

Proceedings of the  
**6<sup>th</sup> National Symposium on Challenges and Opportunities for  
Sustainable Management of Groundwater Resources in Nepal**  
19 March 2015



Organized by



GWRDB

**Proceedings of the**  
**6<sup>th</sup> National Symposium on Challenges and Opportunities for**  
**Sustainable Management of Groundwater Resources in Nepal**  
**19 March 2015, Kathmandu, Nepal**

**Organized by**

Center of Research for Environment, Energy and Water (CREEW)  
The Small Earth Nepal (SEN)  
Environment and Public Health Organization (ENPHO)  
Kathmandu Valley Water Supply Management Board (KVWSMB)  
Groundwater Resource Development Board (GWRDB)

**Co-organized by**

WaterAid Nepal  
International Water Management Institute (IWMI) Nepal

**In association and supported by**

Water and Energy Commission Secretariat (WECS)  
Institute of Engineering (IoE) of the Tribhuvan University (TU)  
Asian Institute of Technology (AIT) Thailand  
Interdisciplinary Centre for River Basin Environment at University of Yamanashi (ICRE-UY) Japan  
Kurita Water and Environment Foundation (KWEF) Japan

## **Editors**

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Responsibility for statements made and opinions expressed in the contributions included in the proceeding rests entirely with their respective authors.

**Cover photo:** A private water supply tanker filling water extracted from groundwater tube well installed along the Bishnumati River corridor in Kathmandu at Manamaiju (CREEW)

**Back cover photo:** Participants of the 6<sup>th</sup> National Groundwater Symposium (CREEW)

## **ACKNOWLEDGEMENTS**

The organizers would like to thank all the authors for contributing valuable articles and presenting them at the symposium, and to all the session chairs for kindly accepting the role and chairing the session. The organizers also acknowledge the rapporteurs of all the sessions for taking record of the presentations made.

The organizers sincerely express gratefulness to the opening session chairman Mr. Gajendra Kumar Thakur, Secretary of Water and Energy Commission Secretariat (WECS), Government of Nepal; chief guest Mr. Arjun Kumar Karki, Secretary of Ministry of Urban Development (MoUD), Government of Nepal; guest Mr. Jagat Prasad Joshi, Executive Director of Groundwater Resource Development Board (GWRDB); and keynote speaker Dr. Dibya Ratna Kansakar, Team Leader, Water Resources Project Preparation Facility, MOI/DOI/DWIDP/ADB.

The organizers wish to thank all the participants for attending and actively participating in the symposium.

Lastly, the organizers appreciate the support from Water and Energy Commission Secretariat (WECS), Institute of Engineering (IoE) of Tribhuvan University (TU), WaterAid Nepal, International Water Management (IWMI) Nepal, Asian Institute of Technology (AIT) Thailand, Interdisciplinary Research Center for River Basin Environment at University of Yamanashi (ICRE-UY) Japan, and Kurita Water and Environment Foundation (KWEF) Japan for the symposium.

**Organizers:** CREEW, SEN, ENPHO, KVWSMB & GWRDB

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## **INTRODUCTION**

### **Background**

Groundwater in Nepal is vital resource for drinking, industrial use and irrigation. Climate change, population growth, increased water demand and degradation of the environment could possibly degrade the quality and deplete the level of groundwater. Thus research, findings and studies should be used for water management and its betterment.

In this context, 6<sup>th</sup> National Symposium on Challenges and Opportunities for Sustainable Management of Groundwater Resources of Nepal was jointly organized by Center of Research for Environment, Energy and Water (CREEW), The Small Earth Nepal (SEN), Environment and Public Health Organization (ENPHO), Groundwater Resource Development Board (GWRDB) and Kathmandu Valley Water Supply Management Board (KVWSMB); co-organized by WaterAid Nepal and International Water Management Institute (IWMI) Nepal and; in association and supported by Water and Energy Commission Secretariat (WECS), Institute of Engineering (IoE) of Tribhuvan University (TU), Asian Institute of Technology (AIT) Thailand, Interdisciplinary Research Center for River Basin Environment at University of Yamanashi (ICRE-UY) Japan, Kurita Water and Environment Foundation (KWEF) Japan, WaterAid Nepal and to mark the World Water Day 2015 as part of the Nepal National Water Week 2015 led by WECS of the Government of Nepal on 19 March 2015. The theme of the World Water Day 2015 was “Water and Sustainable Development”.

### **Objectives**

- 1) Share latest research findings and raise awareness on groundwater issues.
- 2) Share and be familiar with research activities on groundwater.
- 3) Promote research and its utilization for management of groundwater.
- 4) Enhance networking, collaborations and cooperation for sustainable management of groundwater resource.

### **Themes**

- 1) Groundwater modeling and quantification
- 2) Groundwater recharge/managed aquifer recharge
- 3) Groundwater and energy nexus
- 4) Groundwater contamination and treatment
- 5) Application of isotope tools to groundwater studies
- 6) Groundwater and surface water interactions
- 7) Groundwater policy, regulations and governance

## Participants

The participants in the symposium were from government and their agencies, universities and research institutes, UN agencies, INGOs, NGOs and media. In total there were 61 participants (Annex II).

## OPENING SESSION

### Welcome speech

Dr. Suman K. Shakya (Executive Director, ENPHO) welcomed all the guests, participants, presenters, and representatives from different organization to share their valuable knowledge and better understanding to resolve groundwater problems and issues of Nepal and make sustainable use of the resource.



### Keynote speech on “Regulating Common Pool Groundwater Resource under Fugitive Water Law: A Paradox”

*Dr. Dibya Ratna Kansakar, Team Leader, Water Resources Project Preparation Facility, MOI/DOI/DWIDP/ADB*

Groundwater extraction has escalated in Nepal during the past couple of decades. With the availability of cheap pumps in the market and expanded network of electricity supply systems, groundwater has become an easily accessible and affordable option for water supply in both domestic uses as well as in irrigation sectors. Growing water demand from ever-rising urban populations and insufficient municipal water supply has impelled private investment in groundwater extraction for drinking and other purposes. After the abolition of capital cost subsidy by the Government in 1999 AD, it is the private sector funding that has supported all the recent growths in shallow tube well installations in Terai and elsewhere, but the scale of this recent development is unknown. Explosion of pump market since 1999 AD sufficiently indicate that this growth has been much higher compared to the earlier periods, but there is a serious lack of institutional and legal mechanisms to keep track of this development in the country.



Quantity-wise, the available groundwater resource base in Terai is much larger compared to its present use. It can also support the planned growth in groundwater irrigation in the Terai. It should be, however, remembered that almost the whole population of Terai also depends on the same resource for their basic daily water requirements. Again, there are a sizable number of industries that also use the same groundwater resource. Un-regulated development or exploitation of this common pool resource may create problems like the issues of beneficial use of the resource, equity and protection of groundwater quality.

The groundwater characteristics are uniquely distinct from those of surface water resources. Among others, the most important one is that groundwater is a common pool resource whereas surface water is a typical fugitive resource. This important distinction has not been recognized in the existing laws and regulations related to water resource in Nepal.

The main principles for water resources utilizations adopted by the Water Resources Act, 2049 BS, are the principles of the beneficial use, economic efficiency and equity. It has embraced a hybrid doctrine in the allocation and/or re-allocation of water resources in the country. Following the doctrine of public trust, water resources have been treated as a public property under the trustee-ship of the State. Applying the economic principles of “efficient natural resource use”, legal instrument, namely licensing mechanism, has also been provided to establish the property right over water (utilization) in the law.

A straight forward enforcement of licensing mechanism cannot be effective in regulating groundwater exploitation, because unlike over a fugitive surface water resource, a license holder cannot always be protected from “third party intervention or other outside interferences” particularly when a groundwater resource becomes scarce, and when a large number of other legitimate holders of water rights also exploit the same resource simultaneously. The situation of groundwater exploitation in Kathmandu valley is an example to this.

The legal provisions available for protecting and controlling the quantity and quality aspects of water resources are highly scattered at present. At times, they are even contradictory to one another. Again, those existing provisions are directed mainly towards regulating the surface water resources. Bringing those provisions into effect to control and protect groundwater resources is difficult, if not impossible. Conservation and protection of water source areas (that includes groundwater recharge areas) have not been covered directly by any of the existing laws in Nepal.

### **Remarks by Guest**

Mr. Jagat Prasad Joshi, Executive Director, Groundwater Resource Development Board (GWRDB), discussed and highlighted the activities of GWRDB focusing on the infancy of groundwater research in the hilly region.



### **Remarks by NNWW 2015 Secretary**

Mr. Sudarshan Rajbhandari, Vice President of The Small Earth Nepal (SEN), presented the start of groundwater symposium as one of the major events of the Nepal National Water Week.



### **Remarks by Chief Guest**

Chief Guest of the inaugural session Mr. Arjun Kumar Karki, Secretary, Ministry of Urban Development (MoUD), Government of Nepal, centered his remarks on the need for strong and coordinated involvement of government and other stakeholders for the successful implementation of groundwater policies and regulations.



### **Vote of thanks**

Dr. Rabin Malla, Executive Director, CREEW expressed sincere thanks to all the distinguished guests, presenters, participants and the supporting institutions of the symposium.



### **Closing remarks**

Chairman of the inaugural session Mr. Gajendra Kumar Thakur, Secretary, Water and Energy Commission Secretariat (WECS) thanked the organizing committee of the 6<sup>th</sup> National Groundwater Symposium, presenters, participants and wished for fruitful achievements in the technical sessions.



## ORAL PRESENTATION SESSION

### TECHNICAL SESSION I

Chair: Dr. Khadananda Dulal, Hillside College (HC), PU

Rapporteurs: Sarad Pathak and Buddha Bajracharya

#### **Presentation abstract 1: Search for groundwater potential areas in and nearby the Kathmandu Valley**

*Nabaraj Shrestha*

*Three D Consultants Pvt. Ltd.*

Ground water resource constitute major portion in the Kathmandu water supply. The increasing population in the valley and increasing built up area, which diminishes the available recharge area both create increasing stress to aquifers resulting in large gap between water demand and supply. There is need now to search for other aquifer system to solve the water scarcity problem



The studies conducted so far showed that shallow and deep aquifers exist in the valley and are being exploited in large scale. Central ground water district has many tube wells and large ground water volume is being exploited daily as many commercial establishments are situated here. There are areas which are still little explored, mainly in the Bhaisepati, Bungamati in the southern part of Lalitpur district and Kakani-Shivapuri and nearby areas in the southern part of Nuwakot district in northern part of Kathmandu valley. The study was conducted to see the ground water potential in these areas. The result revealed presence of highly potential bedrock aquifers in Kakani-Shivapuri area and alluvial deposit in southern area, which can contribute significantly in solving water scarcity problem in the valley.

## **Presentation abstract 2: Shallow aquifer mapping of Kathmandu Valley**

*S.R. Shrestha, S. Shah and K.P. Upadhya*

*Groundwater Resource Development Board (GWRDB)*

Water scarcity for ever-growing population of the Kathmandu Valley is increasing significantly causing high pressure on groundwater that contributes nearly half the amount of water being distributed within the valley and shallow aquifer is the main source for this supply. So far, there is no substantial study carried out about the shallow tubewell potential of the valley. In this context, Groundwater Resources Development Board (GWRDB), Babarmahal carried



detail study on Shallow Aquifer and its Mapping in Kathmandu Valley with the objective of preparing the shallow aquifer potential map of the Kathmandu Valley. The study was based on a weighted overlay method in ArcGIS 9.3. The thematic layer considered were general geology, aquifer thickness, discharges from shallow tube wells, precipitation and land use data. In ArcGIS, model builder was used to develop shallow aquifer potential model and to run weighted overlay operation. With the available data, the outcome of the study is the potential map that delineates shallow aquifer potential zones of Kathmandu valley which are categorized as good, fair and poor. The spatial distribution of the various zones of groundwater potential obtained from the study generally shows regional patterns related to surface geology and aquifer thickness. The good potential area is mostly extended at the northern and north-eastern part of the valley; the fair potential areas are mostly distributed at the northern and southern part of the valley; and the poor potential areas are mostly distributed around the central part of the Kathmandu Valley extending generally from east to west.

### Presentation abstract 3: Spring study and climate change of Tanahun District

*Binod Shakya and Resham Phuldel*

*Rural Water Supply and Sanitation Project in Western Nepal (RWSSP-WN)*

In recent days, several spring sources have been dried out or slowly decreasing its yield across the country due to changing character of rainfall, increasing evaporative losses and some other manmade causes such as land use change, infrastructure development work etc. To sustain the hilly communities, the sources have to be able to provide sufficient water to serve the population, either on its own or in conjunction with other sources.



Rural Water Supply and Sanitation Support Project Phase III (RWSSSP III) has measured all water sources in Tanahun district in 2004 and they were located with the GPS. Rural Water Supply and Sanitation Project in Western Nepal Phase II (RWSSP-WN II) repeated the exercise in 2014 to see changes in the district. The comparative study is based on 2,387 sources. Between 2004 and 2014, 50% flow rate (yield) deduction of point sources' average yield in 10 years is found. Similarly 21.6% and 34% deductions of average yield were found in spring and stream water sources respectively. The rainfall from 2002 to 2013 shows erratic rainfalls in district. The monsoon peak month is not consistent and the trend shows decrease of annual rainfall by 16.7 mm/year. Further, the temperature trend between 2002 and 2013 shows warming of + 0.041 °C/year.

**Presentation abstract 4: Groundwater resources assessment and estimation of future demand for irrigation in three districts of Nepal**

*Romulus O. Okwany, Ram Chandra Bastakoti and Sanmungam A. Prathapar  
International Water Management Institute (IWMI, Nepal)*

Climate change has been projected to lead to increased incidences of extreme rainfall events without any significant changes in precipitation received. This will result in increased flooding and droughts by causing higher incidences of flash flooding and reduced recharge to groundwater aquifers. The impact to groundwater availability is thus very complex and poorly understood as the large flows and floods may enhance recharge in some areas whereas the short duration of the floods may limit recharge in some areas. Further, the projected increase in irrigated agriculture to support the agrarian based economy of Nepal will put more demands on groundwater use and irrigation withdrawals further complicating the groundwater status.



A study to assess the status of groundwater resources was thus carried out in three districts of Nepal Terai. The study examined the potential groundwater availability and demand as physical components for rural development. Using historical groundwater data a current state of withdrawals and recharges were quantified. Further modeling was done to project future scenarios of increased groundwater withdrawals and changes in cropping patterns as a result of Nepal's growing agrarian economy. This study presents the results of an assessment of the status of groundwater resources in three districts of Nepal's Terai. We examined both potential groundwater availability and demand as a physical component of rural agricultural development. We examined historical groundwater status and modelled the likely future water use influenced by climate change and changes in cropping patterns as a result of growing agrarian economy.

This report thus describes the findings of case studies in the three districts by evaluating the historical trends in groundwater status and modeling future pressures against increased irrigation intensity visions of the national government policy.

## **Open discussion**

Mr. Saroj Yakami (MetaMeta) questioned Dr. Binod Shakya about how they could replicate the learning from the presentation about the water sources increasing in other places. Dr. Shakya replied that rainfall is not uniform all over the country. So he was not sure whether the result would be same or not from the replication of same procedures.

Mr. Dilli Bhattarai (SEN) revealed his view that it is due to the steep slopes which make it difficult to recharge groundwater in Nepal and the possibility of other reasons for the climate change apart from the depleting rainfall. To this, Dr. Shakya responded the focus must be on how the recharge can be done through technologies.

Similarly, Dr. Dibya Ratna Kansakar raised question to Dr. Romulus O. Okwany about the current level of shallow groundwater withdrawal in Terai for each district as data of 2010 was presented. Also, he suggested that it would have been better if both old data (2010) and new data were presented. Dr. Okwany replied that there was very high variation in the level of groundwater at every 2 km distance.

## TECHNICAL SESSION II

Chair: Prof. Ishwor Man Amatya, Institute of Engineering (IOE), TU

Rapporteurs: Meera Prajapati and Bal B. Thakurathi

### Presentation abstract 1: Groundwater a vital water source for emergency and disaster scenario

*Prajwal Shrestha*

*Environment and Public Health organization (ENPHO)*

Today we are going through rapids of development in all aspects. The exploding urban growth and poor urban planning is creating unprecedented challenges, among which shrinkage of water bodies and its quality is the major issue. Since, the process of development is unstoppable and irreversible; the focus on the rehabilitating measures complimentary with development cycle and making it more sustaining is required. Moreover, with the climate change and its impact is becoming visible in our daily life. Water is one of important and basic resource, which due to its widespread use and application, needs to be managed and conserved for supporting lifestyle in the changing environment. The change in natural ways of hydrological cycle is causing is adding a new vulnerability to natural disasters. In any case of disaster like earthquake, flood, etc. water is the basic need that has to be supplied. Specifically in earthquake scenario, due to loss of infrastructures for the water collection, treatment, conveyance and storage, water becomes the prime resource. Many studies have been made to simulate the scenario and to suggest water management measures. Very few have made attempt to quantify the sociological damages and its associated economic cost due to earthquake.



One way of managing and harvesting the water is groundwater. However, the techniques of or the management plan has not been strongly footed on the technical and scientific investigations, database and policy unlike prevalent practices of implementing plans for the records sake.

## **Presentation abstract 2: Groundwater recharge and steps towards sustainable management**

*Sweachha Rajbhandari*  
*SmartPaani/ One Planet Solutions*

In the context of Kathmandu Valley accommodating growing needs of urbanization and changing living standards and lifestyles of the people, the increasing number of large scale housing complexes and apartments coming up within the valley has increased water demand in the valley. The increased population and modernization need lots of water for their survival and to fulfill



their daily domestic needs. At present situation the municipal water supply system can't supply sufficient amount of water and the supply system is concentrated in the city core area so people in the valley have only the viable option of ground water extraction. Thus, the exploitation of the local Ground Water is increasing and will be increasing with the unplanned urbanization in the valley. Taking consideration into the present water scarcity scenario of Kathmandu Valley, groundwater recharge is the important step in the groundwater management.

One Planet Solution Pvt. Ltd. is a company formed by experienced technicians, researchers, and businessman in September 2011 to provide eco-friendly and economical solutions to water, energy, and waste issues in Nepal. One Planet solution has been trying to put its step in water conservation and management. The effort are being flourished in water management through rainwater harvesting, ground water recharge, treatment of waste water (both black and grey) and drinking water filtration system. We have contributed to a quite large no of installations of rain water harvesting, biosand filtration unit along with recharge activities in household, school, industrial, hotels and institutions. The company has completed over 250 installations and has together recharged about 500,000 Kilo Liters of rainwater impacting more than 1500 plus student life and many others. Our contribution to groundwater recharge is also to bring awareness among people to know the importance of recharging. We have conducted presentation in schools, commercial entities and more to allow them to know what the loss in letting the water is go through the drain and what is the benefit in allowing it to go back to the ground.

### **Presentation abstract 3: Shallow aquifer characteristics and geological setting of southern part of Kathmandu Valley**

A. Khanal<sup>1, \*)</sup>, S.D. Shrestha<sup>2)</sup> and T. Nakamura<sup>3)</sup>

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<sup>2)</sup> Central Department of Geology, Tribhuvan University, Kirtipur, Kathmandu, Nepal

<sup>3)</sup> ICRE, University of Yamanashi, Japan

Being capital city of the country, the groundwater sources and its dynamics within the regional geology of the Kathmandu Valley has always been a topic of great interest for the researchers. It is necessary to understand the water quality scenario and recharge dynamics of groundwater sources for future management of water resources in the valley. Shallow well has been the major drinking water source for the valley since centuries. Existing shallow and deep well were selected from the southern part of



Kathmandu Valley for the sampling and some samples were taken from spring and river also for the comparative analysis. Existing geological maps and lithologs were studied thoroughly for the surface and subsurface geological analysis of the area. Ion- chromatography was performed to quantify the water quality condition. Stable water isotope analysis was performed to understand the recharge dynamics of the area.

Geologically the area is composed of heterogeneous lithological composition ranging from semi-consolidated sandy clayey silt to sub-round to rounded silty sandy gravel at southern end and majority of grey to dark, silty clay and clayey silt at central part. Calcium Bicarbonate Type and Sodium Bicarbonate Type aquifer was identified in the area. Dynamic recharge system was identified at the core city area while outskirts contain local recharge system. Wide range of <sup>16</sup>O and <sup>2</sup>H (D) value suggests numerous type of recharge condition available in the area which needs vigorous sampling density for better demarcation.

## **Open discussion**

Mr. Saroj Yakami (MetaMeta) raised his concern to Ms. Sweachha Rajbhandari that how the activities of SmartPaani could help in the sustainable groundwater management of the Kathmandu Valley. Also, he asked her whether the recharge was normal or pressurized. Ms. Rajbhandari replied that recharge in valley is normal recharge and due to urbanization each year around 48 billion liters of rainfall prevent from recharging. Furthermore, she added that for sustainable groundwater management, SmartPaani has initiated some rainwater harvesting experiments around Kathmandu valley which found out that rainwater harvesting and recharging it to subsurface is one of the low cost efficiency and environment friendly method. For more details, she requested to contact respective office. Mr. Yuwa R. Guragain inquired Ms. Sweachha Rajbhandari that what was the process to make sure that the recharge capacity is everywhere. She told detail study and analysis will be carried out for this.

Mr. Yuwa R. Guragain was interested to know the source of recharge of the southern part shallow aquifer in the Kathmandu Valley as shown from the isotope analysis result. In response to this, presenter Mr. Anoj Khanal replied that the result showed that Patan area is being recharged from the high elevation hill precipitation which lies in the southern part of the valley.

Mr. Prajwal Shrestha, one of the presenter suggested Mr. Khanal to carry out well layout mapping to identify declining trend of traditional stone spout.

### TECHNICAL SESSION III

Chair: Dr. Dhundi Raj Pathak

Rapporteurs: Sarita Shrestha and Sabina Adhikari

#### **Presentation abstract 1: Hydrogeological characteristics of shallow groundwater system of Patan area, Lalitpur Sub metropolis, Nepal**

Yuwa Raj Guragain<sup>1\*</sup> and Jaya Kumar Gurung<sup>2)</sup>

<sup>1</sup> College of Applied Sciences-Nepal (\* Email: yuwarajworld@gmail.com)

<sup>2</sup> Nepal Development Research Institute

Continuous decrease in water table in shallow groundwater sources of Patan has been characterized by decrease in discharges and drying up of perennial stone spouts and shallow dug wells. Adequate hydrogeological understanding of the shallow water system is therefore a requisite for the adoption of appropriate shallow water augmentation technologies and curbs water scarcity. In this study an attempt has been done to understand the general hydrogeological features of shallow groundwater system especially shallow ground lithology, shallow groundwater flow, shallow water recharge and discharge zones and shallow water chemistry. Borehole logs were obtained from auger hole method; central tendency, dispersion and correlation statistics were used for shallow water table response over precipitation and ArcGIS was used to map flow direction and delineate recharge and discharge zones. Similarly, SOPs were followed to analyze water quality from shallow groundwater sources. The study found that shallow ground lithology of Patan varies from place to place with non-uniformly distributed strata of gravel, sand, silt and clay. Shallow groundwater flow direction was from southern Patan towards northern/northeast Patan with east-west and west-east distortions in eastern and western regions respectively. Shallow groundwater was flowing in peak saturated conditions and groundwater pools were observed during peak dry season. Overall, high elevated terrains were observed as recharge areas and low elevated terrains as possible discharge areas for shallow groundwater of Patan. Apart from the local geochemical effect, organic pollution, preferably of faecal origin, was found as major problem in shallow groundwater sources of Patan.



**Presentation abstract 2: Formation of Bis Hazari Tal, a wetland in Chitwan District, Central Nepal**

*Kabita Karki*  
*Department of Mines and Geology*

It had been said that Bis Hazari and associated Tal were extended after the construction of Khageri canal. The proposed study was expected to provide clues on the hydrogeological relationship of wetland with the canal. Geophysical studies, auguring and questionnaires survey were the primary whereas map review and well logs from different organization were the secondary data collection methods applied. ERT profiles were carried out to understand the link between the lake and canal. The questionnaires survey and map study had indicated the formation of lake after the construction of Khageri Canal. Before the construction of canal there was a non-perennial stream instead of lake. The lake had formed precisely in that location simply by damming its own channel. The source of the water is the annual precipitation. The geophysical studies and the auguring indicate very low or the negligible amount of seepage from lake to canal. The silty or clayey sand at the side and floor of the channel had support to retain the water in the lake.



**Presentation abstract 3: Hydrogeological mapping for determining the impact of deep boring to the springs in Godawari area, Lalitpur District, Central Nepal**

*Sabindra Bahadur Shrestha  
Three D. Consultant Pvt. Ltd.*

The people of Thaiba-Harisiddhi are said to be facing severe water scarcity problem in their daily life. To solve the problem, they had drilled a borehole in Thaiba near the two reservoirs of 300m<sup>3</sup>. But, the borehole failed due to presence of continuous black clay up to 135 m depth. So, the people of Thaiba- Harisiddhi area were compelled to drill a borehole in Godawari V.D.C. near the spring from where they are getting present supply of drinking water. They had drilled a borehole near the spring upto 40m depth. But, due to opposition from the local people and offices in Godawari area, the drilling was stopped. They were concerned with the impact of deep boring in nearby springs which feeds their present water supply system. After some discussion, the local authority of Godawari area came to a conclusion that the ongoing drilling can proceed if and only if there is no adverse effect on the discharge of nearby springs.



#### **Presentation abstract 4: Subsurface geology and aquifer system in western parts of the Chitwan Dun Valley**

*S. Bhandari <sup>1)</sup>, K. Karki <sup>1)</sup>, and S.D. Shrestha <sup>2)</sup>*

<sup>1)</sup>*Department of Mines and Geology, Nepal*

<sup>2)</sup>*Central Department of Geology, Tribhuvan University, Kirtipur, Kathmandu, Nepal*

The hydrogeological study of western part of the Chitwan Dun Valley was carried out to know about the subsurface geology and aquifer system in the study area. The study area covers 274.48 km<sup>2</sup> area and the population is 1,15,739. Drainage pattern parallel to the main river course of the Narayani River is present in the area. The study area consists of alluvial deposits of the Narayani and the Rapti River of Pleistocene to recent age. Litho logically whole the study area consists of sand, gravels and boulders while clay layers were encountered only at Sukranagar and Jagatpur area. Aquifers in the study area are unconfined, semi confined to confined types. In north-east and west part of the area including Shivanagar, Gunjanagar, Sharadanagar, Dibyanagar and Meghauri, shallow aquifers present are unconfined to semi confined type. At southern part, mainly at Sukranagar and Jagatpur, both shallow and deep aquifers are confined type. They are recharged primarily through precipitation.



## **Open discussion**

Mr. Ram Bahadur Ghimire (WaterAid Nepal) questioned Mr. Yuwa Raj Guragain if he had any relevant data for different shallow water levels during different time phase. Mr. Guragain responded that Urban Environment Management Society (UEMS) carried out research on measuring water levels for 15 days in 150 wells. And he collected data from UEMS for 50 wells which had more relevant data.

In addition, Ms. Sarita Shrestha (CREEW) also inquired him regarding the possible reasons of seasonal changes in the water quality of Patan area such as: water was acidic during pre-monsoon whereas, the concentrations of nitrate and ammonia were higher in monsoon season. Mr. Guragain replied that the shallow groundwater was compared using chemical parameters. The black soil is in the organic form. And water became acidic during pre-monsoon due to carbon acidification. It also had higher nitrate level because of its interaction with nitrate sources; agriculture and fecal sources. But, the main source of nitrate in shallow groundwater of Patan areas was fecal source rather than other sources, which had also been proved by a Japanese researcher.

Mr. Ram Bahadur Ghimire (WaterAid Nepal) raised his query to Ms. Kabita Karki if she had any water variation data after the formation of Bis Hazari Tal. Ms. Karki replied that the water table had decreased and the time difference showed that water discharge had decreased. Similarly, Mr. Saroj Yakami (MetaMeta) also inquired Ms. Karki regarding the benefits of Bis Hazari Tal. She replied that the formation of Bis Hazari means an addition to wetland areas and buffer zone of Chitwan National Park. This has fostered tourism around the area. Furthermore, she added that it has enhanced the beauty of the area and increased the total number of bird's species. According to her, this Tal had also brought difference in the ecosystem. Another question was raised by Ms. Sweachha Rajbhandari, if she were able to study the bio-diversity of the Bis Hazari Tal area and if she has any plan of studying on it in nearby future. Ms. Kabita Karki replied that, she didn't focus on bio-diversity and she has no plans to research on it in the future.

## **CLOSING SESSION**

Dr. Rabin Malla, Executive Director, CREEW, closed the session by thanking all the participants, presenters and promising to meet next year with the issues of water resources in Nepal.

## ANNEX I: PROGRAM SCHEDULE

Date: 19 March 2015

Venue: Begnas Hall, Radisson Hotel, Lazimpat, Kathmandu

Registration: 8:40 am - 9:00 am



### Program Schedule

MC: Ms. Echhya Bajimaya

OPENING SESSION		
9:00-9:05	Welcome address	Dr. Suman K. Shakya, Executive Director, Environment and Public Health Organization (ENPHO)
9:05-9:30	Keynote presentation	<b>“Regulating Common Pool Groundwater Resource under Fugitive Water Law: A Paradox”</b> . Dr. Dibya Ratna Kansakar, Team Leader, Water Resources Project Preparation Facility, MOI/DOI/DWIDP/ADB
9:30-9:40	Remarks by Guest	Mr. Jagat Prasad Joshi, Executive Director, Groundwater Resource Development Board (GWRDB)
9:40-9:45	Remarks by NNWW 2015 Secretary	Mr. Sudarshan Rajbhandari, Vice President, The Small Earth Nepal (SEN)
9:45-9:50	Remarks by Chief Guest	Mr. Arjun Kumar Karki, Secretary, Ministry of Urban Development, Government of Nepal
9:50-10:00	Vote of thanks	Dr. Rabin Malla, Executive Director, Center of Research for Environment Energy and Water (CREW)
10:00-10:05	Closing remarks by the Chairperson	Mr. Gajendra Kumar Thakur, Secretary, Water and Energy Commission Secretariat (WECS), Government of Nepal

### Group Photo Session and Tea Break (10:05-10:15)

### Photo Exhibition by WaterAid Nepal (10:15-10:40)

TECHNICAL SESSION I		
Chair: Dr. Khadananda Dulal, Hillside College (HC), PU Rapporteurs: Sarad Pathak and Buddha Bajracharya		
10:40-10:55	Search for groundwater potential areas in and nearby the Kathmandu Valley	Mr. Naba Raj Shrestha, Three D Consultants Pvt. Ltd.
10:55-11:10	Shallow aquifer mapping of Kathmandu Valley	Mr. Krishna Prasad Upadhyaya, Groundwater Resources Development Board (GWRDB)
11:10-11:25	Spring study and climate change of Tanahun District	Dr. Binod Shakya, Rural Water Supply and Sanitation Project in Western Nepal (RWSSP-WN II)

11:25-11:40	Groundwater resources assessment and estimation of future demand for irrigation in three districts of Nepal	Dr. Romulus O.Okwany, IWMI
11:40-11:55	<b>Questions and discussion</b>	
<b>Lunch Break (11:55-12:15)</b>		
<b>TECHNICAL SESSION II</b>		
Chair: Prof. Ishwor Man Amatya, Institute of Engineering (IOE), TU Rapporteurs: Meera Prajapati and Bal B. Thakurathi		
12:15-12:30	Groundwater a vital water source for emergency and disaster scenario	Mr. Prajwal Shrestha, Environment and Public Health Organization (ENPHO)
12:30-12:45	Groundwater recharge and steps towards sustainable management	Er. Sweachha Rajbhandari SmartPaani / One Planet Solution (P). Ltd.
12:45-13:00	Shallow aquifer characteristics and geological setting of southern part of Kathmandu Valley	Mr. Anoj Khanal, Central Dept. of Geology, TU
13:00-13:15	<b>Questions and discussion</b>	
<b>Tea Break (13:15-13:25)</b>		
<b>TECHNICAL SESSION III</b>		
Chair: Dr. Dhundi Raj Pathak, Engineering Study & Research Center Rapporteurs: Sarita Shrestha and Niranjana Bista		
13:25-13:40	Hydrogeological characteristics of shallow groundwater system of Patan area, Lalitpur submetropolis, Nepal	Mr. Yuwa Raj Guragain, College of Applied Sciences-Nepal
13:40-13:55	Formation of Bis Hazari Tal, a wetland in Chitwan District, Central Nepal	Ms. Kabita Karki, Department of Mines and Geology
13:55-14:10	Hydrogeological mapping for determining the impact of deep boring to the springs in Godawari area, Lalitpur District, Central Nepal	Mr. Sabindra Bahadur Shrestha, Three D Consultants Pvt. Ltd.
14:10-14:25	Subsurface geology and aquifer system in Western parts of the Chitwan Dun Valley	Ms. Sushmita Bhandari, Department of Mines and Geology
14:25-14:40	<b>Questions and discussion</b>	
<b>CLOSING SESSION</b>		
14:40-15:00	Session close with remarks	Dr. Rabin Malla, Executive Director, (CREW)

## ANNEX II: LIST OF PARTICIPANTS

S.N.	NAME	ORGANIZATION
<b>Government organizations</b>		
1.	Arjun Kumar Karki	Ministry of Urban Development
2.	Gajendra Kumar Thakur	Water and Energy Commission Secretariat (WECS)
3.	Jagat Prasad Joshi	Groundwater Resource Development Board (GWRDB)
4.	Dr. Dibya Ratna Kansakar	Jalsrot Vikas Sanstha (JVS)
5.	Upendra Sthapit	GWRDB
6.	Krishna P. Upadhya	GWRDB
7.	Bal B. Thakurathi	KVWSMB
8.	Anju Subedi	KVWSMB
9.	Srijana Khadka	KVWSMB
10.	Sangita Acharya	KVWSMB
11.	Sushmita Bhandari	DMG
12.	Kabita Karki	DMG
13.	Jeebachh Mandal	WECS
14.	Krishna Rana	SEIU
15.	Dr. Dhundi R. Pathak	SWMTSC
<b>Academic/ Research Institutions</b>		
16.	Pratistha Pyakurel	COES
17.	Pramod Shrestha	IOE, Pulchowk Campus
18.	Yuwa Raj Guragain	College of Applied Sciences
19.	Ishwor Man Amatya	IOE
20.	Prabha Karmacharya	IOE
21.	Nimesh Shrestha	Thames International College
22.	Dr. K.N. Dulal	Hill Side College
23.	Anoj Khanal	CDG, TU
<b>UN Agencies and International Organizations</b>		
24.	Ram Bahadur Ghimire	WaterAid Nepal
25.	Upama Adhikari	WaterAid Nepal
26.	Sheema Sunuwar	WaterAid Nepal
27.	Dr. Romulus O.Okwany	IWMI
28.	Dr. Ram C. Bastakoti	IWMI
29.	Marielouise Ryan	Fullbright
<b>NGOs and Others</b>		
30.	Dr. Rabin Malla	CREEW
31.	Sarita Shrestha	CREEW
32.	Meera Prajapati	CREEW
33.	Shanta Sedhain	CREEW
34.	Sarad Pathak	CREEW
35.	Upendra Jung Shahi	CREEW
36.	Nihit Bhattarai	CREEW

*Proceedings of the 6<sup>th</sup> National Symposium on Challenges and Opportunities for Sustainable Management of Groundwater Resources of Nepal, 19 March 2015, Kathmandu*

37.	Shraddha Gurung	CREEW
38.	Suyasha Regmi	CREEW
39.	Dr. Suman K. Shakya	ENPHO
40.	Prajwal Shrestha	ENPHO
41.	Padmaja Shrestha	ENPHO
42.	Buddha Bajracharya	ENPHO
43.	Pragyan Bhatttari	ENPHO
44.	Sudarshan Rajbhandari	SEN
45.	Dilli Bhattarai	SEN
46.	Sabina Adhikari	SEN
47.	Er. Sweachha Rajbhandari	One Planet Solution
48.	Naba Raj Shrestha	Three D. Consultants Pvt. Ltd.
49.	Sabindra B. Shrestha	Three D. Consultants Pvt. Ltd.
50.	Saroj Yakami	MetaMeta
51.	Resham Phuldel	RWSSP-WN
52.	Pallavi Pandey	SEN
53.	Echhya Bajimaya	ENPHO
54.	Rohit Prasad.Gautam	NISSAKU
55.	Guheswari Tuladhar	UEMS
56.	Sudan Shrestha	Moments Frame Them
57.	Sudarshan Rajbhandari	SEN
58.	Dr.Binod Shakya	RWSSP
59.	Veeneta Singha	Sharing 4 Good
60.	Janak Tiwari	JVE Nepal
61.	Rabin Raclal	Reporter

### **ANNEX III: COMMITTEES OF THE SYMPOSIUM**

#### **Technical Committee**

Prof. Narendra Man Shakya (IOE, TU), Assoc. Prof. Dr. Sangam Shrestha (AIT), Assoc. Prof. Dr. Suresh Das Shrestha (TU), Dr. Suman K. Shakya (ENPHO), Dr. Vishnu Prasad Pandey (AITM), Prof. Futaba Kazama (ICRE-UY), Assoc. Prof. Nishida Kei (ICRE-UY)

#### **Organizing Committee**

Dr. Rabin Malla (CREEW), Sarita Shrestha (CREEW), Bal Bahadur Thakurathi (KVWSMB), Sudarshan Rajbhandari (SEN), Niranjan Bista (SEN), Dr. Suman K. Shakya (ENPHO), Buddha Bajracharya (ENPHO), Upendra Sthapit (GWRDB)



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