Initial Environmental Examination

January 2013

NEP: Kathmandu Valley Wastewater Management Project

Prepared by the Kathmandu Upatyaka Khanepani Limited, Ministry of Urban Development, Government of Nepal for the Asian Development Bank.

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Ref. No. 517/069/070

Anamnagar
Date : 04 January, 2013

Mr. Fei Yue,
Director, Urban Development Division, SAU
Asian Development Bank
1550 Metro Manila, Philippines.

RECEIVED
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BY:.....

Subject: **Endorsement of Safeguard Document (Kathmandu Valley Waste Water Management Project).**

Dear Sir,

We would like to endorse the safeguard document and requesting for disclosing the same through ADB website. The Draft Project Documents have been forwarded to concerned office for review and approval.

Thanking you.

.....

Er. Abadh Kishore Mishra
Project Director

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Project Director

CC:
M/S Ministry of Urban Development
Singha Durbar, Kathmandu.

Mr. Kenichi Yokoyama, Country Director,
ADB, NRM, Kathmandu, Nepal.

CURRENCY EQUIVALENTS

(as of 10 December 2012)

Currency unit	–	Nepalese rupee (NRs/NRe)
NRs1.00	=	$ 0.01145
$1.00	=	NRs 87.32

ABBREVIATIONS

ADB	Asian Development Bank
BAP	Bagmati Action Plan
CBP Team	Capacity Building and Public-Private Partnership Support Team
CITES	Convention of International Trade in Endangered Species of Wild Fauna and Flora
CAPC	Community Awareness and Participation Consultants
CEMP	Construction Environmental Management Plan
DBO	design build 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
IUCN	International Union for Conservation of Nature
JICA	Japanese International Cooperation Agency
JBIC	Japanese Bank for International Cooperation
KUKL	Kathmandu Upatyaka Khanepani Limited
KVWMP	Kathmandu Valley Wastewater Management Project
KVWSMB	Kathmandu Valley Water Supply Management Board
LICSU	Low Income Consumer Support Unit
MoUD	Ministry of Urban Development
MOEST	Ministry of Environment, Science and Technology

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	–	centimeter
db	–	decibels
ha	–	hectare
kg	–	kilogram
km	–	kilometer
km^2	--	square kilometer
l	–	liter
m	–	meter
m^2	–	square meter
m^3	–	cubic meter
mg/l	–	milligrams per liter
ml	–	milliliter
MLD	–	million liters per day mega liters per day (1 mega litre = 1000m^3)
mm	–	millimeter
µg/m^3	–	micrograms per cubic meter

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

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Executive Summary

1. The proposed Kathmandu Valley Wastewater Management Project (KVWMP) 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.

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 project's expected impact will be sustainable wastewater services for the residents of Kathmandu Valley. The expected outcome will be an improved wastewater collection and treatment system and increased access of wastewater services to the residents of Kathmandu Valley 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 Urban Development (MOUD) 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, MOUD, 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 participation consultant (CAPC) 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. Construction activities will be done in close coordination with the Department of Archaeology at Patan and Durbar squares. There are no protected areas, wetlands, mangroves, or estuaries in or near the subproject location. Trees, vegetation, and animals are those 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

[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).

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 siting 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) minimising vegetation clearance along the slopes; and (iii) avoid laying of interceptors in unstable slopes. Prior to construction at Patan and Durbar squares, approval will be sought from Department of Archaeology in accordance to The Ancient Monuments Preservation Rules 2046 (1989) Section 4.1.1. Excavation will be through hand digging at these sites to minimise impact on adjacent structures.

8. The construction and rehabilitation of WWTPs will be on existing treatment plant sites which are in residential areas. Mitigation measures during the design phase of the WWTPs have been included to ensure minimum nuisance to residents pertaining to odor and noise. This includes (i) air quality dispersion modelling for selection of appropriate odor management technologies; and (ii) establishment of tree screens to maintain an appropriate green zone buffer and fencing to restrict public access. In particular, air quality dispersion modelling during the design phase of the project will assist in analysing if odour concentrations are above the threshold limit and determine what additional measures may be required to reduce odour nuisance.

9. Operational and maintenance efficiency of the WWTPs were considered to ensure minimum impact to aquatic and public health. These include (i) WWTP processes designed to meet the prescribed BOD_5 reductions prior to discharge; (ii) operation of the WWTPs using a risk based approach through the development and implementation of WWTP water safety plans; and (iii) incorporating a long-term operational and maintenance component embedded in the design, build and operate (DBO) contract.

10. 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.

11. 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 and Madhyapur Thimi, Bhaktapur, and Kirtipur Municipalities Offices. A copy of the IEE will be disclosed on the ADB and project-related websites, and will also be available from PID upon request.

12. 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.

13. **Consultation, Disclosure and Grievance Redress.** Public consultations and disclosures will be continuous in the future during the design, construction and operation phases. The CAPC 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.

14. **Monitoring and Reporting.** The safeguards staff within the PID will monitor the implementation of the EMP with support from the DSC and CAPC. 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.

15. **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. Any potential odour nuisance will be assessed through air quality dispersion modelling during the design phase of the WWTPs and appropriate measures will be implemented to mitigate the nuisance. 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, Madhaypur, and Kirtipur.

2. The project has the ultimate objectives of:

(i) rehabilitating and expanding the sewerage networks;
(ii) modernizing, expanding, and constructing wastewater treatment plants (WWTPs); and
(iii) supporting operational and financial improvements and capacity building.

3. The purpose of this initial environmental examination (IEE) is to examine the proposed infrastructure components to ensure that they will not have significant environmental impacts and to provide guidance for their design, construction, and operation. Potential environmental impacts are identified, their significance assessed, and mitigation measures devised to avoid or reduce these impacts to an acceptable level.

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.

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. National Law and Rules

7. 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).

8. 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

1. Policies and Legal Framework of KUKL

9. 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.

10. The National Urban Policy (2007) highlights the historical imbalances and haphazard nature of urban development in Nepal. It views urban centers 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.

11. 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.

12. The Local Self Governance Act (1999) 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.

13. The Government's 3 Year Plan (2010/11–2012/13) provides the most recent guidance on urban sector priorities. It underscores the need to make use of the available opportunities in the protection of the environment and in the minimization of the adverse impacts due to climate change. The plan aims to increase sanitation facilities to cover 60% of the population. It places importance on wastewater management in urban and semi-urban areas to keep the rivers less polluted.

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. The process for carrying out the IEE in Nepal is as follows:

(i) The responsibility for undertaking and getting an IEE approved lies with KUKL/PID as the proponent for the Ministry of Urban Development (MoUD) (the Executing Agency).
(ii) The environmental assessments are carried out by consultants hired by KUKL/PID. (IEEs are approved by the respective ministries. All EIAs are approved by the Ministry of Environment, Science and Technology [MOEST]).
(iii) Public involvement, including notification of stakeholders, dissemination of information, and consultation is a requirement, particularly during the review and approval of the IEE report.
(iv) KUKL/PID prepares the terms of reference (TOR) as described in Schedule 3 of the Environment Protection Rules and submits it to MoUD.
(v) MoUD reviews the TOR and returns it with comments and suggestions for improvement, where necessary.
(vi) If the TOR is found satisfactory, MoUD will approve it and will inform the consultant through KUKL/PID.
(vii) KUKL/PID will arrange for the study to be conducted by a consultant as soon as the TOR is approved by MoUD.
(viii) The IEE report will be prepared in the format as described in Schedule 5 of the Environment Protection Rules and in accordance with the ADB environmental guidelines.

(ix) Rule 7 stipulates that a notice has to be published in Nepali in a national daily newspaper and provided to the concerned village development committee (VDC) or municipality, district development committee (DDC) office, schools, concerned individuals and institutions, hospitals, and health offices. The latter shall be requested to give written comments and suggestions within 15 days regarding the likely impacts on the environment of the proposed project. A deed of public enquiry also needs to be prepared and included in the IEE report.

(x) The IEE report should be submitted to MoUD through KUKL/PID. KUKL/PID will review the report and then forward it to MoUD for decision making. Both KUKL/PID and MoUD can send the document back to the consultant for revision, if required. When approved, MoUD will inform the municipal authorities through KUKL/PID.

(xi) As required by the Environment Protection Act and its rules, KUKL/PID should implement the proposed project only after the approval of the IEE report, which will be monitored and evaluated by MoUD through KUKL/PID.

III. DESCRIPTION OF THE PROJECT

A. Existing Infrastructure Modernization and Expansion

18. In May to September 2011, a mapping exercise of the existing sewer systems in the five municipalities under KUKL/DSC/02 was carried out. The exercise showed the approximate location and length of the sewers based on desktop analysis. The base maps of the five municipalities with location of existing sewer pipeline network, roads, and rivers were prepared. 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 1 shows the summary of existing sewer network (for interceptor sewers, main sewers, collectors, and tertiary or neighbourhood sewers).

Table 1: Most Recent Sewer Length Data

Municipality	Approximate Length of Existing Sewer (in kilometer)
Kathmandu	909
Lalitpur	245
Bhaktapur	74
Thimi	73
Kirtipur	39
Total	1,340

Note: Includes only sewer lines of municipal areas.

19. The wastewater service area is smaller than the KUKL water service area as it only includes the municipalities of Kathmandu, Lalitpur, Bhaktapur, Madhyapur-Thimi, and Kirtipur. The water service area covers a number of Village Development Committees (VDCs) outside of the municipalities. Wastewater services will logically be required in all urban areas regardless

of whether the area is a municipality or a VDC. 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.

20. There are only five major wastewater treatment plants (WWTP) in Kathmandu Valley. Table 2 presents a snapshot of these plants.

Table 2: Snapshot of Existing Centralized WWTPs

Parameter	WWTP				
	Hanumanghat	**Sallaghari**	**Kodku**	**Dhobighat**	**Guheshwori**
Year established	1975	1983	1982	1982	2002
Reported nominal capacity (MLD)	0.5	2	1.1	15.4	16.4
Original supporting agency	GTZ/ Germany	GTZ/ Germany	IDA, Engineering Science/ USA	IDA, Engineering Science/ USA	Government of Nepal
Operator	KUKL	KUKL	KUKL	KUKL	HPCIDBC
Type of plant originally installed	Aerated lagoon	Aerated lagoon	Waste stabilization pond	Waste stabilization pond	Oxidation ditch
Catchment served	North-east Bhaktapur	North & south Bhaktapur	East Lalitpur	Kathmandu and Lalitpur	Gokana & Chabahil
Existing operation status	treatment significantly below design intentions	treatment significantly below design intentions	treatment significantly below design intentions	Not operational since 1982	treatment below design intentions

HPCIDBC = High Powered Committee for Integrated Development of Bagmati Civilization, IDA = international development assistance, KUKL = Kathmandu Upatyaka Khanepani Limited, MLD = million liters per day, USA = United States of America, WWTP = wastewater treatment plant.

Hanumanghat WWTP

21. The total area of Hanumanghat WWTP is 0.35 ha. It consists of four stabilization ponds. Currently there is very low influent flow and load. Hanumanghat WWTP was originally an aerated lagoon, but the aerators have been removed many years ago and the water level has been decreased from the original 3.5 m to 1.0 m.

22. Currently, Hanumanghat WWTP acts as through-flow reactor having low detention time with many short circuiting and producing vegetation and sludge. During dry weather there is no effluent flow, which means that wastewater is partly bounding to the plants and partly evaporating into the air.

23. Given the small size of this plant, Hanumanghat WWTP will be closed and all wastewaters from this site be diverted to the new Sallaghari WWTP.

Sallaghari WWTP

24. The total area of Sallaghari WWTP is 3.4 ha. It consists of four stabilization ponds. Currently there is a very low influent flow and load because of nil-operation of the south collector and only a small flow coming from the north collector.

25. Sallaghari WWTP was originally designed as an aerated lagoon, but the aerators were removed many years ago and the water level has been decreased from the original 3.0 m to 0.5 m. Currently, Sallaghari WWTP acts as through-flow reactor having a low detention time with short circuiting and producing vegetation and sludge. During dry weather there is no effluent flow.

Kodku WWTP

26. The total area of Kodku WWTP is 6.5 ha consisting of four ponds, currently with a relatively low influent flow (1,500 m^3/d) and load (1,000 kgBOD/d). The first two basins were originally anaerobic ponds with 4 meters of water depth. This is no longer the situation and the depth now is only about 0.5 m. The next pond is facultative and the last one is smaller. Disinfection equipment has not been in operation for many years.

27. Kodku WWTP was also originally a stabilization pond having a small sludge drying bed. Kodku WWTP acts as through-flow reactor having a low detention time with short circuiting and producing vegetation and sludge. During dry weather there is no effluent flow.

Guheshwori WWTP

28. Guheshwori WWTP was commissioned in 2001. It provides inlet pumping station and mechanical treatment and consists of an oxidation ditch process with carrousel-type aeration basins and circular secondary sedimentation basins. It is being operated by HPCIDBC and served by 2 sewer lines from the Gokarna and Mitrapark areas. The total existing WWTP area is 5.0 ha.

29. The volume of aeration basins are 2 x 5,200 m^3 and the surface area of secondary sedimentation basins is 2 x 570 m^2. Aeration has been implemented with large surface aerators (total of 6 pieces of equipment). Total power capacity was designed to be 375 kW.

30. Average dry weather flow has been measured to be approximately 200 – 250 l/s, from which the lower volume, 17,000 m^3/d, has been chosen as the current average dry weather flow. Maximum flow has been measured to be as 400 l/s (35,000 m^3/d).

31. The designed and existing influent and effluent loading situation is presented in table 3. The original design for Stage I has been set at a capacity of 74,000 equivalent persons (4,430 kgBOD_5/d, 60 g/inh d). Existing estimated influent BOD-load calculated with the measured average concentration and total flow is about 6,500 kg/d (PE 108,000 inhabitants, 60 g/inh.d).

32. This means that the treatment plant is considerably overloaded and cannot receive the total influent load to the treatment process. Daily by-passes have been estimated to be 30 % in average in accordance with the daily electricity outage time (7 hours).

33. To avoid excess flow of untreated water during the monsoon into the Bagmati River, just in front of holy Pashupatinath Temple, the WWTP effluents are diverted to outside of the temple boundary through a bypass tunnel. The plant has not been functioning according to its capacity.

34. The operation of the treatment plant is very difficult because of long daily (about 7 hours) outage in electricity power. This means that inlet pumps, aerators and return sludge pumping is stopped and influent is conveyed as a bypass to the receiving waters. Such a long time without aeration damages and destroys microbes of activated sludge, also worsening the treated effluent quality. The use of the existing type of surface aerators also disperses aerosols to the air, causing health risks to the plant staff.

Table 3: Performance of Guheshwori WWTP

Parameter	Unit	Influent		Treated Effluent	
		Designed	Existing 2011	Designed	Existing 2011
Population equivalent	inhabitant	75,000	108,000	-	-
Average influent/treated flow	m^3/d	16,400	17,000	16,400	12,000
Average flow by-passed	m^3/d	-	5,000	-	-
BOD_5	mg/l	270	380	25	174
	kg/d	4,430	6,500	410	4,000
COD_{Cr}	mg/l	1,150	720	250	558
	kg/d	18,900	12,200	4,100	10,300
SS	mg/l	216	300	100	255
	kg/d	3,540	5,100	1,640	4,560
NH_4-N	mg/l	-	46	-	48
	kg/d	-	780	-	800
Total Performance	mg/l	-	3	-	8.9
	kg/d	-	51	-	80

Dhobighat WWTP

35. The total area of Dhobighat WWTP is 30.4 ha consisting originally of four stabilization ponds (area totally 19.4 ha). However, the plant has had no influent flow and load since the 1980s because of total non- operation of the Sundarighat pumping station.

36. The treatment plant area is now used for different farming, and recreation and informal purposes as well as being used by KUKL as a storage area for sewer pipes.

Gokarna WWTP

37. There is also a smaller treatment plant site at Gokarna. The total area of Gokarna is 0.925 ha. It currently consists of one government building and a flat area. The plant was originally designed as Reed Bed Treatment System (RBTS). There is only very little flow going through the system with no treatment.

B. Project Rationale

38. 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.

39. 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.

40. Kathmandu Valley is the most densely populated region in Nepal whose population has been increasing rapidly, especially in Kathmandu, the center 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.

41. 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 into a highly polluted watercourse. Congested and crowded roads have brought hardship to travelers 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.

42. WWTPs will be constructed and rehabilitated at 5 of the existing site and the sewerage network 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.

43. 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.

C. Description of Proposed Project

44. The proposed 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 five wastewater treatment plants of 90.5 MLD capacity; and (iv) energy generation of approximately 910 KW through sludge digestion and gasification, etc.

45. The rehabilitation and expansion of sewerage networks will involve (i) rehabilitation of 126 km sewer and replacement of about 40 km old brick sewers and 13.5 km lateral sewers, (ii) expansion of service coverage by laying about 151 km new sewer, (iii) connecting new customer, (iv) separation of the combined sewer system to sanitary and stormwater, wherever possible (initial assessment of about 109.5 km) and cleaning of sewers blockage of 55.5 km. The following Metro/sub-metro/municipalities will be targeted:

(i) **Kathmandu Metropolitan** - The cleaning of existing sewers, rehabilitation of existing combined sewer, separation by laying new sanitary sewer and storm water drain will cover whole city area where as new laying of sewer will be in periphery area and new laying replacing brick sewer will be in core areas.

(ii) **Lalitpur Sub- metropolitan** - The cleaning of existing sewers will be from Jawalkhel to Ekantakuna and other places. Rehabilitation of existing combined sewer will be within core areas. The separation by laying new sanitary sewer will cover Natole- Gabahal, Mangal bazaar, Sankhamul, Kumaripati- Minbhawan, Lagankhel-Batukbhairav & other areas. Whereas separation by laying new storm water drain will be in the flooding areas such as Mahapal, Patan Campus, Kumaripati, Kusunti, Satdobato-Gwarko, Bakhundole-Kupondole, ICIMOD-Hatiban.

(iii) **Bhaktapur Municipality** - The cleaning of existing sewers will be in Sangam Chowk, Chochhen, Lachichha Gali, and Byasi Kamal Vinayak. Rehabilitation of existing combined sewer will be in Kamicha Galli, Gachhen, Dekocha, Hanumanghat, Chasukhel, Dockche, and Ichadole. Whereas separation by laying new storm water drain will be in Bhaktapur Industrial area, Wachu to gella, Thulo Byasi, Bhelukhel, Lakulach, Thucho tole.

(iv) **Kirtipur Municipality** - In Kirtipur, cleaning of existing sewers will be proposed in Nayabazar, Sagal, Samal, Nagaon, Baghbhairav, Khasi Bazar area. Rehabilitation of existing combined sewer will be within the town planning area. The separation by laying new storm water drain will be in Nayabazar, whereas new sewage pipeline will be laid in Panga Chinchu, Nagaon, Creative School, Karki Tole, Dhusi, and Dathal.

46. 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 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.

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

48. The total length of interceptor/collector to be constructed along the streams and rivers will be approximately 101 Km. The work includes the cleaning of existing and laying of new interceptors in the ROW (as fixed by HPCIDBC) along the banks of following rivers of Kathmandu valley:

(i) <u>Cleaning of existing interceptors (Kathmandu)</u>

- Left bank of Bishnumati from Dhalko to Teku

(i) <u>New laying of Interceptors</u>

Kathmandu

- Right bank of Bagmati from Dhobighat WWTP to Manohara
- Both banks of Bishnumati from Bagmati confluence to Mahadev Khola
- Both banks of Dhobikhola from Bagmati confluence to Mahankal
- Right bank of Manohara from Bagmati confluence

Lalitpur

- Left bank of Bagmati from Khokana to Dhobighat WWTP
- Left bank of Bagmati from Dhobighat WWTP to Manohara confluence

Bhaktapur

- Left bank of Khasyangkhusung Khola till Sallaghari WTP
- Right bank of Hanumante from Sallaghari to Hanumanghat WWTP
- Left bank of Hanumante from Sallaghari WWTP

Madhyapur Thimi

- Left bank of Manohara from Bode Dhunchapakha to Hanumante confluence
- Right bank of Hanumante from Manohara confluence

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 meter on both banks of rivers in Kathmandu as ROWs and so the interceptors will be laid within the RoWs.

49. Five new WWTPs at Kodku, Sallaghari, Dhobighat, Guheshowri, and Gokarna will be constructed to a combined capacity of 90.5 MLD at existing sites.

50. Rehabilitation of the existing WWTP at Guheshwori will be conducted to improve operational efficiency in addition to the construction of a new WWTP at the existing site. Rehabilitation works at Guheshwori will see the surface aerators replaced by diffuser blocks attached to the floor (air is pumped through the diffuser blocks that oxygenates the liquor and also provides the necessary stirring action). The works will also consist of cleaning, sludge removal, repair works, construction of a new treatment processes to cater to the increasing population, and establishment of environmental buffer zones.

51. The new WWTPs will employ the activated sludge process (ASP). This mechanical process has been selected to ensure operational efficiency and reduce the likelihood of odors. Appropriate ASP technologies (SBR, MBBR, oxidation ditch etc) will be established. Environmental buffer zones (i.e. tree screenings etc) will be established at the new WWTP sites to minimise nuisance to neighbouring residents.

52. The effluent BOD of Guheshwori and Gokarna WWTP will be designed for an ultimate 15 mg/l effluent BOD for the years 2020 and 2030 as shown in Table 4.

Table 4: Wastewater Treatment Scenario in Kathmandu Valley in 2020 and 2030

Wastewater Treatment Plants	**Wastewater to be Treated** (MLD)		**WWTP Area Available** (hectare)	**Effluent Standards** (BOD mg/l)	
	Year 2020	**Year 2030**		**2020**	**2030**
Guheswori	30.6	30.6	5.0	15.0	15.0
Gokarna	0.6	0.6	0.93	15.0	15.0
Sallaghari	13.1	13.1	3.4	50.0	30.0
Kodku	7.0	11.2	6.5	50.0	30.0
Dhobighat	39.2	81.6	30.0	50.0	50.0
Khokana*	-	245.0	38.5	50.0	50.0
TOTAL	**90.5**	**382.1**	**84.33**	**-**	**-**

MLD = million liters per day, WWTP = wastewater treatment plant.
*Land still to be acquired.

53. 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.

54. The estimated population to be served by the new and rehabilitated WWTPs are provided below:

(i) **Kodku WWTP** – The new WWTP will accept and treat wastewater for an equivalent population of 80,000 and 110,000 by year 2020 and 2030 respectively.

(ii) **Sallaghari WWTP -** It is estimated that the new WWTP will treat wastewater for an equivalent population of 100,000 and 125,000 by years 2020 and 20130 respectively.

(iii) **Dhobighat WWTP** – The new WWTP will serve about 200,000 and 1,600,000 population of Kathmandu valley by the year 2020 and 2030 respectively.

(iv) **Guheshwori WWTP** - It is estimated that after the rehabilitation of the existing plant and construction of a new plant, it will serve an estimated population of 300,000 by 2020.

(v) **Gokarna WWTP** - After the construction of the new WWTP, it will serve an estimated population of 7,200.

55. Figure 1 shows the proposed wastewater components of the proposed subprojects. Some details may change (e.g. pipe diameters and lengths and locations) during the detailed design phase as this study has been done to determine the overall feasibility and costs.

56. The preliminary/schematic layout plans of the WWTPs are attached (Figures 2 to 6).

Figure 1: Proposed Project Components

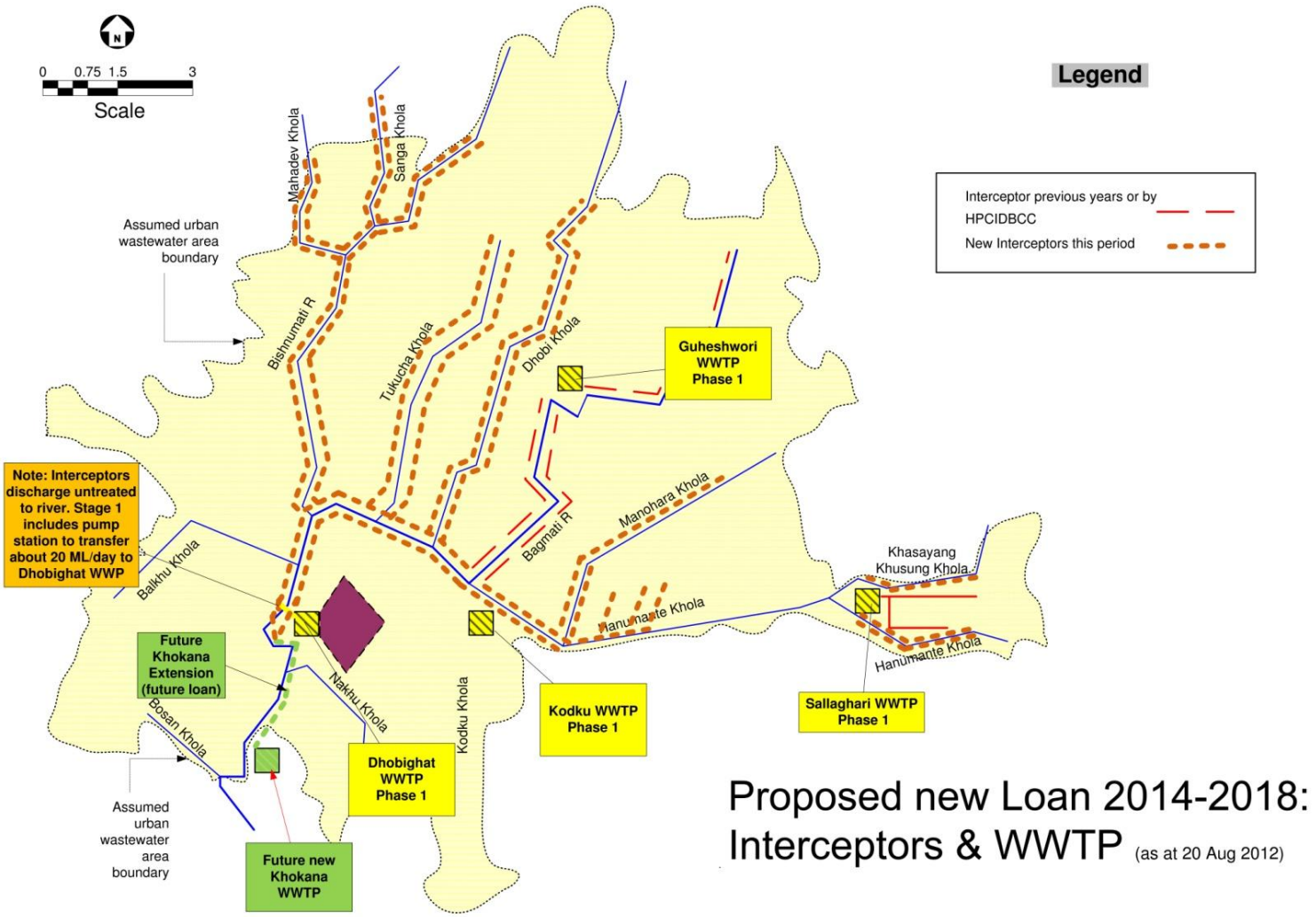


Figure 2- Sallaghari Wastewater Treatment Plant

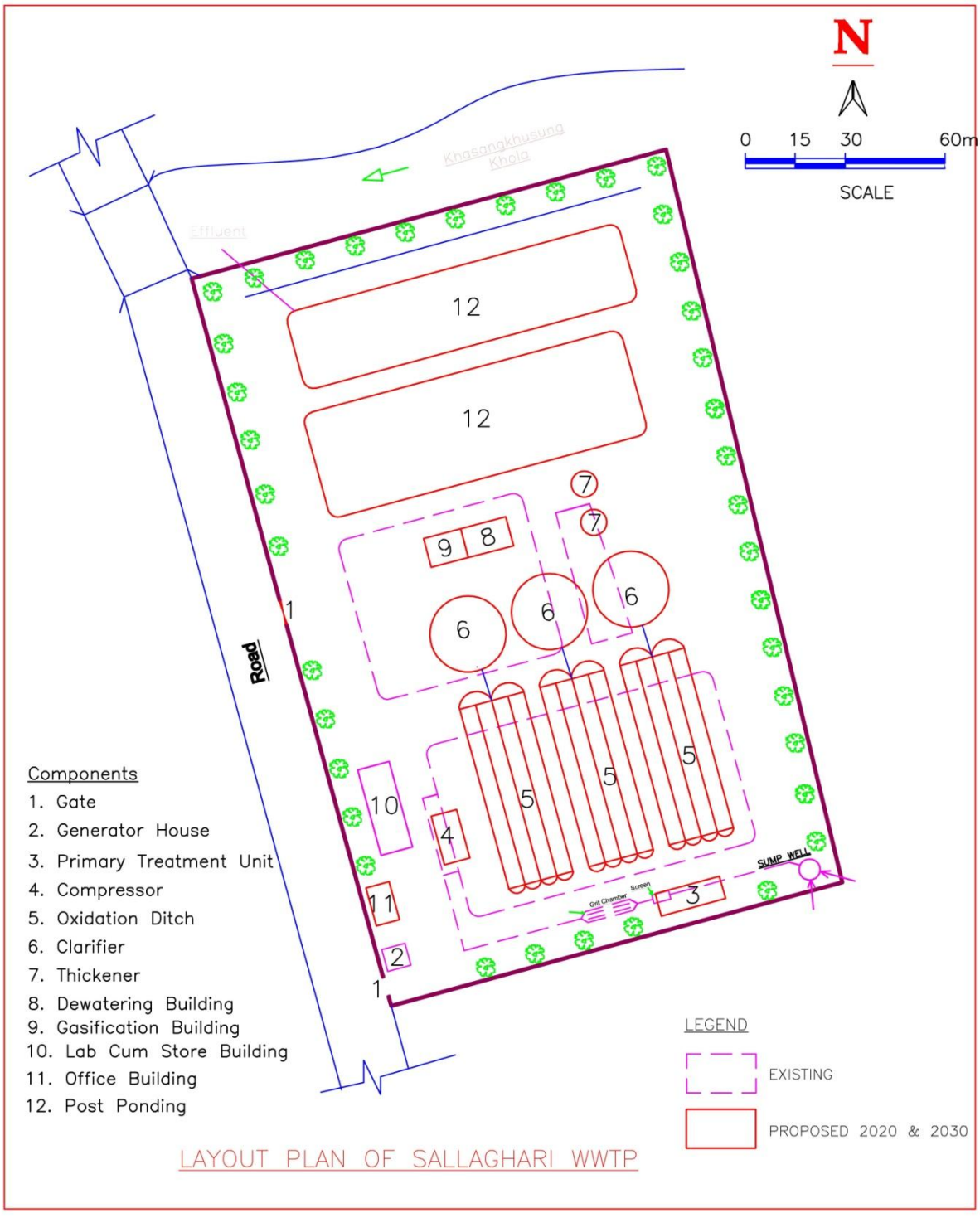


Figure 3: Kodku Wastewater Treatment Plant

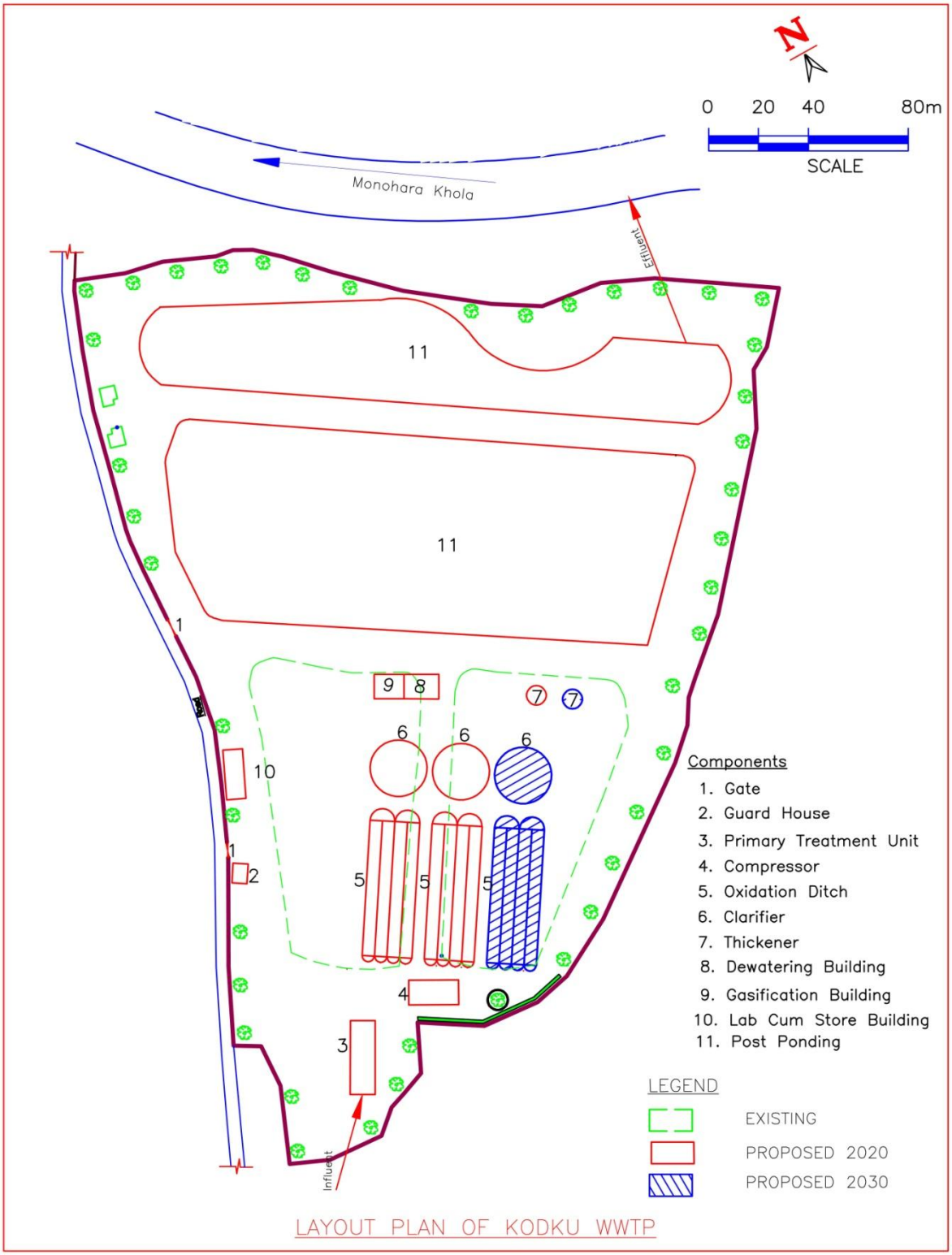


Figure 4: Guheswari Wastewater Treatment Plant

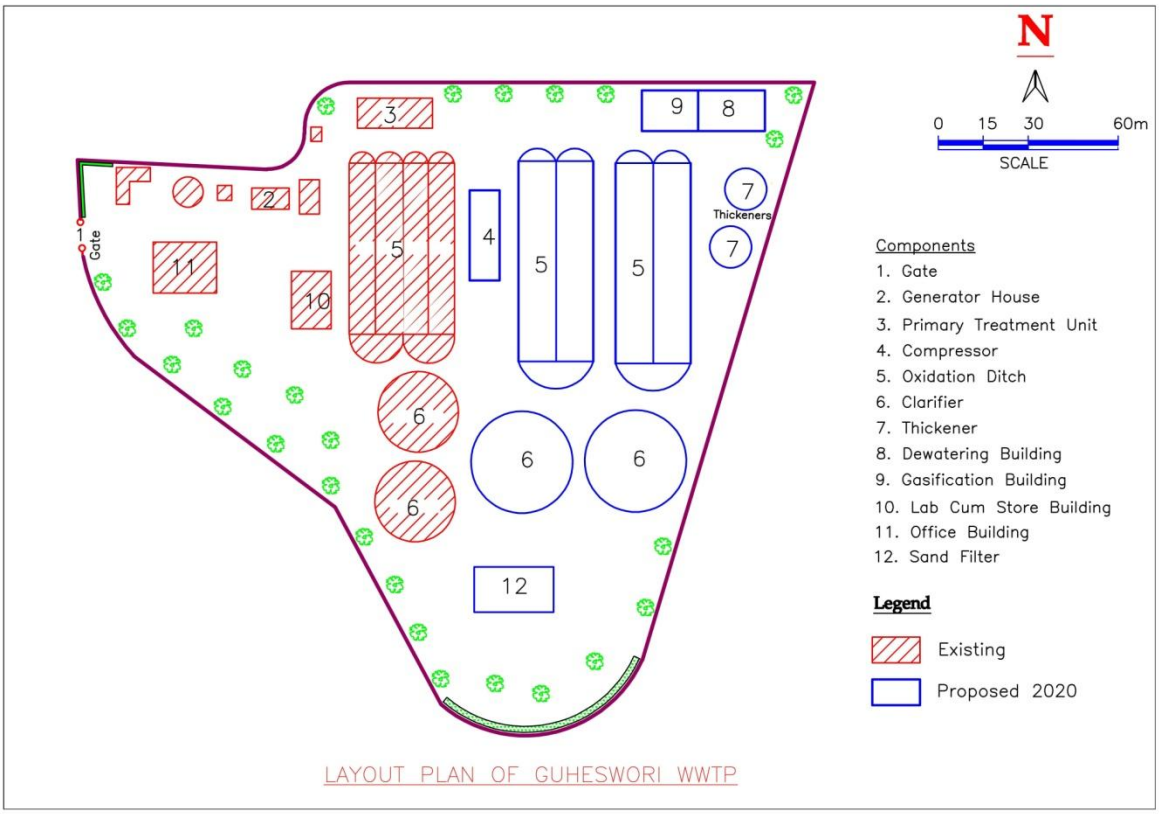


Figure 5: Gokarna Wastewater Treatment Plant

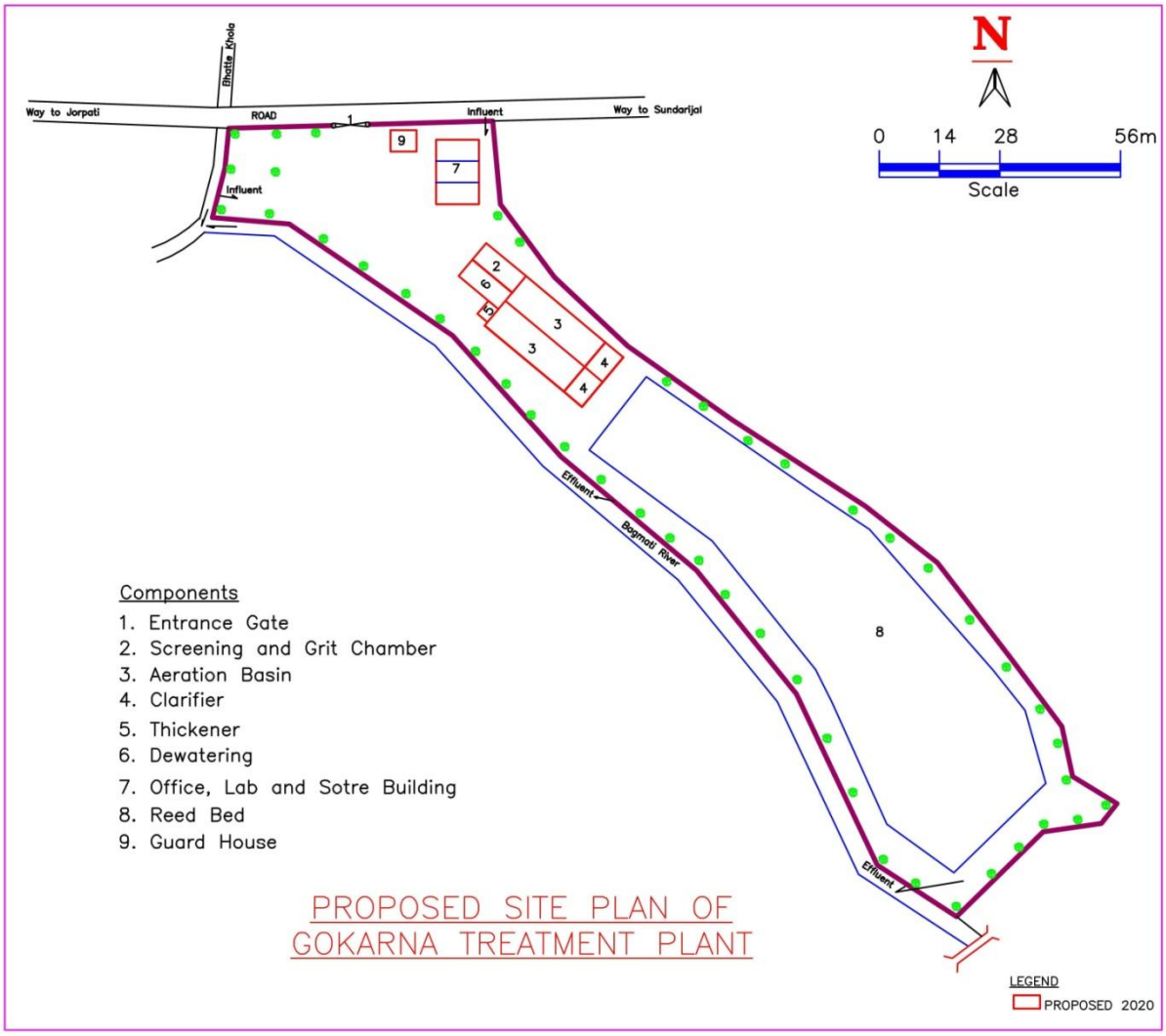
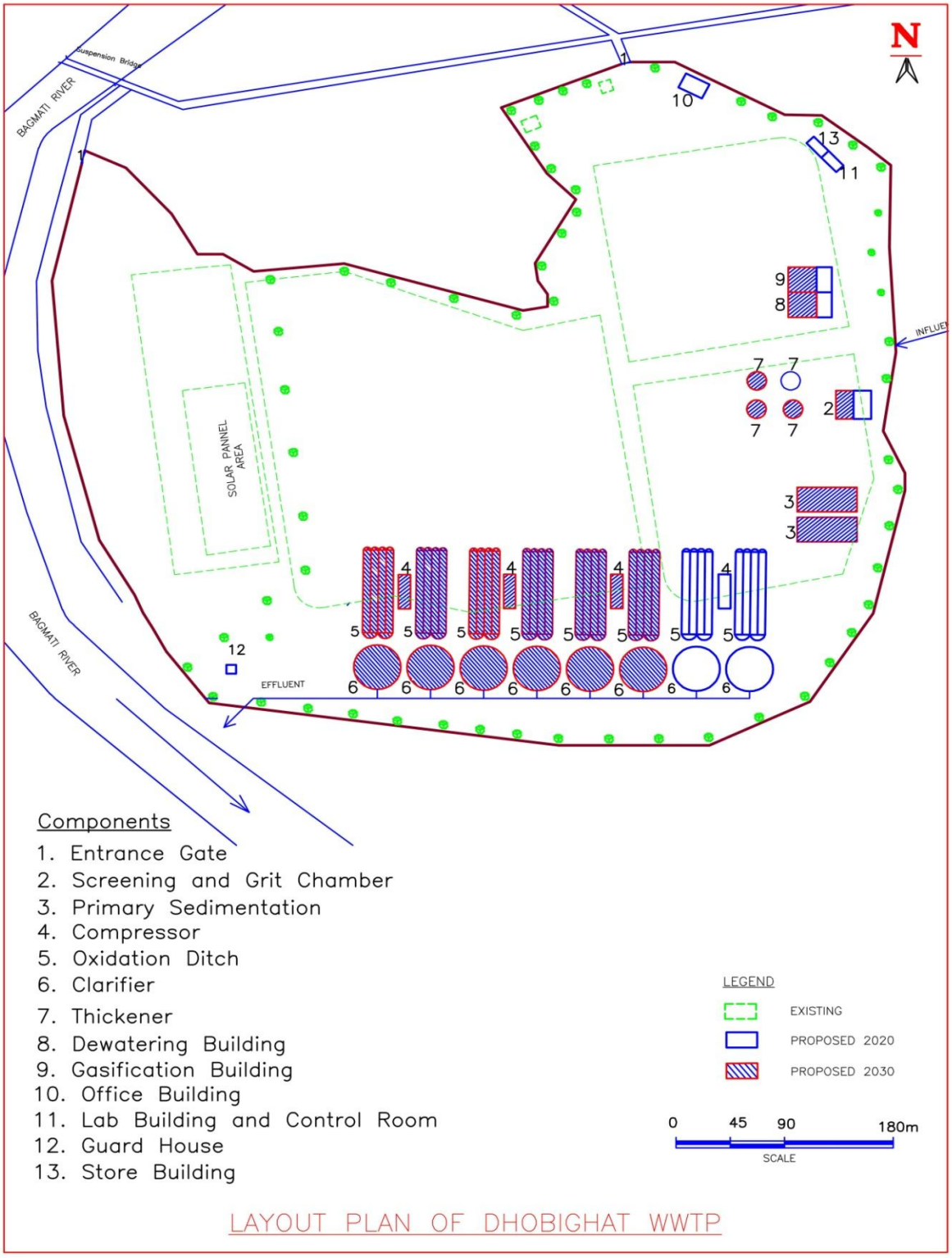


Figure 6: Dhobighat Wastewater Treatment Plant



IV. DESCRIPTION OF THE ENVIRONMENT

A. Kathmandu Valley

57. Kathmandu Valley (Figure 8) lies between latitudes 27º35' to 27º48'N and longitudes 85º12' to 85º33'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 (the Pashupati Nath Temple) is located in the banks of the Bagmati River.

58. Bhaktapur, one of the adjoining cities of Kathmandu, is located between latitudes 27º37' to 27º44'N and longitudes 85º02' to 85º32'E. It is bounded by Kavrepalanchowk in the east, Kathmandu and Lalitpur in the west, Kathmandu in the north, and Kavrepalanchowk and Lalitpur in the south. 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. The Bagmati River does not flow through Bhaktapur; both the Manohara and Hanumante rivers are the major tributaries of the Bagmati River.

59. Bhaktapur is one of the three historic royal towns in Kathmandu Valley (15 km from Kathmandu) with rich architectural and urban heritage. It was founded in the 8th century A.D. and has remained relatively well preserved. The city is inhabited by 83,893 people. The main occupation of its inhabitants is agriculture; crafts (weaving, wood carving, metal crafts, clay work, and stone carving) and businesses are secondary occupations. The Bhaktapur Durbar Square and the Changunarayan Temple are among the seven world heritage sites in Kathmandu Valley.

60. Lalitpur is another adjoining city of Kathmandu and is located between latitudes 27º 22 to 28º50'N and longitudes 85º14' to 85º26'E. It is bounded by Kavrepalanchowk 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.

61. 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*. UNESCO has enlisted the conglomerate of the buildings in Patan Durbar Square as a world heritage site, one of the seven heritage sites in Kathmandu Valley.

62. Kathmandu Valley is accessible by major roads to different parts of the country and to India in the south and Tibet in the north. Kathmandu has an airport that caters to national and international airlines to many parts of the country and abroad.

B. Physical Resources

1. Topography

63. Kathmandu Valley is about 1,300 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, and Manohara River.

a. Geology and Soil

64. 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.

65. 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).

66. The Kalimati formation surrounds the Jawalakhel and Lagankhel hills, which are located in the Chapagaun formation. At Jawalakhel Chowk, a soil investigation conducted by the Japan International Cooperation Agency (JICA) under the Study on Earthquake Disaster Mitigation in Kathmandu Valley, 2000−2001 found a non-liquefiable soil profile of good strength capacity. Most of the soils with moderate to high liquefaction potential are to be found along riverbanks, in the so-called recent flood plains. Generally, apart from soils located at the foot of mountains, those soils in the Kathmandu Valley located above 1,300 m are expected to be either non-liquefiable or to have a low liquefaction potential.

b. Climate

67. Nepal, in a year, receives about 1,500 millimeters (mm) of rainfall in a good monsoon regime (Department of Hydrology and Meteorology Records). Rainfall is concentrated, and more than 75% of the annual rainfall occurs during the monsoon months beginning June through September. The months between October and May are dry and rainfall is sporadic. In winter, rainfall is caused by the weather system originating from the Mediterranean region. The winter rain reaches Nepal and causes significant precipitation in the western part.

68. The climatic condition of the Bagmati watershed is quite variable because of the intricate topography. Temperature generally decreases with elevation; it is low in winter and increases with the advent of spring. Climatically, the Bagmati watershed region can be classified into three regions:

(i) Tropical climate of the southern Terai, Bhabar, Chure (Shiwalik), and the Inner Terai with mild and dry winter
(ii) Warm temperate climate of the Mahabharat region above the elevation of 2,000 m with warm summers and cool winters
(iii) Cool temperate climate of the high Mahabharata region above the altitude of 3,000 m with cool summers and cold winters; snow falls in the winter months and persists on the high slopes throughout the winter.

69. 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. Water Resources

1. Surface Water

70. 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.

71. The Bagmati River forms a medium-sized river basin with a catchment area of 3,700 km^2 at the Nepal-India border. It extends from latitudes 20^0 42' to 27^0 50'N and longitudes 85^0 02' to 85^0 58'E. It originates from the Shivapuri hills in the Mahabharat range of mountains and flows down south into the Terai plains before crossing the Indo-Nepal border. Along its course the river passes through eight districts, namely, Bhaktapur, Kathmandu, Lalitpur, Kavrepalanchowk, Makwanpur, Sindhuli, Rautahat, and Sarlahi. The major tributaries of the Bagmati River are Manohara, Bishnumati, Kulekhani, Kokhajor, Marin, Chandi, Jhanjh, and Manusmara. Kathmandu Valley comprises 15% of the basin area in Nepal. The basin as a whole can be divided into three parts:

(i) upper Bagmati basin comprising Kathmandu Valley plus the upper part of the Nakhkhu Khola and Dakshinkali area,
(ii) middle Bagmati basin comprising the remainder of the basin in the hills including the Kulekhani Khola, and
(iii) lower Bagmati basin comprising the basin in the Terai, plus some tributaries which originate in the Shiwaliks.

72. The major tributaries of the Bagmati River are Nakkhu, Kulekhani, Kokhajor, Marin, and Chandi River. The longitudinal profile of the Bagmati basin is shown in Figure 9 and gives the location and details of the study area.

Figure 7: Location Map of Kathmandu Valley and WWTPs

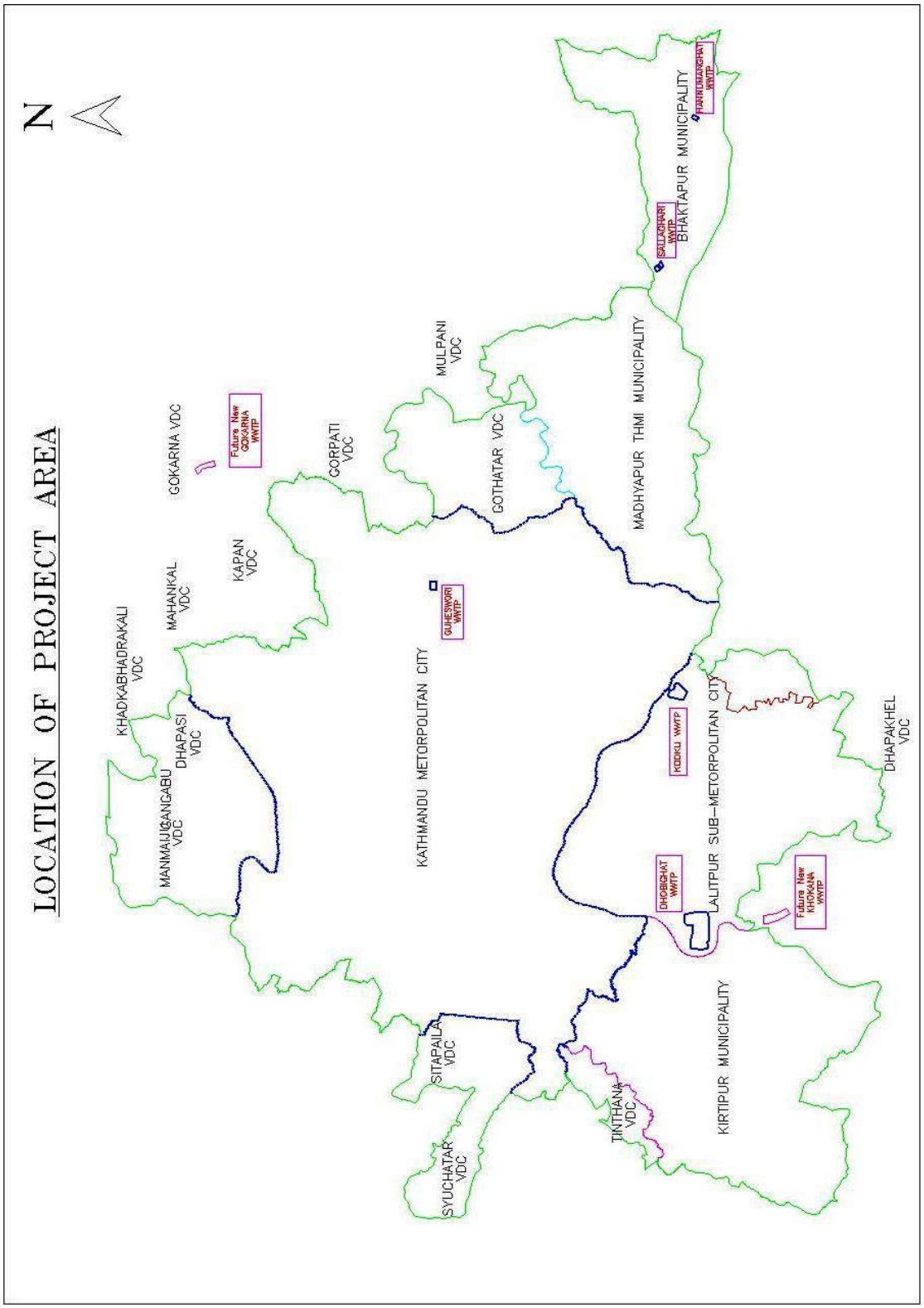


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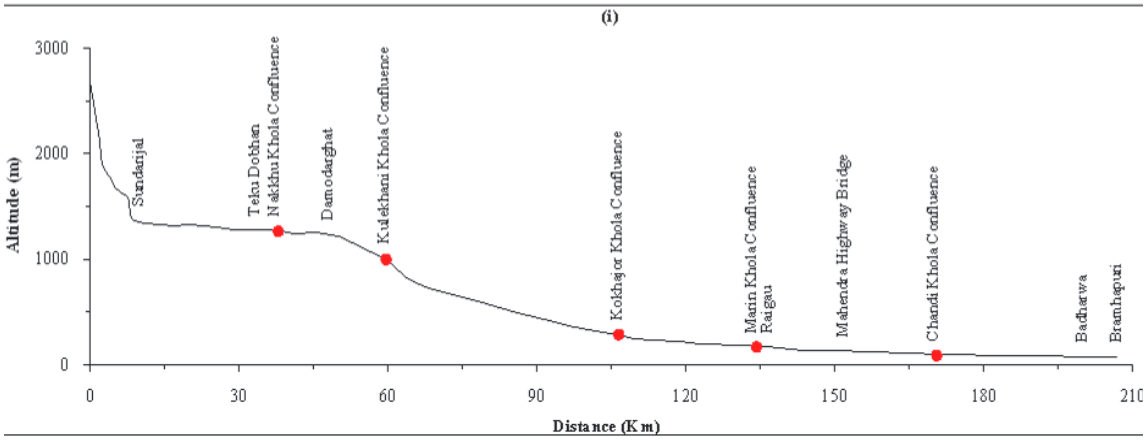
Figure 8: Longitudinal Profile of the Bagmati River Basin



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

74. 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.

2. Surface Water Quality

75. The BOD_5 level in different stretches of the Bagmati River at different seasons provides a clear indication of high level of pollution at all seasons of the year (BOD_5 levels range from 1.7 to 239.4 mg/l in the pre-monsoon, 2.1 to 84.7 mg/l in the monsoon, and 2.3 to 119.4 mg/l in the post-monsoon seasons). The main reason for the deteriorating water quality of the Valley's rivers is discharge of untreated sewage in the urban areas of Kathmandu, although solid waste dumping along the river is also a contributing factor.

3. Groundwater

76. The groundwater aquifers of Kathmandu Valley are divided into three districts: Northern (157 km^2 with 59 km^2 recharge area), Central (114 km^2 with about 6 km^2 recharge area), and Southern (55 km^2 with about 21 km^2 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).

77. 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).

78. 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.

4. Groundwater Quality

79. Of the 57 deep tube wells tested, many have exceeded the country's standards for color, turbidity, ammonia, iron, and manganese. Two of the wells exceeded the arsenic standard. In some wells, ammonia concentration was found to be extremely high (50 fold above the threshold value of 1.5 mg/l). Twenty of the 57 wells showed bacterial contamination (ENPHO, 2009).

D. Ecological Resources

1. National Parks

80. The Shivapuri Nagarjun 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 more than 1 million liters of 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 Shivapuri Nagarjun National Park.

2. Forests

81. 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. *Populus sp* and Eucalyptus sp are mostly found along the Ring Road.

82. The Nagarjun National Park (area: 15 km^2) was annexed in 2009 to the Shivapuri National Park (area: 144 km^2) and called the Shivapri Nagarjun National Park. The intension was “to provide extended habitat for the wildlife population and as a representation of intact mid-hill forest ecosystems whose representation is comparatively low in the protected area system. The Shivapuri Nagajun 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).

3. Flora

83. 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

84. 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 th*reatened species), and 60*0 species of but*terflies found in Nepal, thus making the National *Park a paradis*e for flora and fauna. The threatened wildlife found a*re wild boar (Sus scrofa*), *barking deer (Muntiacus muntijak*), rhesus monkey (*Macaca mulata*), porcupine (*Hystrix indica*), goral (*Naemorhedus goral*), Himalayan black bear (*Ursus thibetanus*), leopard (*Panthera pardus*), pangolin (*Manis*

spp.), cloded leopard (*Pardofelis nebulosa*), leopard cat (*Primailurus bengalensis*), and jungle cat (*Felischaus*).

E. Socio-economic Profile

1. Social and Household Profile

85. **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.

86. With more than 1.5 million people, Kathmandu Valley is the urban center of Nepal and includes five major cities, namely Kathmandu, Lalitpur, Bhakatapur, Kritipur, and Madhyapur (Thimi). Kathmandu Valley spans the three districts of Kathmandu, Lalitpur, and Bhaktapur and consists of 1 metropolitan city, 4 municipalities, and 38 village development committees (VDCs). Kathmandu metropolitan areas have the highest population and households followed by Lalitpur and Bhaktapur municipalities. A third of its residents live in slum dwellings and about 18,000 people are squatters (without land rights). Rice, wheat, corn, vegetable, and a variety of fruits including bananas and orange are grown in the fertile valley, which supports a relatively high percentage of the hill population. Kathmandu Valley, along with the Terai region, has witnessed an intensive migration and urbanization process. Table 6 presents the household profile in Kathmandu Valley.

87. **Age.** The economically active age group (from 15 to 44 years old) constitutes about 56% of the project district's population. The other main age group is from 5 to 14 years old. Only about 5% of the population are 60 years and above. There are no significant differences in the age distribution of population in KUKL service areas.

88. Table 6 summarizes the distribution of gender and households in the five main metros and municipalities in the valley.

Table 6: Household Profile in Kathmandu Valley

Metro/Sub-metro/ Municipality	Population			Total Household
	Male	Female	Total	
Kathmandu Metro	532,728	473,928	1,006,658	277,789
Kirtipur Municipality	36,726	29,344	66,070	21,854
Bhaktapur Municipality	42,947	40,946	83,893	19,273
Madhyapur Thimi Municipality	43,643	40,616	84,259	21,758
Lalitpur Sub- Metro	116,082	107,203	223,285	58,127

Source: Compiled from Census 2011 (Preliminary), CBS.

2. Employment

89. 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.

90. Kathmandu Valley has developed as a center of trade links with India and Tibet (People's Republic of China). According to the Economic Survey 2010−2011, Nepal in fiscal year 2009−2010 exported 71% of its goods to India and 29% to countries such as the United States, United Kingdom, Italy, Germany, Canada, and Japan. The main export commodities are ready-made garments, woolen carpets, woolen and pashmina goods, and handicrafts of which most are manufactured in Kathmandu Valley. Nepal imported 68% of goods from India and the rest, from other countries. The major import items are petroleum products, medicines, electronic goods, gold, transport equipment, and fertilizers. A significant share of imported goods is consumed in the valley. Kathmandu Valley is the entry point for the majority of tourists. In 2009, a total of 602,867 tourists arrived in Nepal, of which, more than 80% entered through the Kathmandu international airport.

91. About 53% of the total population aged 10 years and above in the valley are economically active (Census 2001). They are engaged in agriculture and forestry (36%), manufacturing (17%), commerce (16%), construction (4%), and transportation/ communication (3%).

92. Table 7 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%), whereas the Kirtipur Municipality has the lowest (13%). Among the households engaged in non-farm activities, nearly 45% are engaged in trade and business followed by services (32%) and manufacturing (9%). Nearly 50% of the households in Kirtipur and Kathmandu are engaged in trade and business.

Table 7: 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
Madhyapur Thimi	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
Kirtipur	13.34	9.72	51.42	2.84	22.83	13.19
Total	34.43	9.02	44.66	3.76	32.41	10.14

Source: CBS. 2003. Population Census 2001 (selected urban tables).

93. 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 8).

Table 8: 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

94. The rapid population growth has created a number of slums and squatter settlements in Kathmandu Valley. Table 9 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 9: 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
Madhyapur Thimi Municipality	382	1981	5.19	85
Lalitpur Sub - Metropolitan	391	1,866	4.77	62
Kathmandu Metropolitan	3,784	16,575	4.38	58
Kirtipur Municipality	1,674	7,767	4.64	64
Squatters				
Kathmandu Metropolitan	1,861	8,774	4.71	95
Total	**8,846**	**40,237**	**4.67**	**66**

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

95. 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 center 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.

96. 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.

97. Being the capital city and a commercial center 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

98. The land use and land cover statistics (Table 10) 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. Built-up areas occupy an insignificant portion, less than 1%, of the total area. The metropolitan city of Kathmandu, sub-metropolitan city of Lalitpur, and municipal cities of Bhaktapur, Madhyapur Thimi, and Kirtipur are the major built-up areas in the watershed.

Table 10: 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
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.

F. Infrastructure

1. Transportation

99. 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).

100. The Tribhuvan International Airport is just 30 minutes away from the town center. 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

101. Not all households and people in the Valley receive safe drinking water. Various sources of drinking water for households are shown in Table 11.

Table 11: Sources of Drinking Water

	Kathmandu		Lalitpur		Bhaktapur		Kathmandu Valley	
	Household	%	Household	%	Household	%	Household	%
Tap	197,851	84.1	57,237	83.0	30,755	73.5	285,843	82.6
Well	14,714	6.3	6,745	9.8	4,4843	11.6	26,302	7.6
Tube well	13,478	5.7	825	1.2	2,977	7.1	17,280	5.0
Spouts	6,082	2.6	3,099	4.5	2,632	6.3	11,813	3.4
River/stream	195	0.1	113	0.2	29	0.1	337	0.1
Others	1,616	0.7	477	0.7	277	0.7	2,370	0.7
Not stated	1,581	0.6	425	0.6	339	0.8	2,145	0.6
Total	**235,317**	**100**	**68,921**	**100**	**41,852**	**100**	**346,090**	**100**

Source: National Water Supply Corporation (NWSC). 2005.

102. 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 12. It shows that less than 75% of the population receives piped drinking water supply from the then Nepal Water Supply Corporation (now KUKL).

Table 12: 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

103. 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

104. 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

105. Kathmandu Valley has long been considered the center 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).

106. 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 13 shows the number of schools by level for the three districts.

Table 13: Total Number of Schools by Grade and Level

	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.

107. 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.

108. 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

109. Kathmandu is the center 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

110. 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).

111. 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).

G. Economic Characteristics

1. Industries

112. 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.

113. 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.

114. 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.

115. 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

116. 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.

117. 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.

118. 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.

119. 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

120. 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).

121. 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) Centre for Integrated Urban Development
(iv) Environment and Public Health Organization (ENPHO)
(v) Nepal Water for Health (NEWAH)
(vi) Action Aid
(vii) Water Aid
(viii) Plan International
(ix) UDLE (Urban Development through Local Efforts)
(x) Red Cross.

4. Cultural Heritage

122. 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.

H. Major Environmental Problems

123. The environmental problems of Kathmandu Valley are many.

124. **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).

125. 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.

126. 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 14). 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 14: Comparison of Emission Inventories in 1993, 2001, and 2005

Sources	TSP (tons/year)			PM_{10} (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 fuel	582	NA	NA	292	NA	NA
Domestic fuel combustion	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

Sources	TSP (tons/year)			PM_{10} (tons/year)		
	1993	**2001**	**2005**	**1993**	**2001**	**2005**
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

127. 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.

128. 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.

129. 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.

130. 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.

131. **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.

132. **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 current

water 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.

133. **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).

134. 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.

135. 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.

136. 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.

137. **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.

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

Table 15: 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 (^{o}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.coli cfu/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.

139. **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).

140. 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).

141. Sanitary conditions within Kathmandu Valley are hazardous (Halcrow Fox and Assocites, 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.

142. 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 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.

143. 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.

144. 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

145. The Rapid Environmental Assessment is in Annex 1.

146. 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.

147. The summary of the anticipated environmental impacts and the corresponding mitigation measures are shown in Table 16.

A. Design Phase

1. Environmental impacts due to project design

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

149. 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 laying of interceptors where slope stability is a concern.

150. 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. These may include covering the inlet works as typically majority of the odors are emitted from raw sewage, Wastewater sludge reduction measures using the latest available appropriate technologies should be used in the design. No trees will be cut and only overgrown grass will be cleared. To produce energy, sludge gasification will be used.

151. 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.

152. 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.

153. 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.

154. 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, such as Darbar Squares of Patan and Hanumandhoka, from the Department of Archaeology, and (iii) digging of roads from the Department of Roads and the concerned municipalities. Two UNESCO heritage sites (Kathmandu Durbar Square and Patan Durbar Square) are located in areas where sewer improvements are planned. 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. 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 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 Patan Square and Darbar Square: (a) no vibrating machinery near heritage buildings, (b) only hand digging will be allowed, (c) informing the community prior to daily construction of sections, (d) ensuring no blockage to tourist areas, (e) putting up clear signage related to KUKL works, (f) 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.

155. 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.).

156. 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).

157. 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.

158. All the WWTPs should have buffer zones. As land areas for the WWTPs have already been defined and residents are nearby, it is suggested that a minimum of 30 m green buffer zone along the site boundary with trees with thick foliage be planted to minimize nuisance due to odor, noise, lights, and improper operation and maintenance (O&M).

B. Construction Phase

1. Environmental impacts due to project construction

a. Physical Environment

Soil erosion and slope stability due to excavation

159. 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.

160. 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.

161. 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.

162. 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.

Change in river hydrology and morphology

163. 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

164. 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.

165. 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.

166. ***Pollution due to air, noise, and vibrations***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.

167. 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) prohibiting the operation of crushing plants and construction vehicles between 7 p.m. and 6 a.m. in residential areas; (ix) compensating the damages caused by vibrations to buildings, and (x) providing ventilation in confined working areas. Annex 7 gives the recommended standards for vibration in construction sites.

168. Adverse impacts could be caused due to inadequate buffer zones around pumping and treatment plants to alleviate noise and other possible nuisances, and protect facilities. Adequate mitigating measures (including developing buffer zones around the treatment plants) should be included in the project design. Noise should be monitored as provided for in Annex 6. As land areas for the WWTPs have already been defined and there are residents nearby, it is suggested that a minimum of 30 m green buffer zone along the site boundary with trees with thick foliage be planted to address nuisance due to odor, noise, lights and improper O&M. To avoid disturbing religious ceremonies, construction activities in Guheswori treatment plant should be restricted in consultation with the head priest of the temple. For example, worshippers visit the temple from about 5 a.m. to 9 a.m. during which no construction activities should be done.

b. Biological Environment

169. 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, disruption of protected areas, 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.

170. Mitigation measures consist of the following: (i) cutting only the trees that are marked and have been agreed with the Department of Forestry 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 and community forests. To save the fisheries and riverbed aquatic ecology, work should be done in the dry season only and river diversions and bunding of sections should be carried out.

c. Socio-Economic and Cultural Environment

Compensation

171. 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

172. 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. Mitigation is to be done through coordination with concerned utilities personnel and the local people, detailed design drawings, geotechnical testing in sensitive areas, and traffic management and emergency response plans. When excavating trenches for the installation of new sewers in heritage sites (e.g. Patan and Kathmandu Darbar Squares) manual labor shall be employed and the use of mechanical equipment avoided.

Influx of outside workers, money, and unwanted activities

173. 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

174. 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

175. 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

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

Dislocation of archaeological artifacts

177. Kathmandu Valley has a rich and varied cultural heritage, including many temples, ghats, stupas, and shrines. The archaeological and cultural sites should be protected and in case of relocation, the local communities must be consulted. There is a risk that any work involving ground excavation could uncover and damage archaeological and historical remains. If there are any chance finds, work has to 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 Protection Act, 1956 and Rules, 1989.

178. The Ancient Monuments Preservation Rules 2046 (1989) states:

> ”4.1.1 Pursuant to Sub- section (5) of Section 3 of the Act, any person or Association willing to install telephone and electricity, to dig the land for drinking water and sewerage, to construct and repair the road, to shoot a film, cinema, to celebrate festival and fare, to dance or to park vehicles or to place the poster and photograph, shall have to submit an application to the Department, for its approval in format as prescribed in Schedule- 1 (Annex 8).”
>
> “4.3.2 If the Local Officer found any information of finding of any archaeological object in his working District he shall have to fill the description of such object in the form as prescribed in Schedule-4 (Annex 8) within 35 days from the date of finding of such object, and, if possible, the photograph of such project also shall have to be sent to the Chief Archaeology Officer”.

179. Two areas fall under the UNESCO Heritage sites (Kathmandu Durbar Square, and Patan Durbar Square) where wastewater improvements are planned. Prior permission will have to be taken from the Department of Archaeology as stated in The Ancient Monuments Preservation Rules 2046 (1989) Section 4.1.1 above.

Traffic management

180. 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 Appendix 10 of the IEE prepared for NEP: Kathmandu Valley Water Supply Improvement project as mentioned in paragraph 169 (Annex 11). 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.

C. Operation Phase

181. The release of untreated wastewater or sewage could cause downstream pollution and adversely impact the aquatic ecosystem and pose health risks to humans. The following should be undertaken to address the impacts: Treat the wastewater to meet the prescribed effluent standards of BOD_5 or less before releasing it to the receiving waters. Regularly monitor the quality of the treated wastewater and that of the receiving water both upstream and downstream (Annex 3). Operate the WWTPs using a risk management based approach to ensure optimal operation of the plant at all times. This will include the development and implementation of a WWTP safety plans which are similar to a hazard analysis and critical control point plan (HACCP) prior to the commissioning of the WWTPs. All WWTP safety plans will need to be submitted to ADB for review and endorsement prior to plant commissioning. WWTPs will also need to employ programmable logic controllers for plant operation.

182. 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.

183. 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.

184. 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 Environment, Science

and Technology to control illegal waste discharges into the sewers. A trade waste policy, including setting discharge criteria from industries, needs to be developed.

185. 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, including safety showers at the WWTP sites, should be provided.

186. Improper operation and breakdown of the WWTP will lead to the accumulation of untreated wastewater 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. A green buffer zone made by planting trees around the WWTP boundary should be established so that residents living next to the WWTP do not get annoyed by the foul smell and noise. Standby generators should be provided (the diesel generator is the second backup power.) The first 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 is not operated for long hours using diesel generators. The constant source of electricity supply, if available, will also be used. Emergency response procedures have to be developed and implemented (The plant operation will follow the Hazard Analysis and Critical Control Point Plan and programmable logic controllers).

187. Inert grit from grit chambers should be collected and dispose of at landfill sites. The char from gasification plants can be used as construction material.

188. 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. 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

189. 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.

190. 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.

191. 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 the

registered 30,284 NGOs working in the environmental protection sector, 514 were from Kathmandu, 69 from Lalitpur, and 9 from Bhaktapur. They include Batabaran Samrachahan Tatha Digo Bikasko Lagi Yuba Sakti, Bishnumati Yuba Club, Buddhanagar Yuwa Samuh, Batabaran Samrachhan Samudaya, Nepal Batabaran Club, Friends of Environment, Swacha Pani Tatha Batabaran Samuha etc.

192. All wastewater treatment plants should have a basic laboratory for the analysis of wastewater and a dedicated, trained, and qualified laboratory technician.

Cumulative Impacts

193. 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.

194. 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.

195. 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.

196. 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.

197. 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.

Transboundary and Cumulative Impacts

198. There will be no environmental trans-boundary and cumulative impacts with respect to air pollution and loss of habitat. However, with respect to water pollution, the Bagmati river will be less polluted than it is today when it reaches the Indian border. 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 City and starts decreasing at Teku Dovan (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.

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

Table 16: Summary of Mitigation Measures for Sewerage Systems and WWTPs

Project Stage	Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibility	Cost (NRs)
Pre-project activity (Project Design)	Incorporation of critical areas in project design	Soil erosion and slope instability	Incorporate measures and sites for handling excessive spoil materials Incorporate drainage plan into the final design Geotechnical investigations to be carried out prior to design of interceptors Design technical specifications to include minimum vegetation clearance and avoid areas where slope stability is a concern	Design Supervision Consultant (DSC)/ Kathmandu Upatyaka Khanepani Limited (KUKL)/ Project Implementation Directorate (PID)	DSC cost
	Training preparation	Health and safety of the community and workers Operations and maintenance (O&M)	Prepare training in Nepali (or local languages) with notes and sketches on community health and safety and potential occupational health and safety Prepare training in Nepali with notes and sketches, erection of signage in construction areas	DSC/KUKL/PID DSC/KUKL/PID	DSC cost DSC cost
	Location of sewers	Interference with other utilities (telephone lines, electric poles, and wires, and water lines)	Identify locations of utilities in detailed design documents to prevent disruption of services during construction. Conduct detailed survey of all services; obtain constructed drawings where possible. Provide budget for restoration/replacement of damaged utilities and a contingency plan in case of disruption.	DSC/KUKL/PID	DSC cost
	Estimation of sludge volume (wastewater) and provision for their treatment	Sludge waste problem	Incorporate sludge reduction measures using gasification into the design to generate power to run the wastewater treatment plan (WWTPs)	DSC/KUKL/PID	DSC cost
	WWTP design	Odor emission	Conduct air quality dispersion modeling during design of WWTP Design technical specifications to include appropriate odor control measures/ technologies including appropriate environmental buffer to be maintained (i.e. tree screening etc).	DSC/KUKL/PID	DSC cost
	Incorporation of bypassing arrangements	Health hazards caused by the overflow of sewage	Provide bypassing arrangements to control overflow since sewerage network will be in built-up areas; detailed design to minimize overflow and flooding and storm water ingress	DSC/KUKL/PID	DSC cost

Project Stage	Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibility	Cost (NRs)
			management.		
	Location of water and sewage pipes in the same trench	Contamination of water supply due to sewage infiltration, causing health hazards and disease outbreaks	Place water pipes and sewers in different trenches opposite to each other (if on the same side, the bottom of the water service pipe must be at least 0.3 meters (m) above the top of the sewer line to avoid seepage with the water pipe above the sewer); ensure close coordination between water and sewerage system designers	DSC/KUKL/PID	DSC cost
	Digging of trenches for laying sewers	**Disruption of archaeological and historic remains**	Consult the Department of Archaeology before digging in archaeological areas of Patan, Bhaktapur, and Kathmandu and along river ghats and consider alternative sewer alignments. Conduct detailed survey of the area before construction.	DSC/KUKL/PID	DSC cost
Preparation for construction	**Preparation of project site**				
	Consult relevant persons and submit applications to get approvals. Submit agreement and permits to DSC for official information	May result in social conflict and legal obstructions resulting in the delay of works	Obtain letters of approval and agreement for (i) temporary acquisition of land and properties, (iii) disruption of water supply and irrigation canals, (iv) get required permits (e.g. cutting trees, construction works in heritage sites and religious river ghats from the Department of Archaeology) Transfer land and treatment plant in the Kathmandu Valley Water Supply Management Board (KVWSMB)'s name. Provide detailed designs, initial environment examination (IEE), etc. to relevant authorities. Sites to be demarcated and sign posted. Affected communities to be consulted and due notifications given for possible interruptions due to construction.	KVWSMBKUKL/PID	None
	Construct temporary workforce camp	Haphazard camps resulting in social stress and degradation of the local environment	Establish temporary workers camps with sanitary amenities at designated sites only. As Nepal has no standards regarding number of ablution blocks to be constructed in temporary labor camps, follow the 1 toilet for every 15 persons (separate for men and	Contractors/ DSC	Contractor cost

Project Stage	Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibility	Cost (NRs)
			women) based on the IFC Guidelines. In Kathmandu, most of the laborers will be local who will not stay in the camps.		
	Make employment policy for local and affected people based on the environmental management plan	The local people may be deprived of opportunities, minors may be employed	Employ local people (not under age 16) especially the affected families and women . Settle wage rates based on the District Wage Evaluation Committee (DWEC) and provide the list of employees to DSC.	Contractors/ DSC	Contractor cost
	Baseline photographs of project area (including buildings and temporary sites) and river water quality	False claims from people; water quality changes due to construction	Take photographs of buildings and temporary sites before construction for verification; measure water quality of rivers and streams before construction.	KUKL/DSC	DSC cost
	Prepare traffic plans	Traffic congestion and public annoyance	Prepare traffic plans to prevent traffic jams and annoyance by the public.	KUKL/DSC	DSC cost
Construction phase	**Construction Activity**				
	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 matting); 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		

Project Stage	Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibility	Cost (NRs)
			dewatering to use settlement tanks.		
		Runoff from construction areas including stockpiled materials	Use temporary bunds and catchment basins. Grade soil/sand stockpiles to prevent erosion.		
		Excavation and laying of pipeline/ siphons 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		
		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 reservoir excavations, including temporary supply provided if flow is affected; provide permeable base and side backfill at deeply excavated reservoir sites or an alternate source of drinking water at the existing location.		
	Quarrying from river bed	Change in river hydrology and morphology	Do not allow quarrying/mining activities in river/streams to extract construction materials and change the river cross sections and longitudinal profiles.	Contractors/DSC	Contractor cost
	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 bunded areas for storage.	Contractors/DSC	Contractor cost

Project Stage	Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibility	Cost (NRs)
			Dispose of any wastes generated by construction activities in designated areas. Provide training to workforce on safe handling of toxic materials and occupational health and safety measures during construction. Use personal protective equipment at all times while on site.		
	Quarrying 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. Limit vehicle speed to 10-15 km/hr; 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 Operation of construction machineries and equipment Horn honking	Noise and vibration	Monitor noise levels regularly at site to meet the noise standards (Annex 6) Fit mufflers in vehicles to control noise. Limit the speed of vehicles. Ban the use of power horns in vehicles. Regularly maintain the equipment. Prohibit the operation of crushing plants and construction vehicles from 7 p.m. to 6 a.m. in residential areas. Compensate the damages caused by vibration if caused by construction activities.	Contractors/DSC	Contractor cost

Project Stage	Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibility	Cost (NRs)
	Construction of project structures	Vegetation clearance Damages to fisheries and aquatic ecology of riverbeds and habitats.	Cut only trees that are marked and have been approved by the Department of Forestry. Plant and rear tree saplings at the rate of 25 saplings for each felled tree. Do construction during dry season only and use river 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 such as irrigation canals, electricity poles, telephone lines, drinking water pipes, sewerage lines, roads, 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	KVWSMB cost
	Influx of outside workforce, money, and unwanted activities.	Increase in crime and community stress	Prohibit gambling and alcohol consumption in contractors' camp sites. Instruct the workforce to respect the local cultures, traditions, rights, etc. Provide security in contractors' camps.	KVWSMB/KUKL/Contractor	Contractor cost
	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 checkups, 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	Contractors/DSC/KVWSMB/KUKL	Contractor cost

Project Stage	Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibility	Cost (NRs)
			• 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 from wastewater treatment plants. • 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.		
	Laying of sewers	Delivery and unloading of pipes and fittings: pipes may move/roll or be tampered with by others	Provide secure stockpile for pipes and fittings; unload and stock pipes strictly in accordance with the manufacturers' recommendations and minimize height of pallets/stockpile; use correct manual handling techniques and mechanical aids where possible; carry pipes close to the ground while moving and control lifted weights.	Contractors/DSC	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.		
		Traffic can cause personal injury to the	Develop a traffic control plan and keep areas clean and clear of obstacles.		

Project Stage	Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibility	Cost (NRs)
		public, contractors, and employees; and vehicle accidents.			
		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.		
		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.		
		Excavation by plant and equipment will create noise, falling objects, damage to existing surfaces, material spillage, and injuries by moving parts.	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 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.		
		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.		
		Sloping ground can	Maintain good housekeeping (remove		

Project Stage	Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibility	Cost (NRs)
		cause the falling of rolling objects.	debris, trip hazards, site tidiness). Select locations to minimize potential for movement. Stack materials at level below excavation. Secure/retain potential falling/rolling objects.		
		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. Provide submersible pump to dewater trenches where ground is water-charged. Use personal protective equipment. No load/personnel movement across trench.		
		Falling into trenches	Install a shoring system. Where possible backfill trenches. Erect 1.8 metre (min) security fence if open excavation is to be left unattended, or cover open excavation with steel plating if left unattended. No personnel movement across trench.		
		Other risks associated with confined spaces such as gases etc.	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.		
		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. Provide necessary personal protective		

Project Stage	Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibility	Cost (NRs)
			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.		
		Contaminated soil can cause impact on health of persons.	Use protective clothes/shoes/gloves.		
		Defective materials can cause injuries	Visual inspection of materials by experienced persons.		
		Storage of hazardous materials can cause injuries and illnesses.	Handling and storage to be done carefully under guidance.		
		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.		
		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. Have a first aid kit at the site.		
		Public hazards due to inadequate compaction, construction refuse, and inadequate re-surfacing	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		

Project Stage	Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibility	Cost (NRs)
		during site restoration.	or uneven surfaces and erect fence around hazardous areas until they are safe and restored.		
		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.		
		Weather conditions (e.g. hot, cold, wet, flooding/inundation, high winds) can cause dehydration and dizziness.	Supply adequate drinking water in the work area.		
		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.		
		Untidy site can cause slips and falls.	Keep worksite clean and tidy at all times, free from clutter and rubbish. Store materials in designated areas as specified in site plans		
		Materials stored may be dislodged and fall onto people or property particularly when site is unattended.	Store materials safely by barricading or fencing the area.		
		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.		

Project Stage	Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibility	Cost (NRs)
		Public safety may be at risk due to improper storage of plant.	Store/park plant and equipment off site and in a secure area.		
		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.		
		Soil erosion, silt runoff, and settling of street surfaces. Water could get polluted, land values degraded and be a nuisance to pedestrians. Street surfaces would settle, bringing about ponding of water.	Precautionary measures should be taken during construction such as backfilling of excavated trenches. Construction activities should be, as far as possible and avoided during the rainy season. Provide temporary diversions and sign boards for pedestrians.		
		Workers and the public are at risk from accidents on site	Prepare and implement a site health and safety plan that includes these measures: exclude the public from all construction sites ensure that workers use protective equipment provide health and safety training for personnel follow documented procedures for site activities keep accident reports and records As far as possible, the local people (who know the local conditions) should be hired.		
		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.		
		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		

Project Stage	Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibility	Cost (NRs)
			to avoid seepage with the water pipe above the sewer)		
	Dislocation of archaeological artifacts, if any	Loss of archaeological and cultural sites Finding of any archaeological artifact 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 the Chief 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.	Contractors/DSC/KVWSMB/KUKL	KVWSMB cost
	Traffic management at construction sites	Traffic congestion (temporary disruption to local access due to open trenches, excavation across roads, or road closures due to construction).	Develop a traffic plan to minimize traffic flow interference from construction activities. Provide advance local public notification of construction activities, schedule, routing, and affected areas including road closures. Erect alternative routing signage in Nepali and English languages. Use steel plates or other temporary materials across trench facilities in key areas such as pedestrian access, sidewalks, and parking areas. Arrange for night-time construction for activities in congested/ heavy day-time traffic areas. Arrange for onsite "grievance handling" through the use of liaison officers. Undertake trench closure and facilitate surface rehabilitation or paving as quickly as feasible.	Contractors/DSC	Contractor cost
Operational Phase	Release of inadequately treated wastewater to river	Downstream pollution, health and environmental risks.	Treat wastewater to meet the effluent standards (50 mg/l BOD_5 or 15 mg/l BOD_5 at Gokarna and Guheshwori) before releasing it to receiving waters; regularly monitor (using online meters hooked up to the SCADA network) the quality of the treated wastewater and that of	KUKL/KVWSMB	KUKL cost

Project Stage	Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibility	Cost (NRs)
			the receiving water upstream and downstream from the outfall. Develop and implement a WWTP safety plans (similar to HACCP plans).		
	Overflow flooding	Hazards to public health and the environment due to overflow flooding and groundwater pollution	Ensure careful design and operation of wastewater system to meet peak wastewater loads of 3 times the dry weather flow; provide stand-by generators for pumping stations. Train operators for regular inspection, cleaning, and maintenance of plant and sewers.	KUKL/KVWSMB	KUKL cost
	Discharge of industrial wastes	Hazards to public health and the environment due to overflow flooding and groundwater pollution	Train workers in OHS hazards and provide PPE; monitor illegal discharge of industrial wastes to the system through regular audits/spot inspections of the industries in the catchment area; monitoring of DO and electrical conductivity at the inlet of the WWTPs and enforce strict regulations in coordination with the Ministry of Environment, Science and Technology. Storage of treatment chemicals in designated areas that are bunded.	KUKL/MOEST	KUKL cost
	Sewer cleaning	Health and safety of sewer cleaning staff at risk of communicable diseases	KUKL to ensure operation and maintenance staff of sewerage system are fully aware of the hazards in running the system by training them in hygiene procedures to avoid infection from wastewater and sludge handling and health and safety procedures against exposure to hazardous gases; workers to be inoculated against infectious diseases and kept under medical supervision; emergency procedures to be developed by KUKL; protective clothing provided to sewer cleaning workers.	KUKL/KVWSMB	KUKL cost
	WWTP operation	Improper operation and breakdown will lead to accumulation of untreated wastewater that may cause smell and nuisance	Prepare a WWTP safety plan for the WWTPs that will include standard operating procedures (SOP) including automated operation of the WWTPs (automatic shut down procedures etc).	KUKL	KUKL cost

Project Stage	Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibility	Cost (NRs)
		to the surrounding residential areas	Provide regular training to the staff. Provide a green buffer zone by planting trees around the WWTP boundary (appropriate buffer to be determined following air quality dispersion modeling at the design stage). Provide standby generators (the diesel generator is the second backup power. The first is the power generated from the gasification plant.) In Dhobighat WWTP, the existing solar plant of 680 kw capacity will also be used so the WWTP is not operated for long hours from diesel generators. The constant source of electricity supply, if available, will also be used.		
		Spill and contamination from fuel and lubricants	Recover used oil and lubricants, and reuse or remove them 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 must be 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.		
	Grit (from WWTP) and char (from gasification plant) collection and disposal	Grit can reduce the efficiency of the WWTP	Collect inert grit from grit chambers and dispose of at landfill sites Char from gasification plants can be used as construction material.	KUKL	KUKL cost

Project Stage	Project Activity	Potential Environmental Impacts	Proposed Mitigation Measures	Institutional Responsibility	Cost (NRs)
	Sewer line system maintenance	Hazards due to blockage of sewer lines causing overflows and nuisance to people and serious health and sanitation problems; contamination of soil and groundwater	Workers/operators likely to be working in sewers and confined spaces to be provided with safety equipment/gas detectors and awareness and safety training. Explosive gases generated in the sewage treatment process (e.g. methane / carbon monoxide) to be collected and either flared or used for power generation. Fire extinguishers and training to be provided. Workers who come in contact with raw or partially treated sewage and sludge to be provided with protective wear (e.g. gum boots, gloves and face masks). Provide sufficient staff and equipment for cleaning; establish a system for registering public complaints (grievance redress mechanism) and urgent clearance of system blockages.	KUKL/ KVWSMB	KUKL cost

DSC = Design and Supervision Consultant, DWEC = District Wage Evaluation Committee, IEE = initial environment examination, KUKL = Kathmandu Upatyaka Khanepani Limited, KVWSMB = Kathmandu Valley Water Supply Management Board, MOEST = Ministry of Environment, Science, and Technology, PID = Project Implementation Directorate, WWTP = wastewater treatment plant.

VI. ANALYSIS OF ALTERNATIVES

A. Without the Project / Zero Option

200. Rapid urbanization and population growth have resulted in uncontrollable deterioration of the environment of Kathmandu Valley. The Bagmati Action Plan 2009-2014, mentions “The urbanization of the Kathmandu Valley is strongly related with the river systems. The process of urbanization is now more rapid and massive, mainly because it is now rampant in the Kathmandu Valley. The present trends in the Valley clearly reflect that there will be a growing pressure on limited resources. The direct impacts of present urbanization are especially visible in the Bagmati River and its tributaries”. Untreated domestic wastewater is on the increase contributing to the pollution of surface waters and groundwater. The drinking water quality and quantity have also decreased bringing adverse impacts to human health. Physical, chemical (BOD and TSS increasing above the threshold levels), and the biological environment in the rivers of the Kathmandu Valley has depleted significantly. At the origin in Sundarijal, the BOD is 1.3 mg/l, increasing to 65.0 mg/l as it moves downstream to Khokana and similarly TSS increases from 5 mg/l to 70 mg/l (MWSP, 2000) (Annex 2). “Different studies show that there are significant decreases in aquatic diversity due to highly polluted water especially in the urban core areas. The trend of decreasing aquatic biodiversity increases as the river flows down to the urban core (Bagmati Action Plan, 2009-2014, pg. 25)”.The water quality downstream has also been affected thereby decreasing the Quality of Life. The adverse impacts on the social and cultural environment will be: increase in water borne diseases; unusable river water for irrigation and other purposes; loss in aesthetics (due to smell etc.), cultural values and deterioration of cultural sites (ghats, temples and shrines) if the project does not go ahead.

201. A study done by KAPRIMO (2007) has mentioned that the water quality and quantity has reached alarming situations and that most of the Valley rivers are extremely polluted which has adverse impacts on the overall urban environment and human health. UN-HABITAT (2008) mentions “The general public should be made aware that the health costs are much higher than the investment for WWTPs”. So, without secondary treatment of the wastewater, lives of the people of the Kathmandu Valley and its environment would get worse. The Kathmandu Valley is deteriorating in terms of social life, health hazards, income poverty and environmental consequences. If all the negative consequences are valued in terms of the economic value this will be a huge economic loss to the nation.

B. With project

202. With the project, the wastewater will be treated to an improved quality that meets National standards before being discharged to the river. The discharge of improved effluent will improve the quality of the river overtime and improve its aquatic life. There is also the possibility of using the treated wastewater for agriculture and reuse. There will be a dramatic decrease in diseases and improvement in the health of the people (thereby, the Quality of Life) and the ecosystems. Tourism, one of the main industries, will flourish because of the environmentally friendly Kathmandu Valley.

203. The wastewater collection networks feeding the existing 6 KUKL wastewater treatment plants will be cleaned, rehabilitated and extended, where practical, to include recent urban areas. The treatment technologies of the plants will be upgraded in order to cater for the larger population that has developed since originally constructed.

204. The wastewater interceptors have been routed along the rivers and tributaries by the roads and in such a way so as to avoid agricultural land as much as possible. Wastewater has been discharged into rivers through hundreds of small sewers and drains and so the river bank is the best location to intercept the sewage and convey it to the WWTP. Building byelaws and HPCIDBC have specified the Right of Way from 4 to 40 m along the Valley rivers where the government can lay interceptors without legal complications and least amount of disturbance to the public. Furthermore, the Government will not have to purchase any land but just compensate for the crops destroyed while laying the interceptors. Correct use of machinery to avoid heavy human work and maximizing use of human labour, where it is applicable in construction of trenches and installation pipes. The construction schedule will be planned to avoid the rainy season as much as possible.

205. Quantifying environmental and health benefits is difficult because of the need for data to establish the magnitude of the impacts of the improvements and to separate out the effects of an improved sewerage system from other factors such as personal hygiene habits, housing standards, water quality, health department campaigns, etc.

206. Compared to the zero-option (no project at all) the proposed options will bring a positive environmental change, improve the public health of the project area population and improve the wastewater management system in the Kathmandu Valley. This in turn will contribute to the improvement of the water quality of the river overtime.

VII. INFORMATION DISCLOSURE, CONSULTATION, AND PARTICIPATION

207. 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.

208. 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.

209. FGDs were not thought to be necessary for Guheswori WWTP because there is enough land for the addition of another modern unit and maintenance of the existing unit; and at Dhobighat WWTP as recently there have been a number of strikes and bandhs from the local people opposing the rehabilitation of squatters that were evicted from the Bagmati River banks and tensions prevailed.

210. A Focus Group Discussion for the proposed rehabilitation, laying of new sewer pipelines was also held in Khasi Bazaar, Ward no 5, Kirtipur Municipality. The main complaint was

overflow of sewage from the small sized sewer due to clogging of solid waste and people wanted a larger sized sewer and separation of stormwater from sewage so that the stormwater could be used for irrigation (Annex 9).

211. People of Ta Dhoka, Lalitpur, Maru Dhoka, Kathmandu and Panga, Kirtipur had similiar comments that they wanted public participation in project implementation, a donor agency for the project, an implementation agency and better improved services. People from Purano Jagati, Bhaktapur (with poor households) and Jagritinagar want livelihood training programs for women and employment in projects (Annex 9).

212. 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 17 and in Annex 9.

Table 17: Meetings, workshops, consultations and focus group discussions held

SNo.	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 Madhyapur Thimi Municipality	4	Engineer and Community Development Officer of Municipality, PPTA Team
6	24 April 2012	Scope and objectives of PPTA -7936; ongoing activities and FGD on problematic areas of Kirtipur Municipality	3	Municipality Engineer, PPTA Team
7	26 April 2012	FGD on identification of project intervention areas	17	Kirtipur Municipality, Lalitpur Sub-Metropolitan City, Bhaktapur Municipality, Madhyapur Thimi Municipality, KVWSMB, KUKL,PID, PPTA Team
8	31 May 2012	Ongoing activities of CBP Team, status of sewer networks, GIS activities in KUKL	6	CBP Team Leader, GIS expert, PPTA Team
9	22 June 2012	Meeting on coordination on the wastewater sector	13	MoUD, HPCIDBC, PID, KUKL, Kathmandu Metropolitan City, KVWSMB, PPTA
10	28 June 2012	FGD in Sallaghari WWTP	14	Local people
11	29 June 2012	FGD in Kodku WWTP	8	Local people(refused to sign their presence)

SNo.	Date	Topic	No. of participants	Institutions
12	29 June 2012	Ongoing activities of DSC under HPCIDBC, design criteria of sewer lines	15	PID, KUKL, BDA, Stakeholders
13	9 July 2012	FGD in Ta Dhoka Purnchandi, Lalitpur	12	Local people
14	10 July 2012	FGD in Maru Dhoka, Kathmandu	12	Local people
15	13 July 2012	FGD in Khasi Bazaar, Kirtipur	11	Local people
16	16 July 2012	FGD in Jagritinagar	20	Local people
17	16 July 2012	FGD in Panga, Lachi, Kirtipur	11	Local people
18	17 July 2012	FGD in Gokarna VDC Ward 6 on WTP	15	Local people
19	18 July 2012	FGD in Shantinagar Baneshwor	10	Local people
19	19 July 2012	FGD in Thola Byasi, Bhaktapur	20	Local people
20	20 July 2012	FGD in Purano Jagati Bhaktapur	14	Local people
21	14 August 2012	Consultative Stakeholders Workshop on Interim Report	53	PID, ADB, MOUD, KUKL, HPCIDBC, PPTA Team, Municipalities

213. 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.

214. Consultations have been made with the UNESCO office in Kathmandu (Annex 8) who advised the Project to "...make necessary coordination with the Department of Archaeology throughout the initial planning to implementation stages. The Ancient Monument Preservation Act for the Protected Monument Zones would be the basis for the safeguard activities within the Protected Monument Zones (Annex 8)".

215. Mr. Bhim Prasad Nepal, the Chief of the National Archives, the Department of Archaeology, who was involved in the drafting of the Ancient Monuments Preservation Rules 2049 (1989), considered that an Archaeological Impact Assessment (AIA) would not be necessary for the Project since all works would be done in the existing public roads. However, an application should be made by KUKL/PID to the Department of Archaeology with detailed drawings of the proposed work according to the prescribed format (Annex 8) for obtaining permission to proceed.

216. 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 Madhyapur Thimi, Bhaktapur, and Kirtipur Municipalities Offices.

217. 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 firm will continued 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 WWTP areas where people have different opinion for the construction of WWTP.

218. The community awareness consultant will 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 was 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.

VIII. GRIEVANCE REDRESS MECHANISM

219. A grievance redress mechanism (GRM) will be 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.

220. **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.

221. **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.

222. **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.

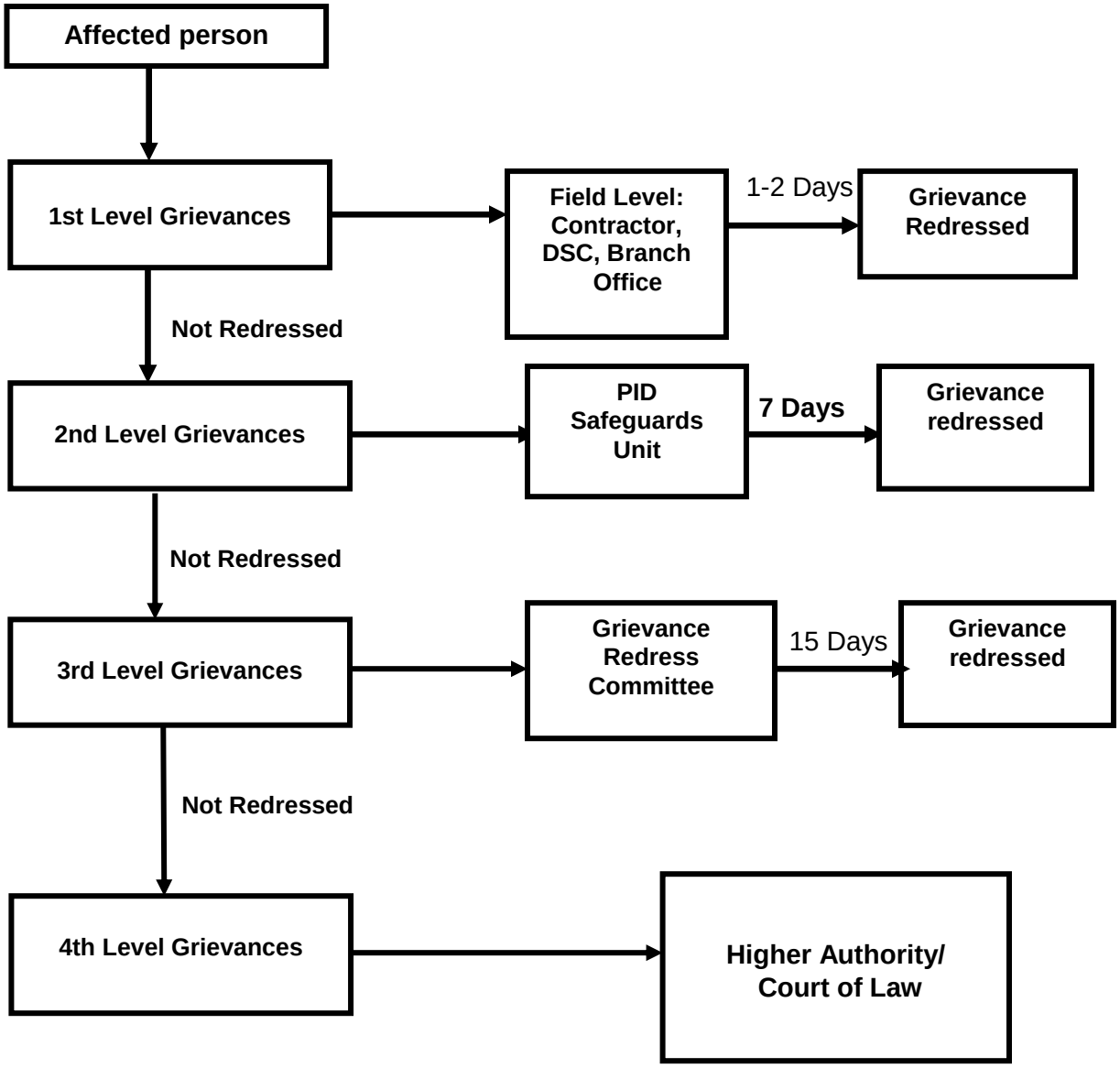
223. **Fourth level of GRM.** In the event that a grievance is not addressed by the contractor, DSC, branch office, PID, or GRC, the affected person can seek legal redress of the grievance in the appropriate courts, the fourth level of the GRM, which is the formal legal court system. The grievance redress mechanism and procedure is depicted in Figure 10.

224. **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)

225. 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.

Figure 10: Grievance Redress Mechanism (GRM)



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

IX. ENVIRONMENTAL MANAGEMENT PLAN (EMP)

A. Environmental Management Plan and Objectives

226. 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 - pre-construction, 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

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

228. A detailed self-explanatory environmental management and monitoring program is presented in Table 18. 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.

229. 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 18: Environmental Management and Monitoring Plan

Impacts / Project Activities	Monitoring Plan					
Impacts due to	Mitigating Measures	Parameters to be monitored	Measurements	Location	Frequency	Responsibility
DESIGN PHASE						
Soil erosion and slope instability	Incorporate drainage system in final design	Review if detailed drainage systems with plans have been designed	None	Design document, Technical specifications	Twice (once after first draft and once before final approval)	DSC/KUKL/PID and experts as required
Sludge disposal	Incorporation of optimum sludge reduction using gasification in design for power generation.	Review if designs for sludge management have been made	Design considerations	Design document, Technical specifications	Twice (once after first draft and once before final approval)	DSC/KUKL/PID and experts as required
Health and safety of community and workers	Prepare training manuals in Nepali (or local languages) with notes and sketches on Community Health and Safety and Potential Occupational Health and Safety	Review information for errors and quality	None	Notes and sketches	Twice (once after first draft and once before final approval)	DSC/KUKL/PID and experts as required
Treatment plant inefficiency	Develop and Implement HACCP plans as part of the O&M manuals and provide in Nepali with sketches and regular training to the staff	Operation of plant as per HACCP Plan and O&M Manual. Operational reports (including incidence reports)	Audit of HACCP Plans and O&M manuals (Audit reports) Submission of operational reports	Treatment Plants	Annually Quarterly	DSC/KUKL/PID
PRE-CONSTRUCTION ACTIVITIES						
Permits and Approval	Consult with relevant government authorities and municipalities and obtain required permits and approval and agreement for disruption of utilities, working in heritage sites, digging	Letters of Approval, Permits and submitted to DSC for information /action	Whether approvals have been received from authorities	Project Office/Site Office	Once	KUKL/PID/DSC/Contractors

Impacts / Project Activities	Monitoring Plan					
Impacts due to	Mitigating Measures	Parameters to be monitored	Measurements	Location	Frequency	Responsibility
	roads and cutting trees					
Lack of public consultations and awareness programs	Develop and implement a project communications plan to make the stakeholders feel they are part of the project and it belongs to them.	Implementation of communications plan throughout the project. Arrange meetings, workshops and group discussions to disseminate project final designs, plans and activities	Audit of communications plan (Audit reports) Number of meetings, awareness programs held	Project sites	Bi-annually for the first 2 years of the project then annually. As required throughout the Project duration	KUKL/PID/DSC
Workforce camps	Establish temporary workforce camps with sanitary amenities at designated sites only	Ensure temporary workforce camps are established within designed area with sanitary facilities and first aid facilities	Visual inspections of wastewater disposal, solid waste management, noise and air pollution, health of workforce, potable drinking water, kerosene availability	Project site	Monthly	Contractors and DSC
CONSTRUCTION PHASE						
Job opportunity	Employ local people (not under age 16). Settle wage rate based on DWEC and provide the list of employees to DSC	Number of local persons employed, number of under-aged people employed. Whether the wage rate is at par with DWEC	List of employees , nationality, age of employees, wages	Project site	During construction every month	Contractor and DSC
Change in hydrology and morphology of streams and rivers	Quarrying/mining activities in river/streams for extraction of construction materials shall not be done so as to change the river cross sections and longitudinal profiles. Ensure that irrigation canals are not blocked due to construction activities. Ensure that existing flows of stone	Cross sections of river before construction and during construction upstream (at the quarry site, upstream and downstream) and river discharge	Cross-section of river; Visual inspection, discussion with locals, discharge measurements using flowmeters and photographs before and during construction	Along the construction lengths of the municipalities	During construction every month Regularly	DSC/Contractors

Impacts / Project Activities	Monitoring Plan					
Impacts due to	Mitigating Measures	Parameters to be monitored	Measurements	Location	Frequency	Responsibility
	spouts are not disturbed due to construction activities.					
Soil erosion and slope stabilization	Separate stockpiling of topsoil for further use; spoil disposal at designated and stabilized sites; excavated areas' backfill to be compacted and include replacement of topsoil; avoid work during the rainy season as much as possible; mulching to stabilize exposed areas; use bioengineering techniques (e.g. re-vegetating areas promptly); provide channels and ditches for post-construction flows; lining of steep channels and slopes (e.g. use of jute matting); prevent off-site sediment transport using settlement ponds, silt fences Use of settling basins at reservoir sites; use of straw for filtering of small discharges; routine inspection and monitoring of larger discharges to watercourses. Use of temporary bunds; use of catchment basins below steep reservoir sites. Construction to be done in the dry season only; use of river diversions with	Drainages systems Stockpiling of top soil for its re-use Bio-engineering measures Management of excessive spoil materials	Site drawings showing drainage system in project sites. Visual inspections, photographs and the local people's views if excavation and other site works have caused soil erosion; stockpiling of excavated soils have been done or not (logbook on transportation of excess spoil materials from the site); whether spoils have been disposed in approved areas or not and whether the contractor has taken mitigation measures or not (site plan showing areas for disposal with bunding etc). Number of trees or saplings planted Site operations log book (to determine if construction works is being carried out in the wet or dry season). Log book of water delivery to people being served.	Project Site	During construction (Weekly) Quarterly	Contractor/DSC

Impacts / Project Activities	Monitoring Plan					
Impacts due to	Mitigating Measures	Parameters to be monitored	Measurements	Location	Frequency	Responsibility
	bundings. Local wells and springs to be bunded from temporary spoil dumps; local wells and spring fed spouts or kuwas to be monitored particularly downhill of excavations plus temporary supply provided if flow is affected; permeable base and side backfill required at deeply excavated sites or an alternate source of drinking water provided at the existing location.					
Air Quality	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. Limit vehicle speed. See that vehicles comply with the National Vehicle Mass Emission Standards, 2056 BS. Regular maintenance of vehicles. Provide ventilation in confined working areas.	Operation of dust suppression tanks, sprinklers on site Stockpiles covered with appropriate sheeting. Vehicle maintenance records; renewal of “green stickers”. Ventilators in confined spaces	Visual inspection if water is sprinkled or not; logbook of operation of dust suppression trucks. Photographs of stockpiles, visual inspection reports Check maintenance records and “green stickers”. Inspection reports of site plans and no of ventilators (meets international standards).Site drawings showing location of ventilators, no of ventilators	Project location Project location Project location	During construction/ every week During Construction/ every day Weekly Before construction and during construction(half yearly) Weekly inspection	Contractor/ DSC Contractor/ DSC Contractor/DSC

Impacts / Project Activities	Monitoring Plan					
Impacts due to	Mitigating Measures	Parameters to be monitored	Measurements	Location	Frequency	Responsibility
Noise level and vibration	Monitoring of noise levels regularly at site. Fit mufflers in vehicles to control noise. Limit the speed s of vehicles. Ban the use of power horns in vehicles. Regular maintenance of equipment. Prohibit the operation of crushing plants and construction vehicles between 7 PM to 6 AM. Compensate the damages caused by vibrations.	Baseline noise level Adoption of noise level control measures as specified; vehicles with mufflers installed or not; speed limit signage erected; maintenance schedule of equipment; operation log of crushing plants. Nearby structures/buildings in construction areas.	Sound level (dBA); feedback/complaints from nearby residents; number of vehicles installed with mufflers; number of vehicles with/without power horns; number of speed limit signage at the project site; inspection reports/photographs of nearby buildings/structures for cracks before/during construction	Project Site Project Site Project Site	Every week Before and During Construction	Contractor/ DSC KUKL/Contractor/ DSC KUKL/PID Contractor /DSC
Waste management	Store all materials, toxic, non-toxic and hazardous materials in safe place (warehouse). Collect, segregate and dispose waste at designated areas	Waste management plan Log of collection and disposal of waste from the site	Check amount of solid waste generated and if solid waste management is carried out efficiently. Audit of waste management plans; inspection of disposal areas/site plan drawings, photographs etc.	Project site	During the construction period	KUKL/Contractor/ DSC
Vegetation Clearance	Provide LPG/kerosene to workforce. Stockpile the felled trees and take permission from concerned authority for its use Plant and rear tree saplings at the rate of 25 saplings for each felled tree.	Cutting of only the specified and marked trees; use of timber and wood; availability of LPG/kerosene; plantation @ 25 tree saplings per cut tree Permits for tree felling and its use	Check records of trees cut and planted; whether LPG/kerosene is available in camp sites. Photographs, expiry date of permits and number of permits etc.	Project Site	Regularly	Contractor/DSC

Impacts / Project Activities	Monitoring Plan					
Impacts due to	Mitigating Measures	Parameters to be monitored	Measurements	Location	Frequency	Responsibility
Affected roadside business and people	Compensate people doing roadside business and provide disturbance costs. Arrangement of a "grievance redress committee". Establish technical committee to assess compensation for damages caused by vibration.	Compensation measures as specified implemented or not. Operation of technical committees, compensation claims	Check records of payments and discuss with affected people. Number of claims, number of complaints; minutes of technical committee etc.	Project Site	As required	KVWSMB/KUKL / PID/Contractor /DSC/Grievance redress committee
Damaged infrastructures and services	Reinstate/relocate community assets that are disturbed such as irrigation canals, electricity poles, telephone lines, drinking water pipes, sewerage lines, roads, etc. to the a standard as before and/ or better.	Reinstatement of structurally damaged infrastructures like temples, bridges, irrigation channels, electricity poles, telephone lines, drinking water pipes, sewers, access roads, cracks in buildings etc.	Field observation to visually assess if disturbed community assets are reinstated. Design drawings and technical specifications showing areas for potential reinstatement, photographs before and after construction in sensitive areas etc.; emergency response plans	Project Site	Once construction in the area is over.	KUKL/ PID/Contractor /DSC/
Crime and community stress	Prohibit gambling and alcohol consumption in camp sites. Instruct the outside workforce to respect the local cultures, traditions, rights etc. Provide security in camps	Situation of social disharmony Awareness program. Workers/ Staff conduct policy	Crime records and causes; camp issues; enforcement of remedies; security situation in camps. Audit of staff/ workers conduct policy	Project Location	Once a month Once a month	Contractor /DSC

Impacts / Project Activities	Monitoring Plan					
Impacts due to	Mitigating Measures	Parameters to be monitored	Measurements	Location	Frequency	Responsibility
Health and hygiene	Provide regular health checkups, sanitation and hygiene, training in community health and safety, OHS measures, health care, and control of epidemic diseases to the workforce. Launch awareness programs concerning human trafficking and the possibility of spread of STDs and HIV/AIDS using brochures, posters, and signboards. Make available first aid kits, ambulance and fire extinguishers in camp sites.	The use of safety equipment by workforce The provision of health measures and training Awareness program Signs and posters Compensation for health	Health records; records of outbreak of diseases; maintenance of health clinic; health complaints; number of awareness programs launched; number of persons trained.	Project Site	Every week	Contractor/ KUKL/ KVWSMB/DSC
Archaeological and cultural heritage sites	Protect archaeological and cultural heritage sites: In case of relocation, consult the local community Inform the Chief District Officer (in case of chance finds) 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. Use manual labour for digging trenches and avoid heavy equipment and pneumatic drills.	Surveys and discussion with local residents and community Notification to CDO and Department of Archaeology before works are to begin Availability of workers and equipment to undertake the	Field observation of archaeological and cultural sites and number of chance finds to authorities. No. of notifications sent and meeting minutes/ letters of correspondence Design and technical specification documents specifying requirements. No of workers available etc	Project site	Every month Before construction is to commence	Contractor/SE/ KVWSMB/KUKL/DSC

Impacts / Project Activities	Monitoring Plan					
Impacts due to	Mitigating Measures	Parameters to be monitored	Measurements	Location	Frequency	Responsibility
		works				
Traffic Management	Develop a traffic plan to minimize traffic flow interference from construction activities. Advance local public notification of construction activities, schedule, routing, and affected areas including road closures. Erect signage in Nepali and English languages. Use of steel plates or other temporary across trench facilities in key areas such as foot trails or livestock routes; arrange for pedestrian access and sidewalks and parking areas. Arrange for night-time	Working schedules and traffic plans. Information about construction schedule to the local people	Visual observation of traffic; complaints from travellers and locals; existence of signage and effectiveness of speed control and diversion measures.	Project site	Every week	Contractor/DSC

Impacts / Project Activities	Monitoring Plan					
Impacts due to	Mitigating Measures	Parameters to be monitored	Measurements	Location	Frequency	Responsibility
	construction for activities in congested/ heavy day-time traffic areas. Undertake trench closure and facilitate rehabilitation as quickly as feasible.					
Operation Phase						
Discharge of industrial wastes to WW treatment System	Train workers in OHS hazards and provide PPE; monitor illegal discharge of industrial wastes to the system and enforce strict regulations in coordination with the Ministry of Environment, Science and Technology	Observation; implementation of training plans, OHS policy, implementation of trade waste policy. Monitoring at the inlet of WWTPs for electrical conductivity and DO using online instrumentation.	Visual observation, audit of training plan, OHS policy and trade waste policy. EC (for electrical conductivity), mg/L (for DO)	Nearby Industries	Once a month	KUKL/MOEST
Wastewater release	Treat wastewater to meet the effluent standards before releasing it to natural surface sources; regular monitoring the quality of the treated wastewater and that of the receiving water.	Quality of treated wastewater that will be released to river (TSS, BOD_5, and heavy metals in mg/l; pH, T (^0C) as mentioned in Annex 3)	Influent BOD/COD, pH, TSS, T, heavy metals; effluent BOD/COD, pH, TSS and heavy metals; stream water quality (TSS, T, BOD/COD, pH)	At the WWTP outlet and downstream of wastewater release	Regularly during operation (fortnightly)	KUKL
Overflow flooding	Careful operation of wastewater system according to the Operation Manual and HACCPP; provide stand-by generators for pumping stations.	Standby generators in operating conditions with sufficient fuel (the diesel generator is the second backup power. The first is the power generated from the gasification plant. In Dhobighat WWTP, the	Visual observation Audit of O&M manual, schedules, HACCP plans. No of incident reports	Treatment plants	Once a month	KUKL

Impacts / Project Activities	Monitoring Plan					
Impacts due to	Mitigating Measures	Parameters to be monitored	Measurements	Location	Frequency	Responsibility
	To ensure O&M, training of operators to be provided for regular inspection, cleaning and maintenance of plant and sewers.	existing solar plant of 680 kw capacities will also be used. So WWTP is not expected to be operated for long hours from diesel generators. The constant source of electricity supply, if available will also be used). Emergency response procedures have to be developed and implemented. . Operation and maintenance schedules Trainings conducted	View training records		Once a year	
Sewer cleaning	KUKL to ensure operation and maintenance staff of sewerage system are fully aware of the hazards in running the system by training of operation and maintenance staff in hygiene procedures to avoid infection from wastewater and sludge handling and health and safety procedures against exposure to hazardous gases; workers to be inoculated against infectious diseases and kept under medical supervision; emergency	Trainings provided Medical records of workers	Visual Observation Visual observation whether PPEs are used	Along sewer cleaning points (manholes)	Once a month	KUKL

Impacts / Project Activities	Monitoring Plan					
Impacts due to	Mitigating Measures	Parameters to be monitored	Measurements	Location	Frequency	Responsibility
	procedures to be developed by KUKL; protective clothing to sewer cleaning workers.	Use of PPE				
Sewer line system operation	Workers / operators likely to be working in sewers and confined spaces to be provided safety equipment / gas detectors with awareness and safety training. Fire extinguishers and training to be provided. Workers who come in contact with raw or partially treated sewage and sludge to be provided with protective wear (e.g. gum boots, gloves and face masks). Provision of sufficient O&M staff and equipment for cleaning; system to register public complaints (Grievance Redress Mechanism) and urgent clearance of system blockages.	Availability of safety equipment and protective clothing and provision of safety training; catchment plans implemented, sewers designated to take peak loads O&M Staff availability; and existence of Grievance Redress Mechanism	Visual observation and checks; review of complaints and actions taken Audit of catchment plan, public awareness communications (brochures, newsletters etc.) to educate public on what not to put down drains to avoid blockages; design drawings of network showing key valves and automatic shutdown measures if there are blockages and/or an overflow in a section of the network.	Treatment plants, sewer network	Once a month	KUKL
Health and safety	Provide trainings to workers on OHS	Number of trainings given	Quizzes and interviews, audit of OHS policy, number of workers participated etc.	Plant sites	Once a month	KUKL

C. Implementation Arrangements

1. Environmental Procedures and Institutions

230. The Ministry of Environment, Science and Technology (MOEST) is in charge of environmental control and management for all sector agencies. The Ministry of Urban Development (MoUD) 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 MOEST. In case of an Initial Environmental Examination (IEE), the final approval lies with MoUD.

231. The MOUD 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, MOUD, 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.

232. 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,

- The Ancient Monuments Preservation Rules 2046 (1989) mentions:

  ”4.1.1 Pursuant to Sub- section (5) of Section 3 of the Act, any person or Association willing to install telephone and electricity, to dig the land for drinking water and sewerage, to construct and repair the road, to shoot a film, cinema, to celebrate festival and fare, to dance or to park vehicles or to place the poster and photograph, shall have

to submit an application to the Department, for its approval in format as prescribed in Schedule- 1 (Annex 8).

Two areas fall under the UNESCO Heritage sites (Kathmandu Durbar Square, and Patan Durbar Square) where wastewater improvements are planned. Prior permission will have to be taken as stated in The Ancient Monuments Preservation Rules 2046 (1989) Section 4.1.1, as stated above.

233. Table 19 defines the roles of different organisations and groups in environmental monitoring:

Table 19: Institutional/organizational responsibilities in environmental monitoring

SNo.	Organization	Roles and Responsibilities		
		Pre-construction phase	Construction phase	Operation phase
1	**Ministry of Environment, Science and Technology**	• review and approve EIA reports and approve all mitigation measures. • review monthly monitoring reports.	• review monitoring report to examine: (i) whether or not all recommended measures have been implemented, (ii) effectiveness of these measures, (iii) implementation of compliances, and (iv) employment of an independent third party monitoring consultant once a year.	• project auditing after two years of operation.
2	**Ministry of Urban Development (MoUD)**	• review IEE document and submit to donors; approve IEE report, • review design and tender documents in order to examine whether or not mitigation prescriptions	• review EMP Report (i) to ensure EMP implementation (ii) effectiveness of the implementation measures and (iii) compliance	• review bi-annual monitoring reports, and • annual site inspection.

SNo.	Organization	Roles and Responsibilities		
		Pre-construction phase	Construction phase	Operation phase
		are included, and instruct KUKL.		
3	**Kathmandu Valley Water Supply Management Board (KVWSMB)/ Kathmandu Upatyaka Khanepani Limited (KUKL) and Projection Implementation Directorate (PID)**	•review final design and tender documents and forward them to MoUD, •instruct PID to update RAP and get it approved, •establish 'Safeguard Unit/Utility Management Coordination Sub-committee /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 (i) mitigation implementation (ii) effectiveness (iii) enhancement programs (iv) appoint monitoring team (v) ensure public participation (vi) RAP implementation (vii) environmental compliance and (viii) prepare quality monitoring report to submit to MoUD/ MOEST.	•ensure smooth operation of water supply and sewerage systems
4	**Design and Supervision Consultant (DSC)**	•incorporate all provisions of EMP in the final design, •incorporate all mitigation measures in the tender documents,	•approval of construction works •monitoring of the contractor's performance on EMP implementation	

SNo.	Organization	Roles and Responsibilities		
		Pre-construction phase	Construction phase	Operation phase
		• 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.	/ mitigation effectiveness / impact monitoring • labor employment as per regulations • instruct contractor for corrective actions • impose fine/or null payment in case of non-compliance 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 socio-economic environment in the project area • conduct trainings and Community Awareness and periodic meetings with stakeholders and • submit monthly and bi-annual progress reports, including monitoring results and	

SNo.	Organization	Roles and Responsibilities		
		Pre-construction phase	Construction phase	Operation phase
			mitigation activities.	
5	**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

234. 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.

235. 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.

236. 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

237. 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.

238. A domestic Community Awareness and Participation Consultant (CAPC) firm will be hired to 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.

239. 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 program has been estimated at $ 4,000. The orientation program will consist of (i) environmental issues in WWTP construction and the laying of sewers, (ii) implementation of mitigation measures, (iii) monitoring of implementation and (iv) preparation of the Environmental Mitigation Execution Plan.

240. Costs for the operation and maintenance phase trainings of KUKL staff, including monthly monitoring of influent and effluent wastewater quality of the WWTP, noise and air quality will be included in the WWTP construction contract for 5 years.

241. 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 a 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 $600 that will be borne by the project. According to the Resettlement plan, 10 ha of agricultural land will be disrupted during the laying of interceptors amounting to compensation of US$ 25,850.

242. The annual and total environmental cost for 5 years is given in Table 21.

Table 20: Annual estimated environmental cost

No.	Item	Cost per year (US$)	Total Cost (US$)
1	Cost of public awareness campaign and IEC	30.000	150,000
2	Awareness training to contractors (one day) (lump sum)	4,000	4,000
Total Cost		34,000	154,000

4. Implementation Schedule

243. Detailed design of WWTP packages will begin in the mid of 2013, interceptors package and sewer network will begin in third quarter 2013. Construction is scheduled to commence in the mid of 2014 to be completed by mid of 2018.

244. The project implementation schedule is given in Figure 11 for a period of 5 years. Most of the activities have been scheduled on a continuous basis.

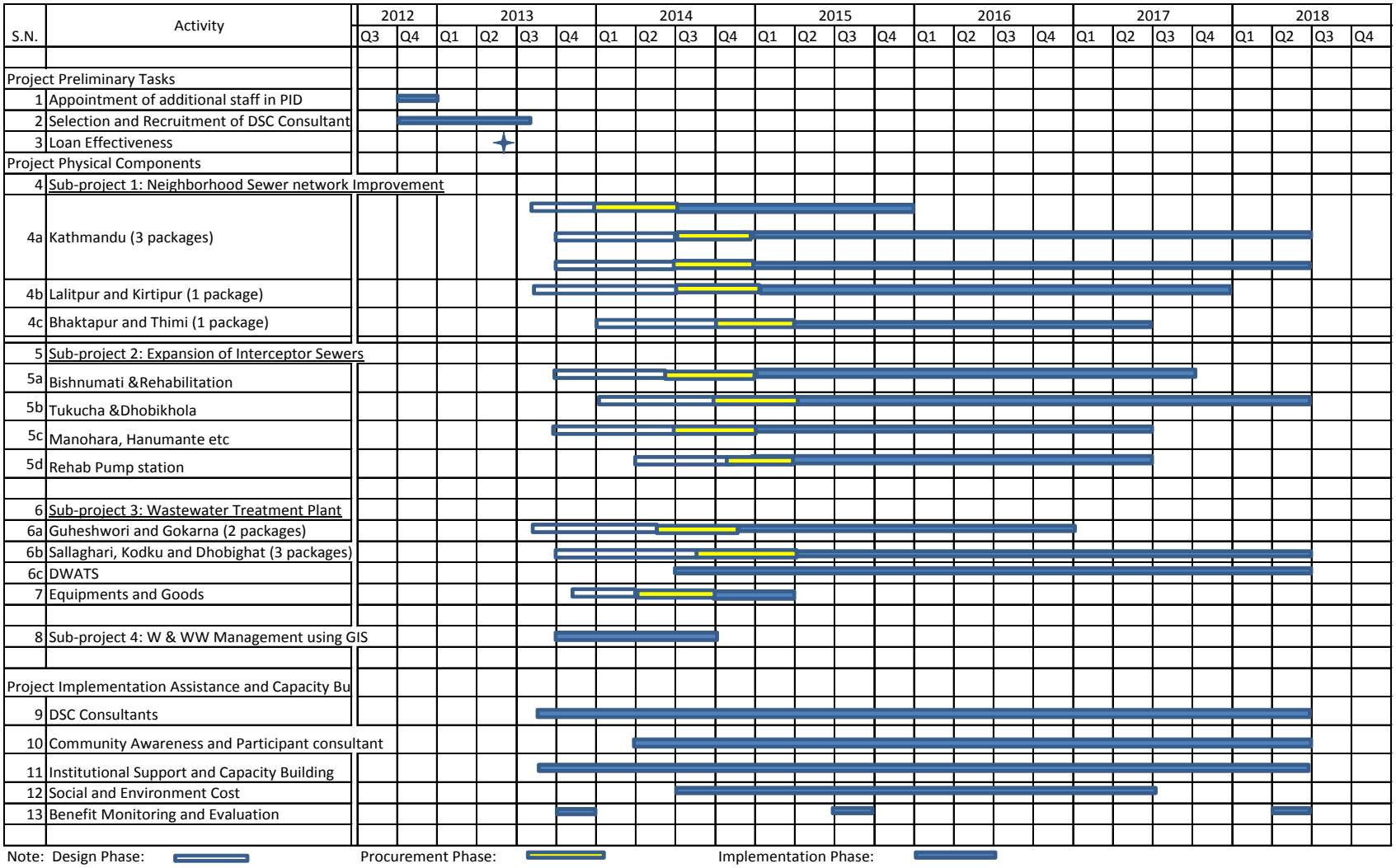
245. Under the General Manager of KUKL, there is a Technical Division (headed by a Deputy Technical Manager). Under the Technical Division, there are 10 Branch Offices in the Valley headed by a Deputy Manager each. Before operation, KUKL/PID/DSC, with the help of the Safeguards Unit and the Technical 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.

246. 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.

247. 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.

Figure 9: Project Implementation Schedule

Proposed Project Implementation Schedule



X. CONCLUSIONS AND RECOMMENDATIONS

248. 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.

249. The project will contribute significantly to the improvement of the health and quality of life of the people due to the wastewater improvements in Kathmandu Valley.

250. 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.

251. 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.

3. **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/ constructed in existing sites owned by the Government.
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 construction approval will be sought from Department 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 Protection Act, 1956 and Rules, 1989.

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.
▪ 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 discharge standards and monitoring through regular audits conducted by health inspectors.
▪ 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.

Screening Questions	Yes	No	Remarks
▪ 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.
▪ 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. Personnel will also be provided with relevant inoculations.
▪ 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.

Screening Questions	Yes	No	Remarks
▪ 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

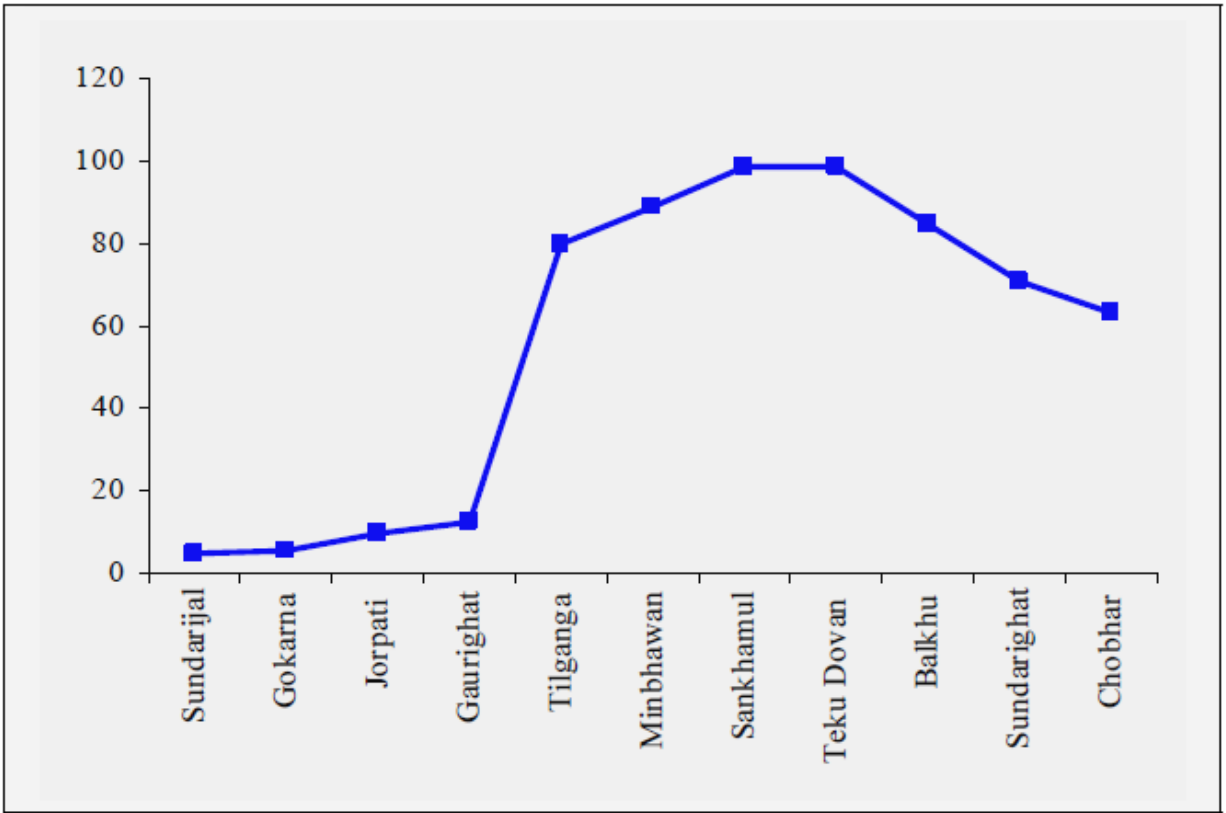
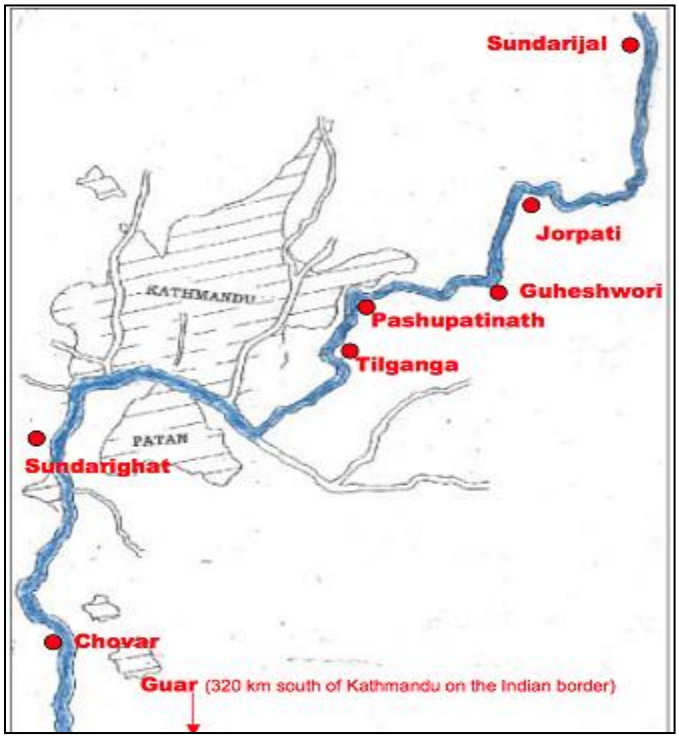


Fig. 2.6. BOD level in average at different locations of Bagmati

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



Locations along the Bagmati River

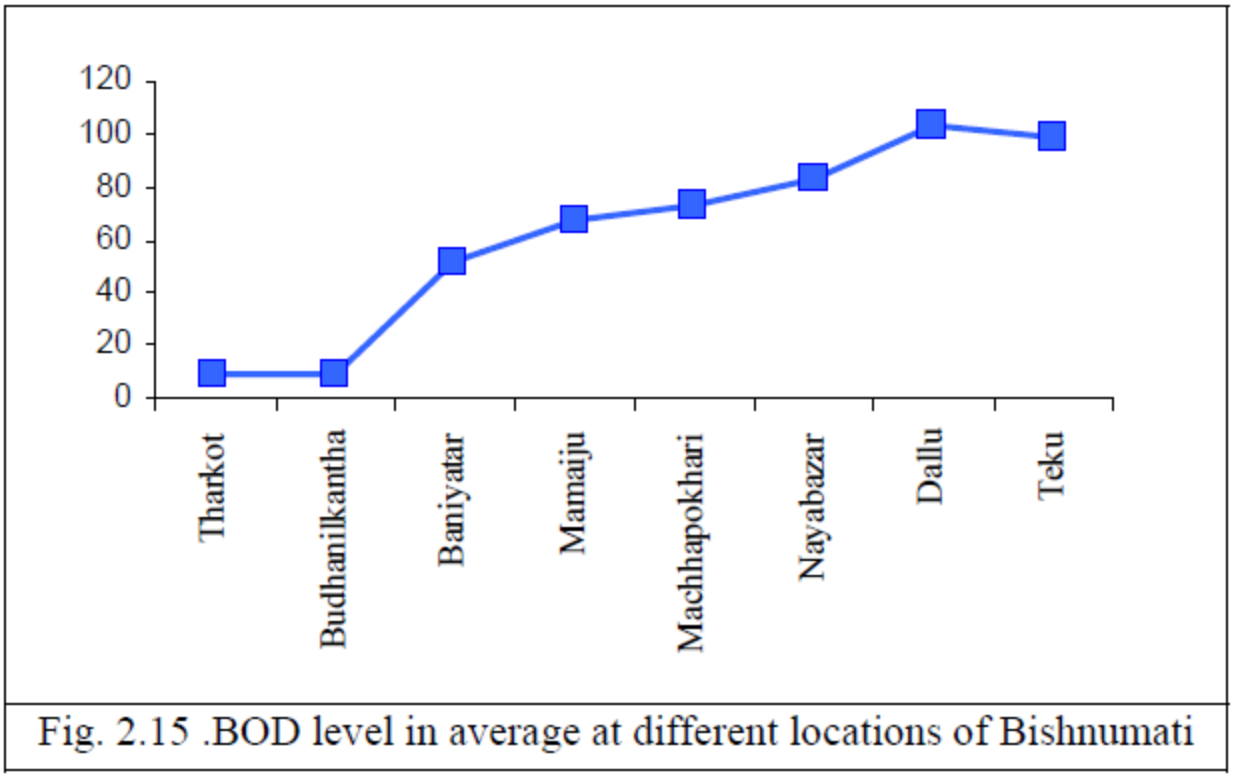


Fig. 2.15 .BOD level in average at different locations of Bishnumati

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

Table 3.1. Water quality parameters

Parameters	Sundarijal	Khokana
TSS mg/l	5	70
Chloride mg/l	1	24
Ammonia mg/l	0.03	11
BOD mg/l	1.3	65
Coliform counts per 100 ml	1000	1,000,000
DO mg/l	8.9	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

Polluted Bagmati River

Appendix 3: Tolerance limits for wastewater to be discharged into inland surface waters from 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) Civil Aviation Act, 1958
3) Aquatic Animals Protection Act, 1960
4) Plant Protection Act, 1964
5) National Parks & Wild Life Conservation Act, 1987
6) Public Road Act, 1974
7) Trust Corporation Act, 1976
8) Tourism Act, 1978
9) King Mahendra Nature Conservation Trust Act, 1982
10) Soil & Watershed Conservation Act, 1982
11) Nepal Petroleum Act, 1983
12) Nepal Electricity Authority Act, 1984
13) Mines & Mineral Act, 1985
14) Pashupati Area Development Trust Act, 1987
15) Solid Waste (Management & Resource Mobilization) Act, 1987
16) Town Development Act, 1988
17) Kathmandu Valley Development Authority Act, 1988
18) Nepal Water Supply Corporation Act, 1989
19) The Constitution of the Kingdom of Nepal, 1990
20) Pesticides Act, 1991
21) Village Development Committee Act, 1991
22) District Development Committee Act, 1991
23) Municipality Act, 1991
24) Water Resources Act, 1992
25) Forest Act, 1992
26) Electricity Act, 1992
27) Motor Vehicle & Transportation Management Act, 1992
28) Labour Act, 1992
29) Industrial Enterprises Act, 1992
30) Nepal Tourism Board Act, 1996
31) Environment Protection Act, 1996
32) 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) Khaptad National Park Rules, 1987
9) Ancient Monuments Protection Rules, 1989
10) Solid Waste (Management & Resource Mobilization) Rules, 1989
11) Water Resources Rules, 1993

12) Pesticides Rules, 1993
13) Labour Rules, 1993
14) Electricity Rules, 1993
15) Forest Rules, 1994
16) Buffer Zone Management Rules, 1995
17) Royal Bardiya National Park Rules, 1996
18) Conservation Area Management Rules, 1996
19) Vehicle & Transportation Management Rules, 1997
20) Environment Protection Rules, 1997

Appendix 5: National Ambient Air Quality Standards for Nepal

Parameters	Units	Averaging Time	Concentration in Ambient Air, maximum	Test Methods
TSP (Total Suspended Particulates)	$\mu g/m^3$	Annual	-	
		24-hours*	230	High Volume Sampling
PM_{10}	$\mu g/m^3$	Annual	-	
		24-hours*	120	Low Volume Sampling
Sulphur Dioxide	$\mu g/m^3$	Annual	50	Diffusive sampling based on weekly averages
		24-hours**	70	To be determined before 2005.
Nitrogen Dioxide	$\mu g/m^3$	Annual	40	Diffusive sampling based on weekly averages
		24-hours**	80	To be determined before 2005.
Carbon Monoxide	$\mu g/m^3$	8 hours**	10,000	To be determined before 2005.
		15 minute	100,000	Indicative samplers ***
Lead	$\mu g/m^3$	Annual	0.5	Atomic Absorption Spectrometry, analysis of PM_{10} samples****
		24-hours	-	
Benzene	$\mu g/m^3$	Annual	20	Diffusive sampling based on weekly averages
		24-hours	-	

***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.	Noise Exposure (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: Recommended Standards for Vibration from Construction Sites

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

Source: Vibration Regulation Law 64 of 1976, Japan

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: Schedules 1 and 4 of the Ancient Monuments Preservation Rules 2046 (1989)

Schedule-1

(Relating to Sub- rule 4.1.1)

Department of Archaeology
…….

I am / We are going to carry out the following construction work in …… monuments conserved zone, located in ……of……..District, ……..Zone, within the Following time period. Therefore, I/ We have field this application for obtaining the approval of the Department. I am / We are ready to bear any punishment, as per the prevailing laws, if construction work is made other than written in this application.

Description of the construction work, which is going to be carried out within the monuments conserved areas and tentative time period to complete the construction: - ……

Of the applicant,

Name and Surname –

Signature –

Date –

Permanent Address–-

TemporaryAddress–

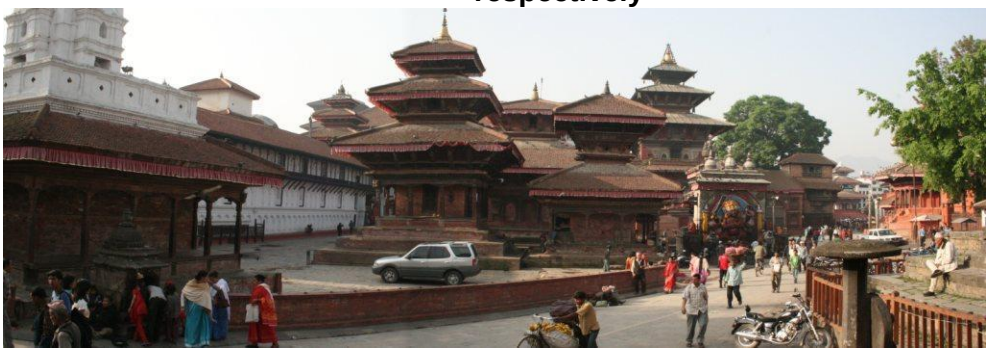
Schedule-4
(Relating to Sub-rule 4.3.1)
The Description of Archaeological Object Form-2

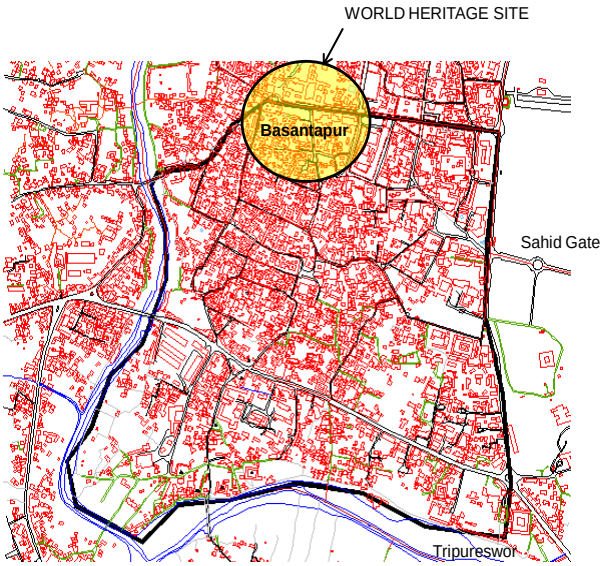
Zone:
District:

SNo.	Archaeological Object				Archaeological Object Found					Remarks
	Name	Material Composition	Oldness (probable year)	Measurements (length, width, thickness etc.)	VDC/Municipality	Ward no.	Village	Tole	Description of area	

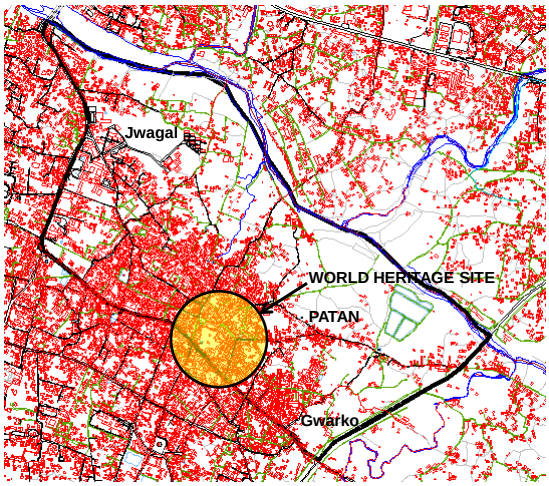
The Local Officer:
Date:
Modified by the Ancient Monument Conservation (First Amendment) Rules, 2049 (1992) Annex 10:

Heritage Sites: Patan Darbar Square and Kathmandu Darbar Square, respectively





LOCATION PLAN: Kathmandu Darbar Square



LOCATION PLAN: Patan Darbar Square

Gmail by Google

Kiran Bhattarai <kiran.bhattarai@gmail.com>

Heritage Sites

Shrestha, Nipuna <s.nipuna@unesco.org> **Fri, Mar 5, 2010 at 2:41 PM**
To: Kiran Bhattarai <kiran.bhattarai@gmail.com>
Cc: info@doa.gov.np, "LIN Chih-Hung, Roland" <r.lin@unesco.org>, "Plathe, Axel" <A.Plathe@unesco.org>

Dear Kiran sir,

Thank you very much for your email informing the KUKL plan for the years 2012-2016 about laying out pipelines within the durbar square areas of Patan and Hanuman Dhoka which are included inside the Kathmandu Valley World Heritage Site (KVWHS).

As for the concern for UNESCO, I would like to let you know that the Department of Archaeology (DoA), under the Ministry of Federal Affairs, Constituent Assembly, Parliamentary Affairs and Culture, is the state party to the 1972 convention concerning the protection of the World Cultural and Natural Heritage. So, it is very important that KUKL make necessary coordination with the DoA from initial planning to implementation process. The ancient monument preservation act for the Protected Monument Zones (PMZ) would be the basis for your activities within the PMZ. The site offices of DoA at each Monument Zone would also be able to help you for site-level coordination.

As you are also conducting environmental assessment, it seems that the project is a large-scale one, and the critical part for your consideration would be to protect the site and its heritage value, specially the Outstanding Universal Value, for which these monument zones have been inscribed within the KVWHS, from any adverse effects that may be caused by the project implementation. I am copying this email to the Department of Archaeology for their necessary information.

I hope the above will be of help for you.

Regards

Nipuna

From: Pant, Tap Raj
Sent: Monday, March 01, 2010 11:44 AM
To: Kiran Bhattarai
Cc: Shrestha, Nipuna
Subject: RE: Heritage Sites

Dear Bhattarai sir

Thanks for your e-email. I am forwarding this e-mail to our colleague (copied here) responsible for culture unit to respond you. Now she is on mission and hope she will answer back to you once she is back in the office on Wednesday, 3 March 2010.

Regards

Tap Raj Pant

From: Kiran Bhattarai [mailto:kiran.bhattarai@gmail.com]
Sent: Monday, March 01, 2010 11:39 AM
To: Pant, Tap Raj
Subject: Heritage Sites

Dear Tap Raj Pantaji

It was nice meeting you. KUKL (Kathmandu Upatayka Khanepani Limited) will be laying drinking water pipelines and sewers in the Darbar Squares of Patan and Hanumandhoka in the years 2012 to 2016. As we are conducting an environmental assessment of the project, we would be grateful if there are any UNESCO guidelines to be followed during the construction works in the Heritage Sites.

Thanks once again.

Best Regards

Kiran Bhattarai

Appendix 9: Focus Group Discussions, Stakeholders Consultations/ Workshops and Meetings

(A) Attendance Sheet of the Participants (...Focus Group Discussion - FGD...)

काठमाण्डौ उपत्यका शहरी वातावरण सुधार आयोजना
पि.पि.टि.ए (आयोजना तयारी प्राविधिक सहायता)
नं. ७९३६८ (नेपाल)
समुहगत छलफल सम्बन्धि उपस्थिती

शहरी विकास मन्त्रालय (Ministry of Urban Dev), काठमाण्डौ उपत्यका खानेपानी लिमिटेड (केयूकेएल), आयोजना कार्यान्वयन निर्देशनालय (पि.आइ.डी) को काठमाण्डौ उपत्यका शहरी वातावरण सुधार आयोजना अर्न्तगत Sallaghari WWTP फोहोरपानी सुधार प्लान्टको निर्माण, विस्तार र सुदृढिकरण कार्य गर्दा सामाजिक, आर्थिक, साँस्कृतिक क्षेत्रमा पर्न सक्ने प्रभाव विश्लेषण (Impact Analysis) सम्बन्धि विविध विषयमा निम्न व्यक्तिहरुको उपस्थितिमा छलफल गरियो ।

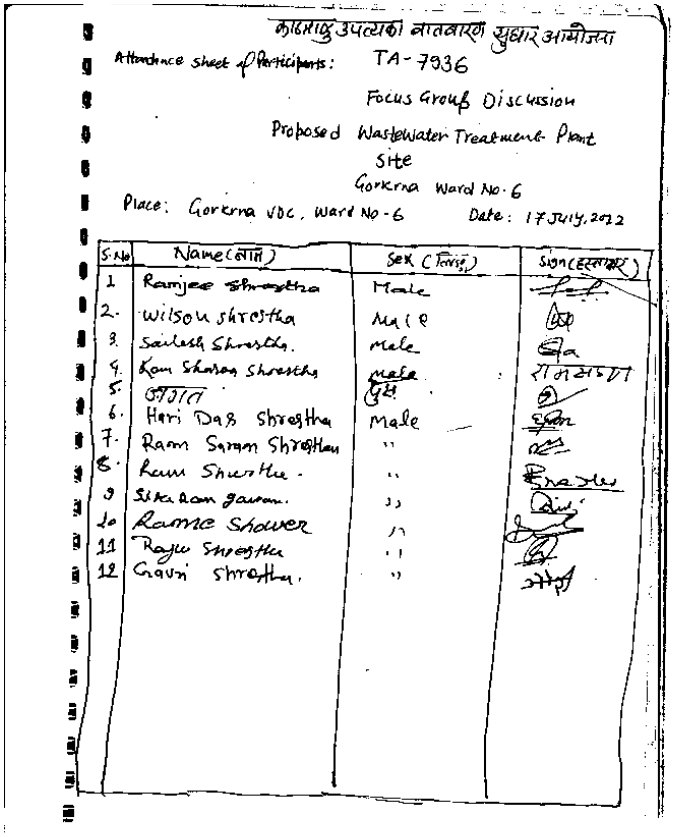
जिल्ला :- Bhaktapur नगरपालिका Bhaktapur स्थान :- Sallaghari मिति :- 28/06/2012

गा.वि.स./वडा नं. :- 15

सि.नं.	नाम	लिङ्ग	ठेगाना	पेशा	हस्ताक्षर
१)	[illegible]	पु.			
२)	लक्ष्मि नारायण श्रेष्ठ	पु.			
३)	दिनेश कुमार सुवाल	पु.			
४)	शिव [illegible]	पु.			
५)	लक्ष्मी प्र. कोइरी	पु.			
६)	रामहरी गाउ	पु.			
७)	महिश्वर श्रेष्ठ	पु.			
८)	द्वारका श्रेष्ठ वैद्य	पु.			
९)	राम केशरी	म			
१०)	[illegible]	पु.			
११)	दान बहादुर श्रेष्ठ	पु.			
१२)	[illegible]	पु.			
१३)	[illegible]	म			
१४)	पुष्पराज [illegible]	पु.			
१५)	राम [illegible]	पु.			

पुरुष : १२
महिला : २
जम्मा सहभागी : १४

FGD at Sallaghari Treatment Plant



काठमाडौं उपत्यका नालवारण सुधार आयोजना

Attendance sheet of Participants: TA-7936

Focus Group Discussion

Proposed Wastewater Treatment Plant Site

Gorkrna Ward No. 6

Place: Gorkrna VDC, Ward No-6 Date: 17 July, 2022

S.No	Name (नाम)	Sex (लिङ्ग)	Sign (हस्ताक्षर)
1	Ramjee Shrestha	Male	
2.	Wilson shrestha	Male	
3.	Sailesh Shrestha.	male	
4.	Ram Sharan Shrestha	male	
5.	[illegible]	[illegible]	
6.	Hari Das Shrestha	Male	
7.	Ram Saran Shrestha	"	
8.	Ram Shrestha.	"	
9	Sita Ram gauam.	"	
10	Ramie Shower	"	
11	Raju Shrestha	"	
12	Gauri Shrestha.	"	

FGD at GokarnaTreatment Site

Meeting Agenda

१) गोकर्ण वडा नं. ६ मा आधुनिक फोहरपानी प्लान्ट निर्माण, विस्तार गर्ने सम्बन्धमा

२) WWTP प्लान्ट तयार गर्दा आउनसक्ने समस्याहरु

३) पर्न सक्ने प्रभाव (Impact Analys) विश्लेषण र समाधानका उपायहरु बारे

निर्णयहरु

Agenda 1 मा छलफल गर्दा waste water treatment system लाई निम्न किसिमले गर्ने निर्णय गरियो

१) River bed treatment system लाई Split गरी Vetiver system बाट community base मा गर्ने

१क) प्रत्येक घरको sewerage लाई गुठेमा मा प्रयोग गर्ने

१ख) ठाउँको अभाव को कारण ठूलो प्लान्ट राख्न नसकिने।

२) सो काम को लागी सामुदायीक सहभागीता हुनु पर्ने।

FGD at GokarnaTreatment Site (continued)

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/ Focus Group Discussion for the Proposed Rehabilitation, laying of new sewer pipeline in Khasi Bazaar, Ward no 5, Kirtipur Municipality

Venue: Community building, Khasi bazaar, ward no 5, near police post
No. of participants:…….
Issues/ discussion

- The main sewer passes through this area. Due to the small size of the sewer, waste water always overflows in this area due to clogging of solid wastes.
- About 400 meter of a larger diameter sewer is required to be laid so as to solve the overflow problem.
- People are paying 50% tariff for sewerage, on the total drinking water tariff to KUKL, , People are ready to pay more if the sewerage system is improved.

- The local people have objected to the connection of a small diameter sewer in the upper side of *Togal Tole.*
- The existing road should be as rehabilitated to its original state after the replacement of bigger sewer.
- People are now using the old septic tanks because of the frequent overflow of wastewater from the sewer which was constructed in 2054 BS (1997).
- Stormwater pipes and sewers should be separated.
- If stormwater pipes are separated, the stormwater could be used for irrigation purposes by collecting it in the 3 existing ponds in this area which are now almost empty.
- There is also lack of space for solid waste disposal. People dispose their households waste into the streets or in the open places of the municipality though most of the people have compost bins (only for organics). The non-organic waste is disposed on the streets.

Consultation/ Focus Group Discussion for the Proposed Rehabilitation, laying of new sewerage pipeline in Sikucha, Panga, Ward no 10, Kirtipur Municipality
Venue: Sikucha, Panga, ward no 10, Kirtipur Municipality
No. of participants: 10
Date: 16 July 2012
Issues/ discussion

- Panga covers ward no 9, 10 , 11, 12 wards of the Municipality
- Almost all the ethnic /caste are Newars except Chetrri in Karki gaun.
- Kirtipur has one Municipality consisting of 19 wards and 8 VDCs
- There is no problem of sewerage pipe but the problem of outlet. At the moment all the discharge have been collected in 2 septic tanks constructed by PLAN International (INGO) about 15 years ago. The sewerage pipeline come from Bhatkepati. Na gau has been also connected from that pipeline.
- The sewerage pipeline can be connected to Sundarighat for treatment
- East belt of Panga area is most problematic, severe problem of clogging and overflow of waste water found in that areas.
- Community would fully support the project if implemented. If any grievances/ issues rose during the construction, the community will solve it.
- Regarding the tariff, each households is spending about Rs. 12, 000 per year for the management of wastewater. If the tariff increased by the government, people will accept it and ready to pay if constructed properly and covered all problematic areas.
- There should be separate storm water drainage and sewerage pipeline. This will solve the problem clogging and overflow from the sewerage pipeline.
- The sewerage problematic areas identified by the project does not cover all the areas so it should be update. Some problem areas are missing.
- There is already formation of one joint committee of 4 political party to look different problems of the area and to solve them. So there will be no problem of coordination in this area.

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 Sudhar Samittee* (Community Improvement Committee) for the development of community. Dirghayu Tole is a new settlement
- They have initiated to construct the sewerage pipeline.
- The settlement adjoin 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.

(B) Attendance Sheet of the Participants (Khasi Bazar)

काठमाण्डौ उपत्यका शहरी बातावरण सुधार आयोजना
पि.पि.टि.ए (आयोजना तयारी प्राविधिक सहायता)
नं. ७९३६८ (नेपाल)
समुहगत छलफल सम्बन्धि उपस्थिती

शहरी विकास मन्त्रालय, काठमाण्डौ उपत्यका खानेपानी लिमिटेड (केयूकेएल), आयोजना कार्यान्वयन निर्देशनालय (पि.आइ.डी) को काठमाण्डौ उपत्यका शहरी वातावरण सुधार आयोजना अर्न्तगत ढल संजाल बिस्तार, निर्माण तथा सुदृढिकरण कार्य गर्दा आयोजना क्षेत्रभित्रका विभिन्न बस्तीहरुमा पर्न सक्ने सामाजिक, आर्थिक, साँस्कृतिक क्षेत्रमा प्रभाव विश्लेषण (Impact Analysis) र न्युनतम आय भएका मानिसहरुको समस्या पहिचान र आयोजना तयारीमा समेटनु पर्ने सबालहरु■ सम्बन्धि विविध विषयमा निम्न व्यक्तिहरुको उपस्थितिमा छलफल गरियो ।

जिल्ला :- Kritipur नगरपालिका Kritipur स्थान :- Khasi Bazar मिति :- 13/07/2012

गा.वि.स./वडा नं. :- 5

सि.नं.	नाम	लिङ्ग	हस्ताक्षर
१)	किशोर कुमार महर्जन	पु.	
२)	श्याम गोपालन		श्याम
३)	सीमा मल्ल		सीमा मल्ल
४)	[illegible]	५२	
५)	[illegible]		
६)	पुण्य मान		
७)	सिद्धी गोपाल जोशी		
८)	[illegible]	५	
९)	सुदेला जोशी		
१०)	[illegible]		
११)	[illegible]		

FGD in Khasi Bazaar

(B) Attendance Sheet of the Participants (PANGA KRITIPUR**)**

काठमाण्डौ उपत्यका शहरी वातावरण सुधार आयोजना
पि.पि.टि.ए (आयोजना तयारी प्राविधिक सहायता)
नं. ७९३६८ (नेपाल)
समुहगत छलफल सम्बन्धि उपस्थिती

शहरी विकास मन्त्रालय, काठमाण्डौ उपत्यका खानेपानी लिमिटेड (केयूकेएल), आयोजना कार्यान्वयन निर्देशनालय (पि.आइ.डी) को काठमाण्डौ उपत्यका शहरी वातावरण सुधार आयोजना अर्न्तगत ढल संजाल बिस्तार, निर्माण तथा सुदृढिकरण कार्य गर्दा आयोजना क्षेत्रभित्रका विभिन्न बस्तीहरुमा पर्न सक्ने सामाजिक, आर्थिक, साँस्कृतिक क्षेत्रमा प्रभाव विश्लेषण (Impact Analysis) र न्युनतम आय भएका मानिसहरुको समस्या पहिचान र आयोजना तयारीमा समेटनु पर्ने सबालहरु सम्बन्धि विविध विषयमा निम्न व्यक्तिहरुको उपस्थितिमा छलफल गरियो ।

जिल्ला :- Kathmandu **नगरपालिका** Kritipur **स्थान :-** Panga Lachi **मिति :-** 16 July, 2012

गा.वि/स./वडा नं. :- 10+11

सि.नं.	नाम	लिङ्ग	हस्ताक्षर
1	इन्दु लाल श्रेष्ठ	पुरुष	
2.	सुर्य बहादुर श्रेष्ठ	पुरुष	
3	[illegible]	"	
4	प्रज्ञान भुइयाँ	"	
5	[illegible]	"	
6	[illegible]	"	
7	[illegible]	"	
8	[illegible]	"	
9	[illegible]	"	
10	[illegible]	"	

FGD in Panga, Kirtipur

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 Sub-Metropolitan 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	Madhyapur Thimi 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 detail

analysis 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 Khasyang Khusung 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 from newly developed areas and treatment of wastewater at Sallaghari WWTP.

B. Kirtipur Municipality:

Er. Bhola Krishna Maharjan informed that Kirtipur Municipality has an area of about 15 km^2 but the people are concentrated mainly in Kirtipur, Panga, Nagaon and Chovar. He briefed that Plan International constructed sanitary sewage of about 200 mm. dia. in 1991 for the population of 35, 000. Now the population increased upto 50,000 and some 30,000 students live in the city making total population of about 80,000. The population growth, open drain in some places and throwing of solid waste in sewers are some reasons, which cause sewerage problem in Kirtipur. The frequent overflow of sewage during rainy season is common phenomenon. The sanitary sewer has been converted into combined sewer, which obviously cannot withstand storm water. The major problematic areas are Naya Bazar and Vihar area. The foul smell in Vihar causes nuisance to many foreign visitors to the Vihar.

Only 50% of the second biggest settlement of the Kirtipur municipality i.e. Panga has been connected with piped sewerage system. Two community septic tanks were constructed but they have not been functioning properly in recent days and emit foul smell.

DUDBC recently assigned one consulting firm to prepare detail wastewater management plan of Kirtipur, which takes time to produce report.

The upgrading of sewer sizes in Kirtipur and laying of new sewer lines in Panga are two major issues in the municipality. The other settlements are practicing on-site sanitation system and will continue.

C. 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 Kodku Khola (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. The overflow of sewage is common in many places in core area after a spell of heavy rain. The main problematic flooding areas are Kumaripati, Mahapal, Kusunti and near Patan Campus..The main cause of flooding is due to inadequate size of main collector sewer but in some cases the inlet and outlet sewers are of appropriate size but the intermediate sewer are of inadequate size. . Some existing sewers are under the houses e.g. in Kumbheshwar area making it difficult to rehabilitate or to maintain. Mr Prabin Shrestha suggested that diversion of some sewage coming to core area of town (Mahapal area) to west side of town would relieve the load on existing sewer at Mahapal and municipality is working towards making such diversion.

The major problematic areas are as follows:

S.N.	Area	Ward No.
Flooding Area		
1	Mahapal	18, 22
2	Patan Campus	21, 10
3	Kumaripati	5, 19
4	Kusunti Dole	13
5	Satdobato - Gwarko	
6	Bakungol - Kopundol	1
7	ICIMOD - Hattiban	15
Clogging Area		
1	Na Tole - Gabahal	
2	Mangal Bazar - Sankhmul	

In Kumaripati area, the municipality tried to divert sewage load to other existing sewer lines but the downstream people protested this fearing overflow in their area.

They also suggested the necessity of construction of Interceptor sewer along Nakhu river to protect it from pollution as it is important from religious point of view. They also commented on the activities of ongoing water supply DNI project in Kusunti area and suggested that the water supply lines should be installed at both sides of road which are wide.

D. 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 Madhyapur Thimi municipality. Similarly, the wastewater can be managed through DEWATS in this area.

E. 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.

He informed that KUKL has not constructed any sewer line in Madhyapur and have received no complaints so far. But there is a high demand of Jetting machine in Kirtipur because of frequent clogging. The major problematic areas are Baghbhairav, Nayabazar, Khasibazar etc.

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. Hannu Pelkonen	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 upto Balkhu 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.

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. Hannu Pelkonen, 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 Session

11:45 – 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 coordinate

with 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. Hannu Pelkonen, **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 also

discussed 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 Babu Aryal, 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 requested

to 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, Madhyapur Thimi 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 10: 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 acommodation.

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 handwash facilities is provided to workers. Standards range from 1 unit to each 15 persons to 1 unit per 6 workers. Handwash 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. Showers/bathrooms are conveniently located.

5. 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

Appendix 11: 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. Analyze 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:

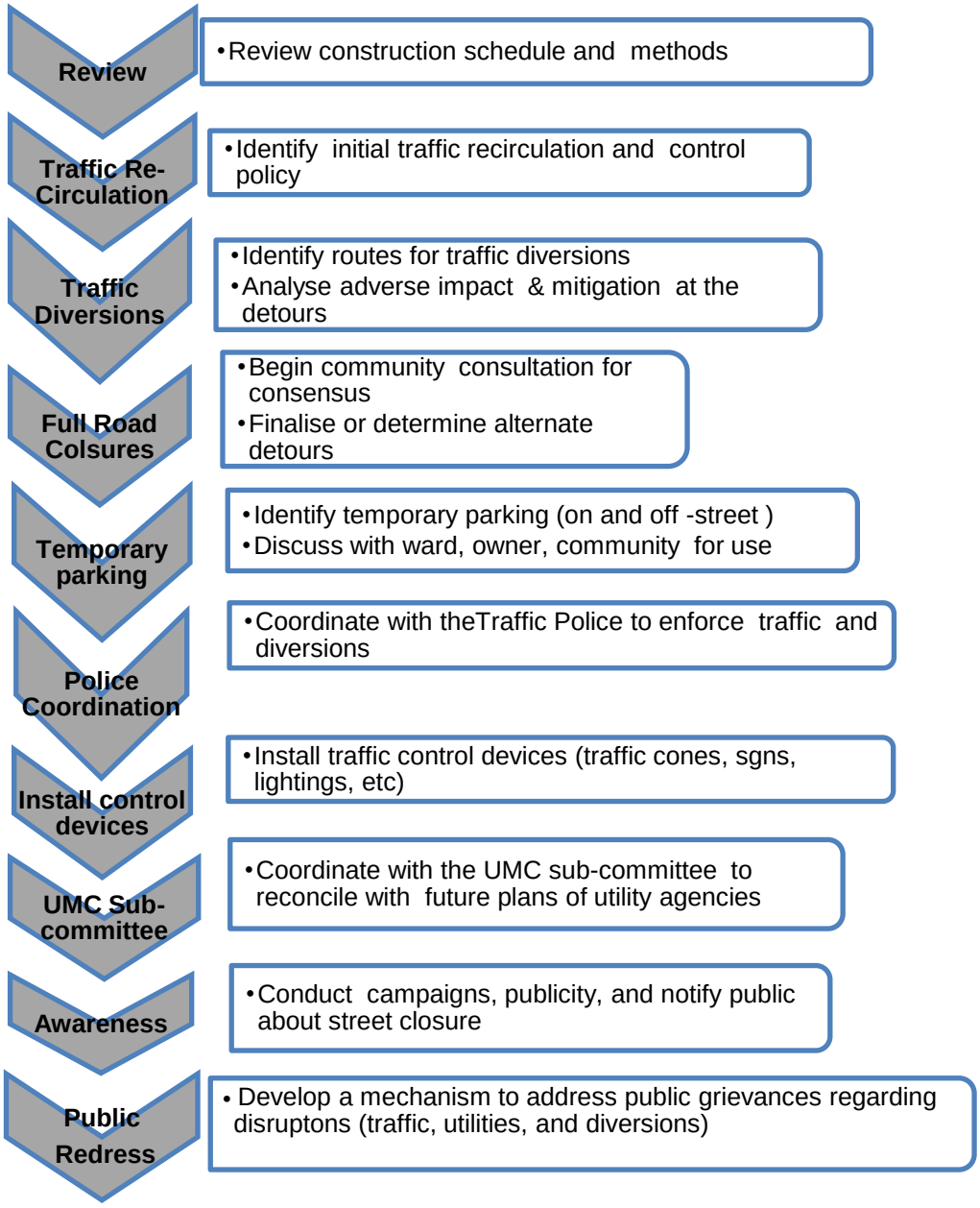
(i) approval from the ward office or community to use the local streets as detours;
(ii) consultation with businesses, community members, traffic police, Department of Roads, etc, regarding the mitigation measures necessary at the detours where the road is diverted during the construction;
(iii) determining 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.

Figure A12.2: Policy Steps for the TMP



6. 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.

7. 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.

8. 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.

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

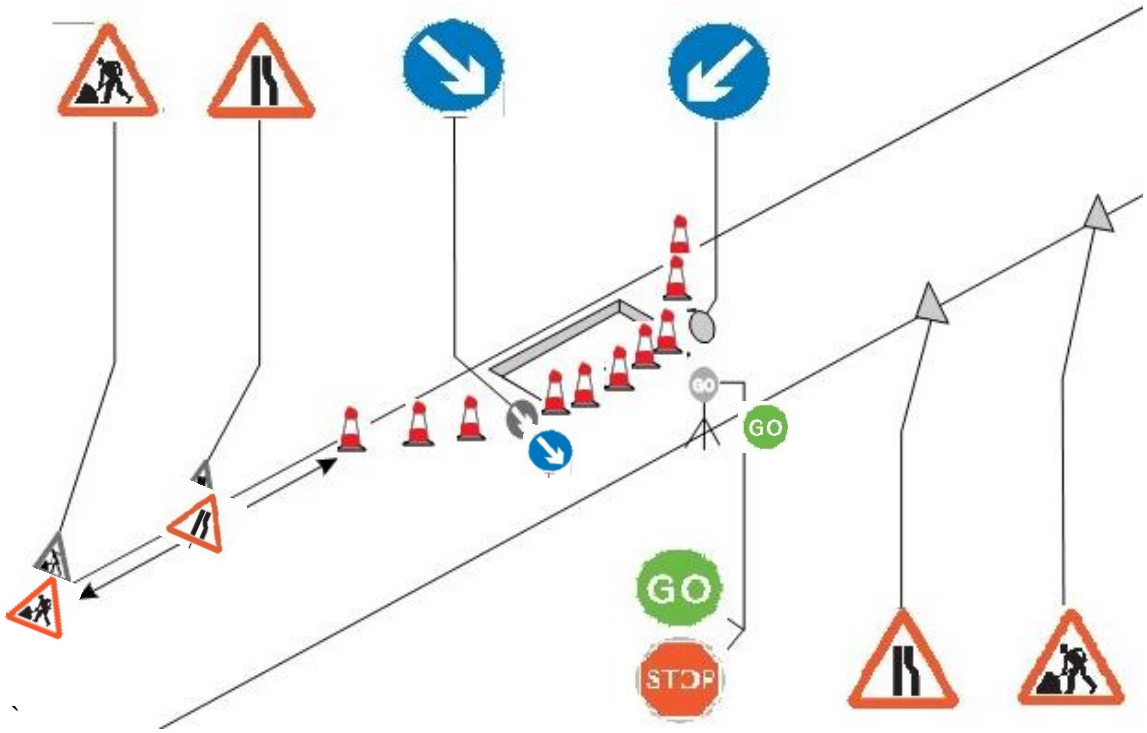
E. Install traffic control devices at the work zones and traffic diversion routes

10. 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.

11. 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.

12. **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.

13. 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.

14. 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.

15. 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.

16. 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 12: 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 Wastewater 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 and sampling and relaying critical information, assessing 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 sampling and relaying critical information, assessing facilities, and providing recommendations to the wastewater system manager.	Phone: Mobile:
Mr/Ms…….. **Office Administrator**	Responsible for administrative functions in the office including receiving phone calls and keeping a log of events. This person will provide a standard carefully 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 Mobilel 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 neighboring 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.
Designate a spokesperson and alternates

Spokesperson	Alternate

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. Analyze 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	

L. Cyber attack

Assessment	
Immediate Actions	
Notifications	
Follow-up Actions	

M. Other

Assessment	
Immediate Actions	
Notifications	
Follow-up Actions	

Section 8.
Returning to Normal Operation

Returning to normal operations

Action	Description and Actions

Section 9.
Plan Approval

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 13: 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

4. 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 µg/m3	SO2 µg/m3	NO2 µg/m3

Site No.	Date of Testing	Site Location	Parameters (Monitoring Results)		
			PM10 µg/m3	SO2 µg/m3	NO2 µg/m3

Water Quality Results

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

Site No.	Date of Sampling	Site Location	Parameters (Monitoring Results)					
			pH	Conductivity µS/cm	BOD mg/L	TSS mg/L	TN mg/L	TP mg/L

Noise Quality Results

Site No.	Date of Testing	Site Location	LA_{eq} (dBA) (Government Standard)	
			Day Time	Night Time

Site No.	Date of Testing	Site Location	LA_{eq} (dBA) (Monitoring Results)	
			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	

Inspection

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

Site Restored to Original Condition Yes ☐ No ☐

Signature
_____

Sign off

_____ _____

Name **Name**
Position **Position**