mapping were the key basis for generating baseline information. All the survey formats were designed by the consultant. A Senior Socio-economic Consultant led the Socio-economic study. A Socio economist, local enumerators, assisted the Senior Socio-economic Consultant. The enumerators were given one days intensive orientation at the field regarding the generating the information through household survey. The district supervisor was stationed fulltime at field while the Socio-economic Consultant visited the sites for monitoring of the progress and check the quality of data.

6.2 BASELINE SURVEY FINDINGS

6.2.1 DEMOGRAPHIC CHARACTERISTICS

The actual beneficiary households and population of the delineated project location is estimated to be 3117 and 15600. Among the 10wards, The population of the Project Area is estimated to be increasing at the annual rate of 1.32 percent. The average family size in the Project Area is 5, total population of delineated project area is give table.

Table: Total Population of Delineated Project (House hold Survey 2017)

S/N	Name of Village/Community/Institution	Ward No.	Total No. of HH & Population		Distribution of Population by Gender	
			HH	Pop.	Male	Female
1	Newar Hatiya Phinam	12	33	165	91	74
2	Pipal Thok Phinam	12	191	955	528	427
3	Gairikuwa Khaphal Ghari	4	106	530	293	237
4	Swara	4	97	485	268	217
5	Paslang Pasimkali Mandir	4	23	115	64	51
6	Mandre Dhunga	5	73	365	202	163
7	Simal gairi	6	49	245	135	110

8	Aalevanjyang	7	128	640	354	286
9	hilepokhari campus	6	132	660	365	295
10	Kattel danda	8	145	725	401	324
11	Nareswor	14	199	995	550	445
12	Ghalyang	15	550	2750	1521	1229
13	Dumri danda Nagarpalica Office area	6	78	390	216	174
14	Tindhara wsp coverd area	1,2,3	200	1000	553	447
15	Sanusahari wsp coverd area	1,2,3,6	1100	5500	3042	2459
16	Karnekhola wsp coverd area	1,2,4	420	2100	1161	939
17	Hatiyathok pokhar thok wsp coverd area	1	160	800	442	358
18	Aamdanda	8	125	625	346	279
	Total population		3809	19045	10532	8513

Source: Household survey 2015

Among the total population, 55 percent ~~aremale~~are male and 45 are female.

6.2.2 EDUCATIONAL STATUS

The Project Area is served by 9 primary, 1 lower secondary, 3 ~~secondary,6~~secondary higher secondary school and 2 campus. 3,2,3,4,1,2,3,2,1 schools are located in ward number 1,3,4,5,6,7,8,12,14 respectively.. These schools hold 6664 students with teacher individual student of different School area mention in following table

Table: Wards-wise Distribution of Educational Institutions

S/N	Name of School	Ward No	Male	Female	Total
1	Bal Mandir Ma V	1	126	96	222
2	Gorakhkali Ni Ma V	4	54	39	93
3	Prithvi Narayan Bal Bikash Pra V	3	30	37	67
4	Jana Kalyan Pra V	4	6	5	11
5	Suryodaya Pra V	7	15	14	29
6	Shiva Shakti Pra V	4	18	12	30
7	Gorakhkali Pra V	8	30	31	61
8	Chandrodaya Pra V	5	5	3	8
9	Ratna Laxmi Ma V	6	91	56	147
10	Prithvi Smarak Pra V	5	11	12	23
11	Nawa Jyoti Ma V	5	230	170	400
12	Sarasawoti Uchha Ma Vi	7	424	481	905
13	Mahalaxmi Uchha Ma Vi	8	369	318	687
14	Shakti Uchha Ma Vi	3	321	278	599
15	Mahendra Jyoti Uchha Ma Vi	1	387	248	635
16	Srikrishna Pra V	1	64	51	115
17	Gorkha bahumukhi Campus	5	507	369	876
18	Drabeshaha Bahumukhi Campus	8	623	427	1050

19	Saraswati Uchha Ma V	12	170	151	321
20	Bindabasini uchha Ma V	14	201	166	367
21	Jal Kanya Pra V	12	12	6	18
	Total		**3694**	**2970**	**6664**

Source: Household survey 2015

6.2.3 HEALH STATUS

The Project area is served by one Gorkha district hospital having 50 beds and another Aama ba hospital having 15 beds. Also 3 health post situated in project area.

S/N	Name of hospital	location	no.of bed
1	Gorkha Hospital	Bosipani	50
3	Paslang Nagar Health ~~center~~centre	Paslang	
4	Raniswara Health post	Rani swara	
5	Aama ba Hospital	Tindara	15

Source: house hold survey 2015

6.2.4 BANKING AND FINANCIAL INSTITUTIONS

S/N	Name of Bank	Total No	S/N	Name of Bank	Total No
1	Banijya Bank	1	7	Clean Energy bank	1
2	Krishi Bikash Bank	1	8	Prime Comercial Bank	1
3	Gramin Bikash Bank	1	9	Everest bank	1
4	Gandaki Bikas bank	1	10	Manaslu Bank	1
5	Nabil Bank	1	11	Gorkha Bikas Bank	1
6	Himalayan Bank	1	12	Chhimeki Bikash bank	1
		1	13	Finance	78

Source: Household survey 2015

6.2.5 HOTEL AND LODGE

S/N	Name of hotel	Ward no	S/N	Name of hotel	Ward no
1	Hotel Bindraban	4	28	Hotel Bhandari	3
2	hotel Chautari	2	29	Hotel BHU.PU. Sainik	3
3	milan Hotel	2	30	Hotel Sirdibas	3
4	Hotel Gorkhakali	2	31	Panta Hotel	3
5	Hotel Jiban	2	32	Hotel New Sirdibas	3
6	Hotel Rupesh	2	33	Hotel Suraj	3
7	Hotel Sadiksha	2	34	Hotel New Ghairung	3
8	Hotel Anmol	2	35	Gangan Hotel	3
9	Hotel Milan	2	36	Hotel swara sulikot	3
10	Hotel Barpaki Himalayan	2	37	Gandaki Hotel	3
11	Hotel Gorkhali	2	38	Hotel borlang kota kali	3

12	Hotel Mustang Marpha	1	39	masel Hotel	3
13	Hotel Thakali	1	40	Hotel Annapurna	3
14	Hotel New Park	2	41	Hotel Mirakal	3
15	Hotel Namaste	2	42	Hotel vision	3
16	Hotel Sumitra	1	43	Pahuna Ghar	1
17	Hotel Everst	1	44	Hotel Himalaya	3
18	Hotel Satyam	1	45	Masasulu bambo katej Resort	4
19	Hotel Gurkha In	1	46	Hotel Prinsh	2
20	Hotel Gorkha Bisauni	3	47	Hotel Gorkha Chautari	4
21	Hotel Mannu	3	48	Gaunle Bhetghat Hotel	3
22	Hotel Sorathai	3	49	Hotel Laliguras	6
23	Hotel Manish	3	50	Hotel Crauwn Resort	8
24	Hotel shimjung	3	51	Gorkha Gaunghar Resort	8
25	Hotel loktantrik	3	52	Lapu Hotel	3
26	Hotel Pandrung	3	53	Paslang HomeStay	4
27	Hotel Borlang Shrestha	3	54	kattel Danda Homestay	4

Source: Household survey 2015

6.2.6 OTHER INSTITUTIONS

Government office	24
Non-Govermetn office	27
Cinema hall	1(200 seat)

Source: Household survey 2015

6.2.7 WATER INSTITUTIONS AND CAPABILITES

Primarily, DWSS's divisional office, Gorkha will be responsible for the executive of the project. However, water Users and Sanitation Committee (WUSC) also play an instrumental role both during the project execution as well as during the operation phase of the project. From the field inspection it was realized that the WSC is strong enough for handling/managing the project.

6.3 CONCLUSION AND RECOMMENDATION

Based on the analysis of socio-economic information it is concluded that drinking water is the top priority project of the beneficiaries in the Project Area and the communities are ready to contribute a significant amount of money for the connection of private tap and willing to pay monthly tariff and although the desired the desired level of tariff is quite low. The existing water supply system is inadequate to meet the demand of all the proposed wards. Meanwhile, it is also essential to assume the community for the adequate and quality supply of drinking water and drainage service to collect the required water tariff for the sustainable operation and maintenance of the project.