CHAPTER 8:

VALUED ENVIRONMENTAL COMPONENT: WATER RESOURCES

Rationale for Screening

Water availability in the Trishuli River Basin (TRB) depends on annual rainfall and glacier melt (upstream in the Tibet Autonomous Region) and is affected by extreme events and interventions such as river diversion schemes (Dandekheya et al, 2017). These have led to increased problems for water supply systems.

Stakeholder consultations indicate that other than domestic purposes, surface water from the Trishuli River itself is not used for drinking purposes. Most of the communities consulted indicated that they use untreated water from springs and from piped water systems provided by municipalities. However, consultations on potential VECs indicated that hydropower construction activities (particularly muck disposal), coupled with other factors such as sand and gravel mining and blasting for construction, have led to the following:

- Decline in surface water quality of the Trishuli River and also certain tributaries such as Tadi Khola, Chilime, and Mailung Khola
- Drying up of springs

Communities also indicate that in the aftermath of the 2015 earthquake they have also seen an intensification of water shortages. In view of limited baseline studies that consider water resources across the basin in its entirety, stakeholder consultations indicated the need to consider the same as a VEC.

Key Stressors

Local communities as well as chairpersons of municipalities perceive the following factors as stressors for water resources:

- Sand and gravel mining across the river basin (in spite of local regulations and interventions for control, such as in Dhading)
- Landslides and dumping of spoil as a consequence of access road construction
- Increased urbanization and lack of solid waste management, which result in waste dumping and sewage at locations along the banks of the river, particularly in Nuwakot and tourist towns of Rasuwa
- Climate change
- Potential that affected urban and rural municipalities around under-construction hydropower projects (HPPs) have experienced springs drying up due to tunneling, blasting, and other intrusive excavation activities

Based on information provided, there are no functional sewage treatment plants at a municipality and/or HPP level that have been installed in the basin.

Baseline Conditions

Upstream

It has been reported that during the earthquake, water infrastructure such pipes in Rasuwa District were badly damaged, leaving villages with no access to clean and safe drinking water (CAFOD 2015). On the other hand, there is no use of river water for irrigation or for drinking due to the altitude and general riparian topography, which make access to the riverbank difficult.

The provision of new and improved water services is reported to be slow. In Gosaikunda, it is reported that community settlements rely on two to four springs for water, and that communities depend on one to two springs in Parbati Kunda, Kalika and Uttargaya. Three villages in Gosaikunda were badly affected by water shortages—Chilime, Goljung, and Sayphrubeshi. Consultations suggested that impacts on springs are due to the earthquake, landslides, and hydropower development. The shortage of water increased the workload for women and girls, since they have to walk long distances to alternative sources to procure water for drinking for daily use.

Midstream

The midstream area in Nuwakot faces scarcity of safe drinking water, which is exacerbated by landslides, which engulf available drinking water pipelines (Dandekhya and Piryani 2015). In Kispang, Bidur, and Benighat, the major drinking water source is piped water supply and not linked to the river or to springs. The exception is in some villages, like Belkotgadi, where the communities have installed wells on the banks of the Trishuli.

Elsewhere, villagers had no quality concerns, but some communities depend on river water (from both the main river and its tributaries) for drinking during the latter part of the dry season, as the springs dry up and the public system is not reliable. The reduction in rainfall is seen to have increased the dependence on river water, while at the same time reducing the volume of surface water (which leads to deteriorating water quality and has health implications). In the monsoon season, landslides and intense rainfall have led to a reported disruption of water sources and spring conveyance systems (Dandekhya and Piryani 2015).

Downstream

It is estimated that each settlement in this district has one or two streams. Local communities use piped water for drinking (and not the Trishuli River). However, the source of water for agriculture varies from river water being channeled directly to the fields to some small-scale storage systems in the form of ponds and tanks. However, poor operation and maintenance of irrigation systems have been noted as a limiting factor in cultivating two or three crops per year. Water access is generally high due to the increased use of motor pumps and tube wells.

Surface Water Quality

The stressors noted in the "Key Stressors" section of Chapter 8 influence the levels of turbidity and coliform. These specific parameters have been used as indicators of the baseline condition of water quality as provided in Table 8.1.

As indicated, turbidity and coliform levels increase as the river moves downstream. While turbidity is highly dependent on seasonal variations in flow, increasing during the snowmelt and the monsoon, other factors such as sand and gravel mining, dumping of spoil from

Table 8.1 Baseline Water Quality (based on turbidity and coliform levels) at Various Sections along the River

Location	Turbidity (NTU)	Exceedance of NDWQS	Coliforms	Exceedance of NDWQS	Source
Upstream					
Rasuwagadhi	17-33	Yes	None	No	EIA of Rasuwagadhi HPP (NESS 2014a)
UT-1	<1-39	Yes	High	Yes	EIA for UT-1 (NESS 2014b)
Midstream					
Uttar Gaya	140	Yes	>1100	Yes	Water quality reports (NESS 2016)
Ratmate	130	Yes	>1100	Yes	Water quality reports (NESS 2016)
Belkogadi	110	Yes	>1100	Yes	Water quality reports (NESS 2016)
Downstream					
Galchi	180	Yes	>1100	Yes	Water quality reports (NESS 2016)

Note: *NTU = Nephelometric Turbidity Units; NDWQS = National Drinking Water Quality Standards.*

road construction, and landslides can contribute to increases in turbidity. However, turbidity levels are high as the river flows through the midstream and downstream sections, and it is likely that sand and gravel mining are significant contributors to high turbidity levels.

E-coli concentrations, while exceeding the National Drinking Water Quality Standards (NDWQS) at all sampling locations, is highest in the midstream and downstream sections. These are where major towns such as Betrawati, Bidur, Kurintar, and Ratmate are located. The release of untreated sewage into the river appears to be a major cause for these elevated levels.

Springs

The upstream area in Rasuwa District has witnessed drying up of springs in the aftermath of the earthquake. A study conducted by Youth Network for Social and Environmental Development (YONSED) in Laharepauwa, Ramche, and Bhorle villages in Rasuwa, identified 29, 30, and 55 springs, respectively, that had dried up (Dandekhya et al. 2017). Communities have reported that landslides had also washed away spring sources and affected water availability. Studies undertaken along tributaries midstream (Poudel and Duex 2017) have attributed drying up of springs to changes in hydrometeorological patterns.

Methodology

Available information on baseline water availability, arrangements, and quality were qualitatively assessed to determine if multiple HPPs can cumulatively further exacerbate water quality and shortages as well as impacts on springs. The methodology has the following limitations:

- There is no available information on monitoring of water quality in reservoir areas near the operational HPPs.
- There is limited hydrogeological data in the existing impact assessment reports on inventory of springs and impacts for the same that can be spatially represented.

Significant Cumulative Impacts

Surface Water

Water quality is already poor in the TRB, specifically in the midstream and downstream sections. Addition of future projects under the scenarios discussed are unlikely to act in concert to result in cumulative impacts. As discussed in "Overall Ecosystem Integrity" in Chapter 5, while additional projects are likely to further degrade habitats in the midstream sections (already highly degraded), these impacts cannot be considered cumulative, as they will tend to be spatially restricted. In addition, the impacts of stressors such as sand and gravel mining and disposal of soil seem to be more significant than hydropower development.[1]

Springs

There is limited multidisciplinary research on the watershed hydrogeology, socioeconomic dependence, impacts of climate change, and natural hazards on spring water to provide any conclusion remarks. However, a majority of the available literature has attributed drying up of springs to natural factors and not specifically to cumulative effects of HPPs. At a project level, a preconstruction baseline of springs in and around the dam, diversion tunnels, and other excavation areas (such as quarries) needs to be undertaken. Thereafter, hydropower developers (along with local municipality and district authorities) can consider launching watershed-scale spring rejuvenation programs targeting depression and contact springs by involving local communities, government agencies, and other stakeholders.

1 A contractor of UT3A was found to be engaged in sand mining downstream of the project. This type of extraction may repeat in construction of other HPPs and trigger local commercial operations that continue well after HPP-triggered extraction has ceased.