adpc

Climate Adaptation and Resilience (CARE) for South Asia Project

Water Sector Policies and Guidelines of Nepal

REVIEW REPORT

Climate Adaptation and Resilience (CARE) for South Asia Project

Water Sector Policies and Guidelines of Nepal

REVIEW REPORT

adpc

No. 979/66-70, SM Tower, 24th Floor, Phaholyothin Road,
Phyathai, Bangkok 10400, Thailand
Telephone: +66 2 298 0681-92
Website: www.adpc.net

This publication is produced by Asian Disaster Preparedness Center as part of the project titled "Climate Adaptation and Resilience (CARE) for South Asia" funded by the World Bank (WB Reference: P171054). The findings, interpretations, and conclusions expressed in this work do not necessarily reflect the views of Asian Disaster Preparedness Center, its Board members, or the governments they represent. The boundaries, colors, denominations, and other information shown on any map in this work do not imply any judgment on the part of ADPC concerning the legal status of any territory or the endorsement or acceptance of such boundaries.

Citation—Laxman Sharma, Niladri Gupta, Senaka Basnayake. 2021. Water Sector Policies and Guidelines of Nepal: Review Report. Bangkok: ADPC

Document No: ADPC/CARE/WAT/NP-03

Date of Publication: May 2021

Table of Contents

List of tables

List of Abbreviations

ADB	Asian Development Bank
AFOLU	Agriculture, Forestry and Other Land Use
CBS	Central Bureau of Statistics
CRI	Climate Risk Index
DEM	Digital Elevation Model
DHM	Department of Hydrology and Meteorology
DoED	Department of Electricity Development
DWTFC	Drinking Water Tariff Fixation Commission
EPC	Environment Protection Council
ETFC	Electricity Tariff Fixation Commission
FAO	Food and Agriculture Organization of the United Nations
GCF	Green Climate Fund
GDP	Gross Domestic Product
GHG	Green House Gases
GLOFs	Glacial Lake Outburst Floods
GoN	Government of Nepal
GWP	Global Water Partnership
IBN	Investment Board Nepal
ILOSTAT	International Labour Organization Statistics
IMP	Irrigation Master Plan
IPPU	Industrial Processes and Product Use
IWRM	Integrated Water Resources Management
LAPA	Local Adaptation Plan of Action
masl	meters above seas level
MOEAP	Ministry of Economic Affairs and Planning
MoF	Ministry of Finance
MoFE	Ministry of Forest and Environment
MoIAL	Ministry of Internal Affairs and Law

MoITFE	Ministry of Industry, Tourism, Forestry and Environment Committee
MoLMAC	Ministry of Land Management, Agriculture, and Cooperatives
MOPE	Ministry of Population and Environment
MOPID	Ministry of Physical Infrastructure Development
MoSD	Ministry of Social Development
MW	Mega Watt
NAP	National Adaptation Plan
NAPA	National Adaptation Programme of Action
NEA	Nepal Electricity Authority
NDC	National Development Council
NPC	National Planning Commission
NWRDC	National Water Resources Development Council
O&M	Operations and Maintenance
REDD+	Reducing Emissions from Deforestation and Forest Degradation
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
WB	The World Bank
WEC	Water and Energy Commission
WECS	Water Energy Commission Secretariat
WRRDC	Water Resource Research and Development Centre
VRA	Vulnerability and Risk Assessment

EXECUTIVE SUMMARY

Nepal, home to the mighty Himalayas, is rich in water resources; its rivers discharge about 225 billion m^3 of water, annually. Major rivers emerge from the snowfields and glaciers, cascade through gorges and valleys, and emerge into the flat lands of Terai. Despite the abundance of water and great potential for hydropower generation, these rivers are yet to deliver on the hope it offers in terms of being a means of prosperity for the nation. Furthermore, climate change impacts pose a serious threat to the livelihoods of the larger population and derail development efforts. It is essential that suitable policies are established and implemented correctly to achieve the target of significantly improving the living conditions of the Nepali people in a sustainable manner.

A comprehensive review of the policies, strategy, plans, and legislations related to the water resources sector in Nepal was carried out recently under the CARE for South Asia project. The study revealed that water policies in Nepal, underpinning the concept of integrated water resources management (IWRM), are evolving and attempting to conform to the recently adopted federal structure: the three tiers of governance in Nepal, at federal, provincial and local levels.

The water resources of Nepal are spatially and temporally varying in nature, with problems of both abundance and shortages occurring at different times and locations. The hydropower development sector is still developing, as the nation recently emerged from the throes of load-shedding. The country's economy is dependent upon agriculture, remittances, and the service sector, with the gross domestic product estimated to be US $1,085 (CBS, 2020). The aspirations and expectations of the people demand a policy environment that accelerates the growth of the water sector that, in turn, helps achieve the current slogan of 'prosperous Nepal-happy Nepali'.

Nepal's new Constitution, adopted in 2015, states that every citizen has the right to a clean and healthy environment. It further prescribes that the State shall carry out multi-purpose development of water resources, ensure availability of energy, develop sustainable and reliable irrigation and reduce water-induced disasters adopting good river management. The new federal structure allocates the responsibility of managing water resources to all three tiers of government on the basis of the size of projects.

The Water Resources Strategy 2002 was pivotal in directing the government to adopt a policy based on conservation of resources, protection of the environment, and an understanding that river basins should be managed holistically by decentralized, autonomous, and accountable agencies underpinned by the ideas of economic efficiency as well as social equity. The National Water Plan 2005 (WECS, 2005) laid out short- medium- and long-term action plans to achieve the stated national goals. A comprehensive new Water Resources Act was envisioned by the National Water Plan, but its formulation got derailed by the then changing political scene of Nepal. Later attempts at passing the Bill were not successful. The Electricity Bill which will replace the Electricity Act 2001 has met a similar fate and is still pending.

The National Water Resources Policy 2020, however, was released recently by the government with the goal "to sustainably conserve, manage and to carry out multipurpose development of available water resources to contribute to the economic prosperity and social transformation of the country". It accepts multisectoral dimensions of water and embraces IWRM principles adopting the basin as a unit of water administration. It spells out the objectives and lays out strategies to achieve them, and each is defined by action plans. These include that the water accounting allocation as well as auditing - shall be carried out with the adoption of river basin plans. It prescribes a science and fact-based approach in planning and management.

Importantly: It should be noted that the existing legal framework for water resources management in Nepal is still set out in the Water Resources Act 1992, as complemented by the Water Resources Rules 1993. The primary features of the Act, amongst others, are, ownership of water resources lies with the nation; uses of water resources may only be lawfully undertaken on the basis of a license and setting a priority order for the use of water resources. The order is drinking water, irrigation,

agriculture, hydropower, and so on, and is not based on economics or comparative loss and benefit analyses.

The government promulgated Irrigation Policy 2013, Hydropower Development Act 2001, Environment Protection Act 2019 as well as more than 70 other related policies, acts, rules, etc. with direct bearings on the development and management of water resources in the country. One can conclude that the water resources sector is a heavily regulated sector that often confuses the private sector and often deters involvement.

The situation at the provincial level, however, is slightly different. The provincial governments are yet to fully enact their legislation related to water and conform to the spirit of federalism. The federal level needs to set standards, umbrella policies, and Acts to streamline the provincial and local actions.

The review also showed that there existed a discord in policy statements and the actual implementation mechanisms in the country. Great policies exist, but the actual tools to implement them are missing. There are issues with both the availability of information and extent of utilization of available resources. There are further immediate areas of concern in implementing the provisions of the constitution and the Water Resources Policy 2020.

These include clearly delineating the powers and responsibilities of the federal, provincial, and local authorities as directed by the constitution, for which a national consensus and political willpower is a must. A national agreement on the type and extent of development of water resources is also required. There is a need to translate policies into actions.

Institutions need to be strengthened in the planning, implementation, and monitoring of projects, along with attracting capital in the water sector. Specific strategies to address seasonal and spatial shortages, as well as build climate adaptation and resilience, are required. Water harvesting, inter-basin transfers, water use efficiencies and reuse, and groundwater development can be adopted towards the sustainable development of the water sector in Nepal. Essential capacities for analyses, negotiations, and dialogue required for international or bilateral cooperation also need to be developed. Only then can the water sector be instrumental in helping to transform the nation into a more prosperous one.

The average annual water availability in Nepal is more than sufficient to irrigate the 22,650 km^2 of agricultural land that is deemed as irrigable, if there were no spatial or temporal constraints. The government has prepared an irrigation masterplan (IMP 2019, still to be formally promulgated), to irrigate almost all land by 2050 through: Improved water supply, modernization of previously built systems, construction of new systems to be irrigated by surface water and groundwater as suitable in the Terai, and developing some systems in the hill areas through gravity or pumped systems.

Irrigation systems increase resilience to drought and climate change as well as help in reducing poverty reduction and enhance the adaptation capabilities from climate change. It was estimated, in 2011, that 15 billion m^3 of the total volume of water was consumed every year in Nepal (WECS, 2011). The agriculture sector is the major consumer with around 95.9% of the total consumption while 3.8% is used for domestic purposes and the remainder 0.3% is used up by the industrial sector. Current values can be estimated to be similar.

The policy and guideline review report concluded with recommendations that the nation, in all of its governance systems, proactively plan and adapt to the challenges imposed by climate change by adopting a science-based decision-making approach in its policies. Though the country's policies do appear responsive overall, they need to be translated with proper action plans support to be more sustainable and climate-resilient and fulfill the nation's obligations to future generations. The following needs to be the priority areas of action in refining and developing policies, guidelines, and manuals for better development and management of water resources in Nepal.

- To build a legal system for the development and management of water resources delineating the power and responsibility of the federal, provincial, and local level authorities.

- To address seasonal fluctuation and spatial shortages adopting suitable strategies, e.g., water harvesting for sufficient and sustainable availability of water which is likely to be affected by increasing climate change risks.
- To develop sustainable and quality infrastructure such as dams, diversion structures, embankments, tunnels, and reservoirs to address problems of adverse geological conditions, complex landforms and to enhance water conservation and efficiencies.
- To extend and upgrade hydro-meteorological measurement system to ensure that more reliable information is available for water irrigation and resource management planning and designing.
- To adopt a river basin approach in managing water resources with proper water accounting and auditing mechanisms.
- To maintain the standards of sustainable utilization, recharge, and quality of groundwater resources.
- To maintain a consensus among the various stakeholders, particularly at decision-making levels, concerned with the development and management of water resources.
- To garner the required capital for the development of the water resources sector;
- To maintain cooperation and collaboration with the downstream riparian countries primarily focusing on a framework defining the bilateral relations and the key considerations.
- To train and build capacity in advocacy, planning, and implementation of climate-responsive water resources management as well as capacities in analysis, bargaining, and dialogue for international or bilateral negotiations.

1 INTRODUCTION

The “Climate Adaptation and Resilience for South Asia” or CARE for South Asia project is ongoing with the overall objective to contribute to an enabling environment for climate resilience policies and investments in South Asia. The five-year initiative, 2020 -2025, supported by the World Bank is jointly implemented by the Asian Disaster Preparedness Center (ADPC) and the Regional Integrated Multi-Hazard Early Warning System for Africa and Asia (RIMES). The project is currently going on in Bangladesh, Nepal, and Pakistan.

ADPC is carrying out component 2 of the project which is Enhancing Policies, Standards, and Capacities for Climate Resilient Development. This comprises of subcomponents (2.1) Advisory services for policy and investment interventions; (2.2) Promoting Climate Resilient Design and Standards; and (2.3) Implementation Support to Climate-Risk Management Solutions: Capacity building and technical support.

As a part of sub-component 2.2, the activities of reviewing existing policies and related documents were carried out for the water sector in Nepal. This review includes the national policies, Acts/laws, international treaties, frameworks, and strategies relevant to the water sector and climate change. The national adaptation plan (NAP), national and local action plan on adaptation (NAPA and LAPA), Nationally Determined Contributions (NDCs) are also studied from the lens of the water resources sector.

Nepal is highly vulnerable to climate change due to its young geological formations, high relief topography, fragile socio-economic conditions, and sensitive ecosystems. The overall livelihoods being highly dependent on natural resources makes Nepal more vulnerable to the effects of climate change. The water sector is a primary resource that is expected to contribute to the nation’s growth and it is also impacted by climate change. It is essential to manage this resource suitably to aid in the nation’s resilience to climate change.

The objective of the review is to prepare a summary understanding of these government policies and allied documents; which will feed into the subsequent project activities of carrying out a gap and needs assessment. Coupled with extensive stakeholder participation, this is further expected to help in identifying priority inputs into the policy scenario and work on developing relevant national and regional guidelines.

This report is presented with a brief background section, introducing the physical setting and the resources as well as the concerns related to climate change in Chapter 2 before delving into the actual reviews of the policies and legal instruments related to water in Chapter 3. This Chapter also summarily describes the institutional structure at the federal and provincial levels and the stakeholders identified. Chapter 4 describes the climate adaptation actions as well as the Nationally Determined Contributions in the contest of water resources as well as the integration of climate adaptation and resilience in the water policies. The report continues further with key findings, conclusions, and recommendations and attempts to tie it all into the CARE for South Asia project interventions.

2 BACKGROUND

Nepal is a mountainous country in the central Himalayan region, located between China and India in South Asia as shown in (Figure 2-1). It extends from 26°22′ to 30°27′N in latitude and 80°04′ to 88°12′E in longitude and includes the high Himalayas in the North, including the tallest mountain on the earth, Mt. Everest (8848 m) and flatlands of Terai in the south.

Nepal went through a recent transformation from a centralized State to a three-tier federal system with the enactment of the new Constitution of Nepal in 2015. It became a Federal Democratic Republic with 7 Provinces with 753 local levels. This includes a larger autonomy to the lower units of governance but also poses both opportunities and challenges. Policies and administrative procedures are therefore at a flux and are being redefined and rolled out gradually while institutions jostle for authority and access to resources.

Nepal has a total area of 147,516 km^2, but a large portion of it (~86%) is composed of hills and mountain areas. Forests cover about 43.4% of the area of the country while agricultural land is 24.1%. Almost half of the agricultural land is terraced farming while the rest is Terai, flatlands, and valleys. The average annual precipitation ranges from less than 200 mm to areas with more than 5000 mm. The average rainfall of Nepal is estimated to be from 1530 mm (WECS, 2005) to 1830 mm (MOFE, 2019). Nepal's freshwater accounts for an estimated 2.27% of the total world supply (WB and ADB, 2021).

Figure 2-1: Administrative provinces and the river basins of Nepal (adapted from www.ngiid.gov.np)

The Terai plain, Figure 2-2, is the grain belt of Nepal and occupies 14% of the nation's area with a tropical climate. The annual rainfall averages 1100 – 3000 mm. The Siwaliks, or the Chure range, north of Terai, is a range of hills with elevations ranging from 200 to 1,500 masl. The annual rainfall averages are similar to the Terai region, but the region is prone to landslides, mass wasting, and debris flow being geologically young and fragile. This area is also the major recharge zone for the aquifers in the Terai region.

The middle mountain region, Figure 2-2, with elevation from 1,000 to 3,000 masl and temperate climate averages 275-2300 mm of rainfall, is intersected by large rivers flowing north to south. The

High Himalaya region includes the Himalayan Range and the areas north of it. The climate is of tundra and arctic type. It has an extremely rugged terrain with steep slopes and deep valleys. Some rivers – Kosi, Gandaki, and Karnali predate the uplift of the Himalayan ranges and dissect the Himalayas through deep valleys. Precipitation is estimated to be 150-200 mm, though the weather instrumentation is rather scarce.

The Terai and the valleys in the middle mountains are prime areas of agriculture and residential development. The Irrigation Master Plan[1] (IMP, 2019), states that out of the total net agricultural lands of 35,610 km^2 about 64% of this land or only 22,650 km^2 has irrigation potential , while the rest is not irrigable. Soil erosion is a major issue in Nepal and a concern for the loss of productivity and land degradation. It also causes serious sediment issues in hydropower, irrigation systems, and other infrastructures.

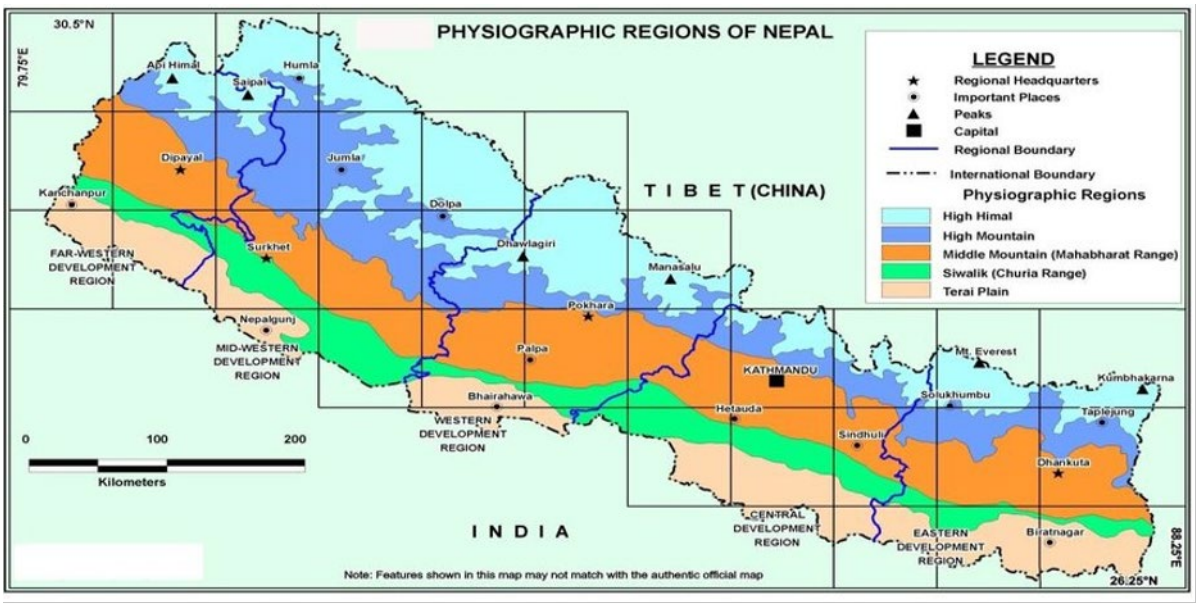

Figure 2-2: Physiographic regions of Nepal (Source: Baral, 2012)

The current population of Nepal is estimated to be 30.27 million (https://cbs.gov.np/). Agriculture is the mainstay of Nepalese people, 60% of the population list agriculture as their prime occupation (CBS, 2012), it contributes about a quarter of the gross domestic product. The GDP per capita is estimated to be US $1,085 for the fiscal year 2019/20 (CBS, 2020). Remittance is the next major contributor as a large portion of its youth goes outside the country for work, mostly as unskilled workers. Seasonal or temporary migration of youth, mostly men, have at places created a shortage of young men for farm work in communities and has put on additional responsibilities and burden on women.

The rapid development of the agriculture sector with good irrigation facilities is essential to absorb and retain labor in agriculture to transform the economy. Water plays a pivotal role in supplying irrigation to enhance agricultural productivity as well as provide energy through hydropower generation.

2.1 SURFACE WATER

The current estimate of the average total surface water annually available in the country is 225 billion m^3 per annum, equivalent to an average flow of 7,125 m^3/s or about 7,422 m^3/person/year. The major river systems of Nepal are Mahakali, Karnali, Narayani (Gandaki), and Koshi. These rivers originate from the Himalayas and beyond, are fed from snow and glaciers, and have appreciable dry season flow. Figure 2-1 shows the river basins of Nepal.

[1] The Master Plan is yet to be approved by the government.

Table 2-1: River Basins of Nepal, Their Catchment Areas and Estimated Runoff (Sources: WECS, 2003)

SN	Basin (River) Names	Area of Basin		Average Annual Estimate		Fraction of total runoff from Nepal
		Overall (km^2)	Nepal Only (km^2)	Average Runoff (m^3/s)	Volume (million m^3)	
1	Mahakali	15,260	5,410	698	22,012	78%
2	Karnali	44,000	41,890	1,441	45,443	
3	Narayani	34,960	28,090	1,753	55,283	
4	Sapta Koshi	60,400	31,940	1,658	52,287	
5	Babai	3,400	3,400	103	3,248	8%
6	West Rapti	6,500	6,500	224	7,064	
7	Bagmati	3,700	3,700	178	5,613	
8	Kankai	1,330	1,330	68	2,144	
9	Other Rivers (Kamala, Mechi and Southern Blocks)	24,921	24,921	1,001	31,568	14%
Total		**194,471**	**147,181**	**7,125**	**224,662**	**100%**

Table 2-1 shows the basin areas and annual average runoffs and volumes of water discharged from the river basins of Nepal (WECS 2003). It should be noted that these values have been used in Nepal since the 1990s or even before, and newer estimates are warranted.

The first four rivers listed in Table 2-1 are major snow-fed rivers with sustained low flows contributing to about 78% of the total runoff volume. These are water surplus basins. The other rivers have large flows during rainy seasons causing inundation and flood damage to large tracts of agricultural lands and infrastructures. They have very low to almost no flows in the dry season and are water-deficit basins.

2.2 GROUNDWATER

Nepal has good resources for groundwater in the Terai region, where the hydro-geology of the aquifers is favorable for obtaining water for irrigation and water supply as it is a part of the larger system of the Indo-Gangetic plains - one of the most productive aquifers in the subcontinent.

The geological formations in the upper fringe of the Terai region are formed by the outwash fans of rivers and the colluvium from the young sedimentary Siwaliks forms the Bhabar Zone. This zone is the main recharge area for the Terai aquifers with the formations having a very high permeability in the range of 100-150 meters per day (WECS, 2005) and the average annual recharge exceeds 450 mm. Another study (IMP, 2019) estimates that the average annual renewable groundwater resources for the Terai region are of the order of 13 billion m^3, and the Eastern Terai has a higher annual recharge and storage yield.

2.3 WATER RESOURCES POTENTIAL

The water resources in Nepal have a large potential for development and the efforts to date are far from satisfactory. The extent of utilization of this key strategic resource is extremely low. The obvious potentials are irrigation and hydropower, while drinking water, navigation flows, environmental, recreational, and religious uses, and potentials also exist. The benefits are not only for Nepal but accrue also for the riparian countries.

2.3.1 Irrigation

The available annual water volume is more than sufficient to irrigate all of the 22,650 km^2 of irrigable agricultural land if there are no spatial or temporal constraints. Irrigation is a consumptive use and a priority accorded by the Water Resources Act. It directly benefits the rural agrarian population. But there do remain technical and socio-economic difficulties in making it perform better. Only a third of the total irrigated area in Nepal receives year-round irrigation. There are temporal and spatial discords in irrigation needs and the availability of water. The option is to have storage projects to harvest water during excess flow season or to have inter-basin transfers from rivers with surplus water to deficient areas. The government has prepared the Irrigation Masterplan 2019 to enhance irrigation, through the improved water supply, inter-basin transfers, modernization of built systems, utilizing groundwater, and adopting pumped systems in the Terai and suitable hill areas. Renewable energy and newer technology, such as solar pumps, to pump water to suitable areas to increase productivity have also been proposed.

Irrigation systems increase resilience to drought and climate change as well as help in reducing poverty reduction and enhance the adaptation capabilities from climate change.

2.3.2 Hydropower

The hydropower potential of Nepalese rivers is high. Rivers originate, the larger ones, in the snowclad highlands above 5000 m and have a significant volume of water cascading through steep slopes through deep river valleys and emerge into the Terai plain. The elevation of the Terai ranges from 64 m to 200 m. Therefore, the rivers of Nepal have high discharges and elevation drops within a short distance which translates, theoretically, into a large potential for hydropower generation.

Since the 1960s, numerous documents state that the theoretical hydropower potential is 83,290 MW, whereas the economic potential is cited as 42,133 MW (WECS, 2013) as summarized in Table 2-2.

Table 2-2: Theoretical and Economic Hydropower Potentials of Nepal

River Basin	Theoretical Potential (MW)			Economic Potential (MW)	
	Rivers with Basin Area >1000 km^2	Rivers with Basin Area 300-1000 km^2	Total (MW)	Number of Sites	Economic Potential Capacity (MW)
Koshi	18,750	3,600	22,350	40	10,860
Gandaki	17,950	2,700	20,650	12	5,270
Karnali and Mahakali	32,680	3,500	36,180	7	24,000
				5	1,125
Southern Rivers	3,070	1,040	4,110	2	878
Total Nepal	72,450	10,840	83,290	66	42,133

It should be noted that large-scale development of irrigation and hydropower is concomitant with broader socio-economic and environmental issues involving the construction of dams, reservoirs, and often diversion of water from one basin to another. Suitable policies and safeguards need to be enforced to ensure good practices are adopted.

2.4 CURRENT AND PROJECTED WATER DEMAND

The sectoral water demands available are rather outdated. It was estimated, in 2011, that 15 billion m^3 was consumed every year (WECS, 2011). The agriculture sector is the major consumer with around 95.9 % of the total consumption while 3.8% is used for domestic purposes and the remainder 0.3% is used up by the industrial sector. Hydropower use is a non-consumptive use as it does not consume any water, though it may alter the spatial and temporal availability of water. The total installed capacity of hydropower plants in Nepal is reported to be 1278 MW (NEA, 2020).

No research or documents were found during our review that stated the current use and projected sectoral demands with any detailed accounting. A preliminary analysis using the water requirement ratio, which is also commonly referred to as the annual irrigation efficiency, states that the irrigation use of water in 2002 was 9.32 km^3 per year (9,320 million m^3) (FAO, AQUASTAT, http://www.fao.org/aquastat/). This database shows that the annual total water withdrawal for the year 2002 was 9.536 km^3. Another report (Kumar et al., 2016) with unavailable cited reports, states that the total consumptive use in the year 2002 was 13,880 million m^3 per year which was then estimated to grow to 38,980 million m^3 eventually.

It must be noted that the irrigation use would reduce source water flow as it is considered a consumptive use, in practice, it does not consume the whole diverted water, but appreciable return flow occurs recharging drains or streams downstream of the command areas and the underlying groundwater. Similarly, all most all of diverted domestic water returns as polluted water through drainage and sewer systems.

2.5 TRANSBOUNDARY WATER RESOURCES

Nepal borders China to the North and India to the east, south, and west. As is evident from the analysis of the figures in Table 2-1 the first 4 rivers also drain catchments in India and China. The Mahakali has a larger drainage area in India. Humla Karnali, a tributary of the Karnali River; Trishuli, a tributary of Gandaki River; Arun and Tamkoshi rivers the tributaries of the Koshi River drain considerable areas in China. Mechi River in the East also drains some areas from India as it forms a boundary river at some reaches there.

All rivers from Nepal flow from Nepal into India and ultimately join the Ganges River.

Nepal is thus a downstream riparian country, with respect to China; and an upstream, riparian country with respect to India, regarding the rivers mentioned above.

Regional expectations, from India and Bangladesh, as perceived from a lot of reports, is that the excess monsoon water causing flooding in downstream countries could be stored in Nepal in large surface storage projects so that a controlled release can be done during the lean flow season to augment the flow in the Ganges. This would alleviate flooding, help irrigate millions of hectares of land and in navigation. The rivers in Nepal are considered the most effective sources as their dry season contribution to the flow of Ganges at Farakka dam is about 71% and annual contribution is about 41% (Khan, 1996). On the other hand, these large reservoir projects would cause the inundation of fertile valleys and inhabited areas and are deemed unacceptable to the local inhabitants.

The above factor clearly describes the regional dimension of this resource and upstream-downstream linkages of water that could be strained by climate change with increased flooding or low water levels.

2.6 MAJOR ISSUES AND CONCERNS RELATED TO CLIMATE CHANGE

Rising temperatures due to climate change impact water because water vapor, wind, and the hydrological fluxes are all directly driven by the radiant energy and the ambient temperature. Nepal contributes only 0.027% to the global greenhouse gas (GHG) emission but is most vulnerable to

the impacts of climate change (MOPE, 2016). Nepal ranked 9th on the long-term Climate Risk Index (CRI) on averaging the annual values from 1999 to 2018 (Eckstein et al., 2020).

The increased temperatures and increase in extremities will mean more floods and droughts, creating more pressures on communities. Droughts will mean a shortage of water for household uses and irrigation as well as a general decrease in soil moisture which will put even more pressure o n the water projects. Droughts lead to a reduction in crop yields and food scarcity. Elevated temperatures will mean higher evapotranspiration, leading to greater evaporation losses from water storage reservoirs, ponds, and lakes. This will be a loss of water to the utility at that point.

A diagnostic study (ADB, 2020) estimates that 1.9 million people are highly vulnerable, and an additional 10 million are increasingly at risk of potential climate change impacts. The economic cost of climate change in agriculture, hydropower, and water-induced disasters is estimated at 2%–3% of GDP per year by 2050.

One of the major issues in climate change is the wide variation and uncertainty in quantifying the future impacts to be usable at local scales by administrators. Estimated rainfall and discharge values depend upon the methodology chosen to translate global circulation models to local levels. Choosing certain circulation models, regional models, scenarios of representative concentration pathways, and downscaling to local levels always introduces errors and the outcomes of the model are still probabilistic in nature. How to estimate the future climate with a degree of accuracy and convey this uncertainty and risk in a manner that the decision-makers can understand is a major issue and a challenge for scientists and technicians in climate science. Some other major issues and concerns related to climate change are summarized below (adapted from WB and ADB, 2021).

1. ***Increase in average overall temperature:*** Warming in Nepal is projected to be higher than the global average with the higher elevations heating more. It is estimated that the temperature will rise by 1.2°C–4.2°C compared to the period 1986–2005 under the RCP8.5 high emission scenario.

2. ***The range in temperatures is going to rise more.*** The minimum and maximum temperatures are expected to be more extreme so the range is going to be greater than the change in average temperature. The temperature increase is expected to be higher in the winter months.

3. ***The environment will be changing too.*** Climate change is already impacting the environment in Nepal, with tropical species' being observed at higher elevations. Insects and vectors of diseases not found in hills are now getting common. Invasion of weeds and foreign plants could alter the flora of a region, while fauna will be finding new habitats. These all affect the ecosystem and the watershed.

4. ***Increased natural hazard intensities or occurrences.*** Natural hazards such as drought, heatwave, cold wave, river flooding, and glacial lake outburst flooding are and will be stronger or frequent in the near future, further increasing disaster risks and endangering human lives and property. For example, it has been suggested that the number of people annually affected by river flooding could be more than double by 2030 while the economic costs of flooding would be even higher (triple).

5. ***The vulnerable will be the hardest hit and inequalities will rise.*** Communities that are poor and living in remote areas, and barely making a living with subsistence agriculture are likely to be hit harder by climate changes. Some important adaptation methods, such as irrigation, water storage, and new crop varieties, air-conditioning will be out of reach to these communities. Inequalities will widen and limit access to resources for the poor.

6. ***Increased Migration.*** Unable to sustain their livelihoods due to scarcity of water and produces, communities, will leave for more rewarding locations seeking better opportunities. It has already been seen that some hamlets and villages have moved on due to a shortage of drinking water supply.

To address the effects of climate change, the Government of Nepal has prepared its National and Local Adaptation Program of Action (NAPA and LAPA). These documents identify different priority actions and recognize the need for local-level adaptation. The implementation remains a challenge, e.g., in some municipalities, the elected officials are not even aware of their adaptation plans.

3 POLICIES AND LEGAL INSTRUMENTS RELATED TO WATER IN NEPAL

3.1 NATIONAL WATER POLICIES / GUIDELINES / ACTS / LAWS

The policy is a principle or a rule to guide decisions and achieve desired outcomes while strategy is the way or method adopted to bring about that desired outcome. Policies in the water sector have traditionally evolved from a sense of ensuring collective action on a common resource for the good of all. Whether it was for ensuring in maintaining canals and ditches for irrigation in the hills and Terai of Nepal or in excavating karez or qanats, in Balochistan and Afghanistan or further west, sustainable systems existed in the region.

The constitution of any country is the major document, the ultimate source of all policies, strategies, and legal frameworks that defines how the country is to be governed. Communal activities in the water resources sector have gradually eroded and as formal government activities emerged in the sector. Nowadays, developing an irrigation system is primarily a state responsibility in Nepal, of either of the three levels of government – the federal, province, and the local levels. Hydropower is open to private investments. Policies have therefore evolved in the hydropower sector seeking private as well foreign investments.

3.1.1 Constitution of Nepal 2015[2]

Nepal's new Constitution, adopted in 2015 ushers in the federal structure of the polity with three tiers of governance – federal, province, and the local municipalities. It defines the functions, in terms of water and related areas of the natural environment, that every citizen has the right to a clean and healthy environment - Article 30(1), and the right of access to clean drinking water and sanitation - Article 35 (4). It also decrees that the State policy shall, among other matters, be the following related to water.

- To carry out multi-purpose development of water resources, while according priority to domestic investment based on public participation.
- To ensure that a reliable supply of energy is affordable and available with ease, and to make good use of energy, for the fulfillment of the basic needs of citizens, by generating and developing renewable energy.
- To develop sustainable and reliable irrigation, controlling water-induced disasters, and adopting good river management (Article 51).

The Constitution provides for a central federal nation with 7 Provinces and local levels of urban and rural municipalities (Article 56). The distribution of powers between the three levels is specified in Article 57 with lists contained in schedules to the Constitution, with the Federation enjoying a residual power on any matter not included therein. Articles 59 and 60 address the important aspect of financial authority and distribution of revenues.

[2] The policies and Acts in Nepal are officially written with the Nepali calendar year in which it was enacted. These dates are converted to the Gregorian calendar here for ease of understanding

Table 3-1: Overlaps in Jurisdiction of the Federal, Province and Local Levels

Entities	Schedule	Item No. and Item of the schedule
Federal Jurisdiction only	5	7. International treaties or agreements, extradition, mutual legal assistance and international borders, international boundary rivers 11. Policies relating to conservation and multiple uses of water resources 14. Central level: large electricity, irrigation and other projects 27. National and international environment management, national parks, wildlife reserves and wetlands, national forest policies, carbon services
Province Jurisdiction	6	7. Province level electricity, irrigation and water supply services, navigation 19. Use of forests and waters and management of environment within the Province
Concurrent jurisdiction of the Federation and the Provinces	7	13. Province boundary rivers, waterways, environment protection, biological diversity 18. Tourism, water supply and sanitation 23. Utilization of forests, mountains, forest conservation areas and waters stretching in inter-State form
Local municipalities Jurisdiction	8	19. Water supply, small hydropower projects, alternative energy 21. Protection of watersheds, wildlife, mines and minerals
Concurrent jurisdiction of the Federation, Provinces and Local Level	9	5. Services such as electricity, water supply, irrigation 7. Forests, wildlife, birds, water uses, environment, ecology and bio- diversity 14. Royalty from natural resources

Schedules 5 to 9 of the constitution are important in terms of allocation and management of water resources of Nepal which specify powers and how they are distributed. Schedule 9 establishes those powers which are to be held concurrently by Federation, States, and the Local Level – and water features strongly in these concurrently held powers.

As can be seen from Table 3-1, certain matters are subject to the concurrent jurisdiction of the Federation and the Provinces; while some are of all three levels. Understanding and clarity regarding how to implement the provisions concerning water amongst the three tiers of government is. Therefore. a fundamental requirement in order to be able to better plan, manage and safeguard the nation's water resources.

One should understand that the constitution is relatively new, the three-tier governance structure needs some time to mature itself and come to terms with its responsibilities, authorities, and limitations.

It is important that the guidance to implement the concurrent powers is soon defined for all three tiers of government to remove confusion. It is also to be noted that potential investors in new water resources projects will see this lack of clarity as a significant project risk and may deter investment.

It is also important that there is a clear and robust dispute settlement procedure that can be accessed by the three tiers of government as well as by communities and individuals.

Previously under the Water Resources Rules 2050[3] (1993), Chapter 4 and Rule 28, there was a stipulation for a committee that could undertake investigations of water disputes and this was headed by a representative of the water resources ministry, with members representing relevant district development committee and the NPC regional office. However, this provision was made before the enactment of the new constitution and the new government system, so this either needs to be revised or else replaced by a new set of procedures and entities.

3.1.2 Water Resources Strategy 2002

The Nepal government, had earlier in 2002, formulated a National Water Resources Strategy whose goal was defined as "living conditions of Nepali people are significantly improved in a sustainable manner." The strategy, in 2002, laid out the short-term (5 years), medium-term (15 years), and long-term (25 years) strategies obtained through a number of widescale stakeholder consultations.

The policy principles that drove the strategy formulation included the adoption of IWRM principles based on conservation of resources and protection of the environment understanding that the river basin should be managed holistically. It further stressed the belief in decentralized, autonomous, and accountable agencies underpinned on the ideas of economic efficiency as well as social equity.

The objective of the strategy was defined as the following, which shows that this was the first attempt at a holistic approach to water resources development and recognized it as a path to the overall development of the Nepalese society.

- helping in the reduction of the incidence of poverty, unemployment, and under-employment;
- providing people with access to safe and adequate drinking water and sanitation to ensure health security;
- increasing agricultural production and productivity, ensuring food security of the nation;
- generating hydropower to satisfy national energy requirements and to allow export of surplus energy;
- supplying the needs of the industrial and other sectors of the economy;
- facilitating water transport, particularly connected to a seaport;
- protecting the environment and conserve the biodiversity of natural habitat; and
- preventing and mitigating water-induced disasters
- The strategy laid out ten outputs in three categories related to security, usage, and mechanisms as listed below.

Security:

1. Effective measures to manage and mitigate water-induced disasters are made functional.
2. Sustainable management of watersheds and aquatic ecosystems is achieved.

Uses:

3. An adequate supply of and access to potable water and sanitation and hygiene awareness is provided.
4. Appropriate and efficient irrigation is made available to support the optimal and sustainable use of irrigable land.
5. Cost-effective hydropower is developed in a sustainable manner.

[3] The year 2050 refers to the Nepali calendar year in which the Rule was promulgated, the Gregorian calendar is shown in parenthesis.

6. Economic use of water by industries and water bodies by tourism, fisheries, and navigation is optimized.

Mechanisms:

7. Enhanced water-related information systems are made functional.
8. Appropriate legal frameworks are made functional.
9. Regional cooperation for substantial mutual benefits is achieved.
10. Appropriate institutional mechanisms for water sector management are made functional.

This strategy set the background for the National Water Plan, which was released in 2005 and paved the way for holistic planning in the water sector.

3.1.3 National Water Plan 2005

The National Water Plan 2005 (WECS, 2005) built upon the broad objectives of the strategy and adopted the overall national goals of economic development, poverty alleviation, food security, public health and safety, decent standards of living for the people, and protection of the natural environment. The plan included short- medium- and long-term action plans for the water resources sector identifying activities for each time horizon as well as the associated fiscal and institutional requirements.

The National Water Plan set long-term targets for the year 2027, which is just 6 years to go. But the envisaged activities and programs have not been fully started and therefore the goal of the plan is far from close to being achieved.

The Water Plan in the irrigation sector had targeted that the area developed as a percentage of the potential irrigable area would be 71, 85, and 97 for the years 2007, 2017, and 2027 respectively. The current estimate (IMP, 2019) is about 48%, a reduced achievement since the potential irrigable area has been revised and increased to 2.265 million hectares from the then (2002) estimated 1.76 million hectares. This would revise the current irrigation development to only about 62%; while the target for 2017 was set 85%. Other targets using other indicators in the irrigation sector such as cropping intensity, crop yield, irrigation efficiency, crop diversification, irrigation service fee recovery, etc. all of which have fell sort by a long way.

Similarly, the target for the hydropower sector set the hydropower production capacity to be 700 MW in 2007, 2100 MW in 2017, and 4000 MW in 2027 to meet domestic demand and sell to the neighboring country if in excess. The current installed capacity is only 1247.51 MW from a total of 107 hydropower plants (DoED website, accessed on 5th March 2021). The actual production is lesser than that.

Furthermore, the water plan had identified enabling areas of improvement - legal and institutional frameworks and these could not be implemented and thus have rendered the national plan incomplete. Furthermore, the challenging political scenario with the upheavals that followed, pushed the focus away from water into general governance, repeated elections, and the formation of the new constitution.

One important positive thing that has happened is that the Plan did set off a series of motions to revamp the legal and institutional aspects of water and also put water resources on the mainstream agenda of the public. It did set the ground for accepting integrated water resources management approaches as the key to water resources management and drafting a new Water Resources Policy and Bill to redefine the government's approach as well as revise the older Water Resources Act 1992.

3.1.4 Water Resources Act 1992

The existing legal framework for water resources management in Nepal is still set out in the Water Resources Act, 2049 (1992) as completed by the Water Resources Rules, 2050 (1993). Efforts to replace the Act with a newer one in line with the National Water Plan 2005 and the subsequent new Constitution of Nepal have not been successful till date. This Water Resources Act comprises 25 sections. The primary features of the Act are that:

- The ownership of water resources in the vests with the State (nation);
- It provides that, with certain exceptions, all uses of water resources may only be lawfully undertaken on the basis of a license;
- Provides for the establishment of Water User's Associations as legal entities;
- Sets a priority order for the use of water resources (not based on economics or loss and benefit analyses);
- Contains provisions on survey and utilization licenses while providing that licenses for hydro-power are to be issued on the basis of the Electricity Act;
- Provides that the Government may develop or use water resources without a license and that it may transfer projects to water user associations in ownership;
- States that contracts may be concluded for water supply and that licenses holders may provide services from water resources development in return for payment;
- Contains provisions on entry into premises and land acquisition;
- Confers powers upon the Government to decide for the security of structures, to establish standards for water resources for different uses, and binding pollution tolerance limits;
- States that the use of water resources shall not cause substantial adverse effects on the environment;
- Provides for the cancellation of licenses, if required or warranted;
- Sets out penalties and provisions for appeals; and
- Confers broad rule (regulation) making powers upon the Government.

The provisions of the Water Resources Act are further developed in the Water Resources Rules, which contain some 40 rules on such matters as water user associations, District Water Resources Commit-tees, licensing and licensing procedures, dispute resolution, water resources use fees (for commercial purposes), land acquisition and miscellaneous matters.

The priority uses as per the Act are, listed below in terms of priority,

1. Drinking water and domestic uses;
2. Irrigation;
3. Agricultural uses such as animal husbandry and fisheries;
4. Hydroelectricity;
5. Cottage industry, industrial enterprises, and mining uses,
6. Navigation;
7. Recreational uses and

8. Other uses.

At the date of its adoption, the Water Resources Act was a sound piece of legislation. Indeed, it is still far in advance of the water legislation in neighboring countries. The idea of introducing a licensing regime for the use of water resources was certainly correct, although it is not clear how many licenses have actually been issued on the basis of this Water Resources Act itself and not through the Electricity Act. This is because government schemes are exempted from the licensing requirements and both drinking water and irrigation water user associations do not need to hold licenses (either because they are exempt or because they operate government-built schemes that have been transferred to them).

There is also a question mark as to the desirability of licensing hydropower projects on the basis of a different act, i.e., the Electricity Act.

Having said that, it is clear that since its adoption the Water Resources Act has become outdated and that it is currently in need of reform. In particular, it does not provide a sufficient basis for the implementation of IWRM in that inter alia it makes no provision for river basin management planning or institutions or the setting of minimum/environmental flows. Moreover, experience clearly shows that attempting to address water pollution on the basis of standards alone, in other words without making provision for site-specific wastewater discharge licenses, is in practice inadequate and unworkable.

The Act, does not provide for customary rights of fishermen who are traditional fishermen and their livelihoods are dependent upon fishing, instead, it makes them illegal if they do not have licenses. Also, there is a provision permitting the licensee to sell the license. This may promote the risk of license brokering rather than advancing the beneficial use of water resources. The regulatory framework should therefore be amended in order to discourage license brokering.

A key reason why the Water Resources Act needs to be substantially reformed is that it predates, and therefore does not consider, the new constitution.

3.1.5 Water Resources Bill 2020

The government has tabled a revised Water Resources Bill 2020, to repeal and replace the existing Act. This Bill is under review by the parliament and it has not been accepted to date. A primary issue that has been contentious is the authority, responsibility, and liability regarding the ownership of the water resources. The bill says, like the previous Water Resources Act that the ownership lies with the State (the nation). The constitution says that there will be ownership with the Federal, Provinces, and local levels for the water bodies as specified. So, the delineation of the ownership and authority needs to be ascertained better so that there will be no confusion later on.

Nonetheless, it was seen that this Bill is important in terms of the acceptance and adoption of the river basin approach in the development and formation of river basin offices as well as adhering to the principles of IWRM and states the strengthening of the Water Energy Secretariat and having these basin offices as their field offices. Questions may be raised on why the office that prepared the Bill is proposing to increase its work areas and authority.

3.1.6 Water Resources Policy 2020

The government of Nepal recently, in Dec 2020, released the new Water Resources Policy, which has adopted the principles of IWRM and the river basin organizations to advance the management of water resources. The goal of this new policy is "to sustainably conserve, manage and to carry out multipurpose development of the available water resources contributing to the economic prosperity and social transformation of the country."

There are 7 objectives targeted by the policy. These include the following:

1. To judiciously use water resources to fulfill multisectoral demands with ease
2. Contribute to enhanced productivity of the nation
3. To make science and fact-based decisions
4. Ensure a coordinated effort amongst the State, provinces, and local levels
5. Fulfill citizen demands of water and water-related products
6. To develop the water resources with minimal negative impact to the environment
7. Reduce water-induced disasters and related risks reduction.

The policy has further specified 11 working strategies to achieve these targets and the goal. Each strategy is further described by action plans. The strategies are briefly stated as (unofficial translations):

1. Water resources utilization and management shall be done on the basis of a river basin master plan.
2. IWRM and multipurpose uses shall be given priority in developing and managing water resources
3. Suitable institutions shall be developed for conservation, development, management, and regulation of water resources.
4. The participation of related stakeholders and the private sector shall be encouraged and increased for the conservation and development of water resources.
5. Study and research in the water sector shall be increased with assimilation of knowledge and data, analysis, and uses of them.
6. Institutions and human resources in the sector shall be further developed.
7. The roles and responsibilities of the federation, provinces, and the local municipalities shall be clearly laid out for coordinated effort in water resources development
8. The water resource project affected areas and people shall be cared for and protected
9. The basic necessities of the people of the project area in terms of energy, drinking water, and irrigation benefits shall be awarded with ease and accessible to them on the principles of equity.
10. The water resources shall be developed by minimizing the negative impacts on society, culture, and the environment.
11. Watershed or basin management shall be made effective with control and reduction of water-induced disasters and risk reduction.

Therefore, the new water resource policy of Nepal seems adequately incorporating IWRM principles and adopting the basin as a unit of water administration. It is said that action plans describing the strategic plans, water accounting, allocation as well as auditing shall be done with the adoption of river basin plans. It describes a science and fact-based approach in planning and management.

There still remains, a difficulty, as it has not spelled out in clarity the roles and responsibilities of all the tiers of the government – federal, provincial and local – that may pose problems and raise concerns.

3.1.7 Irrigation Policy 2013

The Government of Nepal's strategy for irrigation development and management is built upon the Water Resources Strategy (2002), National Water Plan (2005), Irrigation Development Vision and Action Plan (2006), and recently, the Irrigation Policy (2013). The main vision described in these documents is to integrate agriculture and irrigation development in order to realize the full benefits from investment in irrigation and provide sustainable services to the agriculture sector through well-operating irrigation facilities, based on local resources mobilization through a partnership of the users and the government.

The objective of the Irrigation Policy is for the fulfillment of the following:

- To provide round the year irrigation facility to the irrigation suitable land by effective utilization of the current water resources of the country.
- To develop the institutional capability of Water Users for sustainable management of the existing system.
- To enhance the knowledge, skill, and institutional working capability of technical human resources, water users, and non-governmental associations/organizations relating to the development of the irrigation sector

There is an emphasis on:

- provision of year-round irrigation services to increase the productivity of irrigated agriculture and extending the cropping seasons;
- the need for a service-oriented management approach as a means for providing more reliable and flexible water services to farmers; and
- the progressive shifting of operation and maintenance (O&M) costs to water users to enhance efficiency, equity, and sustainability.

This irrigation policy predates the new Constitution and should be revised to incorporate the essence and the direction dictated by the Constitution.

Nonetheless, the policy is climate responsive. As described by a report investigating the integration of climate-related issues in policies (MOFE, 2020) that the irrigation policy emphasizes strategies that include storage of floodwater and inter-basin water transfer to address spatial and temporal variations in the water supply that will be exacerbated by climate change. It also promotes integrated water resources management which can be an effective tool to address climate change at the basin scale. The policy also helps reduce risks in the reliability of rain and discharge in canals by the development of irrigation systems to provide round the year irrigation, effective management of existing water resources; institutional capacity building of water users for sustainable management of existing systems; and enhanced knowledge, skills and institutional working capability of technical human resources, water users, NGOs and other stakeholders (MOFE, 2020).

3.1.8 National Climate Change Policy 2019

The National Climate Change Policy 2019 supersedes the old Climate Change policy of 2011. The policy, in terms of water resources and energy, states that energy security will be ensured by promoting multiple uses of water resources and the production of low carbon energy.

The policy says that the following strategies and working policies shall be included:

- Technologies for storage, multiple-use, and efficient use of water will be developed and promoted in risk-prone areas and settlements considering the effects of climate change on the availability of, and access to, water.

- Rainwater harvesting ponds will be constructed for groundwater recharge and their multiple uses.
- Standards will be developed and implemented for the sustainable use of groundwater resources in urban areas.
- Production and use of renewable energy and use of energy-efficient technologies will be encouraged.
- Selection of environment-friendly sites will be made and climate-friendly technologies will be used while constructing infrastructures including that of hydroelectricity, drinking water, and irrigation.
- Measures to mitigate adverse impacts on river ecosystems will be adopted while generating hydroelectricity.
- The safe outlet will be managed by decreasing the water level for the reduction of glacial lake outburst risks.
- Dissemination of information relating to weather will be systematized by expanding weather stations in various geographical regions and their capacity will be enhanced.

In relation to irrigation, it states that Water-efficient irrigation technology will be promoted and selection of environment-friendly sites will be in project designs as well as the adoption of climate-friendly technologies will be done while constructing infrastructures including that for hydroelectricity, drinking water, and irrigation.

3.1.9 Irrigation Master Plan 2019

The Department of Water Resources and Irrigation has developed an Irrigation Masterplan following on from Master Plan of 1990 to develop a long-term strategy of developing the irrigation sector based on the available resources and policies and implement an investment program that is consistent with the strategy. This new Master Plan, though not yet approved by the government, has prioritized research and development areas also includes the following:

- Mainstreaming climate change adaptation in irrigation planning and management:
- Sustainable storage development in the Greater Himalayan Region:

It is important to note that the Master Plan identifies the possibility of utilizing water storage capacity in the Greater Himalayan region for adaptation to climate change. It may be possible to harness the natural systems in the biosphere through initiatives such as wetlands conservation and improved watershed management in the hills and mountains, as well as groundwater aquifer recharge in the foothills. Small ponds and tanks for rainwater harvesting could also be built on hill farms and around hill communities. The construction of large dammed reservoirs on the downstream plains is a further option and has been carefully considered in this Irrigation Master Plan. It also states that the knowledge gap concerning such sustainable water storage will have to be addressed through fresh research studies.

3.1.10 Agricultural Development Strategy 2015

The irrigation sector is intrinsically linked with the agriculture sector as it is one of the inputs to enhance agriculture productivity. This is a long-term strategy, 2015- 2035, of the agricultural sector. The vision of the ADS has been stated as a self-reliant, sustainable, competitive, and inclusive agriculture sector that contributes to economic growth, improved livelihood, and food and nutrition security. ADS emphasizes promoting self-sufficiency in food grains and import substitution in a number of commodities where the country has the potential to grow. It seeks to increase coverage of year-round irrigation from 18% (in 2010) to 30% in short term (5 years), 60% in the medium term (10 years), and 80% in long term (20 years).

3.1.11 Hydropower Environmental Impact Assessment Manual 2018

The MOFE has in consultation with relevant line agencies and ministries issued a comprehensive EIA manual that dictates the minimum standards, administrative systems, processes and templates to be followed during an EIA for any qualifying project.

The manual prescribes, under scoping exercise, that the information on local-scale climate change projections and resilience are required when describing the physical and chemical environment. Chapter 7 on identifying existing conditions recommends including climate change projections, from the Intergovernmental Panel on Climate Change, regional and national agencies or organizations, into the assessment of existing climate conditions on-site to determine any potential effects throughout the duration of hydropower operations. Use of appropriate tools to carry out climate risk screening, including information on evaporation and evapotranspiration, is recommended. It also states that Baseline information on weather and climate will be used in hydrological flow modeling that will be used to assess impacts on changes in instream flows.

Chapter 8, on assessing impacts, describes relevant climate change impacts that are generated through different types of hydropower project lifecycles in terms of greenhouse gas emissions. It describes the possible sources of greenhouse gases depending on the type of hydropower project, which may include loss or decomposition of submerged vegetation; combustion of fuels in vehicles and other machinery, etc. It requires the EIA process to discuss what impacts greenhouse gas emissions and loss of carbon storage through vegetation clearing and/or soil degradation will occur during the construction and operation of the hydropower plants.

Appendix C of the guideline requires that emergency preparedness and response protocols for disaster risk reduction and climate change adaptation are to be prepared. It suggests that these may be required in relation to flow diversion, intake, reservoir or pondage, and sediment flushing mechanisms.

3.1.12 Guidelines in the Hydropower Development Sector

There are a number of guidelines in the development of the hydropower sector. These are

- Guidelines for Study of Hydropower Projects, 2003
- Guidelines for Water Conveyance System, DOED 2006;
- Guidelines for Power System Optimization of Hydropower Projects, DOED 2015
- Guidelines for Operation and Maintenance of Hydropower Plants, Substations and Transmission Lines, DOED 2017
- Design Guidelines for Headworks, DOED 2018;

None of these guidelines directly talk about climate change and how climate change information is to be integrated into project formulation, design, and operation stages. The department apparently is lacking the evidence of concrete recommendations on how the climate information can be integrated into their design standards and guidelines.

3.1.13 Guidelines and Manuals in the Irrigation and Water Resources Sector

The design guidelines and manuals in the irrigation sector are those that were developed in the 1990s is the PDSP manual (UNDP NEP 85/103/World Bank -1990) used by the Department of Irrigation is the main design manual available and used apart from standard textbooks. The PDSP manuals date back to 1990 when much fewer data were available. It is likely that the procedures could be improved and it is recommended that there is a comprehensive review of the methods in designing irrigation structures.

Irrigation design must evolve to include large-scale projects, basin-diversion schemes, tunneling, and construction of dams. It must also specify design criteria and methodology for designing hydraulic structures, embankments, and even hydro-mechanical components of the irrigation sector. Information on how to incorporate climate change methods also needs to be specifically described so that the design engineers can qualitatively incorporate and mainstream climate change into irrigation projects.

3.2 OTHER POLICIES, ACTS, RULES, AND ORDERS

The major water resources policies and legal documents are discussed above. Since water is an essential part of personal livelihood in particular and the society in general there are other sectoral legal instruments that have some bearing on the utilization and management of water resources. These range from encouraging private participation in the development process, such as the Public-Private Partnership Policy to Public-Private Partnership and Investment Act, 2019 to regulatory policies and guidelines on environmental protection, land acquisition, etc. These are listed below and summarily described in Annex A.

Policies

- The Hydropower Development Policy, 2001
- Forest Policy, 1993
- Climate Change Policy, 2011 (old policy)
- Land Use Policy, 2015
- Rural Energy Policy, 2004
- Rural water supply and Sanitation National Policy, 2004
- National Agriculture Policy, 2004
- Water-induced Disaster Management Policy, 2015
- Land Acquisition, Resettlement and Rehabilitation Policy, 2015
- Public-Private Partnership Policy, 2015

Acts

- Aquatic Protection Act, 2017
- Civil Code, 2017
- Criminal Code, 2017
- Consumer Protection Act, 1999
- Development Board Act, 1956
- Disaster Risk Reduction and Management Act, 2017
- Electricity Act, 1992
- Electricity Theft Control Act, 2002
- Environment Protection Act, 1997
- Essential Commodity Protection Act, 1955
- Foreign Investment and Technology Transfer Act, 1992
- Forest Act, 1993

- Inter-governmental Fiscal Management Act, 2017
- Investment Board Act, 2010
- Industrial Enterprises Act, 1992
- Land Acquisition Act, 1977
- Land Revenue Act, 1978
- Local Government Operation Act, 2017
- Natural Resources and Fiscal Commission, 2017
- Nepal Electricity Authority Act, 1984
- Nepal Water Supply Corporation Act, 1989
- Public-Private Partnership and Investment Act, 2019
- Ship Registration Act, 1971
- Water Supply Management Board Act, 2006
- Water Supply Tariff Fixation Commission Act, 2006
- Water Tax Act, 1966
- Nepal Electricity Regulatory Commission Act, 2017
- Irrigation Act (draft Bill), 2015
- Draft Water Resources Act (Bill)-

Rules

- Drinking Water Rules, 1998
- Drinking Water Service Charge (Recovery) Rules, 1994
- Drinking Water Service Operation Directive, 2012
- EIA/IEE Working Procedure for Hydropower and Transmission Lines, 2016
- Electricity Leakage Control Rules, 2002
- Electricity Rules, 1993
- Electricity Tariff Fixation Rules, 1994
- Environment protection Rules, 1997
- Guidelines for Study for Hydropower Projects, 2003
- Irrigation Rule, 2000
- National Drinking water quality standard, 2005
- National EIA Guideline 1993
- Pesticide Rule, 1994
- Rafting Rule, 2006
- Solid Waste Management Rules, 2013
- Water Resources Rule, 1993

Treaties and bi-lateral Minutes

- Agreement between Government of Nepal and the Government of India on the Gandak Irrigation and Power Project, 1959
- Treaty Between Government of Nepal and The Government of India concerning the Integrated Development of the Mahakali Barrage Including Sarada Barrage, Tanakpur Barrage, and Pancheshwar Project, 1996
- Revised Agreement between Government of Nepal and The Government of India on The Koshi Project, 1975

Orders

- Formation order of Groundwater Resources Development Board, 1975
- Formation Order of Water and Energy Commission, 1992
- Formation order of Rural Drinking water and sanitation Fund, 1996
- Formation Order on reformation of National Water Resources Development Council, 1997
- Formation Order of Melamchi Drinking Water Committee, 1998
- Formation order of Electricity Development Committee Fund, 2002

Furthermore, Public-Private Partnership Investment Act, Inter Government Fiscal Management Act, Nepal Electricity Regulatory Commission Act, Land Acquisition Act, Local Government Operation Act and Proposed Drafts on IWRM related provincial laws, Water Resources Act, National Priority Project Act, Draft Forest Act, Draft Environment Act, Draft Land Use Act may also impact to some extent the utilization and development of water resources and related projects.

It should be noted that it is often said that the water resources sector and the related aspects of developing it with projects is a highly regulated system with one of the highest numbers of Acts, rules, and regulations to follow, such that the water projects always require more time to complete than normally envisaged. This also overruns the project costs. Addressing this aspect, the Investment Board Act 2010 was passed and the Investment Board was formed to fast-track large projects and help ease foreign direct investment.

The policies and Acts, in general, are geared towards surface water irrigation, and the aspect of groundwater irrigation is often lacking. It is increasingly clear that the groundwater is increasingly being compromised, whether it is through over-extraction or contamination of aquifers, or degradation of recharge areas. There is no clear mechanism of regulating it to date, despite it being recognized as a major source of water for consumptive use and expediating irrigation coverage. New technologies in energy for driving the pumps, primarily solar, are also being increasingly used for isolated tube-well irrigation.

3.3 PROVINCIAL WATER POLICIES AND LAWS

Nepal includes seven Provinces and local governing bodies. The local bodies number total of 753 bodies including six metropolises, 11 sub-metropolises, 276 municipal councils, and 460 village councils. The provinces have their own legislative body and executive offices.

The provinces do have responsibilities for water resources development but the laws and regulations to enable them are still being formed and carried over from the national laws and policies. The existing scenario is that the federal or existing laws are carried on as inherited laws and assumed applicable unless the governing body deems necessary to formulate its own policies and laws.

Province 1 has promulgated the Provincial Electricity Act 2019, while the Irrigation Bill was not passed by the legislation and still remains a Bill. Province 2 has promulgated the Provincial Act related to

Electricity, 2020, while the Sudurpaschhim Province has passed the Environment Protection Act 2019. These are promising signs of the provinces attempting to make their own decision.

The proposed Irrigation Bill of Province 1 had provisioned provincial jurisdiction for irrigation in terms of size or command area. Irrigation projects within 200 to 20,000 ha in the Terai and 50 to 1,000 ha in the hills/mountains were proposed to be under provincial jurisdiction.

One of the prime areas for which the province and local level governments are at contention is the mining of sand, aggregates, and rocks for construction materials. This is often viewed as a lucrative business and income for the local level municipalities and often the rivers, riverbanks, and hillsides are indiscriminately mined without regard to the effect it has on the hydrology, morphology, and even danger to the built infrastructures.

Defining relationships between the three tiers of governments in terms of their authority, liabilities, and responsibilities is an area that requires urgent attention. The legal definitions of their respective areas need to be clearly stated without any duplicity and confusions rapidly removed. This is an area for policymakers and the stakeholders to come together and solve now.

3.4 TRANSBOUNDARY WATER POLICY AND LAW

Nepal has a significant history of transboundary water-sharing agreements with India including the 1954 Koshi Project Agreement and the 1959 Gandak Agreement as well as The Mahakali Treaty of 1996. There is no specifically spelled out policy instrument regarding the transboundary waters. Nepal also has not entered into treaties or understandings on any of the rivers flowing into Nepal from China.

Nepal's recent stance has been, with India, and spelled out in a number of bilateral forums, that the cost of and benefits of any development must be shared between both the parties equitably. Development of reservoirs would render large tracts of a fertile farm, forests and villages/ infrastructure underwater, incurring huge economic, social, and environmental costs to Nepal while there would be augmented flow in the rivers flowing downstream benefitting India in enhancing its crop yield through the higher intensity of irrigation, as well as benefits from floods due to regulated waters.

Transboundary water treaty practice has developed considerably in the international arena over the past four decades and of particular note is The Convention on the Law of Non-Navigational Uses of International Watercourses, commonly referred to as the UN Watercourses Convention. This has entered into force globally in 2014 has taken since 1997 to attract the requisite number of ratifications from the member countries.

The UN Watercourses Convention has codified a number of principles of international law concerning the obligations of nations that share watercourses and these include:

- Article 5: Equitable and reasonable utilization and participation
- Article 7: Obligation not to cause significant harm
- Article 8: General obligation to cooperate
- Article 9: Regular exchange of data

It should be noted that the historic notion of absolute territorial integrity (also called the Harmon Doctrine) – in which a country can choose to utilize the water flowing through its territory in its entirety and without any concern of its co-riparian countries has completely failed to gain traction as a principle of transboundary water law. What has come to the fore in modern transboundary water law is the principle of achieving equitable and reasonable utilization by all the riparian countries of an international watercourse – which in essence requires those countries to agree to a shared working apportionment of the available water. This has therefore superseded notions that a downstream

state can require an upstream state to fix flows in perpetuity based upon some earlier historic flow rate. Cleary to do so would be to restrict the potential for development in the upstream state. Examples of such strong tactics to stop upstream development have definitely occurred around the world as well as in the region.

But, despite the principles stated above, stronger nations have always manipulated or strong-armed weaker nations, and history is a testament to that. This could be from preventing other third parties to cooperate, such as in securing financing for the project or even threatening military actions.

In the context of transboundary water sharing between Nepal and India, there is an enormous scope of beneficial cooperation. Nepal has the water resources but has neither the market for the product nor the economy that can sustain investing them on a large scale.

India has a well-developed economy that can make large investments as well as the market to consume the product, i.e. electricity, but it does not have the water resource. The economy is strong and it needs sustainable energy sources- hydropower as well as sustained flows important for irrigation of the dry farmlands, drinking water supplies, and protection from floods. Nepal could also benefit from navigational access to India's major waterways and feels that avenues to fund the development could be agreed to if the avoided costs of flooding and benefits of sustained flows are quantified and attributable to Nepal so that adequate compensations for the areas submerged or acquired for water projects can be duly made. There may therefore be merit in considering developing a combined water and benefit-sharing framework agreement first to get the cooperation rolling.

A number of bilateral, trilateral, and regional efforts are ongoing to foster cooperation and streamline concerted efforts. The bilateral cooperation mechanisms are through joint committees at various levels. The efforts for a trilateral committee have not been fruitful with India, not in favor of trilateral committees. These have often become merely functional, such as the SAARC initiatives or the efforts in getting a trilateral (Bangladesh, India, and Nepal) committee set up for water resources cooperation. The World Bank and the Government of India funded the Ganges Strategic Basin Assessment report (World Bank, 2014), on the other hand, states that the significance and role of storage projects in downstream flood protection and flow augmentation are not clear, so the cooperation for hydropower development should go ahead on a fast track as it promises better benefits. This report has been objected to by Nepali experts and the government.

3.5 INSTITUTIONAL STRUCTURE AND COORDINATION MECHANISM FOR WATER GOVERNANCE

The institutional structure and the coordination mechanism are currently being redefined to some extent after the promulgation of the new constitution and could be divided into four categories (Kumar et al., 2016). These are:

1. Policy/planning and coordinating bodies,
2. Sectoral policy and planning and programming organizations,
3. Regulatory bodies, and
4. Service providers with autonomous nature, including local governance bodies.

3.5.1 Policy Planning and Coordinating Bodies

In Nepal, if one analyses the legal documents and recollects the recent history, there are high-level policy and planning bodies, either sectoral specific or overall national level. These are:

1. National Planning Commission (NPC),
2. National Development Council (NDC),

3. Investment Board Nepal (IBN),
4. Environment Protection Council (EPC),
5. National Water Resources Development Council (NWRDC),
6. Water and Energy Commission (WEC).

The NPC and the NDC are general national policy formulating and planning bodies, while the IBN is more geared towards promoting direct international investments into large projects in Nepal. EPC is an environment-related council that will definitely influence water and water-related development. The NWRDC and the WEC are directly related to water and are authorized to carry out policy planning and other related studies. The Water and Energy Commission (WEC) was established by GoN in 1975 with the objective of developing water and energy resources in an integrated and accelerated manner. Consequently, a permanent secretariat of WEC was established in 1981 and was given the name, Water and Energy Commission Secretariat (WECS). The primary responsibility of WECS is to assist the Government of Nepal, different ministries related to water resources, and other relating agencies in the formulation of policies and planning of projects in the water resources sector.

Of these, the NWRDC has been inactive and a top-heavy organization with a large number of political heavyweights in on the council. It is rarely heard of ever meeting or convening. The WEC and its secretariat the Water and Energy Commission Secretariat are more active led by a government Secretary, and other bureaucrats.

3.5.2 Sectoral Policy and Planning and Programming Organizations

There are sector-specific ministries, which are specifically designated to carry out activities related to that sector. These offices carry out sectoral policy and planning activities as well program development and implementation. The implementation activities may be done through its subsidiary organizations, usually the departments. These ministries are:

1. Ministry of Agriculture and Livestock Development
2. Ministry of Energy, Water Resources and Irrigation
3. Ministry of Federal Affairs and General Administration
4. Ministry of Forest and Environment
5. Ministry of Water Supply

The activities or the subject purview of the Ministries are self-evident from their names. The departments under these ministries that carry out the relevant works throughout the nation are through their field offices and project offices are:

1. Department of Agriculture
2. Department of Electricity Development
3. Department of Water Resources and Irrigation
4. Department of Hydrology and Meteorology
5. Department of Local Infrastructure
6. Department of Forest and Soil Conservation
7. Department of Environment

8. Water Resource Research and Development Centre (WRRDC)

Furthermore, all provinces carry out province-level development activities and the local bodies (municipalities) also implement their own programs.

3.5.3 Regulatory Bodies

1. Electricity Tariff Fixation Commission (ETFC)
2. Drinking Water Tariff Fixation Commission (DWTFC)

3.5.4 Service Providing Autonomous Bodies and Local Governance Bodies

1. Nepal Electricity Authority (NEA)
2. Ground Water Development Board
3. Municipalities (urban, rural, and various metropolises)

3.6 PROVINCIAL-LEVEL INSTITUTIONS

The new constitution's federal setup has provided for 7 Provinces. The provinces from east to west are: Province 1, Province 2, Bagmati Province (previously called Province 3), Gandaki Province (previously called Province 4), Lumbini Province (previously called Province 5), Karnali Province (previously called Province 6), and Sudurpaschim Province (previously called Province 7).

The Provinces have their unicameral provincial assembly (Pradesh Sabha) which elects the executive Chief Minister of the province. The following institutional structures are listed below.

1. Office of the Chief Minister and Council of Ministers
2. Provincial Policy and Planning Commission
3. Ministry of Economic Affairs and Planning (MOEAP)
4. Ministry of Internal Affairs and Law (MOIAL)
5. Ministry of Industry, Tourism, Forestry and Environment Committee (MOITFE)
6. Ministry of Land Management, Agriculture and Cooperatives (MOLMAC)
7. Ministry of Physical Infrastructure Development (MOPID)
8. Ministry of Social Development (MOSD)

A review of the institutional system at the provincial level shows that the water sector activities are executed by the Ministry of Physical Infrastructure Development (MOPID), while the overall multisectoral planning would be done by the Provincial Policy and Planning Commission. Climate Change Division is located within the Provincial Ministry of Industry, Tourism, Forest, and Environment while agriculture is looked over by another branch - Ministry of Land Management, Agriculture and Cooperatives (MOLMAC).

The country continues to face regional, urban-rural, and social disparities, despite policies and efforts directed towards it. Poverty in rural areas inhabited by 81% of the population in 2011 was almost twice as high as in urban areas. The far-western region, presently the Sudur paschim Province (Province 7) and the hill regions of western Nepal are more disadvantaged in terms of access to government resources and development efforts. Poverty in socially disadvantaged groups such as Dalits, Madhesis, Muslims, and indigenous Janajatis is significantly higher than that of the national average.

3.7 WATER SECTOR STAKEHOLDER MAP

The above listing of the government institutions and bodies as well as the various boards and commissions represent the larger group of stakeholders from the government sector. Of these, the primary stakeholders whose areas are directly and actively related to policy, planning, and implementation of water sector activities are:

1. Ministry of Energy, Water Resources and Irrigation
2. Water and Energy Commission Secretariat
3. Department of Water Resources and Irrigation
4. Department of Hydrology and Meteorology
5. Department of Electricity Development
6. Water Resources Research and Development Center

The activities and works carried out are evident in the names of the organizations themselves. The ministry is the overall executive office of the government that is exclusively involved in policy formulations, planning, program implementation, monitoring, and evaluation in the water sector. The Ministry devolves some of its power to the departments or subsidiary organizations for program implementation and feedback. These are responsible for federal-level programs.

The Water Energy Commission Secretariat is, as described before, is sort of a "think tank" for the formulation of policies and planning of projects in the water resources sector. With the recent introduction of the Water Resources Policy and the proposed Water Resources Act that under consideration at the house, the role of WECS is going to be even bigger as the custodian of the river basin information and all data related to water resources planning, allocation and monitoring usage in the basin. It will also be developing as the clearinghouse for all related projects that require water or discharge into water bodies eventually.

4 STATUS OF ADAPTATION ACTIONS IN WATER SECTOR

To address the effects of climate change, the Government of Nepal has prepared its National and Local Adaptation Program of Action (NAPA and LAPA). These documents identify different priority actions and recognize the need for local-level adaptation. The government has initiated adaptation plans but the implementation has remained a challenge, for example, in some municipalities for whom the adaptation plans were developed, even the elected officials were unaware of them.

4.1 NATIONAL ADAPTATION PLAN

Nepal is yet to finalize the National Adaptation Plan and has not submitted the National Adaptation Plan yet. There is a lot of work going into it. Because the NAP going to take time, Nepal prepared and submitted the National Adaptation Plan of Action to UNFCCC in 2010.

Nepal started its National Adaptation Plan (NAP) process in September 2015. It received, in 2016, the NAP Readiness funding from the Green Climate Fund (GCF) through the support of the UN Environment Programme (UNEP). Vulnerability and Risk Assessment (VRA) framework and indictors developed in 2017 along with the preparation of the observed climate trend scenarios. Currently, the vulnerability risk assessment is going on and the NAP is being drafted.

The NAP preparation process is engaging thematic working groups. There are eight thematic areas and four cross-cutting areas as listed below.

Thematic Areas (8)

1. Agriculture and food security
2. Forests, biodiversity and watershed conservation
3. Water resources and energy
4. Rural and urban settlements
5. Industry, transport and physical infrastructure
6. Tourism, natural and cultural heritage
7. Health, drinking water and sanitation
8. Disaster risk reduction and management

Cross-cutting Areas (4)

1. Gender equality and social inclusion, and livelihoods and governance
2. Awareness raising and capacity development
3. Climate change finance management
4. Research, technology development and expansion

The NDC document states that the NAP will be completed by 2021. Through this process, Nepal intends to implement medium and long-term adaptation needs, including urgent and immediate priorities. Key outputs of NAP include the following:

- It will incorporate adaptation and resilience milestones to be achieved in the short-term (by 2025), medium-term (by 2030), and long-term (by 2050).

- Climate Information System will be established and operationalized by 2025.
- NAP Monitoring, Reviewing, and Reporting Framework will be developed and operationalized by 2022.

The thematic area of the NAP on water resources and energy comprises 19 members and the coordinator is the Ministry of Energy, Water Resources and Irrigation. It was learned that the group had met only once online and once in a physical meeting and initiated the works of the thematic group. The group recently met to finalize procedures for vulnerability risk assessment and the NAP sectoral report is yet to be finalized.

4.2 LOCAL ACTION PLAN FOR ADAPTATION

The government of Nepal submitted to the UNFCCC the national framework on Local Adaptation Plans for Action (LAPAs) to strengthen and implement their NAPA prioritized adaptation actions. The Government of Nepal (GoN) endorsed the National Climate Change Policy in 2011 that supported the NAPA and LAPA implementation. A major highlight of the policy is that it proposed a bottoms-up approach earmarking to "allocate at least 80% of available funds for field-level climate change activities."

The LAPA process ensures "direct participation of the climate-vulnerable communities in identification, prioritization, planning, implementation, and monitoring of adaptation actions. "LAPA framework 2011 was developed for localizing adaptation actions and ensuring funds for local-level activities for LAPA. The seven steps of LAPA are:

STEP 1. Sensitization,

STEP 2. Vulnerability & Adaptation Assessment,

STEP 3. Prioritization of Adaptation Options,

STEP 4. Adaptation Plan Development,

STEP 5. Integrating the Adaptation Plan,

STEP 6. Implementing Adaptation Plan, and

STEP 7. Assessing Progress

It is reported that there are more than 100 LAPAs carried out in a number of selected districts that were scoring high on the vulnerability assessment.

4.3 NATIONAL DETERMINED CONTRIBUTIONS

Nepal submitted its first Nationally Determined Contributions (NDC) on 05 October 2016, after ratifying the document by the parliament of Nepal on 04 October 2016. The extended NDC was recently submitted on 08 December 2020.

Nepal is committed to acting on climate change in line with the Paris Agreement, despite the country's negligible emissions. It is viewed that the efforts should be made to limit global average temperature rise to 1.5°C as it significantly lower risks for Nepal when compared to 2°C or higher. Nepal faces climate risks in addition to the existing impacts and vulnerabilities of climate change in the country. Nepal seeks all Parties to move collectively onto emission reduction pathways consistent with the Paris Agreement's 1.5°C warming limit (GoN, 2020). Nepal's NDC covers adaptation as well as mitigation actions to arrest climate change. The targeted reductions are stated to be contingent upon international support.

4.4 MITIGATION TARGETS

The mitigation measures to be adopted include activity-based targets and policy targets in key sectors, including emissions reduction in some sectors. The mitigation component includes energy; Industrial Processes and Product Use (IPPU); Agriculture, Forestry, and Other Land Use (AFOLU); and Waste sectors. The target period is ten years from 01 January 2021 till 31 December 2030 with an update in 5 years in 2025. The details of the mitigation are described meticulously in the NDC itself. The relevant aspects related to the water sector are described below.

Energy Generation

- It targets the clean energy generation from approximately 1,400 MW to 15,000 MW, of which 5-10 % will be generated from mini and micro-hydro power, solar, wind, and bio-energy. In this commitment, of this, 5,000 MW is an unconditional target, and the rest is dependent upon the availability of funding and investments from the international and community.
- The commitment also includes ensuring that 15% of the total energy demand is supplied from clean energy sources.

Forestry Sector

- Maintain 45% of the total area of the country under forest cover including other wooded land limited to less than 4% by 2030.
- Manage half the Terai and Inner Terai forests and a quarter of the middle hills and mountain forests sustainably by 2030 including through the use of funding from REDD+ initiatives.

Waste

- A target of 380 million liters/day of wastewater is set to be treated before being discharged by the year 2025 as well as managing 60,000 cubic meters/year of fecal sludge. It is estimated that this will reduce about 258 gigagrams CO2 equivalent compared to business as usual.
- The current NDC further details the mitigation targets above to facilitate clarity, transparency, and understanding according to protocols.

4.5 ADAPTATION TARGETS

In the context of adaptation, the NDC primarily covers agriculture and climate-induced disasters. For this, the National Adaptation Plan is being considered. As discussed previously under NAP, Nepal intends to implement medium and long-term adaptation to address needs, including urgent and immediate priorities. Key adaptation timelines are:

- It will incorporate adaptation and resilience milestones to be achieved in the short-term (by 2025), medium-term (by 2030), and long-term (by 2050).
- Climate Information System will be established and operationalized by 2025.
- NAP Monitoring, Reviewing, and Reporting Framework will be developed and operationalized by 2022.

These adaptation targets and milestones will be stated in the NAP document which is still being prepared.

5 INTEGRATION OF CLIMATE ADAPTATION AND RESILIENCE IN WATER POLICIES

The government recently approved the National Water Resources Policy 2077 (2020) to contribute to sustainable and equitable management of water resources by adopting policies to minimize water-induced hazards and negative impacts on economic, social, and environmental aspects. The policy recognizes in the introduction part itself that both population growth and climate change will put greater pressure on our water resources. It also recognizes the increased risks from extreme weather and the receding snowline and increasingly melting glaciers are threats to our water supply spurred on by climate change.

It must be noted at the onset that the Water Resources Strategy 2002 and the ensuing National Water Plan 2005 both address environmental issues quite well but do not focus on or address climate change issues (MOFE, 2020).

The Water Resources Policy sets to "reduce water-induced disasters and carry out related water risks reduction" implying the threat of glacier lake outburst floods, landslide induced floods, as well as droughts and dry spells brought in by climate change.

It is well understood that when one has to deal with the uncertainties of climate change and changing patterns, the best management unit for water is at the basin level. One can prepare water assessments and prepare water budgets amongst different users including ecosystem requirements, allocate water as per priority set amongst the stakeholders and as mandated by law. The policy also provides for amending or revising the priority allocations if necessitated with changes in flows affected by climate change. These methods of adapting to scarcity are expressly stated in the current National Water Resources Policy.

This National Water Resources Policy 2077 integrates explicitly the climate adaptation and resilience activities. The strategic plan under strategy number 10 says that the government will carry out plans and programs for addressing climate change induced effects and impacts to control or mitigate them.

The Strategy 11 of the policy states that "water-induced disaster shall be controlled or reduced by effective management of the watershed." This strategy is being taken up through the action plan (number 11) which says that "To reduce the impacts of climate change measures such as collection of rainwater, construction of storage ponds, drip and sprinkler irrigation, lift irrigation, piped irrigation, tunnel farming and novel practices of artificial rain and virtual water technologies shall be adopted."

One of the methods of resilience and adaptation is flood zone planning, which is specifically laid out under the same strategy as above, and action plan 12, that flood and inundation mapping for each river shall be carried out to identify risk-prone areas and settlements and construction activities in such areas shall be prohibited. It also talks about capacity building at the national, provincial, and local levels.

It is also recognized that the Irrigation Policy (2013) can be considered as one of the key policies, strategies, and action plan that open avenues to build adaptive and resilience capacity to address climate change impacts in specific sectors (MOFE, 2020).

The latest policies in the water sector have well-integrated the concepts of adapting to climate change and resilience. These concepts and policy level statements need to be translated into actions with guidelines and standards. Our observations show that this translation of policy into real beneficial actions on the ground is slow and difficult to be realized in Nepal. The National Water Plan in 2005 had set out the direction for making policy changes to the water and related sector championing integrated water resources management, but the achievements have been far less than satisfactory. Leadership at the federal and provincial level is usually diverted to immediate priorities of governance and activities addressing concerns that have more visible and direct benefits rather than on

changing policies and directives which may take time to show dividends and meet resistance at first. Sensitization of issues and greater consultations amongst stakeholders is required on critical topics to energize the bureaucracy to address policy and legal issues that help establish a robust system and have long-term benefits. The government ministries and departments, therefore, need some assistance on these activities to bring them to the forefront for discussion and resolution.

6 KEY FINDINGS

This report has discussed the water resources policies, institutions and a review of the existing policies, strategies preceded with a background discussion on the resources of Nepal. This discussion and review manifest a few important findings, which can be classified in terms of the following.

6.1 MAJOR WATER ISSUE AND CHALLENGES

6.1.1 Water Resource Information

Extreme variable resource: There is extreme variability in rainfall in the basin areas and hence discharges in the rivers. The variability is in time (seasonality and temporal) as well as in location (spatial). The country may appear rich at times in terms of water but may be considered poor later when it is not available when needed. Different locations within Nepal are showing, on average, water-deficient areas and surplus areas. Deficiency here is defined in terms of whether the resource present in the areas or basins, is less than that required to irrigate suitable agricultural areas in the basin or sub-basin.

Unverified data/information: There is difficulty in obtaining quality data on water resources. Most of the information is mostly "passed on information" without peer review and audits. Information on rainfall discharge etc. is still missing or not reliable. We are still using data presented in reports prepared 25-30 years ago. We have a barrage at the outlet of the Kosi River into India and we are not sure what is the average discharge rate of the Kosi River! Available "passed on" information is not peer verified. We should have a better custodian of data, vetting information, updating reports and studies.

6.1.2 Resource Utilization

Extremely low usage: Despite having adequate water and plenty of need, Nepal has not been able to utilize this resource, it suffers from a low level of usage. Whether it is in terms of hydropower development or building irrigation systems, Nepal's results of engaging in this field for decades have neither delivered the goods nor the experience. It doesn't gain the external investors' confidence also.

Low investment capability: Water projects are large investment projects with long gestation periods and require longer payback times for repaying credits. Being a nation of low economic activity, the nation has a multitude of demands or "sinks" for fiscal resources that cannot be evaded. Garnering large funds for implementing larger projects is difficult as well as the disbursement and absorbing capacity of the economy also needs to be investigated.

Challenging environment: The physical terrain of Nepal is challenging which makes project implementation costly. Add on to this the prevalent red-tapism, multiple regulatory hassles (from counting trees for environmental clearance to obtaining import clearance for critical machinery and raw materials), the costs soon add up higher than what is prevalent in other parts of the world and the neighboring countries. We are a water resource-rich country and are using the costliest electricity in the South Asia region, even when our energy source is water, a renewable resource.

6.2 KEY ISSUES OF GOVERNANCE

6.2.1 Policy Problems and Implementation Dichotomy

Our goals and policies are well-intended but often lack the follow-through mechanism of implementation. Good intentions in policy are not being transformed into good infrastructure or service delivery in Nepal. Policies are not followed through, in tandem, with legal and institutional instruments such as well thought out action plans, guidelines, and operational manuals. Poor service delivery often emanates from unawareness of ones' impact on the program's end result as

well as lack of confidence and procedural difficulties in implementation. The government sector also lacks a sufficient number of well-designed guidelines and procedural directions in carrying out one's designated tasks. There is also a question of job satisfaction, a fair and transparent reward system.

6.2.2 New Governance Structure and Old Styles

Confusion within the three-tier system: The new constitution with federalism and the three-tier governance system is supposed to reduce the central hegemony and improve access to governance enhancing service delivery of the system. But this has instead resulted in greater confusion in terms of scope, authority, responsibility, and liability. Procedures have not been written or established yet and it all originates from the lack of clarity on who owns water, the river stretch, and the resource and problems associated. The provincial and local governing bodies also mimic older days of ruling with impunity and being unanswerable. Mechanisms to redress complaints, smooth out overlapping jurisdictions, and ironing out differences requires maturity of the system, as well as an accepted method of sharing costs and benefits, which is direly needed.

Service delivery needs improvement: Government service delivery is slow to transform, innovate and improve itself. The governance system needs to be responsive to citizen's demands and change to become more service-oriented. Capacity building of the government employees and building specialized teams for specialized tasks is required so that there exist capable employees who are service providers.

6.3 CLIMATE INTERVENTIONS REQUIRED

6.3.1 Uncertainties Need to be Conveyed with Certainty

Climate change has introduced uncertainties in the water sector in terms of availability or non-availability so that confusion exists on whether to carry on with business-as-usual approach or change it to better design solutions. Questions still remain on how can one become adaptive to change or be mitigating the change? These questions need to be answered with certainty and build the working attitude of the common employee as well as prepare a responsive population. Tools, informatics, and guidelines need to be developed or updated to include how to address climate change and the changes brought about by it. Basic training to people in planning, as well as those in the executing positions, should be given to mainstream their work performance.

6.3.2 Make Decisions Based on Science and Facts

Often misinformation and rumors help aggravate climate impacts. Understanding the basic science of the problem often leads to identifying potential solutions, methods, and instances to prevent these problems from happening. Mitigation measures can be designed from a common science-based approach and replicating or scaling out success stories from other areas. The importance of communication and knowledge documentation and sharing becomes important here. Here also, updated guidelines, operating procedures, manuals make it easier for policymakers, workers, and employees to make appropriate decisions based on some scientific basis. Interventions and change processes are costly and require resources, it is better to be analytical and logical in making the best decisions to move forward to make the best possible impact.

6.3.3 Suite of Adaptive Measures

A suite of adaptive measures is required which can be customized to local situations and settings. Floods or droughts cannot be prevented, in general, the damage from floods does occur, but we need to manage the risks so that losses are minimized. We need to adapt ourselves, our practices, and our development efforts. Adaptative measures can be in the form of prescriptive guidelines, for example, on preparing for floods and how to respond in times of flood to preparing better standards in the construction of levees and embankments, flow retarding mechanisms, etc. we could plan and build storage schemes to address drought and shortage of water. Even non-structural methods and interventions in land use planning to map out flooding zones, stating

probabilities or risks of flooding and utilize this information to categorize allocated areas to functions that can bear those risks. This can translate to not allowing hospitals and schools and important infrastructures in areas with higher risks of flooding and inundations. Flood zoning and land use planning policies could be developed for areas with high risks and vulnerability. A compendium of adaptive measures should be prepared so that the local authorities and trained personnel can identify the most suitable ones to adapt to their needs.

6.3.4 Suite of Mitigating Measures

Climate change can be tackled by mitigating the change as well as adapting to change. Mitigation processes require the adoption of climate-smart technologies and practices. The technological advances and products need to be made available and promoted in the market so that climate-smart decisions are made choosing products that prevent the release of greenhouse gases. Reduction in fossil fuel consumption, decreasing the carbon footprint and water footprint are all practices that help mitigate climate change. All countries have NDCs, which layout national commitments including mitigating measures. These state the targets to achieve and they also describe the methods to achieve them. A suite of such mitigating measures should be made related to climate change impacts on the water sector.

7 CONCLUSIONS

The water resources sector of Nepal is introduced in the report before going straight to review the policies and legislations to gain an understanding of the scope and magnitude of the nation's resources to help better understand the policy and legal aspects of water resources development and management. The water resource sector is viewed as a critical partner to help achieve national goals of economic development, poverty alleviation, food security, public health and safety, decent standards of living for the people, and protection of the natural environment

The water resources of Nepal demonstrate a spatially and temporally varying nature which arises from different climatic systems posing unique problems and opportunities for its development and management. The country has good water resources potential but it is present with a wide spatial and temporal variability. The country is rich in groundwater with good recharge zones and aquifers in the Terai region.

A review of the water sector policies and other related documents was carried out. More than 80 official documents (policies, plans, strategies, acts, etc.) were reviewed with some in greater detail for those directly related to water resources. The National Water Resources Policy 2020 was recently released with the goal "to sustainably conserve, manage and to carry out multipurpose development of the available water resources contributing to the economic prosperity and social transformation of the country." It adopts the principles of IWRM and the river basin organizations to advance the management of these important resources. It was found that the province-level governments are still behind in forming legislation or regulations related to water and following the inherited policies or newly enacted federal policies.

The key findings illustrate that there are issues in both availabilities of information and the extent of utilization of the resources available. Reliable and accurate data to plan and implement water sector activities are not available. The distribution of water resources is highly variable in season and location and thus requires finer resolution data with greater accuracy and reliability to quantify water availability or determine the extent of the deficit. The amount of water used is still small compared to the annual availability signifying the inability to use the resource and capitalize on its presence. This is a classic case of low resource utilization, accruing low benefits and again minimizing the capacity to utilize further due to the absence of sound policies, transparent procedures, and unifying consensus on the use of the critical resource.

Problems of governance in water emerged in this review with the issues of policy and implementation on the ground level. Our goals and policies are well-intended but mostly lack the follow-through mechanism of implementation. Good intentions in policy are not enough, it needs to be translated to good infrastructure or service delivery. Policies are not followed through, in tandem, with legal and institutional instruments such as well thought out action plans, guidelines, and operational manuals.

It was seen that climate-related interventions are required in the water resources development sector so that the uncertainties are conveyed with more conviction, decisions are made based on facts and science adopting both mitigating and adaptive measures. Often solid foundation works to build upon and inform decision-makers into making suitable policies, guidelines and operational procedures are missing. Decisions based on populistic and opportunistic modes do not benefit the citizens and the institutions.

In terms of climate-related policies and the water sector, a portfolio of adaptive measures and mitigating measures with descriptive notes on prescriptive situations is to be prepared so that efficient responses and benefits are offered by the government.

8 RECOMMENDATIONS

All efforts in water sector development should be geared towards achieving the goal "to sustainably conserve, manage and to carry out multipurpose development of the available water resources contributing to the economic prosperity and social transformation of the country."

It is recommended that the nation, in all of its governance systems, be proactive to the challenges imposed by climate change by adopting science-based decision-making systems in its policies. Though the country's policies do appear responsive overall, they need to be translated with proper action plans to be more sustainable and climate-resilient and fulfill our obligations to future generations. It is evident from the review that the following need to be the priority areas of action for better development and management of its water resources.

- To build a legal system for the development of water resources and management delineating the power and responsibility of the federal center, province, and local level as directed by the constitution.
- To address seasonal fluctuations and spatial shortages adopt suitable strategies, e.g., water harvesting or interbasin transfers, to provide sufficient and sustainable availability of water in an adverse situation likely to be caused upon the water resources sector and the whole natural ecosystem due to climate change.
- To develop sustainable and quality infrastructure to address problems of adverse geological conditions, complex landforms, and enhancing water conservation and efficiencies.
- To extend and upgrade hydro-meteorological measurement system to ensure that more reliable information is available for planning and designing in the water resources sector and irrigation.
- To adopt a river basin approach in managing water resources with integrated planning, water accounting and auditing mechanisms.
- To maintain the sustainable utilization, recharge, and quality standards of groundwater resources.
- To maintain a consensus among the various stakeholders, and particularly the stakeholders at decision-making levels, concerned with the development and management of water resources;
- To garner the required capital for the development of the water resources sector;
- To maintain cooperation and collaboration with the riparian countries primarily focusing on a framework agreement and understanding the bilateral relations.

To train and build capacity in being more responsive to climate change, enable capacities to advocate for, plan and implement the above recommendations as well as enhancing capacities for international or bilateral negotiations with proper analyses, bargaining, and dialogue.

9 LINKAGES AND ALIGNMENT WITH CARE PROJECT INTERVENTIONS

CARE for South Asia project's broader and specific objectives will bring synergies in both the National Water Resources Policy 2020 and Climate Change Policy 2019 with a particular emphasis on developing tailored strategies for water conservation and integrated water resources management. This project's activities and the policies, in terms of the water sector, are underpinned by adopting the basin approach in integrated water resources management.

(SEE CARE introductory brochure and strategy documents)

In addition, the Climate Change Policy 2019 of Nepal envisions a country spared from the adverse impacts of climate change by optimizing economic, social, and environmental returns on water resources. The policy aims to ensure strategies and measures that will lead to an adaptive techno-economic plan involving the interaction of water, land use, ecosystem, and climate change with development outcomes. Protection of water resources, besides development and expansion of rainwater harvesting and storage, are envisaged as important contributors to development.

The CARE for South Asia undertakes the following, which is in tune with the water sector and climate change policies of Nepal.

- Envisages training and capacity building
- Science and fact-based decision making
- Promotes stakeholder engagement and consultation in the formulation of action plans

As it has been discussed above, the water sector activities of the CARE for South Asia project will be ensuring excellent stakeholder consultation with the line agencies and ministries that are involved in the climate change and water sectors with the establishment of sector focal persons and contact points, participation in discussion and "formulation of the way forward" activities to coalesce our activities and eventually let the government agencies own the product.

Water is the most-cited pathway through which all countries experience climate impacts. The water sector is also often the most prioritized sector through which countries seek to build resilience in their economies, their populations' livelihoods, and their natural ecosystems. (GWP, 2019)

In the water sector, the CARE for South Asia project's identified major activities in Nepal is the following that has clear linkages with the governments' priorities.

- Support the water harvesting strategy development in the context of the Integrated Water Resource Management (IWRM) framework. The activity will include a comprehensive analysis of the national approach on IWRM in Nepal as it is one of the main areas of the recently approved policies on water resources and climate change as well as features predominantly in the tabled Water Resources Bill. It will also identify needs and issues related to water harvesting in Nepal by supporting the government in developing a water harvesting strategy that will cater to both the agriculture and energy sectors of the country. A digital water atlas for Nepal will be developed as part of the initiative.
- Conduct workshops and dialogues on water, food, and energy security and develop a policy brief based on the outcome of the workshops and national dialogues with key stakeholders.
- Support the development of guidelines through active participation of government stakeholders to decide on technical support in the priority areas e.g. drought management, water demand and supply, and local level water conservation and management, which will

fulfill the objectives of the recently approved Climate Change Policy and Water Resources Policy. Scientific papers and policy briefs will be developed as part of this activity.

- Capacity building to increase understanding of climate-resilient adaptive policy-making, design, and solutions in the water sector. The activity will focus on strengthening the capacity of organizations in the water and agriculture sectors. In addition, efforts will be put together to make ensure effective utilization of climate and hydrometeorological data for planning and investment design of water sector programs in the context of IWRM. The activity will consist of detailed training needs assessment, development of training modules, and setting up of a pool of master trainers for the long-term sustainability of the nationwide training efforts.

9.1 EXPECTED OUTCOMES FROM CARE FOR SOUTH ASIA PROJECT (NEPAL)

The project's uniqueness lies not only in supporting the government's policies on climate change through national and regional dialogues, pilot concepts, and capacity enhancement of stakeholders at all levels, but also in mainstreaming potential interventions into plans, policies, and investments for a more climate-resilient future.

The water harvesting strategy for Nepal will enable better management of surface and groundwater resources and support in envisaging the integrated approach of water resources management.

The national dialogues will foster communication and understanding across different stakeholders and reach common ground on policies or instruments that will help towards better programs to ensure water, food, and energy security as well as support in the development of guidelines to fulfill the objectives of the water and climate change policies of the government.

The capacity development efforts will enable stakeholders to understand the scientific information generated as part of technical support and translate these to water management and development and adopt investment strategies to accelerate climate-resilient water resources development.

REFERENCES

Baral T. 2012. Evapotranspiration from Natural and Planted Forest in the Middle Mountains of Nepal. M.Sc. Thesis, University of Twente, The Netherlands.

CBS, 2012. National Population and Housing Census 2011 (National Report). Central Bureau of Statistics, National Planning Commission, Government of Nepal, Kathmandu.

CBS, 2019. Environmental Statistics of Nepal 2019. Central Bureau of Statistics, National Planning Commission, Government of Nepal, Kathmandu.

Eckstein, D., Künzel, V., Schäfer, L. and Winges, M., 2019. Global climate risk index 2020. Bonn: Germanwatch.

FAO. 2011. AQUASTAT Country Profile – Nepal. Food and Agriculture Organization of the United Nations (FAO). Rome, Italy.

GoN, 2020. Second Nationally Determined Contributions, Government of Nepal, Kathmandu, Nepal.

GWP, 2019. Addressing Water in National Adaptation Plans-water supplement to the UNFCCC NAP technical guidelines. Second Edition, April 2019, Global Water Partnership.

ICIMOD. (2014). Land cover of Nepal 2000 [Data set]. ICIMOD. https://doi.org/10.26066/rds.19590

IMP, 2019. Irrigation Master Plan Preparation through Integrated River Basin Planning. Water Resources Project Preparatory Facility, Department of Water Resources and Irrigation, Ministry of Energy, Water Resources and Irrigation, Nepal.

Japan International Cooperation Agency (JICA). 2012. Review of Food Production and Agriculture in Terai–JICA's Support Strategy. Kathmandu.

Khan, 1996. Management and Sharing of the Ganges. Natural Resources Journal, 36(3), 455-479. Retrieved Feb 02, 2021, from http://www.jstor.org/stable/24885859

Kumar DM, Dhungel DN, Mirza MNQ and Suhardiman D, 2016. Institutions and Policies Governing Water Resources Management, in The Ganges River Basin Status and Challenges in Water, Environment and Livelihoods, Ch 14, Part 3. Ed. Luna Bharati, Bharat R. Sharma, Vladimir Smakhtin, Routeledge.

MOF, 2018. Economic Survey 2017/18. Ministry of Finance, Government of Nepal, Kathmandu.

MoFE, 2019. Climate Change Scenarios for Nepal for National Adaptation Plan (NAP). Ministry of Forests and Environment, Kathmandu.

MOFE, 2020. A Report on Proposed Revisions of the Selected Policies, Strategies and Plans to Integrate Adaptation to Climate Change. Ministry of Forests and Environment (MoFE), Government of Nepal.

MOPE, 2016. Nationally Determined Contributions. Ministry of Population and Environment, Government of Nepal.

National Research Council 2012. Himalayan Glaciers: Climate Change, Water Resources, and Water Security. Washington, DC: The National Academies Press. https://doi.org/10.17226/13449.

Qing-Long You, Guo-Yu Ren, Yu-Qing Zhang, Yu-Yu Ren, Xiu-Bao Sun, Yun-Jian Zhan, Arun Bhakta Shrestha, Raghavan Krishnan, 2017. An Overview of Studies of Observed Climate Change in the Hindu Kush Himalayan (HKH) region. Advances in Climate Change Research, Volume 8, Issue 3, Pages 141-147. https://doi.org/10.1016/j.accre.2017.04.001

Shrestha, B.N., 2012. Rivers of Nepal. Border Nepal. https://bordernepal.wordpress.com/2012/06/06/rivers-of-nepal/. Accessed 08 April, 2021.

UNDESA, 2019. World Population Prospects: The 2019 Revision. Rev 1. New York. https://population.un.org/wpp/. Accessed 28 February 2021.

UNESCO, UN-Water, 2020: United Nations World Water Development Report 2020: Water and Climate Change, Paris, UNESCO.

WB and ADB, 2021. Climate Risk Country Profile: Nepal (2021): The World Bank Group and the Asian Development Bank.

WECS, 2005. National Water Plan, Water and Energy Commission Secretariat, Kathmandu.

WECS, 2011. Water Resources of Nepal in the Context of Climate Change. Water and Energy Commission Secretariate, Kathmandu, Nepal.

WECS, 2013. Nepal's Energy Sector Vision 2050 AD. Water and Energy Commission Secretariate, Kathmandu, Nepal.

WECS. 2003. Water Resource Strategy Nepal. Water and Energy Commission Secretariat, Kathmandu, Nepal.

World Bank, 2014. Ganges Strategic Basin Assessment: A Discussion of Regional Opportunities and Risks. The World Bank, Washington DC, USA.

ANNEXURE: LEGAL INSTRUMENTS RELATED TO WATER SECTOR

The following legal instruments demonstrate the landscape of legal and policy provisions in Nepal.

S.N.	Legal Instruments	Key Provisions Related to Water Sector
Policy		
1.	Hydropower Development Policy (HDP), 1992	Rendered assistance in the conservation of environment by supplying clean energy through the development of hydroelectric power. Extend the use of electricity for making the minimum utilization of fuelwood and to render necessary assistance in the conservation of forest and environment. To minimize the environmental hazards construction or operation of hydroelectric project shall be made in such a way that it would have minimum adverse effect on the environment. This policy is superceded by a newer one in 2001 described below.
2.	The Hydropower Development Policy, 2001	Stressed on environmental protection while developing hydro projects. Policy includes environment protection by developing hydropower as an alternative to biomass and thermal energy and to mitigate of adverse environmental impacts likely to result from the operation of hydropower projects, appropriate provision shall be made to resettle the displaced families. EIA study report shall be made in the project to govern the environment-related matters during the construction of hydropower projects. Provision has made to release at least ten per cent of the minimum monthly average discharge of the river/stream or the minimum required as identified in the EIA study report.
3.	Forest Policy, 1993	Stressed on contribute food production through effective interaction between forestry and farming system, to protect land against degradation by soil erosion, landslide, and other effects of ecological disturbances, and to conserve ecosystem and genetic resources. Re-emphasizes to avoid forest destruction or tree cutting while constructing infrastructures during implementation of project other than forest sector. Prioritized the protection of Siwalik, the geologically vulnerable area, with a view to ensure watershed conservation, and maintenance of water recharge. The policy also stresses conservation of endangered species. Emphasizes the implementation of community and private forestry development, Programs, national parks and conservation areas management programs, soil and watershed conservation program, management and development of medicinal plants, and conservation of biological diversity.

S.N.	Legal Instruments	Key Provisions Related to Water Sector
4.	Climate Change Policy, 2011 (Superceded now)	Improve livelihoods by mitigating and adapting to the adverse impacts of climate change, adopting a low-carbon emissions socio-economic development path and supporting and collaborating in the spirits of country's commitments to national and international agreements related to climate change. Requires allocating more than 80 percent of the total climate change fund for field level activities. This has been superceded by the Climate Change Policy.
5.	Land Use Policy, 2015	Categorize or classify entire lands of the country into various Land Use Zones (LUZs), devise of level wise (Federal, Provincial and Local) Land Use Plans (LUPs) and to ensure of the use of Land and Land Resources(LLRs) on the basis of land use plans (LUPs) for protection of agricultural land, hygienic, beautiful, well-facilitated settlement and sustainable urbanization, and for forests areas including natural heritages, biodiversities and historical, cultural and religious, archaeological and areas of strategic importance. In further, it has addressed issues such as to mitigate natural and human created-disastrous hazards and to assess and apply minimum property valuation and progressive tax system on lands on the basis of specific use after getting prepared of plot-based records. Land-use change management is great importance in nature conservation. Entail to formulate in a coordinated way by ensuring the participation of government and public agencies as well as the private sector by linking productivity, environmental balance and conservation, social and economic prosperity and poverty alleviation to be linked.
6.	Rural Energy Policy, 2004	Cautioned on environmental degradation and stressed on developing environmentally friendly energy resources and emphasizes on environmentally friendly rural energy technology.
7.	Rural water supply and Sanitation National Policy, 2004	Stressed on safe, accessible and adequate water supply and sanitation.
8.	National Agriculture Policy, 2004	Envisioned that agricultural sector shall be to bring about an improvement in the standard of living through a sustainable agricultural development to be achieved by transforming the current subsistence-oriented farming system into a commercial and competitive farming system. Policy obliged that natural resources, as well as the environment and bio-diversity, shall be conserved, promoted and properly utilized.

S.N.	Legal Instruments	Key Provisions Related to Water Sector
9.	Irrigation Policy, 2013	Recommended an optimal use of water resources in providing round the year irrigation services to the cultivable areas as far as possible. Identified that the project/system shall be completed by minimizing the negative effects on the environment in the course of construction of the project/ system. Necessary public awareness campaign shall be increased at the governmental, non-governmental and local level in this regard. The environmental impact evaluation (IEA) or preliminary environment examination (IEA) shall be conducted as per necessary under the prevailing law through public hearing in connection with the negative impact on the environment from the project. This Policy has been superceded by a new policy described in the main text.
10.	Water-induced Disaster Management Policy, 2015	Emphasized that water-induced disaster management programs to be aligned with IWRM principle and the river basin development concept; to align with integrated river basin development and conservation and a master plan at national level and at local level to be formulated; and to be prioritized according to short term, medium term and long-term perspective and implemented with active community participation.
11.	Land Acquisition, Resettlement and Rehabilitation Policy, 2015	Enacted to facilitate the land acquisition process for infrastructure project. Outlines the need to conduct an economic and social impact assessment of the development project despite existing Land Acquisition Act is lacing of these issues. Adds all expenses related to land acquisition, compensation and the implementation of resettlement and rehabilitation plans should be considered as project cost. Underlines that compensation amount entails to provide as per market rate to the displaced. Provisioned to act against from Goon to those disrupting land acquisition processes or create hurdles for project developers that have acquired land by the due process of law.
12.	Public-Private Partnership Policy, 2072	The policy aims to increase private participation in development of the infrastructure sector by adopting policies to attract the private sector and create a win-win situation that can be rewarding for both public and private sectors. To promote PPP related current principles and norms of international standards in all feasible areas, apparatus, organs and entities of the state. To create conducive atmosphere for investment of additional capital, means and resources required for the development, reconstruction, management and operation of infrastructure services from private (domestic and foreign) sector. To make optimal utilization of professionalism, entrepreneurship, ability, competency and latest technologies of private (domestic and foreign) sector in the development, reconstruction, up-gradation, operation and management of infrastructure services for country's overall development.

S.N.	Legal Instruments	Key Provisions Related to Water Sector
13.	Draft Water Resources Policy-	Entail three different level of government to ensure clarity in the role and responsibilities along with WECS through legal instruments, policy measures and institutional support.
Strategy		
14.	National Energy Strategy of Nepal, 2013	Need for simplification of EIA for small hydropower projects, recommended to make simpler and differentiate the time frame for EIA for small, medium and big hydro power plants.
15.	Rural water supply and Sanitation National Strategy, 2004	Environmental appraisal/screening for implementing projects, procedures to be prepare to minimize environmental damage, public participation while screening the projects.
16.	Agriculture Development Strategy (2015-2035)	A self-reliant, sustainable, competitive, and inclusive agricultural sector that drives economic growth and contributes to improved livelihoods and food and nutrition security leading to food sovereignty. Improved Resilience of Farmers to Climate Change, Disasters, Price Volatility, and Other Shocks
Act		
17.	Aquatic Protection Act, 2017	Provisioned on the protection of aquatic animals. Provides legal protection of the aquatic animals and their habitats. Prohibited application of harmful fishing gears such as explosives, poisonous chemicals, and electric rod as well as hunting of waterfowls and destruction of water resource development related infrastructures. Permits only the use of safe pesticides in case any poisonous substance recommended by technical officer is to be used for catching aquatic life.
18.	Civil Code, 2017	Restricted to use entire water stream or polluting water originates from personal property and entail to minimum stream flow to downstream level from river, irrigated lands are ensured regular access of water and new canals shall not reduce substantial water flow to irrigated field.
19.	Criminal Code, 2017	Pollution to the environment fall under criminal code. Environment should not be polluted and everyone is entitled not to make significant adverse effects in the environment. Harmful waste is strictly forbidden with imprisonment and monetary fines.
20.	Consumer Protection Act, 1999	Protect consumers from irregularities concerning the quality, quantity and prices of consumer goods or services, ensuring that no one lowers or removes the attributes or usefulness of consumer goods or services, safe and quality consumer goods or services, and protecting the rights and interests of consumers.
21	Development Board Act, 1956	Provisions for the expeditious and smooth execution of development plans and development. Based on this formation order has been executed for energy, hospital and etc.
22.	Disaster Risk Reduction and Management Act, 2017	Provisioned for disaster management policy, plan and strategy approval and implementation by doing disaster cycle management—preparedness, response, recovery and mitigation.

S.N.	Legal Instruments	Key Provisions Related to Water Sector
23.	Electricity Act, 1992	Governs the use of water for hydropower production and establishes a system of licensing. Sets out the powers, functions and duties of a license holder also provides certain financial incentives for license holders.
24.	Electricity Theft Control Act, 2002	Provisioned for controlling electricity theft.
25.	Environment Protection Act, 1997	The Environment Protection Act, 1997 of GoN contains several legal provisions to institutionalize the integration of environmental concerns in development projects including road sector, and empowers the Most to approve EIA reports. Similarly, in case of IRE level study, the line Ministry, which is Ministry of Physical Infrastructure and Transport (MoPIT) for the proposed Project, is authorized to approve the final IEE Report. Major highlights of the EPA, 1997 are as follows: • Recognizes the interdependence between development and the environment and shows the concerns for minimizing the impacts of environmental degradation on people, animal, and plant species and their physical surroundings, • Obliges the proponent to undertake IEE and EIA of proposal, plans or projects which may cause changes in existing environmental condition and authorizes the then MoSTE to clear all EIA and line ministries for IEE study, • Empowers the MoSTE to prohibit the use of any matter, fuel, equipment or plant, which has adverse effects on the environment, • Compensate affected persons from polluting activities/ polluters, • Empowers government to provide additional incentives to any industry, occupation, technology or process, which has positive impacts on environmental conservation, • Establishes an Environmental Protection Fund to be used for environmental protection, pollution control and heritage conservation, and • Gives the government authority to declare specific area as environmentally protected area.
26.	Essential Commodity Protection Act, 1955	Identified as drinking water an essential commodity and strictly protects drinking water and prohibits any unauthorized use or misuse, stealing, damaging etc. of drinking water.
27.	Foreign Investment and Technology Transfer Act, 1992	Promotes foreign investment and technology transfer for making the economy viable, dynamic and competitive through the maximum mobilization of the limited capital, human and the other natural resources.

S.N.	Legal Instruments	Key Provisions Related to Water Sector
28.	Forest Act, 1993 Repealed by the Forest Act 2019	Requires decision makers to take account of all forest values, including environment services and bio-diversity, not just production of timber and other commodities. The basis of Act is resource oriented rather than use-oriented. Contains several provisions to ensure the development, conservation, management and sustainable use of forest resources, based on an approved work plan. The work plan should contain a list of activities that should be implemented in the different forest categories; national, community, leasehold, private, and religious forests. Empowers the government to delineate any part of the national forest, which has 'special environmental, scientific or cultural importance', as a protected forest. Forest Act to provide parts of any type of forest for the implementation of a national priority plan with the assurance that it does not adversely affect the environment significantly. Superceded by the Forest Act 2019.
29.	Soil and Watershed Conservation Act 1982	The Soil and Watershed Conservation Act 1982 has a legal arrangement to conserve soil and watershed by controlling natural hazards like flood, landslide and soil erosion.
30.	Inter-governmental Fiscal Management Act, 2017	Intergovernmental Fiscal Management Act, the central government is required to give 15 percent of the VAT and excise duty collected natural resources such as electricity, mines and mineral and water and other natural resources to the local government, and another 15 percent to the provincial governments.
31.	Investment Board Act, 2010 (repealed by PPP Investment Act, 2019)	To promote foreign direct investment and streamline government procedure the Investment Board was formulated. This Act has been recently superceded by the Public Private Partnership Act. And Investment Act 2019.
32.	Industrial Enterprises Act, 1992	Requires permission for the extension and diversification of environmentally sensitive industries. Provides financial incentives for industrial enterprises that minimize harmful effects on the environment.
33.	Land Acquisition Act, 1977	Empowers the government to acquire land for public purposes, by providing compensation for the private land and properties, as determined by the Compensation Fixation Committee. Government can acquire land at any place in any quantity by giving compensation, for the land acquired for any public purpose or for operation of any development project initiated by government institutions (Section 3 and 4). The power given under these sections are very broad as government is empowered to acquire any land in the name of public works.
34.	Land Revenue Act, 1978	Enacted Act to collect and recovery of the land revenue and to make some additional provisions on cultivation of land.

S.N.	Legal Instruments	Key Provisions Related to Water Sector
35.	Local Government Operation Act, 2017	Local government are empowered under the heading of additional functions, duties and powers to formulate land use plan and policies, action plan and implementation as per federal and provincial level laws and regulations. For the relating to environmental conservation and ecological diversity issues, under the Sub-section 2 (j), Section 11, functions, duties and roles of local government has been empowered to work on (12) to prepare environmental conservation, ecological diversity related policy, law, standard, plan formulation, implementation, monitoring and regulation, (13 &14) reducing local level environmental hazard and pollution (15) solid waste management (17) conservation and protection of green areas, and (19) local level environmental protection by determining of environmental protection areas. Moreover, relating to water resources, wild life and minerals (p) entails to be preserved and protected by the local government. Under the Subsection (4) forest, wildlife, water uses, environment, ecological diversity has been empowered under local government subject to central and provincial laws and regulation.
36.	Natural Resources and Fiscal Commission, 2017	National Natural Resource and Fiscal Commission shall devise a formula for the distribution of grants, revenues and royalties to subnational governments. Duties has including natural resources protection, makes decision on uses of natural resources among central, provincial and local government.
37.	Nepal Electricity Authority Act, 1984	Enacted legislation for the establishment and management of the Nepal electricity Authority to make arrangements for power supply by generating, transmitting, and distributing electricity in an efficient, reliable and convenient manner.
38.	Nepal Water Supply Corporation Act, 1989	Establishment the Nepal Water Supply Corporation as an autonomous government-controlled corporation responsible for the supply of drinking water. Prohibits certain acts and provides penalties/punishment for violation.
39.	Public Private Partnership and Investment Act, 2019	As a majority of the infrastructure projects implemented by Investment Board Nepal are being developed under the public-private partnership model, the government recently introduced this new law replace the existing Investment Board Act. The Act is sets the role of the Public-Private Partnership Centre at Investment Board of Nepal is to identify projects, manage public financing, control and oversee public-private partnership projects, develop a public-private partnership framework, advise and support agencies to implement public-private partnership projects, act as a knowledge centre and, in some cases, also work as a project bank. The Investment Centre will promote Nepal as an investment destination besides providing investment approvals. This Act repeals the Investment Board of Nepal Act.

S.N.	Legal Instruments	Key Provisions Related to Water Sector
40.	Ship Registration Act, 1971	Provisioned for the registration of ships of Nepal ships travelling at sea
41.	Water Supply Management Board Act, 2006	Enacted to establish and operate the Water Supply Management Board on making proper and effective, reliable services to the residents of the municipal areas by making water supply and sanitation services regular, managed, qualitative and easily available.
42.	Water Supply Tariff Fixation Commission Act, 2006	Establishment of the Water Tariff Fixation Commission for the protection of the Interests of consumers by providing qualitative and reliable water supply and sanitation service to the consumers at a reasonable price, by fixing the tariff of water supply and sanitation service.
43.	Water Tax Act, 1966	Mo manage modus operandi of recovering the amount of the water tax leviable
44.	Nepal Electricity Regulatory Commission Act, 2017	A regulating body for energy sector and has been designed to regulate the quality and safety of the respective business practices. Has a duty to regulate tariffs for retail and wholesale levels. Has to aim at providing access for transmission and distribution sector, so that unbundling process moves smoothly on those sectors.
45.	Draft Water Resources Act-	New draft Act entail to address following; • Set rights and accountability provisioned at Constitution of Nepal relating to water resources use to federal, provincial and local level; • River basin boundaries entitled does not fall under provincial or local jurisdiction • Stressed on optimizing benefits from each river basin, an integrated approach leading to multipurpose projects under IWRM is required to different level of government (s).
Rule(s)		
46.	Drinking Water Rules, 1998	Regulates the use of drinking water. Provides for the formation of Drinking Water User Associations and sets out the procedure for registration, deals with licensing of use drinking water and deals with the control of water pollution and maintenance of quality standards for drinking water. Sets out the conditions of service utilization by consumers. Provides for the acquisition of house and land and compensation.
47.	Drinking Water Service Charge (Recovery) Rules, 1994	Provisioned for water connection/access, meter reading, rate of water etc.
48.	Electricity Tariff Fixation Rules, 1994	Formation of tariff fixation commission, meeting procedures of commission
49.	Electricity Rules, 1993	Provisioned procedure for obtaining a license and powers, functions and duties of license holders. Process of acquisition of house and land and compensation.
50.	Electricity Leakage Control Rules, 2002	Investigation and Inquiry, Assessment of Unit of Stolen Electricity, provisions of fines

S.N.	Legal Instruments	Key Provisions Related to Water Sector
51.	Environment protection Rules, 1997	Contains the elaborative provisions on the process to be followed during the preparation and approval of projects requiring EIA and IEE including scoping document, terms of reference, information dissemination, public consultation and hearing, and environmental monitoring and auditing. EPR calls for the public consultation prior to the preparation of scoping document and ToR and public hearing prior to the approval of EIA Report.
52.	Irrigation Rule, 2000	Deals with Irrigation Water User Associations and the transfer of projects to Irrigation Water User Associations. Deals with Irrigation and River Control Committee. Sets out the conditions of service utilization. Sets out the obligations of user of irrigation and provides for service charges. Deals with the protection, repair and maintenance of irrigation systems. This rules will need to be revised to enable the new Water Resources Policy 2020, even the Irrigation Policy was renewed in 2013 after this rule.
53.	Rafting Rule, 2006	Prevails rafting entrepreneurship for conducting rafting business. Rafting Business has been Restricted for doing business without License or without getting license. Provisions related to the environmental clearing and waste management to make responsible for license holder entrepreneurs.
54.	Water Resources Rule, 1993	An umbrella Rule governing water resource management. Sets out the procedure to register a Water User Association and to obtain a license. Establishes the District Water Resource Committee. Sets out the rights and obligations of Water User Associations and license holders. Deals with the acquisition of house and land and compensation.
55.	Pesticide Rule, 1994	Provisioned for import, export, production, purchase, sale and use of the pesticides.
56.	Solid Waste Management Rules, 2013	Local government is responsible for segregation and discharge of the solid wastes and made responsible everyone for harmful wastes.
Guidelines /Directives/Manuals/ Working Procedures		
57.	National EIA Guideline 1993	National EIA Guidelines were endorsed by Government in September 1992 and gazetted in June 1993. The guidelines also provide clear directions on how EIAs are to be conducted in Nepal and specify responsible agencies. These guidelines were developed in the process of establishing a national system of EIA in Nepal.
58.	Guidelines for Study for Hydropower Projects, 2003	Recommended PFS/FS for IEE and EIA under EPA/EPR, developed guidelines for hydrological and sediments study, energy computation and benefit assessment.
59.	National Drinking water quality standard, 2005	Standard has fixed parameter of rural surface water system as well as rural ground water supply system.

S.N.	Legal Instruments	Key Provisions Related to Water Sector
60.	Drinking Water Service Operation Directive, 2012	Directives to regulate water supply providers, monitoring and evaluation, ensuring of water quality, regular access, transparency and accountability applicability to service providers.
61.	EIA/IEE Working Procedure for Hydropower and Transmission Lines, 2016	Enacted Guidelines for simplifying EIA process under Electricity Rules, 1993.
Treaties and bi-lateral Minutes		
62.	Treaty Between Government of Nepal and The Government of India concerning the Integrated Development of the Mahakali Barrage Including Sarada Barrage, Tanakpur Barrage and Pancheshwar Project, 1996	Determined to development of water resources, Realizing the desirability to enter into a treaty on the basis of equal partnership to develop water resources and its utilization, Nepal and India had entered into an arrangement for the construction of the Sarada Barrage in the Mahakali River, whereby Nepal is to receive some waters from the said Barrage.
63.	Revised Agreement between Government of Nepal and The Government of India on The Koshi Project, 1975	India was desirous of constructing a barrage, headworks and other appurtenant works about three miles upstream of Hanuman Nagar town on the Kosi River with afflux and flood banks, and canals and protective works on land lying within the territories of Nepal for the purpose of flood control, irrigation, generation of hydro-electric power and prevention of erosion of Nepal areas on the right side of the river, upstream of the barrage.
64.	Agreement between Government of Nepal and the Government of India on the Gandaki Irrigation and Power Project, 1959	Nepal and India to construct a barrage, canal head regulators and other appurtenant works about 1,000 feet below the existing Tribeni canal head regulator and of taking out canal systems for purposes of irrigation and development of power.
65.	Minutes of the First Meeting of India - Nepal Joint Standing Technical Committee (JSTC), held on 8-9 December, 2008 at New Delhi.	Joint Standing Technical Committee was constituted to rationalize technical committees and sub-committees that are existing between India and Nepal related to flood management, inundation problems and flood forecasting activities besides projects specific committees on hydro power.
Orders		
66.	Formation Order of Water and Energy Commission, 1992	Review the multipurpose, mega and medium scale water resources projects before endorsed by the GoN, and recommend for their implementation as well. Formulate and cause to formulate on necessary policies and strategies conducting study, research, survey and analysis with regard to various aspects of water resources and energy development in keeping with priorities and targets of the GoN. Analyze the bilateral or multilateral projects relating to the development of water resources and energy, to formulate policies and to review the detailed study and analysis of such projects. Enact and causes to enact the necessary laws pertaining to the development of water resources and energy. Establish and causes to establish the coordination among national and sectoral policies relating to water resources and energy sector.

S.N.	Legal Instruments	Key Provisions Related to Water Sector
67.	Formation Order on reformation of National Water Resources Development Council, 1997	Council reformed for maximize use of water resources and bring economic prosperity to public and establish effective coordination among government agencies and reforming water resources related policies.
68.	Formation Order of Melamchi Drinking Water Committee, 1998	Committee has roles and responsibility including implementing project on public, domestic, industrial, environmental or availability of other uses of drinking water in Kathmandu valley
69.	Formation order of Rural Drinking water and sanitation Fund, 1996	Fund has been established to maintain water related project sustainable, cost effective and committee to support through economical, technical and institutional means.
70.	Formation order of Electricity Development Committee Fund, 2002	Fund has been established to arrange fund to develop hydropower project, promoting private investment, issue loan to identified hydro project, fund management; mobilization, operation etc.
71.	Formation order of Groundwater Resources Development Board, 1975	Formed Order under Development Board Act, 1956 responsible for identification of groundwater potential area, policy formulation, planning and advisory services.

Asian Disaster Preparedness Center
SM Tower, 24th Floor, 979/66-70 Paholyothin Road,
Phayathai, Bangkok 10400 Thailand

Tel: +66 2 298 0681-92
Fax: +66 2 298 0012
Email: adpc@adpc.net

www.adpc.net
Asian Disaster Preparedness Center - ADPC
@ADPCnet
Asian Disaster Preparedness Center (ADPC)