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Flood Water Management (FWM) for the Prosperity of Nepal

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ABSTRACT

Nepal is a water stressed country with stress of over availability of water in the monsoon and its scarcity in the rest of the year however, the overabundance of water in the monsoon can be converted into valuable asset with meaningful value addition. The value addition discussed hereunder is flood water management (FWM) by creating reservoirs of water for regulating the flow to supply it as per the demand as an invaluable resource that can provide Nepal benefits in terms of billions of USD annually.

The total annual benefit to Nepal from flood water management is estimated as sum total of all the benefits that amount to about 17 BiUSD. This amounts to about 41 percent of the total GDP and 69 percent of the GDP of 2016/17, the base year for economic calculations. The prosperity to Nepal due to flood water management can be judged on the basis of per capita income of Nepal, which will reach close to 1400 USD per person.

Key words: Flood water management, Regulated water, Sapta Koshi, Sapta Gandaki, River flow

INTRODUCTION

Nepal, situated at the lap of the Great Himalaya, is a highly water stressed country: water stressed by the floods in the monsoon and drought during the rest of the year (Pokharel, 2018) Pokharel G. S., Nepal-Bharat Relations, Economic Development and Cooperation, Neeti Anusandhan Pratishthan Nepal, NeNAP, 2018. Out of the 225 BCM of water that flows from Nepal to India annually on an average (Sharma, 1983) Sharma C. K, Water and Energy Resources of the Himalayan Block, 1983 , over 180 BCM flows in the monsoon creating havoc in all the physiographic regions of Nepal continuing the curse into India with increased or multiplied pace. Peak instantaneous floods in the main as well as in the tributary rivers take account for all possible eventualities causing widespread disasters with loss of lives and loss of enormous amount of property annually. The cumulative curse of the monsoon floods generally increases in the direction of the river flow.

In the lean season, the water is mostly limited to main rivers like Sapta Kosi, Sapta Gandaki, Karnali, Mahakali, the second category rivers and their main tributaries. Most of the 6000 rivers and rivulets including most of the water springs that feed the rivers remain dry in the lean season (Gyawali, 2003).

As a result, most of the hill residents face water shortage: one has to carry water from as far as 2 to 3 hours of walking distance from the house and many hill hamlets have been reported to be migrating due to acute water shortage (Kantipur Daily, 2019c, 2019b, 2019a). In Terai, the ground water table is moving low (Kantipur Daily) Kantipur Daily, 05052019d, Muhanai Sukayera CrusherSat Saya Pariwar ka Dharama Pani aauna Xodyo, Ramesh Kumar Paudel, Chitwan and low despite the fact that a good amount of recharge is taking place and that a meager amount is used for any economic activities within Nepal (Acciavatti, 2015)**.** The Ganges Water Crisis, published in the opinion page of the New York Times, June 17, 2015. In western Nepal, tube wells for household water use are constructed from the bottom of dug wells due to acute decline in ground water table.

On the basis of table 1 and the fact that most of the river flow is rain fed and that most of the precipitation occurs in the monsoon, the Table 2 showing the disparity of river flow in various season is prepared.

It is evident for table 2 that the ratio of maximum to minimum flow in the first order rivers varies between 53 and 93 but the same for second order rivers of Nepal varies between 281 and 652. This means that the water stress along the second order rivers both due to floods and drought is much more than the first order rivers. It is more disastrous for the third order rivers, which remain dry most of the time with floods in the monsoon only.

It clearly shows the need for flood water management in Nepal for minimizing the risk from floods at the same time for maximizing the availability of regulated water in the lean season to fight the drought. The volume of flood water that can be subjected to such management for all of Nepal is calculated to be more than 180 BCM, which is more than four times the total flow for all of the lean season. Out of this total, about 32 BCM precipitates in the Terai and hence is available for short term management only. The remaining quantity of 148 BCM can be collected in the monsoon for its regulated consumption based on demand including the lean season. This figure shows a great potential for flood water management in Nepal.

Table 1: River flow characteristics of some main rivers of Nepal

Name of River Basin	Basin Area, sq. km	Annual average discharge, cumecs	Total Annual Discharge, BCM	Minimum Lean season Flow, cumecs
Sapta Kosi at Chatara	60,400	1638	51.655	280
Sapta Gandaki at Naranghat	34,960	1568	44.449	190
Karnali at Chisapani	43,679	1337	42.164	214
Mahakali at Pancheshwar	15,260	600	20.151	
Kankai at Mainachuli	1148	60	1.89	9.0
Kamala River	1450	45	1.42	3.0
Bagmati at Karmaiya	2700	137	4.32	23.0
West Rapti at Jalkundi	5150	123	3.88	15.0
Babai at Bargad	3000	87	2.74	11.0

Table 2: Disparity of River Flow

Name of River Basin	Basin Area, sq. km	Total Annual Discharge, BCM	Annual Average Discharge, cumecs	Peak Instantaneous Discharge, cumecs	Minimum Lean Season Flow, cumecs	Ratio of PID to LSF
Sapta Kosi at Chatara	60,400	51.655	1638	25,853	280	92.33
Sapta Gandaki at Naranghat	34,960	44.449	1568	10,160	190	53.47
Karnali at Chisapani	43,679	42.164	1337	19,890	214	92.94
Mahakali at Pancheshwar	15,260	20.151	600	16,651		
Kankai at Mainachuli	1148	1.89	60		9.0	
Kamala River	1450	1.42	45		3.0	
Bagmati at Karmaiya	2700	4.32	137	15,000	23.0	652.17
West Rapti at JalKundi	5150	3.88	123	4,228	15.0	281.87
Babai at Bargad	3000	2.74	87	3,875	11.0	352.27

DEMAND FOR REGULATED WATER

The demand for such regulated water is very high in the north Ganga basin, which is home to almost 500 million people living in an area of over 200,000 square kilometers. Moreover, the demand for such flood water management is unquestionable for saving the lives of the people and the loss of property due to floods; not to mention the cost of fear and inconvenience of living together with snakes on the same tree and the inconvenience of women-folks not being able to use toilet for days together due to lack of privacy during the floods. This situation is generally ignored by the bureaucrats and politicians in power as these areas are often under poverty and therefore voiceless.

In Nepal, the situation is better but not satisfactory. The area that can be brought under flood water management in Nepal Terai is estimated at 11,000 square kilometers (SINA, 2016) Statistical Information on Nepalese Agriculture 2073/74 (2016/17), Government of Nepal. Other areas that can be feasibly included in the above maybe considered as additional 500 square kilometers. Therefore, the area that can be subjected to flood water management and agro revolution in Nepal has been considered as 11,500 sq. km.

Water requirement for all season irrigation for 11,500 square kilometers mostly in Terai

It is estimated on the basis of water requirement (delta) for all 4 crops in a year (Garg, 1976). Irrigation Engineering and Hydraulic Structures, pp. 22-57, calculated as 200cm in which the delta for rice is taken as half of the prescribed value as the other half is considered to be supplied directly through the rain in monsoon.

Total volume of stored and regulated water required in BCM is 11500 sq.km x 1000000 x 200 cm/100/1000000000 = 23 BCM in 365 days excluding the volume of unregulated rain water that can be used for irrigation and ground water recharge during the monsoon. The total volume of rain water that will be available for irrigation for paddy cultivation is calculated as fifty percent of the total monsoon rainfall in the Terai region calculated as 16 BCM.

Therefore, the total volume of water used for irrigation in Nepal will be 39 BCM.

Water requirement for household and industrial water supply is estimated as under:

a. Household water supply

The first step is the water requirement for the total present population calculated as 100 liter of water per capita per day, which amounts to 15000000 ppl x 100/1000 cum of water x 365 days = 0.55 BCM, which can be made available from the ground water extraction as well. Considering the population rise by a factor of 3 and efficiency of water supply as 0.75, the total estimated water requirement is 2.2 BCM per year.

b. Industrial water requirement

As Nepal has not yet started any meaningful industrialisation, it is hard to estimate any value at the moment. However, a value equal to fifty percent of the household water supply amounting to 1.1 BCM has been taken.

c. Other requirement is neglected in the calculation as a large portion of the estimated quantity presented herein above can be fulfilled from the ground water.

d. Therefore, the total estimate of water requirement for household and industrial use is calculated as 3.3 BCM.

e. The amount of water that is required for navigation is estimated at 300 cumecs amounting to 6.9 BCM

Therefore, the total water requirement for Nepal Terai and the vicinity from the storages created for flood water management including water requirement for navigation, which is sellable after either Kursela or Farakka (in case of export to Bangladesh) is estimated at 33.2 BCM.

ESTIMATE FOR MANAGEABLE FLOOD WATER

The estimate for the flood water that can be feasibly subjected to flood water management in Nepal is made as under:

a. Total amount of flood water available for FWM

It is calculated as about 148 BCM plus total flow of the lean season calculated at about 41 BCM. Therefore, the total volume of FWM can be as high as 189 BCM.

b. Total amount of flood water that can be subjected to FWM in the Koshi Basin is estimated at about 48BCM. Similarly, the volume of water that can be subjected to FWM in other basins of Nepal may amount to a figure much higher than the same for the Kosi basin. Therefore, the volume of water that can be subjected to FWM in Nepal is estimated for this study at about three times the same for the Kosi river equaling to 144 BCM.

c. The total quantity of water required for Nepal as estimated above is 33.2 CM.

d. Hence, the total volume of water that can be subjected to FWM for potential export to India and Bangladesh is 110.8 BCM plus 6.9 BCM used for navigation, say 117 BCM.

BENEFITS FROM THE SCHEME

This volume of regulated water can irrigate about 60,000 sq.km. of land with 4 crops annually producing additional 64 million tons of processed rice costing about 23 billion USD at NPR 40/kg.

Similarly, Nepal Terai can have an additional agricultural production of 23/117 x 38 =7.42 BiUSD. Other non-consumptive benefits of regulated water for Nepal can be as follows:

a. Electricity generation of 100,000 GWh based on 40,000 Gwh from Kosi only at 5.5US cent/KWh =5.5 BiUSD/year

b. Fishery production of 20 lakh tons amounting to about 1.0 BiUSD excluding he cost of production

c. Navigation, tourism and hospitality management will be very feasible economically

d. Water supply to places like Dharan and many cities in India will have an enormous socio-economic advantage. Similarly, ground water recharge due to infiltration of water from all the water bodies created for FWM will make the scheme highly beneficial for both Nepal and India with more benefits for India than for Nepal.

e. Large elongated reservoirs created as a result of FWM will help promote inland navigation that on the one side help earn over a billion USD annually and help save cost of expensive road construction and their maintenance that can amount to more than the benefits from inland navigation.

Hence, the total benefit to Nepal from flood water management is estimated as sum total of all the numbers mentioned hereinabove is calculated at about 17 BiUSD. This amounts to about 41 percent of the total GDP and 69 percent of the GDP of 2016/17, the base year for economic calculations. The prosperity to Nepal due to flood water management can be judged on the basis of per capita income of Nepal, which will reach close to 1400 USD per person.

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