Draft Initial Environmental Examination

May 2017

NEP: Regional Urban Development Project (RUDP) Solid Waste Management Subproject, Dhangadhi Sub-metropolitan City, Kailali

Asian Development Bank

CURRENCY EQUIVALENTS

(as of 7 February 2017)

Currency unit	–	Nepalese Rupee (NPR)
NPR 1.00	=	$ 0.00930
$1.00	=	NPR 107.52600

ABBREVIATIONS

3R	=	Reduce, Reuse and Recycle
AAPA	=	Aquatic Animals Protection Act
ADB	=	Asian Development Bank
CBS	=	Central Bureau of Statistics
CFUG	=	community forest users group
CITES	=	Convention on International Trade of Endangered Species of Wild Fauna and Flora
DADO	=	district agriculture development office
DDC	=	district development committee
DEECCU	=	district energy, environment and climate change unit
DFO	=	district forest office
DIZ	=	direct impact zone
DMC	=	developing member country
DSC	=	design and supervision consultants
DUDBC	=	Department of Urban Development and Building Construction
DWEC	=	daily wage execution committee
EARF	=	environmental assessment and review framework
EHS	=	environment, health and safety
EIA	=	environmental impact assessment
EMAP	=	environmental management action plan
EMEP	=	environmental mitigation execution plan
EMP	=	environmental management plan
EPA	=	Environment Protection Act
EPM	=	Environmental Protection Measures
EPR	=	Environment Protection Rules
FGD	=	focused group discussion
FWR	=	far western Region
FY	=	fiscal year
GDP	=	gross domestic product
GFP	=	grievance focal points
GHG	=	green house gas
GO	=	governmental organizations
GON	=	Government of Nepal
GRC	=	grievance redress committee
GRC	=	grievance redress cell
HDPE	=	high density polyethylene pipe
IEC	=	information, education and communication
IEE	=	initial environmental examination
IIZ	=	indirect impact zone
INGO	=	International Governmental Organizations

ISWM	=	integrated solid waste management
IUCN	=	International Union for Conservation Nature
IUD	=	Integrated Urban Development Project
IWPS	=	Integrated Waste Processing Sites
LGCDP	=	Local Governance and Community Development
LS	=	lump sum
MOFALD	=	Ministry of Federal Affairs and Local Development
MOFSC	=	Ministry of Forest and Soil Conservation
MOPE	=	Ministry of Population and Environment
MOUD	=	Ministry of Urban Development
MPMC	=	Municipal Project Management Committee
MSW	=	municipal solid waste
NEA	=	Nepal Electricity Authority
NGO	=	non-governmental organization
NRS	=	Nepalese Rupees
NTFP	=	non-timber forest products
NWSC	=	Nepal Water Supply Corporation
OHS	=	occupational health and safety
PAF	=	project affected families
PCO	=	project coordination office
PHC	=	public hearing committee
PIU	=	project implementation unit
PMSC	=	project management and supervision consultants
PPE	=	personal protective equipment
PPTA	=	project preparatory technical assistance
REA	=	rapid environmental assessment
RUDP	=	Regional Urban Development Project
SEA	=	strategic environmental assessment
SHS	=	solar home system
SPM	=	suspended particulate matter
SPS	=	Safeguard Policy Statement
SWMTSC	=	Solid Waste Management and Technical Support Centre
TLO	=	Tole Level Organization
ToR	=	terms of reference
TSP	=	total suspended particles
VDCs	=	village development committees
WUA	=	water users association
ZoI	=	zone of influence

NOTES

(i) The fiscal year (FY) of the Government of Nepal ends on 15 July. FY before a calendar year denotes the year in which the fiscal year ends, e.g., FY2017 ends on 15 July 2017.
(ii) In this report, "$" refers to US dollars

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EXECUTIVE SUMMARY

1. The Regional Urban Development Project (RUDP) will improve resilient and sustainable urban infrastructure in 8 municipalities located in the southern Terai region of Nepal bordering India. The project will also support regional and urban planning, municipal infrastructure investments, and institutional strengthening to foster regional competitiveness and regional cooperation. The project will also strengthen government capacity for preparation of transformational projects with high readiness for cities in Nepal through a project bank facility.

2. Pre-feasibility has been undertaken in the Far Western Region (FWR) towns of Attariya, Bheemdatt, Dhangadhi, and Jhalari-Pipaladi. Construction of a solid waste management landfill and associated facilities were proposed in each of these municipalities for the overall improvement of solid waste management (SWM) system.

3. **Subproject scope and location.** The SWM subproject at Dhangadhi sub-metropolitan city is one of the subprojects proposed under RUDP. The subproject includes construction of a new landfill with compost plant, internal roads, boundary wall and transfer stations.

4. Dhangadhi sub-metropolitan city is located in Kailali District, one of the two districts in FWR that lies in the Terai belt of the country. It is located between 28'22^{o} and 29'05^{o} latitude and 80' 30^{o} and 81'18^{o} longitude. Geologically, Kailali District is divided into 2 different regions, Chure and Terai belt respectively. Topographically, Dhangadhi sub-metropolitan city is a flat terrain with an average elevation of 100 m to 110 m above mean sea level. The sites of the SWM components are not within or adjacent to ecologically-sensitive areas.

5. **Implementation Arrangements.** The subproject will be implemented by the Dhangadhi sub-metropolitan citywith support from the Department of Urban Development and Building Construction in the Ministry of Urban Development.

6. **Screening and Categorization.** An environmental assessment of the subproject is required per ADB's Safeguard Policy Statement (SPS, 2009). Based on preliminary designs of the proposed SWM subproject in Dhangadhi, environmental assessment using ADB's Rapid Environmental Assessment (REA) checklist for solid waste management (**Appendix 1**) was conducted and results of the assessment show that the subproject is unlikely to cause significant adverse impacts.

7. Potential environmental impacts are identified, their significance assessed, and strategies devised to avoid these impacts or reduce them to an acceptable level. These strategies (called mitigation measures) are then incorporated into the environmental management plan (EMP). Thus the Dhangadhi SWM subproject is classified as environmental category B as per ADB SPS and an initial environmental examination (IEE) has been prepared in accordance with ADB SPS's requirements for environment category B projects.

8. **Purpose of the initial environmental examination.** This IEE is to examine the proposed SWM subproject in Dhangadhi sub-metropolitan, ensure that the environmental issues associated with the development are effectively managed and they will not damage the environment, and provide guidance for the planning, construction and operation of the proposed

subproject. This IEE is based on preliminary design and will be updated/ finalized[1] once the subproject detailed design is completed.

[1] PCO will ensure that IEEs will be properly updated with site specific information, design and locations considered site selection criteria and guidelines, environmental measures implemented during construction and O&M phases. The updated/finalized IEE will include monitoring program to measure progress of implementation of the mitigation measures.

9. This IEE will be included in the bid documents, binding on all contractors operating on the site and will be included in the contractual clauses. Non-compliance with, or any deviation from, the conditions set out in this document constitutes a failure in compliance.

10. **Environmental management plan (EMP).** The EMP is to ensure that the activities are undertaken in a responsible, non-detrimental manner by providing proactive, feasible, and practical working tools and specific actions necessary to mitigate environmental impacts of the subproject. The EMP also assigns responsibilities, timescales, and performance indicators/standards for each mitigation measure to make sure that they are implemented and not ignored. An environmental monitoring plan is also included in the EMP which recommends protocols and responsibilities for monitoring the subproject.

11. For this SWM subproject, the contractor will be required to (i) establish an operational system for managing environmental impacts, (ii) carry out all of the monitoring and mitigation measures set forth in the EMP, and (iii) implement any corrective or preventative actions set out in safeguards monitoring reports that the employer will prepare from time to time to monitor implementation of this IEE and EMP. The contractor shall allocate a budget for compliance with these EMP measures, requirements and actions. The contractor will also be required to post relevant EMP information on the work sites at all times.

12. **Consultation, disclosure and grievance redress.** The stakeholders were involved in developing the IEE through on-site discussions and public consultation, after which views expressed were incorporated in the planning and development of the subproject and into the IEE. The consultation process will be continued and expanded during project implementation to ensure that stakeholders are fully engaged in the project and have the opportunity to participate in its development and implementation. The IEE will be made available at public locations in the Dhangadhi sub-metropolitan cityand will be disclosed to a wider audience via the ADB and PCO project websites. A grievance redress mechanism is described within the IEE to ensure any public grievances are addressed quickly.

13. **Monitoring and reporting.** The project coordination office (PCO), project implementation unit (PIU) in Dhangadhi sub-metropolitan, and design and supervision consultants (DSC) will be responsible for safeguard monitoring. The DSC will work closely with the contractors for guidance on EMP implementation and will submit monthly monitoring reports to PCO. The PCO will send semi-annual monitoring reports to ADB. ADB will post the semi-annual environmental monitoring reports on its website as part of its disclosure requirements.

14. **Conclusions and recommendations.** The citizens of Dhangadhi sub-metropolitan citywill be the major beneficiaries of this subproject. With the improved SWM services, they will enjoy improved over-all cleanliness, livability and better public health in the area. Therefore, the proposed subproject is unlikely to cause significant adverse impacts and net environmental benefits will be positive. The potential impacts that are 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.

15. Based on the findings of the IEE, there are no significant impacts and the classification of the subproject as Category “B” per ADB SPS is confirmed. No further special study or detailed environmental impact assessment (EIA) needs to be undertaken to comply with ADB SPS.

I. INTRODUCTION

1. The Regional Urban Development Project (RUDP) will improve resilient and sustainable urban infrastructure in 8 municipalities located in the southern Terai region of Nepal bordering India. The project will also support regional and urban planning, municipal infrastructure investments, and institutional strengthening to foster regional competitiveness and regional cooperation. The project will also strengthen government capacity for preparation of transformational projects with high readiness for cities in Nepal through a project bank facility.

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6. This IEE will be included in the bid documents, binding on all contractors operating on the site and will be included in the contractual clauses. Non-compliance with, or any deviation from, the conditions set out in this document constitutes a failure in compliance.

II. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

7. Both the Nepali law and ADB policy require that the environmental implications of individual developments are taken into account in the planning and decision making process and that action is taken to reduce the impacts to acceptable levels. This is done through environmental assessment process, which has become an integral part of lending operations and project development and implementation worldwide.

A. ADB Policy

8. ADB requires the consideration of environmental issues in all aspects of ADB's operations, and the requirements for environmental assessment are described in ADB SPS, 2009. This states that ADB requires environmental assessment of all ADB investments.

9. **Screening and categorization.** The nature of the environmental assessment required for a project depends on the significance of its environmental impacts, which are related to the type and location of the project; the sensitivity, scale, nature, and magnitude of its potential impacts; and the availability of cost-effective mitigation measures. Projects are screened for their expected environmental impacts, and are assigned to one of the following four categories:

(i) **Category A.** Projects could have significant adverse environmental impacts. An EIA is required to address significant impacts.
(ii) **Category B.** Projects could have some adverse environmental impacts, but of lesser degree or significance than those in category A. An IEE is required to determine whether significant environmental impacts warranting an EIA are likely. If an EIA is not needed, the IEE is regarded as the final environmental assessment report.
(iii) **Category C.** Projects are unlikely to have adverse environmental impacts. No EIA or IEE is required, although environmental implications are reviewed.
(iv) **Category FI.** Projects involve a credit line through a financial intermediary or an equity investment in a financial intermediary. The financial intermediary must apply an environmental management system, unless all projects will result in insignificant impacts.

10. **Environmental assessment.** ADB SPS highlights a number of areas that require attention in ADB's environmental assessment process: (i) need for more upstream environmental assessment at the level of country programming, (ii) more structured consultation in the conduct of environmental assessments, (iii) greater emphasis on monitoring and compliance with environmental requirements during project implementation, and (iv) need to view environmental assessment as an ongoing process rather than a one-time event.

11. **Environmental management plan.** An EMP, which addresses the potential impacts and risks identified by the environmental assessment, shall be prepared. The level of detail and complexity of the EMP and the priority of the identified measures and actions will be commensurate with the project's impact and risks.

12. **Public disclosure.** ADB will post the safeguard documents on its website as well as disclose relevant information in accessible manner in local communities:

(i) for environmental category A projects, draft EIA report at least 120 days before Board consideration;
(ii) final or updated EIA and/or IEE upon receipt; and
(iii) environmental monitoring reports submitted by the project coordination office (PCO) during project implementation upon receipt.

13. **Pollution prevention and control technologies.** During the design, construction, and operation of the project the PMU and PIUs will apply pollution prevention and control technologies and practices consistent with international good practice, as reflected in internationally recognized standards such as the World Bank Group's Environment, Health and Safety Guidelines.[2] These standards contain performance levels and measures that are normally acceptable and applicable to projects. When Government of India regulations differ from these levels and measures, the PMU and PIUs will achieve whichever is more stringent. If

[2] www.ifc.org/ehsguidelines

less stringent levels or measures are appropriate in view of specific project circumstances, the PMU and PIUs will provide full and detailed justification for any proposed alternatives that are consistent with the requirements presented in ADB SPS.

Table 1: Applicable WHO Ambient Air Quality Guidelines

Table 1.1.1: WHO Ambient Air Quality Guidelines[7,8]		
	Averaging Period	Guideline value in µg/m³
Sulfur dioxide (SO_2)	24-hour 10 minute	125 (Interim target-1) 50 (Interim target-2) 20 (guideline) 500 (guideline)
Nitrogen dioxide (NO_2)	1-year 1-hour	40 (guideline) 200 (guideline)
Particulate Matter PM_{10}	1-year 24-hour	70 (Interim target-1) 50 (Interim target-2) 30 (Interim target-3) 20 (guideline) 150 (Interim target-1) 100 (Interim target-2) 75 (Interim target-3) 50 (guideline)
Particulate Matter $PM_{2.5}$	1-year 24-hour	35 (Interim target-1) 25 (Interim target-2) 15 (Interim target-3) 10 (guideline) 75 (Interim target-1) 50 (Interim target-2) 37.5 (Interim target-3) 25 (guideline)
Ozone	8-hour daily maximum	160 (Interim target-1) 100 (guideline)

Table 2: World Bank Group's Noise Level Guidelines

Table 1.7.1- Noise Level Guidelines[54]		
	One Hour L_{Aeq} (dBA)	
Receptor	Daytime 07:00 - 22:00	Nighttime 22:00 - 07:00
Residential; institutional; educational[55]	55	45
Industrial; commercial	70	70

B. National Laws, Policies, Acts, Regulations, Standards and Guidelines

14. Implementation of all subprojects will be governed by Government of Nepal's environmental acts, rules, policies, and regulations. These regulations (**Table 3**) impose restrictions on the activities to minimize/mitigate likely impacts on the environment. Many of these are cross-sectoral and several of them are directly related to environmental issues. The most important of these are the Environment Protection Act, 1997 (EPA, 1997), and the Environment Protection Rules (EPR, 1997).

Table 3: List of Acts, Laws, Rules, and Regulations

S.N.	Environmental Acts, Regulations and Guidelines	Description of Requirements
1.	Constitution of Nepal, 2072BS (2015AD)	Constitution of Nepal mandates Environmental Protection as state policy. The State shall give priority to the protection of the environment, and also to the prevention to its further damage due to physical development activities by increasing the awareness of the general public about environmental cleanliness, and the State shall also make arrangements for the special protection of the environment and the rare wildlife. Provision shall be made for the protection of the forest, vegetation and biodiversity, its sustainable use and for equitable distribution of the benefit derived from it.
2.	Environment Protection Act, 2053 BS (1997AD)	Any development project, before implementation, to pass through environmental assessment, which may be either IEE or an EIA depending upon the location, type and size of the projects.
3.	Forest Act, 2049 BS (1993AD)	Requires decision makers to take account of all forest values, including environmental services and biodiversity, not just the production of timber and other commodities.
4.	Environment Protection Rules, 2054 BS (1997AD) (Amendment, 1999)	Obliges the proponent to inform the public on the contents of the proposal in order to ensure the participation of stakeholders.
5.	Solid Waste Management Act, 2011	This act outlines the duties of local government to take action to control haphazard waste generation, disposal or collection and has provisions for various punitive measures against those engaged in activities detrimental to the intentions of the act. Special features of this act are as follow: • Hazardous waste, medical waste, chemical waste or industrial waste must be managed by the person/institution responsible for producing/ generating it. • Local body shall only manage the processed hazardous waste/ medical waste/ chemical waste by levying fees. • It shall be duty of every person to reduce the production of solid waste. Further it will be the duty of person/institution to make arrangement for biodegradable waste within its boundary and discharge the remaining waste • Promotion of source separation of waste • Empowers local body the right to set collection point for systematic collection of solid waste • Transportation of solid waste: Only prescribed vehicle shall be used and only segregated waste shall be collected. • Adaptation of reduce, reuse and recycle principle. • Provision for the waste management by the private sector upon receiving of license form the local body • Provision for charging of service fee by the local body for the solid waste management services to the institution/concerned person or body. • Various punishment/penalties who violates this act
6.	Soil and Water Resource Conservation Act, 2039 BS (1939 AD)	This act is enacted to manage the watersheds of Nepal. Section 3 empowers the government to declare any area as a protected watershed area. Section 4 provides that a watershed conservation officer has the authority to implement the following works in protected

S.N.	Environmental Acts, Regulations and Guidelines	Description of Requirements
		watershed areas
7.	Land Acquisition Act, 2034 BS (1978AD)	Government can acquire land at any place in any quantity by giving compensation pursuant to the act for any public purposes or for operation of any development project initiated by government institutions.
8.	Local Self Governance Act , 2055 BS (1999AD) and Rules, 2056BS (2000AD)	Empowers the local bodies for the conservation of soil, forest and other natural resources and implements environmental conservation activities.
9.	Aquatic Animals Protection Act 2018BS (1961AD) and first amendment, 1998	This act provides legislative protection of the habitats of aquatic species. Section 3 of the AAPA renders punishable any party introducing poisonous, noxious or explosive materials into a water source, or destroying any dam, bridge or water system with the intent of capturing or killing aquatic life. However, no agency has been designated the responsibility for administering and enforcing the AAPA.
10.	Water Resources Act, 1992 & Water Resources Regulation, 2000	Water Resource Act is an umbrella act governing water resource management. It declares the order of priority of water use; vests ownership of water in the state; prohibits water pollution; and provides for the formation of Water User Association and system of licensing. The regulation sets out the procedure to register a WUA and to obtain a license and sets out the rights and obligations of WUA and license holders.
11.	Labor Act, 1991AD	It emphasizes on occupational health and safety of workers thereby providing necessary safety wares and adopting necessary precautionary measures against potentially hazardous machines/ equipment. It stipulates to make arrangements such as removal of waste accumulated during production process and prevention of dust, fume, vapor and other waste materials, which adversely affect the health of workers. The provisions related to environment in labor law can be summarized as: • Spells about the provision for a healthy, safe and secure environment for workers. • Prescribes provisions for solid waste management and control noise pollution in the working areas, • Imposes mandatory provision that only Nepal citizens can be employed on permanent basis in any enterprises, permission must be sought from the Labor Department to employ non-Nepali specialists on contract basis.
12.	Child labor (Prohibition and Regularization) Act, 2001AD	The Child Labor (Prohibition and Regulation) Act 2000 is the main legal expedient to prohibit engaging children in factories, mines or similar risky activities and to make necessary provisions about their health, security, services and facilities while engaging them in other activities. Under the Section 3 of the Act, child having not attained the age of 14 years is strictly prohibited to be engaged in works as a laborer. Similarly, under Section 4, engagement of child in works as a laborer against his/ her will by way of persuasion, misrepresentation or by subjecting his/ her to any influence or fear or threat or coercion or by any other means is prohibited. Under Section 6, in case any Enterprise has to engage a child in works, an approval has to be obtained from the concerned labor office or any authority or official prescribed by that office and form the father, mother or guardian of the child.

S.N.	Environmental Acts, Regulations and Guidelines	Description of Requirements
13.	Electricity Act, 1993	The clause 24 of the electricity act 1993 states about the environment which reads No Substantial Adverse Effect be made on Environment further it states While carrying out electricity generation, transmission or distribution, it shall be carried out in such a manner that no substantial adverse effect be made on environment by way of soil erosion, flood, landslide, air pollution etc.
14.	Public Roads Act, 1974AD	The major provisions of the Public Roads Act, 1974 are: • Prescribes rules for planned road construction; regulating road width and boundaries, within which no houses can be built; • Maintains road environment through plantation along public roads; • Government of Nepal agencies and public needs prior approval from Department of Roads to carry out work on roads and road boundaries.
15.	Forest Rules, 2051BS (199AD)	Elaborates legal measures for the conservation of forests and wildlife.
16.	Local Self Governance Regulations, 2000	This regulation empowers the local bodies for the conservation of soil forest and other natural resources and implements environmenta conservation activities
17.	Solid Waste Management Rules, 2013	Solid Waste Management Rules has provided authority to local bodies for the segregation, transportation and disposal of solid waste as well as operation of sanitary landfill site. Local bodies may also empower the company, organization and agency, producing solid wastes, for segregating, reducing the solid wastes at its source, reuse and recycling use solid wastes and mobilize community and non-governmental organization for creating awareness for the management of the solid waste. Local bodies have also the authority to determine service charge for solid waste management.
18.	Three Years Interim Development Plan, GoN, 207-2073BS (2013-2016AD)	The plan focuses on the need for setting up national environmental standards with strategy of internalizing environmental management into the development programs. The plan has also realized to carryout SEA with the long-term policy of promoting environmental governance. The plan emphasizes on the local participation in environmental conservation, as envisaged in the Local Self Governance Act, 2055, through the local bodies, make them responsible and capable to manage local natural resources.
19.	National EIA Guidelines, 1993	The guidelines provide guidance to project proponent on integrating environmental mitigation measures, particularly on the management of quarries, borrow pits, stockpiling of materials and spoil disposal, operation of the work camps, earthworks and slope stabilization, location of stone crushing plants, etc.
20.	Environmental Guidelines published by MoPE, 2006	The guideline provides clear directions about the process of conducting EIA. This guideline makes EIA in Nepal legally mandatory and contains process for ensuring public involvement during the preparation of EIA report. It calls for information regarding identification of physical, biological, socioeconomic and cultural impacts. Impacts ranking method also suggested in this guideline. It stresses the inclusion of mitigation measures to avoid, minimize and mitigate adverse impacts and maximize beneficial impacts resulting from the development project and Monitoring & environmental auditing in the EIA report. Its revision in 1997 calls for the ensuring local people's participation, collection of relevant information, identifying major issues of public

S.N.	Environmental Acts, Regulations and Guidelines	Description of Requirements
		concerns, evaluate them and establishing priorities for EIA study. The Environmental Guidelines published by MOPE (2006) contains the following components: • Methods for screening of the projects requiring an application of environmental assessment Scoping, impact identification and prediction, report review, monitoring and evaluation and impact auditing; • Methods for ensuring public participation during the preparation of the EIA report, including the need for clear documentation of the impact mitigation measures in the EIA report; • Provisions for identifying socio-economic-cultural, biological, and physical impacts and prescription of mitigation measures to avoid, eliminate and/or minimize adverse effects and to augment beneficial impacts resulting from the project implementation; and • Emphasis on the adoption of monitoring, evaluation and environmental auditing frameworks in the EIA report.
21.	Batabaraniya Nirdesika (Nepal, MLD), 2057BS (2000AD)	The directive is focused in the practical implementation of small rural infrastructures through the minimization of environmental impacts. This directive includes the simple methods of environmental management in the different phases of the project cycle. More emphasis is given to prevention rather than cure. So, the recommendations for the mitigation measures are provided only when it is necessary.

AAPA = Aquatic Animals Protection Act, EIA = environmental impact assessment, IEE = initial environment examination, MOPE = Ministry of Population and environment, SEA = strategic environment assessment.

15. Environmental Protection Rules, 2054 (1997) lists in its Schedule 2, the types of projects which require an IEE. The following are relevant in the context of RUDP subprojects:

(i) Improvement, upgrading and reconstruction of national highways and feeder roads;
(ii) Supply of drinking water to a population ranging from two thousand to twenty thousand;
(iii) Waste management activities to be undertaken with the objective of providing services to a population ranging between two thousand and ten thousand;
(iv) Filling of land with one hundred to one thousand tons of waste a year; (landfills of more than 1000 t per year would require an EIA);
(v) Selecting, picking, disposing, and recycling waste through chemical, mechanical or biological techniques in an area up to two hectares;
(vi) Activities relating to compost plants in an area ranging between one to five hectares;
(vii) Operations of sewerage schemes; and
(viii) Clearing of national forests covering up to one hectare in the hills and five hectares in the Terai.

16. Schedule 2 also list the projects requiring an EIA. It mentions projects to be implemented in "flood prone and other dangerous areas"; it is therefore recommended, especially in the case of larger schemes (the largest being waste disposal sites, where flood risks are an issue), to clarify this question with the competent authorities in an early stage of project preparation.

17. Environmental Guidelines (2006) published by Ministry of Population and Environment (MOPE) makes EIA in Nepal legally mandatory and contains process for ensuring public involvement during the preparation of EIA report. It calls for information regarding identification of physical, biological, socioeconomic and cultural impacts. Impacts ranking method is also suggested in this guideline. It stresses the inclusion of mitigation measures to avoid, minimize and mitigate adverse impacts and maximize beneficial impacts resulting from the development project and monitoring and environmental auditing in the EIA report.

18. The Environmental Guidelines (2006) contains the following components:

(i) Methods for screening of the projects requiring an application of Environmental Assessment Scoping, impact identification and prediction, report review, monitoring and evaluation and impact auditing;
(ii) Methods for ensuring public participation during the preparation of the EIA report, including the need for clear documentation of the impact mitigation measures in the EIA report;
(iii) Provisions for identifying socioeconomic-cultural, biological, and physical impacts and prescription of mitigation measures to avoid, eliminate and/or minimize adverse effects and to augment beneficial impacts resulting from the project implementation; and
(iv) Emphasis on the adoption of monitoring, evaluation and environmental auditing frameworks in the EIA report.

19. **Table 4** provides the environmental classification of RUDP subprojects. Dhangadhi SWM subproject falls in Category B. However, PCO will confirm with MOPE if geotechnical studies and detailed design will reveal the SWM sites are within "flood prone and other dangerous areas" as defined by Environmental Protection Rules, 2054 (1997).

Table 4: Environmental Classification of Proposed Subprojects Per Government of Nepal Environmental Guidelines (2006)

Subproject	Component	Key Activities	Environment Classification per GoN	Indicative Classification per ADB SPS[3]
1. City road improvement	Road provisions (include road resurfacing, roadside footpath, roadside drains, road signs, road/ pavement markings, intersection improvement, or high mast lighting)	re-construction and extension of road (feeder road, local road)	Cat B IEE to be prepared	Cat B IEE to be prepared
2. Drainage improvement	Primary network (includes domestic connections or primary drains)	Engineering works Engineering works	Cat B IEE to be prepared	Cat B IEE to be prepared
	Secondary network (includes secondary drains)			Cat B IEE to be prepared
	Tertiary network (includes main drains and drainage outfalls)			

[3] To be confirmed upon submission of the ADB REA Checklist

Subproject	Component	Key Activities	Environment Classification per GoN	Indicative Classification per ADB SPS[3]
3. Municipal Building/ Public Building	Construction of public buildings	No similar facility	Cat B IEE to be prepared	Cat B IEE to be prepared
4. Water supply	Source augmentation (includes tube wells, surface water intake, overhead or ground reservoir, pumps and pump house, water treatment plant (WTP) or chlorination facility)	Engineering works	Cat B IEE to be prepared	Cat B IEE to be prepared
	Water transmission (includes pumping main, overhead reservoir, or pumps and pump houses)	Water, power and gas distribution line laying/ relaying/extension.	Cat B IEE to be prepared	Cat B IEE to be prepared
	Network improvements (include ring main, distribution/ carrier mains, bulk valves and flow meter, household connections or household meters)			Cat B IEE to be prepared
5. Solid waste management	Community storage bins	No similar facility	Cat B IEE to be prepared	Cat B IEE to be prepared
	Secondary transfer station			
	Waste disposal (includes sanitary landfill, composting site, or access road)	Land-filling by industrial, household and commercial wastes	Cat A for SWM sites with population > 10,000 people	Cat B IEE to be prepared

III. DESCRIPTION OF THE PROJECT

20. RUDP aims to improve livability and urban services in the municipalities of Attariya, Bheemdata, Jhalari-Pipaladi and Dhangadhi in the FWR of Nepal through planning, infrastructure investments, and institutional strengthening. Nepal's National Urban Policy (2007) identifies Dhangadhi as 1 of 5 potential regional economic centers in addition to the existing centers of Pokhara and the Kathmandu Valley. The project is in line with the Thirteenth Plan (Three-Year Plan, FY2014-FY2016), which aims to bring about a direct positive change in the living standards of the general public by reducing economic and human poverty.

21. Dhangadhi sub-metropolitan cityis situated in Kailali District, Seti Zone of the Far–Western Development Terai Region of Nepal and got municipality status in 2033 B.S. Urma and Fulbari VDCs located in the east of Dhangadhi municipality were also merged in 2014 and the Municipality later got the sub-metropolitan citystatus. The territory of the municipal area occupies the slope facet and top of a Terai that rises from an elevation from 109 m above sea level.

22. Dhangadhi is the premier municipality in the FWR. Being located on the close proximity to the border, Dhangadhi is recognized as the biggest market center of the region for the trading of household goods, equipment and agriculture products. Administratively, the municipality is divided into 14 wards covering an area of 104 sq.km, with the gross population density of about 10 persons per hectare. The market is elongated about 4km east-west; starting from the junction of the north-south highway popularly known as Chauraha. Except some areas of wards 1, 2, 3, 4 and 5, close to the main market road, the settlements are thinly spread all over the municipality with no particular concentration. Hasanpur, Baiya Behadim Santosi Tol, Basant Tol are few prominent urban clusters. The east of the municipality is bounded by Khutia River and the west by Mohana River; south of the municipality is India whereas the north part of municipality adjoins Attariya municipality. The municipality has several lakes and wetlands, among which, Jakhor lake and Tilke lake are prominent, and quite a reasonable amount of forest within its territory.

A. Exiting Situation

23. At present, Dhangadhi sub-metropolitan cityhas a crude dumping site located at a distance of 500 m from the city center. This is a temporary open piles at the river bank. The collected waste is disposed in temporary open piles at the river bank area. The unloaded waste is managed to fall in the steep depressed land and once it is filled, it will be covered by dust and tree leaves. The sub-metropolitan citypresently has no functioning solid waste collection and disposal system; mainly, there are no solid waste treatment and disposal sites. Presently, solid waste is disposed of in unsuitable locations, often along water courses. During high flow conditions, a considerable part of this waste is then carried downstream.

24. **Waste type and generation.** In general, municipal waste covers the solid waste generated from households, commercial and institutional establishments. According to a field survey undertaken in 2012[4], the average household and municipal solid waste (MSW) generation in Dhangadhi was reported to be 0.14 and 0.28 kg/ capita/ day. With these per-capita waste generation rates and projected population for the year 2016, the total MSW waste generation from Dhangadhi municipality is estimated at 75.82 tons/day. The population projection for 40 years has been done and projection of waste quantity has been done accordingly (**Table 5**).

Table 5: Projected Daily Waste Generation in Dhangadhi over 2016-2056

Year	Population	HH SW generation (kg/day/cap)	Total HH waste (t/day)	Commercial/ industrial/ institutional waste (t/day)	Total Solid Waste (t/day)
2016	150436	0.42	63.18	12.64	75.82
2021	164391	0.47	77.26	15.45	92.72
2026	179640	0.52	93.41	18.68	112.10
2031	196304	0.57	111.89	22.38	134.27
2036	214513	0.62	133.00	26.60	159.60
2041	234412	0.67	157.06	31.41	188.47
2046	256157	0.72	184.43	36.89	221.32
2051	279918	0.77	215.54	43.11	258.64
2056	305884	0.82	250.82	50.16	300.99

[4] ADB, 2012; http://www.adb.org/publications/solid-waste-management-nepal-current-status-and-policy-recommendations.[5] Source from Nepal Seismic Zone Map – Google Maps

25. **Solid waste composition.** The waste obtained from the household, commercial and institutional waste is categorized into seven different types, as listed below.

26. In Dhangadhi the household waste composition consists of organic wastes (68%), paper (10%), plastic (13%), metal (1%), glass (3%), rubber and leather (2%), and other (3%). However, paper/ paper products are main fractions in institutional waste with 51% followed by plastic with 18% and organic waste with 16%. In commercial waste sources, plastic dominated the waste composition with 28%, followed by organic with 23%, glass with 15%, paper and paper products with 12% while others are less than 10%.

27. When all three major sources of wastes are combined, the average composition of MSW becomes as follows: organic waste 44%; plastics 19%, paper and paper products 16%; glass 7%; metals 3%; textiles 1%; rubber and leather 3%; and others 7%.

28. **Street cleaning and primary collection.** The municipality has scheduled waste collection two times every day; i.e. early in the morning and in the afternoon in the main city street. The municipal workers sweep the streets every day only in the morning and the collected waste is handled by the municipal workers. All the waste is collected in municipality trucks which is finally dumped on the bank of nearby Kailali nala after collection; about 300m from the municipality office.

29. The current waste collection rate is about 19%; i.e. the municipality is able to collect about 12 tons of waste per day from estimated 64 tons of generated waste. The household waste, commercial waste is placed either in containers or on the roadside in front houses, which is then collected by the municipality. The municipality provides a roadside pick-up service. There is no door-to-door service.

30. **Waste transportation.** For the collection and transportation of solid waste different types of equipment / vehicles are used, which are listed in **Table 6**.

Table 6: Equipment used for the SWM

S.N.	Equipment	Number	Volume (cu m)
1	Tractor	1	4.5
2	Compactor	1	8
3	Cart	10	0.2
4	Rickshaws	10	0.5
5	Shawls	3	-
6	Broom	90 kg/month	-

31. There is no transfer station in Dhangadhi municipality. All waste collected by the municipal vehicles is directly taken to the disposal site. Recently, the municipality purchased land in ward No.2, about 2 km south from main city center for establishing a waste sorting/ processing center and possible transfer station.

32. **Organic waste composting.** In rural municipal areas, organic household wastes generated are fed to domestic animals (e.g. cow, pig, etc.) or the decomposable waste is used for composting at domestic level. Few households in urban areas practice household composting. Some years ago the municipality provided some compost bins to the households with awareness training from SWMTSC. However, none of the community level composting bins is presently in operation. There is not any private composting plant and municipality scheduled to construct and operate a small scale composting plant by mid of 2015 (2072),

which is not yet done.

33. **Recycling.** Waste segregation is not officially organized in the municipality but recyclable wastes that can be sold to the waste pickers are stored separately. The scrap dealer collects reusable and recyclable fractions like paper and paper products, plastic, metals, glass bottles. In exchange they mainly give food items in exchange for the waste. The waste pickers sort the wastes, which are then transported, either to India or to Nepalgunj.

34. **Final disposal.** The collected waste is disposed off in temporary open piles in open spaces and along riversides. The collected waste from the municipality is dumped in the steep depressed land of a river. All the waste from the municipality including household, institutional, commercial, hospital, industrial, bulky waste, workshop waste, and farm waste are dumped together, some of which might be hazardous.

35. **Fecal sludge management.** As per the national requirements, municipalities are responsible for collection and treatment of the fecal sludge from the on-site sanitation system. Presently there is no fecal sludge treatment plant in the municipality and fecal sludge is disposed of openly on the surface. Since the municipality is providing no fecal sludge collection services, majority of the demand for fecal sludge collection is met by manual cleaners. There is no reliable data available regarding the daily demand for fecal sludge collection and disposal in Municipality.

B. SWM institutions

1. Municipal Authorities

36. Environment and sanitation unit under the social development section of Dhangadhi sub-metropolitan city is responsible for the waste management of the municipality. The activities under the SWM includes street sweeping, waste collection and transportation to dumping site, mobilization and supervision of sanitation staffs, and maintenance of equipment.

37. The head of environment and sanitation unit is solely responsible for decision making in waste management and environmental improvement. Beside the unit head, there are two supervisors, 2 drivers and 25 sweepers involved in SWM in Dhangadhi sub-metropolitan, but none have had adequate training in waste management.

2. Private Enterprises

38. The private sector is not directly involved in SWM for the municipality. However, the municipality had contracted a private firm called VOC Nepal to manage solid waste but terminated the contract due to legal issues.

3. NGO and CBO Initiatives and Informal Sector

39. Dhangadhi sub-metropolitan city(mainly social development section) carries out public awareness and trainings on waste segregation, household level composting on the regular basis. Sometimes the municipality involves the communities in clean up campaigns. Dhangadhi sub-metropolitan cityhas started to work with local communities, Tole Lane Organization (TLO) and NGOs in conducting awareness program on the waste management.

40. This awareness program is done to promote 3R (recycling, reuse and reduce) and

composting. The municipality has organized awareness programs for households with the help of women health volunteers. The municipality has also conducted sanitation education in different schools of Dhangadhi. Further, one of the TLOs called Taranagar TLO is getting involved to manage community wastes at community level. The informal sector like cycle vendors (scavenger) and few scrap shops are involved in collecting and selling reusable and recyclable fractions of MSW.

41. Due to the common perception that solid waste management is the sole responsibility of municipality, there has been little participation of people in waste management activities undertaken in the municipality, which eventually lead to failure of SWM programs.

C. Proposed Subproject

42. Potential landfill sites have been identified in 1km east of Saraswatinagar settlement in ward no 2 of Dhangadhi sub-metropolitan. At present, it's a agricultural land and lies in the south of Kailali Nala river and north of Mohana river (**Figures 1 to 3**).

Figure 1: Location of proposed landfill site in Map of Nepal and Dhangadhi Sub-metropolitan

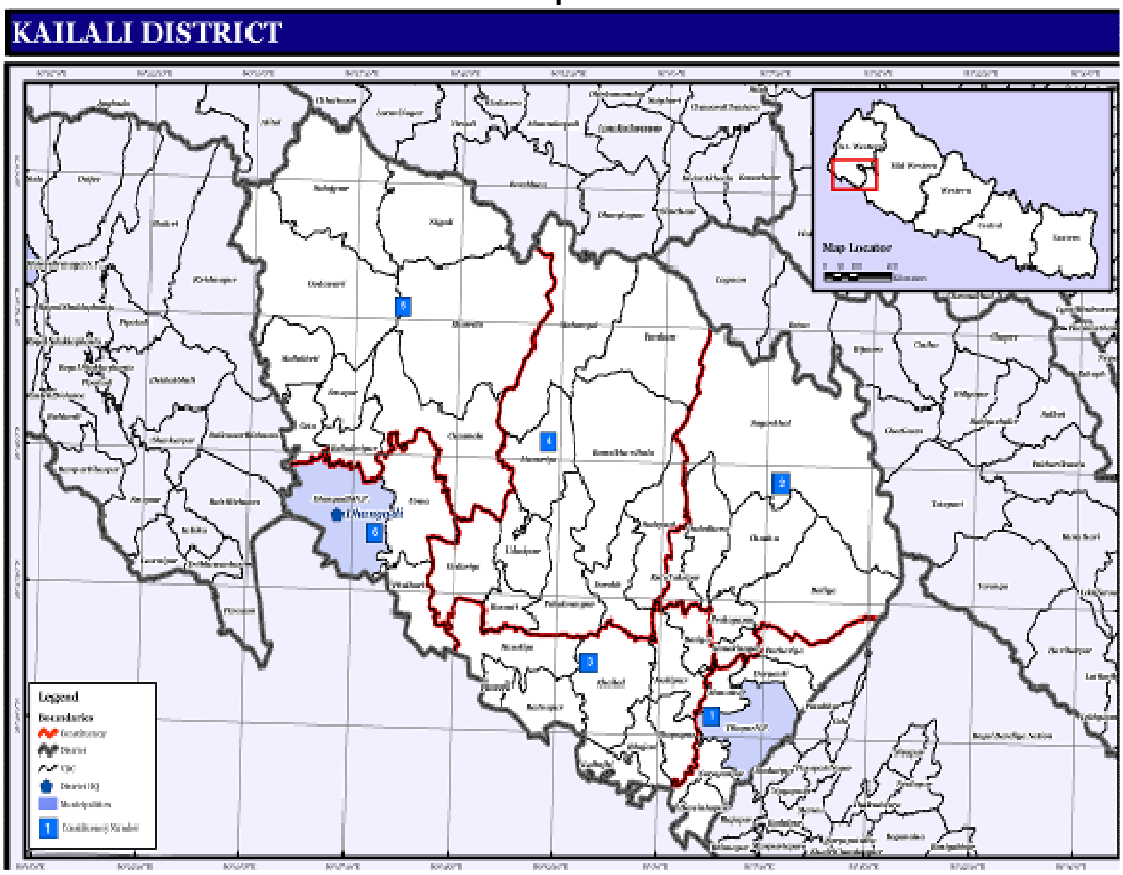


Figure 2: Map of Dhangadhi Sub-metropolitan city *(Source: LGCDP/MFALD, 2015)*

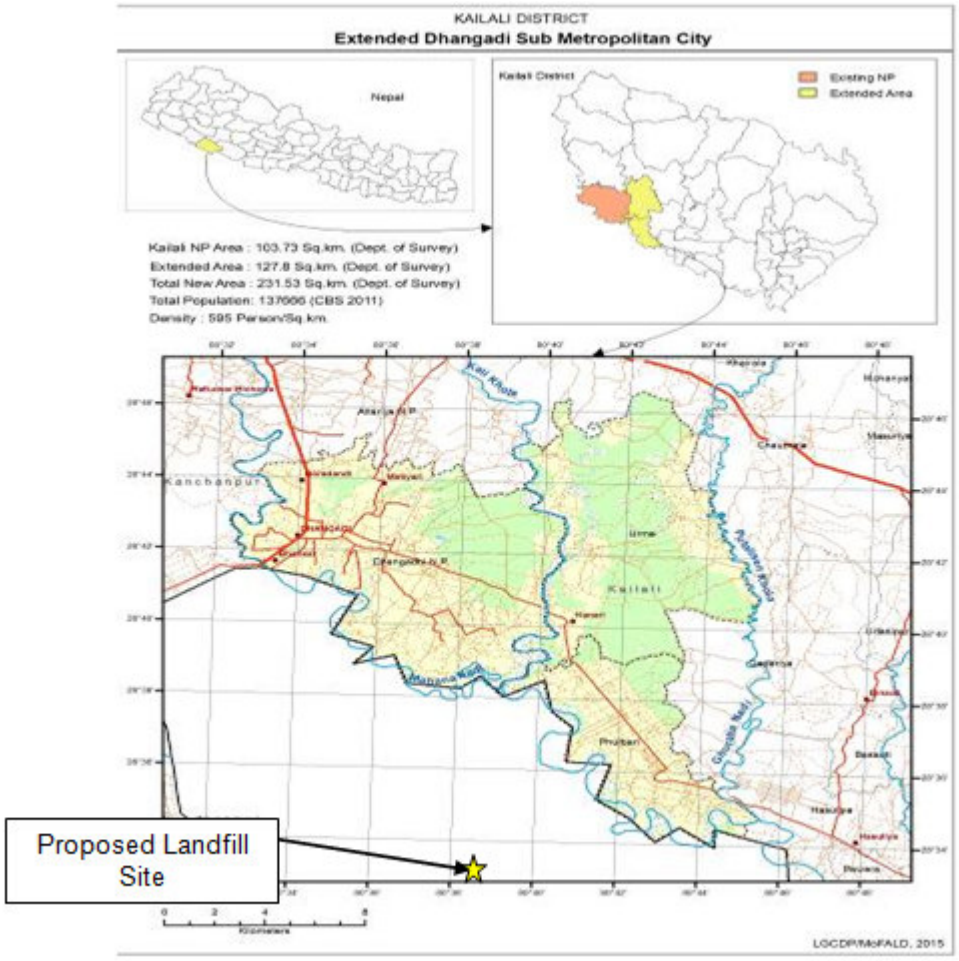
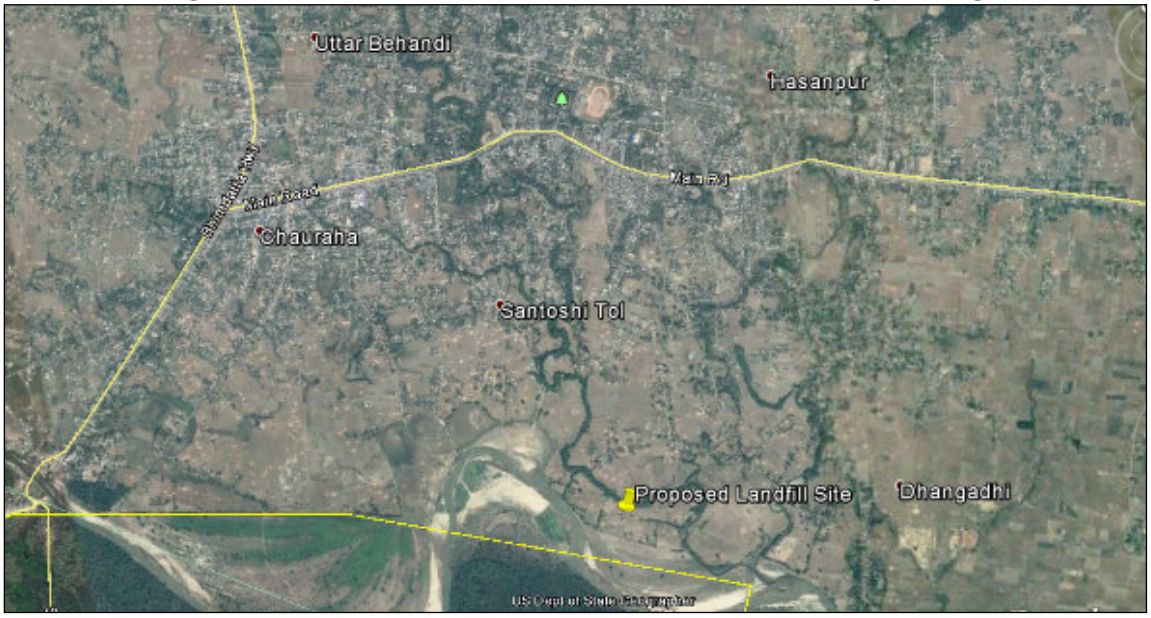


Figure 3: Location of Proposed Landfill Site in Google Image



43. **Overall approach for solid waste management in Dhangadhi.** The overall approach for solid waste management in Dhangadhi metropolitan area will involve implementation of scheme based on 3R (reduce, reuse and recycle) approach and lessons-learned in the ongoing community-led solid waste management system in selected households within the municipality; and at the same time solid waste collection system will be improved in the remaining parts of the municipality. To ensure scientific disposal of collected wastes, a sanitary controlled landfill will be developed at a suitable selected site.

44. Medical wastes, which currently untreated and end up being disposed along with other wastes will be segregated and managed as per the local regulatory requirements. Municipality staff capacity will be improved to enable them to manage the system. The community will be involved in various awareness raising activities to ensure sustainability of the subproject.

45. **Site selection.** The selected subproject site excluded locations which might have significant negative environmental impacts; ecologically sensitive area such as reserved forests critical wetlands and encroachment on cultural features like places of worship, cultural heritage sites, graves/ cemeteries, historical monuments, etc.

46. The following criteria were considered to the maximum extent possible for site selection and finalization:

(i) Available land area and volume is sufficient to provide landfill capacity so that the projected need can be fulfilled for future expansion requirements.
(ii) The landfill site has suitable buffer zones between land fill site and population.
(iii) Low lying areas need to be avoided as much as possible.
(iv) The landfill area having steep gradient (where stability of slope could be problematic) should not be selected.
(v) The water level in ground water table should be sufficient below the base of any excavation to enable landfill development.
(vi) The area having significant biodiversity and ecological sensitivity should be avoided.
(vii) Public and private irrigation water supply wells should be well away from the boundaries of landfill site because these supply wells will be at risk of contamination.
(viii) Landfill area should not be very close to significant water bodies (water courses or dams). There will be the risk of contamination of water bodies, which can be hazardous for aquatic life.
(ix) No major power transmission or other infrastructure like sewers, water supply lines should be crossing through landfill developmental area.
(x) No residential development is close to the boundaries of the proposed site.
(xi) The area is not unstable and seismic risks are within tolerable risks.
(xii) No fault lines or significantly fractured geological structures are expected in the site area.

47. **Improving waste storage for secondary collection of waste.** There are fixed dustbins, trailers and open waste collection points in the municipality. In order to improve waste storage for secondary collection, small size demountable containers (2-2.5 m3 volume) are recommended for the municipality in lieu of open waste collection points and dustbins. It has also been recommended to initiate house-to-house waste collection services in the municipalities using rickshaw vans with 6-8 containers. The containers can then directly discharge the waste into the closed demountable containers for secondary collection of waste;

this will reduce multiple handling of waste. Depending upon the population of the wards, at least one container should be placed in each ward. The containers should be placed on a raised base of 9 to 12 inches to avoid water infiltration inside the containers in the case of water logging during monsoon. Moreover, the containers should be not placed near the drains. It is proposed to construct transfer station for solid waste management. Moreover, the containers should be not placed near the drains. All the identified STSs are on government land. Proposed layout for sample transfer station is shown in **Figure 2**.

48. **Improving waste transportation.** In terms of total waste transportation, labor production, and loading time, demountable trucks with closed containers appear extremely efficient compared to open trucks. As such, municipality should move from an open truck waste collection and transportation system to demountable container trucks. Depending upon the road width, different types of demountable container trucks can be used. It is recommended to use small and medium size demountable container trucks in the municipalities; these types of trucks can make between 6-8 trips per day. Apart from container trucks, tractors with trailers have also been recommended for use in the peripheral wards.

49. **Improving disposal of waste and resource recovery.** The extension of the existing site should be conclusively selected following the Government guidelines for landfilling. Moreover, an adequate buffer zone must be provided and a distance of 500 m to the nearest dwelling should be declared as a 'no development zone' by the Municipality. The site will have facilities for landfilling of waste, a composting plant, fecal sludge treatment plant, leachate collection and treatment system, boundary wall, small weigh bridge, office facilities, RCC internal road, and an embankment. The landfill will have a liner at the base of the landfill site with landfill gas collection and venting system. Figure shows proposed location of existing landfill with extension.

50. **Sanitary landfill components.** Preliminary conceptual design includes the following components along with the landfill (i) earthen embankment to isolate it from the surrounding lands; (ii) extensive plantation of trees on the embankment and its outer side slopes to have adequate slope stabilization; (iii) a composting plant; (vi) leachate collection, holding pond, and recirculation system; (v) groundwater protection (either clay or HDPE Liner based on detailed design); (vi) internal and access roads; (vii) fecal sludge management; and (viii) shed, office and workers room complete with water supply and sanitation facilities.

51. Detail technical and financial analyses for the sanitary landfill facility (SLF) site as well as institutional and financial mechanism for operational arrangements including sustainability must be carefully studied and agreed during detail design phase. The identified 16.54 ha plus additional 10 ha land for future WWTP site at Ward no 2, Saraswoti Nagar in Dhangadhi SMC is near the border to India and near the confluence of Mohana river, Kailali Nala and Seti Nala. The site can be developed as a landfill site for about 40 years. The access road from Jailghar chautara to Krishna mandir (2 km) new road needs upgrading. A new road from Saraswotinagar to SLF (1 km) must be built. River training and flood protection should be required as site is located near the confluence of Mohana, Kailali Nala and Seti Nala.

52. The location of the waste sorting/ transfer station in ward no 2 and final disposal site along with future WWTP site in ward no 1 in Dhangadhi sub-metropolitan city are indicated in **Figure 5**.

53. The conceptual design of the Dhangadhi SWM subproject is provided in **Figure 6**. The design accommodates the waste processing and composting sites plus septage drying beds for

fecal sludge management. A leachate treatment system and ground water monitoring well and weather station are included with provision of buffer area, fencing and service road.

54. The actual landfilling will be done in cells and in phase wise manner so that there is no nuisance and daily cover using soil will be placed. The site will be prepared prior to landfilling using clay liners and necessary geomembrane and geotextile as necessary with proper provision of stormwater drains and cut off drains.

55. **Table 7** provides the details of the Dhangadhi SWM subproject.

Table 7: Components of Dhangadhi Solid Waste Management Subproject

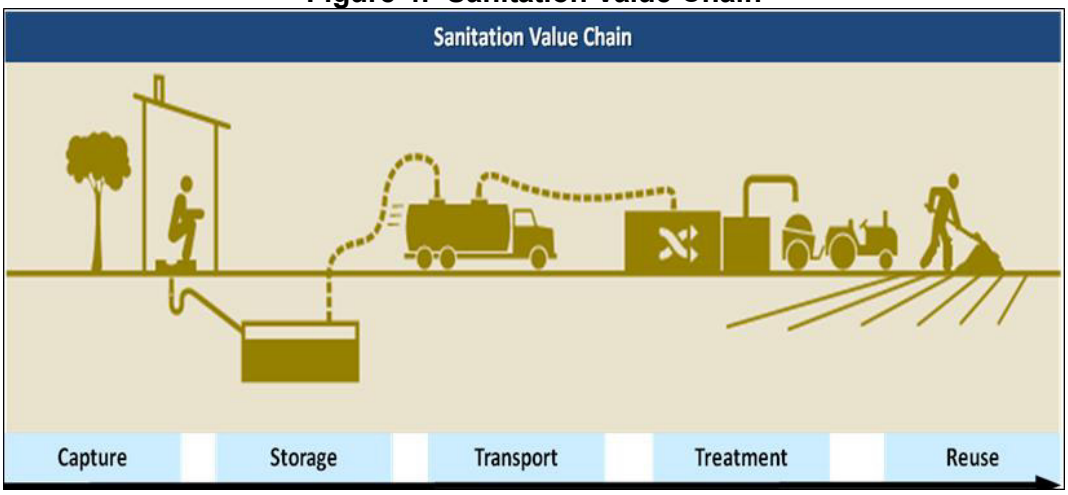
Components	Materials/goods	Unit	Area Required and Location
A. Primary waste collection			
i. Waste collection plastic bins for identifide households	- color coded (green for organic, blue for inorganic), - 10 liter (L) capacity, covered	Numbers (Nos.)	None. To be located within premises of households.
ii. Tricycle rickshaws–each tricycle to be fitted with 6 30-L capacity plastic bins. One tricycle rickshaw will collect inorganic wastes from households	Tricycle	Nos.	Not applicable (NA)
	Large size plastic bins	Nos.	NA
iii. Uniforms and personal protective equipment (PPE) for use by the household waste workers/ collectors	Uniform and PPE	Sets	NA
B. Secondary waste collection			NA
i. Trailers with tractor for waste handling	Trailers Tractors	Nos.	NA
ii. Dump truck (3 ton capacity) for waste transportation	Dump truck	Nos.	NA
iii. Uniforms and personal protective equipment (PPE) for use by the waste workers at the transfer station and MRFs	Uniform and PPE	Sets	NA
C. Composting plant			
Construction of composting plant (semi-mechanized with aerobic composting) with shredders, aerators, turning and sieving equipment, bagging, quality control equipment, etc.	5 tons capacity	No.	Area = 360 m^2 at landfill site
Uniforms and PPE for use by the waste workers at the composting plant	Uniform and PPE	Sets	NA
D. Medical Waste segregation			
Supply color coded bins for segregation of medical waste.	color coded bins	No.	NA
Medical waste will be segregated at source and will not be transferred to the landfill site. .			NA
E. Controlled landfill			
Construction of landfill, boundary wall and embankment and tree plantation as per design capacity		m	Around the landfill site
Construction of impermeable layer at the base of the site and inner side slope of the		m^2	Base area and area of inner side

Components	Materials/goods	Unit	Area Required and Location
embankment for groundwater protection, in case no underneath impermeable soil layer there (subject to the detailed geological investigation during detailed design)			slope of the embankment
Construction of leachate collection pond		m^2	
Leachate collection pipe		m	
Leachate circulation systems--hose pipe, pump, sprinklers, etc.		set	Within the landfill site
Fecal sludge management facility		m^2	Within the landfill site
Heavy equipment shed	RCC floor with tin roof supported by iron truss	m^2	At the front side of the landfill site
Compost plant/ area	Office, worker shed, bagging area, screen shed, curing shed, windrow platform,	m^2	Within the landfill site
Water supply and sanitation			At all required locations
Storm water drainage		m	Along the embankment
Wheel loader	Wheel loader	No.	To be parked at the heavy equipment shed
Uniforms and PPE for use by the waste workers at the SWM facilities.	Uniform and PPE	Sets	Not applicable.
F. Awareness campaigning, capacity building training			
Awareness campaigning	Advertisement on newspapers,	No	NA
	Posters	No	NA
	discussion meetings, etc.	No	NA
Capacity building training	Pilot scheme-van drivers and waste pickers	No.	NA
	Medical waste management- private clinics, diagnostic centers, government hospital	No.	NA
	Waste collector/van drivers	No.	NA
	Municipality personnel	No.	NA
	Landfill workers	No.	
	Fecal sludge management and Composting technicians and workers	No.	NA

56. **Proposed interventions for fecal sludge management (FSM).** It is recommended to construct the fecal sludge treatment plant (FSTP) at the landfill site. Integrated landfill and resource recovery facilities can be established here with an adequate buffer zone as

recommended by the Environment Department. Within the landfill sites, a certain area has to be earmarked for fecal sludge treatment. The proposed fecal sludge management intervention will focus on the entire sanitation value chain (**Figure 4**), i.e., safely collecting fecal sludge/ septage from pits and septic tanks, and conveying it to the FSTP.

Figure 4: Sanitation Value Chain



57. The FSTP will cater to the existing volume of fecal sludge and also have a provision for incremental expansion. The IEE will be updated during the detailed design stage with information on existing capacity and future expansion requirements. This is keeping in view that an efficient, town-wide FSM system would require effective regulations (standardizing septic tank designs and sizing, disconnection of pits/ septic tanks connected to drains) and operational efficiency in desludging practices. This scenario cannot be presumed as an immediate state of affairs but has to be brought about by means of generating awareness and training municipality personnel. It is recommended that the municipality should possess a set of all the collection and conveyance equipment mentioned in Table below to meet daily demands.

58. **Table 8** provides the required equipment for Dhangadhi FSM.

Table 8: Equipment required for Collection and Conveyance of Fecal Sludge/ Septage

S. No.	Equipment
1	Bucket System (Manual Gear) with Push Cart
2	Gulper
3	Submersible Pump
4	Transfer Station
5	Vaccu tug (2.0 cum) existing
6	Vaccu tug (1.5 cum) on pick-up
7	Dung Beetle (0.7 cum) with auto rickshaw or Dung Beetle (0.7 cum) with Power Tiller

59. A transfer station is an intermediate storage arrangement for the sludge collected from the septic tanks/ pits using small motorized system (which cannot travel far distances for disposal). Transfer stations are suitable for unplanned and high density settlement areas with limited or no access road width to the location of desludging. The municipality officials, in discussion with other stakeholders, should locate these potential areas for establishing a transfer station. An alternative for transfer stations is to unload the collected fecal sludge from small vehicles (such as dung beetle) to large vaccu trucks of 1.5 cum or 2.0 cum; these can

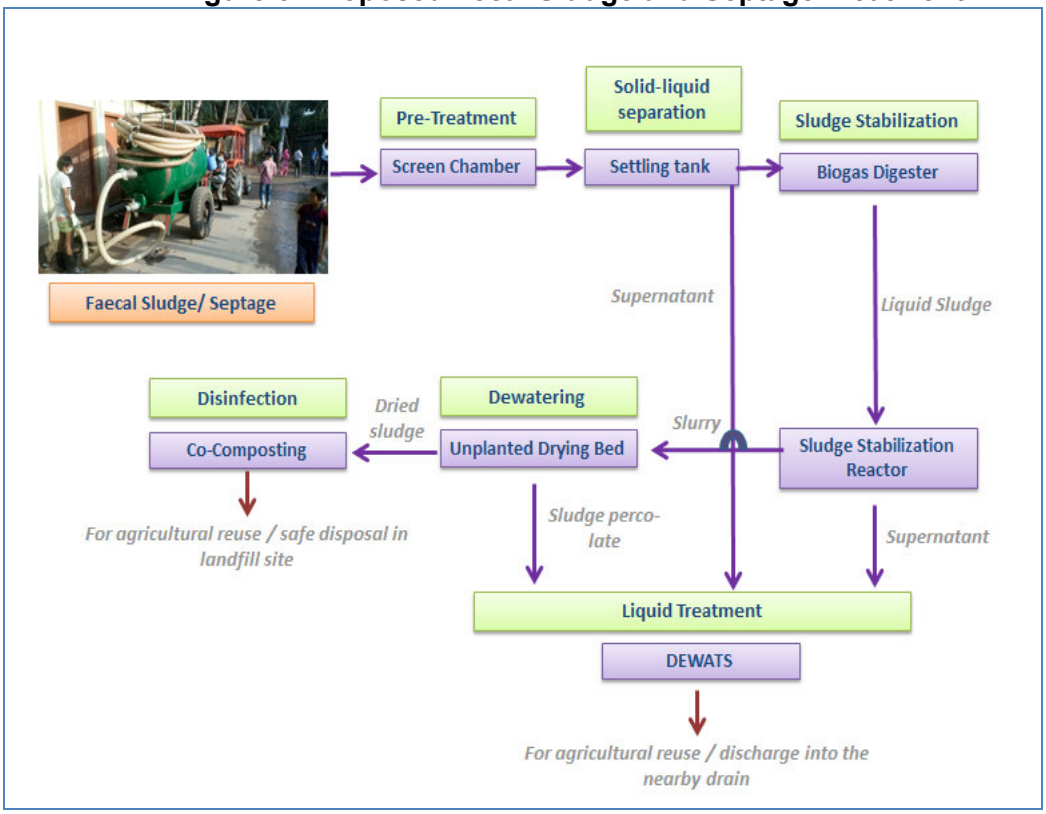
serve as a mobile transfer station for onward transportation of the collected fecal sludge to the fecal sludge treatment plant.

60. **Treatment and reuse of fecal sludge.** For treatment of fecal sludge/septage, it is recommended that the FSTP be established with a combination of the following modules having a capacity of 5 cum per day:

(i) Screen and Grit Chamber
(ii) Settling Tank
(iii) Anaerobic Digester
(iv) Stabilization Reactor
(v) Unplanted Drying Bed
(vi) DEWATS or Trickling Filter

61. **Composting plant for treatment of dried fecal sludge from drying beds with solid waste.** The co-composting of dried fecal sludge with solid waste will sanitize the dried fecal sludge by using aerobic thermophilic composting. Co-composting of fecal sludge with solid waste will make the fecal sludge safe for agricultural reuse. If the municipality is not interested in co-composting, the dried fecal sludge should be landfilled. Proposed conceptual design of the FSTP is shown in **Figures 5**.

Figure 5: Proposed Fecal Sludge and Septage Treatment



62. **Human resources required per vehicle for collection and conveyance of fecal sludge.** Periodic desludging (collection and conveyance) of pits and septic tanks should be undertaken solely by trained personnel. The collection and conveyance of fecal sludge/ septage should be managed in small teams generally consisting of personnel outlined in **Table 9**.

Table 9: Human Resources Required per Vehicle for Collection and Conveyance

Function	Number	Responsibility
Supervisor	1	Effective collection and conveyance operation, documentation, on-site supervision, certification of activity completion
Vehicle Driver	2	Safe driving of vehicle; can also work as an operator if needed
Operator	2	Carrying out collection and conveyance activities, inspections of septic tanks and pits
Helper	2	Support the operator. If driver works as an operator, operator works as a helper. (A helper is only required for desludging of a septic tank)

63. **Human Resources required for FSTP operation.** As part of building the required technical capacity to run the treatment facility should be provided the required training in alignment with the roles and responsibilities mentioned in **Table 10**. In addition to the incumbent staff members' training, a dedicated operator will be provided for the FSTP's maintenance activities.

Table 10: Human Resources Required for FSTP

Sl. No.	Technical Supervisor	Technical Engineer	Operator
1	To understand the project and technical design component of the treatment system	To assist the executive engineer	To carry out on-site operational activities as directed by the executive engineer or assistant engineer
2	To plan resources for the O&M activities - time frame, number of staff, equipment required, etc.	To mobilize resources for the O&M activities	
3	To prepare maintenance contract and signing the contract	To supervise O&M activities and to ensure timely completion	
4	To ensure overall supervision of the O&M activities	To train the operator/supervisor	
5	To maintain records and prepare documents and reports		
6	To train assistant engineers and operators		

64. **Operation and maintenance of FSTP.** Following options are available for operation and maintenance of FSTP.

(i) Option 1: Municipally Owned and Operated System
(ii) Option 2: Municipally Owned and Privately Operated System
(iii) Option 3: Privately Owned and Operated System

65. Municipality start by establishing the FSM system as a fully municipal owned and operated system as in Option 1 above. Before specific components of the system can be outsourced to private operators (as in Option 2 above), the following features need to be finalized: the capacity of the municipality needs to be established, the system should be fully operational, the costs to be understood, and the benefits should be visible to the public. Once the municipality has built the capacity to manage private operators, it can consider Option 3 where the entire system is privatized. A phased-out transition, as described above, is possible under the phased-out implementation that has been proposed for all municipality, wherein each starts with a basic set of de-sludging equipment and a modular FSTP unit. The approach recommended is one of incremental expansion.

66. The management system can also gradually increase its level of sophistication in corresponding stages. If the municipality is interested in reusing the treated fecal sludge, co-composting of dried fecal sludge seems to be an attractive option since it will be possible to treat and recycle both the fecal sludge and municipal organic waste at the same site. The National Sanitation Strategy 2014 also recommends the use of treated fecal sludge as compost. However, the most critical issue in a co-composting project is the engagement of a competent operator.

D. Indicative SWM Component Packages and Cost

67. Costs based on construction of Integrated SWM system for Nepalgunj (IUDP) with a similar geographical condition and waste generation pattern is presented in **Table 11**.

Table 11: Indicative Cost of the Dhangadhi SWM Subproject

Component Description	Cost Estimate (NRs. million)
Sanitary Landfill Site development Leachate collection and treatment plant	220 20
Other development works (internal service road, weighbridge, power supply, water supply, administrative building etc)	70
Compost Plant for bio-degradable fraction (5 ton/day windrow composting plant) plus dried septage sludge Septage sludge drying beds 3R promotion activities Development of Number of collection points (sheds) within SMC Environmental management plan	30 20 10 15 10
Equipments/ Vehicles/ Tools	60
Recycling facilities	15
Miscellaneous costs including land, access road, flood protection etc.	70
Total NRs.	540
US $	US$ 5.14 million

E. Implementation Schedule

68. The subproject is currently at preliminary concept stage. A draft indicative project management schedule covering different activities is provided as Appendix.

Figure 6: Location for Waste Sorting /Transfer and Final Disposal Sites

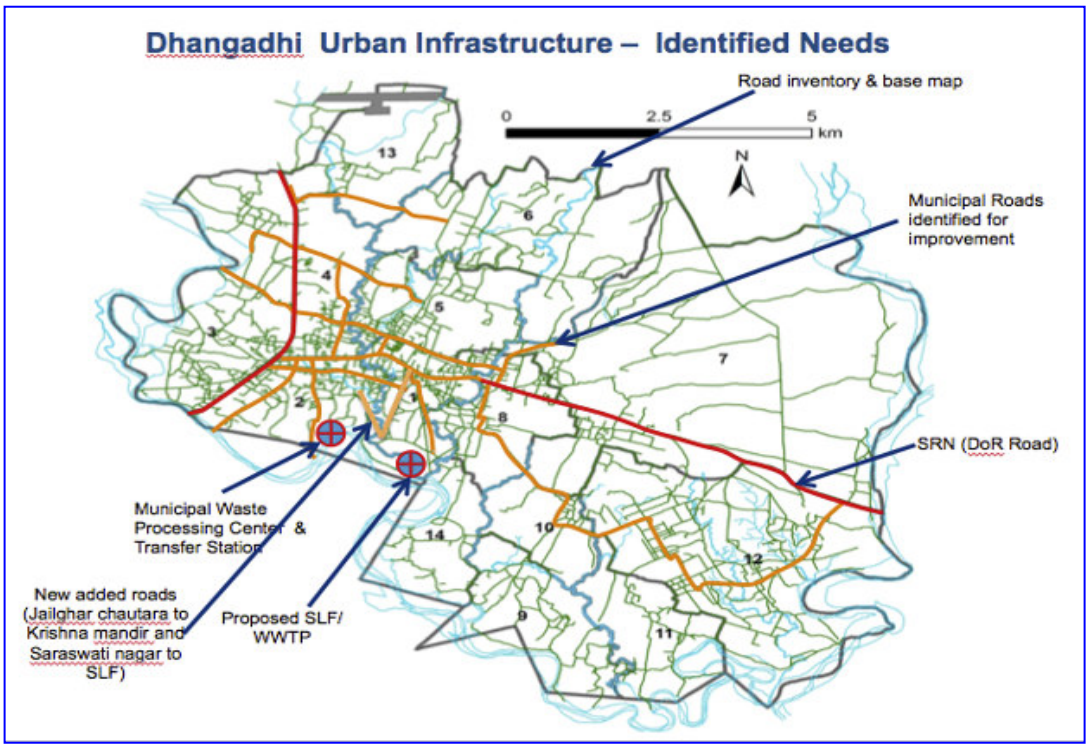
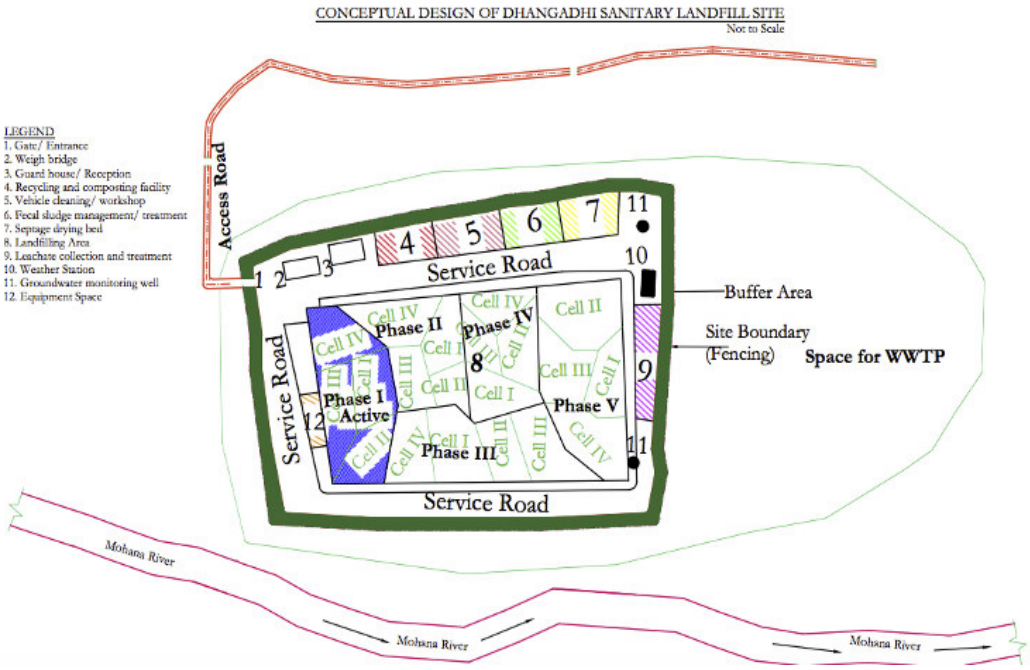


Figure 7: Conceptual Design of Dhangadhi Sanitary Landfill site



IV. DESCRIPTION OF THE ENVIRONMENT

69. Baseline information on the existing physical, biological as well as socio-economic and cultural environment of the proposed sub project are described below.

A. Physical Resources

70. **Topography.** Kailali district is one of the two districts in FWR that lies in the Terai belt of the country. It is located between 28' 22o and 29' 05o latitude and 80' 30o and 81' 180 longitude. Geologically, Kailali district is divided into 2 different regions, Chure and Terai belt respectively. Topographically, the landfill site project area of Dhangadhi sub-metropolitan citylies in the western Terai region which is a flat terrain with an average elevation of 100 m to 110 m above mean sea level. The terrain land is the most fertile for agricultural purpose while the hilly region is suitable for horticulture and livestock farming.

71. **Land use patterns.** The areas adjoining to the project area even within the municipal boundary are agricultural land. Many of the rural households are dependent upon agriculture products and the area is famous for its paddy production. The major crops produced here are paddy, wheat, maize and seasonal vegetables

72. Land use pattern of Kailali district shows that almost 65% of the area is covered by forest land. About 27.8% comprises of agricultural land and only 1.94% comprises of pasture land. The remaining part of the district has been occupied by rivers and rivulets, market area, etc. which makes up about 5.43 %.

73. Dhangadhi municipality was formed in 2033 B.S. (1976) with total 14 wards. Due to urbanization, the composition in land use pattern is changing. Because of the overall infrastructure development and the people's choice to settle in the urban area, the municipality is changing fast from its previous land use pattern. The agriculture land is still dominant. The trend of constructing houses in the Municipality is fast growing. The existing land use pattern is depicted in the **Table 12** below.

Table 12: Land Use Pattern in Dhangadhi Sub-metropolitan

S.N.	Land Use	Area In Ha.	%	Land Use	Area In Ha.	Area In %
1	Agricultural land	5772	66	cultivation	7,005	67.4
2	urban area	582.1	7	bush	163	1.6
3	forest	2436.2	28	forest	2602	25.0
				barren land	0.1	0.0
				grass land	190	1.8
				lake and pond	26	0.3
				orchard	1.4	0.01
				sand	272	2.6
				swamp	0.5	0.0
				water body	141.5	1.4
					10,400	100.0

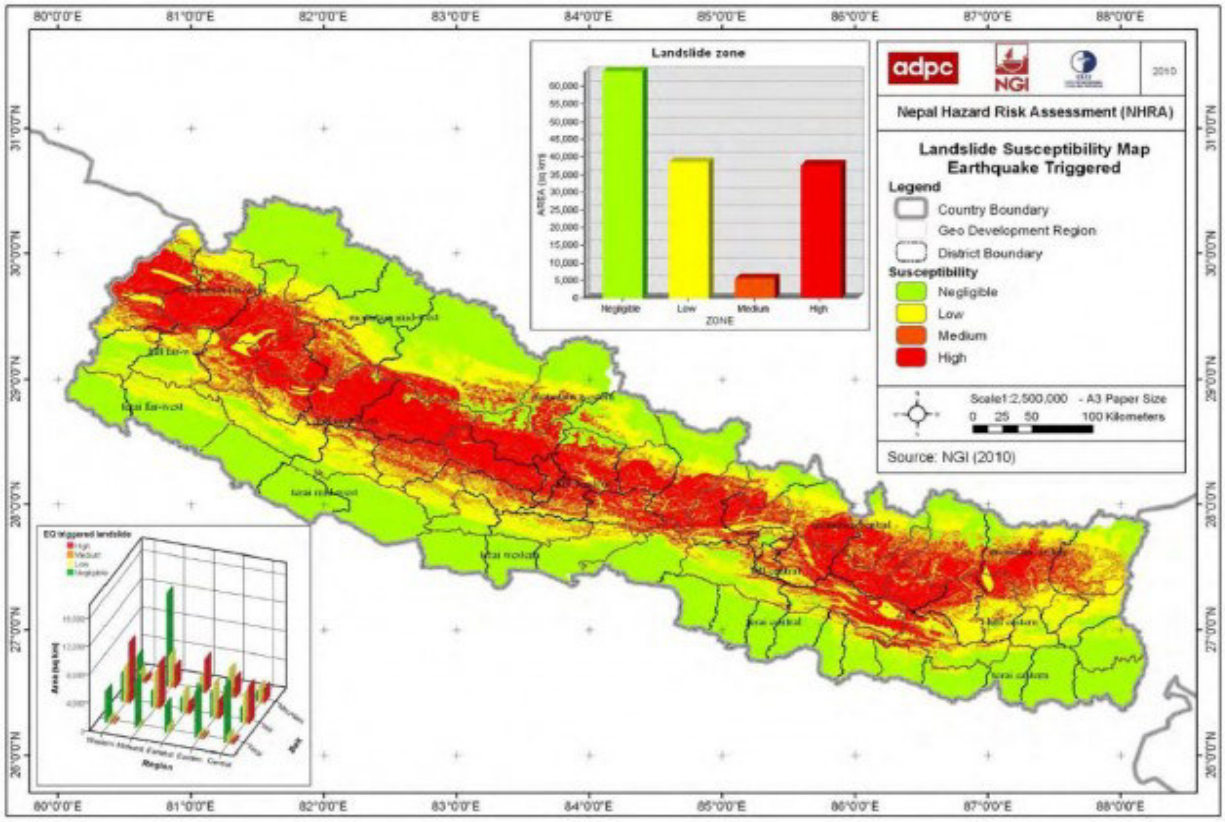
Source: Municipality Profile of Nepal, 2008 (GIS Map, Department of Survey)

74. **Climate.** Since the district covers both Terai as well as Chure region, the climate of the project area ranges from tropical to a temperate climate type. The average maximum temperature ranges about 19oC-43oC whereas average minimum temperature ranges about

7.5oC-23.5oC. However, the average annual temperature of the district is about 38^{o}C. The temperature rises during the pre-monsoon period (February to May) and declines during the post monsoon season (October to January). The average rainfall is about 1840 mm of which 80 –85% of the total rainfall occurs during monsoon season. The area receives a small amount of rain brought by the south westerly winds from the Arabian Sea. It lies in thermo-xero-chimenic bioclimatic zone represented by hot and humid bio-climates with 5-6 dry months.

75. **Geology.** Almost the entire landmass within the municipality consists of flat land. The project area lies in the Southern Terai Zone and consists of main sediments of Gangetic Plain. This zone is composed of finer sediments like sand, silt and clay. This zone is composed of finer sediments. The sediments become finer and also show change of farcies. The water table is about 3 m below the surface.

76. Earthquake: Dhanagadhi municipality is in the Terai region and is not prone to earthquake or landslides caused due to earthquakes (refer figure below from Nepal Hazard Risk Assessment[5]). Site-specific geotechnical studies will be conducted during detailed design to determine measure to be incorporated to address seismic risks.



77. **Hydrology.** There is a small stream, Kailali Nala (**Photo 1**), which runs north to south and then toward east direction near to the location of the proposed landfill site. This stream finally joins Mohana Nadi in the south. The water table of the area is at a depth of around 3 meters below the surface.

[5] Source from Nepal Seismic Zone Map – Google Maps

Photo 1: Kailali Nala

78. Mohana River (**Photo 2**) is the main water body in the project area which flows through the plain, in a generally eastern direction, along the Indian border. As it originates from mountain and leads to very wide river beds as soon as they enter the plain, in which the rivers show a braided pattern, meaning that, at least during the dry season, they split into several smaller and larger channels. These channels are rather instable due to shifting masses of sediments during the rainy season. At the edge of the river beds, erosion occurs, and the river bed, as such, can actually shift. During exceptionally high flows, the water level will rise above the river banks and can flood large proportions of the adjacent floodplains. The only parts of the Terai which are not subject to at least occasional flooding are the low ridges between the floodplains of the rivers; these are mainly covered with forest. The floodplains in the area are all used for agriculture, and all the settlements are located within them. This means that all the settlements as well as the agricultural areas are under threat from fluvial (river) flooding.

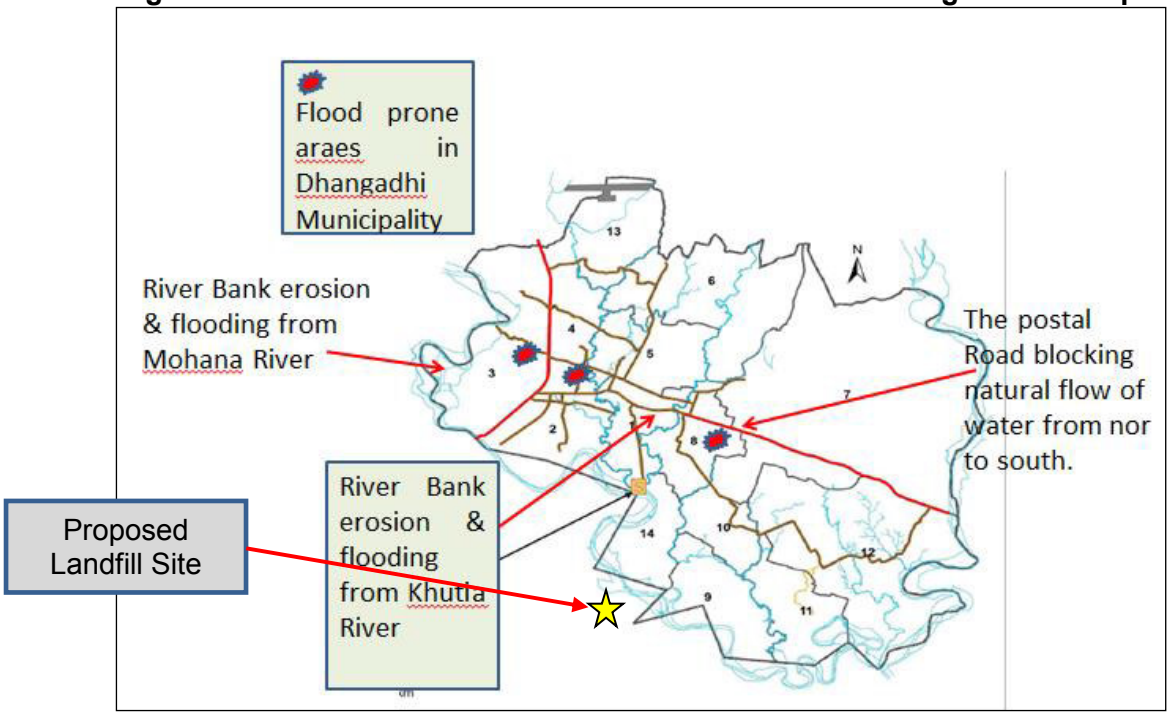
Photo 2: Mohana River

79. Apart from the surface water source as described above (which are not reliable sources), the most reliable water source for the project area is ground water source. Two types of ground water sources are available here. One type is shallow tube well (Hand pump) which is used by the people in service area and another one is deep tube well in which water has to be

exploited from the inner aquifer layer. Water from this aquifer is supposed to be safe biologically and chemically. The average depth of the aquifer is about 120 m-150 m inside the ground.

80. **Flooding.** Mohana River flows along the western boundary of the municipality, causing over-bank spill flooding and river bank erosion. In addition to the Mohana River, Kailali Nala and several local drains which flow north to south are responsible for flooding the city. The reasons being: ill-maintenance, chocking due to garbage dumps, encroachment, flattening slopes, etc. Figure 8 provides map of flood risk areas in Dhangadhi Municipality.

Figure 8: General Assessment of Flood Risk Areas in Dhangadhi Municipality



Source: Flood Mapping Report for Subregion No. 1-Far Western Terai (Bhimadatta, Jhalari-Pipaladi, Attariya, and Dhangadhi), TA-6498 REG: Knowledge and Innovation Support for ADB's Water Financing Program, 2016

81. **Water quality.** Although, the water quality data of water bodies (River and Nalas) i.e. Mohana river, Kailali Nala and other small water bodies as well as underground water sources are not available, People use underground water sources for the drinking water and the quality of water appears to be within drinking water quality standard. These are being widely utilized for drinking, washing and irrigation purposes.

82. **Air and noise quality.** There are no major industries in Dhangadhi sub-metropolitan. The few and small cottage industry doesn't contribute significant aspect to create air pollution. Air pollution is caused by fugitive dust from vehicle movements particularly over unpaved roads and other unpaved grounds, construction activities, street sweeping and wind action on unpaved exposed surfaces. Gas emissions come from household cooking, open burning, and moving vehicles. Emissions from these sources are scattered/ spread apart both in terms of locations and timing. Information on vehicle movement and other sound-producing activities is required to assess the level of noise at various sites.

B. Ecological Resources

83. The SWM subproject site does not fall under ADB SPS definition of modified, natural, critical or legally protected area (national park, wildlife reserve or conservation area) or any kind of wildlife habitat area. The area does not lie within forest of any type and there's no forest in the project adjoining/surrounding area. It's mainly agricultural land with some rural settlements in the distance.

84. However, Kailali district lie in the corridor of two important conservation areas in Nepal: Bardiya national park and Suklaphanta conservation area. Dudhiya national park lies in India across the border. These are not near the project area and need not be considered for the project.

85. **Vegetation.** The proposed landfill site is on agricultural land (Photo 3). The main natural vegetation of the project area is riverine khair-jamun (Acacia catechu-Eugenia jambolina), Simal (Bombax ceiba), Dalbergia sissoo trees and grassland (Imperata spp., Saccharum sp). along the river bank of Mohana river.

Photo 3: Vegetation in the SWM Site and Vicinities

86. **Grassland.** The adjacent terrestrial grassland vegetation (Photo 4) is equally rich comprising Cyperus distans, Phragmites karka, Cyperus esculentus. Cyperus imbricatus, Cassia tora, Chrysopogon acicualatus, Desmodium triflorum, Alternanthera sessilis, Phyllanthas urinaria, Cynodon dactylon, Centella asiatica, Justicia spimplex, Imperata cylindrica. In the less grazed area, species like Cynodon dactylon and Centella asiatica are found dominant.

Photo 4: Grasslands in the Vicinities of the SWM Sites

87. **Non-Timber Forest Products (NTFPs) in Kailali and project areas.** The non-timber forest product available and collected from the project area include fruits like Amala, Amaro, Harro, Bel, Satabari etc. Other important products are sal gum, honey and lac. Local people use Bahunia bark for making ropes for making dye.

88. **Agrobiodiversity found in project areas.** In project region and in some part of ZoI the project is agricultural land. Various kinds of crops, cash crops, oilseeds, pulses, vegetables and fruits are grown there major of which are rice (Oryza sativa), wheat (Triticum aestivum), maize (Zea mays),musuro; lentil (Lens culinaris), mustard (Brassica rapa),peanut (Arachis hypogaea), sugarcane (Sacharum officinarum), sweet potato (Ipomoea batatas), potato (Solanum tuberosum), tomato (Lycopersicum esculentum), onion (Allium cepa), cauliflower (Brassica oleracea), pea (pisum sativum), carrot (Daucas carrota), garlic (Allium sativum), radish (Raphanus sativus), mango (Mangifera indica), banana (Musa paradisiaca), papaya (Carica papaya), jackfruit (Artocarpus integra), litchi (Litchi chinesis),nibuwa (Citrus limon), lemon (Citrus aurantifolia), guava (Psidium guajava), water lemon (Citrullus lanatus) etc.

89. **Fauna.** The fauna reported to be present in the nearby forests are listed in **Tables 13** to **14**[6].

Table 13: List of Mammals Found in Kailali District

Common Name	Scientific Name
Rhesus monkey	*Macaca mulatta*
Asian Elephant	Elephas *maximus*
Hanuman langur	*Presbites entellus*
Jungle cat	*Felis chaus*
Fishing cat	*Felis viverrina*
Leopard cat	*Felis bengalensis*
Common mongoose	*Herpestes edwardsi*
Jackal	*Canis aureus*
Indian Fox	*Vulpes bengalensis*
Otter	*Lutra lutra*
Squirrel	*Fanambulus sps*
Flying squirrel	*Petaurista petaurista*
Hare	*Lepus nigrcollis*

90. Local people reported about the occasional appearance of wild Asian elephant in the project site, Asian Elephant (Elephas maximus) is included in IUCN Red List with 'E' status. The visit of wild elephant is very rare and it usually comes from Indian Border side. It's not a breeding/ feeding/ or resting place for the elephant.

Table 14: List of Birds

Common name	Scientific Name
Indian moor hen	Gallunila *chloropus*
Pigmy goose	Nettapus coromandeeliarnus
White breasted kingfisher	*Halcyon smyntensis*
Stork-billed kingfisher	*Pelargopsis indicus*
Large golden-backed woodpecker	*Chrysocolaptes lucidus*
Gray tit	*Parus major*
Jungle babbler	*Tudoides striatus*
Pin tail duck	*Anal acuta*
Jungle crow	*Corvus macrorhynchos*
Spotted dove	*Streptopelia chinensis*

[6] Table 13, 14 and 15 are based on secondary data and available literature for the region. No rare, endangered or protected species have been identified during site visits and assessments in the subproject area.

Blossom headed parakeet	*Psittacula cyanocephala*
Rose ringed parakeet	*Psittacula krameri*
Scarlet minivet	*Pericrococotus pandicerainus*
Lesser wood shrike	*Tephrodomis pondicerianus*
Gray hornbill	*Tockus birostris*
Red whiskered bulbul	*Pycnonulus jocosus*
Gray headed fly catcher	*Cullcicappa ceylonensis*

91. **Aquatic species.** Fishes found in the nearby small streams and rivers are given in **Table 15**.

Table 15: List of Fishes

Common Name	Scientific name
Rawa	*Cirrhinus sps.*
Rohu	*Labeo rohita*
Andha bam	*Amphipnos cuchia*
Bhoti	*Chauna gachura*
Bam	*Mastacembelus sps.*
Garahi	*Chauna punctatus*
Mahasir	*Tor putitora*
Sahar	*Tor tor*

.

C. Social and Cultural Resources

92. **Demography.** The total population of the sub-metropolitan cityis 101,970; out of which 51,439 are male and 50,531 are female. The total number of household in the municipality is 21,030. The average household size is 4.85. (Source: CBS, 2011)

93. Project area is in ward no. 2 of the sub-metropolitan. Population of ward no 2 is 12,459; out of which 6,410 are male and 6,049 are female. Saraswatinagar settlement is nearest settlement of Dhangadhi municipality, Ward no. 2 with around 300HH. (Source: CBS, 2011). Similarly, population of ward no 1, which is also very close to proposed landfill site is 14,333; out of which 7,326 are male and 7,007 are female. Om Shanti Tol (62 household), Malika Tol (75 household and Navadurga Tol (45 househod) are the nearest settlements of Dhangadhi municipality, Ward no. 1. Most of the households in the project area are rural households.

94. **Caste and ethnicity.** The major ethnic groups in Saraswatinagar settlement are Tharu, Brahmins, Chhetries and Dalits (Sunar, Bishwokarma).

95. **Health facilities.** The zonal and district hospital exists in the Dhangadhi sub-metropolitan. Similarly, there are some private hospitals in the sub-metropolitan.

96. **Educational facilities.** The educational status of the project beneficiaries is good in the sub-metropolitan. Nearly 90 % of the project population are literate and/or with higher educational status. But, the rural area of ward no. 1 and 2 are relatively backward in education facilities. There's one secondary school and one private boarding school in the ward. People with higher education degree are very difficult to find in the ward.

97. **Employment.** Most of the populations (over 90 %) in the project area are employed. Major occupational activity is agriculture, daily wage work and service/ jobs holder. Other occupational activities in the area are foreign employment mainly in India.

D. Physical Infrastructure

98. **Transportation.** The subproject area is accessible through motorable road from main city area of Dhangadhi sub-metropolitan, but the whole section of the road is not yet blacktopped. The nearest airport is the Dhangadhi airport at Attariya municipality (then Geta VDC), where daily flights from Kathmandu provide their services. In addition to this, the project area is near the Indian Border and thus can also be accessed at Gauri Phanta border.

99. From the bus park located in Dhangadi sub-metropolitan, numbers of buses operate to different parts of Nepal. Both night as well as day bus services are available in the district. Nearly all the wards of the municipality are linked by all-weather black topped road. Ward Nos. 1,2,3,4,5,6,7,8,10 and 13 are facilitated and linked by all-weather black topped road which make up about 70 km. Other than this within the municipality, 140.4 km road has been graveled whereas 200 km road is at vulnerable state as they are not all weather road. During summer, these roads get very dusty whereas during monsoons travelling through any form of transportation is very difficult. Rickshaws are the major medium of transportation within the sub-metropolitan. Most people in the project area have bicycles which is also major medium of transportation in Dhangadi sub-metropolitan.

100. **Drinking water supply.** The existing NWSC water system is a groundwater based system with overhead tanks and intermittent supply through private household connections. Source of water for the existing system is groundwater boreholes, over 150 meters in depth and fitted with submersible pumps. In the district nearly 93% population has got access to drinking water.

101. Most households, which are generally rural, rely on shallow tube wells, dug wells and springs. The shallow tube wells extract water from the top layer aquifer which is susceptible to contamination.

102. **Sanitation and wastewater.** Existing sanitation facilities are generally quite basic in the rural areas of Dhangadhi sub-metropolitan. Although the sub-metropolitan city has imposed mandatory provision to construct toilets with septic tank and soak pit in each house, some of the poorer households still only have simple pit latrines while about 10% of households still do not have their own toilet facilities.

103. There is no municipal sewerage or service offered for removing septage (septic sludge) from the septic tanks. Usually, households will contact a local contractor who will arrange to empty the tank manually or by vacuum tanker.

104. **Solid waste management.** The average MSW generation in Dhangadhi was reported to be 0.14 and 0.28 kg/ capita/ day. With these per-capita waste generation rates and projected population for the year 2015, the total MSW generation from Dhangadhi sub-metropolitan city is estimated at 31 tons/day.

105. The sub-metropolitan city has scheduled waste collection two times every day in the main city street. The current waste collection rate is only 42%. All waste is collected in sub-metropolitan citytrucks which are finally dumped on the bank of nearby Kailali nala, about 2 km from the city center. Recently, the sub-metropolitan city purchased land about 2km south of the city center for establishing a waste sorting/ processing center and transfer station.

106. There is no official waste segregation in the sub-metropolitan. But recyclable wastes are sold to the waste pickers who collect fractions like paper and paper product, plastic, metals, glass bottles. In exchange they often give food items for the waste. The waste pickers sort the wastes which are sold and transported either to India or to Nepalgunj.

107. The sub-metropolitan city does not have any system for collecting and managing medical waste or any other type of special waste separately. Medical waste from these establishments is dumped along with regular municipal waste.

108. **Urban roads and surface water drainage.** There are 561 km of roads (black topped, gravel road and earthen surface/track) including Mahakali Highway and Postal Road in Dhangadhi sub-metropolitan. Besides the 13km of main highway, about 20% (113km) municipal roads are reported as blacktopped. All the remaining roads are either gravel or earthen surfaced.

109. **Electricity.** All the wards of the Dhangadhi municipality have electricity for household consumption supplied by Nepal Electricity Authority (NEA) through its national grid. Altogether there are 8,363 consumers of electricity in the municipality. A total of 105,650 households have electricity supplied from NEA and among these only 24.6% of household have metered connection. Apart from NEA, the consumers fulfill their electricity demand from alternative sources such solar home system (SHS).

110. **Communications.** Dhangadhi municipality has been facilitated by telephone and mobile phone services which include GSM, CDMA, and sky mobile. Most of the organizations in the district have telephone as well as internet facilities. In the district 5.38 telephone lines have been distributed per thousand people. In the project area there are 15 cyber cafes which are providing internet facilities to the public residing within the municipality. Majority of people living in and around municipality have television in their home. 53.7% households of the district have access to radio facility. Municipality is facilitated by different national daily newspapers. Besides, there are altogether 15 local newspapers which are being published either on daily, weekly or monthly basis. There is also good facility of postal service in the district as there are one district post office, 13 regional post offices and 33 additional post offices. (Source: District Profile, Kailali district, 2066).

E. Economic Characteristics

111. **Industries.** There are no sizeable industries in and around project area but there are 153 industries operating within the municipalities (Source: District Profile, Kailali district, 2066). Majority of these industries are of small scale or cottage industry. Regarding commerce, there is no big business in the service area but few small businesses for local residents are found running well.

112. **Agricultural development.** The areas adjoining to the project area even within the municipal boundary are good for agriculture and many of the rural households are dependent upon agriculture produce. The area is famous for its paddy production. The major crops produced are paddy, wheat, maize and seasonal vegetables. Beside agriculture most of the families maintain some livestock.

113. **Tourism development.** The subproject area hasn't got any significant tourist attraction; however, tourism industry is flourishing well in the Kailali district for internal as well as external tourists. Presence of airport in the district could be the plus point in attracting both national as well as international tourists. Jokhar Baba and Tilke Lake could be major tourist attracting destination of the district. Jakhaur Lake is nearest recreational centre within the municipality for local, domestic as well as international tourists. Presence of cool and pleasant environment with dense covering of Sal forest is major attraction of the area around Jokhar Lake. Devariya Botanical garden if maintained and upgraded can generate lot of national as well as international currency for the municipality through its natural beauty.

114. **Physical or cultural heritage.** There are usual temples at various locations in the sub-metropolitan citybut no culturally important place in the surrounding of the project area. However, Kailali district have several cultural and religious sites as listed below:

(i) Jokhar Baba Lake
(ii) Buddha Temple
(iii) Pashupati Temple
(iv) Nainadevi Temple
(v) Kalika Bhairav
(vi) Bandevi Temple
(vii) Godha-Godhi Lake
(viii) Laxmi-Narayaan Temple
(ix) Rajyog Sewa Kendra

115. The main festivals celebrated in the area are Dashain, Tihar, Maghi, Gaura, and Holi.

F. Major Environmental problems

116. Some of the environmental problems prevalent in the municipality are:

(i) lack of landfill site for solid waste management as currently solid wastes are dumped along the river side;
(ii) lack of proper management of medical wastes from Seti zonal Hospital; and
(iii) during the rainy season there is major problem of river bank erosion along the alignment of the Mohana River due to which the nearby crop land suffer severe damage to its fertility and production capability.

V. ALTERNATIVE ANALYSIS

A. Project Alternatives

117. The alternative analysis in this study has considered "No Action" option with the implementation of proposed action option. "No action" option represents the scenario of the present situation, which means the condition without any intervention. "With Action" means the condition with some intervention in terms of implementation of proposed action.

B. Design Alternative

118. The SWM subproject has been formulated to improve the solid waste management system in the municipality. To achieve that, a sanitary landfill site is needed to be designed with

associated facilities. Therefore, the proposed subproject has been envisaged to streamline the various systems and develop an appropriate landfill site. The present project is designed with due consideration of these aspects and thus the proposed design has no alternatives.

C. Project Site/ Location Alternative

119. No significant adverse environmental impacts are found with present location of the project. The location of the landfill site has been finalized after consultation with the local community. Among various sites identified by the municipality, proposed landfill site has been considered as the best one, since the site is far from the settlement area and the distance from the city core area is only around 3 km, though the site needs some flood protection measures along the bank of Mohana river and Kailali Nala. Therefore, the proposed location of the project has no alternatives.

D. Alternative in Technology, Implementation Procedure and Raw Materials

120. The work involved is labor intensive and minimum use of mechanical equipments is involved. Most of the construction work will be done by labor force which will produce minimum environmental impacts. Trained manpower will be used so that there is minimum disturbance of the local system and no health and safety hazards to workers arise.

121. The working procedures proposed are participatory one and the beneficiaries will be actively participating in all the phases of the project. Except from some mechanical equipment for excavation, most of the raw materials used will be local in nature. Similarly, as far as possible, local people will be employed for the project so that the chances of conflict are minimal.

E. No Project Option

122. The no-project alternative prevents the implementation of the project. Such action will impede the local people of the area from the right of living in sanitary environment. If the project is not implemented, urban environmental quality will be poor as usual. It also limits the chances of socio-economic development of the area.

123. On the other hand, if the project is implemented, the people of the area not only benefit from better solid waste management system, but project implementation will also create job opportunities, thereby improving the socio-economic condition of the local people and help in improving their quality of life. The do-nothing option will be able to avoid some minor environmental impacts; however, solid waste management problem will remain intact.

VI. ANTICIPATED ENVIRONMENTAL IMPACTS

A. Methodology

124. Issues for consideration have been raised by the following means: (i) input from interested and affected parties, (ii) desktop research of information relevant to the proposed subproject, (iii) site visits, and (iv) evaluation of proposed design scope as per PPTA study and potential impacts.

125. The area of impacts considered is: (i) area occupied by proposed landfill site, and (ii) immediate surroundings of the landfill site facilities (30 m circumference). Categorization of the

subproject and formulation of mitigation measures have been guided by ADB's REA Checklist for solid waste management and ADB SPS, 2009.

B. Screening out Areas of No Significant Impact

126. From the preliminary design and results of the rapid environmental assessment, implementation of proposed SWM subproject will not have major negative impacts because activities will be localized/ site-specific and short. Moreover, the area of impact of the subproject will be on existing sites, vacant lands, and immediate surroundings, and construction will be conducted within a relatively small area. Because of these there are several aspects of the environment that are not expected to be affected by the subproject and thus can be screened out of the assessment at this stage but will be assessed again during detailed design stage and before implementation (**Table 16**).

Table 16: Fields in which the Subproject is Not Expected to Have Significant Impacts

Field	Rationale
A. Physical Characteristics	
Topography, landforms, geology and soils	Required amount of materials will not cause alteration of topography, landforms, geology and soils. Erosion hazard is insignificant as trenching and excavation works will be conducted only during construction stage (short-term) and specific to sites along public ROWs.
Climatic conditions	Short-term production of dust is the only effect on atmosphere. However, impact is short-term, site-specific and within a relatively small area. There are well developed methods for mitigation.
B. Biological Characteristics	
Biodiversity	Activities will not cause direct impact on biodiversity values. The construction activities do not anticipate large scale cutting of trees. Trees cut will be replanted as per local regulatory requirements.
C. Socioeconomic Characteristics	
Land use	No alteration on land use.
Type of community spread	No alteration on type of community spread.
Existing provisions for pedestrians and other forms of transport	Road closure is not anticipated. Hauling of construction materials and operation of equipment on-site can cause traffic problems. However, the proposed subproject will follow existing ROW alignment and impact is short-term, site-specific and within a relatively small area. There are well developed methods for mitigation.
Socio-economic status	Subproject components will be on government land and existing ROWs thus there is no requirement for land acquisition or any resettlements. Manpower will be required during the 24-month construction stage. This can result in generation of contractual employment and increase in local revenue. Thus, potential impact is positive and long-term.
Other existing amenities for community welfare	Construction of subproject components involves simple techniques of civil work. The anticipated impacts are temporary and for short duration.
D. Historical, Cultural, and Archaeological Characteristics	
Physical and cultural heritage	There are no scheduled or unscheduled historical, archaeological, pale-ontological, or architectural sites of heritage significance listed by local and/or national authority and/or internationally (UNESCO) within or adjacent to subproject sites.

C. Anticipated Impacts and Mitigation Measures–Planning and Design Phase

127. **Subproject selection criteria.** The project environmental assessment and review framework specifies environmental criteria to avoid or minimize adverse impacts during the identification and finalization of drainage subprojects. The following criteria were considered to the maximum extent possible for site selection and finalization:

128. **Land acquisition, land use change and resettlement.** Any land acquisition and involuntary resettlement impacts will be addressed in the resettlement plan prepared as per requirements of ADB SPS and Government of Nepal rules and regulations. The conversion of the agricultural land into constructible area will have significant impact on the land use. Land of project site, which is now an agricultural land will be occupied with construction activities and stockpiling of construction materials and it will change the present pattern of land use. During construction stage, due to the development of proposed road, land occupied by the road will be converted as a bituminous surface permanently. Expansion of roadside settlement and changes in land use will have huge impact on loss of agricultural land, which will directly reduce the agricultural production. This impact will be experienced by people living in Indirect Impact Zone. The impact will be of direct nature, high in magnitude, local in extent and long term in duration.

129. Cutting of trees will not be required as per preliminary design. This will be reassessed during detailed design stage and if cutting of trees will be required, compensatory plantation will be done as per the government's guidelines by the contractor, who will also maintain the saplings for the duration of his contract.

130. A Plantation plan will be developed including location, resources, number and type of trees to be planted per tree loss and survival rate during implementation will be monitored and reported.

131. Planning principles and design considerations have been reviewed and incorporated into the site planning process whenever possible. Locations and siting of the proposed infrastructures were considered to further reduce impacts.

132. The concepts considered in design of the Dhangadhi sub-metropolitan city solid waste management subject are: (i) locating facilities on lands owned by the government/ Dhangadhi sub-metropolitan city; (ii) taking all possible measures in design and selection of site to avoid resettlement impacts; (iii) avoiding where possible locations that will result in destruction/ disturbance to historical and cultural places/ values; (iv) avoiding tree-cutting where possible; and (v) ensuring all planning and design interventions and decisions are made in consultation with local communities and reflecting inputs from public consultation and disclosure for site selection.

133. **Environmental considerations in design.** By considering certain features in the engineering design of a sub-project, it is often possible to reduce or eliminate some of the possible adverse environmental impacts during both construction and operational phases of a subproject. **Table 17** shows environmental impacts and environmental considerations to be included in design to reduce the impacts, this can be considered during detailed design. The updated IEE should provide detailed information on how the measures are considered in the design.

Table 17: Environmental Impacts and Environmental Considerations to be Included in Design to Reduce the Impacts

Subproject	Environmental Impacts	Design Considerations to mitigate impacts

Subproject	Environmental Impacts	Design Considerations to mitigate impacts
Solid waste management	High volume of solid waste Lack of recycling and segregation of waste Improper solid waste management secondary transfer stations may cause leachate leaching to nearby water bodies including groundwater. This will substantially reduce the dissolved oxygen of the water bodies and affecting the aquatic ecology. Improper disposal of bio-medical waste	Enhance sustainability and promote the 3Rs of waste (reduce, reuse and recycle) Diversion and conversion of bulk part (about 50%) of the waste into resources (compost, biogas, energy, inorganic waste recycling). The remainder will go to a scientifically managed 'cut and fill' system (controlled landfill), where leachate water from waste, venting of landfill gas, impermeable matter introduced at the base as liner, daily cover material on the top fresh waste are considered to be handled scientifically. Secondary transfer station should not be placed within near water body and drains. Depending upon the population of the wards, at least one container should be placed in each ward. The containers should be placed on a raised base of 9 to 12 inches to avoid water infiltration inside the containers in the case of water logging during monsoon. Proper solid waste management practice is strictly required to follow. Regular water quality monitoring of nearby surface water bodies and ground water is required to conduct A bio medical waste management facility is also to be incorporated into the design of the proposed facility. All these approaches are already incorporated in the preliminary design of the solid waste management The existing landfill pollutes the groundwater underneath, nearby water bodies and creates environmental nuisance. Proposed landfill with proper design, operation and maintenance will improve the existing situation. However, groundwater and surface water monitoring is required.

134. **Selection of construction camp, material shed and site selection of sources of materials**. Site selection of construction work camps, stockpile areas, storage areas, and disposal areas will be done to avoid any impacts on the nearby environment and community.

135. **Climate change adaptation and disaster risk management considerations.** Dhangadhi sub-metropolitan city needs to deal with the impacts of climate change that are mainly associated with increased rainfall, rain-driven drainage congestion and urban flash flooding. Inadequate drainage and waste management systems are contributing to localized flooding, drainage congestion, waterlogging and water pollution. The majority of waterlogged areas seem to be in the municipality's newer areas, away from its historic business district. Inadequate drainage and waste management systems are contributing to localized flooding, drainage congestion, water logging and water pollution.

136. Flash flood and waterlogging will be accelerated due to increase of climate change impacts. It is recommended that project design construction, especially design material, method of construction should be taken appropriate to make the project climate-proof and disaster

resilient. During the detailed design, the environment specialist properly consulted with the design team to incorporate this impact. The climate change impact and necessary consideration in design for adaptation is shown in **Table 18**.

Table 18: Climate change impact and design considerations

Climate change effect/ impact factor	Impact	Design consideration for mitigation
Water level high/ Sea level rise	Inundation of low laying area. Creation of nuisance due to frequent inundation if solid waste landfill and/or secondary transfer station are located on low laying area	Location of the landfill and STS should not be in the low laying area. Build the embankment around the landfill with a height considering highest flood level. Location of landfill should be at least 20m preferably 100m away from river. Tree plantation need on the embankment to create buffer zone.
Salinity	All construction material will be impacted due to salinity: corrosion and dampness	All construction material should saline resistant, anti-saline admixture can be used.
Cyclone and tidal surge	Wind speed will damage structurally to building, damage to plant and vegetation, tidal surge will damage embankment, cyclone may damage landfill operation, may dislocate waste and create naissance	Structural design should consider cyclone wind speed; wind breaker can be introduced around the building and site. Plant timber trees, proper cross drainages should be provided to the embankment, design should consider height of the storm surge; drain valve can be used at drain outlet to protect backwater flow from drain. Landfill daily cover and compaction should be strictly maintain in daily operation of the landfill.
Floods and water logging	Erosion to internal road surface and structural damage to drain and road due to over topping and water logging; ground floor of the building can be flooded due to low plinth building; overflow of sanitation can create nuisance and disease spreading, tube-well can be contaminated due to intrusion of flood water. Nuisance may create due to frequent flooding/waterlogging if solid waste landfill and/or secondary transfer station are located on flood prone or water logged area	Proper side drainage and cross drainage should be provided to road, road and drain design should consider high flood level, plinth level of building should be raised considering high flood level, toilet and other sanitation structure should constructed on raised ground, tube-well should be also placed raised ground. Location of the landfill and STS should not be in the flood prone/ water logging area. Build the embankment around the landfill with a height considering highest flood level.
Lack of drinking water	Effect on water supply, disease can be spread due to drink impure water	Water supply should consider water demand properly, surface water should be used as water source for treatment plant.
Drought	Impact on plant and vegetation, water scarcity, delay in landfill digestion mechanism due to lake of moisture, load shedding of electricity	Pond should be excavated and re-excavated. Proper electric supply system should be established, solar electric should be used rather than conventional electric supply. More

Climate change effect/ impact factor	Impact	Design consideration for mitigation
		tube-well should be sunk.
Construction materials' quality		Most durable materials possible, even if higher cost, e.g. concrete, high quality bricks should be chosen; anti saline admixture should be used. Construction quality should be monitored and controlled.
Rising temperatures		Works during most favorable times of year and day should be executed. Preparing, placing and curing concrete and mortar, to ensure placement, etc., during most favorable times should be monitored and controlled; plain high-quality un-rendered brickwork and high quality cement mortar in preference to rendered low-grade bricks should be used; sulphate resisting cement should be used in vulnerable locations (higher heat gain during curing) or cement containing fly ash (less heat gain, so preferred).
Runoff		Trapezoidal section side drains with small low-flow section (cunette) for low flows should be used. Side drains should be lined to achieve higher discharge velocities without increasing risk of scour, etc.

D. Anticipated Impacts and Mitigation Measures–Construction Phase

137. In the case of this subproject (i) most of the individual elements are relatively small and involve straightforward construction, so impacts will be mainly localized and not greatly significant; (ii) most of the predicted impacts are associated with the construction process, and are produced because that process is invasive, involving excavation and earth movements; and (iii) being located in the area designated by Dhangadhi sub-metropolitan city for SWM facilities, will not cause direct impact on biodiversity values.

138. **Construction method.** Trenches will be dug by backhoe digger, supplemented by manual digging where necessary. Excavated soil will be placed nearby, and the materials (brought to site on trucks and stored on unused land nearby) will be placed in the trench by crane or using a small rig. The infrastructures will be constructed manually according to design specifications. Any excavated road will be reinstated.

139. Under the SWM subproject the civil construction works are for SLF development including controlled building, worker shed, heavy equipment shed, compost facility, leachate treatment pond, waste unloading area, leachate collection pond and embankment around the landfill site. The controlled building, worker shed, and heavy equipment shed all will be of tin-shed supported by iron/wooden truss, brick walls and brick/ reinforced cement concrete (RCC) foundation. Other than the heavy equipment shed all will have cement concrete (CC) floor and brick/ RCC foundation. The heavy equipment shed will be of RCC floor. For the waste unloading

area and down-ramp there will be RCC works of top surface and the underneath is sand filling with side slope protection works. Except the front side, which is the highway, three sides of the area will be enclosed with an earthen embankment. The soils required for the construction of the embankment will be imported from other areas. Alternatively, the soils can be taken by making borrow pits in the area inside the embankment subject to the soil investigation; this will increase the waste loading capacity and so the lifespan of the landfill site. The compost plant area will be of CC floor and tin-shed without any surrounding wall to encourage free flow of air/oxygen for promotion of aerobic digestion of composting. The area of the plant will be formed with earth-filling along with side slope protection works for the earth filling works. The leachate pond will be constructed of digging earth subject to the geological investigation of the area (in case there is a natural impermeable soil layer for groundwater protection and groundwater depth is much high). For artificial liner at the base and groundwater depth is low, the pond will be made of RCC works and in this regard a special type of high density concrete will be required to use.

140. Also there will be two rooms (one for recyclable material storage and sorting, and the other for hazardous medical waste storage and putting other equipment). These two rooms will have tin-sheds, CC floor, brick walls, and brick/ RCC foundation.

141. There is sufficient space for a staging area, construction equipment, and stockpiling of materials. However, the contractor will need to remove all construction and demolition wastes on a daily basis.

142. **Positive impact due to increase in employment opportunity to local people.** The project will generate direct employment opportunities to the local people of the area. As the project involves construction work it will offer a grand opportunity for various skilled and non-skilled work forces. The amount of money earned by the local people will directly affect the local economy thereby reducing the chances of seasonal migration of the local people. The project will provide short term direct employment benefit to majority of the construction workers and even long term employment to few workers during the operation of the project. In order to augment such benefits, priority will be given to employ local laborers as far as possible.

143. **Positive impact due to increased economic activities.** The project requires large quantities of different type of construction materials such as cement, sand, aggregate, wood, steel reinforcement, sanitary fittings, etc. these materials shall be brought from the local market. The cement mixer, wheel barrow, pulley etc. shall also be hired from local market. The worker shall also buy their daily consumable goods from the local grocery and have breakfast, lunch, tea and snacks in local restaurants and tea shops. Thus, the local businessman and suppliers shall be benefited from this opportunity. The magnitude of the impact shall be high, local, short term and impact is very significant.

144. Although construction of these project components involves quite simple techniques of civil work, the invasive nature of excavation and the project sites in built-up areas of Dhangadhi sub-metropolitan city, where there are a variety of human activities, will result in impacts to the environment and sensitive receptors such as residents, businesses, and the community in general. These anticipated impacts are short-term, site-specific and within a relatively small area. There are no impacts that are significant or complex in nature, or that need an in-depth study to assess the impact. Thus, Dhangadhi sub-metropolitan city SWM subproject is unlikely to cause significant adverse impacts. The potential adverse impacts that are associated with construction activities can be mitigated to acceptable levels with the following mitigation measures (**Table 19**).

Table 19: Anticipated Impacts and Mitigation Measures–Construction Phase

Field	Impacts	Significance, Duration and Magnitude	Mitigation Measures
A. Physical Characteristics			
Topography, landforms, geology and soils	On a cumulative effect of all types of subprojects in Dhangadhi sub-metropolitan city, a significant amount of gravel, sand, and cement will be required for this subproject. Extraction of construction materials may cause localized changes in topography and landforms.	The impacts are negative and long-term but site-specific within a relatively small area and reversible by mitigation measures.	• Utilize readily available sources of materials. If contractor procures materials from existing burrow pits and quarries, ensure these conform to all relevant regulatory requirements. • Borrow areas and quarries (If these are being opened up exclusively for the subproject) must comply with environmental requirements, as applicable. No activity will be allowed until formal agreement is signed between PIU, landowner and contractor.
Water quality	Trenching and excavation, run-off from stockpiled materials, and chemical contamination from fuels and lubricants may result to silt-laden runoff during rainfall which may cause siltation and reduction in the quality of adjacent bodies of water.	The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.	• Prepare and implement a spoils management plan • Prioritize re-use of excess spoils and materials in construction activities. If spoils will be disposed, consult with Dhangadhi sub-metropolitan city on designated disposal areas. • All earthworks must be conducted during dry season to maximum extent possible to avoid the difficult working conditions that prevail during monsoon season such as problems from runoff. • Location for stockyards for construction materials shall be identified at least 300m away from watercourses. Place storage areas for fuels and lubricants away from any solid waste management (SWM) leading to water bodies. • Take all precautions to minimize the wastage of water in the construction activities. • Take all precautions to prevent entering of wastewater into streams, watercourses, or irrigation system. Install temporary silt traps or sedimentation basins leading

Field	Impacts	Significance, Duration and Magnitude	Mitigation Measures
			to the water bodies. • Ensure diverting storm water flow during construction shall not lead to inundation and other nuisances in low lying areas. • While working across or close to any water body, the flow of water must not be obstructed. Ensure no construction materials like earth, stone, or appendage are disposed of in a manner that may block the flow of water of any watercourse Monitor water quality according to the environmental management plan.
Air quality	Conducting works at dry season and moving large quantity of materials may create dusts and increase in concentration of vehicle-related pollutants (such as carbon monoxide, sulfur oxides, particulate matter, nitrous oxides, and hydrocarbons) which will affect people who live and work near the sites.	The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.	• Damp down exposed soil and any sand stockpiled on site by spraying with water when necessary during dry weather. • Use tarpaulins to cover soils, sand and other loose material when transported by trucks. • Unpaved surfaces used for haulage of materials within settlements shall be maintained dust-free. • Arrangements to control dust through provision of windscreens, water sprinklers, and dust extraction systems shall be provided at all hot-mix plants, batching plants and crushers (if these establishments are being set up exclusively for the subproject). • Monitor air quality.
Acoustic environment	Temporary increase in noise level and vibrations may be caused by excavation equipment, and the transportation of equipment, materials, and people. However, the proposed subproject will follow existing ROW alignment and impact is short-term, site-specific and within a relatively small area.	The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.	• Involve the community in planning the work program so that any particularly noisy or otherwise invasive activities can be scheduled to avoid sensitive times. • Plan activities in consultation with Dhangadhi sub-metropolitan city local authority so that activities with the greatest potential to generate noise are conducted during

Field	Impacts	Significance, Duration and Magnitude	Mitigation Measures
			periods of the day which will result in least disturbance. • Use of high noise generating equipment shall be stopped during night time. • Horns should not be used unless it is necessary to warn other road users or animals of the vehicle's approach. • Utilize modern vehicles and machinery with the requisite adaptations to limit noise and exhaust emissions, and ensure that these are maintained to manufacturers' specifications at all times. • All vehicles and equipment used in construction shall be fitted with exhaust silencers. Use silent-type generators (if required). • Monitor noise levels. Maintain maximum noise levels not exceeding 80 decibels (dBA) when measured at a distance of 10 m or more from the vehicle/s. • If it is not practicable to reduce noise levels to or below noise exposure limits, the contractor must post warning signs in the noise hazard areas. Workers in a posted noise hazard area must wear hearing protection. • Identify any buildings at risk from vibration damage and avoiding any use of pneumatic drills or heavy vehicles in the vicinity. Complete work in these areas quickly.
Aesthetics	The construction activities do not anticipate any cutting of trees but will produce excess excavated earth (spoils), excess construction materials, and solid waste such as removed concrete, wood, packaging materials, empty containers, spoils, oils, lubricants, and other similar items.	The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.	• Prepare the debris disposal plan • Remove all construction and demolition wastes on a daily basis. • Coordinate with Dhangadhi sub-metropolitan city local authority for beneficial uses of excess excavated soils or immediately dispose to designated areas. Avoid stockpiling of any excess

Field	Impacts	Significance, Duration and Magnitude	Mitigation Measures
			spoils. • Suitably dispose of collected materials from SWM, unutilized materials and debris either through filling up of pits/ wasteland or at pre-designated disposal locations. • All vehicles delivering fine materials to the site and carrying waste debris for disposal shall be covered to avoid spillage of materials. All existing roads used by vehicles of the contractor, shall be kept clear of all dust/ mud or other extraneous materials dropped by such vehicles. • Lighting on construction sites shall be pointed downwards and away from oncoming traffic and nearby houses. • In areas where the visual environment is particularly important or privacy concerns for surrounding buildings exist, the site may require screening. This could be in the form of shade cloth, temporary walls, or other suitable materials prior to the beginning of construction. • The site must be kept clean to minimize the visual impact of the site. Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas.
B. Biological Characteristics			
Biodiversity	Activities being located in the built-up area of Dhangadhi sub-metropolitan. There are no protected areas in or around subproject sites, and no known areas of ecological interest. There are no trees at the site that need to be removed.	The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.	• Check if tree-cutting will be required during detailed design stage. No trees, shrubs, or groundcover may be removed or vegetation stripped without the prior permission of the environment management specialist. • All efforts shall be made to preserve trees by evaluation of minor design adjustments/ alternatives (as applicable) to save trees.

Field	Impacts	Significance, Duration and Magnitude	Mitigation Measures
			• Special attention shall be given for protecting giant trees and locally-important trees (with religious importance) during implementation. • A Plantation plan will be developed including location, resources, number and type of trees to be planted per tree loss and survival rate during implementation. This will be monitored and reported on a regular basis. • Prevent workers or any other person from removing and damaging any flora (plant/vegetation) and fauna (animal) including fishing in any water body in the subproject vicinity. • Prohibit employees from poaching wildlife and cutting of trees for firewood.
C. Socioeconomic Characteristics			
Existing provisions for pedestrians and other forms of transport	Road closure is not anticipated. Hauling of construction materials and operation of equipment on-site can cause traffic problems. However, the proposed subproject will follow existing ROW alignment.	The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.	• Prepare and implement a traffic management plan • Plan transportation routes so that heavy vehicles do not use narrow local roads, except in the immediate vicinity of delivery sites. • Maintain safe passage for vehicles and pedestrians throughout the construction period. • Schedule truck deliveries of construction materials during periods of low traffic volume. • Erect and maintain barricades, including signs, markings, flags and flagmen informing diversions and alternative routes when required. • Notify affected sensitive receptors by providing sign boards informing nature and duration of construction activities and contact numbers for concerns/ complaints. • Leave spaces for access between mounds of soil.

Field	Impacts	Significance, Duration and Magnitude	Mitigation Measures
			• Provide walkways and metal sheets where required to maintain access across for people and vehicles. • Increase workforce in front of critical areas such as institutions, place of worship, business establishment, hospitals, and schools. • Consult businesses and institutions regarding operating hours and factoring this in work schedules. Ensure there is provision of alternate access to businesses and institutions during construction activities, so that there is no closure of these shops or any loss of clients. • Ensure any damage to properties and utilities will be restored or compensated to pre-work conditions.
Socio-economic status	Subproject components will be located in government land and existing ROWs thus there is no requirement for land acquisition or any resettlements. Manpower will be required during the construction stage. This can result in generation of contractual employment and increase in local revenue.	Potential impact is positive and long-term.	• Employ at least 50% of labor force from communities in the vicinity of the site. This will have the added benefit of avoiding social problems that sometimes occur when workers are imported into host communities, and avoiding environmental and social problems from workers housed in poorly serviced camp accommodation. • Secure construction materials from local market.
Other existing amenities for community welfare	Although construction of subproject components involves quite simple techniques of civil work, the invasive nature of excavation and the subproject sites being in built-up areas of Dhangadhi sub-metropolitan city where there are a variety of human activities, will result to impacts to the sensitive receptors such as residents, businesses, and the community in general. Excavation may also	The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.	• Provide safety signage at all sites visible to public • Provide safety barriers near any trenches, and cover trenches with planks during non-work hours. • Obtain details from Dhangadhi sub-metropolitan city nature and location of all existing infrastructure, and plan excavation carefully to avoid any such sites to maximum extent possible; • Integrate construction of the various infrastructure

Field	Impacts	Significance, Duration and Magnitude	Mitigation Measures
	damage existing infrastructure (such as water distribution pipes, electricity pylons, etc.) located alongside the roads.		subprojects to be conducted in Dhangadhi sub-metropolitan city (roads, water supply, etc.) so that different infrastructure is located on opposite sides of the road where feasible and roads and inhabitants are not subjected to repeated disturbance by construction in the same area at different times for different purposes. • Consult with local community to inform them of the nature, duration and likely effects of the construction work, and to identify any local concerns so that these can be addressed. • Existing infrastructure (such as water distribution pipes, electricity pylons, etc.) shall be relocated before construction starts at the subproject sites. • Prior permission shall be obtained from respective local authority for use of water for construction. Use of water for construction works shall not disturb local water users. • If construction work is expected to disrupt users of community water bodies, notice to the affected community shall be served 7 days in advance and again 1 day prior to start of construction. • Ensure any damage to properties and utilities will be restored or compensated to pre-work conditions.
Community health and safety	Construction works will impede the access of residents and businesses in limited cases.	The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.	• Provide safety signage at all sites visible to public. • Provide safety barriers near any trenches, and cover trenches with planks during non-work hours. • Contractor's activities and movement of staff will be restricted to designated construction areas. • Locations of hot-mix plants, batching plants and crushers (if these establishments are being

Field	Impacts	Significance, Duration and Magnitude	Mitigation Measures
			set up exclusively for the subproject) shall be shall be located at least 100 m away from the nearest dwelling preferably in the downwind direction. • Consult with Dhangadhi local authority on the designated areas for stockpiling of, soils, gravel, and other construction materials. • If the contractor chooses to locate the work camp/ storage area on private land, he must get prior permission from the environment management specialist and landowner. • Use small mechanical excavators to attain faster trenching progress. For rock and concrete breaking, use non-explosive blasting chemicals, silent rock cracking chemicals, and concrete breaking chemicals.[7] • Under no circumstances may open areas or the surrounding bushes be used as a toilet facility. • Recycling and the provision of separate waste receptacles for different types of waste shall be encouraged. • A general regard for the social and ecological well-being of the site and adjacent areas is expected of the site staff. Workers need to be made aware of the following general rules: (i) no alcohol/ drugs on site; (ii) prevent excessive noise; (iii) construction staff are to make use of the facilities provided for them, as opposed to ad hoc alternatives (e.g. fires for cooking, the use of surrounding bushes as a toilet facility); (iv) no fires permitted on site except if needed for the

[7] These products come in powder forms, and once mixed with water (being the catalyst) simply expand, and crack the rock from hole to hole. This product is environmentally friendly and can be washed away after it has been used.

Field	Impacts	Significance, Duration and Magnitude	Mitigation Measures
			construction works; (v) trespassing on private/commercial properties adjoining the site is forbidden; (vi) other than pre-approved security staff, no workers shall be permitted to live on the construction site; and (vii) no worker may be forced to do work that is potentially dangerous or that he/ she is not trained to do. • Interested and affected parties need to be made aware of the existence of the complaints book and the methods of communication available to them. The contractor must address queries and complaints by: (i) documenting details of such communications; (ii) submitting these for inclusion in complaints register; (iii) bringing issues to the environment management specialist's attention immediately; and (iv) taking remedial action as per environment management specialist's instruction. • The contractor shall immediately take the necessary remedial action on any complaint/grievance received by him and forward the details of the grievance along with the action taken to the environment management specialist within 48 hours of receipt of such complaint/grievance.
Workers health and safety	There is invariably a safety risk when construction works such as excavation and earthmoving are conducted in urban areas. Workers need to be mindful of the occupational hazards which can arise from working in height and excavation works.	Potential impacts are negative and long-term but reversible by mitigation measures.	• Comply with requirements of Government of Nepal Labor Law and all applicable laws and standards on workers H&S. • Ensure that all site personnel have a basic level of environmental awareness training. If necessary, the environmental management

Field	Impacts	Significance, Duration and Magnitude	Mitigation Measures
			specialist and/or a translator shall be called to the sites to further explain aspects of environmental or social behavior that are unclear. • Produce and implement a site health and safety (H&S) plan which include measures as: (i) excluding the public from worksites; (ii) ensuring all workers are provided with and required to use personal protective equipment (reflectorized vests, footwear, gloves, goggles and masks) at all times; (iii) providing H&S training[8] for all site personnel; (iv) documenting procedures to be followed for all site activities; and (v) maintaining accident reports and records. • Arrange for readily available first aid unit including an adequate supply of sterilized dressing materials and appliances • Maintain necessary living accommodation and ancillary facilities in functional and hygienic manner in work camps. Ensure (i) uncontaminated water for drinking, cooking and washing, (ii) clean eating areas where workers are not exposed to hazardous or noxious substances; and (iii) sanitation facilities are available at all times. • Provide medical insurance coverage for workers; • Provide H&S orientation training to all new workers to

[8] Some of the key areas that may be covered during training as they relate to the primary causes of accidents include (i) slips, trips and falls; (ii) personal protective equipment; (iii) ergonomics, repetitive motion, and manual handling; (iv) workplace transport; and (v) legislation and responsibilities. Training can provide the foundations of competence but it does not necessarily result in a competent worker. Therefore, it is essential to assess staff competence to ensure that the training provided is relevant and effective. Supervision and monitoring arrangements shall be in place to ensure that training has been effective and the worker is competent at their job. The level of supervision and monitoring required is a management decision that shall be based on the risks associated with the job, the level of competence required, the experience of the individual and whether the worker works as part of a team or is a lone worker.

Field	Impacts	Significance, Duration and Magnitude	Mitigation Measures
			ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to fellow workers; • Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted; • Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas; • Ensure moving equipment is outfitted with audible back-up alarms; • Mark and provide sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall be in accordance with international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate; and • Disallow worker exposure to noise level greater than 85 dBA for a duration of more than 8 hours per day without hearing protection. The use of hearing protection shall be enforced actively.
D. Historical, Cultural, and Archaeological Characteristics			
Physical and cultural heritage	Construction works will be on built-up areas of Dhangadhi sub-metropolitan city thus risk for chance finds is low.	Local/ site-specific, short-term term and impact is not significant	• All fossils, coins, articles of value of antiquity, structures and other remains of archaeological interest discovered on the site shall be the property of the government. • Prevent workers or any other persons from removing and damaging any fossils, coins, articles of value of antiquity, structures and other remains of

Field	Impacts	Significance, Duration and Magnitude	Mitigation Measures
			archaeological interest. • Stop work immediately to allow further investigation if any finds are suspected.

E. Anticipated Impacts and Mitigation Measures–Operation and Maintenance

145. The Dhangadhi sub-metropolitan city local authority and contractor will manage the operations and maintenance (O&M)[9] of the composting plant and SWM facilities, or through a sub-contractor. The contractor, in consultation with Dhangadhi sub-metropolitan, will also develop an O&M manual for the regular and preventive maintenance of the facilities.

146. **SLF operation and maintenance**. The design will be updated and detailed design will be prepared at the time of detailed design. Operation and maintenance manual will be prepared by DSC and training will be provided to Dhangadhi sub-metropolitan city for proper implementation.

147. **Recyclables and reusables.** Source separation at house is encouraged. Awareness will be raised by awareness raising program on source separation of recyclables and reusable. Training will provided to Dhangadhi sub-metropolitan city staff. The 2nd stage separation will be conducted by house to house collectors and 3rd stage separation will be done at secondary transfer stations. Amount of waste separated and subsequently recycled and reused will be recorded. Record will be kept by Dhangadhi sub-metropolitan cityity and regular inspection and audit will be conducted (monthly or quarterly) by expert team.

148. **Fecal sludge operation and maintenance[10].** Financial, technical and managerial inputs are needed to ensure the continuous operation of FSTP systems. Operation procedure or operational manual will be prepared during detailed design stage that establish how the treatment facility and equipment are utilized, are documented in several O&M plans, monitoring program, reports and log books, and health and safety plans, which outline the step-by-step tasks that employees are required to carry out in order to ensure the long-term functioning of the FSTP. While many O&M activities are process- specific, others are common to all facilities and all O&M Plans should therefore include information on:

(i) the procedures for receiving and off-loading of fecal sludge (FS) at the FSTP;
(ii) the operation of specific technologies such that they function as designed;
(iii) maintenance program for plant assets to ensure long-term operation and to minimize breakdowns;
(iv) the monitoring and reporting procedures for the FSTP O&M activities as well as the management of treatment end products;
(v) management of health and safety aspects for protection of the workers and the environment;
(vi) the organizational structure, distribution of and the management of administrative aspects;

[9] Maintenance activities will include replacement of equipment and consumables, and also horticultural maintenance and repairs to equipment, pavements and other civil works which are part of the contract.

[10] Magalie Bassan and David M. Robbins, Operation, Maintenance and Monitoring of Faecal Sludge Treatment Plant, In book: Faecal Sludge Management, systems approach for implementation and operation, IWA publication

(vii) procedures for the onsite storage of FS and the off-site transportation;
(viii) the engineering drawings and FSTP specifications;
(ix) the manufacturer's literature and equipment operation guidelines;
(x) the responsible person for each task;
(xi) the frequency of each activity;
(xii) the operation procedures and tools required to perform the task;
(xiii) the safety measures required;
(xiv) the information that is to be monitored and recorded; and
(xv) record will be kept by Dhangadhi sub-metropolitan city and regular audit will be conducted (monthly or quarterly) by expert team

149. **Required manpower is proposed in the preliminary design of FSTP, landfill and hospital waste management.** Monitoring will include visual observations of plant conditions, such as scum on a treatment lagoon, the color of the sludge, or odors emanating from a pump tank by using test kits; field monitoring for measuring pH, dissolved oxygen, or temperature; and laboratory testing of samples (either onsite or offsite). Responsibility of engineer, operator and maintenance is shown in **Appendix 7**.

150. Effective O&M programs for FSTPs require that accurate records be kept of all O&M activities, monitoring as well of any malfunctions. Operator frequently refers to records in order to identify previous fluctuations in the operation of the facility and operational problems that may recur periodically, review the effectiveness of mitigation measures that may have been used to correct past operating problems, and to optimize the O&M procedures. These records should therefore be easily accessible to FSTP operator.

151. **Hospital waste collection, transport and storage.** The key to minimization and effective management of health-care waste is segregation (separation) and identification of the waste. Appropriate handling, treatment, and disposal of waste by type reduce costs and does much to protect public health. The most appropriate way of identifying the categories of health-care waste is by sorting the waste into color-coded plastic bags or containers, which is proposed in preliminary design. In addition to the color-coding of waste containers, the following practices are recommended:

(i) General health-care waste should not join the stream of domestic refuse for disposal.
(ii) Sharps should all be collected together, regardless of whether or not they are contaminated.
(iii) Containers should be puncture-proof (usually made of metal or high-density plastic) and fitted with covers. They should be rigid and impermeable so that they safely retain not only the sharps but also any residual liquids from syringes. To discourage abuse, containers should be tamper-proof (difficult to open or break) and needles and syringes should be rendered unusable. Where plastic or metal containers are unavailable or too costly, containers made of dense cardboard are recommended (WHO, 1997); these fold for ease of transport and may be supplied with a plastic lining.
(iv) Bags and containers for infectious waste should be marked with the international infectious substance symbol
(v) Highly infectious waste should, whenever possible, be sterilized immediately by autoclaving. It therefore needs to be packaged in bags that are compatible with the proposed treatment process: red bags, suitable for autoclaving, are recommended.

(vi) Cytotoxic waste, most of which is produced in major hospital or research facilities, should be collected in strong, leak-proof containers clearly labelled “Cytotoxic wastes”.
(vii) Small amounts of chemical or pharmaceutical waste may be collected together with infectious waste.
(viii) Large quantities of obsolete or expired pharmaceuticals stored in hospital wards or departments should be returned to the pharmacy for disposal. Other pharmaceutical waste generated at this level, such as spilled or contaminated drugs or packaging containing drug residues should not be returned because of the risk of contaminating the pharmacy; it should be deposited in the correct container at the point of production.
(ix) Large quantities of chemical waste should be packed in chemical resistant containers and sent to specialized treatment facilities (if available). The identity of the chemicals should be clearly marked on the containers: hazardous chemical wastes of different types should never be mixed.
(x) Waste with a high content of heavy metals (e.g. cadmium or mercury) should be collected separately.
(xi) Aerosol containers may be collected with general health-care waste once they are completely empty, provided that the waste is not destined for incineration.
(xii) Low-level radioactive infectious waste (e.g. swabs, syringes for diagnostic or therapeutic use) may be collected in yellow bags.
(xiii) The storage area should have an impermeable, hard-standing floor with good drainage; it should be easy to clean and disinfect.
(xiv) There should be a water supply for cleaning purposes.
(xv) The storage area should afford easy access for staff in charge of handling the waste.
(xvi) It should be possible to lock the store to prevent access by unauthorized persons.
(xvii) Easy access for waste-collection vehicles is essential.
(xviii) There should be protection from the sun.
(xix) The storage area should be inaccessible for animals, insects, and birds.
(xx) There should be good lighting and at least passive ventilation.
(xxi) The storage area should not be situated in the proximity of fresh food stores or food preparation areas.
(xxii) A supply of cleaning equipment, protective clothing, and waste bags or containers should be located conveniently close to the storage area.
(xxiii) Health-care waste should be transported within the hospital or other facility by means of wheeled trolleys, containers, or carts that are not used for any other purpose and meet the following specifications: easy to load and unload; no sharp edges that could damage waste bags or containers during loading and unloading; easy to clean.
(xxiv) The vehicles should be cleaned and disinfected daily with an appropriate disinfectant. All waste-bag seals should be in place and intact at the end of transportation. Different types of vehicle for the onsite transportation of health-care waste.
(xxv) record will be kept by Dhangadhi sub-metropolitan city and regular audit will be conducted (monthly or quarterly) by expert team.

152. **Land contamination.** The composting plant, autoclave room, sorting room/ staging area, and SWM facilities will not contaminate the lands the way other industrial operations can. The main reason for this is that all facilities will have cemented flooring while the SWM facilities

will have special impermeable layers underneath (in case such protection is not naturally there artificial impermeable layer will be constructed.) Preliminary design has considered lining of the soil in order to protect contamination of soil and groundwater.

153. **Generation of waste materials and by-products.** In general, pollutants generated from the facilities include: wastewater from toilet and cleaning of premises, improper storage of delivered wastes and end-products, and leachate from the solid waste. The contractor will be required to keep the ancillary sites of the transfer composting plants, and SWM facilities clean, tidy and orderly condition free of litter, waste material (whether solid or liquid) and debris. The contractor will also be responsible for the maintenance of the approach road in consultation with roads and highways (RHD) to the controlled landfill (if damaged by his/her works) and to keep it free from litter.

154. **Generation of wastewater and water contamination[11].** The liquid wastes from the facilities are high in biological oxygen demand. The quantity of leachate may also be huge during especially in the rainy seasons. The wastes from the facilities can end up in water bodies, polluting water resources. Although the contaminants are non-toxic in nature, they can introduce bacterial contamination and increase nitrates, phosphates and sulfates concentration in water, leading to health problems. Special drains will be constructed to allow wastewater from the transfer stations and composting plants to be diverted away from water wells and adjacent properties. Leachate generated from the controlled landfill will be channeled to a leachate collection pond and will be allowed to evaporate. Leachate will be aerated by falling it from higher height. Remaining leachate will be re-circulated as part of daily maintenance of waste covers and also will be used for composting plant.

155. **Odor.** The facilities will always give a particular stink due to decomposition of wastes. Excessive odor is a nuisance to locals and attracts pests and vermin.

156. **Noise.** Major sources of noise are the chaos created by the laborers working in the facilities and heavy vehicular movement to during collection and transport of wastes.

157. **Health, hygiene, and safety.** Spread of diseases to workers and their families may occur due to inadequate provision of safety equipment and lack of practice of safety rules and precautions. Sufficient, safe, potable and constant supply of fresh water will be made available at adequate pressure throughout the premises of the composting plant and controlled landfill. Suitable facilities for washing of hands and nail brushes should be there, soap or detergent will be provided for the workers. All sanitary facilities will be equipped with suitable flushing appliance.

158. When the controlled landfill begins to function, it is expected to provide a modern sanitary facility for the workers and staff as well as systematic handling, transportation and disposal of solid waste without causing environmental pollution. Providing this occurs there should be few negative environmental impacts and there are several fields that should be unaffected. These are identified in **Table 20**, with an explanation of the reasoning in each case. These factors are thus screened out of the impact assessment and will not be mentioned further.

[11] The groundwater monitoring wells will be provided to ensure no leachate seepage. These are included not for drinking water purposes. EHS guidelines will be considered in the design for the actual numbers and locations.

159. The potential adverse impacts that are associated with O&M activities can be mitigated to acceptable levels with the following mitigation measures (**Table 20**).

Table 20: Anticipated Impacts and Mitigation Measures–O&M Phase

Field	Impacts	Significance, Duration, and Magnitude	Mitigation Measures
A. Physical Characteristics			
Water quality	Run-off from stockpiled wastes and end-products of composting which may cause siltation and reduction in the quality of adjacent bodies of water. The impacts are negative and long-term, site-specific within a relatively small area and reversible by mitigation measures.	Local/ site-specific, long-term term and impact is not significant	• Take all precautions to prevent entering of run-off into streams, watercourses, or irrigation system. Install temporary silt traps or sedimentation basins along the channels leading to the water bodies. • Remove all wastes, by-, and end-products immediately. • Monitor discharge of leachate including review of Environmental Compliance Certificate (ECC) conditions. Parameters to be monitored include suspended solids, dissolved solids (inorganic), pH, ammoniac nitrogen (as N), total nitrogen (as N), biochemical and chemical oxygen demand, arsenic mercury, lead, cadmium, total chromium, copper, zinc, nickel, cyanide, chloride, fluoride, phonemic compounds and others as per Government of Nepal rules and regulations. • Monitor compost quality. Visual inspection to ensure that glass, plastic and other physical inerts and fragments are absent in compost and it has no offensive smell. Also testing of compost to meet standards for arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc, pH and other parameters as prescribed by the relevant National policy of the Government. • Monitor treated wastes quality as per conditions of the ECC. Tests at the minimum include measurement of temperature, pressure, contact time, spore tests, and other routine tests (visual).
Air quality	Moving wastes, by- and end-products (such as composts) may create dusts during dry season. Landfill gas generation.	The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation	• Use bin covers and/or tarpaulins during transport of wastes, by-, and end products (compost) • Use tarpaulin to cover soils, sand and other loose material that will be used in the controlled landfill. • Green belt will be developed around

Field	Impacts	Significance, Duration, and Magnitude	Mitigation Measures
		measures.	the facilities to act as a barrier for dust pollution. • Only inert waste will be sent to controlled landfill so that landfill gas formation is minimum.
Acoustic environment	Increase in noise level due to presence of workers and movement of vehicles.	The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.	• Plan activities in consultation with Dhangadhi sub-metropolitan city so that activities with the greatest potential to generate noise are conducted during periods of the day which will result in least disturbance.
B. Biological Characteristics			
Biodiversity	Activities in the built-up area of Dhangadhi sub-metropolitan. There are no protected areas in or around subproject sites, and no known areas of ecological interest.	Local/ site-specific, short-term term and impact is not significant	• No trees, shrubs, or groundcover may be removed or vegetation stripped without the prior permission. • Prevent workers or any other person from removing and damaging any flora (plant/ vegetation) and fauna (animal). • Monitor survival rate of vegetation (plants and trees) in the green belt of the facilities. • Develop and implement a plantation plan including location, resources, number and type of trees to be planted per tree loss and survival rate during implementation.
C. Socioeconomic Characteristics			
Existing provisions for pedestrians and other forms of transport	Increase in traffic in Dhangadhi sub metropolitan city during collection, loading and unloading of wastes.	The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.	• Early hour collection will be enforced before the peak traffic hours. • Maintain safe passage for vehicles and pedestrians. • Erect and maintain barricades, including signs, markings, flags and flagmen informing diversions and alternative routes when required. • Notify affected sensitive receptors by providing sign boards and contact numbers for concerns/ complaints. • Increase workforce in front of critical areas such as institutions, place of worship, business establishment, hospitals, and schools. • Consult businesses and institutions regarding operating hours and factoring this in work schedules. • Ensure any damage to properties and utilities will be restored or compensated to pre-work conditions.
Workers health	Workers need to be	Potential impacts	• Comply with requirements of

Field	Impacts	Significance, Duration, and Magnitude	Mitigation Measures
and safety	mindful of the occupational hazards working in waste management facilities.	are negative and long-term but reversible by mitigation measures	Government of Nepal Labor Law and all applicable laws and standards on workers' health and safety (H&S). • Ensure that all site personnel have a basic level of H&S training. • Produce and implement a O&M, H&S plan which include measures as: (i) excluding the public from worksites; (ii) ensuring all workers are provided with and required to use personal protective equipment (reflectorized vests, footwear, gloves, goggles and masks) at all times; (iii) providing H&S training[12] for all site personnel; (iv) documenting procedures to be followed for all site activities; and (v) maintaining accident reports and records. • Arrange for readily available first aid unit including an adequate supply of sterilized dressing materials and appliances • Provide H&S orientation training to all new workers to ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to fellow workers; • Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas; • Mark and provide sign boards. Signage shall be in accordance with international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate. • Disallow worker exposure to noise level greater than 85 dBA for a duration of more than 8 hours per day without hearing protection. The use of

[12] Some of the key areas that may be covered during training as they relate to the primary causes of accidents include (i) slips, trips and falls; (ii) personal protective equipment; (iii) ergonomics, repetitive motion, and manual handling; (iv) workplace transport; and (v) legislation and responsibilities. Training can provide the foundations of competence but it does not necessarily result in a competent worker. Therefore, it is essential to assess staff competence to ensure that the training provided is relevant and effective. Supervision and monitoring arrangements shall be in place to ensure that training has been effective and the worker is competent at their job. The level of supervision and monitoring required is a management decision that shall be based on the risks associated with the job, the level of competence required, the experience of the individual and whether the worker works as part of a team or is a lone worker.

Field	Impacts	Significance, Duration, and Magnitude	Mitigation Measures
			hearing protection shall be enforced actively.
Community health and safety	Possible accumulation of waste causing health problems for community. Pests and vermin.	Potential impacts are negative and long-term but reversible by mitigation measures.	• Wet/ biodegradable wastes will be emptied directly from the bins to primary collection vehicles daily and dry/ non-biodegradable wastes once in a week. The number and type of bins and vehicles to be procured under the project is sufficient to ensure no accumulation of wastes in the community. • Wastes will be collected regularly to prevent pests and vermin.

160. **Better management of solid waste in the municipality and improvement in health and sanitation status of the municipality.** The SWM subproject will adopt broad categories of tested technologies for processing MSW such as source reduction, reuse and recycling, biological processing technologies on the conversion of organics, production of ecological-friendly compost for enriching soil quality in farmland, waste recovery system, disposal system, leachate management etc. This would greatly improve solid waste management system in Dhangadhi sub-metropolitan city and improve aesthetic value and quality of urban area and water bodies as well as land substantially reduce water pollution, and eventually quality of life in urban areas. Community development program undertaken, including health and hygiene education, reduction, reuse and recycling of solid waste, skill training of low income people and investment in small-scale community facilities, would be of great benefit to local community. The magnitude of the impact shall be high, local, long term and impact is very significant.

161. **Positive impact due to availability of access road and other infrastructure development.** The construction of access road form the city center to the project site, the electrical line, and other infrastructures developed between the site and highway could help develop local activities benefitting local community. Upgrading of road will enhance the access of people to social services. Quick transportation of goods in many rural places (ward no. 1 and 2) of sub-metropolitan city saves travel time and cost will be cheaper. The road will connect wards with market center which leads to travel to nearest market center of sub-metropolitan. The project will made provision of some amount of money for social safeguard in the project area for improving general condition of schools, water sanitation and hygiene, and religious/ cultural aspects. Implementation of project will increase accessibility of people living within ZoI and nearby settlements to these places. This impact will be experienced by people living in entire of Zone of Influence. The impact will be direct, high significance, long term, and local in nature.

162. **Increased economic opportunities.** After the completion of the project there is a possibility of migration from rural areas towards the town due to better environmental condition and transcend opportunities. The increased economic level will add a great value to the land uplifting their economic status. These benefits can be maximized by ensuring advanced waste management and by promoting land development activities in the area. The impact will be direct, high significance, long term, and local in nature.

F. Cumulative Impact Assessment[13]

163. The cumulative impact assessment examined the interaction between the subproject's residual effects (i.e., those effects that remain after mitigation measures have been applied) and those associated with other past, existing, and reasonably foreseeable future projects or activities. The interaction of residual effects associated with multiple projects and/or activities can result in cumulative impacts, both positive and negative. The project's potential cumulative effects were considered with respect to valued components in environmental and socioeconomic categories, in four areas:

(i) of any potential residual project effects that may occur incrementally over time;
(ii) consideration of other known relevant projects or activities within the specified study area boundaries, even if not directly related to the project;
(iii) potential overlapping impacts that may occur due to other developments, even if not directly related to the proposed subproject; and
(iv) future developments that are reasonably foreseeable and sufficiently certain to proceed.

164. The project has identified the valued components as water quality, air quality, acoustic environment, socioeconomic and socio-community components, and human health and safety. There are no foreseeable projects that will overlap with the subproject. The spatial boundaries of the subproject are the areas where the facilities (transfer stations, composting plant, and controlled landfill) are located. The temporal boundary can be considered as the whole Dhangadhi sub-metropolitan.

165. **Water quality.** Due to nature of the subproject there is risk of contaminating groundwater and nearby bodies of water during O&M phase. However the infrastructures have been designed ensuring impermeability of surfaces by having concrete surfaces for the transfer stations and composting plant while HDPE/ clay liners for the controlled landfill. Drains within the facilities will also ensure wastewater generated during operations will be diverted away from any channel leading to agricultural lands, water bodies, and water sources/ tube wells. Short-term negative impacts are possible but can be mitigated through design and implementation of EMP. Potential residual effects is considered to be negligible.

166. **Air quality.** Emissions of common air contaminants and fugitive dust may be elevated in proximity to active work sites during construction and O&M phases; these impacts will be short-term and localized to the immediate vicinity of SLF. Greenhouse gas (GHG) emissions may increase as a result of the subproject activities (i.e., vehicle and equipment operation, concrete production, disposal of excavated material, land-filling of residual wastes). Given the subproject's relatively minor contribution to common air contaminants and GHG emissions during construction, the overall significance rating of both these potential residual effects is considered to be negligible.

167. **Acoustic environment.** Noise levels during construction and O&M activities in immediate proximity of work sites are expected to increase. The duration of exposure will be

[13] Detailed Cumulative Impact Assessment at the detail design phase will be conducted and the findings included in the updated IEE.

relatively brief and imperceptible. The exposure represents a temporary, localized, adverse residual effect of low significance for affected receptors. While building damage due to ground vibrations is unlikely, there may be annoyance to spatially located receptors during construction and O&M activities. The overall significance rating of potential residual effects is considered to be negligible.

168. **Socioeconomic and socio-community.** Concerns on existing provisions for pedestrians, other forms of transport, and over-all impact on livability particularly nearby the transfer stations and composting plant will occur spatially during construction and O&M activities. Traffic movement will be improved once the construction activities are completed. Since the subproject involves small-scale facilities, it will not conflict with existing or planned land use. O&M manuals for the facilities, comprehensive capacity building, and community involvement to be provided under RUDP will ensure efficient operation of the facilities and acceptability by the stakeholders. However, following improvement in infrastructures and services, added residential developments, commercial, and business facilities and increased densities are expected to develop and enhance Dhangadhi sub-metropolitan city. This can be considered a long-term cumulative benefit of the subproject.

169. Given the scale of the project it is likely that a number of local people will obtain at least temporary socioeconomic benefits, by gaining employment in the construction workforce, and thus raising their levels of income. In addition, a significant amount of employments will be generated associated with the O&M of the facilities to be developed under the subprojects. These benefits can bring wider social gains if they are directed at vulnerable[14] groups.

170. **Community and workers health and safety.** No adverse residual effects to human health will occur as a result of construction or O&M activities, and mitigation measures are in place to ensure public and worker safety, and will be closely monitored. While exposure to elevated noise levels, fugitive dust and common air pollutants will occur in proximity to work sites, due to their short-term and localized nature, these effects are expected to be minor and insignificant with no measurable effects on human health.

171. Upon completion of the subproject, the socio-community will be the major beneficiaries of this subproject. With the improved solid waste management facilities, additional vehicles and workers PPE, they will be provided with reliable and climate-resilient municipal services. In addition to improved environmental conditions, the subproject will reduce occurrence of diseases and people would spend less on healthcare and lose fewer working days due to illness, so their economic status should also improve, as well as their overall health. These are considered a long-term cumulative benefit.

172. Therefore the project will benefit the general public by contributing to the long-term improvement of municipal services and community livability in Dhangadhi sub-metropolitan city.

173. In the case of this subproject (i) most of the individual elements are relatively small and involve straightforward construction, so impacts will be mainly localized and not greatly significant; (ii) most of the predicted impacts are associated with the construction process, and are produced because that process is invasive, involving excavation and earth movements; and

[14] Vulnerable groups as those without legal title to land and other assets; households headed by single earner females, the elderly or disabled; indigenous peoples (based on ADB OM); and households with incomes that are below the poverty line.

(iii) being located in the built-up area of Dhangadhi sub-metropolitan city, will not cause direct impact on biodiversity values.

G. Greenhouse Gas Emissions (GHG)

174. Through plantation in and around the landfill area and turfing and using solar electricity for street light may reduce Carbon-di-oxide gas emission. Composting also reduce substantial amount of carbon emission. The subproject preliminary design includes such approach, which will in fact provide lots of environmental benefit and on the other hand these will reduce GHG emission. Since it is proposed aerobic composting for part of the collected organic waste, there is an emission reduction potential in the sub-project for SWM.

VII. ENVIRONMENTAL MANAGEMENT PLAN

175. The EMP is to ensure that the activities are undertaken in a responsible, non-detrimental manner by providing proactive, feasible, and practical working tools and specific actions necessary to mitigate environmental impacts of the subproject. The EMP also assigns responsibilities, timescales, and performance indicators/standards for each mitigation measure to make sure that they are implemented and not ignored. An environmental monitoring plan is also included in the EMP which recommends protocols and responsibilities for monitoring the subproject.

176. For this SWM subproject, the contractor will be required to (i) establish an operational system for managing environmental impacts, (ii) carry out all of the monitoring and mitigation measures set forth in the EMP; and (iii) implement any corrective or preventative actions set out in safeguards monitoring reports that the employer will prepare from time to time to monitor implementation of this IEE and EMP. The contractor shall allocate a budget for compliance with these EMP measures, requirements and actions. The contractor will also be required to post relevant EMP information on the work sites at all times.

A. Institutional Arrangement

177. **Executing and implementing agencies.** The Ministry of Urban Development (MOUD) having prior experience in managing urban and water supply projects financed by ADB, will be the executing agency of the overall project. The participating municipalities will be the implementing agencies.

B. Safeguard Implementation Arrangement

178. **Project coordination office.** A PCO has been established for the overall management of the ongoing IUDP project and the same will function for the proposed RUDP financing. The PCO is headed by project director supported by officials including two deputy project director's and other project managers. The project coordination office (PCO) receives support from the PMSC and DSC established under the IUDP. PMSC and DSC will be providing support to the PCO for the RUDP in the same fashion. While there is no designated environmental safeguards officer in the PCO, The deputy project director's and the project director are regularly apprised of the safeguards management by the PMSC and DSC. Key tasks and responsibilities of the PCO relating to safeguard (environment) are as follows:

(i) confirm existing IEEs/ EMPs are updated based on detailed designs, and that new IEEs/ EMPs are prepared in accordance with the EARF and subproject selection criteria related to safeguards;
(ii) confirm whether IEEs/ EMPs are included in bidding documents and civil works contracts;
(iii) provide oversight on environmental management aspects of subprojects and ensure EMPs are implemented by project implementation unit (PIU) and contractors;
(iv) establish a system to monitor environmental safeguards of the project, including monitoring the indicators set out in the monitoring plan of the EMP;
(v) facilitate and confirm overall compliance with all government rules and regulations regarding site and environmental clearances, as well as any other environmental requirements (e.g., location clearance certificates, environmental clearance certificates, etc.), as relevant;
(vi) supervise and provide guidance to the PIUs to properly carry out the environmental monitoring and assessments as per the EARF;
(vii) review, monitor, and evaluate the effectiveness with which the EMPs are implemented, and recommend necessary corrective actions to be taken as necessary;
(viii) consolidate monthly environmental monitoring reports from PIUs and submit semi-annual monitoring reports to ADB;
(ix) ensure timely disclosure of final IEEs/ EMPs in locations and form accessible to the public; and
(x) address any grievances brought about through the grievance redress mechanism in a timely manner.

179. **Project implementation unit.** The participating municipalities will establish a PIU within the municipal structure. The PIUs will (i) be responsible for land acquisition if any; (ii) take necessary action for obtaining rights of way if required; (iii) plan, implement and monitor public relations activities, gender mainstreaming initiatives and community participation activities at municipal level; (iv) disseminate information related to the project to the public and media; (v) ensure compliance with loan covenants concerning safeguards measures; and (vi) facilitate implementation of safeguards plans. The PIUs will each designate a safeguard focal person[15] and will receive assistance from the assigned DSC to:

(i) update IEEs/ EMPs during detailed design stage and prepare new IEEs/EMPs in accordance with the EARF;
(ii) conduct environmental compliance audit of existing facilities as per Item F, Appendix 6 of ADB SPS, 2009;
(iii) include IEEs/ EMPs in bidding documents and civil works contracts;
(iv) comply with all government rules and regulations;
(v) take necessary action for obtaining rights of way;
(vi) oversee implementation of EMPs including environmental monitoring by contractors;
(vii) take corrective actions when necessary to ensure no environmental impacts;
(viii) submit monthly environmental monitoring reports to PCO;
(ix) conduct continuous public consultation and awareness;

[15] It is recommended that existing municipality senior officer (executive engineer) will also work as responsible safeguard officer in addition to his/her regular responsibilities within the municipality.

(x) address any grievances brought about through the Grievance Redress Mechanism in a timely manner as per the IEEs; and
(xi) organize an induction course for the training of contractors preparing them on EMP implementation, environmental monitoring requirements related to mitigation measures; and taking immediate actions to remedy unexpected adverse impacts or ineffective mitigation measures found during the course of implementation.

180. **Design and Supervision Consultants (DSC).** DSC will be engaged to work closely with and advise the PCO, to be involved in project supervision including monitoring during construction phase. The DSC will have environmental specialist(s), but not limited to:

(i) Work under the general supervision of the team leader and deputy team leader;
(ii) Review the environmental guidelines and requirement of the government of Nepal and ADB's SPS, 2009, environmental subproject selection guidelines and EARF and guide the implementation of future subprojects;
(iii) Provide technical support to the PCO and PIUs including review and update of EARF and guidelines for specific type of subprojects and assist in preparing terms of reference for environmental assessment;
(iv) Assist and guide the PIU's and contractor's environmental officers to provide support to environmental management functions including updating subproject IEEs in respect to EMP;
(v) Assist in preparing IEEs and assist in monitoring impact and mitigation measures associated with subprojects;
(vi) Assist PIUs working in the steps for preparing the IEE and EIA, capacity building and training, preparation of guidelines and procedure and subproject specific guidance;
(vii) Provide support and guidance in undertaking environmental monitoring by PIUs;
(viii) Support PCO in submitting semi-annual environmental monitoring reports to ADB;
(ix) Facilitate in grievance redress and corrective actions;
(x) Train PIU officials regarding environmental requirement and issues; and
(xi) Perform any other task assigned by the team leader, deputy team leader and the project director.

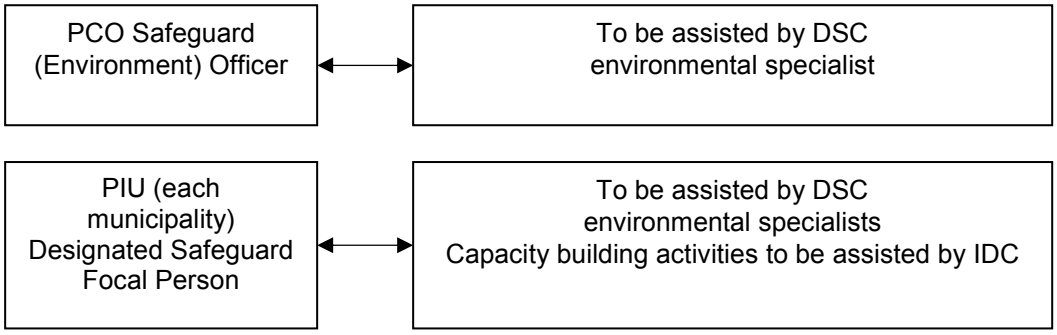
181. **Civil works contracts and contractors.** EMPs are to be included in bidding and contract documents and verified by the PIUs and PCO. The contractor will be required to designate an environmental supervisor to (i) coordinate with DSC on updating the IEE/ EMP based on detailed designs, and (ii) ensure implementation of EMP during civil works. Contractors are to carry out all environmental mitigation and monitoring measures outlined in their contract. The contractors responsibilities are:

(i) **Bidding stage:**
  (a) Understand the EMP requirements and allocate necessary resources (budget, staff, etc.,)
  (b) Understand the regulatory compliance requirements related to labour welfare, safety, environment etc.
  (c) Make available a budget for environmental measures in the EMP

(ii) **Construction stage:**
  (a) Ensure that all regulatory clearances (both project related and contractor related) are in place before start of the construction work

(b) Mobilize EHS supervisor prior to start of work
(c) Confirm with PIU availability of rights of way at all project sites prior to start of work
(d) Prepare method statement and get it approved prior to start of work
(e) Prepare SEP and submit to PCO/PIU for approval
(f) Prepare the following duly incorporating EMP measures, and submit to the PIU : (i) construction waste management (CWM) plan; (ii) traffic management plan; (iii) occupational health & safety (OHS) plan
(g) Implement the mitigation measures as per the EMP including CWM & traffic management plan
(h) Follow the EMP/ SEP measures/ guidelines for establishment of temporary construction camps, construction waste disposal sites, and material borrow areas, etc.
(i) Implement EMP and ensure compliance with all the mitigation and enhancement measures
(j) Conduct environmental monitoring (air, noise, water etc.,) as per the EMP
(k) Undertake immediate action as suggested by PIU/ PMU/ PMC to remedy unexpected adverse impacts or ineffective mitigation measures found during the course of implementation
(l) Submit monthly compliance reports on EMP implementation
(m) Act promptly on public complaints and grievances related to construction work and redress in a timely manner in coordination with PIU
(n) Comply with applicable government rules and regulations
(o) Site clean-up and restoration

Figure 9: Safeguards Implementation Arrangement



C. Institutional Capacity Development Program for EMP Implementation

182. The DSC environmental specialists will be responsible for trainings on environmental awareness and management in accordance with both ADB and government requirements. Specific modules customized for the available skill set will be devised after assessing the capabilities of the target participants and the requirements of the project. Typical modules would be as follows: (i) sensitization; (ii) introduction to environment and environmental considerations in city roads and drainage, solid waste management and water supply projects; (iii) review of IEEs and integration into the project detailed design; (iv) improved coordination within nodal departments; and (v) monitoring and reporting system. The contractors will be required to conduct environmental awareness and orientation of workers prior to deployment to work sites. The proposed training project along with the frequency of sessions is presented in **Table 21**.

D. EMP Tables

183. **Tables 21 to 26** provide the specific mitigation measures, responsibilities of PIU, DSC and contractors. The contractor will be required to submit to PIU, for review and approval, a site environmental plan (SEP) including (i) proposed sites/ locations for construction work camps, storage areas, hauling roads, lay down areas, disposal areas for solid and hazardous wastes; (ii) specific mitigation measures following the approved EMP; (iii) monitoring program as per SEP; and (iv) budget for SEP implementation. No works are allowed to commence prior to approval of SEP.

E. Environmental Monitoring Program

184. **Tables 21 to 26** provide the indicative monitoring program based on the EMP tables. The detailed and final environmental monitoring program has to be provided by the contractor as part of the SEP. During the construction period, it is the contractor's responsibility to ensure mitigation measures are implemented and to conduct environmental sampling and analysis. PCP and PIU will verify and conduct site inspections from time to time. The contractor is required to submit results of environmental monitoring which PIU will include in the environmental monitoring reports.

185. PIU and DSC will work closely with the contractor in developing site-specific monitoring checklists.

Table 21: EMP for Design and Pre-Construction Stage

Project Activity	Anticipated Environmental Impacts	Mitigation Measures	Responsibility
Project Design	Loss of land/ livelihood, impacts due to solid waste processing and landfill development	• Identify government site to avoid land acquisition and resettlement impacts.	Municipality, DSC
	Loss of aesthetics, property values to neighbors due to location of solid waste processing and landfill facilities	• Select the site ideally away from the Municipality development zone	Municipality, DSC
	Health and safety of community and workers	• Prepare training manuals/ plans in Nepali with sketches on Community Health and Safety and Potential Occupational Health and Safety, including a training manual for Landfill Operations and Maintenance	DSC
	Odor nuisance	• Provide an adequate green belt buffer around the site • The landfill site should be at least 500 m away from residential areas and sensitive receptors. In this case it is 1 km away.	DSC
	Contamination of groundwater and surface water due to leachate and runoff from landfill area and the septage sludge drying beds	• The groundwater table should be identified and appropriate protections designed as follows: Provide leachate collection and treatment system before disposal. The leachate from the landfill and septage drying beds will be collected through under drains in a pond and aerated. After aeration portions of the aerated leachate will be recirculated in the landfill and the remaining treated in reed beds. The final treated effluent will be discharged into the Mohana River if it meets the effluent discharge standards of the government or it will be fed back into the landfill site. • Provide a drainage system and collect/treat the runoff together with the leachate • Provide a liner system with low permeability, robust, durable and resistant to chemical attack, puncture, rupture, etc.; the liner system could be a minimum of 60 cm thick compacted clay of permeability (k) not greater than 10-7 cm/sec , a 1.5 mm thick HDPE geo-membrane liner and a drainage layer of 300 mm thick granular material of permeability not greater than 10-2 cm/ sec	DSC
	Hazards due to methane gas emissions from landfill site	• Provide gas control systems (gas vents and flaring system)	DSC
	Risk due to flood hazard	• flood hazard and exposure information of vulnerable areas will be upgraded and flood risk analysis shall be carried out in the project area.	DSC

Project Activity	Anticipated Environmental Impacts	Mitigation Measures	Responsibility
Pre-Construction	Social tensions/ conflicts of illegal occupants and persons encroaching government property and acquiring of temporary land	• Delineate project temporary and permanent land (pegging) and prepare the list of project affected people and resources • Prepare resettlement plan for permanent and temporary acquisitions • Notify the people • Implement resettlement plan and provide compensation	Municipality, DSC, Contractor
	Legal obstructions resulting in delay of work	• Obtain letters of approval and agreement for (i) temporary/ permanent acquisition of land and properties, and (ii) disruption of water supply, and irrigation canals.	Municipality, DSC
	Haphazard workforce camps resulting in social stress and degradation of local environment	• Establish workforce camps with sanitary amenities at designated sites only	Contractor/ DSC
	Local people may be deprived of opportunities, minors may be employed	• Employ local people (not under age 14) especially project affected families and women in jobs • Settle wage rate based on DWEC and provide the list of employees to DSC	Contractor/ DSC
	False claims from people; water quality changes due to construction	• Take baseline photographs of buildings and temporary sites before construction for verifications; measure water quality of groundwater and streams before construction	Contractor/ DSC
	Establishment of pre-construction site conditions	• Record the conditions of roads, agricultural lands, and other infrastructure prior to start of works on site and within 500 meters around site. • Record conditions 100-200 meters upstream, adjacent to the site, and 100-200 meters downstream of the Mohana River and Nala (photographs and water quality testing) • Determine baseline air quality condition on site and within 500 meters around the site • Determine baseline noise levels on site and within 500 meters around site (more on areas with sensitive receptors such as schools, hospitals, places of worship, residences, etc.).	Contractor/ DSC

Table 22: EMP for Construction Period

Field	Impacts	Significance, Duration and Magnitude	Mitigation Measures	Responsibility for Implementation	Items to be Monitored
A. Physical Characteristics					
Topography, landforms, geology and soils	On a cumulative effect of all types of subprojects in Dhangadhi sub-metropolitan city, a significant amount of gravel, sand, and cement will be required for this subproject. Extraction of construction materials may cause localized changes in topography and landforms.	The impacts are negative and long-term but site-specific within a relatively small area and reversible by mitigation measures.	• Utilize readily available sources of materials. If contractor procures materials from existing burrow pits and quarries, ensure these conform to all relevant regulatory requirements. • Borrow areas and quarries (If these are being opened up exclusively for the subproject) must comply with environmental requirements, as applicable. No activity will be allowed until formal agreement is signed between PIU, landowner and contractor.	Contractor	• Sources of materials (location, permits, quantities) • Implementation of mitigation measures
Water quality	Trenching and excavation, run-off from stockpiled materials, and chemical contamination from fuels and lubricants may result to silt-laden runoff during rainfall which may cause siltation and reduction in the quality of adjacent bodies of water.	The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.	• Prepare and implement a spoils management plan (**Appendix 8**). • Prioritize re-use of excess spoils and materials in construction activities. If spoils will be disposed, consult with Dhangadhi sub - metropolitan city on designated disposal areas. • All earthworks must be conducted during dry season to maximum extent possible to avoid the difficult working conditions that prevail during monsoon season such as problems from runoff.	Contractor	• Spoils management plan • Quantity of spoils generated and disposed • Disposal sites • Complaints received • Water quality of Mohana River and Nala • Implementation of mitigation measures

Field	Impacts	Significance, Duration and Magnitude	Mitigation Measures	Responsibility for Implementation	Items to be Monitored
			• Location for stockyards for construction materials shall be identified at least 300m away from watercourses. Place storage areas for fuels and lubricants away from any solid waste management (SWM) leading to water bodies. • Take all precautions to minimize the wastage of water in the construction activities. • Take all precautions to prevent entering of wastewater into streams, watercourses, or irrigation system. Install temporary silt traps or sedimentation basins leading to the water bodies. • Ensure diverting storm water flow during construction shall not lead to inundation and other nuisances in low lying areas. • While working across or close to any water body, the flow of water must not be obstructed. Ensure no construction materials like earth, stone, or appendage are disposed of in a manner that may block the flow of water of any watercourse Monitor water quality according to the		

Field	Impacts	Significance, Duration and Magnitude	Mitigation Measures	Responsibility for Implementation	Items to be Monitored
			environmental management plan.		
Air quality	Conducting works at dry season and moving large quantity of materials may create dusts and increase in concentration of vehicle-related pollutants (such as carbon monoxide, sulfur oxides, particulate matter, nitrous oxides, and hydrocarbons) which will affect people who live and work near the sites.	The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.	• Damp down exposed soil and any sand stockpiled on site by spraying with water when necessary during dry weather; • Use tarpaulins to cover soils, sand and other loose material when transported by trucks. • Unpaved surfaces used for haulage of materials within settlements shall be maintained dust-free. • Arrangements to control dust through provision of windscreens, water sprinklers, and dust extraction systems shall be provided at all hot-mix plants, batching plants and crushers (if these establishments are being set up exclusively for the subproject). • Monitor air quality.	Contractor	• Dust • Vehicle emissions • Air quality • Implementation of mitigation measures
Acoustic environment	Temporary increase in noise level and vibrations may be caused by excavation equipment, and the transportation of equipment, materials, and	The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.	• Involve the community in planning the work program so that any particularly noisy or otherwise invasive activities can be scheduled to avoid sensitive times. • Plan activities in consultation with Dhangadhi sub-metropolitan city local authority so that activities	Contractor	• Noise • Vibrations • Implementation of mitigation measures

Field	Impacts	Significance, Duration and Magnitude	Mitigation Measures	Responsibility for Implementation	Items to be Monitored
	people. However, the proposed subproject will follow existing ROW alignment and impact is short-term, site-specific and within a relatively small area.		with the greatest potential to generate noise are conducted during periods of the day which will result in least disturbance. • Use of high noise generating equipment shall be stopped during night time. • Horns should not be used unless it is necessary to warn other road users or animals of the vehicle's approach; • Utilize modern vehicles and machinery with the requisite adaptations to limit noise and exhaust emissions, and ensure that these are maintained to manufacturers' specifications at all times. • All vehicles and equipment used in construction shall be fitted with exhaust silencers. Use silent-type generators (if required). • Monitor noise levels. Maintain maximum noise levels not exceeding 80 decibels (dBA) when measured at a distance of 10 m or more from the vehicle/s. • If it is not practicable to reduce noise levels to or below noise exposure limits, the contractor must post warning signs in the noise		

Field	Impacts	Significance, Duration and Magnitude	Mitigation Measures	Responsibility for Implementation	Items to be Monitored
			hazard areas. Workers in a posted noise hazard area must wear hearing protection. • Identify any buildings at risk from vibration damage and avoiding any use of pneumatic drills or heavy vehicles in the vicinity. Complete work in these areas quickly.		
Aesthetics	The construction activities do not anticipate any cutting of trees but will produce excess excavated earth (spoils), excess construction materials, and solid waste such as removed concrete, wood, packaging materials, empty containers, spoils, oils, lubricants, and other similar items.	The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.	• Prepare the debris disposal plan • Remove all construction and demolition wastes on a daily basis. • Coordinate with Dhangadhi sub-metropolitan city local authority for beneficial uses of excess excavated soils or immediately dispose to designated areas Avoid stockpiling of any excess spoils • Suitably dispose of collected materials from SWMs, unutilized materials and debris either through filling up of pits/ wasteland or at pre-designated disposal locations. • All vehicles delivering fine materials to the site and carrying waste debris for disposal shall be covered to avoid spillage of materials. All existing roads used by	Contractor	• Site housekeeping • Stockpiles of materials • Construction wastes • Workers place • Implementation of mitigation measures

Field	Impacts	Significance, Duration and Magnitude	Mitigation Measures	Responsibility for Implementation	Items to be Monitored
			vehicles of the contractor, shall be kept clear of all dust/mud or other extraneous materials dropped by such vehicles. • Lighting on construction sites shall be pointed downwards and away from oncoming traffic and nearby houses. • In areas where the visual environment is particularly important or privacy concerns for surrounding buildings exist, the site may require screening. This could be in the form of shade cloth, temporary walls, or other suitable materials prior to the beginning of construction. • The site must be kept clean to minimize the visual impact of the site. Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas;		
B. Biological Characteristics					
Biodiversity	Activities being located in the built-up area of Dhangadhi sub-metropolitan. There are no protected areas in or around subproject sites,	The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.	• Check if tree-cutting will be required during detailed design stage. No trees, shrubs, or groundcover may be removed or vegetation stripped without the prior permission of the environment management specialist.	Contractor	• Flora and fauna • No paoching of wildlife allowed at any time • Implementation of mitigation measures

Field	Impacts	Significance, Duration and Magnitude	Mitigation Measures	Responsibility for Implementation	Items to be Monitored
	and no known areas of ecological interest. There are no trees at the site that need to be removed.		• All efforts shall be made to preserve trees by evaluation of minor design adjustments/ alternatives (as applicable) to save trees. • Special attention shall be given for protecting giant trees and locally-important trees (with religious importance) during implementation. • Prevent workers or any other person from removing and damaging any flora (plant/ vegetation) and fauna (animal) including fishing in any water body in the subproject vicinity. • Prohibit employees from poaching wildlife and cutting of trees for firewood.		
C. Socioeconomic Characteristics					
Existing provisions for pedestrians and other forms of transport	Road closure is not anticipated. Hauling of construction materials and operation of equipment on-site can cause traffic problems. However, the proposed subproject will follow existing ROW alignment.	The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.	• Prepare and implement a traffic management plan (**Appendix 9**) • Plan transportation routes so that heavy vehicles do not use narrow local roads, except in the immediate vicinity of delivery sites. • Maintain safe passage for vehicles and pedestrians throughout the construction period. • Schedule truck deliveries of construction materials during periods of low traffic volume.	Contractor	• Traffic build up in the area • Complain/s from community • Signboards for traffic management • Walkways, planks, other form of access for people • Target timeline for inconvenience to local community • Information provided to local community on

Field	Impacts	Significance, Duration and Magnitude	Mitigation Measures	Responsibility for Implementation	Items to be Monitored
			• Erect and maintain barricades, including signs, markings, flags and flagmen informing diversions and alternative routes when required. • Notify affected sensitive receptors by providing sign boards informing nature and duration of construction activities and contact numbers for concerns/ complaints. • Leave spaces for access between mounds of soil. • Provide walkways and metal sheets where required to maintain access across for people and vehicles. • Increase workforce in front of critical areas such as institutions, place of worship, business establishment, hospitals, and schools. • Consult businesses and institutions regarding operating hours and factoring this in work schedules. Ensure there is provision of alternate access to businesses and institutions during construction activities, so that there is no closure of these shops or any loss of clients. • Ensure any damage to		schedule of works • Implementation of mitigation measures

Field	Impacts	Significance, Duration and Magnitude	Mitigation Measures	Responsibility for Implementation	Items to be Monitored
			properties and utilities will be restored or compensated to pre-work conditions.		
Socio-economic status	Subproject components will be located in government land and existing ROWs thus there is no requirement for land acquisition or any resettlements. Manpower will be required during the construction stage. This can result in generation of contractual employment and increase in local revenue.	Potential impact is positive and long-term.	• Employ at least 50% of labor force from communities in the vicinity of the site. This will have the added benefit of avoiding social problems that sometimes occur when workers are imported into host communities, and avoiding environmental and social problems from workers housed in poorly serviced camp accommodation. • Secure construction materials from local market.	Contractor	• Complain/s from affected businesses • Signboards for traffic management • Walkways, planks, other form of access for people • Target timeline for inconvenience to local community • Information provided to local community on schedule of works • Implementation of mitigation measures
Other existing amenities for community welfare	Although construction of subproject components involves quite simple techniques of civil work, the invasive nature of excavation and the subproject sites being in built-up areas of Dhangadhi sub-metropolitan city	The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.	• Provide safety signage at all sites visible to public • Provide safety barriers near any trenches, and cover trenches with planks during non-work hours. • Obtain details from Dhangadhi sub-metropolitan city nature and location of all existing infrastructure, and plan excavation carefully to avoid any such sites to maximum extent possible; • Integrate construction of the	Contractor	• Traffic build up in the area • Complain/s from community • Signboards for traffic management • Walkways, planks, other form of access for people • Target timeline for inconvenience to local community • Information provided to local community on

Field	Impacts	Significance, Duration and Magnitude	Mitigation Measures	Responsibility for Implementation	Items to be Monitored
	where there are a variety of human activities, will result to impacts to the sensitive receptors such as residents, businesses, and the community in general. Excavation may also damage existing infrastructure (such as water distribution pipes, electricity pylons, etc.) located alongside the roads.		various infrastructure subprojects to be conducted in Dhangadhi sub-metropolitan city (roads, water supply, etc.) so that different infrastructure is located on opposite sides of the road where feasible and roads and inhabitants are not subjected to repeated disturbance by construction in the same area at different times for different purposes. • Consult with local community to inform them of the nature, duration and likely effects of the construction work, and to identify any local concerns so that these can be addressed. • Existing infrastructure (such as water distribution pipes, electricity pylons, etc.) shall be relocated before construction starts at the subproject sites. • Prior permission shall be obtained from respective local authority for use of water for construction. Use of water for construction works shall not disturb local water users. • If construction work is expected to disrupt users of community water bodies, notice to the affected		schedule of works • Implementation of mitigation measures

Field	Impacts	Significance, Duration and Magnitude	Mitigation Measures	Responsibility for Implementation	Items to be Monitored
			community shall be served 7 days in advance and again 1 day prior to start of construction. • Ensure any damage to properties and utilities will be restored or compensated to pre-work conditions.		
Community health and safety	Construction works will impede the access of residents and businesses in limited cases.	The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.	• Provide safety signage at all sites visible to public • Provide safety barriers near any trenches, and cover trenches with planks during non-work hours. • Contractor's activities and movement of staff will be restricted to designated construction areas. • Locations of hot-mix plants, batching plants and crushers (if these establishments are being set up exclusively for the subproject) shall be shall be located at least 100 m away from the nearest dwelling preferably in the downwind direction. • Consult with Dhangadhi local authority on the designated areas for stockpiling of, soils, gravel, and other construction materials. • If the contractor chooses to locate the work camp/storage area on private land, he must get prior permission from the	Contractor	• Complains from local community • Implementation of mitigation measures

Field	Impacts	Significance, Duration and Magnitude	Mitigation Measures	Responsibility for Implementation	Items to be Monitored
			environment management specialist and landowner. • Use small mechanical excavators to attain faster trenching progress. For rock and concrete breaking, use non-explosive blasting chemicals, silent rock cracking chemicals, and concrete breaking chemicals.[16] • Under no circumstances may open areas or the surrounding bushes be used as a toilet facility. • Recycling and the provision of separate waste receptacles for different types of waste shall be encouraged. • A general regard for the social and ecological well-being of the site and adjacent areas is expected of the site staff. Workers need to be made aware of the following general rules: (i) no alcohol/ drugs on site; (ii) prevent excessive noise; (iii) construction staff are to make use of the facilities provided for them, as opposed to ad hoc alternatives (e.g. fires for		

[16] These products come in powder forms, and once mixed with water (being the catalyst) simply expand, and crack the rock from hole to hole. This product is environmentally friendly and can be washed away after it has been used.

Field	Impacts	Significance, Duration and Magnitude	Mitigation Measures	Responsibility for Implementation	Items to be Monitored
			cooking, the use of surrounding bushes as a toilet facility); (iv) no fires permitted on site except if needed for the construction works; (v) trespassing on private/ commercial properties adjoining the site is forbidden; (vi) other than pre-approved security staff, no workers shall be permitted to live on the construction site; and (vii) no worker may be forced to do work that is potentially dangerous or that he/ she is not trained to do. • Interested and affected parties need to be made aware of the existence of the complaints book and the methods of communication available to them. The contractor must address queries and complaints by: (i) documenting details of such communications; (ii) submitting these for inclusion in complaints register; (iii) bringing issues to the environment management specialist's attention immediately; and (iv) taking remedial action as per environment management specialist's instruction. • The contractor shall		

Field	Impacts	Significance, Duration and Magnitude	Mitigation Measures	Responsibility for Implementation	Items to be Monitored
			immediately take the necessary remedial action on any complaint/grievance received by him and forward the details of the grievance along with the action taken to the environment management specialist within 48 hours of receipt of such complaint/ grievance.		
Workers health and safety	There is invariably a safety risk when construction works such as excavation and earthmoving are conducted in urban areas. Workers need to be mindful of the occupational hazards which can arise from working in height and excavation works.	Potential impacts are negative and long-term but reversible by mitigation measures.	• Comply with requirements of Government of Nepal Labor Law and all applicable laws and standards on workers' health and safety (H&S). • Ensure that all site personnel have a basic level of environmental awareness training. If necessary, the environmental management specialist and/or a translator shall be called to the sites to further explain aspects of environmental or social behavior that are unclear. • Produce and implement a site H&S plan which include measures as: (i) excluding the public from worksites; (ii) ensuring all workers are provided with and required to use personal protective equipment (reflectorized vests, footwear, gloves, goggles and masks) at all	Contractor	• Accident occurred • H&S Training provided • PPEs provided • Compliance with labor laws • Complains from workers • Complains from local community • Implementation of mitigation measures

Field	Impacts	Significance, Duration and Magnitude	Mitigation Measures	Responsibility for Implementation	Items to be Monitored
			times; (iii) providing H&S training[17] for all site personnel; (iv) documenting procedures to be followed for all site activities; and (v) maintaining accident reports and records. • Arrange for readily available first aid unit including an adequate supply of sterilized dressing materials and appliances • Maintain necessary living accommodation and ancillary facilities in functional and hygienic manner in work camps. Ensure (i) uncontaminated water for drinking, cooking and washing, (ii) clean eating areas where workers are not exposed to hazardous or noxious substances; and (iii) sanitation facilities are available at all times. • Provide medical insurance coverage for workers; • Provide H&S orientation training to all new workers to		

[17] Some of the key areas that may be covered during training as they relate to the primary causes of accidents include (i) slips, trips and falls; (ii) personal protective equipment; (iii) ergonomics, repetitive motion, and manual handling; (iv) workplace transport; and (v) legislation and responsibilities. Training can provide the foundations of competence but it does not necessarily result in a competent worker. Therefore, it is essential to assess staff competence to ensure that the training provided is relevant and effective. Supervision and monitoring arrangements shall be in place to ensure that training has been effective and the worker is competent at their job. The level of supervision and monitoring required is a management decision that shall be based on the risks associated with the job, the level of competence required, the experience of the individual and whether the worker works as part of a team or is a lone worker.

Field	Impacts	Significance, Duration and Magnitude	Mitigation Measures	Responsibility for Implementation	Items to be Monitored
			ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to fellow workers; • Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure also that visitor/s do not enter hazard areas unescorted; • Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas; • Ensure moving equipment is outfitted with audible back-up alarms; • Mark and provide sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall be in accordance with international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate; and		

Field	Impacts	Significance, Duration and Magnitude	Mitigation Measures	Responsibility for Implementation	Items to be Monitored
			• Disallow worker exposure to noise level greater than 85 dBA for a duration of more than 8 hours per day without hearing protection. The use of hearing protection shall be enforced actively.		
D. Historical, Cultural, and Archaeological Characteristics					
Physical and cultural heritage	Construction works will be on built-up areas of Dhangadhi sub-metropolitan city thus risk for chance finds is low.	Local/ site-specific, short-term term and impact is not significant	• All fossils, coins, articles of value of antiquity, structures and other remains of archaeological interest discovered on the site shall be the property of the government. • Prevent workers or any other persons from removing and damaging any fossils, coins, articles of value of antiquity, structures and other remains of archaeological interest. • Stop work immediately to allow further investigation if any finds are suspected.	Contractor	• Affected structures • Chance find procedure • Implementation of mitigation measures
E. Post-Construction Clean-up					
Post-construction clean-up	Damage due to debris, spoils, excess construction materials	Local/ site-specific, short-term term and impact is not significant	• Remove all spoils wreckage, rubbish, or temporary structures (such as buildings, shelters, and latrines) which are no longer required • All excavated roads shall be reinstated to original condition. • All disrupted utilities restored • All affected structures	Contractor	• Affected structures • Records of pre-construction activities • Implementation of mitigation measures

Field	Impacts	Significance, Duration and Magnitude	Mitigation Measures	Responsibility for Implementation	Items to be Monitored
			rehabilitated/ compensated • The area that previously housed the construction camp is to be checked for spills of substances such as oil, paint, etc. and these shall be cleaned up. • All hardened surfaces within the construction camp area shall be ripped, all imported materials removed, and the area shall be top soiled and regrassed • The contractor must arrange the cancellation of all temporary services. • Restore the work sites to pre-project conditions; PIU to approve in writing that site is restored		

Table 23: Environmental Management Plan (During Operations and Maintenance)

Field	Impacts	Significance, Duration, and Magnitude	Mitigation Measures	Responsibility for Implementation of Mitigation Measures	Items to be Monitored
A. Physical Environment					
Water quality	Run-off from stockpiled wastes and end-products of composting which may cause siltation and reduction in the quality of adjacent bodies of water. The impacts are negative and long-term, site-specific within a relatively small area and reversible by mitigation measures.	Local/ site-specific, long-term term and impact is not significant	• Take all precautions to prevent entering of run-off into streams, watercourses, or irrigation system. Install temporary silt traps or sedimentation basins along the channels leading to the water bodies. • Remove all wastes, by-, and end-products immediately. • Monitor discharge of leachate including review of Environmental Compliance Certificate (ECC) conditions. Parameters to be monitored include suspended solids, dissolved solids (inorganic), pH, ammoniac nitrogen (as N), total nitrogen (as N), biochemical and chemical oxygen demand, arsenic mercury, lead, cadmium, total chromium, copper, zinc, nickel, cyanide, chloride, fluoride, phonemic compounds and others as per the Government of Nepal	SWM Operator	• Eluent quality • Implementation of mitigation measures • Environmental safeguard requirements in the O&M Manual

Field	Impacts	Significance, Duration, and Magnitude	Mitigation Measures	Responsibility for Implementation of Mitigation Measures	Items to be Monitored
A. Physical Environment					
			rules and regulations and applicable WB/IFC EHS standards. • Monitor compost quality. Visual inspection to ensure that glass, plastic and other physical inerts and fragments are absent in compost and it has no offensive smell. Also testing of compost to meet standards for arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc, pH and other parameters as prescribed by the relevant National policy of the Government. • Monitor treated wastes quality as per conditions of the ECC. Tests at the minimum include measurement of temperature, pressure, contact time, spore tests, and other routine tests (visual).		
Air quality	Moving wastes, by- and end-products (such as composts) may create dusts during dry season. Landfill gas generation.	The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.	• Use bin covers and/or tarpaulins during transport of wastes, by-, and end products (compost) • Use tarpaulin to cover soils, sand and other loose material that will	SWM Operator	• Ambient air quality • Implementation of mitigation measures • Environmental safeguard requirements in the O&M Manual

Field	Impacts	Significance, Duration, and Magnitude	Mitigation Measures	Responsibility for Implementation of Mitigation Measures	Items to be Monitored
A. Physical Environment					
			be used in the controlled landfill. • Green belt will be developed around the facilities to act as a barrier for dust pollution. • Only inert waste will be sent to controlled landfill so that landfill gas formation is minimum.		
Acoustic environment	Increase in noise level due to presence of workers and movement of vehicles.	The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.	• Plan activities in consultation with Dhangadhi sub-metropolitan city so that activities with the greatest potential to generate noise are conducted during periods of the day which will result in least disturbance.	SWM Operator	• Vehicle noises • Equipment noise levels • Implementation of mitigation measures • Environmental safeguard requirements in the O&M Manual
B. Biological Characteristics					
Biodiversity	Activities in the built-up area of Dhangadhi sub-metropolitan. There are no protected areas in or around subproject sites, and no known areas of ecological interest.	Local/ site-specific, short-term term and impact is not significant	• No trees, shrubs, or groundcover may be removed or vegetation stripped without the prior permission. • Prevent workers or any other person from removing and damaging any flora (plant/ vegetation) and fauna (animal). • Monitor survival rate of vegetation (plants and trees) in the green belt	SWM Operator	• Implementation of mitigation measures • Environmental safeguard requirements in the O&M Manual

Field	Impacts	Significance, Duration, and Magnitude	Mitigation Measures	Responsibility for Implementation of Mitigation Measures	Items to be Monitored
A. Physical Environment					
			of the facilities.		
C. Socioeconomic Characteristics					
Existing provisions for pedestrians and other forms of transport	Increase in traffic in Dhangadhi sub-metropolitan city during collection, loading and unloading of wastes.	The impacts are negative but short-term, site-specific within a relatively small area and reversible by mitigation measures.	• Early hour collection will be enforced before the peak traffic hours. • Maintain safe passage for vehicles and pedestrians. • Erect and maintain barricades, including signs, markings, flags and flagmen informing diversions and alternative routes when required. • Notify affected sensitive receptors by providing sign boards and contact numbers for concerns/complaints. • Increase workforce in front of critical areas such as institutions, place of worship, business establishment, hospitals, and schools. • Consult businesses and institutions regarding operating hours and factoring this in work schedules. • Ensure any damage to properties and utilities will be restored or compensated to pre-work conditions.	SWM Operator	• Implementation of mitigation measures • Environmental safeguard requirements in the O&M Manual

Field	Impacts	Significance, Duration, and Magnitude	Mitigation Measures	Responsibility for Implementation of Mitigation Measures	Items to be Monitored
A. Physical Environment					
Workers health and safety	Workers need to be mindful of the occupational hazards working in waste management facilities.	Potential impacts are negative and long-term but reversible by mitigation measures	• Comply with requirements of Government of Nepal Labor Law and all applicable laws and standards on workers' health and safety (H&S). • Ensure that all site personnel have a basic level of H&S training. • Produce and implement a O&M H&S plan which include measures as: (i) excluding the public from worksites; (ii) ensuring all workers are provided with and required to use personal protective equipment (reflectorized vests, footwear, gloves, goggles and masks) at all times; (iii) providing H&S training[18] for all site personnel; (iv) documenting procedures to be followed for all site activities; and (v) maintaining accident reports and records.	SWM Operator	• Implementation of mitigation measures • Environmental safeguard requirements in the O&M Manual

[18] Some of the key areas that may be covered during training as they relate to the primary causes of accidents include (i) slips, trips and falls; (ii) personal protective equipment; (iii) ergonomics, repetitive motion, and manual handling; (iv) workplace transport; and (v) legislation and responsibilities. Training can provide the foundations of competence but it does not necessarily result in a competent worker. Therefore, it is essential to assess staff competence to ensure that the training provided is relevant and effective. Supervision and monitoring arrangements shall be in place to ensure that training has been effective and the worker is competent at their job. The level of supervision and monitoring required is a management decision that shall be based on the risks associated with the job, the level of competence required, the experience of the individual and whether the worker works as part of a team or is a lone worker.

Field	Impacts	Significance, Duration, and Magnitude	Mitigation Measures	Responsibility for Implementation of Mitigation Measures	Items to be Monitored
A. Physical Environment					
			• Arrange for readily available first aid unit including an adequate supply of sterilized dressing materials and appliances • Provide H&S orientation training to all new workers to ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to fellow workers; • Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas; • Mark and provide sign boards. Signage shall be in accordance with international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate. • Disallow worker exposure to noise level greater than 85 dBA for a duration of more than 8 hours per day without		

Field	Impacts	Significance, Duration, and Magnitude	Mitigation Measures	Responsibility for Implementation of Mitigation Measures	Items to be Monitored
A. Physical Environment					
			hearing protection. The use of hearing protection shall be enforced actively.		
Community health and safety	Possible accumulation of waste causing health problems for community. Pests and vermin.	Potential impacts are negative and long-term but reversible by mitigation measures.	• Wet/ biodegradable wastes will be emptied directly from the bins to primary collection vehicles daily and dry/non-biodegradable wastes once in a week. The number and type of bins and vehicles to be procured under the project is sufficient to ensure no accumulation of wastes in the community. • Wastes will be collected regularly to prevent pests and vermin.	SWM Operator	• Implementation of mitigation measures • Environmental safeguard requirements in the O&M Manual

Table 24: Environmental Monitoring Program

Project Activity	Mitigation measures	Location	Responsible for Mitigation	Monitoring Method	Frequency	Responsible for Monitoring
Project Design	• Identify government site to avoid land acquisition and resettlement impacts	Landfill site	Municipality, DSC	Site visits, discussions with the local people	As required	Municipality
	• Select the site ideally away from the Municipality development zone	Landfill site	Municipality, DSC	Site visits, discussions with the local people	As required	Municipality
	• Identify the site so as to avoid flood risk zone • Upgrade the flood hazard and exposure information of vulnerable areas and carry out flood risk analysis of Mohana River and Kailall Nala in the project area.	Landfill site	Municipality, DSC	Site visits, discussions with the local people	As required	Municipality
	• Prepare training manuals/plans in Nepali with sketches on Community Health and Safety and Potential Occupational Health and Safety, including a training manual for Landfill Operations and Maintenance	Design office	DSC	Review of the manuals/plans by experts as required	Twice (review of first draft and final with expert's opinions)	Municipality
	• Provide an adequate green belt buffer around the site • The landfill site should be at least 500 m away from residential areas and sensitive receptors	Landfill site	DSC	Site visits, discussions with the local people	Once	Municipality
	• Identify groundwater table and design leachate system to protect groundwater • Provide a liner system with low permeability, robust, durable and resistant to chemical attack, puncture, rupture, etc.; the liner system could be a minimum of 60 cm thick compacted clay of permeability (k) not greater than	Landfill site	DSC	Review of the design by experts as required	Twice (review of first draft and final with expert's opinions)	Municipality

Project Activity	Mitigation measures	Location	Responsible for Mitigation	Monitoring Method	Frequency	Responsible for Monitoring
	10-7 cm/sec , a 1.5 mm thick HDPE geo-membrane liner and a drainage layer of 300 mm thick granular material of permeability not greater than 10-2 cm/sec • Provide leachate collection and treatment system before disposal • Provide a drainage system and collect/treat the runoff together with the leachate					
	• Provide gas control systems (gas vents and flaring system)	Landfill site	DSC	Review of the design by experts as required	Twice (review of first draft and final with expert's opinions)	Municipality
Preparation for Construction	• Delineate project temporary and permanent land (pegging) and prepare the list of project affected people and resources • Prepare resettlement plan for permanent and temporary acquisitions • Notify the people • Implement resettlement plan and provide compensation	Landfill site	Municipality, DSC, Contractor	• Review records of loss of private properties, affected people and resources and cost implications. • See if all payments and arrangements have been made to the satisfaction of the people	As required	Municipality
	• Obtain Letters of Approval and agreement for (i) temporary acquisition of land and properties, (iii) disruption of water supply, and irrigation canals.	Municipality	Municipality, DSC,	See whether written approvals have been received from the authorities	Once	Municipality
	• Establish workforce camps with sanitary amenities at designated sites only	Project site	Contractor/ DSC	Visual inspections of wastewater disposal, solid waste management	Once before start of project and then monthly	DSC

Project Activity	Mitigation measures	Location	Responsible for Mitigation	Monitoring Method	Frequency	Responsible for Monitoring
				, noise and air pollution, health of workforce, potable drinking water, kerosene availability		
	• Employ local people (not under age 14) and women in jobs • Settle wage rate based on DWEC and provide the list of employees to DSC	Project site	Contractor/ DSC	Check/verify list of employees, age of employees, wages	Every month	DSC
	• Take baseline photographs of buildings and temporary sites before construction for verifications; measure water quality of groundwater and streams before construction	Project site and surroundings	Contractor/ DSC	Photographs and water sampling and testing before construction and after construction is over	Twice (before and after construction) for photographs and monthly for water quality	DSC

DSC = Design and Supervision Consultant, DWEC = daily wage execution committee.

Table 25: Construction Stage Environmental Monitoring Plan (Indicative)

Project Activity	Mitigation measures	Location	Responsible for Mitigation	Monitoring Method	Frequency	Responsible for Monitoring
Construction	• Prohibit the use of fuelwood and timber collection. • Prohibit illegal collection of NTFPs and trade. • Provide LPG/ kerosene to workforce. • Stockpile the felled trees and take permission from concerned authority for its use • Compensate all private trees affected.	Landfill site	Contractor/ DSC	whether LPG/ kerosene is available in camp site and whether affected private trees are compensated	As required	Municipality
	• Use tarpaulins/ plastic sheets to cover the materials during transport • Transport required construction materials when and as required; avoid temporary storage • Consult DSC on the designated areas for stockpiling of construction materials • Transport required construction materials when and as required; avoid temporary storage • Use tarpaulins/plastic sheets to cover the materials during transport • Dust suppression on surroundings by sprinkling water as required at regular intervals • Routine monitoring for TSP, PM_{10} to meet air quality standards • Limit vehicle speed • Fit mufflers in vehicles to control noise • See that vehicles and machinery comply with the National Vehicle	Landfill site and access road to landfill site	Contractor	Air quality analyses for TSP, PM_{10} and SPM; visual inspection if water is sprinkled or not; check vehicle maintenance records and green stickers for vehicle emission standards	Visual observations; during construction/ every day to see if sprinkling is done and every week for air quality analyses	DSC

Project Activity	Mitigation measures	Location	Responsible for Mitigation	Monitoring Method	Frequency	Responsible for Monitoring
	Mass Emission Standards, 2056 BS • Regular maintenance of vehicles					
	• Cover stockpiled materials with tarpaulins/ plastic sheets • Reuse excess spoils and materials • Consult DSC on spoil disposal sites • Proper storage of construction aggregates, hazardous and toxic materials, lubricating oils and used batteries in safe areas and the segregation and disposal of chemical containers, packaging materials, plastic bags etc. • Provide training to workforce on safe handling of toxic materials and OHS measures during construction • Prohibit washing of vehicles next to rivers and streams • Provide designated areas with collection bins for wastes. • Provide sanitary toilet facilities and prohibit open defecation. • Check stream water quality according to EMP	Landfill site and surroundings	Contractor	Visual observations; water quality of receiving waters, including groundwater	Once a month	DSC
	• Monitoring of noise levels regularly at site to meet the noise standards • Fit mufflers in vehicles to control noise. • Limit the speed s of vehicles. • Ban the use of power horns in vehicles. • Regular maintenance of	Landfill site and access road to landfill site	Contractor/ DSC	Observations; measurement of sound levels; feedback from nearby residents	Every week	DSC

Project Activity	Mitigation measures	Location	Responsible for Mitigation	Monitoring Method	Frequency	Responsible for Monitoring
	equipment. • Prohibit the operation of crushing plants and construction vehicles during the night so as to cause the least disturbance • Compensate the damages caused by vibration if caused by construction activities.					
	• Obtain construction materials from quarries approved by the Municipality. • Borrow pits should be leveled so as to suit the aesthetics of the area as to its original state after the project is complete • 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.	Quarries	Construction Contractor, DSC	Visual inspection; discussion with locals; discharge measurements of streams before and during construction; changes in cross-section of the stream	During construction every month	DSC
	• 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	Landfill site and surroundings and quarry sites	Contractor, Municipality	Field observation to visually assess if disturbed community assets are reinstated	As required	Municipality
	• Prohibit gambling and alcohol consumption in contractors' camp sites. • Instruct the outside workforce to respect the local cultures, traditions, rights etc. • Provide security in contractors' camps	Labor camps	Contractor	Crime records and causes; camp issues; enforcement of remedies; security situation in camps	Once a month or as required	Municipality

Project Activity	Mitigation measures	Location	Responsible for Mitigation	Monitoring Method	Frequency	Responsible for Monitoring
	• 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 alternative routing signage in Nepali and English languages. • Arrange for onsite grievance handling‖ through use of liaison officers	Access road to landfill site	Contractor/ DSC	Visual observation of traffic; complaints from people; existence of signage and effectiveness of speed control and diversion measures	Every week	DSC
	• Provide regular health checkups, sanitation and hygiene, health care, and control of epidemic diseases to the workforce. • Make available first aid kits, ambulance and fire extinguishers in camp sites. • Make available PPE to all construction workers and compensate for the loss of life or any type of injuries. • Provide insurance to the workers and training in OHS and Community Health and Safety. • Launch awareness programs concerning human trafficking and the possibility of spread of STDs and HIV/AIDS using brochures, posters, and signboards.	Landfill site	Contractor	Health records; records of outbreak of diseases; maintenance of health clinic; health complaints; number of awareness programs launched; number of persons trained	Every week	DSC, Municipality

DSC= Design and Supervision Consultant, EMP = environmental management plan, PPE = personal protection equipment

Table 26: Operation and Maintenance Environmental Monitoring Program (Indicative)

Project Activity 89+	Mitigation measures	Location	Responsible for Mitigation	Monitoring Method	Frequency	Responsible for Monitoring
Operation & Maintenance	• Treat leachate to maintain to meet Ministry of Population and Environment's (MOPE) discharge standards; measure groundwater and receiving water • Conduct regular sampling and testing of effluent to ensure compliance. • Do not discharge if above regulations. Feed back into the landfill.	Treated effluent of leachate treatment plant at the landfill site and receiving waters	Municipality	Sampling and effluent and groundwater quality measurement to meet MOPE's effluent standards;	Once in 2 months	Municipality
	• Avoid open dumping of waste including in and around the landfill site and provide inert/ soil cover over the waste spread immediately	Landfill site	Municipality	Visual observation	Once a week	Municipality
	• Ensure regular waste collection. • Waste shall be disposed directly into the containers and ensure no spillage in the surrounding area	Municipality streets	Municipality	Observation and strict enforcement	Daily	Municipality
	• Ensure that the landfill gas is flared and not allowed to directly escape into the atmosphere	Landfill site and vicinity	Municipality	Air quality measurement (SPM, SO_2, CH_4, 24 hour average NH_3, 1 hr average CO	Once in 6 months	Municipality
	• Strictly follow the Potential Occupational Health and Safety Plan • Provide personal protection equipment Avoid manual handling of waste • Train workers on safe handling of waste • Ban waste-pickers and the public from the landfill site • Provide medical insurance coverage for workers	Landfill site and waste handlers in municipality	Municipality	Observation and strict enforcement	Once a week	Municipality

F. Monitoring and Reporting

186. Prior to commencement of the works, the contractor will submit a compliance report to PIU that all identified pre-construction mitigation measures as detailed in the EMP are undertaken. Contractor should confirm that the environmental health and safety supervisor is mobilized. PIU with the assistance of the DSC will review the report and permit commencement of works.

187. During construction, results from internal monitoring by the contractor will be reflected in their monthly EMP implementation reports to the PIU. PIU will review and advise contractors for corrective actions if necessary. A semi-annual environmental monitoring report (EMR) summarizing compliance and corrective measures taken, will be prepared by PMC and submitted to PIU. PMU will submit to ADB the semi-annual (6-monthly) EMR. Once concurrence from the ADB is received the report will be disclosed on the PCO and PIU websites.

188. DSC will be responsible for checking the monthly progress reports submitted by the contractor/s and field verified whether or not the contractor has complied with the approved conditions as stated in the EMEP. The contractor's 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. The reports will suggest corrective actions where necessary.

189. ADB will review project performance against the MOUD commitments as agreed in the legal documents. The extent of ADB's monitoring and supervision activities will be commensurate with the project's risks and impacts. Monitoring and supervising of social and environmental safeguards will be integrated into the project performance management system.

G. Training Activities on EMP Implementation

190. **Table 27** presents the outline of capacity building program to ensure EMP implementation. The detailed cost and specific modules will be customized by DSC in consultation with PCO and PIU after assessing the capabilities of the target participants and the requirements of the project. The responsibility of organizing and conducting the training will be by the DSC environmental specialist.

Table 27: Outline Capacity Building Program on EMP Implementation

Description	Contents	Schedule	Participants
Pre-construction stage			
Orientation program	- RUDP Environmental safeguard requirements - Implementation arrangement - Monitoring & reporting - Corrective actions	½ day orientation workshop - at the start of the program	PCO, PIUs – all senior and mid-level officials and engineers involved in DWSSIP
Training program on EMP implementation & monitoring	Module 1–Orientation - ADB SPS - Government of Nepal Environmental Laws and	2 day training program - .prior to invitation of any bids for civil works	PCO & PIU staff

Description	Contents	Schedule	Participants
	Regulations. Module 2–Environmental Assessment Process. - Environmental process, identification of impacts and mitigation measures, formulation of an EMP, implementation, and monitoring requirements; - Review and approval of environmental assessment reports Module 3: EMP Implementation, monitoring & reporting - Incorporation of safeguard clauses and EMP in bid and contract documents - Pollution prevention and abatement (IFC EHS Guidelines) - Monitoring & evaluation - Formulation of corrective action plans (CAP) - Reporting Module 4: Consultation & disclosure - Grievance redress mechanism	under RUDP	
Construction stage			
Orientation program	- Contractual requirements - Legal & regulatory requirements - EHS requirements - Site Environment Plan (SEP) preparation, EMP implementation and reporting - Roles and responsibilities	½ day orientation course to during mobilization	Contractors and PIUs, DSC supervising staff
Training program/ workshop for contractors and supervisory staff.	- Environmental issues during construction; - Site specific SEP - EMP Implementation - Day to day monitoring - Periodic ambient monitoring - Reporting - Consultation & grievance redress	1 day workshop immediately after mobilization	Contractors and PIUs, DSC supervising staff
Periodic refresher training workshop	Same as above	½ day workshop thrice a year	Contractors and PIU, DSC supervising staff
Stakeholder workshop Experience and best practices sharing	- Experience of EMP implementation–issues and challenges; and - Best practices followed.	½ day workshop Once in a year during implementation	PIU, and stakeholder agencies

H. Cost estimates

191. Costs of all mitigation measures during the construction phase will be included in the tender and contract documents and will be borne by the contractors. The contractors and

engineers shall be made aware of the importance of meeting environmental safeguard standards in the contracts, and the importance of preparing, submitting and getting the SEP (to be prepared for each subproject, according to the EMP) approved before construction starts.

192. One day awareness training has been estimated at $ 1,000. An NGO will be hired for facilitating training programmes for 5 years. The costs for the public awareness specialist, support team, and information, education and communication (IEC) materials have been earmarked as USD 10,000 per year.

193. The annual and total environmental cost for 5 years is given in **Table 28**.

Table 28: Indicative Cost of EMP Implementation

S. N.	Description	Unit Cost (USD)	Total Cost (USD)	Source of Fund
1	Project Management Specialist PMC: 24 months Environmental Specialist DSC: 6 person months	 3,000 2,500	 72,000 15,000	 PMC package DSC package
2	Public awareness campaign + IEC (on an intermittent basis)	10,000 per year	30,000	Project cost
3	EMP awareness training to contractors and engineers (1 day training)	Lump sum	1,000	Project cost
4	Air, noise and water quality monitoring (specific sites will be provided to construction contractors after detailed design & awarding of the contract	Lump sum	2,000	Contractor cost
5	Cost of mitigation measures according to EMP by the Contractor	-	-	Contractor cost

VIII. INFORMATION DISCLOSURE, CONSULTATION AND PARTICIPATION

A. Public Consultation and Information Disclosure:

194. Meaningful stakeholder consultation and participation is part of the project preparation and implementation strategy. Consultation, participation, and disclosure will ensure that information is provided and feedback on SWM subproject design is sought early, right from the project preparation phase, so that the views/preferences of stakeholders, including potential beneficiaries and affected people, can be adequately considered in project design, and continue at each stage of project preparation, processing, and implementation.

195. A variety of approaches has been adopted. At minimum, stakeholders were consulted regarding the scope of the IEE. **Table 29** provides the summary of the consultations conducted.

Table 29: Summary of Public Consultations Conducted in Dhangadhi for the SWM Subproject

Date: January 26, 2017 Location: Saraswatinagar, Ward No. 2, Dhangadhi sub-metropolitan Participants (number): 35	
Issues/ Concerns Raised	**Measures in the IEE to address concerns**
Project should be sensitive towards the public health impact of the landfill site to the surrounding community	• Provide safety signage at all sites visible to public • Provide safety barriers near any trenches, and cover trenches with planks during non-work hours • Contractor's activities and movement of staff will be restricted to designated construction areas. • Locations of hot-mix plants, batching plants and crushers (if these establishments are being set up exclusively for the subproject) shall be shall be located at least 100 m away from the nearest dwelling preferably in the downwind direction. • Consult with Dhangadhi local authority on the designated areas for stockpiling of, soils, gravel, and other construction materials. • If the contractor chooses to locate the work camp/ storage area on private land, he must get prior permission from the environment management specialist and landowner. • Use small mechanical excavators to attain faster trenching progress. For rock and concrete breaking, use non-explosive blasting chemicals, silent rock cracking chemicals, and concrete breaking chemicals.[19] • Under no circumstances may open areas or the surrounding bushes be used as a toilet facility. • Recycling and the provision of separate waste receptacles for different types of waste shall be encouraged. • A general regard for the social and ecological well-being of the site and adjacent areas is expected of the site staff. Workers need to be made aware of the following general rules: (i) no alcohol/ drugs on site; (ii) prevent excessive noise; (iii) construction staff are to make use of the facilities provided for them, as opposed to ad hoc alternatives (e.g. fires for cooking, the use of surrounding bushes as a toilet facility); (iv) no fires permitted on site except if needed for the construction works; (v) trespassing on private/commercial properties adjoining the site is forbidden; (vi) other than pre-approved security staff, no workers shall be permitted to live on the construction site; and (vii) no worker may be forced to do work that is potentially dangerous or that he/she is not trained to do. • Interested and affected parties need to be made aware of the existence of the complaints book and the methods of communication available to them. The contractor must address queries and complaints by: (i) documenting details of such communications; (ii) submitting these for

[19] These products come in powder forms, and once mixed with water (being the catalyst) simply expand, and crack the rock from hole to hole. This product is environmentally friendly and can be washed away after it has been used.

	inclusion in complaints register; (iii) bringing issues to the environment management specialist's attention immediately; and (iv) taking remedial action as per environment management specialist's instruction. • The contractor shall immediately take the necessary remedial action on any complaint/ grievance received by them and forward the details of the grievance along with the action taken to the environment management specialist within 48 hours of receipt of such complaint/ grievance.
The distance between landfill site and nearest human settlement should be as per standard.	
There should be plantation around the boundary of landfill site and along the bank of rivers (Mohana and Kailali Nala)	• Plantation of local plant species will be done along the river and in the surrounding area of the landfill site to create buffer zone.
Odour nuisance from the landfill site should be totally controlled	• Operational manual of the landfill site will be prepared. • Staffs of the landfill site operation will be trained and operated as per operation manual.
Since the project site lies in flood prone area of Mohana river and Kailali Nala, adequate flood protection measures should be applied accordingly during project implementation	• Adequate flood protection measures like construction of embankment; and river training will be provisioned in design of landfill site.
alternative site of this agricultural land should be explored for the landfill site if possible	• Municipality and PIU has explored all the possible landfill sites and concluded that this site as the most appropriate one
All the possible pollution due to landfill site on the natural resources and local environment should be fully controlled	• Take all precautions to prevent entering of run-off into streams, watercourses, or irrigation system. Install temporary silt traps or sedimentation basins along the channels leading to the water bodies. • Remove all wastes, by-, and end-products immediately. • Monitor discharge of leachate including review of ECC conditions. Parameters to be monitored include suspended solids, dissolved solids (inorganic), pH, ammoniac nitrogen (as N), total nitrogen (as N), biochemical and chemical oxygen demand, arsenic mercury, lead, cadmium, total chromium, copper, zinc, nickel, cyanide, chloride, fluoride, phonemic compounds and others as per Government of Nepal rules and regulations. • Monitor compost quality. Visual inspection to ensure that glass, plastic and other physical inerts and fragments are absent in compost and it has no offensive smell. Also testing of compost to meet standards for arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc, pH and other parameters as prescribed by the relevant National policy of the Government. • Monitor treated wastes quality as per conditions of the ECC. Tests at the minimum include measurement of temperature, pressure, contact time, spore tests, and other routine tests (visual). • Use bin covers and/or tarpaulins during transport of wastes, by-, and end products (compost) • Use tarpaulin to cover soils, sand and other loose

	material that will be used in the controlled landfill. • Green belt will be developed around the facilities to act as a barrier for dust pollution. • Only inert waste will be sent to controlled landfill so that landfill gas formation is minimum. • Plan activities in consultation with Dhangadhi sub metropolitan city so that activities with the greatest potential to generate noise are conducted during periods of the day which will result in least disturbance.
Beside landfill site project, there should be other community development activities in the surrounding area.	• Will be provisioned in the project
There's risk of river cutting by Mohana river and Kailali Nala and adequate protection measures should be applied to control the possible river cutting in the project area.	• Flood and river cutting risk will be studied in detail during design phase and necessary protection measures will be provisioned accordingly.
Employment opportunities should be provided to local people as much as possible.	• Preference will be given to local people for any employment opportunities in the project.
Project should disseminate the sufficient information regarding adverse impact of the project on public health and adequate measures should be applied to minimize the impact.	• Related IEC materials will be produced and disseminated to local people. • Awareness programmes related to health, hygiene, sanitation and solid waste management will be carried out among local community and municipal residents
Municipality should fulfill the commitments made to local community during project initiation phase	
There should be adequate buffer zone of trees between landfill site and human settlements.	• Plantation will be done in the surrounding area of the landfill site
Landfill site should be operated as envisaged in project concept and design.	• Operational manual of the landfill site will be prepared. • Staffs of the landfill site operation will be trained and operated as per operation manual.
Operation of landfill site should not pollute the nearby water sources e.g. river, well, underground water sources.	• Take all precautions to prevent entering of run-off into streams, watercourses, or irrigation system. Install temporary silt traps or sedimentation basins along the channels leading to the water bodies. • Remove all wastes, by-, and end-products immediately. • Monitor discharge of leachate including review of ECC conditions. Parameters to be monitored include suspended solids, dissolved solids (inorganic), pH, ammoniac nitrogen (as N), total nitrogen (as N), biochemical and chemical oxygen demand, arsenic mercury, lead, cadmium, total chromium, copper, zinc, nickel, cyanide, chloride, fluoride, phonemic compounds and others as per Government of Nepal rules and regulations. • Monitor compost quality. Visual inspection to ensure that glass, plastic and other physical inerts and fragments are absent in compost and it has no offensive smell. Also testing of compost to meet standards for arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc, pH and other parameters as prescribed by the relevant National policy of the Government.

	• Monitor treated wastes quality as per conditions of the ECC. Tests at the minimum include measurement of temperature, pressure, contact time, spore tests, and other routine tests (visual). • Use bin covers and/or tarpaulins during transport of wastes, by-, and end products (compost) • Use tarpaulin to cover soils, sand and other loose material that will be used in the controlled landfill. • Green belt will be developed around the facilities to act as a barrier for dust pollution. • Only inert waste will be sent to controlled landfill so that landfill gas formation is minimum. • Plan activities in consultation with Dhangadhi sub-metropolitan city so that activities with the greatest potential to generate noise are conducted during periods of the day which will result in least disturbance.

Date: January 26, 2017 Location: Navadurga Tol, Ward No. 1, Dhangadhi sub-metropolitan Participants (number): 33	
Issues/ Concerns Raised	**Measures in the IEE to address concerns**
Project should be sensitive towards the public health impact of the landfill site to the surrounding community	• Provide safety signage at all sites visible to public • Provide safety barriers near any trenches, and cover trenches with planks during non-work hours. • Contractor's activities and movement of staff will be restricted to designated construction areas. • Locations of hot-mix plants, batching plants and crushers (if these establishments are being set up exclusively for the subproject) shall be shall be located at least 100 m away from the nearest dwelling preferably in the downwind direction. • Consult with Dhangadhi local authority on the designated areas for stockpiling of, soils, gravel, and other construction materials. • If the contractor chooses to locate the work camp/ storage area on private land, he must get prior permission from the environment management specialist and landowner. • Use small mechanical excavators to attain faster trenching progress. For rock and concrete breaking, use non-explosive blasting chemicals, silent rock cracking chemicals, and concrete breaking chemicals.[20] • Under no circumstances may open areas or the surrounding bushes be used as a toilet facility. • Recycling and the provision of separate waste receptacles for different types of waste shall be encouraged. • A general regard for the social and ecological well-being of the site and adjacent areas is expected of the site staff. Workers need to be made aware of the following general rules: (i) no alcohol/ drugs on site; (ii) prevent

[20] These products come in powder forms, and once mixed with water (being the catalyst) simply expand, and crack the rock from hole to hole. This product is environmentally friendly and can be washed away after it has been used.

	excessive noise; (iii) construction staff are to make use of the facilities provided for them, as opposed to ad hoc alternatives (e.g. fires for cooking, the use of surrounding bushes as a toilet facility); (iv) no fires permitted on site except if needed for the construction works; (v) trespassing on private/commercial properties adjoining the site is forbidden; (vi) other than pre-approved security staff, no workers shall be permitted to live on the construction site; and (vii) no worker may be forced to do work that is potentially dangerous or that he/she is not trained to do. • Interested and affected parties need to be made aware of the existence of the complaints book and the methods of communication available to them. The contractor must address queries and complaints by: (i) documenting details of such communications; (ii) submitting these for inclusion in complaints register; (iii) bringing issues to the environment management specialist's attention immediately; and (iv) taking remedial action as per environment management specialist's instruction. • The contractor shall immediately take the necessary remedial action on any complaint/grievance received by him and forward the details of the grievance along with the action taken to the environment management specialist within 48 hours of receipt of such complaint/grievance.
The distance between landfill site and nearest human settlement should be as per standard.	
Project should consider about the possible impact to the access road and surrounding settlements during transportation of solid waste	• Prepare and implement a traffic management plan • Plan transportation routes so that heavy vehicles do not use narrow local roads, except in the immediate vicinity of delivery sites. • Maintain safe passage for vehicles and pedestrians throughout the construction period. • Schedule truck deliveries of construction materials during periods of low traffic volume. • Erect and maintain barricades, including signs, markings, flags and flagmen informing diversions and alternative routes when required. • Notify affected sensitive receptors by providing sign boards informing nature and duration of construction activities and contact numbers for concerns/ complaints. • Leave spaces for access between mounds of soil. • Provide walkways and metal sheets where required to maintain access across for people and vehicles. • Increase workforce in front of critical areas such as institutions, place of worship, business establishment, hospitals, and schools. • Consult businesses and institutions regarding operating hours and factoring this in work schedules. Ensure there is provision of alternate access to businesses and institutions during construction activities, so that there is no closure of these shops or any loss of clients.

	• Ensure any damage to properties and utilities will be restored or compensated to pre-work conditions.
Plantation should be done along the river bank and surrounding area of landfill site	• Plantation of local plant species will be done along the river and in the surrounding area of the landfill site to create buffer zone.
Odor nuisance caused by the landfill site should be totally controlled.	• Operational manual of the landfill site will be prepared. • Staffs of the landfill site operation will be trained and operated as per operation manual.
Since the project site lies in flood prone area of Mohana River and Kailali Nala, adequate flood protection measures should be applied accordingly during project implementation	• Adequate flood protection measures like construction of embankment; and river training will be provisioned in design of landfill site.
alternative site of this agricultural land should be explored for the landfill site if possible	• Municipality and PIU has explored all the possible landfill sites and concluded that this site as the most appropriate one
All the possible pollution due to landfill site on the natural resources and local environment should be fully controlled	• Take all precautions to prevent entering of run-off into streams, watercourses, or irrigation system. Install temporary silt traps or sedimentation basins along the channels leading to the water bodies. • Remove all wastes, by-, and end-products immediately. • Monitor discharge of leachate including review of ECC conditions. Parameters to be monitored include suspended solids, dissolved solids (inorganic), pH, ammoniac nitrogen (as N), total nitrogen (as N), biochemical and chemical oxygen demand, arsenic mercury, lead, cadmium, total chromium, copper, zinc, nickel, cyanide, chloride, fluoride, phonemic compounds and others as per Government of Nepal rules and regulations. • Monitor compost quality. Visual inspection to ensure that glass, plastic and other physical inert and fragments are absent in compost and it has no offensive smell. Testing of compost to meet standards for arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc, pH and other parameters as prescribed by the relevant National policy of the Government. • Monitor treated wastes quality as per conditions of the ECC. Tests at the minimum include measurement of temperature, pressure, contact time, spore tests, and other routine tests (visual). • Use bin covers and/or tarpaulins during transport of wastes, by-, and end products (compost) • Use tarpaulin to cover soils, sand and other loose material that will be used in the controlled landfill. • Green belt will be developed around the facilities to act as a barrier for dust pollution. • Only inert waste will be sent to controlled landfill so that landfill gas formation is minimum. • Plan activities in consultation with Dhangadhi sub-metropolitan city so that activities with the greatest potential to generate noise are conducted during periods of the day which will result in least disturbance.

196. Future consultations will be done during the detailed design stage, construction and operation stages in line with the requirements of ADB SPS 2009.

B. Information Disclosure

197. Information is disclosed through public consultation and making relevant documents available in public locations. The following documents will be submitted to ADB for disclosure on its website:

(i) Draft and final IEE;
(ii) a new or updated IEE and corrective action plan prepared during project implementation, if any; and
(iii) Semi Annual environmental monitoring reports.

198. MOUD will send written endorsement to ADB for disclosing these documents on ADB's website. It will also provide relevant safeguards information in a timely manner, in an accessible place and in a form and languages understandable to affected people and other stakeholders.

199. For illiterate people, other suitable communication methods will be used.

C. Grievance Redress Mechanism

200. A project-specific grievance redress mechanism (GRM) will be established to receive, evaluate, and facilitate the resolution of affected persons concerns, complaints, and grievances about the social and environmental performance at the level of the project. The GRM will aim to provide a time-bound and transparent mechanism to voice and resolve social and environmental concerns linked to the project.

201. **Common GRM.** A common GRM will be in place for social, environmental, or any other grievances related to the project; the resettlement plans and IEEs will follow the GRM described below, which is developed in consultation with key stakeholders. The GRM will provide an accessible and trusted platform for receiving and facilitating resolution of affected persons' grievances related to the project. The multi-tier GRM for the project is outlined below, each tier having time-bound schedules and with responsible persons identified to address grievances and seek appropriate persons' advice at each stage, as required.

202. Affected persons will have the flexibility of conveying grievances/ suggestions by dropping grievance redress/suggestion forms in complaints/suggestion boxes Installed by project municipalities, or through telephone hotlines at accessible locations, by e-mail, by post, or by writing in a complaint's register in municipal offices. **Appendix 3** has the sample grievance registration form. Careful documentation of the name of the complainant, date of receipt of the complaint, address/ contact details of the person, location of the problem area, and how the problem was resolved will be undertaken. The PCO safeguard officer will have the overall responsibility for timely grievance redressal on environmental and social safeguards issues and for registration of grievances, related disclosure, and communication with the aggrieved party through the PIU designated safeguard focal person.

203. PIU will be the main responsible body for handling grievances. For this reason, PIU will appoint one grievance officer in charge of receiving, handling, and documenting all cases. PIU, supported by the DSC as may be required, will also be responsible for informing the affected population on their rights to grievance and the mechanisms to be followed.

204. Once an affected person submits a grievance, PIU, after registering the complaint, will seek in a first step to find a solution and come to an agreement with the complainant. Depending on the nature of the complaint, this may also involve the contractor, DSC or other involved parties. The contractors and PIU grievance officer can immediately resolve on-site in consultation with each other, and will be required to do so within 7 days of receipt of a complaint/grievance.

205. If a solution cannot be found, PIU will report the case to the municipality. Municipality will appoint an arbitration board to hear and settle the case. The arbitration board will attempt to resolve the complaint/grievance within 15 days. The PIU grievance officer will be responsible to see through the process of redressal of each grievance.
206.

207. If again a solution cannot be reached, or if the parties do not agree with the decision of the arbitration board, each party can take the case to court according to applicable legislation. The court verdict will be final and binding for all parties.

Figure 10: Project Grievance Redress Mechanism

208. **Recordkeeping.** Records of all grievances received, including contact details of complainant, date the complaint was received, nature of grievance, agreed corrective actions and the date these were resolved and final outcome will be kept by PIU. The number of grievances recorded and resolved and the outcomes will be displayed/ disclosed in the PCO office, municipal office, and on the web, as well as reported in monitoring reports submitted to ADB on a semi-annual basis.

209. Periodic review and documentation of lessons learned. The PCO safeguard officer will periodically review the functioning of the GRM in each municipality and record information on the effectiveness of the mechanism, especially on the project's ability to prevent and address grievances.

210. **Costs.** All costs involved in resolving the complaints (meetings, consultations, communication and reporting/information dissemination) will be borne by the concerned PIU at municipal level; while costs related to escalated grievances will be met by the PCO. Cost estimates for grievance redress are included in resettlement cost estimates.

IX. CONCLUSION AND RECOMMENDATION

211. Overall, the impacts of the project will be very positive, befitting the environment and the people. Some negative impacts are anticipated during implementation but in specific areas and for short duration (dust, noise, traffic problems, access to buildings etc.). It is expected that the adverse environmental impacts of the planned subproject will in general not be significant and can be easily and reasonably mitigated and prevented through mitigation measures and regular monitoring during the design, construction and operation phases.

212. If the Project is properly implemented and environmental issues are duly considered, there will be a significant improvement in the health of the environment and people due to the proposed subproject and thereby an increase of the quality of life.

213. Although primarily a Category B subproject under ADB environmental categorization, the subproject's sanitary landfill subproject requires for an environmental impact assessment (EIA) under EPR 1997. The EIA for government purposes will be done by the DSC. Prior to commencement of detailed design and finalization of land acquisition, this IEE together with the scope and ToR will be formally submitted to the concerned Ministry (the MOUD), by the proponent (the DUDBC) as the—proposal required under the regulations to initiate the approval process.

APPENDIX 1: RAPID ENVIRONMENTAL ASSESSMENT CHECKLISTS

Solid Waste Management (SWM) Rapid Environmental Assessment (REA) Checklist
Town: Dhangadhi Sub Metropolitan City
Subproject Title: Solid Waste Management Landfill Development Project

Screening Questions	Yes	No	Remarks
A. Project Siting Is the project area adjacent to or within any of the following environmentally sensitive areas?		ø	The project area is not adjacent to or within any environmentally sensitive area.
Cultural heritage site		ø	
Protected area		ø	
Wetland		ø	
Mangrove		ø	
Estuarine		ø	
Buffer zone of protected area		ø	
Special area for protecting biodiversity		ø	
B. Potential Environmental Impacts Will the Project cause…			
Impacts associated with transport of wastes to the disposal site or treatment facility	ø		Transport of waste may increase some traffic volume in the access road; similarly there could be odor nuisance, if waste will not be transported with necessary precautions like covering of vehicle etc.
Impairment of historical/ cultural monuments/ areas and loss/ damage to these sites?		ø	
Degradation of aesthetic and property value loss?	ø		There could be degradation of aesthetic value of the project area, but can be minimized with mitigation measures.
Nuisance to neighbouring areas due to foul odor and influx of insects, rodents, etc.?	ø		There could be nuisance to neighboring areas if landfill site is not operated in proper way.
Dislocation or involuntary resettlement of people?	ø		Private land has to be acquired for the project, but no structures will be lost.
Disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?		ø	
Risks and vulnerabilities related occupational health and safety due to physical, chemical, biological, and radiological hazards during project construction and operation?	ø		Project should apply necessary mitigation measures during project construction and operation.
Public health hazards from odor, smoke from fire, and diseases transmitted by flies,	ø		Public health hazard can be minimized through application of

Screening Questions	Yes	No	Remarks
insects, birds and rats?			mitigation measures.
Deterioration of water quality as a result of contamination of receiving waters by leachate from land disposal system?	ø		Necessary measures should be incorporated in project design.
Contamination of ground and/or surface water by leachate from land disposal system?	ø		Necessary measures should be incorporated in project design.
Land use conflicts?		ø	There's no land use conflict.
Pollution of surface and ground water from leachate coming form sanitary landfill sites or methane gas produced from decomposition of solid wastes in the absence of air, which could enter the aquifer or escape through soil fissures at places far from the landfill site?	ø		Necessary measures should be incorporated in project design.
Inadequate buffer zone around landfill site to alleviate nuisances?		ø	There's adequate buffer zone around the landfill site to alleviate nuisances.
Road blocking and/or increased traffic during construction of facilities?	ø		There could be increased traffic during construction of facilities.
Noise and dust from construction activities?	ø		There could be noise pollution and dust emission to some extent due to construction activities.
Temporary silt runoff due to construction?	ø		There could be temporary silt run off during earthwork excavation (mainly in rainy season).
Hazards to public health due to inadequate management of landfill site caused by inadequate institutional and financial capabilities for the management of the landfill operation?	ø		Existing institutional and financial capabilities of the municipality should be strengthened for the management of landfill site operation.
Emission of potentially toxic volatile organics from land disposal site?		ø	Hazardous waste will not be disposed in the landfill site.
Surface and ground water pollution from leachate and methane gas migration?	ø		Necessary mitigation should be applied in project design, construction and operation.
Loss of deep-rooted vegetation (e.g. tress) from landfill gas?		ø	
Explosion of toxic response from accumulated landfill gas in buildings?		ø	
Contamination of air quality from incineration?		ø	Incinerator will not be operated in the landfill site.
Health and safety hazards to workers from toxic gases and hazardous materials in the site?		ø	Hazardous material will not be disposed in the landfill site.
Large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and		ø	Local workers will be used for most of the construction work and there will be insignificant burden in social infrastructure and services.

Screening Questions	Yes	No	Remarks
sanitation systems)?			
Social conflicts if workers from other regions or countries are hired?		ø	No such incidences are expected.
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?		ø	No explosive, fuel or other chemical will be transported to the landfill site, Necessary precaution will be taken if fuel or other chemical should be transported, used, stored or disposed.
Community safety risks due to both accidental and natural hazards, especially where the structural elements or components (e.g., landfill or incinerator) 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?		ø	The site will be fenced and the project site will not be accessible to the public.

A Checklist for Preliminary Climate Risk Screening

Screening Questions		Score	Remarks[1]
Location and Design of project	Is siting and/or routing of the project (or its components) likely to be affected by climate conditions including extreme weather related events such as floods, droughts, storms, landslides?	1	Project site could be affected by extreme flooding cases in Mohana River and Kailali Nala.
	Would the project design (e.g. the clearance for bridges) need to consider any hydro-meteorological parameters (e.g., sea-level, peak river flow, reliable water level, peak wind speed etc)?	1	Project design should consider the hydrological parameters especially peak river flow of Mohana River and Kailali Nala.
Materials and Maintenance	Would weather, current and likely future climate conditions (e.g. prevailing humidity level, temperature contrast between hot summer days and cold winter days, exposure to wind and humidity hydro-meteorological parameters likely affect the selection of project inputs over the life of project outputs (e.g. construction material)?	0	

[1] If possible, provide details on the sensitivity of project components to climate conditions, such as how climate parameters are considered in design standards for infrastructure components, how changes in key climate parameters and sea level might affect the siting/routing of project, the selection of construction material and/or scheduling, performances and/or the maintenance cost/scheduling of project outputs.

Screening Questions		Score	Remarks[1]
	Would weather, current and likely future climate conditions, and related extreme events likely affect the maintenance (scheduling and cost) of project output(s)?	1	there's likely extreme flooding events likely affect the maintenance of project output, hence the implementation of flood protection measures around the project site is necessary.
Performance of project outputs	Would weather/climate conditions, and related extreme events likely affect the performance (e.g. annual power production) of project output(s) (e.g. hydro-power generation facilities) throughout their design life time?	0	

Options for answers and corresponding score are provided below:

Response	Score
Not Likely	0
Likely	1
Very Likely	2

Responses when added that provide a score of 0 will be considered low risk project. If adding all responses will result to a score of 1-4 and that no score of 2 was given to any single response, the project will be assigned a medium risk category. A total score of 5 or more (which include providing a score of 1 in all responses) or a 2 in any single response, will be categorized as high risk project.
Result of Initial Screening (Low, Medium, High): Medium risk

Subproject Classification as per ADB SPS 2009:
The impacts are not major and impacts are local. No significant irreversible impacts are envisioned on human populations or environmentally sensitive areas including wetlands, forests, grasslands, and other natural habitats. All impacts can be mitigated under the scope of IEE.

Classification: Category B

Subproject Categorization as per ECR

Classification: B
Environmental Assessment Requirements: IEE as per ADB SPS (2009) and EIA as per ECR

Date: Jan 26, 2016

APPENDIX 2: RELEVANT ENVIRONMENTAL QUALITY STANDARDS

Table A2.1: Ambient Air Quality Standards

Parameter	Averaging Period	Nepal Standards[1] (µg/m³)	WHO Air quality Guidelines	
			Global Update[2] 2005 (µg/m³)	2nd Edition[3] 2000 (µg/m³)
TSP	Annual 24 h	- 230	- -	- -
PM_{10}	Annual 24 h	- 120	20 50	- -
PM_{25}	1 year 24 h	- -	10 25	- -
SO_2	Annual 24 h 10 minutes	50 0 -	- 20 500	- - -
NO_2	1 year 24 h 1 h	40 80 -	40 - 200	- - -
CO	8 h 15 minutes	10,000 100,000	-	10.000 100,000
Pb	1 year	0.5	-	0.5
Benzene	1 year	20	-	-

[1] National Air Quality Standards for Nepal, 2003.
[2] IFC. World Bank Group. *Environmental, Health and Safety General Gudielines 2007*.
[3] *Air Quality Guidelines for Europe Second Edition*, 2000, WHO Regional Office for Europe, Copenhagen
Source: National Planning Commission Secretariat. Government of Nepal. *Environment Satistics of Nepal 2011*. Central Bureau of Statistics, Kathmandu.

Table A2.2: Noise Level Standards

Receptor / Source	National Noise Standard Guidelines 2012 (dB)		WHO Guideline Values for Noise Level Measured Out of Doors (1 h L_{Aeq} in dBA)	
	Day	Night	07.00-22.00	22.00-07.00
Industrial area	75	70	70	70
Commercial area	65	55		
Rural residential area	45	40	55	45
Urban residential area	55	50		
Mixed residential area	63	55		
Quiet area	50	40	-	-
Water pump	65		-	
Diesel generator	90		-	

Source: WHO: Guidelines for Community Noise, 1999.

Table A2.3: Drinking Water Quality Standards

Group	Parameter	Unit	Nepal[1]	WHO[2]
Physical	Turbidity	NTU	5 (10)	-
	pH		6.5-8.5	-
	Color	TCU	5 (15)	-
	Taste and odor	-	not objectionable	
	TDS	mg/l	1000	-
	Electrical conductivity	µS/cm	1500	-
Chemical	Iron	mg/l	0.3	-
	Manganese	mg/l	0.2	-
	Arsenic	mg/l	0.55	0.01
	Cadmium	mg/l	0.003	0.003
	Chromium	mg/l	0.05	0.05
	Cyanide	mg/l	0.07	none
	Fluoride	mg/l	0.5 - 1-5	1.5
	Lead	mg/l	0.01	0.01
	Ammonia	mg/l	1.5	-
	Chloride	mg/l	250	-
	Sulphate	mg/l	250	-
	Nitrate	mg/l	50	50
	Copper	mg/l	1	2
	Total hardness	mg/l	500	-
	Calcium	mg/l	200	-
	Zinc	mg/l	3	-
	Mercury	mg/l	0.001	0.006
	Aluminium	mg/l	0.2	-
	Residual chlorine	mg/l	0.1-0.2	5
Bacteriological	E. coli	MPN/100 ml	0	not detectable in any sample
	Total coliform	MPN/100 ml	0 in 95% of samples	

[1] *National Drinking Water Quality Standards*. 2006.
[2] *WHO Guidelines for Drinking Water Quality, 4th Edition*, 2011.

Table A2.4: Tolerance Limits for Wastewater to be Discharged into Inland Surface Waters from Combined Wastewater Treatment Plants

Parameter	Unit	Tolerance limit
TSS	mg/l	50
Particle size of suspended solids		Shall pass 850 µ sieve
pH		5.5 - 9.0
BOD5 and 20°C	mg/l	50
Oil and grease	mg/l	10
Phenolic compounds	mg/l	1
Cyanide	mg/l	0.2
Sulphides (as s)	mg/l	2
Radioactive materials Alpha emitters Beta emitters	 c/ml c/ml	 10^{-7} 10^{-8}
Insecticides		absent
Total residual chlorine	mg/l	1
Fluorides (as F)	mg/l	2
Arsenic	mg/l	0.2
Cadmium	mg/l	2
Chromium (as Cr^{+6})	mg/l	0.1
Copper	mg/l	3

Parameter	Unit	Tolerance limit
Lead	mg/l	0.1
Mercury	mg/l	0.01
Nickel	mg/l	8
Selenium	mg/l	0.05
Zinc	mg/l	5
Ammoniacal nitorgen	mg/l	50
COD	mg/l	250
Silver	mg/l	0.1

Source: National Planning Commission Secretariat. Government of Nepal. *Environment Satistics of Nepal 2011*. Central Bureau of Statistics, Kathmandu, Nepal.

APPENDIX 3: SAMPLE GRIEVANCE REGISTRATION FORM

(To be available in Nepali and English)

The _____Project welcomes complaints, suggestions, queries, and comments regarding project implementation. We encourage persons with grievance to provide their name and contact information to enable us to get in touch with you for clarification and feedback.

Should you choose to include your personal details but want that information to remain confidential, please inform us by writing/typing *(CONFIDENTIAL)* above your name. Thank you.

Date		Place of registration			
Contact information/personal details					
Name		Gender	* Male * Female	Age	
Home address					
Place					
Phone no.					
E-mail					
Complaint/suggestion/comment/question Please provide the details (who, what, where, and how) of your grievance below: If included as attachment/note/letter, please tick here:					
How do you want us to reach you for feedback or update on your comment/grievance?					

FOR OFFICIAL USE ONLY

Registered by: (Name of official registering grievance)	
Mode of communication: Note/letter E-mail Verbal/telephonic	
Reviewed by: (Names/positions of officials reviewing grievance)	
Action taken:	
Whether action taken disclosed:	Yes No
Means of disclosure:	

APPENDIX 4: SAMPLE SEMI-ANNUAL ENVIRONMENTAL MONITORING REPORT TEMPLATE

I. INTRODUCTION

(i) Overall project description and objectives
(ii) Environmental category as per ADB Safeguard Policy Statement, 2009
(iii) Environmental category of each subproject as per national laws and regulations
(iv) Project Safeguards Team

Name	Designation/Office	Email Address	Contact Number	Roles
1. PMU				
2. PIUs				
3. Consultants				

(v) Overall project and subproject progress and status
(vi) Description of subprojects (package-wise) and status of implementation (preliminary, detailed design, on-going construction, completed, and/or O&M stage)

Package Number	Components/List of Works	Contract Status (specify if under bidding or contract awarded)	Status of Implementation (Preliminary Design/Detailed Design/On-going Construction/Completed /O&M)[1]	If On-going Construction	
				%Physical Progress	Expected Completion Date

II. COMPLIANCE STATUS WITH NATIONAL/ STATE/ LOCAL STATUTORY ENVIRONMENTAL REQUIREMENTS[2]

Package No.	Subproject Name	Statutory Environmental	Status of Compliance[4]	Validity if	Action Required	Specific Conditions that

[1] If on-going construction, include %physical progress and expected date of completion.
[2] All statutory clearance/s, no-objection certificates, permit/s, etc. should be obtained prior to award of contract/s. Attach as appendix all clearance obtained during the reporting period. If already reported, specify in the "remarks" column.

		Requirements[3]		obtained		will require environmental monitoring as per Environment Clearance, Consent/Permit to Establish[5]

III. COMPLIANCE STATUS WITH ENVIRONMENTAL LOAN COVENANTS

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

IV. COMPLIANCE STATUS WITH THE ENVIRONMENTAL MANAGEMENT PLAN (REFER TO EMP TABLES IN APPROVED IEE/S)

(i) Confirm if IEE/s require contractors to submit site-specific EMP/construction EMPs. If not, describe the methodology of monitoring each package under implementation.

Package-wise IEE Documentation Status

Package Number	Final IEE based on Detailed Design				Site-specific EMP (or Construction EMP) approved by Project Director? (Yes/No)	Remarks
	Not yet due (detailed design not yet completed)	Submitted to ADB (Provide Date of Submission)	Disclosed on project website (Provide Link)	Final IEE provided to Contractor/s (Yes/No)		

(ii) For each package, provide name/s and contact details of contractor/s' nodal person/s for environmental safeguards.

Package-wise Contractor/s' Nodal Persons for Environmental Safeguards

Package Name	Contractor	Nodal Person	Email Address	Contact Number

[4] Specify if obtained, submitted and awaiting approval, application not yet submitted

[3] Specify (applicable requirements such as environmental clearance or Permit / consent to establish or Forest clearance; etc.)

[5] Example: Environmental Clearance requires ambient air quality monitoring; and Forest Clearance/Tree-cutting Permit requires 2 trees for every tree, etc.

(iii) With reference to approved EMP/site-specific EMP/construction EMP, complete the table below

Summary of Environmental Monitoring Activities (for the Reporting Period)[6]

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						

[6] Attach Laboratory Results and Sampling Map/ Locations.

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

V. APPROACH AND METHODOLOGY FOR ENVIRONMENTAL MONITORING OF THE PROJECT

(i) Briefly describe the approach and methodology used for environmental monitoring of each subproject.

VI. MONITORING OF ENVIRONMENTAL IMPACTS ON PROJECT SURROUNDINGS (AMBIENT AIR, WATER QUALITY AND NOISE LEVELS)

(i) Discuss the general condition of surroundings at the project site, with consideration of the following, whichever are applicable:

(a) Confirm if any dust was noted to escape the site boundaries and identify dust suppression techniques followed for site/s.
(b) Identify if muddy water is escaping site boundaries or if muddy tracks are seen on adjacent roads.
(c) Identify type of erosion and sediment control measures installed on site/s, condition of erosion and sediment control measures including if these are intact following heavy rain.
(d) Identify designated areas for concrete works, chemical storage, construction materials, and refueling. Attach photographs of each area in the Appendix.
(e) Confirm spill kits on site and site procedure for handling emergencies.
(f) Identify any chemical stored on site and provide information on storage condition. Attach photograph.
(g) Describe management of stockpiles (construction materials, excavated soils, spoils, etc.). Provide photographs.
(h) Describe management of solid and liquid wastes on-site (quantity generated, transport, storage and disposal). Provide photographs.
(i) Provide information on barricades, signages, and on-site boards. Provide photographs in the Appendix.
(j) Indicate if there are any activities being under taken out of working hours and how that is being managed.
(k) Briefly discuss the basis for environmental parameters monitoring.
(l) Indicate type of environmental parameters to be monitored and identify the location.
(m) Indicate the method of monitoring and equipment used.
(n) 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

VII. GRIEVANCE REDRESS MECHANISM

(i) Provide information on establishment of grievance redress mechanism and capacity of grievance redress committee to address project-related issues/ complaints. Include as appendix Notification of the GRM (town-wise if applicable).

VIII. COMPLAINTS RECEIVED DURING THE REPORTING PERIOD

(i) Provide information on number, nature, and resolution of complaints received during reporting period. Attach records as per GRM in the approved IEE. Identify safeguards team member/s involved in the GRM process. Attach minutes of meetings (ensure English translation is provided).

IX. SUMMARY OF KEY ISSUES AND REMEDIAL ACTIONS

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

X. APPENDIXES

(i) Photos
(ii) Summary of consultations
(iii) Copies of environmental clearances and permits
(iv) Sample of environmental site inspection report
(v) all supporting documents including **signed** monthly environmental site inspection reports prepared by consultants and/or contractors
(vi) Others

APPENDIX 5: ATTENDANCE LIST OF PUBLIC CONSULTATION MEETING

नेपाल सरकारद्वारा एशियाली विकास बैंकको सहयोगमा संचालन हुने क्षेत्रीय शहरी विकास आयोजना अन्तर्गत सुदूर पश्चिमाञ्चल विकास क्षेत्रको धनगढी उपमहानगरपालिका, वडा नं २ मा प्रस्ताव गरिएको फोहरमैला विसर्जनस्थल (Landfill Site) को प्रारम्भिक वातावरणीय परीक्षण अध्ययनका लागि सार्वजनिक परामर्श गर्ने सिलसिलामा सम्बन्धित वातावरणीय सवालहरुका बारेमा प्रस्ताव कार्यान्वयन हुने क्षेत्रका सरोकारवाला व्यक्ति, संस्थाको लिखित राय सुझाव लिन देहायका स्थान र मितिमा सार्वजनिक बैठक आयोजना गरि छलफल गर्ने तथा रायसुझावहरु लिने कार्य सम्पन्न भयो ।

स्थान: [illegible] धनगढी उपमहानगरपालिका-९
मिति: २०७३।१०।१३ ।

क्र सं	नाम, थर	सम्बन्धित कार्यालय, पेशा	ठेगाना	हस्ताक्षर
१	[illegible]	[illegible]	[illegible]	[illegible]
२	[illegible]	[illegible]	[illegible]	[illegible]
३	[illegible]	[illegible]	[illegible]	[illegible]
४	[illegible]	[illegible]	[illegible]	[illegible]
५	[illegible]	[illegible]	[illegible]	[illegible]
६	[illegible]	[illegible]	[illegible]	[illegible]
७	[illegible]	[illegible]	[illegible]	[illegible]
८	[illegible]	[illegible]	[illegible]	[illegible]
९	[illegible]	[illegible]	[illegible]	[illegible]
१०	[illegible]	[illegible]	[illegible]	[illegible]
११	[illegible]	[illegible]	[illegible]	[illegible]
१२	[illegible]	[illegible]	[illegible]	[illegible]
१३	[illegible]	[illegible]	[illegible]	[illegible]
१३	[illegible]	[illegible]	[illegible]	[illegible]
१४	[illegible]	[illegible]	[illegible]	[illegible]

क्रं सं	नाम, थर	सम्बन्धित कार्यालय, पेशा	ठेगाना	हस्ताक्षर
१५.	ज्ञान वि.क.		चक्रमनपा-१	
१६.	रुपक कामी		,,	
१७.	तुलाराम कोली		,,	तुलाराम
१८.	पुदम कार्की		,,	
१९.	पूर्ण ब. आवा		,,	
२०.	रुपनारायण फुलारा		,,	
२१	ज्ञानेन्द्र मल्ल		,,	
२२.	रतन देव फुलारा		,,	
२३	लोकबाल सिंह रहे		,,	
२४	टेक ब. बोगटी		,,	
२५.	विपिन मल्ल		,,	
२६.	हेम राज फुलारा		,,	
२७	सिता वड			सिता
२८.	राजु नगरी		,,	
३०	गणेश ब. ओड		,,	
३१	धर्मराज उपाध्याय		,,	
३२.	बाटु कामी		,,	बाटु कामी
३३.	मनेश्वरी शर्मा	सा.प. -१	,,	

नेपाल सरकारद्वारा एशियाली विकास बैंकको सहयोगमा संचालन हुने क्षेत्रीय शहरी विकास आयोजना अन्तर्गत सुदूर पश्चिमाञ्चल विकास क्षेत्रको धनगढी उपमहानगरपालिका, वडा नं २ मा प्रस्ताव गरिएको फोहरमैला विसर्जनस्थल (Landfill Site) को प्रारम्भिक वातावरणीय परीक्षण अध्ययनका लागि सार्वजनिक परामर्श गर्ने सिलसिलामा सम्बन्धित वातावरणीय सवालहरुका बारेमा प्रस्ताव कार्यान्वयन हुने क्षेत्रका सरोकारवाला व्यक्ति, संस्थाको लिखित राय सुझाव लिन देहायका स्थान र मितिमा सार्वजनिक बैठक आयोजना गरि छलफल गर्ने तथा रायसुझावहरु लिने कार्य सम्पन्न भयो ।

स्थान: धनगढी उपमहानगरपालिका-२, सरस्वतीनगर, नयाँबस्ती (अतिक्रमबस्ती)
मिति: २०७३/१०/१३.

क्र सं	नाम, थर	सम्बन्धित कार्यालय, पेशा	ठेगाना	हस्ताक्षर
१	भगवति ढकाल	सं. वडा ना. मे.	धन.उ.म.न.पा.२	[illegible]
२	हेमराज भण्डारी	वडा सचिव	,,	[illegible]
३	चक्रराज पाण्डेय	ले. का. प्र.	,,	[illegible]
४	विष्णु बुढी	नेकपा एमाले	,,	[illegible]
५	हरिप्रसाद भट्ट	स्व. धन.उ.म.न.पा.		[illegible]
६	मान बहादुर सिंह	सं. वडा ना. मे.	धन.उ.म.न.पा.२	[illegible]
७	अम्बिका भण्डारी	[illegible]	धन.उ.म.न.पा.२	[illegible]
८	[illegible] राजभोजी	[illegible]	धन.उ.म.न.पा.	[illegible]
९	देव बहादुर वि.क.	,, ,,	,, ,,	[illegible]
१०	विक्रम डंगौरा	,, ,,	,,	[illegible]
११	खेमराज मुल	ने.क.पा. एमाले जि.स. अध्यक्ष		[illegible]
१२	डम्बर सुनार	,,		[illegible]
१३	ठग्गु चौधरी	[illegible]	वडा नं. २	ठग्गु
१४	के. आई. सिं. चौधरी	[illegible]	,,	[illegible]

क्र सं	नाम, थर	सम्बन्धित कार्यालय, पेशा	ठेगाना	हस्ताक्षर
१५.	गगन ब. कोली	लेकनाथ चोक	घा.उ.म.न.पा.-२	
१६.	अशोक थापा	जग्गा धनी	"	
१७	जनक राज अवस्थी	—"—	"	
१८	भागवत चौ	"	"	
१९	प्रेम	-		प्रेम
२०	मान ब. थापा	-	-	
२१.	लाल ब. डगौरा		"	लाल बहादुर
२२	दल ब. वि.क.	"	"	दल बहादुर
२३.	कालिराम थापा		"	कालीराम थापा
२४	लेहाक चौधरी		"	
२५.	दिनेश चौधरी		"	
२६.	भरत चौधरी			Bhat
२७.	सन्तराम "		"	कमल चौधरी
२८	कमल "		"	
२९	गोरे वि.क.		"	
३०.	इन्दु ब. कोली		"	
३१.	गोरख ब. सिंह		"	
३२.	रमेश चौधरी		"	
३३.	आनेश्वरी शर्मा	सा.प. वडा नं. १		
३४	ना.प्र. ओली	" २	"	
३५.	निर्मला खड्का	सा.प. २	"	

S.N.	Name	Office/Address	Affiliation/ Position / Profession
1.	Ram Lal Shrestha	Dhangadhi sub-metropolitan, Kailali	Executive Officer, Office of Dhangadhi sub-metropolitan
2.	Deej Raj Bhatta	Dhangadhi sub-metropolitan, Kailali	Engineer, Office of Dhangadhi sub-metropolitan
3.	Nirmal Deuba	Dhangadhi sub-metropolitan, Kailali	Sub-engineer, Office of Dhangadhi sub-metropolitan
4.	Chamaru Rana	Jugeda Katan, Dhangadhi sub-metropolitan-11, Kailali	Member, Ward Citizen Forum/*Bhalmansa* (Village Chief of Rana Tharu)
5.	Jagadish Singh Rana	Jugeda, Dhangadhi sub-metropolitan-11, Kailali	Local Farmer
6.	Raju Rana	Jugeda, Dhangadhi sub-metropolitan-11, Kailali	Local Farmer/ affected landowner
7.	Bhadu Rana	Jugeda, Dhangadhi sub-metropolitan-11, Kailali	Local Farmer/ affected landowner
8.	Puskal Karmacharya	Dhangadhi sub-metropolitan, Kailali	Local Leader, NCP-UML
9.	Rom Swanr	Dhangadhi sub-metropolitan, Kailali	Local Leader, Ra. Pra.Pa.-Nepal
10.	Nirmal Shah	Dhangadhi sub-metropolitan, Kailali	Local Leader, NCP-Maoist Centre
11.	Ram Prasad Rana	Dhangadhi sub-metropolitan, Kailali	Social Mobilizer, Dhangadhi Sub-metropolitan-11
12.	Sudhir Neupane	District Office of Plant Resources, Dhangadhi	Assistant Forest officer
13.	Nir Bahadur Shah	Division Office of Water Induced Disaster Prevention, Dhangadhi	Sub-Engineer
14.	Prakash Khadka	Division Office of Water Induced Disaster Prevention, Dhangadhi	Sub-Engineer
15.	Ram Govinda Arya	District Soil Conservation Office, Dhangadhi	Chief Conservation Officer
16.	Yogendra Prasad Ojha	Office of District Development Committee, Kailali, Dangadhi,	Programme Officer
17.	Ram Autar Chaudhari	District Forest Office, Kailali	Forest Ranger
18.	Bharat Prasad Shrestha	District Forest Office, Kailali	Assistant Forest Officer
19.	Jagadish Prasad Gupta	District Forest Office, Kailali	Senior Forest Officer
20.	Sambhu Singh	District Forest Office, Kailali	Assistant Forest Officer
21.	Dinesh Kumar Shrestha	Division Office of Urban Development and Building Construction, Dhangadhi	Engineer
22.	Narendra Khatri	Office of Groundwater Development Committee, Dhangadhi	Division Chief
23.	Surendra Shah	Office of Groundwater Development Committee, Dhangadhi	Hydrogeologist
24.	Naresh Majhi	Irrigation Development Division Office, Dhangadhi	Sub-engineer
25.	Shivaraj Joshi	District Office of Drinking Water Supply and Sanitation	Office Staff
26.	Dipesh Thakur	Office of District Development Committee, Eenrgy and Environment Unit, Dhangadhi	Engineer

S.N.	Name	Office/Address	Affiliation/ Position / Profession
27.	Harka Bahadur Kathayat	Office of District Development Committee, Dhangadhi	Planning and Admin Officer
28.	Krishna Bahadur Malla	Dhangadhi sub-metropolitan-1	Ex-Ward Chairperson, Ward No. 1
29.	Santosh Mudvari	Dhangadhi sub-metropolitan-1	Coordinator, Ward Citizen Forum
30.	Bal Krishna Fulara	Dhangadhi sub-metropolitan-1	Member, Ward Citizen Forum
31.	Chet Raj Fulara	Dhangadhi sub-metropolitan-1	Tol Development Organization
32.	Dharma Raj Joshi	Dhangadhi sub-metropolitan-1	Malika Tol, Local People
33.	Gagan Balayer	Dhangadhi sub-metropolitan-1	Navadruga Tol, Local people
34.	Nar Bahadur Bist	Dhangadhi sub-metropolitan-1	Malika Tol, Local people
35.	Nar Bahadur Malla	Dhangadhi sub-metropolitan-1	Malika Tol, Local people
36.	Dal Bahadur Bist	Dhangadhi sub-metropolitan-1	Malika Tol, Local people
37.	Navaraj Fulara	Dhangadhi sub-metropolitan-1	Malika Tol, Local people
38.	Tej Malla	Dhangadhi sub-metropolitan-1	Malika Tol, Local people
39.	Ram Aauji	Dhangadhi sub-metropolitan-1	Malika Tol, Local people
40.	Jagadish Fulara	Dhangadhi sub-metropolitan-1	Navadurga Tol, Local people
41.	Dipak Bista	Dhangadhi sub-metropolitan-1	Navadurga Tol, Local people
42.	Dipak Sob	Dhangadhi sub-metropolitan-1	Navadurga Tol, Local people
43.	Gagan Bika	Dhangadhi sub-metropolitan-1	Navadurga Tol, Local people
44.	Khadak Kami	Dhangadhi sub-metropolitan-1	Navadurga Tol, Local people
45.	Tularam Koli	Dhangadhi sub-metropolitan-1	Navadurga Tol, Local people
46.	Padam Karki	Dhangadhi sub-metropolitan-1	Navadurga Tol, Local people
47.	Purna Bahadur Malla	Dhangadhi sub-metropolitan-1	Navadurga Tol, Local people
48.	Krishna Raj Fulara	Dhangadhi sub-metropolitan-1	Navadurga Tol, Local people
49.	Gyanendra Malla	Dhangadhi sub-metropolitan-1	Navadurga Tol, Local people
50.	Ratan Dev Fulara	Dhangadhi sub-metropolitan-1	Navadurga Tol, Local people
51.	Keshav Raj Bhatta	Dhangadhi sub-metropolitan-1	Navadurga Tol, Local people
52.	HArka Bahadur Bogati	Dhangadhi sub-metropolitan-1	Navadurga Tol, Local people
53.	Bipin Malla	Dhangadhi sub-metropolitan-1	Navadurga Tol, Local people
54.	Hem Raj Fulara	Dhangadhi sub-metropolitan-1	Navadurga Tol, Local people
55.	Sita Badu	Dhangadhi sub-metropolitan-1	Navadurga Tol, Local people
56.	Raju Nagari	Dhangadhi sub-metropolitan-1	Navadurga Tol, Local people
57.	Ganesh Bahadur Aade	Dhangadhi sub-metropolitan-1	Navadurga Tol, Local people
58.	Dharma Raj Upadhyaya	Dhangadhi sub-metropolitan-1	Navadurga Tol, Local people
59.	Batu Kami	Dhangadhi sub-metropolitan-1	Navadurga Tol, Local people
60.	Bhageswori Sharma	Dhangadhi sub-metropolitan-1	Social Mobilizer
61.	Bhagawati Hamal	Dhangadhi sub-metropolitan-2	Coordinator, Ward Citizen Forum
62.	Hemraj Bhandari	Dhangadhi sub-metropolitan-2	Ward Secretary
63.	Chakraja Pandey	Dhangadhi sub-metropolitan-2	Representative, Nepali Congress
64.	Bishnu Puri	Dhangadhi sub-metropolitan-2	Representative, NCP (UML)
65.	Hari Prasad Bhatta	Dhangadhi sub-metropolitan-2	Local people
66.	Man Bahadur Singh	Dhangadhi sub-metropolitan-2	Member, Ward CItizern Forum
67.	Ambika Bhandari	Dhangadhi sub-metropolitan-2	Local people
68.	Laxmi Raj Joshi	Dhangadhi sub-metropolitan-2	Local People

S.N.	Name	Office/Address	Affiliation/ Position / Profession
69.	Deb Bahadur Bi. Ka.	Dhangadhi sub-metropolitan-2	Local People
70.	Bikram Dagaura	Dhangadhi sub-metropolitan-2	Local People
71.	Khemraj Bhul	Dhangadhi sub-metropolitan-2	District Member, NCP (UML)
72.	Dambar Sunar	Dhangadhi sub-metropolitan-2	Member, NCP (UML)
73.	Thaggu Chaudhary	Dhangadhi sub-metropolitan-2	Local People
74.	K. I. Singh Chaudhary	Dhangadhi sub-metropolitan-2	Bhalmansa (Local Tharu Community leader)
75.	Gagan Bahadur Oli	Dhangadhi sub-metropolitan-2	Local people
76.	Ashok Thapa	Dhangadhi sub-metropolitan-2	Local people
77.	Janak Raj Awasthi	Dhangadhi sub-metropolitan-2	Local people
78.	Bhagwat Chaudhary	Dhangadhi sub-metropolitan-2	Local people
79.	Prem Chaudhary	Dhangadhi sub-metropolitan-2	Local people
80.	Man Bahadur Thapa	Dhangadhi sub-metropolitan-2	Local people
81.	Lal Bahadur Dagaura	Dhangadhi sub-metropolitan-2	Local people
82.	DAL Bahadur Bika	Dhangadhi sub-metropolitan-2	Local people
83.	Kashiram Thapa	Dhangadhi sub-metropolitan-2	Local people
84.	Lahanu Chaudhary	Dhangadhi sub-metropolitan-2	Local people
85.	Dinesh Chaudhary	Dhangadhi sub-metropolitan-2	Local people
86.	Bharat Chaudhary	Dhangadhi sub-metropolitan-2	Local people
87.	Santa Ram Chaudhary	Dhangadhi sub-metropolitan-2	Local people
88.	Kamal Chaudhary	Dhangadhi sub-metropolitan-2	Local people
89.	Gore Bika.	Dhangadhi sub-metropolitan-2	Local people
90.	Indra Bahadur Koli	Dhangadhi sub-metropolitan-2	Local people
91.	Gorakh Bahadur Singh	Dhangadhi sub-metropolitan-2	Local people
92.	Ramesh Chaudhary	Dhangadhi sub-metropolitan-2	Local people
93.	Bhageswori Sharma	Dhangadhi sub-metropolitan-1	Social Mobilizer, Ward No. 1
94.	Tara Prasad Joshi	Dhangadhi sub-metropolitan-2	Local people
95.	Nirmala Khadka	Dhangadhi ub-metropolitan-2	Social Mobilizer, Ward No. 2

	
Proposed landfill site in Dhangadhi sub-metropolitan-2, Saraswatinagar	Agricultural land and some trees seen in proposed landfill site, Dhangadhi sub-metropolitan-2, Saraswatinagar
	
Trees along the Kailali Nala river, also a border of proposed landfill site	Existing agricultural land in proposed landfill site
	
Existing landfill site along the river bank	Existing landfill site along the river bank
	
Public Consultation meeting with local community of proposed landfill site, Dhangadhi-2, Saraswatinagar	Public Consultation meeting with local community of proposed landfill site, Dhangadhi-2, Saraswatinagar

	
Public Consultation meeting with local community of proposed landfill site, Dhangadhi-1, Navadurga Tol	Public Consultation meeting with local community of proposed landfill site, Dhangadhi-2, Navadurga Tol
	
Public Consultation meeting with local community of proposed landfill site, Dhangadhi-2, Navadurga Tol	Public Consultation meeting with local community of proposed landfill site, Dhangadhi-2, Navadurga Tol

APPENDIX 6: PROJECT IMPLEMENTATION SCHEDULE

Activities	2016	(QTR) 2017				(QTR) 2018				(QTR) 2019				(QTR) 2020				(QTR) 2021				(QTR) 2022			
	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
Output 1: Urban infrastructure constructed and/or upgraded																									
Implemented by R-PIU for FWR Municipalities																									
Obtain necessary environmental clearances from government																									
Detailed engineering designs and bidding documents																									
Procurement of civil works contracts for drainage and road improvements, building works, and ISWM																									
Award of civil works contracts																									
Construction																									
Operation of ISWM																									
Management Activities																									
Recruit project management support consultant (PMC)																									
Recruit design and supervision consultant (DSC)																									
Finalize land acquisition for landfills/ dumpsites																									
Commence surveys and investigations																									
Prepare urban development and land use plans for each municipality																									
Develop infrastructure master plans																									
Finalize phased capital																									

Activities	2016	(QTR) 2017				(QTR) 2018				(QTR) 2019				(QTR) 2020				(QTR) 2021				(QTR) 2022			
	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV	I	II	III	IV
investment plans																									
Complete civil contract packages ensuring gender and disadvantaged sensitive designs																									
Recruit institutional development consultant (IDC)																									
Conduct initial trainings for municipal staff																									
Implementation of Environmental and Social Safeguard requirements																									
Annual/ Mid-term review																									
Project completion report																									

APPENDIX 7: KEY FUNCTIONS, ROLES AND RESPONSIBILITIES DURING THE FSTP OPERATIONS & MAINTENANCE

A. Plant In-charge

1. The FSTP in-charge forms part of the management team and is responsible for the day to day management of the FSTP. The In-charge defines the goals, objectives, policies and priorities, concerning the O&M, and is responsible for:

(i) all paperwork and correspondence, grounds and equipment maintenance, and supervision of personnel;
(ii) participating in the development and implementation of goals, objectives, policies, and priorities;
(iii) coordinating the organization, staffing, and operational activities including assuming responsibility for critical decisions regarding operational changes, process control, maintenance priorities, scheduling, and compliance;
(iv) identifying opportunities for improving O&M, monitoring and safety methods and procedures;
(v) directing, coordinating, and reviewing the work plan for O&M functions;
(vi) directing the testing of various treatment phases, interpreting tests to determine necessary changes in treatment parameters;
(vii) directing the adjustment and repair of equipment such as pumps, chlorinators, metering devices, electrical control panels, and treated or digested sludge dewatering;
(viii) serving as a team member on construction project teams with construction management companies and contractors;
(ix) selecting, training, motivating, and evaluating assigned personnel;
(x) overseeing safety programs for assigned sections and work groups and assisting with action planning for safety programs; and
(xi) participating in the development and administration of assigned programme budget.

B. Plant Engineer

2. The FSTP engineer serves as the chief technical employees' member. Typical roles and responsibilities include:

(i) ensuring the overall efficiency of the plant and optimization of the treatment process;
(ii) controlling operating expenses;
(iii) organizing and coordinating the work carried out by subordinate teams (e.g. sludge removal from drying beds, etc.)
(iv) recommending technical solutions to problems that may be encountered;
(v) contributing to the monitoring and reporting on the performance of equipment and processes; and
(vi) managing technical subcontractors and suppliers.

C. Plant Operator

3. The FSTP operator is responsible for carrying out the day-to-day technical aspects of plant operations in order to ensure that equipment is operating properly and in compliance with all requirements. Typical duties include:

(i) performing equipment inspections, monitoring operations, and collecting samples in order to verify system performance in collaboration with laboratory employees;
(ii) operating trucks, pumps, blowers, generators, compressors, and other machinery/equipment;
(iii) testing, calibrating, repairing, and operating control and instrumentation systems under general supervision;
(iv) keeping records of operational activities, degradations and failures;
(v) preparing field and office reports summarizing the records and providing recommendations for optimizing the system; and
(vi) assisting in site environmental investigations, field surveys, and cleanups as required.

D. Plant Maintenance Technician

4. The FSTP maintenance technician performs routine and emergency maintenance and repairs on plant facilities, pumps, engines, motors, filters, bar screens, valves, pipes, and other equipment at the FSTP. Typical responsibilities include:

(i) checking, adjusting and maintaining mechanical equipment including greasing of moving parts, changing oil, and performing other routine maintenance activities;
(ii) maintaining buildings, roads and grounds;
(iii) performing janitorial work;
(iv) replacing worn parts and performing routine and emergency service and repairs including replacing motors, bearings, flanges, seals and other equipment components;
(v) inspecting mechanical and hydraulic equipment being installed under contracts to ensure compliance with contract requirements;
(vi) monitoring facilities and equipment in order to identify and repair leaks or other malfunctions; and
(vii) keeping records through the logging of maintenance activities and repairs, and preparing reports summarizing the main activities, malfunctions and recommendations.

APPENDIX 8: SAMPLE OUTLINE SPOILS MANAGEMENT PLAN

I. Spoils information
- A. Materials type
- B. Potential contamination
- C. Expected volume and sources
- D. Spoil classification

II. Spoils management
- A. Transportation of spoil
- B. Storage of spoil
- C. Contaminated spoil
- D. Approved reuse and/or disposal sites

III. Records of reuse and/or disposal

APPENDIX 9: SAMPLE OUTLINE TRAFFIC MANAGEMENT PLAN

A. Principles

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 traveling 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. The following principles will help promote safe and efficient movement for all road users (motorists, bicyclists, and pedestrians, including persons with disabilities) through and around work zones while reasonably protecting workers and equipment.

(i) Make traffic safety and temporary traffic control an integral and high-priority element of every project from planning through design, construction, and maintenance.
(ii) Inhibit traffic movement as little as possible.
(iii) Provide clear and positive guidance to drivers, bicyclists, and pedestrians as they approach and travel through the temporary traffic control zone.
(iv) Inspect traffic control elements routinely, both day and night, and make modifications when necessary.
(v) Pay increased attention to roadside safety in the vicinity of temporary traffic control zones.
(vi) Train all persons that select, place, and maintain temporary traffic control devices.
(vii) Keep the public well informed.
(viii) Make appropriate accommodation for abutting property owners, residents, businesses, emergency services, railroads, commercial vehicles, and transit operations.

3. **Figure A9.2 to Figure A5.12** illustrates the operating policy for TMP for the construction of water pipes and the sewers along various types of roads.

C. Analyze the impact due to street closure

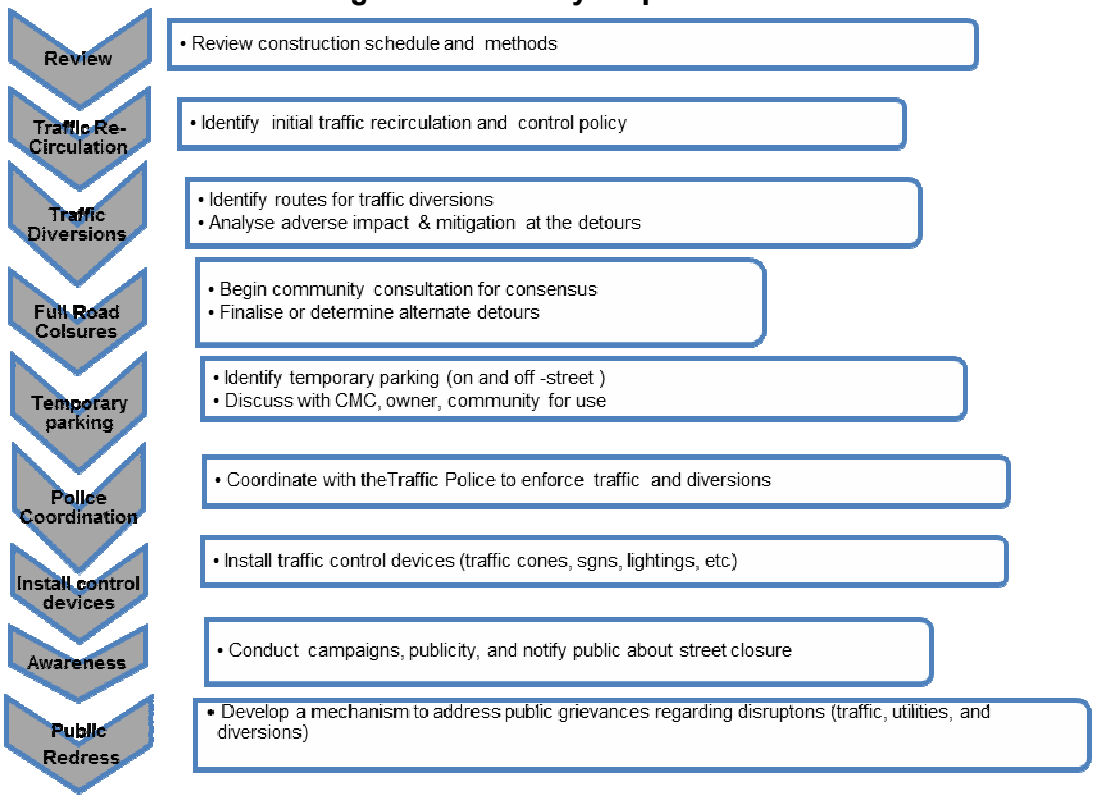
4. Apart from the capacity analysis, a final decision to close a particular street and divert the traffic should involve the following steps:

(i) approval from the ULB/ CMC/ Public Works Department (PWD) to use the local streets as detours;
(ii) consultation with businesses, community members, traffic police, PWD, 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.

5. 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 Saturday night and ending on Monday morning prior to the morning peak period.

Figure A9.1: Policy Steps for the TMP



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.

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 public notices, ward level meetings and city level meeting with the elected representatives.

7. The PIU 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 conduct the awareness programs/campaigns on road safety during construction.

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 and community centers. 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 PIU, 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 (name, telephone, mobile number of the contact person; 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. The following traffic control devices are used in work zones:

(i) Signs;
(ii) Pavement Markings;
(iii) Channelizing Devices;
(iv) Arrow Panels; and
(v) Warning Lights.

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 along major roads, and the minor internal roads. As such, the traffic volume and road geometry vary. The main roads carry considerable traffic; internal roads in the new city areas are wide but in old city roads very narrow and carry considerable traffic. 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”).

12. **Figure A9.2 to Figure A9.12** illustrates a typical set-up for installing traffic control devices at the work zone of the area, depending on the location of work on the road way, and road geometrics:

(i) Work on shoulder or parking lane
(ii) Shoulder or parking lane closed on divided road
(iii) Work in Travel lane
(iv) Lane closure on road with low volume
(v) Lane closure on a two-line road with low volume (with yield sign)
(vi) Lane closure on a two-line road with low volume (one flagger operation)
(vii) Lane closure on a two lane road (two flagger operation)
(viii) Lane closure on a four lane undivided Road
(ix) Lane closure on divided roadway
(x) Half road closure on multi-lane roadway
(xi) Street closure with detour

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.

14. 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. Flaggers/ 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.

Figure A9.2 and A9.3: Work on Shoulder or Parking Lane and Shoulder or Parking Lane Closed on Divided Road

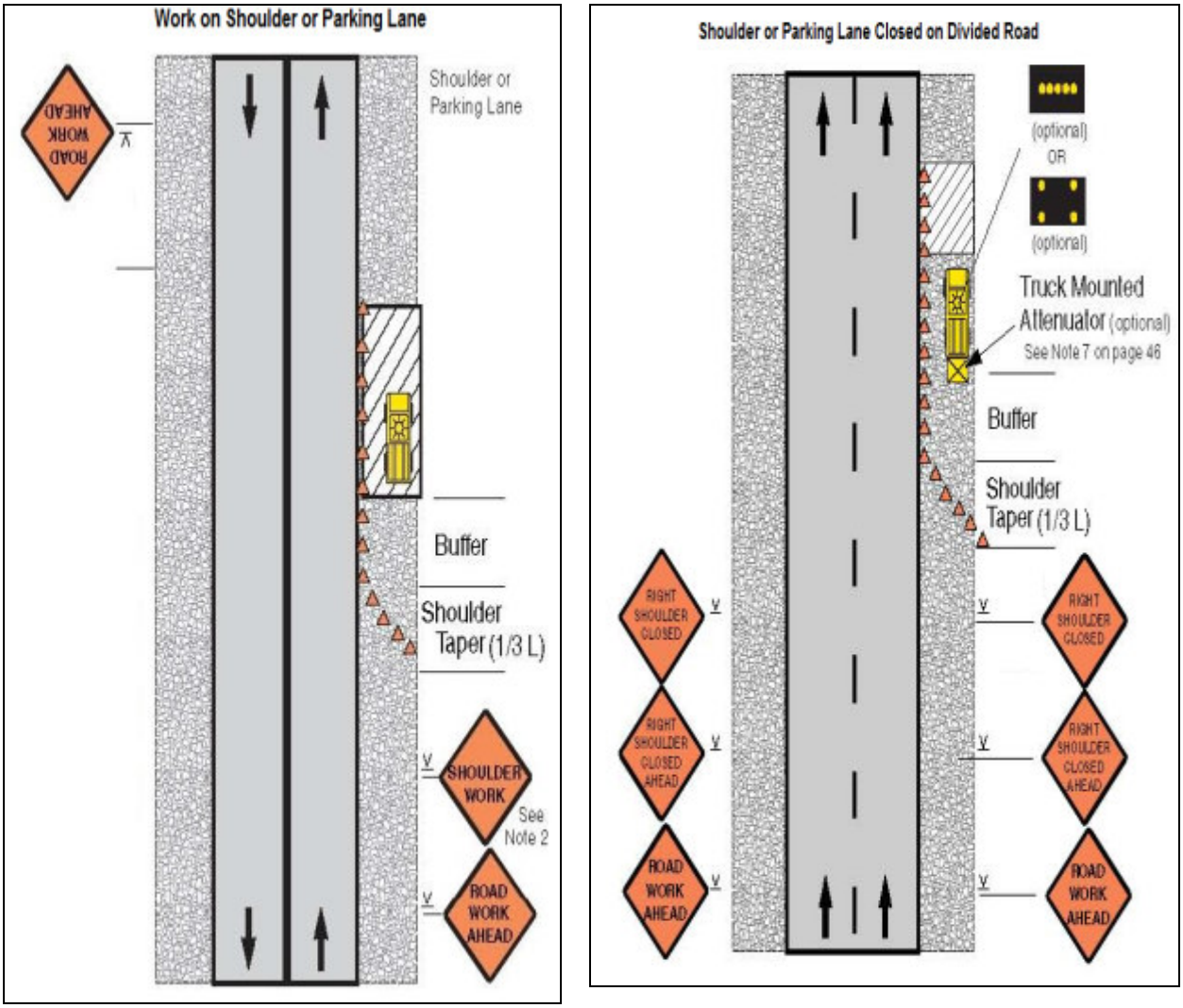
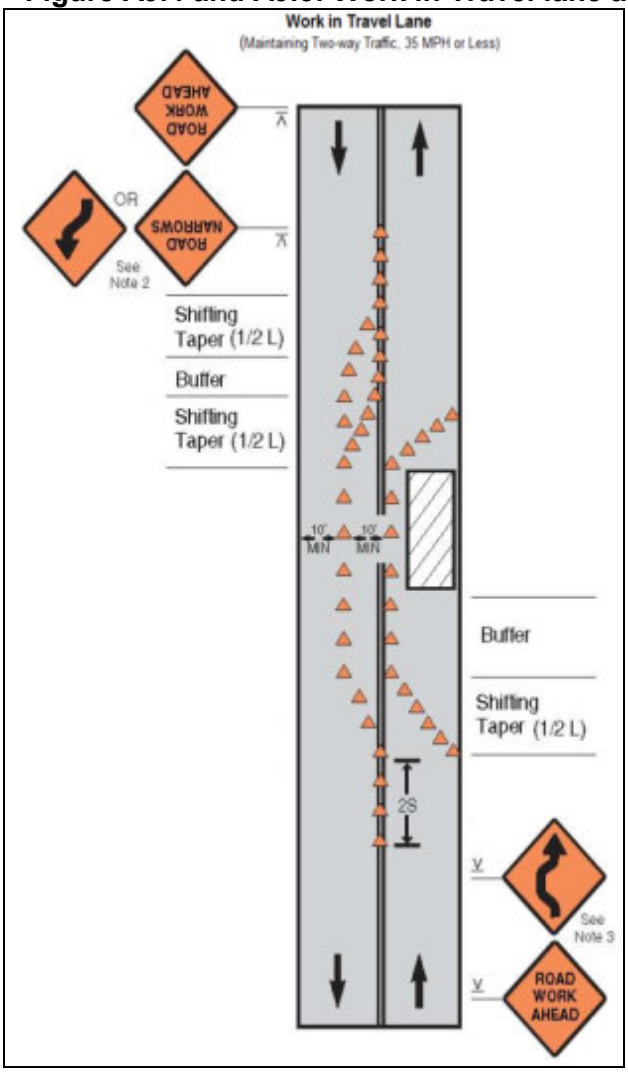


Figure A9.4 and A9.5: Work in Travel lane and Lane Closure on Road with Low Volume



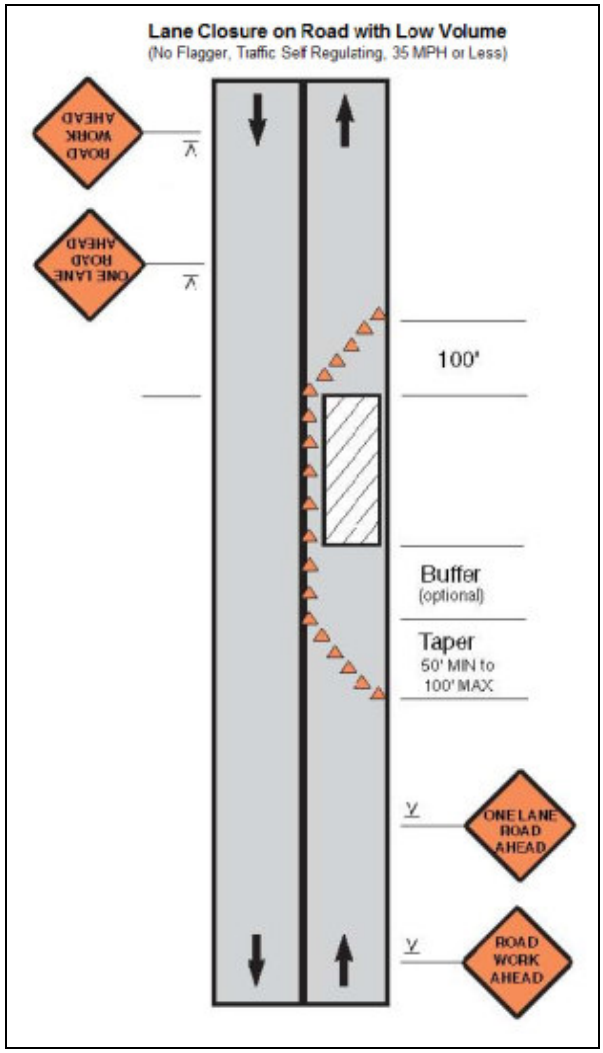
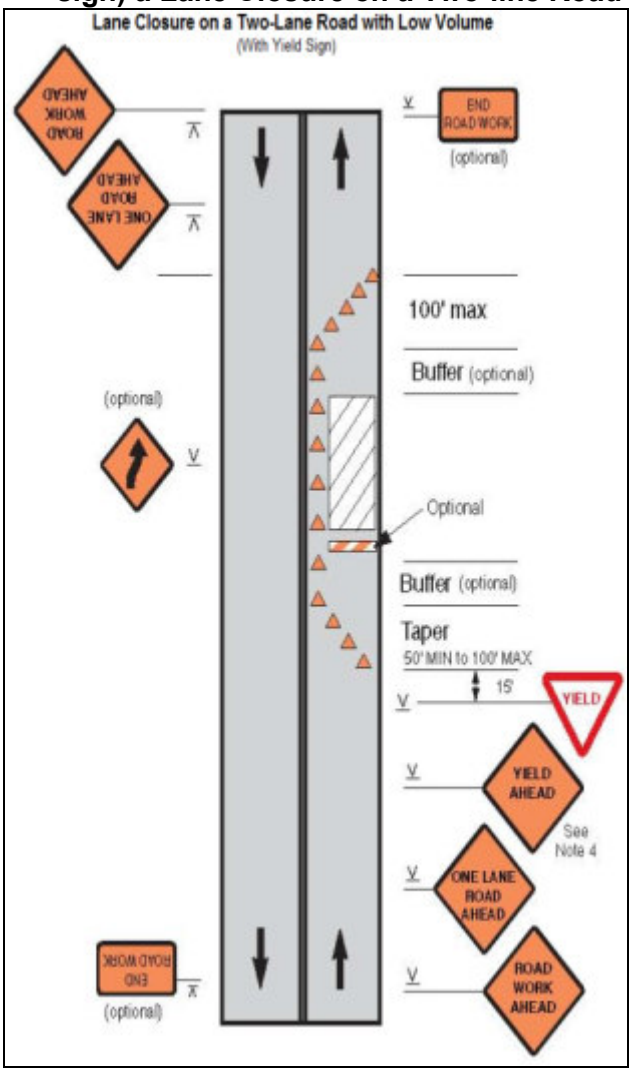


Figure A9.6 and A9.7: Lane Closure on a Two-line Road with Low Volume (with yield sign) a Lane Closure on a Two-line Road with Low Volume (one flagger operation)



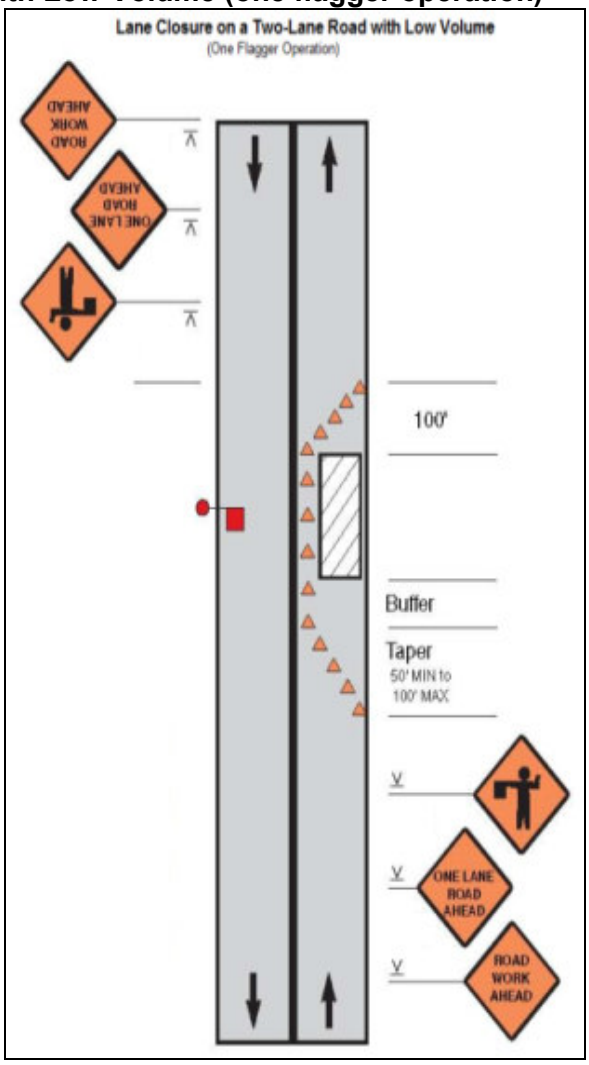


Figure A9.8 and A9.9: Lane Closure on a Two-Lane Road (Two Flagger Operation) & Lane Closure on a Four-Lane Undivided Road

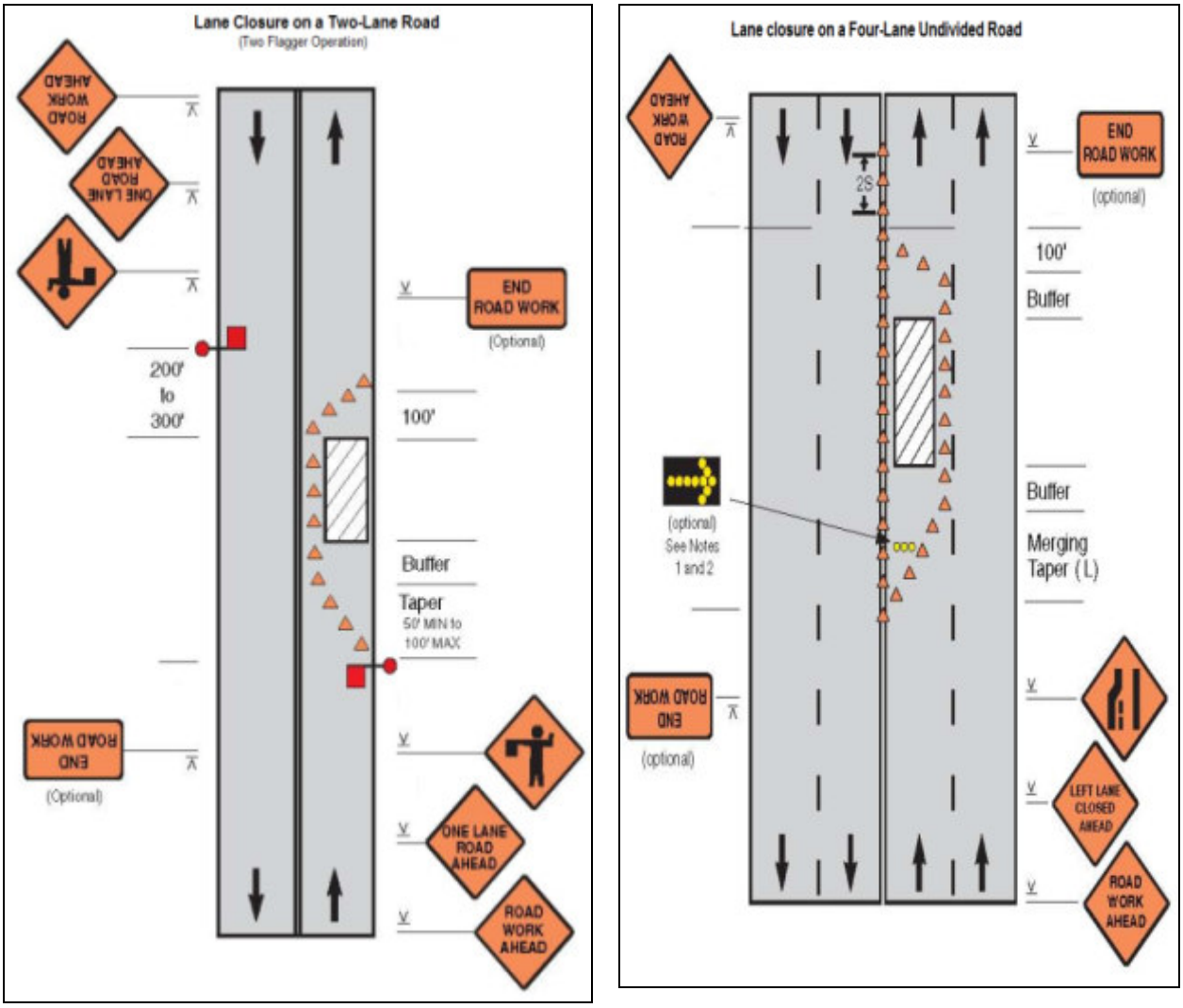
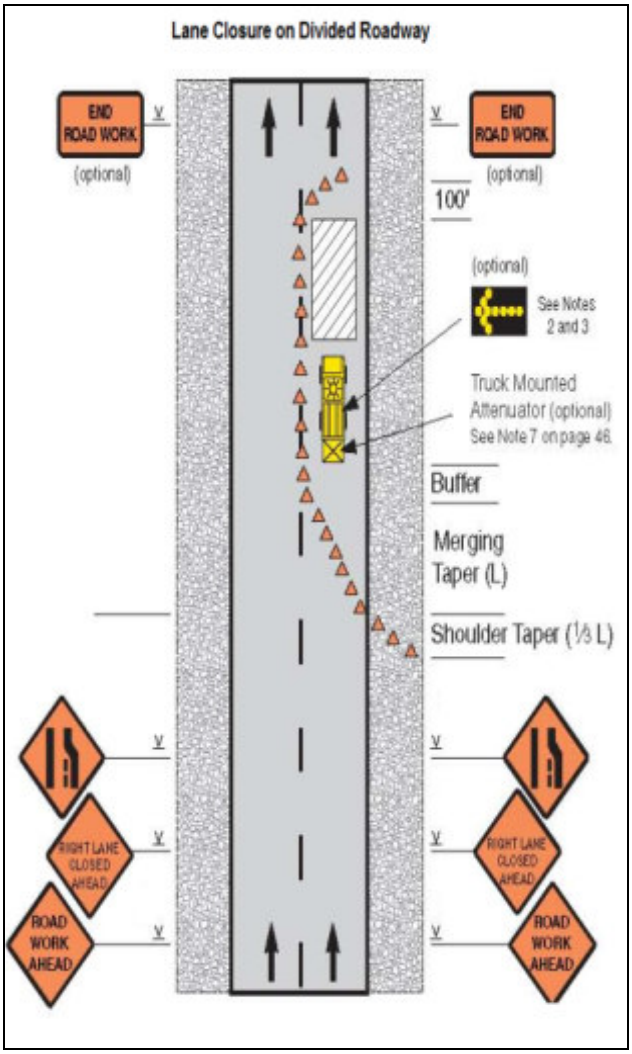


Figure A9.10 and A9.11: Lane Closure on Divided Roadway and Half Road Closure On Multi-Lane Roadway



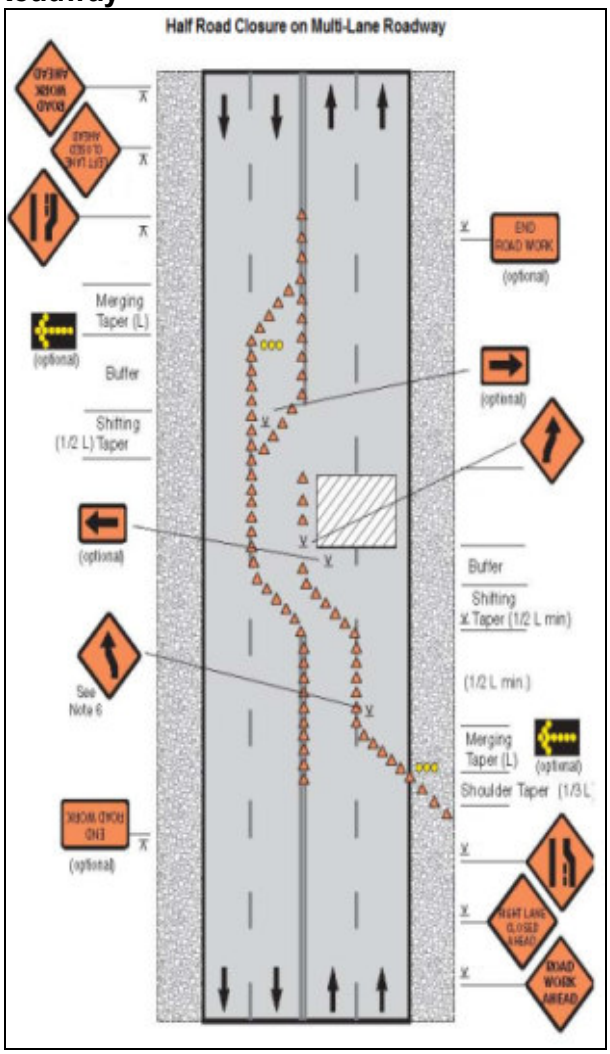


Figure A9.12: Street Closure with Detour