

Conservation of Water Heritage in Kathmandu Metropolitan City

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Abstract: Water sustains life on earth. Water was supplied in earlier times by understanding the natural topography and utilizing all natural materials, forms and features to develop a highly engineered water supply system which is evident in the traditional water supply system of the Kathmandu Valley. Not only the construction but also maintenance was forethought and responsibilities were given to the families, community and city level by intertwining the maintenance and public welfare into religious and cultural practices organized annually. The study focuses on the scenario of water heritage (ponds, *hities* or stonespouts and wells) and their linkages in the city core sector of Kathmandu Metropolitan City.

The water heritage have served centuries of civilization and are still in operation. But, ignorance of the locals towards traditional water supply system due to modern household water supply has led to the defunct condition and loss of water heritage. Nevertheless, the conservation approaches has revived some of the water heritage and there is a possibility of conserving water heritages. The positive approaches, ground water recharge, source conservation and surface water management would add to the sustainability of water heritage and give the utilitarian value to the water heritages rather than a work of art and architecture.

Keywords: Water heritage; conservation; ponds; *hities*; wells

1. Introduction

Water heritages of Kathmandu Metropolitan City are mainly stone water spouts, ponds and wells. According to the Kathmandu Nagar Chetra Inventory (B.S. 2039) [1] there were 119 stone water spouts and 15 ponds documented in Kathmandu area.

The three large water supply works of historic time in Kathmandu Valley were the canals from Budhanilkantha to core of Kathmandu, the Tikabhairav canal supplying the ponds of Patan and the Bageswori canal feeding Bhaktapur water system that was established. [2]

To provide potable water in the cities, a series of *rajkulos*, man-made ponds and sunken water conduits from peripheral higher ground to the lower settlement area were developed. The distribution of water was done with the study of topography supported by gravity flow and linked by clay and terracotta channels at sub surface. [3] The knowledge of topography and water engineering is evident from the settlement pattern in the valley with compact settlement in tar areas or higher grounds and agriculture area at the low lands with irrigation facilities and development of canals to deliver water to the settlement from the source.

Primarily, there were two water supply outlets used by the Newars: *hiti*, the water spouts at manmade depressions and *tun*, the dug wells. The sources of both these water conduits were shallow ground water. Lohn *hiti*, meaning stone spout and *gaa hiti*, meaning spout

at depression are the two terminologies normally used by the Newars for the stone spouts. [3]

Natural charging of the *hities* was done through local aquifers and recharging the local aquifers was possible by conveyance canals popularly known as *deidhā* or *rajkulo* through ponds.[3] Network of canals, ponds and the water conduits was integrated in such a way that the city had water supply of adequate quality and quantity to its population throughout the year.

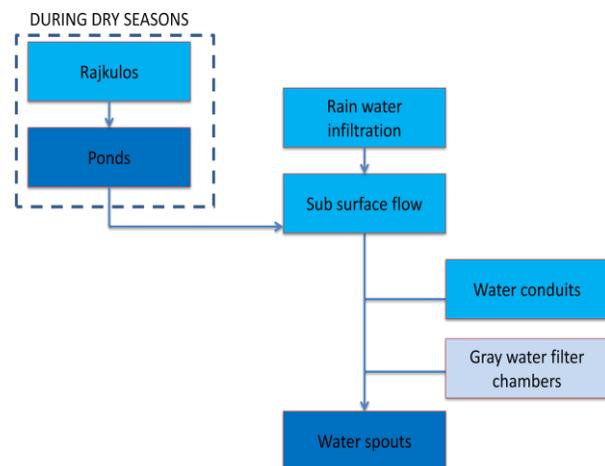


Figure 1: Flow chart showing the operating system of traditional water supply system in Kathmandu valley

2. Statement of the Problem

The traditional water supply system and its components are disappearing fast owing to haphazard urbanization and fast-paced development. With the introduction of piped water supply system in late 1800 by Rana rulers, these water heritage were not valued and ignored.

The limited resources and weak management capabilities of the government to meet water demand has led these old systems to be taken into consideration as many water heritage are still functioning and are sustainable.

In the absence of proper policies to maintain the system, to stop uncontrolled exploitation of the natural aquifers and heavy extraction of ground water, these heritages are disappearing so there is a dire need of conservation and maintenance.

3. Methodology

The research was based on positivism / post positivism belief. In this study focus was done on the physical condition of water heritages and their links and also the socio-cultural aspects created by the water heritage around it.

The research was based on inductive thinking. The study of historical attempts for water supply in the settlement area of Kathmandu was done to understand the overall picture of traditional water supply with comparison to the existing scenario as to how it has changed and why some of the water heritages are still in operation unlike others. By the observations, questionnaire survey, interviews with the key person analysis about the major challenge for the conservation of the heritage area was carried out.

4. Study Area

The study area is the city core sector of Kathmandu metropolitan city comprising of 14 no. of wards (12, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, and 30)

It includes the historical core city of Kathmandu as well as some peripheral regions. The area includes the historical settlement, highly commercialized hub, peripheral fringe with the development of land pooling and even the funerary area.

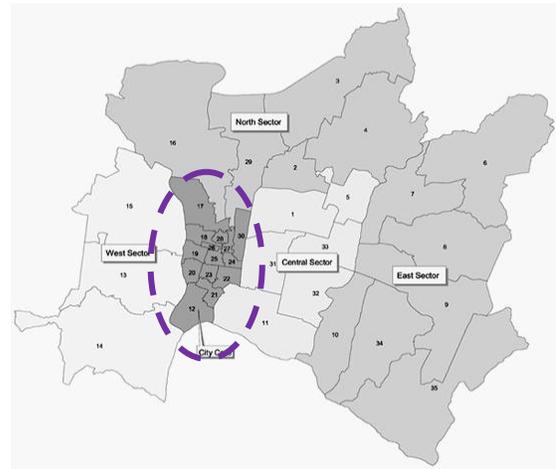
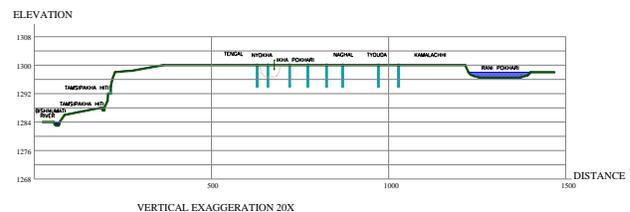


Figure 2: Study area- City Core Sector

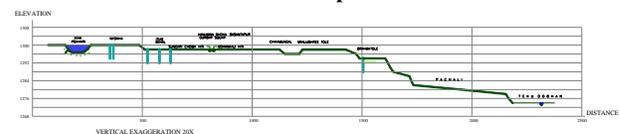
Table1: Ward wise list of water heritage in city core sector [4]

Ward No.	Population 2001	Hities	Wells	Ponds
12	10313	2	2	
17	19876	11	14	1
18	8065	7	5	
19	7400	6	8	
20	8240	4	1	
21	12369	4		
22	5840	1		
23	8289	1	1	
24	5272			
25	4310	3	22	2
26	3764		27	
27	7789		50	
28	5462		40	
30	9896	1	14	
Total		40	184	4

5. Profile through City Core Sector



East -West profile



North south profile

The above profiles through city core sector shows the linkages of water heritages. The profile shows that Ikha Pokhari and Rani Pokhari recharging the sub surface

and wells and *hities* sharing the sub surface water for water supply.

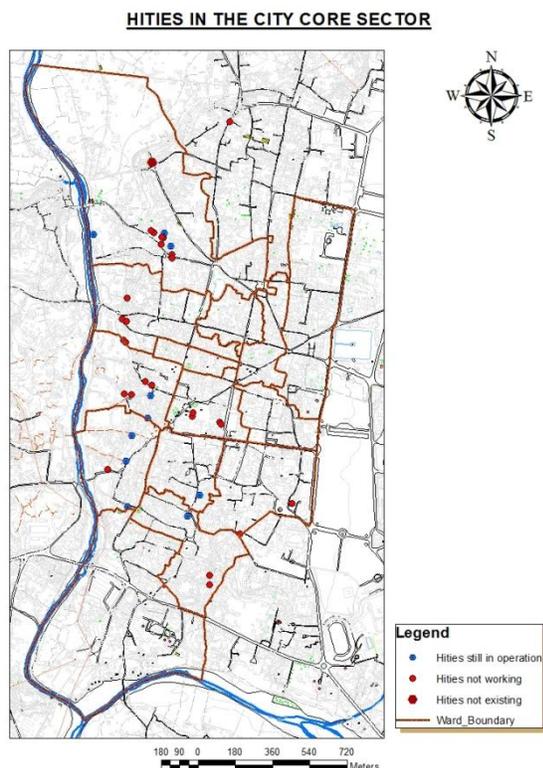
6. Status of water heritage in KMC

6.1 Ponds

In the city core area the only significant pond is the Ikha pokhari, which was a huge pond earlier but now it has decreased in size by encroachment. The other ponds are Naag pokhari, Jalashaya Narayan Pokhari inside Hanumandhoka Durbar Square. Ponds like Paku pukhu, Khecha pukhu and Naag pokhari does not exist now.

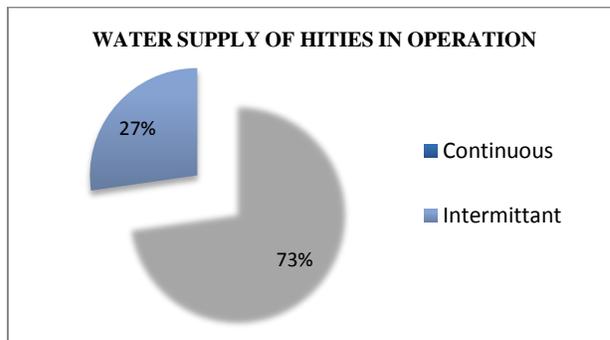
6.2 *Hities or stone spouts or dhungedhara*

The *hities* are located at the road crossings and transitional elevation situation. *Hities* are seen mainly around the central city core sector towards the peripheral north, south and west directions. *Hities* are located in such a pattern showing some linkages to one another in the Dhalko Dhobichaur, Nayapacho and Dhoka tole-Banja *hiti* area. The map below shows the *hities* of city core sector of KMC.



Among the *hities* of city core sector of KMC 32% of the *hities* are still in operation while 55% of the *hities* have gone dry where as the 13% does not exist. The state of the *hities* reveal that *hities* are going dry due to

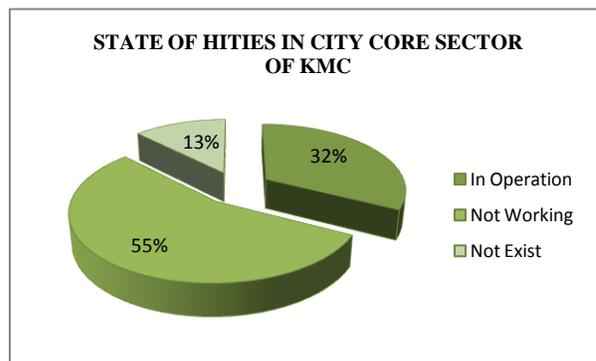
various reasons of deterioration may it be the new building construction or road construction.



The Pie chart above shows the water supply condition from *hities* in operation in city core sector with 73% continuous and 27% seasonal or intermittent supply conditions. The volume of water in rainy season increases due to rain water infiltration but in other season the volume is comparatively reduced.

All the *hities* had potable water supply in earlier times and eventhough the water quality is fine, people are reluctant in using it for drinking purpose. *Hities* that supply potable water are:

- Ko *hiti* –Quality check has been done and the water is potable
- Dhobichaur *hiti*
- Kaldhara
- Baishnab Devi Temple *hiti*
- Yangal *hiti*

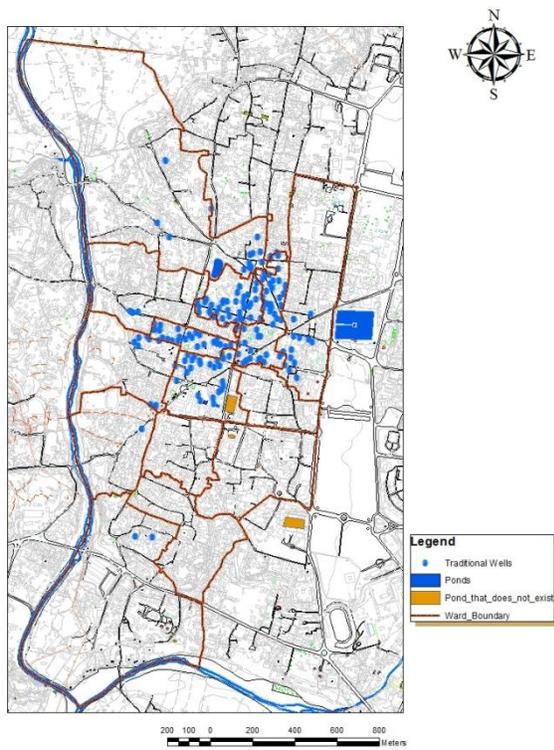


The water from these *hities* is mainly collected by rental population, as the original inhabitants are reluctant in using the water from these *hities*, the physical environment is degrading. The only purpose of utilizing the water by the original inhabitants is for the pure water requirement (Ni-la) to worship deity daily. 0.68% of water demand during wet season is fulfilled by *hities* of Kathmandu comparing 2009 data from annual report of KUKL and NGOFUWS. [5]

6.3 Traditional dug wells

The map below shows the location of traditional dug wells in the city core sector which indicates that the dug wells are mainly concentrated in the central core area mostly towards the northern part from new road and also that the area may have more sub surface water recharged by Rani pokhari and Ikha pokhari.

TRADITIONAL WELLS AND PONDS IN THE CITY CORE SECTOR



6.4 Recharge and green areas

There were agricultural fields; parks and kitchen garden (Khya (open space), bun (agricultural field) and Keba (Kitchen garden)) in the earlier times but now these areas are converted mostly into built up area which is the major reason of the water heritages drying out. The name of place in the city core reveal that the area must have been agriculture field or park or kitchen garden like Bhurankhya, Khyakeba, Chibakhya, Khushibu, Fasikeba, Kusle chaur etc. Every green area in the upper elevation is important to recharge the sub surface and retain water in the sub surface.

7. Deterioration of Water Heritages

7.1 Ponds

Ponds in the study area are filled during rainy season but completely dry out in other seasons. In the other

seasons Ikha pokhari becomes a play ground to the children. The main reason of pond drying out is the heavy extractions of ground water and deep boring all around the periphery of the pond i.e. the households and the school.

7.2 Hities

New building construction is the main cause of water spout going dry. The newly constructed buildings are going tall requiring deeper foundation which not only seal the water flow but also destroy the channels during foundation construction. The ground and garden (khya and keba) for recharge of the rain water are all sealed.

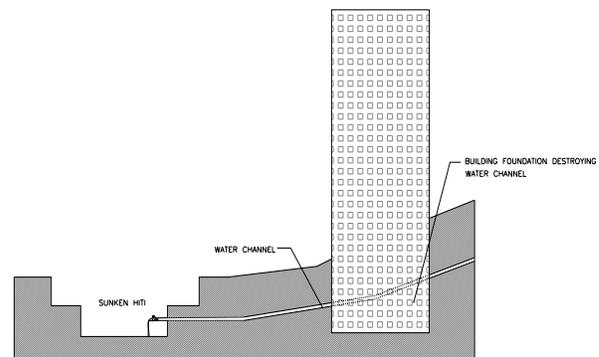
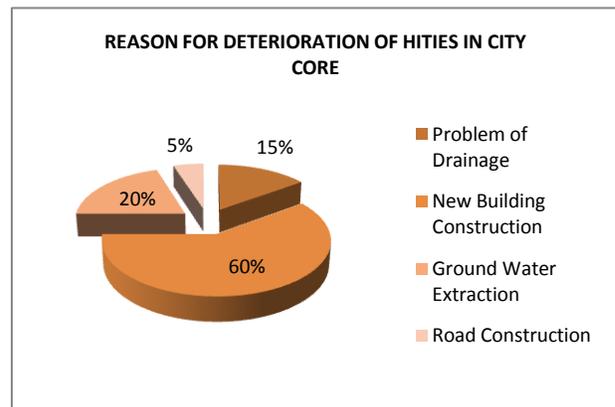


Figure 3: Deterioration of water channels by new building construction

Heavy extraction of ground water or water tapping at upper elevation from the well and deep boring has disrupted the flow of water in the *hities* at lower elevation. The newly constructed wells and bore holes have come into the way of channels of traditional water supply destroying the channels. The construction of road has also demolished the water channels in Nayapacho tole.

Encroachment, construction of Underground tank and deep boring for the water extraction is evident in the *hiti* premises leading to the *hities* deterioration.

Problem of drainage are seen in Nabahal, Yangal and Lun *hiti* have caused water ponding and is the reason for deterioration of these *hities*. The water from the *hiti* is used for bathing, washing which uses soap and sachet of shampoo which has increased the drainage problems.

7.3 Wells

The level of water in the wells of the city core sector has lowered down. Wells with original inhabitants around are limited to their usage but in the area like

Khyabahal the well is used mostly by the rental population for all domestic purposes.

Wells with high religious values are enclosed by peripheral wall restricting the usage as incase of Tara Nani well and Bara Barse Inar.

Traditional wells in some area are disintegrating due to the age or the vegetative growth as in Dharma chakra Ta Nani. Additional Rings have been inserted to find water in Ta Nani.

8. Conservation through Cultural practices

Cultural Practices	Level	Conservation Activities
Indra Jatra (Maru <i>hiti</i>), Bathing festival (Sundhara)	City Level	Management, operation and maintenance of <i>hities</i> and its source (Indra Daha) [6]
Balachaturdashi (Dhobidhra), Kojagrat purnima (Yangal and Keta <i>hiti</i>)	Neighborhood Level	The <i>guthies</i> responsible for <i>hiti</i> management and worshipping activities
Sithinakha, Naagpanchami (Dug wells)	Family Level	Cleaning up wells and <i>hiti</i> complex and opening the drain and worshipping the <i>nagas</i>

9. Case study of Aalok *hiti*

The local youths of Ikhachhen formed a committee to resolve the problem of water supply. In 2003, a committee Aalok *Hiti* Conservation and Drinking Water Supply User's Committee (AHCDWSUC) was formed to develop the small scale drinking water supply project. [7]



The committee stored free flowing water from the traditional stone spout, Aalok *hiti* during the night time and distributing it to the neighboring households through a network of pipelines. The project was completed without any technical expert and financial assistance. The users committee also revived the traditional stone spout and with expansion of the road.

Recharge pits have been constructed in two different places 50m and 150 m from the *hiti* premises where the Rain water is directed towards the pit. The drained water from the Aalok *hiti* is also being utilized by collecting in a recharge pond (6 anna of area) where fishing is done.

Aalok *hiti* has revived the traditional spout with the efforts from the local for the social benefit which is the core purpose of constructing the *hities*. The revival of Aalok *hiti* has fulfilled the water demand and is operating successfully as well as it has provision of water in case of fire hazards. The remarkable efforts from Ikhachen locals can be taken as best practice for the *hiti* conservation.

10. Discussions

Water the basic requirement for the existence of life is supplied from the centuries old water heritages for free till now. Many reasons have led to the deterioration of these important monuments. The deterioration of water heritages is occurring due to two main reasons. Firstly, the heavy ground water extraction in the city core has reduced the water table. The ponds have gone dry, well are drying out except for rainy season. Secondly, the building construction in the upland where source and water channels exist, destroying the channels sealing the recharge areas.

So, the condition needs to be checked by detail research on the source and water channel. If the process continues the remaining operating *hities* will also be out of work. Drainage problem are also faced in *hities* as the city drain or river are at higher level than the *hiti* drain.

The cultural and religious practices linked with the water heritages has maintained and managed it till now. So, both the tangible and intangible heritage helps in the sustainability of traditional essence linking water heritages with the day to day cultural practice of requiring *ni-la* or pure water for daily worship, speaks for the maintenance. Rental population in the city core sector are the main users of the water from these water heritages. They are highly exploiting the heritages especially *hities* and wells until and unless original inhabitants interfere. The rental population have no concern for the conservation with only focus on utilization of maximum quantity of water.

Locals have tried to tap water from *hities* but in a small scale for filling up the water tanks and distributing it in scare season in nominal price. The idea of recharging and making the system sustainable is not much realized in city core. The quality of water supply from this water heritage depends upon the sub surface water condition so the check on the contamination of the sub surface water should be done. Priceless water supply from the water heritages needs to be conserved and the initiation should be taken from the locals.

Eventhough, locals, government officials, NGOs and INGOs have put their effort in conserving water heritage the effort seems to be short termed lacking long term planning.

11. Recommendations

11.1 Policy

- Building permission to be issued where source of *hities* are located only with the condition that the 30-20% of land area to be allocated as recharge or green areas.

The majority of land of the country is privately owned. Due to such condition government cannot impose any planning measures directly. The public and private coordination is required in any plan implementation. So, acquiring land in the source area and water channels path of water heritages is not possible due to lack of funds and budget of government. The only way out is to make policy that would conserve the water heritage and reduce further effects. Policy recommended allocates land for the ground water recharge and both public and private parties play the role in conservation.

- Building foundation restriction upto 6' along the way of water channels should be done

From the observation at Nabahal hiti recently retained, the water channels are at the depth of 8'. So to protect water channels from damage the foundation restriction is recommended and further study is required as to locate the water channels of the hities.

- Permission should be taken from municipality for deep bore holes more than 60' depth

From the field study the depth of wells range from 20-40 feet depending upon the location of the wells. Additional rings are added to reach the ground water at many places. The recommendation is made so as to restrict the owners to randomly built bore holes to extract water affecting the supply of water heritages.

- Declaration of green areas and the source of water heritages as preserved areas

The green areas in the upland are disappearing resulting to, decrease in rain water recharge which is the main source for the water supply in the heritages. Bylaws restricting the ground coverage should be implemented well and public open space like play grounds (chaur), parks should be declared as preserved areas

- Encroachment of the water heritage premise should be inspected regularly and not allowed

Encroachment of hiti premise is done by the neighboring households by placing their personal

water tanks, as the hiti is not in operation. The heritage complex is public so no encroachment should be allowed. The regular inspection should be done to stop the encroachments.

11.2 Plans

- Awareness program should be conducted regarding the system of traditional water supply system, its importance and conservation of the source, sub surface to the locals and rental population
- The conservation plan of Ikha Pokhari should be implemented [8]
- Detail research for the source, water channels and drainage of *hities* should be done
- *Hities* in operation should restrict washing and bathing activities
- Continuation of cultural practices related to water heritage conservation and if possible monitored by KMC (heritage section)
- Water Recharging elevation level in the city core is at the elevation ranging from 1296 to 1300m

The elevation recommended for recharge is the highest elevation of the city core sector. Recharging of water at the source of water heritages is recommended by rain water harvesting or developing recharge pits. If possible every chowks with recharge pits could be developed

- Promote Rain water harvesting as well as source conservation
- Quality test for the water should be done at regular interval to check the water borne diseases by the locals with the help of ward office
- Drainage problem in 3 *hities* (Lun *hiti*, Yangal *hiti*, Na bahal *hiti*) of city core should be solved by consulting technical experts (KMC)
- Water tapping in the night time from the *hities* and distribution in the surrounding locality should be encouraged. Water tapping in Maru *hiti*, Kohiti, Banja *hiti*, Dhobidhara and Kaldhar are possible
- Restriction in quantity and the hours of water collection from the dug wells would stop the over exploitation. Disseminating the concept of recharging the wells by rain water harvesting or digging recharge pits which have shown positive results in various areas would make the locals aware and convince them

- Awareness to the youths, clubs and user community about the water demand and supply scenario and the best practices of water heritages conservation in the city core to fulfill the demand so that they can utilize and implement in their own community.

12. Conclusion

The conservation of water heritage in city core sector of KMC has many challenges. Main challenge of conservation of water heritage is that new building construction sealing the sub surface water flow, breaking the supply channels and also the ground water table has gone down by the high extraction of ground water without recharge, making the water system nonfunctional and further confronted by loss of heritages. The quality of water from these *hities* is questionable which requires some treatments.

Fifty five percent (55%) of the *hities* are not working with thirteen percent (13%) of *hities* has disappeared. Ponds have disappeared and have found alternative usage. Concrete rings are added in the dug wells to go deep to get ground water. The technical assistance and community effort could solve and revive the traditional historical heritages.

Recharging the ponds of Buikhel and Rani pokhari by rain water harvesting has set an example to sustain these historical ponds or reservoirs naturally.[9] [10] Maintaining of ground water is also possible as is done in Ta Nani by rain water harvesting and recharging the water in the recharge pits. [11]

Tapping of water from the traditional water spouts and distributing it in a modern mechanism by preserving the source, conserving recharge area for rain water infiltration to maintain ground water level and recharging the ground again by construction recharge pond are the efforts made by locals of Patan at Ikhachen Tole for Aalok *hiti*. The *hiti* has incorporated both natural and modern mechanism to provide the essential water to the 200 households. [19]

Aalok *hiti* has set an example of conserving the water heritage and maintaining the essence of life on the whole. The example of Aalok *hiti* is an ideal one to be followed if the source and drainage of the *hiti* are known. Eventhough, Aalok *hiti* has made an achievement in sustaining the traditional water supply system it has to face the dry season (Falgun to Baishak) with lack of water and again depending on the water from tankers.

Revival of the water heritage would revive the ancient water system and also the essence of historical

ambience. Kathmandu Metropolitan Office (Heritage section) is not active in the conservation of water heritage even though they have the authority of such public entities. These heritages are of national importance that has served the whole civilization for ages and it is a high time to conserve these *hities* and also the whole system of traditional water supply.

This scenario of traditional water supply is shocking, as they are in a verge of losing its utilitarian value and becoming a mere showpiece or even worse disappear and become the foundation for new construction. The recommendations are made to reverse the situation and conserve the water heritages.

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