Initial Environmental Examination

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NEP: Kathmandu Valley Wastewater Management Project − Interceptor Sewer

Package No: KUKL/WW/IS-02

Prepared by the Project Implementation Directorate, Kathmandu Upatyaka Khanepani Limited, Ministry of Water Supply, Government of Nepal for the Asian Development Bank.

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CURRENCY EQUIVALENTS

(as of December 2018)

Currency unit	-	Nepalese rupee (NRs/NRe)
NRs1.00	=	$ 0.0091
$1.00	=	NRs 109.80

In this report, "$" refers to US dollars.

ABBREVIATIONS

ADB	Asian Development Bank
BAP	Bagmati Action Plan
CBP Team	Capacity Building and Public-Private Partnership Support Team
CBS	Central Bureau of Statistics
CITES	Convention of International Trade in Endangered Species of Wild Fauna and Flora
CASSC	Community Awareness and Social Safeguard Consultant
CEMP	Construction Environmental Management Plan
DBO	Design Build and Operate
DDC	District Development Committee
DWEC	District Wage Evaluation Committee
DNI	distribution network improvement
DSC	Design and Supervision Consultant
EA	Executing Agency
EARF	Environmental Assessment and Review Framework
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
ENPHO	Environmental and Public Health Organisation
EPA	Environment Protection Act
EPR	Environment Protection Rules
ERP	Emergency Response Plan
HACCPP	Hazard Analysis and Critical Control Point Plan
HH	Household
HPCIDBC	High Powered Committee for Integrated Development of Bagmati Civilization
IEC	information, education and communication
IFC	International Finance Corporation
Lpcd	Liters per capita per day
LPG	liquefied petroleum gas
ICIMOD	International Centre for Integrated Mountain Development
IDA	International Development Assistance
IEE	Initial Environmental Examination
INGO	international nongovernment organization
ICSU	Income Consumer Support Unit
IUCN	International Union for Conservation of Nature
JICA	Japanese International Cooperation Agency
JBIC	Japanese Bank for International Cooperation
KUKL	Kathmandu Upatyaka Khanepani Limited Kathmandu
MoUD	Ministry of Urban Development
MoFE	Ministry of Forest and Environment
MoWS	Ministry of Water Supply
VWMPK	Valley Wastewater Management Project Kathmandu
VWSMB	Valley Water Supply Management Board
MSDS	Material Safety Data Sheets
MWSDB	Melamchi Water Supply Development Board

MWSP	Melamchi Water Supply Project
NEWAH	Nepal Water for Health
NGO	Nongovernment organization
NTFP	Non-timber forest product
NTNC	Nepal Trust for Nature Conservation
NWSC	Nepal Water Supply Corporation
OHS	occupational health and safety
PD	Project Director
PID	Project Implementation Directorate
PIU	Project Implementation Unit
PLC	Programmable Logic Controllers
PPE	personal protective equipment
PPP	public-private partnership
PPTA	Project Preparatory Technical Assistance
REA	Rapid Environmental Assessment
RoW	Right of Way
RP	Resettlement Plan
SAPI	Special assistance for project implementation
SPAF	Severely project affected family
SPS	Safeguards Policy Statement
SWC	Social Welfare Council
SWNCC	Social Welfare National Coordination Council
UDLE	Urban development through local efforts
UN	United Nations
UNEP	United Nations Environment Programme
VDC	Village Development Committee
WWTP	Wastewater treatment plant

WEIGHTS AND MEASURES

cm	- centimetre
db	- decibels
ha	- hectare
kg	- kilogram
km	- kilometre
km^2	- square kilometre
l	- litre
m	- meter
m^2	- square meter
m^3	- cubic meter
mg/l	- milligrams per litre
MSL/msl	- Mean Sea Level
ml	- millilitre
MLD	- million litres per day, mega litres per day (1 mega litre = 1000m3)
mm	- millimetre
|jg/m^3	- micrograms per cubic meter

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Executive Summary

1. The proposed Kathmandu Valley Waste Water Management Project (KVWWMP) will support the ongoing efforts of the Government of Nepal towards improving the wastewater services in Kathmandu Valley. The project will invest in rehabilitation and expansion of sewerage network, modernization and new construction of wastewater treatment plants, and improvement of wastewater management in Kathmandu Valley, which will complement the past and ongoing Asian Development Bank (ADB) projects.[1] The project is expected to increase operational efficiency, improve service delivery, and result in positive impact on health and quality of life for inhabitants of Kathmandu Valley. ADB requires the consideration of environmental issues in all aspects of its operations as per its Safeguard Policy Statement (SPS 2009). This initial environmental examination (IEE) has been prepared for the proposed infrastructure components of the project; (i) rehabilitation and expansion of sewerage network; and (ii) modernization and expansion of wastewater treatment plants. This IEE is updated for Interceptor Sewer line facilities along the both banks of the Manohara River. The sewers which collect the wastewater from the designated service areas and conveys and discharge the wastewater to the proposed wastewater treatment plants at Kodku. The Manohara interceptor sewer line will be implemented as IS-02.

2. **Categorization.** The project is considered Category B as per the SPS 2009 as no significant impacts are envisioned. This IEE assesses the environmental impacts and provides mitigation and monitoring measures to ensure no significant impacts as a result of the project.

3. **Scope.** The package expected impact will be sustainable wastewater services for the residents of package area. The expected outcome will be an improved wastewater collection and treatment system and increased access of wastewater services to the residents of package area (Ward 7,8,2,1 of Madhyapur Thimi, wards 9,7 of Kageshwori Manohara Municipality, ward 32 of Kathmandu Metropolitan City, ward 5,3,2 of Mahalaxmi M, ward 9 of Lalitpur Metropolitan City) including poor women and men. The project will further consolidate the continuing efforts of the government and ADB in institutional development and improvement of governance in the wastewater sector.

4. **Implementation Arrangements.** The Ministry of Water Supply (MoWS) will be the executing agency responsible for overall strategic planning, guidance, and management of the project, and for ensuring compliance with loan covenants. Kathmandu Upatyaka Khanepani Limited (KUKL) will be the implementing agency, and the existing Project Implementation Directorate (PID) in KUKL will be responsible for (i) project planning, implementation, monitoring, and supervision; (ii) reporting to KUKL Board of Directors, MOWSS, and ADB; and (iii) coordination of all activities in the project. PID has already established a safeguards unit staffed with environmental, social, and legal specialists. The PID, KUKL will recruit two consulting firms, design, supervision and management consultant (DSC) and Community Awareness and Safeguard Support Consultant (CASSC) firm. The DSC will have an environmental and social safeguard specialist to facilitate PID in implementation and supervision of safeguards-related works.

5. **Description of the Environment.** The project is located in Kathmandu Valley which is densely populated. The project sites are located in existing right of ways (RoWs) and government-owned land. There are no protected areas, wetlands, or estuaries in or near the subproject location. Trees, vegetation, and animals are those

[1] Melamchi Water Supply Project (ADB 1820-NEP); Kathmandu Valley Water Supply Improvement Project (ADB 2776-NEP); Bagmati River Basin Improvement Project (ADB PPTA -43448).

which are commonly found in urban areas. Traffic management will be necessary during the rehabilitation and construction of sewer pipes on busy roads.

6. **Environmental Management.** An Environmental Management Plan (EMP) is included as part of this IEE. It will guide all stakeholders including PID, KUKL, DSC and contractors in the environmentally sound design, construction and operation of infrastructure under this project. In particular the EMP (i) recommends the measures and means of testing to be implemented to reduce the likelihood of potential environmental impacts during the design, construction and operation phase of the project; (ii) provides the necessary tools to carry out onsite environmental performance monitoring; (iii) ensures compliance with recommended standards and safety measures; (iv) recommends the public consultation and disclosure procedures; and (v) provides a grievance redress mechanism. The EMP will be included in the civil work bidding and contract documents.

7. Locations and sitting of the proposed infrastructures were considered to further reduce impacts. These include (i) locating all facilities on government-owned land to avoid the need for land acquisition and relocation of people; (ii) laying of sewerage pipes in RoWs to reduce acquisition of land and impacts on livelihoods specifically in densely populated areas of the valley. The laying of interceptors along river banks could potentially cause soil erosion and sedimentation. These are common impacts and can be readily mitigated through the (i) identification of erosion prone areas using geotechnical surveys and incorporating drainage plans into the design; (ii) minimizing vegetation clearance along the slopes; and (iii) avoid piling of excavated material close to the river bank and upon private cultivated land. Prior to construction approval will be sought from Department of Archaeology in accordance to the Ancient Monuments Preservation Rules 2046 (1989) Chapter II if required. However, no any archaeological site is located within the proposed alignment. Excavation will be through hand digging at these sites to minimise impact on adjacent structures.

8. Mitigation measures have been developed to reduce all negative impacts to acceptable levels. Mitigation will be assured by a program of environmental monitoring to be conducted during design, construction and operation phases. The environmental monitoring program will ensure that all measures are implemented and will determine whether the environment is protected as intended. It will include observations on- and off-site, document checks, photographs, monitoring of key parameters and interviews with workers and beneficiaries. Any requirements for corrective action will be reported to the ADB.

9. The stakeholders were involved in developing the IEE through discussions on-site and public consultation, after which views expressed were incorporated into the IEE and in the planning and development of the subproject. Several meetings, workshops, and focus group discussions were held with local residents, stakeholders and technical persons to keep them informed of the project and to get their feedback for the project design, as required. To provide for more transparency in planning, and for further active involvement of key stakeholders including the general public, the project information will be disseminated through disclosure of the translated versions of the IEE. The information will be made available at public places, including the offices of PID, KUKL main office and branch offices, and the Kathmandu Metropolitan city, Lalitpur Sub-Metropolitan city. A copy of the IEE will be disclosed on the ADB and project-related websites and will also be available from PID upon request.

10. The most noticeable long-term benefit of the project will be the improved wastewater management system in Kathmandu Valley which will in turn improve the water quality of the rivers overtime and safeguard public health.

11. **Consultation, Disclosure and Grievance Redress.** Public consultations and disclosures will be continuous in the future during the design, construction and operation phases. The CASSC with the help of the Safeguard unit of PID will be responsible for the public consultations and information disclosures. Grievances will be addressed by the grievance redress mechanism, which incorporates a clear and grassroots process for addressing public complaints quickly.

12. **Monitoring and Reporting.** The safeguards staff within the PID will monitor the implementation of the EMP with support from the DSC and CASSC. The DSC Environmental Safeguards Officer will prepare quarterly progress reports and submit to PID and PID will prepare semi-annual monitoring reports and submit to ADB. ADB will post the environmental monitoring reports on its website. These reports will describe the progress of the implementation of the EMP, any compliance issues and corrective actions.

13. **Conclusion and Recommendations.** Overall the potential impacts of the project will be very positive, benefitting both the environment and the people. Some negative impacts are anticipated during implementation, but in specific areas and for a short duration (e.g., dust, noise, traffic problems, erosion, sedimentation, etc.). It is expected that these environmental impacts of the project will in general not be significant and can be reduced and/ or prevented through adequate mitigation measures and regular monitoring during the design, construction, and operation phases of the project. Based on the findings of the IEE, there are no significant environmental impacts, and the classification of the project as category B is confirmed, and no further special study or detailed environmental impact assessment (EIA) needs to be undertaken to comply with ADB SPS (2009).

I. INTRODUCTION

A. Purpose of the Report

1. The Kathmandu Valley Wastewater Management Project (KVWMP) will support the ongoing efforts of the Government of Nepal toward improving the wastewater services in Kathmandu Valley. The main urban concentration within the valley consists of the two twin cities of Kathmandu and Lalitpur followed by Bhaktapur, and Madhaypur.

2. The project has the ultimate objectives of:

(i) rehabilitating and expanding the sewerage networks and connecting to wastewater treatment plants (WWTPs); and
(ii) Supporting operational and financial improvements and capacity building.

3. The purpose of this initial environmental examination (IEE) is (i) to provide information on existing geographic, ecological, social and temporal context including associated facilities with the package (IS-01) area of influence, (ii) to find out the likely positive and negative direct and indirect impacts to physical, biological, socioeconomic and physical cultural resources in the package area of influence, (iii) identify mitigation measures and any negative impacts that should be mitigated during planning, implementation and operation, (iv) to establish Grievance Redress Mechanism for resolving environmental issues, (v) to describe the monitoring measures and reporting procedures to ensure early detection conditions that require particular mitigation measures, (vi) to describe the process undertaking during project design to engage stakeholders and affected persons and the planned information disclosure measures and the process of carrying out consultation with affected people and facilitating their participation during project implementation, (vii) to identify who is responsible for carrying out the mitigation and monitoring measures.

4. The mitigation measures are then carried forward into the Environmental Management Plan (EMP). The EMP assigns responsibilities, time frames, and performance indicators or standards for each mitigation measure to make sure that it is implemented. An environmental monitoring plan is also prepared. This monitoring plan identifies methods and responsibilities for checking the operation of the project against a range of relevant and agreed performance indicators.

B. Basis and Scope of the IEE

5. Both Nepal's law and the ADB policy require that the environmental impacts of development projects are identified and assessed as part of the planning and design processes, and that action is taken to reduce adverse impacts to acceptable levels. This is done through the environmental assessment process, which has become an integral part of project development and implementation worldwide. This IEE is updated for Interceptor Sewer line facilities along the both banks of the Manohara River. The sewers which collect the wastewater from the designated service areas and conveys and discharge the wastewater to the proposed wastewater treatment plants Kodku (proposed as TP-02). The Manohara interceptor sewer (IS) line will be implemented as IS-02.

II. POLICY, LEGAL, AND ADMINISTRATIVE FRAMEWORK

A. ADB Policy

6. The Safeguard Policy Statement (SPS, 2009) of ADB stipulates addressing environmental concerns, if any, of a proposed activity in the initial stages of project preparation. For this, ADB categorizes the proposed components into categories (A, B, or C) to determine the level of environmental assessment required to address the potential impacts. The project has been categorized as B. This IEE has been prepared to address the potential impacts, in line with the recommended IEE content and structure for category B projects. Stakeholder consultation was an integral part of the IEE. An EMP outlining the environmental measures to be adhered to during implementation of the project has also been prepared. The EMP will form part of the bidding and contract documents for civil work.

B. ADB Safeguards policy

7. ADB's environmental safeguards policy principles are defined in SPS, 2009, Safeguard Requirements 1 and the IEE is intended to meet these requirements, Table II-1:.

Table II-1: ADB SPS, 2009 Safeguard Requirements 1: Environment

SPS 2009 - Safeguard Requirements	Remarks
Use a screening process for each proposed project, as early as possible, to determine the appropriate extent and type of environmental assessment (EA) so that appropriate studies are undertaken commensurate with the significance of potential impacts and risks.	REA has been undertaken (Annex A), indicating that subproject is NOT: (i) environmentally critical; and (ii) adjacent to or within environmentally sensitive/critical area.
SPS 2009 - Safeguard Requirements	Secondary influence areas. Significant adverse impacts during construction will be temporary and short-term, can be mitigated without difficulty. There is no adverse impact during operation. Hence, IEE is sufficient. The IEE including specific description of the environment and corridor of impact will be updated as necessary based on the final design and alignments.
Conduct EA to identify potential direct, indirect, cumulative, & induced impacts and risks to physical, biological, socioeconomic (including impacts on livelihood through environmental media, health and safety, vulnerable groups, and gender issues), and physical cultural resources in the context of the project's area of influence. Assess potential trans boundary global impacts, including climate change.	IEE has been undertaken to meet this requirement. (Section VI). No trans boundary & global impacts, including climate change.
Examine alternatives to the project's location, design, technology, and components and their potential environmental and social impacts and document the rationale for selecting the	Analysis of "with-subproject "or "without subproject" is presented in Section III.

SPS 2009 - Safeguard Requirements	Remarks
particular alternative proposed. Also consider the no project alternative.	
Avoid, and where avoidance is not possible, minimize, mitigate, &/or offset adverse impacts and enhance positive impacts by means of environmental planning & management. Prepare an EMP that includes the proposed mitigation measures, environmental monitoring and reporting requirements, related institutional or organizational arrangements, capacity development and training measures, implementation schedule, cost estimates, and performance indicators.	An EMP has been prepared to address this requirement. Section IX
Carry out meaningful consultation with affected people & facilitate their informed participation. Ensure women's participation. Involve stakeholders, including affected people & concerned NGOs, early in the project preparation process & ensure that their views & concerns are made known to & understood by decision makers and taken into account. Continue consultations with stakeholders throughout project implementation as necessary to address issues related to EA. Establish a GRM to receive & facilitate resolution of affected people's concerns & grievances on project's environmental performance.	Key informant and random interviews have been conducted (Annex C). A grievance redress mechanism for the resolution of valid project- related social and environmental issues/concerns is presented in Section VIII.
Disclose a draft IEE (including the EMP) in a timely manner, before project appraisal, in an accessible place & in a form & language(s) understandable to affected people & other stakeholders. Disclose the final EA, & its updates if any, to affected people & other stakeholders.	The draft IEE will be disclosed on ADB's website prior to project appraisal. Copies of both SPS- compliant IEE and Government of Nepal- approved IEE will be made available at the offices of the PMO, Project Implementation Support Unit (PISU) and Water Users' and Sanitation Committee (WUSC)for public consultation. For the benefit of the community, the summary of the IEE will be translated in the local language and made available at (i) offices of executing and implementing agencies, (ii) area offices, (iii) consultant teams' offices; and (iv) contractor's campsites. It will be ensured that the hard copies of IEE are kept at places which are conveniently accessible to people, as a means to disclose the document and at the same time creating wider public awareness. An electronic version of the IEE will be placed in the official website of executing and implementing agencies and the ADB website after approval of the IEE by ADB.

SPS 2009 - Safeguard Requirements	Remarks
Implement the EMP and monitor its effectiveness. Document monitoring results, including the development and implementation of corrective actions, and disclose monitoring reports.	EMP implementation, reporting and disclosure of monitoring reports are in this IEE.
Do not implement project activities in areas of critical habitats, unless (i) there are no measurable adverse impacts on the critical habitat that could impair its ability to function, (ii) there is no reduction in the population of any recognized endangered or critically endangered species, and (iii) any lesser impacts are mitigated. If a project is located within a legally protected area, implement additional programs to promote and enhance the conservation aims of the protected area. In an area of natural habitats, there must be no significant conversion or degradation, unless (i) alternatives are not available, (ii) the overall benefits from the project substantially outweigh the environmental costs, and (iii) any conversion or degradation is appropriately mitigated. Use a precautionary approach to the use, development, and management of renewable natural resources.	The subproject does not encroach into areas of critical habitats.
Apply pollution prevention and control technologies and practices consistent with international good practices as reflected in internationally recognized standards such as the World Bank Group's Environmental, Health and Safety Guidelines. Adopt cleaner production processes and good energy efficiency practices. Avoid pollution, or, when avoidance is not possible, minimize or control the intensity or load of pollutant emissions and discharges, including direct and indirect greenhouse gases emissions, waste generation, and release of hazardous materials from their production, transportation, handling, and storage. Avoid the use of hazardous materials subject to international bans or phase-outs. Purchase, use, and manage pesticides based on integrated pest management approaches and reduce reliance on synthetic chemical pesticides.	This requirement is only minimally applicable to the subproject in the aspect of waste generation, e.g., effluent from septic tanks and generated sludge and sludge disposal from water supply and sanitation structures. The subproject will not involve hazardous materials subject to international bans/phase outs.
Provide workers with safe and healthy working conditions and prevent accidents, injuries, and disease. Establish preventive and emergency preparedness and	EMP provides measures to mitigate health and safety hazards during construction and operation.

SPS 2009 - Safeguard Requirements	Remarks
response measures to avoid, and where avoidance is not possible, to minimize, adverse impacts and risks to the health and safety of local communities.	
Conserve physical cultural resources and avoid destroying or damaging them by using field- based surveys that employ qualified and experienced experts during environmental assessment. Provide for the use of "chance find" procedures that include a pre-approved management and conservation approach for materials that may be discovered during project implementation.	The subproject will not affect any physical cultural resource. The EMP recommends the measure/s to mitigate adverse impact on physical cultural resources (PCRs) in case of chance find.

B. National Law and Rules

8. The requirement for environmental assessment in Nepal is established by the National Environment Protection Act (1997). The procedures are defined in the Environment Protection Rules, as amended. These rules require IEE for sewerage projects costing more than NRs. 50 lakhs. The Government's Urban Environmental Management Directive (2011) sets the standards for wastewater effluents (Annex 3).

9. The legal provisions for environmental protection in Nepal are found in different laws and regulations (Annex 4). Nepal is also a signatory to many international agreements and conventions related to environmental conservation such as

(i) Plant Protection Agreement for Asia and the Pacific Region, 1956
(ii) Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), 1973
(iii) Convention Concerning the Protection of World Cultural and Natural Heritage (World Heritage Convention), 1972
(iv) International Tropical Timber Agreement, 1983
(v) Convention on Biological Diversity, 1992

C. Policies and Legal Framework of KUKL

10. The Government of Nepal remains fully committed to providing safe drinking water and sanitation services--considered as a fundamental human need and a basic human right--for all of its citizens. The Government is committed to providing improved water supply and sanitation services of medium and higher levels commensurate to the capacity to pay of the served populations. In the 1990s, political liberalization and a focus on decentralization saw important new actors in the sector emerge, namely the community groups, local governments, and the private sector, including nongovernment organizations (NGOs). However, the ever-growing urban population and increasing water demand has been placing a strain on the existing urban water supply and sanitation services. There have been a number of efforts to streamline planning and investment in the sector. Some of the major efforts are examined below.

11. The National Urban Policy (2007) highlights the historical imbalances and haphazard nature of urban development in Nepal. It views urban centres as catalysts of economic development linked to north-south and east-west access corridors. The policy also flags poor sanitation, environmental degradation, and lack of services by the urban poor as requiring urgent attention. It proposes the building of capacity of municipalities to plan and manage integrated local development activities, including the preparation of urban master plans to be

moderated by central and regional authorities. Private sector involvement and investment in infrastructure development is specifically sought.

12. The National Urban Water Supply and Sanitation Sector Policy (2009) was formulated to provide the overall policy support and guidance toward achieving equity in service delivery by ensuring that the financially marginalized households within the service areas are mainstreamed as valid customers through the design and implementation of financial incentives, where required.

13. The Local Governance Operationalization Act, 2074 (2017) provides the legal basis for the devolution of responsibilities and authorities for social, economic, institutional, and physical infrastructure development, including water and sanitation systems, to the local government. While periodic district plans have been formulated in 52 districts, a decade-long political conflict, including the absence of locally elected officials for most of this period, have frustrated implementation plans.

14. The Nepal Water Supply Corporation Act (2007), as amended, Water Supply Management Board Act (2006), and Water Supply Tariff Fixation Commission Act (2006) have facilitated the improved management of Kathmandu Valley's water and sanitation services. They established the legal basis for private sector management of water supply and independent tariff setting and regulations that are applicable to all urban areas.

15. The Ancient Monuments Protection Act (1991) states the rights and duties of the Government to make arrangements for the protection of historically and archaeologically important areas and monuments by preventing any misappropriation and misuse.

16. Nepal's procedures for environmental assessment of development projects are described in the Environment Protection Act (1997) and the Environment Protection Rules (1997), as amended). Projects that need EIA and IEE are identified in the rules. Accordingly, the responsibility for undertaking an IEE for this proposed project lies with the Kathmandu Upatyaka Khanepani Limited (KUKL/Project Implementation Directorate (PID) as the project proponent, on behalf of the Kathmandu Valley Water Supply Management Board (KVWSMB). Public involvement, including notification of stakeholders, dissemination of information, and consultation, is a requirement, particularly during the review and approval of the IEE report.

17. Public Notice of HPCIDBC about RoW of River: -The High-Powered Committee for Integrated Development of The Bagmati Civilization (HPCIDBC) had also published prohibition notice of construction of any structures on the Right of Way (Row) of the Rivers of Kathmandu Valley. The notice was published on 19 Asadh 2063 (3 July 2012) in the government daily newspaper *(Gorkhapatra*). This prohibition notice covers construction of any structures within the Right of Way (RoW) on the following banks of rivers in Kathmandu Valley:

(i) Bagmati, Bishnumati, and Manohara rivers –20 m from either side of the banks of the rivers.
(ii) Hanumante Rivers—20 m from either side of the banks of the rivers.

18. Public Notice of HPCIDBC about RoW of River published in newspaper is attached in Appendix 14.

III. DESCRIPTION OF THE PROJECT

A. Existing Infrastructure Modernization and Expansion

19. In May to September 2011, a mapping exercise of the existing sewer systems in the five municipalities under KUKL/DSC/02 was carried out. A sewer asset management survey was carried out by KUKL Project Implementation Directorate (PID) on 2016. The exercise showed the approximate location and length of the sewers based on desktop analysis. However, the conditions of the sewers including the diameter, gradient, material type, joint details, and condition of manhole details were not covered by the study. Table III-1 shows the summary of existing sewer network length of project districts.

Table III-1: Approximate length of existing sewer network.

SN	Municipality	Approximate length of existing sewer (Km)
1.	Bhaktapur	47.51
2.	Kageshwori Manohara	23.69
3.	Kathmandu	658.74
4.	Lalitpur	166.09
5.	Mahalaxmi	20.05
	Total	**916.09**

Source: Sewer asset management survey, PID 2016

20. The wastewater service area is smaller than the KUKL water service area as it only includes the municipalities of Kathmandu, Lalitpur and Bhaktapur. The water service area covers a number of municipalities within the valley. Wastewater services will logically be required in all urban areas of municipalities. There is strong correlation between this study area and the zones adopted in the Bagmati Action Plan. Based on the population census in 2011, the adopted population for the urban wastewater area was 2,510,788 million, inclusive of the permanent and other population categories.

A. Project Rationale

21. Improvement of wastewater systems are urgently needed in Kathmandu Valley because it is currently suffering from the lack of properly functioning sewerage systems. This project has been designed to raise the quality of the infrastructure and services of selected areas of Kathmandu Valley, thereby increasing the quality of life of the people.

22. Kathmandu Valley has gone through a phase of rapid and unplanned urbanization and industrialization without adequate infrastructure development. To improve the present conditions of the wastewater services in Kathmandu Valley, the Government, with the assistance of ADB, has embarked on a two-pronged improvement strategy that includes capital investments for infrastructure development, i.e. supply augmentation and system improvement, and institutional reforms.

23. Kathmandu Valley is the most densely populated region in Nepal whose population has been increasing rapidly, especially in Kathmandu, the centre of administration, commercial, social, and economic activities. During the last 3 decades, growth in population has been significantly driven by in-migration. The in-migration is largely due to better employment and business opportunities and better educational and medical facilities, but also countrywide insurgency and security concerns in the recent years.

24. The rapid urbanization of Kathmandu Valley has brought negative impacts to its overall development. Water has become scarce as demand exceeds supply. Lack of

operational wastewater system facilities has converted the holy Bagmati River including its other tributaries and sub-tributaries such as Hanumante, Manohara, Khasangkusung River into a highly polluted watercourse. Congested and crowded roads have brought hardship to travellers and road junctions have become garbage dumping sites. Despite these negative impacts, the urbanization of the valley has continued at a similar rate over the past 10 years. According to urban planners, from urban basic service management and disaster relief management aspects, Kathmandu Valley has a carrying capacity of only 5 million people.

25. Interceptor Sewer networks will be constructed improved and expanded. Septage from individual septic tanks for 30% of the households not having access to the sewerage system will be pumped out, transported, and treated together with the sludge from the WWTPs for the production of energy.

26. KUKL, which legally commenced operation in February 2008, established a Project Management Unit. The Government and ADB in April 2009 have restructured the unit into a Project Implementation Directorate (PID) to manage and implement ADB-assisted projects. The PID includes a Safeguards Unit to monitor and evaluate all social and environmental aspects of ADB projects.

B. Description of Proposed Project

27. The proposed project includes (i) rehabilitation and expansion of sewerage network including property connections; (ii) rehabilitation and construction of interceptors along the streamsetc. The following Metro/sub-metro/municipalities will be targeted:

(i) **Kathmandu Metropolitan** - The laying of interceptor sewer on the both bank of Manohara River will be started near from theSun City Colony Town Planning area situated in the right bank. The starting point is ward 32 of Kathmandu Metropolitan city.

(i) **Madhyapur Thimi Municipality** –The left bank of Manohara River from the beginning of the interceptor sewer comprises some wards of Madhyapur Thimi Municipality of Bhaktapur District.

(ii) **Lalitpur Sub- metropolitan** –The proposed interceptor sewer line traverse through the Mahalaxmi Municipality on the left bank at the Hanumante and Manohara confluence. Whereas the last section of the proposed sewer line will be situated within the Lalitpur Metropolitan City ward 9.

Table III-2:Project municipalities and wards

Sn	Municipality	Wards	District
1.	Madhyapur Thimi	7,8, 2,1	Bhaktapur
2.	Kageshwori Manohara M	9, 7	Kathmandu
3.	Kathmandu Metropolitan City	32	
4.	Mahalaxmi M	5,3,2,	Lalitpur
5.	Lalitupur Metropolitan City	9	

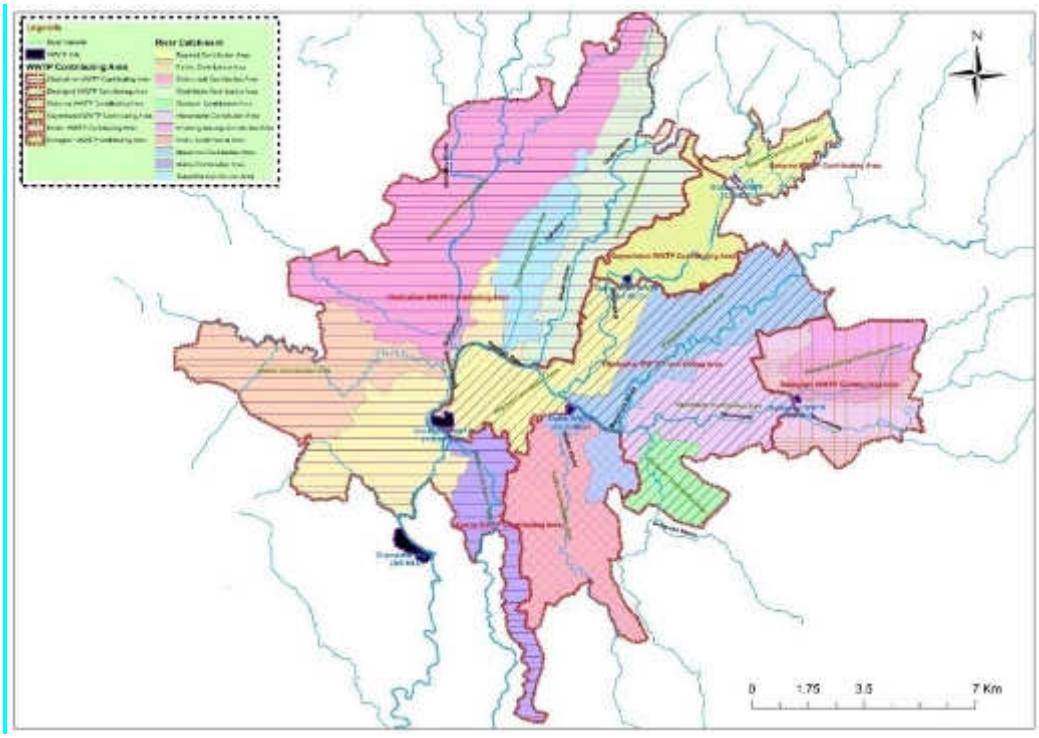


Figure III-1: Proposed Interceptor locations and existing natural drainages within the valley.

28. Due to the lack of information of the drainage network, it is difficult to identify the existing drainage network and expansion of sewerage network in the valley. The length of the sewer is estimated on the basis of desktop analysis and the road location. So, the project thus recommended an Assets Condition Survey to know the exact locations and conditions of the sewer network in the valley so that the cleaning of existing sewer and sewerage expansion can be made possible.

29. The above rehabilitation and expansion of sewerage network will be within the government owned land and right of way (ROW).

30. High Powered Committee for Integrated Development of the Bagmati Civilization (HPCIDBC) has recently published a public notice regarding the construction prohibition for any structures within the RoW fixed for different rivers of Kathmandu Valley which was decided by the Government of Nepal (2065/08/01-2008/11/06) (Appendix 1). The pipeline alignments will be on existing RoWs. GoN has defined 20 meters on both banks of rivers in Kathmandu as ROWs and so the interceptors will be laid within the RoWs.

31. The Septage from individual households will be accepted and managed in the Kodku, Guheswori, Sallaghari, and Dhobighat WWTPs along with the sludge produced from the wastewater treatment process, for energy production. Approximately a combined capacity of 910 kW will be generated through sludge digestion and/ or gasification.

32. Sewer package IS02 includes extension and construction of intercepting sewer system along both banks of Manohara River from Sun City Colony upstream up to Manohara and Hanumante confluence and further up to Kodku WWTP downstream. The total length of interceptor sewer on the both banks is 11.36 km. Other major components included in the system are 284 nos. of manhole, 6 nos. of river crossing.

Table III-3: Interceptor Sewer components and features of the project IS-02

Sn.	Particulars	Description
1.	Project	Extension and Construction of Intercepting Sewerage System along Manohara River
2.	Total Length of Interceptor Sewer	11.36 km
3.	Major Work	Hume pipe laying: 11.36 km Manholes: 284 nos. Aqueducts/crossings: 4 River Training works: 6,976 m Overflow/outfall structures: 33/33
4.	Contract Amount	NRs. 3,160,623,000 (US$ 30,015,414)
5.	Contract Period	720 Days (24 months)

Source: Detailed Design and Construction Supervision of Manohara Interceptor, October 2015

33. The schematic layout plans of the proposed interceptor sewers are presented in*Figure III-3*. Whereas Figure III-2shows the overall proposed locations.

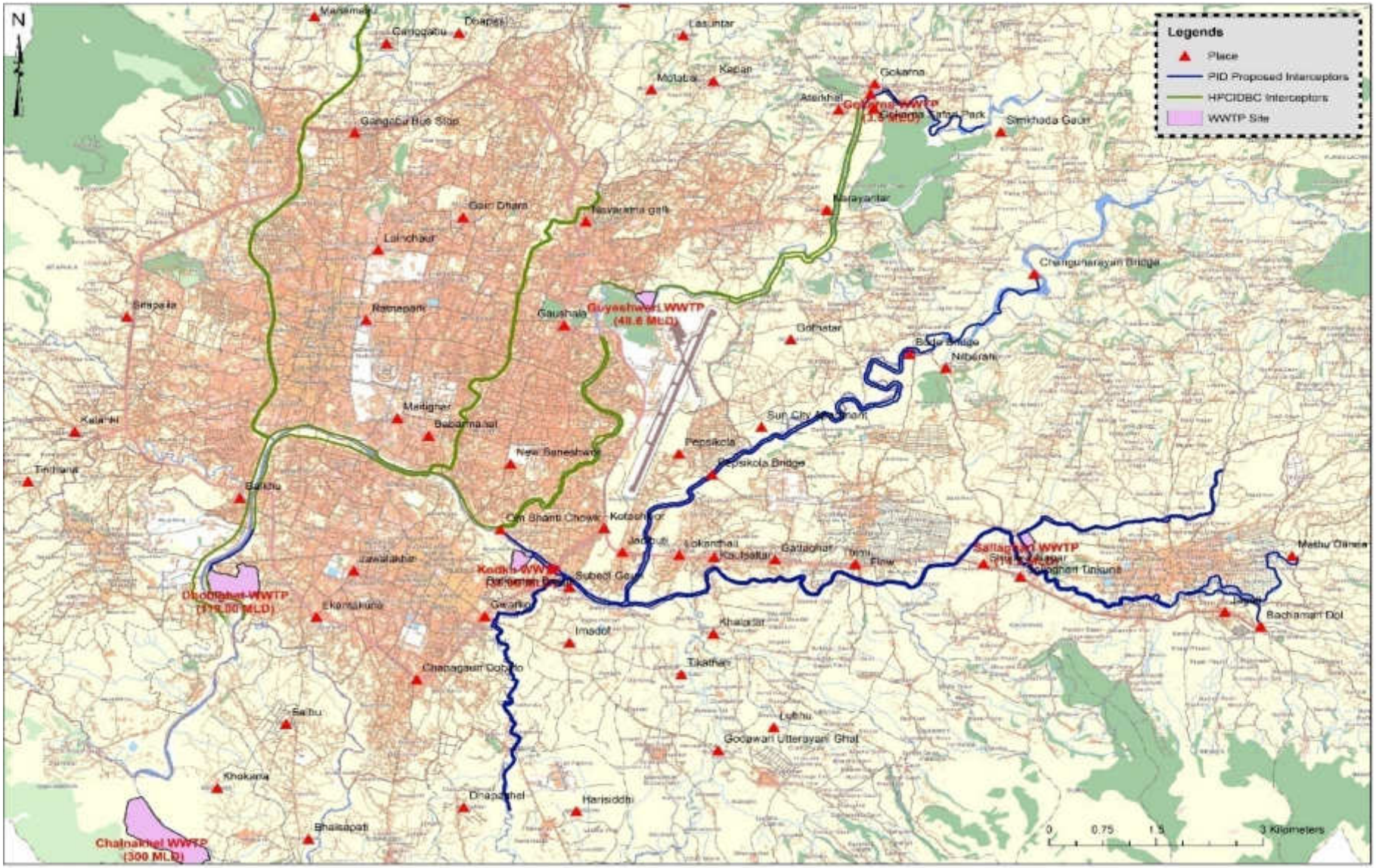


Figure III-2: Project components and schematic layout of Kathmandu Valley with proposed Treatment plants and interceptor alignments

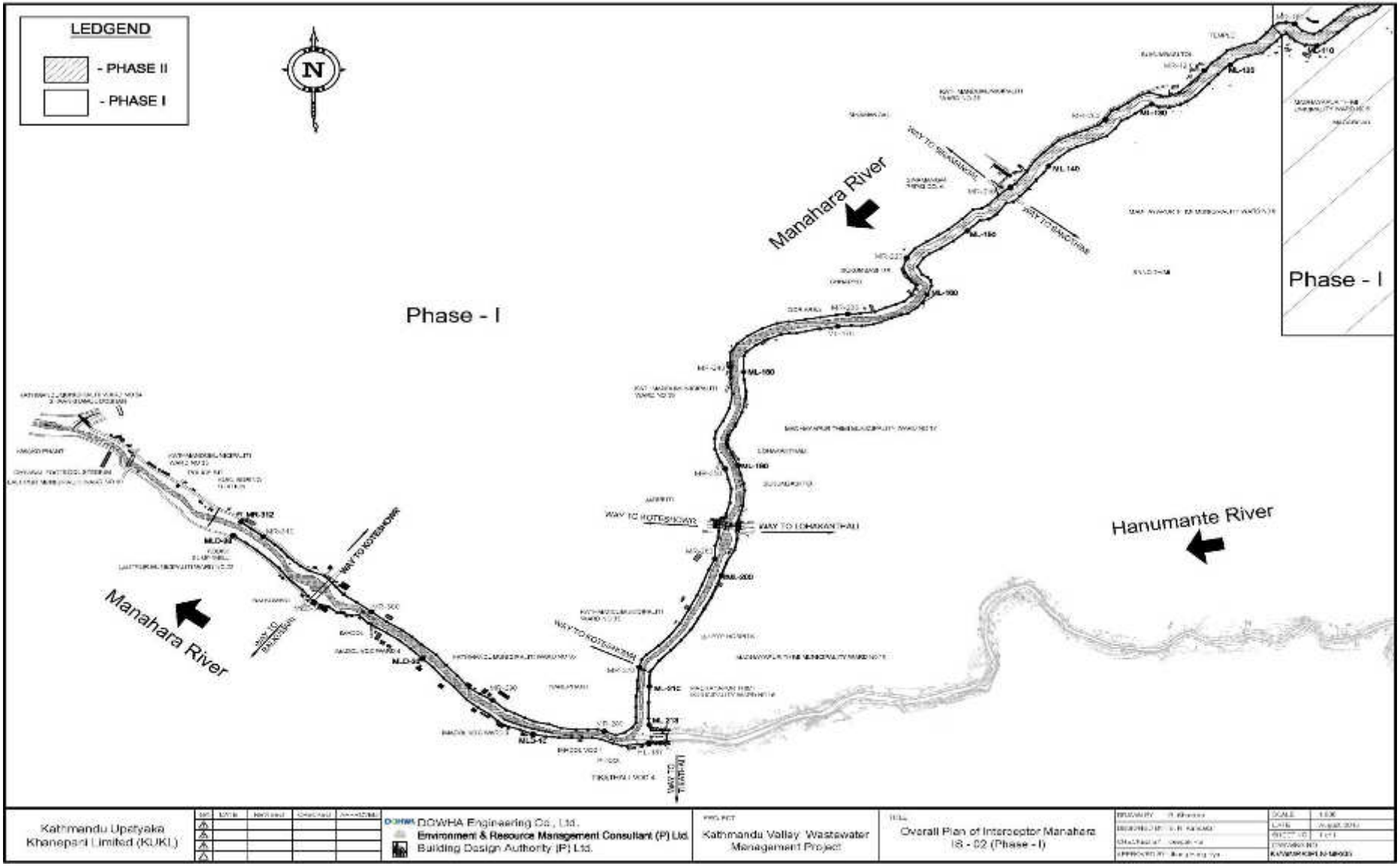


Figure III-3:Layout of Sewer Interceptor-IS02

IV. DESCRIPTION OF THE ENVIRONMENT

A. Kathmandu Valley

34. Kathmandu Valley (**Error! Reference source not found.**) lies between latitudes 2 7^{0}35' to 27°48'N and longitudes 85^{0}12' to 85°33'E. The altitude of the district ranges between 1, 372 m and 2,732 m above mean sea level. The major rivers flowing in the district are the Bagmati River, Bishnumati River, and Manohara River. The length of Bagmati River within Kathmandu Valley is 28 km. The Bishnumati, Manohara, Dhobikhola, Nagmati, and Balkhu rivers are the main tributaries of the Bagmati River. The Bagmati River is important both for water consumption and for religious purposes. One of the most famous temples of the Hindus (Pashupati Nath Temple) is located in the banks of the Bagmati River.

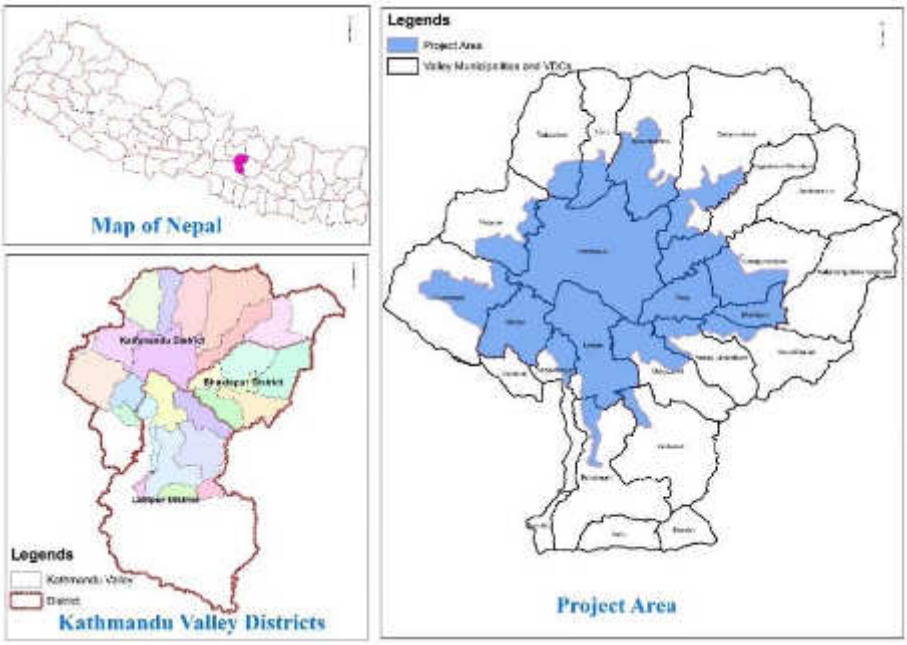


Figure IV-1: Kathmandu Valley and project area.

35. This project IS02 passes through three districts of Kathmandu Valley and they are Kathmandu, Lalitpur and Bhaktpur.

36. Bhaktapur, one of the adjoining cities of Kathmandu, is located between latitudes 27°37' to 27°44'N and longitudes 85°02' to 85°32'E. The average elevation ranges from 1,372 m to 2,166 m above mean sea level. Rivers and streams are the predominant water resource in the Bhaktapur district. The main rivers are the Hanumanate and Manohara rivers. Manohara and Hanumante rivers are the major tributaries of the Bagmati River.

37. Lalitpur is another adjoining city of Kathmandu and is located between latitudes 27° 22 to 28°50'N and longitudes 85°14' to 85°26'E. It is bounded by Kavrepalan chowk in the east, Makwanpur in the west and south, and Bhaktapur and Kathmandu in the north. Bagmati River serves as boundary between Lalitpur and Kathmandu. The major tributary of the Bagmati River in the Lalitpur district is the Nakkhu Khola.

38. The Lalitpur sub-metropolitan city, popularly known as Patan, is located about 5 kilometers southeast of Kathmandu. Lalitpur is extremely rich in arts and architecture and boasts of the largest community of artisans, especially metal and wood workers. It has a large number of sacred buildings, temples, pagodas, *Stupas* and *Shikharas,* monasteries, maaths and *Chaityas.*

B. Physical Environment

1. Topography

39. Kathmandu Valley is about 1,300 manging from 1200 to 2300 m above mean sea level with an area of about 340 km^2. The valley has a bowl-like structure surrounded by high hills. The altitudes from the Valley floor vary between 500 m and 1,400 m. It lies between the Himalayas in the north and the Mahabharat range in the south. The prominent boundary features of the Valley are Phulchowki Hill (3,132 m) in the southwest, Shivapuri (2,713 m) in the north, Chapa Devi (2,400 m) in the southwest, and Nagarjun (2,100 m) in the west. The major rivers flowing into the district are the Bagmati River, Bishnumati River, Dhobi khola and Manohara River.

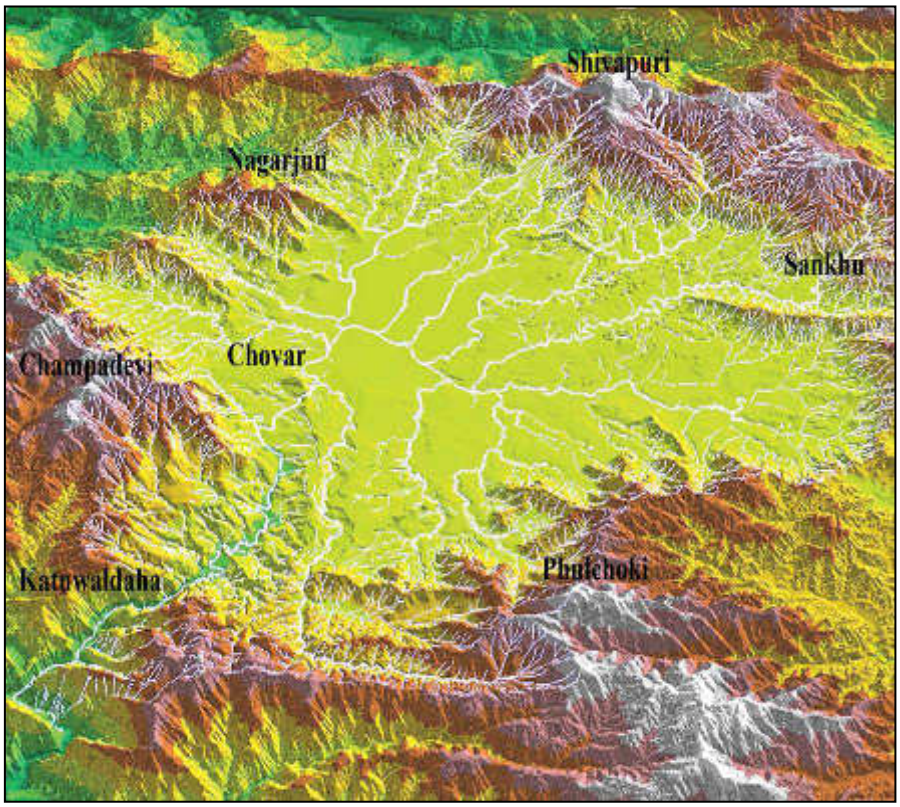


Figure IV-2: Topography of the Kathmandu valley

a. Geology and Soil

40. Kathmandu Valley is a synclinal tectonic basin consisting of fluvio-lacustrine deposits from the Pleistocene age resting on top of Precambrian metamorphic bedrock. In Kathmandu Municipality, the Gokarna (to the northeast) and Kalimati (to the southwest) formations are predominant. Bhaktapur City is located on a hill that is part of the Kalimati formation. In Latitpur Municipality, the Kalimati and Chapagaun formations are predominant. The Gokarna formation typically consists of light to brownish-grey fine laminated and poorly graded silt sand with intercalation of clay of variable thickness. Shallow SP sandy soils, which are highly prone to liquefaction even under small to moderate intensity earthquakes (MMI = VII-VIII), are often found within the Gokarna formation.

41. The Kalimati formation is grey-to-dark silt clay and clayey silt. Organic clay, fine sand beds, and peat layers are commonly found. SM silty-sand soil layers intercalated with silt or clay layers are often found from 5 to 15 meters down. Such layers are prone to liquefaction under moderate to high intensity earthquakes (MMI = VIII-IX).

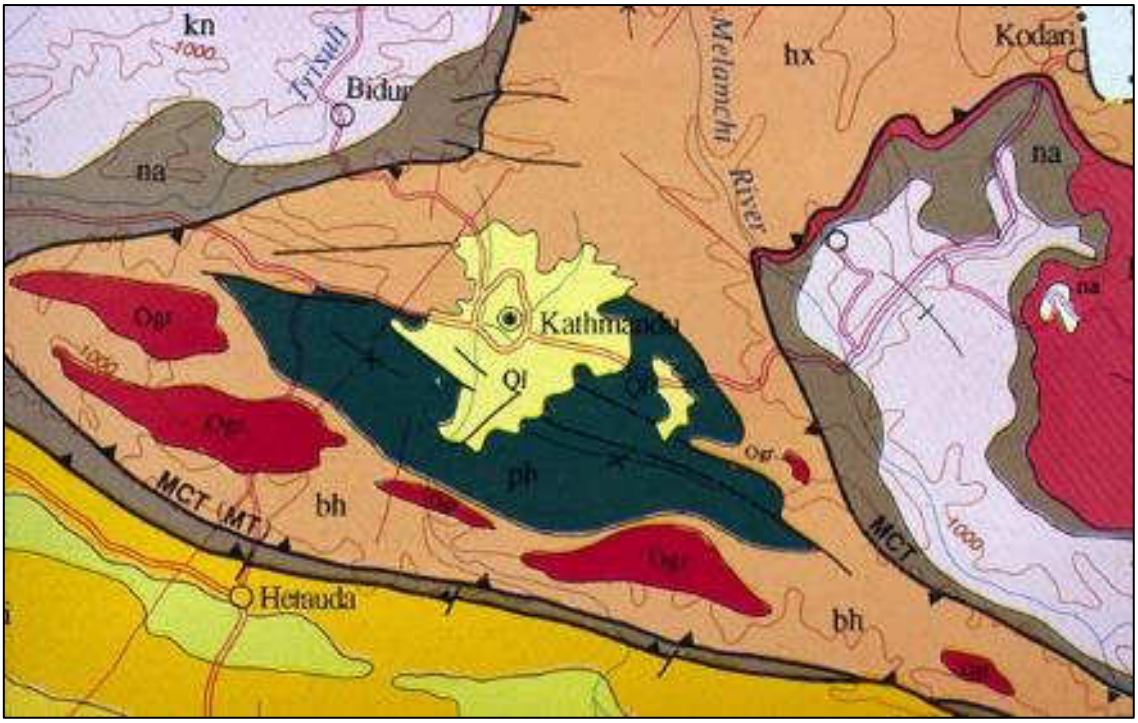


Figure IV-3: Geological map of Kathmandu Valley

b. Climate and precipitation

42. The climate of Kathmandu Valley is sub-tropical cool temperate with maximum of 35.6°C in April and minimum of –3°C in January. The annual average humidity is 75%. The temperature in general is 19°C to 27°C in summer and 2°C to 20°C in winter. The monthly average maximum temperature is 28.9 °C and monthly minimum temperature is 13.8 °C. The average rainfall is 1465 millimeters, most of which falls during June to September.

43. Rainfall occurs from the months of June through September due to the southeast monsoon. The humid monsoon air stream blowing from the Bay of Bengal is forced to rise as it meets the Himalayas. As a result, heavy rainfall occurs in some sections of the southern Himalayan slopes. Rainfall is also high along the Chure range. Regions close to the Indian border receive about 1,500 mm rain in a year, while at the foothills of Chure the annual rainfall reaches 2,000 mm. In the northern side of Chure, the rainfall diminishes again. In the lee-ward side, rainfall is reduced due to rain shadow effects. Orographic effect is pronounced and governs the rainfall pattern.

C. Hydrology

Manohara River System

44. The catchment area of Manohara River varies from the elevation 1450m to 1300 m above MSL. It consists of mostly hilly terrain with steep to moderate slope and most of the catchment area is covered by forest followed by cultivated area.

45. Major tributaries of Manohara River are: Salinadi, Ghatte Khola, Manomatta Khola, Mahadevi Khola and Hanumante Khola. The high flood in this river is noticed within 3-4 hours after the rainfall.

46. The river changes their path more frequently and hence the river banks are not permanent. As rivers descend to the plains, they start depositing boulders and gravels and start eroding the bank with the formation of bends. The bed material remains same almost over the river length. Several river banks problems are observed due to the over extraction of sand from the river bed along the entire reach of the river. The river system is shown in Figure 1.

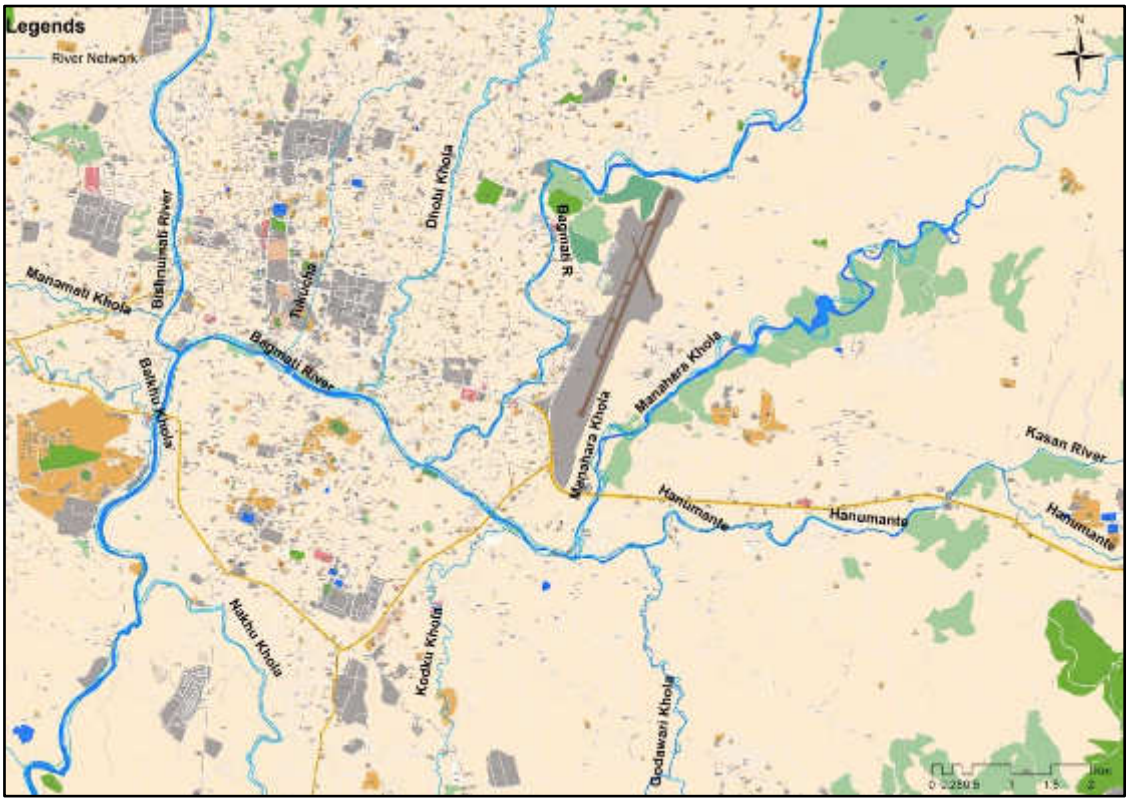


Figure IV-4: River System of Kathmandu Valley

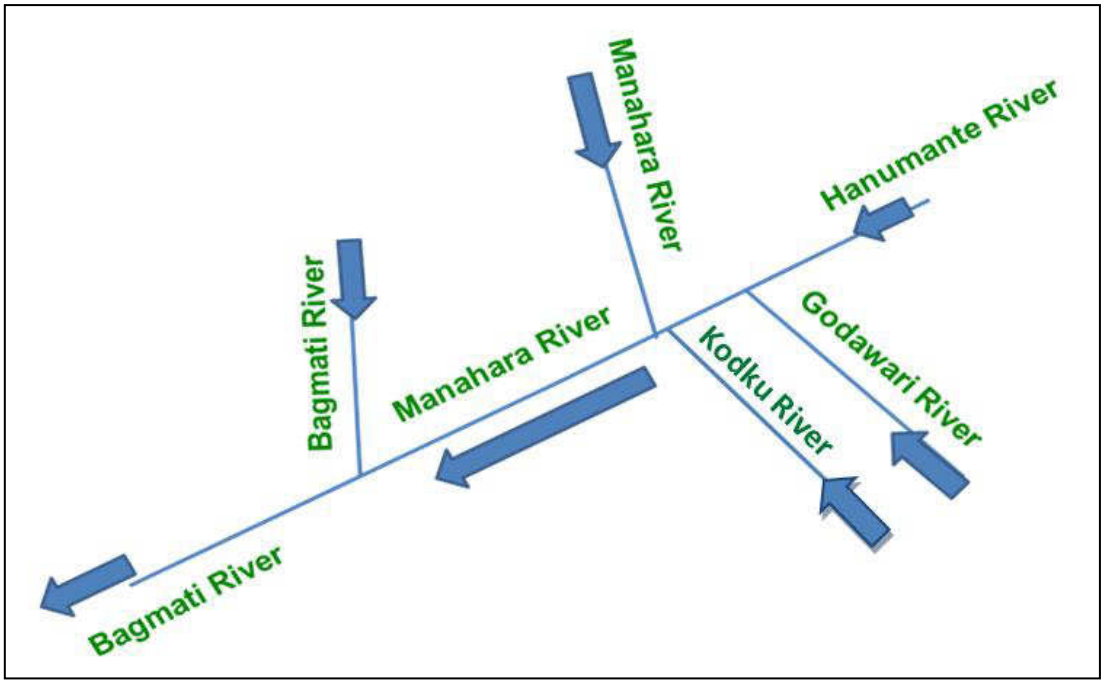


Figure IV-5: Manohara River System

High Flood Discharge

47. The high flood discharge values at different river sections of Hanumante and Manohara rivers were calculated by the Modified Dicken's method, WECS/DHM method and the Rational Method for 20 years return period. The summary of the results is shown in Table IV-1.

Table IV-1:Comparison of High Flood Discharges

River Section	Method		
	Modified Dicken's	WECS/ DHM	Rational
	Qp (m^3/s)		
Brahmayani u/s of Hanumante	70.2	55.0	48.4
Brahmayani d/s of Hanumante	105.8	79.5	62.4
Hanumante Khola at Sallaghari	150.2	109.1	68.5
Hanumante Khola at Katunje	242.6	168.9	84.1
Hanumante Khola d/s to Godavari Confluence	344.9	233.4	98.2
Hanumante Khola u/s to Manohara Confluence	425.6	283.4	95.7
Manohara Khola u/s of Hanumante Khola Confluence	241.8	168.4	60.9
Manohara Khola u/s of Shankhamul Confluence	678.6	436.9	117.6

Source: Design Report Volume I

48. The Modified Dicken's method is developed by the UPIRI for Upper Pradesh and the Himalayan basins of Uttranchal state of India. One of the critical parameters in the Modified Dicken's method is permanent snow-covered area. Since there is no permanent snow-covered area in the catchment of Hanumante and Manohara, this method is not particularly suitable for estimating flood flow values of the rivers in this project. Also, the resulting flood flow values from the Modified Dicken's method are unreasonably high for the rivers in the Kathmandu Valley.

River Training Stretches

49. The banks of the Manohara River were investigated in detail for the necessity of the river training works. On the basis of the field survey, analysis and economy, the various types of river training works have been depending upon the nature of severity of flood damage and possible threats from floods. Some stretches of the river have exiting river training works made of gabion or stone masonry wall. Minor improvements have been recommended in the existing river training structures. The river training will not be required in some stretches such as river crossings, road crossings, kholsis and bridge location. The description of the proposed and existing river training works in the various stretches along the both banks of the Manohara River is shown in the following table.

Table IV-2: Proposed and Existing River Training Works

S N	Centre Chainage		Bank Chainage		Length	Proposed River Training Work Structure	Remark
	From	To	From	To	(m)		
Manohara River Right Bank – Phase I							
1	7+770	7+790	0+000	0+021	21	RCC Steps	
2	7+800	7+950	0+021	0+171	150	RCC Crib Wall	
3	7+960	7+960	0+171	0+192	21	RCC Steps	
4	7+960	8+000	0+192	0+224	32	RCC Retaining Wall	

S N	Centre Chainage		Bank Chainage		Length	Proposed River Training Work Structure	Remark
	From	To	From	To	(m)		
5	8+000	8+140	0+224	0+361	137	RCC Retaining Wall	
6	8+140	8+190	0+361	0+427	67	RCC Retaining Wall	
7	8+230	8+230	0+427	0+448	21	RCC Steps	
8	8+240	8+280	0+448	0+486	38	RCC Retaining Wall	
9	8+280	8+300	0+486	0+604	118		Existing Gabion Wall
10	8+300	8+400	0+604	0+613	9		Existing Stone Masonry Wall
11	8+400	8+500	0+613	0+713	100		Existing Stone Masonry Wall
12	8+500	8+570	0+713	0+802	90		Existing Stone Masonry Wall
13	8+570	8+610	0+802	0+818	16		Existing Gabion Wall
14	8+610	8+690	0+818	0+961	143		Existing Gabion Wall
15	8+690	8+690	0+961	0+972	12	RCC Crib Wall	
16	8+760	8+810	0+972	1+011	39	RCC Crib Wall	
17	8+820	8+820	1+011	1+032	21	RCC Steps	
18	8+820	8+830	1+032	1+074	42	Gabion Wall	
19	8+820	8+830	1+074	1+115	41	Gabion Wall	
20	8+830	8+860	1+115	1+129	14	RCC Retaining Wall	
21	8+860	8+900	1+129	1+168	38	RCC Retaining Wall	
22	8+900	8+990	1+168	1+258	90	RCC Retaining Wall	
23	8+990	9+020	1+258	1+278	20	RCC Retaining Wall	
24	9+020	9+090	1+278	1+356	78	RCC Retaining Wall	
25	9+090	9+160	1+356	1+431	75	RCC Retaining Wall	
26	9+170	9+260	1+431	1+531	100	RCC Crib Wall	
27	9+270	9+270	1+531	1+552	21	RCC Steps	
28	9+280	9+360	1+552	1+652	100	RCC Crib Wall	
29	9+360	9+390	1+652	1+692	40	RCC Retaining Wall	
30	9+390	9+460	1+692	1+725	34	RCC Retaining Wall	
31	9+460	9+500	1+725	1+779	53	RCC Retaining Wall	
32	9+530	9+630	1+779	1+879	100	RCC Crib Wall	
33	9+640	9+640	1+879	1+900	21	RCC Steps	
34	9+660	9+740	1+900	2+000	100	RCC Crib Wall	
35	9+750	9+840	2+000	2+088	88	RCC Retaining Wall	
36	9+840	10+200	2+088	2+277	188	RCC Retaining Wall	
37	10+020	10+020	2+277	2+297	21	Gabion Wall	
38	10+030	10+030	2+297	2+315	18	Gabion Wall	
39	10+030	10+050	2+315	2+330	15	RCC Crib Wall	
40	10+060	10+060	2+330	2+351	21	RCC Steps	
41	10+070	10+150	2+351	2+451	100	RCC Crib Wall	
42	10+150	10+180	2+451	2+484	33	RCC Crib Wall	
43	10+180	10+230	2+484	2+526	43		Existing Gabion Wall

S N	Centre Chainage		Bank Chainage		Length	Proposed River Training Work Structure	Remark
	From	To	From	To	(m)		
44	10+230	10+270	2+526	2+571	45		Existing Gabion Wall
45	10+270	10+340	2+571	2+629	58	RCC Retaining Wall	
46	10+340	10+440	2+629	2+745	116	RCC Retaining Wall	
47	10+460	10+480	2+745	2+795	50	RCC Crib Wall	
48	10+500	10+500	2+795	2+816	21	RCC Steps	
49	10+510	10+710	2+816	2+997	181	RCC Crib Wall	
50	10+740	10+740	2+997	3+018	21	RCC Steps	
51	10+750	10+760	3+018	3+064	46	RCC Crib Wall	
52			3+064	3+064	0		Bridge
53	10+790	10+870	3+064	3+139	75		Existing Gabion Wall
54	10+870	10+891	3+139	3+160	21	RCC Steps	
55	10+891	10+897	3+160	3+166	6	Gabion Wall	
56	10+897	11+130	3+166	3+396	230		Existing Gabion Wall
57	11+130	11+151	3+396	3+417	21	RCC Steps	
58	11+151	11+398	3+417	3+669	252		Existing Gabion Wall
59	11+402	11+685	3+669	3+927	258		Existing Gabion Wall
60	11+685	11+790	3+927	4+027	100	Gabion Wall	
61	11+790	11+915	4+027	4+151	124		Existing Gabion Wall
62	11+915	11+940	4+151	4+172	21	RCC Steps	
63	11+940	11+948	4+172	4+180	8	Gabion Wall	
64	11+948	12+094	4+180	4+329	149		Existing Gabion Wall
65	12+094	12+177	4+329	4+408	79	RCC Retaining Wall	
66	12+177	12+229	4+408	4+458	50	RCC Crib Wall	
67	12+229	12+253	4+458	4+479	21	RCC Steps	
68	12+253	12+461	4+479	4+688	209	RCC Retaining Wall	
69	12+461	12+734	4+688	4+969	281		Existing Gabion Wall
70	12+734	12+737	4+969	4+975	6	Gabion Wall	
71	12+737	12+760	4+975	5+002	27	RCC Retaining Wall	
72	12+760	12+793	5+002	5+023	21	RCC Steps	
73	12+793	12+855	5+023	5+075	52	RCC Retaining Wall	
74	12+884	13+000	5+075	5+181	106	RCC Retaining Wall	
75	13+000	13+021	5+181	5+202	21	RCC Steps	
76	13+021	13+057	5+202	5+240	38	RCC Crib Wall	
77	13+057	13+078	5+240	5+268	28	Gabion Wall	
78	13+078	13+251	5+268	5+440	172		Existing Gabion Wall
79	13+251	13+259	5+440	5+451	11	Gabion Wall	
80	13+259	13+280	5+451	5+472	21	RCC Steps	

S N	Centre Chainage		Bank Chainage		Length	Proposed River Training Work Structure	Remark
	From	To	From	To	(m)		
Manohara River Left Bank – Phase I							
1	7+770	7+810	0+000	0+041	41	RCC Crib Wall	
2	7+810	7+850	0+041	0+080	39	RCC Retaining Wall	
3	7+850	7+960	0+080	0+177	97	RCC Retaining Wall	
4	7+960	8+000	0+177	0+216	39	RCC Retaining Wall	
5	8+000	8+140	0+216	0+359	143	RCC Retaining Wall	
6	8+140	8+190	0+359	0+416	56	RCC Retaining Wall	
7	8+190	8+230	0+416	0+464	49	RCC Retaining Wall	
8	8+230	8+300	0+464	0+533	69	RCC Retaining Wall	
9	8+300	8+400	0+533	0+620	86	RCC Retaining Wall	
10	8+400	8+500	0+620	0+717	98	RCC Retaining Wall	
11	8+500	8+570	0+717	0+793	76	RCC Retaining Wall	
12	8+570	8+610	0+793	0+831	38	RCC Retaining Wall	
13	8+610	8+690	0+831	0+962	131	RCC Retaining Wall	
14	8+760	8+850	0+962	1+062	100	RCC Crib Wall	
15	8+860	8+860	1+062	1+083	21	RCC Steps	
16	8+860	8+900	1+083	1+114	31	RCC Retaining Wall	
17	8+880	8+880	1+114	1+114			Bridge
18	8+900	8+990	1+114	1+201	87	RCC Retaining Wall	
19	8+990	9+020	1+201	1+240	39	RCC Retaining Wall	
20	9+020	9+090	1+240	1+300	60	RCC Retaining Wall	
21	9+090	9+160	1+300	1+371	71	RCC Retaining Wall	
22	9+160	9+260	1+371	1+469	98	RCC Retaining Wall	
23	9+260	9+330	1+469	1+525	56	RCC Retaining Wall	
24	9+330	9+390	1+525	1+589	64	RCC Retaining Wall	
25	9+390	9+460	1+589	1+662	73		Existing Gabion Wall
26	9+460	9+500	1+662	1+705	43		Existing Gabion Wall
27	9+500	9+540	1+705	1+742	37		Existing Gabion Wall
28	9+540	9+540	1+742	1+748	6	Gabion Wall	
29	9+540	9+610	1+748	1+854	106		Existing Gabion Wall
30	9+650	9+650	1+854	1+875	21	RCC Steps	
31	9+650	9+670	1+875	1+892	16		Existing Gabion Wall
32	9+680	9+710	1+892	1+931	39	Gabion Wall	
33	9+710	9+750	1+931	1+988	58		Existing Gabion Wall
34	9+750	9+840	1+988	2+126	138		Existing Gabion Wall
35	9+840	9+940	2+126	2+229	103	RCC Retaining Wall	
36	10+000	10+050	2+229	2+279	50	RCC Crib Wall	
37	10+060	10+060	2+279	2+300	21	RCC Steps	
38	10+070	10+130	2+300	2+350	50	RCC Crib Wall	

S N	Centre Chainage		Bank Chainage		Length	Proposed River Training Work Structure	Remark
	From	To	From	To	(m)		
39	10+130	10+190	2+350	2+402	51	RCC Retaining Wall	
40	10+190	10+230	2+402	2+439	38	RCC Retaining Wall	
41	10+230	10+270	2+439	2+480	41	RCC Retaining Wall	
42	10+270	10+340	2+480	2+556	76	RCC Retaining Wall	
43	10+340	10+440	2+556	2+655	98	RCC Retaining Wall	
44	10+440	10+470	2+655	2+684	29	RCC Retaining Wall	
45	10+470	10+520	2+684	2+725	41	RCC Retaining Wall	
46	10+520	10+600	2+725	2+848	123	RCC Retaining Wall	
47	10+640	10+730	2+848	2+893	45	RCC Retaining Wall	
48	10+740	10+740	2+893	2+914	21	RCC Steps	
49	10+750	10+770	2+914	2+979	65	RCC Retaining Wall	
50	10+770	10+790	2+979	2+979			Bridge
51	10+800	10+889	2+979	3+064	85		Existing Gabion Wall
52	10+889	10+910	3+064	3+085	21	RCC Steps	
53	10+910	11+130	3+085	3+308	223		Existing Gabion Wall
54	11+130	11+151	3+308	3+329	21	RCC Steps	
55	11+151	11+236	3+329	3+417	88		Existing Gabion Wall
56	11+236	11+400	3+417	3+576	159		Existing Gabion Wall
57	11+400	11+400	3+576	3+576			Bridge
58	11+400	11+521	3+576	3+691	115		Existing Gabion Wall
59	11+529	11+609	3+691	3+774	83		Existing Gabion Wall
60	11+609	11+640	3+774	3+806	32		Existing Stone Masonry Wall
61	11+640	11+670	3+806	3+806			River Crossing
62	11+670	11+732	3+806	3+875	69		Existing Gabion Wall
63	11+732	11+811	3+875	3+950	75	Gabion Wall	
64	11+811	11+922	3+950	4+061	111		Existing Gabion Wall
65	11+922	11+941	4+061	4+082	21	RCC Steps	
66	11+941	12+033	4+082	4+177	95		Existing Gabion Wall
67	12+033	12+157	4+177	4+303	126	RCC Retaining Wall	
68	12+157	12+210	4+303	4+353	50	RCC Crib Wall	
69	12+210	12+227	4+353	4+374	21	RCC Steps	
70	12+227	12+275	4+374	4+424	50	RCC Crib Wall	
71	12+275	12+389	4+424	4+537	113	RCC Retaining Wall	
72	12+389	12+393	4+537	4+543	6	Gabion Wall	
73	12+393	12+650	4+543	4+795	252		Existing Gabion Wall
74	12+650	12+660	4+795	4+795			River Crossing
75	12+660	12+666	4+795	4+820	25	Gabion Wall	

S N	Centre Chainage		Bank Chainage		Length	Proposed River Training Work Structure	Remark
	From	To	From	To	(m)		
76	12+666	12+810	4+820	4+971	151	RCC Retaining Wall	
77	12+810	12+830	4+971	4+992	21	RCC Steps	
78	12+830	12+840	4+992	5+004	12	RCC Retaining Wall	
79	12+840	12+890	5+004	5+004			Bridge
80	12+890	13+015	5+004	5+130	126	RCC Retaining Wall	
81	13+015	13+119	5+130	5+230	100	RCC Crib Wall	
82	13+119	13+140	5+230	5+251	21	RCC Steps	
83	13+140	13+208	5+251	5+316	65	RCC Retaining Wall	
84	13+208	13+229	5+316	5+337	21	RCC Steps	
85	13+229	13+285	5+337	5+390	53	RCC Retaining Wall	

Source: DPR, IS02

1. Surface Water

50. Nepal has many small to large size rivers, which flow from north to south. It has over 6,000 rivers with a combined length that exceeds 45,000 km. About 1,000 of these rivers are more than 10 km long and 100 are more than 160 km long. The surface water available is estimated to be around 224.7 billion cubic meters (m^3) per annum. The flow rate is around 7,125 cusecs. Nepal receives a yearly average precipitation of more than 1,500 mm.

51. The major tributaries of the Bagmati River inside the Kathmandu Valley are Bishnumati, Balkhu, Tukucha, Dhobi Khola, Manohara, Kodku, and Nakhu Khola. These tributaries are highly polluted. The municipal wastes and industrial effluents are directly discharged into these rivers and have made the water unusable for human and ecological needs along most of the course. In addition, Kathmandu Valley is facing a severe shortage of water due to rapid urbanization. The annual groundwater use for domestic and industrial purposes in the valley is almost two times the annual rechargeable groundwater available. The Bagmati River has a high religious value. It also adds to the aesthetics of the valley as it passes through, along with its tributaries, the major three cities of the valley.

52. Kathmandu Valley (As the project area passes through Kathamndu, Lalitpur and Bhaktapur districts) has a chronic water shortage. The sole water utility operator, Kathmandu Upatyaka Khanepani Limited (KUKL) has not been able to meet water demand of rapidly growing population of urban and semi urban areas of KV within its service area. There is thus a large disparity between demand and the supply. KUKL is adapting intermittent supply to cope with this shortage and customers are sometimes supplied with drinking water for only about an hour once every six days during wet season, and as little as 1-2 hours once every eight days during dry season in some locations. The demand for drinking water is increasing annually.

53. Tanker water supply is a flourishing business in Kathmandu Valley and is complementing the meagre supply of water by the utility. Their supply areas are mainly urban core and newly developed semi-urban areas where there is high density of hotels, hospitals and other institutions. There are 700-800 water tankers in operation being operated by about 216 water tanker entrepreneurs. Most tanker companies have their own water sources and use both surface as well as groundwater source, but predominantly groundwater source.

54. The shallow wells are a common source of water used to supplement inadequate public supply for domestic use. Most houses in Kathmandu Metropolitan City have either dug

well or shallow tube-well (Rower pump). In 2009, the number of houses possessing a private well was about 74.3 % in Kathmandu Metropolitan City and 20.2% in Bhaktapur Municipality.

55. The other sources commonly used are bottled water, stone spouts, rainwater harvesting arrangement and other springs and rivers.

56. The present consumption of water in Kathmandu Valley varies between municipalities and the availability of water. The population of KMC and LMC has higher water demand than other smaller municipalities. The population with private tube-wells has significantly higher consumption than people without them. The consumer survey carried out in 2009 showed that every house in Kathmandu with a private tube-well consumed 98 lpcd in average whereas a house without private well consumed only 47 lpcd. The analysis of data from the baseline survey showed that the total water consumed for domestic purposes (from all sources) in Kathmandu valley is about 107.43 MLD. Table 4-2 presents the breakdown of water consumption in five municipalities and the VDCs (Consumer Survey, 2009).

57. The unconstrained water demand in the five municipalities and the VDCs is estimated by the baseline survey study to be in the range of 100-120 lpcd for fully plumbed connections, 50 lpcd for yard taps and 25 lpcd for public stand post. These demand values have been used for forecasting post-Melamchi water demand (year 2020 water demand) while preparing the Capital Investment and Asset Management Program for Kathmandu Valley. The CIAMP has assumed the water demand to grow with economic growth and availability of water. The water consumption in the year 2025 in Metropolitan Kathmandu is expected to be 135 lpcd for fully plumbed, 70 lpcd for yard tap and 45 lpcd for public stand post. The total water demand within the service area in Kathmandu Valley is estimated in CIAMP to be 445 MLD and 685 MLD in the year 2020 and 2025 respectively.

Table IV-3: Water Consumption by consumers in Kathmandu Valley from all sources

Municipality name	Pop^n (2011)	Pop^n served by KUKL	Pop^n Served	Pop^n with private well in compound			Pop^n with private tube well in the compound			Total water consumption (MLD)
		Percent	Number	Percentage	Per capita consumption (lpcd)	Total consumption (MLD)	Percentage	Per capita consumption (lpcd)	Total consumption (MLD)	
Kathmandu	1,006,656	84.9	854,651	74.3	97.7	62.04	25.7	46.9	10.30	72.34
Lalitpur	223,285	87..9	196,268	59.4	86.2	10.05	40.6	49.6	3.95	14.00
Bhaktapur	83,893	63.0	52,853	20.2	67.4	0.72	79.8	29.1	1.23	1.95
Total	1,313,834		1,103,772			72.81			15.48	88.29

Source: Consumer survey, 2009

2. Groundwater

58. The groundwater aquifers of Kathmandu Valley are divided into three districts: Northern (157 km2 with 59 km2 recharge area), Central (114 km2 with about 6 km2 recharge area), and Southern (55 km2 with about 21 km2 recharge area) (Dixit and Upadhya 2005). The heavy extraction of groundwater to meet the domestic as well as commercial demands is alarming because it depletes the groundwater level. There is haphazard extraction of water from both shallow and deep aquifers in Kathmandu Valley at present. According to the hydro-geological conditions of Kathmandu Valley and the recharge rate of the basin, only 15 MLD of groundwater can be safely extracted in a day (JICA 1990). This

rate is being exceeded by more than 70% by the Nepal Water Supply Corporation (NWSC) tube wells alone. Due to the increase of built-up areas, groundwater recharge is reduced with the rerouting of the natural drainage. The unsustainable extraction of groundwater causes land subsidence, which is already evident in many cities in Asia (e.g., Bangkok).

59. It is estimated that the groundwater of Kathmandu Valley is decreasing at an average rate of 2.5 meters per year. The depletion varies by location as the geological structure within the Kathmandu Valley is diverse. If the current rate of groundwater extraction continues, water will be sufficient for the next 90 years only (http://guthi.net).

60. Many households have installed rower pumps to extract groundwater from the shallow aquifer when NWSC could not meet their demand, but the bacteriological quality of the water poses some concern and has to be looked into. Due to the necessity of stopping groundwater mining, it is urgent to enact a law and formulate rules and regulations on the extraction of groundwater in Kathmandu Valley.

61. The chemical quality of most of the water is within the World Health Organization (WHO) guidelines.

Table IV-4: Water Quality of Different Water Sources in Kathmandu Valley

Parameters	Water Sources				WHO GV
	PTW	PUTW	Well	SS	
pH	6.5-8.2	6.5-7.5	7.5	7.5	6.5-8.5
Temp (°C)	13-18	12-15	15-18	15-18	25
Iron (mg/l)	ND-0.2	0.2	0.2	0.3	0.3=3.0
Chlorine (mg/l)	ND	ND	ND	ND	0.2
Chloride (mg/l)	10-30	22-45	22-45	23-45	250
N-NH_4 (mg/l)	ND-0.2	0.2	0.2	0.2	0.04-0.4
PO_4–P (mg/l)	0.1	0.1	0.1	0.1	0.4-5.0
Coliform bacteria (source)	+/-	+	+	+	-
Coliform bacteria (consumption)	+				-
E.colicfu/100 ml	10-131	3-20	48-200	58	0

Note: PTW = private tap water, PUTW = public tap water, SS = stone spout, WHO GV = World Health Organization guideline value. Source: Pradhan et al. 2005.

3. Melamchi and Other Water Supply Projects

62. Major infrastructural development works are on-going in Kathmandu Valley for augmentation of water supply, and expansion and rehabilitation of distribution network. Melamchi Water Supply Project (Melamchi Water Diversion Subproject 1), which will bring in170 MLD water from Melamchi River to Kathmandu Valley in the first phase, is under implementation. The subsequent phases of Melamchi project would bring in 170 MLD water from Yangri Khola in the second phase and 170 MLD water from Larke Khola in the third phase. The Melamchi water diversion project involves construction of about 27.5 km tunnel, river intake and a de-silting basin. The water treatment plant proposed at Sundarijal is under construction. The construction work of the project has been on-going since April 2009. Although the originally scheduled completion date of tunnel construction is September2013, it is now expected that the project will be completed by April 2016.

63. KUKL is currently implementing Kathmandu Valley Subproject 2 of Melamchi Project (Loan 1820). It has completed some works for immediate improvement of water supply service in Kathmandu Valley. KUKL PID is now implementing distribution network improvement works and other related activities.

D. Existing Wastewater System

1. Introduction

64. This section provides an overview of the wastewater services. It covers issues relating to the wastewater collection network and conveyance system. It includes the neighborhood system, main collectors and interceptors which ultimately convey wastewater to the treatment plants. The issues concerning the wastewater treatment systems have been dealt in the separate reports under different packages.

2. Development of Sewer System in Kathmandu Valley

65. The first sewers in the Kathmandu valley were constructed around 1800 AD during Malla period for surface drainage and kitchen sullage and the sewerage system of the core areas of the valley between 1898 and 1950 during Rana regime. These were combined sewers. These Rana sewers were brick sewers typically 600 m circular sections or 1050 x 1050 mm ovoid sections. These were constructed with a flushing system using gates to allow sudden release of flows.

66. After the widespread introduction of the water flush household toilets in the beginning of 1950, the houses of adjoining sewers started discharging domestic sewage into these sewers. Under the three IDA projects, the first project undertaken during (1976 - 1983) and second (1980 – 1985) were constructed as separate sanitary and storm water systems. The first IDA project during 1976-83 laid down approximately 26 km of sanitary sewers including cleaning of some Rana sewers. Also, in the IDA projects two wastewater treatment plants (WWTPs) were constructed at Balkumari (now known as Kodku) and Sundarighat (now known as Dhobighat). The most recent WWTP constructed is the Guheshwori WWTP under Bagmati Area Sewerage Project (BASP). Since then, many agencies have constructed sanitary sewers and storm water conduits in the valley. During the course of time majority of households were connected indiscriminately to both storm water conduits and sanitary sewer pipes.

67. The Nepal Water Supply and Sewerage Corporation (NWSC) also constructed about 35km of trunk sewer from 1983 to 1990. Municipalities also initiated a Public Private Partnership (PPP) model to accelerate the construction of sewers. Under the PPP model a large quantity of sewer pipelines was constructed during the recent time in the city core areas and surrounding urban clusters of Kathmandu valley. Such sewers under PPP model were laid haphazardly without any proper planning and design.

68. Kathmandu Upatyaka Khanepani Limited (KUKL), a public company, established in February 2008, estimated that by February 2014 all existing wastewater treatment plants are to be functional and run each plant to at least 90% of its hydraulic capacity. Also, KUKL stated that by the beginning of the fifth year after the commissioning of Melamchi Project, wastewater services in the form of sewer or on-site sanitation should be made accessible to 90% of the population in the service area. KUKL is not currently responsible for the operation and maintenance of Guheshwori WWTP (commissioned in November 2006). This is under the control of the High-Powered Committee for Integrated Development of Bagmati Civilization (HPCIDBC).

Wastewater Quantity generation
Kathmandu valley wastewater management Project – DSC 04

Name of Municipality/VDC	Project Area	Projected Population			Population Connected to off-site system			Wastewater Quantity Generation																	
								Domestic Sewage (MLD)	Nondomestic Sewage (MLD)	Infiltration (MLD)	Average DWF (MLD)	Peak DWF (MLD)	Domestic Sewage (MLD)	Nondomestic Sewage (MLD)	Infiltration (MLD)	Average DWF (MLD)	Peak DWF (MLD)	Domestic Sewage (MLD)	Nondomestic Sewage (MLD)	Infiltration (MLD)	Average DWF (MLD)	Peak DWF (MLD)
	(ha)	2015	2020	2030	2015	2020	2030	2015					2020					2030				
Kathmandu Metropolitan City																						
Ward 1	138.21	8,008	8,008	8,008	5,606	6,006	6,406	0.448	0.045	0.045	0.538	1.211	0.481	0.048	0.048	0.577	1.297	0.615	0.062	0.062	0.738	1.661
Ward 2	81.69	13,448	13,448	13,448	9,414	10,086	10,758	0.753	0.075	0.075	0.904	2.033	0.807	0.081	0.081	0.968	2.179	1.033	0.103	0.103	1.239	2.789
Ward 3	308.56	42,883	55,245	93,188	30,018	41,059	74,550	2.401	0.240	0.240	2.882	6.484	3.333	0.333	0.333	3.999	8.998	7.157	0.716	0.716	8.588	19.323
Ward 4	334.93	37,206	72,457	116,144	40,044	54,828	92,915	3.204	0.320	0.320	3.844	8.650	4.446	0.445	0.445	5.215	11.735	8.920	0.892	0.892	10.704	24.084
Ward 5	78.89	19,868	21,494	23,869	13,758	16,120	20,536	1.101	0.110	0.110	1.322	2.974	1.250	0.125	0.125	1.548	3.482	1.972	0.197	0.197	2.366	5.323
Ward 6	360.63	71,634	88,734	138,191	50,137	66,551	108,955	4.011	0.401	0.401	4.813	10.830	5.324	0.532	0.532	6.389	14.375	10.460	1.046	1.046	12.552	28.241
Ward 7	175.03	57,374	65,538	85,518	40,162	49,154	68,415	3.213	0.321	0.321	3.856	8.675	3.932	0.393	0.393	4.719	10.617	6.568	0.657	0.657	7.881	17.733
Ward 8	291.76	11,309	12,065	13,733	7,916	9,049	10,586	0.633	0.063	0.063	0.760	1.710	0.724	0.072	0.072	0.869	1.955	1.056	0.106	0.106	1.266	2.848
Ward 9	293.68	45,917	53,932	74,404	32,142	40,449	59,523	2.571	0.257	0.257	3.086	6.943	3.236	0.324	0.324	3.888	8.747	5.714	0.571	0.571	6.857	15.428
Ward 10	156.38	47,240	58,487	89,655	33,068	43,800	71,724	2.645	0.265	0.265	3.174	7.143	3.509	0.351	0.351	4.211	9.475	6.886	0.689	0.689	8.263	18.591
Ward 11	181.27	18,887	20,388	23,760	13,221	15,291	19,008	1.058	0.106	0.106	1.269	2.856	1.223	0.122	0.122	1.468	3.303	1.825	0.183	0.183	2.190	4.927
Ward 12	49.84	14,866	16,651	21,386	10,296	12,473	17,109	0.823	0.082	0.082	0.988	2.217	0.998	0.100	0.100	1.197	2.694	1.643	0.164	0.164	1.971	4.435
Ward 13	228.83	42,767	55,396	72,883	32,037	40,047	58,146	2.563	0.256	0.256	3.076	6.920	3.204	0.320	0.320	3.845	8.650	5.582	0.558	0.558	6.698	15.071
Ward 14	348.68	72,260	94,108	153,291	50,582	70,583	122,633	4.047	0.405	0.405	4.856	10.926	5.647	0.565	0.565	6.776	15.246	11.773	1.177	1.177	14.127	31.787
Ward 15	333.55	67,037	86,857	141,481	46,919	65,143	113,185	3.754	0.375	0.375	4.504	10.135	5.211	0.521	0.521	6.254	14.071	10.866	1.087	1.087	13.039	29.338
Ward 16	463.33	104,608	135,427	218,504	73,225	101,570	174,603	5.858	0.586	0.586	7.030	15.817	8.126	0.813	0.813	9.751	21.939	16.781	1.678	1.678	20.137	45.309
Ward 17	66.71	28,834	32,931	42,054	20,183	24,698	34,364	1.615	0.162	0.162	1.938	4.360	1.970	0.198	0.198	2.371	5.335	3.299	0.330	0.330	3.959	8.907
Ward 18	18.24	12,053	12,775	12,775	8,437	9,581	10,220	0.675	0.068	0.068	0.810	1.823	0.767	0.077	0.077	0.920	2.070	0.981	0.098	0.098	1.177	2.649
Ward 19	15.09	10,731	10,731	10,731	7,488	8,033	8,569	0.600	0.060	0.060	0.720	1.620	0.643	0.064	0.064	0.771	1.735	0.823	0.082	0.082	0.987	2.221
Ward 20	13.39	10,968	10,968	10,968	7,678	8,226	8,774	0.614	0.061	0.061	0.737	1.658	0.658	0.066	0.066	0.790	1.777	0.842	0.084	0.084	1.011	2.274
Ward 21	13.37	13,727	13,727	13,727	9,609	10,295	10,982	0.769	0.077	0.077	0.923	2.076	0.824	0.082	0.082	0.988	2.224	1.054	0.105	0.105	1.266	2.847
Ward 22	18.71	5,699	5,699	5,699	3,989	4,274	4,559	0.319	0.032	0.032	0.383	0.862	0.342	0.034	0.034	0.410	0.923	0.438	0.044	0.044	0.525	1.182
Ward 23	10.35	8,357	8,357	8,357	5,850	6,268	6,686	0.468	0.047	0.047	0.562	1.264	0.501	0.050	0.050	0.602	1.354	0.642	0.064	0.064	0.770	1.733
Ward 24	8.53	3,488	3,488	3,488	2,442	2,616	2,790	0.195	0.020	0.020	0.234	0.528	0.209	0.021	0.021	0.251	0.565	0.268	0.027	0.027	0.321	0.723
Ward 25	10.31	3,486	3,486	3,486	2,440	2,615	2,789	0.195	0.020	0.020	0.234	0.527	0.209	0.021	0.021	0.251	0.565	0.268	0.027	0.027	0.321	0.723
Ward 26	3.80	4,133	4,133	4,133	2,893	3,100	3,306	0.231	0.023	0.023	0.278	0.625	0.248	0.025	0.025	0.298	0.670	0.317	0.032	0.032	0.381	0.857
Ward 27	7.70	7,592	7,592	7,592	5,314	5,694	6,074	0.425	0.043	0.043	0.510	1.148	0.456	0.046	0.046	0.547	1.230	0.583	0.058	0.058	0.700	1.574
Ward 28	8.82	5,611	5,611	5,611	3,928	4,208	4,489	0.314	0.031	0.031	0.377	0.848	0.337	0.034	0.034	0.404	0.909	0.431	0.043	0.043	0.517	1.163
Ward 29	197.13	55,812	72,255	117,695	39,068	54,191	94,156	3.125	0.313	0.313	3.750	8.439	4.335	0.434	0.434	5.202	11.705	9.039	0.904	0.904	10.847	24.405
Ward 30	25.91	8,563	8,563	8,563	5,994	6,422	6,850	0.480	0.048	0.048	0.576	1.295	0.514	0.051	0.051	0.617	1.387	0.658	0.066	0.066	0.789	1.776
Ward 31	103.71	16,050	17,021	20,033	11,235	13,440	16,026	0.898	0.090	0.090	1.138	2.563	1.075	0.108	0.108	1.290	2.903	1.539	0.154	0.154	1.846	4.154
Ward 32	127.89	37,764	44,168	60,419	26,435	33,126	48,335	2.115	0.212	0.212	2.538	5.710	2.650	0.265	0.265	3.180	7.155	4.640	0.464	0.464	5.568	12.529
Ward 33	86.03	27,343	30,042	35,741	19,280	22,521	28,593	1.542	0.154	0.154	1.851	4.164	1.803	0.180	0.180	2.163	4.867	2.745	0.275	0.275	3.294	7.411
Ward 34	253.31	72,982	82,270	102,704	51,090	61,932	84,263	4.087	0.409	0.409	4.905	11.035	4.955	0.496	0.496	5.946	13.378	8.118	0.812	0.812	9.742	21.919
Ward 35	398.26	100,012	132,281	213,961	70,009	99,436	172,769	5.601	0.560	0.560	6.721	15.122	7.955	0.796	0.796	9.546	21.478	16.586	1.659	1.659	19.903	44.782
Total for Kathmandu Metropolitan City	5,194.15	1,133,178	1,364,080	1,980,684	792,537	1,023,059	1,584,546	63.403	6.340	6.340	76.082	171.185	81.845	8.185	8.185	98.214	220.981	152.117	15.212	15.212	182.541	410.715

Name of Municipality/VDC	Present Area	Projected Population			Population Connected to off-site system			Wastewater Quantity Generation													
								Domestic Sewage (MLD)	Nondomestic Sewage (MLD)	Infiltration (MLD)	Average DWF (MLD)	Peak DWF (MLD)	Domestic Sewage (MLD)	Nondomestic Sewage (MLD)	Infiltration (MLD)	Average DWF (MLD)	Peak DWF (MLD)	Domestic Sewage (MLD)	Nondomestic Sewage (MLD)	Infiltration (MLD)	Average DWF (MLD)	Peak DWF (MLD)
	(ha)	2015	2020	2030	2015	2020	2030	2015					2020					2030				
Lalitpur Sub-Metropolitan City																					
Ward 1	44.10	9,030	9,860	11,729	6,328	7,395	9,383	0.506	0.051	0.051	0.607	1.367	0.592	0.059	0.059	0.710	1.597	0.901	0.090	0.090	1.081	2.432
Ward 2	128.54	23,613	30,137	49,090	16,529	22,603	39,272	1.322	0.132	0.132	1.587	3.570	1.808	0.181	0.181	2.170	4.882	3.770	0.377	0.377	4.524	10.179
Ward 3	151.03	15,754	18,127	23,098	11,028	13,585	19,198	0.882	0.088	0.088	1.059	2.382	1.088	0.109	0.109	1.305	2.937	1.843	0.184	0.184	2.212	4.976
Ward 4	179.33	17,284	20,811	29,150	12,099	15,608	23,320	0.968	0.097	0.097	1.162	2.615	1.249	0.125	0.125	1.498	3.371	2.239	0.224	0.224	2.687	6.045
Ward 5	70.55	6,404	6,404	6,404	4,483	4,803	5,123	0.359	0.036	0.036	0.430	0.968	0.384	0.038	0.038	0.461	1.037	0.492	0.049	0.049	0.590	1.328
Ward 6	20.97	6,959	7,190	7,674	4,871	5,392	6,139	0.390	0.039	0.039	0.468	1.052	0.431	0.043	0.043	0.518	1.165	0.589	0.059	0.059	0.707	1.591
Ward 7	24.77	8,512	9,421	11,261	5,959	7,066	9,009	0.477	0.048	0.048	0.572	1.287	0.565	0.057	0.057	0.678	1.526	0.865	0.087	0.087	1.038	2.335
Ward 8	44.90	13,581	16,912	30,215	9,509	12,684	16,173	0.761	0.076	0.076	0.913	2.054	1.015	0.102	0.102	1.218	2.740	1.553	0.155	0.155	1.863	4.192
Ward 9	78.87	17,164	21,288	31,969	12,015	15,966	25,575	0.961	0.096	0.096	1.153	2.595	1.277	0.128	0.128	1.533	3.449	2.435	0.246	0.246	2.946	6.629
Ward 10	82.32	7,008	7,767	9,380	4,947	5,825	7,504	0.396	0.040	0.040	0.475	1.069	0.466	0.047	0.047	0.559	1.258	0.720	0.072	0.072	0.864	1.945
Ward 11	10.11	4,458	4,458	4,458	3,121	3,344	3,566	0.250	0.025	0.025	0.300	0.675	0.268	0.027	0.027	0.321	0.722	0.342	0.034	0.034	0.411	0.924
Ward 12	12.88	5,891	5,891	5,891	4,124	4,418	4,713	0.330	0.033	0.033	0.396	0.891	0.353	0.035	0.035	0.424	0.954	0.452	0.045	0.045	0.543	1.221
Ward 13	94.42	18,348	23,417	38,144	12,844	17,563	30,515	1.028	0.103	0.103	1.233	2.774	1.405	0.141	0.141	1.686	3.794	2.929	0.293	0.293	3.515	7.909
Ward 14	166.00	26,203	35,462	56,052	18,342	25,322	44,841	1.467	0.147	0.147	1.761	3.962	2.026	0.203	0.203	2.431	5.470	4.305	0.431	0.431	5.166	11.623
Ward 15	239.04	15,009	16,583	20,244	10,506	12,437	16,195	0.841	0.084	0.084	1.009	2.269	0.995	0.100	0.100	1.194	2.687	1.555	0.156	0.156	1.866	4.198
Ward 16	9.03	4,362	4,362	4,362	3,053	3,272	3,490	0.244	0.024	0.024	0.293	0.659	0.262	0.026	0.026	0.314	0.707	0.335	0.034	0.034	0.402	0.905
Ward 17	34.96	12,814	16,160	25,240	8,970	12,120	18,592	0.718	0.072	0.072	0.861	1.938	0.970	0.097	0.097	1.164	2.618	1.785	0.179	0.179	2.142	4.819
Ward 18	13.49	5,777	5,777	5,777	4,044	4,333	4,622	0.324	0.032	0.032	0.388	0.874	0.347	0.035	0.035	0.416	0.936	0.444	0.044	0.044	0.533	1.198
Ward 19	17.66	7,385	7,385	7,385	5,170	5,539	5,908	0.414	0.041	0.041	0.496	1.117	0.443	0.044	0.044	0.532	1.196	0.567	0.057	0.057	0.681	1.531
Ward 20	18.16	7,721	7,721	7,721	5,405	5,791	6,177	0.432	0.043	0.043	0.519	1.167	0.463	0.046	0.046	0.556	1.251	0.593	0.059	0.059	0.712	1.601
Ward 21	8.25	4,659	4,659	4,659	3,261	3,494	3,727	0.261	0.026	0.026	0.313	0.704	0.280	0.028	0.028	0.336	0.755	0.359	0.036	0.036	0.429	0.966
Ward 22	47.15	11,016	12,004	14,255	7,711	9,003	11,404	0.617	0.062	0.062	0.740	1.666	0.720	0.072	0.072	0.864	1.943	1.095	0.110	0.110	1.314	2.956
Total for Lalitpur Sub-Metropolitan City	1,518.62	240,328	290,097	393,057	174,529	217,573	314,445	13.962	1.397	1.397	16.755	37.698	17.406	1.741	1.741	20.887	46.996	30.187	3.019	3.019	36.224	81.504

Name of Municipality/VDC	Present Area	Projected Population			Population Connected to off-site system			Wastewater Quantity Generation													
								Domestic Sewage (MLD)	Nondomestic Sewage (MLD)	Infiltration (MLD)	Average DWF (MLD)	Peak DWF (MLD)	Domestic Sewage (MLD)	Nondomestic Sewage (MLD)	Infiltration (MLD)	Average DWF (MLD)	Peak DWF (MLD)	Domestic Sewage (MLD)	Nondomestic Sewage (MLD)	Infiltration (MLD)	Average DWF (MLD)	Peak DWF (MLD)
	(ha)	2015	2020	2030	2015	2020	2030	2015					2020					2030				
Bhaktapur Municipality																					
Ward 1	27.48	4,805	4,805	4,805	3,364	3,604	3,844	0.269	0.027	0.027	0.323	0.727	0.288	0.029	0.029	0.346	0.778	0.369	0.037	0.037	0.443	0.996
Ward 2	83.31	7,411	8,422	10,433	5,213	6,319	8,338	0.417	0.042	0.042	0.500	1.126	0.506	0.051	0.051	0.607	1.365	0.800	0.080	0.080	0.960	2.161
Ward 3	23.84	3,472	3,528	3,644	2,430	2,646	2,915	0.194	0.019	0.019	0.233	0.525	0.212	0.021	0.021	0.254	0.572	0.280	0.028	0.028	0.336	0.756
Ward 4	120.64	12,240	13,859	17,060	8,574	10,394	13,648	0.686	0.069	0.069	0.823	1.852	0.832	0.083	0.083	0.998	2.245	1.310	0.131	0.131	1.572	3.538
Ward 5	32.50	3,530	3,623	3,811	2,745	3,217	3,969	0.300	0.030	0.030	0.360	0.809	0.337	0.034	0.034	0.405	0.911	0.477	0.048	0.048	0.572	1.288
Ward 6	11.93	2,126	2,126	2,126	2,168	2,345	2,501	0.175	0.018	0.018	0.210	0.473	0.188	0.019	0.019	0.225	0.507	0.240	0.024	0.024	0.288	0.648
Ward 7	14.17	4,437	4,437	4,437	3,105	3,328	3,550	0.249	0.025	0.025	0.298	0.671	0.266	0.027	0.027	0.319	0.719	0.341	0.034	0.034	0.409	0.920
Ward 8	4.47	3,138	3,138	3,138	2,197	2,354	2,510	0.176	0.018	0.018	0.211	0.475	0.188	0.019	0.019	0.226	0.508	0.241	0.024	0.024	0.289	0.651
Ward 9	3.90	2,071	2,071	2,071	1,450	1,553	1,657	0.116	0.012	0.012	0.139	0.313	0.124	0.012	0.012	0.149	0.335	0.159	0.016	0.016	0.191	0.430
Ward 10	30.92	4,643	4,759	4,993	3,249	3,569	3,962	0.260	0.026	0.026	0.312	0.702	0.286	0.029	0.029	0.343	0.771	0.380	0.038	0.038	0.456	1.027
Ward 11	14.03	3,287	3,287	3,287	2,301	2,465	2,630	0.184	0.018	0.018	0.221	0.497	0.197	0.020	0.020	0.237	0.532	0.253	0.025	0.025	0.303	0.682
Ward 12	16.98	3,781	3,781	3,781	2,647	2,837	3,026	0.212	0.021	0.021	0.254	0.572	0.227	0.023	0.023	0.272	0.613	0.291	0.029	0.029	0.349	0.784
Ward 13	7.14	2,225	2,225	2,225	1,558	1,669	1,780	0.125	0.013	0.013	0.150	0.337	0.134	0.013	0.013	0.160	0.361	0.171	0.017	0.017	0.205	0.461
Ward 14	12.34	4,486	4,486	4,486	3,139	3,350	3,573	0.250	0.025	0.025	0.300	0.675	0.268	0.027	0.027	0.322	0.724	0.343	0.034	0.034	0.412	0.926
Ward 15	65.21	6,438	6,918	8,037	4,482	5,188	6,430	0.359	0.036	0.036	0.431	0.970	0.415	0.042	0.042	0.498	1.121	0.617	0.062	0.062	0.741	1.667
Ward 16	16.69	3,726	3,783	3,839	2,608	2,822	3,071	0.209	0.021	0.021	0.250	0.563	0.226	0.023	0.023	0.271	0.610	0.295	0.030	0.030	0.354	0.796
Ward 17	164.67	11,186	12,806	17,044	7,770	9,605	13,635	0.622	0.062	0.062	0.746	1.678	0.768	0.077	0.077	0.922	2.075	1.309	0.131	0.131	1.571	3.534
Total for Bhaktapur Municipality	670.61	85,740	91,018	102,548	60,018	68,265	82,039	4.801	0.480	0.480	5.762	12.964	5.461	0.546	0.546	6.554	14.745	7.876	0.788	0.788	9.451	21.265

Table IV-5: Existing Outfalls Details, Manohara River Right Bank

SN	Manhole	Pipe Diameter	Invert RL	Remark
		(mm)	(m)	
1	MH-MR-77	600	1310.957	Phase II
2	MH-MR-83	300	1308.511	Phase II
3	MH-MR-180	1000	1297.429	Phase II
4	MH-MR-183	450	1297.510	Phase I
5	MH-MR-188	600	1296.488	Phase I
6	MH-MR-190	300	1297.624	Phase I
7	MH-MR-192	900	1295.197	Phase I
8	MH-MR-201	600	1296.940	Phase I
9	MH-MR-204	600	1297.065	Phase I
10	MH-MR-209	5.0 m x 2.5 m	1296.002	Phase I
11	MH-MR-211	900	1296.671	Phase I
12	MH-MR-237	2.0 m x 1.3 m	1293.603	Phase I
13	MH-MR-239		1293.011	Phase I
14	MH-MR-242		1293.036	Phase I
15	MH-MR-256	600	1291.437	Phase I
16	MH-MR-257	600	1290.847	Phase I
17	MH-MR-262	450	1289.070	Phase I
18	MH-MR-263	450	1289.601	Phase I
19	MH-MR-280	600	1287.092	Phase I
20	MH-MR-283	300	1286.636	Phase I
21	MH-MR-285	300	1289.449	Phase I
22	MH-MR-287	450	1287.793	Phase I
23	MH-MR-292	450	1286.768	Phase I
24	MH-MR-298	600	1285.593	Phase I
25	MH-MR-304	900	1286.389	Phase I
26	MH-MR-305	900	1283.687	Phase I

Table IV-6: Manohara River Left Bank Upstream

SN	Manhole	Pipe Diameter	Invert RL	Remark
		(mm)	(m)	
1	MH-ML-194	1000	1290.708	Phase I
2	MH-ML-195	600	1291.729	Phase I
3	MH-ML-206	900	1289.016	Phase I

Table IV-7: Manohara River Left Bank Downstream

SN	Manhole	Pipe Diameter	Invert RL	Remark
		(mm)	(m)	
1	MH-MLD-01		1288.069	Phase I
2	MH-MLD-06		1289.681	Phase I
3	MH-MLD-09	1000	1286.829	Phase I
4	MH-MLD-12	900	1287.764	Phase I
5	MH-MLD-31	1200	1285.458	Phase I
6	MH-MLD-33		1285.018	Phase I
7	MH-MLD-036	1500	1283.947	Phase I

3. Collection System

69. Sewage collection networks have been developed in the core of metropolitan and municipality areas. Most previous planning reports recommended adopting separate systems. However, the emphasis has been, and continues to be, using combined sanitary and storm water drains. In areas where storm water drains were constructed, it is very common to connect sanitary drainage into these drains. It is common to use pipes constructed to convey sanitary sewage for storm water – either direct from roofs or from lanes and roads. The system is very entrenched and thus nearly all drains are considered as combined sewers.

70. The sewer lines, especially the tertiary networks, have generally not been laid with proper gradient and sizes. Asset records (either plans or asset condition) are for all practical purposes, non-existent. The actual condition of existing sewers is not known as even manhole covers are hard to locate in many locations.

71. In absence of good operational data, complaint and maintenance logs, good and widespread asset condition survey, it is difficult if not impossible to determine the real operational status of the existing collection system. The sewers are often clogged with solid waste and street dusts and silts and plastics. KUKL's experience is that silt from road cleaning is regularly placed in sewers and is a major cause of such blockages. As these clogged sewers have not been cleaned routinely, they tend to overflow in rainy season. This is aggravated by the poor construction quality control of new sewers. Since many sewers have been designed as water drains with larger diameter and low gradient, they are often unsuitable as sewers in dry season, as there is insufficient self-cleaning flow. The asset condition survey of the existing sewer network in the service areas of KUKL has been carried out by Lama – Aviyan – Soiltest – Genesis – DAN - NESS under contract no KUKL/WSI/01/04.

4. Sewer Materials

72. Existing sewer materials are mostly concrete pipes, with collar jointed pipes and brick manholes. In a recent project at Buddhanagar, concrete rubber ring jointed pipes have been used. This is in line with the recommendations of the CWWMP.

5. Construction Standards

73. The PPTA (2012) has raised serious concerns about the current construction standards of the sewerage network, especially based on inspections in Buddhanagar and Minbhawan areas. From other observations, the poor standard of work is found widespread. Pipes are laid with little attention to gradient, and bedding joints are not water-proof. The implications of the poor construction practices include:

- high infiltration and inflow of storm water and groundwater into sewerage network
- potential contamination of adjacent water pipes (especially as the water network is intermittent in operation)
- hydraulic capacity is impossible to determine due to the uneven grades between manholes
- blockages are likely to be more common
- poor covering leads to broken pipes
- poor bedding leads to settlement which leads to infiltration/leakage of
- sewage from the pipe or excessive inflow/infiltration into the sewers
- poor quality of construction including that of manholes leads to depression in road surfaces
- little attention is paid on the impact of construction to local residents and customers, and to workers' health and safety.

6. House Connections

74. KUKL is the only authority responsible for house connections in the valley. However, many private land developers and house owners have been connecting to the city sewer network illegally without due procedure. As per PPTA report, this practice is widespread – e.g. the house owner approaches to the KUKL for legal permission only if there is a necessity of black-topped road cutting for connection to nearby manhole. KUKL has not been updating the house connection figures and the official figure of 93,000 is considered to be outdated.

7. Sewer Network Systems

75. In the past the Kathmandu valley used to have two different sanitary systems: the conservation system where wastes are collected, conveyed and disposed of without water and water carriage system where collection, conveyance and disposal using water borne system. The conservation system is no more in use.

76. The Kathmandu Valley has three separate systems to collect domestic sewage. They are separate, combined and partially combined/separate system. The combined system is designed to collect and convey both sanitary and storm water with storm relief (overflow) structures so that treatment plant is not overloaded during rainy season.

77. The first sewers in the Kathmandu Valley were constructed around 1800 AD (Malla period) for surface drainage and kitchen sullage. In the Rana period (about 100 years ago) combined sewers were built. Such sewers were typical brick sewers and were constructed with a flushing system using gates to allow sudden release of flows (SMEC, 1990).

78. After the widespread introduction of the water flush toilets in 1950, the houses of adjoining sewers started discharging domestic sewage into these sewers converting them into combined sewers. Under the IDA Project, approximately 26 km of sanitary sewer network were laid to collect and convey domestic sewage during 1976-83. In this period also, some of the old sewers of Rana period were thoroughly cleaned (SMEC, 1990). Since then, many agencies have constructed sanitary sewers and storm water conduits in different locations of the Kathmandu valley. During the course of time both sanitary sewers and storm water conduits are being used as combined sewers. The IDA projects I and II have constructed both separate sanitary and storm water systems. Since then, many agencies have constructed sanitary sewers and storm water conduits in the valley. However, over the time, many household sanitary wastes have been connected indiscriminately to both storm water drainage and sewer pipelines.

79. There are no reliable records of existing sewers of all five municipalities and their adjoining surrounding semi urban areas. According to the Conceptual Wastewater Master Plan 2010, the expected total length of sewers is of the order of 700 to 800 km, but this figure is not based on any measurement from the field or maps. The master plan has only presented a wastewater service area with existing sewer pipe network of Kathmandu valley. But no field verification of existing sewer network with details such as their sizes, grades and condition were carried out during preparation of conceptual master plan. The service areas adopted for master plan include all 5 municipalities and 17 surrounding VDCs (Tinthana, Sitapaila, Syuchatar, Gongbu, Manamaiju, Dhapasi, Mahankal, Gothatar, Mulpani, Jorpati, Gorkana, Kapan, Budhanilkantha, Khadka Bhadrakali, Imadol, Dhapakhel and Saibu).

8. Branch and Tertiary Systems

80. Branch and Tertiary Systems collect sewage directly from households and transfer to the larger main collector system. The total length of branch and tertiary sewer network is reported as 192 km (KVEO, 2007). The sewers usually used are 150 mm diameter reinforced concrete pipes with collar joints. The laying of sewer pipes as branch and tertiary network is rapidly expanding in newly developed urban areas. Municipalities have also

initiated a Public Private Partnership (PPP) model to accelerate the construction of branch and tertiary sewer networks in the municipality's core urban areas. Municipalities and local communities have jointly connected a large number of households involving reinforced concrete sewer pipes under a public private participation (PPP) model in mostly core urban areas. The emphasis of these schemes is on solving local drainage problems. According to KUKL, the sizing of sewers appears to be haphazard and grading of sewer pipes is poorly controlled and quality of construction is found poor due to less supervision and monitoring by the technical teams.

81. The IDA implemented Phase I and II sewers are the most heavily blocked sewers as considered by the KUKL's sewerage operation and maintenance staff. Regarding the jointing of pipes in branch and tertiary networks, KUKL had carried out investigations on adopting spigot and socket joint types (with rubber ring). At that time, such types of joint were not available in the market place.

9. Main Collector Sewers

82. The records on main collector sewers, which combine flows from upstream system and discharge it to the trunk or interceptor sewer, are not available as many agencies especially municipalities are also involved in their design and construction. The main collector sewers are also constructed from reinforced concrete pipe with collar joints.

10. Interceptors

83. Interceptor sewers are the main trunk sewers which collect sewer from collector systems and they are usually laid along the river banks leading to the treatment plants or sites. If the sewer network connecting to the interceptor is a combined sewer, a predetermined flow only will be conveyed to the interceptor or trunk sewer during high flows. There is about 40 km of interceptors as per ICIMOD (2007) reports. The Nepal Water Supply and Sewerage Corporation (NWSC) also constructed about 35km of trunk sewer from 1983 to 1990.

84. As reported in the conceptual wastewater master plan and additional information received from the agencies involved in wastewater sector, the existing interceptors along the major rivers are shown in Figure IV-6.

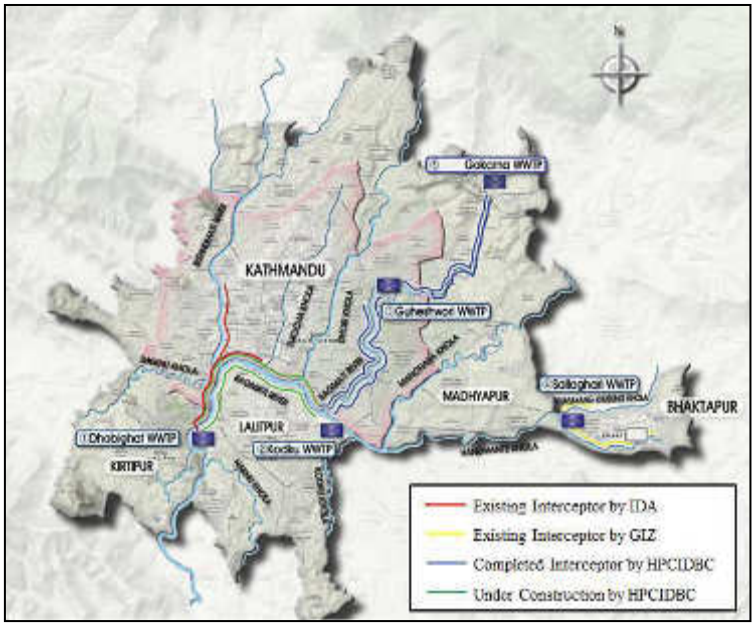


Figure IV-6: Existing Interceptors

85. The details of exiting interceptors along the major rivers are as follows:

A) IDA Interceptors

86. In the IDA first phase project (c1980), the following interceptors were constructed.

- Right bank of Bagmati River (from Tukucha Khola confluence to Sundarighat pumping station)
- Left bank of Bishnumati from Dhalko to Teku.

87. Meanwhile, the interceptor from Teku to Dhobighat has not been functioning for several years. In addition, a pressure main with 800 mm. dia. DI pipe from Sundarighat pumping station to Dhobighat WWTP (1.76 km.) was constructed but breached many years ago (early 1980s) and is not functioning.

B) HPCIDBC Interceptors

88. HPCIDBC has constructed around 22 km sewer network in the upstream catchment area of Guheshwori WWTP in recent years. HPCIDBC has been continuing the construction of interceptors from upstream of Bagmati River and planning laying down to Sundarighat pumping station. Although the construction of interceptors along Bishnumarti and Dhobi Khola are included in this package originally, HPCIDBC has intended to construct these interceptors. Hence, these interceptors have not been included in this package.

89. At present, HPCIDBC is also engaged with river improvement work of Bagmati River. Its works include laying of interceptors and construction of 8m wide roads and 15 m green belts on both sides of Bagmati Rver from Jorpati to Dhobighat. Table IV-8provides summary of interceptors under HPCIDBC program.

Table IV-8: Summary of Interceptors under HPCIDBC Program

Location	Length (m)	Status
Gokarna – Guheshwori	6,000 × 2	Under operation
Tilganga – Minbhawan	4,000 × 2	Construction completed
Minbhawan - Shankhamul Bridge	on both sides	Under construction
Shankhamul Bridge - Sundarighat	on both sides	Under construction

C) GTZ Interceptors

90. GIZ (previously GTZ) designed and constructed combined sewer and two WWTPs in Bhaktapur Municipality. With some minor deficiencies, the sewer network is still functioning. The south collector which used to feed wastewater to Sallaghari WWTP was out of operation for many years due to pumping breakdown. As an alternate to that collector, GIZ designed a new collector with gravity system in 2002 but this has not materialized to date. The PPTA proposed two Interceptors along both banks of Hanumante River. The GIZ designed collector cannot be used as right bank interceptor as new settlements have been developed along the proposed route. Besides, this interceptor cannot collect sewage from the whole catchment.

11. Existing Storm Water Disposal System

91. The storm water in Kathmandu Valley is drained to rivers through road side drains, storm sewers and combined sewers. The old sewers in Kathmandu Valley were constructed mainly for surface drainage and kitchen sullage. These brick sewers of 1050 x 1050 mmovoid sections or 600 mm circular sections were constructed with a flushing system using gates to allow sudden release of flows to clean the system. These storm water sewers wereconverted to combined sewer after water flushed toilet system was introduced, and domestic sewage discharged into these sewers.

92. There has been large number of storm water drains and combined sewers constructed in urban areas of Kathmandu Valley by NWSC/KUKL and the municipalities. Many sewers have also been constructed under the community participation program where the beneficiaries contribute as much as 20 to 65% of the development cost and the rest is borne by either the municipalities or NWSC/KUKL. The ownership of these sewers is not fully identifiable and the maintenance of such sewers is either done by KUKL, the municipalities or by the community itself. In case of sewers where the maintenance is done by the community themselves, they have refrained from paying sewerage charges to KUKL.

93. In most parts of urban areas of the valley, there is no separation of sanitary sewers and storm water drains. Most households are connected to either one or both forms of drainage depending on what type of sewer is closer or most convenient, which means that almost all sewers in Kathmandu Valley are presently operating as combined sewers. They have adopted this since the early stage of development. The sewerage system constructed later has been used mainly as a sanitary sewer.

94. There is no clear demarcation about which agency is responsible for development and maintenance of the storm water system. Although the Department of Roads is primarily responsible for development and management of storm water drains, a lot of the responsibility also rests with KUKL as it is operating and maintaining many combined sewers. The management of combined sewers therefore by default also includes management of some storm water. As the local roads inside the municipality come under the jurisdiction of municipalities, the municipal authorities are also responsible. The municipalities complain that this additional responsibility has been given to them without allocating additional financial resources to manage it.

95. The responsibility for development and maintenance of the storm water drainage system will become more important when a policy of separation of sanitary sewer and storm sewer is implemented. KVWSMB and KUKL will be responsible for development and operation of sanitary sewers while new arrangements will be required to be put in place for development, operation and maintenance of storm water system.

12. Existing Solid Waste Disposal System

96. The PPTA (2012) has roughly estimated that about 20% of solid waste generation is spread to open water ways. The five municipalities in the valley generate approximately 650tonnes of solid waste daily of which more than 70% comes from the Kathmandu Metropolitan City. The final disposal sites are always controversial and opposed by the local people and much of the solid waste is disposed at the river banks and in open areas. The current location of disposal is located at Sisdol - 25 km west from Kathmandu. However, this landfill site was designated for three years that have already passed. A new municipal waste disposal site has been identified and is in the process of being developed.

97. The daily solid waste generation is assumed to be 0.25 kg/p/d. Studies have revealed that the composition of solid waste in Kathmandu is mainly organic (58 to 66%)with 5% plastics. The use of plastic bags has increased over the years. Since plastic bags are not-bio-degradable their use should be discouraged or even banned.

98. Sewers collect considerable solid wastes which contribute to blockages. Dumping ofsolid waste along river banks also affects the quality of river water.

13. Air quality, traffic management, and noise pollution

99. The emissions of the increasing number of vehicles (274,000 as of 2004−2005) account for about 38% of the air pollution in Kathmandu Valley. Industrial emissions also

contribute substantially to air pollution (KVEO 2007).

100. Kathmandu Valley is particularly vulnerable to air pollution because of its bowl-shaped topography that restricts air movement. The situation is worse during the winter when temperature inversion during the night and early morning traps a layer of cool air under a layer of warmer air, trapping pollutants close to ground level for extended periods. Besides the topography, the relatively high elevation of the Valley also results in increased vehicular emissions.

101. Vehicular emissions have become the main source of air pollution in Kathmandu Valley. An inventory of emission sources by the then Ministry of Population and Environment (MoPE) indicated that exhaust fumes had increased more than four times in the 8 years between 1993 and 2001. According to a more recent inventory, vehicular emissions are responsible for 38% of the total particulate matter < 10µm (PM_{10}) emitted in Kathmandu Valley, compared to 18% from the agricultural sector and 11% from brick kilns (Gautam 2006; Table 1). Increase in emissions is mainly due to the increase in the number of automobiles, as well as poor transport management and poor vehicle maintenance.

102. Recently, a study on traffic noise in Kathmandu Valley was carried out. The noise levels in Kathmandu City range from 79 decibels (dB) to 112 dB, higher than those of the major cities in India. The rate of increase of noise level in Kathmandu City was found to be 1 dB per year.

103. Three different types of noise areas were identified for Kathmandu Valley, although there is no data available on the noise levels produced from the existing WWTPs:

(i) Low noisy areas: Noise levels below 70 dB.
(ii) Moderate noisy areas: Noise levels between 70 dB and 80 dB; include Hotel Shangrila, Gairidhara, Galkhupakha, Gausala, Satdobato, Balkhu, Swoyambhu, Pulchwok, and Maitidevi.
(iii) Hazardous areas: Noise levels were beyond 80 dB; include Putalisadak, New Baneshwore, Kalanki, Narayan Gopal Chowk, Tripureshwor, Kalimati, and Koteshwore.

104. A survey showed that the frequency of health problems arising from noise pollution increases with the degree of noise levels. About 95% of tested affected people come from hazardous areas, 88% from moderate noisy areas, and 62% from low noisy areas.

E. Ecological Resources

1. National Parks

105. The ShivapuriNagarjun National Park is the only national park near Kathmandu Valley. Shivapuri is the second highest peak among the hills surrounding the valley. It is 2,732 m high with numerous sharp ridges radiating to all sides. Due to its strategic location and convenience, being situated toward the north of Kathmandu Valley, Shivapuri was proclaimed as a watershed area supplying natural spring water to the city. After Shivapuri had experienced several problems concerning soil erosion as a result of deforestation, over-grazing, cultivation on steep slopes, etc., which reduces the quality and quantity of the water, the Government initiated a program to protect Shivapuri and its adjoining areas as a watershed and wildlife reserve in 1975. In 2002 Shivapuri Watershed and Wildlife Reserve was officially given the national park status. In 2009, Nagarjun was annexed to the Shivapuri National Park and renamed the ShivapuriNagarjun National Park. The proposed sewer network is situated within the core city area of LMC and hence no any National Park is existed.

2. Forests

106. The valley has 20,945 ha of forests, which constitutes 32.7% of its total area. The natural vegetation, except in a few conservation areas, has been under intense pressure. The area under natural forest cover, excluding shrubs, is 9,580 ha (45.7% of the total forest land), of which only about 22% has good forest cover with more than 50% of crown coverage. Mature hardwood forests are now confined to parks and sacred areas such as Nagarjun (Raniban), Gokarna, Shivapuri National Park, and Bajrabarahi forest. Shrubland occupies nearly 34% of the total forest area. The forests in the Valley are not in good condition; most are in the regenerating stage. The crown coverage of Rhododendron and Quercus is more than 70%, while those of *PINUS ROXBURGHII* and *SCHIMA-CASTONOPSIS* are less than 40%. About 1,312 plant species belonging to 162 vascular families are found in the Valley, representing 26% of the total number of plants recorded in Nepal. About 7 species of gymnosperms, 170 species of ferns, and 97 species of orchids are found in the Valley. About 250 species of birds have been reported in the Phulchowki area and many birds are found in Nagarjun, Shivapuri, Tuadaha, Tokha, and Bajrabarahi. Many migratory birds are sighted at Taudaha pond. About 33 bird species have disappeared from the Valley due to habitat destruction. Some patches of forest exist in Bajrabarahi, Hattiban, Balkumari, Karya Binayak, Mhaipi, Pashupatinath, Raniban, and Bansbari. These are mostly of eucalyptus, *PROTEA SP, JACARANDA SP,* and camphor. Green belts are found in some cities. *POPULUSSP* and Eucalyptus sp are mostly found along the Ring Road.

107. The Nagarjun National Park (area: 15 km2) was annexed in 2009 to the Shivapuri National Park (area: 144 km2) and called the ShivapriNagarjun National Park. The intension was "to provide extended habitat for the wildlife population and as a representation of intact midhill forest ecosystems whose representation is comparatively low in the protected area system. The ShivapuriNagajun National Park is one of the primary sources of freshwater for Kathmandu Valley, providing about 40% of the drinking water to the Valley" (Department of National Parks and Wildlife Conservation 2009).

108. However, no any forests, national parks and protected area is existed within the proposed project locations.

3. Flora

109. Since Shivapuri lies in the transition zone between a subtropical and a temperate climate, the vegetation consists of a variety of natural forest types, depending on altitude and aspects. Most of the areas below 1,800 m are covered with *Schima castanopsis* forest in which pines (*Pinus roxburghii*) appear on the southern dry ridges, with utis (*Alnus nepalensis*) along the streams. A forest of oak species such as *Quercus semicarpifolia* and *Quercus lamelosa* mixed with rhododendron and a variety of orchids flourish in the northern slopes. There are more than 2,122 species of flora; 16 of them are endemic flowering plants found in the Shivapuri Nagarjun National Park. A variety of medicinal herbs are found at higher altitudes. About 130 species of mushrooms have been so far identified and catalogued from the Shivapuri National Park.

4. Fauna

110. The Shivapuri National Park is home to 311 species of birds, 21 species of mammals, and more than 102 species of butterflies, some of which are endemic and rare. This is out of the 800 species of birds, 130 species of mammals (of which 11 are threatened species), and 600 species of butterflies found in Nepal, thus making the National Park a paradise for flora and fauna. The threatened wildlife found are wild boar (*Sus scrofa*), barking deer (*Muntiacusmuntijak*), rhesus monkey (*Macacamulata*), porcupine (*Hystrixindica*), goral (*Naemorhedus goral*), Himalayan black bear (*Ursusthibetanus*),

leopard (*Panthera pardus*), pangolin (*Manis spp.*), cloded leopard (*Pardofelisnebulosa*), leopard cat (*Primailurusbengalensis*), and jungle cat (*Felis chaus*).

F. Socio-economic Profile
1. Social and Household Profile

111. **Social classification**. The majority of the people living in the valley are Hindus followed by Buddhist. The number of people with other religions is minimal. Households are divided into different ethnic groups such as Newars, Brahmins, Chettris, Tamangs, and Magars. Newars are the prominent inhabitants followed by Brahmins, Chettris, Tamangs, and Magars. These ethnic groups are not of the same level of socio-economic development. In Kathmandu Valley, Newars are considered as advanced indigenous people's group. Besides Newars, Brahmins and Chhetris are the major ethnic groups. Similarly, Tamangs and Magars comprise a small percentage of the total population of the Valley.

112. The Kathmandu Valley is bowl cup shaped which is surrounded by the mountains. Its administrative boundary has not been defined. The boundary of the Kathmandu Valley developed from the map study along with the municipalities within the Kathmandu Valley are shown in Figure *IV-7*.

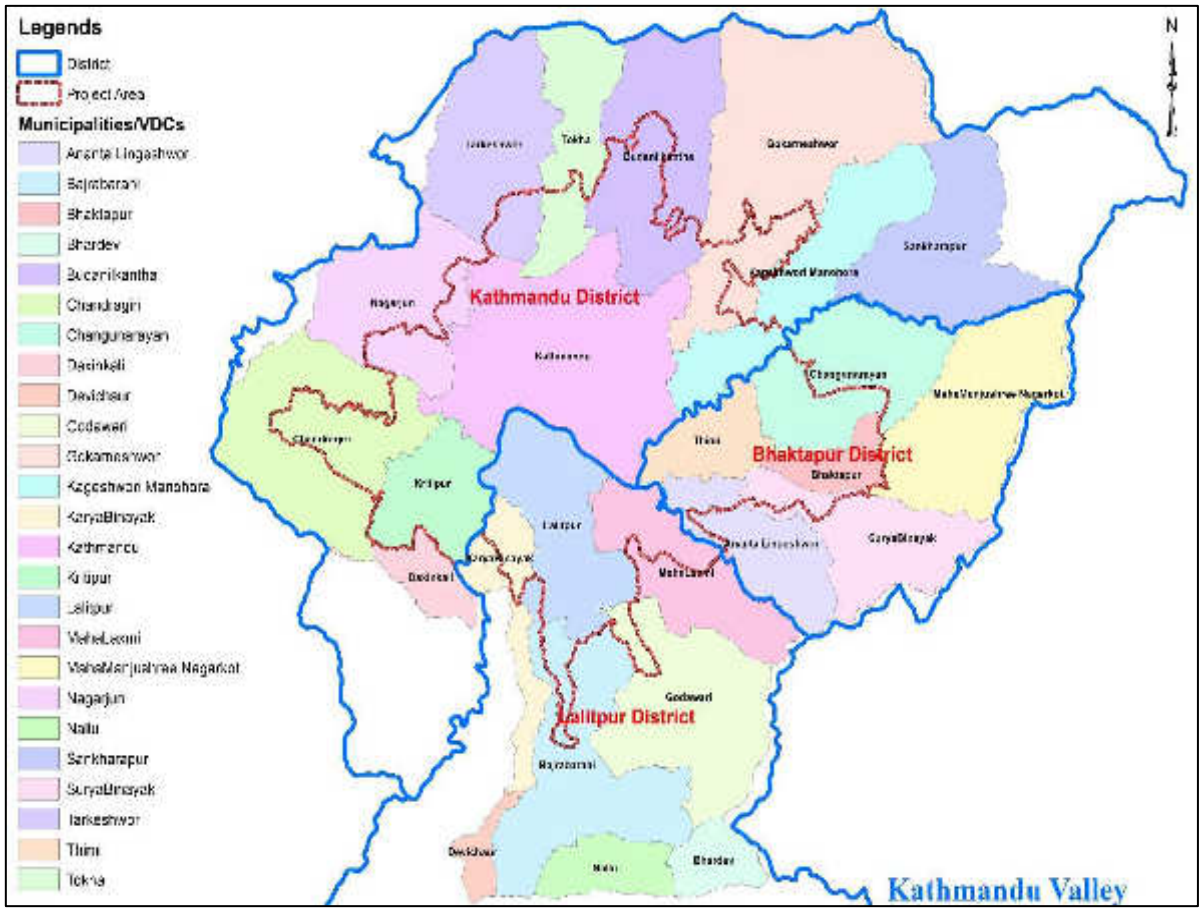


Figure IV-7: Kathmandu Valley Boundary

113. A detail Socio-economic survey was conducted to investigate affected households income, crop loss, livelihood options, structures and other assets. Total 6 affected households, socio-economic survey was carried out with consistence of 27 populations. The Table 1 provides summary of the affected households. Socio economic survey of affected households was carried out in January 2018.

Table IV-9: Summary of Affected Households by the Subproject

SN	Details	Affected HHs
1	Interviewed Household	6
2	Affected Population	27
a	Male	9(33.33%)
b	Female	18(66.67%)
3	Household By Ethnicity	
3a	Janajati Household	5(83.33%)
3b	Brahmin/Chhetri Household	1 (16.67%)
4	Female Headed Household	1
5	Average HHs Size	4.5

Source: Household Survey: January 2018

Demographic Composition

114. The construction of sewer line affects six households. Details are included in Appendix 2. Altogether, 27 family members will be affected in which the number of female is higher than male. The average family household size is 4.5.

Table IV-10: Population of affected Households

Affected HHs	Male	Female	Total	HHs Size
6	9	18	27	4.5

Source: Household Survey: January 2018

115. The project construction site is located in mainly Bhaktapur and some parts in Kathmandu and Lalitpur District of Nepal. Among the affected families the Janajati (83.33%) are high in number in compare to Brahmin/Chhetri. The table below shows the ethnic composition.

Table IV-11: Ethnic Composition

Caste/Ethnicity	HHs/No	Percentage
Brahmin/Chhetri	1	16.67
Janajati	5	83.33

Source: Household Survey: January 2018

Age Distribution

116. Among the project affected population, majority (77.78%) are economically active and about 22.22% populations are dependent which indicates that these age group populations are economically inactive and dependent for their livelihood.

Table IV-12: Age Group

Age Group	Male	Percentage	Female	Percentage	Total	Percentage
Below 5						
6-15yrs	1	11.11	3	16.67	4	14.81
16-60yrs	7	77.78	14	77.78	21	77.78
Above 60	1	11.11	1	5.56	2	7.41
	9	100.00	18	100.00	27	100.00

Source: Household Survey: January 2018

Education and Literacy Status

117. Regarding the educational status of population aged 5 years and above, the socio-economic survey data reveals that about 77.78 percent are literate except infant. By level of education, 14.81 percent of total household population is literate without formal school education. Almost 14.81 percent of population has attained primary level education, 18.52 percent population with lower secondary level, 25.93 percent with secondary level and 3.70 percent of population is found with Intermediate. The distribution of household population by educational status for each ward is outlined in table below.

Table IV-13: Literacy Status

Education	Number	Percentage
Illiterate	6	22.22
Literate	4	14.81
Primary	4	14.81
Lower Secondary	5	18.52
Secondary	7	25.93
Intermediate	1	3.70
Bachelor degree	0	0
Master degree	0	0
	27	100

Source: Household Survey: January 2018

Occupation of Affected Household

118. The households were asked the major sources of income of the affected households. They depend in multiple source of income. Among them, business and pension is the main source of income.

Table IV-14: Occupation of Affected Household

Occupation	No of population	Percentage
Services	0	
Business	12	52.17
Labor	0	
Agriculture Labor	0	
Pension	1	4.35
Student	9	39.13
Agriculture	0	
Household work	1	4.35
	23	

Source: Household Survey: January 2018

Level of Income

119. Business is the major sources of income among the affected HHs. The range of income shows that they have sufficient income level. 50% affected households earn in between 200000-300,000 per year. No households fall below district poverty level. The poverty line for Nepal, in average 2010-11 prices, has been estimated at Rs.19261.00 and for Kathmandu it has been estimated at Rs 40933.00. An individual in Nepal is considered poor if his /her per capita total annual consumption is below Rs. 19261.The table below shows the income level of affected households.

Table IV-15: Level of Income

Income Range	Households	Percentage
Below 50000		
50000-100000		
100000-150000		
150000-200000	1	16.67
200000-300000	3	50.00
Above 300000	2	33.33

Source: Household Survey: January 2018

Source of Water

120. The major source of water is pump water in project area. 4 HHs have access to pump water. 2HHs consume Jar water for drinking purpose. The table below shows the source of water.

Table IV-16: Source of Water

SN	Type	No of HHs	Percentage
1	Boring/pump	4	66.67
2	Tap water		
3	Private Tanker		
4	Govt. Tanker		
5	Jar water	2	33.33
6	Open Well		
7	Close Well		
		6	

Source: Household Survey: January 2018

Toilet Facility

121. Open defecation can pollute the environment and cause health problems. All affected HHs have toilet Facility in their houses. The table below shows the toilet facility.

Table IV-17: Toilet Facility

Toilet	No of HHs	Percentage
Yes	6	100.00
No	0	0
	6	

Source: Household Survey: January 2018

122. Religion.Kathmandu's present demography is very cosmopolitan in which Newars; the indigenous people of Kathmandu still comprise a large segment of the population followed by Bramhin and Chhetri. Other ethnic groups like Sarki, Damai, Dalit, etc. are in minority. But now many ethnic groups are migrating from other districts of Nepal and found mixed ethnic groups in Kathmandu valley. Kathmandu's culture has been inspired by the convergence of Hindu and Buddhist. Hindu and Buddhist are the main religion with Christian and Muslims as minors.

2. Employment

123. The economy of Kathmandu Valley is based on trade, commerce, and manufacturing industries (e.g., carpets and garments). Other important sectors are agriculture, education,

transport, and hotels and restaurants. Tourism is also a key component of the Valley's economy. However, in the rural areas, the economy is still based on agriculture.

124. The following table summarizes the economic activities in the urban areas of Kathmandu Valley. About 34% of the households are engaged in small-scale non-farm activities. The Lalitpur Municipality has the highest percentage (50%). Among the households engaged in non-farm activities, nearly 45% are engaged in trade and business followed by services (32%) and manufacturing (9%).

Table IV-18: Household in Non-Farm Economic Activities in Kathmandu Valley

Municipalities	Share of Households Engaged in Non-Farm Activities (%)	Type of Activities				
		Manufacturing	Trade/ Business	Transport	Services	Others
Lalitpur	50.18	13.25	33.22	4.29	42.37	6.86
Bhaktapur	40.83	13.24	38.55	4.26	26.54	17.40
MadhyapurThimi	35.02	11.39	41.88	4.48	23.26	18.98
Kathmandu	31.57	6.86	49.49	3.49	30.26	9.90
Total	34.43	9.02	44.66	3.76	32.41	10.14

Source: CBS, 2003

125. According to the 2001 Census and the Nepal Human Development Report 2004, the poverty status and human development index of Kathmandu Valley was lower than the national level (Table IV-19).

Table IV-19: Kathmandu Valley Development Indicators

District	**Human Development Index (HDI)**	**Human Poverty Index (HPI)**	**Gender-related Development Index (GDI)**
All Nepal	0.471	39.6	0.452
Kathmandu	0.652	25.8	0.635
Lalitpur	0.588	25.0	0.569
Bhaktapur	0.595	29.9	0.578

Source: Census 2001; UNDP. 2004. Nepal Human Development Report.

3. Slums and Squatter Settlements

126. The rapid population growth has created a number of slums and squatter settlements in Kathmandu Valley. Table IV-20 summarizes the findings of a survey conducted by LICSU, KUKL in 2008. There were 39 squatter settlements and 137 slums in the valley with 40,237 population and 8,846 households. Of these, 22% have no access to piped water supply and none have adequate sanitation.

Table IV-20: Slums and Squatter Settlements in Kathmandu Valley

Type of Residence	No. of Households	Total Population	Average Household Size	Share of Households Without Piped Water Supply
Slums				
Bhaktapur Municipality	754	3274	4.34	32
MadhyapurThimi Municipality	382	1981	5.19	85

Type of Residence	No. of Households	Total Population	Average Household Size	Share of Households Without Piped Water Supply
Lalitpur Sub - Metropolitan	391	1,866	4.77	62
Kathmandu Metropolitan	3,784	16,575	4.38	58
Squatters				
Kathmandu Metropolitan	1,861	8,774	4.71	95

Source: Mapping of Slums, Squatters and Stand Posts in Kathmandu Valley updated by LICSU, KUKL, June 2008, AVIYAAN Consulting (P) Ltd.

4. Economic Development and Prospects for Growth

127. Compared to the rest of Nepal, Kathmandu Valley fares better because it has basic facilities such as water supply, sanitation, electricity, bottled gas, telecommunications, roads, education, security, and transportation. The valley is also the centre for several major industries such as textile, food & beverage, non-metallic mineral products, publishing, and printing. Such facilities and opportunities are a huge attraction to the rural poor resulting in high migration rates into the Valley; hence the rapid population growth and demand for urban services, especially water supply, within the Valley.

128. The valley's annual industrial output is estimated to be NRs.14.6 billion ($190 million), which is nearly 9.4% of the total national industrial output. The industrial sector employment in the valley is about 37,500, which is 22.1% of the national employment in the sector. Similarly, indirect employment in the industrial sector is about 38,900, which is about 21.9% of the national figure.

129. Being the capital city and a commercial centre for the country, Kathmandu and its surrounding valley is developing and urbanizing fast, compared to the rest of Nepal. It is the most important urbanized area in Nepal. New products and services are first introduced in the Valley, giving the inhabitants access to modern equipment and technology. An indication of confidence in economic growth is the high demand for new housing real estate and the number of new vehicles on the roads, which is rising rapidly. In addition, there are plans for major transportation improvements such as the Kathmandu outer ring road and the new link road to India via Terai.

5. Land Use

130. The land use and land cover statistics (Table IV-21) derived from the 1992 topographical sheet show that almost 50% of the Bagmati watershed is occupied by forests. The Midlands and the Mahabharat Ranges are characterized mainly by deciduous and coniferous forests, while hardwood and mixed hardwood forests characterize the Shiwaliks and the low-lying areas of the Midlands and the Mahabharat Range. Next to the forests are cultivated lands, which cover about 37% of the total area. Agricultural activities are confined mainly in the river valleys and the gentle slopes of the hilly region. The metropolitan city of Kathmandu, sub-metropolitan city of Lalitpur, and municipal cities of Bhaktapur and Madhyapur Thimi are the major built-up areas in the watershed.

Table IV-21: Land Use and Land Cover in the Bagmati River Basin

Land Use/Land Cover	**Area (ha)**	**Percent**
Forest	186,340	49.6
Cultivation	141,986	37.8

Land Use/Land Cover	Area (ha)	Percent
Sand	18,118	4.8
Bush	13,367	3.6
Grass	5,241	1.4
Channel	4,441	1.2
Built-up area	2,378	0.6
Barren land	1,264	0.3
Orchard	785	0.2
Scattered tree	551	0.1
Nursery	360	0.1
Pond or lake	141	0.0
Others	628	0.2

Source: DWIDP/SILT/ERMC/TECHDA. 2005. Preparation of Water-Induced Hazard Maps of Bagmati River Basin.

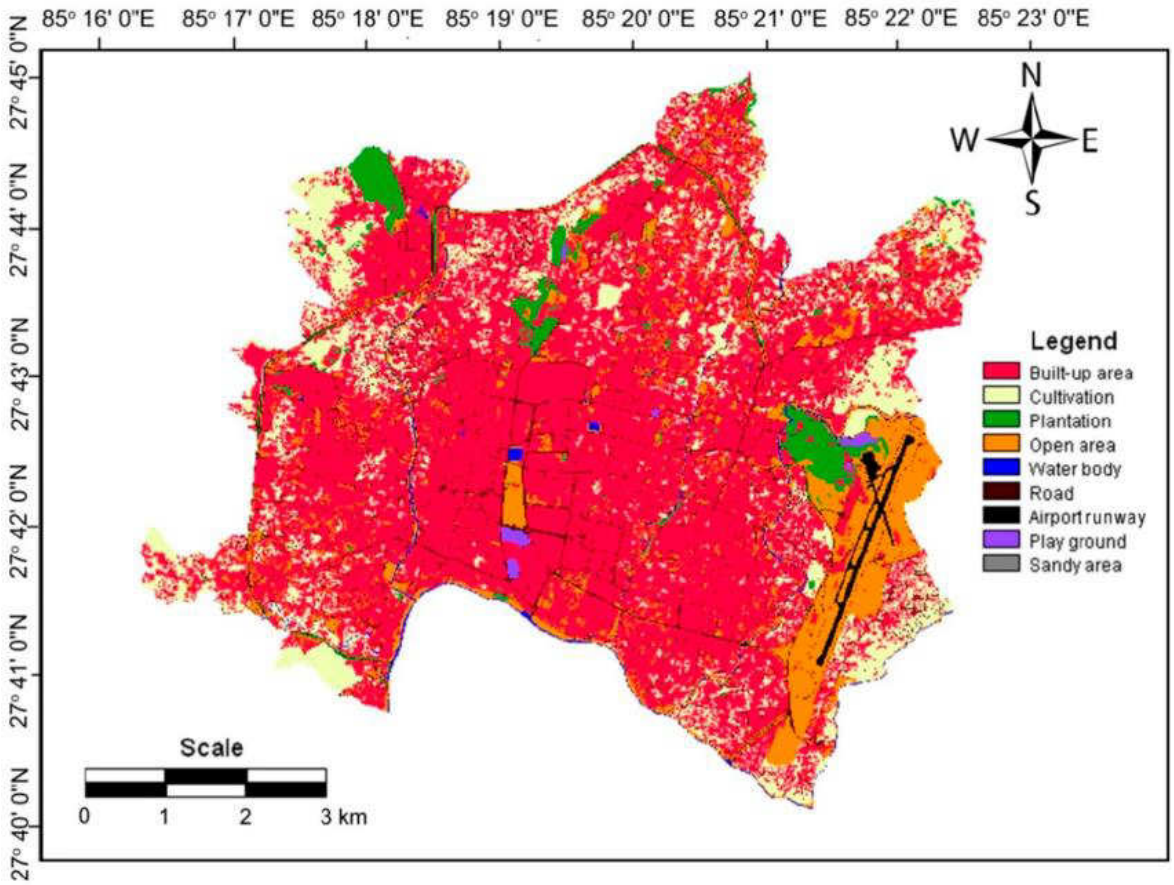


Figure IV-8: Land use map of Kathmandu district

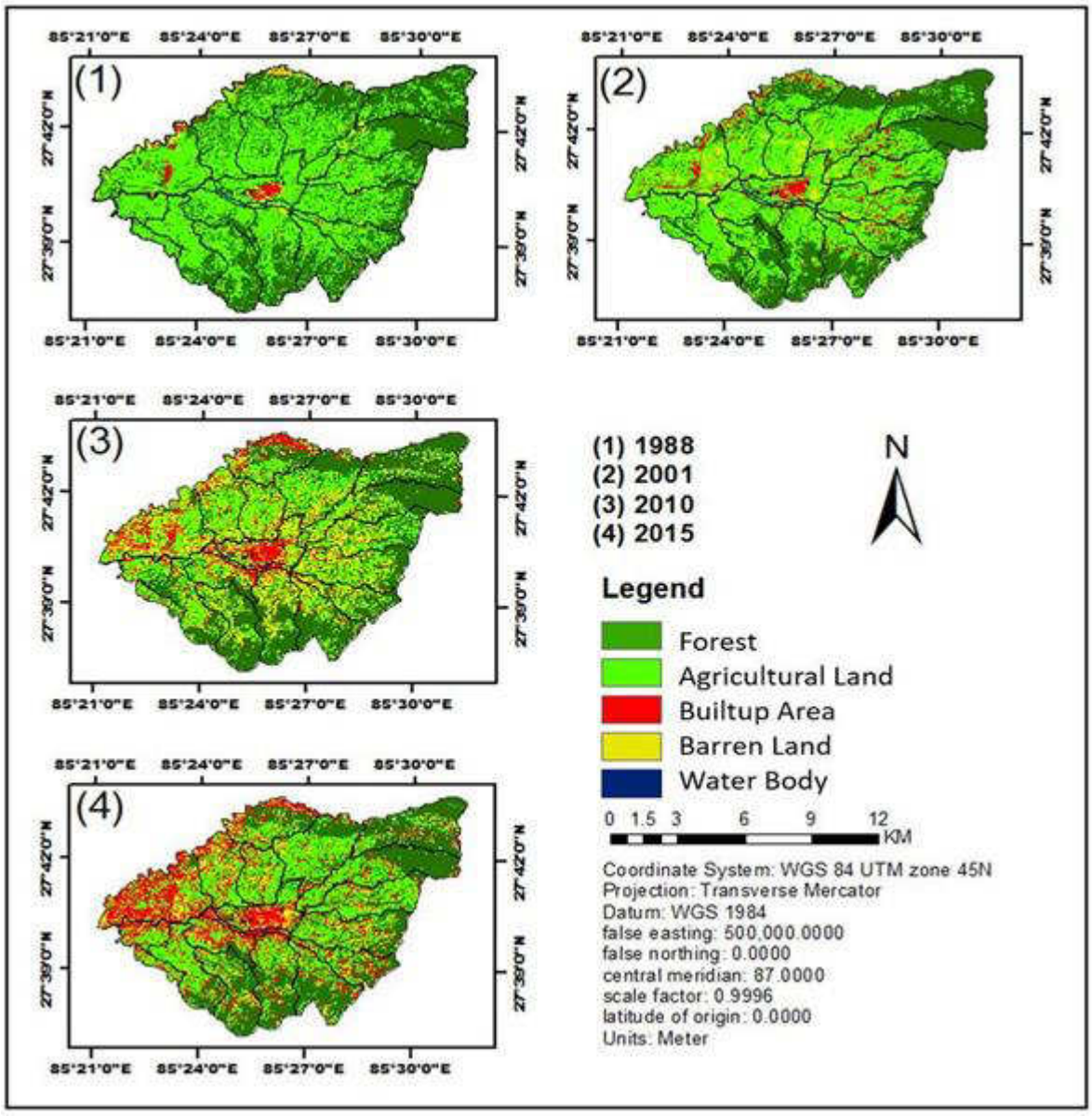


Figure IV-9: Land use map of Bhaktapur district

G. Infrastructure

1. Transportation

131. Long-distance bus services from Kathmandu provide services to the people throughout the country. Private transport includes buses, microbuses, vans, cars, jeeps, and three- wheelers operated by petroleum, liquid petroleum gas (LPG), and batteries. The total length of roads in Kathmandu, Lalitpur and Bhaktapur is 813,337 and 181 km, respectively, or a total of 1,331 km of roads within the Kathmandu Valley (Department of Roads 2004).

132. The Tribhuvan International Airport is just 30 minutes away from the town centre. There are numerous daily flights from Kathmandu to international destinations as well as regular flights to many areas of the country. Many international airlines fly to the Kathmandu international airport.

2. Drinking Water Supply

133. Not all households and people in the Valley receive safe drinking water. Various sources of drinking water for households are shown in Table IV-22.

Table IV-22: Sources of Drinking Water

Types	Kathmandu Metropolitan City		Lalitpur Sub-metropolitan city		Bhaktapur Municipality		MadhyapurThimi Municipality	
	HHs	%	HHs	%	HHs	%	HHs	%
Tap	163,339	64.2	33,378	61.2	15,998	90.7	13,431	66.2
Tube well	18,574	7.3	801	1.5	107	0.6	1,412	7.0
Covered well/kuwa	10,890	4.3	6,045	11.1	444	2.5	2,085	10.3
Uncovered well	1,341	0.5	940	1.7	217	1.2	602	3.0
Spouts	4,830	1.9	2,708	5.0	350	2.0	1,389	6.8
River/stream	52	0.0	38	0.1	4	0.0	2	0.0
Others	53,275	21.0	10,242	18.8	425	2.4	1,263	6.2
Not stated	1991	0.8	429	0.8	94	0.5	118	0.6
Total	254,292	100.0	54,581	100.0	17,639	100.0	20,302	100.0

Source:CBS, 2011.

134. Based on the 2005 data of the Department of Drinking Water and Sewerage, the number and percentage of the population receiving water by district and for the Kathmandu Valley are shown in Table IV-23. It shows that less than 75% of the population receives piped drinking water supply from the then Nepal Water Supply Corporation (now KUKL).

Table IV-23: Population Receiving Drinking Water

District	Estimated Population in 2005	Beneficiary Population in 2005	Percentage
Kathmandu	1,246,110	947,630	76.05
Lalitpur	366,010	286,250	78.21
Bhaktapur	244,130	152,270	62.37
Total	**1,856,250**	**1,386,150**	**74.67**

Source: NWSC. 2005.

3. Surface Drainage, Sanitation, and Sewerage

135. Stormwater drainage systems function in the valley through side drains but not well enough. The sewers of Kathmandu are largely a combined sewer/drainage system. For many years, reports on Kathmandu sewerage have highlighted the value of separating stormwater and sanitary sewage, but the process has not yet started. The increased use of plastic bags has also worsened the problem as plastics frequently clog the drains.

4. Electricity

136. Not all households in the valley have electricity, but the overall proportion of households connected to electricity is high at roughly 95%. Based on the Nepal Human Development Report 2001 (UNDP 2002), about 96.81%, 87.64%, and 96.41% of households in Kathmandu, Lalitpur, and Bhaktapur, respectively, have electricity.

5. Educational Institutions

137. Kathmandu Valley has long been considered the centre for higher education in Nepal. In 2007, it had 6,106 high schools and 474 higher secondary, college, and university-level educational institutions. The number of students enrolled during the period at in high school and higher education level was 573,779 and 156,828 respectively (ICIMOD, MOEST, UNEP 2007).

138. Education has been progressing continuously, specifically in the Kathmandu Valley and as a result, educational institutions, levels of education, and fields of study have been increasing. Table IV-24shows the number of schools by level for the three districts.

Table IV-24: Total Number of Schools by Grade and Level

Districts	Primary	Lower Secondary	Secondary	Higher Secondary
Kathmandu	920	671	514	148
Lalitpur	277	147	108	47
Bhaktapur	243	137	85	9
Total	**1,440**	**955**	**707**	**204**

Source: Compiled from NIDI 2006; ICIMOD, Ministry of Environment, Science and Technology (MOEST), United Nations Environment Programme (UNEP) 2007.

139. Tribhuvan University, the national university, has five institutes (Engineering, Agriculture and Animal Sciences, Medicine, Forestry Science, and Science and Technology) and four faculties (Law, Management, Education, and Humanities and Social Sciences), which offer almost all the popular disciplines at different academic levels, including master's and doctorate.

140. There are 3 medical and more than 12 engineering colleges offering up to master's level education. The Council for Technical Education and Vocational Training is another regulatory body monitoring the curriculums for technical and vocational training as well as diploma courses in different subjects to produce skilled manpower.

6. Health Facilities

141. Kathmandu is the centre for all types of health services (general medicine, surgery, heart care, orthopaedic care, kidney care, dental care, children's care, eye care, mental care, neurology, etc.). The number of health facilities owned by the Government or provided by local and international NGOs and the private sector is relatively higher (and with better services) in Kathmandu than in Lalitpur and Bhaktapur districts. However, the ratio of health institutions to the population served is higher in Kathmandu at 1: 9,574 compared to 1: 5,637 in Bhaktapur or 1: 4,119 in Lalitpur.

7. Communications

142. There are 3,991 post offices in Kathmandu Valley, including the general post office, regional postal directorates, district post offices, area post offices, and other post offices. A number of private postal care companies provide a wide range of postal services (ICIMOD, MOEST, WNEP, 2007).

143. The telecommunication system in Kathmandu Valley is excellent. As of 2005-2006, the Nepal Telecommunications Authority had issued basic telephone service license to two agencies, cellular mobile service license to two agencies, and internet licenses to 38 agencies (more than 50,000 customers) (ICIMOD, MOEST, UNEP, 2007).

H. Economic Characteristics

1. Industries

144. Kathmandu Valley has many traditional cottage industries: textile weaving or handlooms, brick and tiles, pottery, handicrafts, precious ornaments, traditional food processing and preservation (e.g., rice milling, beaten rice, oil milling, sweetmeats, and traditional dairy products), wooden furniture and carving, bamboo crafts, traditional textile printing and dyeing, traditional art and paintings, copper and brass metal utensils, herbal medicines, forges, and leather crafts.

145. Kathmandu Valley has three industrial districts, namely, Balaju Industrial District, Patan Industrial Estate, and Bhaktapur Industrial Estate. Public sector brick factories, leather tanning, and shoe manufacturing are also found in the valley. Food and beverages, plastic products, construction materials, carpets, and readymade garment industries have flourished. However, the number of industries and employment provided by them has decreased drastically over the last decade. Industries are concentrated along the Kathmandu-Bhaktapur and Kalanki-Thankot roads. Most of the polluting industries such as textile dyeing, tanning, and distilling have been closed or transferred to places outside the Valley.

146. Of the remaining industries in the valley, the main polluting industries are only small scale. These include brick kilns, wool dyeing and carpet washing, textile dyeing, pottery, polyurethane and rubber foam, beaten rice, dairy products, metal casting, metal craft industries and gold plating; and alcoholic and non-alcoholic beverages.

147. With the worsening industrial pollution and rising awareness of the general public about the adverse impact of pollution, complaints have increased and measures have been taken to address them. The Industrial Promotion Board formulated an industrial location policy. There have been revisions to the policy and the latest location policy for industries specifies the following:

(i) List A: Types of industry that can be established in municipal areas of the Valley
(ii) List B: Types of industry that are not allowed in the Valley
(iii) All types of industry that have pollution prevention and safety measures can be established inside any designated industrial district (ICIMOD, MOEST, UNEP, 2007)

2. Agricultural Development

148. Rice is the main crop in the rural areas of Kathmandu and Bhaktapur, whereas maize is the prominent cereal crop of Lalitpur. The other cereal crops in the project districts are millet, wheat, and barley. Other agricultural produce such as lentil, soya bean, pea, and black gram are the main pulses grown, as well as potato and oil seeds.

149. Raising livestock is the second most important activity. Most of the households in the rural areas rear animals for income, food, or draft power. Goats are the most common, followed by cattle and buffaloes; their products have a ready market in the city area.

150. The population growth in Kathmandu Valley is bringing considerable changes to farming. Rapid urbanization and the introduction of new agricultural technologies have encouraged farmers to change their cropping patterns from traditional (low-value crops) to new crops (high- value crops). Land under cultivation of green leafy vegetables is increasing rapidly in the urban and semi-urban areas.

151. The increasing population growth and haphazard housing construction have resulted in the rapid decline of agricultural lands. If the current trend continues, there will be no more lands left for agriculture in the Valley. According to the District Agricultural Office, agricultural lands in Kathmandu will be reduced from 64% in the year 2041 to 41% in 2066(http://www.gorkhapatra.org.np/rising.detail.php?article id=28619&cat id=27).

3. Development Organizations

152. The Social Services' National Coordination Council regulates and supervises NGOs, while the Social Welfare National Coordination Council (SWNCC) deals with most of the funding agencies. There are 7,004 active NGOs in Kathmandu Valley registered with the Social Welfare Council (SWC). Kathmandu has 5,969, Lalitpur 856, and Bhaktapur 179 NGOs. According to SWC, there are 157 international NGOs across the country; of these, almost all have head office in Kathmandu Valley and more than 80% are working in the Valley (ICIMOD, MOEST, UNEP 2007).

153. There are also various NGOs working in the water and sanitation sector in the Valley. These organizations have focused mostly in slums and squatter settlements and rural areas. They have constructed water tanks of 5 m^3 capacity and a number of latrines/toilets with drains for the communities. The major NGOs working in the water and sanitation sectors are:

(i) Lumanti Support Group for Shelter
(ii) NGO Forum for Urban Water and Sanitation
(iii) Environment and Public Health Organization (ENPHO)
(iv) Nepal Water forHealth (NEWAH)
(v) Action Aid
(vi) Water Aid
(vii) Plan International
(viii) UDLE (Urban Development through Local Efforts)
(ix) Red Cross.

4. Cultural Heritage

154. Kathmandu Valley is known for its ancient art, culture, craftsmanship, and numerous monuments of historic and archaeological importance that have been described by UNESCO as a "living heritage site." There are many temples, palaces, monasteries, and stupas that are centuries old. UNESCO has classified seven sites as world heritage sites. There are more than 360 'vihars,' 'chaityas,' and monasteries and many important religious and cultural sites on the river banks. The Patan Darbar Square and the Kathmandu Darbar Square, both declared as world heritage sites, are within the project area. However, no any installation of sewer will be carried out in the heritage sites by these construction packages.

I. Major Environmental Problems

155. The environmental problems of Kathmandu Valley are many.

156. **Air quality, traffic management, and noise pollution**. The emissions of the increasing number of vehicles (274,000 as of 2004-2005) account for about 38% of the air pollution in Kathmandu Valley. Industrial emissions also contribute substantially to air pollution (KVEO 2007).

157. Kathmandu Valley is particularly vulnerable to air pollution because of its bowl-shaped topography that restricts air movement. The situation is worse during the winter when temperature inversion during the night and early morning traps a layer of cool air under a layer of warmer air, trapping pollutants close to ground level for extended periods. Besides the topography, the relatively high elevation of the Valley also results in increased vehicular emissions.

158. Vehicular emissions have become the main source of air pollution in Kathmandu Valley. An inventory of emission sources by the then Ministry of Population and Environment (MoPE) indicated that exhaust fumes had increased more than four times in the 8 years between 1993 and 2001. According to a more recent inventory, vehicular emissions are responsible for 38% of the total particulate matter < 10pm (PM_{10}) emitted in Kathmandu Valley, compared to 18% from the agricultural sector and 11% from brick kilns (Gautam 2006; Table *IV-25*). Increase in emissions is mainly due to the increase in the number of automobiles, as well as poor transport management and poor vehicle maintenance.

Table IV-25: Comparison of Emission Inventories in 1993, 2001, and 2005

Sources	**TSP (tons/year)**			**PM10 (tons/year)**		
	1993	**2001**	**2005**	**1993**	**2001**	**2005**
Mobile Sources						
Vehicle exhausts	570	1971	NA	570	3,259	4,708
Road dust re-suspension	1,530	7,008	12,239	400	1,822	3,182
Subtotal	2,100	8,979	12,239	970	5,081	7,890
Stationary Sources						
Industrial/commercial	582	NA	NA	292	NA	NA
Domestic fuel	2,328	NA	630	1,166	NA	347
Brick kilns	5,180	6,676	1,850	1,295	1,688	1,437
Himal cement	6,000	3,612	0	800	455	0
Stone crushers	NA	NA	1,720	NA	NA	372
Industrial boilers	NA	28	28	NA	15	15
Fugitive Emissions						
Refuse burning	385	687	172	190	339	172
Agricultural sector	NA	NA	NA	NA	NA	2,337
Cremation	NA	NA	NA	NA	NA	79
Total	16,575	19,982*	16,797	4,712	7,580	12,649

NA = not available, PM = particulate matter, TSP = total suspended particles.

* In original report 19,884

Source: Shah and Nagpal 1997; Gautam 2006; MOEST 2005; and http://www.nepalnews.com.np/contents/englishweekly/sundaypost/2003/mar/mar16/2ndpage.htm

159. Recently, a study on traffic noise in Kathmandu Valley was carried out. The noise levels in Kathmandu City range from 79 decibels (dB) to 112 dB, higher than those of the major cities in India. The rate of increase of noise level in Kathmandu City was found to be 1 dB per year.

160. The permissible level for road traffic noise is 70 dB. An earlier study listed Kupondol Height, Thapathali, Sahidgate, Koteshwor, Gwarko, Gongabu, and Gyaneshwor as hazardous areas because their noise levels were found to be beyond 80 dB. The present study indicated that noise levels in Kathmandu were beyond the permissible values.

161. Three different types of noise areas were identified for Kathmandu Valley, although there is no data available on the noise levels produced from the existing WWTPs:

(i) Low noisy areas: Noise levels below 70 dB.
(ii) Moderate noisy areas: Noise levels between 70 dB and 80 dB; include Hotel Shangrila, Gairidhara, Galkhupakha, Gausala, Satdobato, Balkhu, Swoyambhu, Pulchwok, and Maitidevi.

(iii) Hazardous areas: Noise levels were beyond 80 dB; include Putalisadak, New Baneshwore, Kalanki, Narayan Gopal Chowk, Tripureshwor, Kalimati, and Koteshwore.

162. A survey showed that the frequency of health problems arising from noise pollution increases with the degree of noise levels. About 95% of tested affected people come from hazardous areas, 88% from moderate noisy areas, and 62% from low noisy areas.

163. **Settlement patterns**. Kathmandu Valley is developing haphazardly with the rapid increase of its population. It was estimated that by 2025, its population will be nearly 4.0 million, from only about 1.3 million in 2001. The valley's fertile lands are getting fragmented and residential houses are being constructed unabatedly. This kind of growth has created problems on transportation, electricity supply, drinking water supply, and river pollution.

164. **Water resources**. Extensive deterioration of river water quality (Annex 2) and quantity in urban areas due to excessive pollution loads has already taken place. Increasing demand for drinking water has placed a heavy strain on already insufficient supply and has created water scarcity. Almost all major rivers have been tapped at source for drinking water. The currentwater supply is only about 131 MLD during the rainy season and 94 MLD during dry season of the estimated daily demand of 350 MLD. In the dry season, 60%-70% of the water supply comes from groundwater.

165. **Waste management**. The main policy for waste management in Nepal is stated in the Solid Waste Management National Act enacted in 2011. The daily solid waste generation is assumed to be 0.25 kilogram per person per day (kg/p/d). Studies have revealed that the composition of solid waste in Kathmandu is mainly organic (58% to 66%) with 5% plastics. The use of plastic bags has increased over the years and since they are non-biodegradable (taking 400 to 1,000 years to biodegrade fully), its use should be discouraged or even banned. These plastics litter the streets and rivers, clog the drains, fill up landfill sites, get stuck on trees, and ultimately spoil the aesthetics of the natural environment. Animals mistake them for food and eat them and die as they obstruct the digestive systems. People even burn them, unaware of the effect of the toxic fumes. Furthermore, they are made from polyethylene, a product of petroleum, a non-renewable resource (www.reusablebags.letseegreener.co.uk,www.natural-environment.com).

166. A major issue in Kathmandu Valley is the accumulation of huge amounts of solid wastes due to the various demands of the people near the landfill site who obstruct the trucks carrying the solid waste. Another major issue is the dumping of hazardous and infectious wastes from hospitals and nursing homes together with domestic solid wastes.

167. Most of the plastics and reusable materials like bottles, metals etc. are picked up by scavengers daily who are helping the municipality by reducing the waste volume. Tourism is Nepal's topmost industry and if it is to thrive, solid waste management should be tackled well in all the municipalities and be given top priority.

168. The PPTA Team has estimated that nearly 25% of the generated solid waste is spread to open water ways. The five municipalities generate approximately 650 tons of solid waste daily, of which more than 70% comes from the Kathmandu Metropolitan City. The final disposal sites are always controversial and opposed by the local people and most of the solid waste is disposed of at the river banks and in open areas.

169. **Natural disaster preparedness**. Earthquakes and landslides are identified as the two most prominent potential natural disasters in Kathmandu Valley. The Valley is located in a seismic zone; lack of public awareness about earthquakes, lack of adequate planning, and lack of coordination are the main factors that impact negatively on disaster preparedness. Excavation of slopes, deposition of loads on slopes, deforestation, irrigation, mining, and water leakage are the main human activities causing landslides.

170. **Water quality.** Deterioration of water quality during transmission is a problem in almost all urban areas due to the ingress of polluted water into the pipes (intermittent supply), leakage, absence of chlorination, and absence of monitoring of water quality. Almost all available reports on drinking water quality of Kathmandu reveal that most of the urban water supply has bacterial contamination (Table *IV-26*). The chemical quality of most of the water is within the World Health Organization (WHO) guidelines.

Table IV-26: Water Quality of Different Water Sources in Kathmandu Valley

Parameters	**Water Sources**				**WHO**
	PTW	**PUTW**	**Well**	**SS**	**GV**
P^H	6.5-8.2	6.5-7.5	7.5	7.5	6.5-8.5
Temp (ºC)	13-18	12-15	15-18	15-18	25
Iron (mg/l)	ND-0.2	0.2	0.2	0.3	0.3=3.0
Chlorine (mg/l)	ND	ND	ND	ND	0.2
Chloride (mg/l)	10-30	22-45	22-45	23-45	250
$N\text{-}NH_4$ (mg/l)	ND-0.2	0.2	0.2	0.2	0.04-0.4
PO_4 - P (mg/l)	0.1	0.1	0.1	0.1	0.4-5.0
Coliform bacteria (source)	+/-	+	+	+	-
Coliform bacteria (consumption)	+				-
E.colicfu/100 ml	10-131	3-20	48-200	58	0

Note: PTW = private tap water, PUTW = public tap water, SS = stone spout, WHO GV = World Health Organisation guideline value.Source: Pradhan et al. 2005.

171. **Health and sanitation**. Individual septic tanks and soakpit systems and some pour flush latrines and pit latrines do exist in urban areas (the pollution of groundwater due to the leachate does exist but has not yet been quantified), but most of the effluent reaches the municipal drains, and ultimately the rivers or agricultural lands. People without toilets defecate in open fields and river banks. Public latrines hardly exist in urban towns and if they do, they are so poorly maintained (personal observation). There are only 18 public toilets in Kathmandu City, which has a population of around 2 million. They are ill-maintained as well and far below standards thereby turning the main town areas into open defecation places (Sedhai, R. 2012).

172. The Bagmati River is the main river system with tributaries that drain the Kathmandu Valley. The visible pollution of the Bagmati and its tributaries within the city reaches due to discharge of untreated domestic sewage, dumping of solid wastes, washing of vehicles, sand quarrying, and discharge of untreated industrial and hospital wastes, is severe (Bagmati Action Plan 2009-2014, 2008, Annex 2).

173. Sanitary conditions within Kathmandu Valley are hazardous (Halcrow Fox and Associtates, 1991). A visual tour of the valley is sufficient to conclude that rivers, drains, and streams are highly polluted with sewage and industrial wastes. The use of septic tanks, pit, or pour-flush latrines is common. Bhaktapur and Greater Kathmandu have sewerage systems and sewage treatment plants, but the treatment plants in Greater Kathmandu are not functional. Many sewers overflow as there is no regular cleaning and maintenance. This report adopts the findings of UN-Habitat (2009) that overall, 30% of houses have a septic system. UN-Habitat estimated that there are 77,000 septic systems in the Valley. Only 35% have a soak-pit associated with a septic tank. The remaining tanks presumably discharge septic tank effluent directly to surface flows.

174. Storm water drains that were constructed more than 60 years ago in the core areas of Kathmandu are being used as combined sewers (Many reports, including the 2010 Conceptual Wastewater Master Plan mention this). Furthermore, the Asset Condition Survey in Buddhanagar and Kalopul also confirmed this. It is found that storm water drains laid by the municipality are now working as combined drains. Sanitary sewers have been added to some areas of Greater Kathmandu and there are about 93,000 sewer connections registered

with KUKL (KUKL Annual Report, 2008). The rest discharge the effluent ultimately to the holy Bagmati River.

175. The majority of households in the valley districts have toilet facilities: about 81% in Lalitpur, 90% in Bhaktapur, and 92% in Kathmandu (CBS 2001). Most of the households' toilets do not have septic tanks and they are directly connected to the sewerage lines that discharge waste to the nearby river. For households with septic tanks, a municipal service is available for emptying the septic tanks on request. The Ministry of Environment Science and Technology is mandated to regulate unauthorized dumping. Domestic wastewater makes up approximately 93% of the total wastewater generation by the cities; the remaining 7% is industrial wastewater.

176. The existing sewage treatment plants are not functioning, except for the Guheswari treatment plant. The newly expanded residential areas are usually devoid of sewers. In a few cases, however, sewage is channelled through hume pipes connecting to nearby rivers. Due to the direct discharge of untreated sewage and wastewater into the rivers, all the rivers in the Valley have been turned into open sewers. It is estimated that about 50,000 kg of BOD_5 per day is produced in the Valley. An average of 20,846 kg BOD/day has been recorded for the Bagmati River at the outlet, constituting 42% of the total BOD load produced (CEMAT 2000).

V. ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

177. The Rapid Environmental Assessment is in Annex 1.

178. Environmental impacts on the physical, biological, and socio-economic and cultural environments during design, construction, and operation phases are discussed here in detail together with the mitigating measures. Most of the impacts will be localized, not greatly significant, and relatively small during construction and operation. All the WWTPs lie on government-owned land and the laying of sewers will be done in the RoWs of existing roads and river banks, thereby land acquisition will not be required and will not directly impact the existing biodiversity values.

A. Design Phase

1. Environmental impacts due to project design

179. One of the most important activities before construction is the identification of the likely adverse impacts and their mitigation measures before construction works commence.

180. Identification of erosion-prone areas prior to construction is important to prevent or minimize soil erosion, sedimentation, and slope instability. To mitigate these adverse impacts, it is necessary to incorporate drainage plans into the project design, identify measures and sites for handling excessive spoil materials, and stabilize unstable areas. In particular, geotechnical investigations need to be carried out prior to conducting design of interceptors to identify areas that are fragile. The design and specifications should consider minimum vegetation clearance and avoid piling of excavated materials close to river or along the river banks and to the adjacent private lands affecting cultivation.

181. During the preparation phase, the land areas required by the project should be demarcated and sign posted accordingly. Ongoing consultation with affected communities should be conducted and due notifications to any interruptions as a result of construction should be provided in a timely manner.

182. Haphazard construction of camps for workers without basic amenities could result in social stress and the degradation of the local environment. Therefore, it is very important that these camps be provided with sanitary amenities at designated areas. As Nepal has no standards regarding the number of ablution blocks to be constructed in temporary labor camps, the 2009 IFC Guidelines (Annex 10), that is, 1 toilet for every 15 persons (separate for men and women) will be followed. In Kathmandu, most of the labor will be local people who will not stay in the camps.

183. An employment policy that avoids depriving the local communities of opportunities should be prepared to prevent tensions and dissatisfaction. The local people, especially the project-affected families and women above the age of 16 (Children's Act 1992), should be given first preference in employment. Wages should be settled based on the District Wage Evaluation Committee resolution or guidelines and the list of employees submitted to the Design and Supervision Consultant.

184. Letters of approval and agreements should be obtained for the following: (i) temporary acquisition of land and properties for use by contractors, (ii) digging of roads from the Department of Roads and the concerned municipalities. This advice has been carried over for this project as the location of proposed project sites are the same as on Loan 2776. However, during the preparation of detailed design the PID will consult with UNESCO to provide them with more detailed information. However, the interceptor sewer alignments not proposed within any archaeological and cultural heritage sites. Chance find protocol will be provided to contractors prior to the commencement of activities. Additional precautions in these sites include the following:

(i) photographing all sites within the heritage area if existed to enable before and after comparison (all roads are to be reinstated to original character, especially in heritage areas, and buildings are to be left untouched);
(ii) avoiding disturbance to any historic or heritage buildings or structures by taking necessary precautions (working away from heritage buildings, hand digging, no heavy equipment, etc.); and
(iii) adopting the following measures for sewer works in roadways within dense settlement and narrow road width and congestion areas: (a) only hand digging will be allowed, (b) informing the community prior to daily construction of sections, (c) ensuring no blockage to tourist areas, (d) putting up clear signage related to KUKL works, (e) ensuring reinstatement of roads to original condition, (g) ensuring extra measures (fencing and/or barriers) to protect tourists and the public from construction site, and (h) ensuring that a construction supervisor is onsite at all times.

185. Baseline photographs of the construction areas and water quality of streams and rivers that would be impacted will help the project in identifying/justifying/verifying the adverse impacts due to construction activities (e.g. cracks in houses, restoration of temporary sites to their original condition, water quality deterioration, etc.).

186. Detailed traffic plans should be prepared to help in mitigating traffic congestions and disturbance to pedestrians and businesses. A traffic management planning document that can be easily used by contractors to develop detailed plans should be formulated. Refer to Appendix 10 of the IEE prepared for NEP: Kathmandu Valley Water Supply Improvement Project (http://www.adb.org/sites/default/files/linked-docs/34304-043-nep-ieeeab.pdf).

187. The training manual should be written in Nepali (or local languages) with notes and sketches on community health and safety and occupational health and site safety.

B. Construction Phase

1. Environmental impacts due to project construction

a. Physical Environment

Soil erosion and slope stability due to excavation

188. Impacts likely to occur from the improvement and construction of sewerage systems will include trench excavations and topsoil stripping, which may induce soil erosion and slope instability. This is will be an issue particularly near the rivers where interceptors will be constructed. Haphazard disposal of spoil materials may create erosion problems, disturbances to the existing drainage lines, and changes to the existing land use practices. Mitigating measures to be used are separate stockpiling of topsoil in a safe yard for further use, spoil disposal at designated and stabilized sites, compaction of the backfill of excavated areas including replacement of topsoil, avoiding work during the rainy season as much as possible, mulching to stabilize exposed areas, use of bioengineering techniques (e.g., re-vegetating areas promptly), providing channels and ditches for post-construction flows, lining of steep channels and slopes (e.g., use of jute matting), preventing off-site sediment transport using settlement ponds, and silt fences. Prior to the construction of interceptors along the rivers, erosion and sedimentation control such as blankets, geofabrics and/ or vegetation need to be completed including the installation of appropriate drainage systems.

189. Impacts of surface water discharges on the local drainage from trench excavation should be mitigated by the use of settling tanks before discharging the water to waterways.

190. Excavation and laying of pipelines/siphons at river crossings could have adverse impacts on the river water quality and the aquatic ecosystem. Mitigation measures to be used include construction to be done in the dry season only, use of river diversions with

bundings, and prior notification to temple and religious *ghat* officials of construction activities.

191. Deep excavations can intercept and interfere with the local groundwater thereby affecting flows from irrigation canals, springs, and wells and causing water shortages. Mitigation measures to be used include the following: (i) local wells, springs, and irrigation canals to be bunded from temporary spoil dumps; (ii) local wells and spring fed spouts or kuwas to be monitored, particularly downhill of excavations plus temporary supply provided if flow is affected; and (iii) permeable base and side backfill required at deep excavated sites or an alternate source of drinking water provided at the existing location. (iv) shoring along the deep excavated trenches to be applied during the time of laying of interceptor sewer pipes.

Change in river hydrology and morphology

192. The construction, rehabilitation, and operation of the sewerage system could have impacts on the river hydrology and morphology due to quarrying from river beds for sand and gravel, particularly during the dry season. Water pollution problems could occur because of the dumping of spoil materials into the river, excavation of boulders from the river channel, direct disposal of liquid wastes, and leakage of oil and lubricants. Quarrying/mining activities in river/streams for extraction of construction materials shall not be done to avoid changing the river cross sections and longitudinal profiles and should be done in approved sites only.

Water and land pollution

193. Dumping of wastes or discharging wastewater effluents from toilets into the river can pollute the river water, making it unhealthy for downstream users. Mitigation measures to be used include avoiding construction of labor camps facilities within the drainage area, providing designated areas with collection of bins for wastes, providing toilet facilities and prohibiting open defecation, and prohibiting washing of vehicles next to rivers and streams.

194. Pollution of land and water could also be mitigated by observing proper storage of construction aggregates, hazardous toxic materials, lubricating oils, used tyres, and exhausted batteries; and segregating and disposing of chemical containers, packaging materials, plastic bags, etc. Used oil and lubricants should be recovered and reused or removed from the sites. Storage areas for fuels and lubricants should be away from any drainage leading to water bodies. All fuel use areas (e.g., generator) must have drip basins installed to prevent any leakages and recycled. All fuelling, repair, and maintenance work should be done on a concrete surface provided with a catch tank that can be cleaned and all spilled fuel recovered and recycled. Provision of training on the safe handling of toxic materials and occupational health and safety measures during construction could help in mitigating many of the adverse impacts mentioned above.

Pollution due to air, noise, and vibrations

195. Earth excavation, construction materials stockpiling, aggregate crushing, drilling, quarrying, and plying of vehicles will produce dust (TSP, PM_{10}), hydrocarbons (CO, CO_2, CH_4), SO_2, NO_X, H_2S, etc.), noise, and vibrations. Plying of trucks on non-metallic roads will produce huge amounts of dust that can deteriorate the air quality and increase the noise levels to above 90 dB. Annex 5 gives the national ambient air quality standards for Nepal.

196. Mitigating measures to be employed include the following: (i) dust suppression on roads or at open sites by sprinkling water as required at regular intervals; (ii) covering earth stockpiles using plastic sheets or cement jute bags; (iii) routine monitoring of sound and vibrations at regular intervals; (iv) limiting vehicle speeds and banning power horns; (v) seeing that vehicles comply with the National Vehicle Mass Emission Standards, 2056 BS; (vi) fitting of mufflers in vehicles to control noise; (vii) regular maintenance of vehicles; (viii) compensating the damages caused by vibrations to buildings, and (ix) providing ventilation

in confined working areas. Annex 7 gives the recommended standards for vibration in construction sites. Similarly, Noise should be monitored as provided for in Annex 6.

b. Biological Environment

197. Although most of the construction and improvement works will take place in urban areas, there will be some impacts on the ecological resources (loss of trees and vegetation, damages to fisheries and riverbed aquatic ecology) due to construction of project structures vegetation clearance for construction activities, and construction activities at pipeline crossings over riverbeds.

198. Mitigation measures consist of the following: (i) cutting only the trees that are marked and will be agreed with contractor in a piece meal approach for removal and planting and rearing tree saplings at the rate of 25 saplings for each cut tree; (ii) providing LPG/kerosene to the workforce; (iii) stockpiling the cut trees and obtaining permission from concerned authorities for their use; and (iv) compensating all the affected private trees. To save the fisheries and riverbed aquatic ecology, disposal of construction materials and solid wastes generated from the camps into the rivers shall be avoided and river diversions and bunding of sections should be carried out.

c. Socio-Economic and Cultural

***Environment* compensation**

199. The contractor's temporary land use and housing acquisition and compensation to affected people are two of the most important aspects of any construction project. The mitigation measures include the following: (i) compensation for crops destroyed along the sewer alignment according to the Government's rules; (ii) establishment of a "grievance redress committee"; (iii) restoration of temporary sites to their natural or stable conditions as agreed with the land owners; (iv) planting endemic vegetation in exposed areas of temporary sites; (v) making sure that the proponent reports in writing that temporary areas have been vacated and restored to pre-project conditions before acceptance of the works; (vi) provision of disturbance and rehabilitation costs to local businesses; (vii) protection of the traditional rights of the local people; (viii) compensation for any loss of crops, trees and other natural resources; and (ix) establishment of a technical committee to assess the compensation for damages caused by vibrations of construction equipment and vehicles (photographs of the damaged structures should be taken and compared to the baseline photographs taken before construction).

Reinstatement of damaged community services and infrastructure

200. Construction activities could have adverse impacts on community services and infrastructure. Any adverse impacts (e.g., cracks in buildings and structures during trenching, use of rollers for compaction and pneumatic drills, and unusable access roads) on community assets such as, temples, bridges and irrigation channels, electricity poles, telephone lines, drinking water pipes, sewerage lines, roads, etc. will be mitigated, compensated, reinstated, or relocated to the satisfaction of the community.

Influx of outside workers, money, and unwanted activities

201. Alcohol abuse, gambling, prostitution, and other social disharmony are likely to occur in the construction site. There will be an influx of workers to the project site with their immediate family members. This can increase crime and social stress, create unwanted congestion, and exert pressure on the limited local resources. The mitigation measures to be carried out consist of prohibiting gambling and alcohol consumption in construction camp sites; instructing the outside workforce to respect the local cultures, traditions, rights etc.; and providing security in the camps.

Health and safety

202. There could be adverse impacts on the health and hygiene of the workers due to unsafe working conditions, accidents, fire hazards, transmission of communicable diseases etc. To mitigate these adverse impacts, these should be undertaken: (i) provide regular health checkups, sanitation and hygiene, health care, and control of epidemic diseases to the workforce; (ii) launch awareness programs concerning human trafficking and the possibility of spread of sexually transmitted diseases (STDs) and HIV/AIDS using brochures, posters, and signboards; (ii) make available first aid kits, ambulance, and fire extinguishers in camp sites; (iii) provide personal protection equipment to all construction workers and compensation for the loss of life (a zero tolerance to loss of life policy should be developed and implemented) or for any type of injuries; and (iv) provide insurance to the workers. Health and safety training for all site personnel is very important and must be mandatory. Another significant impact is the effect on people and communities, particularly health, if water supply is interrupted for extended periods during works on the sewer networks. If water supply has to be stopped, notice should be given to the affected people and alternative provisions of potable water arranged.

d. Occupational Health and Safety

203. The potential occupational health and safety impacts or hazards and mitigation measures for the laying of drinking water pipes and sewers in trenches are given in Table 16. Before construction begins, the contractor will inform and provide training to its workers on occupational health and safety and mitigation measures to be used during construction. The training must be done in Nepali (or local language of the workers) with handouts distributed and information posted in conspicuous places. As most of the workers would be uneducated, pictorial presentations depicting the hazards and the mitigation measures should be used during the training. Appropriate signage providing safety messages including restrictions to public access need to be erected at construction sites.

e. Community Health and Safety

204. The contractor should be aware of the adverse health and safety impacts of the construction works on communities along the construction areas.

Traffic management

205. Traffic congestion and temporary disruption to local access due to open trenches, excavation across roads, or road closures due to construction could have impacts on pedestrians, vehicles, and businesses. To mitigate these, traffic management plans should be developed for key areas along the construction site. There should be a traffic management planning document that can be easily used by contractors to develop detailed plans. Refer to (Annex 10). Advance local public notifications of construction activities, schedules, routings, and affected areas including road closures should be made. Erect signage in Nepali and English languages. Use steel plates or other temporary materials across trench facilities in key areas such as footpaths or livestock routes; arrange for pedestrian access and sidewalks and parking areas; and arrange for night-time construction for activities in congested or heavy day-time traffic areas. Arrange for onsite "grievance handling." Undertake trench closure and facilitate rehabilitation as quickly as feasible. Coordinate with the Kathmandu Metropolitan Traffic Police Division, the authority in charge of traffic management. Obtain permission from the Department of Roads for digging in the main urban roads and from the municipalities for digging in inner urban roads.

B. Operation Phase

206. All Interceptor Sewerage safety plans will need to be submitted to ADB for review and endorsement prior to plant commissioning. Interceptor Sewerage will also need to employ programmable logic controllers for plant operation.

207. Hazards to public health due to overflow flooding and groundwater pollution due to failure of the sewerage system could have adverse impacts on human health and the environment. The system will have to be carefully designed and operated. The project design should include stand-by generators (the diesel generator is the second backup power). The first source is the power generated from the gasification plant. In Dhobighat WWTP, the existing solar plant of 680 kW capacity will also be used, so that the WWTP will not be operated for long hours using diesel generators. The constant source of electricity supply, if available, will also be used. An emergency response plan (ERP) that includes notification and reporting protocols will need to be developed. The ERP is important for managing wastewater systems during emergencies as pipe breaks, equipment malfunctions, power outages takes place, and leakage or spills of hazardous materials happen. Floods, earthquakes, and storms can also damage collection systems and equipment. Having emergency response procedures can save lives, prevent diseases, and minimize environmental and property damage. The ERP should be developed in coordination with all the key stakeholders, including the Executing Agency (EA), project implementation units, consultants, contractors, and other key government organizations. A modified ERP Template (www.rcap.org) is attached in Annex 12.

208. Health and safety hazards to workers could occur from toxic gases and hazardous materials which may be contained in sewage flow and exposure to pathogens in sewage and sludge. The workers should be trained in the management of occupational health and safety hazards and provided with personal protective equipment. Inoculations should be administered on a regular basis.

209. Discharge of hazardous materials and illegal disposal of industrial waste discharges into sewers could damage the wastewater system and be dangerous to workers. It is important to ensure that the existing industries do not illegally discharge their effluents into the sewer system. Regulations should be developed and enforced by the Ministry of Forest and Environment, to control illegal waste discharges into the sewers. A trade waste policy, including setting discharge criteria from industries, needs to be developed.

210. Sewer cleaning staff will be at risk of communicable diseases. KUKL should ensure that the operation and maintenance staff of sewerage system are fully aware of the hazards by training them in hygiene procedures to avoid infection from wastewater, sludge handling, and health and safety procedures against exposure to hazardous gases. Workers should be inoculated against infectious diseases and kept under medical supervision. Emergency procedures need to be developed by KUKL and protective clothing to sewer cleaning workers should be provided.

211. Improper operation will lead to the accumulation of wastewater along some manholes that may cause smell and nuisance to the surrounding residential areas. To address this, the project should prepare and strictly follow standard operating procedures (SOP) and provide regular training to staff.

212. Hazards may occur due to blockage of sewer lines causing overflows and nuisance to people, serious health and sanitation problems, and contamination of soil and groundwater. Workers and operators stationed at sewers and confined spaces should be provided with safety equipment or gas detectors and awareness and safety training. Fire extinguishers should be readily available and in place to maintain safety. Workers who come in contact with raw or partially treated sewage and sludge should be provided with protective wear (e.g., gum boots, gloves and face masks). To avoid sewer blockages, catchment management is important. Avoid root intrusion, create public awareness, educate the public

on the types of waste to be disposed of to the sewer system, provide sufficient staff and equipment for cleaning, and establish a system for registering public complaints (grievance redress mechanism) and urgent clearance of system blockages.

Potential Environmental Enhancement Measures

213. Potential environmental measures that shall be taken by KUKL before the project commences are training and awareness programs on health, occupational health and safety measures, and community health and safety to the general public.

214. Sufficient human resources should be trained in maintaining the sewerage systems and treatment plants. The efficiency level of the treatment plants should be recorded by regularly monitoring the wastewater characteristics.

215. There are many environmental youth clubs in Kathmandu Valley. They should be mobilized to observe the sewer system in their areas and report problems like overflows to KUKL. By 2010, there were 4,321 youth services affiliated or registered with the Social Welfare Council: 697 were from Kathmandu, 43 from Bhaktapur, and 130 from Lalitpur. Out of theregistered 30,284 NGOs working in the environmental protection sector, 514 were from Kathmandu, 69 from Lalitpur, and 9 from Bhaktapur. They include BatabaranSamrachahanTathaDigoBikaskoLagi Yuba Sakti, Bishnumati Yuba Club, BuddhanagarYuwaSamuh, BatabaranSamrachhanSamudaya, Nepal Batabaran Club, Friends of Environment, SwachaPaniTathaBatabaranSamuha etc.

Cumulative Impacts

216. The valued components identified in the IEE are air quality, water (surface and groundwater) quality, noise, traffic management, socio-economic, cultural resources, and human health.

217. Air quality will be affected during construction. Emissions of common air contaminants and fugitive dust may increase near the construction sites but will be short term and localized. Greenhouse gas emissions may increase due to vehicle and equipment operation, disposal of excavated material, concrete production, etc. But their contribution during construction will not be very significant.

218. Noise levels near the construction sites will increase but the duration will be short. Ground vibrations due to concrete mixers, rollers, and excavators may be annoying, and damages may occur especially to older buildings, but mitigation measures if implemented as proposed in the environment management plan (EMP), will minimize these problems.

219. Traffic management during construction will be very important. Site-specific mitigation measures will be implemented to see that disruptions are minimized and are temporary. After the project is over, the improvements made will have a long-term cumulative benefit to the people.

220. Although there will be temporary increase in the noise levels, fugitive dust, and common air emissions near the construction areas, no adverse residual effects to human health will occur because the impacts are short-term, localized, and not significant.

Cumulative Impacts

221. There will be no environmental cumulative impacts with respect to air pollution and loss of habitat. It can be seen from Annex 2 (Figure 2.6 Bagmati Pollution) that the BOD level increases from the source (Sundarijal) and keeps on rising as it traverses through the Kathmandu Cityand starts decreasing at TekuDovan (where the Bagmati River meets the second biggest tributary, the Bishnumati river). As the Bagmati river leaves the Kathmandu Valley at Chovar gorge, the BOD is still above 60 mg/l. The BOD then keeps on decreasing downstream where the area is less habited and the Bagmati River gets bigger as it is fed with numerous tributaries. The WWTPs will contribute to reducing the current level of water pollution.

222. The project will help develop employment opportunities and enhance the local skills in sewer pipe laying and construction and overlaying of sewer pipelines for future works in Nepal. Concrete sewer pipes can be manufactured locally, which can boost the local construction industries.

VI. INFORMATION DISCLOSURE, CONSULTATION, AND PARTICIPATION

200. As part of the feasibility studies, an extensive consultation program with key stakeholders was carried out, in line with the requirements pertaining to environment and social considerations of ADB. The tools used for consultations were stakeholder workshops and meetings, interviews, structured questionnaires, and focus group discussions (FGD). These consultations provided inputs for identification of the felt needs of the communities, and the relevant stakeholders.

201. During the business survey, business/shops of different core areas of cities were informed about the project activities such as replacement, rehabilitation, cleaning of sewer, separation of storm water drain and sewer, new laying of sewer etc. in the main road and inner roads of the cities. They were informed about the possible impacts such as disruption to the local inhabitants, and pedestrians during construction. During the business survey, the business owners and the shop keepers were informed about the possibility of disruption to the business and the survey was a preliminary activity to determine possible profit losses if full closure of the road was required during construction. They were informed that future public consultations and disclosures would be held regarding possible disruption to businesses and issues of compensation modality would be discussed. They were also informed that they will get more information about the project activities during topographical survey.

202. The Project Affected People of Kathmandu Valley have been informed about the rehabilitation/modernization of existing and new construction of WWTPs and laying of new interceptors and collectors; rehabilitation and cleaning of existing interceptors/collectors and replacing existing brick sewers. Discussions were held with the participants in a closed circle and the details of the dates, number of participants are given in Table VI-1and in Annex 9.

Table VI-1: Meetings, workshops, consultations and focus group discussions held

SN	Date	Topic	No. of participants	Institutions
1	26 March 2012	Scope and objectives of PPTA - 7936 and PPTA-43448; ongoing activities of HPCIDBC; BAP implementation	6	Project Manager and Deputy Project Manager HPCIDBC; PPTA Team
2	19 April 2012	Scope and objectives of PPTA - 7936; ongoing activities and problematic areas of Lalitpur Municipality	4	Environment Section Chief and Drainage Section Chief Lalitpur Municipality; PPTA Team
3	19 April 2012	Scope and objectives of PPTA - 7936; ongoing activities and FGD on problematic areas of Kathmandu Metropolitan City	4	Division Chiefs, PPTA Team
4	20 April 2012	Scope and objectives of PPTA - 7936; ongoing activities and FGD on problematic areas of Bhaktapur Municipality; vision on wastewater management	5	Ex-Mayor and Engineers, PPTA Team
5	20 April 2012	Scope and objectives of PPTA - 7936; ongoing activities and FGD on problematic areas of MadhyapurThimi Municipality	4	Engineer and Community Development Officer of Municipality, PPTA Team
6	31 May 2012	Ongoing activities of CBP Team, status of sewer networks, GIS activities in KUKL	6	CBP Team Leader, GIS expert, PPTA Team

7	22 June 2012	Meeting on coordination on the wastewater sector	13	MoWSS, HPCIDBC, PID, KUKL, Kathmandu Metropolitan City, KVWSMB, PPTA
8	29 June 2012	Ongoing activities of DSC under HPCIDBC, design criteria of sewer lines	15	PID, KUKL, BDA, Stakeholders
9	9 July 2012	FGD in Ta DhokaPurnchandi, Lalitpur	12	Local people
10	14 August 2012	Consultative Stakeholders Workshop on Interim Report	53	PID, ADB, MOWSS, KUKL, HPCIDBC, PPTA Team, Municipalities

203. In addition, the Resettlement Team undertook a random survey of 90 households (vendors, hawkers businesses and shops to obtain information on the loss of income due to temporary disruption of business during laying/rehabilitation/cleaning of sewerage pipeline in different problematic areas of the Municipalities. Results of the survey are included in the Resettlement Plan.

204. PID will make copies of the IEE report and any other project reports available to interested people in the Nepali language (if required) to ensure that stakeholders understand the objectives, policy, principles and procedures. These reports will be made available at public places, including the offices of PID, KUKL main office and branch offices, and the Kathmandu Metropolitan city, Lalitpur Sub-Metropolitan city and MadhyapurThimi, Bhaktapur Municipalities Offices.

205. The PID will extend and expand the consultation and disclosure process during the detailed design stage and construction period of the project. A community awareness firm will be recruited to ensure ongoing consultations and public awareness during project implementation. The CASSC firm will continue the consultations with the affected communities through distribution of leaflets, about the project activities and entitlement matrix and the project contact persons for outreach and queries. Intensive consultations will be made on those sewer pipeline areas where people have different opinion for the installation of sewer pipelines.

206. The community awareness consultant (CASSC)will further coordinate with the PID, design and DSC, and contractors to ensure that communities are made fully aware of project activities in all stages of construction. A community awareness and participation plan were also prepared for the project and will be implemented by the recruited firm in coordination with the PID and DSC safeguards staff. Community groups such as tole committees and vendor associations will be consulted and made aware of the civil works and project activities prior to construction and even during the time of construction.

207. Further, public consultation program with key stakeholders has been carried out during the year of 2016/17 in line with the requirements pertaining to environmental and social considerations of ADB. During the detailed design of WWTPs and Interceptors, discussions and consultation meetings were held with Bhaktapur Municipality, Mahalaxmi Municipality and Madhyapur Municipality. During the consultation information about the project including project alignment and location of WWTPs and Interceptors has been discussed with the participants. Informal discussions and consultations were held with farmers present in the field and disclosed project information. They were also informed the possibilities of some disturbances and crop losses that might take place during construction works.

Figure VI-1: Summary of Public Consultations

SN	Date/Month	Location	No.ofParticipant			TopicsDiscussed	IssuesRaised/
			Male	Female	Total		
1.	May 31, 2016	Madhyapur Thimi Municipality for IS 02.	14	-	14	Coordination Meeting	N/A
2.	July 5, 2016	Meeting with Municipal Authorities (MadhyapurThimi, Bhaktapur and Suryabinayak) for TP-02, IS-01	33	3	36	Coordination Meeting	N/A
3	February 21, 2017	Lokanthali, Bhaktapur for IS-02	14	0	14	Information dissemination of the project	N/A
4.	March 1,2017	Bhaktapur Municipality Ward No 17 for IS-02	32	3	35	Information dissemination of the project to the all interested stakeholders of the Municipality	N/A
5	May 28,2017	Madhyapur Thimi Municipality Ward No,9 for IS-02	30	2	32	Information dissemination of the project to the all interested stakeholders of the Municipality	N/A
6.	June 7,2017	Bhaktapur Municipality Ward No 17 for IS-02	50	21	71	Information dissemination of the project to the all interested stakeholders of the Municipality	
7.	June 14,2017	Bhaktapur Municipality Ward No 8 for IS-02.	17	1	18	Information dissemination of the project to the all interested stakeholders of the Municipality ward people	N/A
8.	June 29,2017	Mahalaxmi Municipality	10	4	14	Coordination Meeting	N/A

VII. GRIEVANCE REDRESS MECHANISM

208. A grievance redress mechanism (GRM) has been established to receive, evaluate, and facilitate the resolution of affected people's concerns, complaints, and grievances about the social and environmental performance of the project. The GRM aims to provide a trusted way to voice and resolve concerns linked to the project, and to be an effective way to address affected people's concerns. The GRM for the project is outlined below and consists of four levels with time-bound schedules and specific persons to address grievances. The minutes of GRC formation at local level is presented in Appendix 14.

209. **First level of GRM.** The first level and most accessible and immediate contact for the fastest resolution of grievances are the contractors and supervision consultants on site. Prior to construction of any works, the community awareness consultants, DSC, and contractors are to hold local community meetings to notify the local residents and businesses of the temporary disturbance, and to inform them of the project. If a local area committee (LAC) exists, they should also be informed. If any complaints arise, the contractors, DSC, and PID can immediately resolve the complaints on site. The PID branch offices can also be involved in grievance redress at this stage. The KUKL hotline and PID office phone numbers will be posted in public areas within the project area and construction sites. Any person with a grievance related to the project can contact the project to file a complaint. The PID branch offices are staffed with a consumer relations officer to field and resolve complaints. The consumer relations officer or branch manager will document the complaint, and immediately address and resolve the issue with the contractor within 1-2 days, if the complaint remains unresolved at the field level. The branch manager may seek the assistance of the DSC safeguards specialists (the environmental specialist or social safeguards specialist) to help resolve the issue. The consumer relations officer or branch manager will notify the PID safeguards unit that a complaint was received, and whether it was resolved. The branch manager will fully document the following information: (i) name of the person, (ii) date complaint was received, (iii) nature of complaint, (iv) location, and (v) how the complaint was resolved.

210. **Second level of GRM.** Should the grievance remained unresolved, the branch manager will forward the complaint to the PID safeguards unit. The person filing the grievance will be notified by the consumer relations officer or Branch Manager that the grievance was forwarded to the PID safeguards unit. For resettlement issues, the resettlement officer will address the grievance; for environmental issues, it will be the environmental officer. Grievances will be resolved through continuous interactions with affected persons, and the PID will answer queries and resolve grievances regarding various issues, including environmental, social, or livelihood impacts. Corrective measures will be undertaken at the field level by the PID safeguards staff within 7 days. The relevant safeguards unit staff will fully document the following information: (i) name of the person, (ii) date complaint was received, (iii) nature of complaint, (iv) location, and (v) how the complaint was resolved.

211. Third level of GRM. Should the grievance remain unresolved, the PID's Project Director will activate the third level of the GRM by referring the issue (with written documentation) to the local Grievance Redress Committee (GRC) of KUKL, who will, based on review of the grievances, address them in consultation with the PID safeguards unit, Project Director, and affected persons. The local GRC will consist of members of PID, affected persons, and local area committee, among others determined to provide impartial, balanced views on any issues. The GRC should consist of around 5 persons. A hearing will be called with GRC, if necessary, where the affected person can present his or her concern/issues. The process will promote conflict resolution through mediation. The local GRC will meet as necessary when there are grievances to be addressed. The local GRC will suggest corrective measures at the field level and assign clear responsibilities for

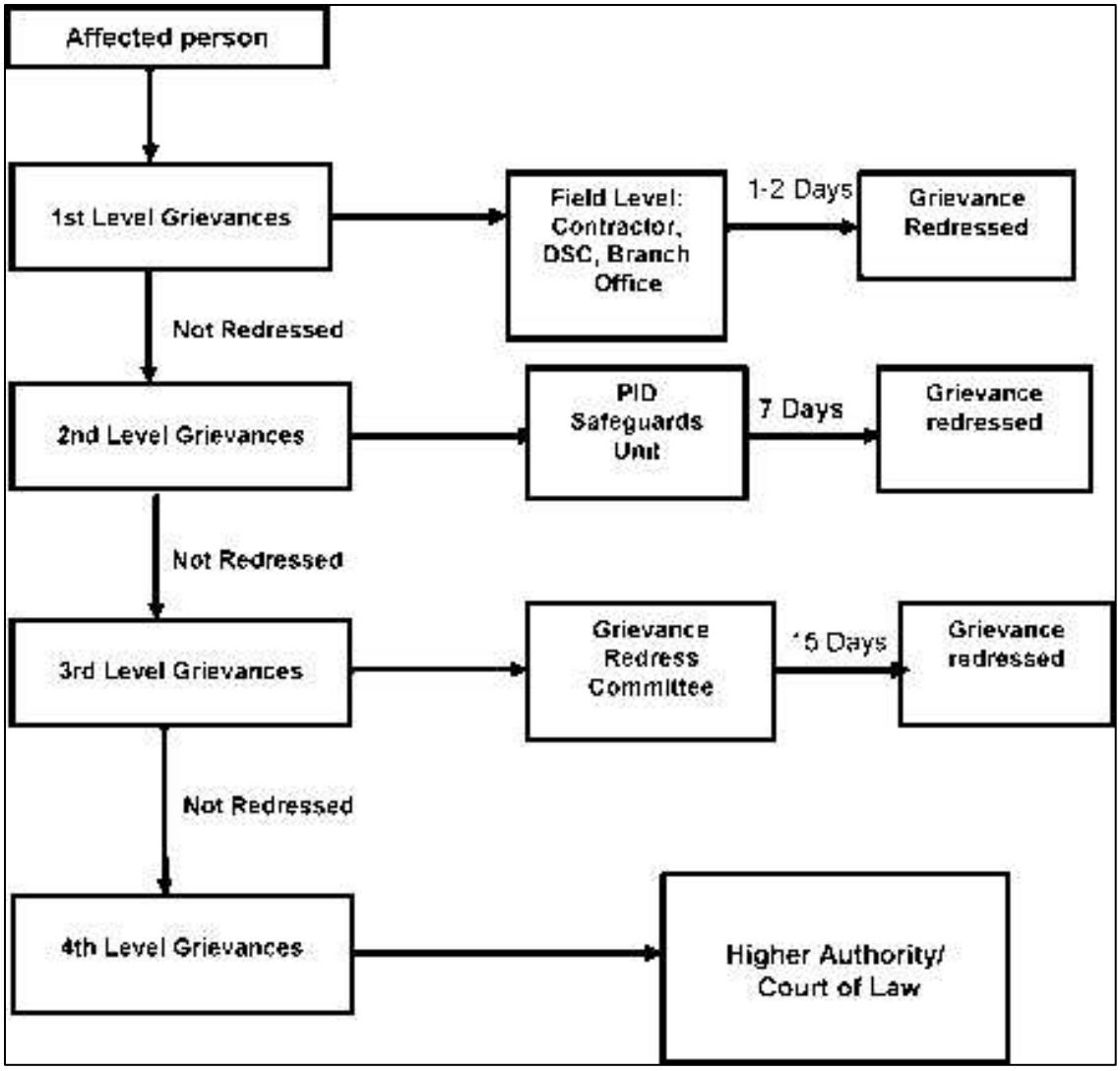
implementing its decision within 15 days. The functions of the local GRC are as follows: (i) to provide support to affected persons on problems arising from environmental or social disruption, asset acquisition (if necessary), and eligibility for entitlements, compensation, and assistance; (ii) to record grievances of affected persons, categorize and prioritize them, and provide solutions within 15 days; and (iii) to report to the aggrieved parties developments regarding their grievances and decisions of GRC. The PID safeguards officers will be responsible for processing and placing all papers before the GRC, recording decisions, issuing minutes of the meetings, and taking follow-up action to see that formal orders are issued and the decisions carried out.

212. Fourth level of GRM. In the event that a grievance is not addressed by the contractor, DSC, branch office, PID, or GRC, the affected person can seek legal redress of the grievance in the appropriate courts, the fourth level of the GRM, which is the formal legal court system. The grievance redress mechanism and procedure is depicted in Figure VIII-1.

213. GRC Composition. Below is the GRC members composition under the project:

(i) GRC Chairman - PID Director
(ii) GRC Members:
(iii) Concerned municipality representative
(iv) Tole Community representative as AP's representative
(v) Appointed NGO representatives as independent party
KUKL/ KVWSMB/DSC (as relevant)

214. ADB Accountability Mechanism. In the event when the established GRM is not in a position to resolve the issue, Affected Person also can use the ADB Accountability Mechanism (AM) through directly contact (in writing) to the Complain Receiving Officer (CRO) at ADB headquarters or to ADB Nepal Resident Mission (NRM). The complaint can be submitted in any of the official languages of ADB's DMCs. The ADB Accountability Mechanism information will available in the PID to distribute to the affected communities, as part of the project GRM.



DSC= design and supervision consultant, PID=project implementation directorate.

Figure VII-1: Grievance Redress Mechanism (GRM)

VIII. ENVIRONMENTAL MANAGEMENT PLAN (EMP)

A. Environmental Management Plan and Objectives

215. The basic objectives of the EMP are to:

(i) to ensure that all mitigation measures and monitoring requirements will actually be carried out at different stages of project implementation and operation - preconstruction, construction and operation and maintenance;
(ii) recommend a plan of action and a means of testing the plan to meet existing and projected environmental problems;
(iii) establish the roles and responsibilities of all parties involved in the project's environmental management;
(iv) describe mitigation measures that shall be implemented to avoid or mitigate adverse environmental impacts and maximizing the positive ones;
(v) ensure implementation of recommended actions aimed at environmental management and its enhancement; and
(vi) ensure that the environment and its surrounding areas are protected and developed to meet the needs of the local people and stakeholders.

B. Mitigation and monitoring

216. Anticipated environmental impacts and mitigation measures have been dealt in detail in Section D and Table16.

217. A detailed self-explanatory environmental management and monitoring program is presented in *Table VIII-1*. The Table lists the environmental impact, its mitigating measures; the parameters to be monitored (including location, measurement and frequency) and the cost. The program will evaluate: (i) the extent and severity of the adverse environmental impacts as compared to what was predicted, (ii) how effective the mitigating measures were and compliance with the regulations and the (iii) overall effectiveness of the EMP.

218. The environmental monitoring of the Wastewater System includes field supervision and reporting of project activities prior to and during the project construction and operation in order to ensure that the works are being carried out in accordance to the approved design and that the environmental mitigation measures are fully implemented in accordance with the EMP.

Table VIII-1: Environmental Management and Monitoring Plan of IS-02

Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibility	Cost (NRs.)
Construction phase				
Earthworks	Soil erosion and slope instability due to topsoil stripping and excavation for trenches	Separate stockpiling of topsoil for further use; spoil disposal at designated and stabilized sites; compact the excavated areas" backfill and include replacement of topsoil; adopt cut and fill approach; avoid work during the rainy season as much as possible; do mulching to stabilize exposed areas; use bioengineering techniques (e.g., re-vegetating areas promptly); Provide channels and ditches for post-construction flows; line steep channels and slopes (e.g. use of jute netting); prevent off-site sediment transport using settlement ponds, silt fences. Dispose of excess materials in designated areas.	Contractors/DSC	Contractor cost
	Surface water discharges to local drainage from trench construction	Use settling basins at reservoir sites; use straw to filter small discharges; do routine inspection and monitoring of larger discharges to water courses, Excavation dewatering to use settlement tanks.	Contractors/DSC	Contractor cost
	Runoff from construction areas including stockpiled materials	Use temporary bunds and catchment basins. Grade soil/sand stockpiles to prevent erosion.	Contractors/DSC	Contractor cost
	Excavation and laying of pipeline/ siphons, aqueduct and overflow wire at river crossings could impact the river water quality and ecosystem	Do construction in the dry season only; use river diversions with bundings; give prior notification of construction activities, schedule and affected areas including anticipated effects in river sections.	Contractors/DSC	Contractor cost
	Interception and interference with localized groundwater flows due to deep excavations.	Bund local wells, springs, and irrigation canals from temporary spoil dumps; monitor local wells and spring fed spouts or kuwas particularly downhill of excavation of trench, including temporary supply provided if flow is affected; provide permeable base and side backfill at deeply excavated sites or an alternate source of drinking water at the existing location.	Contractors/DSC	Contractor cost
Quarrying from river bed	Change in river hydrology and morphology	Do now allow quarrying/mining activities in river/streams to extract construction materials and change the river cross sections and longitudinal profiles.	Contractors/DSC	Contractor cost
Construction Phase				
Dumping of waste in the river. Construction of toilets in the camps Storing of materials and dumping of excess materials in the project area. Handling of toxic materials	Water and land pollution	Provide designated areas with collection bins for wastes. Provide toilet facilities and prohibit open defecation. Prohibit washing of vehicles next to rivers and streams. Ensure site is well-signed indicating the restrictions. Store construction aggregates, hazardous and toxic materials, lubricating, oils and used batteries in safe areas and away from any drainage leading to water bodies; have designated bounded areas for storage. Dispose of any wastes generated by construction activities in designated areas. Provide training to workforce on safe	Contractors/DSC	Contractor cost

Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibility	Cost (NRs.)
		handling of toxic materials and occupational health and safety measures during construction. Use personal equipment at all times while on site.		
Quarry operations Movement of vehicles Operation of crusher Earthworks Stockpiling of construction waste and construction materials	Air quality deterioration	Dust suppression on roads or at open sites by sprinkling water as required at regular intervals. Cover earth stockpiles using plastic sheets or cement jute bags. Use tarpaulins to cover sand and other loose materials during transport. Cover stockpiling materials with tarpaulin sheets during rainy and windy season in order to prevent runoff and erosion of stockpiling materials. Limit speed to 10-15 km/hr for construction vehicles; site to be signed specifying speed limits. Ensure that vehicles comply with the National Vehicle Mass Emission Standards, 2056 BS. Do regular maintenance of vehicles. Provide ventilation in confined working areas.	Contractors/DSC	Contractor cost
Movement of vehicles Operation of crusher	Noise and vibration	Monitor noise levels regularly at site to meet the noise standards; fit mufflers in vehicles to control noise, limit the speed of vehicles.	Contractors/DSC	Contractor cost
Constructionof project structures	vegetation clearance Damages to fisheries and aquatic ecology of riverbeds and avian habitats.	Cut only trees that are marked and have been approved by the DSC. Solicit instruction from DSC before cutting any trees and removing any vegetation. Plant and rear tree saplings at the rate of 25 saplings for each felled tree at identified plantation sites along the river bank. Do construction during dry season only and use diversions and bunding work sections.	Contractors/DSC	Contractor cost
Reinstatement of damaged community services and infrastructures.	Reinstatement of community services and infrastructures	Compensate or reinstate/relocate community assets that are disturbed by the construction work such as electricity poles, telephone lines, drinking water pipes, road lengths etc. to the satisfaction of the people. Coordinate with concerned utilities, local people, design maps of the area with utilities and emergency response plans (develop and include an emergency response plan/template that includes notification and reporting protocols).	KVWSMB/KUKL/Contractor/DSC	Contractor cost
Influx of outside workforce, and unwanted activities.	Increase in crime and community stress	Prohibit gambling and alcohol consumption in labour “camp sites”. Instruct the workforce to respect the local cultures, traditions, rights, etc.	KVWSMB/KUKL/Contractor	Contractor cost

Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibility	Cost (NRs.)
Project activities relating to health and safety issues at work areas	Health and hygiene (Unsafe working conditions, accidents, fire hazard, transmission of communicable diseases, etc.)	Provide regular health check-ups, sanitation and hygiene, health care, and control of epidemic diseases to the workforce. Launch awareness programs concerning human trafficking and the possibility of spread of sexually transmitted diseases (STDs) and HIV/AIDS using brochures, posters, and signboards. Provide insurance to workers and training in occupational health and safety. Give importance to community health and safety: • Provide alternate potable water supply during maintenance works and notify the public in advance • Prevent pollution of air in agricultural land, vegetation, and human settlements due to dust and vehicular emissions. • Avoid wastewater pollution on land, humans, receiving waters, and the environment. • Minimize nuisance due to traffic noise and vibrations. • Prevent nuisance from odors and noise • Avoid traffic accidents and traffic jams. • Prevent the possibility of accidents to the people of the community due to trench excavations. • Make available first aid kits, ambulance and fire extinguishers in camp sites. Make available protection gears to all construction workers and compensate for the loss of life or any type of injuries.	Contractors/DSC/KVWSMB/KUKL	Contractor cost
	Injury to a member of the public during pipe delivery	Provide fencing and/or barricades as per site risk assessment. Apply signage and pedestrian control. Devise and implement system for site inspection and security. Ensure security and equipment necessary to minimise vandalism.	Contractors/DSC/KVWSMB/KUKL	Contractor cost
	Traffic can cause personal injury to the public, contractors, and employees; and vehicle accidents.	Develop a traffic control plan and keep areas clean and clear of obstacles.	Contractors/DSC/KVWSMB/KUKL	Contractor cost
	Slips, trips and falls, strains and sprains; manual handling of injuries such as back damage	Conduct site inspection to ensure access/space is adequate for the task activities.	Contractors/DSC/KVWSMB/KUKL	Contractor cost
	Existing underground services can cause explosion, electrocution, and damage	Inform site in-charge before digging/excavation; check relevant authority (e.g. power, water, telephone) records for existing location of services. If in doubt use the experienced service of people in the locality.	Contractors/DSC/KVWSMB/KUKL	Contractor cost
	Excavation by plant and equipment will create noise, falling objects, damage to	Operations of plant by licensed personnel. Use personal protective equipment–hardhat, high visibility vest, hearing protection etc. Maintain a safety working area clear of any clutter etc. Around the	Contractors/DSC/KVWSMB/KUKL	Contractor cost

Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibility	Cost (NRs.)
	existing surfaces, material spillage, and injuries by moving parts.	moving plant. Protect surfaces from plant movements. Ensure plant noise control. Maintain clean-up equipment on site. Maintain (specified) spillage control equipment. Employ observers where possible.		
	Falling objects during storage of materials during excavation.	No materials to be placed or stacked near the edge of any excavation. No load to be placed or moved near the edge of the excavation where it is likely to cause collapse of side of work. No load handling/movement across excavation. No rollable objects stored uphill from excavation.	Contractors/DSC/KVWSMB/KUKL	Contractor cost
	Overhead and underground power cables can cause electrocution during excavation.	Determine location of underground services. If underground power cables are located in the vicinity, exercise extreme care while excavating. Consider any restriction on kinds of tools and equipment that may be required and comply with the requirements. Liaise with relevant authority.	Contractors/DSC/KVWSMB/KUKL	Contractor cost
	Sloping ground can cause the falling of rolling objects.	Maintain good housekeeping (remove debris, trip hazards, site tidiness). Select locations to minimize potential for movement. Stack materials at level below excavation. Secure/retain potential falling/rolling objects.	Contractors/DSC/KVWSMB/KUKL	Contractor cost
	Trench collapse and falling objects.	Support / bench / batter excavation. Keep safe distance from edge of trench (at least 0.6 m away from sides of trench depending on soil type and conditions to be decided by DSC during detailed design and to be barricade/fenced to debar the public). Materials not to be placed or stacked near the edge of trench. No load to be placed or moved near the edge of trench where it is likely to cause collapse of the trench. All trenches to have safety barricades when left open for a period of time.	Contractors/DSC/KVWSMB/KUKL	Contractor cost
	Water logging and pounding in the excavated trench and as a mosquito breeding site	Provide submersible pump to dewater trenches where ground is water-charged. Use personal protective equipment. No load/personnel movement across trench. Avoid mosquito breeding in the excavated trench.	Contractors/DSC/KVWSMB/KUKL	Contractor cost
	Falling into trenches	Install shoring system. Where possible backfill trenches where possible to avoid falling into it or any accidents. Erect 1.8-meter (min) security fence if open excavation is to be left unattended or cover open excavation with steel plating if left unattended. Erect safety signage boards to prohibit into the area and to avoid personnel movement across trench.	Contractors/DSC/KVWSMB/KUKL	Contractor cost
	Other risks associated with confined spaces.	Where trench/conduit is considered to be a confined space, use experienced trained personnel. No smoking and use of mobile phone use and avoid sparking.	Contractors/DSC/KVWSMB/KUKL	Contractor cost
	Trip hazard; dust–eye injury; environmental damage due to storage of fill.	Provide necessary environmental protection measures: Secure fill stockpile. Provide a dedicated area for fill. Watering of material.	Contractors/DSC/KVWSMB/KUKL	Contractor cost

Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibility	Cost (NRs.)
		Provide necessary personal protective equipment to workers. Cover /fill when unattended or unable to be watered.		
	Manual handling (shovelling) can cause strains and sprains, injuries such as back damage, injuries due to lifting pipes and swinging loads	Correct manual handling techniques. Provide adequate rest periods, allowed job rotation, minimize repetitious twisting and shovelling. Use mechanical aids where possible. Maintain control of loads when lifting and moving. Carry pipes close to ground while moving if mechanical aid is used.	Contractors/DSC/KVWSMB/KUKL	Contractor cost
	Contaminated soil can cause impact on health of persons.	Use protective clothes/shoes/gloves.	Contractors/DSC/KVWSMB/KUKL	Contractor cost
	Defective materials can cause injuries.	Visual inspection of materials by experienced persons/ engineers.	Contractors/DSC/KVWSMB/KUKL	Contractor cost
	Storage of hazardous materials can cause injuries and illnesses.	Handling and storage to be done carefully under guidance.	Contractors/DSC/KVWSMB/KUKL	Contractor cost
	Earth mounds can cause engulfment and dust can cause eye injuries.	Control operation of mobile plant by competent person. Watering of material. Control slopes, Delineate earth mounds. Put up warning signage. Cover earth mounds when unattended or unable to be watered.	Contractors/DSC/KVWSMB/KUKL	Contractor cost
	Personal injury due to working plant and equipment.	Maintain a safe distance from working plant. Wear personal protective equipment including high visibility clothing and hard hat, etc. Put up perimeter fencing. Place trained personnel on the look-out. Firstaid kit shall be in place at the site.	Contractors/DSC/KVWSMB/KUKL	Contractor cost
	Public hazards due to inadequate compaction, construction refuse, and inadequate re-surfacing during site restoration.	Compaction to specified international standard (backfill shall be compacted to a dry density of not less than 90% of the maximum dry density); clear site of debris and refuse; re-surface without leaving gaps or uneven surfaces and erect fence around hazardous areas until they are safe and restored.	Contractors/DSC/KVWSMB/KUKL	Contractor cost
	Inadequate training, consultation, planning and improvisation can cause task-specific injuries due to inexperience, inadequate consultation or failure to provide required equipment.	All personnel on-site should be trained and kept aware and should be suitably qualified. Provide competent supervision to be on-site.	Contractors/DSC/KVWSMB/KUKL	Contractor cost
	Weather conditions (e.g. hot, cold, wet, flooding/inundation, high winds) can cause dehydration and dizziness.	Supply adequate drinking water in the work area.	Contractors/DSC/KVWSMB/KUKL	Contractor cost
	Slippery surfaces can cause slips and falls.	Wear non-slip safety footwear in all work sites. Ensure extreme care when working in wet and slippery areas. Personnel should never run on worksite.	Contractors/DSC/KVWSMB/KUKL	Contractor cost

Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibility	Cost (NRs.)
	Untidy site can cause slips and fall, particularly when site is unattended.	Keep worksite clean and tidy at all times, free from clutter and rubbish. Store materials in designated areas as specified in site plans.	Contractors/DSC/KVWSMB/KUKL	Contractor cost
	Public safety make be at risk due to pipes or drums accidentally rolling onto the roadway causing an accident or may be rolled by unauthorised persons particularly when site is unattended causing injury to persons.	All materials to be secured by blocks or wedges, sandbags or other means. All pipes not laid during the course of a day are to be returned to the stockpile and secured.	Contractors/DSC/KVWSMB/KUKL	Contractor cost
	Public safety may be at risk due to improper storage of plant.	Store/park plant and equipment off site and in a secure area.	Contractors/DSC/KVWSMB/KUKL	Contractor cost
	Nuisance due to excavated soil. Deterioration of air quality due to dust.	Provide for safe disposal and re-use of excavated soil. Remove waste soil as soon as it is excavated. Sprinkle water to avoid dust.	Contractors/DSC/KVWSMB/KUKL	Contractor cost
	Soil erosion, silt runoff, and settling of street surfaces. Water could get polluted; land values degraded and are a nuisance to pedestrians. Street surfaces would settle, bringing about pounding of water.	Precautionary measures should be taken during construction such as backfilling of excavated trenches maintaining slope and drainage for surface runoff. Construction activities should be, as far as possible and avoided during the rainy season. Provide temporary diversions and sign boards for pedestrians.	Contractors/DSC/KVWSMB/KUKL	Contractor cost
	Local residents and sites of social/cultural importance may be disturbed by noise, dust and impede access	Carry out the work as quickly as possible to minimize disturbances. Consult residents; inform them of work in advance. Erect “work to commence” and “work in progress” signage.	Contractors/DSC/KVWSMB/KUKL	Contractor cost
	Pollution of water distributed can cause health hazards.	Place water distribution pipes away from sewers to avoid infiltration of sewage (the bottom of the water service pipe must be at least 0.3 m above the top of the sewer line to avoid seepage with the water pipe above the sewer)	Contractors/DSC/KVWSMB/KUKL	Contractor cost
Dislocation of archaeological artefacts, if any	Loss of archaeological and cultural sites. Finding of any archaeological artefact during excavation works.	Protect archaeological and cultural sites, use manual digging, and avoid heavy equipment during the digging of trenches for the laying of pipes in sensitive areas. Inform DSC and to theChief District Officer who has to report the findings in writing to the Department of Archaeology within 35 days, according to the Ancient Monuments Protection Act, 1956 and Rules, 1989. Arrange for onsite “grievance handling” through the use of liaison officers. Undertake trench closure and facilitate surface rehabilitation or pavingas quickly as feasible.	Contractors/DSC/KVWSMB/KUKL	Contractor cost

DSC = Design and Supervision Consultant, DWEC = District Wage Evaluation Committee, KUKL = Kathmandu UpatyakaKhanepani Limited, KVWSMB = Kathmandu Valley Water Supply Management Board, MOPE = Ministry of Population and Environment, PID = Project Implementation Directorate, WWTP = Wastewater Treatment Plant.

A. Implementation Arrangements

1. Environmental Procedures and Institutions

219. The Ministry of Forest and Environment (MoFE) is in charge of environmental control and management for all sector agencies. The Ministry of Water Supply and Sanitation (MoWSS) has the overall responsibility for environmental monitoring of all water supply and sewerage projects. In case of an EIA, it has to be finally approved by MoPE. In case of an Initial Environmental Examination (IEE), the final approval lies with MoWSS.

220. The MOWSS will be the executing agency responsible for overall strategic planning, guidance, and management of the project, and for ensuring compliance with loan covenants. As part of institutional reforms under the ongoing loans, three water and wastewater organizations were created - Kathmandu Valley Water Supply Management Board (KVWSMB), the asset owner; KUKL, the asset operator and service provider; and Water Supply Tariff Fixation Commission (WSTFC), the regulator. KVWSMB will continue to discharge its responsibilities as asset owner of water supply and wastewater systems and monitoring of performance of KUKL as provided in the lease and license agreement between KVWSMB and KUKL. KUKL will be the implementing agency, and the existing PID in KUKL will be responsible for (i) project planning, implementation, monitoring, and supervision; (ii) reporting to KUKL Board of Directors, MoWSS, and ADB; and (iii) coordination of all activities. The experience of PID, KUKL in implementing Kathmandu Valley Water Supply Improvement Project (ADB 2776-NEP) will be useful in taking advance actions for the Project.

221. Some clearances are required to be taken before the Project commences:

• In the forest regulations, if the project "will result in clear cutting of national forest" or "falls within protected area". The Forest Act, 1993 Article 68 mentions that in order to implement any project with "priority status" and "with no other alternatives than to use the forest", "only in such situation and conditioned that there will not be any adverse environmental effect by implementing such schemes", the Government of Nepal may give permission to use some part of forest (organized forest/conserved forest/community forest/lease hold forest) to implement such projects. The Ministry of Forests and Soil Conservation (2009) also requires that all the costs related to the clearing off the forest, its transportation to the approved location and works related to environmental mitigation shall be borne by the project itself. It is mandatory to plant 25 saplings for every tree cut and maintain/nurture them for 5 years. If the proponent cannot nurture the saplings, the proponent will provide the total cost involved to the National Parks and Wildlife who shall rear/nurture the saplings for 5 years. The clearance is sought from the Department of National Parks and Wildlife. Laying of the new sewers will be aligned to avoid the cutting of trees. If during the detailed design, it is found that tree cutting is unavoidable, then the above procedures will be followed. However, the proposed sewer alignments do not fall under any national and government forest area, conservation area, protected area and national parks. Similarly, the proposed treatment plants area also does not fall under any such protected and conservation area. All the lands of treatment plants belong the project and no any private land partials are existed within the boundary of those treatment plant. Some of the trees existed within the boundary shall be considered as private trees and the project will provide appointed contractor to cut the required trees in piecemeal basis. The contractor will be responsible to plant tree saplings in the ratio of 1:25 and will also be responsible to protect it at list for 5 years.

222. Table VIII-2 defines the roles of different organisations and groups in environmental monitoring:

Table VIII-2: Institutional/organizational responsibilities in environmental monitoring

S N	Organization	Roles and Responsibilities		
		Pre - construction phase	**Construction phase**	**Operation phase**
1	Ministry of Water Supply and Sanitation (MoWSS)	• Review IEE document and submit to donors; approve IEE report, • review design and tender documents in order to examine whether or not mitigation prescriptions are included and instruct KUKL.	• review EMP Report • to ensure EMP implementation • effectiveness of the implementation measures and • compliance	review bi-annual monitoring reports, and annual site inspection.
2	Kathmandu Valley Water Supply Management Board (KVWSMB)/ Kathmandu UpatyakaKhanepani Limited (KUKL) and Projection Implementation Directorate (PID)	• review final design and tender documents and forward them to MoWSS, • instruct PID to update RAP and get it approved, • establish 'Safeguard Unit/Utility Management Coordination Subcommittee /appoint Design and Supervision Consultant (DSC) • obtain all necessary permissions and permits, notify, carry out land acquisition (if required), and crop compensation evaluation • select contractor, award and review EMEP document prepared by the contractor and approve it.	• conduct frontline monitoring on mitigation implementation • effectiveness • enhancement programs • appoint monitoring team • ensure public participation • RAP implementation • Environmental compliance and • prepare quality monitoring report to submit to MoWSS.	ensure smooth operation of water supply and sewerage systems
3	Design and Supervision Consultant (DSC)	• incorporate all provisions of EMP in the final design, • incorporate all mitigation measures in the tender documents, • assist in site inspection during land intake, and • Baseline monitoring of air and receiving water quality, noise level and vibrations and overall environmental status of the project area.	• approval of construction works • monitoring of the contractor's performance on EMP implementation/ mitigation effectiveness / impact monitoring • labour employment as per regulations • instruct contractor for corrective actions • impose fine/or null payment in case of noncompliance and • prepare monthly monitoring report/ participate in inspection • periodic monitoring of air quality, receiving water quality and noise and vibration levels at the project area • monitoring of impacts on physical, biological and socioeconomic environment in the project area	

S N	Organization	Roles and Responsibilities		
		Pre - construction phase	**Construction phase**	**Operation phase**
			• conduct trainings and Community Awareness and periodic meetings with stakeholders and • submit monthly and bi-annual progress reports, including monitoring results and mitigation activities.	
4	Construction Contractor	• prepare EMEP for contracts, • select temporary land use sites, and • assist the supervising engineer in joint site inspection of KVWSMB/ KUKL for approval.	• get permission to start work from DSC • ensure that all prescriptions of EMP are included in the work activities • ensure employment opportunities for the locals and maintain records of employment, and submit to the Supervising Engineer • carry out corrective measures as recommended by DSC • participate in monitoring and inspection • prepare an operational manual to submit to DSC • provide training to the monitoring personnel, and • submit monthly reports on EMP compliance to DSC.	

2. Monitoring and Reporting Procedures

223. The Construction Contractor should develop a construction environmental management plan (CEMP) based on the EMP. The CEMP should be approved by PID/KUKL and DSC. Contractors are to submit monthly CEMP implementation status reports to DSC. DSC should submit quarterly reports to PID which should be reviewed by the Safeguard Unit of PID. PID should submit semi-annual monitoring reports to ADB in a similar format provided in Annex 13. The reporting system should be based on site supervision to see whether mitigation measures are carried out according to the Monitoring Plan. DSC is responsible for checking the monthly progress reports submitted by the Contractor and field verified whether or not the Contractor has complied with the approved conditions as stated in the CEMP.

224. DSC should then prepare a quarterly environmental monitoring report based on the monthly report submitted by the Contractor and submit to PID/KUKL for review. The report is developed based on field inspection, investigation, consultation and information given in the monitoring report. 10 copies of the reports should be submitted to PID/KUKL every month, which should be distributed to the responsible agencies for review. The Environmental Specialist of DSC should then review the comments and suggestions from the various authorities and act accordingly.

225. Monthly progress reports, including bi-annual and annual reports on the implementation of EMP should be produced on a regular basis. The monthly progress report should contain information on the works carried out and the results of all monitoring and investigation works performed during that particular month. The report should also include cases of compliance and non-compliance and the corresponding further mitigation measures to be adopted to correct the non-compliances and also include the outcome of the monitoring, important issues identified and the measures to be undertaken to ameliorate them.

3. Procurement plan and cost estimates

226. The EMP will be incorporated into the bidding and contract documents and the contractors will make available a budget for all such environmental mitigation measures.

227. A domestic Community Awareness and Safeguard Support Consultant (CASSC) firm will facilitate community awareness and participation programs over the 5-year period. The cost for the public awareness specialist, support team, and IEC (Information, Education and Communication) materials has been estimated as $600,000.

228. The Contractors and their supervisory staff should be made aware on the importance of meeting environmental safeguard standards in the contracts, and the importance of preparing, submitting and getting the Environmental Mitigation Execution Plan (EMEP) (to be prepared for each subproject, according to the EMP) approved before construction starts. A one-day orientation programs will be provided to construction contractor as and when required. The orientation program will consist of (i) environmental issues in interceptor sewer construction and laying of sewer pipes, (ii) implementation of mitigation measures, (iii) monitoring of implementation and (iv) preparation of the Environmental Mitigation Execution Plan.

229. Costs for the operation and maintenance phase trainings of KUKL staff, including monthly monitoring.

230. All the costs related to cutting of trees (if there are any and which will be known once the final alignment of the pipelines have been fixed by DSC), their transportation to an approved location and works related to environmental mitigation shall be borne by the project itself. The new sewers will be laid so as to avoid the cutting of trees. If during the

detailed design, it is found that tree cutting is unavoidable, it is mandatory to plant 25 saplings for every tree cut and maintain them for 5 years. The cost for the cutting and nurturing of 1 tree for 5 years has been estimated as $600 that will be borne by the project.

The EMP cost included in BOQ is as presented below.

Table VIII-3: EMP cost

	Particulars	Stages	Unit	Quantity	Rate (NRs.)	Cost (NRs.)	Cost covered by
A.	**Mitigation Measures**						
1	Compensatory plantation measures including seed sowing on embankment slope (average estimate)	Construction	Number	3200	553	1,769,600.00	Project
B.	**Administrative Costs**						
1	Legislation, permits, and agreements	Permit for excavation, tree-cutting permits, etc	Lump sum	LS		25,000.00	These consents are to be obtained by contractor at his own expense.
2	Environmental assessment and environmental clearances as per EPA 1997 and EPR, IEE presentation at review committee related expenses	Preconstruction	Lump sum	1		10,000.00	PMO cost
3	Public consultations and information Disclosure	Information disclosure and consultations during preconstruction and construction phase, including public awareness campaign through media	As per requirement	Lump sum		150,000.00	covered under DSMC contract
4	GRM implememntation	Costs involved in resolving complaints (meetings, consultations, communication, and reporting/inform ation dissemination)		Lump sum		170,400.00	PMO cost
5	Any unanticipated impact due to project Implementation	Mitigation of any unanticipated impact arising during construction phase		Lump sum		250,000.00	Civil works contract–
6	Social Safeguard and GESI activities	Costs involved in resolving complaints (meetings, consultations, communication, and reporting/ informing	As per requirement	Lump sum		125,000.00	Civil works contract
C.	Reinstatement of relocation of public utilities within land services. Ie. Electric pole, transformer, telephone poles, underground water	Construction				10,000,000.00	

	Particulars	Stages	Unit	Quantity	Rate (NRs.)	Cost (NRs.)	Cost covered by
	supply pipe, street lignting, etc as per instruction of engineer. (Spec. 12.5.8)						
	Total					12,500,000.00	

4. Implementation Schedule

231. Detailed design of interceptor packages and sewer network began in third quarter of 2013. Construction is scheduled to commence in the mid of 2014 to be completed by mid of 2018.

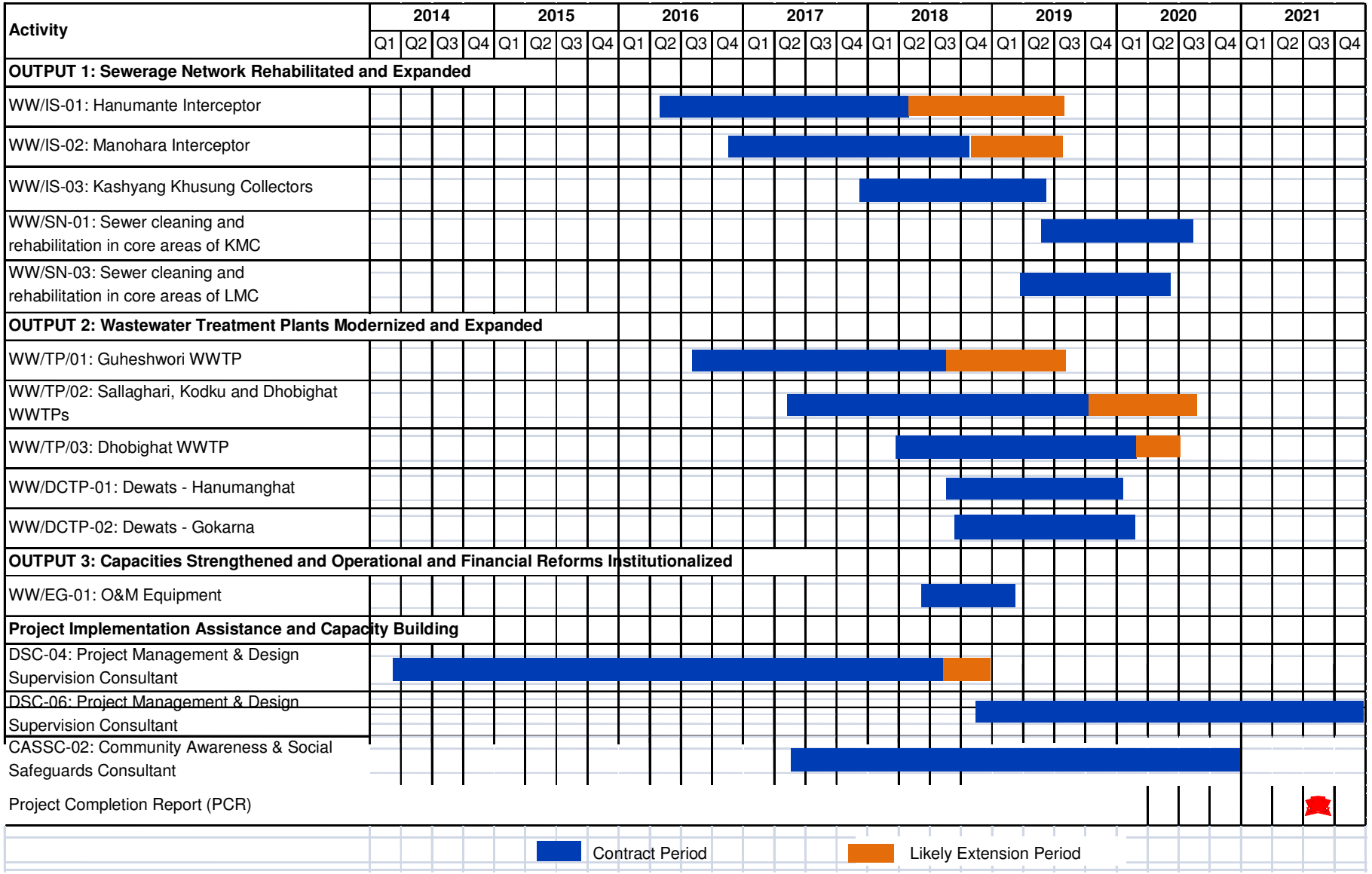
232. The project implementation schedule is given in Table VIII-4for a period of 5 years. Most of the activities have been scheduled on a continuous basis.

233. Under the General Manager of KUKL, there is a Technical Division (headed by a Deputy Technical Manager). Under the Technical Division, there are 10 Branch Offices in the Valley headed by a Deputy Manager each. Before operation, KUKL/PID/DSC, with the help of the Safeguards Unit and the Technical Division of KUKL will develop detailed work plans for implementing mitigation measures and monitoring plans based on the EMP. These plans will be incorporated into the project contracts which will then be submitted to the relevant Branch Offices to help in supervising the works.

234. Before construction, KUKL/PID will develop detailed responsibilities and requirements for contractors and will provide detailed cost estimates of mitigation measures and environmental monitoring in the construction contracts. KUKL/PID will also detail the responsibilities of their environmental management offices and prepare their work schedules.

235. Before operation, KUKL/PID will develop detailed work plans for environmental management and monitoring during operation based on the EMP. These work plans will be submitted to the concerned persons to help them supervise implementation.

Table VIII-4: Project Implementation Schedule



IX. CONCLUSIONS AND RECOMMENDATIONS

236. Overall the impacts of the Project will be very positive, benefitting the environment and the people. Some impacts are anticipated during implementation but in specific areas and for short duration (dust, noise, traffic problems, erosion, sedimentation etc.). It is expected that the adverse environmental impacts of the planned project for will in general not be significant and can be reduced and/ or prevented through mitigation measures and regular monitoring during the design, construction and operation phases.

237. This IEE is updated for Interceptor Sewer line facilities along the both banks of the Manohara River. The sewers which collect the wastewater from the designated service areas and conveys and discharge the wastewater to the proposed wastewater treatment plants at Kodku. The Manohara interceptor sewer (IS) line will be implemented as IS-02.

238. The project is unlikely to cause significant adverse impacts. The potential adverse impacts associated with design, construction, and operation can be mitigated to standard levels without difficulty through proper engineering design and the incorporation or application of recommended mitigation measures and procedures as detailed in the EMP.

239. Based on the findings of the IEE, the classification of the project as category - B is confirmed, and no further special study or detailed EIA needs to be undertaken to comply with ADB SPS (2009).

Appendix 1: Rapid Environmental Assessment (REA) Checklist Kathmandu Valley Wastewater Management Project

1. The Kathmandu Valley Wastewater Management Project (KVWMP) will support the ongoing efforts of the Government of Nepal toward improving the wastewater services in Kathmandu Valley.

2. The proposed infrastructure components of this project includes (i) rehabilitation and expansion of sewerage network including property connections; (ii) rehabilitation and construction of interceptors along the streams; (iii) rehabilitation and construction of 5 wastewater treatment plants of 90.5 MLD capacity; and (iv) energy generation of approximately 910 KW through sludge digestion and gasification, etc.

Categorization (Environment) - Category B. No significant impacts. Potential impacts are site specific, few if any of them are irreversible, and in most cases mitigation measures can be designed readily. An IEE with EMP was prepared.

Screening Questions	Yes	No	Remarks
B. Project Siting Is the project area.			
a) Densely populated?	x		Rehabilitation of sewerage network will be in urban areas. Extension of interceptors will be in non-populated areas. WWTPs will be rehabilitated/
b) Heavy with development activities?		x	In established residential areas
c) Adjacent to or within any environmentally sensitive areas?			
Cultural heritage site	x		Sewer will be laid on the streets of the Heritage sites. Prior to approval will be sought from of Archaeology in accordance to The Ancient Monuments Preservation Rules 2046 (1989) Section 4.1.1
• Protected Area		x	
• Wetland		x	
• Mangrove		x	
• Estuarine		x	
• Buffer zone of protected area		x	
• Special area for protecting biodiversity		x	
• Bay		x	
Potential Environmental Impacts Will the Project cause.			
■ impairment of historical/cultural monuments/areas and loss/damage to these sites?	x		If there are any chance finds, work will be stopped immediately, the Chief District Officer contacted immediately, and the findings reported in writing to the Department of Archaeology within 35 days, according to the Ancient Monuments

Screening Questions	Yes	No	Remarks
■ interference with other utilities and blocking of access to buildings?	x		Detailed surveys will be conducted of all services and as constructed drawings obtained where possible to locate existing services and to prevent disruption during construction. Budget for restoration/replacement of damaged utilities will be made available and a contingency plan in case of disruption prepared and implemented.
■ nuisance to neighboring areas due to noise, smell, and influx of insects, rodents, etc.?		x	Not anticipated.
■ dislocation or involuntary resettlement of people?		x	No displacement of communities required in this project.
■ disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?		x	Not applicable.
■ impairment of downstream water quality due to inadequate sewage treatment or release of untreated sewage?		x	Project involves construction of WWTPs designed to allow for expansion as wastewater flows increase in the future. WWTPs to be operated using WWTP safety plans that use a risk based approach to operation.
■ overflows and flooding of neighboring properties with raw sewage?		x	Sewers will be designed to meet peak flow to ensure no overflows of raw sewage. provide stand-by generators for pumping stations. Train operators for regular inspection, cleaning, and maintenance of plant and sewers.
■ environmental pollution due to inadequate sludge disposal or industrial waste discharges illegally disposed in sewers?		x	Sludge will be treated and managed to produce energy at 4 WWTPs via gasification, anaerobic digestion etc.
■ noise and vibration due to blasting and other civil works?	x		No blasting activities. Restrictions on operational hours of crushing plants and construction vehicles etc will be applied.
■ risks and vulnerabilities related to occupational health and safety due to physical, chemical, and biological hazards during project construction and operation?		x	Use of PPE at all sites will be applied strictly. The EMP ensures occupational health and safety measures are included. No hazardous chemicals will be used during construction and operation.

Screening Questions	Yes	No	Remarks
■ discharge of hazardous materials into sewers, resulting in damage to sewer system and danger to workers?		x	Not anticipated. Sewerage to be collected from residential areas. Some commercial connections are anticipated. Waste from these industries discharged to the sewer network will be restricted through the implementation of appropriate
■ inadequate buffer zone around pumping and treatment plants to alleviate noise and other possible nuisances, and protect facilities?		x	Establishment and maintenance of environmental buffer zones in WWTP along with secure fencing. Design of pumping stations will include appropriate housing for pumps for noise proofing and protection of the facility.
■ road blocking and temporary flooding due to land excavation during the rainy season?		x	Not anticipated. Construction activities to be conducted during non-rainy season.
■ noise and dust from construction activities?	x		Anticipated during construction activities. However impacts are temporary and short in duration. The EMP ensures measures are included to mitigate the impacts.
■ traffic disturbances due to construction material transport and wastes?	x		Anticipated during construction activities. However impacts are temporary and short in duration. A traffic management plan will be developed and implemented by the contractor. Contractors will also coordinate with the local traffic police.
■ temporary silt runoff due to construction?	x		Run-off during construction is anticipated. However impacts are temporary and short in duration. The EMP ensures measures are included to mitigate the impacts. Spoil disposal will be immediate and any stockpiling will be away from drain channels etc.
■ hazards to public health due to overflow flooding, and groundwater pollution due to failure of sewerage system?		x	Not anticipated. Sewer system to be designed to accept future flows and peak flows. Design to also include stand-by generators for pumping stations.

Screening Questions	Yes	No	Remarks
■ deterioration of water quality due to inadequate sludge disposal or direct discharge of untreated sewage water?		x	Not anticipated. The EMP ensures measures are included to manage the sludge. Design of plants include management of sludge for energy generation. Design to include plant to accept future flows. Water safety plans for the plants will be developed and implemented to ensure effluent complies with government standards and minimize operational failure.
■ contamination of surface and ground waters due to sludge disposal on land?		x	Not anticipated. Sludge to be managed and used for energy generation.
■ health and safety hazards to workers from toxic gases and hazardous materials which maybe contained in confined areas, sewage flow and exposure to pathogens in untreated sewage and unstabilized sludge?		x	Not anticipated. The EMP ensures measures are included to mitigate the impacts. Occupational, health and safety training provided to all personnel. PPE to be worn at all times. Emergency response plans to be developed and implemented.
■ large population increase during project construction and operation that causes increased burden on social infrastructure (such as sanitation system)?		x	Priority in employment will be given to local residents. Contractors will provide workers camps with sanitary amenities that meet the IFC 2009 guidelines.
■ social conflicts between construction workers from other areas and community workers?		x	Priority in employment will be given to local residents.
■ risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during construction and operation?		x	Not anticipated. Construction will not use explosives and chemicals. The EMP ensures measures are included to manage storage, use and disposal of fuel for construction equipment. Storage will be in designated areas away from water bodies. Fuel use areas to have drip basins/ catch tank (for fuelling) to prevent leakage and catch spills. Fuel to be recycled where possible or disposed in designated areas.
■ community safety risks due to both accidental and natural hazards, especially where the structural elements or components of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning?		x	Operation area will be clearly demarcated and restrict public access.

Climate Change and Disaster Risk Questions The following questions are not for environmental categorization. They are included in this checklist to help identify potential climate and disaster risks.	Yes	No	Remarks
■ Is the Project area subject to hazards such as earthquakes, floods, landslides, tropical cyclone winds, storm surges, tsunami or volcanic eruptions and climate changes (see Appendix I)?	x		Kathmandu Valley is located in a seismic zone.
■ Could changes in precipitation, temperature, salinity, or extreme events over the Project lifespan affect its sustainability or cost?		x	Not applicable.
■ Are there any demographic or socio-economic aspects of the Project area that are already vulnerable (e.g. high incidence of marginalized populations, rural-urban migrants, illegal settlements, ethnic minorities, women or children)?		x	The project will improve the socio-economic conditions of both, the poor and non-poor populations of Kathmandu valley.
■ Could the Project potentially increase the climate or disaster vulnerability of the surrounding area (e.g., increasing traffic or housing in areas that will be more prone to flooding, by encouraging settlement in earthquake zones)?		x	Improved wastewater services could potentially attract migrants to the area.

Appendix 2: Bagmati River pollution

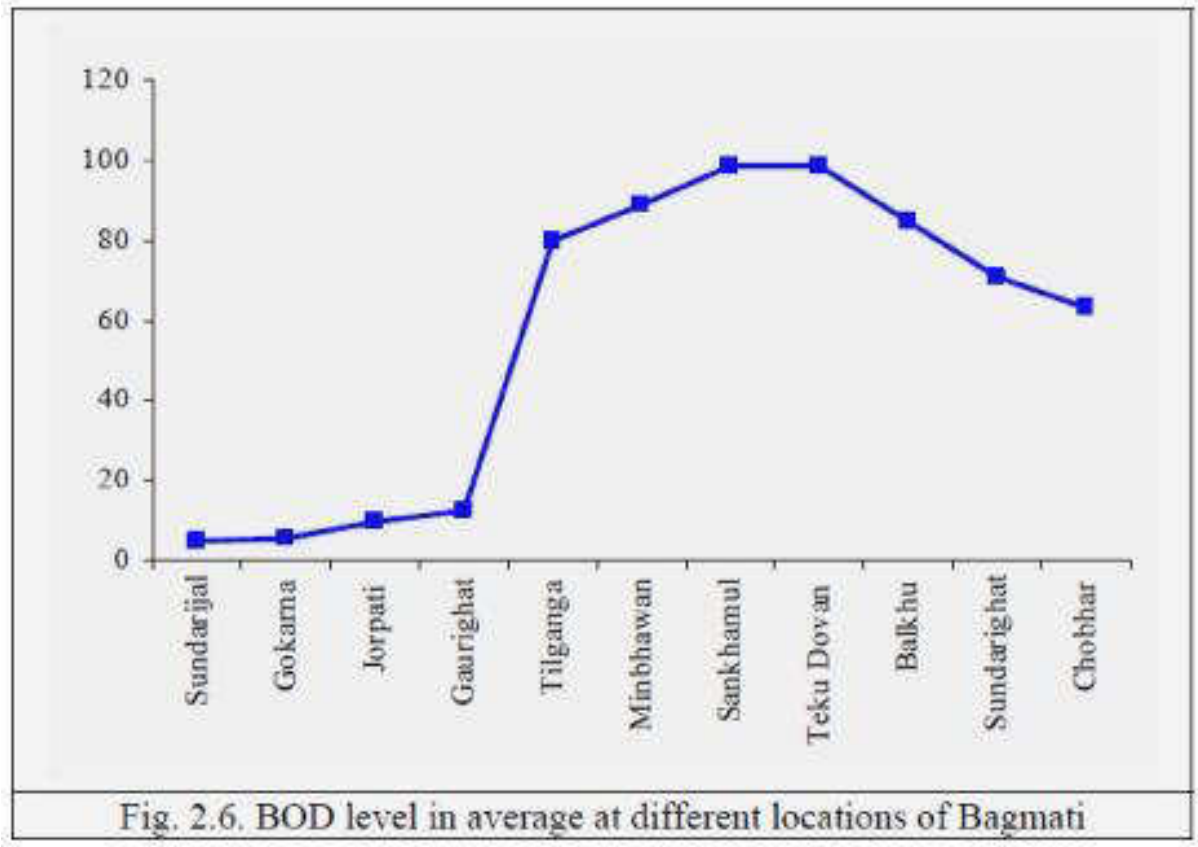


Fig. 2.6. BOD level in average at different locations of Bagmati

Y- Axis: BOD (mg/l); X-Axis: Locations in Kathmandu Valley

Waiter quality parameters

Parameters	Sundarijal	Khokana
TSS mg/1	5	70
Chloride mg/1	1	24
Ammonia mg/1	0.03	11
BOD mg/1	1.3	65
Coliforai counts per 100 ml	1000	1.000.000
DO mg/l	S.9	1.7

Source: MWSP (2000)

Source: BAGMATI ACTION PLAN (2009-2014), DRAFT REPORT,

March 31, 2008 Submitted to: National Trust for Nature Conservation
Submitted by Joint Venture of Astra Development Network Pvt. Ltd, GeoSpatial Systems Pvt. Ltd, Innovative Solution Pvt. Ltd

Appendix 3: Tolerance limits for wastewater to be discharged into inland surface watersfrom combined wastewater treatment plant (generic standards)

Characteristics	Tolerance Limit
Total Suspended solids, mg/L, Max	50
Particle size of total suspended particles	Shall pass 850-micron Sieve.
pH	5.5 to 9.0
Temperature	Shall not exceed 40 degree C in any section of the stream within 15 meters down-stream from the effluent outlet.
Biochemical oxygen demand (BOD) for 5 days at 20 degree C, mg/L, Max	50
Oils and grease, mg/L, Max	10
Phenolic compounds, mg/L, Max	1
Cyanides (as CN), mg/L, Max	0.2
Sulphides (as S), mg/L, Max	2
Radioactive materials:	
a. Alpha emitters, c/ml, Max	7-Oct
b. Beta emitters, c/ml, Max	8-Oct
Insecticides	Absent
Total residual chlorine, mg/L	1
Fluorides (as F), mg/L, Max	2
Arsenic (as As), mg/L, Max	0.2
Cadmium (as, Cd), mg/L, Max	2
Hexavalent chromium (as Cr), mg/L, Max	0.1
Copper (as Cu), mg/L, Max	3
Lead (as Pb), mg/L, Max	0.1
Mercury (as Hg), mg/L, Max	0.01
Nickel (as Ni), mg/L, Max	3
Selenium (as Se), mg/L, Max	0.05
Zinc (as Zn), mg/L, Max	5
Ammonia nitrogen, mg/L, Max	50
Chemical Oxygen Demand, mg/L, Max	250
Silver, mg/L, Max	0.1

Source: Urban Environment Management Framework 2068 (2011), GON

Note:
This generic standard applies to discharge of wastewater into inland surface waters from combined wastewater treatment plants. The municipal wastewater treatment plants in the proposed project will collect and treat only domestic wastewater from Kathmandu Valley. Therefore, in the absence of generic standards for domestic wastewater to be discharged into inland surface water from municipal wastewater treatment plants, this standard will only be applied as a guide. The project will assist in the development and implementation of domestic sewage discharge standards.

Appendix 4: Environment Related Acts and Regulations in Nepal

Acts

1) Ancient Monuments Protection Act, 1991
2) Aquatic Animals Protection Act, 1960
3) Plant Protection Act, 1964
4) National Parks & Wild Life Conservation Act, 1987
5) Public Road Act, 1974
6) Trust Corporation Act, 1976
7) Tourism Act, 1978
8) Soil & Watershed Conservation Act, 1982
9) Nepal Petroleum Act, 1983
10) Nepal Electricity Authority Act, 1984
11) Mines & Mineral Act, 1985
12) Pashupati Area Development Trust Act, 1987
13) Solid Waste (Management & Resource Mobilization) Act, 1987
14) Town Development Act, 1988
15) Kathmandu Valley Development Authority Act, 1988
16) Nepal Water Supply Corporation Act, 1989
17) The Constitution of the Kingdom of Nepal, 1990
18) Pesticides Act, 1991
19) Municipality Act, 1991
20) Water Resources Act, 1992
21) Forest Act, 1992
22) Electricity Act, 1992
23) Motor Vehicle & Transportation Management Act, 1992
24) Labour Act, 1992
25) The Local Governance Operationalization Act, 2074 (2017)
26) Industrial Enterprises Act, 1992
27) Nepal Tourism Board Act, 1996
28) Environment Protection Act, 1996
29) Children' s Act, 1992

Rules

1) National Parks & Wild Life Conservation Rules, 1973
2) Plant Protection Rules, 1974
3) Wild Life Reserve Rules, 1977
4) Himalayan National Park Rules, 1979
5) Mountaineering Rules, 1979
6) King Mahendra Nature Conservation Trust Rules, 1984
7) Petroleum Rules, 1984
8) Solid Waste (Management & Resource Mobilization) Rules, 1989
9) Water Resources Rules, 1993
10) Pesticides Rules, 1993
11) Labour Rules, 1993
12) Electricity Rules, 1993
13) Forest Rules, 1994
14) Buffer Zone Management Rules, 1995
15) Royal Bardiya National Park Rules, 1996
16) Conservation Area Management Rules, 1996
17) Vehicle & Transportation Management Rules, 1997
18) Environment Protection Rules, 1997

Appendix 5: National Ambient Air Quality Standard, 2012 for Nepal

Parameters	Units	Averaging Time	Concentration in Ambient Air, maximum	Test Methods
TSP (Total Suspended Particulates)	µg/m³	Annual	-	
		24-hours*	230	High Volume Sampling
PM10	µg/m³	Annual	-	
		24-hours*	120	Low Volume Sampling
Sulphur Dioxide	µg/m³	Annual	50	Diffusive sampling based on weekly averages
		24-hours**	70	To be determined before 2005.
Nitrogen Dioxide	µg/m³	Annual	40	Diffusive sampling based on weekly averages
		24-hours**	80	To be determined before 2005.
Carbon Monoxide	µg/m³	8 hours**	10,000	To be determined before 2005.
		15 minute	100,000	Indicative samplers ***
Lead	µg/m³	Annual	0.5	Atomic Absorption Spectrometry, analysis of PM_{10} samples****
		24-hours	-	
Benzene	µg/m³	Annual	20	Diffusive sampling based on weekly averages
		24-hours	-	
PM10	µg/m³	24-hours	40	
Ozone	µg/m³	8-hours	157	

***Note:** 24 hourly values shall be met 95% of the time in a year. 18 days per calendar year the standard may be exceeded but not on two consecutive days

****Note:** 24 hourly standards for NO_2 and SO_2 and 8 hours standard for CO are not to be controlled before MOPE has recommended appropriate test methodologies. This will be done before 2005

*****Note:** Control by spot sampling at roadside locations: Minimum one sample per week taken over 15 minutes during peak traffic hours, i.e. in the period 8am - 10am or 3pm - 6pm on a workday. This test method will be re-evaluated by 2005

******Note:** If representativeness can be proven, yearly averages can be calculated from PM10 samples from selected weekdays from each month of the year.

Appendix 6: Recommended noise exposure limits for the work environment (adopted from Occupational Safety and Health Administration (OSHA)

S.No	NoiseExposure(dBA)	Permissible exposure (Hours and Minutes)
1.	85	16 hrs.
2.	87	12 hrs. -18 min.
3.	90	8 hrs.
4.	93	5 hrs - 18 min.
5.	96	3 hrs.-30 min.
6.	99	2 hrs. - 18 min.
7.	102	1 hr. - 30 min.
8.	105	1 hr.
9.	108	40 min.
10.	111	26 min.
11.	114	17 min.
12.	115	15 min.
13.	118	10 min.
14.	121	6.6 min.
15.	124	4 min.
16.	127	3 min.
17.	130	1 min.

Source: Marsh, 1991

Recommended Average Equivalent Sound Levels for Protecting the Public Health and Welfare

S.No	Land Use	Measure	To Protect Against Activity Interference and Hearing Loss Effects (dBA)
1.	Residential including farm residences	Leq (24)	55
2.	Commercial	Leq (24)	70
3.	Hospitals	Leq (24)	55
4.	Industrial	Leq (24)	70
5.	Educational	Leq (24)	55
6.	Recreational Areas	Leq (24)	70
7.	Farmland and general unpopulated land	Leq (24)	70

Source: U.S Environmental Protection Agency, 1974

Note: Leq (24) = Equivalent Sound Level in decibels for 24 hours.

Appendix 7: Source: Vibration Regulation Law 64 of 1976, Japan

Type of Restriction	Area Classified	
Standard Value	I & II	85 dBA
Work Prohibited Time	I	7.00 P.M. - 7.00 A.M.
	II	10.00 P.M. - 6.00 A.M.
Maximum Working Duration	I	10.00 hrs. per Day
	II	14 hrs. per Day
Maximum Consecutive Working Days	I & II	6 Days
Working Prohibited Days	I & II	Saturdays & Holidays

Recommended Standards for Vibration from Construction Sites

Notes: 1. Area I, stands for areas to which one of the following descriptions applies:

- Areas where maintenance of quiet is particularly needed to preserve the residential environment.
- Areas which require maintenance of quiet since they are need for residential purposes.
- Areas need for commercial and industrial as well as residential propose which are in need of measures to prevent vibration pollution since a considerable number of houses are located.
- The neighbourhood of schools, hospitals and the like.
- Area II stands for areas where there is a need to preserve the living environment of in habitants and other than Area I.

2. Vibration level shall be measured at the boundary line of the specified construction work site.

Recommended Limits for Road Traffic Vibration

Area	Day time	Night time	Applicable areas
I	65 dB	60 dB	Areas where maintenance of quiet is particularly needed to preserve a good living environment and where quiet is called for us as they are used for residential purpose.
II	70 dB	65 dB	Areas need for commercial and industrial as well as residential purposes where there is a need to preserve the living environment of local inhabitants and areas mainly serving industrial proposes which are in need of measures to prevent the living environment of local residents from deteriorating.

Source: Vibration Regulation Law 64 of 1976, Japan
Note: Vibration level shall be measured at the boundary line of the road.

Appendix 8: Focus Group Discussions, Stakeholders Consultations/Workshops and Meetings

Consultations/ Focus Group Discussion with the stakeholders of proposed Gokarna wastewater treatment plant

Venue of discussion: Private house, Gokarneshowr VDC, ward no. 6 **No. of participants:** 12 **Issues raised**

- At present more than 90 % of the HHs discharge wastewater into the Bagmati river.
- The coverage of the present reed bed treatment plant is very low (only for HHs of ward no. 1.
- Focus should be given to other wards also-1,2,3,4,5,6,and 8.
- Sewage disposal is the main problem in different wards.
- The proposed land for wastewater treatment is not sufficient. There should be a provision of roads on both sides of the bank of the river as it has been proposed in other wards also. The people of ward no 6 should have access to the river bank.
- There are more than 3 drinking water pipes and cables under the existing road. There will be no space for laying sewers in the existing road unless the road is widened further.
- The population growth is very high in this VDC. More than 500 houses will be constructed during the next five years. Land has been fragmented in very small pieces. So the population will reach more than 9,000 by 2020.
- The community is going to form a committee in the near future to look into the basic needs of the community like roads, sewage treatment, water supply, and drainage etc..

Basically, the stakeholders agreed on the following agenda:

1. Wastewater treatment should be done using the Vetiver system and should be community based.
2. Another option of treatment of sewage is to divert the sewage to the existing Guheshowri WWTP.
3. Due to lack of space, a large WWTP is not feasible.
4. Active participation of the local community is a must for the management of the wastewater treatment system.

Consultation with the stakeholders at Shantinagar (New settlement)

Venue: Dirghayu Tole, Shantinagar No. of participants: 10 Date: 18 July 2012 Issues/ discussion:

- Formed a *Tole SudharSamittee* (Community Improvement Committee) for the development of community. Dirghayu Tole is a new settlement
- They have initiated to construct the sewerage pipeline.
- The settlement adjoining the squatters area which is located in the west bank of Bagmati River
- All the squatters are settled here almost 10 years ago and discharge their residential waste directly into the river
- The Dirghayu Tole (settlement) has about 680 households including squatters in the area
- Bagmati High Powered Committee (project) has constructed sewerage pipeline of about 36 " diameter in the west side of Bagmati River (interceptors?) recently (about 4 months ago) but has not functioned yet.
- The existing sewerage pipeline is very small. It could not cope with the increased population.
- The committee strongly demanded that the government should look these new areas and manage the sewerage and drainage system immediately.

Minutes of Focus Group Discussion
on identification of project intervention areas

A Focus Group Discussion (FGD) was held with an objective of involving key stakeholders and receiving their input in identification and prioritization of the project intervention areas in relation to the sewerage network improvement.

Date: 26th April 2012 (Thursday)

Time: 11:00 - 14:00

Venue: Falcha/SAP Nepal, Babarmahal,

Kathmandu Presence:

S N	Name	Designation	Institution
1	Krishna Bhola Maharjan	Engineer	Kirtipur Municipality
2	Rudra Prasad Adhikari	Civil Engineer	Lalitpur SubMetropolitan City
3	Prabin Shrestha	Arch. Infrastructure Planner/PWD	”
4	Narayan Kumar B.C.	Sr. Finance Officer	KVWSMB
5	Shree Krishna Nyaichyai	Civil Engineer	Bhaktapur Municipality
6	Satya Narayan Sah	Sr. Engineer	MadhyapurThimi Municipality
7	Sudan Raj Panthee	Deputy Project Director	KUKL/PID
8	Richard H. Pope	Vice General Manager	KUKL
9	Shekhar Adhikari	Deputy Manager	KUKL
10	Noor Kumar Tamrakar	DTL	PPTA
11	Himesh A. Vaidya	Sr. Engineer	PID/KUKL
12	Carlo Pandolfi	GIS Expert	PPTA
13	Darryl Jackson	Wastewater Engineer	PPTA
14	Raja Ram Pote Shrestha	Wastewater Engineer	”
15	Susheela Chand	Office Manager	”
16	Abadh Kishor Mishra	Project Director	PID/KUKL
17	Chandra Lal Nakarmi	Manager	KUKL

Deputy Project Director of KUKL/PID Mr. Sudan Raj Panthee opened the FGD with brief introduction of the programme. It was followed by brief introduction of all the participants. Wastewater Engineer (Int.) Mr. Darryl Jackson made a power point presentation and briefed on the background and scope of PPTA and the selection criteria for identification of project intervention areas. Wastewater Engineer (Nat.) Mr. Raja Ram Pote Shrestha recalled the meeting with all five municipalities in respective municipality before the FGD and requested to make a presentation on problematic areas based on maps and tables provided to them by PPTA team earlier. He informed that the identified areas from this FGD will be considered for further detailanalysis and will be screened through technical and other criteria for inclusion in project development. He also facilitated the FGD.

A. Bhaktapur Municipality

Er. Shree Krishna Nyaichyai briefed about the existing sewerage system in Bhaktapur Municipality. He informed that the municipality has two different problems in core area and in new developed urban areas. GTZ developed sewerage system with combined system in core area, which has been running till date. The major problem in core area is related with overflow of pipes during rainy season due to clogging of pipe in some places. The north

collector is a gravity run system and has been running to some extent but south collector which consisted of pumping system is out of order due to problems in pumping system.

The new settlements have been developed in north and both sides of Arniko Highway in south. Although the municipality prohibits disposal of sewage into Hanumante river, they have been discharging on their own. The sewage discharge from these areas and surrounding VDCs causes pollution of Hanumante and KhasyangKhusung river.

The major problematic areas in the municipality are Kamal Vinayak (Ward No. 4) and other 3 newly developed land pooling areas.

The municipality is planning to implement land pooling project with 75 Ha, which will include sewerage network as well.

The major areas of concern/priority for the municipality is to rehabilitate/relay north collector to make it operable without pumping system and rehabilitate existing south collector and sewer lines in core area, lay interceptor sewers along Hanumante and Khasyangkhusung river to intercept sewer.

B. Lalitpur Municipality

Mr. Prabin Shrestha and Mr. Rudra Prasad Adhikari joined the discussion with elaboration on geographical structure of municipality. The city has been surrounded by KodkuKhola (east), Bagmati (north) and Nakhu (west). They informed that the municipality can be divided into several catchment areas and wastewater management plan has to be prepared for each of the catchment considering decentralization of wastewater disposal. The municipality has three type of sewer lines, one constructed during Rana period, second constructed by IDA project (Bhandari Builders) in 1988 and the last constructed by the municipality and NWSC/KUKL after the year 2000. All these sewers have been converted into combined sewer although some of them (IDA sewers) have been designed as sanitary sewer and old sewers have been designed as storm water sewer. They informed that old Rana period sewers and new sewers constructed after year 2000 are still functional but sewers constructed under IDA project are mostly clogged and non-functional.

C. Madhyapur Municipality

Er. Satya Narayan Sah informed that the municipality consists of 4 valleys. Although urbanization process has accelerated along Arniko Highway in recent years, the large portion of the municipality still remains unorganized. Considering this, on site sanitation system has been practiced in these areas. Although the septic tank is mandatory for new house construction, many people tend to avoid this. The Natural Resources Committee of the Parliament has suggested to construct community septic tank in the municipality, which is also being considered. As per people's demand, the municipality has been laying sewer lines in urban areas. Municipality feels that there is a need to construct four interceptor sewers. .

The most problematic areas are Lokanthali and Garkhu. In Garkhu, the Rajkulo has been converted into a drain but the problem of flooding is still recurring each year. The municipality has been laying main sewer lines of 1200 mm. to 1500 mm diameter. These sewers have been designed as combined sewer..

As the Supreme Court prohibited discharge of wastewater into rivers, the municipality does not allow discharge of sewage into river. It is also considering laying Interceptor along left bank of Manohara to protect the river. The municipality has also discussed about laying Interceptor along Hanumante river.

The local community has been successfully operating Sunga WWTP designed for 200 HHs. Such type of DEWATS is feasible and easily manageable. Considering topography of the municipality, at least 4 DEWATS can be constructed in the municipality.

Since the municipality is newly developed, the possibility of separation of sanitary sewer and storm water line is still possible in the MadhyapurThimi municipality. Similarly, the wastewater can be managed through DEWATS in this area.

D. KUKL:

Er.Shekhar Adhikari, Chief of Sewerage Operation Department (SOD)/KUKL highlighted the role played by SOD in managing wastewater in the valley. He raised the necessity of south collector in Bhaktapur and informed that other problematic areas in the Bhaktapur are Byasi to Kamal Vinayak and Bhaktapur Industrial Area.

The problematic areas in Lalitpur are Kumaripati and Mangalbazar, where Jetting machine has to be used every week because of clogging and small size pipes. The other areas are Lagankhel to Batukbhairav and Jawalakhel to Ekantakuna. The sewer lines in this area are clogged with fatty materials because of haphazard disposal by restaurants.

He briefed that there are several problematic area in Kathmandu. The most problematic areas are Jamal area, Kamalpokhari-Putalisadak and Tripureshwor. The SOD has been managing these areas through diversion of wastewater into nearby other sewer lines. The Thamel area is suffering from clogging due to small pipe size and fatty materials.

Mr. Richard Pope, Vice GM of KUKL appreciated the PPTA efforts and informed that improvement in wastewater sector is very necessary. He stressed on the synchronization of works between water supply and wastewater works especially in DNI areas. He also emphasized to give due attention to rehabilitate sewer lines in narrow lanes.

Mr. Carlo Pandolfi briefed the meeting about asset condition assessment survey and the preparation of GIS of sewerage network which the PPTA is preparing to carry out. He informed that the survey work will start by the end of May 2012 and requested for the cooperation of municipalities and KUKL in conducting this survey.

Mr. Darryl Jackson concluded the FGD and informed that the suggestions will be considered to identify and prioritize areas for intervention. He thanked all the participants for positive feedback and informed that similar interaction will be conducted in future to finalise the areas.

Minutes of Meeting on Coordination on Wastewater Sector

A meeting was organized with an objective of coordinating activities of different stakeholders working on wastewater management sector in Kathmandu Valley.

Date: 22nd June 2012 (Friday)

Time: 15:00 - 16:00

Venue: Meeting Hall, Ministry of Urban Development (MoUD), Singh Durbar, Kathmandu Presence:

S.N.	Name	Designation	Institution
1	Mr. Tana Gautam	Secretary	MoUD
2	Mr. Gajendra Thakur	Project Manager	HPCIDBC
3	Mr. Abadh Kishore Mishra	Project Director	PID
4	Mr. Anil Bhadra Khanal	Deputy Project Director	,,
5	Mr. Sanjeev Bikram Rana	,,	,,
6	Mr. Himesh A. Vaidya	Eng. Section Chief	,,
7	Mr. Prayag Lal Joshi	Chairman	KUKL
8	Mr. Kiran Amatya	General Manager	,,
9	Mr. Narayan B. Bhattarai	Division Chief	Kathmandu Metropolitan City
10	Mr. Narayan Kumar B.C.	Sr. Finance Officer	KVWSMB
11	Mr. HannuPelkonen	Team Leader	PPTA Team
12	Mr. Noor Kumar Tamrakar	DTL	,,
13	Mr. Raja Ram Pote Shrestha	Wastewater Engineer	,,

Mr. Tana Gautam, Secretary of MoUD chaired meeting and initiated it briefing on the objective of organizing this coordination meeting. He requested an active participation to make the meeting success. Thereafter, Mr. Abadh Kishore Mishra, PID Director elaborated the agendas of the meeting.

Mr. Noor Kumar Tamrakar made a power point presentation and briefed on the background and scope of the PPTA. He also informed the expected outputs of the project and requested the participants to express their opinion on the several coordination issues like scope of work, design parameters, ongoing & planned programmes of different stakeholders, coordination mechanism etc. The presentation was then followed by discussion.

Major Issues Discussed:

1. Several agencies like KUKL/PID, High Powered Committee for Integrated Development of Bagmati Civilization (HPCIDBC), Municipalities are working on wastewater sector in Kathmandu valley. There are some other stakeholders like Kathmandu Valley Development Authority (KVDA), Department of Roads (DoR), Department of Survey, Town Development Fund (TDF) and some other agencies working in this sector and their activities should be coordinated to have better results.
2. Kathmandu Municipalities has gradually decreased laying of sewer lines. In recent years, it has been supplying hume pipes to some limited local users committees.
3. The design parameters used by various agencies are different and there must be

common understanding to apply uniform design guidelines to sewer network improvement work.

4. HPCIDBC intends to be river basin management organization. It is not interested to operate Guhyeswari WWTP and if KVWSMB comes with suitable proposal, it is ready to handover. The issue of wastewater tariff collection in Guhyeswari WWTP area has also been discussed.
5. The HPCIDBC is planning to lay Interceptors along banks of all nine rivers in the valley. It is expected that the contract will awarded to lay Interceptor uptoBalkhu within three months. The necessity of coordination of these activities with PPTA team was discussed.
6. There are several sewer network problems in the valley and KUKL alone cannot improve the whole situation. The proposed ADB project is an opportunity, which will not come again and again. Considering this, the fund should be utilized not only for WWTP and Interceptor construction but also for neighborhood network improvement. But before that, asset condition survey should be carried out to propose improvement projects. Implementation should be realistic and not very ambitious.

Decisions:

1. It was agreed to form two committees on coordination issues. One Coordination Committee will be formed to oversee all coordination issues, which will be headed by MoUD. Another will be technical coordination committee, where KUKL/PID, HPCIDBC, KVDA, Municipalities and both ADB PPTA will represent. The meeting will be conducted at least once in a month.
2. There will be uniform design guidelines on sewerage works carried out by various agencies, which will be proposed by technical committee.
3. The Chairperson of the meeting thanked all the participants for fruitful discussion and informed that the suggestions will be considered to improve the working modalities of different agencies.

Summary of Proceedings

Consultative Stakeholders Workshop on Interim Report

Background:
The consulting team (FCG in association with TMC and ERMC) is working under PPTA 7936 funded by Japanese Fund for Poverty Reduction and executed by the Asian Development Bank to prepare a project for wastewater service improvement in Kathmandu Valley for a project grant from Asian Development Bank and other development partners.

The proposed wastewater service improvement investment has focussed on: a) neighbourhood sewer rehabilitation, improvement and expansion; b) construction of new interceptor and collector sewers to convey sewage from neighbourhood network to WWTPs; c) Modernisation, expansion and construction of new WWTPs to treat sewage before discharge into river system and d) institutional development and capacity-building programs for efficient and effective management of wastewater sector. The consultants have prepared an interim report on the project feasibility study and Project Implementation Directorate (PID)/KUKL has organised a consultative stakeholder‟s workshop.

Objectives:
The objectives of the meeting are to discus and obtain a broad consensus on the range of necessary improvement works on wastewater management of Kathmandu Valley and to develop investment programs for ADB financial assistance for a period of 2013-18.

Time: 09:00am –16:25 pm
Date: 14th August 2012 (Tuesday)
Venue: Hotel Everest, New Baneshwor, Kathmandu, Nepal

PROGRAMME
9:00 - 9:30 AM : Registration and Tea
9:30 – 9:45AM : Informal Opening Session
9:30 AM : Call on Dignitaries to Dais by the MC/Moderator
: Welcome Remarks Mr. Abadh Kishore Mishra, Project Director, PID
: Opening Remarks Mr. Kenichi Yokoyama, Country Director, ADB
: Opening Remarks Mr. Tana Gautam, Secretary MoUD
9:45 – 10:05 AM : Presentation on Project Overview, components and implementation by Mr. HannuPelkonen, Team Leader, PPTA
10:05 – 10.25 AM : Presentation on Existing Wastewater Management in KV Mr. Tirtha Raj Poudel Manager, Sewerage Operation Department, KUKL
10:25 – 10:40 AM : Discussion
10:40 – 11:05 AM : Refreshment (Light)
11:05 – 11:35 AM : Presentation on Sewer Network by Mr. Raja Ram Pote Shrestha, Wastewater Expert, PPTA, including: issues related to combined/separate sewers operation and maintenance of sewerage network issue of synchronization and/or double excavation of water pipeline networks and sewerage networks;
11:30 – 11:45 PM : Discussion Session11:45 – 12:15 AM : Presentation on Wastewater Treatment Plants and related Issues, Sludge Management and Energy Generation by Mr. Ari Niemela, Wastewater Treatment
Plant Expert, PPTA, including: comparative analysis of various wastewater treatment technologies and the
Recommendations applicability of and recommendations for decentralized wastewater treatment systems (DEWATS) in KV.

12:15 – 12:30 PM : Discussion Session
12:30 – 12:45 PM : Institutional and Capacity Building Issues, by Mr. Rajendra Giri, Institutional Expert, including: suggestions for proper institutional structure and capacity building of institutions responsible for O&M of wastewater systems in KV; demarcation of role and responsibilities among various institutions involved in wastewater management in KV
12: 45 – 1:00 PM : Discussion
1:00 – 2:00 PM : Lunch
2:00 – 2:25 PM : GIS Development on Sewerage and Water Supply Infrastructure in KUKL, by Mr. Carlo Pandolfi, GIS Expert, including recommendations to develop sewerage GIS and the action plan by the CBP team to develop such GIS;
2:25 – 2:40 PM : Discussion
2:40 – 3:00 PM : Resettlement, Gender and Social issues, by Ms. Gita Adhikari, Social Development Specialist, including important concerns and recommendations to make the project more inclusive focusing on social and gender aspects and ensuring community participation

3:00 – 4:00 PM : Main Discussion Session, opening by Mr. Noor Tamrakar, DTL, including
O&M and sustainability of wastewater management with special emphasis on
availability of personnel, uninterrupted power and O&M budget – key issues
4:00 – 4:10 PM : Conclude/Remarks on Discussion, by Mr. Noor Tamrakar, DTL
4:10 – 4:25 PM : Closing Remark by Mr. Prayag Lal Joshi, Chairperson, KUKL

Meeting Proceedings:
The Workshop was conducted in two sessions namely Opening Session and Technical Session.

A. Opening Session:
Mr. Abadh Kishore Mishra, Project Director of Project Implementation Directorate (PID) made first welcome remarks. He welcomed all the participants and briefed about the background of KVWMP. He informed the activities carried out by PPTA and the objectives of the present workshop. He emphasized on the improvement of waste water network, upgrading of existing wastewater treatment plants and construction of new plants. He expressed his view that the water supply and sewerage system will be more effective in the Valley after the completion of Melamchi Water Supply Project by the end of 2015. He requested all invitees to actively participate in the discussion.

Mr. Kenichi Yokoyama, Country Director of Asian Development Bank (ADB) highlighted the role of this PPTA to improve urban environment of Kathmandu Valley and asked to coordinatewith other similar projects especially with another ADB funded Bagmati River Basin Improvement Project. He emphasized two key issues which should be considered seriously by the government. There is a need to enhance project readiness for smooth implementation of the project. The disbursement rate is less than 9 % out of 25% targeted in most of the on-going ADBs projects. So it needs to expedite and implement the projects without any delay. Second issue is related with operation and maintenance of wastewater management system including sewerage network and WWTP. He asked to consider an uninterrupted power supply as a key challenge in implementing the proposed project. He asked to complete PPTA works resolving all pending issues by taking advanced actions in coordination with KUKL, HPCIDBC, PID, DSC and other agencies. He also requested the strong commitment of the government for successful completion of this project.

Mr. Tana Gautam, Secretary, Ministry of Urban Development (MoUD) informed that the Government of Nepal has considered this project very seriously. He informed that the KVWMP is the priority project for Kathmandu Valley and expected that the project will contribute to government policy of providing sanitation to all by 2017. He highlighted the present status of waste water and emphasized the need to treat the waste water before discharging into the river. He lauded the role of ADB in implementation of projects on water and sanitation. He concluded his remarks asking all participants to contribute from their sides to make the project a successful.

Speaking from the Chair, **Mr. Prayag Lal Joshi, Chairman, KUKL** mentioned that the sewerage and drainage are the complicated issues in the valley. He requested to consider some critical issues like land availability for WWTP, social problems and synchronization of sewerage works with DNI activities. There are multiple actors involved in this sector which had made the system more complicated. There is no coordination between and among them and the work has been done haphazardly. He closed the opening session requesting all for active participation and contribution in the discussion.

B. Technical Session: Interim Report Findings Presentation

Mr. HannuPelkonen, **Team Leader of PPTA** made first presentation and elaborated on the overall Project overview, components, scope and magnitude of the project and implementation. He also introduced the objective and the development of the interim report, prepared by the PPTA and submitted to MoUD, KUKL, PID and ADB.

Thereafter, **Mr. Tirtha Raj Poudel, Manager of Sewerage Operation Department, KUKL** made presentation on Existing Wastewater Management in Kathmandu Valley. He briefed about the existing wastewater management system of Kathmandu and role of KUKL in managing it. He informed that KUKL activity at the moment is limited to cleaning and repairing some sewer lines due to limited budget, human resources and other technical constraints.

Mr. Raja Ram Pote Shrestha, Wastewater Expert of PPTA presented on Sewer Network, Interceptors and Related Issues. He briefed the existing condition on network informing that the actual condition is not known. He highlighted some key issues in managing sewer network like issues related to combined/separate system, O & M of sewerage network and issue of synchronization and/or double excavation of water pipeline networks and sewerage networks. He then presented proposed projects on network and interceptors with justification and limitation. He raised some major coordination issues which are very important for successful implementation of the proposed project.

Mr. Ari Niemela, Wastewater Treatment Plant Expert of PPTA made presentation on Wastewater Treatment Plants and related Issues, Sludge Management and Energy Generation. He briefed on the existing wastewater treatment system in the valley and informed the operational condition of existing WWTPs. He elaborated the proposed WWTP projects with comparative analysis of various wastewater treatment technologies and the recommendations. He alsodiscussed on applicability of and recommendations for decentralized wastewater treatment systems (DEWATS) in KV.

Mr. Rajendra Giri, Institutional Development Expert of PPTA presented on Institutional and Capacity Building Issues. He elaborated on existing institutional issues in KUKL on wastewater sector and roles played by various agencies in this sector. He suggested a list of manpower and capacity building activities required to implement and sustain this project.

Mr. Carlo Pandolfi, GIS Expert of PPTA made presentation on GIS Development on Sewerage and Water Supply Infrastructure in KUKL. He briefed the current situation and ongoing activities of KUKL in relation to GIS. He presented on proposed structure and recommendations of the PPTA team to develop sewerage GIS and action plan to be taken by CBP team to develop such GIS.

Mr. Sushil BabuAryal, Social Safeguard Specialist of PPTA presented on Resettlement Issues. He briefed about the potential resettlement issues in project implementation and proposed some mitigation measures.

Ms. Gita Adhikari, Social Development Specialist of PPTA made presentation on Gender and Social Issues. She informed the findings of the FGD and other consultation meetings with the community people. She highlighted some important concerns and recommendations to make the project more inclusive focusing on social and gender aspects to ensure community participation.

Mr. Noor Tamrakar, Deputy Team Leader of PPTA presented on Operation and Maintenance of Sewerage System. He elaborated on the existing O & M issues in this sector in KUKL with due consideration of financial issues. He highlighted key issues on O&M and sustainability of wastewater management with special emphasis on availability of personnel, uninterrupted power and O&M budget.

C. Discussion:

The presentation has been followed by floor discussion, where the following remarks/issues were raised.

Mr. Prayag Lal Joshi, Chairman, KUKL

He commented on the involvement of multiple agencies in the construction of sewerage and drainage system without proper design. This has created a serious problem in the functioning of the system. Such haphazard system of construction should be discouraged.

Ms. Laxmi Sharma, Project Officer, ADB/NRM

She raised the issue on the involvement of different organization in the construction of drainage and sewerage system. Since, KUKL has been given the mandate for the management of sewerage, why permission is given to different organizations to connect the storm water into sewerage system. She also raised the issues of quality work and insufficient manpower for the project implementation. She requested to have better coordination with the Department of Urban Development and Building for implementation of provision of construction of septic tank while issuing building permit for new house construction.

Mr. Gajendra K. Thakur, Project Manager, HPCIDBC

Mr. Thakur mentioned the deterioration of water quality in the river due to the approval of new house plan/construction by the Municipality without mandatory construction of Septic Tank. Prior to 2050 BS (1993), one could not construct a new house without constructing Septic Tank. After 1993, the Municipality did not administer strict rule of compulsory construction of Septic Tank. People started to discharge wastewater from their house directly into the river. He also requestedto mention expenditure done by HOCIDBC in managing wastewater system, which is about NRs. 30 million per year.

Mr. Ganesh Thapalia, Kathmandu Metropolitan City

Mr. Thapalia defended the existence of the policy of compulsory construction of Septic tank when one seeks approval of housing plan from Kathmandu Metro. He argued that there is a problem in the upstream of river. The river is being polluted from the upstream. Further, he mentioned the problem of sludge management in Kathmandu Metro. He asked the audience where to dispose the sludge which comes from the Septic tank. The present coordination problems with different organization involved in waste water sector has made the wastewater management in the valley more difficult. He requested that Kathmandu Metro should be informed about the project activities and the assistance required from the Metro to solve the problem. He also requested all to cooperate in the awareness programs launched by Kathmandu Metro for cleaning the rivers of Kathmandu Valley.

Mr. Satya Narayan Shah, Engineer, MadhyapurThimi Municipality

Mr. Shah opined that the centralized system of wastewater treatment will not be practical in Nepal. He gave the example of the failure of Bhaktapur Wastewater Treatment Project constructed in 1970s. He recommended decentralized wastewater management system through local community based small treatment plant. He informed that the Municipality used to have only on-site sanitation system in the past, which later on polluted dug wells. As a result they now emphasized on sewerage system.

He suggested the need of good relationship between KUKL and Municipality in solving the problem. He also raised the issue of tariff on the sewerage. The Municipality does not have any taxation system on the sewerage management. For the effectiveness of Septic tank, sufficient water should be available which we do not have.

Mr. Mahesh Bdr. Basnet, Chairman, HPCIDBC

Mr. Basnet opined that the pollution of river increased dramatically after the starting of PPP model program for laying of sewer by Municipalities which discharged raw sewage directly into the river. If small WWTP had been constructed, the present problem would not have come. He attributed deteriorating river water quality on not following the rule and regulations of the government. He requested the concerned organization/authority to implement the restriction or prohibition of discharging waste water into the river. He also commented on the recent amendment of reducing right of way in Dhobikhola bank corridor from 12 meter to 9 meter. He pointed out that the PPP model started by Municipality encouraged people to lay sewer and drain lines haphazardly.

Mr. Tirtha Raj Poudel, Manager, KUKL

Mr. Poudel opined that there may a need to dig the same road many times unless proper coordination of DNI works and Sewerage network construction is done. He asked for synchronization of DNI activities and proposed network improvement works. He commented on proposed laying of interceptor sewers on both side of the *Tukucha* River since there is no space to construct. Mr. Poudel also stressed on the importance of land acquisition for the proposed Wastewater Treatment Plant at Khokana. He urged implementation of different rules and regulations to manage wastewater system in the valley.

Mr. Richard Popes, Vice General Manager, KUKL

Mr. Popes expressed the view that since there is not much space for locating WWTPs and not much expertise in design and management of wastewater treatment plant and so Kathmandu should have centralized system of WWTP and not isolated many treatment plants. Every treatment plant will be different based on quality of raw sewage and has to be designed differently. So having centralized WWTP simplifies both the design and the operation and maintenance of the plant. He emphasized that the interceptor sewers should be designed at right level and proper technology should be adopted for laying it.

Mr. Rammani Bhattarai, Executive Officer, Bhaktapur Municipality

Mr. Bhattarai requested the workshop organizer to conduct such workshop on government holidays, so that everybody can participate whole day in the workshop.

The Workshop was concluded with closing remarks by **Mr. Prayag Lal Joshi, Chairman of KUKL.** He summed up the discussion and presented his views on the proposed project. Mr. Joshi opined that the project has covered everything but left out some policy aspects in planning, formulation of laws, regulations, organizations responsibility, and enforcement mechanism for separate system (i.e. storm water and sewerage). He suggested the consultant to look on the decentralized wastewater treatment system in the valley. He requested the consultant to recommend some specific training programs to the KUKL staff. He further requested to recommend scientific tariff structures and collection procedure for the sewerage.

At the end, he thanked all the experts for presenting different technical papers and the participants in actively participating in the discussions and providing very useful inputs.

Appendix 9: IFC/EBRD | Guidance on Workers' Accommodation Sanitary and toilet facilities

It is essential to allow workers to maintain a good standard of personal hygiene but also to prevent contamination and the spread of diseases which result from inadequate sanitary facilities. Sanitary and toilet facilities will always include all of the following: toilets, urinals, washbasins and showers. Sanitary and toilet facilities should be kept in a clean and fully working condition. Facilities should also be constructed of materials that are easily cleanable and ensure privacy. Sanitary and toilet facilities are never shared between male and female residents, except in family accommodation. Where necessary, specific additional sanitary facilities are provided for women.

Benchmarks

1. Sanitary and toilet facilities are constructed of materials that are easily cleanable.
2. Sanitary and toilet facilities are cleaned frequently and kept in working condition.
3. Sanitary and toilet facilities are designed to provide workers with adequate privacy, including ceiling to floor partitions and lockable doors.
4. Sanitary and toilet facilities are not shared between men and women, except in family accommodation.

Toilet facilities

Toilet arrangements are essential to avoid any contamination and prevent the spread of infectious disease.

Benchmarks

1. An adequate number of toilets is provided to workers. Standards range from 1 unit to 15 persons to 1 unit per 6 persons. For urinals, usual standards are 1 unit to 15 persons.

2. Toilet facilities are conveniently located and easily accessible. Standards range from 30 to 60 metres from rooms/dormitories. Toilet rooms shall be located so as to be accessible without any individual passing through any sleeping room. In addition, all toilet rooms should be well-lit, have good ventilation or external windows, have sufficient hand wash basins and be conveniently located. Toilets and other sanitary facilities should be ("must be" in cold climates) in the same building as rooms and dormitories.

Showers/bathrooms and other sanitary facilities

Hand wash basins and showers should be provided in conjunction with rooms/dormitories. These facilities must be kept in good working condition and cleaned frequently. The flooring for shower facilities should be of hard washable materials, damp-proof and properly drained. Adequate space must be provided for hanging, drying and airing clothes. Suitable light, ventilation and soap should be provided. Lastly, hand washing, shower and other sanitary facilities should be located within a reasonable distance from other facilities and from sleeping facilities in particular.

Benchmarks

1. Shower/bathroom flooring is made of anti-slip hard washable materials.
2. An adequate number of hand wash facilities is provided to workers. Standards range from 1 unit to each 15 persons to 1 unit per 6 workers. Hand wash facilities should consist of a tap and a basin, soap and hygienic means of drying hands.
3. An adequate number of shower/bathroom facilities is provided to workers. Standards range from 1 unit to 15 persons to 1 unit per 6 persons.
4. Shower/bathroom facilities are provided with an adequate supply of cold and hot running water.

Source:http://www1.ifc.org/wps/wcm/connect/9839db00488557d1bdfcff6a6515bb18/workers accomodation.pdf?MOD=AJPERES

List of other consultation carried out along the IS02

Date	Subproject	Municipality /Settlement	Total No	Male	Female	Issue and decision
2074/05/06	IS02	Kathmandu	13	12	13	Information to local people about construction
2074/05/03	IS02	Kathmandu	12	9	3	Meeting about pipe laying and information
2074/07/11	IS02	Kathmandu	25	24	1	Start pipe laying work, coordination with concern agency for compensation
2074/11/28	IS02	Kageshwori, Kathmandu	22		22	Women group orientation program
2074/12/18	IS02	Kageshwori, Kathmandu	36		36	Women group orientation program
2074/12/19	IS02	Kageshwori, Kathmandu	18		18	Women group orientation program
2074/12/20	IS02	Kathmandu	18	5	13	Wastewater management orientation
2075/01/09	IS02	Kathmandu	19		19	Wastewater management orientation for women group
2075/01/25	IS02	Kathmandu	38	5	33	Wastewater management orientation
2075/02/02	IS02	Kadaghari, Kathmandu	33	6	29	Wastewater management orientation
2075/02/03	IS02	Kageshwori, Kathmandu	43		43	Wastewater management orientation for women group
2075/02/04	IS02	Kathmandu	37	2	35	Wastewater management orientation for women
2075/02/16	IS02	Mahalaxmi, Lalitpur	20	11	9	Extending pipe laying work and compensation distribution
2075/02/25	IS02	Bhaktapur	30	5	25	Wastewater management orientation for women group
2073/08/21	IS-02	Bhaktapur	10	9	1	Focus group discussion on project issues with stakeholder
2075/02/20	IS-02	Bhaktapur	23	18	5	Meeting affected people about reconstruction of affected structure
2074/06/02	IS-02	Site office	8	6	2	Continuation of the work

Appendix 10: Traffic Management Planning (TMP)

A. Principles for TMP around the Sewer Construction Sites

1. One of the prime objectives of this TMP is to ensure the safety of all the road users along the work zone, and to address the following issues:

(i) the safety of pedestrians, bicyclists, and motorists travelling through the construction zone;
(ii) protection of work crews from hazards associated with moving traffic;
(iii) mitigation of the adverse impact on road capacity and delays to the road users;
(iv) maintenance of access to adjoining properties; and
(v) addressing issues that may delay the project.

B. Operating Policies for TMP

2. Figure A12.1 illustrates the operating policy for TMP of the sewer works.

C. Analyse the impact due to street closure

3. Apart from the capacity analysis, a final decision to close a particular street and divert the traffic should involve the following steps:

(i) approval from the ward office or community to use the local streets as detours;
(ii) consultation with businesses, community members, traffic police, Department of Roads, etc, regarding the mitigation measures necessary at the detours where the road is diverted during the construction;
(iii) determining of the maximum number of days allowed for road closure, and incorporation of such provisions into the contract documents;
(iv) determining if additional traffic control or temporary improvements are needed along the detour route;
(v) considering how access will be provided to the worksite;
(vi) contacting emergency service, school officials, and transit authorities to determine if there are impacts to their operations; and
(vii) developing a notification program to the public so that the closure is not a surprise. As part of this program, the public should be advised of alternate routes that commuters can take or will have to take as result of the traffic diversion.

4. If full road-closure of certain streets within the area is not feasible due to inadequate capacity of the detour street or public opposition, the full closure can be restricted to weekends with the construction commencing on Friday night and ending on Sunday morning prior to the morning peak period.

D. Public awareness and notifications

5. As per discussions in the previous sections, there will be travel delays during the constructions, as is the case with most construction projects, albeit on a reduced scale if utilities and traffic management are properly coordinated. There are additional grounds for travel delays in the area, as most of the streets lack sufficient capacity to accommodate additional traffic from diverted traffic as a result of street closures to accommodate the works.

Steps	Review	Review construction schedule and methods
1.	Traffic Re-Circulation	Identify initial traffic recirculation and control policy
2.	Traffic Diversion	Identify routes for traffic diversions. Analyse adverse impact and mitigation at the detours
3.	Full Road Closures	Begin community consultation for consensus. Finalize or determine alternate detours
4.	Temporary Parking	Identify temporary parking (on and off-street)- Discuss with ward, owner, community for use
5.	Police Coordination	Coordinate with the Traffic Police to enforce traffic and diversions
6.	Install Control Devices	Install traffic control device (traffic cones, signs, lightings, etc).
7.	UMC Sub-committee	Coordinate with the UMC sub-committee to reconcile with the future plans of utility agencies
8.	Awareness	Conduct campaigns, publicity, and notify public about street closure
9.	Public Redness	Develop a mechanism to address public grievances disruptions (traffic, utilities, and diversions.

7. The awareness campaign and the prior notification for the public will be a continuous activity which the project will carry out to compensate for the above delays and minimize public claims as result of these problems. These activities will take place sufficiently in advance of the time when the roadblocks or traffic diversions take place at the particular streets. The reason for this is to allow sufficient time for the public and residents to understand the changes to their travel plans. The project will notify the public about the roadblocks and traffic diversion through print, TV, and radio media. In addition, the project, in collaboration with the utility management coordinator, will also seek the assistance of the ward office, local clubs, and others to post the public notice regarding street closure and traffic diversions in the future.

8. The utility management coordinator will also conduct an awareness campaign to educate the public about the following issues:

(i) traffic control devices in place at the work zones (signs, traffic cones, barriers, etc.);
(ii) defensive driving behaviour along the work zones; and
(iii) reduced speeds enforced at the work zones and traffic diversions.

9. It may be necessary to employ a road safety education specialist to design an appropriate program for road safety, and to conduct the awareness programs.

10. The campaign will cater to all types of target groups i.e. children, adults, and drivers.

11. Therefore, these campaigns will be conducted in schools, civic centres and community centres. In addition, the project will publish a brochure for public information. These brochures will be widely circulated around the area and will also be available at the KUKL Project Directorate, Office of both the contractor and consultant, and the contractor's site office. The text of the brochure should be concise to be effective, with a lot of graphics. It will serve the following purpose:

(i) explain why the brochure was prepared, along with a brief description of the project;
(ii) advise the public to expect the unexpected;
(iii) educate the public about the various traffic control devices and safety measures adopted at the work zones;
(iv) educate the public about the safe road user behaviour to emulate at the work zones;
(v) tell the public how to stay informed or where to inquire about road safety issues at the work zones (website, name, telephone, mobile number of the contact person; and SMS service or traffic information on FM radio, e.g. Ujyalo FM Station); and
(vi) indicate the office hours of relevant offices.

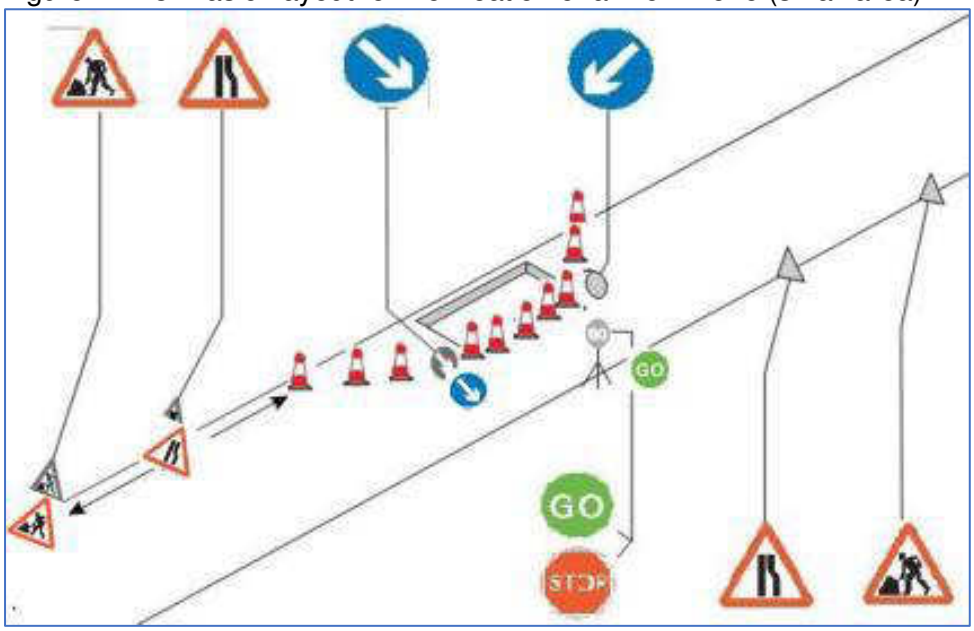
E. Install traffic control devices at the work zones and traffic diversion routes

12. The purpose of installing traffic control devices at the work zones is to delineate these areas to warn, inform, and direct the road users about a hazard ahead, and to protect them as well as the workers. As proper delineation is a key to achieve the above objective, it is important to install good traffic signs at the work zones.

13. Procedures for installing traffic control devices at any work zone vary, depending on road configuration, location of the work, construction activity, duration, traffic speed and volume, and pedestrian traffic. Work will take place both at both minor streets and major streets. As such, the traffic volume and road geometry vary, with the latter requiring more elaborate settings. However, regardless of where the construction takes place, all the work zones should be cordoned off, and traffic shifted away at least with traffic cones, barricades, and temporary signs (temporary "STOP" and "GO"). The work will closely follow the guidelines outlined in the DOR Traffic Sign Manual 1997 (which includes DOR 1996 document "Safety at Roadwork") and other literature available in this respect.

14. Figure A12.3 illustrates a typical set-up for installing traffic control devices at the work zone of the area.

Figure A12.3: Basic Layout for Delineation of a Work Zone (small area)

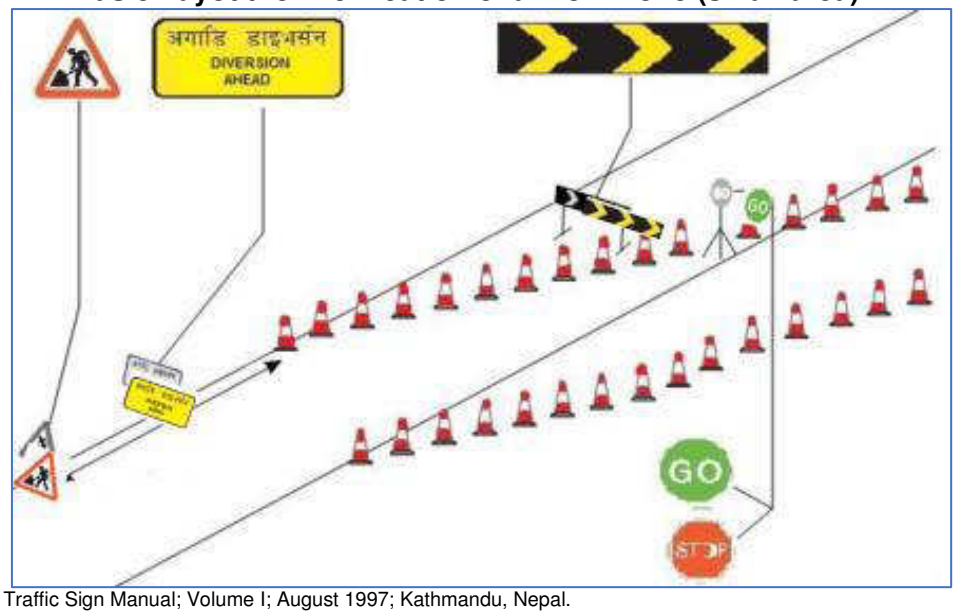


Source: DOR Traffic Sign Manual; Volume I; August 1997; Kathmandu, Nepal.

15. The work zone should take into consideration the space required for a buffer zone between the workers and the traffic (lateral and longitudinal) and the transition space required for delineation, as applicable. For the works, a 30-cm clearance between the traffic and the temporary STOP and GO signs should be provided. In addition, at least 60 cm is necessary to install the temporary traffic signs and cones. Figure 5 clarifies that the "ROAD NARROWS" warning-sign is only necessary at the works zones where high traffic speeds are likely during the off-peak hours and at night. All the temporary traffic signs should be reflectorized, especially for the works to be conducted during nighttimes, as per the DOR Traffic Sign Manual 1997.

16. All the traffic diversions should be properly delineated through proper "DIVERSION AHEAD" and "ROADWORK AHEAD" signs as indicated in Figure A12.4. In addition, the "B46" temporary warning sign for sharp bends used at the temporary diversion should be in place after the start of the taper of the traffic cones. Flashing beacons should be installed at the entry to the work zone and traffic diversion for night construction, or if backfilling of the sewer trench does not take place after the completion of a day shift.

Figure A12.4: Basic Layout for Delineation of a Work Zone (small area)



Source: DOR Traffic Sign Manual; Volume I; August 1997; Kathmandu, Nepal.

17. Traffic police should regulate traffic away from the work zone and enforce the traffic diversion result from full street closure in certain areas during construction. One person is necessary at each entry to the diversion from both directions. These personnel should be equipped with reflective jackets at all times and have traffic control batons (preferably the LED type) for regulating the traffic during night time.

18. In addition to the delineation devices, all the construction workers should wear fluorescent safety vests and helmets in order to be visible to the motorists at all times. There should be provision for lighting beacons and illumination for night constructions. In light of the ongoing load-shedding problem in Nepal, it is practical to use solar-powered LED lights, which are energy efficient, wherever feasible.

Appendix 11: Emergency Response Plan Template

Section 1.
System Information

Keep this basic information easily accessible to authorized staff for emergency responders, repair people, and the news media.

System information

System Name and Address		
Directions to the System		
Basic Description and Location of System Facilities		
Population Served and Service Connections	people	connections
System Owner		
Name, Title, and Phone Number of Person Responsible for Maintaining and Implementing the Emergency Plan		Phone Mobile

Section 2.
Chain of Command - Lines of Authority

The first response step in any emergency is to inform the person at the top of this list, who is responsible for managing the emergency and making key decisions.

Chain of command - lines of authority

Name and Title (as required)	Examples of Responsibilities During an Emergency	Contact Numbers
Mr/Ms ..... **Wastewater System Manager**	Responsible for overall management and decision making for the wastewater system. The System Manager is the lead for managing the emergency, providing information to regulatory agencies, the public and news media. All communications to external parties are to be approved by the wastewater system manager.	Phone: Mobile:
Mr/Ms ..... **Wastewater System Operator**	In charge of operating the wastewater collection system, performing inspections, maintenance sampling and relaying critical information, facilities, and providing recommendations to the wastewater system manager.	Phone: Mobile:
Mr/Ms **Wastewater Treatment Plant Operator**	In charge of running wastewater treatment plant, performing inspections, maintenance and and relaying critical information, assessing and providing recommendations to the system manager.	Phone: Mobile:
Mr/Ms ..... **Office Administrator**	Responsible for administrative functions in the office including receiving phone calls and keeping events. This person will provide a standard pre-scripted message to those who call with general questions. Additional information will be released through the wastewater system manager.	Phone: Mobile:
Mr/Ms ..... **Field Staff**	Delivers door hangers, posts notices, and supports wastewater system operator.	Phone: Mobile:

Section 3.
Events that Cause Emergencies

The events listed below may cause wastewater system emergencies. They are arranged from highest to lowest probable risk.

Events that cause emergencies

Type of Event	Probability or Risk (High-Med-Low)	Comments

Section 4.
Emergency Notification

Notification call-up lists - Use these lists to notify first responders of an emergency.

Emergency Notification List				
Organization or Department	**Name & Position**	**Telephone**	**Night or Cell Phone**	**Email**
Local Law Enforcement				
Fire Department				
Emergency Medical Services				
Wastewater Operator (if contractor)				
Primacy Agency Contact				
Interconnected Wastewater System				
Neighboring Wastewater System (not connected)				
KUKL Contact				

Priority Customers				
Organization or Department	**Name & Position**	**Telephone**	**Night or Mobile Phone**	**Email**
Hospitals or Clinic(s)				
Public or Private Schools				
Public Water System				

Notification List				
Organization or Department	**Name & Position**	**Telephone**	**Night or Mobile Phone**	**Email**
Police				
Regulatory Agency				
Authorized Testing Laboratory				

Service / Repair Notifications				
Organization or Department	**Name & Position**	**Telephone**	**Night or Mobile Phone**	**Email**
Nepal Electricity Authority				
Electrician				
Gas Supplier				
Water Testing Lab.				
KUKL				
Nepal Telecommunications				
Plumber				
Pump Supplier				
“Call Before You Dig”				
Rental Equipment Supplier				
Polymer Supplier				
Pipe Supplier				

Media Notification List				
Organization or Department	**Name & Position**	**Telephone**	**Night or Mobile Phone**	**Email**
Newspaper - Local				
Radio				
Radio				
TV Station				

Notification procedures

Notify wastewater system customers

Who is Responsible:	
Procedures:	

Alert local law enforcement, or regulatory officials, and local health agencies

Who is Responsible:	
Procedures:	

Contact service and repair contractors

Who is Responsible:	
Procedures:	

Contact neighbouring wastewater systems, if necessary

Who is Responsible:	
Procedures:	

Contact downstream water systems, if necessary

Who is Responsible:	
Procedures:	

Procedures for issuing a health advisory

Who is Responsible:	
Procedures:	

Other procedures, as necessary

Who is Responsible:	
Procedures:	

Section 5.
Effective Communication

Communication with customers, the news media, and the general public is a critical part of emergency response.
Designated public spokesperson
Designate a spokesperson (and alternate) and contact regulatory agency for delivering messages to the news media and the public.

Spokesperson	Alternate

Designate a spokesperson and alternates _____

Section 6.
The Vulnerability Assessment

This is an evaluation of each wastewater system component to identify weaknesses or deficiencies that may make them susceptible to damage or failure during an emergency. It also assesses facilities for security enhancements that may guard against unauthorized entry, vandalism, or terrorism.

Facility vulnerability assessment and improvements identification

System Component	Description and Condition	Vulnerability	Improvements or Mitigating Actions	Security Improvements
Collection System				
Sewage Pumping				
Effluent Disposal				
Computer and Telemetry System				

Section 7.
Response Actions for Specific Events

In any event there are a series of general steps to take:

1. **Analyse the type and severity of the emergency;**
2. **Take immediate actions to save lives;**
3. **Take action to reduce injuries and system damage;**
4. **Make repairs based on priority demand; and**
5. **Return the system to normal operation.**

The following tables identify the assessment, set forth immediate response actions,define what notifications need to be made, and describe important follow-up actions.

A. Power outage

Assessment	
Immediate Actions	
Notifications	
Follow-up Actions	

B. Collection system blockage or line break

Assessment	
Immediate Actions	
Notifications	
Follow-up Actions	

C. Collection system pumping facilities failure

Assessment	
Immediate Actions	
Notifications	
Follow-up Actions	

D. **Treatment system failure**

Assessment	
Immediate Actions	
Notifications	
Follow-up Actions	

E. Effluent disposal failure

Assessment	
Immediate Actions	
Notifications	
Follow-up Actions	

F. Chemical contamination

Assessment	
Immediate Actions	
Notifications	
Follow-up Actions	

G. Vandalism or terrorist attack

Assessment	
Immediate Actions	
Notifications	
Follow-up Actions	

H. Flood

Assessment	
Immediate Actions	
Notifications	
Follow-up Actions	

I. Earthquake

Assessment	
Immediate Actions	
Notifications	
Follow-up Actions	

J. Hazardous materials spill into collection system

Assessment	
Immediate Actions	
Notifications	
Follow-up Actions	

K. Electronic equipment failure

Assessment	
Immediate Actions	
Notifications	
Follow-up Actions	

Cyber attack

Assessment	
Immediate Actions	
Notifications	
Follow-up Actions	

M. Other

Assessment	
Immediate Actions	
Notifications	
Follow-up Actions	

Section 8.

Returning to Normal Operation

Action	Description and Actions

Section 9. Plan Approval

This plan is officially in effect when reviewed, approved, and signed by the following people:

Name/Title	Signature	Date

Section 10.
Certificate of Completion

I certify to the Government of Nepal that this wastewater system has completed an Emergency Response Plan (ERP).
I certify that this document was prepared under my direction or supervision.

Wastewater Systems: _____

System Name: _____

Address: _____

Print Name of Person Authorized to Sign this Certification on behalf of the System:

Title:

Signature:

Phone: **Fax:** **Email:**

Completion of the following:
□ Security Vulnerability Assessment

□ Emergency Response Plan

Source: www.rcap.org (modified)

Appendix 12: Sample Semi-Annual Environmental Monitoring Report Template

This template must be included as an appendix in the EIA/IEE that will be prepared for the project. It can be adapted to the specific project as necessary.

1. Introduction

- Overall project description and objectives
- Description of sub-projects
- Environmental category of the sub-projects
- Details of site personnel and/or consultants responsible for environmental monitoring
- Overall project and sub-project progress and status

No.	Sub-Project Name	Status of Sub-Project				List of Works	Progress of Works
		Design	Pre Construction	Construction	Operational Phase		
		□	□	□	□		
		□	□	□	□		
		□	□	□	□		

2. Compliance status with National/ State/ Local statutory environmental requirements

No.	Sub-Project Name	Statutory Environmental Requirements	Status of Compliance	Action Required

3. Compliance status with environmental loan covenants

No. (List schedule and paragraph number of Loan Agreement)	Covenant	Status of Compliance	Action Required

3. Compliance status with the environmental management and monitoring plan

- Provide the monitoring results as per the parameters outlined in the EMP. Append supporting documents where applicable, including Environmental Site Inspection Reports.
- There should be reporting on the following items which can be incorporated in the checklist of routine Environmental Site Inspection Report followed with a summary in the semi-annual report send to ADB. Visual assessment and review of relevant site documentation during routine site inspection needs to note and record the following:
- What are the dust suppression techniques followed for site and if any dust was noted to escape the site boundaries;
- If muddy water was escaping site boundaries or muddy tracks were seen on adjacent roads;
- Adequacy of type of erosion and sediment control measures installed on site, condition of erosion and sediment control measures including if these were intact following heavy rain;
- Are their designated areas for concrete works, and refuelling;Are their spill kits on site and if there are site procedure for handling emergencies;
- Is there any chemical stored on site and what is the storage condition?
- Is there any dewatering activities if yes, where is the water being discharged;
- How are the stockpiles being managed;
- How is solid and liquid waste being handled on site;
- Review of the complaint management system;
- Checking if there are any activities being under taken out of working hours and how that is being managed.

Summary Monitoring Table

Impacts (List from IEE)	Mitigation Measures (List from IEE)	Parameters Monitored (As a minimum those identified in the IEE should be monitored)	Method of Monitoring	Location of Monitoring	Date of Monitoring Conducted	Name of Person Who Conducted the Monitoring
Design Phase						
Pre-Construction Phase						
Construction Phase						
Operational Phase						

Overall Compliance with CEMP/ EMP

No.	Sub-Project Name	EMP/ CEMP Part of Contract Documents (Y/N)	CEMP/ EMP Being Implemented (Y/N)	Status of Implementation (Excellent/ Satisfactory/ Partially Satisfactory/ Below Satisfactory)	Action Proposed and Additional Measures Required

Approach and methodology for environmental monitoring of the project

- Brief description on the approach and methodology used for environmental monitoring of each sub-project

Monitoring of Environmental Impacts on Project Surroundings (ambient air, water quality and noise levels)

- Brief discussion on the basis for monitoring
- Indicate type and location of environmental parameters to be monitored
- Indicate the method of monitoring and equipment to be used
- Provide monitoring results and an analysis of results in relation to baseline data and statutory requirements

As a minimum the results should be presented as per the tables below.

Air Quality Results

Site No.	Date of Testing	Site Location	Parameters (Government Standards)		
			PM10 pg/m3	SO2 pg/m3	NO2 pg/m3

Water Quality Results

Site No.	Date of Sampling	Site Location	Parameters > Government Standards)					
			pH	Conductivity pS/cm	BOD mg/L	TSS mg/L	TN mg/L	TP mg/L

Noise Quality Results

Site No.	Date of Testing	Site Location	LAea (dBA) (Government Standard)	
			Day Time	Night Time

Summary of Key Issues and Remedial Actions

- Summary of follow up time-bound actions to be taken within a set timeframe.

Appendices

- Photos
- Summary of consultations
- Copies of environmental clearances and permits
- Sample of environmental site inspection report
- Other
-

SAMPLE ENVIRONMENTAL SITE INSPECTION REPORT

Project Name
Contract Number

NAME:_____ DATE: _
TITLE: _____ DMA: _
LOCATION:_____ GROUP:

WEATHER CONDITION:

INITIAL SITE CONDITION:_____

CONCLUDING SITE CONDITION:

Satisfactory ____ Unsatisfactory ____ Incident _____ Resolved_____ Unresolved

INCIDENT:
Nature of incident:

Intervention Steps:

Incident Issues

Resolution

Project Activity Stage	Survey	
	Design	
	Implementation	
	Pre-Commissioning	
	Guarantee Period	

Emissions	Waste Minimization
Air Quality	Reuse and Recycling
Noise pollution	Dust and Litter Control
Hazardous Substances	Trees and Vegetation

Yes No

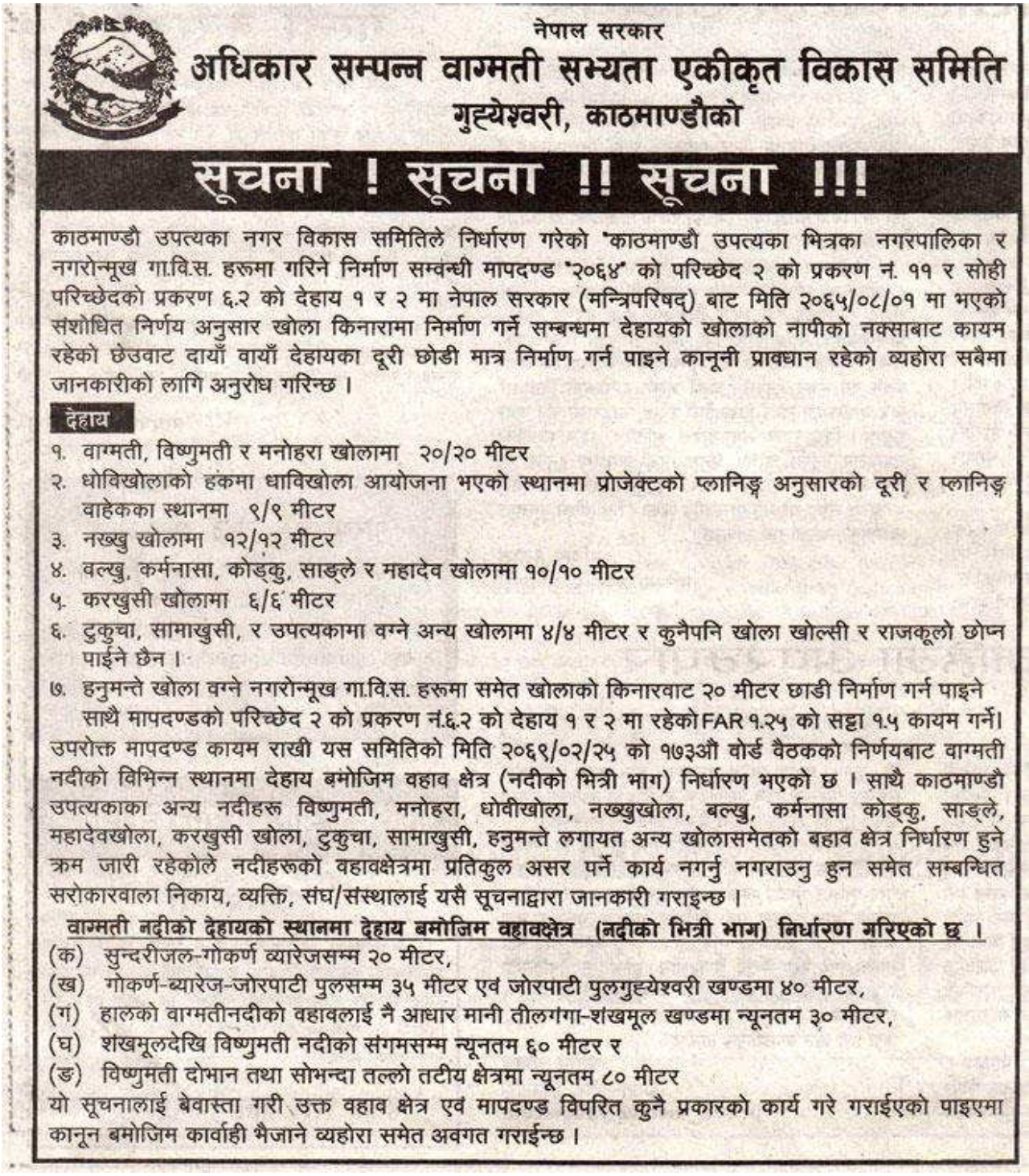
Site Restored to Original Condition

Signature

Sign off

Name
Position

Appendix 13: Public Notice of HPCIDBC about RoW of River published in newspaper



नेपाल सरकार

अधिकार सम्पन्न वाग्मती सभ्यता एकीकृत विकास समिति

गुह्येश्वरी, काठमाण्डौको

सूचना ! सूचना !! सूचना !!!

काठमाण्डौ उपत्यका नगर विकास समितिले निर्धारण गरेको "काठमाण्डौ उपत्यका भित्रका नगरपालिका र नगरोन्मूख गा.वि.स. हरूमा गरिने निर्माण सम्वन्धी मापदण्ड "२०६४" को परिच्छेद २ को प्रकरण नं. ११ र सोही परिच्छेदको प्रकरण ६.२ को देहाय १ र २ मा नेपाल सरकार (मन्त्रिपरिषद्) बाट मिति २०६५/०८/०१ मा भएको संशोधित निर्णय अनुसार खोला किनारामा निर्माण गर्ने सम्बन्धमा देहायको खोलाको नापीको नक्साबाट कायम रहेको छेउवाट दायाँ वायाँ देहायका दूरी छोडी मात्र निर्माण गर्न पाइने कानूनी प्रावधान रहेको व्यहोरा सबैमा जानकारीको लागि अनुरोध गरिन्छ ।

देहाय

१. वाग्मती, विष्णुमती र मनोहरा खोलामा २०/२० मीटर
२. धोविखोलाको हकमा धाविखोला आयोजना भएको स्थानमा प्रोजेक्टको प्लानिङ्ग अनुसारको दूरी र प्लानिङ्ग वाहेकका स्थानमा ९/९ मीटर
३. नख्खु खोलामा १२/१२ मीटर
४. वल्खु, कर्मनासा, कोड्कु, साङ्ले र महादेव खोलामा १०/१० मीटर
५. करखुसी खोलामा ६/६ मीटर
६. टुकुचा, सामाखुसी, र उपत्यकामा वग्ने अन्य खोलामा ४/४ मीटर र कुनैपनि खोला खोल्सी र राजकूलो छोप्न पाईने छैन ।
७. हनुमन्ते खोला वग्ने नगरोन्मूख गा.वि.स. हरूमा समेत खोलाको किनारवाट २० मीटर छाडी निर्माण गर्न पाइने साथै मापदण्डको परिच्छेद २ को प्रकरण नं.६.२ को देहाय १ र २ मा रहेको FAR १.२५ को सट्टा १.५ कायम गर्ने।

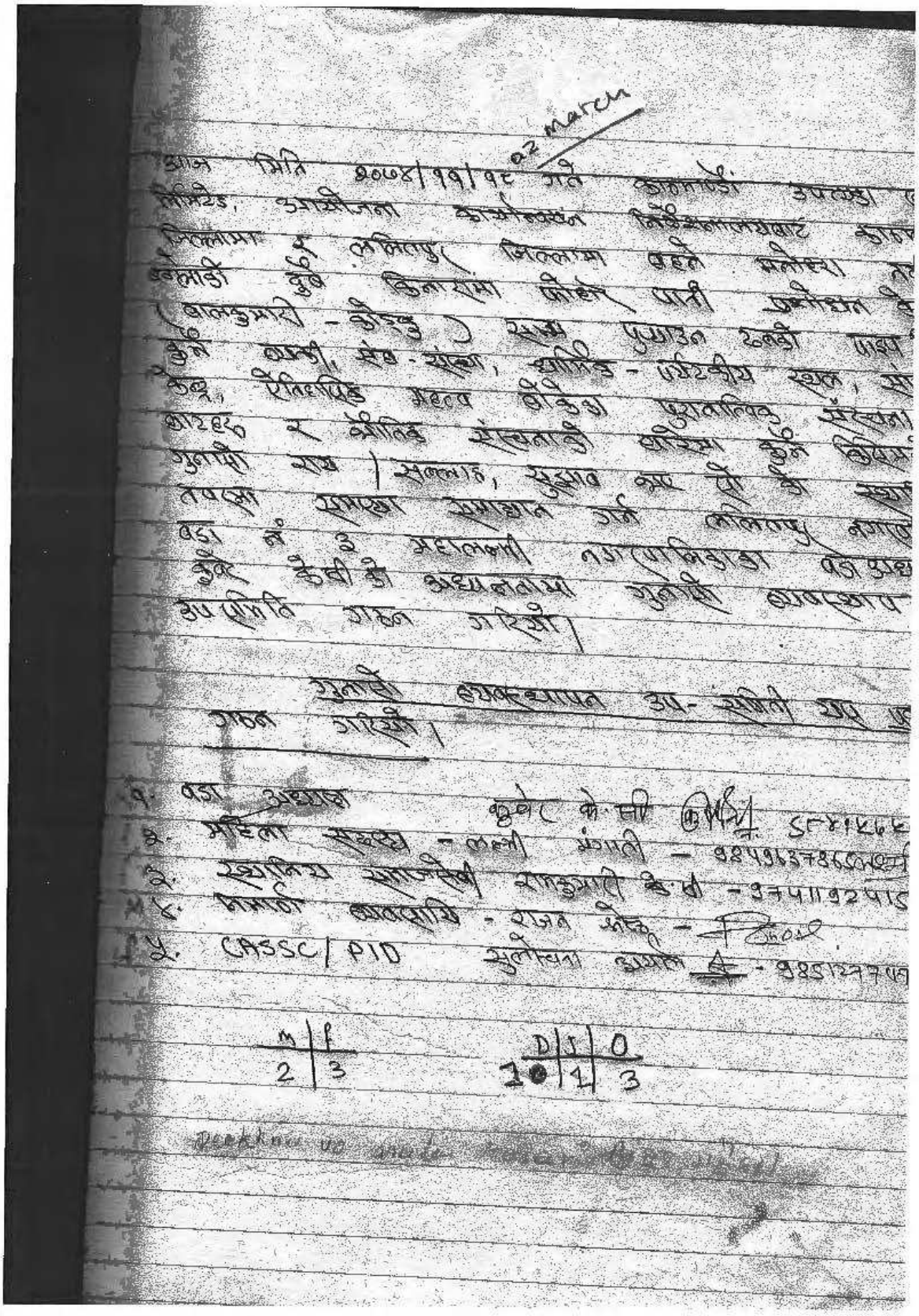
उपरोक्त मापदण्ड कायम राखी यस समितिको मिति २०६९/०२/२५ को १७३औं वोर्ड वैठकको निर्णयबाट वाग्मती नदीको विभिन्न स्थानमा देहाय बमोजिम वहाव क्षेत्र (नदीको भित्री भाग) निर्धारण भएको छ । साथै काठमाण्डौ उपत्यकाका अन्य नदीहरू विष्णुमती, मनोहरा, धोवीखोला, नख्खुखोला, बल्खु, कर्मनासा कोड्कु, साङ्ले, महादेवखोला, करखुसी खोला, टुकुचा, सामाखुसी, हनुमन्ते लगायत अन्य खोलासमेतको बहाव क्षेत्र निर्धारण हुने क्रम जारी रहेकोले नदीहरूको वहावक्षेत्रमा प्रतिकुल असर पर्ने कार्य नगर्नु नगराउनु हुन समेत सम्बन्धित सरोकारवाला निकाय, व्यक्ति, संघ/संस्थालाई यसै सूचनाद्वारा जानकारी गराइन्छ ।

वाग्मती नदीको देहायको स्थानमा देहाय बमोजिम वहावक्षेत्र (नदीको भित्री भाग) निर्धारण गरिएको छ ।

(क) सुन्दरीजल-गोकर्ण व्यारेजसम्म २० मीटर,
(ख) गोकर्ण-व्यारेज-जोरपाटी पुलसम्म ३५ मीटर एवं जोरपाटी पुलगुह्येश्वरी खण्डमा ४० मीटर,
(ग) हालको वाग्मतीनदीको वहावलाई नै आधार मानी तीलगंगा-शंखमूल खण्डमा न्यूनतम ३० मीटर,
(घ) शंखमूलदेखि विष्णुमती नदीको संगमसम्म न्यूनतम ६० मीटर र
(ङ) विष्णुमती दोभान तथा सोभन्दा तल्लो तटीय क्षेत्रमा न्यूनतम ८० मीटर

यो सूचनालाई बेवास्ता गरी उक्त वहाव क्षेत्र एवं मापदण्ड विपरित कुनै प्रकारको कार्य गरे गराईएको पाइएमा कानून बमोजिम कार्वाही भैजाने व्यहोरा समेत अवगत गराईन्छ ।

Appendix 14: Minutes of GRC formation at local level



गुनासो समाधान उप समिति

आज मिति २०७४/१०/१६ का दिन काठमाण्डौ उपत्यका खानेपानी लिमिटेड, आयोजना कार्यान्वयन निर्देशनालयबाट काठमाण्डौं जिल्लामा बहने वागमति खोलाको दुवै किनारामा फोहर पानी प्रशोधन केन्द्रसम्म पूर्याउने ढल पाइप विद्छाउदा कुनै व्यक्ति, संघ/संस्था, धार्मिक, सास्कृतिक केन्द्र, ऐतिहासिक महत्व बोकेको पुरातात्विक सँरचना तथा घाटहरु र भौतिक सँरचनाको बारेमा कुनै किसिमको गुनासो /राय/सल्लाह र सुझाब भए सो को स्थानीय स्तरमा समाधान गर्न यस काठमाण्डौ

न.पा./म.न.प. ८ न. वडा अध्यक्ष/ सदस्य श्री दिनेश कुमार ढुंगेल

को अध्यक्षतामा गुनासो व्यवस्थापन उप - समिति देहायको सदस्य रहने गरी गठन गरियो ।

गुनासो व्यवस्थापन उप - समिति यस प्रकार गठन गरियो ।

१. ८ वडा अध्यक्ष/ सदस्य श्री दिनेश कुमार ढुंगेल ..... अध्यक्ष

२. ८ न. वडा महिला सदस्य श्री इन्दिरा भण्डारी ९८४१४९३६०६ सदस्य

३. ८ स. वडा सदस्य/ स्थानीय समाजसेवी श्री ध्रुव कणाली (९८४११९४२.९५) सदस्य

४. निमार्ण व्यवसायी प्रतिनिधि श्री ..... सदस्य

५. CASSC/ PID को परामर्शदाता को तर्फबाट श्री सुलोचना अर्याल सदस्य सचिव

गुनासो समाधान उप समिति

आज मिति २०७४/१०/८ का दिन काठमाण्डौ उपत्यका खानेपानी लिमिटेड, आयोजना कार्यान्वय निर्देशनालयबाट काठमाण्डौं जिल्लामा बहने मनोहरा नदी / खोलाको दुवै किनारामा फोहर पा प्रशोधन केन्द्रसम्म पूर्याउने ढल पाइप विद्वचाउदा कुनै व्यक्ति, सँघ/सँस्था, धार्मिक, सास्कृतिक के ऐतिहासिक महत्व बोकेको पुरातात्विक सँरचना तथा घाटहरु र भौतिक सँरचनाको बारेमा क किसिमको गुनासो /राय/सल्लाह र सुझाब भए सो को स्थानीय स्तरमा समाधान यस.....

न.पा./म.न.प...३२...न. वडा अध्यक्ष/ सदस्य श्री.....को अध्यक्षतामा गुनासो व्यवस्थापन उप - समिति देहायको सदस्य रहने गरी गठन गरियो ।

गुनासो व्यवस्थापन उप - समिति यस प्रकार गठन गरियो ।

१.....वडा अध्यक्ष/ सदस्य श्री..... अध्य

२.....न. वडा ~~महिला~~ सदस्य श्री..... सद

३.....न.वडा सदस्य/ स्थानीय समाजसेवी श्री..... सद

४. निमार्ण व्यवसायी प्रतिनिधि श्री..... सद

५. CASSC/ PID को परामर्शदाता को तर्फबाट श्री..... सदस्य स

SOUTH ASIA REGIONAL DEPARTMENT
SAFEGUARDS INFORMATION LOG FOR SAUW PROJECTS

Project:	NEP: Kathmandu Valley Wastewater Management Project (Interceptor Sewer- IS-01) of L-3000		
Loan No.:	3000	**Package No.:** KUKL/WW/IS-02	Interceptor Sewer – IS-02
Components:	This IEE is updated for Construction of Intercepting Sewerage System along the Manohara interceptor sewer (IS) line which will be implemented as IS-02. Total Length of Interceptor Sewer is 11.36 km. Major works include; Hume pipe laying of 11.36 km, Manholes: 284 nos.; Aqueducts/crossings: 4; River Training works: 6,976 m and overflow/outfall structures: 33/33.		
Contract Type:	NCB		
Date of IEE:	Updated January 2018		

Draft IEE	**Updated/Revised IEE**	**Others**
	Additional information required	A draft IEE has been prepared based on preliminary design. The draft IEE is disclosed on ADB website (https://www.adb.org/sites/default/files/linked-documents/43524-014-nep-ieeab.pdf) which included interceptors. The civil works contract is on-going. No records of final IEE submitted. The revised/updated IEE has been submitted to ADB for review and clearance on XXX.

	Section	**Status**		**Comments/Remarks (include date accomplished or obtained, if applicable)**	**Comments incorporated**
1.	Environmental assessment report (EIA/IEE/envi due diligence) has been prepared?	**Yes** X	**No**	KVWMP Cat B project. IEE is required. Draft IEE was prepared during project preparation. Environmental assessment for this updated/revised IEE is based on outdated information (>7 years data) and sources are not properly cited in the IEE. Environmental assessment conducted is not site-specific and not chainage-wise. **Action required:**Update baseline environmental conditions and provide proper referencing on sources of information. Identify and assess potential impacts based on site-specific conditions.	Baseline chapter has been revised and updated with proper referencing and with potential site specific impact as far as possible.
2.	EIA/IEE/envi due diligence based on project components	**Yes** Additional information required	**No**	Cover page shows “Updated IEE dated January 2018” however the section on subproject description lacks the necessary information based on detailed engineering design	Updated, Table IV 2: Proposed and Existing River Training Works Information is present in Chapter

	Section	Status		Comments/Remarks (include date accomplished or obtained, if applicable)	Comments incorporated
	and detailed engineering design?			**Action required:**Provide information based on detailed engineering design and consistent with the works as specified in the bid and contract documents. Include a table showing chainage-wise information: - Length - Diameter - Width required for excavation - Width of available ROW - Vegetation to be cleared? (Y/N) - Number of trees to be cut - Utilities to be shifted - Area for materials storage - Amount of excess materials to be disposed Include location and photographs of disposal sites.	2, Para 18 Project area is free of vegetation
3.	Statutory Requirements		Forest Clearance	Package-specific information not provided. **Action required:**Specify all statutory clearances and no-objection letters to be obtained for this package. Provide status of application. If already obtained, include as appendix to the IEE.	Not required.
			No Objection Certificate		
			Site Location Clearance		
			Environmental Compliance Certificate		
			Permit to Construct (or equivalent)		
			Permit to Operate (or equivalent)		
			Others		
5.	Policy, legal, and administrative framework	Adequate	Not Adequate	Discussions are very generic and do not provide package-specific information. It is not clear which are applicable to the subproject. **Action required:**Revise section to reflect package-wise information and status of environmental clearances.	Updated
			X		
		EIA/IEE/envi due diligence included discussion on:			
		incomplete	National regulation/law on EIA		
		incomplete	Environmental agency		
		none	Relevant international environmental agreements	No discussion.	Updated in Chapter 2
		To be confirmed	Environmental standards (IFC's EHS Guidelines)	ADB SPS requirements are not discussed. Insufficient information that contractor's measures and practices are in line with internationally-accepted	Updated Chapter 2

	Section	Status			Comments/Remarks (include date accomplished or obtained, if applicable)		Comments incorporated
					practices (as required by ADB SPS). **Action required:** Include ADB SPS requirements and highlight contractor's responsibilities on environment and community health and safety. Confirm contractor's site-specific EMP satisfactorily meet ADB SPS requirements (provide as appendix contractor's current practices to support confirmation).		
6.	Anticipated environmental impacts and mitigation measures	EIA/IEE/envi due diligence satisfactorily discussed impacts and risks on:	Mitigation measures provided?		Impacts and risks are generic and not package-specific. Information in the IEE is not adequate to assess applicability of mitigation measures **Action required:**Construction already started. Site-specific EMP should have been prepared by now. Please send as part of the IEE.		Updated and present in Chapter IX
			Yes Partial information provided		No		
		Biodiversity conservation			n/a	Endangered species and habitats not present in subproject area.	Sub project does not have any Endangered species and habitats
			Pollution prevention and abatement	Additional information required		Section IV provides activities that should be completed way ahead of the construction (i.e. paras 132-141). **Action required:**revise to provide status of design and pre-construction activities. Describe how environmental impacts were avoided thru design. Provide details of contractor's pre-construction activities to ensure they will comply with ADB SPS requirements.	Updated, Chapter V
		Health and	Additional information required			Discussion on health and safety	Updated, Chapter IX

	Section	Status			Comments/Remarks (include date accomplished or obtained, if applicable)		Comments incorporated
		safety				impacts and risks are generic and not package-specific. **Action required:**revise according to contractor's site-specific EMP and health and safety measures being implemented on-site.	
		Physical cultural resources (PCR)	Presence / absence to be confirmed.			No information provided if presence/absence of PCR in subproject alignment. **Action required:**Revise to confirm presence/absence of PCR along the IS-02 alignment. If present, provide detailed information, impacts and mitigation measures.	Updated, Chapter IV
		X	Cumulative impacts			No mitigation measures required.	Agreed
			Transboundary impacts			Not applicable	Updated
7.	Impacts from Associated Facilities	Addressed		Not Addressed	Not applicable	No associated facilities. WWTPs where wastewater will be conveyed and treated are part of L3000.	Updated
					X		
8.	Analysis of Alternatives	**Yes**	**No**		Not required for Cat B and no need to include in IEE. **Action required:**Delete.		Chapter removed.
9.	EMP budget included	**Yes**	**No**		The environmental cost related to public awareness campaign and IEC and contractors training is included (Annual cost USD 34000). The EMP implementation cost details is not provided. It is not clear if this cost relates to specific package or all packages under IS/TP together.		EMP budget as per BOQ included.
			X				
10.	EMP	**Yes**	**No**		Included in PAM during loan processing. Included in		EMP included

	Section	Status		Comments/Remarks (include date accomplished or obtained, if applicable)	Comments incorporated
	implementation integrated in PAM, and in bid and contract documents			Section 8 of bid documents. **Action required:**Confirm in IEE	
		X			
11.	Consultation and Participation	**Yes**	**No**	Preliminary consultations have been conducted. Consultations Summary post-detailed design has been included in the updated IEE. **Action required:** Confirm consultations conducted meet ADB SPS requirements for "meaningful consultations". Provide breakdown of Male/Female. Include photographs, minutes of meetings/consultations, environmental issues/concerns raised and details on how the subproject address these issues/concerns.	
		X			
12.	Grievance Redress Mechanism	**Yes**	**No**	GRM mechanism included in IEE. **Action required:**Confirm GRM is notified and GRC members have the capacity to address project-related grievances/complaints. Confirm contractors are given instructions and orientation on GRM. Attach GRM notification as appendix to IEE.	GRC committee formation at local level and PID level. Minutes attached in Appendix 14.
		X			
		Description of GRM		Included in IEE (main text)	Included in chapter and in appendix.
		Identification of GRC members		Done.	
13.	Disclosure	Endorsement to disclose on ADB website		Pending. This will be requested when the IEE has been cleared by ADB.	
		Disclosed on project website		Pending. This will be requested when the IEE has been cleared by ADB.	
		Relevant information available to stakeholders and affected people in language and form they understand		Pending. This will be requested when the IEE has been cleared by ADB.	
14.	Mobilized PID Environment	**Yes**	**No**	**Action required:**Update the IEE on status of appointment PID Envi Officer	Safeguard unit chief appointed
		To be included			

	Section	Status		Comments/Remarks (include date accomplished or obtained, if applicable)	Comments incorporated
	Officer				
15.	Mobilized PIU Environment Specialist	**Yes**	**No**	Not applicable. NO PIU in L3000	
16.	Mobilized DSC Environment Specialist	**Yes**	**No**	**Action required:**Update the IEE on status of DSC Environment Specialist as of time of writing this IEE. If he/she is not available, provide reasons and include corrective actions with timeframe to appoint DSC Environment Specialist.	
		To be included			DSC environment specialist mobilized and report updated by him.
17.	Confirm bid and contract documents and/or EMP include requirement for the contractor to appoint EHS supervisor and/or nodal person for environmental safeguards	**Yes**	**No**	**Action required:**Update the institutional arrangement regarding requirements on contractors. Specify contractors' detailed responsibilities to ensure EMP implementation	
		To be included			EMP included in Bidding document and contractor has informed.
18.	If contract awarded already, confirm contractor's appointment of EHS supervisor and/or nodal person for environmental safeguards	Yes	No	**Action required:** provide information in the IEE	Updated
		To be included			
19.	Awareness training on compliance to safeguard requirements	**Yes**	**No**	**Action required:** This should be package-specific. Provide information in the IEE on dates, topics discussed and attendance sheet.	Updated, Table VII-1
		Details to be included			

	Section	Status		Comments/Remarks (include date accomplished or obtained, if applicable)	Comments incorporated
20.	Monitoring and Reporting	**Yes**	**No**		Updated
		To be included		**Action required:** This should be package-specific. Provide information on frequency of report submission by contractor to DSC, DSC to PMU, and PMU to ADB. Attach as appendix the checklists or templates or forms used in documentation and reporting.	
21.	Others/Remarks	**Specific comments:** The updated IEE needs to be further revised.			
		Para 18, population figure to be corrected.		Please correct the present value given as was 2,510,788 million.	Updated
		Para 27 mentions that "the project has recommended an Assets Condition Survey to know the exact locations and conditions of the sewer network in the valley so that the cleaning of existing sewer and sewerage expansion can be made possible"		Please provide details of such survey if completed. Based on findings of this survey, please elaborate section on existing condition of the sewerage network. Page 22 mentions'The asset condition survey of the existing sewer network in the service areas of KUKL has been carried out by Lama – Aviyan – Soiltest – Genesis – DAN - NESS under contract no KUKL/WSI/01/04' – Please include findings from this survey if available.	The text was copied from earlier IEE report. However, that document is not available to us now.
		The schematic layout plans of the proposed interceptor sewer is presented in Figure III 3. Whereas Figure III 2 shows the overall proposed locations. – Project description should also include the details relating to the pipe dia; cross-section; length of each of these pipes and areas where they would be laid down.		Please provide section / pipe dia. and length details based on detailed design.	Chapter IV, Table IV-5, Table IV-6 and Table IV-7
		Para 46 & 49 are repeated.		Kindly correct	updated
		Para 31 'The total length of interceptor sewer on the both banks is 25.331 km with 400 mm to 1000 mm diameter of sewer. The system includes 648 nos. of manhole, 166 nos. of outfall and overflow structures, 6 nos. of river crossing and 8.7 km of river protection works'.		The locations are provided on the Map, however, please elaborate more on the environmental conditions of the specific locations of the manholes, outfalls and overflow structures, river crossings and river protection works including design details.	Updated
		Page 26; Issues and Implications for this Project.		Please update the section with the latest information.	Updated

	Section	Status	Comments/Remarks (include date accomplished or obtained, if applicable)	Comments incorporated
		Para 134 “Air quality dispersion modelling for all WWTP sites need to be conducted as part of the design phase to determine appropriate odor management measures that will need to be established. Since the WWTPs to be established will employ activated sludge process, odors will already be minimal in comparison to odors emitted from waste stabilisation ponds. However, since all the WWTPs will be established <100m from the nearest dwelling additional odor management measures will need to be implemented”	This may be included in the IEE for WWTPs. Was such modelling conducted?	Updated
		Para 138 “Letters of approval and agreements should be obtained for the following: (i) temporary acquisition of land and properties for use by contractors, (ii) construction in UNESCO recognized areas, from the Department of Archaeology, and (iii) digging of roads from the Department of Roads and the concerned municipalities. Permission will have to be obtained from the Department of Archaeology as stated in The Ancient Monuments Preservation Rules 2046 (1989), Section 4.1.1 (paragraphs 190 to 192). The permission is granted by the Department of Archaeology as per advice provided by UNESCO in March 2010 during the preparation of Loan 2776, Kathmandu Valley Water Supply Improvement Project and not UNESCO (discussions were held with UNESCO in the earlier TA 4893-NEP, Annex 8). This advice has been carried over for this project as the location of proposed project sites are the same as on Loan 2776. However, during the preparation of detailed design the PID will consult with UNESCO to provide them with more detailed information”	Please include a list of all such clearances obtained and provide in the updated IEE.	No UNESCO site within the project area. Clearance not required.
		Para 141 “The training manual should be written	Please confirm if this has been prepared.	Training manual is under

	Section	Status	Comments/Remarks (include date accomplished or obtained, if applicable)	Comments incorporated
		in Nepali (or local languages) with notes and sketches on community health and safety and occupational health and site safety"		preparation
		Para 152. "Mitigation measures consist of the following: (i) cutting only the trees that are marked and will be agreed with contractor in a piece meal approach for removal and planting and rearing tree saplings at the rate of 25 saplings for each cut tree"	Based on detailed design, latest status on the number of trees expected to be impacted – location for tree plantations – to be included in the IEE.	No loss of tree
		Para 155. "Mitigation is to be done through coordination with concerned utilities personnel and the local people, detailed design drawings, geotechnical testing in sensitive areas"	Please include details on the identified sensitive areas and geotechnical test results – based on detailed design in the IEE.	No sensitive area identified
		Page 21: Section D- Existing Waste Water System	This section provides information on the existing waste water system in the Kathmandu Valley including challenges posed by the non-availability and operational deficiency of the present system. Please include a section on how the subproject activities will help in overcoming the existing challenges and the different measures undertaken to resolve the existing issues with the help of the subproject implementation.	Updated
		Section IV: ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES: Construction Phase impacts – e (Community Health and Safety)	Please elaborate this section particularly in reference to impacts on nearby community from dust / air pollution during construction. Please provide more details on the mitigation measures planned for reducing these impacts. Kindly also provide reference to the measures as laid out in the EMP.	Updated
		Appendix 9: Focus Group Discussions, Stakeholders Consultations/ Workshops and Meetings	Please add the details / pictures	
		Implementation Schedule	Kindly update the IEE as per the latest available implementation schedule.	Updated implementation schedule attached.