INTERBASIN WATER TRANSFER AND CHANGES IN RURAL WATER MANAGEMENT INSTITUTIONS: A CASE STUDY FROM THE MELAMCHI RIVER BASIN IN NEPAL

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ABSTRACT

Recently, the Nepal Government has launched a mega scale interbasin and intersectoral water transfer scheme to divert Melamchi river water through a 26.5 Km long tunnel to meet the growing water needs of its capital, the Kathmandu City. This case study focuses on local water institutional issues involved in the mega scale interbasin and intersectoral water transfer project, often key to the success of projects in developing countries. In particular, this paper describes the evolution of water management institutions in the face of growing water demands in the remote mountain areas of Nepal. Rural water users have developed over centuries time tested water allocation mechanisms to meet the local needs. These institutions may provide a means to buffer the increasing stress brought about by the diversion of water out of the Melamchi, but they are at present insufficient to deal with issues of formal water rights, river water allocation, and negotiation with Kathmandu city agencies. The present institutions however could provide the building blocks to carry out these functions. The Melamchi Water Supply Project represents a situation that is common worldwide. Increasing demands from cities will pull water from rural water users. These users often will not have the institutional arrangements during the water transfer process to negotiate and manage water adequately after the water transfer has taken place. Adequate and reliable data may not be available to know the extent to which changes will affect local users. The Melamchi Project has correctly paid a lot of attention to the affected area in the donor basin. This interbasin diversion may be an excellent opportunity to catalyze institutional development for managing water resources in the donor basin where competition will increase.

INTRODUCTION

The Melamchi Water Supply Project is the first of such mega scale intersectoral and interbasin water diversion project being implemented in this Himalayan

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kingdom. The project costs are estimated to be US $464 million, spread over six years, almost half of the annual budget (GDP) of the Himalayan kingdom. A successful project will surely benefit Kathmandu, but is likely to stress water management arrangements along the Melamchi. A major question is whether present rural institutions in Nepal can cope with such a change, and how institutions might evolve to better manage cross-sectoral, cross-basin water resources. The major objective of this paper is to analyze the institutional changes and evolution of new institutions during the initiation of the Interbasin Water Transfer (IWT) project in Nepal to meet the growing urban water demand of Kathmandu valley.

Urban water demand is escalating everywhere in the developing countries, particularly more in South Asia due to extensive urbanization in the recent past. Only about 85% of the urban population and 76% of the total population in South Asia has access to improved water sources (World Bank, 2001). Moreover, a smaller percentage of the population has access to piped supply drinking water in the region. The safe drinking water supply situation in Nepal is precarious as only 44% of total population has access to improved water sources (World Bank, 2001). The dry season piped water supply in Kathmandu City is sufficient to meet the basic water requirement (demand) for only half of the city population. Therefore, the interbasin water transfer (IWT) for Kathmandu may be the only feasible option for supplying enough water, given the rising population, and already an acute water shortage situation.

This paper focuses on the evolution of water management institutions in the rural donor basin, the Melamchi. The major question is whether present institutional arrangements in the Melamchi, are sufficient to deal with the stress brought about by the interbasin transfer. The objectives of the paper are to provide a case study on institutions to understand how institutions evolve, and to give an indication of what types of institution building can help to cope with changes. The paper first explores the present institutional arrangements within the Melamchi Basin. Next, a brief description of the project is given with an indication of the magnitude of the change that will take place in the donor basin. A description of the process of negotiation and institution building is given to show how the problem is being coped with. Finally, some general conclusions are drawn.

WATER MANAGEMENT – THE PRESENT STATUS

The *Melamchi* River basin, a sub-basin within the larger *Indrawati* River basin **(Figure 1)** has a long history of complex water use practices.

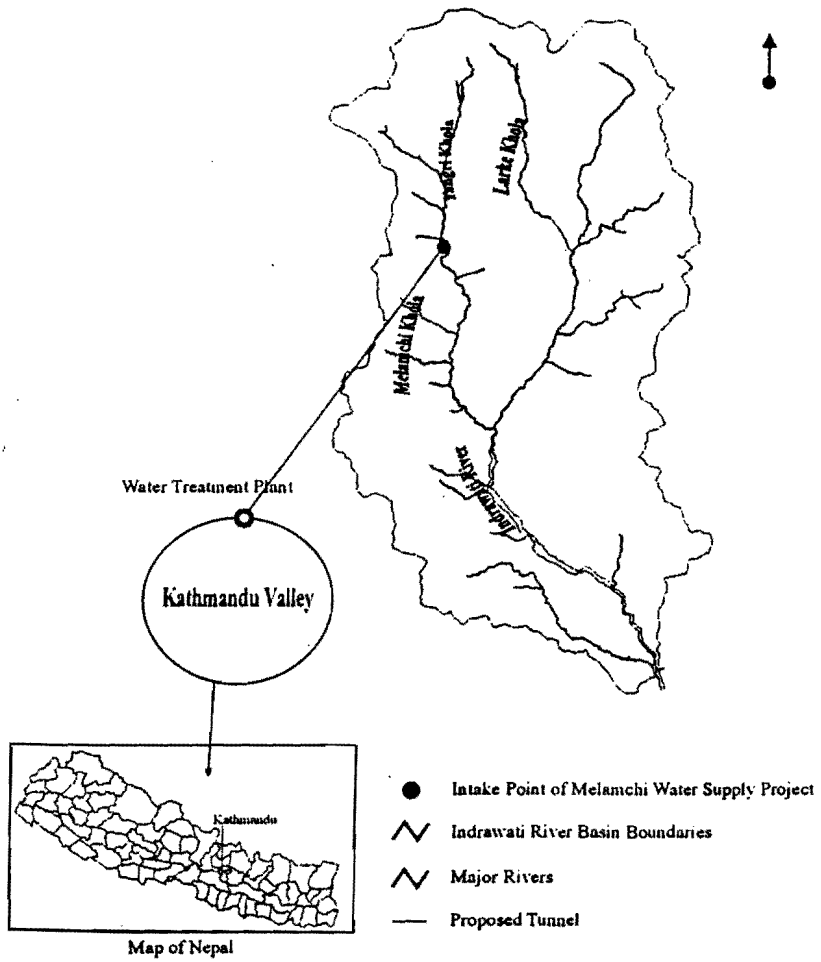

Fig. 1. Map Showing the Melamchi River Basin watershade, Nepal

The local communities have developed several formal and informal water sharing arrangements and water suited to local conditions. (Also described in Pradhan, 1989; Yoder, 1994, and Pradhan, 1990). Removing a large volume of water is likely to change the hydrologic characteristics, and create more stress on institutional mechanisms for allocation and conflict resolution. The question is whether these existing community level institutional arrangements can cope with

the institutional crises brought by this level of external shock. It is believed that these century-old community developed and practiced innovative water use institutions could somewhat buffer the extent of shock, and also could provide a sound basis for developing Integrated Water Resource Management (IWRM) at the basin level. The concept of building on existing institutions deserves merit and further exploration.

Local water users have been diverting water from the Melamchi River and its tributaries by constructing temporary intake at different places for various water use activities, like irrigation, grain milling[3], and micro-hydro power and for drinking water. The installation of micro-hydro is a recent development in the area, only since 1999. As a perennial river basin, these water use systems are operated throughout the year. The present water allocation in the Melamchi river basin is mainly within canals that serve both irrigators and water mills. According to the customary practices followed in the area, drinking water gets first priority over all other water uses, followed by irrigation systems, and then water mills. Most of the present drinking water needs of the donor community (Melamchi project site area) is being fulfilled from the perennial streams and waterfalls tributary to the Melamchi surrounding the community. Hence, the local community is not directly dependent on Melamchi river flow for drinking water needs.

There are 22 water mills and 18 locally community managed irrigation systems operating in the Melamchi River basin as shown in the diagram of Figure 2. The irrigation systems range from as small as 2.5 ha to larger of 150 ha irrigation scheme, providing year round irrigation access to about 500 ha of land. Two micro-hydro power turbines (with water mills) are also operating in the river basin to provide electricity to the local communities. In addition, there is a plan to rehabilitate an irrigation system and to provide irrigation to an additional 210 ha of lands. Government (DOI) as well as some INGOs and NGOs are providing support for maintenance and performance improvement of these communities managed irrigation systems. The water mills are mostly privately owned, whereas the irrigation systems are community managed and owned by the local community stakeholders (FMIS), as common property resources.

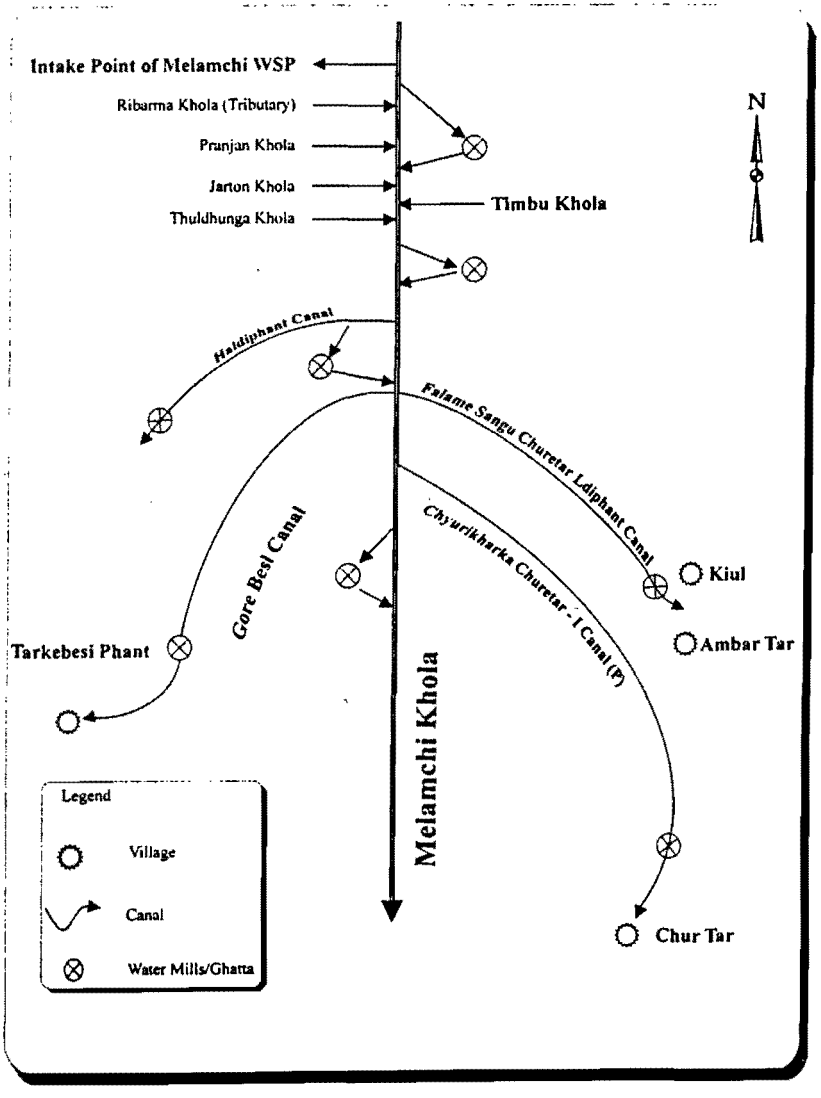

Fig. 2. Schematic Diagram of Water Use Practices in Melamchi WSP Intake in Melamchi Khola, Nepal. (Not in Scale)

The water allocation systems followed are based on the customary water practices and informal traditions, without use of any formal rules and regulations.

Typically, diversion structures made of stones and wood, direct water to canals that bring water to water mills and irrigators. The irrigated areas are e usually located at the upstream of the canal whereas the water mills operate at the tail end of the canal. The mill owner usually constructs the temporary headwork with an earthen canal, and also maintains the canal up to the mill. By doing so, the mill owner usually obtains the rights on the land on which the water canal passes. The understanding between the mill owners and irrigators is that the farmers get unhindered access to the water for irrigation. Sharing the water rights among the different users based on the mutual negotiation and customary practices is followed. Before construction of the water canal and mills, the farmers used to divert water from small seasonal rivulets, which were mostly seasonal in nature (monsoon). A mutually beneficial arrangement has evolved to deal with irrigation and milling. .

Another interesting facet of the water sharing mechanism is that the mill owner performs all the operation and maintenance of the canal without any cost sharing and compensation from irrigation users, though the benefits of canal water are shared by both groups. The mill owner has relatively larger individual stakes in the operation of the canal due to the larger scale of investment, and its location at the tail end position of the canal. Any reduction of canal water flow has a relatively larger investment risk on water mill owner. This gives a positive incentive to the mill owner for timely repair and maintenance of the irrigation canal system, which are in general common property natural resources. Plenty of water is available for all during the monsoon, so there is little problem of water sharing. However, the situation is different in the dry season (January to April). The mill owner usually needs unhindered supply of 180 to 200 lps in the canal for smooth operation. There were occasions in the recent past when the mill owners had to even shutdown the mill for 2-3 hours at the request of the farmers to provide water for irrigation needs. In some cases, the irrigation is done during the night while leaving the water uses to the mill in the daytime.

Usually, the mill owner negotiates with the farmers to try to obtain written consent with the farmers for unhindered access to canal water. Except for providing land for the canal, the farmers obtain water free of charge. Even though it is informal, complex water rights sharing mechanism exists. The irrigation users get first priority for the use of water even for the dry season crops, despite the fact that the mill owner bears the canal construction and maintenance costs. This may seem an unfair arrangement from the outsiders' observation, but this kind of informal arrangement is socially desirable with low transaction costs leading to smooth operation of the irrigation systems. Otherwise, involvement of larger number of smallholder farmers, instead of a single mill owner, would be time consuming and incur large transaction costs for collective choice decisions.

Timely repair and maintenance of the canal is the critical factor in the adverse mountain environment, where flash flood and landslide are daily phenomenon during the monsoon.

The available water is barely adequate both for irrigation and water mill operating simultaneously during those dry months. The competition for water use is growing as new water use activities emerge. The water allocation practice followed in the area is to start irrigation at the head reach first, then middle, and then the tail reach last. Adequate availability of the water at the source (Melamchi River), and the construction of new canals at the downstream has to some extent eased the local water disputes, but these may worsen with short supplies.

Some water related disputes occur when the irrigation users disrupt the water flow to the mill (*Ghatta),* without informing the mill owner (Ghatta). This happens especially for the winter and spring season crops, when the water flows in the canal is reduced at minimum level. Moreover, these water disputes between the irrigation users and the mill owner are usually resolved through the mutual dialogue between the two parties, only occasionally such water disputes are brought to Village Development Council (VDC). In the recent past, one of the VDCs resolved such a water dispute between two irrigation systems (farmers) in one of the tributaries (*Jageswor kulo)* of *Melamchi Khola* by allocating the water between the upstream and downstream users proportionate to the land holding, and also in the rotational system. The *water* was allocated for four days (Jageswar Kulo) to one group, and three days to another (*Tarshera phant kulo).* Both the upstream and downstream users have been abiding the VDC decision.

Other than that there is no serious water conflicts so far noticed among the different water users in the community. Different factors help to reduce such water-related frictions, some of them are:

- Abundance of water availability in river basin compared to the water use activities.
- Existing flexible customary practices for water sharing between the mill owner and the irrigation users based on the need and urgency.
- All the turbine mills, except few of the water mills are at the downstream of canal, thus, the mill owner takes responsibility for operation and Maintenance of the canal.
- There is a customary practice of maintaining at least 200 meter distance between the upstream and downstream intakes; thus the downstream users would not allow a new construction if upstream user do not follow this practice.
- Availability of micro sources of irrigation to cater to the need of the scattered area.

In summary, the institutional framework has evolved adequately and ingeniously to manage local water supplies. Fortunately, there is ample water available in the river except in a few dry months that help to "lubricate" conflicts. Along the river, there is little need for upstream-downstream coordination because of the sufficient amount of water in the river, but there have been cases where local institutions have resolved the matter. The source of water for drinking is different than that for irrigation, minimizing cross-sectoral local water conflicts. The mill owners and irrigators have adapted an effective operation and maintenance system for the canal networks. Informal water rights and enforcement mechanisms have evolved to match the local situation. Locally derived operation and maintenance procedures exist and are fairly well adapted to the rough mountainous conditions.

If water is reduced in the Melamchi, will this type of institutional arrangement suffice? With this setup, can people adequately negotiate with the urban water users from Kathmandu? Can they manage potential upstream-downstream conflicts that may arise when water supplies are less? What changes are needed in the present institutional setup? Part of the answer lies in how much water will remain in the river after the transfer, and in the institutional development efforts of the Melamchi project. Let us first give some more details about the water transfer project.

THE MELAMCHI INTERBASIN WATER TRANSFER (IWT) PROJECT

The Melamchi Water Supply Project is designed to transfer water from the Upper Mountain range to meet the urban water needs of Kathmandu Valley. This kind of commercial use water transfer is first of its kind in Nepal. At present, the average daily water demand of Kathmandu Valley is 180 million-liter per day (MLD[4]), equivalent to 150 liters per capita per day. The Nepal Water Supply Corporation (NWSC), a government owned agency, has capacity to supply only 120-140 (MLD in the rainy season (100 to 116 liters per capita per day). This is reduced to 80-90 MLD during the dry season (i.e., 66 to 75 liters per capita per day). The water demand[5] in Kathmandu city is projected to increase to 510 MLD in 2018 (MWSB, 2000). Considering all these factors, there is clearly an urgency to identify a suitable alternative for a continuous supply of drinking water.

After studying several options, the Nepal government decided to transfer water from a nearby Melamchi river basin to Kathmandu Valley through the implementation of Melamchi Water Supply Project (MWSP). The details of project descriptions are given in Table 1, 2 and 3. Moreover there is also an additional provision to supplement the water flow in the project intake canal

[4] 1 million liter per day (MLD)=0.01157Cumecs

[5] Based on the Kathmandu valley population, 1.2 million now, which is growing at the rate of 3.3 percent per year.

diverting water from other nearby river and tributaries if it is later required for the growing population of Kathmandu City. The first stage of the project is designed to divert 170MLD (1.97 cumecs of water from Melamchi River. In the second and third stages it is proposed to supplement an additional 170 MLD of water by diverting it from Yangri and Larke tributaries of Indrawati River to the same Project intake canal. Thus, it is expected that this project least would be able to meet the long-term (more than 30 years) water demand of the Kathmandu City.

Table 1: Melamchi IWT Project Salient Features.

	Features	Unit	Description
1	Project name		Melamchi Water Supply Project (MWSP)
2	Executing Agency		Government of Nepal, Ministry of Physical Planning and Works, Melamchi Water Supply Development Board (MWSDB)
3	Project Duration	Year	6 year (July,2001-July,2006)
4	Estimated cost	US$	464 Million
5	IRR	%	13.5
6	Financiers/ Donors	No:9	Asian Development Bank -US$ 120 million; World Bank- US$ 80 millions Other Bilateral donors - US$ 146 millions Government of Nepal - US$ 118 millions
7	Source of Water	No:3	Stage I: Melamchi River (perennial) in HELAMBU VDC of Sindupalchowk District located 40 KM north east of Kathmandu Stage II & III: Yangri and Larke (tributaries of Indrawati)
8	Major Components of Project	No:5	• Melamchi Diversion Scheme (MDS): Included access road and tunnel adit, a diversion weir dam 5-7 m high, control system and sediment exclusion and 26.5 Km long tunnel starting from Ribarma to Mahankal, Sundarijal VDC in Kathmandu. • Water Treatment Plant (WTP): Conventional gravity water treatment plant will treat the water for WHO drinking water standard through the process of chemical flocculation, sedimentation, filtration and chlorination. The plant will be located at Sundarijal VDC, outskirts of Kathmandu City. • Bulk Distribution System (BDS): Treated water will be conveyed by network of peripheral distribution system of ductile iron pipe of dia.300-1400 mm to the reservoirs built at high locations. • Distribution Network Improvement (DNI): Distribution to the consumers by rehabilitated and extended network ensuring quality and equitable distribution, and reduction of leakage and wastage.

Langtang National Park and the Helambu area both famous eco-tourism trekking routes are located in the upper water catchment area of the Melamchi River basin. Several environmental impact assessment reports and detailed feasibility studies conducted in the past have not reported any project related adverse environmental impacts on these sectors. The Melamchi IWT project is still a complex and costly adventure in Nepal. It involves construction of a 26.5 Km long tunnel. The total project costs are estimated at US$ 464 million. About 30 percent of the project financing is committed by the multilateral and bilateral donors as grants, about 45 percent by the World Bank and the Asian Development Bank as loan financing, and remaining 25 percent project costs are financed by the Nepal government (Table 1). Private sector involvement during the construction phase as well as management of the water supply system in Kathmandu City, through privatization of the Government owned Nepal Water Supply Corporation, are some of the preconditions of the donor financing on the project. By involvement of the private sectors in the construction and city water supply and management in the future, the project is planned as a (nearly) full cost recovery type of infrastructure project.

Considering the nature and scale of the water diversion project, it has also brought several other institutional changes in Nepal, particularly in the infrastructural development and related project-financing sectors. The experience gained during planning and implementation of the Melamchi project, inclusion of wider stakeholders in the project decisions, are solid foundations upon which the future mega-scale water projects planning in Nepal can be built upon. Likewise, the government's experience on negotiating with several multilateral and bilateral donors together on this project, which lasted more than a decade, could be a valuable information base, and experiences for any future large scale water resources project planning and development in Nepal Figure 3 shows the average flow pattern in the Melamchi as reported by several studies. It is important to note that one of the difficulties in the analysis of water availability has been the paucity of data available leading to some uncertainty in the results. The line at the bottom of the graph represents the constant 1.97 m^3/demand of Kathmandu that will in the future be subtracted from discharge in the Melamchi.

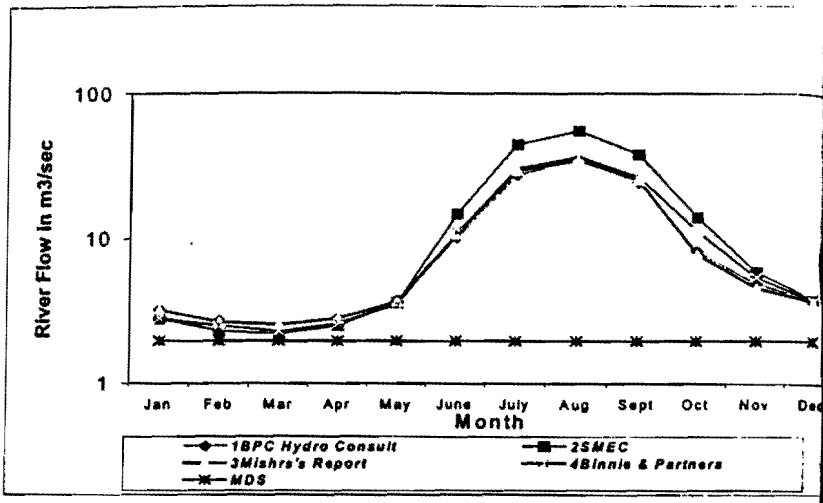

Fig. 3. Comparison of Average Monthly Flows with Respect to Water Diversion from the Proposed Project.

The graph above indicates that March is the driest month with an average river flow being 2.5 m^3/s at the MDS intake. According the project authority, the Melamchi project is designed to leave at least 0.4 m^3/s even in the driest season downstream of the intake (HMGN/MWSDB, EIA report, 2000). The figure suggests that the existing and future water use activities in the Melamchi river basin could face increased water stress, especially from February to May. The affect on water use activities would be felt in the immediate downstream stretch of MDS intake. In dry years, there would be more stress.

In the lack of extensive long time series data reporting and water accounting status study in the basin, there are several uncertainties on the future water balance situation in the river basins. It was observed that the greatest source of tension was around discussions about the water remaining in the river after the project.

THE LOCAL RESPONSE TO THE PROJECT

The Melamchi Water Supply Project (MWSP) was conceived at the higher political and administrative level in Nepal. Supply of adequate drinking water to in the Kathmandu City, has been a major political agenda in Nepalese politics for more than three decades. Considering the nature and scale of the project, its implementation would not have been materialized without strong political commitment, which involves huge investments and several institutional reforms

in Nepal. This has been a dream project of each successive government in Nepal for the last several years. Likewise, negotiation with the prospective donors for funding and convincing the local people were other major tasks for which higher level political commitment was required to materializing the project.

Table 2: Comparison of Average Monthly Flow (m^3/sec) at MDS Intake.

Month	SOURCES				
	[1]BPC Hydro Consult	[2]SMEC	[3]Mishra's Report	[4]Binnie & Partner	Proposed water diversion (MDS)
January	3.2	2.8	3.2	2.8	1.97
February	2.7	2.3	2.6	2.5	1.97
March	2.5	2.2	2.6	2.3	1.97
April	2.8	2.5	2.8	2.6	1.97
May	3.7	3.6	3.7	3.5	1.97
June	10.2	14.8	10.8	11.0	1.97
July	27.4	44.4	29.3	30.5	1.97
August	34.4	55.3	34.8	36.7	1.97
September	24.4	38.0	25.5	26.6	1.97
October	8.2	14.1	7.9	11.3	1.97
November	4.9	5.9	4.6	5.4	1.97
December	3.7	3.8	3.7	3.7	1.97
Average	10.7	15.7	11	11.6	1.97

Sources: From the several project feasibility studies conducted by following companies.
(1) BPC - Butwal Power Company, Nepal; 1997.
(2) SMEC - Snowy Mountain Eng. Corp. Australia; 1992.
(3) Mishra Report - Researcher, IWMI/Nepal. Water Accounting Study, 2000.
(4) Binnie & Partners - International Consultant, United Kingdom; 1998.
(5) Proposed MDS - Proposed water diversion from the Melamchi river.

Melamchi Project plan has assigned concerned District Development Committee (DDC) of Kathmandu and Sindhupalchowk for coordinating the local NGOs' activities in the project areas, known as NGO Participation Plan (NGOPP). The DDC is a local elected institution in Nepal responsible for coordination and implementation of all the governmental local development activities in the district. Likewise, concerned Village Development Councils (VDCs) are also assigned for coordinating and monitoring the activities implemented by the NGOs in their respective jurisdiction. This project has given consideration in involving local elected entities in the project implementation activities. Likewise, a Local Consultative Group at Melamchi valley has been formed to facilitate better [illegible] in the project activities, consisting of 15-member

committee (representatives of line agencies, high school principal, women representative, and the Melamchi project field officers.

Table 3: The Physical Characteristics of Melamchi River Basin.

SN	Description	Unit	Quantity
1	Total Length of River: Main stream	km	41
2	Tributaries	No	14
3	Catchment area of MDS intake	km^2	157
4	Catchment area of River	km^2	330
5	Catchment area of the nearest River gauge	km^2	122
6	Elevation at Intake from Mean Sea level (msl)	m	1445
7	Elevation at tunnel end from msl	m	1410
8	Elevation at confluence with Indrawati river from msl.	m	820
9	Elevation of the river origin from msl	m	5863
11	Average monthly max flow at Intake	m^3/s	10.92
12	Average monthly min. flow at Intake (March)	m^3/s	2.55
13	Average monthly max. flow at confluence	m^3/s	76.00
14	Average monthly min. flow at confluence	m^3/s	5.62
15	Slope of the river	%	12
16	Distance at Intake from Confluence	km	20
17	Average annual rainfall in intake of catchment	mm	3212
18	Average Annual rainfall in the Melamchi basin	mm	3050

Source: HMGN/NWSDB, 2000; and Mishra, 2000

Emergence of NGOs and local pressure groups in the project area is one of the important developments and institutional changes brought by the Melamchi project in the infrastructure project sectors as a whole in Nepal. 65 NGOs have already been officially registered in the project area, however, not all of these NGOs are all equally effective to look after the interests of the local communities. These NGOs have until now focused more on getting involved in implementation of economic packages under the project, rather than looking at the basin level water management as a whole, and its impact on the livelihood of local people. Nevertheless, the NGOs have played an important role in raising awareness and concerns in the communities about the project. Some of the NGOs have already been assigned to the role of facilitator for the implementation of various social development components of the project compensation package.

According to the recent water acts of Nepal (1992 and 1993), the ownership of all the water resources in the country is vested in the central government. The water law has prioritized the use of water in the following order: first drinking water, then irrigation and agricultural uses (animal husbandry), hydropower, cottage industry, industrial enterprises including mining, navigation, recreational use and

guaranteed the customary use right and prior appropriation right of water uses in Nepal. According to this, the local water use practices should not be adversely affected by any water diversion from the river basin without due compensation, since community water users have the first right over the water resources. In the absence of adequate information on how much water will be left in the river after diversion, however it is not sure whether the customary water use right, or the legal water rights of the present user will be protected.

In the absence of the any formal rule and regulation for a bulk water transfer scheme, it is the governmental agency to decide how it is going to compensate to the donors communities for its decisions for such water transfer scheme. Nepal government has proposed to spend US $18.33 million for the general welfare improvement activities in the communities as a compensation package to mitigate some of the environmental, social and economic adverse effects imposed by the project. Considering the present development stage and socioeconomic activities in the donor communities, this level of compensation package represents a considerable sum. Included, $15 million is allocated for Resettlement Action Plan (hospital, road, and school services in the local communities, etc) and the remaining US $ 3.33 millions are for social upliftment programs in the local communities (poverty reduction and equity related project programs).

Viewing the on-going project activities, and the involvement of local NGOs and even international agencies like UNDP for implementing some of the mitigating activities, the local community may get due compensation. However, actual distribution of the benefits of the project compensation package, within the community disproportionate to the actual project's affected sector due to skewed land holdings. Since, most of the mitigation expenditures are concentrated on provision of public goods like school construction, road constructions, hospital buildings, benefits of which can be obtained by the people permanently residing there, and not by the people directly affected. While certainly these programs are worthwhile, there seems to be little effort to develop local water management institutions.

DISCUSSIONS AND CONCLUSIONS

The existing formal and informal institutions for water management in the Melamchi River basin are adequate to cope with local canal water management. Local institutions have evolved to resolve within canal system water allocation and disputes. There have been limited examples of resolving problems of neighboring canal systems. But these same institutions have not been put to the test of negotiating formal water rights along rivers and large-scale water transfers with a powerful neighbor like the city of Kathmandu. They are likely to be adequate to help buffer additional water allocation and competition problems brought about by a reduced supply. There seems to be an opportunity to use these existing institutional structures to develop better arrangements to manage

water resources in the Melamchi River. The project could be a good catalyzing event to bring stakeholders together in the area to improve their water management arrangements to better deal with less resource, and to better negotiate with Kathmandu.

Had there been firm water rights for the Melamchi users, the negotiation for transfer of water may have been much different, with the negotiation between those with water rights and the city. Unlike in the western USA and other developed countries, there is no such formal (or informal) rule and regulation related to bulk water transfer in Nepal (and in much of South Asia). This is one reason for a lack of direct negotiation between different stakeholders. This is particularly relevant in the face of growing urban drinking water crises worldwide, more in the context of developing countries. Here, Nepal government has brought a one time project compensation package to mitigate some of the negative impacts of the Melamchi project, and due compensating the donor communities for their loss of water rights. The compensation was materialized after several years of project related discussion in the nation. The importance of the compensation package is quite important and should not be understated. In our view though, more could be done to use the situation to stimulate institutional development for water management. Rather than negotiate with entities set up by the project authority, it would perhaps be better in the long run to negotiate through upgraded institutions.

The Melamchi river basin is in average years a water surplus basin considering its present water use activities and annual water flow in the river basin. From March to April the area faces more stress with low flows during the dry season. The different water balance studies in the recent past have provided mixed results. In the absence of enough hydrological information shared and discussed among different stakeholders of the river basins, there is still unease among the current water users in the basin. Some of the recent studies (based on existing scant data) have reported it is likely that there will be adequate water left over in the Melamchi River even after the proposed diversion (Mishra, 2000) in average years. But there remains a large uncertainty in the absence of adequate information provided from the project implementation authority, and inadequate scientific validation of the hydrological facts and figures.

Uncertainty in information about streamflow reduction has been an area of dispute between local stakeholders and those implementing the project. This underscores the need for good hydrologic information, transparency about what information exists, and straightforward reporting about uncertainties and what is not known.

Unlike other infrastructural project in Nepal, various activities are proposed to benefit the local people in this project. The Melamchi project board has recently allocated a compensation package of US $ 18.33 million for the various programs

and project activities in the local communities to mitigate some of the project adverse impacts. Several NGOs and local organizations are also being involved in the project implementation process. The successful completion of these activities will certainly benefit the local people, however, it is not sure whether these activities would provide adequate and due compensation to those most affected. Largely, it also depends upon how these activities will be implemented and how local community concerns are included in the long run operation of the project

While ample attention on general development was given precedence, development of local water management institutions could be given more prominence. The project does provide a unique opportunity to develop people to better manage their local water resources. Given the large numbers of current stakeholders and water users in the Melamchi River basin, and large scale of interbasin transfer of water involved, adoption of an integrated River Basin Management arrangement might have been a better option to resolved some of these issues raised earlier. Such integrated River Basin level Planning and Management practices, if initiated earlier could provide better arrangement for the integration of the watershed, land-use, river use regulation, community's overall welfare improvement, and meeting urban water needs at he same time. However, such opportunity may not yet been completely missed, and there still is opportunity to use the project for some institution building.

The Melamchi Water Supply Project represents a situation that is common worldwide. Increasing demands from cities will pull water from rural water users. These users often will not have the institutional arrangements to negotiate and manage water adequately after the water transfer has taken place. Plus adequate and reliable data may not be available to know the extent to which changes will affect local users. The Melamchi Project has correctly paid a lot of attention to the affected area in the donor basin. This interbasin diversion may be an excellent opportunity to catalyze institutional development for managing water resources in the donor basin where competition will increase.

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