WEPA Water Environment Partnership in Asia
アジア水環境パートナーシップ

Updates of Water Environment Governance in Nepal

Jaya Ram Prajapati

Water and Energy Commission Secretariat

Singhadurbar, Kathmandu, Nepal

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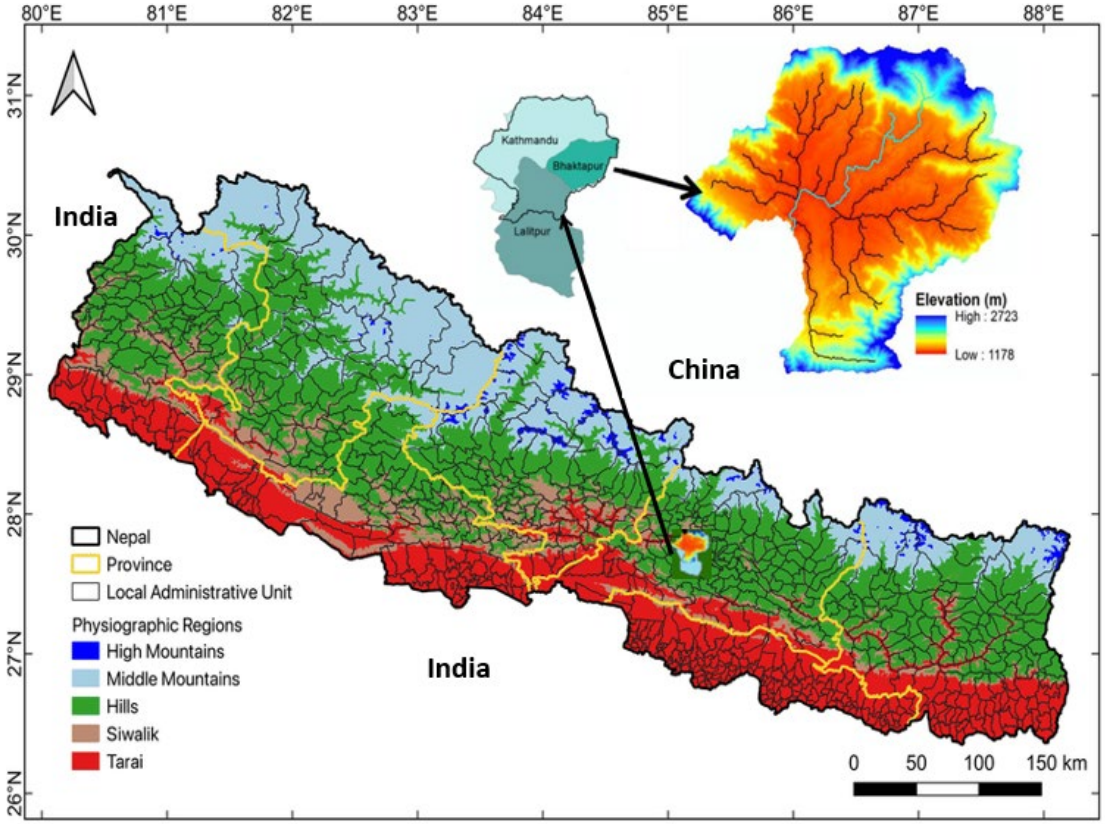
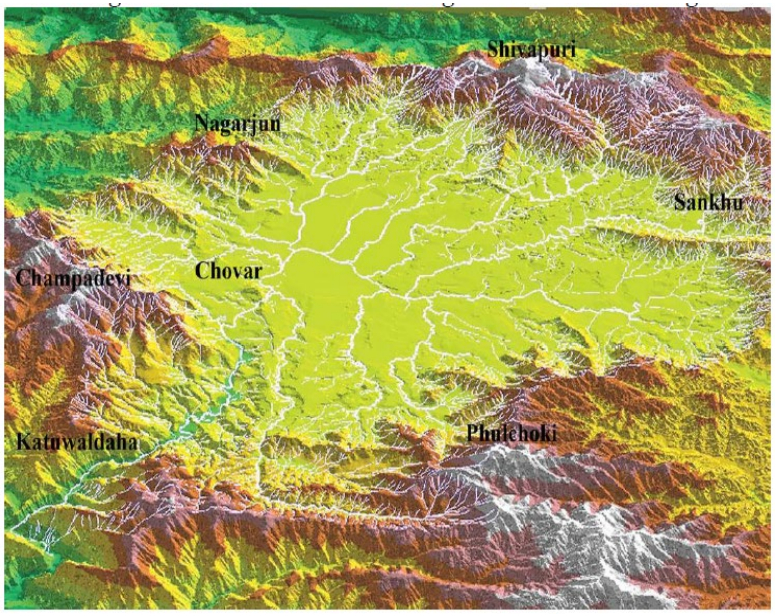
The 20th Annual Meeting

Vientiane, Lao PDR

1. Watershed

Bagmati Watershed at Kathmandu Valley:





Location Map of Upper Bagmati basin

Kathmandu valley comprises of 2 Metropolitan cities, 16 Municipalities and 2 Rural Municipalities.

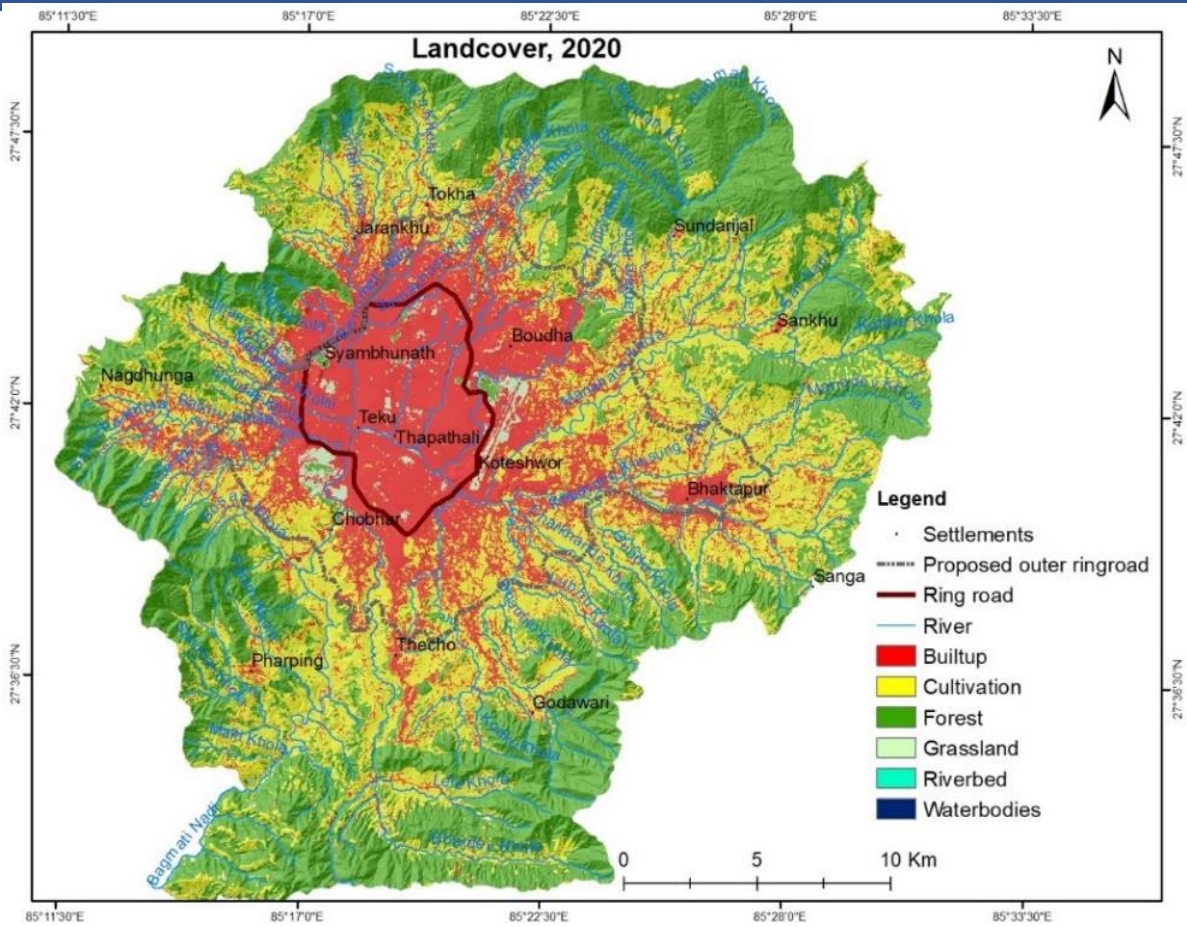
Bagmati is the holy river of the Hindus.

Pashupatinath temple at the bank of Bagmati river is enlisted in World Heritage site.

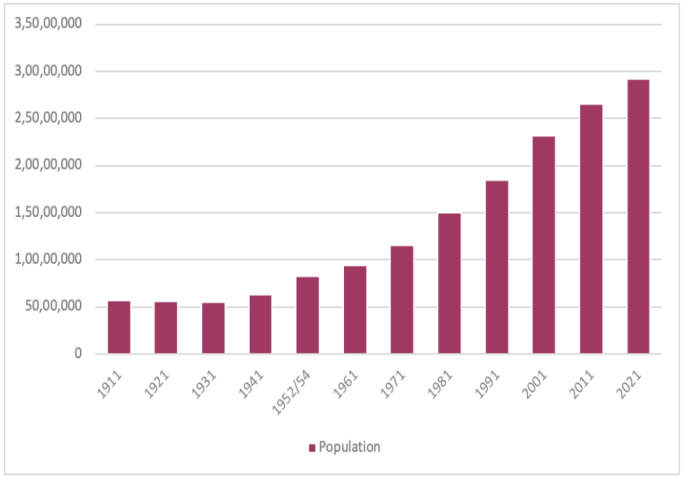
Population in Kathmandu Valley : 3.7 million(2022)

Pashupatinath temple

1. Watershed



Land cover in 2020

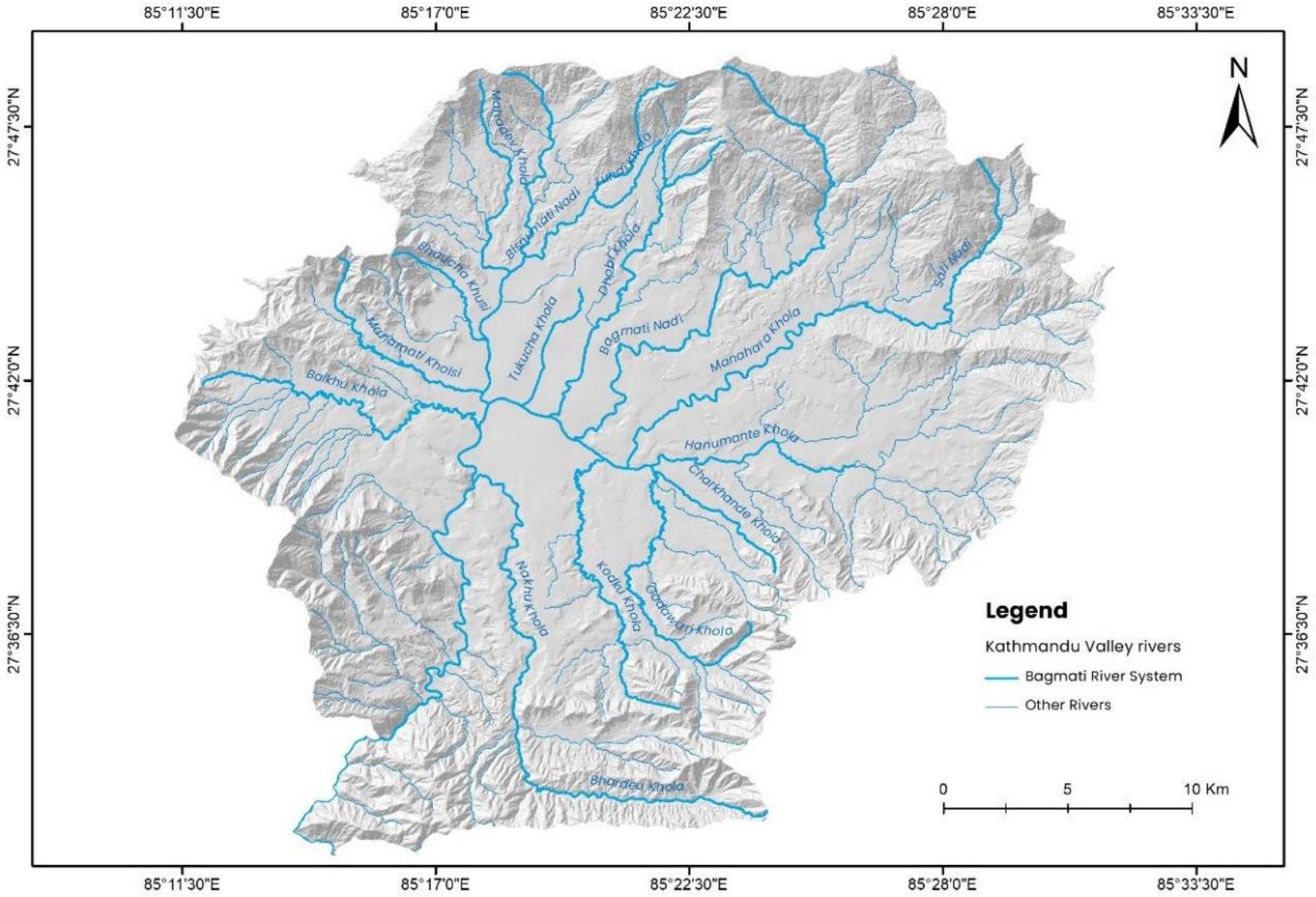


Population change in decade

The population has reached to 2,953,731 in 2021 which is increment of 1.90% per year since 2011.

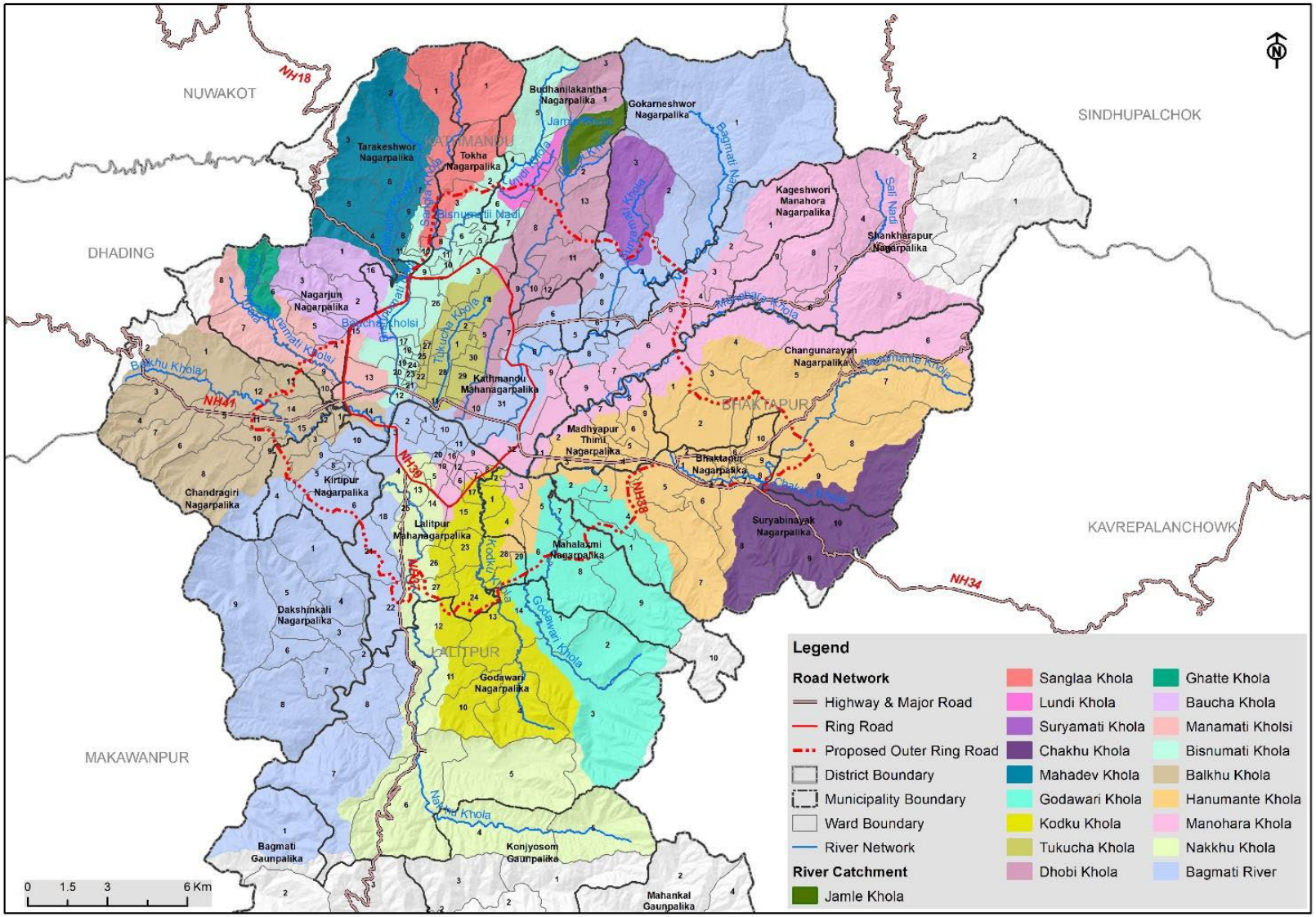
- **The land cover change of Kathmandu valley is facing the rapid urbanization with 4.56 % annual increment in built-up during last decade (2010)**
- **Majority 40.33% area covered by forest. Cultivation land covers 35.95% area. Built-up accounts for 22.61% area and Water bodies and riverbeds represent only 0.04% area**

1. Watershed



River network of Kathmandu Valley

1. Watershed



Catchment Map of Major Rivers in Kathmandu Valley

2. Pollutant loads in the watershed

Main sources of water pollution:

- Solid waste dumping, direct discharge of sewer and industrial effluents and use of chemical fertilizers and pesticides in agriculture are found responsible factors for water pollution which is enhanced by depletion of water discharge caused by watershed degradation.
- With rapid increased in households and industrialization led to an increase in the discharge of pollutants in river. Disposing municipal waste in the river banks is still very common. There is no any systematic sewage treatment system till date.
- The sewage generation consists of

  i) Domestic sewage,

  ii) Non-domestic sewage consisting of industrial and commercial sewage and

  iii) infiltration.
- The sewerage system in the Kathmandu valley has mostly turned out to be unmanaged and chaotic. The respective local governments are simply diverting the sewerage through sewer/drainpipes and dislodging in the nearest river.

2. Pollutant loads in the watershed

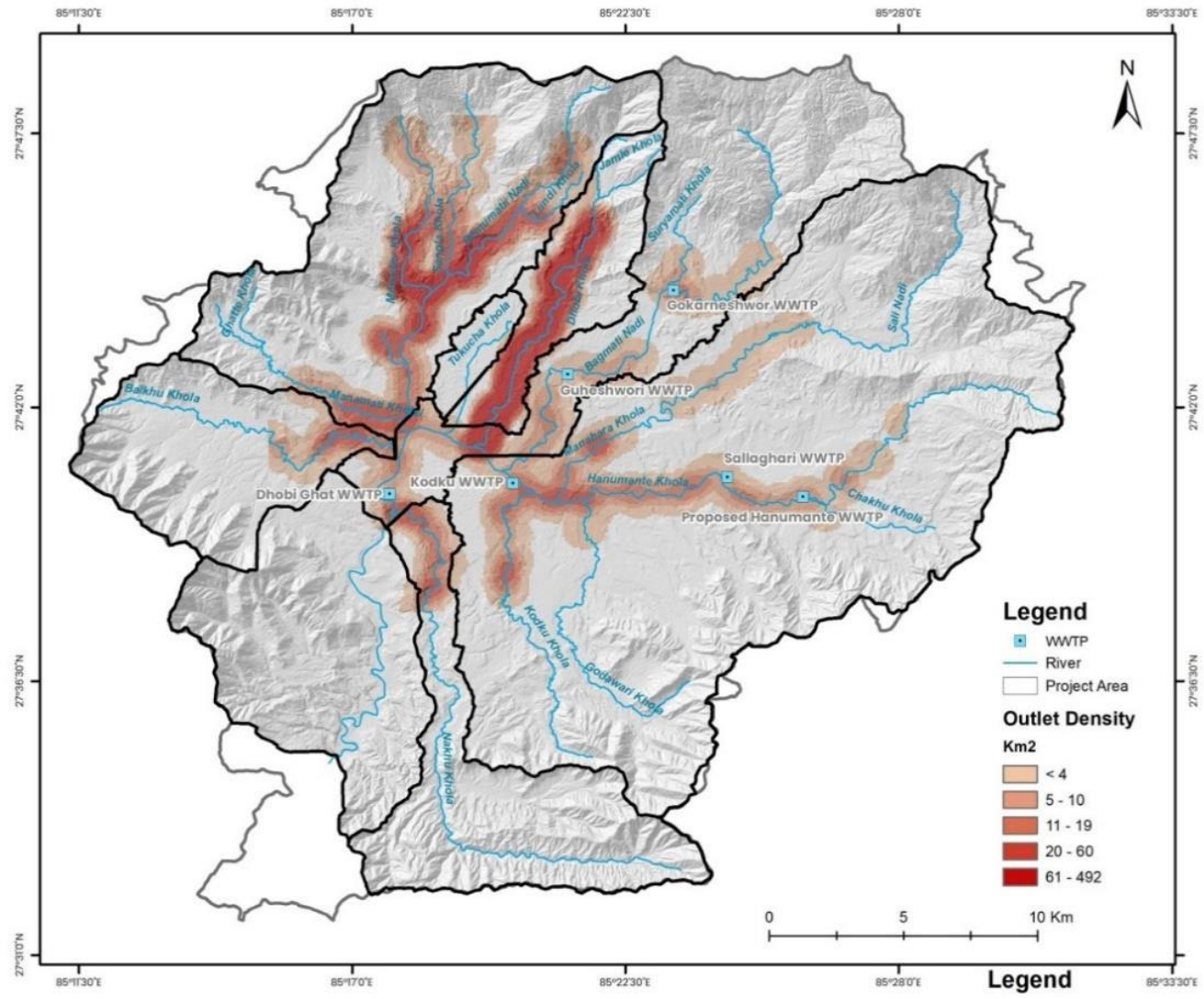
Majority houses are connected to municipal sewer pipes that ultimately drain most of the wastewater directly into the river without treatment.

Sewerage outlet density in Bagmati River and its tributaries

S. N.	River	Number of Sewerage Outlet		
		Left	Right	Total
1	Bagmati	51	28	79
2	Suryamati	2	3	5
3	Nakhu	38	42	80
4	Balkhu	23	32	55
5	Sangla	32	22	54
6	Mahadev	121	160	281
7	Manahara	43	38	81
8	Hanumante	49	45	94
9	Chankhu	3	1	4
10	Bishnumati	194	275	469
11	Manamati	39	74	113
12	Baucha	20	17	37
13	Lundi	50	25	75
14	Jamle	-	-	-
15	Ghatte	3	2	5
16	Dhobi Khola	703	659	1362
17	Tukucha	Not reachable		NA
18	Kodku	17	20	37

Source: Preparation of Bagmati Action Plan Report

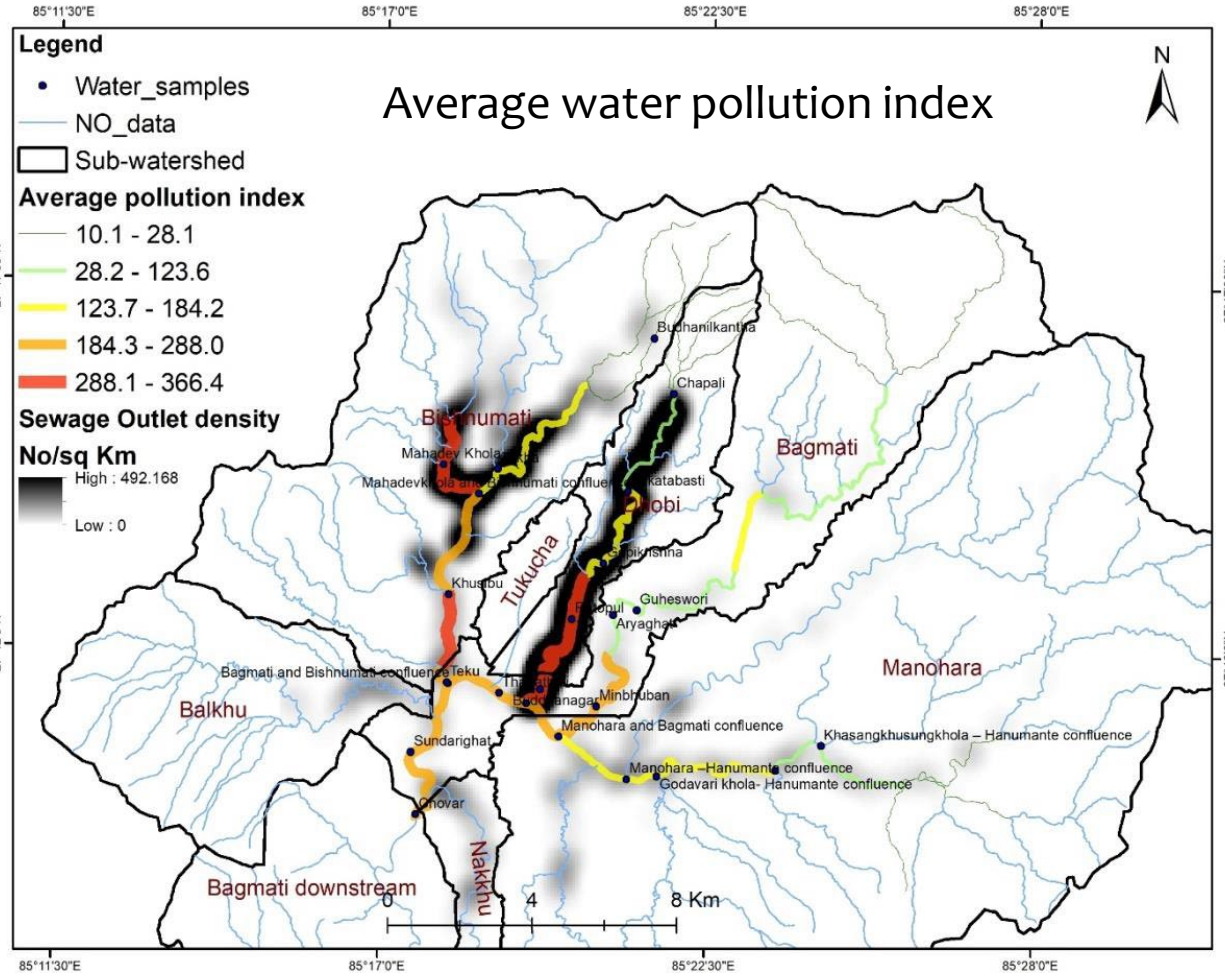
2. Pollutant loads in the watershed



- Water consumption rate = 120 lpcd
- Sewage flow = (80% of water consumption) =96 lpcd
- The population of Kathmandu Valley (KV) is 2.95million in 2021.
- The floating population is assume 3.79 million in 2022.
- The Population of KV in 2032 and 2042 are predicted 4.66 million and 5.89 million.
- The total sewerage generation in 2022, 2032 and 2042 are 426 MLD, 537 MLD and 679 MLD respectively.

Sewerage outlet density in Bagmati River and its tributaries

2. Pollutant loads in the watershed

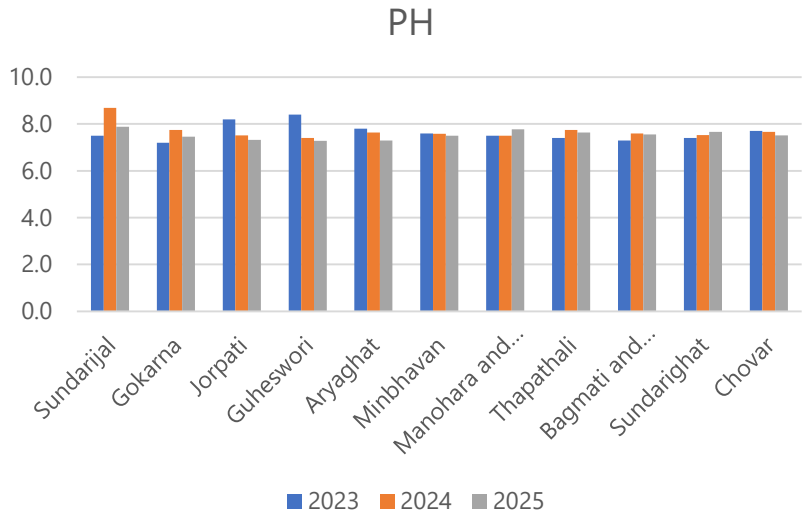


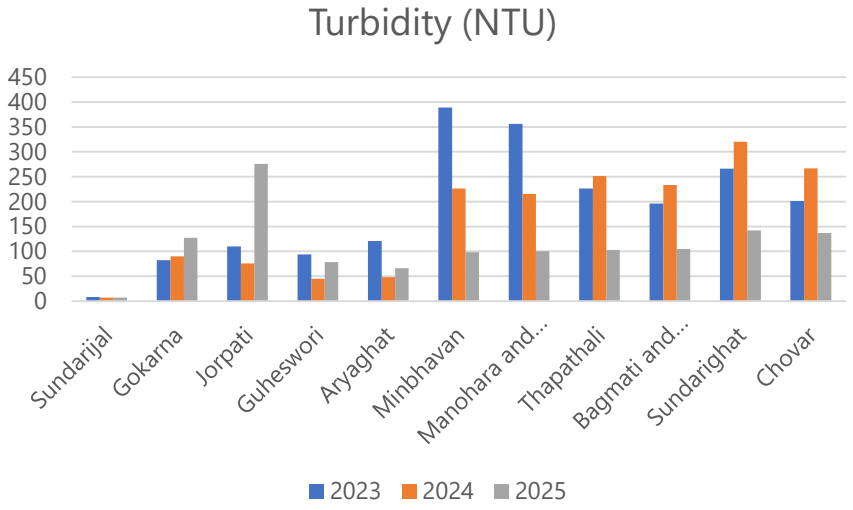
- **Pollution level on different stretch of Bagmati, Dhobi Khola, Bishnumati and Hanuumante were evaluated that upstream areas are less polluted.**
- **Dhobi Khola downstream from Ratopul stretch is found as most polluted river, followed by Mahadev Khola and Bishnumati downstream from Khusibu stretch.**
- **Coherently, these areas also receive higher number of sewage discharge, reflecting the main cause of pollution of the Bagmati river system.**

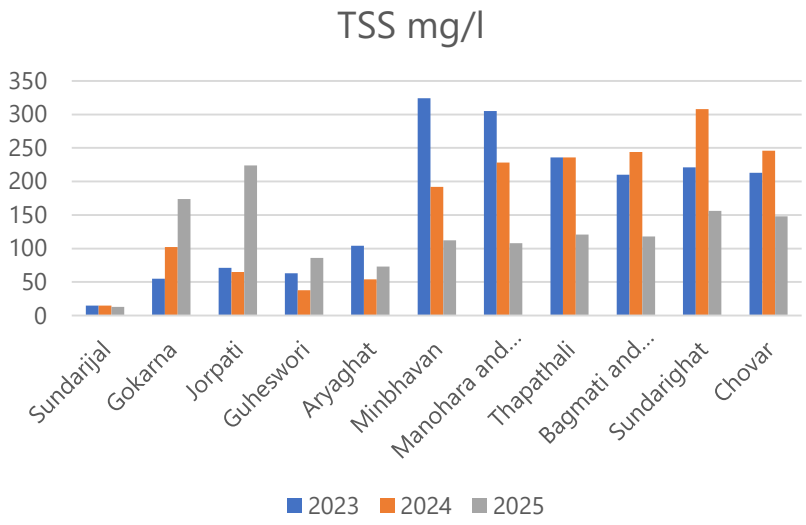
A composite pollution index was produced through summing of the product of weight and pollution value of each variable; Pollution index = Σ ViWi
Where, Vi = Pollution value of variables and Wi = Weight of each variable

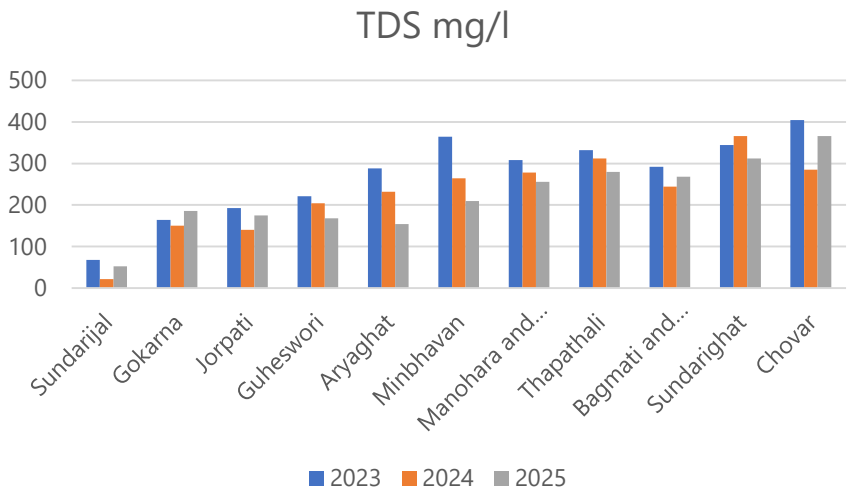
2. Pollutant loads in the watershed

Water quality analysis at different sampling points of Bagmati River









Source: HPCIDBC website

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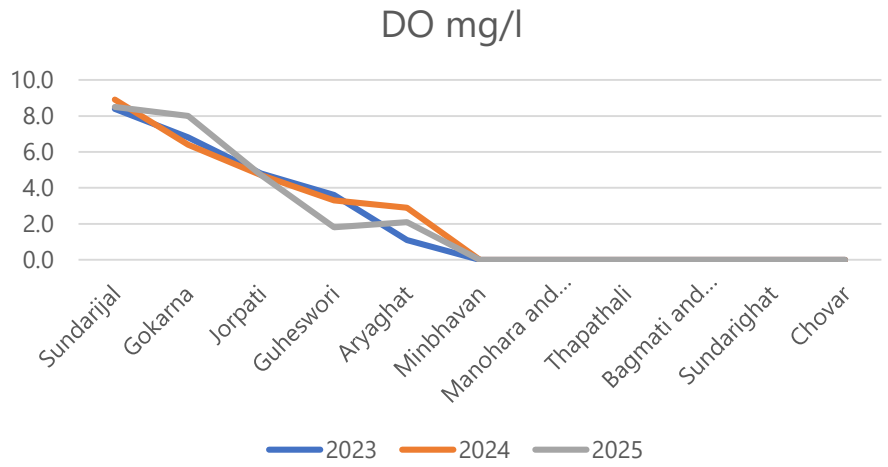
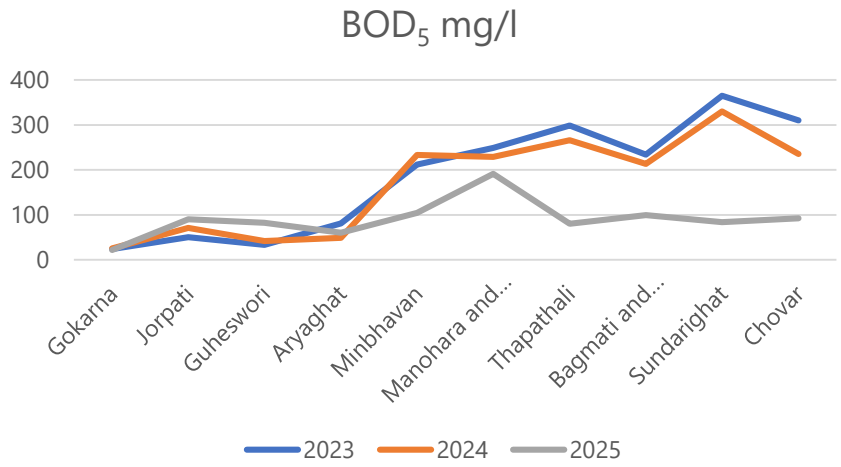
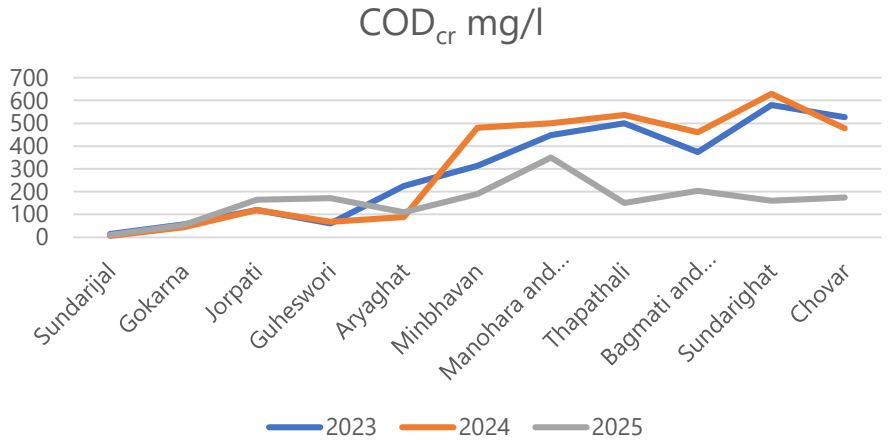
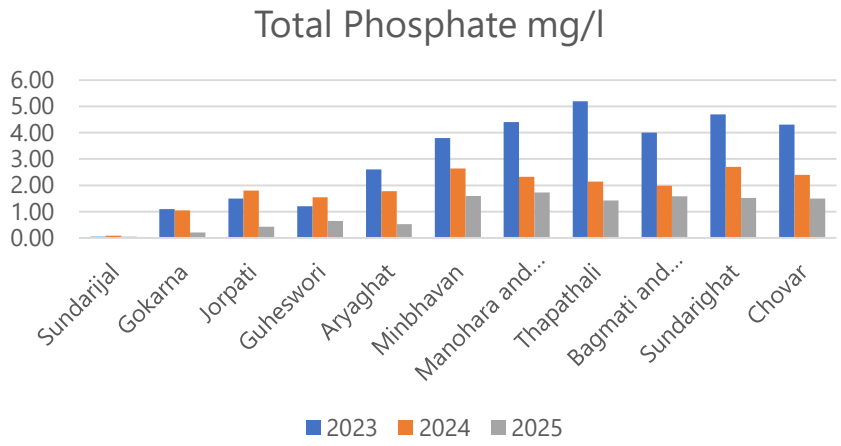








Source: HPCIDBC website

3. Issues in the watershed

The key issues related to the river environment and socio-economic issues

- **Bagmati river system with many heritage sites and traditional settlements that are rich with numerous tangible and intangible heritages is collectively termed as 'Bagmati Civilization'.**
- **The critical issues of Bagmati River and its tributaries are primarily related to river ecosystem, river side land use change, preservation of culture and heritage and institutional related arrangements.**
- **The key issues and challenges are variation in their extents due to change in urban context with increased built-up density and land use conversions.**
- **The major issues of the Valley Rivers are related to decrease in water discharge and degradation of the river ecosystem and depletion of aquatic biodiversity.**
- **Degradation of water quality and catchment quality, narrowing and deepening of waterway, eroding cultural values, riverside landuse change.**
- **The socio-cultural issues are associated with the encroachment and deterioration of religious, cultural and historical heritages.**
- **To cope with climate change issues within the river system**

3. Issues in the watershed

The major issues in Upper Bagmati basin:

Decrease in river flow due to different water use

Disposal of untreated waste water

Encroachments of river regime

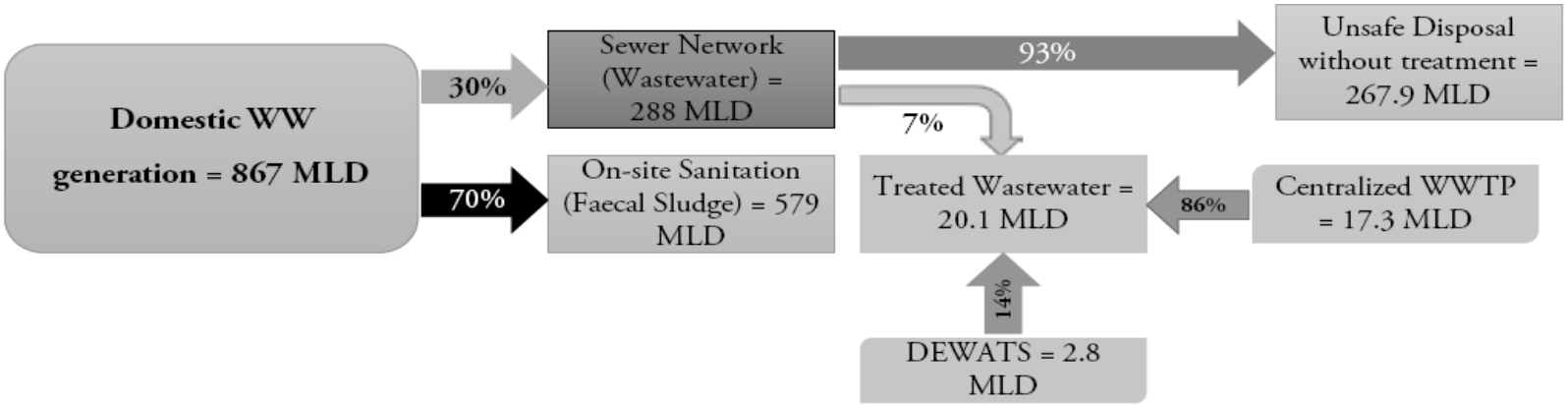
Solid waste dumping on river bank

Sand extraction

Haphazard urbanization and rapid population growth

4. Measures taken to address issues

Domestic Wastewater Management in Nepal as of 2016



- **Centralized WWTP** have been unsuccessful as the existing traditional lagoons or activated sludge type wastewater treatment plants are not functioning or partially functioning at far below capacity.
- **DEWATs** are recommended within the community level upto 1 MLD capacity as per land availability and topography, which decreases the load in centralized municipal level WWTP.
- It is recommended that 20% of the sewage generated shall be treated by DEWATs. **DEWATs** provides the possibility of a nature-based, low-cost and sustainable wastewater treatment.

4. Measures taken to address issues

Summary of Existing WWTPs in Kathmandu Valley

Year established	Hanumanghat	Sallaghari	Kodku	Dhobighat	Guheshwori
	1975	1983	1982	1982	2001
Original situation					
Design flow(m^3/d)	500	2,000	1,100	15,400	16,400
Process type	Aerated lagoon	Aerated lagoon	Stabilization pond	Stabilization pond	Oxidation ditch
Situation 2012 (Waste Water Quality of influent)					
Connected people to WWTP	600	100	30,000	0	138,000
Average flow(m^3/d)	-	-	2,090	0	17,000
Dry weather flow (m^3/d)	30	5	1,500	0	-
Nominal WW flow (l/inh.D)	50	50	50	-	-
Process type	Stabilization pond	Stabilization pond	Stabilization pond	-	Oxidation ditch
BOD_5(mg/l)	253	233	670	-	380
SS (mg/l)	19	1,384	1,070	-	300
COD_{Cr}(mg/l)	422	410	1,710	-	720
T-N (mg/l)	40	22	-	-	-
NH_4-nitrogen (mg/l)	-	-	127	-	46
T-P (mg/l)	3.3	-	7	-	3
Phosphate P (mg/l)	-	1	-	-	-

Source: KVWMP, KUKL 2022

4. Measures taken to address issues

National legislation, acts, policies, rules related to the water environment

S.N.	Documents	Category	Enactment Year	Purpose
1	Water Tax Act	Act	1966	It provides modus operandi of recovering the amount of the water tax leviable pursuant to the prevailing law.
2	Water Resources Act	Act	1992	The umbrella Act governing water resource management and declares the order of priority of water use .
3	Water Resources Rules	Rules	1993	The umbrella Rules governing water resource management, Sets out the procedure to register a Water User Association and to obtain a license.
4	Drinking Water Service Charge Rules	Rules	1994	Details the procedures for Tap connection and hole change and ownership of Taps and its transfer.
5	National Solid Waste Management Policy	Policy	1996	Waste management by Local Bodies; mobilize wastes as resources and reduce wastes at sources.
6	Drinking Water Rules	Rules	1988	Regulates the use of drinking water; provides for the formation of Drinking Water User Associations and sets out the procedure for registration.
7	Water Resources Strategy	Strategy	2002	Sets out sectoral and cross cutting short, medium and long term strategies to optimize the sustainable benefits from the resource.
8	National Water Plan	Plan	2005	Plots short, medium and long term action plans for Water Resource Sector; More focused on Environmental Concerns; Introduces Integrated Water Resources Management (IWRM).

4. Measures taken to address issues

S.N.	Documents	Category	Enactment Year	Purpose
9	Water Supply Management Board	Act	2006	The act puts emphasis on the participation of local bodies and WaSH institutions in water and sanitation services in the urban areas.
10	Sanitation and Hygiene Master Plan	Plan	2011	Recognizes the leadership and Coordination of local bodies; ODF status as entry point of Total Sanitation.
11	Local Government Operation Act	Act	2014	Sets out the powers, functions and duties of local government in relation to water and Sanitation.
12	Environment Protection Act	Act	2019	The umbrella Act governing over all environmental protection of the country and responsibilities are also assigned to local level and province level Govt.
13	Environment Protection Rules	Rule	2020	The umbrella rule governing over all environmental protection of the country and further elaborates the Act.
14	Water Resource Policy	Policy	2020	The policy is aimed to cover all aspects of water resources development and management based on the Integrated Water Resources Management (IWRM) principle by three tires of government.
15	Water Supply and Sanitation Act	Act	2022	To access easy availability of clean and quality water supply and to achieve access to adequate Sewerage and Wastewater Management

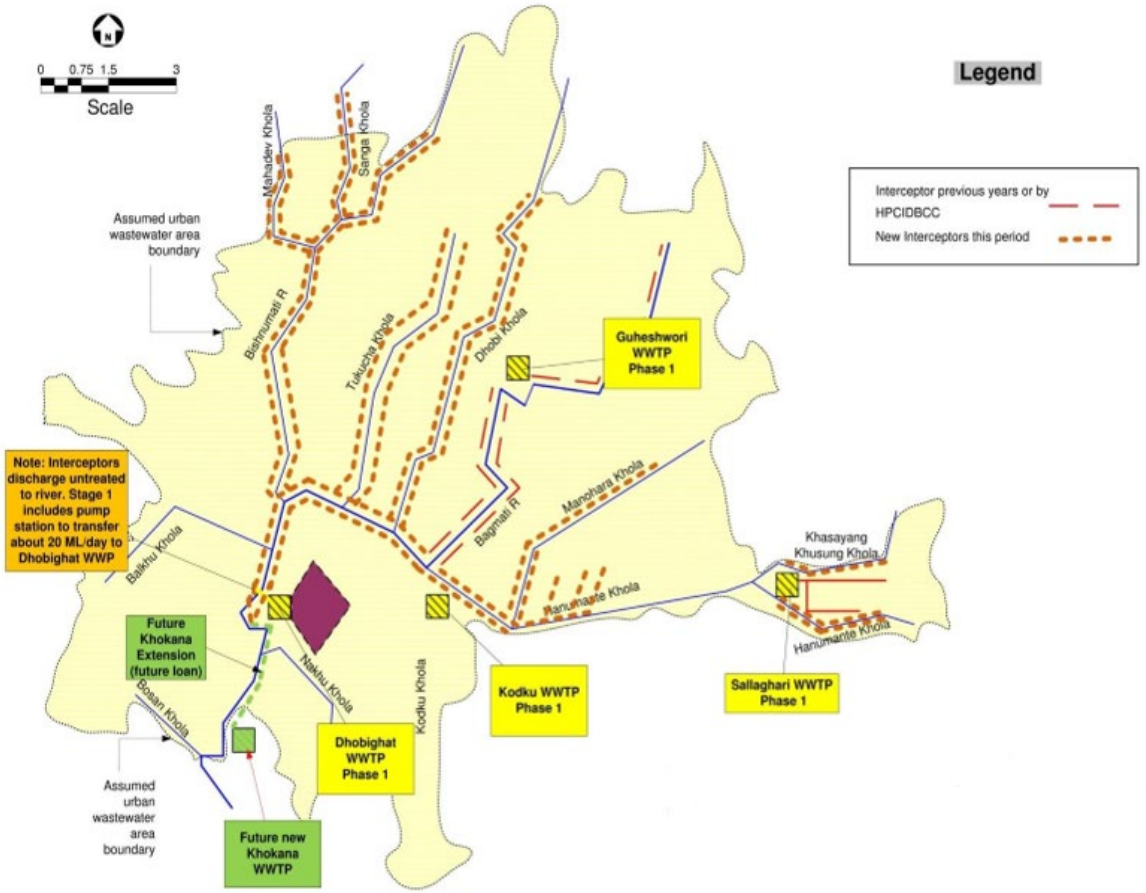
4. Measures taken to address issues

Name	Level	Working Area and Roles
Ministry of Energy, Water Resources and Irrigation	Central	Over all Energy, Hydropower, Irrigation and Water Resources development of the country.
Ministry of Water Supply	Central	Water supply, sanitation and hygeine development and management of the country.
Ministry of Urban Development	Central	Over all urban planning, development and Management for the development of municipalities in the country.
Ministry of Forest and Environment	Central	Forest resources and environmental development and management and enforcement environmental mandates.
Water and Energy Commission Secretariat	Central	Policy and planning regarding energy and water resources development and management covering all sectors. Advisory role on critical issues related to large water resources projects.
Department of Environment	Central	Responsible for the implementation and the compliance of Environmental Protection Act , and Rule (EPR), and pollution control standard as promulgated by the Government of Nepal.
Ministry of Physical Infrastructure Development	Provincial	Provincial level policy planning formulation and development of all sorts of management.physical infrastructures and their environmental
Department of Water Supply and Sewerage (DWSS)	Central	DWSS is dedicated to planning and implementation of both rural and urban WaSH projects.
High Powered Committee for Integrated Development of the Bagmati Civilization (HPCIDBC)	Kathmandu Valley	HPCIDBC is responsible to keep Bagmati River and its tributaries clean by preventing the direct discharge of solid and liquid wastes to the river and to conserve the river system within the Kathmandu Valley
Kathmandu Upatyaka Khanepani Limited (KUKL)	Kathmandu Valley	KUKL is responsible for the operation and management of water and wastewater services in the Valley, and will assume responsibility for infrastructure built by the Melamchi Water Supply Project
Municipalities	Local	Local level planning and development in close coordination with the Province

5. Outcomes

Existing and Proposed Wastewater Treatment and On-site Sanitation Facilities in Kathmandu Valley:

- The 6 WWTP (Dhobighat, Sallaghari, Hanumante, Kodku, Guheshwori and Gokarna) will be rehabilitated and upgraded and their treatment capacity will be increased.
- A new 64.2 MLD Wastewater treatment facility will be constructed in Khokana.
- Construction of intercepting sewerage system along both the banks of the rivers to collect the sewage for WWTP. 71.7 km of Interceptor has been laid on Bagmati, Bishnumati, Balkhu, Dhobikhola and Nakkhu



5. Outcomes

Wastewater Treatment Plan in Kathmandu Valley in 2020-2030

Wastewater Treatment Plants	Projected Population ('000)		Wastewater generation (MLD)		Wastewater Treatment plant Capacity (MLD)		WWTP Area Available (hectare)	Effluent Standards(BOD mg/l)	
	Year 2020	Year 2030	Year 2020	Year 2030	Year 2020	Year 2030		Year 2020	Year 2030
Guheshwari	237	454	17.1	41.8	**32.4**	**48.6**	5.0	15	15
Gokarna					**3**	**6**	0.93	15	15
Sallaghari + Hanumanghat	122	153	8.8	14.1	**14.2+1**	**15.2**	3.4	50	50
Kodku + Balkumari	207	380	14.7	35	**17.5**	**35**	6.5	50	50
Dhobighat + Tukucha	2530	4417	182	407	**74+17.2**	**330**	30	50	50
Khokana					-	**64.2**	38.5	50	50
Total	**3096**	**5404**	**223**	**498**	**159**	**499**	**84.33**	50	50

Source: KVWMP, KUKL

5. Outcomes

Project	Major Activities	Progress
Kathmandu Valley Wastewater Management Project (KVWMP)	**To minimize effect of effluent to water bodies by construction of Wastewater Treatment Plant**	**In Operation :** ➢ **Rehabilitation and Expansion of** WWTP operating at at Guheshwari TP1 (Cap. 32.4 MLD) **In Testing & Commissioning Phase :** ➢ Dhobighat WWT 1 unit out of 2 units@37 MLD each **Under Construction & Planning:** ➢ Dhobighat WWTP 1 unit out of 2 units@37 MLD each ➢ Sallaghari WWTP (Cap: 14.2 MLD) ➢ Balkumari WWTP (Cap: 17.5 MLD) **Planned WWTP :** ➢ Gokarna (Cap. 3 MLD) ➢ Kodku (Cap. 17.5 MLD first phase) ➢ Khokana (Cap. 66.2 MLD)
	To stop direct disposal of sewer and effluent to water bodies by construction of Intercepting Sewer line on both bank of the rivers	➢ Construction of Interception Sewer system along Hanumante River 16.83 Km ➢ Extension and Construction of system along Manahara River 11.63 Km ➢ Extension of Sewer Collectors along Kashyang Khusung River 7.65 Km ➢ Hampered due to land acquisition issues

Source: KVWMP, KUKL

6. Further challenges

- Kathmandu Valley is one of the fastest growing metropolitan areas in South Asia and facing the lots of challenges due to rapid urbanization and modernization.
- The complex challenges arising from rapid urbanization, inadequate drainage systems, and vulnerability to climatic events.
- Funding Gap and Limited Resources(Budget, Manpower, laboratory facilities, tools and equipment) at Federal, Provincial and Local Level.
- Lack of Awareness (sensitivity & technology) at Local Level.
- Lack of Specific guideline and Standards for inspection except the effluent standards.
- Lack of Research and Development.
- Land acquisition issue for Wastewater treatment plant.
- Lack of robust monitoring and evaluation.

Thank You