Draft Initial Environmental Examination

April 2013

India: Karnataka Integrated Urban Water Management Investment Program
- Harihar (Urban Water Supply and Sanitation Subproject)

Prepared by Karnataka Urban Infrastructure Development and Finance Corporation, Government of Karnataka for the Asian Development Bank.

CURRENCY EQUIVALENTS

(as of 8 April 2013)

Currency unit	–	Indian Rupee (Re/Rs)
Re1.00	=	$ .0182832069
$1.00	=	Rs54.695

ABBREVIATIONS

ADB	Asian Development Bank
ADB SPS	Asian Development Bank Safeguard Policy Statement
APMC	Agricultural Produce Market Committee
ASI	Archaeological Survey of India
BOD	Bio-Chemical Oxygen Demand
BPL	Below Poverty Line
CAP	Corrective Action Plan
CBO	Community Based Organizations
CC	Complaint Cell
CC Drain	Cement Concrete
CFE	Consent for Establishment
CFO	Consent for Operation
CGWB	Central Ground Water Board
CMC	City Municipal Council
CPCB	Central Pollution Control Board
dbA	Decibels
DI	Ductile Iron
DPR	Detailed Project Report
DS	Double Suction
EA	Executing Agency
EAC	Expert Appraisal Committee
EC	Environmental Clearance
EIA	Environmental Impact Assessment
ELSR	Elevated Storage Reservoir
EMP	Environmental Management Plan
GDP	Gross Domestic Product
GIL	Grasim Industries Limited
GoI	Government of India
GoK	Government of Karnataka
GLSR	Ground Level Service Reservoir
GRC	Grievance Redress Committee
GSDP	Gross State Domestic Product
ha	Hectares
HDPE	High Density Polyethylene
H&S	Health and Safety
IA	Implementing Agency
IEE	Initial Environmental Examination
IWRM	Integrated Water Resource Management
KIUWMIP	Karnataka Integrated Urban Water Management Investment Program
KMRP	Karnataka Municipal Reforms Project
KSCB	Karnataka Slum Clearance Board

KSPCB	Karnataka State Pollution Control Board
KSRTC	Karnataka State Road Transport Corporation
KTCP	Karnataka Town and Country Planning
KUIDFC	Karnataka Urban Infrastructure Development & Finance Corporation
KUWSDB	Karnataka Urban Water Supply & Drainage Board
M&M	Major and Medium
MFF	Multitranche Financing Facility
MoEF	Ministry of Environment and Forest
MSL	Mean Sea Level
NEERI	National Environmental Engineering Research Institute
NGO	Non-Government Organisation
NOx	Nitrogen Oxide
NRW	Non Revenue Water
OCRP	Office of Compliance Review Panel
OHT	Over Head Tank
OSPF	Office of the Special Project Facilitator
O&M	Operations & Maintenance
PC	Program Consultants
PCU	Project Co-ordination Unit
PMU	Program Management Unit
PIU	Project Implementation Unit
PWD	Public Works Department
RCC	Reinforced Cement Concrete
REA	Rapid Environmental Assessment
RF	Resettlement Framework
RP	Resettlement Plan
RSPM	Residual Suspended Particulate Matter
SC	Scheduled Caste
SEIAA	State Environmental Impact Assessment Authority
SIPMIU	State Investment Program Management and Implementation Unit
SPM	Suspended Particulate Matter
SPS	Sewage Pumping Station
ST	Scheduled Tribe
STP	Sewage Treatment plant
SW	StoneWare
TMC	Town Municipal Council
ToR	Terms of Reference
UGD	Under Ground Drainage
ULB	Urban Local Body
UDWSP	Urban Drinking Water & Sanitation Policy
USD	US Dollars
UWSS	Urban Water Supply & Sanitation
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant

WEIGHTS AND MEASURES

Kl	kiloliter
km	kilometer
ha	hectares
HAM	hectares meters
l/hd/dy	liters per head per day
lpcd	liters per capita per day
lps	liters per second
M	million
mbgl	meteres below ground level
mcm	million cubic meters
Mg/l	milligram per liter
Mld	million liters per day
M	meter
mm	millimeter

NOTE{S}

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

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EXECUTIVE SUMMARY

1. The Karnataka Integrated Urban Water Management Investment Program (KIUWMIP, the Program) aims to improve water resource management in urban areas in a holistic and sustainable manner. Investment support will be provided to modernize and expand urban water supply and sanitation (UWSS) while strengthening relevant institutions to enhance efficiency, productivity and sustainability in water use.

2. Harihar water supply and sewerage subproject is one of the subprojects proposed in Tranche-1. Water supply is currently intermittent, unreliable and suffers with huge losses and quality issues. Sewerage system including a wastewater treatment plant is presently in implementation under the World Bank funded Karnataka Urban Reforms Project (KMRP), however this does not cover entire town. ADB requires the consideration of environmental issues in all aspects of the Bank's operations, and the requirements for Environmental Assessment are described in ADB's SPS (2009). This Initial Environmental Examination (IEE) addresses components proposed under Tranche 1 which includes water supply and sewerage components.

3. **Categorization.** Harihar water supply and sewerage subproject is classified as Environmental Category B as per the SPS as no significant impacts are envisioned. Accordingly this Initial Environmental Examination (IEE) has been prepared and assesses the environmental impacts and provides mitigation and monitoring measures to ensure no significant impacts as a result of the subproject.

4. **Subproject Scope.** The subproject is formulated under this Investment Program to address gaps in water and sewerage infrastructure in a holistic and integrated manner. The main objective of the Investment Program is to improve water efficiency, security and have an important effect on public health. Investments under this subproject includes: (i) rehabilitation and augmentation of existing WTP; (ii) construction of service reservoirs; (iii) construction of strategic water network and rehabilitation of water distribution network; (iv) installation of water meters; (v) construction of sewer network and pumping station; and (vi) construction of household and community toilets.

5. **Implementation Arrangements.** Karnataka Urban Infrastructure Development & Finance Corporation (KUIDFC) is the Executing Agency (EA) responsible for overall technical supervision and execution of all subprojects funded under the Investment Program. Implementation activities will be overseen by a separate Program Management Unit (PMU) in its head office at Bangalore, in coordination with its regional office and 2 divisional offices established to to supervise the implementing agencies in each geographical area. A team of senior technical, administrative and financial officials, including safeguards specialists, will assist the PMU in managing and monitoring Program implementation activities. The Implementing Agencies (IA) ULBs. Project implementation units (PIUs) dedicated exclusively to the project are set up in each town. The PIUs will be staffed by qualified and experienced officers and are responsible for the day-to-day activities of project implementation in the field, and will be under the direct administrative control of the PMU. Consultant teams are responsible for subproject planning and management and assuring technical quality of design and construction; and designing the infrastructure and supervising construction; and safeguards preparation.

6. **Description of the Environment.** Subproject components are located in Harihar urban area or in its immediate surroundings which were converted into agricultural or urban use for

many years ago, and there is no natural habitat left at these sites. The subproject sites are located in existing right of ways (RoWs) and government-owned land. There are no protected areas, wetlands, mangroves, or estuaries in or near the subproject location. There are no forest areas within or near Harihar.

7. **Environmental Management.** An environmental management plan (EMP) is included as part of this IEE, which includes (i) mitigation measures for environmental impacts during implementation; (ii) an environmental monitoring program, and the responsible entities for mitigating, monitoring, and reporting; (iii) public consultation and information disclosure; and (iv) a grievance redress mechanism. A number of impacts and their significance have already been reduced by amending the designs. The EMP will be included in civil work bidding and contract documents.

8. Locations and siting of the proposed infrastructures were considered to further reduce impacts. These include (i) locating facilities on government-owned land to avoid the need for land acquisition and relocation of people; and (ii) laying of pipes in RoWs alongside main/access roads, to reduce acquisition of land and impacts on livelihoods specifically in densely populated areas of the city.

9. Potential negative impacts were identified in relation to location, design, construction and operation of the improved infrastructure. Mitigation measures have been developed in generic way to reduce all negative impacts to acceptable levels. Various design related measures suggested for: ensuring the adequate water availability in the river; safe handling and application of chlorine; energy efficiency design and uninterrupted power supply provision; standard operating procedures for operation and maintenance; and imparting necessary training for ULB staff. No notable location specific impacts were noticed.

10. During the construction phase, impacts mainly arise from the need to dispose of moderate quantities of waste soil; and from the disturbance of residents, businesses, and traffic. These are common impacts of construction in urban areas, and there are well developed methods for their mitigation. Considering the importance of annual festival of Harihareswara Temple, it is suggested to avoid construction work during the festival period. Traffic management will be necessary during pipe-laying on busy roads. Once the improved system is operating, the facilities will operate with routine maintenance, which should not affect the environment. Improved system operation will comply with the O&M manual and standard operating procedures to be developed for all the activities.

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

12. The stakeholders were involved in developing the IEE through discussions on-site and public consultation, after which views expressed were incorporated into the IEE and in the planning and development of the subproject. The IEE will be made available at public locations in the city and will be disclosed to a wider audience via the ADB and KUIDFC websites. 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.

13. The citizens of the Harihar Town will be the major beneficiaries of this subproject. With the improved water supply, they will be provided with a constant supply of better quality water, piped into their homes. The sewerage system will cover the presently uncovered areas under KMRP and will remove the human waste from those areas served by the network rapidly and treated at the WWTP, currently in implementation under KMRP, to acceptable standards. With the construction of toilets and targeted awareness program on sanitation proposed, in addition to improved environmental conditions, the subproject will improve the over-all health condition of the town. Diseases of poor sanitation, such as diarrhoea and dysentery, should be reduced, so people should 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.

14. The most noticeable net environmental benefits to the population of the towns will be positive and large as a result of improved: (i) water efficiency and security through the implementation of NRW reduction programs and expansion and rehabilitation water supply infrastructure respectively; and (ii) river water quality through the expansion of sewerage networks, treatment capacity and sanitation coverage.

15. **Consultation, Disclosure and Grievance Redress.** Public consultations were done in the preparation of the project and IEE. Ongoing consultations will occur throughout the project implementation period with the assistance of the NGOs. A grievance redress mechanism is described within the IEE to ensure any public grievances are addressed quickly.

16. **Monitoring and Reporting.** The PMU, PIU, and DSC consultants will be responsible for monitoring. The DSC will submit monthly monitoring reports to PMU, and the PMU will send semi-annual monitoring reports to ADB. ADB will post the environmental monitoring reports on its website.

17. **Conclusions and Recommendations.** Therefore the proposed subproject is unlikely to cause significant adverse impacts. 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. Based on the findings of the IEE, there are no significant impacts and the classification of the subproject as Category “B” is confirmed. No further special study or detailed environmental impact assessment (EIA) needs to be undertaken to comply with ADB SPS (2009) or GoI EIA Notification (2006).

I. INTRODUCTION

A. Introduction to KISWRMIP

1. The Karnataka Integrated Urban Water Management Investment Program (KIUWMIP, the Program) aims to improve water resource management in urban areas in a holistic and sustainable manner. Investment support will be provided to modernize and expand urban water supply and sanitation (UWSS) while strengthening relevant institutions to enhance efficiency, productivity and sustainability in water use. The Program focuses on priority investments and institutional strengthening in water supply and sanitation within an IWRM context.

2. The program intends to enhance water security and improve river environment through integrated urban water management (IUWM) interventions. KIUWMIP aims to build on water supply and sanitation considerations within an urban settlement by incorporating urban water management within the scope of the entire river basin. IUWM will provide flexible planning amongst water user sectors within the watershed basins. This will allow for optimal sequencing of traditional and new infrastructure with alternative management scenarios to improve water use efficiency. The emerging IWUM approach offers a more diverse and versatile set of options for dealing with larger and more complex urban water challenges.

3. The Program will be implemented over a four-year period beginning in 2014, and will be funded by a loan via the Multitranche Financing Facility (MFF) of Asian Development Bank (ADB). The Executing Agency is the Karnataka Urban Infrastructure Development Finance Corporation (KUIDFC) and implementing agencies for the Investment Program will be respective Urban Local Bodies (ULBs). Byadgi, Harihar, Ranebennur and Davangere are the four towns chosen to benefit from the first tranche of the investment.

4. The expected outcome will be improved water resource planning, monitoring and service delivery in 4 towns of the Upper Tunga Bhadra subbasin. Tranche 1 will have 3 outputs; (i) Output 1: Expanded efficient UWSS infrastructure in 4 towns of the Upper Tunga Bhadra subbasin; (ii) Output 2: Improved water resource planning, monitoring and service delivery in Karnataka; and (iii) KUIDFC strengthened capacity. The IEE is based on an assessment of these components within the project area.

II. POLICY & LEGAL FRAMEWORK

A. Extent of the IEE Study

5. Indian law and ADB policy require that the environmental impacts of development projects are identified and assessed as part of the planning and design process, and that action is taken to reduce those impacts to acceptable levels. This is done through the environmental assessment process, which has become an integral part of lending operations and project development and implementation worldwide.

6. This IEE, for the Harihar Water Supply and Sewerage Subproject, discusses the environmental impacts and mitigation measures relating to the location, design, construction and operation of all physical works proposed under this subproject. IEE relies mainly on secondary sources of information and site reconnaissance surveys including on-site informal discussions with the local people. The IEE follows the process and documentation as per the ADB's Safeguard Policy Statement (SPS, 2009).

B. ADB's Environmental Safeguard Policy

7. ADB's Safeguard Policy Statement, 2009, requires the consideration of environmental issues in all aspects of the Bank's operations, and the requirements for Environmental Assessment are described in detail in ADB Environmental Assessment Guidelines, 2003. This states that ADB requires environmental assessment of all project loans, programme loans, sector loans, sector development programme loans, financial intermediary loans and private sector investment operations.

8. The nature of the 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 categories:

(i) Category A: Projects that could have significant environmental impacts. An Environmental Impact Assessment (EIA) is required.
(ii) Category B: Projects that could have some adverse environmental impacts, but of less significance than those for category A. An Initial Environmental Examination (IEE) is required to determine whether significant 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 that are unlikely to have adverse environmental impacts. No EIA or IEE is required, although environmental implications are reviewed.

9. ADB has classed this subproject as Category B and following normal procedure for MFF loans has determined that one IEE will be conducted for each subproject, with a subproject being the water supply and sewerage infrastructure improvements proposed in a subproject town.

C. Government Law and Policies

10. The GoI EIA Notification of 2006 (replacing the EIA Notification of 1994), sets out the requirement for Environmental Assessment in India. This states that Environmental Clearance (EC) is required for specified activities/projects, and this must be obtained before any construction work or land preparation (except land acquisition) may commence. Projects are categorized as A or B depending on the scale of the project and the nature of its impacts.

11. Category A projects require EC from the central Ministry of Environment and Forests (MoEF). The proponent is required to provide preliminary details of the project in the prescribed manner with all requisite details, after which an Expert Appraisal Committee (EAC) of the MoEF prepares comprehensive Terms of Reference (ToR) for the EIA study. On completion of the study and review of the report by the EAC, MoEF considers the recommendation of the EAC and provides the EC if appropriate.

12. Category B projects require environmental clearance from the State Environment Impact Assessment Authority (SEIAA). The State level EAC categorizes the project as either B1 (requiring EIA study) or B2 (no EIA study), and prepares ToR for B1 projects within 60 days. On completion of the study and review of the report by the EAC, the SEIAA issues the EC based on the EAC recommendation. The Notification also provides that any project or activity classified as

category B will be treated as category A if it is located in whole or in part within 10 km from the boundary of protected areas, notified areas or inter-state or international boundaries.

13. None of the components of this water supply and sewerage improvement subproject in Harihar falls under the ambit of the EIA Notification 2006, and, therefore EC is thus not required for the subproject.

14. Besides EIA Notification 2006, there are various other Acts, Rules, Policies and Regulations currently in force in India that deal with environmental issues that could apply to infrastructure development. These are listed in Appendix 2. The specific requirements of this subproject are shown in Table 1.

Table 1: Action Required to Ensure Subprojects Comply with National Environmental Laws

Component	Applicable Legislation	Compliance	Action required
Rehabilitation of water pipelines in the residential area around the temple – if pipelines are laid within 300 m of protected monument (Harihareswara Temple)	The Ancient Monuments and Archaeological Sites and Remains Act, 1958 The Ancient Monuments and Archaeological Sites and Remains Rules, 1959	Any excavation or construction work within in 300 m of protected monument shall be undertaken only after permission of Archaeological Survey of India. No activity is permitted within 100 m of monument.	Submit application form to ASI Based on site visit and case merit, ASI provides permission
Diesel Generators	CPCB guidelines	Procure and operate generators manufactured by CPCB approved manufacturers	Procure generators only from approved manufacturers/suppliers the manufacturer/ supplier shall be registered with the CPCB and shall have valid certificates for "Type Approval" and "Conformity of Production"

III. DESCRIPTION OF THE PROJECT

A. Project Need

15. **Water Supply.** Currently water supply within Harihar is intermittent and varies across the town. The majority of the wards are reported to receive 1 to 2 hours supply every day, whilst others receive 2 to 3 hours, alternate days. The situation is less than desirable in that the amount of water available to consumers is limited and the prolonged periods during which customers have to store water leads to significant deterioration of its quality, exasperated by the warm climate and a lack of customer understanding of the need for hygienic storage facilities. There is an increased risk of contaminated groundwater entering the water network when the mains are de-pressurised; a risk made greater by the accepted poor condition of the network and lack of maintenance.

16. At present, Harihar is supplied by both surface water, from the River Tungabhadra, and ground water sources. The existing intake on River Tungabhadra is at Kawalettu village, 5km from the city. There are 228 boreholes, of these 108 are fitted with pumps and others hand bore wells. At present 9 MLD is supplied from Kawalettu intake while about 1 MLD is abstracted from groundwater sources. Raw water from Kawalettu is pumped via 4.2 km pumping main to the WTP at Harihar. After treatment at WTP (9 MLD capacity), water is pumped to 8 elevated service reservoirs at various locations in the city for further distribution to the households. Total length of distribution network is 55 km and pipes are of uPVC.The current per capita volume made available to customers is assessed at 84litres/head/day, compared with the norm of 135litres/head/day Supply periods for individual areas are based on the availability of water from the treatment works and are commenced and ended by the operation of control valves at the works, storage sites or within the network. There is no formal regulation for the valve operations which can lead to an unfair distribution of water, not helped by the fact that those in the lower areas of the town tend to have a longer supply than those on higher ground. The water losses in the system are very high at 44%.

17. **Sewerage**. At present, Harihar does not have an underground sewerage system. The existing roadside drains receive the sewage and sullage from each household including septic tank effluent. The drains carry dry weather flow as well as storm water to discharge into the natural drainage channels. Under the National River Conservation Plan (NRCP), the drainage channels have been intercepted and wastewater is pumped to the wastewater treatment works. An 8.84 MLD capacity stabilisation pond based WWTP was constructed consisting of one anaerobic pond, three facultative ponds and three maturation ponds. The treated water is discharged into a natural drainage channel and is used for irrigation by the local farmers, although some untreated wastewater is diverted for irrigation before reaching the treatment plant. Due to leakages in the interceptor sewer, very low volume of sewage reaches the WWTP.

18. **Works under Implementation**. A sewerage scheme for Harihar Town is currently being implemented under the World Bank funded Karnataka Municipal Reforms Project. Under the KMRP investment, stabilisation ponds will be rehabilitated to treat a flow initially of 8.8Mld with the potential to be able to treat 14Mld with the addition of aerators. Of the 6 drainage districts, four are being provided with sewerage network in this project. The remaining areas need to be covered with the sewerage system.

19. There are large numbers of toilet-less households in Harihar. In the absence of access to individual/shared toilets or functional community toilets, a very large proportion of these households practice open defecation. It is estimated that approximately 2,519 households in Harihar do not have access to toilets.

20. Based on the disparity in access to sanitation facilities evident in the four towns, especially amongst the low income households and the need for demand promotion to promote ODF communities, OBA mechanism has been proposed to be used. The OBA mechanism will increase the access of sanitation to primarily low income households in the four towns through (i) construction and connection to the sewer network of new individual household toilets; (ii) construction, connection to the sewer network and operation of community toilets; and (iii) sanitation marketing to increase demand for toilet construction and use and promote open defecation free (ODF) communities.

B. Description of the Subproject

21. Table shows the nature and size of the various components of the subproject. The descriptions are based on the present proposals at this feasibility stage. Certain details may change as development of the subproject progresses, particularly in the detailed design stage. It should also be noted that at this stage the infrastructure has been designed in outline only, to determine overall feasibility and budget costs, so certain aspects (such as size of WTP units) have not yet been finalised.

22. The sewer system under implementation was designed as a separate sewer system that carries only the wastewater including sewage and sullage. The underground gravity sewers will carry sewage from households to the Wastewater Treatment Plant (WWTP). The open drain system that exists in the town will cater to storm runoff.

23. Location of subproject components and conceptual layout plans are shown in Figure 1 to Figure 12.

24. **Implementation Schedule**. As per the suggested schedule, preparation of detailed project report and bids for this subproject will commence in the middle of 2013. The construction is likely to start in April-2014, and should be completed in 24 months.

Table 2: Proposed Subproject & Component Descriptions

Infrastructure	Function	Description	Location
1. Water Supply			
Rehabilitation and augmentation of existing Water Treatment Plant	To provide potable drinking water in adequate quantity and quality.	*Rehabilitation & capacity augmentation* Increase water treatment capacity from present 9 MLD to 18 MLD Conventional WTP including: • Additional clariflocculator tank/tube or plate settler • Double the number of existing rapid gravity sand filters • Upgraded chlorine handling and dosing facilities (improve safety) • Sludge dewatering plant & short term on site storage • Site laboratory	Within the existing WTP facility
Clear Water Pump	Conveying clear water from WTP to storage reservoirs	*New & Replacement* • Replacement / installation of new pumps	Within the existing clear water pumping facility near the WTP
Generator	Provide back-up power supply	*New* • Diesel generator	Within the existing clear water pumping facility near the WTP

Infrastructure	Function	Description	Location
Clear Water Mains (strategic network)	To feed clear water to the reservoirs.	*New* 28.7 km 250-400 mm dia DI pipes	Pipes will be laid along the roads
Overhead Service Reservoirs (OHSR)	Provide increased water storage and a head of water required for gravity flow of water through the distribution system.	*New* • 3 no,s - Reinforced Cement Concrete (RCC) tanks, mounted 15 m above ground on an RCC supporting frame (at Amaravathi Colony, Indira Nagar and Court Tank)	Two SRs are within existing CMC park / Govt. Land. One (at Amaravathi Colony) will be constructed on land donated by Housing society
Distribution network (new & replacement)	To convey treated water under gravity from service reservoirs to consumers	*Rehabilitation* 49 km 90- 300 mm; HDPE pipes	Pipes will be laid along the roads, and will almost cover entire city
Bulk Water Meters and District Meters	Monitor water flow in the improved network	20 no,s - Bulk Meters (Dia. varying from 150mm to 400mm) 35 no,s - District Meters (Dia. varying from 80mm to 150mm)	WS Strategic Network and Primary mains Distribution Network
Domestic consumer Meters	Monitor and regulate water usage by consumers and improve cost recovery	20,456 Domestic Meters, 15mm Dia. and 20mm.	Attached to the water delivery pipe at each house
2. Sewerage			
Sewer network	Convey wastewater from dwelling units and other categories of buildings to terminal sewage pumping station and STP	*New* 22.3 km 150-200 mm dia SW pipes manholes collection chamber	Sewers will be laid underground along the roads in three sewerage districts, which are not covered under the ongoing projects – These are mostly outer areas of Harihar
Toilets	Toilets at individual level and community level to cater to households without toilets	*New* 752 - water flush toilets, outlets connected to sewers community toilets (total 74 seats -- water flush toilets, outlets connected to sewers	These are proposed to ensure access to toilets for all households, irrespective of tenure status or economic constraints. Space availability will determine the level of service for a household, i.e., individual or community toilets. Community toilets shall be designed keeping the needs of men, women, elderly, disabled and children in view. Individual toilets are located within the house premises, and community toilets are constructed in the

Infrastructure	Function	Description	Location
			neighbourhood, where space is available
Sewage Pumping Stations	To collect and pump sewage	*New* One sewage pumping station (SPS), consists of- screens, gates, sump well, pumps and 300 mm pumping main.	SPS site is located in south-eastern outskirts of the town, located in a corner of large campus of a market yard owned by government.
Sewage pumping main	To convey sewage from sewage lift station to the nearest manhole for further gravity flow	*New* 1 km 150 mm dia DI pipe	Will be laid from SPS to the manhole along a road

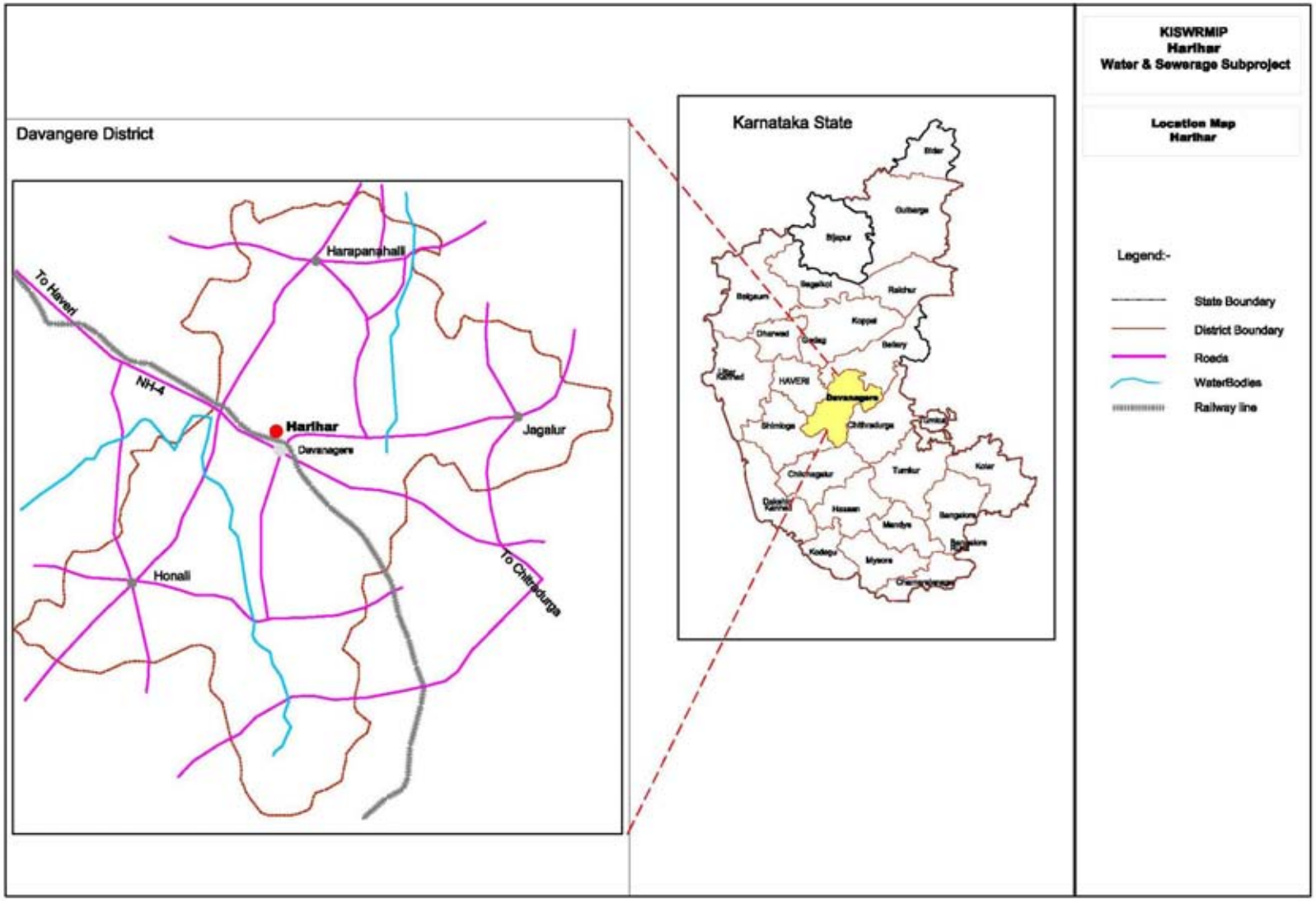

Figure 1: Location of Subproject Town

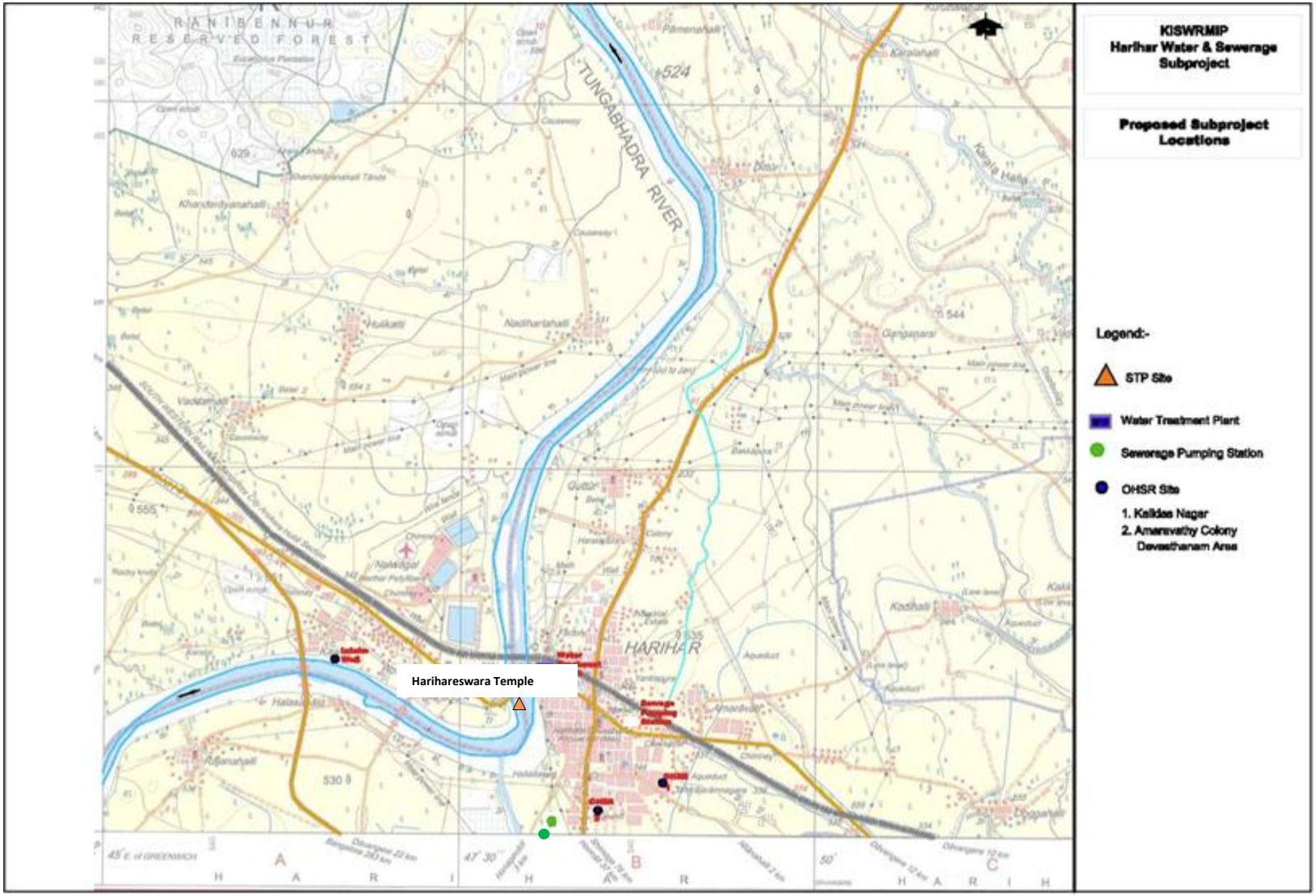

Figure 2: Location Subproject Sites in Town

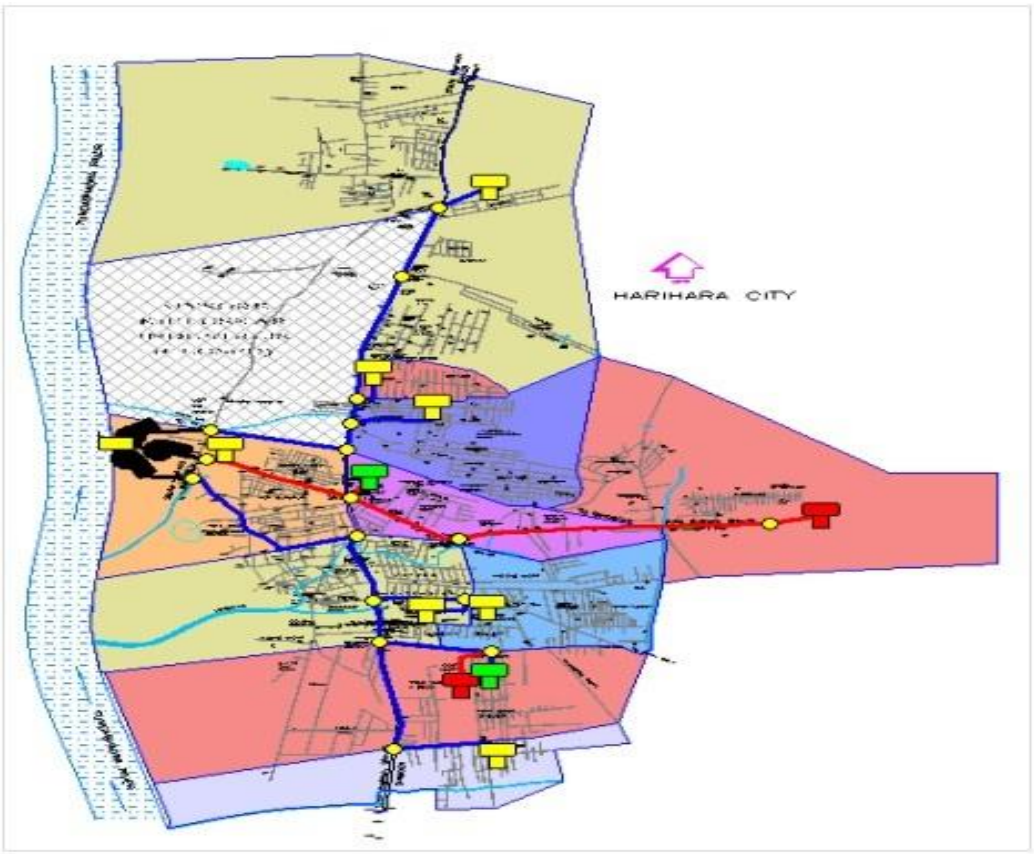

Figure 3: Proposed Strategic Network

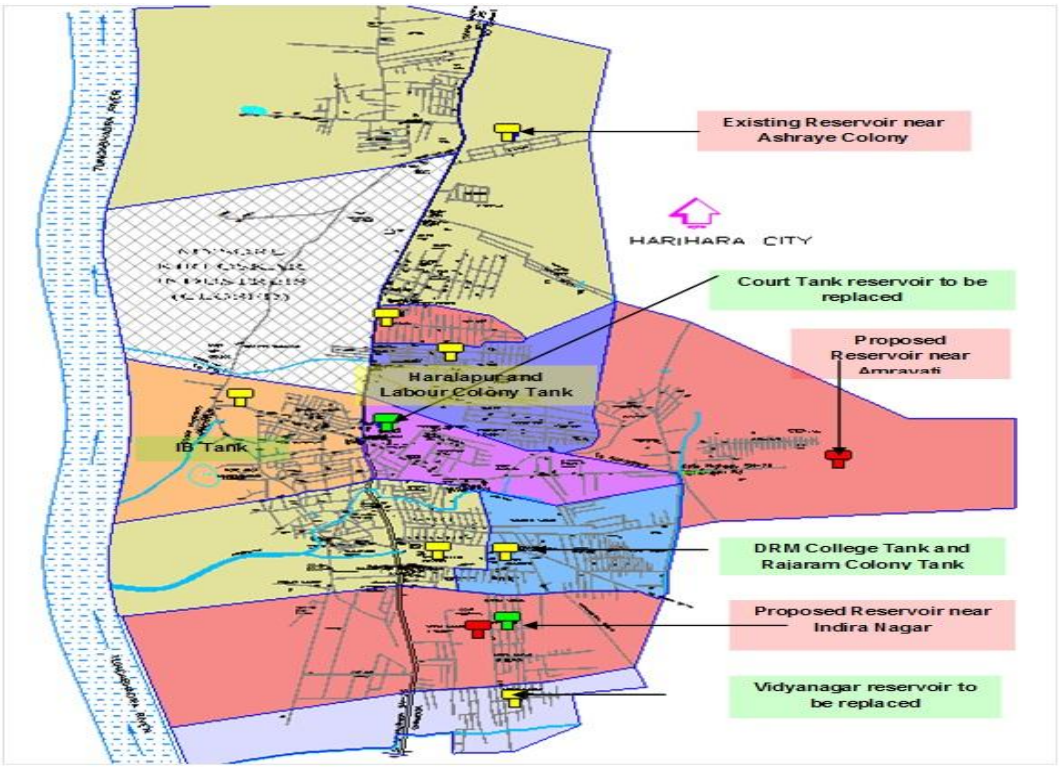

Figure 4: Proposed Supply Zones

Figure 5: View of the Existing WTP

Figure 6: Proposed Augmentation at WTP

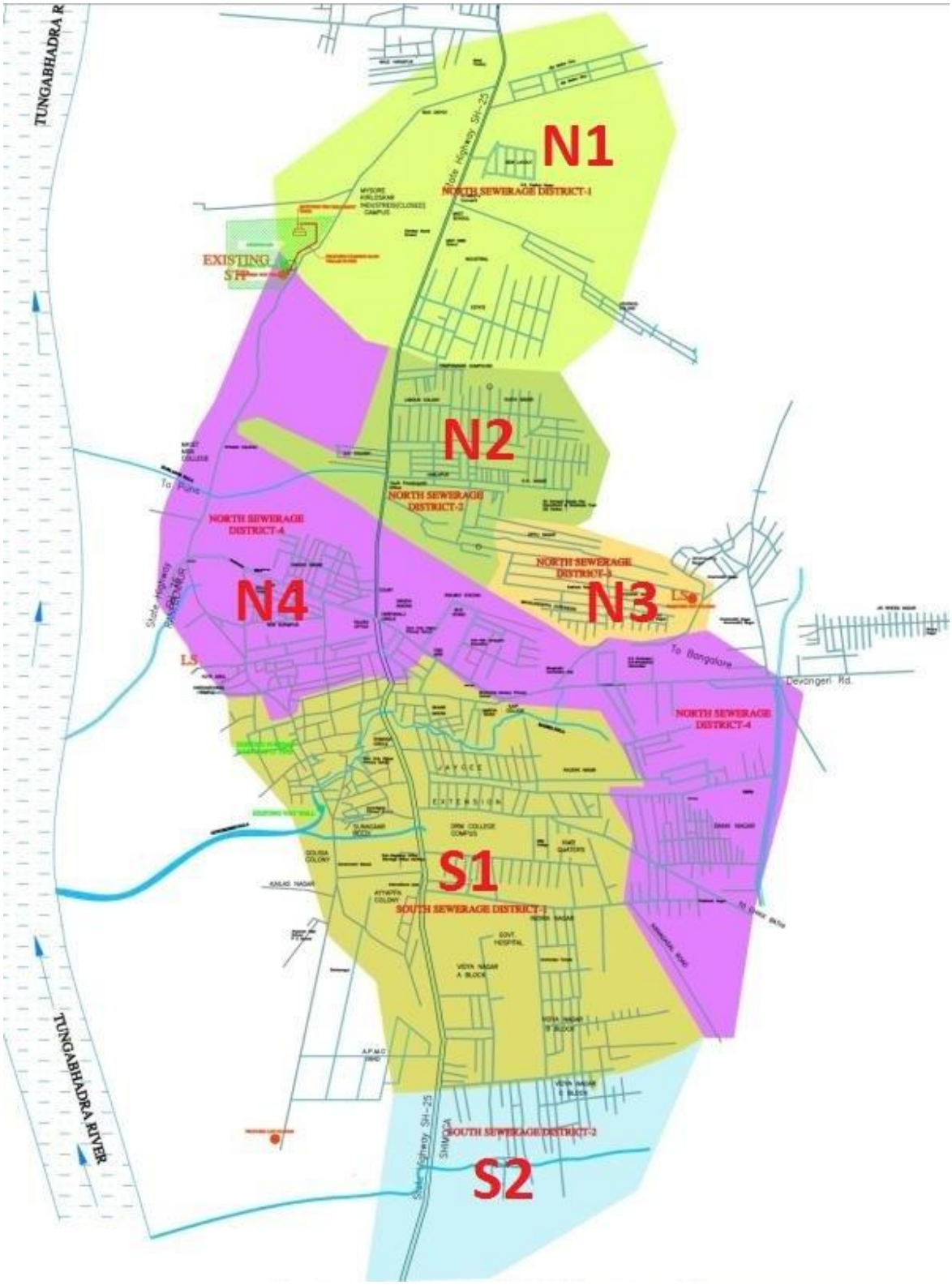

Figure 7: Sewerage District

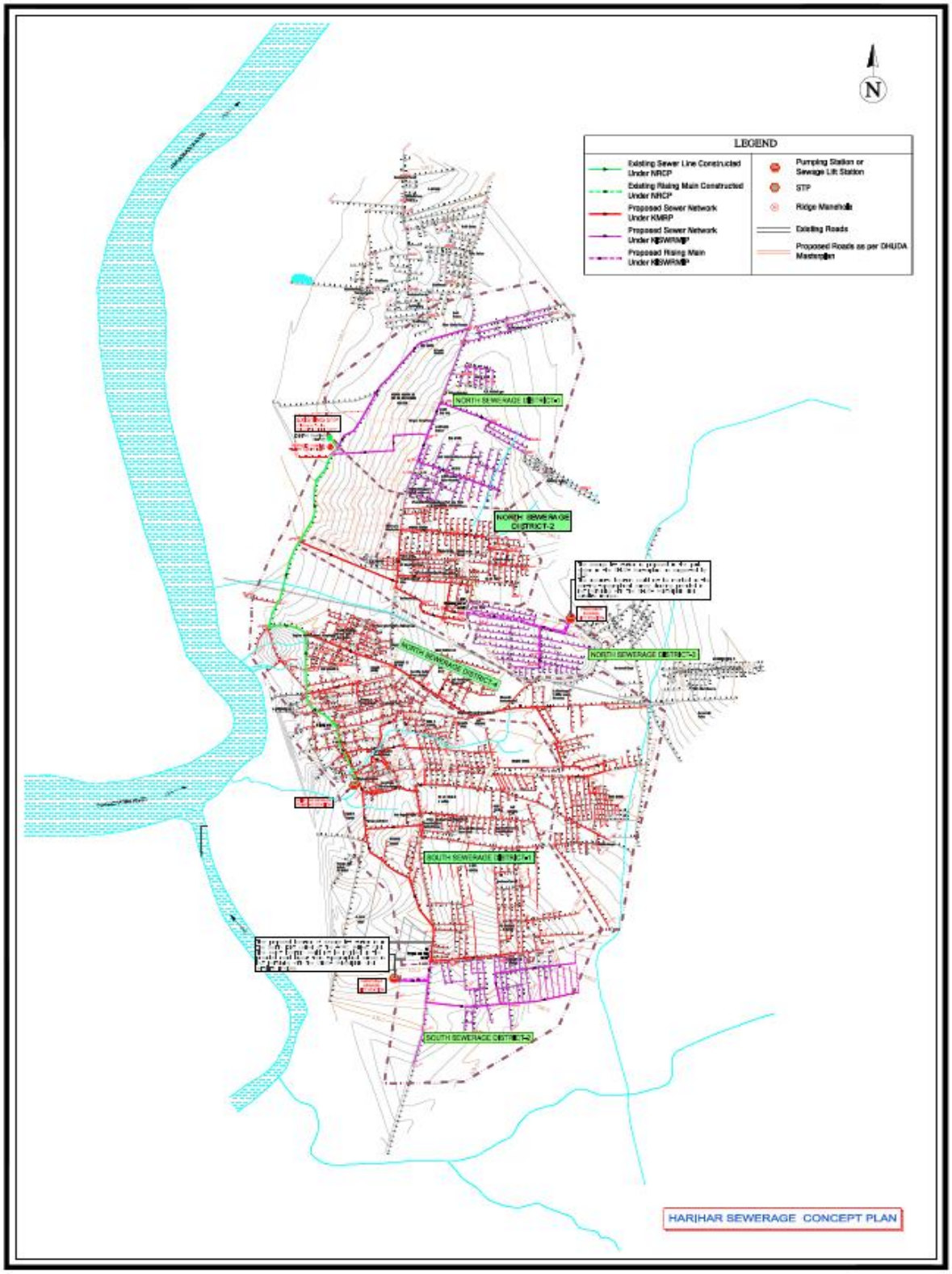

Figure 8: Sewerage Concept Plan

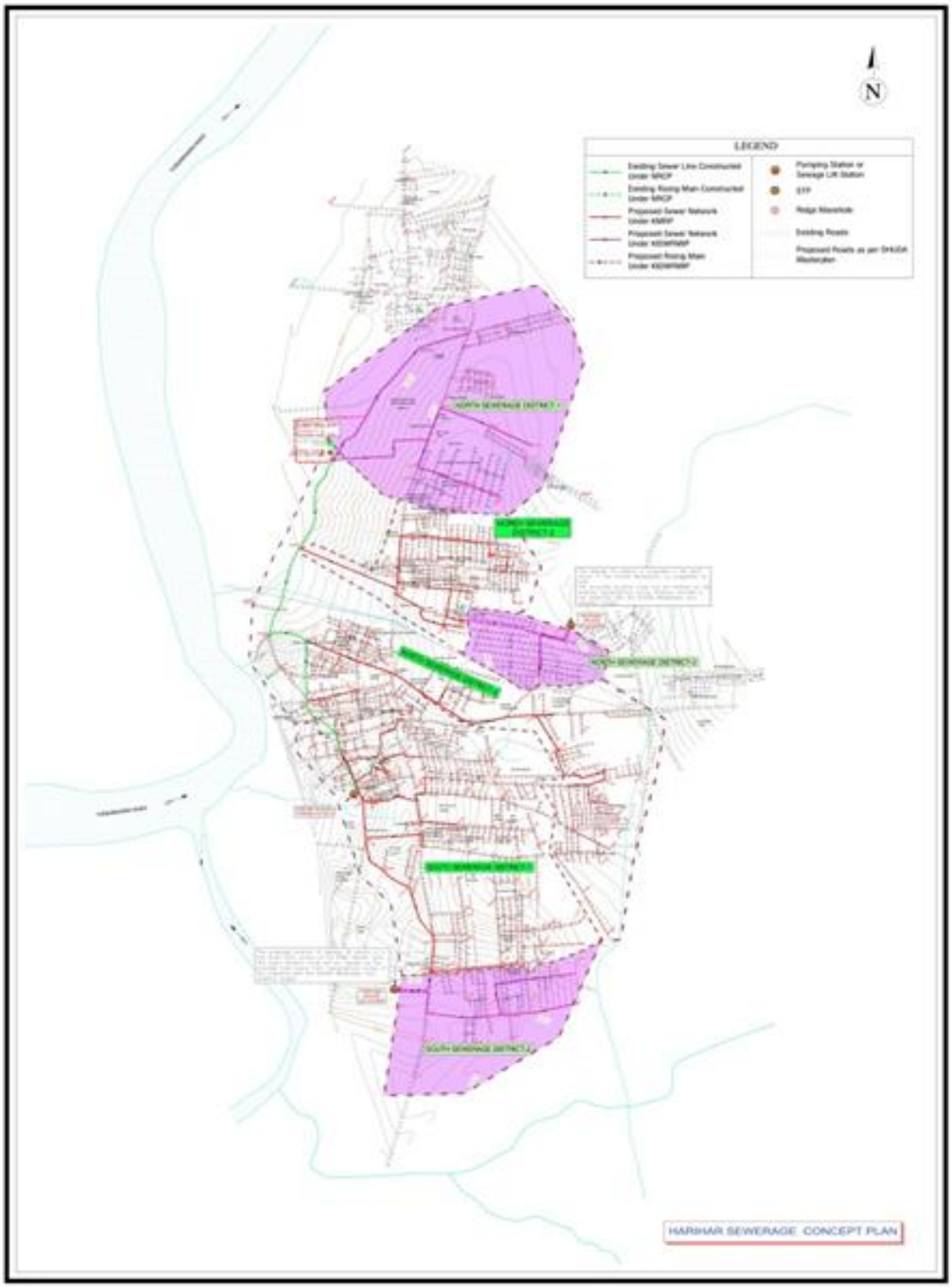

Figure 9: Sewerage Districts (in Purple Colour) Considered in the KISWRMIP

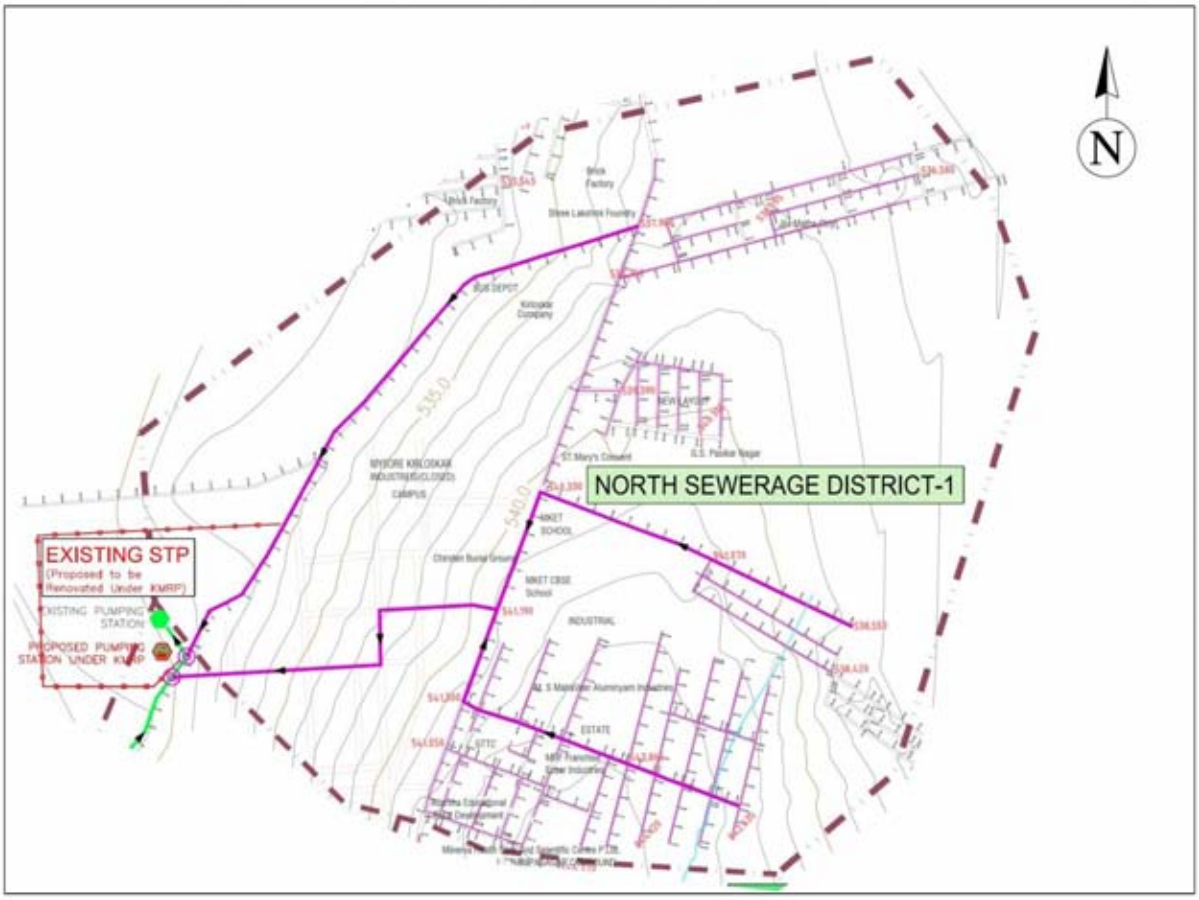

Figure 10: Proposed Sewerage Network for NSD1

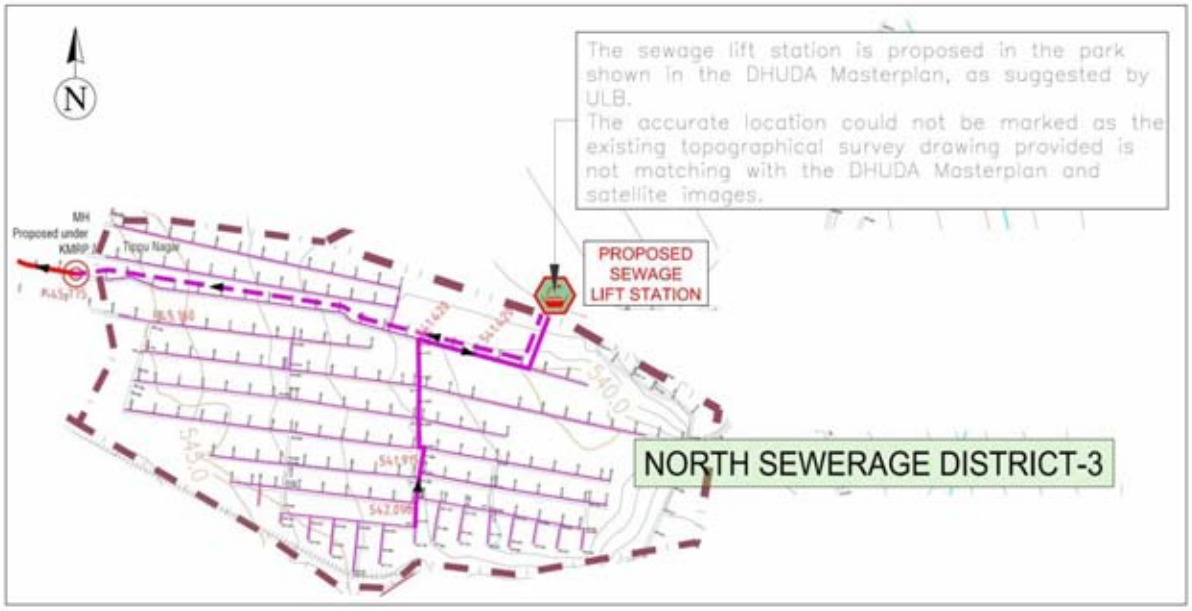

Figure 11: Proposed Sewerage Network for NSD3

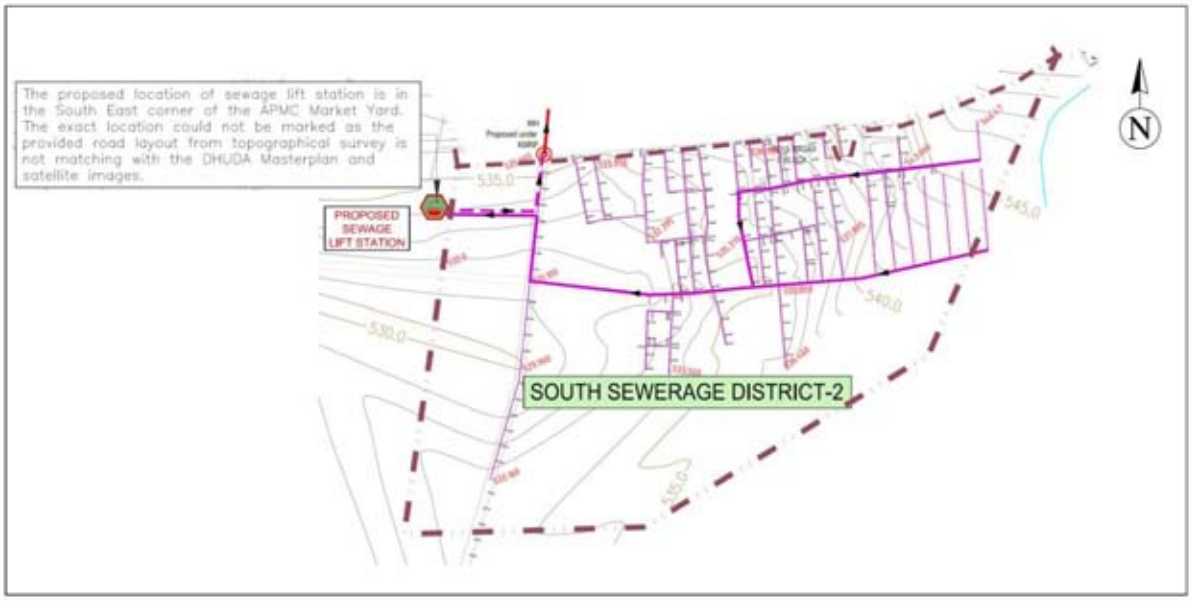

Figure 12: Proposed Sewerage Network for SSD2

IV. DESCRIPTION OF THE ENVIRONMENT

A. Physical Resources

1. Location

25. Geographically Harihar Town is situated at 14°31′N longitude 75°48′E latitude, with an average elevation of 540 metre above the Mean Sea Level. Extending to an area of 7.84 sq km, the town's population is 77,000 (census 2011). Harihar is situated at the centre of the Karnataka State, and administratively is in Davangere District. Developed on the bank of River Tungabhadra, the town is a religious centre and known as "Dakshnia Kashi". It is located at a distance of 14 km from Davangere and 275 km from Bangalore, the State Capital. The Town is well connected with various towns and hinterland in the district by road and rail network. The city is situated at the intersection of two major roads (NH 4 connecting Pune and Mumbai, and SH25 connecting Shimoga and Bellary). The broad gauge railway line connecting Bangalore to Pune/Mumbai passes through Harihar.

2. Topography, Soil & Geology

26. Harihar town is developed on the right bank of Tungabhdra River. Topography is plain and slopes gently towards the river in the west. The town is located in Central Dry Zone as per Agro Climatic Zone classifications in the State. The predominant soil type found in this region is red sandy loams while shallow to deep black soil in the remaining areas. The principal crops grown here are ragi, jowar, pulses and oil seeds.

27. As per the seismic zoning map of India, Harihar Town falls under Zone II, which is the lowest earth quake risk zone in India. This zone is termed as "low damage risk zone".

3. Climate

28. The town experiences dry extreme climatic conditions. In summer season the temperature varies from 40°C to 43°C and in winter season the temperature is minimum 17°C to maximum 20°C. Annual average rainfall is 1,040 mm. Rainfall occurs mainly during the southwest monsoon period of June to September, followed by northeast monsoon period from October to December.

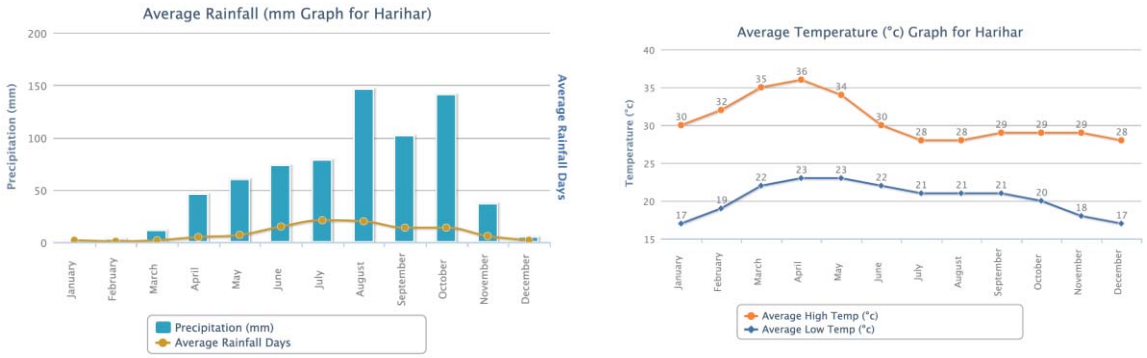

Figure 13: Average Monthly Rainfall and Temperature in Harihar

4. Air Quality

29. The major sources of sound pollution in the city are from the vehicles. Karnataka State Pollution Control Board (KSPCB) monitors air and noise pollution in the State in line with Air (Prevention and Control of Pollution) Act, 1981. KSPCB have monitoring stations located at various places across the state; however covers major cities, district headquarters and industrial locations. Data shows that particulate matter is high because of the dry atmosphere, dusty roads and surrounding land, and Respirable Suspended Particulate Matter (RSPM: particles < 10µm) and Suspended Particulate Matter (SPM) exceed National Ambient Air Quality Standards (NAAQS). In contrast, levels of chemical pollutants (oxides of sulphur and nitrogen) are below national standards.

Table 3: Ambient Air Quality in Harihar

Monitoring Station	SPM (µg/m3)	RSPM (µg/m3)	SO2 (µg/m3)	NOx (µg/m3)
Harihar	247	123	1	19
Ambient Air Quality Standard	200	100	80	80

Source: EIA Report of Grasim Industries Limited prepared by NEERI in 2007

5. Surface Water

30. Harihar is situated on the right bank of Tungabhadra River. River flows north-south, and the town gently slopes towards the river on west. Tungabhadra is one of the two largest tributaries of River Krishna. The River is formed by the confluence of two rivers, Tunga and Bhadra, both of which originate in the Western Ghats in Karnataka. The length of Tunga is 147 km while Bhadra is 171 km, before they join together at Kudli near Holehonnur in Shimoga District. From this confluence point at Kudli, the River is called as Tungabhadra and flows down through the plains and meets River Krishna in Mahaboobnagar District of Andhra Pradesh. The

length of the river is 531 km through Karnataka and Andhra Pradesh states. In Karnataka, it flows over a distance of 293 km through the districts of Chikmagalur, Shimoga, Davanagere, Haveri, Chitradurga, Bellary and Raichur, and drains are area of 57,671 sq km, which is nearly 81% of total Tungabhadra River Basin.

31. During its course in Karnataka, numerous small and big tributaries join the River. Varada and Haggari are the main tributaries of Tungabhadra in Karnataka State; while the former flows through Shimoga, Uttara Kannada and Haveri Districts, the later flows through Chitradurga and Bellary Districts.

32. River Tunga, Bhadra and Tungabhadra are the main sources of drinking water supply. Almost all the towns depend directly on river (direct pumping, infiltration galleries, shallow wells in the river bed etc); during low flow season, the water supply is supplemented by groundwater. Tungabhadra Dam constructed across the River at Hospet in Bellary district is lifeline of Bellary, Raichur and Koppal districts in Karnataka and parts of Andhra Pradesh State. The river is the main source of water for Harihar and for major and small industries on the left bank side of the river. Besides, water is used for irrigation by farmers alongside river by lift pumps.

33. Water quality monitoring of Tungabhadra River is conducted by Karnataka State Pollution Control Board (KSPCB) in Karnataka. The Tungabhadra water quality is classified as Category C “Drinking water source after conventional treatment and disinfection” in the upstream of Harihar town where the intake is situated. However, in the down steam, due to discharges from various industries and sewage from Harihari and Davanagere, the water quality on the downstream side of Harihar is poor. CPCB identified the stretch between the downstream (d/s) of Harihar to Haralahalli bridge as “polluted”. Following table shows the water quality of the river. The intake for Harihar water supply was originally located near the town. Since this location was close to an industrial waste discharge point, it was decommissioned and a new intake was constructed at 7 km upstream at Kawalettu. The water is currently drawn from this intake.

Table 4: Tungabhadra River Water Quality - 2009

Parameters	Water quality criteria		Kudli	Honnali	Haralahalli	Ullanur
			u/s of Harihar		d/s of Harihar	
		Min	25.0	22.0	22.0	26.0
Temp, oC	-	Max	27.0	32.0	32.0	31.0
		Mean	26.0	25.5	25.1	28.0
		Min	5.2	7.3	7.1	6.0
DO, mg/l	> 4 mg/l	Max	7.0	7.5	7.6	8.0
		Mean	6.0	7.4	7.4	7.2
		Min	7.5	7.3	7.5	7.6
pH	6.5 – 8.5	Max	8.3	8.2	8.7	8.4
		Mean	8.0	7.9	8.0	7.9
		Min	116	120	136	270
Conductivity, µmhos/cm	< 2250	Max	400	500	560	1240
		Mean	259	330	381	847
		Min	2.3	1.2	1.2	1.7
BOD, mg/l	< 3 mg/l	Max	3.1	3.4	3.7	5.2
		Mean	2.7	2.6	2.4	3.1
		Min	0.21	0.08	0.1	0.2
Nitrate, mg/l	-	Max	0.54	0.7	0.63	1.4
		Mean	0.33	0.33	0.36	0.54
		Min	-	-	-	-
Nitrite, mg/l	-	Max	-	-	-	-
		Mean	-	-	-	-
	<2500 MPN/100 ml	Min	80	30	40	1100
Feacal Coliform, MPN		Max	240	170	170	9000
		Mean	155	114	82	6872
	<5000 MPN/ 100 ml	Min	110	50	60	2200
Total Coliform, MPN		Max	3000	2220	1300	16000
		Mean	1928	1176	932	13109

6. Ground Water

34. In Harihar Taluk, schists are the main water bearing formation. Ground water occurs within the weathered and fractured rocks. Ground water exploration reveals that aquifer systems are encountered from depth of 21 m below ground level to 51 m below ground level. Yield ranged from 0.07 to 3.28 lps. Transmissivity ranged from 1.0 to 8.0 m^2/day. During May 2006 (pre-monsoon season), the minimum depth to water level and maximum water level was 2.37 m and 8.42 m respectively. During November 2006 (post monsoon), water level ranged from 2.27 m to 7.08 m.

35. Major parts of Davangere, Harpanahalli, Harihar and Jagalpura fall under over exploited category. In Harihar Taluk, 98 percent area falls under over exploited and 2 percent of the area falls under semi critical category. The stage of development of ground water for the taluk is 47 percent, which is the lowest in the district. Table5 shows the summary of ground water estimation studies in Harihar.

36. As per the Central Ground Water Board (CGWB), Flouride content in groundwater is present in excess in the district (Fluoride content more than 1.5 ppm). The Electrical conductivity values in the major part of the district are in the range between 1000 and 2000 micro mhos/cm.

Table 5: Groundwater Development in Harihar Taluk

Particulars	Details
Net Annual Ground Water availability (HAM)	6317.29
Existing gross GW draft for all uses (HAM)	2966.95
Allocation for domestic and industrial use for next 25 years (HAM)	537.23
Net GW availability for future irrigation development (HAM)	3503.09
Balance GW irrigation potential available (HA)	4319.48
Stage of development (%)	47

Source: Central Ground Water Board Report, November 2008

Figure 14: Location of Town in Tungabhadra Basin

B. Ecological Resources

37. Harihar is an urban area surrounded by land that was converted for agricultural use many years ago. There is no remaining natural habitat in the town, and the flora is limited to artificially planted trees and shrubs, and the fauna comprises domesticated animals. There are no forests or any other environmentally sensitive areas in or near the town.

38. Ranebennur Reserve Forest, located at 6 km from the town, is the nearest environmentally sensitive area.

C. Economic Development

1. Land Use

39. The present town area comprises of 7.77 sq .km of which 6.95 sq. km Is in the „developed category' with an average density of 105 persons per hectare. Town Planning Department has demarcated proposed land use boundary of Harihar with a total area of 20.00 sq. km. Commercial development is mainly concentrated along the two main roads (NH 4 connecting Pune and Mumbai, and SH25 connecting Shimoga and Bellary) passing through the city. Table 6 shows the existing land use of Harihar.

Table 6: Existing Land Use for Harihar TMC

Land Use	Existing Land Use (2001)	
	Area in Ha	Percent
Residential	128.88	18.52
Commercial	43.68	6.28
Industrial	131.05	18.83
Public Utilities	6.49	0.93
Transport and Communication	224.03	32.19
Vacant Land	89.39	12.85
Public & Semi Public	28.84	4.14
Parks, Play grounds, Open spaces	43.53	6.26
Total	420	100

2. Industry & Agriculture

40. Owning to its location and connectivity and availability of water, industrial development in Harihar is notable, and it is one of the important clusters in Karnataka. It is well known and important major industrial like - Grasim, Synthite, Shamanur Sugar's and Harihar poly-fiber, etc has contributed much for the economic growth of the town. Apart from these, there are a number of other engineering and small manufacturing units and brick kilns.

41. There are vast agriculturally rich lands around the town, cultivated by Tungabhadra water. Maize, paddy, jowar and cotton are the major crops grown in and around Harihar.

3. Infrastructure

42. **Water Supply**. The city of Harihar is supplied by both surface water and ground water sources. The surface source is from Tungabhadra River at Kawalettu village which is located at a distance of 7 km from the city. KUWS&DB has implemented a comprehensive water supply scheme in the year 2003. The present water supply to the town is 9.55 MLD with per capita rate of water supply of 84 LPCD.

43. **Sewerage and Sanitation**. Currently there is no underground sewerage system in the town. The system of soak pits and septic tanks is used for the disposal of sewage in the city. The wastewater, including sullage and sewage, generally enters into three major drains of the town. - Goudarageri *nala*, Matha *nala* and Kirloskar *nala.* Interception, diversion and treatment works were developed under National River Conservation Project by KUWSDB. The wastewater from the drains is intercepted, and diverted to a treatment plant (stabilization pond based). This interception system caters to about 35% of the town

44. **Storm Water Drainage**. The total length of drains in the city is approximately 98.0 km. It comprises of three major drains with a total length of 12 km. they are Goudarageri *nala*, Matha *nala* and Kirloskar *nala*. At present roadside drains carry both domestic wastewater and surface runoff.

45. **Transportation**. The National Highway No. 4 connecting Bangalore and Pune/Mumbai is the major regional road running in the midst of the city. The Shimoga – Bellary road is another important road passing through the city. The city has direct rail connectivity with a broad gauge line connecting Bangalore – Hubli. This railway line contributes a major share in passenger and goods transportation. With a total length of 117.6 km, internal road network in the city is well developed, however are not in good in condition. Most of the roads in the central part are congested. All the major commercial, transport and administrative buildings are situated along NH-4.

46. **Power Supply**. Hydal power is the main source of energy in Karnataka, with 61% of total installed capacity. Remaining is mostly from thermal power stations. Contribution of wind and solar energy, although increasing, is negligible. Government run Karnataka Power Corporation Limited (KPCL) is responsible for power generation while Karnataka Power Transmission Corporation Limited (KPTCL) is responsible for power transmission. The distribution to users in Harihar is provided by regional company – Bangalore Electricity Supply Company Limited. Power is supplied from the central grid by overhead cables carried on metal and concrete poles, mainly located in public areas alongside roads. The power supply in Harihar is poor; there are frequent outages in warmer months, and fluctuations in voltage.

D. Socio Cultural Resources

1. Demography

47. Harihar population has grown from 73,047 in 2001 to 87,744 in 2011 with a growth rate of 20.12 percent, much higher than the previous decade's 9.6 percent. The decadal growth rates never showed a steady growth over the past few decades as shown in the following table.

Table 7: Population Growth of Harihar Town

Year	Population	Decadal Growth Rate
	Nos.	%
1951	15,290	-
1961	22,829	43.40
1971	33,888	48.44
1981	52,334	54.43
1991	66,647	27.35
2001	73,047	9.60
2011	87,744	20.12

48. **Sex Ratio**. The sex ratio (female population per 1000 male) of 2001 is 950.

49. **Household Size**. There are a total 14,895 numbers of households within the city as per Census 2001. The average household size is 4.9.

50. **Slums**. There are 6 declared slums and 4 undeclared slums in the town.

51. **Literacy**. The literacy rate of the city is 80.9 percent which is high as compared to state urban average of 71.4% and national urban average of 70.1%. The male literacy is 88.2% and female literacy rate is 77.2%.

52. **Area and Population Density**. Present area under CMC jurisdiction is 7.77 sq km. CMC area has remained unchanged from the last three decades. Overall population density of the city is 9401 persons per sq km. While the overall density is moderate, the core area of the city is densely populated as compared to fringe areas of the city.

2. History, Culture & Tourism

53. Harihar is an ancient town located on the banks of Tungabhadra River. According to legend this spot was the capital or stronghold of a giant named Guha or Guhasura. The giant, having by his penance obtained from Brahma the boom of exemption from death at the hands either of Hari (Vishnu) or of Hara (Siva), become in consequence such a tormentor of gods and men that Vishnu and Siva, in order to counteract the spell, combined into one form of Harihara and destroyed him. The descent of this incarnation was at Kudalur, the confluence of the Tungabhadra and the Haridra.

54. Harihar has a rich history of around 1500 years. Predominantly it had been ruled by Hoysalas, Chalukyas of Badami, Cholas, Pandyas, Rashtrakootas, Kaalachooryas, Kings of Vijayanagara, Moghuls and Peshwas. Stone Literatures of Hoysalas, Chalukyas and Kings of Vijayanagara had been found in this place. In 12th century, Hoysala rulers built temple for Sri Harihareshwara. This temple is famous for its rich sculptural works and architecture. Every year during the month of February, Car Ceremony (Brahma Rathotsava) of Sri Harihareshwara is celebrated with great enthusiasm and thousands of tourists visit the city. With its religious importance, Harihar is also known as "Dakshina Kashi". Harihareswara Temple, situated in the centre of the town, is a protected monument under the control of Archaeological Survey of India.

55. Rayara Matha (Raghavendra swami temple on the banks of Tungabhadra) is another important religious place in Harihar.

V. ENVIRONMENTAL IMPACTS & MITIGATION MEASURES

A. Overview

56. As a general practice, an IEE should evaluate impacts due to the location, design, construction and operation of the project. Construction and operation are the two activities in which the project interacts physically with the environment, so they are the two activities during which the environmental impacts occur. In assessing the effects of these processes therefore, all potential impacts of the project should be identified, and mitigation is devised for any negative impacts. Following sections evaluate impacts of the proposed water supply and sewerage project in Harihar.

B. Location Impact

57. **Location.** These Impacts are associated with planning particularly on the site selection. They include impacts due to encroaching on sensitive areas and impacts on the people who might lose their homes or livelihoods due to the development of the proposed site.

58. Proposed subproject sites are carefully selected to avoid encroachment into sensitive areas and minimise the impacts on people livelihoods and homestead. None of the subproject components require acquisition of private land

59. All the sewer and water pipes will be laid within the municipal boundary, along the roads. Larger diameter pipes will mostly be laid along wider roads where there is enough space between the road carriageway and the buildings. Replacement and augmentation of pumps will be undertaken within the existing pumping station near the WTP.

60. Proposed sewage pumping/lift station is located in the south eastern outskirts of the city away from habitation. This site is located in the premises of APMC[1] Market Yard. It is located in a corner of the market yard and will not interfere with day to day activities.

61. Although the site identified for sewage pumping station is located away from habitation, considering market yard and the future development, and mitigate the risk, if any, of odour nuisance to surrounding people, the following measures shall be included in the subproject design:

(i) Provide backup power facilities for continuous and uninterrupted pumping of sewage; ensure that anaerobic conditions are not created in wet well through continues operation
(ii) Provide green buffer zone around the facility – at least a 5m strip of land around the facility shall be planted with trees; this will also improve the aesthetic appearance of the facility

62. **Utilities.** Water supply pipelines, Telephone lines, electric poles, and wires within the proposed subproject locations may require to be shifted in few cases The mitigate the adverse impacts due to relocation of the utilities, IA will:

[1] Agriculture Produce Market Committee (APMC), Government of Karnataka

(i) Identify and include locations and operators of these utilities in the detailed design documents to prevent unnecessary disruption of services during construction phase; and
(ii) Conduct detailed site surveys with the construction drawings and discuss with the respective agencies during the construction phase before ground clearance;
(iii) Require construction contractors to prepare a contingency plan to include actions to be done in case of unintentional interruption of services. In case of disruption of water supply, alternative supply, through tankers, shall be provided.

63. Proposed rehabilitation and capacity augmentation of the water treatment plant (WTP) will be carried out within the existing WTP site. This existing site has sufficient space for construction of additional treatment capacity which will consist of similar processes to those in the existing plant. The existing "sludge settlement tanks" will be demolished to provide the space for the second clariflocculator and part of the second filter house. The existing channel transferring the raw water from the aerator to the existing clariflocculator will be modified to supply an equal flow to both clariflocculators. The WTP site at present has no notable tree cover. Environmental enhancement measures such as tree plantation shall be taken up in the facility as part of the subproject. This will also improve aesthetic appearance of the facility.

64. **Site selection of construction work camps, stockpile areas, storage areas, and disposal areas**. Priority is to locate these near the subproject locations. However, if it is deemed necessary to locate elsewhere, sites to be considered will not result in destruction of property, vegetation, irrigation, and drinking water supply systems. Residential areas will not be considered for setting up camps to protect the human environment (i.e., to curb accident risks, health risks due to air and water pollution and dust, and noise, and to prevent social conflicts, shortages of amenities, and crime). Extreme care will be taken to avoid disposals near the forest, water bodies, swamps, or in areas which will inconvenience the community. All locations would be included in the design specifications and on plan drawings. Construction work camps shall be located at least 200 m from residential areas. Harihar is situated on the bank of River Tungabhadra. Material stockpiles shall be protected by bunds during the monsoon to arrest the silt laden runoff into drains and ultimately into River Tungabhadra. The subproject is likely to generate soil from excavations, which needs to be disposed safely. The following measures should be considered for disposal of surplus/waste soil.

65. **Site selection of sources of materials.** Extraction of materials can disrupt natural land contours and vegetation resulting in accelerated erosion, disturbance in natural drainage patterns, ponding and water logging, and water pollution. To mitigate the potential environmental impacts, locations of quarry site/s and borrow pit/s (for loose material other than stones) would be included in the design specifications and on plan drawings. Priority would be sites already permitted by Mines and Geology Department. If other sites are necessary, these would to be located away from population centers, drinking water intakes and streams, cultivable lands, and natural drainage systems; and in structurally stable areas even if some distance from construction activities.

66. For Harihar subproject, the quarry material required will be sand and stone aggregate, and the nearest quarries are near Harihar and Medleri (sand quarries along River Tunga Bhadra) and Chatra at Motebennur and Hunasikatte in Ranebennur Taluka for stone aggregate. These are existing quarries and are licensed by Mines and Geology Department. The material from the existing quarries will be adequate for the subproject construction, and therefore no new quarry sites will be developed for the purpose

C. Design Impact

67. These impacts arise from the design of the subproject including the technology used, scale of operation/throughput, waste production, discharge specification, pollution sources, and ancillary services.

68. As per the proposed project design, the Tungabhadra River is continued to be the source of water supply to Harihar. To meet the future demand, it is proposed to increase the water abstraction from the river from the present 9 MLD to 27 MLD.

69. **Water availability in the river**. River Tungabhadra is a perennial and an important river of Karnataka. This is formed north of Shimoga Town, by the union of two rivers, the Tunga and the Bhadra, which rise in the Western Ghats at an elevation of about 1 200 metres. The Tunga River emerges from the hills surrounding Varaha Parvata, at a place called Ganga Mula. The river flows through seven districts in Karnataka - Chikmagalur, Shimoga, Davangere, Haveri, Chitradurga, Bellary and Raichur. The river has a dam built across it at Gajanur. After traversing a distance of 147 km long merges with the Bhadra River at Koodli at about 610 m above MSL, a small town in Shimoga District. There is a dam across river Bhadra, 15 km upstream of Bhadravathi Town. Tungabhadra Dam was built across the Tungabhadra River after it traverses 265 km from the origin in Western Ghats. Then the river merges with the Krishna River in Andhra Pradesh state. It has a drainage area of 71 417 km2 out of which 57 671 km2 lies in Karnataka State, and the length of river in the state is 293 km.

70. River flow fluctuates between very high during monsoon months to very low during summers. Almost all the towns and villages in the basin depend on the river for water supplies. Water for Harihar is abstracted from the river at Kawalettu, 7 km upstream of Harihar. There is no water retaining structure at this point; water is collected in a collection well in the river bed and pumped to the WTP. The river course at this section is comparatively deep. This ensures that there is adequate depth of water available throughout the year to pump from the intake, and this gorge also acts as a sort of storage. Discussions with the local staff and community indicates that the flow during summer reduces considerably, and is said to be further affected by unauthorised upstream barriers constructed across the river

71. As the subproject proposes to increase water abstraction from the river, there may be likely impacts. If the increased abstraction reduces the downstream flow, that could affect the downstream users and the river ecosystem. The “sister” TA[2] to that which has produced this Feasibility Study and IEE has within its scope the preparation of a river water balance to ensure the adequacy of raw water for public water supply. For this feasibility study/IEE of Harihar, it has been assumed that (i) measures will be proposed to prevent the construction of unauthorised barriers and that (ii) adequate supplies will be made available by, if necessary, a reduction in water permitted for agriculture, by the construction of barriers etc. or by any other means deemed necessary by the TA. Therefore impacts of increased water abstraction from the river are not considered in this report. It is also assumed that the water balance will take into consideration the minimum flow required downstream to sustain the ecosystem. However, it is necessary, to ensure subproject sustainability, that:

[2] Overall water resource balance in Tungabhadra River Basin and measures for assurance of water availability within the Tungbhadra River for public water supply and other uses will be proposed within KISWRMP Water Resource PPTA. Government of India policy is for priority to be given to public water supply and it is therefore assumed that adequate water resources will be available without effecting current downstream uses.

(i) Adequate water availability is established and necessary provision is made for Harihar water supply through government statutes as required before the start of detailed design.

72. **River water quality**. There are no major pollution sources like industries in the upstream side of the intake at Kewalettu. Most of the villages and towns, however, along the river discharge domestic wastewater into the river without any treatment, although there is no such disposal point in the proximity of intake. The river water quality meets the "Category C quality that make is appropriate as "Drinking water source after conventional treatment and disinfection". A grab sample was collected from the intake and tested for pesticides residues. The results indicated that there are no pesticide residues in the raw water. The subproject includes capacity augmentation of existing water treatment plant, so the raw water will be treated to drinking water standards and supplied to the consumers.

73. **WTP Rehabilitation & Augmentation**. The pipeline from the Intermediate Pumping station will branch off, to a new cascade aerator, from where the water will be conveyed through the raw water channel to the flash mixer and then to the Plate / Tube Settler. No additional structures are required to house chemical treatment processes as the existing chemical house will be utilised for chemical dosing in both the existing and upgraded plant. Provision for re-cycling of filter back wash water will be incorporated to reduce the water losses from filter back wash water from existing and proposed filter houses and sludge from clariflocculator and tube / plate settlers.

74. Environmental audit of the existing Water Treatment Plant has been conducting during the IEE preparation to assess the compliance with environmental legislation and current environmental performance. This audit identified improvements required for the WTP, which are appropriately included in the subproject. This will improve the compliance and environmental performance. Environmental Audit report is presented in **Appendix 7**.

75. There is invariably a safety risk when considerable quantities of chlorine are handled at the WTP. (Chlorine cylinders will be brought by trucks to the site, installed and operated to disinfect the water supplies). Since facilities are located in the urban area, precautions will thus be needed to ensure the safety of both workers and citizens.

76. The average dose of chlorine for pre-chlorination will be about 4mg/l and that for post-chlorination will be about 2 mg/l. With the present water supply 9 MLD, about 54 kg of chlorine is consumed daily. This which will increase to 162 kg per day with the augmented capacity of 27 MLD. Chlorine cylinders (called tonners, with capacity about 900 kg) will be procured from nearest manufacturing unit and stored at the site. Tonners sufficient for a month will be stored in the storage; this will be about 6 tonners (1 - working + 5 - in storage).

77. To avoid any risk to workers and public, the chlorination facility at the WTP should be designed developed with all appropriate safety features and equipment to meet with any accidental eventuality, which may include

(i) Chlorine neutralization pit with a lime slurry feeder
(ii) Proper ventilation, lighting, entry and exit facilities
(iii) Facility for isolation in the event of major chlorine leakage
(iv) Personal protection and safety equipment for the operators in the chlorine plant
(v) Visible and audible alarm facilities to alert chlorine gas leak
(vi) Laboratory facility shall not be housed within the chlorination facility

(vii) Provide training to the staff in safe handling and application of chlorine; this shall be included in the contract of Chlorinator supplier

(viii) Develop an emergency response system for events like chlorine leakage – an ERS template is provided at Appendix 5.

(ix) Supplier of Chlorinator equipment shall provide standard operating manual for safe operation and as well as maintenance and repairs; preferably these shall be provided both in English and Kannada Languages

78. Owing to higher elevation of the town to that of intake at Kewalettu, the energy intensive pumping could not be avoided. The raw water from the intake will be pumped to WTP, and from the WTP treated water will be pumped to elevated service reservoirs (ELSR). From ELSRs, water is supplied by gravity to the consumers. To optimize the power consumption, the following needs to be considered in design and selection of pumping systems:

- Design pumping equipment with maximum efficiency to optimize the energy consumption
- Various combinations of number of pumps, stages, motor speed should be considered to select the best pump with ideal specific speeds.
- Specific speeds of the pumps should be selected to achieve maximum efficiency of pumps. For instace, as per American Standard for DS Centrifugal Pumps issued by Hydraulic Institute, New Jersey, the specific speed for Pumps should be in the range of 2000 to 3000 for attaining optimum efficiency. The pumps should be designed accordingly.
- Attainable efficiency for procuring the pumps and motors should be considered as 88 to 92 percent for pumps and 94 percent for motors. It is proposed that during the procurement, the evaluation of bid shall also be in terms of efficiency.
- The pumps shall conform to IS 1710 – 1989 Specification for Pump and IS 5120–1992 Technical Requirements for Roto-dynamic Special Purpose Pumps and tested to class 3 of IS: 9137-1978 Code for Acceptance Tests for Centrifugal, Mixed Flow and Axial Flow Pumps.

79. **Sludge from WTP - treatment and disposal**. Water treatment process will generate sludge from sedimentation of particulate matter in raw water, flocculated and precipitated material resulting from chemical coagulation, residuals of excess chemical dosage, plankton etc; and waste from rinsing and back washing of filter media containing debris, chemical precipitates, straining of organic debris and plankton. . Following are included in the subproject design to dispose the sludge and back wash:

(i) Provision of recirculation system for backwash water – backwash water from filter beds will be re circulated to WTP inlet and mixed with raw water; this arrangement will minimize wastage of water, which otherwise would have disposed to open drains, and also avoids the pollution of receiving water body

(ii) Provision of sludge drying - accumulated sludge from clariflocculator will be flushed to sludge drying beds, for natural drying.

(iii) Dried sludge will be used as soil conditioner. Periodic testing of dried sludge will be conducted to ensure that it does not contain heavy metals that make it unsuitable for food crops. Tests will be conduct to confirm the concentrations below the following standards. As there are no specific standards notified for sludge reuse, the compost quality standards notified under the

Municipal Solid Waste Management & Handling Rules, 2000 have been adopted here. The MSWMH Rules stipulate that “In order to ensure safe application of compost, the following specifications for compost quality shall be met, namely;

Table 8: Dried Sludge for Use as Soil Conditioner

Parameters	Concentration not to exceed (mg/kg dry basis, except pH value and C/N ratio) *
Arsenic	10.00
Cadmium	5.00
Chromium	50.00
Copper	300.00
Lead	100.00
Mercury	0.15
Nickel	50.00
Zinc	1000.00
C/N ratio	20-40
PH	5.5-8.5
Arsenic	10.00

* Compost (final product) exceeding the above stated concentration limits shall not be used for food crops. However, it may be utilized for purposes other than growing food crops.

Source: Municipal Solid Waste (Management & Handling) Rules, 2000, Government of India

80. **Sewer system – collection & conveyance.** The sewerage system for Harihar is designed as a separate system of sewage collection (i.e. caters only wastewater). There is considerable length of existing surface drains in the project area that can be used for disposal of storm runoff. The underground gravity sewers will carry sewage from households to the WWTP. Harihar CMC should ensure that all existing septic tanks are phased out by bypassing the inlet and connecting the toilet discharge from each house directly to sewerage system.

81. Accumulation of silt in sewers in areas of low over time, overflows, blockages, power outages, harmful working conditions for the workers cleaning sewers etc are some of the issues that needs to be critically looked into during the sewer system design. A properly designed system is a must for system sustainability. Measures such as the following shall be included in sewer system design to ensure that the system provides the benefits as intended:

(i) Limit the sewer depth where possible.
(ii) Sewers shall be laid away from water supply lines and drains (at least 1 m, wherever possible);
(iii) In all cases, the sewer line should be laid deeper than the water pipeline (the difference between top of the sewer and bottom of water pipeline should be at least 300 mm)
(iv) In unavoidable, where sewers are to be laid close to storm water drains or canals or natural streams, appropriate pipe material shall be selected (stoneware pipes shall be avoided)
(v) For shallower sewers, use small inspection chambers in lieu of manholes;
(vi) Design manhole covers to withstand anticipated loads & ensure that the covers can be readily replace if broken to minimize silt/garbage entry
(vii) Ensure sufficient hydraulic capacity to accommodate peak flows & adequate slope in gravity mains to prevent build up of solids and hydrogen sulfide generation

(viii) Equip pumping stations with a backup power supply, such as a diesel generator, to ensure uninterrupted operation during power outages, and conduct regular maintenance to minimize service interruptions. Consider redundant pump capacity in critical areas

(ix) Establish routine maintenance program, including:

- Regular cleaning of grit chambers and sewer lines to remove grease, grit, and other debris that may lead to sewer backups. Cleaning should be conducted more frequently for problem areas.
- Inspection of the condition of sanitary sewer structures and identifying areas that need repair or maintenance. Items to note may include cracked/deteriorating pipes; leaking joints or seals at manhole; frequent line blockages; lines that generally flow at or near capacity; and suspected infiltration or exfiltration; and
- Monitoring of sewer flow to identify potential inflows and outflows

(x) Conduct repairs prioritized based on the nature and severity of the problem. Immediate clearing of blockage or repair is warranted where an overflow is currently occurring or for urgent problems that may cause an imminent overflow (e.g. pump station failures, sewer line ruptures, or sewer line blockages);

(xi) Review previous sewer maintenance records to help identify “hot spots” or areas with frequent maintenance problems and locations of potential system failure, and conduct preventative maintenance, rehabilitation, or replacement of lines as needed;

(xii) When a spill, leak, and/or overflow occurs, keep sewage from entering the storm drain system by covering or blocking storm drain inlets or by containing and diverting the sewage away from open channels and other storm drain facilities (using sandbags, inflatable dams, etc.). Remove the sewage using vacuum equipment or use other measures to divert it back to the sanitary sewer system.

(xiii) Develop an Emergency Response System (ERS) for the sewerage system leaks, burst and overflows, etc. A Template for ERS is provided in Appendix 5.

D. Construction Impacts

1. Construction Method

82. The project involves construction of the following: (i) Rehabilitation of existing WTP including capacity augmentation from the present 9 MLD to 27 MLD; (ii) installation of clear water; (iii) Laying/replacement of water pipes (clear water rising mains, distribution network); (iv) installation of house connections, bulk water meters and consumer meters; (vi) laying of sewer network; and (vii) construction of two sewage lift stations. Following table shows the details of construction activities involved in the subproject.

Table 9: Construction Activities for the Subproject

Component	Construction method	Likely waste generated
Rehabilitation of existing WTP and capacity augmentation	These works will be conducted at the existing WTP facility in the town near Tungabhadra River. The rehabilitation works will be within the existing structure. The additional units for capacity augmentation will be constructed on the site adjacent to the existing WTP. The existing "sludge settlement tanks" will be	Large quantities of debris will be generated from demolition of sludge settlement tanks;

Component	Construction method	Likely waste generated
	demolished to provide the space for the second clariflocculator and part of the second filter house. Demolition work will be carried out by workers using appropriate tools such as hand-held pneumatic drills. The WTP will be constructed in reinforced concrete structure and fixed with mechanical parts imported in ready-to-fix state. Most of the structure will be developed above ground except the clear water storage facility which will be constructed below the ground. Work will involve excavation for foundations, concreting, fixing of mechanical elements, finishing and fixing of electrical instrumentation items. Excavated soil will be used in the site for levelling and excess soil will be transported to disposal site. Material (sand, aggregate) will be procured from local quarries, and brought to the site on trucks and stored temporarily. Concrete will be mixed using a mixer at the site, and concrete will be transported by manual labour. The work will be conducted by a team of 50-60 workers and works will be confined to WTP facility compound.	these are presently empty, and the demolition debris will include concrete including steel
ELSR	The cavity for the foundations for the overhead service reservoirs (OHSR) will be excavated by backhoe, with soil being loaded onto trucks for disposal. Aggregate and concrete will be tipped into each void to create the foundations and floor, after which metal reinforcing rods will be added to create the outline of the walls of the reservoir and the vertical supporting pillars. Sections of reinforcing will then be encased in wooden shuttering and concrete will be poured in, and this process will be repeated to gradually create each structure from RCC, including the tank of the reservoirs. Surfaces will be smoothed and finished where necessary by hand. The work will be conducted by a team of 10-15 workers at each site	500 m3 of excavated soil
Water supply pipelines	Trench excavation along the identified main roads of about 0.5-0.7 m wide and 1.5 m deep Trench will be excavated using backhoe and where not feasible will be done manually. Excavated soil will be placed along the trench, and pipes will be placed and joined, and the excavated soil will be replaced and compacted. Where the pipes are laid in the roadway, handheld pneumatic drill will be used to break the road surface. Construction activity will be conducted along the roads in the town; most of the roads in the centre of the town are congested with traffic, pedestrians and activities; roads outside are comparatively wide and less traffic. The work will be conducted by a team of 5 workers at each site	~47,000 m3 of excavated soil; 95% will be utilized for refill; remaining soil (~2,400 m3) need to be disposed off
Fixing of water meters	Minor civil work – conducted manually	Negligible
Sewer lines	Trench excavation along the identified main roads of about 0.4-1 m wide and 1.5- 5 m deep	~18,000 m3 of excavated soil; 93-

Component	Construction method	Likely waste generated
	Trench will be excavated using backhoe and where not feasible will be done manually. Excavated soil will be placed along the trench. A bed of sand of 100 mm thick will be prepared at the bottom and pipes will be placed and joined. Excavated soil will be replaced and compacted. Where the pipes are laid in the roadway, handheld pneumatic drill will be used to break the road surface. Construction activity will be conducted along the roads in the town and mostly in the outer areas which are not covered under Karnataka Municipal Reforms Project; these are comparatively wide and less traffic. The work will be conducted by a team of 5 workers at each site	94% will be utilized for refill; remaining soil (~1000 m3) need to be disposed off
Sewage lift/pumping station	Sewage pumping station will consists of a wet well to collect the incoming sewage, and a room above the wet well to house the pumping station; excavation will be conducted using backhoe digger; RCC well structure will be created in the void to form wet well; a concrete cover with an opening will be made on the top, above with a one-roomed structured will be construction to house the pumps. Construction activity will be confined to the proposed site	Soil generated from excavation activity will be utilized within the site for raising the ground level

83. As detailed above, except linear components like pipes and sewers, construction activities of all other components will be confined to selected isolated sites (already in use or new). However, the material and waste transport to and from the site will use public roads.

84. Although construction of the of the pipelines and sewers involve quite simple techniques of civil work, the invasive nature of excavation and the subproject locations in the built-up areas of Harihar Town, where there are a variety of human activities, will result to impacts to the environment and sensitive receptors such as residents, businesses, and the community in general. These anticipated impacts are temporary and for short duration. Physical impacts will be reduced by the method of working and scheduling of work, whereby the project components will be (i) constructed by small teams working at a time; (ii) any excavation done near sensitive area like school, religious places and house will be protected as per standard construction practices. These are discussed in detail in the following sections.

85. Prior to starting of work, the contractor should prepare a method statement for pipeline and sewer works. This should be simple and explain the contractor's work process that is actually conducted on site, with safety and safeguard concerns. Method Statement is very important, particularly for pipeline/sewer works along the roads. Method Statement can be prepared for each stretch (say 1 km) /specific site based on the project area. Method Statement should be in a Table format with appended site layout map and cover the following:

- Work description
- No. Of workers (skilled & unskilled)
- Details of Plant, equipment & machinery, vehicles
- Work duration (total, and activity-wise, for example for pipe laying, from excavation to road resurfacing/testing)
- PPE (helmet, gloves, boots, etc) details for each type of work

- Details of materials at each site (type & quantity)
- Risks/hazards associated with the work (for example, Trench excavation will have risks such as trench collapse, persons/vehicles falling into trench, structural risk to nearby buildings, damage to buildings, infrastructure etc)
- Construction waste/debris generated (details & quantity)
- Detail the sequence of work process (step-by-step) including specific details of each work
- Contractor's supervision & management arrangements for the work
- Emergency: Designate (i) responsible person on site, and (ii) first aider
- Typical site layout plan including pipe trenching, placement of material, excavated earth, barricading etc
- The pipeline/sewers are to be laid along the roads, Roads are provided with side drains to carry rain water. The excavated soil, placed along the trench may get disturbed due to wind, rain water and the movement of workers, vehicles and pedestrians, and spill onto road way – disturbing road users, creating dust, road safety issues, etc, and also into nearby open drains. The following should be included in the site layout plan:
  - Provide barricading/security personnel at the site to prevent entry/trespassing of pedestrian/vehicles into the work zone
  - Location of temporary stockpiles and provision of bunds
  - Separation of stockpiles areas with workers/vehicle movement paths to avoid disturbing the stockpiled soil
  - Wetting of soil to arrest dust generation by sprinkling water
- Waste/surplus soil and concrete debris utilization and disposal plan – indicate expected duration of temporary stockpiling along the trench at each site and identify final surplus soil utilization/disposal site in consultation with PIU

2. Impact on Physical Resources

86. **Topography, Soils & Geology**. Subproject activities are not large enough to affect these features; so there will be no impacts.

87. **Sources of Materials**. Significant amount of gravel, sand and aggregate, will be required for this subproject. The construction contractor will be required to:

(i) Use quarry sites and sources permitted by Mines & Geology Department only
(ii) No new quarry sites shall be developed for the subproject
(iii) Verify suitability of all material sources and obtain approval of implementing agency
(iv) Submit on a monthly basis documentation of sources of materials.

88. **Air Quality**. It is most certain that work will be conducted during the dry season, so there is potential for creating dust from the excavation of dry soil, backfilling, transportation to disposal, and from the import and storage of sand/gravel for bedding. Emissions from construction vehicles, equipment, and machinery used for excavation and construction will also induce impacts on the air quality in the construction sites. Anticipated impacts include dusts and increase in concentration of vehicle-related pollutants such as carbon monoxide, sulfur oxides,

particulate matter, nitrous oxides, and hydrocarbons) but temporary and during construction activities only. To mitigate the impacts, construction contractors will be required to:

(i) Consult with PIU on the designated areas for stockpiling of clay, soils, gravel, and other construction materials;
(ii) Damp down exposed soil and any stockpiled on site by spraying with water when necessary during dry weather;
(iii) Bring materials (aggregates, sand, etc gravel) as and when required;
(iv) Use tarpaulins to cover sand and other loose material when transported by vehicles;
(v) Clean wheels and undercarriage of vehicles prior to leaving construction site
(vi) Fit all heavy equipment and machinery with air pollution control devices which are operating correctly; ensure valid Pollution Under Control (PUC) Certificates for all vehicles and equipment used in the construction activity

89. **Noise Levels.** The soils are deep in the subproject area and therefore activities like rock cutting/blasting that generate high noise are not anticipated. In isolated areas where a hard stratum is encountered (especially for deep sewers in some locations going more than 3 m deep) requiring using of pneumatic drills, there will be high noise during the activity. The demolition of existing concrete tanks for WTP will also generate noise. However this site is not located close to habitation. Also, where the pipelines are required to be laid in the roadway, pneumatic drills will be used to break open the road surface. In the central/old town area, where rehabilitation of water pipelines proposed, including around the Harihareswara Temple, most of the roads are surfaced with concrete and/or stone slabs, which need to cut for replacement of pipes. This work will be confined to rehabilitated sections, not entire areas.

90. Pneumatic drills typically generate a equitant noise of 82-98 dBA, at 1 m distance from the activity The sensitive receptors are the general population and socio-cultural institutions in the area. Noise will be for a short term (about 2-3 days at each location) thus impact is minimal and short-term. The construction contractor will be required to:

(i) Plan activities in consultation with the PIU so that activities with the greatest potential to generate noise are conducted during periods of the day which will result in least disturbance;
(ii) Construction work shall be limited to day light hours (6 AM to 6 PM) for all the works located within the town; for facilities outside the town and habitations, the timings may be relaxed with the permission of Harihar CMC and PIU, however no work should be conducted between 10 PM – 6 AM at any site.
(iii) Provide prior information to the local public about the work schedule;
(iv) Ensure that there are no old and sensitive buildings that may come under risk due to the use of pneumatic drills; if there is risk, cut the rocks manually by chiselling;
(v) Minimize noise from construction equipment/pneumatic drills by using silencers, fitting jackhammers with noise-reducing mufflers, and portable street barriers the sound impact to surrounding sensitive receptor; and
(vi) Maintain maximum sound levels not exceeding 80 decibels (dbA) when measured at a distance of 10 m or more from the vehicle/s.

91. **Surface Water Quality.** Harihar topography is primarily plain; the town receives moderate rainfall. The South – West Monsoon winds brings rainfall from June to September while the North – East monsoon winds delivers further rainfall from October to December. The

average annual rainfall received by the town is 1,040 mm. Due to these reasons and also that excavation will not certainly be conducted during rains, there is no impact on drainage and surface water quality is envisaged. In unavoidable case of excavation during monsoons, there may be temporary impacts like flooding of construction sites, mixing of construction waste and material within the runoff, etc. This may lead to silting and blockage of drains and water bodies. These potential impacts are temporary and short-term duration only and to ensure these are mitigated, construction contractor will be required to:

(i) Avoid stockpiling of earth fill especially during the monsoon season unless covered by tarpaulins or plastic sheets
(ii) Prioritize re-use of excess spoils and materials in the construction works. If spoils will be disposed, consult with Implementing Agency on designated disposal areas
(iii) Install temporary silt traps or sedimentation basins along the drainage leading to the water bodies
(iv) Provide temporary bunds for stockpiles and materials
(v) Place storage areas for fuels and lubricants away from any drainage leading to water bodies
(vi) Dispose any wastes generated by construction activities in designated sites; disposal site should be identified prior to the demolition of concrete tanks at WTP;

92. **Groundwater**. Subproject activities do not interfere with groundwater regime, no groundwater abstraction proposed nor do the activities affect groundwater quality.

93. **Landscape and Aesthetics**. The construction work is likely to generate considerable quantities of waste soil. The pipe laying work will generate surplus soil; as small diameter pipes/sewers are proposed it will generate only 5-7% as surplus as most of the soil will be used for refilling after the pipe is laid in trench. Considerable quantities of debris will also be generated from demolition of existing sludge settling tanks at the WTP site. The surplus soil and debris needs to be disposed safely. Indiscriminate disposal of the soil and waste may affect the local environment at the disposal location. These impacts are negative but short-term and reversible by mitigation measures. The construction contractor will be required to:

(i) Prepare and implement Waste Management Plan – it should present how the surplus waste and concrete debris generated will temporarily stocked at the site, transported and disposed properly
(ii) Avoid stockpiling of excess excavated soils as far as possible
(iii) Avoid disposal of any debris and waste soils in the forest areas and in or near water bodies/rivers;
(iv) Coordinate with PIU for beneficial uses of excess excavated soils or immediately dispose to designated areas;
(v) disposal site should be identified prior to the demolition of concrete tanks at WTP; steel recovered from the demolition works should be sent for recycling; concrete debris may be used to raise the ground level or filling low lying areas in the town;

3. Impact on Ecological Resources

94. Subproject sites are located within the town area. There is no natural habitat left in these sites, and therefore no impacts on ecological resources envisaged.

4. Impact on Economic Development

95. **Land Use**. Subproject activities will not affect the land use. All subproject activities are being conducted in the vacant space along the road ways; and other facilities are being developed on government-owned vacant lands.

96. **Accessibility.** Transport infrastructure will be affected by the pipe/sewer laying work, as in the narrower streets there is not enough space for excavated soil to be piled off the road. The road itself may also be excavated in places where there is no available land to locate pipes alongside. Traffic will therefore be disrupted, and in some very narrow streets the whole road may need to be closed for short periods. Potential impact is negative but short term and reversible by mitigation measures. The construction contractor will be required to:

(i) Plan pipeline work in consultation with the traffic police
(ii) Plan work such that trench excavation, pipe laying, and refilling including compacting, at a stretch is completed in a minimum possible time;
(iii) Provide for immediate consolidation of backfilling material to desired compaction - this will allow immediate road restoration and therefore will minimise disturbance to the traffic movement;
(iv) Do not close the road completely, ensure that work is conducted onto edge of the road; allow traffic to move on one line;
(v) In unavoidable circumstances of road closure, provide alternative routes, and ensure that public is informed about such traffic diversions;
(vi) At all work sites public information/caution boards shall be provided – information shall inter-alia include: project name, cost and schedule; executing agency and contractor details; nature and schedule of work at that road/locality; traffic diversion details, if any; entry restriction information; competent official's name and contact for public complaints.
(vii) Prepare a Traffic Management Plan – a template is provided for reference at Appendix 4.

5. Impact on Socio Cultural Resources

97. **Socio Cultural Resources – Chance Finds**. Harihareswara Temple in Harihar town is a protected monument. In general Harihar is an historic place. So there may be a risk that any work involving ground disturbance could uncover and/or damage archaeological and historical remains. Temple is located in the centre of the town, and where habitations are developed all-around long ago. None of the works will disturb/damage/interfere with the protected monument. Excavations for laying of water supply pipelines within 300 m of Temple requires permission from ASI. It will also be necessary to adopt a series of measures, to both avoid sensitive sites and recognize and protect any chance discoveries. These include:

(i) No infrastructure, except unavoidable water supply pipe lines/sewers, shall be constructed within the 300 m of sites.
(ii) Obtain permission from ASI for laying of pipelines within 300 m around the temple
(iii) Ensure that any chance finds are recognized and measures are taken to ensure they are protected and conserved.
(iv) If any chance finds are recognized, the Contractor should:

- Stop work immediately to allow further investigation if any finds are suspected;
- Inform PIU; call in the ASI if a find is suspected, and taking any action they require to ensure its removal or protection in situ.

98. **Impacts on social sensitive areas.** Since the work is being conducted in an urban area, sensitive areas like schools, hospitals and religious centre, the excavation of trenches and pipe/sewer laying activity will create nuisance and health hazard to children and people with ailments. The measures suggested under various heads in this section will minimize the impact in general in all areas however, special attention is necessary at these locations. Following measures shall be implemented in 250 m around the sensitive locations (schools, hospitals, and religious centres:

(i) No material should be stocked in this area; material shall be brought to the site as and when required
(ii) Conduct work manually with small group of workers and less noise; minimize use of equipment and vehicles
(iii) No work should be conducted near the religious places during religious congregations
(iv) Material transport to the site should be arranged considering school timings; material should be in place before school starts;
(v) Notify concerned schools, hospitals etc 2 weeks prior to the work; conduct a 30 minute awareness program on nature of work, likely disturbances and risks and construction work, mitigation measures in place, entry restrictions and dos and don'ts
(vi) Implement all measures suggested elsewhere in this report – dust and noise control, public safety, traffic management, strictly at the sites.

99. **Socio-Economic – Income.** Excavation of trenches and pipe/sewer laying work in the town will obstruct access to residences/commercial buildings adjacent to the pipeline. Disruption of access to commercial establishments may affect livelihood. Since many of the roads are narrow, construction activities may also obstruct traffic. The potential impacts are negative and moderate but short-term and temporary. The construction contractor will be required to:

(i) Leave space for access between mounds of excavated soil
(ii) Provide wooden planks/footbridges for pedestrians and metal sheets for vehicles to allow access across trenches to premises where required
(iii) Consult affected businesspeople to inform them in advance when work will occur
(iv) Address livelihood issues, if any; implement the Resettlement Plan (RP) to address these issues
(v) Provide sign/caution/warning boards at work site indicating work schedule and traffic information; prevent public entry into work sites through barricading and security; and
(vi) Provide sign boards for pedestrians to inform nature and duration of construction works and contact numbers for concerns/complaints.

100. **Socio-Economic – Employment**. Manpower will be required during the 24-months construction stage. This can result to generation of contractual employment and increase in local revenue. Thus potential impact is positive and long-term. The construction contractor will be required to:

(i) Employ at least 50% of the labour force, or to the maximum extent, local persons if manpower is available; and
(ii) Secure construction materials from local market.

101. **Socio-Economic – General.** The benefits of implementing 24 x 7 water supply surpasses the temporary construction impacts. Typical benefits are[3]:

(i) 24x7 supply delivers better quality water for public health - High levels of bacterial contamination are experienced in the first 10 minutes of repressurization of an intermittent system, in some cases persisting for up to 20 minutes. Maintaining full pressure removes that risk.
(ii) 24x7 supply gives significantly better service to all consumers - Access to clean water with improved quantity, timing, and pressure, including effective service to supply pipe „tail ends'.
(iii) 24x7 supply revolutionizes service to the poor - Consumers can access more water for improved health and hygiene while saving time in queuing and carrying, and gainfully using the time thus saved for employment opportunities.
(iv) 24x7 supply converts household coping costs into resources for the service provider - Coping costs that consumers need to incur are reduced; they pay for a better service.
(v) 24x7 supply reduces the burden on water resources - Continuous supply reduces water wastage arising from overflowing storage systems and open taps. It saves on stored household water that is discarded when new supply comes in. Because the network is renewed where needed, it also reduces losses arising from leaks in the old pipes.
(vi) 24x7 supply delivers effective „supply management' and „demand management' - Continuous supply makes possible the effective management of leakage through pressure management and flow measurement. Water conservation is also encouraged through metering and price signals via a volumetric tariff to consumers.
(vii) 24x7 supply enables improved efficiency of service provision - Operational efficiencies are achieved because of a reduced need for valvemen, and a conversion of these jobs into more efficient ones of meter reading and customer care. It also makes possible the management of illegal connections.

102. **Occupational Health and Safety**. 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. The construction contractor will be required to:

(i) Develop and implement site-specific Health and Safety (H and S) Plan which will include measures such as: (a) excluding public from the site; (b) ensuring all workers are provided with and use Personal Protective Equipment; (c) H and S Training[4] for all site personnel; (d) documented procedures to be followed for all site activities; and (e) documentation of work-related accidents;

[3] Water and Sanitation Program, *The Karnataka Urban Water Sector Improvement Project*, Field Note, 2010, Available Online URL: http://www.wsp.org/sites/wsp.org/files/publications/WSP_Karnataka-water-supply.pdf

[4] 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

(ii) All trenches deeper than 2 m shall be protected with wooden bracing to avoid safety risks to workers, public and nearby buildings/structures
(iii) Ensure that qualified first-aid can be provided at all times. Equipped first-aid stations shall be easily accessible throughout the site;
(iv) Provide medical insurance coverage for workers;
(v) Secure all installations from unauthorized intrusion and accident risks;
(vi) Provide supplies of potable drinking water;
(vii) Provide clean eating areas where workers are not exposed to hazardous or noxious substances
(viii) Provide H and 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;
(ix) 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;
(x) Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas;
(xi) Ensure moving equipment is outfitted with audible back-up alarms;
(xii) 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
(xiii) 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.
(xiv) Overall, the contractor should comply with IFS EHS Guidelines on Occupational Health and Safety (this can be downloaded fromhttp://www1.ifc.org/wps/wcm/connect/9aef2880488559a983acd36a6515bb18/2%2BOccupational%2BHealth%2Band%2BSafety.pdf?MOD=AJPERES)

103. **Community Health and Safety**. Hazards posed to the public, specifically in high-pedestrian areas may include traffic accidents and vehicle collision with pedestrians. In most of the cases location of project sites are along the road ways, hence safety risk to community is to be considered. The sewer line work may require deep trenches including in narrow streets; unprotected trench excavation may endanger the stability of nearby buildings/structures. Potential impact is negative but short-term and reversible by mitigation measures. The construction contractor will be required to:

(i) Provide wooden bracing for all deep excavations that may require especially for sewer lines (> 2m); identify buildings at risk prior to start of excavation work and take necessary precautions for safe conduct of work
(ii) Plan material and waste routes to avoid times of peak-pedestrian activities
(iii) Liaise with IA/Harihar TMC in identifying risk areas on route cards/maps

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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.

(iv) Maintain regularly the vehicles and use of manufacturer-approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure
(v) Provide road signs and flag persons to warn of dangerous conditions, for all work sites along the roads
(vi) Overall, the contractor should comply with IFS EHS Guidelines Community Health and Safety (this can be downloaded fromhttp://www1.ifc.org/wps/wcm/connect/dd673400488559ae83c4d36a6515bb18/3%2BCommunity%2BHealth%2Band%2BSafety.pdf?MOD=AJPERES)

104. **Work Camps**. Operation of work camps can cause temporary air and noise pollution from machine operation, water pollution from storage and use of fuels, oils, solvents, and lubricants. Potential impacts are negative but short-term and reversible by mitigation measures. Provision of proper living facilities and basic amenities (water, sanitation, fire safety, health and safety, etc) shall be ensured.

105. The construction contractor will be required to: comply with the following. Overall, the contract should follow the IFC EHS guidelines specific to workers accommodation (this can be downloaded from http://www1.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/ifc+sustainability/publications/publications_gpn_workersaccommodation).

(i) Consult with PIU before locating workers camps/sheds, and construction plants; as far as possible located within reasonable distance of work site
(ii) Minimize removal of vegetation and disallow cutting of trees
(iii) Living facilities shall be built with adequate materials, and should be in good condition and free from rubbish and other refuge
(iv) The camp site should be adequately drained to avoid the accumulation of stagnant water
(v) Provide water and sanitation facilities; water, meeting Indian drinking water standards shall be provided, in adequate quantities (supply of 60- 80 LPCD); all water storage structures must be cleaned regularly and covered properly to avoid any contamination
(vi) Provide separate facilities for men and women; sanitary facilities shall be properly build and well maintained; toilet and bath facilities should be provided on basis of 1 per 15 or less persons
(vii) Train employees in the storage and handling of materials which can potentially cause soil contamination;
(viii) Recover used oil and lubricants and reuse or remove from the site;
(ix) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas;
(x) Remove all wreckage, rubbish, or temporary structures which are no longer required; and
(xi) Report in writing that the camp has been vacated and restored to pre-project conditions before acceptance of work.

E. Operational & Maintenance Impacts

106. The improved water supply system should operate without the need for major repair and maintenance. Although the new sewerage system will need regular maintenance during

operation; with a few simple precautions this can also be conducted without major environmental impacts.

107. The main requirement for maintenance of the new infrastructure will be for the detection and repair of leaks. The generally flat topography and the usage of good quality DI/HDPE pipes should mean that pipeline breaks are very rare, and that leaks are mainly limited to joints between pipes. The repair of household connections and the provision of new connections to increase the number of people supplied should greatly reduce the incidence of illegal connections, which are often a major source of leaks.

108. The bulk meters will allow monitoring of amounts of water flowing through individual parts of the network, which will pinpoint areas where there are leaks. A small Leak Detection Team will then visit these areas with audio devices to locate individual leaks, which will then be repaired in essentially the same way that the pipes were installed. Trenches will be dug to reveal the leaking area and the faulty connection will be re-fitted, or the pipe will be removed and replaced if necessary.

109. The new sewerage system provided under the Investment Program will collect and treat domestic wastewater and sewage produced by two sewerage districts. The proposed treatment plant under the KMRP will treat the sewage collected from the town. The discharge after treatment will comply with Indian wastewater standards.

110. The sewer pipes will not function without maintenance, as silt inevitably collects in areas of low flow over time. The project will therefore provide equipment for cleaning the sewers, including buckets and winches to remove silt via the inspection manholes, diesel-fuelled pumps to remove blockages, etc. Piped sewers are not 100% watertight and leaks can occur at joints. The measures suggested for consideration during the design of sewer network will help in proper functioning of the system Any repairs will be conducted by sealing off the affected sewer and pumping the contents into tankers, after which the faulty section will be exposed and repaired following the same basic procedure as when the sewer was built. Trenches will be dug around the faulty section and the leaking joint will be re-sealed, or the pipe will be removed and replaced.

111. At sewage lift /pumping stations, the wet well receive the wastewater from the catchment area. A screen provided at the inlet will collect solid materials. The screened sewage will flow into the collection well, and the same lifted and pumped into the main sewer for conveying it to the wastewater treatment plant.

112. It is suggested to develop an Emergency Response System (ERS) for the sewerage system leaks, burst and overflows and power failures at sewage pumping stations, etc. A Template for ERS is provided in Appendix 5. Sensitize and train staff in implementation of ERS.

113. The proposed community toilets will not function without regular cleaning and maintenance. Therefore there is a need to develop and implement operation and maintenance (O&M) plans for community toilets with participation from the community. A memorandum of understanding (MoU) between Harihar CMC and community will be reached prior to any construction and operation of community toilets. As a minimum, the O&M plan should specify (i) cleaning procedures and frequency; (ii) responsible personnel; (iii) maintenance and repairs schedule; (iv) emergency contact numbers etc.

114. **General**. The work will follow the same procedures during the construction stage. The Implementing Agency/Harihar CMC needs to prepare Operation and Maintenance (O&M) Manual and operate and maintain the system as per the manual. Preparation of O&M Manual may be included in the scope of DPR consultants (for item rate contracts) or Construction Contractor (for design-build or turnkey contracts). Measures to minimize the disturbance to general public/ business and dust control, as followed during the construction, is to be implemented during maintenance as well. Operation of sewage pumping station will be simple, but requires skilled workforce. It will be ensured that sewage pump stations will be operated by trained staff, and a back-up power facility will be provided to ensure uninterrupted operation.

115. The issues related to quantity of water available from source (i.e. source sustainability) and water quality are being looked into in detail by the "sister" TA[5] to this TA. The "sister" TA has within its scope the preparation of a river water balance to ensure the adequacy of raw water for public water supply. Therefore impacts of increased water abstraction from the river are not considered in this report. It is assumed that the measures suggested by the said TA through the IWRM will make sure that adequate quantity of water will be made available for Harihar water supply without affecting the downstream users and the river ecosystem.

116. **Operation of Water Treatment Plant (WTP)**. This involves various processes: pre-chlorination, alum dosing, flash mixing, flocculation, clarification, filtration, post-chlorination, wash water re-circulation and sludge disposal systems prechlorination, aeration, alum-mixing, flocculation, clarification, filtration, and disinfection. Chemicals such as Alum and chlorine will be used in the treatment processes.

117. The safety risk due to handling of large quantities of chlorine at the WTP should be negligible if all the suggested safety features and equipment to meet with any accidental eventuality are included in the design and development of the facility. During the operation phase, it is necessary that:

(i) chlorinator facility is operated only by trained staff and as per the standard operating procedures
(ii) In case of any accident and/or maintenance activity, the staff should follow documented procedures only
(iii) It is suggested to develop an Emergency Response System (ERS) for the chlorine leakage, . A Template for ERS is provided in Appendix 5. Sensitize and train staff in implementation of ERS.

118. The provision of an improved and expanded water supply and sewerage system is expected to have indirect economic benefits from the expected improvement in the health, environment and economic well-being.

119. The citizens of the Harihar Town will be the major beneficiaries of this subproject. With the improved water supply, they will be provided with a constant supply of better quality water, piped into their homes. The sewerage system will remove the human waste from those areas served by the network rapidly and treated to an acceptable standard. With the construction of toilets and targeted awareness program on sanitation proposed, in addition to improved

[5] Overall water resource balance in Tungabhadra River Basin and measures for assurance of water availability within the Tungbhadra River for public water supply and other uses will be proposed within KISWRMP Water Resource PPTA. Government of India policy is for priority to be given to public water supply and it is therefore assumed that adequate water resources will be available without effecting current downstream uses.

environmental conditions, the subproject will improve the over-all health condition of the town. Diseases of poor sanitation, such as diarrhoea and dysentery, should be reduced, so people should 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.

VI. INSTITUTIONAL ARRANGEMENTS

A. Implementation Arrangements

120. **Executing Agency (EA)**: Karnataka Urban Infrastructure Development & Finance Corporation (KUIDFC) is the executing agency (EA) responsible for implementing the Investment Program. Investment Program implementation activities will be monitored by KUIDFC through a separate Investment Program Management Unit (PMU) for the IWRM Project, which will be set-up within KUIDFC. The Managing Director, KUIDFC will head the PMU and will be assisted by an Executive Director at the Regional office of KUIDFC at Dharwad to oversee the Investment Program progress. A team of senior technical, administrative and financial officials will assist the Executive Director in controlling and monitoring Investment Program implementation activities.

121. The Executive Director will be supported by a new Divisional Office established at Davangere. A Consultant Team will be appointed by EA and the team will work under the Divisional Programme Director (DPD) and will be involved in project planning, preparation of subproject and cost estimates, co-ordination, technical guidance and supervision, financial control, training and overall subproject management

122. All Investment Program decisions will be made by the Executive Director who shall operate from the PMU, Dharwad; only interactions with GoK, GoI and ADB shall be conducted through the KUIDFC office at Bangalore.

123. **Implementing Agency (IA):** The ultimate implementation responsibility lies with respective ULBs (in this case Harihar City Municipal Council). A Programme Implementation Unit (PIU) will be established in each ULB unless one or more of the ULBs decide to form a single PIU.

124. Other than the above institutional setup, District Level Programme Steering Committee will be set up in each district to monitor implementation of subprojects and institutional reforms. The District Level Programme Steering Committee shall consist of Deputy Commissioner of District, Divisional Program Director from concerned divisional office, Municipal Commissioners' / Chief Officers of Investment programme ULB and President / Chair of investment programme ULB. The District Level Programme Steering Committee will report to the PMU Executive Director: Dharwad.

125. At the Executing Agency (i.e. KUIDFC), environmental issues will be coordinated centrally by an environmental specialist at manager-level (designated as Manager-Environment), reporting to the General Manager (Technical). Manager – Environment (supported by an Environmental Expert (Assistant Manager Rank) will ensure that all subprojects comply with environmental safeguards. The IEE/EIA reports will be prepared by the Consultant Team, and will be reviewed by the Manager-Environment as per the ADB's Environmental Guidelines and forwarded to ADB for review and approval. In case of IEE reports**,** the ADB could delegate approval of IEE reports fully to the PMU after reviewing the first two reports. However, all the EIA reports shall be sent to ADB for approval. The Manager-

Environment will be assisted by an Environmental Specialist, who will be appointed by EA in divisional office at Davanagere.

126. The responsibility fulfilling environmental requirements of GoI/GoK and conducting required level of environmental assessment as per ADB guidelines lies with the implementing agency, i.e. Renebennur CMC. The Consultant Team will assist the CMC in this regard.

127. The mitigation measures identified through IEE/EIA are incorporated into the Investment Program cycle. Mitigation measures, which are to be implemented by the Contractor, shall form part of the Contract Documents. The other mitigation measures are undertaken by the IA (itself or in assistance with the Consultant Team) as specified in the IEE. During the construction phase, environmental specialist of Consultant Team will monitor the implementation of the EMP and report to the PMU. The Implementation of EMP and other environmental related measures and the results of environmental monitoring conducted during implementation will be reported to ADB through semi annual Environmental Monitoring Reports. These will also be made available on executing agency (KUIDFC) website for wider public access.

VII. ENVIRONMENTAL MANAGEMENT PLAN

A. Summary Environmental Impact & Mitigation Measures

128. Tables 10 to 12 show the potential adverse environmental impacts, proposed mitigation measures, responsible parties, and estimated cost of implementation. This EMP will be included in the bid documents and will be further reviewed and updated during implementation.

Table 10: Summary Environmental Impacts & Mitigation Measures – Pre-Construction

Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost of mitigation
Nuisance due to location of sewage pumping stations	• Provide backup power facilities for continuous and uninterrupted pumping of sewage; ensure that anaerobic conditions are not created in wet well through continues operation • Provide green buffer zone around the facility – at least a 5m strip of land around the facility shall be planted with trees; this will also improve the aesthetic appearance of the facility	PIU and Design Consultant	$ 2,500 for plantation and 3 year maintenance
Improve of aesthetic appears of WTP site	Plant trees in the WTP facility	PIU and Design Consultant	$ 5,000 for plantation and 3 year maintenance
Disturbance/damage to existing utilities on the sites (Telephone lines, electric poles and wires, water lines within proposed project sites)	• Identify and include locations and operators of these utilities in the detailed design documents to prevent unnecessary disruption of services during construction phase; • Conduct detailed site surveys with the construction drawings and discuss with the respective agencies during the construction phase before ground clearance;;and • Require construction contractors to prepare a contingency plan to include actions to be done in case of unintentional interruption of services. In case of disruption of water supply, alternative supply, through tankers, shall be provided	PIU and Design Consultant	Part of project cost
Source sustainability	Establish adequate water availability and ensure that necessary provision is made for Harihar water supply through government statutes as required before the start of detailed design.	PIU	NA
Risk due to handling and application of chlorine	Design and develop chlorination facility with all safety features and equipment to meet with any accidental eventuality, which may include • Chlorine neutralization pit with a lime slurry feeder • Proper ventilation, lighting, entry and exit facilities • Facility for isolation in the event of major chlorine leakage • Personal protection and safety equipment for the operators in the chlorine plant • Visible and audible alarm facilities to alert chlorine gas leak • Laboratory facility shall not be housed within the chlorination facility • Provide training to the staff in safe handling and application of chlorine; this shall be included in the contract of Chlorinator supplier • Supplier of Chlorinator equipment shall provide standard operating manual for safe operation and as well as maintenance and repairs;	PIU/IA	Part of project cost

Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost of mitigation
	preferably these shall be provided both in English and Kannada Languages • Develop an emergency response system for events like chlorine leakage – an ERS template is provided at Appendix 5.During operation, it shall be ensured that chlorinator facility is operated only by trained staff and as per the standard operating procedures		
Design of pumps (design and procure pumps with higher efficiency to optimize the power consumption)	• Design pumping equipment with maximum efficiency to optimize the power consumption • Various combinations of number of pumps, stages, motor speed should be considered to select the best pump with ideal specific speeds. • Specific speeds of the pumps should be selected to achieve maximum efficiency of pumps. As per American Standard for DS Centrifugal Pumps issued by Hydraulic Institute, New Jersey, the specific speed for Pumps should be in the range of 2000 to 3000 for attaining optimum efficiency. The pumps should be designed accordingly. • Attainable efficiency for procuring the pumps and motors should be considered as 88 to 92 percent for pumps and 94 percent for motors. It is proposed that during the procurement, the evaluation of bid shall also be in terms of efficiency. • The pumps shall conform to IS 1710 – 1989 Specification for Pump and IS 5120–1992 Technical Requirements for Roto-dynamic Special Purpose Pumps and tested to class 3 of IS: 9137-1978 Code for Acceptance Tests for Centrifugal, Mixed Flow and Axial Flow Pumps.	PIU and Design Consultant	Part of project cost
Sewer network	• Limit the sewer depth where possible. • Sewers shall be laid away from water supply lines and drains (at least 1 m, wherever possible); • In all cases, the sewer line should be laid deeper than the water pipeline (the difference between top of the sewer and bottom of water pipeline should be at least 300 mm) • In unavoidable, where sewers are to be laid close to storm water drains or canals or natural streams, appropriate pipe material shall be selected (stoneware pipes shall be avoided) • For shallower sewers, use small inspection chambers in lieu of manholes; • Design manhole covers to withstand anticipated loads & ensure that the covers can be readily replace if broken to minimize silt/garbage entry • Ensure sufficient hydraulic capacity to accommodate peak flows &	PIU and Design Consultant	Part of project cost

Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost of mitigation
	adequate slope in gravity mains to prevent build up of solids and hydrogen sulfide generation • Equip pumping stations with a backup power supply, such as a diesel generator, to ensure uninterrupted operation during power outages, and conduct regular maintenance to minimize service interruptions. Consider redundant pump capacity in critical areas • Establish routine maintenance program, including: o Regular cleaning of grit chambers and sewer lines to remove grease, grit, and other debris that may lead to sewer backups. Cleaning should be conducted more frequently for problem areas. o Inspection of the condition of sanitary sewer structures and identifying areas that need repair or maintenance. Items to note may include cracked/deteriorating pipes; leaking joints or seals at manhole; frequent line blockages; lines that generally flow at or near capacity; and suspected infiltration or exfiltration; and o Monitoring of sewer flow to identify potential inflows and outflows • Conduct repairs prioritized based on the nature and severity of the problem. Immediate clearing of blockage or repair is warranted where an overflow is currently occurring or for urgent problems that may cause an imminent overflow (e.g. pump station failures, sewer line ruptures, or sewer line blockages); • Review previous sewer maintenance records to help identify "hot spots" or areas with frequent maintenance problems and locations of potential system failure, and conduct preventative maintenance, rehabilitation, or replacement of lines as needed; • When a spill, leak, and/or overflow occurs, keep sewage from entering the storm drain system by covering or blocking storm drain inlets or by containing and diverting the sewage away from open channels and other storm drain facilities (using sandbags, inflatable dams, etc.). Remove the sewage using vacuum equipment or use other measures to divert it back to the sanitary sewer system. • Develop Emergency Response Plan for all emergencies such as leaks, overflows, bursts; a template of ERP is provided at Appendix 5		
Community toilets – operation & maintenance impacts	• Develop and implement operation and maintenance (O&M) plans for community toilets with participation from the community. • A memorandum of understanding (MoU) between Ranebennur CMC and community will be reached prior to any construction and operation of community toilets.	Harihar CMC, PIU and Design Consultant	Part of project cost

Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost of mitigation
	• As a minimum, the O&M plan should specify (i) cleaning procedures and frequency; (ii) responsible personnel; (iii) maintenance and repairs schedule; (iv) emergency contact numbers etc.		

Table 11: Summary Environmental Impacts & Mitigation Measures – Construction

Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost of mitigation
Construction impacts	Prepare and submit a Method Statement for pipeline and sewer works in a Table format with appended site layout map and cover the following: • Work description; No. Of workers (skilled & unskilled); Details of Plant, equipment & machinery, vehicles • Work duration (total, and activity-wise, for example for pipe laying, from excavation to road resurfacing/testing) • PPE (helmet, gloves, boots, etc) details for each type of work • Details of materials at each site (type & quantity) • Risks/hazards associated with the work (for example, Trench excavation will have risks such as trench collapse, persons/vehicles falling into trench, structural risk to nearby buildings, damage to buildings, infrastructure etc) • Construction waste/debris generated (details & quantity) • Detail the sequence of work process (step-by-step) including specific details of each work • Contractor's supervision & management arrangements for the work • Emergency: Designate (i) responsible person on site, and (ii) first aider • Typical site layout plan including pipe trenching, placement of material, excavated earth, barricading etc • The pipeline/sewers are to be laid along the roads, Roads are provided with side drains to carry rain water. The excavated soil, placed along the trench may get disturbed due to wind, rain water and the movement of workers, vehicles and pedestrians, and spill onto road way – disturbing road users, creating dust, road safety issues, etc, and also into nearby open drains. The following should be included in the site layout plan: ✓ Provide barricading/security personnel at the site to prevent entry/trespassing of pedestrian/vehicles into the work zone ✓ Location of temporary stockpiles and provision of bunds ✓ Separation of stockpiles areas with workers/vehicle movement paths to avoid disturbing the stockpiled soil ✓ Wetting of soil to arrest dust generation by sprinkling water Waste/surplus soil utilization and disposal plan – indicate expected duration of temporary	Contractor	Good construction practice to be followed by contractor – no additional costs

Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost of mitigation
	stockpiling along the trench at each site and identify final surplus soil utilization/disposal site in consultation with PIU		
Disturbance/ damage to existing utilities on the sites (Telephone lines, electric poles and wires, water lines within proposed project sites)	• Identify and include locations and operators of these utilities in the detailed design documents to prevent unnecessary disruption of services during construction phase	PIU	Part of project cost
	• Conduct detailed site surveys with the construction drawings and discuss with the respective agencies during the construction phase before ground clearance; • Prepare a contingency plan to include actions to be done in case of unintentional interruption of services. • In case of disruption of water supply, alternative supply, through tankers, shall be provided; water may be made available by the Harihar CMC, but it will the responsibility of contractor to supply to affected people	Construction Contractor	
Construction work camps, stockpile areas, storage areas, and disposal areas (disruption to traffic flow and sensitive areas and receptors)	• Prioritize areas within or nearest possible vacant space in the subproject location; • Construction work camps shall be located at least 200 m from residential areas • Do not consider residential areas; for stockpiling the waste/surplus soil; • Material stockpiles shall be protected by bunds during the monsoon to arrest the silt laden runoff into drains	Construction Contractor	Good construction practice to be followed by contractor – no additional costs
Source of construction materials (Extraction of materials can disrupt natural land contours and vegetation resulting in	• Contractor should obtain material from existing mines approved/licensed by Mines and Geology Department/ Revenue Department. • Verify suitability of all material sources and obtain approval of implementing agency • No new quarry sites shall be developed for the subproject purpose • Submit a monthly statement of construction material procured indicating material type, source and quantity.	Construction Contractor	Good construction practice to be followed by contractor – no additional costs

Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost of mitigation
accelerated erosion, disturbance in natural drainage patterns, ponding and water logging, and water pollution)			
Air quality (dust and emissions from construction activity may degrade the air quality)	• Consult with PIU on the designated areas for stockpiling of clay, soils, gravel, and other construction materials; • Construction work shall be limited to day light hours (6 AM to 6 PM) for all the works located within the town; for facilities outside the town/habitation (i.e. WWTP) the timings may be relaxed with the permission of Harihar CMC and PIU, however no work should be conducted between 10 PM – 6 AM at any site. • Damp down exposed soil and any stockpiled on site by spraying with water when necessary during dry weather; • Bring materials (aggregates, sand, etc gravel) as and when required; • Use tarpaulins to cover sand and other loose material when transported by vehicles; • Clean wheels and undercarriage of vehicles prior to leaving construction site • Fit all heavy equipment and machinery with air pollution control devices which are operating correctly; ensure valid Pollution Under Control (PUC) Certificates for all vehicles and equipment used in the construction activity	Construction Contractor	Good construction practice to be followed by contractor – no additional costs
High noisy construction activities may have adverse impacts on sensitive receptors and structures	• Plan activities in consultation with the PIU so that activities with the greatest potential to generate noise are conducted during periods of the day which will result in least disturbance; • Provide prior information to the local public about the work schedule; • Ensure that there are no old and sensitive buildings that may come under risk due to the use of pneumatic drills; if there is risk, cut the rocks manually by chiselling; • Minimize noise from construction equipment by using vehicle silencers, fitting jackhammers with noise-reducing mufflers, and portable street barriers the sound impact to surrounding sensitive receptor; and • Maintain maximum sound levels not exceeding 80 decibels (dbA) when measured at a distance of 10 m or more from the vehicle/s	Construction Contractor	Good construction practice to be followed by contractor – no additional costs
Impacts on surface	• Avoid stockpiling of earth fill especially during the monsoon season unless covered by tarpaulins or plastic sheets	Construction Contractor	Good construction

Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost of mitigation
drainage and water quality due to contaminated runoff from construction areas in monsoon	• Stockpiles shall be provided with temporary bunds • Prioritize re-use of excess spoils and materials in the construction works. If spoils will be disposed, consult with Implementing Agency on designated disposal areas • Install temporary silt traps or sedimentation basins along the drainage leading to the water bodies • Place storage areas for fuels and lubricants away from any drainage leading to water bodies • Dispose any wastes generated by construction activities in designated sites; disposal site should be identified prior to the demolition of concrete tanks at WTP		practice to be followed by contractor – no additional costs
Impacts on landscape and aesthetics due to construction activity	• Prepare and implement Waste Management Plan – it should present how the surplus waste generated will temporarily stocked at the site, transported and disposed properly • Avoid stockpiling of excess excavated soils as far as possible • Avoid disposal of any debris and waste soils in the forest areas and in or near water bodies/rivers; • Coordinate with PIU for beneficial uses of excess excavated soils or immediately dispose to designated areas • Disposal site should be identified prior to the demolition of concrete tanks at WTP; steel recovered from the demolition works should be sent for recycling; concrete debris may be used to raise the ground level or filling low lying areas in the town;	Construction Contractor	Good construction practice to be followed by contractor
Hindrance to traffic movement	• Plan pipeline (water & sewer lines) work in consultation with the traffic police • Plan work such that trench excavation, pipe laying, and refilling including compacting, at a stretch is completed in a minimum possible time; • Provide for immediate consolidation of backfilling material to desired compaction - this will allow immediate road restoration and therefore will minimise disturbance to the traffic movement; • Do not close the road completely, ensure that work is conducted onto edge of the road; allow traffic to move on one line; • In unavoidable circumstances of road closure, provide alternative routes, and ensure that public is informed about such traffic diversions; • At all work sites public information/caution boards shall be provided – information shall inter-alia include: project name, cost and schedule; executing agency and contractor details; nature and schedule of work at that road/locality; traffic diversion details, if any; entry restriction information; competent official's name and contact for public complaints. • Prepare a Traffic Management Plan – a template is provided for reference at Appendix 4.	Construction Contractor	Good construction practice to be followed by contractor – no additional costs
Nuisance/ disturbance to sensitive	• No material should be stocked in this area; material shall be brought to the site as and when required	Construction Contractor	Good construction practice to

Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost of mitigation
areas (schools, hospitals and religious places) due construction work in the proximity (within 250 m of such place)	• Conduct work manually with small group of workers and less noise; minimize use of equipment and vehicles • No work should be conducted near the religious places during religious congregations • Material transport to the site should be arranged considering school timings; material should be in place before school starts; • Notify concerned schools, hospitals etc 2 weeks prior to the work; conduct a 30 minutes awareness program at on nature of work, likely disturbances and risks and construction work, mitigation measures in place, entry restrictions and dos and don'ts • Implement all measures suggested elsewhere in this report – dust and noise control, public safety, traffic management, strictly at the sites.		be followed by contractor – no additional costs
Impediment of access to houses and business	• Leave space for access between mounds of excavated soil • Provide wooden planks/footbridges for pedestrians and metal sheets for vehicles to allow access across trenches to premises where required • Consult affected businesspeople to inform them in advance when work will occur • Address livelihood issues; implement the Resettlement Plan (RP) to address these issues • Provide sign/caution/warning boards at work site indicating work schedule and traffic information; prevent public entry into work sites through barricading and security; and • Provide sign boards for pedestrians to inform nature and duration of construction works and contact numbers for concerns/complaints.	Construction Contractor	Good construction practice to be followed by contractor – no additional costs
Employment generation	• Employ at least 50% of the labour force, or to the maximum extent, local persons if manpower is available • Secure construction materials from local market.	Construction Contractor	-
Workers occupational health & safety	• Develop and implement site-specific Health and Safety (H and S) Plan which will include measures such as: (a) excluding public from the site; (b) ensuring all workers are provided with and use Personal Protective Equipment; (c) H and S Training for all site personnel; (d) documented procedures to be followed for all site activities; and (e) documentation of work-related accidents; • All trenches deeper than 2 m shall be protected with wooden bracing to avoid safety risks to workers, public and nearby buildings/structures • Ensure that qualified first-aid can be provided at all times. Equipped first-aid stations shall be easily accessible throughout the site; • Provide medical insurance coverage for workers; • Secure all installations from unauthorized intrusion and accident risks; • Provide supplies of potable drinking water; • Provide clean eating areas where workers are not exposed to hazardous or noxious substances	Construction Contractor	Good construction practice to be followed by contractor – no additional costs

Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost of mitigation
	• Provide H and 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; • 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; • 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. • Overall, the contractor should comply with IFS EHS Guidelines on Occupational Health and Safety (this can be downloaded from http://www1.ifc.org/wps/wcm/connect/9aef2880488559a983acd36a6515bb18/2%2BOccupational%2BHealth%2Band%2BSafety.pdf?MOD=AJPERES)		
Community health & safety	• Provide wooden bracing for all deep excavations (> 2m); identify buildings at risk prior to start of excavation work and take necessary precautions for safe conduct of work • Plan material and waste routes to avoid times of peak-pedestrian activities • Liaise with Harihar CMC in identifying risk areas on route cards/maps; identify buildings at risk prior to start of excavation work and take necessary precautions for safe conduct of work • Maintain regularly the vehicles and use of manufacturer-approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure • Provide road signs and flag persons to warn of dangerous conditions, for all the sites along the roads • Overall, the contractor should comply with IFS EHS Guidelines Community Health and Safety (this can be downloaded from http://www1.ifc.org/wps/wcm/connect/dd673400488559ae83c4d36a6515bb18/3%2BCommunity%2BHealth%2Band%2BSafety.pdf?MOD=AJPERES	Construction Contractor	Good construction practice to be followed by contractor – no additional costs
Temporary worker camps	• The contractor should establish and operate the temporary worker camps in compliance with IFC EHS Guidelines specific to workers accommodation ((this can be downloaded from	Construction Contractor	Good construction practice to

Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost of mitigation
	http://www1.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/ifc+sustainability/publications/publications_gpn_workersaccommodation), including the following • Consult with PIU before locating workers camps/sheds, and construction plants; ; as far as possible located within reasonable distance of work site • Minimize removal of vegetation and disallow cutting of trees • Living facilities shall be built with adequate materials, and should be in good condition and free from rubbish and other refuge • The camp site should be adequately drained to avoid the accumulation of stagnant water • Provide water and sanitation facilities; water, meeting Indian drinking water standards shall be provided, in adequate quantities (supply of 60- 80 LPCD); all water storage structures must be cleaned regularly and covered properly to avoid any contamination • Provide separate facilities for men and women; sanitary facilities shall be properly build and well maintained; toilet and bath facilities should be provided on basis of 1 per 15 or less persons • Train employees in the storage and handling of materials which can potentially cause soil contamination; • Recover used oil and lubricants and reuse or remove from the site; • Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas; • Remove all wreckage, rubbish, or temporary structures which are no longer required • Report in writing that the camp has been vacated and restored to pre-project conditions before acceptance of work.		be followed by contractor – no additional costs
Works near protected monument	• No infrastructure, except unavoidable water supply pipe lines/sewers, shall be constructed within the 300 m of sites. • Obtain permission from ASI for laying of pipelines within 300 m around the temple • Ensure that any chance finds are recognized and measures are taken to ensure they are protected and conserved. • If any chance finds are recognized, the Contractor should: o Stop work immediately to allow further investigation if any finds are suspected; o Inform PIU; call in the ASI if a find is suspected, and taking any action they require to ensure its removal or protection in situ.	PIU - Construction Contractor	NA

Table 12: Summary Environmental Impacts & Mitigation Measures – Operation

Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Cost of mitigation
General maintenance and repair work of water supply and sewer system (nuisance and disturbance to people, disruption services etc)	• Follow standard procedures as prescribed by O&M Manual • Ensure that all necessary equipment and tools are available for regular maintenance, especially for sewer network • Ensure there is overflow of sewers due to blockages or leaks; in case of occurrence, attend to these at the earliest • Implement all necessary mitigation measures suggested during construction (to avoid disturbance and inconvenience to people, business and traffic) • Ensured that chlorinator facility is operated only by trained staff and as per the standard operating procedures; in case of any accident and/or maintenance activity, the staff should follow documented procedures only • Ensure operation and maintenance of sewer network and pumping stations as per the standard operating procedures to avoid, over flows, blockages, etc and immediately conducting the maintenance work in case of such occurrences • Waste from screens at Sewage Pumping Station shall be sent regularly to STP or landfill site for safe disposal • Implement Emergency Response System (ERS template is provided in Appendix 5 for reference) for events such as chlorine leak,and burst/leaks/overflows of sewers etc) • Implement operation and maintenance (O&M) plans for community toilets with participation of the community.	Harihar CMC	Part of project O&M cost

B. Environmental Monitoring Plan

129. A program of monitoring will be conducted to ensure that all parties take the specified action to provide the required mitigation, to assess whether the action has adequately protected the environment, and to determine whether any additional measures may be necessary. Regular monitoring of implementation measures by construction contractors will be conducted by the PIU with Consultant Team's support. Periodic monitoring and overseeing of implementation of mitigation measures will be PMU. Monitoring during operation stage will be conducted by the Operating Agency, Harihar CMC.

130. Most of the mitigation measures are fairly standard methods of minimizing disturbance from building in urban areas (maintaining access, planning work to minimize public inconvenience and traffic disruptions, finding uses for waste material, etc). Monitoring of such measures normally involves making observations in the course of site visits, although some require more formal checking of records and other aspects. Sampling and quality monitoring of water supplied will be conducted regularly. Laboratory facilities are included in the subproject

131. Following table shows the proposed Environmental Monitoring Plan for this subproject, which specifies the various monitoring activities to be conducted during different phases of the project. The EMP describes: (i) mitigation measures, (ii) location, (iii) measurement method, (iv) frequency of monitoring and (v) responsibility (for both mitigation and monitoring).

Table 13: Environmental Monitoring Plan

Mitigation measures	Location	Responsible for Mitigation	Monitoring Method & Parameters	Monitoring Frequency	Responsible for monitoring	Cost of monitoring
Pre-Construction						
Confirm availability of water (through the PPTA for water resources under IWRM Project) to meet the subproject demand and downstream needs before the start of detailed design.	-	PIU	Review of study recommendations; confirmation on water availability for Harihar CMC; and government's acceptance of recommendations and water allocation to Harihar	Once before start of detailed design	PMU	NA
• No infrastructure, except unavoidable water supply pipe lines/sewers, shall be constructed within the 300 m of sites. • Obtain permission from ASI for laying of pipelines within 300 m around the temple • Ensure that any chance finds are recognized and measures are taken to ensure they are protected and conserved. • If any chance finds are recognized, the Contractor should: o Stop work immediately to allow further investigation if any finds are suspected; Inform PIU; call in the ASI if a find is suspected, and taking any action they require to ensure its removal or protection in situ.	-	PIU	Review & check the inclusion/ provision in DPR, as appropriate	Once before DPR approval	PMU	NA
Provide backup power facilities for continuous and uninterrupted pumping of sewage; ensure that anaerobic conditions are not created in wet well through continues operation Provide green buffer zone around the facility	-	PIU	Review & check the inclusion/ provision in DPR, as appropriate	Once before DPR approval	PMU	NA

Mitigation measures	Location	Responsible for Mitigation	Monitoring Method & Parameters	Monitoring Frequency	Responsible for monitoring	Cost of monitoring
– at least a 5m strip of land around the facility shall be planted with trees; this will also improve the aesthetic appearance of the facility						
Plant trees in the WTP facility	-	PIU	Review & check the inclusion/ provision in DPR, as appropriate	Once before DPR approval	PMU	NA
Design and develop chlorination facility with all safety features and equipment to meet with any accidental eventuality, which may include • Chlorine neutralization pit with a lime slurry feeder • Proper ventilation, lighting, entry and exit facilities • Facility for isolation in the event of major chlorine leakage • Personal protection and safety equipment for the operators in the chlorine plant • Visible and audible alarm facilities to alert chlorine gas leak • Laboratory facility shall not be housed within the chlorination facility • Provide training to the staff in safe handling and application of chlorine; this shall be included in the contract of Chlorinator supplier • Supplier of Chlorinator equipment shall provide standard operating manual for safe operation and as well as maintenance and repairs; preferably these shall be provided both in English and Kannada Languages Develop an emergency response system for events like chlorine leakage – an ERS	-	PIU	Review & check the inclusion/ provision in DPR, as appropriate	Once before DPR approval	PMU	NA

Mitigation measures	Location	Responsible for Mitigation	Monitoring Method & Parameters	Monitoring Frequency	Responsible for monitoring	Cost of monitoring
template is provided at Appendix 5.						
Identify and include locations and operators of the utilities in the detailed design documents	-	PIU / Consultant Team	Review & check the inclusion/ provision in DPR, as appropriate	Once before DPR approval	PMU	NA
Require construction contractors to prepare a contingency plan	-	Contractor	Review the contingency plan	Once prior to the relocation of utilities	PIU	NA
Design pumping equipment with maximum efficiency to optimize the power consumption		PIU / Consultant Team	Review & check the inclusion/ provision in DPR, as appropriate	Once before DPR approval	PMU /PMC	NA
Various combinations of number of pumps, stages, motor speed should be considered to select the best pump with ideal specific speeds.		PIU / Consultant Team	Review & check the inclusion/ provision in DPR, as appropriate	Once before DPR approval	PMU /PMC	NA
Specific speeds of the pumps should be selected to achieve maximum efficiency of pumps.		PIU / Consultant Team	Review & check the inclusion/ provision in DPR, as appropriate	Once before DPR approval	PMU /PMC	NA
Attainable efficiency for procuring the pumps and motors should be considered as 88 to 92 % for pumps and 94 % for motors. It is proposed that during the procurement, the evaluation of bid shall also be in terms of efficiency.		PIU / Consultant Team	Review & check the inclusion/ provision in DPR, as appropriate	Once before DPR approval	PMU /PMC	NA
The pumps shall conform to IS 1710 – 1989 Specification for Pump and IS 5120–1992 Technical Requirements for Roto-dynamic Special Purpose Pumps and tested to class 3 of IS: 9137-1978 Code for Acceptance Tests for Centrifugal, Mixed Flow and Axial Flow Pumps.		PIU / Consultant Team	Review & check the inclusion/ provision in DPR, as appropriate	Once before DPR approval	PMU /PMC	NA
Limit the sewer depth where possible.		PIU / Consultant Team	Review & check the inclusion/ provision in DPR, as appropriate	Once before DPR approval	PMU /PMC	NA

Mitigation measures	Location	Responsible for Mitigation	Monitoring Method & Parameters	Monitoring Frequency	Responsible for monitoring	Cost of monitoring
Sewers shall be laid away from water supply lines and drains (at least 1 m, wherever possible);		PIU / Consultant Team	Review & check the inclusion/ provision in DPR, as appropriate	Once before DPR approval	PMU /PMC	NA
In all cases, the sewer line should be laid deeper than the water pipeline (the difference between top of the sewer and bottom of water pipeline should be at least 300 mm)		PIU / Consultant Team	Review & check the inclusion/ provision in DPR, as appropriate	Once before DPR approval	PMU /PMC	NA
In unavoidable, where sewers are to be laid close to storm water drains or canals or natural streams, appropriate pipe material shall be selected (stoneware pipes shall be avoided)		PIU / Consultant Team	Review & check the inclusion/ provision in DPR, as appropriate	Once before DPR approval	PMU /PMC	NA
For shallower sewers, use small inspection chambers in lieu of manholes;		PIU / Consultant Team	Review & check the inclusion/ provision in DPR, as appropriate	Once before DPR approval	PMU /PMC	NA
Design manhole covers to withstand anticipated loads & ensure that the covers can be readily replace if broken to minimize silt/garbage entry		PIU / Consultant Team	Review & check the inclusion/ provision in DPR, as appropriate	Once before DPR approval	PMU /PMC	NA
Ensure sufficient hydraulic capacity to accommodate peak flows & adequate slope in gravity mains to prevent build up of solids and hydrogen sulfide generation		PIU / Consultant Team	Review & check the inclusion/ provision in DPR, as appropriate	Once before DPR approval	PMU /PMC	NA
Establish routine maintenance program, including: • Regular cleaning of grit chambers and sewer lines to remove grease, grit, and other debris that may lead to sewer backups. Cleaning should be conducted more frequently for problem areas. • Inspection of the condition of sanitary sewer structures and identifying areas that need repair or maintenance. Monitoring of sewer flow to identify potential		PIU / Consultant Team	Review & check the inclusion/ provision in DPR/O&M manual as appropriate	Once before DPR /O&M Manual approval	PMU /PMC	NA

Mitigation measures	Location	Responsible for Mitigation	Monitoring Method & Parameters	Monitoring Frequency	Responsible for monitoring	Cost of monitoring
inflows and outflows						
Conduct repairs prioritized based on the nature and severity of the problem. Immediate clearing of blockage or repair is warranted where an overflow is currently occurring or for urgent problems that may cause an imminent overflow		PIU / Consultant Team	Review & check the inclusion/ provision in DPR/O&M manual as appropriate	Once before DPR /O&M Manual approval	PMU /PMC	NA
Review previous sewer maintenance records to help identify “hot spots” or areas with frequent maintenance problems and locations of potential system failure, and conduct preventative maintenance, rehabilitation, or replacement of lines as needed;		PIU / Consultant Team	Review & check the inclusion/ provision in DPR/O&M manual as appropriate	Once before DPR /O&M Manual approval	PMU /PMC	NA
When a spill, leak, and/or overflow occurs, keep sewage from entering the storm drain system by covering or blocking storm drain inlets or by containing and diverting the sewage away from open channels and other storm drain facilities (using sandbags, inflatable dams, etc.). Remove the sewage using vacuum equipment or use other measures to divert it back to the sanitary sewer system		PIU / Consultant Team	Review & check the inclusion/ provision in DPR/O&M manual as appropriate	Once before DPR /O&M Manual approval	PMU /PMC	NA
Develop Emergency Response Plan for all emergencies such as leaks, overflows, bursts; a template of ERP is provided at Appendix 5.		PIU / Consultant Team	Review & check the inclusion/ provision in DPR/O&M manual as appropriate	Once before DPR /O&M Manual approval	PMU /PMC	NA
Provide necessary health & safety training to the staff sewer cleaning & maintenance; WTP operation; sludge handling		PIU / Consultant Team	Review & check the inclusion/ provision in DPR/O&M manual as appropriate	Once before DPR /O&M Manual approval	PMU /PMC	NA
Provide all necessary personnel protection equipment		PIU / Consultant Team	Review & check the inclusion/ provision in	Once before DPR /O&M Manual	PMU /PMC	NA

Mitigation measures	Location	Responsible for Mitigation	Monitoring Method & Parameters	Monitoring Frequency	Responsible for monitoring	Cost of monitoring
			DPR/O&M manual as appropriate	approval		
For personnel cleaning underground sewers there is a risk due to oxygen deficiency and harmful gaseous emissions (hydrogen sulphide, carbon monoxide, methane, etc); the design should consider these risks and provide for adequate equipment (including oxygen masks) for emergency use		PIU / Consultant Team	Review & check the inclusion/ provision in DPR/O&M manual as appropriate	Once before DPR /O&M Manual approval	PMU /PMC	NA
Develop and implement operation and maintenance (O&M) plans for community toilets with participation from the community. A memorandum of understanding (MoU) between Ranebennur CMC and community will be reached prior to any construction and operation of community toilets. As a minimum, the O&M plan should specify (i) cleaning procedures and frequency; (ii) responsible personnel; (iii) maintenance and repairs schedule; (iv) emergency contact numbers etc.		Harhar CMC, PIU / Consultant Team	Review & check the inclusion/ provision in DPR/O&M manual as appropriate	Once before DPR /O&M Manual approval	PMU /PMC	NA
Construction						
Prepare and submit a Method Statement for pipeline and sewers works in a Table format with appended site layout map Method Statement can be prepared for each stretch (say 1 km) /specific site based on the project area.	At each work site	Contractor	• Review and approve method statement • Site observations during construction	Approve statement before start of work Weekly during construction	PIU	NA
Conduct detailed site surveys with the construction drawings and discuss with the respective agencies during the construction phase before ground clearance;	-	Contractor	Check contractor records • Random checks on site, drawings and interactions with respective	Once prior to the start of ground clearance for construction	PIU	NA

Mitigation measures	Location	Responsible for Mitigation	Monitoring Method & Parameters	Monitoring Frequency	Responsible for monitoring	Cost of monitoring
			agencies			
Prepare a contingency plan to include actions to be done in case of unintentional interruption of services.	-	Contractor	Review the plan	Once prior to start of construction	PIU	NA
In case of disruption of water supply, alternative supply, through tankers, shall be provided; water may be made available by the Harihar CMC, but it will the responsibility of contractor to supply to affected people	Utility relocation site	Contractor	Site observations • Informal public consultations	Weekly Once	PIU	NA
Prioritize areas within or nearest possible vacant space in the subproject location Construction work camps shall be located at least 200 m from residential areas Do not consider residential areas for stockpiling the waste/surplus soil;	Sites for worker camp, material store	Contractor	Site observations	Before & after such establishment	PIU	NA
Material stockpiles shall be protected by bunds during the monsoon to arrest the silt laden runoff into drains	Stockpile sites	Contractor	Site observations	Weekly	PIU	NA
Contractor should obtain material from existing mines approved/licensed by Mines and Geology Department/ Revenue Department. Verify suitability of all material sources and obtain approval of implementing agency No new quarry sites shall be developed for the subproject purpose	-	Contractor	Check sources & approvals	Prior to approval of quarry for material	PIU	NA
Submit a monthly statement of construction material procured indicating material type, source and quantity.	-	Contractor	Record check	Monthly	PIU	NA
Consult with PIU on the designated areas for stockpiling of clay, soils, gravel, and other construction materials;	Stockpile site	Contractor	Site check & approval	Prior to approval	PIU	NA
Damp down exposed soil and any stockpiled on site by spraying with water when necessary during dry weather Bring materials (aggregates, sand, etc gravel) as and when required	Work site	Contractor	Site observations • Informal public consultations	Weekly	PIU	NA

Mitigation measures	Location	Responsible for Mitigation	Monitoring Method & Parameters	Monitoring Frequency	Responsible for monitoring	Cost of monitoring
Use tarpaulins to cover sand and other loose material when transported by vehicles; Clean wheels and undercarriage of vehicles prior to leaving construction site						
Fit all heavy equipment and machinery with air pollution control devices which are operating correctly; ensure valid Pollution Under Control (PUC) Certificates for all vehicles and equipment used in the construction activity	Work site	Contractor	Check valid PUC	Prior to start and quarterly there after	PIU	NA
Plan activities in consultation with the PIU so that activities with the greatest potential to generate noise are conducted during periods of the day which will result in least disturbance; Construction work shall be limited to day light hours (6 AM to 6 PM) for all the works located within the town; for facilities outside the town/habitation (i.e. WWTP) the timings may be relaxed with the permission of Harihar CMC and PIU, however no work should be conducted between 10 PM – 6 AM at any site. Provide prior information to the local public about the work schedule;	Work site	Contractor	Check work schedule of contractor; public consultation records	Prior to start of work	PIU	NA
Ensure that there are no old and sensitive buildings that may come under risk due to the use of pneumatic drills; if there is risk, cut the rocks manually by chiselling;	Work site	Contractor	Site observations	Weekly	PIU	NA
Minimize noise from construction equipment by using vehicle silencers, fitting jackhammers with noise-reducing mufflers, and portable street barriers the sound impact to surrounding sensitive receptor; and	Work site	Contractor	Site observations	Weekly	PIU	NA
Maintain maximum sound levels not exceeding 80 decibels (dbA) when measured at a distance of 10 m or more from the	Work site	Contractor	Noise monitoring	Quarterly	Contractor	NA

Mitigation measures	Location	Responsible for Mitigation	Monitoring Method & Parameters	Monitoring Frequency	Responsible for monitoring	Cost of monitoring
vehicle/s						
Avoid stockpiling of earth fill especially during the monsoon season unless covered by tarpaulins or plastic sheets Stockpiles shall be provided with temporary bunds Prioritize re-use of excess spoils and materials in the construction works. If spoils will be disposed, consult with PIU on designated disposal areas Install temporary silt traps or sedimentation basins along the drainage leading to the water bodies Place storage areas for fuels and lubricants away from any drainage leading to water bodies Dispose wastes generated by construction activities in designated sites; disposal site should be identified prior to the demolition of concrete tanks at WTP;	Work site	Contractor	Site observations	Weekly	PIU	NA
Avoid stockpiling of excess excavated soils as far as possible Avoid disposal of any debris and waste soils in the forest areas and in or near water bodies/rivers; • Coordinate with PIU for beneficial uses of excess excavated soils or immediately dispose to designated areas • Disposal site should be identified prior to the demolition of concrete tanks at WTP; steel recovered from the demolition works should be sent for recycling; concrete debris may be used to raise the ground level or filling low lying areas in the town; Prepare and implement Waste Management Plan – it should present how the surplus	-	Contractor	Waste Management Plan review & approval	Once prior to start of construction	PIU	NA

Mitigation measures	Location	Responsible for Mitigation	Monitoring Method & Parameters	Monitoring Frequency	Responsible for monitoring	Cost of monitoring
waste generated will temporarily stocked at the site, transported and disposed properly						
Plan pipeline work in consultation with the traffic police Plan work such that trench excavation, pipe laying, and refilling including compacting, at a stretch is completed in a minimum possible time; Provide for immediate consolidation of backfilling material to desired compaction - this will allow immediate road restoration and therefore will minimise disturbance to the traffic movement Do not close the road completely, ensure that work is conducted onto edge of the road; allow traffic to move on one line In unavoidable circumstances of road closure, provide alternative routes, and ensure that public is informed about such traffic diversions; Plan material and waste routes to avoid times of peak-pedestrian activities Liaise with Harihar CMC in identifying risk areas on route cards/maps	Work site	Contractor	Work program review Site observations • Informal public consultation	Once prior to start of construction Weekly during work	PIU	NA
At all work sites public information/caution boards shall be provided – information shall inter-alia include: project name, cost and schedule; executing agency and contractor details; nature and schedule of work at that road/locality; traffic diversion details, if any; entry restriction information; competent official's name and contact for public complaints.	Work site	Contractor	Site observations	Once prior to start of construction	PIU	NA
Prepare a Traffic Management Plan – a template is provided for reference at Appendix 4.	Work site	Contractor	Review, approval and on-site implementation of TMP	Once prior to start of construction; weekly	PIU	NA

Mitigation measures	Location	Responsible for Mitigation	Monitoring Method & Parameters	Monitoring Frequency	Responsible for monitoring	Cost of monitoring
				during work		
No material should be stocked in this area; material shall be brought to the site as and when required Conduct work manually with small group of workers and less noise; minimize use of equipment and vehicles No work should be conducted near the religious places during religious congregations Material transport to the site should be arranged considering school timings; material should be in place before school starts; Notify concerned schools, hospitals etc 1 week prior to the work; conduct a 30-m awareness program on nature of work, likely disturbances and risks and construction work, mitigation measures in place, entry restrictions and dos and don'ts Implement all measures suggested elsewhere in this report – dust and noise control, public safety, traffic management, strictly at the sites.	Work near sensitive areas	Contractor	Work program review Site observations • Informal public consultation	Once prior to start of construction Weekly during work	PIU	NA
Leave space for access between mounds of excavated soil Provide wooden planks/footbridges for pedestrians and metal sheets for vehicles to allow access across trenches to premises where required Consult affected businesspeople to inform them in advance when work will occur Address livelihood issues, if any; implement the Resettlement Plan (RP) to address these issues Provide sign/caution/warning boards at work site indicating work schedule and traffic	Work site	Contractor	Site observations • Informal public consultation	Weekly	PIU	NA

Mitigation measures	Location	Responsible for Mitigation	Monitoring Method & Parameters	Monitoring Frequency	Responsible for monitoring	Cost of monitoring
information; prevent public entry into work sites through barricading and security; and Provide sign boards for pedestrians to inform nature and duration of construction works and contact numbers for concerns/complaints.						
Employ at least 50% of the labour force, or to the maximum extent, local persons if manpower is available Secure construction materials from local market.	Work site	Contractor	Review records • Worker consultation	Weekly	PIU	NA
Develop and implement site-specific Environment, Health and Safety (EHS) Plan which will include measures such as: (a) excluding public from the site; (b) ensuring all workers are provided with and use Personal Protective Equipment; (c) H and S Training for all site personnel; (d) documented procedures to be followed for all site activities; and (e) documentation of work-related accidents; All trenches deeper than 2 m shall be protected with wooden bracing to avoid safety risks to workers, public and nearby buildings/structures Ensure that qualified first-aid can be provided at all times. Equipped first-aid stations shall be easily accessible throughout the site; Provide medical insurance coverage for workers; Secure all installations from unauthorized intrusion and accident risks; Provide supplies of potable drinking water; Provide clean eating areas where workers are not exposed to hazardous or noxious substances	Work site	Contractor	Review and on-site implementation of EHS Plan	Once prior to start of construction; weekly during work	PIU	NA

Mitigation measures	Location	Responsible for Mitigation	Monitoring Method & Parameters	Monitoring Frequency	Responsible for monitoring	Cost of monitoring
Provide H and 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; 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; 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. Overall, the contractor should comply with IFS EHS Guidelines on Occupational Health and Safety (this can be downloaded from http://www1.ifc.org/wps/wcm/connect/9aef2880488559a983acd36a6515bb18/2%2BOccupational%2BHealth%2Band%2BSafety.pdf?MOD=AJPERES)						

Mitigation measures	Location	Responsible for Mitigation	Monitoring Method & Parameters	Monitoring Frequency	Responsible for monitoring	Cost of monitoring
Provide road signs and flag persons to warn of dangerous conditions, in case of location near the road Overall, the contractor should comply with IFS EHS Guidelines Community Health and Safety (this can be downloaded from http://www1.ifc.org/wps/wcm/connect/dd673400488559ae83c4d36a6515bb18/3%2BCommunity%2BHealth%2Band%2BSafety.pdf?MOD=AJPERES	Work site	Contractor	Review and on-site implementation of EHS Plan	Once prior to start of construction; weekly during work	PIU	NA
The contractor should establish and operate the temporary worker camps in compliance with IFC EHS Guidelines specific to workers accommodation ((this can be downloaded from http://www1.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/ifc+sustainability/publications/publications_gpn_workersaccommodation), including the following: Consult with PIU/Harihar CMC before locating workers camps/sheds, and construction plants; as far as possible located within reasonable distance of work site Minimize removal of vegetation and disallow cutting of trees Living facilities shall be built with adequate materials, and should be in good condition and free from rubbish and other refuge The camp site should be adequately drained to avoid the accumulation of stagnant water Provide water and sanitation facilities; water, meeting Indian drinking water standards shall be provided, in adequate quantities (supply of 60- 80 LPCD); all water storage structures must be cleaned regularly and	Workers camp site	Contractor	Site observations and facilities	Once prior to start of construction; monthly during work	PIU	NA

Mitigation measures	Location	Responsible for Mitigation	Monitoring Method & Parameters	Monitoring Frequency	Responsible for monitoring	Cost of monitoring
covered properly to avoid any contamination Provide separate facilities for men and women; sanitary facilities shall be properly build and well maintained; toilet and bath facilities should be provided on basis of 1 per 15 or less persons Train employees in the storage and handling of materials which can potentially cause soil contamination; Recover used oil and lubricants and reuse or remove from the site; Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas; Remove all wreckage, rubbish, or temporary structures which are no longer required Report in writing that the camp has been vacated and restored to pre-project conditions before acceptance of work.						
• No infrastructure, except unavoidable water supply pipe lines/sewers, shall be constructed within the 300 m of sites. • Obtain permission from ASI for laying of pipelines within 300 m around the temple • Ensure that any chance finds are recognized and measures are taken to ensure they are protected and conserved. • If any chance finds are recognized, the Contractor should: o Stop work immediately to allow further investigation if any finds are suspected; Inform PIU; call in the ASI if a find is suspected, and taking any action they require to ensure its removal or protection in situ.	Within 300 m radius of Hariha-reswara Temple	Contractor	Site observations and facilities	Once prior to start of construction; daily during work	PIU	NA

Mitigation measures	Location	Responsible for Mitigation	Monitoring Method & Parameters	Monitoring Frequency	Responsible for monitoring	Cost of monitoring
Environmental Quality Monitoring - Construction						
Ambient air quality	2 points (locations will be finalized during detailed design/ implemen-tation)	-	• SPM, RSPM • Monitoring method as prescribed by CPCB	Once before start of construction Quarterly (yearly 4-times) during construction	Contractor	$ 100 per sample – sum $ 1,800
Operation						
Raw water quality at Intake	Intake at Kawalettu		pH, Cl, F, NO3, TC, FC, Hardness, Turbidity BOD, COD, DO, Total Alkalnity	Monthly once	Harihar CMC	Part of laboratory O&M Costs
Monitoring of quality of water supplied to consumers	All Service reservoirs		pH, Cl, F, NO3, TC, FC, Hardness, Turbidity BOD, Total Alkalnity, Total coliform and E-coliform	Monthly once	Harihar CMC	Part of laboratory O&M Costs
	Consumer end-random sampling in all zones		pH, Cl, F, NO3, TC, FC, Hardness, Turbidity BOD, Total Alkalnity, Total coliform and E-coliform	Yearly once	Harihar CMC	Part of laboratory O&M Costs
Sludge quality and suitability as manure	Sludge drying beds WTP	Operator	Analysis for concentration of heavy metals and confirm that value are within the following limits (all units are in mg/kg dry basis except	Yearly once	Harihar TMC through accredited lab	Part O&M costs

Mitigation measures	Location	Responsible for Mitigation	Monitoring Method & Parameters	Monitoring Frequency	Responsible for monitoring	Cost of monitoring
			pH) • Arsenic - 10.00 • Cadmium - 5.00 • Chromium - 50.00 • Copper - 300.00 • Lead - 100.00 • Mercury - 0.15 • Nickel - 50.00 • Zinc - 1000.00 PH - 5.5-8.5			

C. Environmental Management & Monitoring Costs

132. Most of the mitigation measures require the Contractors to adopt good site practices, which are part of their normal procedures, so there are unlikely to be major costs associated with compliance. These costs of mitigation by the contractors are included in the budgets for the civil works. Mitigation and monitoring provided by the PIU/PMU or their consultants will be part of incremental administration costs. Costs required for environmental quality monitoring is indicated in Table 14.

Table 14: Environmental Management and Monitoring Costs

Item	Responsible Agency	Quantity/Details	Total Cost (US$)	Source of funds
Tree plantation at Sewage Pumping Station Site	PIU	Lump sum (plantation & maintenance for 3 years)	2,500	Included in the project cost as BOQ item
Tree plantation at water treatment plant	PIU	Lump sum (plantation & maintenance for 3 years)	5,000	Included in the project cost as BOQ item
Air quality monitoring	Contractor	18 samples	1,800	Included in the project cost as BOQ item
Monitoring of implementation of mitigation measures	PIU / PMU / Consultants	As required	Part of incremental admin costs	-
Water quality monitoring	Operating agency/Harihar CMC	As required	Part of O&M costs of operator	O&M funds
		Total costs	**9,300**	

D. Grievance Redress Mechanism

133. A project specific grievance redress mechanism (GRM) will be established to receive, evaluate and facilitate concerns of, complaints and grievances of the DPs in relation to project's social and environmental performances. The main objective of the GRM will be to provide time bound action and transparent mechanism to resolve social and environment concerns.

134. A project GRM will cover the project's towns for all kinds of grievances and will be regarded as an accessible and trusted platform for receiving and facilitating project related complaints and grievances. The multi-tier GRM for the program will have realistic time schedules to address grievances and specific responsible persons identified to address grievances and whom the DPs have access to interact easily.

135. Awareness on grievance redress procedures will be created through Public Awareness Campaign with the help of print and electronic media and radio. The resettlement NGO will ensure that vulnerable households are also made aware of the GRM and assured of their grievances to be redressed adequately and in a timely manner.

136. There will be multiple means of registering grievances and complaints by dropping grievance forms in complaint/ suggestion boxes at accessible locations, or through telephone hotlines, email, post or writing in a complaint registrar book in ULB's project office. There will be complaint registrar book and complaint boxes at construction site office to enable quick response of grievances/ complaints for urgent matters. The name, address and contact details of the persons with details of the complaint / grievance, location of problem area, date of receipt of complaint will be documented. The RPMU's Social development / Resettlement Officer will be responsible at the project level for timely resolution of the environmental and social safeguards issues and registration of grievances, and communication with the aggrieved persons. Annex 1 is the draft PID to be distributed to all affected communities and DPs which include the contact numbers of the respective ULB officer(s) responsible for the KISWRMIP.

E. Grievance Redress Process

137. There will be several tiers for grievance redress process. Simple grievances for immediate redress will first be resolved at site by Contractor. If unaddressed for up to 7 days the complainants may go to PIU officer in ULB responsible for resettlement/social issues. Project engineer and the resettlement NGO will assist in resolving the issues. Name, designation and contact number of personnel responsible for grievance redress at ULB and RPMU, will be posted at Contractor's and PMDSC's site office in full visibility of public. NGO will be involved in community mobilization and awareness campaign among the communities. Grievances of immediate nature should be resolved at site/ within ULB/PIU level within 15 days of registration of grievances.

138. RPMU's Social safeguards/R&R Officer and PMDSC specialist who will review and resolve within 15 working days of grievance registration with the assistance of the Resettlement NGO and concerned PIU/ULB personnel, if required.

139. The grievances of critical nature and those cannot be resolved at RPMU level should be referred to Grievance Redress Committee (GRC)/Steering Committee (ST) set up at district level to be settled within 30 days. All documents related to grievances, follow up action taken to resolve along with explanatory note on nature, seriousness and time taken for grievance redress shall be prepared by RPMU Social safeguard / R&R Officer and circulated to GRC/SC members at least a week prior to scheduled meeting. The decision taken at the GRC/SC level will be communicated to the DPs by RPMU Social safeguards/R&R officer through ULB/PIU and resettlement NGO.

140. For any issues that remain unresolved by the GRC or SC or the decision taken at such meetings are not acceptable, the complainants /DPs can approach the Court of Law as per Govt. of Karnataka legal procedure.

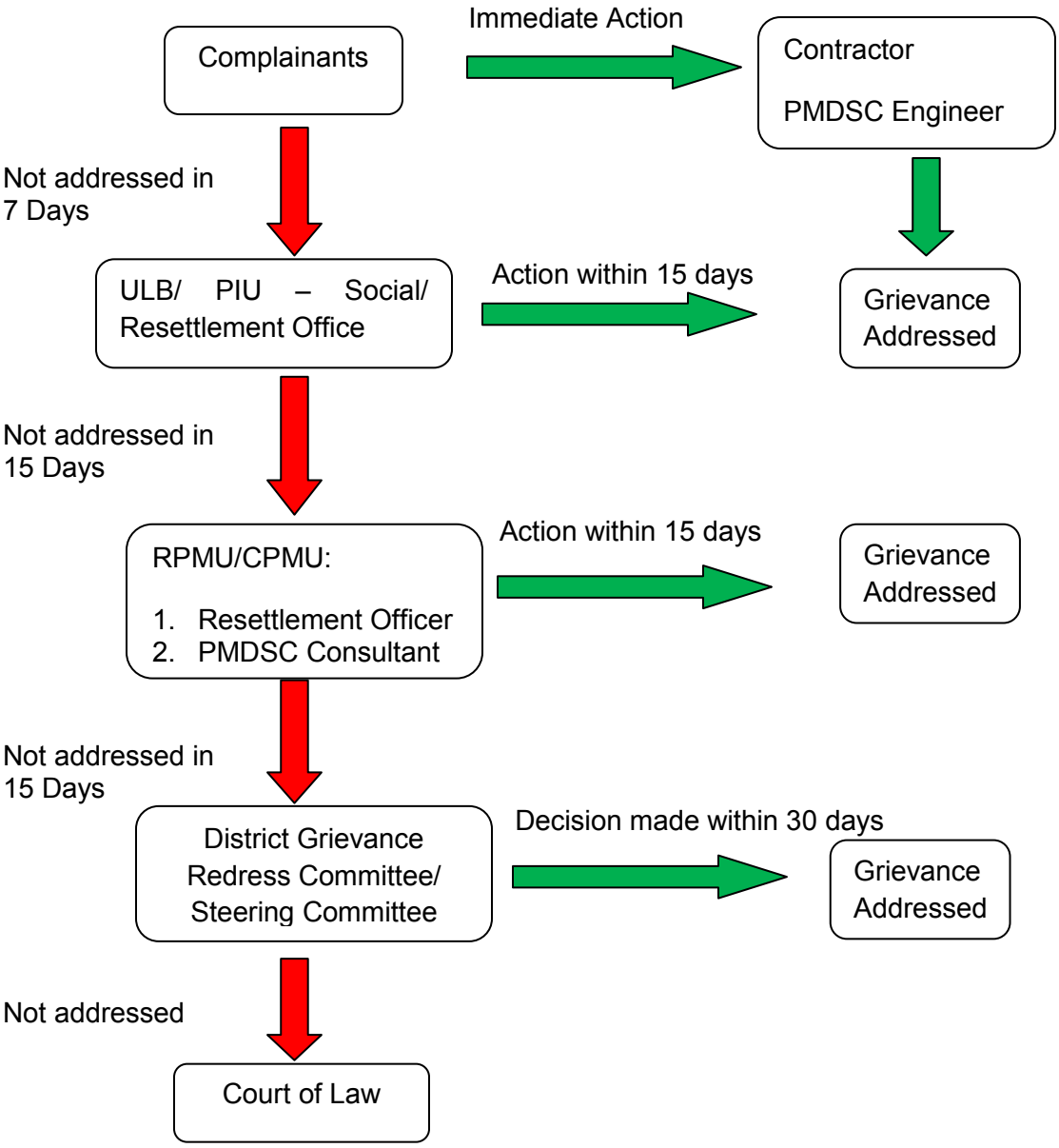
F. GRC / SC composition and selection of members

141. The GRC/ SC for the project will be headed by Dy. Commissioner (DC) of the district with members as followed: (1) ULB Commissioners of project towns,(2) Revenue Department (Registrar) official, (3) RPMU Social safeguard/ R&R Officer of KIUWMIP, (4) ULB officer who will convene the periodic meeting of GRC and will shoulder responsibility of keeping records of grievances/ complaints in details with help from resettlement NGO. Other members, such as, NGO/CBO representatives, wards council representatives, DPs' representatives will be selected by the ULB Commissioner to represent in the GRC/SC meeting. NGO should also deploy one

person in the team who will be responsible for coordinating with all GRC members and the DPs for grievance redress.

142. In the event when the established GRM is not in a position to resolve the issue, Affected Person also can use the ADB Accountability Mechanism (AM) through directly contact (in writing) to the Complain Receiving Officer (CRO) at ADB headquarters or to ADB Indian Resident Mission (INRM). The complaint can be submitted in any of the official languages of ADB's DMCs. The ADB Accountability Mechanism information will be included in the PID to be distributed to the affected communities, as part of the project GRM. A Grievance Redress Mechanism is shown in the Figure 15.

Figure 15: Grievance Redress Process



VIII. PUBLIC CONSULTATION & INFORMATION DISCLOSURE

A. Project Stakeholders

143. Most of the main stakeholders have already been identified and consulted during preparation of this IEE, and any others that are identified during project implementation will be brought into the process in the future. Primary stakeholders are:

(i) Residents, shopkeepers and businesspeople near the work sites;
(ii) Public representatives and prominent citizens of the town
(iii) Harihar City Municipal Council
(iv) KUIDFC, GoK

144. Secondary stakeholders are:

(i) Other concerned government institutions (utilities, regulators, etc)
(ii) NGOs and CBOs working in the affected communities;
(iii) Other community representatives (prominent citizens, religious leaders, elders, women's groups);
(iv) The beneficiary community in general; and
(v) ADB as the funding agency

B. Consultation & Disclosure Till Date

145. A series of public consultation meetings were conducted during the project preparation. Various forms of public consultations (consultation through ad hoc discussions on site) have been used to discuss the project and involve the community in planning the project and mitigation measures.

146. Besides, a public consultation workshop was conducted on October 3, 2012 at Davangere for all the four project towns to discuss the proposed project and likely environmental issues and mitigation measures. Key stakeholders – public representatives, officials from various agencies, district level officers, from each project town, including Harihar, were participated in the workshop. Minutes of this consultation meeting is appended at Appendix 6.

C. Future Consultation & Disclosure

147. EA and IA shall extend and expand the consultation and disclosure process significantly during implementation of the Investment Program.

(i) Consultation during detailed design:

- Focus-group discussions with affected persons and other stakeholders (including women's groups, NGOs and CBOs) to hear their views and concerns, so that these can be addressed in subproject design where necessary; and
- Structured consultation meetings with the institutional stakeholders (government bodies and NGOs) to discuss and approve key aspects of the project.

(ii) Consultation during construction:

- Public meetings with affected communities (if any) to discuss and plan work programmes and allow issues to be raised and addressed once construction has started; and
- Smaller-scale meetings to discuss and plan construction work with individual communities to reduce disturbance and other impacts, and provide a mechanism through which stakeholders can participate in subproject monitoring and evaluation;

(iii) Project disclosure:

- Public information campaigns (via newspaper, TV and radio) to explain the project to the wider town population and prepare them for disruption they may experience once the construction programme is underway;
- Public disclosure meetings at key project stages to inform the public of progress and future plans, and to provide copies of summary documents in Kannada; and
- Formal disclosure of completed project reports by making copies available at convenient locations in the study towns, informing the public of their availability, and providing a mechanism through which comments can be made.

148. Based on ADB requirements, the following will be posted on ADB website: (i) this IEE, upon finalization and approval of ADB; (ii) a new or updated IEE, if prepared, reflecting significant changes in the Project during design or implementation; (iii) corrective action plan prepared during Project implementation to address unanticipated environmental impacts and to rectify non-compliance to EMP provisions; and (iv) environmental monitoring reports. Documents will also be available on the websites of KUIDFC and Harihar CMC.

IX. RECOMMENDATION & CONCLUSION

A. Recommendation

149. The process described in this document has assessed the environmental impacts of all elements of the infrastructure proposed under the Harihar Water Supply and Sewerage Subproject. Potential negative impacts were identified in relation to location, design, construction and operation of the improved infrastructure. Mitigation measures have been developed in generic way to reduce all negative impacts to acceptable levels. These were discussed with specialists responsible for the engineering aspects, and as a result some measures have already been included in the outline designs for the infrastructure. This means that the number of impacts and their significance has already been reduced by amending the design.

150. All the subproject sites are either situated on government owned vacant land parcels or along the public roads (for pipelines and sewers). Subproject has been designed to continue the usage of existing surface water source (Tungabhadra River) with increased abstraction from 9 MLD to 27 MLD to meet the designed water demand of Harihar. The source sustainability issue including the downstream impacts are in the scope of another parallel ADB TA preparing for

IWRM's Water Resources component. This "sister" TA has within its scope the preparation of a river water balance to ensure the adequacy of raw water for public water supply from Tungabhadra River. For this feasibility study of Harihar, it has been assumed that adequate supplies will be made available by, if necessary, a reduction in water permitted for agriculture, by the construction of barriers etc. or by any other means deemed necessary by the TA. Therefore impacts of increased water abstraction from the river are not considered in this report. It is also assumed that the water balance will take into consideration the minimum flow required downstream to sustain the ecosystem. However it is necessary to establish adequate water availability and ensuring that necessary provision is made for Harihar water supply through government statutes as required before the start of detailed design. This will ensure subproject sustainability.

151. During the construction phase, impacts mainly arise from the need to dispose waste soil; and from the disturbance of residents, businesses, traffic and important buildings by the construction work. These are common impacts of construction in urban areas, and there are well developed methods for their mitigation. Since the water pipeline and sewer work are conducted along the roads, this great potential to create disturbance. To minimize this, the contractor should develop a Method Statement, which should be approved by the PIU prior to start of work, and should conduct the work strictly in line with the Method Statement.

152. There were limited opportunities to provide environmental enhancements, but certain measures were included. For example it is proposed that the project will employ in the workforce people who live in the vicinity of construction sites to provide them with a short-term economic gain; and ensure that people employed in the longer term to maintain and operate the new facilities are residents of nearby communities.

153. Once the system is operating, the facilities will operate with routine maintenance, which should not affect the environment. Necessary safety precautions are suggested for safe handling and application of chlorine to disinfect water supplies. As far the sewer network and sewage pumping stations are concerned, the operation and maintenance will comply with the standard operating procedures. SOPs / O&M Manual will be developed during the detailed design stage, and the staff will be provided with necessary training.

154. The citizens of the Harihar Town will be the major beneficiaries of this subproject. With the improved water supply, they will be provided with a constant supply of better quality water, piped into their homes. The sewerage system will remove the human waste from those areas served by the network rapidly and treated to an acceptable standard. With the construction of toilets and targeted awareness program on sanitation proposed, in addition to improved environmental conditions, the subproject will improve the over-all health condition of the town. Diseases of poor sanitation, such as diarrhoea and dysentery, should be reduced, so people should 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. The sewerage system proposed in this subproject, combined with the system under implementation in the World Bank funded KMRP, will collect wastewater including sewage from entire town and treat Indian standards. Adequate capacity of WWTP is included in the KMRP.

155. Mitigation will be assured by a program of environmental monitoring conducted during construction and operation to ensure that all measures are implemented, and to determine whether the environment is protected as intended. This will include observations on- and off-site, document checks, and interviews with workers and beneficiaries, and any requirements for remedial action will be reported to the PIU/PMU. There will also be longer-term surveys to

monitor the expected improvements in the quality of domestic water and the health of the population. There will also be regular and periodic monitoring surveys for quality of water (at intake, reservoirs and at consumer end).

156. Finally, stakeholders were involved in developing the IEE through face-to-face discussions and on site meetings, after which views expressed were incorporated into the IEE and the planning and development of the project. A city level consultation workshop was conducted for larger public participation in the project. The IEE will be made available at public locations in the city and will be disclosed to a wider audience via the ADB website. 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.

B. Conclusion

157. The subproject is unlikely to cause significant adverse impacts. The potential adverse 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.

158. Based on the findings of the IEE, the classification of the Project as Category “B” is confirmed, and no further special study or detailed EIA needs to be undertaken to comply with ADB SPS (2009) or GoI EIA Notification (2006). For replacement and rehabilitation of water pipes within 300 m of Harihareswara Temple, permission from Archaeological Survey of India should be obtained.

159. This IEE needs to be updated as the subproject preparation progresses to detailed design to reflect the latest subproject design.

Site Photographs

Photo 1: View of Existing WTP at Harihar

Photo 2: Proposed WTP Site within the existing WTP area

Photo 3: Proposed ELSR location near Amaravati colony

Photo 4: Proposed ELSR site in Vidhya Nagar C-Block

Photo 5: View of Proposed SPS location in South District

Photo 6: Harihareswara Temple

Photo 7: View of Main road connecting Davangere and Harihar

Photo 10: Streets around Harihareswara Temple

Photo 8: View of Street in Harihar town

Photo 11: Drain adjacent to Proposed SPS location at Vidyanagar

Photo 9: Proposed SPS site at Vidyanagar

Photo 12: View of proposed location for Clear water pumps

Appendix 1: REA Checklist

RAPID ENVIRONMENTAL ASSESSMENT (REA) CHECKLIST
Harihar Water Supply & Sewerage Subproject

Screening Questions	Yes	No	Remarks
A. Project Siting Is the project area…			
▪ Densely populated?	**x**		Subproject activities extend to the entire city including the densely populated areas. There are no major negative impacts envisaged, because water supply/ sewer network will be located in unused government lands alongside the existing roads and can be constructed without causing disturbance to houses and commercial establishments. In narrow streets, disruption to road users is likely, and measures like best activity scheduling/ traffic management, alternative routes, and prior information to road users, houses and shops will minimize the impact to acceptable levels.
▪ Heavy with development activities?	**x**		Harihar is a developing town; urban expansion is considerable.
▪ Adjacent to or within any environmentally sensitive areas?			
▪ Cultural heritage site		**x**	
▪ Protected Area		**x**	
▪ Wetland		**x**	
▪ Mangrove		**x**	
▪ Estuarine		**x**	
▪ Buffer zone of protected area		**x**	
▪ Special area for protecting biodiversity		**x**	
▪ Bay		**x**	
Water Supply			

Screening Questions	Yes	No	Remarks
B. Potential Environmental Impacts Will the Project cause…			
▪ pollution of raw water supply from upstream wastewater discharge from communities, industries, agriculture, and soil erosion runoff?		**x**	Subproject will utilize existing intake.
▪ impairment of historical/cultural monuments/areas and loss/damage to these sites?		**x**	There is no historical / cultural monument in the project location.
▪ hazard of land subsidence caused by excessive ground water pumping?		**x**	No ground water source will be used for this project.
▪ social conflicts arising from displacement of communities ?		**x**	The subproject does not involve land acquisition or displacement.
▪ conflicts in abstraction of raw water for water supply with other beneficial water uses for surface and ground waters?		**x**	Not anticipated. Overall water resource balance in Tungabhadra River Basin and measures for assurance of water availability within the Tungabhadra River for public water supply and other uses will be proposed within the proposed ADB funded Karnataka Integrated Sustainable Water Resource Management project (KISWRMP). Government policy is for priority to be given to public water supply and it is therefore assumed that adequate water resources will be available without effecting current downstream uses.
▪ unsatisfactory raw water supply (e.g. excessive pathogens or mineral constituents)?		**x**	Raw water quality is satisfactory. Water will be treated to drinking water standards before delivery.
▪ delivery of unsafe water to distribution system?		**x**	Subproject involves distribution of treated water supplies
▪ inadequate protection of intake works or wells, leading to pollution of water supply?		**x**	Existing water intake is located ideally. There are no sources in the vicinity that may cause water pollution. Nevertheless, the proposed KISWRMP will look into both water quantity and quality issues.
▪ over pumping of ground water, leading to salinization and ground subsidence?		**x**	No ground water is proposed to be abstracted.

Screening Questions	Yes	No	Remarks
▪ excessive algal growth in storage reservoir?		x	Regular cleaning of storage reservoir shall be ensured to avoid algal growth in the reservoir.
▪ increase in production of sewage beyond capabilities of community facilities?		x	Sewerage system is currently being constructed under World Bank assisted KMRP. Uncovered areas in KMRP will be covered under this sub project. The WWTP being constructed has been designed to accommodate capacity for proposed expansion under this subproject.
▪ inadequate disposal of sludge from water treatment plants?		x	No new treatment plants are proposed under this subproject.
▪ inadequate buffer zone around pumping and treatment plants to alleviate noise and other possible nuisances and protect facilities?		x	Subproject does not include pumping equipment/stations.
▪ impairments associated with transmission lines and access roads?	x		Anticipated during construction activities. However impacts are temporary and short in duration. The EMP includes measure to mitigate impacts.
▪ health hazards arising from inadequate design of facilities for receiving, storing, and handling of chlorine and other hazardous chemicals.		x	Necessary safety measures have been taken into consideration in the design and included in the EMP.
▪ health and safety hazards to workers from handling and management of chlorine used for disinfection, other contaminants, and biological and physical hazards during project construction and operation?		x	Necessary safety measures have been taken into consideration during O&M and included in the EMP.
▪ dislocation or involuntary resettlement of people?	x		The subproject does not involve land acquisition and displacement. There may be temporary disturbance to business and squatters/vendors during construction. A resettlement plan has prepared to mitigate/compensate these impacts.
▪ disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?		x	Not applicable.

Screening Questions	Yes	No	Remarks
▪ noise and dust from construction activities?	x		Short term impact on air quality due to dust generation during construction activities is anticipated. Appropriate dust suppression measures will be taken to minimize dust generation due to construction activities at site. No significant increase in noise level is anticipated due to construction. All equipment and machineries will conform to the Statutory norms.
▪ increased road traffic due to interference of construction activities?	x		Proper traffic management and planning will be ensured during construction.
▪ continuing soil erosion/silt runoff from construction operations?	x		Construction activities (pipe laying, etc.) on hill slopes may increase the chance of land slide and soil erosion. Careful stacking of excavated materials will be ensured to avoid slippage and erosion especially on hill slopes. Construction work during monsoon shall be carried out with due care so that silt run off due to construction operation is prevented. No construction will be allowed during rains.
▪ delivery of unsafe water due to poor O&M treatment processes (especially mud accumulations in filters) and inadequate chlorination due to lack of adequate monitoring of chlorine residuals in distribution systems?		x	Trained and skilled staff will be deployed for O&M. Also, quality of treated water will be regularly monitored through water sample testing to ensure delivery of safe water to consumers.
▪ delivery of water to distribution system, which is corrosive due to inadequate attention to feeding of corrective chemicals?		x	uPVC pipes will be used for distribution system and are non corrosive in nature.
▪ accidental leakage of chlorine gas?		x	Necessary safety measures have been taken into consideration during design and O&M and included in the EMP.

Screening Questions	Yes	No	Remarks
▪ excessive abstraction of water affecting downstream water users?		x	Not anticipated. Overall water resource balance in Tungabhadra River Basin and measures for assurance of water availability within the Tungabhadra River for public water supply and other uses will be proposed within the proposed ADB funded Karnataka Integrated Sustainable Water Resource Management project (KISWRMP). Government policy is for priority to be given to public water supply and it is therefore assumed that adequate water resources will be available without effecting current downstream uses.
▪ competing uses of water?		x	Not applicable.
▪ increased sewage flow due to increased water supply	x		Sewerage system is currently being constructed under World Bank assisted KMRP. Uncovered areas in KMRP will be covered under this sub project. The WWTP being constructed has been designed to accommodate capacity for proposed expansion under this subproject.
▪ increased volume of sullage (wastewater from cooking and washing) and sludge from wastewater treatment plant	x		Sewerage system is currently being constructed under World Bank assisted KMRP. Uncovered areas in KMRP will be covered under this sub project. The WWTP being constructed has been designed to accommodate capacity for proposed expansion under this subproject.
▪ large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?		x	No such impact anticipated as the import of workforce will be limited to skilled workers; local communities in the vicinity of the project would be employed as much as possible.
▪ social conflicts if workers from other regions or countries are hired?		x	Not anticipated as local communities within the project vicinity will be employed as much as possible.

Screening Questions	Yes	No	Remarks
▪ 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 operation and construction?		x	Not applicable. Construction will not involve use of explosives and chemicals.
▪ community safety risks due to both accidental and natural hazards, especially where the structural elements or components of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning?		x	Operational area will be clearly demarcated and access will be controlled. Only workers and project concerned members will be allowed to visit the operational sites.
Sewerage			
C. Potential Environmental Impacts Will the Project cause…			
▪ impairment of historical/cultural monuments/areas and loss/damage to these sites?		x	There are no such areas near the subproject sites
▪ interference with other utilities and blocking of access to buildings; nuisance to neighboring areas due to noise, smell, and influx of insects, rodents, etc.?		x	No blocking/interference with other utilities expected.
▪ dislocation or involuntary resettlement of people?		x	The subproject does not involve land acquisition or displacement.
▪ disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?		x	Not applicable. Sewerage system will cover entire population (both poor and non-poor) and will have positive health impacts due to improved sanitation conditions.
▪ impairment of downstream water quality due to inadequate sewage treatment or release of untreated sewage?		x	Treatment process being constructed is designed to meet the inland water disposal standards set by the Central Pollution Control Board (CPCB).
▪ overflows and flooding of neighboring properties with raw sewage?		x	Sewerage system has been designed considering the population growth. It has been designed to accommodate sewage until year 2028. Design considers standard peak factors and therefore no such impact envisaged.
▪ environmental pollution due to inadequate sludge disposal or industrial waste discharges illegally disposed in sewers?		x	WWTP being constructed has been designed to address sludge treatment and management.

Screening Questions	Yes	No	Remarks
▪ noise and vibration due to blasting and other civil works?		x	No blasting activities envisaged. Temporary nuisance/disturbance due to construction activities will be minimized with appropriate mitigation measures.
▪ risks and vulnerabilities related to occupational health and safety due to physical, chemical, and biological hazards during project construction and operation?		x	Not anticipated. The EMP ensures occupational health and safety measures are implemented.
▪ discharge of hazardous materials into sewers, resulting in damage to sewer system and danger to workers?		x	There are no sources of hazardous material that will find its way into the sewers. Wastewater other than municipal, i.e. industrial, entering the sewerage system must meet the stipulated standards, and therefore it is unlikely that problematic waste will be discharged into the sewers.
▪ inadequate buffer zone around pumping and treatment plants to alleviate noise and other possible nuisances, and protect facilities?		x	Not anticipated. Sewerage pumping station site is located in the outskirts of the town in a corner of large campus of a Market Yard owned by government that is currently not being used. A green buffer perimeter will also be established.
▪ road blocking and temporary flooding due to land excavation during the rainy season?		x	Flooding is unlikely as work will be mostly conducted during dry season.
▪ noise and dust from construction activities?	x		No major noise generating activities like rock blasting is envisaged. Dust will be temporary and will be controlled with proper dust suppression measures.
▪ traffic disturbances due to construction material transport and wastes?	x		Proper traffic management and planning will be ensured during construction.

Screening Questions	Yes	No	Remarks
▪ temporary silt runoff due to construction?	x		Construction activities (pipe laying, etc.) on hill slopes may increase the chance of land slide and soil erosion. Careful stacking of excavated materials will be ensured to avoid slippage and erosion especially on hill slopes. Construction work during monsoon shall be carried out with due care so that silt run off due to construction operation is prevented. No construction will be allowed during rains.
▪ hazards to public health due to overflow flooding, and groundwater pollution due to failure of sewerage system?		x	Not anticipated. The system is designed to accommodate adequate capacity. Staff and workers will be trained in O&M.
▪ deterioration of water quality due to inadequate sludge disposal or direct discharge of untreated sewage water?		x	Not anticipated.
▪ contamination of surface and ground waters due to sludge disposal on land?		x	WWTP being constructed has been designed to address sludge treatment and management.
▪ health and safety hazards to workers from toxic gases and hazardous materials which maybe contained in confined areas, sewage flow and exposure to pathogens in untreated sewage and unstabilized sludge? ▪		x	All necessary health and safety training and necessary personal protection equipment will be given to workers and staff during operation of sewerage system
▪ large population increase during project construction and operation that causes increased burden on social infrastructure (such as sanitation system)?		x	No such impact anticipated as the import of workforce will be limited to skilled workers; local communities in the vicinity of the project would be employed as much as possible.
▪ social conflicts between construction workers from other areas and community workers?		x	Not anticipated as local communities within the project vicinity will be employed as much as possible.
▪ risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during construction and operation?		x	Not applicable. Construction/operation will not involve use of explosives and chemicals.
▪ community safety risks due to both accidental and natural hazards, especially where the structural elements or components of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning?		x	Operational area will be clearly demarcated and access will be controlled. Only worker and project concerned members will be allowed to visit the construction sites. During operation, entry into WWTP will be restricted.

Climate Change and Disaster Risk Questions The following questions are not for environmental categorization. They are included in this checklist to help identify potential climate and disaster risks.	**Yes**	**No**	**Remarks**
• Is the Project area subject to hazards such as earthquakes, floods, landslides, tropical cyclone winds, storm surges, tsunami or volcanic eruptions and climate changes (see Appendix I)?		**x**	There is a low risk of natural hazards in the project areas. All towns are land locked and expansively cultivated. The general topography of the towns is plains with isolated hills fringing some of the towns. The towns are located in an area of low seismological intensity. The towns are generally dry throughout the year except during the monsoon from June to September. Davanegere and Rannebenur receive the lowest rainfall (annual average rainfall between 300 – 600mm). Whereas Byadgi and Harihar receive higher rainfall (annual average rainfall between 700 – 1000 mm).
▪ Could changes in temperature, precipitation, or extreme events patterns over the Project lifespan affect technical or financial sustainability (e.g., changes in rainfall patterns disrupt reliability of water supply; sea level rise creates salinity intrusion into proposed water supply source)?	**x**		Low precipitation and increased temperatures could result in disruption to water supply and security. The project proposes improved water security through the rehabilitation and restoration of river bank reservoirs in selected vulnerable towns.
▪ Are there any demographic or socio-economic aspects of the Project area that are already vulnerable (e.g. high incidence of marginalized populations, rural-urban migrants, illegal settlements, ethnic minorities, women or children)?		**x**	The project will improve the socio-economic conditions of both the poor and non-poor populations of the towns.
▪ Could the Project potentially increase the climate or disaster vulnerability of the surrounding area (e.g., by using water from a vulnerable source that is relied upon by many user groups, or encouraging settlement in earthquake zones)?		**x**	Not applicable.

* Hazards are potentially damaging physical events.

Appendix 2: Environmental Related Legislations in India

i. The Water (Prevention and Control of Pollution) Act, 1974, amended 1988
   - The Water (Prevention and Control of Pollution) Rules, 1975
   - The Water (Prevention and Control of Pollution) Cess Rules, 1971

ii. The Air (Prevention and Control of Pollution) Act 1981, amended 1987
   - The Air (Prevention and Control of Pollution) Rules, 1982

iii. The Environment (Protection) Act, 1986, amended in 1991 and including the following Rules/Notification issued under this Act
   - The Environment (Protection) Rules, 1986, including amendments
   - The Municipal Solid Wastes (Management and Handling) Rules, 2000
   - The Hazardous Wastes (Management and Handling) Rules, 1989
   - The Bio-Medical Waste (Management and Handling) Rules, 1998
   - Noise Pollution (Regulation and Control) Rules, 2000,
   - Wild Life (Protection) Amendment Act, 2002
   - Environmental Impact Assessment Notification, 2006
   - Environmental Standards of Central Pollution Control Board (CPCB)

iv. The Indian Wildlife (Protection) Act, 1972, amended 1993
   - The Wildlife (Protection) Rules, 1995

v. The Indian Forest Act, 1927

vi. Forest (Conservation) Act, 1980, amended 1988
   - Forest (Conservation) Rules, 1981 amended 1992 and 2003
   - Guidelines for Diversion of Forest Lands for Non-Forest Purpose under the Forest (Conservation) Act, 1980

vii. Ancient Monuments and Archaeological Sites and Remains Act 1958
   - Ancient Monuments and Archaeological Sites and Remains Rules 1959
   - Government of India Notification of 1992 under the above-stated Rules

Appendix 3: Environmental Disposal Standards

1. General Standards for Discharge of Environmental Pollutants Part - A: Effluents

Parameter	Inland surface water	Public sewers	Land for irrigation	Marine/coastal areas
Suspended solids mg/l, max.	100	600	200	(a) For process waste water (b) For cooling water effluent 10 per cent above total suspended matter of influent.
Particle size of suspended solids	shall pass 850 micron IS Sieve	-	-	(a) Floatable solids, solidsmax. 3 mm (b) Settleable solids, max 856 microns
pH value	5.5 to 9.0	5.5 to 9.0	5.5 to 9.0	5.5 to 9.0
Temperature	shall not exceed 5oC above the receiving water temperature			shall not exceed 5oCabove the receiving water temperature
Oil and grease, mg/l max,	10	20	10	20
Total residual chlorine, mg/l max	1.0	-	-	1.0
Ammonical nitrogen (as N),mg/l, max.	50	50	-	50
Total kjeldahl nitrogen (as N);mg/l, max. mg/l, max.	100	-	-	100
Free ammonia (as NH3), mg/l,max.	5.0	-	-	5.0
Biochemical oxygen demand (3 days at 27oC), mg/l, max.	30	350	100	100
Chemical oxygen demand, mg/l, max.	250	-	-	250
Arsenic(as As).	0.2	0.2	0.2	0.2
Mercury (As Hg), mg/l, max.	0.01	0.01	-	0.01
Lead (as Pb) mg/l, max	0.1	1.0	-	2.0
Cadmium (as Cd) mg/l, max	2.0	1.0	-	2.0
Hexavalent chro-mium (as Cr + 6),mg/l, max.	0.1	2.0	-	1.0
Total chromium (as Cr) mg/l, max.	2.0	2.0	-	2.0
Copper (as Cu)mg/l, max.	3.0	3.0	-	3.0
Zinc (as Zn) mg/l, max.	5.0	15	-	15
Selenium (as Se)	0.05	0.05	-	0.05
Nickel (as Ni) mg/l, max.	3.0	3.0	-	5.0
Cyanide (as CN) mg/l, max.	0.2	2.0	0.2	0.2
Fluoride (as F) mg/l,	2.0	15	-	15

Parameter	Inland surface water	Public sewers	Land for irrigation	Marine/coastal areas
max.				
Dissolved phosphates (as P),mg/l, max.	5.0	-	-	-
Sulphide (as S) mg/l, max.	2.0	-	-	5.0
Phenolic compounds (as C6H50H)mg/l, max.	1.0	5.0	-	5.0
Radioactive materials: (a) Alpha emitters micro curie mg/l, max.	10^{-7}	10^{-7}	10^{-8}	10^{-7}
(b)Beta emittersmicro curie mg/l	10^{-6}	10^{-6}	10^{-7}	10^{-6}
Bio-assay test	90% survival of fish after 96 hours in 100% effluent	90% survival of fish after 96 hours in 100% effluent	90% survival of fish after 96 hours in 100% effluent	90% survival of fish after 96 hours in 100% effluent
Manganese	2 mg/l	2 mg/l	-	2 mg/l
Iron (as Fe)	3mg/l	3mg/l	-	3mg/l
Vanadium (as V)	0.2mg/l	0.2mg/l	-	0.2mg/l
Nitrate Nitrogen	10 mg/l	-	-	20 mg/l

These standards shall be applicable for industries, operations or processes other than those industries, operations or process for which standards have been specified in Schedule of the Environment Protection Rules, 1989.

Standards for Diesel Generator Sets: Stack Height

The minimum height of stack to be provided with each generator set can be worked out using the following formula:

H = h+0.2x ÔKVA

H = Total height of stack in metre

h = Height of the building in metres where the generator set is installed

KVA = Total generator capacity of the set in KVA

Based on the above formula the minimum stack height to be provided with different range of generator sets may be categorised as follows:

For Generator Sets	Total Height of stack in metre
50 KVA	Ht. of the building + 1.5 metre
50-100 KVA	Ht. of the building + 2.0 metre
100-150 KVA	Ht. of the building + 2.5 metre
150-200 KVA	Ht. of the building + 3.0 metre
200-250 KVA	Ht. of the building + 3.5 metre
250-300 KVA	Ht. of the building + 3.5 metre

Similarly for higher KVA ratings a stack height can be worked out using the above formula.

PART-E Noise Standards

Noise limits for domestic appliances and construction equipments at the manufacturing stage in dB(A).

Window air conditioners of 1 -1.5 tonne	68
Air coolers	60
Refrigerators	46
Diesel generator for domestic purposes	85
Compactors (rollers), front loaders, concentrate mixers, cranes (movable), vibrators and saws	75

Appendix 4: Traffic Management Planning (TMP)

A. Principles for TMP around the Water Pipes Sewer Construction Sites

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

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

B. Operating Policies for TMP

2. 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 A2 to Figure A12** 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

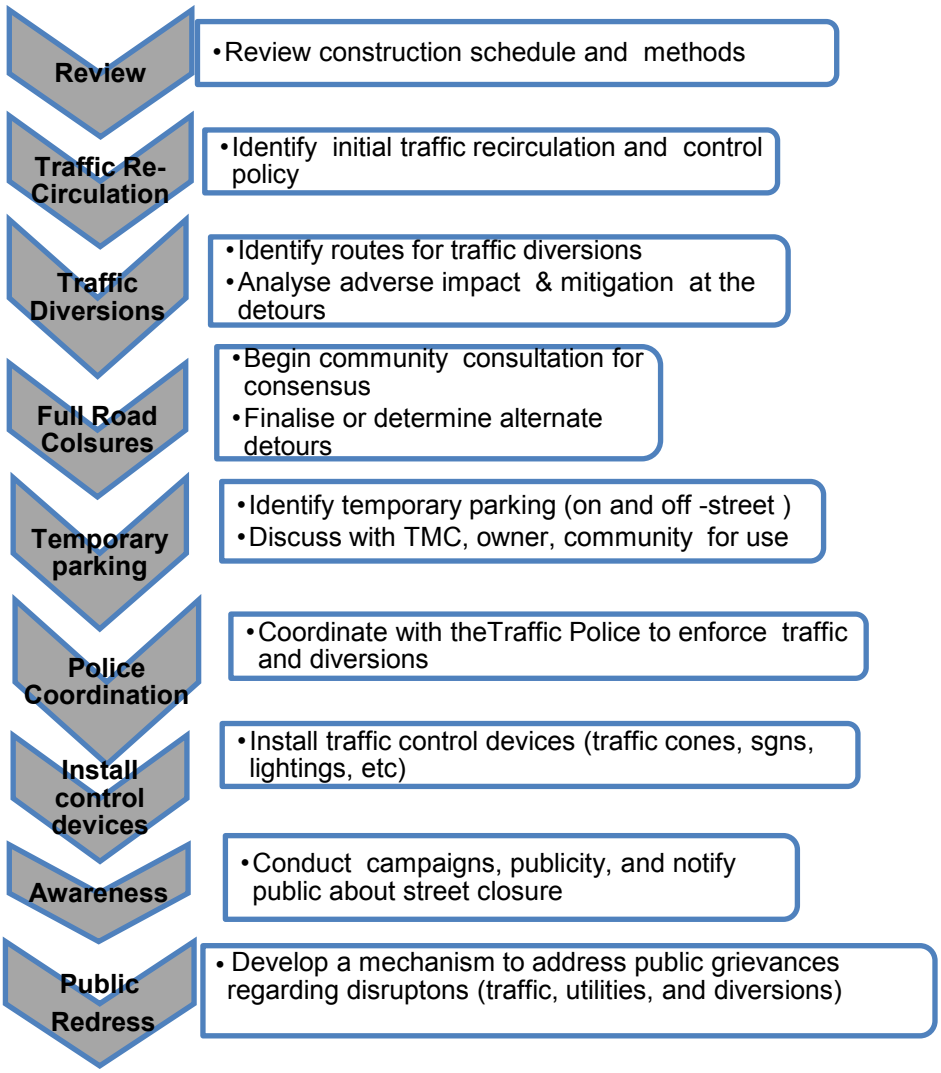
4. Apart from the capacity analysis, a final decision to close a particular street and divert the traffic should involve the following steps:

(i) approval from the Harihar 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 A1: 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 centres. In addition, the project will publish a brochure for public information. These brochures will be widely circulated around the area and will also be available at the 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:

- Signs
- Pavement Markings
- Channelizing Devices
- Arrow Panels
- 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 are narrow but carry very less 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 A2 to Figure A12** 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:

- Work on shoulder or parking lane
- Shoulder or parking lane closed on divided road
- Work in Travel lane
- Lane closure on road with low volume
- Lane closure on a two-line road with low volume (with yield sign)
- Lane closure on a two-line road with low volume (one flagger operation)
- Lane closure on a two lane road (two flagger operation)
- Lane closure on a four lane undivided Road
- Lane closure on divided roadway
- Half road closure on multi-lane roadway
- 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. Flagggers/ 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 A2 & A3: Work on shoulder or parking lane & Shoulder or parking lane closed on divided road)

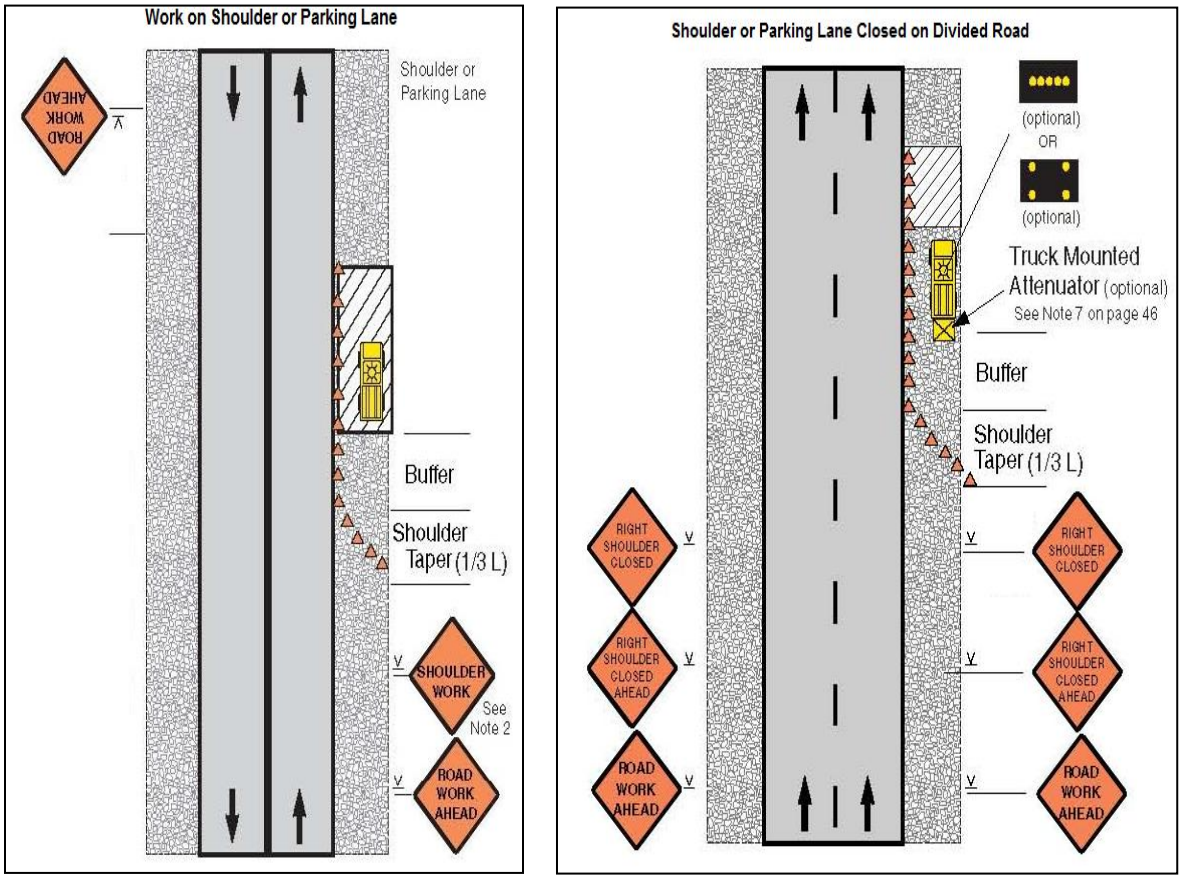
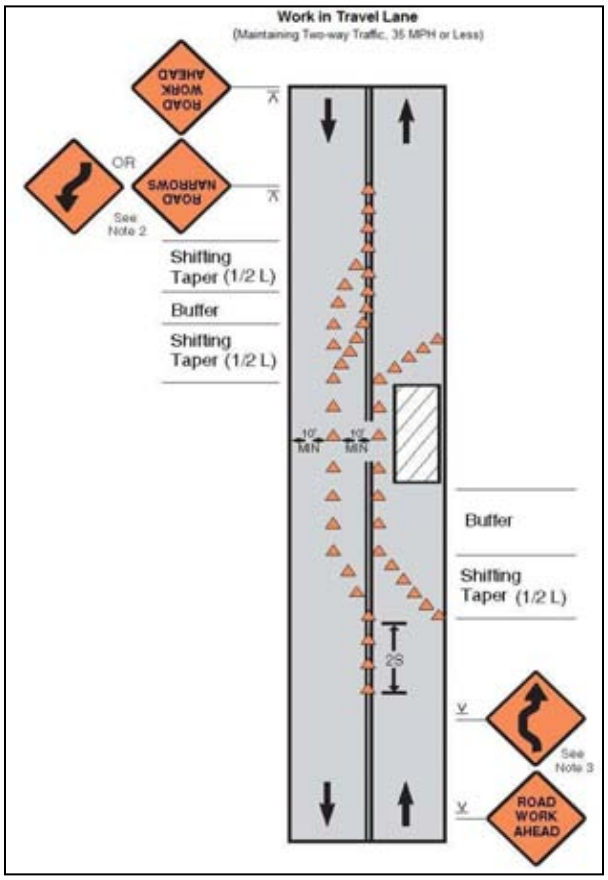


Figure A4 & A5: Work in Travel lane & Lane closure on road with low volume



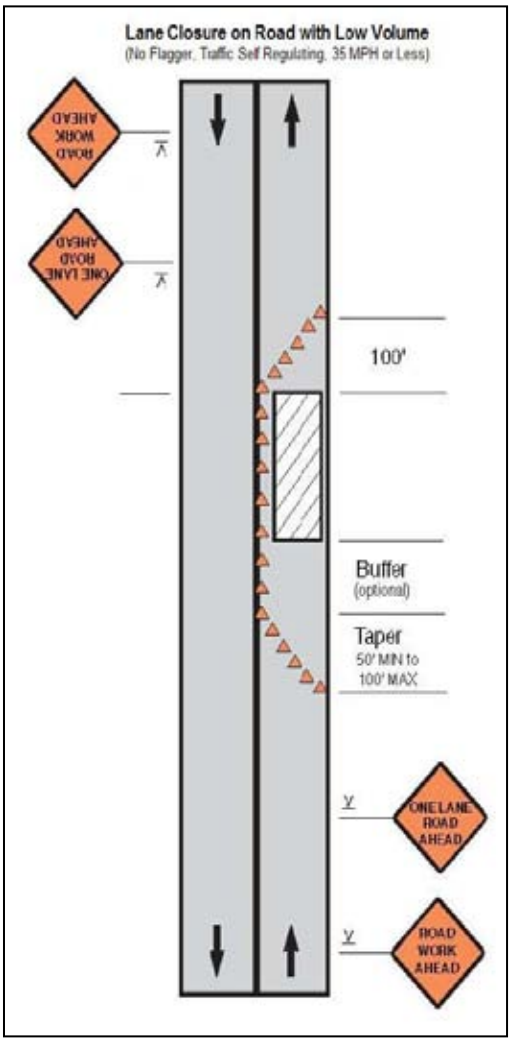
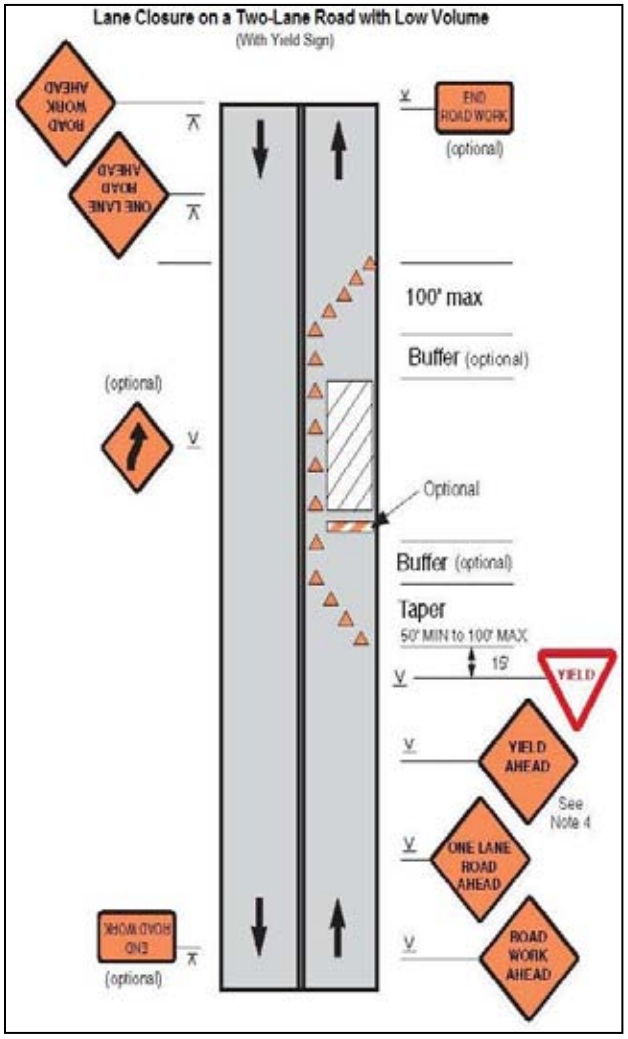


Figure A6 & A7: Lane closure on a two-line road with low volume (with yield sign) & Lane closure on a two-line road with low volume (one flagger operation)



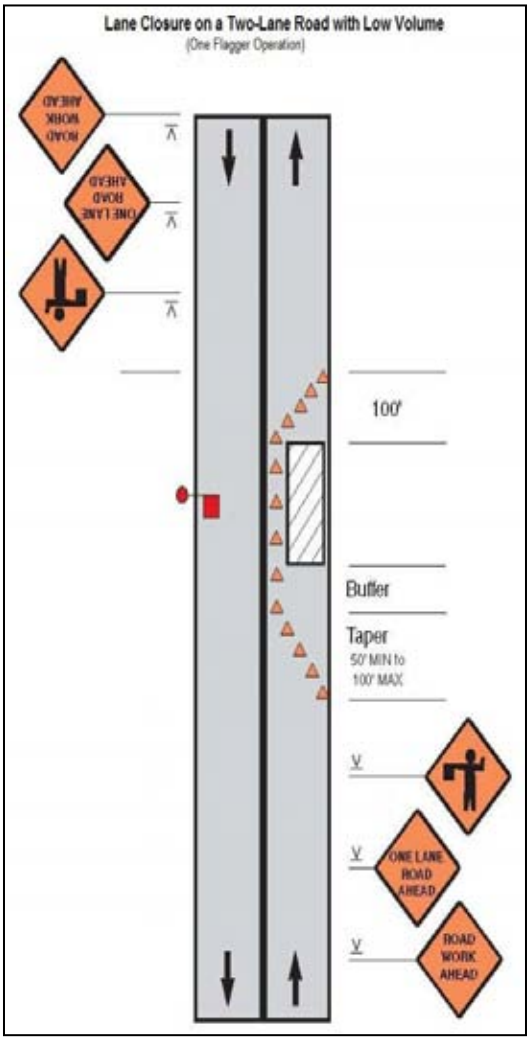
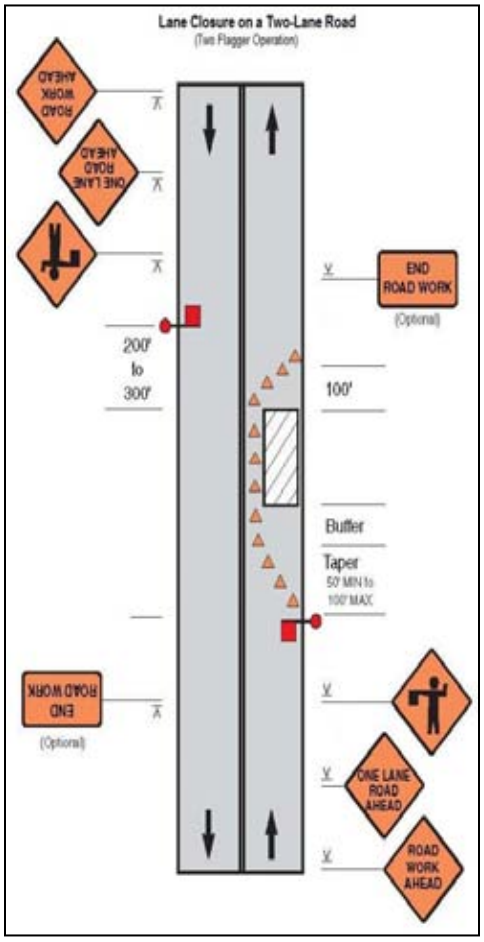


Figure A8 & A9: Lane closure on a two lane road (two flagger operation) & Lane closure on a four lane undivided Road



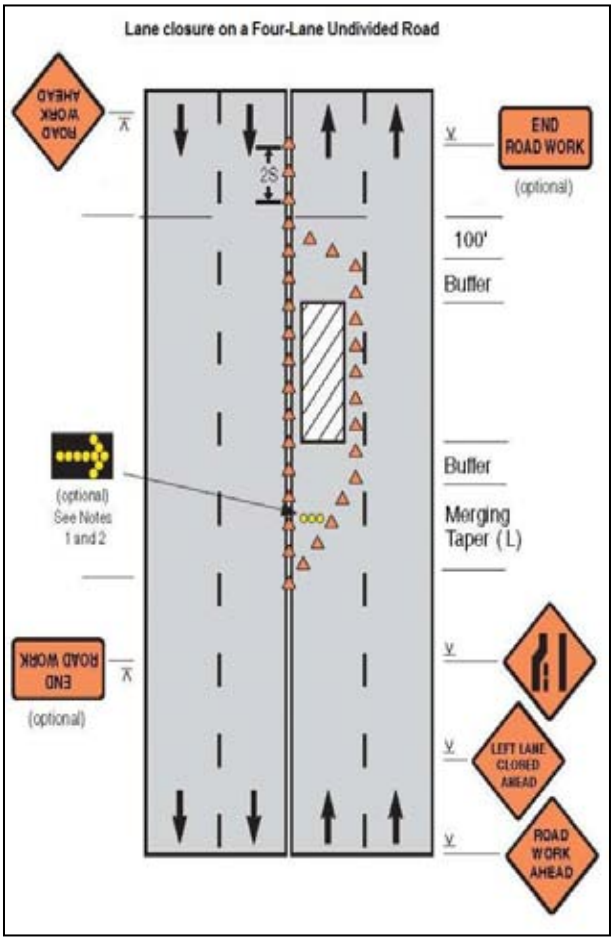
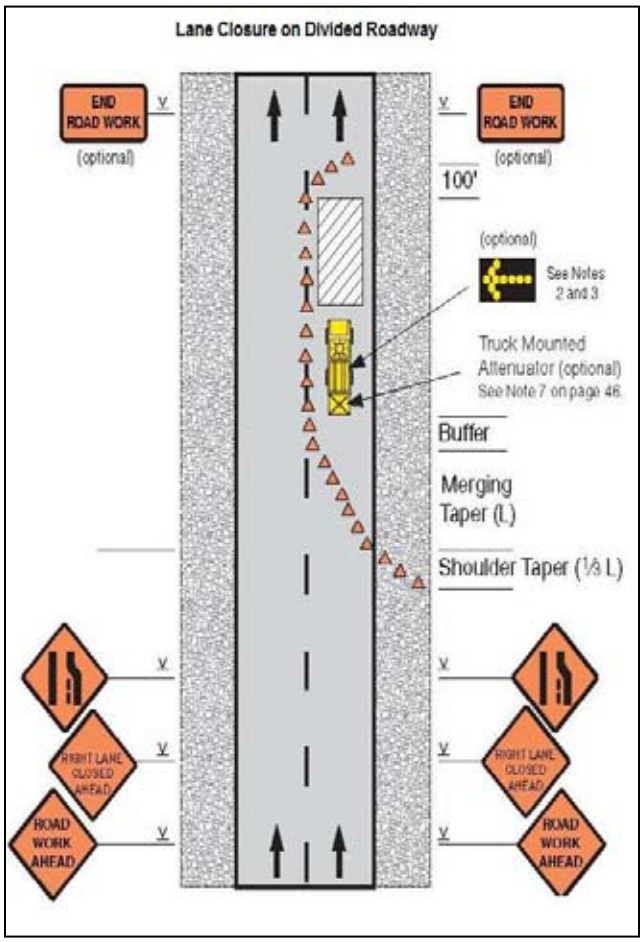


Figure A10 & A11: Lane closure on divided roadway & Half road closure on multi-lane roadway



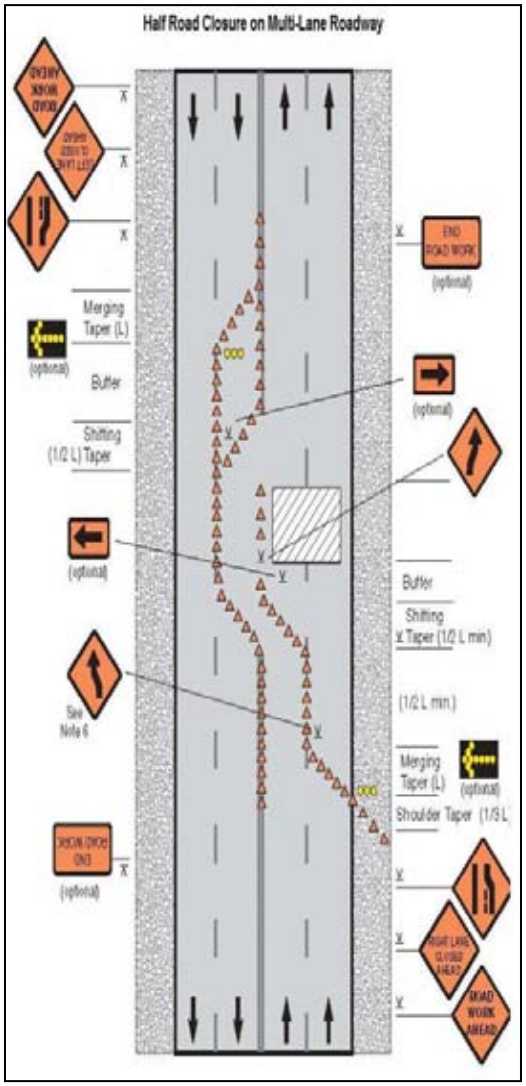
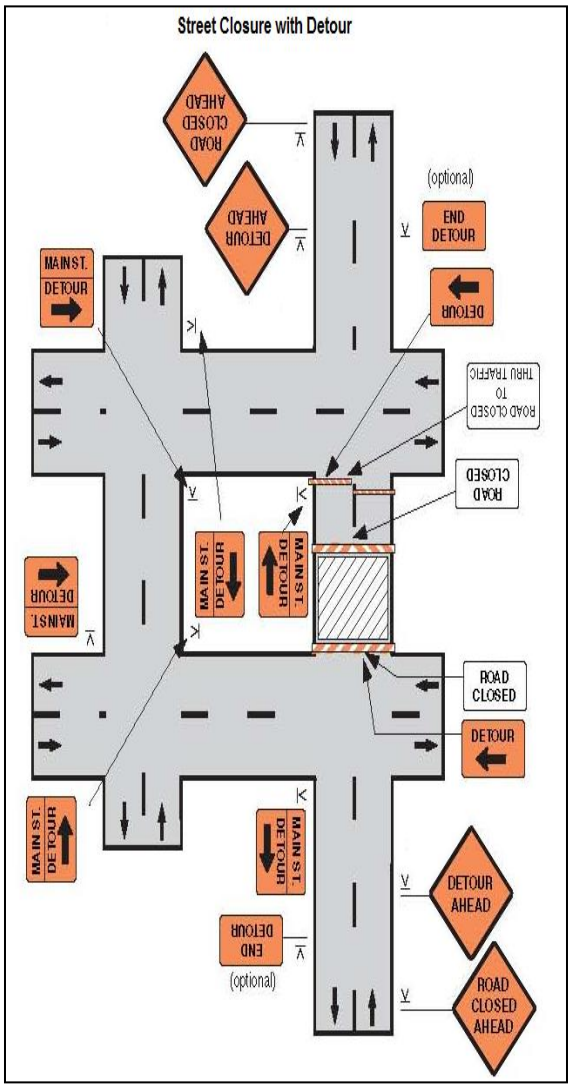


Figure A12: Street closure with detour



Appendix 5: Emergency Response Plan Template – (Chlorine Leakage, Sewer Network Operation, power outage at sewage pumping station etc)

Section 1.
System Information

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

System information

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

Section 2.
Chain of Command – Lines of Authority

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

Chain of command – lines of authority

Name and Title (as required)	Examples of Responsibilities During an Emergency	Contact Numbers
Mr/Ms……. Water & Wastewater System Manager(s)	Responsible for overall management and decision making for the water & wastewater system. The Wastewater System Manager is the lead for managing the emergency, providing information to regulatory	Phone: Mobile:

Name and Title (as required)	Examples of Responsibilities During an Emergency	Contact Numbers
	agencies, the public and news media. All communications to external parties are to be approved by the manager.	
Mr/Ms …….. Water & Wastewater System Operator(s)	In charge of operating the water supply & wastewater systems, performing inspections, maintenance and sampling and relaying critical information, assessing facilities, and providing recommendations to the system manager.	Phone: Mobile:
Mr/Ms Water & Wastewater Treatment Plant Operator(s)	In charge of running treatment plants and chlorine handling system, performing inspections, maintenance and sampling and relaying critical information, assessing facilities, and providing recommendations to the system manager.	Phone: Mobile:
Mr/Ms…….. Office Administrator	Responsible for administrative functions in the office including receiving phone calls and keeping a log of events. This person will provide a standard carefully pre-scripted message to those who call with general questions. Additional information will be released through the wastewater system manager.	Phone: Mobile:
Mr/Ms…… Field Staff	Delivers door hangers, posts notices, and supports wastewater system operator.	Phone: Mobile:

Section 3.
Events that Cause Emergencies

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

Events that cause emergencies

Type of Event	Probability or Risk (High-Med-Low)	Comments
Chlorine leakage at WTP		
Burst of sewer line		
Leak of sewer line		
Overflow of sewer line		
Power outage at SPS		

Section 4.
Emergency Notification

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

Emergency Notification List				
Organization or Department	**Name & Position**	**Telephone**	**Night or Cell Phone**	**Email**
Urban Local Body				
Wastewater Operator (if contractor)				
Primacy Agency Contact				
Wastewater Systems Manager Contact				

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

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

Service / Repair Notifications				
Organization or Department	**Name & Position**	**Telephone**	**Night or Mobile Phone**	**Email**
Bangalore Electricity Supply Company				
Electrician				
Water Testing Lab.				
Wastewater systems operator/manager				
Plumber				

Service / Repair Notifications				
Organization or Department	**Name & Position**	**Telephone**	**Night or Mobile Phone**	**Email**
Pump Supplier				
"Call Before You Dig"				
Rental Equipment Supplier				
Pipe Supplier				

Notification procedures

Notify wastewater system customers

Who is Responsible:	
Procedures:	

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

Who is Responsible:	
Procedures:	

Contact service and repair contractors

Who is Responsible:	
Procedures:	

Procedures for issuing a health advisory

Who is Responsible:	
Procedures:	

Other procedures, as necessary

Who is Responsible:	
Procedures:	

Section 5.
Effective Communication

Communication with customers, the news media, and the general public is a critical part of emergency response.

Designated public spokesperson

Designate a spokesperson (and alternate) and contact regulatory agency for delivering messages to the news media and the public.

Designate a spokesperson and alternates

Spokesperson	Alternate

Section 6.
The Vulnerability Assessment

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

Facility vulnerability assessment and improvements identification

System Component	Description and Condition	Vulnerability	Improvements or Mitigating Actions	Security Improvements
Collection System				
Sewage Pumping				
Other Considerations				

Section 7.
Response Actions for Specific Events

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

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

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

A. Power outage

Assessment	
Immediate Actions	
Notifications	
Follow-up Actions	

B. Collection system blockage or line break

Assessment	
Immediate Actions	
Notifications	
Follow-Up Actions	

C. Collection system pumping facilities failure

Assessment	
Immediate Actions	
Notifications	
Follow-Up Actions	

D. Vandalism or terrorist attack

Assessment	
Immediate Actions	
Notifications	
Follow-up Actions	

E. Flood

Assessment	
Immediate Actions	
Notifications	
Follow-up Actions	

F. Earthquake

Assessment	
Immediate Actions	
Notifications	
Follow-up Actions	

G. Hazardous materials spill into collection system

Assessment	
Immediate Actions	
Notifications	
Follow-up Actions	

H. Electronic equipment failure

Assessment	
Immediate Actions	
Notifications	
Follow-up Actions	

I. Other

Assessment	
Immediate Actions	
Notifications	
Follow-up Actions	

Section 8.
Returning to Normal Operation

Returning to normal operations

Action	Description and Actions

Section 9.
Plan Approval

Plan approval

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

Name/Title	Signature	Date

Section 10.
Certificate of Completion

I certify to the Government of Nepal that this wastewater system has completed an Emergency Response Plan (ERP).

I certify that this document was prepared under my direction or supervision.

Wastewater Systems: _____

System Name: _____

Address: _____

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

_____ **Title:** _____

Signature: _____

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

Completion of the following:

□ Security Vulnerability Assessment

□ Emergency Response Plan

Source: www.rcap.org (modified)

Appendix 6: Minutes of the Stakeholder Consultation Meeting (October 3, 2012, Davangere)

The meeting was attended by key stakeholders from four project towns of Byadgi, Ranebennur, Harihar and Davangere including public/elected representatives from each town, ULB officials, officials from other line departments and executing agency KUIDFC, and NGOs/CBOs. The meeting was chaired by Davangere District Deputy Commissioner,

The PPTA consultants made detailed presentations – in Kannada and English on overall program, pilot towns, technical studies, poverty social development aspects, and environmental and social safeguard issues related to proposed subprojects in respective towns.

Harihar Town Meeting Session

Mr.Vishwanath, president of Harihar CMC made following comments:

- Two ELSRs proposed in the town may not be adequate
- Water supply system should have minimum number of valve operations.
- Concerned about design of existing water supply system and water tariff.
- Harihara ULB engineers suggested that, sewer network proposed in KISWRMIP is not adequate as the proposed network under KMRP is further reduced to 46 km.
- Contractors leaving the trenches open for extended periods during construction causing inconvenience and risk of accidents.(this is with reference to ongoing works in Harihar)
- ASI permission may not be required for the works; PPTA Team clarified that ASI permission will be required for any works within 300 m of Harihareshwara Temple in the town; the Harihar CMC and KUIDFC PIU Harihar engineers indicated that the permission from ASI has been obtained for works under KMRP, and same should be obtained again for these works also

KUIDFC

- Mr.Arifullah Sharief stated that, the Draft Feasibility Studies (DFSs) are subject to change to address stakeholder comments and concerns.
- Mr.Arifullah Sharief suggested to use Ashraya Scheme Government Order(GO) for land acquisition in Byadgi and other ULB, if required. (GO states that, compensation for land acquisition can be paid at 3 times to the guidance value of the land)

Other discussions

- Provision for Sewer Connections – include connection cost as a separate item. Check with project staff of KMRP/NKUSIP.
- Surrounding areas of ULBs and gaps in the existing sewerage system of the town – Check whether the villages and settlements are within the ULB's jurisdiction/ boundary and also population densities.
- Demarcate the roads where larger diameter sewers and WS mains are proposed in all ULBs, to carryout sample surveys and to check impacts during construction. Identify streets where complete road closure is required?
- Maps or drawings to be prepared to show proposals/ options for both water supply and wastewater system.

- Refine the cost estimates to show following items separately: Laying of sewer network: Road restoration cost; Construction of collection chambers and connections from individual properties to collection chambers; Land cost for STPs and Pumping Stations; Construction cost of STP
- Identify industrial demand and location for recycling treated wastewater
- Preparation of comparison table for the selection of pipe material for sewerage and water supply system
- Plan awareness program for the sanitation in each ULB

Appendix 7: Environmental Audit of the Existing Water Treatment Plant in Harihar

I. Introduction

1. The objectives of this environmental audit are to (i) assess the compliance of the existing water treatment plant (WTP) to be rehabilitated/augmented during the implementation of KISWRMIP with environmental legislation; (ii) improve environmental performance through monitoring the effectiveness of the management system; and (iii) increase the Harihar TMC's knowledge of itself and its activities, thus increasing its ability to continually improve and minimize future potential liabilities.

2. The environmental audit was carried out by the PPTA consultants during IEE report preparation from May 2012 to December 2012. The methodology adopted for this audit was to initially review existing plans and technical information and list various activities being carried out in the WTP. Due diligence was carried out to physically check whether environmental performance, health and safety, etc. were in compliance with national and state prescribed standards and guidelines. Team visited the WTP was and observed operations. Meetings and discussions with key personnel were held in the various stages of the audit. Various documentations regarding the operational aspects were also checked.

3. A more detailed environmental audit and risk assessment shall be carried out by competent and independent third party auditors during detailed design stage.

II. Description of Existing Water Treatment Plant at Harihar

Location	Harihar Town Latitude: 14° 31' N Longitude: 75°48' E
Start of operation (year)	2003
Owned by	CMC Harihar
Contact person and designation	Mr Malatesh CM Junior Engineer +91 9845140606
Capacity	13 million liters per day (MLD)
Water supply source	Tungabhadra River (intake at Kawaletty 5 km from upstream of Harihar
Water treatment process	Technology: The treatment process is conventional, and has following units: Cascade Aerator, Raw Water Channel with Parshall Flume for continuous flow measurement, Coagulant & Flocculent chemical makeup tanks, Flash Mixing tank, Clarifier including a flocculation zone in the centre, Four sand filters, Chlorine gas storage cylinders and dosing unit, back wash water storage

	for filters Materials: All civil structures are made of reinforced cement concrete, and mechanical units like the clariflocculator bridge, etc. are of mild steel. Process: the water from raw water pumping main enters into the inlet, and the first unit is cascade aerator. After aeration water passes through parshall flume, where flow is measured. Coagulant and flocculent chemicals (alum and polymer) are added to the water, and mixed in the flash mixer tank, and then flows into clariflocculator. Clarified water flows into sand filters (4 no,s) for filtration and the filtered water is disinfected with chlorine, and allowed to flow into clear water tank from where water pumped into service reservoirs for distribution .
Backwash water and sludge management	-filter backwash water is let into open drains as there is no recycling of backwash into inlet - the settled sludge from the bottom of the clarifier tank is periodically flushed into the drains. -This practice of discharge of backwash and sludge directly into the drains, wastes water, pollutes and silts receiving water bodies. -the untreated backwash and sludge flushing ultimately reaches disposed into River Tungabhadra which is flowing near the site.
Chlorination system	Chlorine dosage system is not proper; there are no safety precautions in place. Chlorine cylinders (900 kg tonners) are placed haphazardly at the facility; the dosage system is not properly functional; no safety systems like leak detection or emergency alarm or lime slurry pit available in the facility. Operators are not aware of safety measures or actions to be performed during any emergency.

III. Compliance with Applicable National and State Laws, Rules, and Regulations

Law, Rules, and Regulations	Description and Requirement	WTP at Harihar
		Y = compliant (if applicable, specify expiration date of permit/clearance) N = non-compliant[1] N/A = not applicable (state justification)
EIA Notification	The EIA Notification of 2006 and 2009 (replacing the EIA Notification of 1994) states that environmental clearance is required for certain defined activities/projects.	N/A Environmental clearance is not required as WTPs are not listed in the EIA Notification's "Schedule of Projects Requiring Prior Environmental Clearance"
Manufacture, Storage, and Import of Hazardous Chemical Rules, 1989	Storage of chlorine (threshold quantity greater than 10 tons but less than 25 tons) in WTPs will require clearance from Karnataka Pollution Control Board (WBPCB).	N/A Normally 1 or 2 tonners (of capacity 900 kg) are stored at the site
Water (Prevention and Control of Pollution) Act of 1974, Rules of 1975, and amendments	Consent to operate from KSPCB	N/A In Karnataka, WTPs do not require consent from KSPCB
Air (Prevention and Control of Pollution) Act of 1981, Rules of 1982 and amendments.	Consent to operate from KSPCB	no source of air emissions (e.g., standby power generators)
Environment (Protection) Act, 1986 and CPCB Environmental Standards	Emissions and discharges from the facilities to be created, refurbished, or augmented shall comply with the notified standards.	
	a. Air emissions	no monitoring conducted
	b. Effluent	no monitoring conducted
CPHEEO Drinking Water Quality Standards	Applicable standards for drinking water at the consumer end	N – No regular monitoring Is conducted; Although period monitoring is said to

[1] Compliant = There is sufficient and appropriate evidence to demonstrate that the particular regulatory requirement has been complied with; non-compliant = clear evidence has been collected to demonstrate the particular regulatory requirement has not been complied with.

		Y = compliant (if applicable, specify expiration date of permit/clearance) N = non-compliant[1] N/A = not applicable (state justification)
		be conducted with the help of outside laboratories no results are readily available There is no laboratory at the WTP
Noise Pollution (Regulation and Control) Rules, 2002 amended up to 2010	Applicable ambient noise standards with respect to noise for different areas/zones	no monitoring conducted
National Institute of Occupational Safety and Health (NIOSH) Publication No. 98-126	Applicable noise exposure levels and duration that no worker exposure shall equal or exceed	no monitoring conducted
Forest (Conservation) Act, 1980 and Forest Conservation Rules, 2003 as amended	As per Rule 6, every user agency, who wants to use any forest land for non-forest purposes shall seek approval of the central government.	N/A WTPs are not located in notified forest lands.
Ancient Monuments and Archaeological Sites and Remains Rules of 1959	No development activity is permitted in the "protected area," and all development activities likely to damage the protected property are not permitted in the "controlled area" without prior permission of the Archaeological Survey of India (ASI). Protected property includes the site, remains, and monuments protected by ASI or the State Department of Archaeology.	N/A
The Child Labor (Prohibition and Regulation) Act, 1986	No child below 14 years of age will be employed or permitted to work in any of the occupations set forth in the Act's Part A of the Schedule or in any workshop wherein any of the processes set forth in Part B of the Schedule are present.	No children between the ages of 14 and 18 will engage in hazardous work.

IV. Institutional Arrangement

Parameter	Palta Water Works
Operations	7 days a week 24 hours a day 3 working shifts per day
Manager per shift	1 junior engineer
Water supply engineer on-site	
Estimated number of technical employees on-site	2-3 staff

Parameter	Palta Water Works
per shift	
Estimated number of laborers on-site per shift	-
Estimated number of employees in charge of environmental management and monitoring	-
Frequency of water quality monitoring (raw water)	-
Frequency of water quality monitoring (treated water for distribution)	-
Frequency of water quality monitoring (sludge supernatant)	not conducted
Frequency of water quality monitoring (WTP effluents)	not conducted
In-house laboratory for water quality analyses (Yes/None). If none, provide name of third-party laboratory.	No in house laboratory

V. Corrective Action Plan

	Gaps	Corrective Action	Time Frame	Responsible Person	Indicator for CMC/ KUIDFC	Indicator for ADB	Budget
A. Compliance With National, State, and Local Laws and Rules							
1	Monitoring of raw and treated water as per CPHEEO Drinking Water Quality Standards	Conduct regular monitoring of water (frequency, parameters and methodology as per CPHEEO Manual requirements for drinking water supply.	O & M phase	Harihar CMC (during O&M phase)	Provision of laboratory as part of the subproject and budget Inclusion in the Environ-mental Monitoring Program	ADB to approve IEE with EMP prior to bidding	Included in CMC cost (during O&M phase)
2	Monitoring of air emissions and effluent not being conducted	EMP to include air emissions and effluent monitoring	Construction phase O&M phase	Contractors (during construction phase) Harihar CMC (during O&M phase)	EMP implemen-tation to include monitoring of air emissions and effluent.	ADB to approve IEE with EMP prior to bidding	Included in contractors cost (during construc-tion phase) Included in CMC cost (during O&M phase)
3	Monitoring of ambient noise levels not being conducted	EMP to include noise level monitoring	Construction phase O&M phase	Contractors (during construction phase) Harihar CMC (during O&M phase)	EMP implemen-tation to include monitoring of ambient noise levels.	ADB to approve IEE with EMP prior to bidding	Included in contractors cost (during construc-tion phase) Included in CMC cost (during

	Gaps	Corrective Action	Time Frame	Responsible Person	Indicator for CMC/ KUIDFC	Indicator for ADB	Budget
							O&M phase)
4	Monitoring of workers' noise exposure levels and duration not being conducted	EMP to include worker noise exposure level and duration monitoring	Construction phase O&M phase	Contractors (during construction phase) CMC (during O&M phase)	EMP implementation to include monitoring of workers noise exposure levels and duration.	ADB to approve IEE with EMP prior to bidding	Included in contractors cost (during construction phase) Included in CMC cost (during O&M phase)
B. Institutional Arrangement							
1	Unidentified employees responsible for environmental management and monitoring	PMU to designate environmental coordinators for EMP implementation	During program implementation	CMC	PMU Environmental Coordinators to work closely with WTP staff. IEE with EMP to specify TOR of PMU Environmental Coordinators	Institutional arrangement for EMP implementation clearly defined in the IEE. ADB to approve IEE with EMP prior to bidding.	Included in CMC cost
2	No information on capacity of WTP engineers to conduct environmental quality monitoring	Build capacity of CMC, PMU Environmental Coordinators, and WTP operators	During program implementation	PIU/ consultant Team	Number of trainings conducted	Semi-annual report to include documentation of trainings conducted	Included in DSC cost
C. Others							
1	No documentation of complaints/ grievances from people regarding noise/odor	Public consultation to include stakeholders from communities adjacent to the WTP	During program implementation	DSC, Contractors, and CMC	GRM documentation and reporting all throughout the program implementation	Semi-annual report to include summary of complaints/ grievances, remedial actions taken, and, if necessary, additional environmental mitigation measures	Included in CMC cost
2	Physical and chemical quality of supernatant not being determined prior to discharge.	EMP to include supernatant monitoring	Decommission phase and defects liability period O&M phase	Contractors (during decommissioning and defects liability period) CMC (during	Results to be submitted to PMU	Semi-annual report to ADB (during decommissioning and defects liability period)	Included in contractors cost (during decommissioning and defects liability period)

	Gaps	Corrective Action	Time Frame	Responsible Person	Indicator for CMC/ KUIDFC	Indicator for ADB	Budget
				O&M)			Included in CMC cost (during O&M phase)
3	Sludge quality not being determined prior to reuse as raw material in manufactu-ring bricks	EMP to include sludge quality monitoring	Decommis-sion phase and defects liability period O&M phase	Contractors (during decommis-sioning and defects liability period) CMC (during O&M)	Results to be submitted to PMU	Semi-annual report to ADB (during decommis-sioning and defects liability period)	Included in contractors cost (during decommis-sioning and defects liability period) Included in CMC cost (during O&M phase)