Spatial Analysis of Water Resources for Local Development in Kirtipur Municipality of Kathmandu Valley

A Thesis
Submitted in Partial Fulfillment of the Requirement
for the Award of the Degree of Master of Arts
in Rural Development

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Tribhuvan University
Kathmandu, Nepal
DECEMBER 2008

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RECOMMENDATION LETTER

This is to certify that the thesis submitted by **Gyanu Raja Maharjan** entitled **"Spatial Analysis of Water Resources for Local Development in Kirtipur Municipality of Kathmandu Valley"** has been Prepared under my supervision in the partial fulfillment of the requirements for the degree of Master of Arts in Rural Development. I forward this thesis to the evaluation committee for approval.

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APPROVAL CERTIFICATE

This is to certify that the thesis entitled **"Spatial Analysis of Water Resources for Local Development in Kirtipur Municipality of Kathmandu Valley"** submitted by Gyanu Raja Maharjan has been examined. It has been declared successful for fulfillment of the academic requirements toward the completion of Masters of Arts in Rural Development.

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ABSTRACT

Natural Resources Management means appropriation, distribution, utilization, and conservation of natural resources and the legitimate way of controlling them. Water is a mobile resource: it falls from the clouds, seeps into the soil, flows through aquifers, runs along stream courses, and eventually returns to the clouds. This natural cycle is the basis of all life support system and people extract resources from this system and used into economic cost. Water is "managed" in different ways: it may be harvested, extracted from the ground, diverted, transported, and stored. This makes it different from all other natural resources. However, each form of management that interferes with the natural cycle exacts a price, not just in economic terms but in terms of environmental damage and greater health hazards. Our water resources, irregularly distributed in space and time, are under pressure due to major population change and increased demand all over the world.

There are altogether 79 water resources which are well, dug well, pond, river, Stone Spout, spring, lake, deep tube well, rain water harvesting, and reservoir. The distributions of water resources are not equal in all the areas in Kirtipur. The ward no. 2 has largest number (12) of water resources and ward no. 19 has not any water resources which lie in the western lowland of Kirtipur Municipality. There are 3 main rivers i.e. Bagmati, Balkhu and Boshan and other rivulets which touch most of the wards. There are 9 reservoirs in different parts of the municipality. The water connection is available in all the settlements and the supply duration and time is different in the day and week.

The drinking water connections which are not sufficient for the daily activities of the local people in Kirtipur. So that they are using water from other sources which are located in the nearest area. Water resources are using in different activities in Kirtipur. Most of the water resources are using in agriculture activities and washing. Other uses are in making alcohol and beer, cleaning, bathing, toilet, dish wash, livestock, construction, Household supply and purification for god.

The most of resources are managed by local people, only the drinking water resources are managed by Kathmandu Upatyaka Khanepani Limited, Kirtipur Branch. It is very effective and sustainable. In our society, culture norms and values play very important roles in water resource managements. From the beginning people believed water is also god (Jal) so that they didn't garbage near to the water resources. From that concept they are managing very well but the new generation are not completely following that norms and values therefore water resources becoming in poor condition.

Water resources play great role in local development. Without water we cannot think our lives as well as other things. Our daily activities, industries, livestock, agricultural activities are very easy to get sufficient of water. Easily available drinking water for households uses reduces the time span and contributes to invest other activities i.e. income generating, which is the prime factor of increasing family standard and human development. It helps in Social as well as economic growth of the people.

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LIST OF ABBREVIATIONS/ACRONYMS

AAN	Action Aid Nepal
ADB	Asian Development Bank
CBS	Central Bureau of Statistics
CDRD	Central Department of Rural Development
CHRDU	Central Human Resource Development Unit
DB	Distribution Boxes
DDCs	District Development Committees
DWSS	Drinking Water Supply System
ESAs	External Support Agencies
FGD	Focus Group Discussion
fig.	Figure
FY	Fiscal Year
GoN	Government of Nepal
HHs	Households
HMG	His Majesty Government
ICIMOD	International Center for Integrated Mountain Development
IDWSSD	International Drinking Water Supply and Sanitation Decade
INGOs	International Non-governmental Organizations
IUCN	Union for Conservation of Nature
Km.	Kilometer
KUKL	Kathmandu Upatyaka Khanepani Limited
MHPP	Ministry of Housing and Physical Planning
MoF	Ministry of Finance
MoH	Ministry of Health
NEWAH	Nepal Water for Health
NFE	Non-Formal Education
NG	Nepal Government
NGOs	Non-governmental Organizations

NPC	National Planning Commission
NWSC	Nepal Water Supply Corporation
PRA	Participatory Rural Appraisal
RRA	Rapid Rural Appraisal
RWSSFDB	Rural Water Supply and Sanitation Fund Development Board
UN	United Nations
UNICEF	United Nations International Cultural Educational Fund
VDC	Village Development Committees
WESS	Water and Environmental Sanitation Sector
WECS	Water Energy Commission Secretariat
WSSUCs	Water Supply and Sanitation Committees
WSSUGs	Water Supply and Sanitation User Groups
WTO	World Trade Organizations

CHAPTER I
INTRODUCTION

1.1 Background

Natural resources refer to any portion of the natural environment such as atmospheres, water, soil, forest, wildlife, land, minerals, and environmental assets. Likewise, goods and services supplied by our living or non-living environment to meet human needs and wants are the natural resources (Pradhan and Pradhan, 2006).

NRM means appropriation, distribution, utilization, and conservation of natural resources and the legitimate way of controlling them which integrates NRM into a framework for analyzing how people use natural resources to make a living. Actually, NRM has an important responsibility of enhancing the resources to the next generation with contemporary use, by which local people (users) can get maximum benefits and resources can also be quite protected and reproduced with various technologies that are available in local level (Upreti, 2002).

On the other hand, NRM requires user's participation. Local people, who know resources very closely, are the real master of resources. Their participation will be more important for eco-balance. There are major two aspects in NRM – users' aspect and resources aspect. A balance, which is defined as NRM, between these two aspects is way of environmental justice by which every elements of ecosystem can get a proper chance to be protected and developed it.

Nowadays, NRM is popularly being used as the means of poverty reduction with the proper use and management of resources, and poor people of developing countries like Nepal are benefiting well. Because of it, we can say that poverty is the result of unequal distribution and unsystematic management of resources. It is obviously seemed that only those people, who exploit it, can preserve the natural resources themselves. It is argued that the participation of local people in the development of natural resource is considered as the best way to preserve, use, and management of it. People always want to exploit locally available resources to a maximum possible through using various technologies and that is defined as development. While local people involved not only in exploitation but also in management, then the development gets sustainability.

Country is only developed when their resources are utilized and managed by proper way. In the world there are huge amount of natural resources in various forms. In the same way Nepal has also lots of natural resources and lots of development potential but wrong utilization and management it became always developing country. Now a day the natural resources are utilizing by the world in unmanageable way so that different nature hazard is facing and it's directly

effects to the human beings, climate change, global warming and ozone layer depletion etc. therefore, we always think that how to use natural resources in proper way and sustained our resources in future.

There are many resources available in Natural. In this research only water resource is taken to the study. Water is a mobile resource: it falls from the clouds, seeps into the soil, flows through aquifers, runs along stream courses, and eventually returns to the clouds via water bodies like sea, great lake etc. This natural cycle is the basis of all life forms and of the economy of nature. Water may be "managed" in different ways: it may be harvested, extracted from the ground, diverted, transported, and stored. This makes it different from all other natural resources. However, each form of management that interferes with the natural cycle exacts a price, not just in economic terms but in terms of environmental damage and greater health hazards. Moreover, water does not occur alone, it is rather part of a complex ecosystem consisting of the land, plants, aquatic and other life forms. The improper and unregulated use of water by humans will not only damage the water source but ecosystem as well. Thus investment projects designed to enable users to have secure access to water will have to be examined from the standpoint of cost and economic benefit as well as in terms of their long-term impact on the environment. To be sustainable, water management schemes should respect the natural "logic" of water systems, and the ecology of which water is an important element.

Water exists in different forms, each of which may have multiple uses. There is surface water which appears to be stationery as in lakes and ponds, running water in the form of rivers and streams, and ground water in aquifers or mixed with the soil. But each form of water does not exist alone or independently of the others; on the contrary, they are all inter-connected through a complex natural process. A water system or water regime denotes the inter-connection among the different forms in a given geographical location. Individuals may make use of one water source or another (or a combination), depending on the nature of their livelihoods and their proximity to the sources of water.

Water is a common property resource and is critical for sustainable livelihoods. To begin with, all households need water for domestic use, i.e. for drinking, food preparation, washing, cleaning, etc. Access to adequate, clean water will greatly contribute to improve health and better productivity. Secondly, there are distinct population groups whose livelihoods are water-based, entirely or to a considerable extent; such groups include fishermen, and artisans such as tanners and potters. Thirdly, water resources can play a significant role in improving food security and household income. Irrigation is the most common means of ensuring sustainable agriculture and coping with periods of inadequate rainfall and drought. Fourthly, water is employed to generate power for use in

industry, services, and by urban households. Finally, in the developed countries, water is an important asset for the leisure industry. The extent to which water resources will contribute to sustainable livelihoods will depend on availability, the nature of rights of access, the system of management and the technology with which the resources are exploited. Moreover, the specific relationship between livelihoods and water resources will determine the nature of the stakeholders and their interest in the resources.

Our water resources, irregularly distributed in space and time, are under pressure due to major population change and increased demand all over the world. Access to reliable data on the availability, quality and quantity of water, and its variability, form the necessary foundation for sound management of water resources. The different options for augmentation expand the boundaries of the water resource in a conventional sense, helping to match demand and supply. All components of the hydrological cycle, and the influence of human activities on it, need to be understood and quantified to efficiently and sustainable develop and protect our water resources.

Water is an essential for human survival and well-being and important to many sectors of the economy. However, resources are irregularly distributed in space and time, and they are under pressure due to human activity. Although water is available in abundant quantity, its distribution is uneven in terms of area coverage and time. Its supply in sufficient quantity particularly in settlement areas is now a growing problem in Nepal. There are number of such places in the hills and tarai regions as well as in urban and rural areas where water scarcity is a burning problem.

Around the world, human activity and natural forces are reducing available water resources. Although public awareness of the need to better manage and protect water has grown over the last decade, economic criteria and political considerations still tend to drive water policy at all levels. Science and best practice are rarely given adequate consideration.

Pressures on water resources are increasing mainly as a result of human activity – namely urbanization, population growth, increased living standards, growing competition for water, and pollution day by day. These are aggravated by climate change and variations in natural conditions.

Water is the largest natural resources of Nepal although only a relatively low percentage of the total population getting safe and clean water for daily use. Water is use for drinking, bathing, washing and cleaning. Besides, it is used for agriculture, industrial, hydropower generation, religious purpose and recreation such as swimming, fishing and different forms of ecotourism. Water is a truly unique commodity without it life does not exist. Life can however, become uncertain even when there is water all around.

It is estimated that only about 3% water is potable in the world whilst Nepal has lavish portion on it. Its rugged topography creates great potential for putting these resources to economically productive uses, such as hydroelectric power generation and irrigation. (council, 1993).There is about 6000 rivers and rivulets in Nepal out of which 100 are more than 10 km long. The total length of all the rivers and rivulets in Nepal exceeds 45000 km. Annual mean flow of Major River is estimate to be 4930 m^3\sec. This amount to 70 percent of total surface run off about 60-80 percent of surface runoff occurs during monsoon. In Nepal, the capacity of hydropower generation is 83000 megawatt but until now, it is only generation 600-mega watt i.e. 0.7% of the total potential (Lekhak, 2003).

The world's water exists naturally in different forms and locations: in the air, on the surface, below the ground, and in the oceans. Freshwater accounts for only 2.5% of the Earth's water, and most of it is frozen in glaciers and icecaps. The remaining unfrozen fresh water is mainly found as groundwater, with only a small fraction present above ground or in the air. The Precipitation process of water like rain, snow, dew etc. plays the key role in renewing water resources and in defining local climatic conditions and biodiversity. Depending on the local conditions, precipitation may feed rivers and lakes, replenish groundwater, or return to the air by evaporation. Glaciers store water as snow and ice, releasing varying amounts of water into local streams depending on the season. But many are shrinking as a result of climate change.

River basins are a useful "natural unit" for the management of water resources and many of them are shared by more than one country. The largest river basins include the Amazon and Congo Zaire basins. River flows can vary greatly from one season to the next and from one climatic region to another. Because lakes store large amounts of water, they can reduce seasonal differences in how much water flows in rivers and streams. Wetlands including swamps, bogs, marshes, and lagoons cover 6% of the worlds land surface and play a key role in local ecosystems and water resources. Many of them have been destroyed, but the remaining wetlands can still play an important role in preventing floods and promoting river flows.

1.2 Statement of Problem

Basically, the concept of Natural Resource Management is accepted as balance between population and natural resources of a particular region. Because of its limited characteristics, natural resources and its balance with growing population are also being appeared obviously as a burning issue. The tremendous pressure on natural resource resulted in forest conservation, deforestation, habitat degradation, fragmentation, and socioeconomic complexities. As a result some problems on resource management are being caused.

Because of increasing population, the access of people over natural resources is further pooring. Increasing population and reducing natural resources are merely producing conflict in society or among the users. Because of over exploitation, natural resources are degrading day by day. For the name of development, resources are being affected negatively, which cannot be defined as development. Sustainable development of resources is essential, because the users able to use and recycle it to hand over the future generation.

There are different types of water resources in Kirtipur Municipality but lack of proper management water scarcity is still major problem through the year. Not only the cause of proper resources management, there are lots of other causes like population growth, deforestation, urbanization, increased living standards, growing competition for water, and pollution day by day.

The water resources play vital role in our daily life. Without water we cannot live and our livelihood activities cannot run smoothly as well as other kinds of works cannot do properly. Now a day, people have not got sufficient water for daily activities. It creates very big problem in our life. The distribution system is failed because of the population pressure in one hand and other is mismanagement where water is available. That means the difference between population distributions is changing in-between the decades in different location in the municipality. But the drinking water supply is based on the old system, so that the some parts have sufficient water and some have crisis.

Under the current trend of decentralization, local government is facing increasing responsibilities in a number of areas, including new roles relating to services delivery, development planning and environmental management in fulfilling its roles in each of these areas, water resource should be a key factor of consideration, as there will have impact on local government's performance. Yet, local government is not at forefront of engaging with integrated water resource management.

Due to these reasons the drinking water is not regularly supply Kirtipur. It is supplied only on alternative days by KUKL and somewhere it seems that once a week in half an hour to one hour. The people manage the use of water in their household activities from other water resources like dug well, well, river, Stone Spout, ponds, Springs. But before a decade as a whole is Kirtipur Municipality were very few tap water connections at home. At time people are using public water tap but now a day there are thousands of water connections at home but water crisis is climbing up. Therefore, this research is also trying to identify the root cause of the lack of water resource management in Kirtipur Municipality.

1.3 Objectives

The overall objective of this study is spatial analysis of existing water resources management in Kirtipur Municipality and share the knowledge about water resources management for the sustainable local development. The specific objectives are as follows:

- To find out the existing water resources;
- To find out the utilization of existing water resources; and
- To analyze water resources management.

1.4 Significance of the study

This study is closely related with water resources management planning in Kirtipur Municipality. It is very useful for water crises problem as well as local development. Furthermore, it has checked a balance between natural resource management and increasing population as well as other sectors. This study has carried out is the study of existing water recourses in different location, their utilizations, quality and quantity, potential water resources, distribution and supply system, which may more important for local development, planning and management in the future. Different institutions had been studied the water resources management in Kirtipur municipality but nobody had detailed study about that for planning. If it will be studied in detail, it provides knowledge and ideas about water resource problem in Kirtipur Municipality and I believe that the planners and policy makers will be benefited for proper rural development planning.

Similarly, this study will be helpful to the concerning institution for water resources management, conservation, water supply, local development etc. Furthermore, this study tries to relate the relationship of population growth and its impact on water resources. Therefore, it will be useful in the formulation and implementation of the plans and policies for the governmental as well as non-governmental organizations, planner, users groups and communities.

1.5 Organization of the Study

This study is covered all the existing water resources in Kirtipur Municipality and collapse resources as well. This study is organized into the 7 chapters. The first chapter deals with introduction about the natural resources with water resources, second has methodology about how to conduct the study, third has literature review about the previous research or study in water resources management, fourth with description of the study area, fifth with water resources in Kirtipur, sixth with water resources management, and seven with conclusion and recommendations respectively.

CHAPTER II
LITERATURE REVIEW

2.1 Concept

Literature review is a process of getting idea by reading all types of publication, which are relevant to the selected topic. Reviewing the literature helps to draw a concrete concept that leads the research systematically. It familiarizes the researcher with the relevant information about the research area. It is important for minimizing the problems, which is to be faced by the researcher because literature shares the experiences which are gained by the previous researcher.

Some of the literatures which researchers have reviewed are mentioned here.

Water is one of the most important and precious of natural resources and a regular and plentiful supply of clean water is essential for the survival and health living organisms. Drinking water and sanitation is widely studied in Nepal. The earlier studies concerned mainly in technical field and in providing the piped drinking water supply in the country. Majority of rural people obtain water from ponds, springs, rivers, stone spouts and wells. Various research works, has been conducted in the field of drinking water, irrigation, community managed, government managed water supply system, methods techniques, and finding out their effectiveness but only a few research have been done about water resources management.

The richest continent in terms of total water supply is South America and Asia. Each has about 12% of the total land area of the worlds but receives about one-fourth of the total global runoff. Its 27% of the total runoff is shared by only 6% of the world population.

The richest country in the world in terms of per capita water supply is Iceland, which has an annual renewable supply of 370,000n 3 (177 million gallon) per person By contrast Kuwait and Bahrain have no renewable water supply. Egypt, u1spite of the fact that the Nile River flows through it, has only 30cu. in per capita per year on a renewable basis, 20,000 times less per person than Iceland.

Stable runoff: It is the part of water available year round that is usually more important than total runoff in determining human use.

Human water use has been increasing about twice as fast as population growth over the past century. The average amount of water withdrawn worldwide is about 646 cu. in (170,616 gal) per person/year. USA has the highest (5400 liter or 1400 gallon) per person per day as compared to 45 liter per person per day in less developed countries.

Uses of withdrawn water vary from region to region and country to country. Globally about 69% of the withdrawn water is used to irrigate 18% of the world's cropland (93% of the withdrawn water in India and 4% in Kuwait). Canada uses only 12% of the water for agriculture. Larger part (7090%) of water used for irrigation goes waste due to evaporation and seeping. Seepage from the fields gets contaminated with fertilizers, pesticides and crop residues making it low quality.

Worldwide about 23% of the water withdrawn is used for energy production (oil and gas production and power plant cooling) and industrial processing, cleaning and removal of wastes. Water withdrawn for energy production and industrial use is highest in Europe and North America, especially USA.

Domestic and municipal use accounts for about 8% of worldwide withdrawal and about 13-16% in industrial countries. Increase in domestic and municipal use and industrial use are usually accompanied by an increase in the wastewater. Along with the growth in population, urbanization and industrialization, volume of wastewater will increase enormously.

Chalise and Gurung (1993) studied the natural resources management only in mountain environment at a broad regional scale of Hindukush Himalayan region. They discussed about forest, diversity, water, and land resources. They viewed and studied country wise about the natural resources. Nature resources are available in all part of the country as well as whole world. If the management of natural resources are studied all part of the country then is will be very effective.

Gurung (1996) studied the customary natural resources management systems of Tarami Magar community of western hill of Nepal. He concentrated his study on NRM with cultural ecology and political history. From the perspective of cultural ecology, he focused particular attention on local cultural systems and socio-political institutions and asked whether they have served or can continue to serve as effective means for regulations of natural resources so that local communities can sustain their livelihoods. From the political and historical perspective, he reconstruct historical process, both at the national and regional as well as the local level, and examined their effects on the local system.

Qadri (2001) has studied about natural resource management with sociopolitical dimension as conflict management. In this study, he has not discussed only about the geographic agents and several natural resource management techniques, but also about the resource related conflict and its resolution processes. His study was limited within five interconnected conflicts – two from irrigation system, one *guthi-land,* one spring water resource, and one from forest pasture-land.

ICIMOD (2003) has located different infrastructure, resources in the study of GIS for the municipal planning of Kirtipur Municipality. Study concentrated information with ward wise distributes of water. In the case of water resources they are missing and ignored small water resources. Thus the planner has difficult to manage the water resources in Kirtipur through this study.

2.2 History of Water Supply in Nepal

The history of England becomes relevant to talk about the development of water supply technique. After the 'Industrial Revolution', many private companies were established to provide drinking water in the cities of England, USA, Germany and France. In England, the private companies used to dig road and peoples have to put water pipes according to their own will but later those companies were made to take the permission from parliament. Those companies whose sole motive is profit, used to supply water to the rich families (Dixit, 2059 BS).

In 1800 AD, out of 10 lakes population of London, only one-forth families had their own private taps. There used to be supplied to their houses thrice a week with one hour a day. Other families/ people had to take water from the public taps. So, poor people got less priority there. The question of equity was raised there, by this kind of activities of private companies.

Since, the ancient times people of Nepal have tried to manage water resources from rivers or streams for drinking. The history of water supply development in Nepal dates back to as early as the Lichhavi days when stone spouts, commonly known as *dhunge dhara* were constructed to bring water near to the settlements. Constructed in the elaborate manner, some of these *dhunge dhara* have lasted until date for centuries. The first drinking water project inaugurated in 1891 BC, which was constructed under supervision of English Engineers, came from Calcutta, was the first Drinking water project in Nepal. Supply known as BirDhara Modern water project the water taken from "Madhav Khola" used to be collected on a tank made in Maharagunj from there the water used to places and houses of high standard officials. At that time, many public taps were also established for locals. After four years, another Bir Dhara tap also has built at Bhaktapur in 1895 BC, Dev Shamser established many pure drinking tap in "Vikshya Pokhari" for the public purpose, which was imagined by his late wife, and he gave fixed shape, he also made another tap in Bhimfedi later. He also constructed another tap of his dead son rememberance in 1921 BS. Prime Minister Chandrashamser's first wife gave order to established tap in her own native village Jagarkot in 1924 and at that time, another drinking water completed in Dhankuta. Becoming the Prime Minister after Chandra Shamser, Bhim Shamser made "Shree 3 Bhim Dhara" in Kathmandu in 1932, Khadaga Shamser banished person from nation also established another water project in

Palpa at Tanshen, the resource was in “Bhulya Khola” in 1930, and another water project established in far western region Doti that was supervision form Indian side (Dixit, 2059 BS).

Most of Nepalese used to suffer from water because the water centre areas were located in remote area. The water had to bring by female, male never bring at all they had to wait many hours for water. The duty was child and they took water, thus the education of children and rest was not available they were deprived. Home near tap was easy to fill water but those who did not have to travel much distance for fetching. In water, carrying process women were only does. In Nepal, lack of pure drinking water many disease came in local people’s health and many died form it too. There were two streams in Drinking Water project but they conducted in their own way. The first stream completed which was by Drinking Water and Sanitation department. There were only opened in urban area and where the peoples number was out of 1500 and they were focused group. Local department donated the survey, design and money and counselors of ‘Design Section’ constructed other function. Local people were deprived form repairing and sanitation. The sanitation department gave item instruct to repair and made them conscious about Drinking Water project. However, in spite of these facts they were unable to go to the ‘focused group’ although large amount of money training also conducted but did not get anything. Another department was also built form government side. Local department took help form HELVATES and UNICEF and started to work for New project. The project plan helped the project gave training to local people about Health, life, and environment and to participate such program after that people got knowledge about Drinking water project. The drinking water project registered in 1989 and published instruction paper how to manage and so on (Dixit, 2059 BS).

So, we can say that, the modern water supply system, in which water is delivered through pipes, began in 1985 A.D. when a piped water supply system was constructed by the then Prime Minister Bir Shamser by the name of Bir dhara. Sporadic works were carried out after that in providing water supply services such as Karma Kumari Dhara (Amlekhganj), Dhankuta Pani Adda (Dhankuta), Balnarsingh Dhara (Pokhara), Dhirdhara (Birganj), Bhaktapur Pani Adda (Bhaktapr), Lalitpur Pani Adda (Lalitpur), Tri Bhim Dhara (Kathmandu), Hoske (Kavre), Tansen (Palpa), and Khalanga (Jajorkot) by the Rana Regime.

2.3 Drinking Water Supply and Sanitation in National Plans

Planned development in Nepal was initiated only in 1956 when the first five-year development plan for the country was launched. The planned development of water supply sub-sector was commenced with advent of the Third Five Year plan (1965-70). However, the thrust in terms of institutional development, population

coverage and increased level of investment came during International Drinking Water Supply and Sanitation Decade (IDWSSD, 1981-1990). The government gave and importance to optimum mobilization of non-governmental sectors, private sectors and public participation only form Eight Five Year Plan. The Eight Five Year Plan (1992-1997) set a target of 72 percent coverage for drinking water supply and 13 percent for sanitation to be achieved with in the plan period. The evaluation report of Eight Five Year Development Plan, clearly mentioned that adequate authority has not been decentralized and sufficient financial authority has not been delegated to local agencies and user's communities. The capability of user's groups and local agencies has not been strengthened and effective co-ordination yet to be maintained among these agencies. However, government claims that population benefited by drinking water supply and the end of Ninth Plan 2001/02 was 71.6 percent and sanitation coverage was 27 percent. By the end of the Ninth Plan 71.6 percent of the total population has the access to drinking water. It was estimated that there are still 28.4 percent of the population deprived of drinking water facility, a basic need of life. The target of the Ninth Plan was to provide basic drinking water to all by the end of the plan period. During the period, increased involvement of the consumer's group as well as wider public participation in the construction, operation and maintenance of drinking water projects created favorable atmosphere to make project more sustainable. The sanitation programs related to health, education and public awareness were also launched during the plan period. In Tenth Plan (2002-2006), it was taken strategy in rural drinking water project on the basis community needs and demands the project under taken, with the involvement of user community for maximum utilization of locally available resources and means. Moreover, it was given emphasis on the conservation of local resources and operating rural drinking water projects through the consumer committees and NGOs such institution had also gave emphasis (Tenth Plan, 2002-2007).

In Economic Survey 2006/07 Community, development is taken "As the effort of government alone is not enough to expand the drinking water facilities, the policy of expanding drinking water facilities, through the involvement and partnership on the basis of their feasibility has been adopted. In order to ensure sustainability and certainty of projects and services, the concept of community management of rural and semi-urban projects was put forward to replace the concept of people's participation. Similarly, for ensuring and promoting the concept of community management, a provision of 20 percent contribution of the cost of execution of the project by the community has been made. However, in case of backward class and targeted groups of people, the policy to contribute only 10 percent of the costs of the costs by community has been adopted. Community based Drinking Water and Sanitation projects have been implemented in districts, which are lagging behind in respect of availability of

drinking water and sanitation facilities and Human Development Index. Similarly, some provisions have been made to set aside a fixed amount of budget in order to ensure realization of expected benefit for drinking water and sanitation facility and positive impact on public health and to develop health education program as an inseparable part of drinking water services. Facility extension programs, aimed at promoting public awareness towards sanitation are in operation as an integral part of drinking water projects. Against the target to complete 13 projects under Small Town Drinking Water Projects under Development of water supply in the current Fiscal Year (FY) that would provide service to 123 thousand people, only 10 projects have been completed and the overall progress is recorded at 78 percent (Economic Survey, 2007).

2.4 Ministerial Level and Policy upon the Water Supply and Sanitation Sector

Government of Nepal has made several policy interventions in the water supply and sanitation sector. As for the water supply sector, although some major works were carried out to provide services to prominent township like Pokhara, Dhangadi and Hetauda, it look more then 16 years to establish a separate department to deal with water and waste water services in the country. Department of Irrigation and Water supply that was established in 1966, was divided in two in 1972 into Department of Water Supply and Sanitation and Department of Irrigation. DWSS continued with its responsibility for larger systems, while Local Development Department, with UNICEF assistance started a program for Small rural water supply. Until the Seventh plan, all water supply programs were run under the Department of Water and Nepal Drinking Water Corporation. The government gave an importance to optimum mobilization of Non-Governmental sector; private sector and public participation only form Eight Five Year Plan. Ministry of Housing and Physical Planning (MHPP, 1989) had reported on the existing situation of the water supply systems in some town of Nepal. It has also highlighted the needs and investment required for the water supply. It has pointed out several shortcomings and forwarded many proposals for reforms. These include needs for more water treatment plants upgrading the existing supply, networks and proposals for the control of contagious water borne disease (Pant, 2002).

The most active provider of the services in the Water and Environmental Sanitation (WES) sector are Department of Water Supply and Sewerage (DWSS), Local Authorities (DDCs & VDCs), External Support Agensices (ESAs), Non-Governmental Organization (NGOs) private sector, Community Based Organization (CBOs), and User Committees.

The National Planning Commission (NPC) is responsible for the overall WES sector planning and coordination. It overlooks development plans and policies and

approves annual budget estimates. The Ministry of Finance (MoF) is responsible for mobilizing and allocating resources for the WES programs. The Ministry of Housing and Physical Planning (MHPP) is responsible for formulating the overall policies and looks after all rural water supply development and 22 urban water supplies. The Nepal Water Supply Corporation (NWSC), also within MHPP, is an autonomous body responsible for water supply and sewerage in 13 urban centers in Nepal, including the Kathmandu. The Central Human Resource Development Unit (CHRDU) is mainly responsible for planning, coordinating, organizing and training activities in the WES sector. MLD is involved in providing water supply facilities through integrated rural development projects. Within MLD, the Women Development Division (WDD), and Remote Area Development Committee (RADC) are also providing a number of water supply and sanitation facilities. In addition, MLD also provides grants to DDCs and VDCs for the implementation of water and sanitation facilities (Pant, 2002).

The Ministry of Health (MoH) is mainly responsible for public health hygiene education and to some extent, promotion of on-site sanitation facilities. The Environmental and community Health Section under the Health Education, Information and Communication Centre of the Department of Health undertakes these activities. The Ministry of Education and Culture (MOEC) provides health education through classroom lectures. It also has a Non- formal Adult Education program that includes hygiene and health sectors.

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 behavior.

The figure for coverage of population by mid July 2003 by drinking water supply was 71.6 %. In the period mid July 2003 to mid July 2007, additional 2.62 million people have been provided access to supply of drinking water thus increasing the coverage figure to 80.4 % of the population. In this 1 million are covered by programs implemented by DWSS and the rest by other agencies working in the sector. The figure for coverage of population by basic sanitation is about 46%.

These figures, however being through secondary sources, the task of having actual database on status is started from the fiscal year 2062/63. This database, besides providing the real picture on where we are in terms of actual coverage and overall sect oral status, will also help in identifying areas of urgent

attentions. Date report will be produced towards end of by 2064/65 (www.dwss.gov.np, 2008).

The term water laws refers to both municipal and international laws, norms, values and principles which project the right of people to access to water resources for various purposes. General speaking, water laws are rules enacted or provide by a legitimate authority that regulate the sectoral use of water. The search for principles governing water resources are motivated by two basic concepts:

Concept of Development Need: To ensure economic development by providing sufficient water for drinking health and sanitation, irrigation, electricity and industry.

Concept of Pursuit of Justice: To ensure the equitable and reasonable allocation, distribution and utilization of water resources.

In this context, water law plays a principal role in:

- Protecting the right to water as a basic human right;
- Ensuring access to water for drinking health and sanitation;
- Ensuring access to water for food production;
- Meeting the water needs of industry and commerce;
- Resolving and preventing disputes over the allocation distribution and use of water resource;
- Facilitating the implementation of effective water policy and
- Ensuring water quality by controlling pollution (Nepal, 2005).

Government of Nepal has made several policy interventions in the water supply and sanitation sector. The government has introduced the water Resources Act 1992 (2049 BS). This is an umbrella Act, governing not only drinking water, but other uses of water and overall water resource management in Nepal. The Act gives priority to the right to use water for drinking purposes over any other domestic or commercial use. There are two regulations under the Act, for drinking water purposes the water Resource Regulation 1993 (2050 BS) and the Drinking water Regulation 1998 (2055BS). The Water Resource Act have following features; proper utilization of water resources; government ownership in all water resources; and guidelines and instructions for the use of water resources to minimize the negative impact on the environment. According to the Act, all Water User committees should be registered with their respective district administration to legalize their action. This act is the umbrella Act governing water resource management. It declares the order of priority of water use. The water resource is vests ownership in the state. It provides, for the formation of

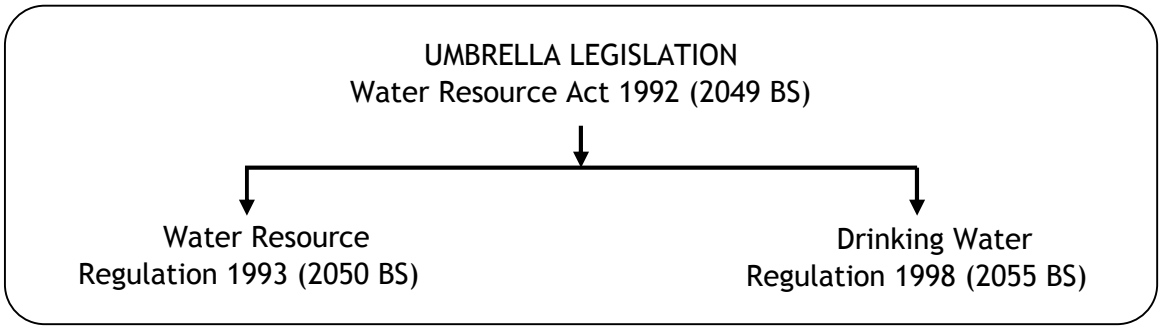
water users associations, established a system of licensing, and prohibits water pollution (Nepal, 2005).

The Water Resource Regulation 1993 (2050 BS) is an umbrella regulation covering all uses of water and providing procedural mechanisms for the implementation of the Water Resource Act 1992 (2049 BS). The Regulation covers the formation of Water User Associations and District Water Resource Committees licensing provides a dispute settlement mechanism in relation to water use service charges, stress out the process to be followed by the State in relation to land acquisition and compensation and provides some forms in the schedules to the regulations for certain administrative procedures.

The Drinking Water Regulation 1998 (2055 BS) specially deals with drinking water sanitation as it affects drinking water. Among other things, this Regulation regulates DWUAs, the quality of drinking water and drinking water supplies.

The other major pieces of legislation governing drinking water are the Nepal Water Supply Corporation Act 1989 (2046 BS). This Act establishes the NWSC as a public corporation responsible for providing clan drinking water and sewerage services to the urban public. The scope of work of the Corporation has been determined by HMG by notification in the Gazette. This Act establishes the right of people to drinking water and sanitation and imposes a duty on the state to provide drinking water and sanitation.

Drinking water is also mentioned on by other legislation not necessarily specifically enacted for that purpose. The Local Self Governance Act 1999 (2055 BS), which primarily deals with the decentralization of government, also gives local bodies some responsibility in relation to the utilization, conservation and management of water resources and the maintenance of sanitation facilities and waste management.



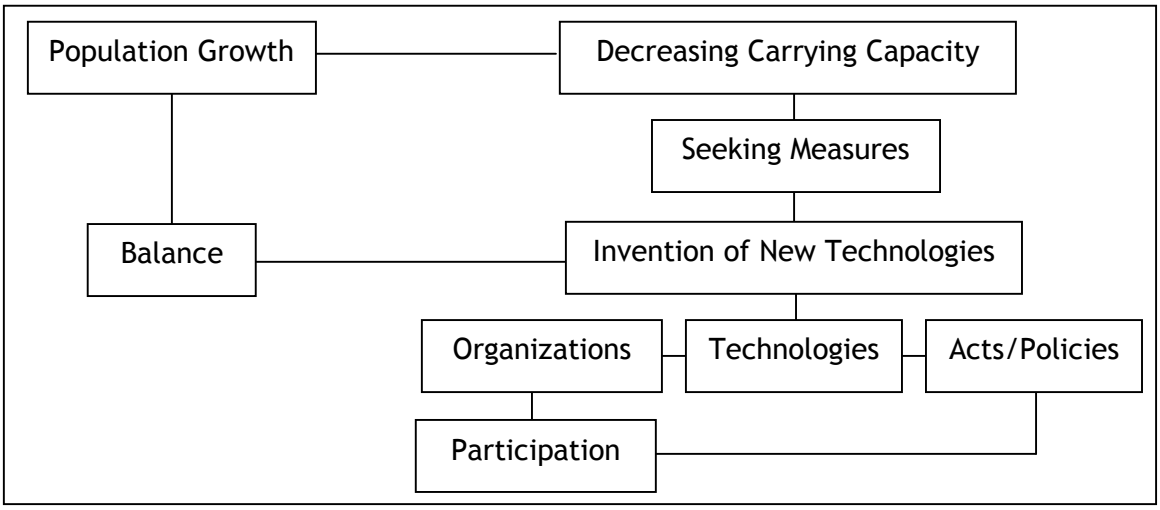
Source: Nepal, G.O., February, 2005

2.5 Natural Resource Management Process

On the basis of ground reality and experience, the concept of NRM process is developed himself by this researcher. The researcher would not like declare it a concrete concept but it is forwarded to be discussed in the scholar arena

whether it is a concept or not. In depth-discussion among the scholar can provide the final shape of this concept According to the concept, the origin point of the NRM concept is breaking of balance between population growth and natural resource. Although Gurung (1996:2) defined the population as not the major cause of misbalance and poverty, population growth leads all kinds of problems such socio-economic, political, and historical problems. After creating misbalance by population growth declining carrying capacity, new measures of balancing are quested. The effort of seeking discovers a new technology and finally the application of new technologies establishes a new balance. NRM process is presented on fig. 2.1. The NRM process can be compared with Darwinian concept of 'Struggle for Existence.' Fundamentally, the struggle for existence in nature arises from the different modes of change in organic and inorganic matter (Hawley 1950: 14). Human practices for establishing balance are its own struggle that developed out as process. The concept of balance, here, is being compared with reestablishing the carrying capacity of natural resources. 'As applied to human population the concept of balance concerns the ratio of numbers to the opportunities for living (Hawley 1950:49). In this NRM process, the issue is arisen because of population growth. Immigration and natural increase play a crucial role in growing population of particular space. That increasing population creates a high demand of resource and tries to consume to meet high level of satisfaction. Because of high consumption, environment starts to loss its carrying capacity. Very slowly, the users notice an imbalance between the emerging population and the available resources and they start to seek some measures that help them to reestablish a balance. Their seeking effort (may) find or invent a new technology – organizational, people's participation, acts and policies, and technologies – that help to meet their goal of establishing a new balance between natural resource and its users. It is assumed that the NRM system of the study area also passing through this process. Population of the study area also is increasing due to the migration and natural increase and users are practicing to establish a balance.

Figure 2.1 Natural Resources Management Process



2.6 Community Managed Drinking Water Supply in Nepal

Besides governmental organization a wide range of some international and national non-governmental organization (NGOs & INGOs) are working on water and sanitation delivery services since 1990s.

United Nation, The World Bank, The Asian Development Bank (ADB) have given emphasis in Community Managed Drinking Water. They are providing donation and aid in this sector. Five Year Development plans have emphasized in the community drinking water. Some time, they are giving conditional aid in the water sector. These agencies have been still making great attempts to our benefit the drinking water related problems. In this regard the quote of Washington Post, June 1, 2004 – "The World Bank today approved two separate projects aimed at poverty reduction through community-led and managed initiatives in Nepal. A US$25.3 million credit was approved to extend water supply and sanitation to over 800,000 people in rural areas of the country. A second US$15 million grant was also approved to the Poverty Alleviation Fund, a pilot initiative created to bring increased opportunities for income generation and access to basic services and infrastructure to poor communities in rural areas".

"While the Government of Nepal struggles to provide effective support to marginalized groups, it also recognizes that some NGOs, community based organizations and donors have implemented a number of successful programs to reach out to the marginalized groups, through community-managed infrastructure, says Ken Ohashi, the World Bank's Country Director for Nepal. "Thus the government has wisely decided to turn the Poverty Alleviation Fund over to those who know how to run it best and to scale up the provision of safe drinking water to the rural poor through mechanisms successfully demonstrated by the Rural Water Supply and Sanitation Fund Board."

Poverty in Nepal is pervasive with about 40 percent of the population living below the poverty line. The poor live predominantly in rural areas and engage in subsistence agriculture on small plots of low quality land, have limited access to credit, infrastructure, markets, and basic social services, such as water and sanitation. Ethnic minorities and lower caste communities in remote areas, and women, especially female-headed households, lag seriously behind in terms of incomes, assets, and most human development indicators in Nepal (http://go.worldbank.org/July 20, 2008).

UNESCO, in 2003, also mentioned about the millennium development goal for access to drinking water which was reconfirmed at world summit for sustainable Development. It stated that the summit set the target for access to sanitation, i.e. halving, by 2015, the portion of people who do not have access to basic

sanitation. In the publication of UNDP in 1994 mentioned that in order to attain these goals, each country should immediately initiate engineering and feasibility studies on projects that considered to one of highest priority, and are based on a cost-effective technology appropriate to local conditions, with community participation, a good management and provision for operation and maintenance. Asian Development Bank will continue to support community initiatives in small towns to develop water supply facilities to be maintained by local community or private enterprisers. Private sectors management contract for urban water supply and sewerage services in Kathmandu valley, under World Bank assistance in 2000, will be an important milestone for further processing for Asian Development Bank assistance for the Melamchi Water Supply project, a 2000 project (Bhattarai, 2006).

2.6.1 Drinking Water and Sanitation in Interim Plan (2007/08- 2009/10)

There has been a wide increase in the involvement and participation of the user's groups in the construction, operation and maintenance of water system. According to the Nepal Demographic and Health Survey, 2006, nearly 90 percent households in urban areas and nearly 80 percent rural households have access to drinking water. In the same way, in case of sanitation, about 37 percent in urban areas and about 20 percent in rural areas (households) have been using improved latrines, from the administrative records, about 77 percent of the people have access to drinking water and about 46 percent people use 16 proper latrines. In the field of drinking water and sanitation, legitimization and coordination are deficient in the works of different agencies. In many places, necessary services have not been provided, in addition, adequate attention has not been paid to improve the quality of the available drinking water, and proper repair and maintenance of the constructed water supply system could not have been done. During this period an additional 400,000 of the population had the facility of drinking water and sanitation facilities were made available to 319,000 people of Nepal. In the FY 2002/03, the Local Infrastructure Development Policy was approved. According to this, works under seven sectors (rural roads, suspension bridge, small irrigation, community water supply and sanitation, etc.), have been developed and conducted through local bodies. However, during this period, notable progress could not be achieved in the area of decentralization and devolution due to conflicts in the country and the absence of local representatives.

Population with access to improved the drinking water is 77- 85 (percentage) in the tenth plan. In order to make local bodies gradually responsible for basic water supply services, water supply and sanitation schemes serving less than one thousand people have been devolved to them. During the Tenth Plan period, drinking water schemes were implemented with due priority given to

improvements in water quality and service standards. There has been a gradual increase in the participation of common masses and the involvement of the government and community based organizations for the development of water supply and sanitation services.

The process of transferring water supply management to the private sector has been initiated in case of the Kathmandu Valley.

Basic Drinking Water Service in Tenth Five Year plan was targets total benefited population was 22,680 (in '000), percentage of benefited population 85, But the achievement was benefited population was 20,434 (in '000) Percentage of benefited population 76.6.

The quantitative targets of the TYIP in the water supply and sanitation service coverage by the end of the TYIP period have been envisaged as mentioned below:

Indicators Status by 2006/07 TYIP Targets;

A) Basic Drinking Water Service

- Total Benefited Population (in '000): 24,327
- Percentage of Benefited in Total: 85

B) Medium and High Level Drinking Water Service

- Total Benefited Population (in '000): 4,293
- Percentage of Benefited to Total: 15

Strategies to attain the objective, during the TYIP period, will include the following:

- Execute simple technology based water supply schemes for extending the basic drinking water supply services.
- Ensure sustainable water supply services through rehabilitation and extension of previously executed old and damaged water supply schemes.
- Gradually improve the quality of drinking water in accordance with the Drinking Water Standards, 2007.
- Gradually extend the service standards as per the Water Supply and Sanitation Policy, 2004.
- Promote and extend sanitation facilities through public awareness at the rural and urban areas with the participation and contribution of the local government and Users' communities.

- Introduce necessary policy, institutional and legal reforms for adopting the Sector Wide Approach through effective coordination between the stakeholder agencies.
- Strengthen organizational capacity for effective and result oriented plan implementation, monitoring and evaluation.
- Update and arrange for the dissemination of data and information on population with or without having access to water supply services.
- Priority will be accorded to complete the on-going drinking water schemes under construction within the three-year period through active participation of the users' groups.

New projects will be selected, based on selection criteria that also evaluate the proportion of peoples' contribution, and priority will be accorded to the execution of those schemes that assure high peoples' participation. In order to ensure sustainable development and management of water supply and sanitation schemes, preparatory stage activities will be compulsorily undertaken prior to the commencement of construction works. 'Coordination Forums' for drinking water users' committees and forest users' committees will be established to strengthen the financial management aspects as well as for conserving the sources of water. The responsibilities for operation, management and repair and maintenance of all the completed schemes will be handed over to the concerned users' committees. The policy regarding subsidy given for operation of the schemes handed over will be modified. The drinking water system (schemes) that are completed but presently not in operation due to lack of proper repair and maintenance will be rehabilitated for service delivery with the initiation and participation of the users' communities. Similarly, in the case of new schemes, provisions of Joint Investment Fund and Advance Repair Maintenance Fund will be made mandatory (Nepal, 2007).

There are many Literatures regarding to community Drinking water, however they are not sufficient to provide such kind of information, which is related to comparison between community tap and public tap. Due to this research is based on community oriented drinking water project of above-mentioned VDC; the literatures it reviewed are empirically related to this field. They focused on other areas too such as health and sanitation, policy etc. It is found that most of the studies are failed to explain about the level of local people's participation. Even though all literatures are regarding to this topic are valuable to generalize the condition of whole country. At last our literatures conclude that community Managed Drinking Water is the best option to combat with water scarcity Zone and sustainable drinking water management.

In this study, local people participation in the use and management of natural resource has been discussed and been analyzed with the sustainable and participatory development approach. Equity social and environmental justice are explore in the use and management system of natural resources through local people's participation with decentralization approach. Involvements of all ethnic and gender in the natural resources management are analyzed here with the participatory development approach that how many and which groups are participating in land and forest resources management. This study has mainly focused on management system, including customary and modern technologies that are being practiced in the study area. So that it will be quite different from former studies.

2.6.2 Nepal Water for Health (NEWAH)

Nepal Water for Health (NEWAH) is a national level non-governmental organization (NGO) that specializes in drinking water, health promotion and sanitation. Established in 1992, it has been working actively in partnership with local NGOs to serve poor communities secure basic services of water and sanitation, strengthening the capacity of these partners to undertake further development activities. It has an executive body comprising of 7 members and is affiliated with the Social Welfare council - the governing body of NGO sector in Nepal and is registered with the District Administration office.

NEWAH operates in selective districts of Nepal from the East to the Far West through its three regional offices located in three development regions (Eastern, Central and Mid Western region) of the country with the support of 93 professional regular staff. Each year NEWAH supports around 60 community based self-help water supply, health promotion and sanitation projects. The community receives financial, technical and capacity building support from NEWAH. So far, NEWAH has worked in 50 districts of the country serving over one million people (estimated to be 3 percent of the national populations) through 1,013 projects working in partnership with 465 local partners (As of November 7, 2007). Social inclusion and equity is promoted all across NEWAH (both at program and at organizational level) by adopting an approach of Gender and Social Inclusion (GSI) although most of its works are carried out in rural areas. It is gradually trying to extend the services for the rapidly expanding semi urban poor areas. NEWAH perceives itself as a 'Learning Organization' and continues to increase its focus on innovative and low cost alternative technologies, approaches as well as learning around water and sanitation such as Fog Water Collection, Rain Water Harvesting, Community Led Total Sanitation (CLTS), School Led Total Sanitation (SLTS), Integrated Water Resource Management etc. to contribute in improving sector’s performance. Scaling up gender and poverty-sensitive community management of water supply and sanitation systems

requires institutional commitment, resources, time and long-term support. NEWAH has clearly demonstrated all of these over the past few years. What is significant is NEWAH's ability to change institutional attitude in accepting and implementing approaches to enhance gender sensitive and pro-poor community management. It is essential to view women and men in a community as equal, regardless of caste or class, and to respond to their needs. This important dimension has been addressed in all stages of NEWAH's project cycle. Addressing gender and poverty issues can substantially contribute to achieving equitable access and sustainability for poverty reduction. We can certainly look forward to these contributions in the next ten years with NEWAH's innovative and valuable work in the development of communities in Nepal. NEWAH conducts subjective researches at regular intervals to identify areas requiring improvement and for enhancing service standards and recommending on new, appropriate and alternative technologies and approaches. In the recent years various studies such as the Water Consumption Study, Sustainability of Hygiene Behaviors, Long Term Sustainability Study, Public Latrine studies, NEWAH Participatory Assessment II, Socio-Economic Impact of WHS projects, etc. have been carried out. These kinds of researches and studies have given basis for new learning, improvements and providing better services and will be continue in the future, although Nepal is naturally bestowed with ample water resources only 82 percent of population has access to safe and clean drinking water. Improved services such as piped water and covered wells make up for almost 93 percent of water coverage in urban areas and 79 percent in rural areas (with 6.7 percent water piped to the house, 32.5 outside the house and 39.6 percent using covered wells). The remaining has to depend upon the conventional sources like unsafe wells, lake, river, spring, etc. A UNICEF report in 2006, estimates that around 13,000 children die every year due to water related diseases before they reach their fifth birthday. Thus, to support rural communities have access to safe drinking water NEWAH supports approximately 80 projects a year through all its regional offices. NEWAH's water supply system mainly consists of Gravity flow and Tube well systems that serve communities with drinking water in the hills and Terai respectively (www.newah.org.np, 2008).

2.6.3 Rural Water Supply and Sanitation Fund Development Board

Rural Water Supply and Sanitation Fund Development Board (RWSSFDB) is promoting demand-driven community based approach in water supply and sanitation sector in Nepal by mobilizing non-governmental and private sector organizations in assisting communities to implement water supply and sanitation schemes. To increase ownership, sustainability, beneficiary communities represented by water supply and sanitation users' committees (WSUCs), implement schemes with the assistance of SOs. The community-based demand-

driven approach to scheme identification, design, construction, operation, and maintenance moves the emphasis from the conventional supply driven development approach in order to increase beneficiaries' participation in decision-making, in implementing their decisions, and in sharing the benefits of the schemes.

The Board provides grant assistance to communities and SOs for the implementation of rural water supply and sanitation programs, which also integrates the following components:

- Community organization and mobilization;
- Non-formal education (NFE);
- Health, hygiene and sanitation education (HSE);
- Capacity building of SOs/SAs and communities;
- Environmental management;
- School sanitation program;
- Skill-based training;
- Women's technical support service linking to income generation;
- Micro-irrigation; and
- Other programs to support sustainable and cost-effective water supply and sanitation development;

On 14 March 1996, the government of Nepal created the Rural Water Supply and Sanitation Fund Development Board to promote sustainable and cost effective demand-led rural water supply and sanitation services in facilitation of Non-governmental and Private Organization to provide full emphasis on community ownership in conformity with the government's Eight Plan (1992-97), Ninth Plan (1997-2002) and Tenth Plan (2002-2007). Sector policies aimed at fundamental changes in the rural water supply and sanitation services delivery mechanism in the country. The Ministry of Physical Planning and works in the line ministry for the Board.

This Board has completed its First Phase (1996-2003) successfully and entered in the Second Phase (2004- 2009) to support rural communities on implementation of water supply and sanitation schemes. The Board is being funded by World Bank and DFID (www.rwss.com, 2008).

2.6.4 Action Aid Nepal (AAN) in Community Managed Drinking Water

Action Aid Nepal has been implementing water projects in hilly rural areas of Nepal since 1984. Over the period, AAN has been learning from its experience and also from those of similar organizations involved in community development.

Different approaches and policies have been adopted and the present approach has actually evolved from experience.

From 1989, AAN changed its working procedures. Some responsibility of project implementation was given to the users. Project planning and prioritization were given by the AAN themselves. Community mobilization, site and store management mason and worker management, project implementation, and decision making once the project was started were taken up by the community. Maintenance fund collection was made compulsory. Priority was given to training, meeting and workshop with users with the purpose of enabling them for qualitative outcomes from the implementation of the project. This helped slightly in improving ownership feeling among users, but was not satisfactory.

In the beginning, AAN had implemented projects directly at the request of the users. There was no assessment and prioritization system which involved the community. Even there was no thinking about the project sustainability. Therefore, the feeling of ownership among the users was lacking. As a result in the initial days AAN had to undertake the task of maintenance and repair itself.

After 1993 onwards, the main responsibility for project selection and implementation has given to users. AAN has providing budget and technical support only. The community has taken up material management decision-making and community mobilization responsibilities. Users are exposed and oriented to the market for the material purpose. Local trained human resource is mobilized form the very beginning of the project implementation which has supported in confidence building in them. Priority has been given to users' awareness on health and sanitation, importance of DWS its sustainability, problem, source and environment protection, use of maintenance funds and so on. This has shown good signs on users' ownership. (Bhattati, 2006)

2.7 Water Resource Stategy on Drinking Water

Strategic planning aims to improve one's current situation in order to attain a higher level goal within a given timeframe. In the water sector, although strategic planning has been increasingly used as the national and sub-national levels, it has prevented to be a complex and time consuming process. Although considered highly desirable, few countries have been able to formulate an integrated national water resources strategy.

Despite the lengthy process, national water resources strategy formulation considered a necessary and worthwhile participatory process. It provides a systematic framework in which to develop and manage water that embodies all the varied facets of resources, and to achieve a specified set of objectives over the long term. In the absence of such a framework, development has been and

hoc and sub-sectoral because respective policies are often too general and slip into sub-sector biases.

Since conditions do changed as change of time, a water resources strategy must remain dynamic, with updates typically required every five years. Creation of the initial strategy for development and management of Nepal's water resources is the great challenge. The decision to formulate a national water resources strategy was taken by former HMG/N in 1995.

Despite its huge water resources potential, one third of population does not have access to safe water. In the past ten years, significant efforts have been made to improve access to water supply and these efforts need to continue if full coverage is to be achieved. Although statistics are not well documented, regarding private sector and community contributions to capital investment and operating costs, there is clearly an increasing shift away from reliance on the public sector. Overall in the water sector, capital investments from the private sector and communities have reportedly been low. Domestic Water supply and sanitation coverage for rural water supply has increased steadily because investment requirements are low; however, imperfect sustainability of schemes may erode some of the gains. If sustainability is maintained, full coverage for rural water supply is feasible in the next 10 to 15 years (Nepal Government of Water and Energy Commission Secretariat, 2002).

Given the enormity of the challenge of environmentally sustainable development, it is recognized that significant progress can only be made with a high level of community participation and ownership. Achieving this goal will require increasing awareness through the delivery of education programs these will in turn lay the basis for communities to take the initiative for watershed management and protection of aquatic ecosystems. In this way, government agencies will simply facilitate the process through the provision of technical advice and channeling of government funding. In addition, for water resource projects, communities should be made partners in the development to ensure that environmental and social impacts are properly identified and mitigated. In fact, many projects can support programs to enhance environmental and social benefits, if coordinated and designed with consideration for the needs to the surrounding communities (Nepal Government of Water and Energy Commission Secretariat, 2002).

Drinking water is a basic human need. Every Nepali should have reasonable access to potable water. In addition, since provision of adequate potable water is not enough by itself to ensure better health conditions, there should be widespread education regarding hygiene and access to appropriate sanitation facilities. In the strategy adopted by former HMG is by the end of 25 years, all

people will be benefiting from adequate water supply and sanitation, with related health improvements.

Former HMG had initially targeted 2001/2002 as the date by which reasonable access to safe water would be provided to the entire population; this goal could be achieved so quickly. The Water Resources Strategy has adopted the following targets for water supply and sanitation (Table 2.1).

Table 2.1 Targets for water supply and sanitation

Year	Access to Safe Water Supply		Provision of Safe Sanitation
	Basic Services	Good Services	
2007	85%	40%	60%
2012	100%	60%	80%
2017	100%	85%	100%
2027	100%	100%	100%

Source*:* WECS, NG, 2002

The main focus of the Water Resources Strategy will be to provide basic levels of coverage to all rural areas as quickly as possible. Thereafter, the emphasis will shift to improving the level of services. Good progress has been made since the past ten years, but one-third of rural people still lack even basic water supply services and the vast majority lack basic sanitation. Another concern is to ensure that the communities can maintain water supply schemes otherwise coverage could eventually decline. The strategy will be to:

- Support and strengthen CBOs and WUSCs;
- Maintain and coordinate rural water supply development programs;
- Promote/support good sanitation and hygiene awareness; and
- Support and strengthen DWSS as a core government organization.

In rural areas of Nepal, Villages are small and housing is often scattered. Accordingly, rural water supply schemes tend to be quite small and aim to provide water at collection points that are no further than 250 m from the beneficiaries. CBOs and/or communities selected by beneficiary groups constitute the best method of implementing and managing those schemes. Nepal will continue to vigorously endorse this approach and will provide support to strengthen CBOs and WUSCs in areas where new water supply schemes are planned (Nepal Government of water and Energy Commission secretariat, 2002).

CHAPTER III
METHODOLOGY

Methodology contains a description of how information were collected and analyzed. The methodology of a study is related to the theoretical approach and the nature of the research problem and the context in which data are to be collected. Methodology constitutes the theory and analysis of how research should proceed. Methodology is inextricably linked to epistemology, our theory of knowledge - what can be known, by whom and through what means; methodology is based on and guided by what we think and should be known about the subject. The methodology we adopt in research comes from our world perception, world view, expression and consequences of our understanding of the world. Epistemology refers to the theory of knowledge or our understanding of the world (Timalsina, 2004).

3.1 Sources of Data and Information

Spatial analysis of all the existing water sources (well, dug well, Stone Spout, pond, and river) in Kirtipur Municipality was done by GIS. Their locations were verified by GPS on the toposheet (1:25,000) and satellite Image. Other information was compiled and analyzed in different tabular forms using Excel and SPSS computer software. The digital information of geographic data was prepared by digital maps published by government of Nepal. For this purpose, ArcGIS software was used throughout the study.

The water quality, quantity, demand, utilization of existing water has observed in the field work by different test, check list survey, and key informants' survey.

The present study has used both the primary and secondary sources of data. Primary data were collected through the individual questionnaire and key informants interview to the water user's people. Besides this, the researcher interviewed eight local key informants and collected relevant information.

3.2 Methods of Data Collection

3.2.1 Primary Data

All the primary data have been collected from field through the method of observation using structured field protocol and Data sheet besides the use of GPS and maps, for collecting data related to geographic position. At least one photograph of all the existing water resources and also other information has been taken. Being constrained by time and resource limitations, for collection of field data the monsoon season (July-October) has been preferred since the year

to year fluctuations in discharge rate of the resources. The researcher visited each ward to build the rapport for his research work. The researcher enquired the informant's leisure time and working time at their houses or in the shops and gathering places. This helped to prepare schedules for interview. The primary information of this study was drawn from Key informants' interviews, Informal discussions using checklist, and Group Discussion in local level.

3.2.2 Secondary Data

The collection of data started with study of related literatures and other secondary sources of information. Information was also collected through different government and Non-government office, Institutions, ICIMOD, Development Agencies and Libraries. Secondary information was collected from the Kathmandu Valley Drinking Water Ltd., Kirtipur Branch, Kirtipur Municipality. The digital data of Kirtipur Municipality was taken from GENESIS Consultancy Pvt. Ltd. and Survey Department. Google was the important search engine used to find additional literatures related to the Water resources management and their facts things. Moreover, related books, journals, articles and newspapers were also collected wherever necessary in this research.

3.2.3 Field Study

a) Observation

Observation means viewing or seeing. In this part the researchers was collected data by direct observation of the water resources and ask to the people who are using water. The researcher engaged in observation from the very first day of field visit until the completion of data collection. Basically this technique was used to observe utilization of water resources by the peoples in their daily life. In that time, the condition of the resources, location, surroundings, water condition should be observed.

B) Focus Group Discussion

Focus group discussion is a research technique which helps to collect the information through group interaction on a topic determined by the researcher. The qualitative information necessary for the research were collected through the focus group discussion. The main purpose of the discussion was to obtain more detailed information about the situation of the water resources; especially management of resources, institutional role, factors responsible for water crisis. To conduct 4 focus group discussions, researcher organized group discussion of people of the different wards. The effort was made to involve water users groups of people. The result of focus group discussion was noted and used during the presentation and analysis.

c) Key Informant Interview

In this interview, the informants were old aged people from the different wards who have get information about the past activities of the water resources. They knew the sources of drinking water, management, utilization and so on. This was also used as a field instrument in this research. It was used to gain overview of the local perception regarding water resources management. The information related to historical overview, utilization, management and establishment of water resources was also discussed. The other benefit was to provide a chance of cross checking information collected from different water user's groups through different methods. Altogether ten persons from different wards were interviewed during the field work. To be a key informant in particular research, they must have particular knowledge about related problem. In this research, previous researchers, different related institution's staff were taken as the informants.

3.3. Sources of Archived data

Almost all of the data related to the study have been collected primarily from the field itself meanwhile following archived data also been used for the study.

i. Topographic maps Sheet no. 2785 06A with the scale of 1:25000 prepared by Survey Department (HMG and FINIDA, 1995).

ii. Satellite Image 1 meter resolution of Kirtipur extracted by Google.

iii. Various Research Reports, Journals and Documents.

iv. GIS digital data of Contours, Ward boundaries, road and river networks in Kirtipur Municipality from Central Department of Geography.

3.4 Data Processing and Analysis

The primary data collected from the field are processed using MS Excel and Arc GIS software. The raw data are classified and assigned value according to the Data Classification which has been prepared on the basis of their information from questionnaires. Quantitative data were processed by using statistical package SPSS and EXCEL. These packages were used to generate tables, simple statistical calculation as well as diagrams. Classified data are stored in the table formats showing related data together. Further processing such as calculation of total, types, quantities are done in the Excess itself using formulae. The summarized and composite value tables of the each component are converted to the database file in Excel format.

The information gathered from different sources and methods were subsequently edited, processed and analyzed. As data were both qualitative and quantitative

in nature, separate methods and techniques were applied to analyze data and to make meaningful conclusion.

3.5 GIS Mapping

Presentations of data by map are done using Arc GIS in following way.

- The GIS data of wards boundary, road networks, river system and contours of Kirtipur Municipality are achieved in Arc GIS.
- From the overall water resources only the required objects are identified and saved as new themes.
- The 79 different existing water resources are located.
- Separate views are created for each category that has to be represented by map with related themes and also the corresponding database files created from Excel are added and linked with.
- The related attribute data are classified and the classes are represented in the map using graduated and unique symbols and colors.
- The GIS mapping techniques are thus used to exact location of the water resources in the maps.

3.6 Limitations

The study was covered all part of the Kirtipur Municipality where the water resources are existed. Some water resources are destroyed which is not seen in the field study and it's also covered through the local people. The researcher had tried to cover the water user's people of different resources when the field work was going on. Other different aspects like health problem, social conflict, and economic aspect also study from the individual questionnaire in the field work. In the observation part resources management, condition, types, location, spring size, area etc were observed.

CHAPTER IV
DESCRIPTION OF STUDY AREA

4.1 Physical Setting

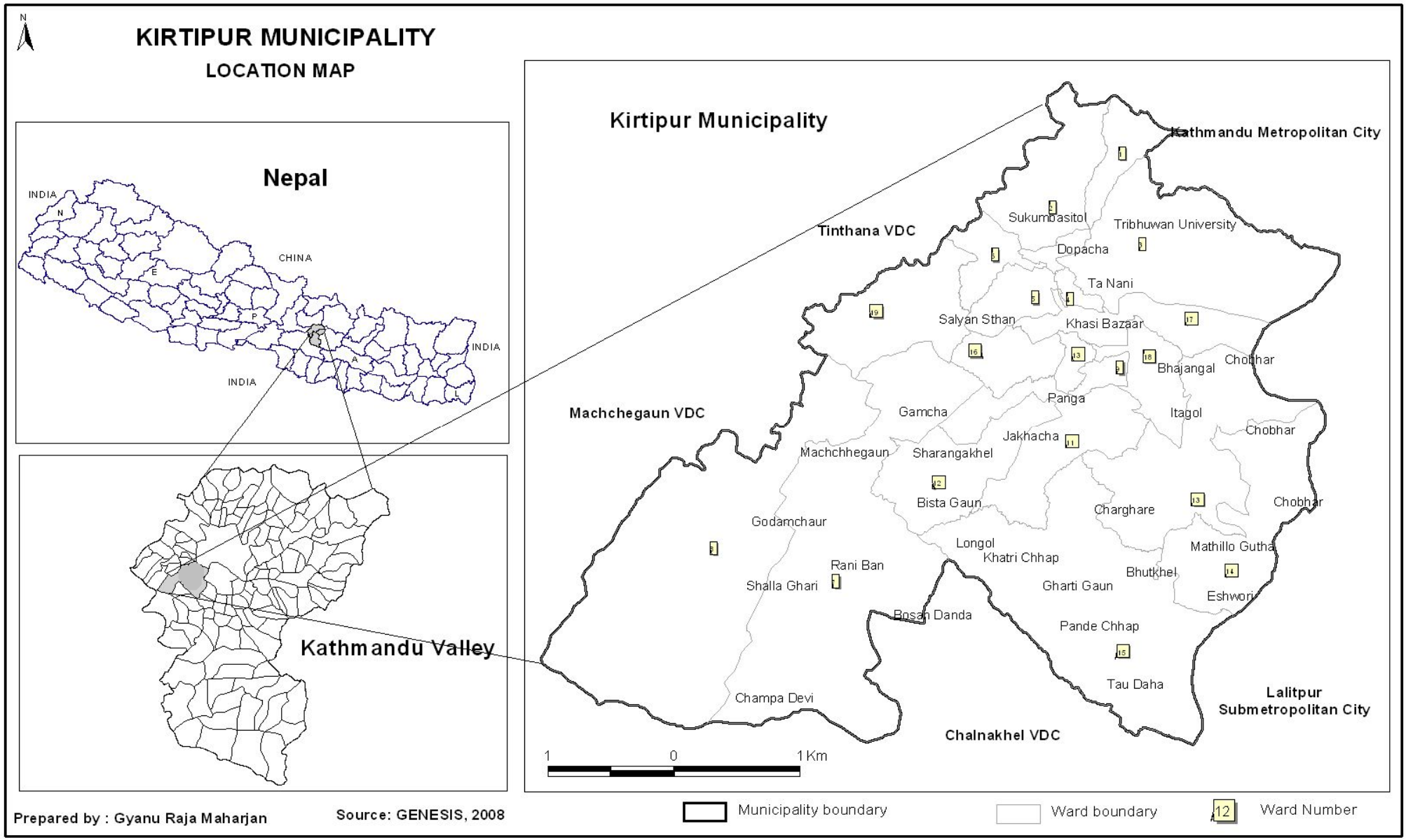
Nepal is a country made up of villages with unparalleled natural beauty and cultural diversity. Rural areas can be depicted as a real face of Nepal since it preserves its own culture, life style, values, livelihood, traditions, institutions and Natural resources. The number of people living in 3915 Village Development Committees exceeds 86 percent of the total population in the country. Farming is the major economic activities of the people living in rural area where others non-farm activities are rare.

Similarly, Nepal is a land lock Himalayan country, where we can find different Himalayas, as well as rivers, forest and much more natural resources. So we can say Nepal is rich in natural resources. Ecologically Nepal has divided into three broad regions such as Mountain, Hill and Terai where no uniform distributions of natural resources are found in these regions. Water resources are most available in mountain region, forest, and horticulture is found in Hill region and agriculture suitability in Terai region.

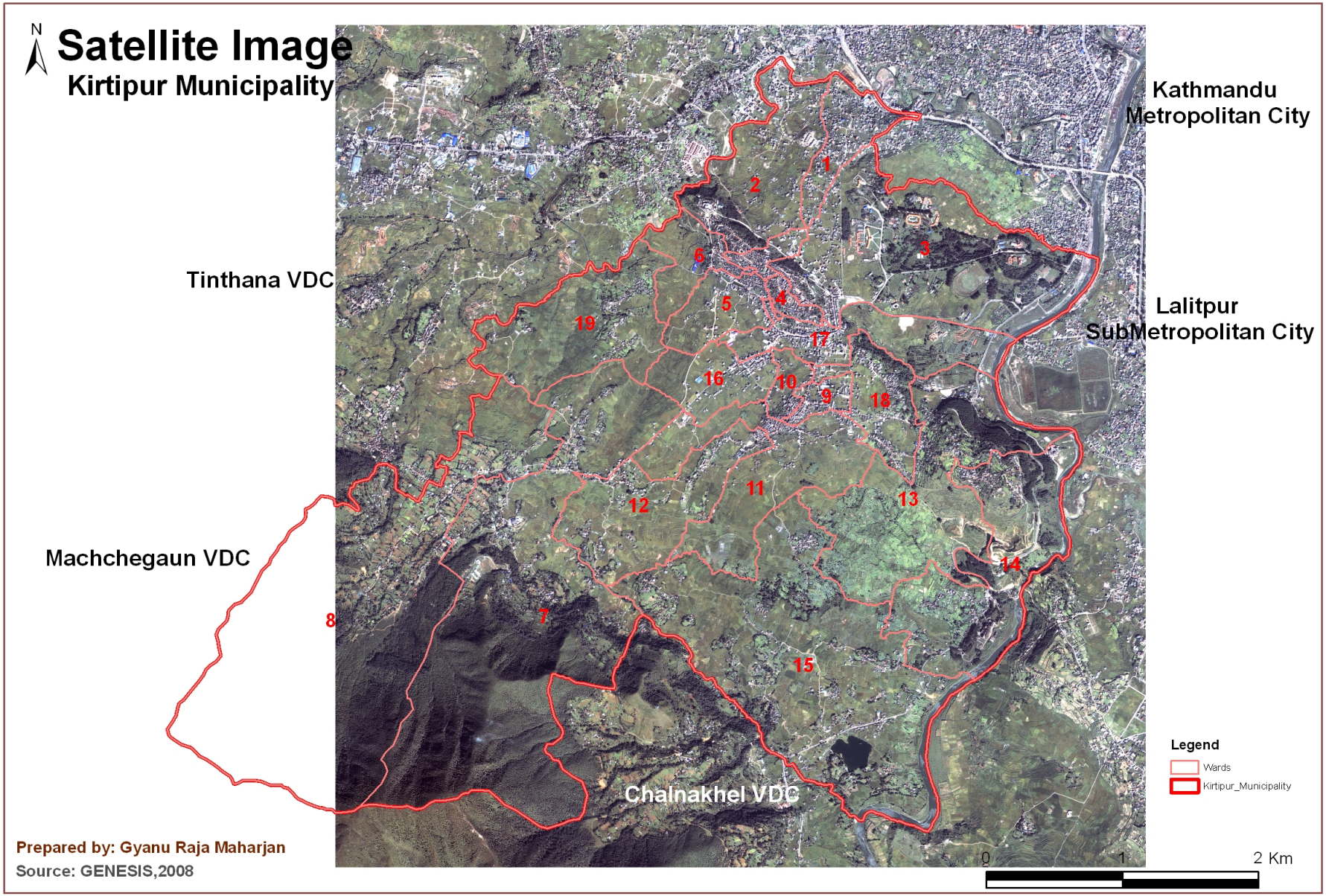
Kirtipur is an old settlement situated on a double hill rock in the southwest of the Kathmandu Valley; it is one of the five municipalities in the valley. It is located at 27°38'37" to 27°41'36"N and 85°14'64" to 85°18'00"E, and at present has 19 wards and covers 1787 ha (14.76 sq. km). It is bordered by the Bagmati River to the east, Machhengaun Village Development Committee (VDC) to the west, Kathmandu Metropolitan City (KMC) to the north, and Chalnakhel VDC to the south. Kirtipur was identified as a 'town' or urban locality in the 1952/54 and 1961 census of Nepal. It was declassified as a town in the 1971 census when the criteria for designing urban localities were changed. Kirtipur Municipality was formed in 1997 by combining eight VDCs, namely Palifal, Layaku, Bahirigaun, Chithubihar, Champadevi, Bishnudevi, Balkumari, and Chobhar. The total population of these VDCs in the 1991 census was 31,338. The 2001 census gives a total population of 40,835 representing 53 percent male and 47 percent female in 9487 households, equivalent to an overall average population density in the municipality of 2.3 persons her hector (ICIMOD, 2003).

There are several types of water resources available in Kirtipur Municipality such as river, lake, well, dug well, Stone Spout, pond, and spring in different locations. The utilization of the resources is in different purposes.

Map 4.1 Location Map of Kirtipur Municipality



Map 4.2 Satellite Image of Kirtipur Municipality



4.2 Change and Development

Being a new municipality with a comparatively low population density, the problems of unplanned growth are not yet severe; however, they are beginning to appear. A study conducted by the Kirtipur Environmental Mapping Project (conducted by the National Society for Earthquake Technology (NSET) with the support of the USAID Urban Environment Programme in 2000) identified solid-waste management, river water pollution, and air pollution as growing problems (NSET 2000). The report noted dumping of solid waste in and around settlement areas, historical ponds, and heritage sites; direct discharge of sewage and untreated industrial waste into surface water drainage systems; air pollution resulting from industries and unpaved roads, among others; poor maintenance of temples, shrines and historical structures; and inadequate financial resources and technical manpower to deal with the environmental problems.

Services such as solid-waste management, drinking-water supply, and roads need the immediate attention of planners. Despite having panoramic views of Kathmandu valley and the mountains beyond, this historic and culturally significant town has not been able to promote itself as a quality tourist destination. Instead, with its poor infrastructure and preponderance of low-income families in the core area, it is seen by tourists as an example of picturesque poverty. It is imperative that the development activities of the municipality are managed and coordinated before the situation becomes worse (ICIMOD, 2004).

4.3 Socio-Economic Setting

4.3.1 Social Setting

Literacy Status

There are 50 education institutions within this municipality. Among them location of the Tribhuvan University indicates the higher educational facility to the local people. Of the total population 6 years of age and over (37,418) in Kirtipur municipality, 73.5 percent is literate. Male literacy is 85.9 percent and female 59.4 percent. Compared with national average, the total overall literacy is higher (national average 53.7 percent).

Educational Attainment

Among total literate population (27,508) in the municipality 24.9 percent has attained Primary education only, 16.4 percent Lower Secondary and 13.7 percent Secondary education. Literates with SLC constituted 12.5 percent. The proportion attaining higher education i.e., beyond SLC is 22.0 percent.

Health and Sanitation

There are only one small hospital, four-health post, same number if sub-health post and some health clinics. The basic facility is not available to more than half

of the wards. In case of emergency the local inhabitants have to rush either to Kathmandu or Patan. Establishment of district level hospital and more health centers is the urgent need for the current population of 46,388. However, the municipality has provision for ambulance service for emergency or general patients to take them to the hospitals in Kathmandu and Lalitpur cities.

Almost 68 percent households have modern flush toilet and about 25 percent households are using ordinary toilet in the municipality. Contrary, about 7 percent of the total households in the municipality use open toilet and the rest of the 1 percent do not stated about their toilet facility. Proportions of households using modern toilet in ward no. 2, 7, and 13 are significantly higher than the proportions of households using ordinary toilet as well as open toilet. The proportions of household using ordinary toilet facility are varying in different wards, which are ranging from 2 percent in ward no. 10 to 67 percent in ward no. 19. The proportion of households using open toilet is ranging from 0 percent in ward no. 19 to 20 percent in ward no. 7 as the highest.

Market Places

Markets are mainly concentrated in the core area and its peripheries. The major local inhabitants of this area are farmers. Kathmandu is relatively easy to reach for agricultural products. As a result, the vegetable market covers 36% of the total market. One can get larger number of not specialized shops such as mixed shop of vegetable, meat, fruits, and fish. According to the observation there are more than 50% non-agriculture based shops.

Public Institutions

It includes banks, co-operatives, post office, ward office, governmental and semi-governmental organization etc. There are 75 public institutions within the area. Besides ward offices, most of the public institutions are located in core area.

Heritage Sites

Kirtipur is one of the oldest cities of the Kathmandu valley. One can find a number of traditional and cultural structures such as Pati (rest places), Temples, Bahal (courtyards), Stupa, Sattal, Cave, and Lake. Around 80% of which is scattered in old core of the city, Panga and Chobhar areas.

Caste and Ethnic Composition

There are many caste/ethnic groups in the municipality. Among them Newar (55.6 percent), Chhetri (19.0 percent) and Brahman-hill (12.6 percent) are the main caste/ethnic groups. Others are Tamang (3.6 percent) and Magar (1.9 percent). Other caste/ethnic groups with less than 1 percent population each in

the municipality are Sarki, Rai, Gurung, Damai/Dholi, Sherpa, Tharu, Yadav, Kami etc.

4.3.2 Economic Setting

Economic condition plays the most important role for survival. So, everyone is trying to maintain their good economic condition and living standard. The different economic settings are established in the different part of Kirtipur.

Occupational Structure

Traditionally agriculture was the main economic activity of the people of Kirtipur. But this activity has significantly been reduced with acquisition of land for Tribhuvan University and Horticulture research centre in 1950s. Kirtipur now has relatively low percentage of families entirely engaged in agriculture. Agriculture, small-scale cottage industries and crafts still dominate the occupational structure of the town (Shrestha, 1991).

Agriculture

Most of the households by land are used for agriculture purpose in Kirtipur Municipality. It is interesting to see that the municipal households with land use for agriculture purpose are slightly lesser than (49%) the household with no land used for agriculture purpose. Most of the wards have relatively lesser the proportion of the land use for agriculture purpose, however some wards i.e., 7, 8, 10, 12, 15 and consists about 45% of the land use for agriculture purpose in this municipality (MUAN, 2006).

Factory/Industries

At present Kirtipur have five national level industries. A few big factories like the Sitaram Gokul Milk and Pasmina Factory are established in different areas. Apart from big industries there are around eighty other industries. Among them predominant is carpet factory. Fifty different scales of these factories like cottage industries, handmade paper, woolen crafts, and copy factory etc. are mostly concentrated on old core and Panga areas. Ward no. 3 and 17 have the greatest number of industries.

Small Scale Economic Activities

Small scale economic activities also support to the livelihood of the people. The people are involved in different small scale economic activities in the Kirtipur Municipality. Some number of households by small scale household economic activities of the municipality. More than 87% of the households have no economic activity in the municipality. Only about 7% of the total households have adopted business and about 3% have services. Other activities are very less. The figure shows that most of the business activities are concentrated in ward

no. 3, 5 and 17 which consist about 42% whereas the services are concentrated in ward no. 17 which is about 17% of the total households of this municipality.

4.4 Population Distribution

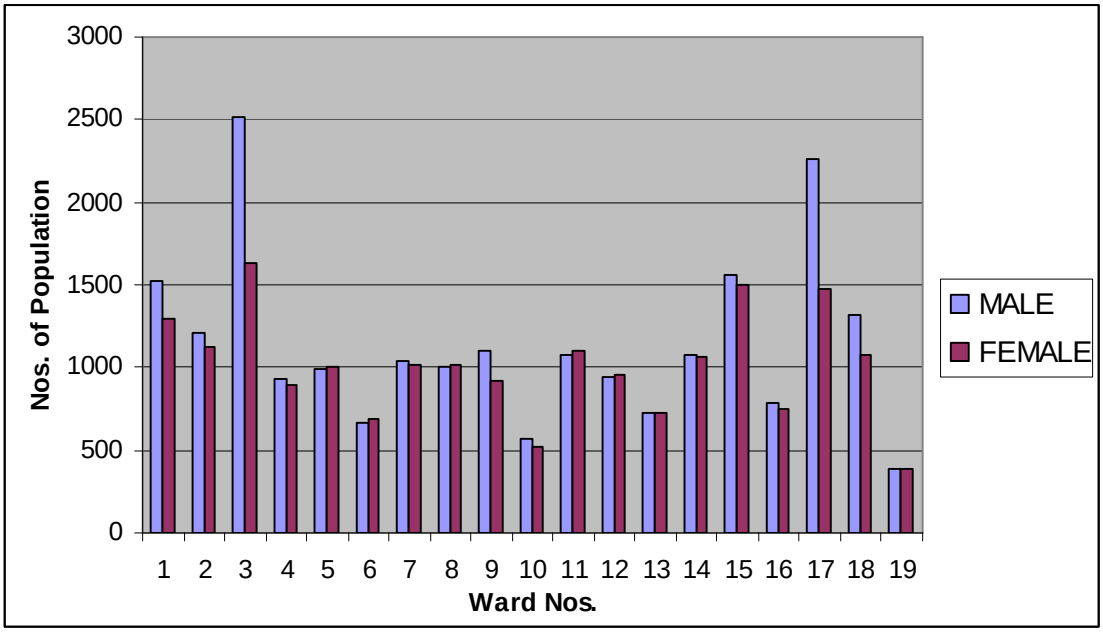
According to the 2001 population census, the total population of Kirtipur was 40,835. In which the number of male population (21,686) was slightly higher than the number of female population (19,149). Kirtipur municipality occupies the second largest densely populated area after Kathmandu metropolitan city in Kathmandu district. With a total number of 9,487 households (HHs) and Kirtipur has an average HH size of 4.3. Ward-wise population distribution is slightly unequal with compare to the area so there is grater alteration of resource distribution (Table 4.1 and Map 4.3).

Table 4.1 Population Distribution of Kirtipur Municipality

WARD	Area Sq. Km.	No. OF HHs	POPULATION			Average HH Size
			TOTAL	MALE	FEMALE	
1	0.55	655	2824	1528	1296	4.31
2	0.32	510	2328	1208	1120	4.56
3	1.51	1278	4149	2513	1636	3.25
4	0.07	388	1828	928	900	4.71
5	0.38	363	1992	993	999	5.49
6	0.17	271	1348	660	688	4.97
7	2.30	418	2051	1037	1014	4.91
8	3.15	393	2024	1007	1017	5.15
9	0.16	474	2019	1105	914	4.26
10	0.04	229	1091	565	526	4.76
11	0.67	489	2172	1077	1095	4.44
12	0.87	409	1895	945	950	4.63
13	1.34	321	1454	726	728	4.53
14	1.05	447	2136	1072	1064	4.78
15	2.31	632	3062	1558	1504	4.84
16	0.82	349	1540	788	752	4.41
17	0.56	1097	3743	2262	1481	3.41
18	0.35	617	2399	1323	1076	3.89
19	0.93	147	780	391	389	5.31
Total	**17.55**	**9,487**	**40,835**	**21,686**	**19,149**	**4.30**

Source: CBS, Population Census 2001.

Figure 4.1 Population Distribution of Kirtipur Municipality



Source: CBS, Population Census 2001.

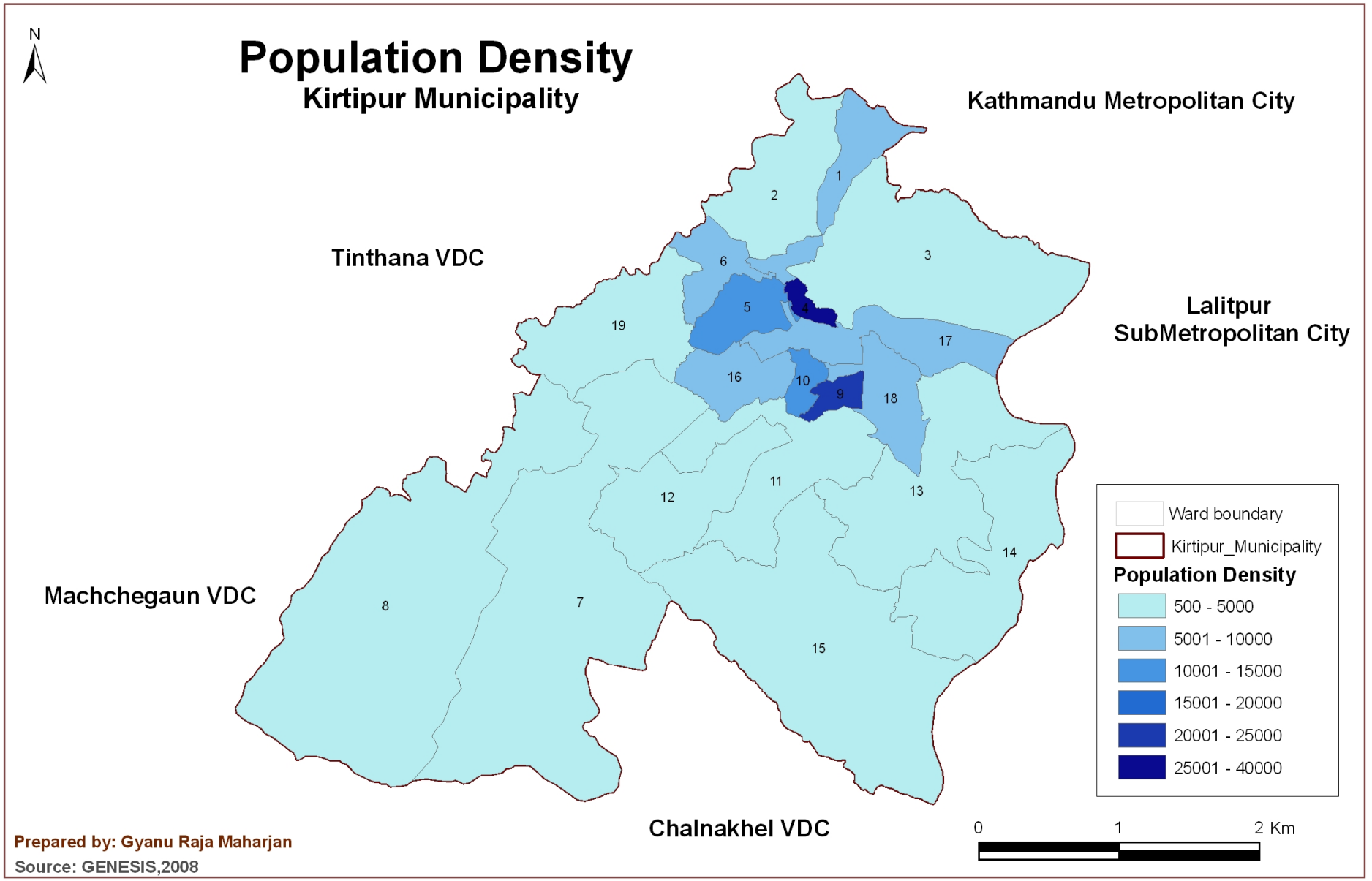
4.5 Physical Infrastructure and Services

Physical infrastructure plays an important role in planned local development. It is a visual indicator to measure a city's status as well as economic status. It covers mainly road, water supply, electricity and telecommunication networks (Map 4.4).

4.5.1 Road Network

There is a total of 34.71 Km metal road, 111.43 KM graveled road and 45.59 Km track road within the municipality. Metal roads are mainly running from the eastern side parallel to the Bagmati river connecting Kirtipur municipality with Kathmandu metropolitan city at northeast side and Dachhinkali area on the southeast. Besides this, metal roads are connected with the core area of the city and Panga settlement, Tribhuvan University and Chobhar industrial area that is the Himal cement factory which has been closed for many years. All wards are accessible with the graveled roads and track.

Map 4.3 Population Density Map of Kirtipur Municipality



4.5.2 Water Supply Network

The water supply network is available in all part of the settlements in Kirtipur municipality. The municipality's two main sources of drinking water are the springs at Dudh Pokhari and Sim Jhawahiti located in ward no. 7. Each of them have a centralized piped water supply system with a capacity of 2200 lm^3 per day for Dodh Pokhari and 1000 lm^3 per day for Sim Jhawahiti. About 92% households have water connection. Lack of drinking water supply a large number of households in the municipality still depend upon traditional water sources such as wells, Stone Spout, springs, and ponds for daily activities except drinking. A number of public taps constructed by Water Supply Corporation (WSC) is able to supply water for an average of three hours, twice a day.

4.5.3 Electricity Network

According to the conversation made with the chief of the Kirtipur Branch Office of the Nepal Electricity Authority (NEA), the electricity facilities can be made available to the 100% population. But only 6500 HHs (75%) is in consumer's list. Rest of the HHs is having illegal connection or extensions from neighboring houses. As a result, unmetering has been the main problem faced by the NEA.

4.5.4 Telephone facility

Information on the telephone network was obtained from the Nepal Telecom office in Kirtipur. The Telephone Exchange Office is located in Bahirigaon. There are 14 telephone cabinets with 420 distribution boxes (DB); each DB has a capacity of 10 telephone line connections. At present, there are 3500 subscribers connected. According to the Telephone Exchange Office, the present infrastructure could provide an additional 500 telephone lines.

Apart from above mentioned infrastructure, waste management has been seen as one of the main infrastructure facilities in the municipal areas. However, there is no waste collection system within the municipality, as a result, household dispose their waste directly on the streets and open fields.

CHAPTER V
WATER RESOURCES IN KIRTIPUR

5.1 Water Resources in Kirtipur

Water is the largest natural resources of Nepal. It is used for drinking, bathing, washing and cleaning, agriculture, industries, hydropower generation, religious and recreation values such as swimming, fishing and different forms of eco-tourism. There are three states of water resources in Nepal i.e. (i) Surface Water Resources, (ii) Lakes and Ponds, and (iii) Ground Water Resources.

Nobody have know about the history of the established of water resources in Kirtipur. In the view of old aged people, all types of resources in this Municipality are established in the very ancient time when the human settlement was established. So that we can conclude that all types of water resources are established in very beginning when the settlements were established in the different areas. The people are established the water resources in the surrounding areas and managing properly. So that these water resources are remaining till now a day. That time the resources are well managed and no water crisis happened. Now a day we have suffering the water crisis because of population growth and resources are remaining as it is. The population growth is directly impact to the water resources.

There are different types of water resources in different areas in Kirtipur i.e. river, lake, well, dug well, Stone Spout, pond, and spring. From the field observation most of the resources are available in dense forest area. In that part the people maintained the resources till now and using the water in their livelihood. In Kirtipur Municipality there are altogether 79 water resources in the different areas. These resources are well, dug well, pond, river, Stone Spout, spring, lake, deep tube well, rain water harvesting, and reservoir. The numbers of the resources and distribution of resources in ward wise are given in the table (Table 5.1 and Map 5.1).

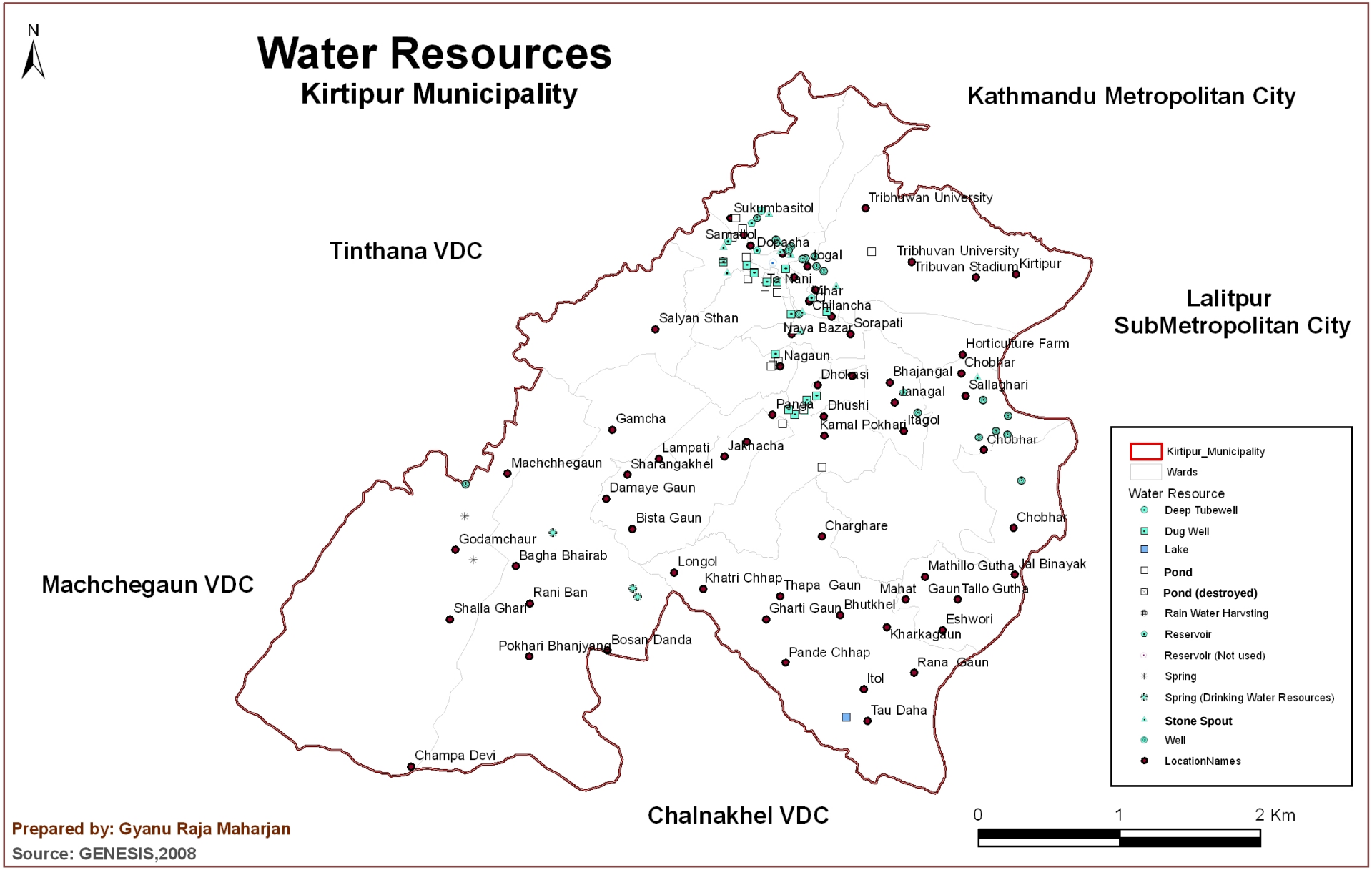
Table 5.1 Ward Wise Distribution of Water Sources

S.N.	W.N.	Types of Water Resources									
No. of ⟶		Well	Dug Well	Pond	River	Stone Spout	Spring	Lake	D. Tu/ R. Wt	Reser voir	
1	1	2	-	1	-	1	-	-	-	2	**6**
2	2	3		4	-	3	-	-	1/-	1	**12**
3	3	3	-	1	-	1	-	-	-	-	**5**
4	4	-	1	-	-	-	-	-	-	1	**2**
5	5	1	3	3	-	-	-	-	-	-	**7**
6	6	-	4	1	-	2	-	-	-/1	1	**9**
7	7	-	-	-	-	-	3	-	-	2	**5**
8	8	1	-	-	-	-	2	-	-	1	**4**
9	9	-	-	1	-	-	-	-	-	-	**1**
10	10	-	3	1	-	-	-	-	-	-	**4**
11	11	-	2	1	-	-	-	-	-	-	**3**
12	12	-	-	1	-	-	-	-	-	-	**1**
13	13	2	-	-	-	1	-	-	-	-	**3**
14	14	4	-	-	-	-	-	-	-	-	**4**
15	15	-	-	-	-	-	-	1	-	-	**1**
16	16	-	1	1	-	-	-	-	-	-	**2**
17	17	2	1	-	-	2	-	-	-	-	**5**
18	18	1	-	-	-	-	-	-	-	1	**2**
19	19	-	-	-	-	-	-	-	-	-	**0**
Total		**19**	**14**	**15**	**3**	**10**	**5**	**1**	**2**	**9**	**79**

Source: Field Study, 2008

The distributions of water resources are not equal in all the areas in Kirtipur. The ward no. 2 has largest number (12) of water resources and ward no. 19 has not any water resources which lie in the western lowland of Kirtipur Municipality. There are 3 main rivers i.e. Bagmati, Balkhu and Boshan and other rivulets which touch most of the wards. There are 9 reservoirs in different parts of the municipality and one reservoir was new constructed which is located in Layaku Tole ward no. 1. It is not using till now and other 8 reservoirs are connected for water supply for the household and public taps in all parts of the municipality. The water connection is available in all the settlements and the supply duration and time is different in the day and week.

Map 5.1 Water Resources Map of Kirtipur Municipality

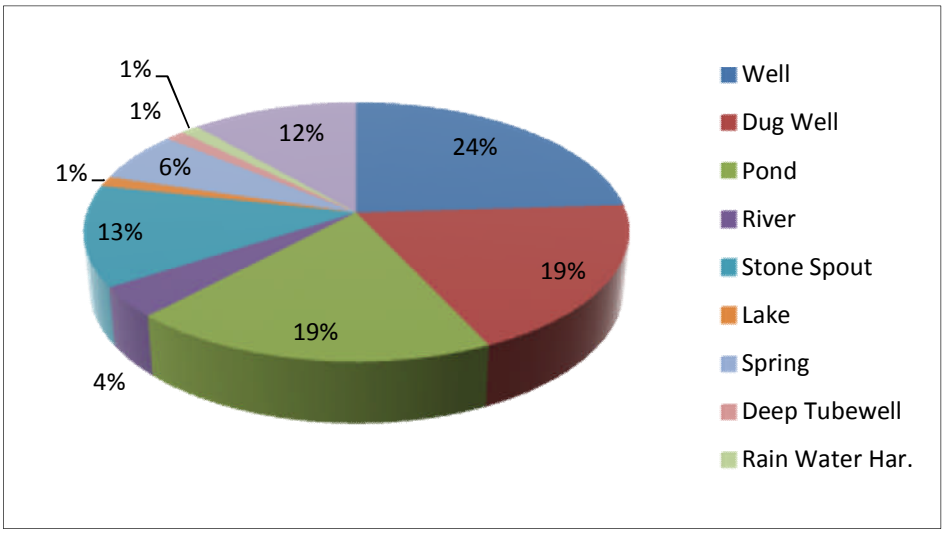


Prepared by: Gyanu Raja Maharjan

Source: GENESIS,2008

The largest numbers of wells are found in core area of Kirtipur and Chobhar. Out of total 79 water resources, 25% of wells rank the first (19) followed by ponds (15) located in the different settlements. The spring is very important water resources in Kirtipur, because this is using for drinking water supply connection through the reservoir. There is a big lake named Taudaha located in ward no. 15 which is very famous for cultural significance as well as popular tourist destination. People are using this lake's water in washing and bathing purposes. (Figure 5.1).

Figure 5.1 Nos. of Water Resources



Source: Field Study, 2008

5.2 Types of Water Resources and its Condition

a) Well (Kuwa)

There are 19 nos. of wells found in 9 different wards. Most of the wells were established in the forest or greenery parts of the Kirtipur. Some wells are open and some are covered by cemented slab for protection. All the wells have sufficient water in every time. People are using that wells for their daily activities.

b) Dug-Well (Innar)

Most of the dug wells are established in the core area of the settlements. There are 15 nos. of dug wells found in 7 different wards. The few dug wells have only sufficient water for household activities and most of the dug wells have not sufficient water because of not use and maintenance. The dug wells are 15-20 m. deep and 1.5m diameter depends upon location. Some dug dells are covered by cemented slab, some are opened.

c) Pond (Pokhari)

The ponds are located in the outer of the settlements. In an ancient time people are using its water for drinking also but now a day people didn't use other household activities because of pollution. There are 15 nos. of ponds found in the different 10 wards. All the boundaries of ponds are fetched and walled up by cemented wall and some ponds water is used for washing purpose.

d) River (Khola)

There are found 3 main rivers i.e. Bagmati, Balkhu and Boshan and other small rivulets like Kaara Dha, Dudha Dha and Yara dha (rivulet) flowing in southern and northern part of the municipality touching ward boundary 1, 5 and 2 respectively. These touch most of the wards. The Bagmati river touches the Ward Nos. 3, 13, 14, 15, and 17, the Balkhu river touches Ward Nos. 1, 2, 6, and 19, Boshan river touches Ward No. 7 and 15, and rivulets touches Ward Nos. 3, 7, 8, 13, 14, 15, and 18. The Bagmati river is much polluted and people didn't use in any activities. Other 2 rivers and 3 rivulets are using most in agricultural activities in the different parts of the Kirtipur. Urban agriculture practices are doing some parts where the river water is available.

e) Stone Spout (Dhunge Dhara)

The Stone Spout means the tap using the stone carving tap for mouth of water cannel from the ground water sources. Most of the Stone Spout was established in holy places. There are 10 nos. of Stone Spouts in 5 different wards. All the Stone Spout's water is very clean except 1-2. In some Stone Spout are of god and snakes pictures are carved in the mouth of Stone Spout. One Stone Spout's water contained maximum quantities of Sulphere Oxide contain, Iron and Its look very orange color. This source is located near in agricultural field and nobody use this water in daily activities.

f) Spring (Padhera)

There are 5 springs found in the 2 different wards in the forest areas of Kirtipur Municipality. All the drinking water supply connection is taking from the springs water located in ward no. 7. The 2 springs are using locally for different household activities. The quality of spring water is very good and people are drinking directly without treatment. There are no treatment pants in any reservoirs.

g) Lake (Taudhaha)

There is only one Lake located in ward no. 15 named Taudaha. It is very famous for cultural, religious and touristic view. Now a day, many people are coming to visit for entertainment. This Lake is very famous for cultural significance. It covered very large surface of that area.

h) Deep Tube Well

There are one Deep Tube Well was established just now in ward no.2 by Kathmandu Valley Drinking Water Supply Limited, Kirtipur Branch. It is 130 m. deep underground. It is not use till now. It is using very fast and supply drinking water in Tyanga Phat area.

i) Rain Water Harvesting

In Kirtipur, ward no. 6 there are one established new settlements for squatters which was shifted from Bishnumati corridor link road area. All together 46 households are there and they have not drinking water connection. They are manage their drinking water from neighbor settlements and other daily activities. They have managed water from the rain water harvesting process and collected in one underground big tank. These water are using in their daily activities except drinking purpose.

j) Reservoir

There are 9 reservoirs in different hill part of the 7 different wards. The reservoirs collected the drinking water from spring resources and supply to the household connection and public connection by time to time. Therefore, all the reservoirs were constructed in the highest part of the Kirtipur, Bhajangal, Dud Pokhari and Sim Jhawahiti area. All the wards and Toles have their pubic water tank in their locality for collecting water and when the scarcity of water supply they are taking water from those tanks.

5.3 Utilization of Water Resources

The drinking water connections which are not sufficient for the daily activities of the local people in Kirtipur. So that they are using water from other sources which are located in the nearest area. (Table 5.2). The availability of water resources is very useful and helpful in their daily activities. In the case of the other rural areas of Nepal, people have very difficult to take water. They have 2-3 hours for taking drinking water and most of the time is passing for collecting the water. But in Kirtipur the availability of water resources is help to the people in local development. They saved time for nearest availability of water resources and using the different resources in the different activities easily.

Table 5.2 Water Resources Using in Different Activities

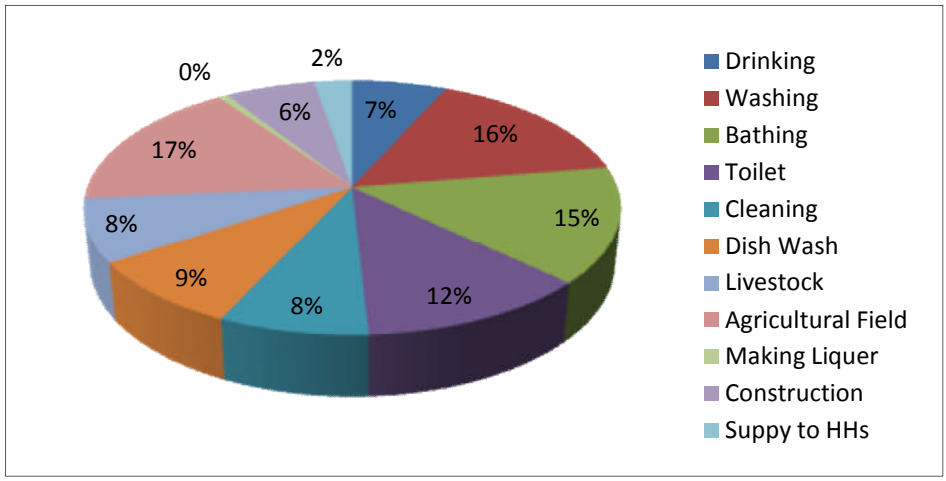
Water Resources →	Well	Dug Well	Pond	River	Stone Spout	Spring	Lake	D. Tu R. Wt	Reser voir	Total
Nos. of Resources →	19	15	15	3	10	5	1	2	9	79
Utilized in ↓	Nos. of Resources									
Drinking	9	2	-	-	3	5	-	1	-	**20**
Washing	19	11	2	2	6	5	1	1	-	**47**
Bathing	17	10	-	2	8	5	1	1	-	**44**
Toilet	7	12	8	2	1	5	-	1	-	**36**
Cleaning	6	6	1	2	2	5	-	1	-	**23**
Dish Wash	6	8	1	-	5	5	-	1	-	**26**
Livestock	5	4	5	2	1	5	1	1	-	**24**
Agriculture	11	7	16	2	7	5	1	1	-	**50**
Making Liquor	-	2	-	-	-	-	-	-	-	**2**
Construction	-	4	10	2	-	2	-	1	-	**19**
HHs Supply	-	-	-	-	-	-	-	-	8	**8**

Source: Field Study, 2008

Reportedly 79 of water resources are using in different activities. There are 50 (17%) of water resources using in agriculture activities. All the available sources are using in agriculture field themselves as well as automatic. These resources are help to the agricultural activities. The agriculture is the main economic activities of the people in the Kirtipur. Therefore these resources are very helpful in local development through economically. There are some parts where the people are making the liquor for their livelihood. They are using water from 2 (<1%) resources of dug wells for making alcohol and beer. The lack of piped water connection, the people are using about 47 (16%) of recourses are using for washing their cloths and 44 (16%) of recourses are using for bathing which is second largest resources are utilized in daily activities in Kirtipur. Other important activities are drinking. The most of the drinking sources are springs. But lack of drinking water connection and crises the people are drinking another sources also i.e. well, dug, well, Stone Spout and deep tube well. About 20 (7%) resources are using for drinking purpose for the people. There are 3 main rivers and other rivulets in Kirtipur. Only 2 river water is using in agriculture field, washing and other activities. Bagmaiti River is much polluted now a day so that its water is not used in any activities. (Figure 5.2). One well is located in Chobhar (ward no. 14) which is only used to god (Adinath temple) worship purposes i.e. *Jal* for people, bathing *Pujari*, and other purification purposes. Only *Pujaris* are using the water of the well and another is not permission to

enter to the well. The well is locked all the time. One deep tube well is just established in Ward No. 2. It is not coming in use.

Figure 5.2 Nos. of Water Resources in Different Activities



Source: Field Study, 2008

5.4 Water Quality

The water quality is very important part of the people. If the water is poor quality the people's health is also automatically poor. So that the people are using of water must be in very good quality for using in different activities. The different organization has carried out water quality test of different water sources. From that report the quality of water is not poor. In this research also found the quality is very good and most of the resources are using by the people for drinking and other purposes. The drinking water was supplied without any treatment plant for the household connection which is coming from the spring resources. Only the chlorination process had done before water supply to the household connection. In lack of drinking water supply, most of the resources are using for drinking except some resources like well, dug well, Stone Spout, pond etc. These resources are using in other household activities.

5.5 Water Pollution

The different water resources have different condition which was found in the field work. The situation of the water resources are not poor condition. Most of the resources are managed by the local communities and user's groups. Most of wells and springs are found in the greenery or forest area where the availability of water is very rich. There are no garbage and waste materials found in the resource sites. Therefore the resources are very clean and no water pollution. Some resources are surroundings nearby dumping site and sewerage pipe line so that their resources are very poor condition and polluted. This water is not used in drinking and other purposes as well. There is bad condition of the pond which

was found in different settlements. The settlement's most water discharge areas are pond because it is occupied very space and deep as well. So that in the rainy season the rain water is collected in the pond and discharge in the earth. But the condition of pond is very poor and polluted. People are using the pond dumping site and throw the waste materials.

Other main things are the modern human civilization also impact to the water resources. The population growth is the main things for water resources scarcity and polluted. If the population is growth, they produced more waste material and lack of dumping sites they throw their waste in any places and these directly impact on the water resources and polluted the resources. In Kirtipur, most of the areas have the sewerage pipe line network and stone paved for modern civilization and cleanliness. No bodies have any idea about their bad impact in the water resources from these works. In that areas there are not water discharge activities will be done when the raining and other waste water from household activities.

5.6 Water Resources: Existing Situation

Some resources are in the process of disappearing because of pollution as well as not properly use. In some parts of Kirtipur, the different resources are being disappeared in different time when the resources have no water, impact and use as dumping site and other purposes because of that surrounding localities are polluted. They have no idea about the resources and the lack of budget for management of resources. Therefore they converted different resources into public building, open spaces for public use. The given table shows that the distribution at risk resources in different wards which are using different purposes (Table 5.3).

Table 5.3 Water Resources Destroyed and their Status

S.N.	W.N.	Water Resources	Location	Status
1	1	Pond (destroyed)	Thambahal, Kirtipur	Open Space
2	2	Well (destroyed)	Galchhe, Kirtipur	Covered Grass
3	2	Pond (destroyed)	Galchhe, Kirtipur	Dumping sites
4	2	Pond (destroyed)	Ga, Kirtipur	Open Space
5	3	Well (destroyed)	Chithu, Kirtipur	Covered Grass
6	3	Pond (destroyed)	Nayabazar, Kirtipur	Open Space/ Dumping sites
7	3	Pond (destroyed)	Nayabazar, Kirtipur	Build Building (Sahid Smarak College)
8	5	Pond (destroyed)	Sagal Tole, Kirtipur	Build Private Building
9	5	Well (destroyed)	Hitigaa, Kirtipur	Open Space (Public Building)
10	9	Pond (destroyed)	Bhuine, Panga	Dumping sites
11	11	Pond (destroyed)	Dane, Panga	Dumping sites
12	16	Pond (destroyed)	Nagaon	Build Public Building
13	16	Pond (destroyed)	Nagaon	Open Space

Source: Field Study, 2008

CHAPTER VI
WATER RESOURCES MANAGEMENT

Most of the water resources are managing by local people in Kirtipur Municipality. Only the drinking water resources are managed by Kathmandu Valley Drinking Water Supply Limited, Kirtipur Branch. The local resources are assets of the local people. So that, they have responsible and priority to maintain and management of the water resources for local development otherwise it is not possible to develop locally.

6.1 Water Resources Status in Nepal

Nepal has more than 6000 rivulets and rivers. Annual mean flow of major rivers is estimated to be 4930m3/sec. This amounts to 70% of total surface runoff. About 60-85% of surface runoff occurs during monsoon (Lekhak, 2003).

- Lakes, ponds and reservoirs amount to 30% of the total surface runoff.
- Total available surface water potential is estimated to be 224 billion m^3.
- Estimated ground water potential is 12 billion m^3.
- Current ground water withdrawal is 0.52 billion M^3 /year.
- Per capita internal renewable water resource declined from 13,800 m^3/year in 1984 to 10,300 m^3/year in 1998.
- Surface and ground water quality has deteriorated. According to a recently published World Water Development Report, Nepal ranked 781' in the global water quality assessment study. UN's report ranked 122 countries according to their quality of water as well as their ability and commitment to improve the situation.
- Water table has lowered substantially due to low recharge which is a result of decreasing forest coverage, increasing urban build-up and other non-agricultural activities.
- Water demand for irrigation has increased tremendously. The irrigated area expanded from 0.739 million ha in 1988 to about 0.88 million ha in 1998. About 90% of withdrawn water is used for irrigation.
- Despite having the capacity of 83,000 megawatt hydropower generation, only about 600 megawatts has been generated so far i.e. 0.7% of the total potential.

6.2 History of Drinking Water Supply in Kirtipur

Thousands of years before the name remained Padam Kasthapur Giri (Puri) of Kirtipur has old historical background. The people had find out the different water resources and using in their livelihood activities since long period. At that period they had established different resources in their locality by own effort

like well, dug well, Stone Spout etc in different areas in Kirtipur. In 1890 BS the time of Jri Bhim Sen Thapa, one very long cannel (Raj Kulo) are constructed which are using water supply from Dhud Pokhari to Bhim Pokhari for drinking purposes. Now a day the cannel also destroyed and the condition of pond is very bad and water is not remaining as well because of unmanaged.

The first 4 inch drinking water pipe line was in 1994 BS from Lhonkot. After 1996 BS the 13 public tap i.e Layaku, Baghbhairab, Chithu, Bhariya Pukhusi, Tujho, Lhodega, Kutujhol, Paghu, Khasi Bazar, Sagal, Samal, Devdhoka and Galchen areas have distributed drinking water. After some year the people of the different areas like Bosigaon, Taukhel, Naikap, Salayansthan, Majhagaon, Tyanglaphat etc. were taken the water from main water pipe line of Lhonkot. These create also water scarcity in Kirtipur again and other things for scarcity of water growth of population.

After the political change in 2007 BS, the public tap was upgrade in numbers in 1916 BS. In 2035, at Kwacho one reservoir was starting the construct which has 200,000 lts. capacity of water store and completed in 2040 BS. Then water was distributed for public and private in Kirtipur. Again the water crisis is remaining same and another water supply 4 inch pipe line connection from Bhajangal reservoir to Kwacho reservoir.

At 2051 BS, the another Drinking Water project had jointly established by Plan International Nepal, Drinking Water Corporation, Kirtipur Drinking Water Management Committee and Local Community participation. This project established new reservoir at Chilancho and 4 inch water connection from Sim Jhawahiti in 2053 BC. This reservoir's storage capacity is also 200,000 lts. Before established of the Kirtipur Municipality there are four VDCs in Kirtipur and the distribution of drinking water is mostly in public tab (Table 6.1). The Public water connection is available in each ward and Tole with their water tank for collection and distribution to all household at morning and evening time.

Table 6.1 VDC Wise Distribution of Water

S.N.	VDC	Public Tap	Private Tap	Nos. of Water Tank
1	Layaku	28	4	25
2	Chithu Bihar	19	Most of the houses in Nayabazar	9
3	Paliphal	20	5 (Like Public)	10
4	Bahirigaon	9	Most of the houses in Nayabazar	6* (* Only in Ward 3&4)

Source: News & View of Kirtipur, 1996

6.3 State of Drinking Water

Safe drinking water is a basic health need. Nearly, two third of our body weight is maintained by water. Much of the ill health is largely associated with lack of safe drinking water. Diarrhea, dysentery, typhoid, cholera, hookworm, pinworm and roundworm etc. are common diseases caused by lack of safe drinking water. Water shortage becomes serous especially during the three months preceding the monsoon, when particularly women and girls have to walk long distance to fetch even a minimum quantity of water. All of which leaves less time and energy with them for other essential works. It also poses serious health risk.

No treatment plant is established in the reservoir or supply station in Kirtipur. Just put chlorine in reservoirs time to time. In that research no body was found ill from the drinking water. It concluded that the drinking water of Kirtipur is very good quality because of spring water resources. About 64% households have drinking water connection. Others households are sharing drinking water from the neighbor households and using other resources like wells, dug wells, Stone Spout, springs etc. So that other resource's water is also consider quality not like drinking water.

Table 6.2 Number of Households by Main Source of Drinking Water

Ward	Total HHs	HOUSEHOLDS BY MAIN SOURCE OF DRINKING WATER						Source not stated
		Piped Water	well	Tube well	Spring water	River/ Stream	Others	
1	655	555	76	1	12	0	9	2
2	510	359	145	2	2	0	2	0
3	1278	1212	58	1	0	0	5	2
4	388	334	0	0	51	0	0	3
5	363	361	2	0	0	0	0	0
6	271	183	26	0	62	0	0	0
7	418	322	80	1	9	0	0	6
8	393	366	9	0	0	0	15	3
9	474	469	1	0	0	0	0	4
10	229	229	0	0	0	0	0	0
11	489	487	0	1	0	0	0	1
12	409	406	0	0	1	0	0	2
13	321	321	0	0	0	0	0	0
14	447	446	0	0	0	0	0	1
15	632	626	1	0	1	0	0	4
16	349	348	0	0	0	0	0	1
17	1097	1079	2	1	9	0	1	5
18	617	616	0	0	0	0	0	1
19	147	47	14	0	86	0	0	0
Total	**9487**	**8767**	**414**	**7**	**233**	**0**	**32**	**35**

Source: MUAN, Municipal Database Analysis of Nepal 2006.

People of Kirtipur Municipality are getting drinking water from various sources. However, piped water (tap) is the major sources of drinking water. Out of total households of the municipality, about 92 percent households get pipe water. Similarly, about 4 and 3 percent households fetch water from well and spring respectively. Besides these sources, some people of the municipality depend on tube well and other sources too for drinking water.

The proportion of households depending on different source of drinking water is varying in different wards in Kirtipur Municipality. The percentage of households using piped water is ranging from 32 percent in ward no. 19 as the least to 100 percent in ward no. 10 as the highest proportion. Piped water could be considered as relatively reliable and safer source of drinking water; however, the percentage of households using natural spring for drinking water is relatively higher in ward no. 19 and 6. Similarly, 28 percent households of ward no. 2 and 19 percent households of ward no. 7 are fetching drinking water from well.

6.4 Water Resources Management

Nobody can create natural resources, if it creates only in the lab for limited quantities for experimental uses. Like that water resources also cannot be creating for the whole living organism in the earth. It is fundamental to human security in both tangible and intangible senses. Drinking water supply, food and livelihoods are the three basic tangible aspects of water use, while groundwater recharge, recreation, and socio- religious functions are its intangible dimensions. Both dimensions contribute to human security and happiness. It comes naturally by natural process. If the natural process will not be managed we have face water scarcity, and water pollution. So that, we will be always proper manage water resources.

In the context of Nepal, the water has religion and tradition norms and values from the beginning therefore resources are remaining maintained till now. But people didn't believe and follow that way now a day so that resources are becoming poor and poor condition. This study carried the management of water resources in Kirtipur which are doing by the different institutions in different ways (Table 6.3).

6.4.1 Institutional Involvement

i) Local Clubs

Local Clubs have managed 11 different resources in various localities of Kirtipur. They have managed sources as per their need. The local resources are using by local people through local clubs formed under leadership of local people. Therefore, they are doing proper manage in their local water resources for sustainable uses.

Table 6.3 Water Resources Manage by Different Organizations

Water Resources →	Well	Dug Well	Pond	River	Stone Tap	Spring	Lake	D. Tu/ R. Wt	Reser voir	Total
Nos. of Resources →	19	16	15	3	10	5	1	2	9	79
Managed By ↓	Nos. of Resources									
1. Local Clubs	3	1	4	-	3	-	-	-	-	11
2. Local Comm	11	11	12	-	7	-	1	-	-	42
3. Users Group	8	2	1	3	2	2	-	-/1	-	19
4. KUKL	-	-	-	-	-	3	-	1/-	9	12
5. Private	-	1	-	-	-	-	-	-	-	1
6. No Body	-	1	-	-	1	-	-	-	1	3

Source: Field Study, 2008

ii) Local Communities

Local Communities are similar to the Local Clubs. Some of local communities are managing their local water resources. All together 43 water resources are managed by the local communities in different parts of the Kirtipur Municipalities. Local communities have great responsible to manage their own local resources. If not another communities did not come to manage those sources, it will be destroyed. The local sources help to local people in providing water for daily activities. So that, they are doing proper manage of water resources for sustainable use.

iii) Users Groups

In some parts the water resources are very far from the settlements or no settlements are near in the water resources. Those areas water resources are managing by users groups. User groups are the group of people who are mostly using their water in different activities. There are 19 water resources are managed by users groups. Mostly no settlements are in rivers side. In the river mostly uses parts are managing by users groups who are using that resources in different activities. Other resources like well, the most of the wells are located in greenery are or out of settlements. So that those resources are using by different parts of the settlements are they are managing these resources time to time for sustainable use.

iv) Kathmandu Upatyaka Khanepani Limited (KUKL)

The drinking water supply in Kirtipur is being managed by Kathmandu Upatyaka Khanepani Limited (KUKL), Kirtipur Branch. These office have responsible for all the drinking water supply related sources and reservoirs. So that, 9 resources (3 springs, 1 tube well and 6 reservoirs) are managing by KUKL. Their work is to collect the resource's water in the reservoirs and supply drinking water supply to

the household connection and public connection. In the Kirtipur all the settlements have drinking water connection but water distribution time is different. Some areas have regular water supply, some have alternate day, some have once a week, some have early morning, some have morning, some have day, some have evening and some have night. The water supplies time duration are also different in location wise. Some areas have 30 minutes, some have 1 hour, and some have 2 hours. Therefore all the people of different wards have comments to the KVDWS office about the supply of drinking water time duration and irregular. They want to pay their bill of water for sufficient supply.

v) Private (Water Tanker Services)

Only one resource (dug well, large diameter) is managing by the private household. The well is located in people's compound. Therefore, the dug well is managing by them. In ward no. 15 there are 3 private companies to serve water tanker service. They are managing the drinking water by commercial way. They are using the water from neighbor VDC named Chalnakhel. The other source is one big springs name Naumule. These 3 companies are piped line from that resource to connection their own reservoirs and treatment that water and to give the water tanker fill service. More than 100 tankers from each company were filled water in a day and supply to the schools, campus, hotel, department stores and hospital etc. One company has product the mineral water pack in bottle as well. These 3 companies are pay tax for using the water to the Chalnakhel VDC and 15 Ward office of Kirtipur.

There are 3 resources are not managing by nobody because of the resources are poor condition and nobody are using that resources. The water quality is also poor. So that, no any institutions are responsible to those resources.

6.4.2 Duration of Maintenance

The water resources are maintain time to time then it will be sustained and product the water what we need. The different water resources are found in the different places and those resources are maintained by different local organization in the different time duration which is shown in the table 6.3. The one resource is maintained in a half-yearly, 32 resources are in yearly, 2 are in Gai Jatra, 5 are in Sithinakha, 4 are 2-3 years, 27 are not fixed and 4 are not maintained.

Sithi Nakha

The Sithi Nakha is a special festival usually fall in the last week of June or July. It is a special day of a fear in which people clean water sources of local area. But among various sources of water people usually clean well, dug well, spring etc. Some organization also observed the day as WATER DAY in Kathmandu Valley too. The scientific reason behind on survey is that to sources of water

must clean to start monsoon of each year so that ground could reaching water sufficiently to supply pure water during way and pass monsoon period. The tradition has been observed in the valley since Lichhavi period too. The festival has got in own importance in Kirtipur Municipality where dense settlement is located.

6.5 Demand of Drinking Water

Runoff is the excess of precipitation over evaporation and infiltration and represents in broad sense, the water available for human use. Globally, fresh water is abundant. Each year an average of more than 7000 cu. in water per person enters streams and rivers. However, the water is not available where and when it is needed.

Table 6.4 Duration of Maintenance of Water Resources

Water Resources →	Well	Dug Well	Pond	River	Stone Tap	Spring	Lake	D. Tu/ R. Wt	Reser voir	Total
Nos. of Resources →	19	15	15	3	10	5	1	2	9	79
Duration ↓	Nos. of Resources									
Half-yearly	1	-	-	-	-	-	-	-	-	1
Yearly	10	4	7	-	4	5	1	-/1	-	32
Gai Jatra	-	-	2	-	-	-	-	-	-	2
Sithinakha	-	5	-	-	-	-	-	-	-	5
2-3 years	1	2	1	-	-	-	-	-	-	4
Not Fixed	7	3	4	3	5	-	-	-	8	27
No maintain	-	1	-	-	1	-	-	1/	1	4

Source: Field Study, 2008

Two common measures of human water need are 'withdrawal' and `consumption'. Water withdrawal is taking water from ground water or surface water source to a place of use. Water consumption occurs when water that has been withdrawn is not returned to the source of withdrawal so that it maybe used again in that area. This usually occurs because the water has evaporated or transpired into the atmosphere worldwide about 60% of the water consumed.

In the context of Nepal, Nepal Government gives authority to National Drinking Water Supply for service provides the drinking water connection to whole country. In the context of Nepal, there are only 23 districts (28 Municipalities, 11 Zones) have drinking water supply network.

In Kirtipur, all the service of drinking water supplying by Kathmandu Upatyaka Khanepani Limited (KUKL), Kirtipur Branch. There are 9,487 households in Kirtipur Municipality and about 6,100 households have drinking water connection. But unequal distribution the water is scarcity most of the wards and people are depending upon the other water resources for their daily activities like washing, bathing, dish wash, agriculture fields, livestock etc. All together 40,835 people are living in Kirtipur Municipality. In average Nepali standard the drinking water is needed 100lts per person per day for their daily activities. The water demand is 40,83,500 lts. per day in the Municipality.

6.6 Supply of Drinking Water

The drinking water supply does not meet in most of the parts of Nepal. The Drinking Water Supply Corporation (DWSC) could not manage the drinking water in all parts of the country. Lack of technical equipments, lack of man power, lack of knowledge they are failure in their works. Other things are the population growth is the main causes of drinking water scarcity. The DWSC didn't manage the drinking water to growth population. They are supplying same quantities from the decade but the populations are growth in double then how can meet the supply for growth population.

In Kirtipur there are supply water from 8 reservoirs to the households' connection and public connection. The supply time is different in different places in various time and different quantities. The KVDWS, Kirtipur Branch is supplying drinking water 25,00,000 lts. per day in whole Kirtipur. The drinking water supply system is very tradition and unscientific. Therefore the problem of water supply is remaining same and people are facing different difficulties. The KUKL, Kirtipur Branch did not study the population of those settlements. First they want to know about the number of population of those settlements then they have to know how much quantities of water will be supplied. Otherwise they will be failed in water supply and always same problem.

6.7 Deficit of Drinking Water

In every part of the world drinking water is scarcity very rapidly day by day. Nepal is also suffering that situation. So that in every parts of the country the water is deficit. The demand of water is very high day by day and supply is less than less every day. If the KUKL, Kirtipur Branch has managed the drinking water and supply systematically, the water crises will be created. They have to know about the living population of each settlement or wards as well as nos. of water connection. After they will supply the water properly this is very systematic and scientific. Then drinking water is not deficit all parts of the Kirtipur. Now the demand of drinking water is very high and supply is very less in quantity so that

drinking water is deficit. There are 20,83,500 lts. water is deficit per day in Kirtipur Municipality.

6.8 Potential Water Resources for Kirtipur

There are many potential water resources near the different ward boundary of Kirtipur Municipality. These water resources are found in neighbor VDC i.e. Chalnakhel, Machhegaon, and Matatirtha. There are huge amount of water are losing. If the water resources are well managed and utilized in proper way and to connect in Kirtipur, the water will be sufficient and to solve the water crisis.

6.9 Plan and Policy

Some unpublished report shows that two billion people in the world are without clean water and sanitation. In the worst water feminized countries, people live on just two gallon of water a day, which is far below the 13.2 gallon stipulated by the UN as the absolute minimum for water needs. In about 20 years time, average water supply per person around the globe is likely to be one third smaller than it is now. Agriculture uses more than 70% of global water and industry about 20% much of it is wasted. Drinking water is the basic minimum need of all human beings and provision of conventional safe, clean and adequate drinking water is the declared commitment of the government of Nepal. Population growth, rapid urbanization and industrialization are imposing rapidly growing demand of water supply and it pressurizes the government for the development of the water resources. The growing imbalance between demand and supply has brought various problems. It has caused the shortage of drinking water and environmental degradation. Most people expect that water supply should be provided free of cost as a social service, because they argue that water is a gift of nature. Traditionally, in Nepal water supply has also been considered as a social service and it is taken to be the obligation of the government or those in power to supply water very cheaply and if necessary even free.

Most of the projects mainly focused on the installation of drinking water supply infrastructure. However, the INGO- and NGO-installed projects have package programs, which include training on agriculture and small income generating activities. Moreover, the INGO-installed DWS projects have includes Non-Formal Education (NFE) program during the construction period. Both INGOs and NGOs are being involved to deliver safe drinking water and sanitation in both urban and rural areas. These NGOs and INGOs have been playing and effective role in the drinking water and sanitation sector through the implementation of water supplies projects which are usually integrative in nature and incorporate which the high level of people's participation. The most active providers of services in

WECS (Water and Environmental Sanitation Sector) are the Department of Water Supply and Sewerage (DWSS), Local Authorities (DDCs and VDCs), External Support Agencies (ESAs), Non-Governmental Organization (NGOs), CBOs and user's committees.

The government has introduced the Water Resource Act 1992, with the following main features: proper utilization of water resources; and guidelines and instructions for the use of water resources to minimize the negative impact on the environment. According to act, all water user committees should be registered with their respective district administration to legalize their action (B.W., 2000)

In order to ensure sustainability and certainty of projects and services, the concept of community management rural and semi-urban projects were put forward to enhance the concept of people's participation. Similarly, for ensuring and promoting the concept of community management a provision of 20% contribution of the cost of execution of the project by the community has been made. However, in the case of backward class and targeted groups of people the policy to contribute only 10% of the costs by community has been adopted. Faculty extension programs, aimed at promotion public awareness towards sanitation are in operation as an integral part of drinking water projects. Against the target to complete 13 projects under development of water in the current Fiscal Year (2006/07) that would provide service to 123 thousand people, only 10 projects have been completed and the overall progress is recorded at 78% (Economic Survey, 2006/07: B.W., 2000). In the Tenth Plan (2002-2006), it was taken strategy in rural drinking water project on the basis community needs and demands the project under taken, with the involvement of user community for maximum utilization of locally available resources and means. Moreover, it was given emphasis on the conservation of local resources and operating rural drinking water projects through the consumer committees and NGOs, such institution had also gave emphasis (Tenth Plan, 2002-2007).

CHAPTER VII
CONCLUSION AND RECOMMENDATION

7.1 Conclusion

Water is a renewable resource: rivers, lakes, springs, and other water sources are all periodically replenished by natural processes. However, this does not mean it is inexhaustible; one the contrary, water is a finite good. Moreover, water is a vulnerable element liable to be easily polluted, wasted or in other ways damaged, with long-term consequences for human livelihoods and the environment. Man-made water regimes should therefore take into account the natural dynamic of water systems and disturb the delicate balance between water and the ecosystem as little as possible. What is required, in other words, is a *new water consciousness* that recognises that to be sustainable water schemes should be resource friendly, and that water users should have sufficient knowledge and respect for the resource which is so vital for their lives.

The distribution system of water started from early civilization. From that period the resources are serving to the people. But the encroachment of the people the water resources are worse day by day. Some are destroyed till now a day. People should take responsible to manage and maintain the resources. Then we are depending to the water in our own local resources. Water resources are the natural assets of the people. We will do proper manage and maintain of the water resources. Then the water resources are sustainable in future and we can use their water in our daily activities.

This is basically related to the demand of water for household consumption, and other economic activities such as industries, hotel and restaurants, transport and others. The piped water supply is far below the need of the people. The gap between demand and supply is widening each year. The world is facing a water crisis of the 21' century. The problem is multi-faceted as it involves not only the issue of water shortage but also those relating to wastage, pollution and flood and drought.

Decentralized approaches to water resource management that focus on river basins are increasingly pursued even across borders. Exchanging information between countries that share river basins will yield both economic and environmental benefits.

It has become evident that:

- Changes in climate are affecting water availability
- Pollution, water diversions and uncertainties about the abundance of water are threatening economic growth, environment, and health.

- Underground water is often being overexploited and polluted.
- To augment water supply, traditional techniques – such as rainwater collection – are now being supplemented by newer technologies like desalination and water reuse.
- Political support is needed to improve information collection that can in turn enable better decision making about the management and use of water.

Water resources development is not an end by itself: it is a means to an end. The end is to alleviate poverty and improve quality of life while protecting crucial ecological services performed by ecosystems. Achieving water security is essential for sustainable development which could be possible only with a radical shift in thinking and radically improved governance.

Like other natural resources, source reduction, reuse, recycling and regeneration policy could help the conservation of water resource. Water resource can be managed and conserved to a large extent by adopting following strategies.

- By watershed management.
- By curbing the wastage (attitude change).
    - by reducing waste through evaporation, leaks and other losses. - by reducing irrigation losses.
    - by wasting less water in industries.
    - by wasting less water in home and business.
    - by raising the water prices.
- By not over exploiting and destroying water resources knowingly or deliberately.
- By not discharging unacceptable quantities of any substance.
- By using water resources in a fair and equitable way.
- By ensuring that drinking water supplies are reliable and fair.
- By managing water in an integrated manner which incorporates the needs of the social communities as well as wider environment in general.
- By recycling and reusing water as much as possible.
- By appropriate waste water treatment
- By appropriate financial arrangement needed for water management.

The quality of water for drinking purposes has deteriorated because of the inadequacy of treatment plants, direct discharge of untreated sewage into rivers and inefficient technical management of the piped water distribution system. Also the quality of water in rivers, ponds and lakes in major urban areas is deteriorating rapidly. As a consequence of such unhygienic water quality condition, water borne diseases such as diarrhea, dysentery, and gastro-intertritis occur often. These diseases are prevalent in both urban and rural areas throughout the developing nations.

Nepal is a country where people have facing several problems including infrastructures such as transportation, communication, electrification, health and pure drinking water. One of the many causes of lacking infrastructures is the lack of policy to hand-over responsibilities to the local community. Most of the government owned programs have failed because of the lack of 'We' or 'Our' feeling of the local community. Therefore, local community managed water resources has found very effective especially in management, maintenance, waste less mobilization of available resources, distribution of benefit sharing meaningful participation of local people, our feeling on local people etc. are the major. The study has found some clues that local community managed water resources and supply system will improves the distribution system, reduces the cost of construction, improves the water quality because of the care of local people, reduces the burden of government etc. In an aggregate, it improves health and hygiene of the consumers, which is great benefit of life as well as from economic perspective. Thus, local community managed drinking water supply system is effective alternative option for drinking water management in Nepal.

7.2 Recommendations

Any kind of natural resources are managed and maintained in proper way for the sustainable use. Therefore, water resources are also managed and maintained in time to time other wise its sources is decreased. Other thing is dumping the waste material in the water resources are very wrong practices. We must clean and non-polluted the water resources. It makes the water resources are always good in conditions and water will be in good quality. In Kirtipur, most of the resources' water is losing always. If we collect that losing water we will use in future. So that in every water resources the overflow collection tank will be constructed is very urgent. In this research the different recommendations are made to responsible organization for sustainable use of water resources.

- Municipality should develop the water resources conservation project and programme.
- Municipality should create the different committee for water resources conservation and management
- The water resources are protected from the waste and other things by wall boundary and collected in the tank. The KUKL will be managed the other sources and to provide their water in nominal rate to the people.
- Municipality should separate the budget to maintenance the water resources.
- Give Motivation to the people about water resources management.
- Public awareness is needed in order to mobilize effective support for sustainable water management and induce the changes in behavior and action required to achieve this. Additionally, public awareness and subsequent pressure for action may be vital in fostering the political will to act.
- People have also utilized the water resources in separate like drinking for piped water and other activities for other sources.
- Government and other agencies have to promote the community managed water supply system.
- Government or other related agencies should provide technical assistance e.g. training for maintenance resource mobilization and support of protection etc.
- Political interference usually misleads the project therefore; it must be free from political interests.
- The government of Nepal and other concern agencies are recommended to provide technical skills for this local community especially on the topic of integrated farming, i.e. floriculture Vs fish/ swan etc.
- The government should give authority to the local Community to manage the water resources and drinking water supply system. It will find very effective in terms of resource mobilization, motivation, construction, maintenance, distribution, participation etc. Therefore, it reduces cost of construction. Moreover, it improves the quality of drinking water and further improves health and hygiene of the consumers. Therefore, it is recommended to adopt by other local communities of the nation and local areas should be developed in the short period.

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Annex-I

Observation Sheet

S.N. ……. Date: …….……

Locality Name: …… Ward No. ……..

Types of Source: ……

GPS Location: ……..N, …….. E, Height: …… m

Established Date: ……..……

Condition: ( ) Constant, ( ) Declining, ( ) Worst, ( ) Renovate

Source Managed by: ( ) Local Committee, ( ) Drinking Water Supply Ltd.,

( ) Users' Group, ( ) Clubs, ( ) Private

Surrounding of the sources: ( ) Sewerage, ( ) Dumping site,

( ) Greenery (Wildering), ( ) Open defecation, ( ) Road,

( ) Boundary wall, ( ) Settlements

Source & Maintenance Periods:

Repairs: ( ) Yearly, ( ) Half-yearly, ( ) Occasion (Specify)
…….

Occasion remarks ……..

……..

Utilization:

( ) Drinking, ( ) Washing Cloths, ( ) Bathing, ( ) Toilet, ( ) Dish Wash, ( ) Cleaning, ( ) Livestock, ( ) Agricultural Field, ( ) Tanker Supply, ( ) Construction, ( ) Others (Specify) ……..

Spring Level (Well): H ……m, W …… m, L ……m, D ……m

V …… m^3

Size: W …… m, L ……m, Area ……. m^2

Water Quality Test: ( ) Palatable, Remarks ……..

Annex-II

Questionnaire for users

1. Name: ……
2. Address: ……..…… Ward. ……
3. Water Connection: ( ) Y, ( ) N, Distance of the sources: ……..……,

   Time duration: ……..
4. Sources and its purpose for daily life?

	Piped Line	Well	Dug Well	Stone Spout	River	Pond	Lake
Drinking							
Washing							
Bathing							
Toilet/Cleani							
Livestock							

5. How is the facility of water in this area?

   ( ) Sufficient ( ) Scarcity If Public, no. of Household ……
6. Does the water supplied from Nepal Water Supply Corporation is adequate for daily life?

   ( ) Yes ( ) No

   If yes, why ……..…….

   If No, why ..……
7. How is the quality of Water Supplied from Nepal Water Supply Corporation?

   ( ) Good ( ) Acceptable ( ) Poor
8. How many hours a day do Nepal Water Supply Corporation provide water?

   ( ) 1/2 hrs ( ) 1 hrs ( ) 2 hrs

   ( ) Alternative days ( ) Regular

9. How many quantity of water in the supply period.

Days	No. of Gagries	20 Liters/ Gagries	Average
1			
2			
3			
4			
5			
6			
7			

10. Do you face any kinds of social problem (conflict) in water sources use?

    ……..

11. Do you have any kinds of health problem when you are using water from different sources?

    ……..……

12. How many Rupees pay water bill in a month for uses of water connection?

    Rs. ……..

13. Can you pay whenever DWC supply the water 24 hrs a day?

    If yes, How much Rs ……., If No. How many hrs per day and how much pay per a month Rs. ……..……

14. Is the ground water sufficient amount?

    ……

15. What are the problems you are facing with the water?

    ……

16. What do you suggest for improvement?

    ……

Thank you for your informative answer!

Annex-III

PHOTOGRAPHS OF WATER RESOURCES

Well, Ward No. 17

Stone Spout, Ward No. 17

Stone Spout, Ward No. 3

Tube Well, Ward No. 2

Stone Spout, Ward No. 6

Dug Well, Ward No. 6

Rain Water Harvesting Tank, Ward No. 6

Stone Spout, Ward No. 6

Well, Ward No. 2

Well, Ward No. 3

Well, Ward No. 3

Well, Ward No. 3

Well, Ward No. 2

Well, Ward No. 1

Stone Spout, Ward No. 1

Stone Spout, Ward No. 2

Well, Ward No. 2

Stone Spout, Ward No. 2

Well, Ward No. 2

Pond, Ward No. 2

Pond, Ward No. 2

Pond, Ward No. 6

Dug Well, Ward No. 6

Pond, Ward No. 5

Pond, Ward No. 5

Pond, Ward No. 5

Spring, Ward No. 8

Well, Ward No. 8

Spring Tap, Ward No. 8

Spring Water Tank, Ward No. 8

Spring Pond (Drinking Water), Ward No. 7

Under Ground Spring & Reservoir, Ward No.7

Reservoir, Ward No.7

Spring Pond (Drinking Water), Ward No.7

Lake (Taudaha), Ward No. 15

Dug Well, Ward No. 6

Dug Well, Ward No. 6

x

Well, Ward No. 5

Dug Well, Ward No. 5

Dug Well, Ward No. 5

Dug Well, Ward No. 5

Pond, Ward No. 1

Stone Spout, Ward No. 17

Well, Ward No. 17

Pond, Ward No. 2

Well, Ward No. 14

Well, Ward No. 14

Well, Ward No. 14

Well, Ward No. 14

Well Tank, Ward No. 13

Well, Ward No. 13

Stone Spout, Ward No. 13

Well, Ward No. 18

Reservoir, Ward No. 18

Reservoir, Ward No. 6

Reservoir, Ward No. 2

Reservoir, Ward No. 1

Well, Ward No. 4

Dug Well, Ward No. 16

Pond, Ward No. 16

Pond (disappeared), Ward No. 16

Pond (disappeared), Ward No. 16

Dug Well, Ward No. 11

Dug Well, Ward No. 11

Pond, Ward No. 12

Pond, Ward No. 11

Pond, Ward No. 10

Dug Well, Ward No. 10

Dug Well, Ward No. 10

Dug Well, Ward No. 9

Dug Well, Ward No. 10

Dug Well, Ward No. 17

Spring (Potential Resources), Chalnakhel VDC

Dug Well, Ward No. 8

Unmanaged Spring Resource, Ward No. 8