Initial Environmental Examination

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IND: Karnataka Integrated Urban Water Management Investment Program (Tranche 2) – Strengthening Distribution System for Implementing 24x7 Water Supply to Mangalore City Corporation

Package No: 02MNG01

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

CURRENCY EQUIVALENTS

(as of 11 May 2018)

Currency unit	–	Indian rupee (₹)
₹1.00	=	$0.019
$1.00	=	₹67.090

ABBREVIATIONS

ADB	–	Asian Development Bank
ASI	–	Archaeological Survey of India
CFE	–	consent for establishment
CFO	–	consent for operation
CPCB	–	Central Pollution Control Board
DPR	–	detailed project report
EHS	–	environmental, health and safety
EIA	–	environmental impact assessment
EMP	–	environmental management plan
GLSR	–	ground level service reservoir
GRC	–	Grievance Redress Committee
GRM	–	grievance redress mechanism
HDPE	–	high density poly ethylene
HSC	–	house service connection
H&S	–	health and safety
IEE	–	initial environmental examination
IFC	–	International Finance Corporation
KIUWMIP	–	Karnataka Integrated Urban Water Management Investment Program
KSPCB	–	Karnataka State Pollution Control Board
KUIDFC	–	Karnataka Urban Infrastructure Development and Finance Corporation
MCC	–	Mangalore City Corporation
NGO	–	nongovernment organization
OHS	–	occupation health and safety
OHT	–	overhead tank
PIU	–	program implementation unit
PMDCSC	–	project management, design, construction and supervision consultant
PMU	–	program management unit
REA	–	rapid environmental assessment
RPMU	–	regional program management unit
SPS	–	Safeguard Policy Statement
ULB	–	urban local body
WTP	–	water treatment plant

WEIGHTS AND MEASURES

m^3	-	cubic meter
dia	-	diameter
kl	-	kiloliter
km	-	kilometer
kmph	-	kilometers per hour
lpcd	-	liters per capita per day
lps	-	liter per second
m	-	meter
mm	-	milliliter
MCM	-	million cubic meters
MLD	-	million liters per day
m^2	-	square meter
km^2	-	square kilometer

NOTE

In this report, "$" refers to United States dollars.

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EXECUTIVE SUMMARY

The Asian Development Bank (ADB) funded Karnataka Integrated Urban Water Management Investment Program (KIUWMIP) 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 while strengthening relevant institutions to enhance efficiency, productivity and sustainability in water use. Mangalore 24x7 water supply distribution network subproject is one of the subprojects proposed in Tranche 2.

Categorization. ADB requires the consideration of environmental issues in all aspects of the Bank's operations, and the requirements for environmental assessment are described in its Safeguard Policy Statement (SPS), 2009. The proposed projects are categorized as A, B, C or FI to determine the level of environmental assessment required. Mangalore water supply subproject is classified as environmental category B as per ADB SPS, 2009 as no significant impacts are envisioned. Accordingly, this initial environmental examination (IEE) report has been prepared. The bulk water supply components proposed under the government funding are required for successful operation of this package. Thus, due diligence for both ADB- and government-funded components have been included in this IEE.

Subproject Scope. Subproject includes the following components: (i) clear water feeder mains of 59.45 kilometers (km) of diameter 200 millimeters (mm) to 660 mm to overhead tanks (OHTs) and ground level service reservoirs (GLSRs); (ii) 14 OHTs and 2 GLSRs; (iii) distribution network of 789 km (diameter 63 mm to 500 mm); and (iv) replacement of 78,969 existing house service connections (HSC) along with meters and providing 11,031 new metered HSCs to uncovered households.

Implementation Arrangements. Karnataka Urban Infrastructure Development and Finance Corporation (KUIDFC) is the executing agency responsible for overall technical supervision and execution of all subprojects funded under the investment program. Implementation activities are overseen by Program Management Unit (PMU) established in its head office at Bangalore in coordination with its regional office (RPMU) in Mangalore. PMU and RPMU are staffed with technical, administrative and financial officials, including safeguards specialists, to manage and monitor program implementation. The implementing agencies are the respective urban local bodies (ULBs). For this package, the implementing agency is Mangalore City Corporation (MCC). A Program Implementation Unit (PIU) has been set up for implementation of day-to-day activities in the field. A consultant team, Project Management, Design and Supervision Consultant (PMDCSC), assists PMU, RPMU and all PIUs in subproject planning and management, assures technical quality of design and construction, designs the infrastructure, and supervises construction including conducting all safeguards tasks.

Description of the Environment. The subproject components are located in Mangalore urban area. Mangalore is located on the western coast, and it is important port city. There are no ecologically-sensitive areas such as protected areas, wetlands, mangroves, or estuaries in or near the subproject locations. All project sites (OHTs, GLSRs and pumping stations, except for the Nekkilagudda OHT site) are government-owned land parcels. Nekkilagudda OHT site is privately owned, and this is selected due to non-availability of government land at the location. All the pipelines will be laid along the public roads within the road right-of-way (ROW). Mangaladevi Temple in Mangalore City is an Archaeological Survey of India (ASI) protected monument, however, this is located outside the project impacted area; there are no works proposed in or close to the monument. The components of bulk water supply project, implemented under the government funded (AMRUT scheme and state funded), are mostly located within the existing

project facilities; the new pipelines are proposed along the roads within the ROW, and of the six OHTs proposed, five are in private lands, while one is in government and falls in the coastal regulation zone (CRZ).

Water Source sustainability. The source of water supply for Mangalore is the perennial Netravati River. To ensure adequate and continuous water supply throughout the year, a vented dam across the river at Thumbe (referred to as “Thumbe dam”) was constructed in 1993. Another dam 50 meters downstream of the vented dam was constructed and commissioned in 2016 to meet future water supply needs of Mangalore City. Thumbe dam is supplemented by the AMR Power Project dam constructed across the same river at Shamboor upstream of Thumbe. There is an agreement between MCC and AMR Power Project that no power is to be generated during the river’s lean flow season (January – May/June), and the water stored in the AMR Power Project dam is to be released to Thumbe dam for Mangalore water supply system. Based on calculations by the design team, water from the dam is adequately available to meet even the lean season demand of Mangalore City. Findings of the water quality analyses conducted by National Institute of Technology Karnataka (NITK) Surthkal during project preparation show water from the dam is suitable for drinking after conventional treatment.

Potential environmental impacts. The sites are selected, and fixed ensuring components are not located in ecologically-sensitive areas. Detailed design of the components incorporated good environmental design and application of effective mitigation measures. However due to the project sites being in urban areas and nature of open cut method for pipelaying works, unavoidable impacts include (i) health and safety hazards to workers during construction and operation, (ii) noise and dust from construction activities, (iii) increased road traffic due to interference of construction activities, (iv) soil erosion/silt runoff from construction waste soils, and (v) increased sewage flow due to increased water supply. In the operational phase, all facilities and infrastructure will operate with routine maintenance, which should not affect the environment. Facilities will need to be repaired from time to time, but environmental impacts will be much less than those of the construction period as the work will be affecting small areas only. Therefore, these potential impacts are site-specific, few if any of them are irreversible, and mitigation measures can be designed readily through good and high-quality construction and operation and maintenance (O&M) practices.

Environmental Management Plan. The environmental management plan (EMP) aims to ensure that the activities are undertaken in a responsible, non-detrimental manner with the objectives of: (i) providing a proactive, feasible, and practical working tool to enable the measurement and monitoring of environmental performance on-site; (ii) guiding and controlling the implementation of findings and recommendations of the environmental assessment conducted for the project; (iii) detailing specific actions deemed necessary to assist in mitigating the environmental impact of the project; and (iv) ensuring that safety recommendations are complied with.

The contractor will be required to submit to PIU, for review and approval, a site environmental management plan (SEMP) including (i) proposed sites/locations for construction work camps, storage areas, hauling roads, lay down areas, disposal areas for solid and hazardous wastes; (ii) specific mitigation measures following the approved EMP; and (iii) monitoring program as per SEMP. No works can commence prior to approval of SEMP.

A copy of the updated EMP / SEMP must be kept on work sites always. The EMP will be included in the bid documents and will be further reviewed and updated during implementation. The EMP will be made binding on all contractors operating on the site and will be included in the contractual

clauses. Non-compliance with, or any deviation from, the conditions set out in this document constitutes a failure in compliance.

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

Mitigation measures for identified impacts include: (i) implementing a health and safety (H&S) plan and providing regular orientation to workers, (ii) noise-producing activities will be kept at minimum by using silencers and working during periods when it will be least affecting sensitive receptors, (iii) water spraying of surroundings to minimize dust, (iv) implementing traffic management plan in coordination with local traffic enforcers, (v) reuse of waste soils, and (vi) ,improving the sewerage system as part of KIUWMIP. Contractors will be providing planks to create access to ensure businesses are not affected.

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 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).

Consultation, Disclosure and Grievance Redress: 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 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 can participate in its development and implementation. A project-specific grievance redress mechanism (GRM) is proposed and described in the IEE to ensure any public grievances are addressed quickly.

Monitoring and Reporting: The PMU, RPMU, PIUs, consultants will be responsible for monitoring the contractors. PMSDC will submit monthly monitoring reports to RPMU, and the PMU will send semi-annual monitoring reports to ADB. ADB will post the environmental monitoring reports on its website.

Permits and Clearances Required. Environmental clearance requirement per Government of India Environmental Impact Assessment Notification is not applicable to this subproject. Environment-related statutory clearance or permission is not required for any of the subproject components. Under the government-funded components, one OHT site falls in CRZ and therefore requires prior permission from Karnataka Coastal Zone Management Authority. No other environmental related clearance or permissions required.

Conclusions and Recommendations. The citizens of the Mangalore will be the major beneficiaries of this subproject as the environmental condition and over-all health of the

community will be improved. With the improvement and expansion of distribution system, they will be provided with a constant supply of better quality water, piped into their homes. The replacement of old pipelines lines will avoid cross contamination and have positive benefit on health by avoiding diseases such as diarrhoea and dysentery, resulting in less expenses on healthcare, improve working days and their economic status.

Based on the findings of the IEE, there are no significant impacts and the subproject as category “B” is confirmed. No further study or detailed environmental impact assessment (EIA) is required to comply with ADB SPS (2009).

I. INTRODUCTION

A. Background

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 integrated water resource management (IWRM) context.

2. 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). Kundapura, Mangalore, Puttur, and Udupi are the four towns chosen to benefit from the Tranche 2 of the investment.

3. The expected outcome will be urban water resource management in four coastal towns (Kundapura, Mangalore, Puttur and Udupi) improved. The outputs are (i) UWSS infrastructure expanded and upgraded; (ii) water resource planning, monitoring and service delivery improved; and (iii) institutional capacity of KUIDFC and ULBs capacity strengthened. This IEE is based on an assessment water supply projects within the project area i.e. Mangalore.

4. **Subproject Scope.** Subproject includes the following components: (i) clear water feeder mains of 59.45 kilometers (km) of diameter 200 millimeters (mm) to 660 mm to overhead tanks (OHTs) and ground level service reservoirs (GLSRs); (ii) 14 OHTs and 2 GLSRs; (iii) distribution network of 789 km (diameter 63 mm to 500 mm); and (iv) replacement of 78,969 existing house service connections (HSC) along with meters and providing 11,031 new metered HSCs to uncovered households.

B. Background of the Initial Environmental Examination

5. **Categorization.** ADB requires the consideration of environmental issues in all aspects of the bank's operations, and the requirements for environmental assessment are described in its Safeguard Policy Statement (SPS), 2009. The proposed projects are categorized as A, B, C or FI to determine the level of environmental assessment required.[1] Rapid environmental assessment using ADB's Rapid Environmental Assessment (REA) Checklist for Water Supply Scheme components were conducted, and results of the assessments show that Mangalore water supply subproject is classified as environmental category B as per ADB SPS, 2009. Accordingly, this initial environmental examination (IEE) report has been prepared. The government-funded

[1] Per ADB SPS, the environmental categorization and level of environmental assessment required for each category are as follows: (i) **Category A**: A proposed project is classified as category A if it is likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented. These impacts may affect an area larger than the sites or facilities subject to physical works. An environmental impact assessment is required. (ii) **Category B**: A proposed project is classified as category B if its potential adverse environmental impacts are less adverse than those of category A projects. These impacts are site-specific, few if any of them are irreversible and, in most cases, mitigation measures can be designed more readily than for category A projects. An initial environmental examination is required. (iii) **Category C:** A proposed project is classified as category C if it is likely to have minimal or no adverse environmental impacts. No environmental assessment is required although environmental implications need to be reviewed. (iv) **Category FI**: A proposed project is classified as category FI if it involves investment of ADB funds to or through a financial intermediary.

components are essential for successful operation of this subproject. Thus, due diligence for both ADB- and government-funded components have been included in this IEE.

6. **Scope of the IEE.** The IEE was based on detailed engineering design/detailed project report (DPR) prepared by KUIDFC, the executing agency in close coordination with Mangalore City Corporation (MCC). MCC has given its formal approval to the DPR by adopting a resolution in its general body meeting. Assessment of potential impacts are based on secondary sources of information and field reconnaissance surveys; no field monitoring (environmental) survey was conducted. Stakeholder consultation was an integral part of the IEE. The IEE will be updated/revised if there are changes in site/locations and design of components during design validation and preconstruction phase. It will also be updated/revised based on contractor's site-specific environmental management plan (EMP). The updated/revised IEE will be submitted to ADB for review and disclosure. No works will be conducted until ADB has cleared the updated/revised IEE.

7. **Report Structure.** This IEE was prepared following KIUWMIP's environmental assessment and review framework[2] and ADB SPS, 2009. The report comprises the following sections: (i) introduction; (ii) description of project components; (iii) policy and legal framework; (iv) description of the environment; (v) screening of potential environmental impacts and mitigation measures; (vi) public consultation and information disclosure; (vii) grievance redress mechanism; (viii) environmental management plan; and (ix) conclusion and recommendations.

II. DESCRIPTION OF THE PROJECT COMPONENTS

8. Located at 12°87'N Latitude and 74°88''E Longitude, Mangalore City is spread over an area of 132.45 square kilometers (km^2). The topography of the city is from plain to undulating with four hilly regions with natural valleys within the city. Mangalore is situated on the west coast of India, and is bounded by Arabian Sea to its west and the Western Ghats to its east. Mangalore lies on the backwaters of the Netravati and Gurupura rivers. These rivers effectively encircle the city, with the Gurupura flowing around the north and west and the Netravati flowing around the south of the city.

9. Mangalore is officially known as Mangaluru and is the chief port city of Karnataka. It is the administrative headquarters of the Dakshina Kannada district. Mangalore is the largest urban centre of coastal Karnataka and the fourth largest city in Karnataka in terms of area and population. Mangalore is located about 350 km west of the state capital, Bangalore. It is one of the most cosmopolitan non-metro cities of India, and is a commercial, industrial, educational and healthcare hub on the West Coast. Mangalore City urban agglomeration extends from Ullal in the south to Mulki in the north, covering a distance of over 40 km. Mangalore has been ranked best in India and second best in Asia for Quality of life and 12th in the global list for healthcare, according to Numbeo.

A. Existing Water Supply System in Mangalore

10. Mangalore municipal area spreads over 132.45 km^2 and is divided into 60 muncipal administrative wards. Presently, 85% of Mangalore is covered under with water supply system. The first piped water supply scheme for Mangalore was introduced in the year 1956 with River

[2] The environmental assessment and review framework has been prepared in 2014 during KIUWMIP loan approval. This has been updated during Tranche 2 to include recent Government of India's environmental laws, rules and regulations and Tranche 2 project components.

Netravati as source of water. The intake works of the scheme are located on the bank of river Netravati at Thumbe towards southeast of the city at a distance of about 17 km from the city center. This scheme was designed for a capacity of 11.35 million liters per day (MLD) to supply water for a population of 180,000, at supply rate of about 70 liters per capita per day (lpcd). An augmentation combined with improvement scheme was formulated and commissioned in 1974 to cater to the demands of the growing city. Intake works of this scheme are also located at Thumbe, close to the old intake works, with a capacity to supply 81.70 MLD of water. The third water supply scheme for Mangalore was commissioned in 2009, with the same river source, under the ADB-funded Karnataka Urban Development and Coastal Environmental Management Project (KUDCEMP) with a designed capacity of 80 MLD. This scheme was designed taking into consideration the demands of Mangalore City and neighbouring towns of Ullal and Mulky, en route villages from intake to city, and the industrial and institutional demands.

11. **Water Source.** Netravati River is the source of water supply for Mangalore. Water is drawn from river intake located at Thumbe, about 17 km from the city (Figure 1). In order to store water for summer lean flow season, a 350 m vented dam of 4 m height with capacity of 9.56 million cubic meters (MCM) was constructed in 1993 across River Netravati at Thumbe, exclusively to provide water supply to Mangalore City. Further in 2010, to cater to the increased water demands, another dam was constructed just downstream side (~50 m) of the 1993 vented dam. This was constructed by Karnataka Urban Water Supply and Drainage Board (KUWSDB) and commissioned in 2016. Its length is 343 m, with 30 vents (size of gates – 10 m wide x 5.5 m height). The design height of the dam is 7 m, and the total water storage capacity is 14.73 MCM. At present, the dam height is being maintained at 6 m, and the corresponding water storage capacity is 10.83 MCM.

12. Besides the Thumbe dam, raw water to Mangalore is also available from a power project dam (AMR Power Project of AMR Group), constructed across the same river (Netravati) at Shamboor, about 12 km upstream of Thumbe dam. Storage capacity is 14.25 MCM. There is an agreement between MCC and AMR Power Project that no power is to be generated during the river's lean flow season (January – May/June), and the water stored in the AMR Power Project dam is to be released to Thumbe dam for Mangalore water supply system. Based on calculations by the design team, water from the dam is adequately available to meet even the lean season demand of Mangalore City. The storage available in both the dams is sufficient for providing 24x7 water supply in Mangalore (Table 1). No new water source is envisaged to be developed for the subproject.

Table 1: Water Availability and Sufficiency of Water Sources (Dams)

No.	Description	**Base Year** (2016)	**Intermediate Year** (2031)	**Ultimate Year** (2046)
1	Available water storage - Thumbe Dam (MCM)	14.73	14.73	14.73
2	Available water storage - AMR Power Project (MCM)	14.25	14.25	14.25
3	Total gross storage (MCM)	28.980	28.980	28.98
4	Losses - 20 % evaporation losses (MCM)	5.796	5.796	5.796
5	Net water availability (MCM)	23.184	23.184	23.184
6	Raw water availability in (million litres, ML)	23,184	23,184	23,184
7	Total bulk water demand (MLD)	137.390	180.00	236.60
8	Adequacy of water storage for supply (days)	169.000	129	98

13. **Water Treatment Plants.** Three water treatment plants (WTPs) are available in Mangalore (Figure 2). These are located in Ramalkatte, close to water source. The first WTP was constructed under 1956 scheme, with a capacity of 10 MLD; this comprises only a settling tank. At present, partially-treated water from this setting tank is supplied to en-route villages located in between WTP and the city. The second WTP was constructed under 1974 scheme with a capacity of 81.7 MLD. This WTP consists only of clariflucculators, and the clarified water is conveyed to rapid sand filters (RSF) located in the city at Bendoor (RSF of 40.85 MLD capacity), and Panambur (RSF of 3 x 27.2 MLD capacity) for further treatment and supply. Water from Bendoor filters is supplied in the core city area, while from Panambur filters, water is supplied to Surathkal area, New Mangalore Port and drinking water requirement of industrial areas. The third WTP of 80 MLD was constructed under the ADB-funded KUDCEMP in 2006. According the DPR, except the old settling tank-based WTP (first WTP), all the WTPs are in good condition, and the quality of water being produced is fit for drinking purpose.

14. **Distribution System.** The entire service area of Mangalore including Mulky, Ullal and en route villages has been divided into three master zones under the KUDCEMP. Master Zone 1 comprises of the areas to the north of Gurupura River. Master Zone 2 comprises of areas between Netravati and Gurupura Rivers and Master Zone 3, i.e., Ullal is situated to the south of Netravati River (Figure 3). There are three core locations: Padil, Bendoor and Panambur from where water is supplied to all zonal reservoirs. All the areas in Mangalore North are served by Panambur as the main source. For water distribution, Mangalore has been divided into 34 distribution zones. Mangalore South comprises of 24 zones (zones 1 to 24) and Mangalore North comprises of 10 zones (25 to 34). There are 30 water storage reservoirs of 35.88 ML capacity including 21 OHTs and 9 GLSRs. At present 160 MLD of water is supplied daily for 8 hours, at a rate of more than 135 lpcd.

15. **Water Quality.** Water quality tests for drinking water purpose as per Central Public Health and Environmental Engineering Organization (CPHEEO) standards have been conducted by National Institute of Technology Karnataka Surathkal (NITK) in June 2015 for project preparation. Two water samples have been collected from intake point (raw water from dam) and after WTP (clear water). The water quality meets the Indian drinking water standards (Table 2).[3]

Table 2: Water Quality

No.	Parameter	Thumbe Dam (Raw Water)	Water Treated Plant	IS 10500 Standard
1	pH	7.09	6.74	6.5 – 8.5
2	Total hardness as $CaCo_3$, mg/l	23	22	300
3	Iron as Fe, mg/l	0.38	0.14	0.3
4	Chloride as Cl, as mg/l	6.5	7.0	250
5	Nitrate as NO_3, as mg/l	Not detectable	Not detectable	45
6	Sulfate, as SO_4, as mg/l	Not detectable	Not detectable	200
7	Coliform most probable number, MPN/100 ml	39	Nil	Nil

$CaCo_3$ = Calcium carbonate, Cl = Chloride, mg/l = milligrams per liter, MPN = most probable number, NO_3 = Nitrate, pH = potential of hydrogen, SO_4 = Sulfate.

[3] Bureau of Indian Standard (IS 10500 and revised module IS 10500:2012) has specifications in Uniform Drinking Water Quality Monitoring Protocol. This standard has two limits i.e. acceptable limits and permissible limits in the absence of an alternate source. If any parameter exceeds the limit, the water is considered unfit for human consumption.

Figure 1 : Netravati River and Thumbe Dam

View of Netravati River

View of Netravati River

Location of Thumbe Dam

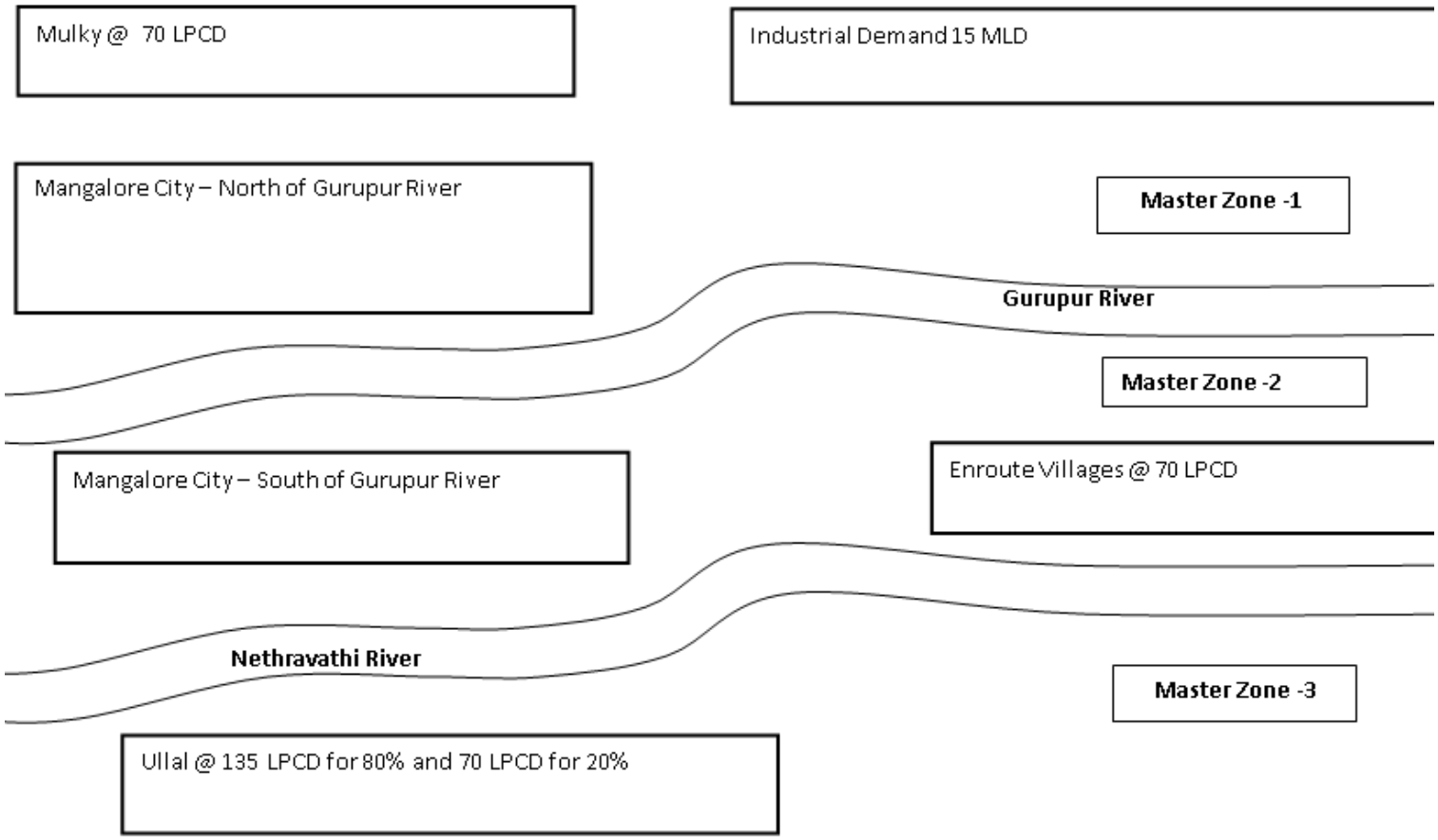
View of 1993 Vented Dam

View of 2010 Dam

Figure 2: View of Water Treatment Plants at Ramalkatte

Source: Google Earth.

Figure 3: Water Supply Master Zones in Mangalore



16. **Need of the subproject.** A detailed assessment of existing situation was carried out, which concludes that the present treated water production of 160 MLD is insufficient to meet water demand of Mangalore till the year 2046 as per national standards of 135 liters per capita per day (lpcd). Table 3 presents the demand and supply gap in Mangalore water supply infrastructure, for present, intermediate and ultimate design years. Following are the deficiencies in the existing distribution system: (i) it covers only 65% of area, (ii) few areas at higher elevation receive water at very low pressure, (iii) existing storage tanks are not sufficient to cater 100% demand up to intermediate stage year, and (iv) currently there is no specific supply pattern followed by the operational staff. Rezoning is proposed, and additional storage reservoirs are proposed for subzones. To ensure equitable and reliable water distribution and minimal O&M costs, the service area is divided into 33 zones and 15 subzones. Besides Mangalore City, it is also proposed to provide potable water to 7 en-route villages located between the WTP and the city. These villages at present, as stated earlier, are supplied from the old settling tank-based WTP, which is not functioning well. KIUWMIP will improve distribution system to address these gaps.

17. As presented in Table 3, for year 2031 there is a gap of about 20 MLD in raw water pumping and water treatment capacity in bulk water supply and some infrastructure gaps in raw water and clear water transmission. The Government of India's Atal Mission for Rejuvenation of Urban Areas (AMRUT) is funding a bulk water supply project and in addition, Government of Karnataka is funding construction of six OHTs of total capacity 8.5 million liters (ML) to address the water supply demand up to 2031.

18. KIUWMIP Tranche 2 will support the distribution network system improvement.

Table 3: Mangalore Water Supply Infrastructure - Demand and Supply Gap

Parameters	**Present Status** (2016)	**Requirement/Demand**			**Gap**
		2016	**2031**	**2046**	
Population covered within Mangalore urban local body (ULB)	554,183	554,183	756,903	1,033,778	2016: Nil 2031: 2,46,676 2046: 5,83,927
Population covered for Ullal Town	60,742	60,742	87,552	126,195	
Population covered for Mulky Panchayat	18,109	18,109	20,864	24,037	
Population covered en-route villages	51,353	51,353	65,744	84,304	
Floating population		15,000	15,000	15,000	
Total		699,387	946,063	1,283,314	
Population serviced	699,387	699,387	946,063	12,83,314	2016: 699,387 2031: 946,063 2046: 1,283,314
Service delivery standards at the consumer end (1) Average per capita supply (2) Duration (3) Quality	135 liters per capita per day (lpcd) 8 hour/day Partially served with potable water	135 lpcd 24 hour/day Potable water (100%)			- 16 hour/day New WTP
Production of potable water required (including nonrevenue water [NRW] losses 15%, fire and floating population. demand)	160 million liters per day (MLD)	137.39 MLD	180.01 MLD	236.60 MLD	2016: Nil 2031: 20.01 MLD 2046: 76.60 MLD
Raw water transmission line	1.2 kilometers (km) laid under 1974 scheme and 1.5 km for 160 MLD is in good condition	A new line of 1.14 km required from Jack well to water treatment plant (WTP) for carrying additional 20 MLD			2016: Nil 2031: 1.14 km 2046: 76.60 MLD
Water Treatment Plant	2 nos. 81.7 MLD is and 80 MLD functional. 1 no	Total requirement 180 MLD. Existing 2 WTP of 160 MLD functional. New WTP for 20 MLD to meet intermediate demand. This WTP will be constructed within the existing facility by replacing the old settling ponds based WTP.			2016: Nil 2031: 20 MLD 2046: 76.60 MLD

Parameters	Present Status (2016)	Requirement/Demand			Gap
		2016	2031	2046	
	Old 10 MLD of settling ponds – this will be replaced with new 20 MLD WTP				
Clear water transmission line	17.12 km of 1000 mm dia and 14 km of 1100 mm dia are good in condition	New line of 0.719 km required for carrying additional 20 MLD			2016: Nil 2031: 0.719 Km 2046: 76.60 MLD
Intermediate Pump Houses	5 Pump houses to pump the clear water to reservoirs	Total 12 pump houses required to pump the clear water to reservoirs. 7 pump houses are proposed to meet the demand of 2046.			2016: Nil 2031: 7 Nos 2046: 7 Nos
Clear Water feeder lines to OHTs	Out of 85.52 km of 200 mm to 600 mm dia, about 32.57 km old pipes are not in good condition	Replacement of 30.928 km of dia 300 to 660 mm and new lines of 27.22 km to meet additional demand of zones			2016: Nil 2031: 58.15 km 2046: 58.15 km
Storage requirements	35.58 ML	61.33 ML	61.33 ML	61.33 ML	2016: 25.75 ML 2031: 25.75 ML 2046: 25.75 ML
Distribution line to cover 48 Zones	Length: 761 km in good condition	1550 km	1550 km	1550 km	2016: 789 km 2031: 789 km 2046: 789 km
Metered house service connection	- 78,969 Nos.	90,000 Nos.	90,000 Nos.	90,000 Nos.	2016: 11,031 no.s 2031: 2046:

Source: Subproject Appraisal Report (SAR), 24x7 Water Supply in Mangalore, KIUWMIP, January 2018.

B. Proposed Subproject

19. It is proposed to improve water supply distribution system under the KIUWMIP Tranche 2 to provide 24x7 water supply in Mangalore.[4] To ensure equitable and reliable water distribution and minimal O&M costs, water distribution area of Mangalore is devised with revised zoning and divided into 33 zones and 15 subzones. Table 4 provides the details of the proposed subproject components based on the detailed engineering design of the subproject. Figures 4 to 6 shows the location and details of proposed components.

[4] Implementing agency is not needed, the IEE is regarded as the final environmental assessment report. (iii) **Category C:** Project components unlikely to have adverse environmental impacts. No EIA or IEE is required, although environmental implications are still reviewed. (iv) **Category FI**: A proposed project involves investment of ADB funds to or through a financial intermediary. Jack well to 20 MLD at Thumbe and replacing all electro mechanical components, (ii) laying raw water main (1.14 km length 610 mm diameter mild steel (MS) pipe) from Jackwell to proposed new water treatment plant (WTP) at Ramalkatte; (iii) construction of new 20 MLD WTP at Ramalkatte by dismantling old 10 MLD settling tanks of 1956; (iv) laying clear water feeder main (0.719 km length 508 mm diameter mild steel pipe) from new WTP to existing clear water sump, and (v) repairs and rehabilitation of existing 1974 WTP (replacement of flash mixer, flocculators, lime mixer, alum mixer, sluice valves and gates and electrical rehabilitation works). Besides, (i) six overhead tanks (OHTs), of total capacity 8.5 ML, (ii) 80 MLD filtration unit for the existing 1974 WTP, and (iii) combined backwash recirculation and sludge management facilities to meet the requirement of both the existing WTPs, are also proposed for implementation with the state government funds. Implementation arrangement for these projects is as follows: KUIDFC as executing agency and Mangalore City Corporation (MCC) as implementation agency will be responsible for implementation.

Table 4: Proposed Subproject Components

<table>
<tr><th>No.</th><th>Component</th><th>Details</th><th>Location</th></tr>
<tr><td>1</td><td>Service reservoirs – to store water further distribution</td><td>14 overheard tanks (OHTs) 2 ground level service reservoirs (GLSRs)
<table><tr><th>A</th><th>OHTs</th><th></th><th></th><th></th><th></th><th></th><th></th></tr><tr><td>1</td><td>Kunjathbail</td><td>Zone 1A</td><td>1,000 KL</td><td>9</td><td>Valancia</td><td>Zone 19</td><td>1,500 KL</td></tr><tr><td>2</td><td>Nekkilagudda</td><td>Zone 3A</td><td>1,500 KL</td><td>10</td><td>Amruthanagara</td><td>Zone 24A</td><td>750 KL</td></tr><tr><td>3</td><td>Maryhill</td><td>Zone 4</td><td>1,500 KL</td><td>11</td><td>Udayanagara</td><td>Zone 25A</td><td>600 KL</td></tr><tr><td>4</td><td>Santhoshnagara</td><td>Zone 5A</td><td>500 KL</td><td>12</td><td>NITK, Thadambail</td><td>Zone 26</td><td>500 KL</td></tr><tr><td>5</td><td>Shaktinagara</td><td>Zone 10</td><td>2,000 KL</td><td>13</td><td>Kodipady</td><td>Zone 28A</td><td>400 KL</td></tr><tr><td>6</td><td>Nehrumaidan</td><td>Zone 17</td><td>2,000 KL</td><td>14</td><td>Krishnapura</td><td>Zone 29A</td><td>1,000 KL</td></tr><tr><td>7</td><td>Nandigudda</td><td>Zone 18A</td><td>2,000 KL</td><td></td><td></td><td></td><td></td></tr><tr><td>8</td><td>Morgansgate</td><td>Zone 18B</td><td>2,000 KL</td><td></td><td></td><td></td><td></td></tr></table>
• GLSRs at Lady hill (1,000 kl) and Bala (1,500 kl)
• 7 intermediate pumping stations at Padil, Bendoor, Bondel, Maryhill, Shaktinagara, Bala and Lady hill</td><td>13 OHTs and 2 GLSRs are proposed on government owned land parcels. A private land is selected for Nekkiladi OHT. For all 7 pumping station sites, government owned land parcels have been identified.</td></tr>
<tr><td>2</td><td>Clear water feeder mains – to convey water from master balancing reservoirs (MBRs) to service reservoirs (overhead tanks/ground level reservoirs)</td><td>59.45 km pipelines of diameter 200 mm - 660 mm, mild steel/ductile iron
(32.33 km replacement of old pipes, and 27.22 km new pipelines lines)

Mild steel pumping mains
• From Bendoor to Light house -1,764 m (559 mm dia)
• Light house to Neharu Maidan - 1,405 m (406 mm)
• Bendoor to Mary hill - 6,866 m (610 mm dia)
• Bendoor to Lalbhag - 3,649m (660 mm dia)
• Lalbhag to Officer club - 225m (406 mm dia)
• Ladyhill sump - 324m (559 mm dia)
• Panambur to Bala Sump - 8,668 m (660mm dia)
Ductile iron pumping mains
• Neharu Maidan to Railway station - 629 m (300 mm dia)
• Maryhill pump house to Maryhill OHT - 66 m (300 mm dia)
• Bendoor to Zone 15 and 18C OHT - 798 m (300 mm dia)
• Padil IPS to Mangalajyoti - 3,713 m (300 mm dia)
• Pachanady, sister colony to Amrutha nagara - 3,843 (300 mm dia)
• Bondel kunjathabail OHT - 66 m (300 mm dia)
• Morgans gate to Shakthinagara OHT - 1,449 m (350 mm dia)
• Padil Nandigudda - 2,875 m (450 mm dia)
• Krishnapura, Bala OHT - 5,515 m (300 mm dia)
• Padupadav to Kodipadi - 1,803 m (200 mm dia)
• Panambur to Mulki - 4,968 m (250 mm dia)</td><td>From pumping stations to OHTs along the public roads within the road right of way</td></tr>
</table>

<table>
<tr><th>No.</th><th>Component</th><th>Details</th><th>Location</th></tr>
<tr><td></td><td></td><td>• NITK to Udayanagara - 2,259 m (200 mm dia)
Ductile Iron gravity mains
• Maryhill GLSR to Nekkilagudda OHT - 4,253 m (300 mm dia)
• Padil to Velancia - 4,314 m (500 mm dia)</td><td></td></tr>
<tr><td>3</td><td>Distribution network – distribution of water from service reservoir to consumers</td><td>789 km distribution pipes of diameter 63 mm to 500 mm of high density polyethylene (HDPE)/ductile iron. This includes: 554.86 km in uncovered area, 229.96 km parallel lines and rider lines, and 4.18 km replacement. Details are provided below:
<table>
<tr><th>Dia (mm)</th><th>Length (m)</th><th>Material</th><th>% of length</th></tr>
<tr><td>63</td><td>232,103</td><td>HDPE</td><td>29.42%</td></tr>
<tr><td>90</td><td>317,024</td><td>HDPE</td><td>40.18%</td></tr>
<tr><td>110</td><td>129,230</td><td>HDPE</td><td>16.38%</td></tr>
<tr><td>160</td><td>32,556</td><td>HDPE</td><td>4.13%</td></tr>
<tr><td>200</td><td>23,476</td><td>HDPE</td><td>2.98%</td></tr>
<tr><td>250</td><td>20,318</td><td>HDPE</td><td>2.58%</td></tr>
<tr><td>300</td><td>11,399</td><td>DI</td><td>1.44%</td></tr>
<tr><td>350</td><td>6,676</td><td>DI</td><td>0.85%</td></tr>
<tr><td>400</td><td>11,982</td><td>DI</td><td>1.52%</td></tr>
<tr><td>450</td><td>1,063</td><td>DI</td><td>0.13%</td></tr>
<tr><td>500</td><td>3,181</td><td>DI</td><td>0.40%</td></tr>
<tr><td></td><td>789,008</td><td></td><td>100.00%</td></tr>
</table></td><td>Pipes will be laid along the public roads within the road right of way.

Rider lines will be laid parallel to the existing pipes, and within the road right of way.

Pipes will be mostly laid in earthen shoulder to avoid road cuttings</td></tr>
<tr><td>4</td><td>House Service Connections</td><td>Replacement of 78,969 water meters for existing connections and providing new water supply connections of 11,031 to un-covered households</td><td>At each household</td></tr>
</table>

C. Implementation Schedule

20. Project implementation schedule is given below. Construction work is likely to start in November 2018 and will be completed by May 2022.

Completion of DPR	March 2018
Tender issue	June 2018
Contract Award	October 2018
Commencement of work	November 2018
Completion of work	May 2022 (42 months)

Figure 4: Water Distribution Zones in Mangalore

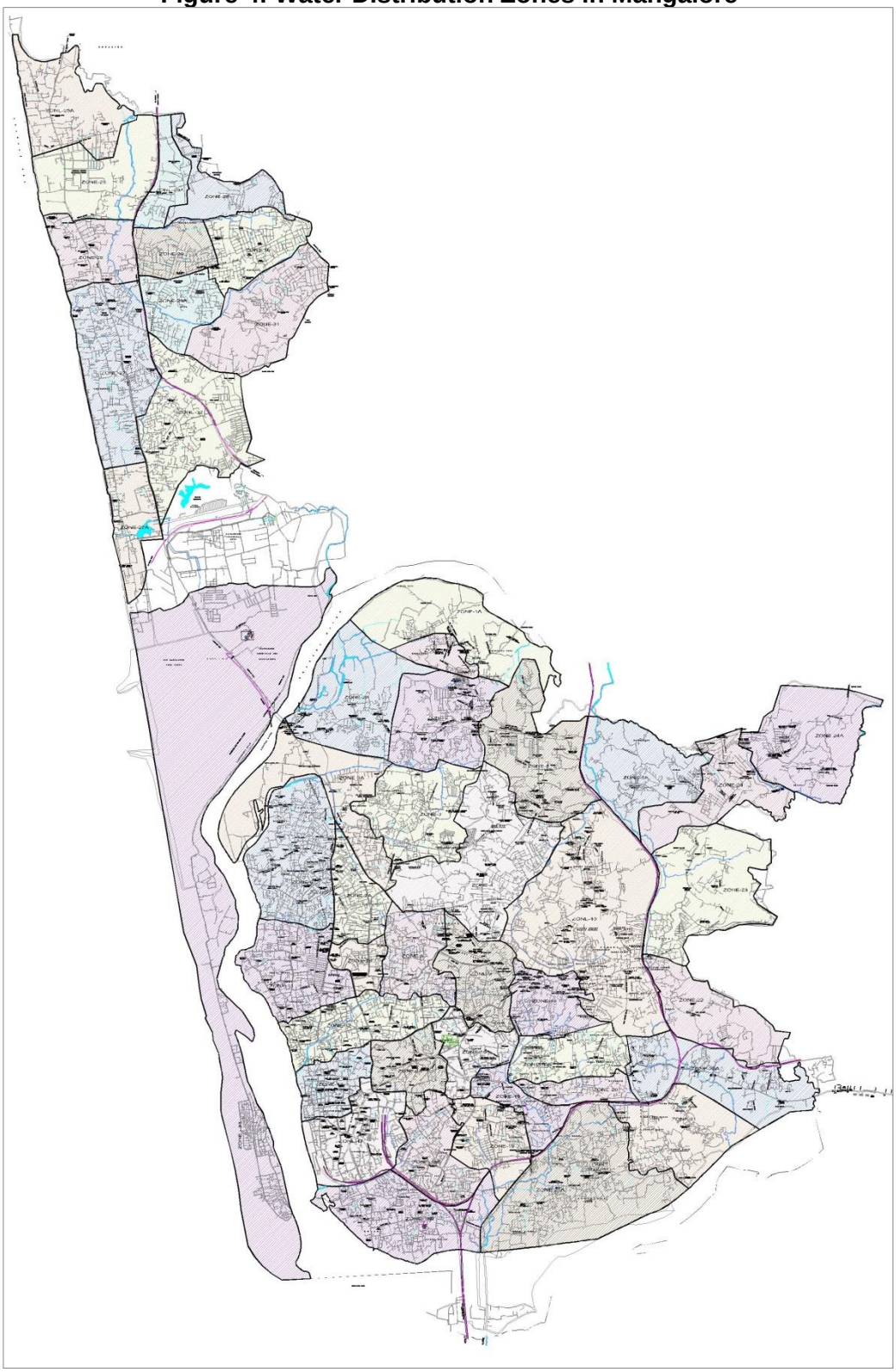


Figure 5: Existing and Proposed Feeder Mains and Overhead Tanks in Mangalore Zone

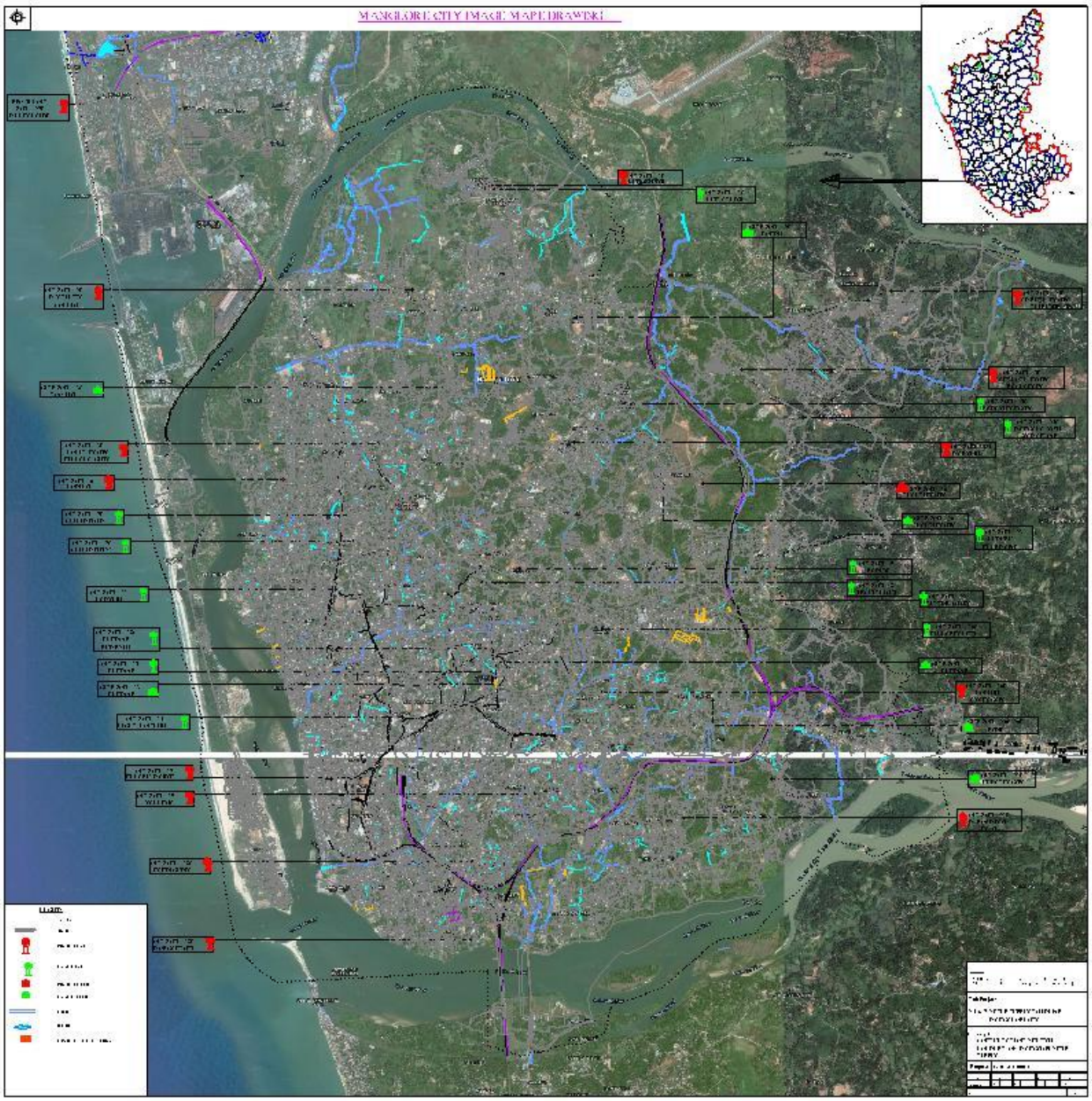


Figure 6: Existing and Proposed Feeder Mains and Overhead Tanks in Surathkal Zone

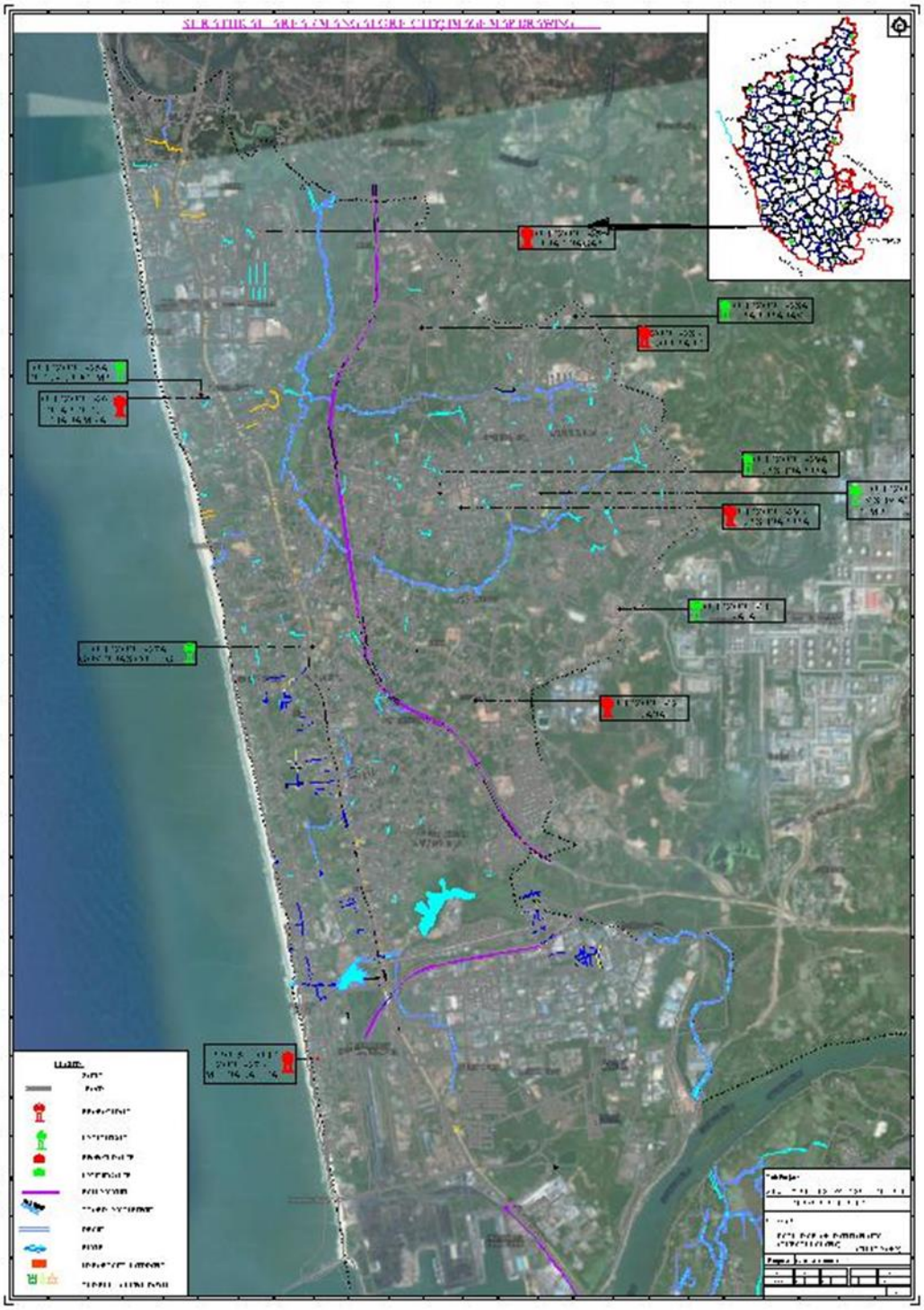


Figure 7: Schematic Diagram of Proposed 80 MLD Water Treatment Plant

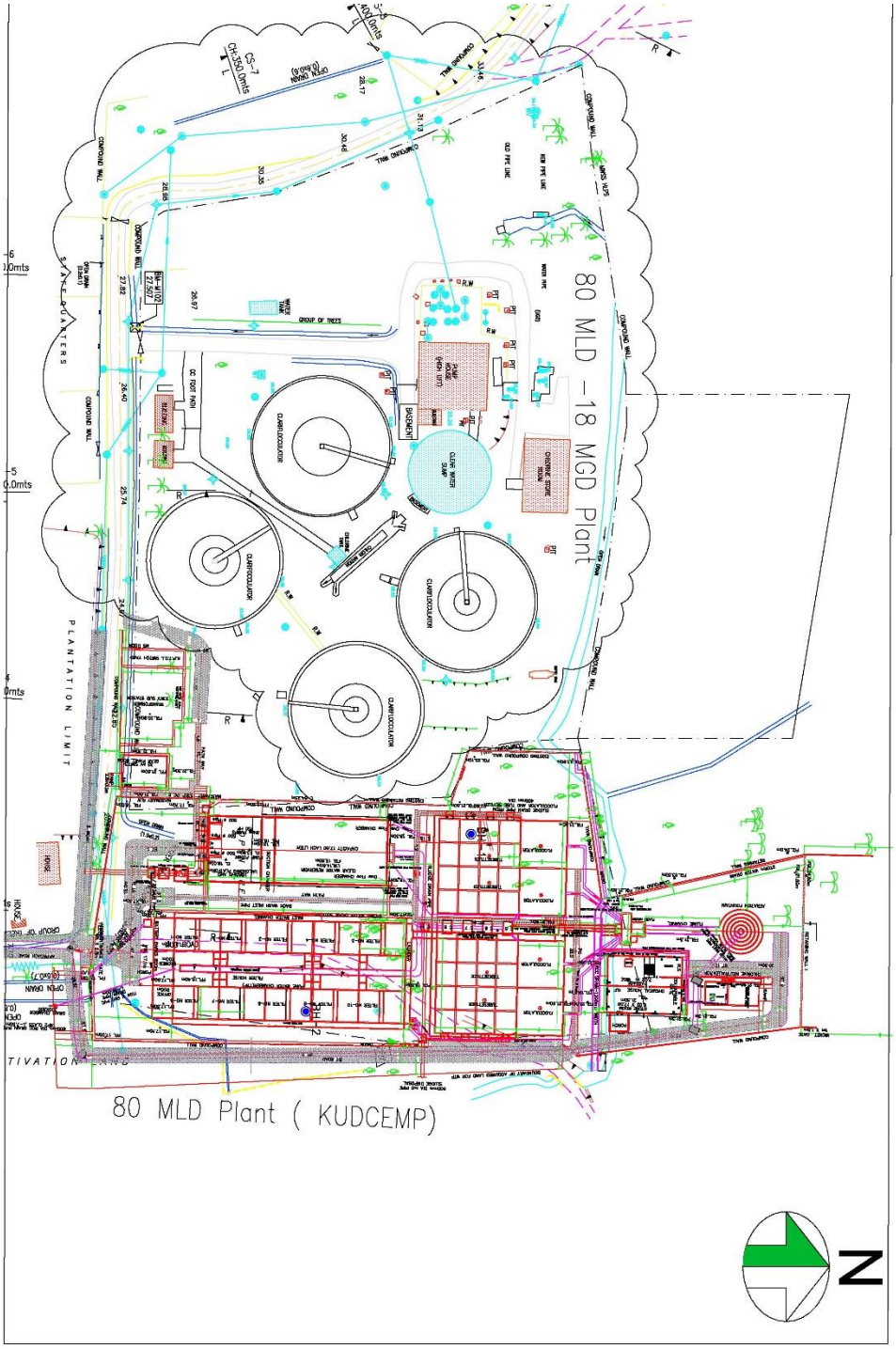
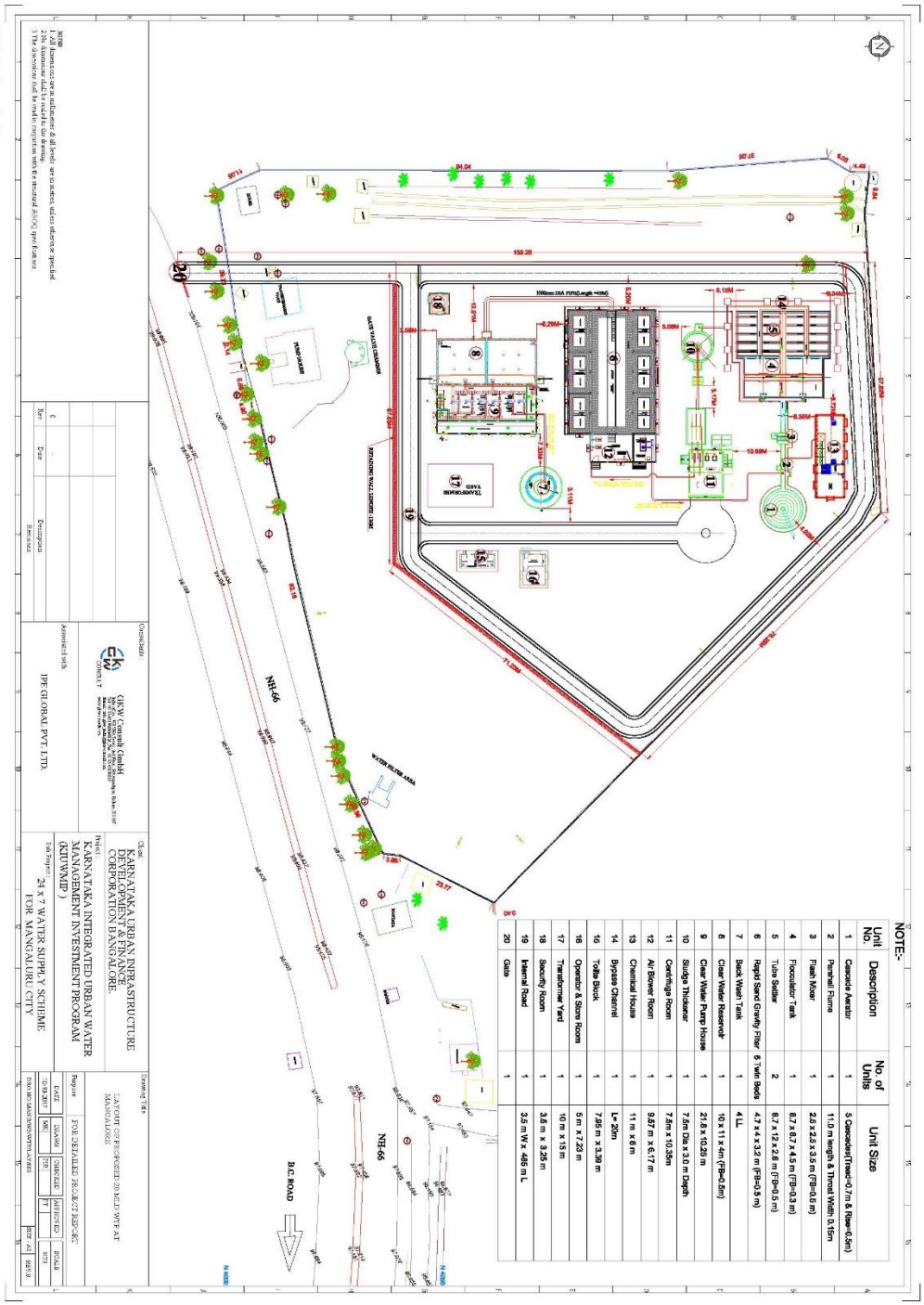


Figure 8: Existing Mangalore Water Treatment Plant



III. POLICY AND LEGAL FRAMEWORK

A. ADB Safeguard Policy Statement, 2009

21. ADB SPS, 2009 requires the consideration of environmental issues in all aspects of the Bank's operations and requires environmental assessment of all project loans, program loans, sector loans, sector development program loans, financial intermediary loans and private sector investment operations.

22. 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 classified as category A, B, C or FI (footnote 1).

23. The ADB Rapid Environmental Assessment Checklist (General) in http://www.adb.org/documents/guidelines/environmentalassessment/eaguidelines002.asp was used to screen the project for environmental impacts and to determine the environment category. The complete checklist is given in Appendix 1.

24. ADB has classed this subproject as category B and following procedure for multitranche financing facility (MFF) loans has determined that one IEE will be conducted for each subproject, with a subproject being the water supply infrastructure improvements proposed in a subproject city.

25. **Environmental Management Plan.** An EMP which addresses the potential impacts and risks identified by the environmental assessment shall be prepared. The level of detail and complexity of the EMP and the priority of the identified measures and actions will be commensurate with the Project's impact and risks.

26. **Public Disclosure.** The IEE will be put in an accessible place (e.g., local government offices, libraries, community centers, etc.), and a summary translated into local language for the project affected people and other stakeholders. The following safeguard documents will be put up in ADB's website so that the affected people, other stakeholders, and the general public can provide meaningful inputs into the project design and implementation:

(i) For environmental category A projects, a draft EIA report at least 120 days before Board consideration;
(ii) Final or updated EIA and/or IEE upon receipt; and
(iii) Environmental monitoring reports submitted by the program management unit (PMU) during project implementation upon receipt.

27. During the design, construction, and operation of the project the pollution prevention and control technologies and practices consistent with international good practice, as reflected in internationally recognized standards such as the **World bank Environmental, Health, and Safety (EHS) Guidelines – General EHS Guidelines: Occupational, Health and Safety** (www.ifc.org/ifcext/enviro.nsf/Content/ Environmental guidelines) and EHS Guidelines for water & sanitation will be followed (http://www.ifc.org/wps/wcm/connect/e22c050048855ae0875cd76a6515bb18/Final%2B-%2BWater%2Band%2BSanitation.pdf?MOD=AJPERE).

28. Employers and supervisors are obliged to implement all reasonable precautions to protect the health and safety of workers. Preventive and protective measures should be introduced according to the following order of priority:

(i) Eliminating the hazard by removing the activity from the work process. Examples include substitution with less hazardous chemicals, using different manufacturing processes, etc;

(ii) Controlling the hazard at its source through use of engineering controls. Examples include local exhaust ventilation, isolation rooms, machine guarding, acoustic insulating, etc;

(iii) Minimizing the hazard through design of safe work systems and administrative or institutional control measures. Examples include job rotation, training safe work procedures, lock-out and tag-out, workplace monitoring, limiting exposure or work duration, etc;

(iv) Providing appropriate personal protective equipment (PPE) in conjunction with training, use, and maintenance of the PPE; and

(v) Comply with Child Labour (Prohibition and Regulation) Amendment Act, 2016; Manufacture, Storage and Import of Hazardous Chemical Rules, 1989 as amended from time to time from appropriate authorities; Trade Unions Act, 1926; The Building and Other Construction Workers (Regulation of Employment and conditions of Service Act) 1996 and the Cess Act of 1996; The Factories Act, 1948; and Prohibition of Employment as Manual Scavengers and Their Rehabilitation Act 2013.

29. Following requirements of ADB SPS, PMO and RPMOs shall apply pollution prevention and control technologies and practices consistent with international good practice. When the Government of India regulations differ from these levels and measures, PMO shall achieve whichever is more stringent. Appendix 3, 4 and 5 provide applicable standards. If less stringent levels or measures are appropriate in view of specific subproject circumstances, PMO will provide full and detailed justification for any proposed alternatives that are consistent with the requirements presented in ADB SPS.

B. Government Law and Policies

25. **Environmental Assessment.** The Government of India's EIA Notification of 2006 (replacing the EIA Notification of 1994), sets out the requirement for environmental assessment in India. This states that environmental clearance 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.

26. Category A projects requires environmental clearance from the Central Ministry of Environment, Forests and Climate Change (MOEFCC). 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 environmental clearance if appropriate.

27. 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 environmental clearance 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.

28. None of the components of this water supply improvement subproject in Mangalore falls under the ambit of the EIA Notification 2006, and, therefore, environmental clearance is thus not required for the subproject.

29. **Environmental Rules, Laws, and Regulations.** 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 regulations are listed in Appendix 2. Table 5 below presents a summary of environmental regulations and mandatory requirements applicable to the subproject.

Table 5: Applicable Environmental Regulations

Law	Description	Requirement
Environmental Impact Assessment (EIA) Notification, 2006	The EIA Notification of 2006, sets out the requirement for environmental assessment in India. This states that environmental clearance is required for certain defined 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. Category A projects requires Environmental Clearance from the Ministry of Environment and Forest (MOEF). Category B projects require Environmental Clearance from the State Environmental Impact Assessment Authority (SEIAA).	Sub project is not a listed activity in Schedule I of this notification and hence environmental clearance is not required.
Water (Prevention and Control of Pollution) Act of 1974, Rules of 1975, and amendments	Control of water pollution is achieved through administering conditions imposed in consent issued under provision of the Water (Prevention and Control of Pollution) Act of 1974. These conditions regulate the quality and quantity of effluent, the location of discharge and the frequency of monitoring of effluents. Any component of the Project having the potential to generate sewage or trade effluent will come under the purview of this Act, its rules and amendments. Such projects have to obtain consent for establishment (CFE) under Section 25 of the Act from Karnataka State Pollution Control Board (KSPCB) before starting implementation and consent for operation (CFO) before	None of the components in this subproject requires CFE or CFO under this act.

Law	Description	Requirement
	commissioning. The Water Act also requires the occupier of such projects to take measures for abating the possible pollution of receiving water bodies.	
Air (Prevention and Control of Pollution) Act of 1981, Rules of 1982 and amendments.	The projects having potential to emit air pollutants into the atmosphere have to obtain CFE under Section 21 of the Air (Prevention and Control of Pollution) Act of 1981 from KSPCB before starting implementation and CFO before commissioning the project. The occupier of the project/facility has the responsibility to adopt necessary air pollution control measures for abating air pollution.	For the project, the following will require CFE and CFO from KSPCB: if, (i) diesel generators; (ii) hot mix plants; and (iii) stone crushers, installed for construction. All relevant forms, prescribed fees and procedures to obtain the CFE and CFO can be found in the KSPCB website (www.kspcb.gov.in).
Environment (Protection) Act, 1986 and Central Pollution Control Board (CPCB) Environmental Standards.	Emissions and discharges from the facilities to be created or refurbished or augmented shall comply with the notified standards notified.	Appendix 3 provides applicable standards for ambient air quality and noise. Appendix 4 provides standards for discharge of effluents Appendix 3 and 4 respectively also provides a comparison of national standards and internationally recognized guidelines with respect to ambient air and noise, and effluent discharge. ADB SPS requires adoption of stringent values for project implementation.
Noise Pollution (Regulation and Control) Rules, 2000 amended up to 2010.	Rule 3 of the Act specifies ambient air quality standards in respect of noise for different areas/zones.	Appendix 3 provides applicable noise standards.
Ancient Monuments and Archaeological Sites and Remains Act, 1958 and Ancient Monuments and Archaeological Sites and Remains (Amendment and Validation) Act, 2010	The Amendment Act designates areas within 100 meters (m) from the “protected property” as “prohibited area” and beyond that up to 200 m as “regulated area” respectively. No “construction” is permitted in the “prohibited area” and any “construction” in the “regulated area” requires prior permission of the National Monument Authority (NMA) through jurisdictional Archeological Survey of India (ASI) office. “Protected property” includes the site, remains, and monuments protected by ASI and “construction” means the construction of any structure or building.	Mangaladevi Temple in Mangalore City is a protected monument under the Act. None of the components are located in or close to the temple. In case of chance finds, measures are suggested in Environmental Management Plan (EMP) to take prompt action to ensure its removal or protection in situ.

Law	Description	Requirement
Labor Laws	The contractor shall not make employment decisions based upon personal characteristics unrelated to job requirements. The contractor shall base the employment relationship upon equal opportunity and fair treatment, and shall not discriminate with respect to aspects of the employment relationship, including recruitment and hiring, compensation (including wages and benefits), working conditions and terms of employment or retirement, and discipline. The contractor shall provide equal wages and benefits to men and women for work of equal value or type.	Appendix 2 provides applicable labor laws including amendments issued from time to time applicable to establishments engaged in construction of civil works.
Biodiversity Act of 2002	The Biodiversity Act 2002 primarily addresses access to genetic resources and associated knowledge by foreign individuals, institutions or companies, to ensure equitable sharing of benefits arising out of the use of these resources and knowledge to the country and the people.	Not applicable to Mangalore Water Supply Scheme as no mentioned activities are involved in the project
Ramsar Convention, 1971	The Ramsar Convention is an intergovernmental treaty that provides the framework for national action and international co-operation for the conservation and wise use of wetlands and their resources. India is one of the signatories to the treaty. The Ramsar convention made it mandatory for the signatory countries to include wetland conservation in their national land use plans.	Not applicable to Mangalore Water Supply Scheme as no Ramsar wetlands present in the project subproject area.
Wildlife Protection Act, 1972	This overarching Act provides protection to wild animals, birds, plants and matters connected with habitat protection, processes to declare protected areas, regulation of wildlife trade, constitution of state and national board for wildlife, zoo authority, tiger conservation authority, penalty clauses and other important regulations.	Not applicable to Mangalore Water Supply Scheme as there are no wildlife protected areas in or near the subproject locations.
Forest (Conservation) Act, 1980	The Forest (Conservation) Act prevents the use of forest land for non-forest uses without the clearance from MOEF, Government of India	Not applicable to Mangalore Water Supply Scheme as there is no forest area within or adjacent to the subproject sites.
Indian Drinking Water Standards	Gives details of the permissible and desirable limits of various parameters in drinking water as per the Bureau of Indian Standards	Appendix 5 provides drinking water standards http://cgwb.gov.in/documents/wq-standards.pdf

Law	Description	Requirement
Karnataka Forest Act, 1963 and Karnataka Forest Rules, 1969	This Act makes the basis for declaration of Reserved Forests, constitution of village forest committees, management of reserved forests and penalties and procedures.	Not applicable to Mangalore Water Supply Scheme as there is no forest area within or adjacent to the subproject sites.
Karnataka Preservation of Trees Act, 1976 and Karnataka Preservation of Trees Rules, 1977	This Act has put restriction on felling of trees in the State unless until permitted by the Tree Officer. Any person desiring to fell a tree shall apply in writing to the tree officer for permission in that behalf. It further defines clauses for planting adequate number of trees, planting in place of fallen/destroyed trees, preservation of trees and adoption of trees.	There are few trees in OHT sites, some of which needs to be cut. Compensatory plantation as stipulated in the tree cutting permission shall be adhered
Coastal Regulation Zone Notification - Ministry of Environment and Forests	This notification declared coastal stretches as Coastal Regulation Zone (CRZ) and restricts new construction, and industrial activities in the CRZ (landward side) include the following: (i) land area from High Tide Line (HTL) to 500 m on the landward side on the sea front; (ii) land area between HTL to 100 m or width of creek whichever is less on the landward side along the tidal influenced water bodies connected to sea and; (iii) land area between HTL and LTL. Notification defines CRZ in I. II, III, IV Categories based on the environmental sensitivity and existing development. The “developed area” within existing municipal limits or in other existing legally designated urban areas which are substantially built-up and has been provided with drainage and approach roads and other infrastructural facilities, such as water supply and sewerage mains are defined as CRZ II.	Per the current subproject locations, none of the components are located in the CRZ. If any component falls in CRZ during implementation, permission/No Objection Certificate (NOC) will be obtained from the Karnataka Coastal Zone Management Authority (KCZMA) prior to start of work.

30. **Clearance Requirements of Bulk Water Components Proposed under Government Funding**. Environmental Clearance requirement per Government of India EIA Notification is not applicable to the government-funded components. one OHT site falls in Coastal regulation zone and therefore requires prior permission from Karnataka Coastal Zone Management Authority. No other environmental related clearance or permissions required.

31. **Clearance Requirements of KIUWMIP Tranche 2**. Environmental Clearance requirement per Government of India EIA Act and its Notifications are not applicable to the distribution network system improvement. Environment-related statutory clearance or permission is also not required. Pipelines passes along or crosses national highways, railways, at various locations as given below, which require permission from respective agencies.

Sections requiring railway permissions:

(i) A clear water feeder line (660 mm diameter MS pipe) crosses Konkan Railway line at Kana in between chainage 735/700-800;
(ii) A clear water feeder line (355 diameter MS pipe) crosses railway line at Baikampady in between chainage 24/400-500; and
(iii) For laying 350 mm diameter DI pipe at chainage 883/4.

Sections requiring National Highway permissions:

(i) Clear water feeder line crosses NH-66 (350 mm diameter DI) at Pump well Circle for length of 60 m;
(ii) Clear water feeder line (610 mm diameter MS pipe) crosses NH-66 at Paduva High school for 45 m. Also, same pipe line passes along NH-66 for a length of 350 m;
(iii) Clear water feeder line (250 mm diameter DI) pipe crosses NH-66 at Panambur beach road for 45 m. Also, for a length of 500 m pipe line passes along NH-66;
(iv) Clear water feeder line (200 mm diameter DI) pipe crosses NH-66 at NITK for a length of 45 m;
(v) Clear water feeder line (355.60 diameter MS pipe) passes along NH-66 from Panambur to Kulai for a length of 4 km;
(vi) Clear water feeder line (300 mm diameter DI pipe) passes along NH-169 from Kongurmutt to Baiturli Junction for a length of 1.4 km; and
(vii) Clear water feeder line (200 mm diameter DI) pipe passes along NH-169 from Mangalajyoti Junction to Vamanjoor Checkpost for a length of 1.8 km.

IV. DESCRIPTION OF THE ENVIRONMENT

A. Introduction

32. The components of water supply subproject are located in Mangalore City. The baseline environmental profile of the Mangalore is presented in this section based on secondary sources of information.

33. Geographically, Mangalore City is located at a latitude of 12°87'N Latitude and 74°88''E Longitude. Mangalore is the Headquarters of Dakshina Kannada District. Mangalore is the largest urban center of coastal Karnataka and the fourth largest city in Karnataka in terms of area and population. Mangalore is located about 350 km west of the state capital, Bangalore. The city spreads in an area of 132.45 km^2 and is divided into 60 wards. The population in Mangalore according to the Census 2011 is 488,968.

B. Physical Environment

1. Climate

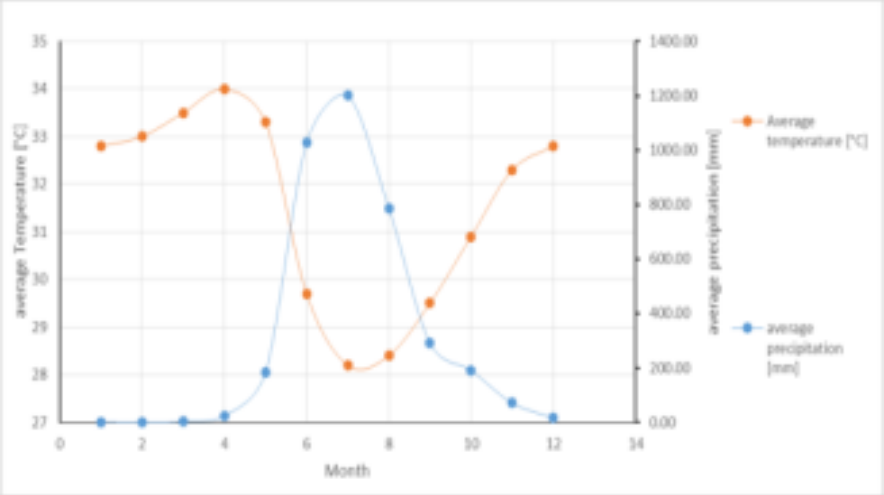
34. The subproject has a tropical monsoon climate and is under the direct influence of the Arabian Sea branch of the southwest monsoon. It receives about 95% of its total annual rainfall within a period of about 6 months from May to October, while remaining is extremely dry from December to March. The annual precipitation is 3,796.9 mm. Humidity is approximately 75% on an average, and peaks during May, June and July. Monthly average temperature and rainfall in Mangalore is depicted in Figure 9 and data is provided in Table 6.

35. **Humidity.** The climate of the study area is marked by high humidity and oppressive weather in hot season. Morning monthly mean relative humidity ranges from 72% to as high as

95%. Comparatively, large variations in the evening relative humidity were observed across a year, ranging from 52% in the month of December to 91% in the month of July.

36. **Wind Speed and Wind Direction.** The winds are strong and mainly westerly and south-westerly in southwest monsoon months. For rest of the year, winds are mainly from north and east in the forenoons and westerly and north –westerly in afternoons. The maximum and minimum monthly mean wind speed recorded in the last decade was 8.5 km per hour (kmph) in February 1993 and 2.6 kmph in November 2001, respectively. The area also experiences high winds of more than 20 kmph during the months of June, July, and August but with low frequency. The winds in the range of 6 kmph to 11 kmph are more frequent during this period.

Figure 9: Average Temperature and Rainfall in Mangalore



Source: Climate data.org, 2015.

Table 6: Climate Data for Mangalore in India

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Record high °C	36.3	37.8	38.1	36.6	36.7	34.4	35.5	32.2	34.6	35	35.6	35.6	38.1
Average high °C	32.8	33	33.5	34	33.3	29.7	28.2	28.4	29.5	30.9	32.3	32.8	31.5
Average low °C	20.8	21.8	23.6	25	25.1	23.4	22.9	23	23.1	23.1	22.4	21.2	22.9
Record low °C	16.1	17.3	18.8	19.7	20.4	20.5	19.8	19.4	20.2	19.1	15.9	16.1	15.9
Average rainfall mm (inches)	1.1	0.2	2.9	24.4	183.2	1,027	1,200	787.3	292.1	190.8	70.9	16.4	3,796
Average rainy days	0.2	0	0.3	1.6	7	23.5	27.4	24.9	13.7	9.1	3.6	0.6	111.9
Average relative humidity (%)	62	66	68	71	71	87	89	88	85	79	73	65	75.3

Source: India Meteorological Department.

2. Topography, Soil and Geology

37. Mangalore's topography is characterized by plain to undulating terrain with hilly regions and natural valleys within the city. Mangalore is situated on the west coast of India, and is bounded by the Arabian Sea to its west and the Western Ghats to its east. Also lies on the backwaters of the Netravati and Gurupur rivers.

38. The soil in the Dakshina Kannada district is mostly lateritic type, found distributed in the Pediplain area characterized by high iron and aluminum content. Lateritic soil is mostly red in color and yellow loamy, pale to bright red colors are also seen. Lateritic soil is suitable for paddy, sugarcane, areca nut (*Areca catechu*), cardamom and plantains. Loamy red soils are distributed in the lower reaches of valleys. Red lateritic soil is the most dominant soil type in the area. The texture of the soil varies from fine to coarse. The soil in valleys and intermediate slopes is rich in loam whereas in upper slopes it is much coarse in nature. The soil responds well to irrigation and other soil - management practices. Silty and loamy soils are of transported origin and are found mostly along river banks and in valley plains. They have good infiltration capacity and are well-suited for agriculture due to their fertility.

3. Surface Water

39. Mangalore is situated on the west coast of India, and is bounded by the Arabian Sea to its west and the Western Ghats to its east. Mangalore lies on the backwaters of the Netravati and Gurupura rivers. These rivers effectively encircle the city, with Gurupura flowing around the north and the Netravati flowing around the south of the city. These rivers, like other of Dakshina Kannada district, flow westward and meet the Arabian Sea after a run varying from 50 km to 300 km. The rivers, generally originate at an elevation ranging from 400 m to 1,600 m above the mean sea level, close to the Western Ghats ridge, and have very steep gradient in the upper reaches and fairly steep in the middle reaches. It is only near the sea that they have relatively flat gradients and some sort of flood plain.

40. There are no major or medium irrigation projects in the district. One vented-dam has been built across the river Netravati at Thumbe near Mangalore, to cater to the drinking water need of Mangalore City. Minor irrigation tanks and temporary *Mudkattas* are the other types of surface water utility structures. The seasonal and perennial springs are located in the foothills of hillocks and forests in the district. A thermal spring which is of very rare occurrence in south India has been found in the district. It is called as 'BendruTeertha" and located at Irde on Puttur-Panaje road at a distance of 13 km from Puttur, and about 60 km from Mangalore. The rock formations exposed in and around the spring are gneisses traversed by veins of quartz and pegmatite on the southern banks of Badantadka river.

4. Groundwater

41. Weathered and fractured gneiss, granite and schist are the major water bearing formations. Alluvial formation of limited thickness and aerial extent is found along the courses of major rivers. Groundwater occurs under phreatic (water table) condition in weathered zones of gneiss, schist and granite and under semi-confined to confined conditions in joints and fractures of these rocks at deeper levels. Weathered and fractured gneiss is the predominant aquifer found in the district followed by schistose and granitic aquifers, which occur as isolated patches in some taluks. The depth to water level during pre-monsoon (May 2006) ranged from 1.85 m below ground level (bgl) in Nelyadi to 15.17 mbgl in Bellare. During post-monsoon (Nov 2006) it ranged from 1.65 m bgl (Nelyadi) to 9.40 m bgl (Bellare). The seasonal fluctuation data reveals that 36.5

percent of the wells show rise while, 63.5% of the wells show a fall in water level. The rise in water level ranges from 015 m to 16.0 m while, the fall ranges from 0.65 m to 4.62 m. Analysis of the long-term water level trend in the last 10 years (1997-2006) reveals that 58% of the wells show a rise in water level ranging from 0.014 m to 0.12 m, whereas, the remaining wells show a fall in the range of 0.01m to 0.19 m. This means, little more than half of the total wells for which data have been analysed show a rise in the water level in the last decade. Bore wells drilled under Groundwater Exploration Program of Central Ground Water Board (CGWB) ranged between 16 m and 200 m. These wells have yielded from less than 1 liter per second (lps) to 19.9 lps. Though the transmissivity ranged from 3 m^2/day to 476 m^2/day, it generally ranges from 3 m^2/day to 20 m^2/day. Good yield can be encountered by scientifically pin-pointing the bore well site. Groundwater quality is generally good and potable. The specific conductivity of ground water in the district varies from 70-140 micromhos per centimeter at 25^{o}C (Central Ground Water Board, 2008).

7. Air Quality

42. The baseline air quality assessment for Mangalore City was carried out by Karnataka State Pollution Control Board under National Ambient Air Quality Monitoring Program (NAMP) covering three type of land uses – industrial area, mixed urban area and sensitive area. Monitoring of air quality was done twice a week for 24 hours at uniform intervals for respirable suspended particulate matter (RSPM), sulfur dioxide (SO_2) and nitrogen dioxide (NO_2). The annual average values of 2015–2016 are given in Table 7.

Table 7: Ambient Air Quality in Mangalore (Annual Average Values, 2015-2016)

No.	Location	SO_2 (µg/m^3)	NO_2 (µg/m^3)	RSPM (µg/m^3)
1	Regional Office -Mangalore	8.0	9.5	35.0
	NAAQ Standards	*50.0*	*40.0*	*60.0*

Source: KSPCB 2015–2016.

43. The results of monitoring indicate that all monitored parameters are well within the stipulated National Ambient Air Quality Standards (Appendix 3).

C. Ecological Resources

44. **Forest**. The district of Dakshina Kannada is blessed with rich and diverse forests. Most of the forests in the Mangalore division lie on the western slopes of the Western Ghats and their foothills to a width of about 25 km in a continuous belt. Principal forest types of the area are evergreen, semi evergreen, moist deciduous and other forests. However, there are no forests in the subproject area, which is located within Mangalore urban area.

45. **Fisheries**. The wide varieties of fish species are found in Gurupura River, some of fresh water fishes are *Hyporanphous limbaius, Puntius Sp. Labeo Sps., Valamugil Sps., Leiza Sps.*etc. Thereare number of Esturian species like *Gerrus filamentus* (Whiptail-silver -biddy), *Gerrusoblongus* (Silver-biddy), *Teropon puta* (Small Scale Terapon), *Stalephorus indicus*(Indian anehovy), *Horabagrus brachysoma* (Gunther's catfish), [*Source: A survey on fish diversity in fresh water of Dakshina Kannada District." Shashikala.K.B, Department of Applied Zoology, Mangalore University, Mangalagangothri, April-2000*].

D. Economic Development

1. Industry and Agriculture

46. Baikampady Industrial Estate is in Mangalore. The New Mangalore Port is India's seventh largest port, in terms of cargo handling. It handles 75% of India's coffee exports and the bulk of its cashew nuts. The city's major enterprises include Mangalore Chemicals and Fertilizers Limited (MCF), Kudremukh Iron Ore Company Limited. (KIOCL), Mangalore Refinery and Petrochemicals Limited (MRPL), BASF, Bharati Shipyard Limited, and Total Oil India Limited (ELF Gas). The leaf spring industry has an important presence in Mangalore, with Canara Workshops Limited and Lamina Suspension Products Limited in the city. The Baikampady and Yeyyadi Industrial areas harbor several small-scale industries. Imports through Mangalore harbour include crude oil, edible oil, LPG, and timber. The city along with Tuticorin is also one of two points for import of wood to South India

47. Major information technology (IT) and outsourcing companies like Infosys, Cognizant Technology Solutions, MphasiS BPO, Thomson Reuters, and Endurance International Group have their branches at Mangalore. Foreign IT companies such as Vecima Networks and Atlantic Data Bureau Services have established their offices in Mangalore. Plans to create three dedicated IT parks are underway, with two parks (Export Promotion Industrial park (EPIP) at Ganjimutt and Special Economic Zone (SEZ) near Mangalore University) currently under construction. A third IT SEZ is being proposed at Ganjimutt. Another IT SEZ, is under construction at Thumbe There is an IT Tech Park by the name Soorya Infra tech park situated in Mudipu. It is expected to have many IT companies in future.

48. Mangalore has a large Agriculture Produce Marketing Committee (APMC) yard that caters to the surrounding towns and villages. Due to good connectivity by roads and railway line with other parts of the region, it has become a focal point for trade and commerce.

2. Infrastructure

49. **Water Supply**. Currently water supply within Mangalore is intermittent and varies across the city. The reported duration and frequency is 8 hours every day. The current per capita volume made available to customers is 135 lpcd. Netravati River is the main source of water supply.

50. **Sewerage.** The first sewerage system was established in 1961 and was designed for an ultimate flow of 27.04 MLD estimated for a design population of 2,00,000 of the year 1991. This scheme was implemented by Public Health Department. The total area covered by the sewerage network is about 25 km^2 with two sewerage disrticts and seven zones. The total length of sewerage network constructed was about 250 km with pipe diameter varying from 150 mm to 600 mm with 7,000 manholes and eight wet wells-cum-pump houses. Later on, from 1974, KUWSDB extended the sewerage networks within the existing 25 km^2 area by another 245 km with 8,000 number of Manholes.

51. The second scheme was established in the year 2003 under KUDCEM project and commissioned in the year 2007–2008 and the sewerage system was upgraded for an ultimate flow of 88.75 MLD for a design population of 6,24,432. Under KUDCEMP extension of sewerage network to adjoining areas of old city and extension to other areas in MCC boundary is made which covers about 50.60 km^2.

52. Overall 60% of the Mangalore about 75.60 km^2 is covered with sewerage systems. Balance about 40% is uncovered area in Mangalore. In the uncovered area only 40 km^2 sewerage systems can be provided. Another 15 km^2 are comes under Port area and Industrial area for which sewer systems cannot be provided.

53. Under KUDCEMP, Mangalore City is considered in two parts as Surathkal and Mangalore and divided into four sewerage districts namely North District, East District, West District and South District. North District covers complete Surathkal area. Other three districts covers Mangalore area. Each district is having one Sewage Treatment Plant. The total length of sewerage network constructed was about 360 km including 14,875 manholes with pipe diameter varying from 150 mm to 900 mm, 20 new wetwells and 2 old wet wells were rehabilitated.

E. Socio Cultural Resources

1. Demography

54. Mangalore is the largest urban center of coastal Karnataka and the fourth largest city in Karnataka in terms of area and population. Mangalore population is about 488,968 (2011 census). Per the census 2011, the sex ratio (female population per 1,000 of male population) is 1,016. Mangalore has the highest literacy rate in Karnataka with 94.03%.The male literacy was 96.49%, while female literacy was 91.63%. About 8.5% population was under 6 years of age. The Human Development Index (HDI) of Mangalore City is 0.83. The birth rate was 13.7%, while death rate and infant mortality rate were at 3.7% and 1.2% respectively. According to the 2011 census, 7726 people reside in slums in Mangalore City, which is 1.55% of the total population. Table 8 shows the population growth of Mangalore from 1961 to 2011.

Table 8: Population Growth of Mangalore

Year	1961	1971	1981	1991	2001	2011
Population	170,253	215,122	273,304	306,078	399,465	488,968
Population growth rate per year (%)	-	2.63	2.70	1.19	3.05	2.24

Source: Census India, 2011.

2. History, Culture and Tourism

55. Mangalore City is well known for its Mangalore port on the Arabian Sea. Mangalore was ruled by several major powers, including the Kadambas, Alupas, Vijayanagar Empire, Keladi Nayaks and the Portuguese. The city was a source of contention between the British and the Mysore rulers, Hyder Ali and Tipu Sultan. Eventually annexed by the British in 1799, Mangalore remained part of the Madras Presidency until India's independence in 1947. The city was unified with the state of Mysore (now called Karnataka) in 1956.

56. Mangalore is the heart of a distinct metalinguistic—cultural region: South Canara, is the homeland of the Tulu-speaking people. In the third century BCE, the town formed part of the Maurya Empire, ruled by the Buddhist emperor, Ashoka of Magadha. From the third century CE to sixth century CE, the Kadamba dynasty, whose capital was based in Banavasi in North Canara, ruled over the entire Canara region as independent rulers. From the middle of the seventh century to the end of the 14th century, the South Canara region was ruled by its own native Alupa rulers. The Alupas ruled over the region as feudatories of major regional dynasties like the Chalukyas of Badami, Rashtrakutas of Manyakheta, Chalukyas of Kalyani, and Hoysalas of Dwarasamudra. During the reign of the Alupa king Kavi Alupendra (c. 1110 – c.1160), the city was visited by the Tunisian Jewish merchant Abraham Ben Yiju, who travelled between the Middle East and India

during the 12th century. The MoroccantravellerIbn Battuta, who had visited the town in 1342, referred to it as Manjarur, and stated that the town was situated on a large estuary, called the "estuary of the wolf," and was the greatest estuary in the country of Malabar. By 1345, the Vijayanagara rulers brought the region under their control. During the Vijayanagara period (1345–1550), South Canara was divided into Mangalore and Barkurrajyas (provinces), and two governors were appointed to look after each of them from Mangalore and Barkur. But many times, only one governor ruled over both Mangalore and Barkurrajyas, and when the authority passed into the hands of Keladi rulers (c. 1550–1763), they had a governor at Barkur alone. In 1448, Abdur Razzaq, the Persian ambassador of Sultan Shah Rukh of Samarkand, visited Mangalore, en route to the Vijayanagara court. The Italian traveller, Ludovico di Varthema, who visited India in 1506 says that he witnessed nearly sixty ships laden with rice ready for sail in the port of Mangalore.

57. Mangalore City is well known for tourist and the city has following locally important religious places:

(i) **Mangaladevi Temple.** This city is called as Mangalore just because of this temple. It is situated 3 km away from main city bus stand. This temple was built by the Ballal family of Attavar in memory of a Princess of Kerala. This is an Archeological Survey of India (ASI) protected monument. However, this monument is located outside the project impacted area, and none of subproject components are located in the 300 m regulated zone of ASI monument;

(ii) **Kadri Manjunath Temple.** Kadri is another ancient historic spot in Mangalore. The Kadri Temple dating back to about 1068 with its nine tanks, its square temple, nestling at the foot of the highest hill, draws to Mangalore hundreds of visitors annually. The Lokeshwara bronze statue of the Kadri Manjunatha Temple is tipped to be the best bronze statue in India. On top of the hill King Kundavarma Bupendra built a mutt which came to be called 'Jogi Mutt'. There are some stone caves on top of the hill which are known as the caves of the Pandavas . It is situated 4 km away from Nehru Maidan bus stand. The idol of Lord Manjunathaswamy of the temple is called as oldest of the South Indian Temples. The seven sacred ponds, Jogi Mutt and caves of Pandavas are the pilgrim attractions here.

(iii) **St. Aloysius Church.** It is situated 1 km away from Nehru Maidan bus stand. The walls of the church are covered with the paintings of the artist Antony Moshaini of Italy. The church was built in the year 1899-1900. St. Aloysius College Chapel, an architectural gem, comparable with the Sistine chapel in Rome, is situated on lighthouse hill. The special beauty of the chapel is the wonderful series of paintings that virtually cover every inch of the interior roof and walls executed by Bro. Moscheni trained in Italy;

(iv) **Sultan Battery**. It is situated in Boloor 6 km away from Mangalore City bus stand. It was built in Black Stones by Tippu Sulthan to prevent warships to enter Gurupura river. Now the remaining part of the fort is called as Tippu's Well. It is today a deserted spot but its construction is bafflingly exquisite. Although it is a watchtower, it gives the impression of a miniature fortress with its arrangements for mounting cannons all-round. This is an ASI protected monument.

(v) **Shri Sharavu.** Mangalore is known as a pilgrim center and boasts of many sacred temples like Sharavu, Kadri, Mangaladevi, Kudroli, etc. Out of these Sri Sharavu Sharabeshwara - Sri Mahaganapathy Kshetra is an outstanding, pious center of great illustrious history of marathon 800 years; and

(vi) **Kudroli Gokarnath Temple.** It is situated 3 km away from main Nehru Maidan bus stand. Recently, this temple has been renovated and now it is one of the tourist attraction places in Mangalore.

F. Environmental Settings Subproject Component Sites

58. There are no ecologically-sensitive feature and no significant sensitive physical and cultural resources within or adjacent to the subproject sites. Except one OHT site at Nekkilagudda, all the other OHTs, GLSRs and pumping station sites selected are on government-owned vacant land parcels, and all the pipelines are proposed along the roads, where there is space along the right-of-way (ROW) to lay the pipeline. There are few trees of local species in some OHT sites. There are no trees in the proposed pipeline alignment along the roads. Photographs and features of the proposed sites are provided in Table 9 (OHT site) and Table 10 (pumping station and GLSR sites). Table 11 shows alignment of feeder and distribution main pipelines along the roads.

Table 9: Photographs of Proposed Overhead Tank Sites

Details of Proposed OHT -Location -Zone -Capacity	**Site Photograph**	**Site features**
Kunjat**hbail** **Zone 1A** **1,000 kl**		ULB owned land; there is an old OHT on the site, which will be dismantled; and the new OHT will be constructed; there are few trees in the site; but will not be removed for OHT construction
Nekkilagudda **Zone 3A** **1,500 kl**		Private land; site is vacant; there are few trees on the boundary of the site; OHT will be built without removing the trees
Maryhill **Zone 4** **1,500 kl**		ULB owned land; site is vacant; there are few trees on the boundary of the site; OHT will be built without removing the trees

Details of Proposed OHT -Location -Zone -Capacity	**Site Photograph**	**Site features**
Santhoshnagara **Zone 5A 500 kl**		ULB owned land; site is covered with shrubs, bushes and small trees, some of which will need to be cut off
Shaktinagara **Zone 10 2,000 kl**		ULB owned land; site is vacant and no notable vegetation
Nehrumaid**an** **Zone 17 2,000 kl**		ULB owned land; site is vacant and no notable vegetation
Nandigudda **Zone 18A 2,000 kl**		ULB owned land; site is vacant and no notable vegetation
Morgansgate **Zone 18B 2,000 kl**		ULB owned land; site is vacant; there are big few trees on the boundary of the site; OHT will be built without cutting/pruning these trees

Details of Proposed OHT -Location -Zone -Capacity	**Site Photograph**	**Site features**
Valancia **Zone 19** **1,500 kl**		ULB owned land; site is vacant; covered with shrubs and bushes, few trees are on the periphery;; OHT will be built without cutting these trees
Amruthanagara **Zone 24A** **750 kl**		ULB owned land; site is vacant; covered with shrubs and bushes; there are no trees
Udayanagara **Zone 25A** **600 kl**		ULB owned land; site is vacant; covered with shrubs and bushes; there are no trees
NITK, Thadambail **Zone 26** **500 kl**		ULB owned land; site is vacant and there are no trees at the identified location. There is an existing OHT, new OHT will be built adjacent to this
Kodipady **Zone 28A** **400 kl**		ULB owned land; site is vacant; covered with shrubs and bushes; few trees are on the periphery of the site, but OHT will built without cutting trees

Details of Proposed OHT -Location -Zone -Capacity	Site Photograph	Site features
Krishnapura **Zone 29A 1,000 kl**		ULB owned land; site is vacant; there are no trees or vegetation

Table 10: Photographs of Proposed GLSR and Pumping Station Sites

	
Site at Ladyhill; vacant land, no trees; shrubs, government owned; at this site both GSLR and pump house are proposed	Site at Bendoor; vacant land, no trees or vegetation; government owned; at this site both GSLR and pump house are proposed
	
Site at Mary hill; vacant land, covered with shrubs and grass; government owned	Site at Padil; vacant land, covered with shrubs and grass; government owned
	
Site at Bondel; vacant land, no trees or vegetation; government owned	Site at Shaktinagara; vacant land, covered with shrubs and grass; government owned

	
Site at Bala; vacant land, no trees or vegetation; government owned	

Table 11: Photographs showing Pipeline Alignment along the Roads

	
Hampanakatta signal to Nehru Maidan OHT	Hampanakatta signal to Nehru maidan road OHT
	
Bendoor well to Balmatta Road	Bendoor Well WTP Pumphouse to Officers Club OHT
	

Bendoor Well WTP Pumphouse to Officers Club OHT	Balmatta to Jyothi
	
Jyothi theatre to Tagore park	Bendoor Well WTP Pumphouse to Officers Club OHT
	
Bendoor Well WTP to Mary Hill GL	Bendoor Well WTP to Mary Hill GL
 Bendoor Well WTP to Mary Hill GL	 Bendoor Well WTP to Mary Hill GL

	
Bendoor Well WTP to Mary Hill GLSR	Bendoor Well WTP to Mary Hill GLSR
	
Padupav to Kodipadi OHT	Padupav to Kodipadi OHT
	
Padupav to Kodipadi OHT	Padupav to Kodipadi OHT
	
NITK to udayanagara OHT	NITK to udayanagara OHT

	
NITK to udayanagara OHT	Krishnapura OHT to Krishnapura Govt School OHT.
	
Krishnapura OHT to Krishnapura Govt School OHT	Panambur WTP Pump House to Meenakaliya OHT
	
Panambur WTP Pump House to Meenakaliya OHT	Panambur WTP Pump House to Meenakaliya OHT

V. SCREENING OF POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

59. The ADB rapid environmental assessment (REA) checklist (Water Supply) was used to screen the project for environmental impacts and to determine the scope of the IEE investigation. The complete checklist is given in Appendix 1.

60. Based on the ADB REA Checklist, the subproject's potential impacts without mitigation includes: (i) increase production of sewage beyond capabilities of community facilities because of the improved water supply system, (ii) impairments associated with transmission lines and

access roads, (iii) health and safety hazards to workers during project construction and operation, (iv) noise and dust from construction activities, (v) increased road traffic due to interference of construction activities, and (vi) continuing soil erosion/silt runoff from construction operations.

61. Therefore, this section provides the assessment of the potential environmental impacts in terms of significance, duration and magnitude during pre-construction (location, design), construction and operation phases of the project. Measures to minimize/mitigate negative impact and monitoring actions to be conducted during the implementation phase is also recommended to reduce the impact further.

(i) **Location Impacts**. There is no ecologically-sensitive feature within or adjacent to the subproject sites. Except one OHT site, all the OHT, GLSR and pumping stations sites selected are on government-owned vacant land parcels, and all the pipelines are proposed along the roads, where there is space along the ROW to lay the pipeline. Due to lack of government land, Nekkilagudda OHT is proposed on a private land, the process of direct purchase of land from the owner is in process. Trees at sites are very minimal and based on detailed design, some of the trees in the OHT sites need to be cut while tree-cutting along the alignment is not required.

(ii) **Design Impact.** Detailed design of the components incorporated good environmental design and following internationally-accepted standards and Indian Building Codes.

(iii) **Construction Impacts.** Due to inherent impacts of constructing OHTs, GLSRs and pumping stations and method for open cut pipe-laying works, impacts cannot be avoided during construction. Impacts are due to site clearing, earthworks, machinery, vehicles and workers. Potential impacts are assessed to be not significant, low magnitude, site-specific and can be managed by good construction practices and strict implementation and monitoring.

(iv) **O&M Impacts.** These include waste streams and occupational health and safety concerns during distribution network maintenance.

A. Source Sustainability

62. Netravati River is the source of water supply for Mangalore. Originating in Western Ghats, Netravati is a perennial river, flows over a length of 103 km and discharges into Arabian sea at Mangalore. Kumaradhara, another important river of Coastal Karnataka, also originating in Western Ghats joins Netravati at Uppinangadi, near Puttur, upstream of Mangalore. The river flows throughout the year, stronger during monsoon and leaner in the summer. The river has been the source of water for Mangalore for several decades. In the past, water was pumped directly from the intake as flow was strong and available throughout the year.

63. As the flow became leaner through the seasons, supply became insufficient to meet the increasing demands. To address the shortage, a 4 m high vented dam was constructed in 1993 across the river at Thumbe, just downstream of the intake, exclusively to provide water supply to Mangalore City. Water storage capacity of this 350 m length vented dam (with 135 vents with gates) was 9.56 million cubic meter (MCM) with a total submergence area of 5,185,000 m^2. In 2010, KUWSDB constructed another dam just downstream (~50 m) of the 1993 vented dam and commissioned it in 2016 to cater to increased water demand. The said dam is 343 m long, with 30 vents (size of gates – 10 m wide x 5.5 m height). The design height of the dam is 7 m, and the total water storage capacity is 14.73 MCM. At present, the dam height is being maintained at 6 m, and the corresponding water storage capacity is 10.83 MCM.

64. Aside from the dam across the river Thumbe, raw water to Mangalore is also available from a power project dam (AMR power project of AMR Group), constructed across the same river (Netravati) at Shamboor, about 12 km upstream of Thumbe dam with a storage capacity of 14.25 MCM. There is an agreement between MCC and AMR power project, which governs the fact that no power is to be generated from January to May/June, or during the river's lean flow season, and water stored in AMR power project dam is to be released to Thumbe Dam for Mangalore water supply. The net storage available in both the dams (after accounting for evaporation losses) is sufficient to provide 24x7 water supply to Mangalore City. These existing facilities will serve as water sources for the bulk water supply and distribution network system subproject.

65. **River Water Quality.** Dam is located at about 12 km from the sea coast (river course length). River water quality is suitable for drinking after conventional treatment.

B. Due Diligence of Government-Funded Components

66. As discussed in the previous chapters, a bulk water supply project with government funding (AMRUT) is also proposed in parallel with the distribution system improvement subproject under KIUWMIP Tranche 2 to comprehensively improve the water supply system in Mangalore City. The AMRUT-funded bulk water supply project will increase the raw water abstraction from the existing water source will be increased by 10 MLD.[5] With this the overall withdrawal will increase from present 170 MLD to 180 MLD, i.e., 5.8%. Government of Karnataka will also increase the treatment capacity by 10 MLD with the construction of new WTP.[6] Overall this WTP improvement will increase treated water supply from the existing 160 MLD to 180 MLD.

67. KIUWMIP Tranche 2-funded distribution network system will provide a distribution channel for the bulk water supply project. Per the discussion in the previous section, existing water source is adequate to meet the demand, and water quality is satisfactory. The main components proposed in the government-funded bulk water project include rehabilitation of existing WTPs, and construction of a new WTP. Other works include construction of six overhead tanks, augmentation of pumping system and laying of two water mains for a total length of 1.85 km, (one, along road and second, within the WTP compound).

1. Statutory Clearance Requirements

68. Environmental Clearance requirement per Government of India's EIA Notification, 2006, is applicable to none of the project components proposed under the government-funded bulk water project. In Karnataka, WTPs do not require permit/consent from Karnataka State Pollution Control Board (KSPCB) either to establish or operate under the current legislations. One OHT site falls in Coastal regulation zone (CRZ) and therefore requires prior permission from Karnataka Coastal Zone Management Authority. This needs to be obtained prior to start of construction. No other environmental related clearance or permissions required.

2. Environmental Audit of Existing Water Treatment Plants (WTP)

69. As presented in the project description section, there are three existing WTPs in Mangalore – 10 MLD WTP constructed in 1956, 81.7 MLD WTP constructed in 1974, and 80 MLD WTP constructed in 2006 under the ADB funded KUDCEMP. Existing WTPs are operated and maintained by MCC. Under the bulk water project, the old WTP of 1956 is being completely

[5] AMRUT-funded bulk water supply project will upgrade the existing one jack well from present 10 MLD to 20 MLD.
[6] New 20-MLD capacity WTP will replace the old WTP (first 10-MLD WTP built in 1956).

replaced by a new WTP of 20 MLD, and the rest two are being rehabilitated. All the WTPs are located in Ramalkatte area, close to water source. Environmental audit of existing two WTPs, which are being rehabilitated, are conducted ((Environmental Audit report is presented in Appendix 10) during IEE preparation to assess the current environmental performance and identify issues of concern. Water quality testing – both and treated water quality, is conducted regularly (2-3 times a week) at the in-house laboratory. The parameters tested include: pH, temperature, turbidity, total suspended solids, chloride, alkalinity, total hardness, calcium, magnesium, iron and residual chlorine. As per the monitoring results (Table 1), treated water quality is good; all the parameters tested are well within the limits of drinking water standards.

70. The audit identified some concerns which need to be addressed. At present, no backwash and sludge collection, treatment or disposal systems available at the existing WTPs. Backwash along with sludge accumulated at different WTP units is disposed into open drains, which will join the natural water bodies. Under the bulk water project, a 20 MLD capacity WTP is proposed to be constructed. 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, and waste from rinsing and back washing of filter media containing debris, chemical precipitates, straining of organic debris and plankton. Chlorination system is working normally in one WTP (KUDCEMP funded), while in the other WTP, the system lacks any proper safety measures. An action plan is suggested in the following Table 12 to ensure the compliance:

Table 12: Corrective Action Plan for Environmental Compliance of Existing WTPs

Concern	Action Required	Timeline	Responsible Agency and Funding Source
Poor backwash wastewater and sludge management – discharged untreated into natural drains	- Provision of backwash recirculation system – to avoid discharge and also to recover raw water -Provision of sludge collection, thickening, drying and reuse/disposal system	Corrective actions such as treatment of backwash water and sludge management system are included in the bulk water project.	MCC / Government of Karnataka This component is already included in the bulk water project. Backwash recirculation and sludge management is proposed for all the plants – 2 existing and a proposed.
Poor handling of chlorination system and lack of safety measures	Improvements to chlorination already included in the subproject.	Same as above	MCC / Government of Karnataka This component is already included in the bulk water project

C. Pre-Construction Impact

71. Proposed subproject sites are carefully selected to avoid ecologically-sensitive areas and minimize the impacts on people livelihoods and homestead. In the case of this project (i) most of the individual elements are relatively small and involve straight forward construction and operation, so impacts will be mainly localized and not greatly significant; (ii) most of the predicted impacts are associated with the construction process, and are produced because that process is invasive, involving excavation and earth movements; and (iii) being located in the urban areas, will not cause direct impact on biodiversity values.

72. **Tree Cutting at Subproject Sites**. All sites are carefully selected, and layouts designed to minimize the tree cutting. Some of the subproject sites (OHTs) have trees, which need to be cut while tree cutting is not envisaged for the distribution network pipes. Following measures need to be implemented, during design validation and preconstruction phase, to minimize and/or compensate for the loss of tree cover:

(i) In detailed design, removal of trees avoided by adopting to site condition and with appropriate layout design (e.g. OHT sites at Santoshanagar, Kodypada, Nekkilagudda); contractor to ensure the same during implementation;
(ii) For any tree cutting that may be required, obtain prior permission from Forest Department; and
(iii) Plant and maintain 10 trees for each tree that is removed.

73. **Permits and No Objection Clearances.** MCC should obtain all necessary clearances before the start of the work. Pipelines passes along or crosses national highways, railways, at various locations as given below, which require permission from respective agencies.

(i) Sections requiring railway permissions:
  (a) A clear water feeder line (660 mm diameter MS pipe) crosses Konkan Railway line at Kana in between chainage 735/700-800;
  (b) A clear water feeder line (355 diameter MS pipe) crosses railway line at Baikampady in between chainage 24/400-500; and
  (c) For laying 350 mm diameter DI pipe at chainage 883/4.
(ii) Sections requiring National Highway permissions:
  (a) Clear water feeder line crosses NH-66 (350 mm diameter DI) at Pump well Circle for length of 60 m;
  (b) Clear water feeder line (610 mm diameter MS pipe) crosses NH-66 at Paduva High school for 45 m. Also, same pipe line passes along NH-66 for a length of 350 m;
  (c) Clear water feeder line (250 mm diameter DI) pipe crosses NH-66 at Panambur beach road for 45 m. Also, for a length of 500 m pipe line passes along NH-66;
  (d) Clear water feeder line (200 mm diameter DI) pipe crosses NH-66 at NITK for a length of 45 m;
  (e) Clear water feeder line (355.6 diameter MS pipe) passes along NH-66 from Panambur to Kulai for a length of 4 km;
  (f) Clear water feeder line (300 mm diameter DI pipe) passes along NH-169 from Kongurmutt to Baiturli Junction for a length of 1.4 km; and
  (g) Clear water feeder line (200 mm diameter DI) pipe passes along NH-169 from Mangalajyoti Junction to Vamanjoor Checkpost for a length of 1.8 km.

74. **Utilities.** During the installation stage of water lines, traffic and human activities like telephone lines, electric poles and wires, water lines within the proposed subproject locations may require to be shifted in few cases which will be temporarily interfered due to the operation of construction machineries. To mitigate the impacts due to relocation of the utilities, PIU will:

(i) Identify and include locations and operators of these utilities in the detailed design documents, during design validation and construction phase, to prevent unnecessary disruption of services during construction phase;
(ii) Conduct detailed site surveys with the construction drawings and discuss with the respective agencies during the construction phase before ground clearance; and

(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.

75. **Site Selection of Construction Work Camps, Stockpile Areas, Storage Areas, and Disposal Areas**. If the work camp is planning to set up, 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. Material stockpiles shall be protected by bunds during the monsoon to arrest the silt laden runoff into drains/streams. 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:

(i) The excavated soil should be removed from construction area at the earliest for beneficial reuse such as land raising/filling of excavated areas;
(ii) Soil should be covered with tarpaulin sheets during the transportation; and
(iii) Soil transportation should not be done during the peak hours and should be avoid narrow and heavy traffic routes and important religious or tourist sites.

76. **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 centres, drinking water intakes and streams, cultivable lands, and natural drainage systems; and in structurally stable areas even if some distance from construction activities.

77. For this subproject, the quarry material required will be sand and stone aggregate, and the nearest quarries are near Karkala 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.

78. **Social and Cultural Resources – Chance Finds.** Any work involving ground disturbance can uncover and damage archaeological and historical remains. However, subproject area is not a known area of archaeological potential, and therefore the risk is low. Nevertheless, construction contractor needs to follow these measures in conducting any excavation work:

(i) Create awareness among the workers and supervisors about the chance finds during excavation work;
(ii) Stop work immediately if any finds are suspected to allow further investigation; and
(iii) Inform archaeological agencies promptly if a find is suspected, and take any action they require to ensure its removal or protection in situ.

D. Design Impact

79. These impacts arise from the design of the investment program, including technology used and construction method for pipe laying works, OHTs, GLSRs and Pumping Stations.

80. **Design of the Proposed Components.** The CPHEEO manual suggests a design period of 30 years in general while designing the system for water supply components. Since, the packages are proposed to be implemented sequentially; theoretically, each of the system components should have a different design year. However, in order to maintain unanimity in the design period and design population, 2046 has been considered as the design year for all the system components. Accordingly, 2016 is the base year and 2031 the intermediate year to cross check the designs pertaining to intermediate demand. The rate of supply has been taken as 135 lpcd for 100%population.

81. **Distribution System Design**. Owning to topography, and residual pressure requirements at consumers ends, a pumping in the system cannot be avoided. Treated water will be pumped to OHTs and from there water will flow under gravity system to consumers. No design specific impacts envisaged.

E. Construction Impact

82. **Construction method for pipe-laying works.** The civil works for pipeline network projects include earthwork excavation trenches, pipe laying, installing valves, flow meters and data loggers, shifting of public utilities (if required) and providing house connections. Earthwork excavation will be undertaken by machine and include danger lighting and using sight rails and boning rods at every 100 m, while pipe laying works will include laying pipes at required gradient, fixing collars, elbows, tees, bends and other fittings including conveying the material to work spot and testing for water tightness.

83. The excavation is done in such a way that there will be a minimum depth of 1 m. Sufficient care will be taken while laying, so that existing utilities and cables are not damaged, and pipes are not thrown into the trenches or dragged, but carefully laid in the trenches. Once they are laid, pipes will be joined as per specification and then tested for any cracks of leakages. The minimum working hours will be 8 hours daily, the total duration of each stage depends on the soil condition and other local features.

84. **Construction Method for Overhead Tanks, GLSRs and Pumping Stations.** Excavation will be done as per the execution drawing for excavation by adopting standard procedures by using excavators. Excavation will be carried out in methodical manner by providing proper approach roads with adequate slopes for machinery movement. Wherever the excavation is not possible by machines – manual excavation by workmen will be carried out.

85. Consolidation will be carried out by knowing the exact geo-technical characteristics of the site. Compaction and consolidation of earth will be carried out up to the desired level of consolidation by adopting standard procedures. The necessary compaction test will be conducted. Before carrying out any concreting works necessary approval of client/consultant in the pour card will be obtained. Bill of materials and Bar bending schedules as per the approved drawings will be prepared and kept ready.

86. The shuttering plates of proper sizes with proper finish or new plywood (waterproof) of adequate thickness will be used along with scaffolding pipes and clamps

87. At the time of placing concrete at every stage required test cubes will be taken and it will be kept under proper curing. These cubes will be tested in the Site laboratory in the presence of client/consultant on 7/14/28 days sampling and testing shall be as per respective specification under the supervision of client/consultant. After completing concrete work required curing arrangements are kept ready. Curing will be carried out as per the IS. The de-shuttering of formwork of concrete surface will be as per IS 456 without any deviations.

88. After the completion of the super structure the required finishes viz. plastering, water proof plastering and other amenity works as per the specifications. Finally, the entire reservoir will be white washed besides application of necessary approved color shade.

89. Following Table 13 shows the details of construction activities involved in the subproject.

Table 13: Construction Activities for the Subproject

Component	Construction Method	Likely Waste Generated
Water Supply line	Trench excavation along the identified main roads of about 1 m plus pipe dia, but in some case, it may go deeper. A bed of sand/murrum 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 and will cover most part of the city. The work will be conducted by a team of 5 workers at each site	365,669 m^3 of soil will be excavated; 90-95% will be utilized for refill; remaining soil (18,250 m^3 -36,500 m^3) need to be disposed off This excess soil shall be used for filling if required or stored/ dumped in approved debris disposal site. An old non-functional OHT needs to be dismantled for construction new OHT at Kunjathbail site. This activity will generate debris which need to be disposed off
Water reservoirs	Excavation, compaction and consolidation of earth, bar bending, concreting, staging and finishing work etc	

m^3 = cubic meter, m = meter, mm = millimeter, OHT = overhead tank.

90. Although construction of the pipelines involve simple civil work techniques, the invasive nature of excavation and the subproject locations in the built-up areas of Mangalore, where there are a variety of human activities, will result to environmental impacts and sensitive receptors such as residents, businesses, and the community in general. These anticipated impacts are temporary and only for a short time period.

91. Physical impacts will be mitigated with the use of a particular type of working method and implementing a specific time schedule. project components will be (i) constructed by small teams working at a time; and (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.

92. While trenching at densely populated areas like market place or layouts, roads with heavy traffics additional care have to be taken care of. Hard barricades should be mandatorily provided along with caution board and traffic diversion boards. Some of the densely populated areas identified in the subproject area are: Hampankatta, Nehru maidan. Balmata, Jyothi Junction, Bavutagudda, Bendoor,Lalbagh, ladyhill, Valancia, Nandigudda, Krishanpuara,. Narrow roads where work proposed include: Bejai cross road, Nekkilagudda Malemar road, and busy traffic

roads include: Bendoor to Jyoti Junction, Jyothi Junction to Bavutagudda, Bavutagudda to Nehrumaidan, Bejai – Bus stand Road, Lalbagh – Ladyhill road, Bendoor-Nantoor Junction, KPT Junction to Maryhill road. Prior to starting of work, contractor should prepare Construction Management Plan. The Construction Management Plan should be site specific and has to be submitted every month before starting the work. The Construction Management Plan will include the method statement for construction works, Utility Management and Contingency Plan, Traffic Management Plan, Work camp and Labor Camp details, Safety measures taken for the workers and the public.

93. The method statement for pipeline works 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 pipe line 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:

(i) Work description;
(ii) Number of workers (skilled and unskilled);
(iii) Details of plant, equipment and machinery, vehicles;
(iv) Work duration (total, and activity-wise, for example for pipe laying, from excavation to road resurfacing/testing);
(v) PPE (helmet, gloves, boots) details for each type of work;
(vi) Details of materials at each site (type and quantity);
(vii) 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);
(viii) Construction waste/debris generated (details and quantity);
(ix) Detail the sequence of work process (step-by-step) including specific details of each work;
(x) Contractor's supervision and management arrangements for the work;
(xi) Emergency: Designate (a) responsible person on site, and (b) first aider;
(xii) Typical site layout plan including pipe trenching, placement of material, excavated earth, barricading; and
(xiii) The pipelines are to be laid along the roads. 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, and also into nearby open drains.

94. The following should be included in the site layout plan:

(i) Provide barricading/security personnel at the site to prevent entry/trespassing of pedestrian/vehicles into the work zone;
(ii) Location of temporary stockpiles and provision of bunds;
(iii) Separation of stockpiles areas with workers/vehicle movement paths to avoid disturbing the stockpiled soil;
(iv) Wetting of soil to arrest dust generation by sprinkling water; and
(v) 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.

95. **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 and 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; and
(iv) Submit on a monthly basis documentation of sources of materials to PMDCSC.

96. **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, Sulphur 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 onsite by spraying with water when necessary during dry weather;
(iii) Bring materials (aggregates, sand, 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; and
(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.

97. **Noise Levels.** The soils in the subproject area are deeper than the excavation depths for pipelines and, therefore, activities like rock cutting/blasting that generate high noise are not anticipated. In isolated areas where a hard stratum is encountered (e.g., for foundations), requiring using of pneumatic drills, there will be high noise during the activity. Also, where the pipelines are required to be laid in the roadway, pneumatic drills will be used to break open the road surface. Pneumatic drills typically generate an equitant noise of 82-98 A-weighted decibels (dBA), at 1 m distance from the activity. Increase in noise level may be caused by excavation equipment, and the transportation of equipment, materials, and people. 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);
(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 chiseling;
(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;
(vi) Maintain maximum sound levels not exceeding 80 dbA when measured at a distance of 10 m or more from the vehicle/s; and
(vii) Horns should not be used unless it is necessary to warn other road users or animals of the vehicle’s approach.

98. **Surface Water Quality.** There will be no construction in the water source, the river Netravati, under the subproject. Mangalore receives high rainfall during southwest (June to September) and northeast (October to December) monsoons. Gurupura and Netravati rivers encircle the city on three sides. Excavation will not be scheduled during rains, there is no impact on drainage and surface water quality is envisaged. There may be temporary impacts like flooding of construction sites, mixing of construction waste and material with the runoff, etc. This may lead to silting and blockage of drains and water bodies. Mobilization of settled silt materials, run-off from stockpiled materials, and chemical contamination from fuels and lubricants during construction works can contaminate downstream surface water quality of the streams draining the city. 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) Laying of pipelines during dry season and closing of all trenches before rainy season and avoid any chances of collecting the water in the trenches or pumping;
(iii) 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 (Appendix 6);
(iv) Install temporary silt traps or sedimentation basins along the drainage leading to the water bodies. Storage structure should consider 110% capacity bund;
(v) Provide temporary bunds for stockpiles and materials;
(vi) Place storage areas for fuels and lubricants away from any drainage leading to water bodies;
(vii) Dispose any wastes generated by construction activities in designated sites; and
(viii) Conduct surface quality inspection and monitoring.

99. **Groundwater**. Subproject activities do not interfere with groundwater regime, no groundwater abstraction proposed nor do the activities affect groundwater quality. Another physical impact that is often associated with excavation is the effect on drainage and the local water table if groundwater and surface water collect in the voids. To ensure that water will not pond in pits and voids near project location, the construction contractor will be required to conduct excavation works on non-monsoon season to the maximum extent possible.

100. **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 are proposed it will generate only 5%-10% as surplus as most of the soil will be used for refilling after the pipe is laid in trench. Indiscriminate disposal of the soil and waste, excess construction material, concrete, packing materials, containers, lubricants and oils 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/Spoil Management Plan – it should present how the surplus Waste 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 MCC for beneficial uses of excess excavated soils or immediately dispose to designated areas;
(v) Recover used oil and lubricants and reuse or remove from the sites;

(vi) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas;
(vii) Remove all wreckage, rubbish, or temporary structures which are no longer required; and
(viii) Request PMU/PMDCSC to report in writing that the necessary environmental restoration work has been adequately performed before acceptance of work.

101. **Accessibility.** Transport infrastructure will be affected by the pipe laying work, as there is not enough space for excavated soil to be piled off the road in the narrower streets. 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. Densely populated areas in Mangalore include: Hampankatta, Nehru maidan. Balmata, Jyothi Junction, Bavutagudda, Bendoor,Lalbagh, ladyhill, Valancia, Nandigudda, Krishanpuara,. Narrow roads where work proposed include: Bejai cross road, Nekkilagudda Malemar road, and busy traffic roads include: Bendoor to Jyoti Junction, Jyothi Junction to Bavutagudda, Bavutagudda to Nehrumaidan, Bejai – Bus stand Road, Lalbagh – Ladyhill road, Bendoor-Nantoor Junction, KPT Junction to Maryhill road. There will disturbance to road users during the construction phase. 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 minimize disturbance to the traffic movement;
(iv) Schedule transport and hauling activities during non-peak hours;
(v) Do not close the road completely, allow traffic to move on one line;
(vi) Plan transportation routes so that heavy vehicles do not use narrow local roads, except in the immediate vicinity of delivery sites;
(vii) In unavoidable circumstances of road closure, provide alternative routes, and ensure that public is informed about such traffic diversions;
(viii) 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;
(ix) Keep the site free from all unnecessary obstructions;
(x) Drive vehicles in a considerate manner; and
(xi) Prepare a Traffic Management Plan.

102. Wherever road width is compromised, there will be temporary loss of access during pipelaying. Under these circumstances, contractor can adopt these following measures:

(i) Inform the affected local population two days in advance about the work schedule;
(ii) Plan and execute the work in such a way that the period of disturbance/ loss of access is minimum; and
(iii) Provide pedestrian access in all the locations until normalcy is restored.

103. **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 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 within 250 m around the sensitive locations (schools, hospitals, and religious centers):

(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, 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; and
(vi) Implement all measures suggested elsewhere in this report – dust and noise control, public safety, traffic management, strictly at the sites.

104. **Socio-Economic – Income.** All of the project components, except one OHT, will be located in government land and existing ROW. It is proposed to procure the private land for one OHT via negotiated settlement at market rate to avoid any resettlement and rehabilitation impacts. These are discussed and detailed in the resettlement plan/due diligence document of the subproject. Excavation of trenches and pipe laying work will obstruct access to residences/commercial buildings adjacent to the pipeline. Disruption of access to commercial establishments may affect livelihood. Since several 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 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;
(vi) Provide sign boards for pedestrians to inform nature and duration of construction works and contact numbers for concerns/complaints;
(vii) Increase workforce in front of critical areas such as institutions, place of worship, business establishment, hospitals, and schools;
(viii) Prepare and implement spoils management plan; and
(ix) Provide alternate sources of clean water until water supply is restored.

105. **Socio-Economic-Employment.** Manpower will be required during the construction period (36 months). This can result to generation of contractual employment and increase in local revenue, therefore, potential impact is positive and long-term. The construction contractor will be required to:

(i) Employ local labor force to the maximum extent, if manpower is available; and
(ii) Comply with labor laws.

106. **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) Comply with all national, state and local core labor laws (See Appendix 2 of this IEE);
(ii) Develop and implement site-specific Health and Safety (H&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&S training [7] for all site personnel; (d) documented procedures to be followed for all site activities; and (e) documentation of work-related accidents;
(iii) All trenches deeper than 1 m shall be protected with hard barricade to avoid safety risks to workers, public and nearby buildings/structures;
(iv) Ensure that qualified first-aid can be provided at all times. Equipped first-aid stations shall be easily accessible throughout the site;
(v) Provide medical insurance coverage for workers;
(vi) Secure all installations from unauthorized intrusion and accident risks;
(vii) Provide supplies of potable drinking water;
(viii) Provide clean eating areas where workers are not exposed to hazardous or noxious substances;
(ix) Provide H&S orientation training to all new workers to ensure that they are apprised of the basic site rules of work at the site, personal protective protection, and preventing injuring to fellow workers;
(x) 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;
(xi) Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas;
(xii) Ensure moving equipment is outfitted with audible back-up alarms;
(xiii) 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;
(xiv) 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; and
(xv) Overall, the contractor should comply with International Finance Corporation (IFC) Environmental Health and Safety (EHS) Guidelines on occupational health and safety.[8]

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

[8] IFC EHS Guidelines. 2007. *2.0 Occupational Health and Safety*.

106. **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 roadways, hence safety risk to community is to be considered. The pipe line work may require trenches along the roads 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 hard barricading for all deep excavations that may require especially for pipe lines; 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 MCC in identifying risk areas on route cards/maps;
(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;

Overall, the contractor should comply with IFC EHS Guidelines Community Health and Safety.[9]

107. **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. The construction contractor will be required to comply with the following. Overall, the contract should follow the IFC EHS guidelines specific to workers accommodation.[10]

(i) Consult with PIU before locating workers camps/sheds, and construction plants; as far as possible located at least 200 m from residential areas;
(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 lpcd - 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;
(xi) Report in writing that the camp has been vacated and restored to pre-project conditions before acceptance of work; and

[9] IFC EHS Guidelines. 2007. *3.0 Community Health, Safety and Security*.
[10] IFC and the EBRD. 2009. *Workers' accommodation: processes and standards*.

(xii) The work camp details should be included in the Construction Management Plan.

108. **Social and Cultural Resources - Chance Finds.** Any work involving ground disturbance can uncover and damage archaeological and historical remains. However, subproject area is not a known area of archaeological potential, and therefore the risk is low. Nevertheless, the construction contractor will be required to:

(i) Create awareness among the workers and supervisors about the chance finds during excavation work;
(ii) Stop work immediately if any finds are suspected to allow further investigation;
(iii) Inform archaeological agencies promptly if a find is suspected, and take any action they require to ensure its removal or protection in situ; and
(iv) Adjacent to important religious sites, undertake excavation and construction work in such a way that no structural damage is caused to the building.

109. **Debris Disposal.** Prior to the commencement of works, contractor shall identify a debris disposal site in consultation with the MCC and adhering to following criteria:

(i) The said site shall be selected preferably from barren, infertile lands. In case agricultural land needs to be selected, top-soil stripping, stacking and preservation should be undertaken prior to initiation of any activities;
(ii) Debris disposal site shall be at least 200 m away from surface water bodies;
(iii) No residential areas shall be located within 100 m downwind side of the site;
(iv) The site is minimum 250 m away from sensitive locations like settlements, ponds/lakes or other water bodies; and
(v) The local governing body and community shall be consulted while selecting the site.

F. Operational and Maintenance Impacts

110 Operation and Maintenance of the water supply system will be carried out by the MCC. The system has a design life of 30 years, during which shall not require major repairs or refurbishments and should operate with little maintenance beyond routine actions required to keep the equipment in working order. The stability and integrity of the system will be monitored periodically to detect any problems and allow remedial action if required. Any repairs will be small-scale involving manual, temporary, and short-term works involving regular checking and recording of performance for signs of deterioration, servicing and replacement of parts.

111. Recurrence of pipe bursting and leakage problems can be managed by the leak detection and water auditing surveys. MCC will be required to ensure that the leakage rectification time is minimized.

112. Improper disposal of silt and debris removed from trenches could cause inconvenience to public. Silt and debris shall be collected in trucks and transported to the approved disposal site and or can be used as covering material for wastes being landfilled.

113. Recurrence of blockage and leakage problems. Although impact is likely to be minimal due to new and well-designed efficient system, it should be ensured that leak detection and restoration time is minimized to the extent possible.

114. Increased water supply will increase the sewage generation, which needs to be safely collected, treated and disposed. A comprehensive sewerage system to be developed.

G. Cumulative Impacts

115. Cumulative impacts are those that result from the successive, incremental, and/or combined effects of a project or activity when added to other existing, planned, and/or reasonably anticipated future ones. The subproject is proposed to improve municipal water supply in Mangalore, by providing new pumping stations, GLSRs, OHTs, distribution lines in currently uncovered areas, and to improving water distribution lines in the presently covered areas. Subproject is limited to improvement of water distribution system and therefore no notable cumulative impacts envisaged. During the construction work, dust pollution is anticipated from the subproject activities. This, combined with the other usual construction activities in urban areas, may increase the particulate matter concentration in ambient air. Dust control measures suggested in the EMP will minimize the dust generation from the subproject construction activities. Therefore, no significant impacts envisaged.

VI. PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

A. Project Stakeholders

116. 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 City;
(iii) MCC; and
(iv) KUIDFC, Government of Karnataka.

117. Secondary stakeholders are:

(i) Other concerned government institutions (utilities, regulators, etc.).
(ii) NGOs and community-based organizations 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 and Disclosure up to Date

118. Public consultation meetings were conducted during the project preparation and design stages. 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.

119. In order to identify the adverse social impact of the project a joint site visit was carried out by the ULB engineers, Resettlement Specialist and design engineer of the consultant team from 10 October 2017 along the clear water pumping lines and from 1 to 10 July 2017 along the busy areas (commercial centres and narrow streets) of in subproject city. Meetings and consultations with relevant government departments were carried out to assess the project approach.

120. Public consultations through Focus Group Discussions (FGDs) were held with project beneficiaries and project-affected people. Consultations were conducted on 10 July 2017 in the surrounding areas of all 14 OHTs' construction sites and also distribution network areas to discuss the proposed project and likely environmental issues and mitigation measures. The public

consultations were conducted along with the Ward Councillors (elected representatives of MCC), MCC officers, PIU officers and Social Development Specialist of PMDCSC. Details of consultation meetings including photographs are attached in Appendix 8. Following are the comments/suggestions of the participants:

(i) The work should be completed within the shortest possible time as people of the project proposed locations are facing a lot of problems due to the absence of the proposed infrastructure at present;
(ii) The local residence should be informed about the trenching at least 1 week before;
(iii) Employment may be provided to the local skilled and semi-skilled laborers during the construction stage;
(iv) Inconvenience and traffic disturbances due to construction work in the city should be minimized as far as possible; and
(v) People are willing to cooperate to implement the project successfully.

C. Future Consultation and Disclosure

121. The executing and implementing agencies shall extend and expand the consultation and disclosure process significantly during implementation of the investment program.

122. **Consultation During Construction.** Prior to start of construction, PIU will conduct meaningful consultation[11] and information dissemination sessions at various places and solicit the help of the local community, leaders/prominent for the project work. Focus group meetings will be conducted to discuss and plan construction work (mainly pipeline work) with local communities to reduce disturbance and other impacts and regarding the project grievance redress mechanism. Project information and construction schedule will be provided to the public via mass media (newspapers, television, websites etc.). A constant communication will be established with the affected communities to redress the environmental issues likely to surface during construction phase. Contractor will provide prior public information (in Kannada and English) about the construction work in the area, once 7 days prior to the start of work and again a day before the start of work via pamphlets. At the work sites, public information boards will also be provided to disseminate project related information.

(i) Public meetings with affected communities (if any) to discuss and plan work programs and allow issues to be raised and addressed once construction has started; and
(ii) 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.

123. **Project Disclosure.** Executive summary of the IEE will be translated in Kannada and made available at the offices of PMU, RPMU, PIU, and MCC and also displayed on their notice boards. Hard copies of the IEE will be accessible to citizens as a means to disclose the document and at the same time creating wider public awareness. Electronic version of the IEE in English and Executive Summary in Kannada will be placed in the official website of the KUIDFC after approval of the IEE by ADB. Stakeholders will also be made aware of grievance register and redress mechanism.

[11] Meaningful consultation will: (i) be carried out on an ongoing basis throughout the project cycle; (ii) involve timely disclosure of relevant information. Affected peoples and stakeholders will have access to relevant project information prior to any decision-making that will affect them; (iii) be conducted free of intimidation or coercion; and (iv) be gender inclusive and responsive, and tailored to the needs of disadvantaged and vulnerable groups.

124. Public information campaigns to explain the project details to a wider population will be conducted. Public disclosure meetings will be conducted at key project stages to inform the public of progress and future. Prior to start of construction, the PIU will issue notification on the start date of implementation in local newspapers A board showing the details of the project will be displayed at the construction sites for the information of public.

125. Local communities will be continuously consulted regarding location of construction camps, access and hauling routes and other likely disturbances during construction. The road closure together with the proposed detours will be communicated via advertising, pamphlets, radio broadcasts, road signage, etc.

(i) Public information campaigns (via newspaper, TV and radio) to explain the project to the wider City population and prepare them for disruption they may experience once the construction program is underway;
(ii) 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
(iii) Formal disclosure of completed project reports by making copies available at convenient locations in the study Cities, informing the public of their availability, and providing a mechanism through which comments can be made.

126. 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 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 (Appendix 9). Documents will also be available on the websites of KUIDFC and MCC.

VII. GRIEVANCE REDRESS MECHANISM

127. The grievance redress mechanism (GRM) for the subproject has been established in accordance with an official Memorandum issued upon the order of Joint Managing Director KUIDFC Official Memorandum dated 28 June 2017. It has been established to receive, evaluate and address the concerns, complaints and grievances of the affected persons in relation to the project's social and environmental performances. The GRM aims to provide time bound action and transparent mechanisms to resolve social and environment concerns.

128. 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 addressing project related complaints and grievances. The multi-tier GRM will have realistic time schedules and identify persons responsible to address grievances and deal directly with complainants to resolve their issues.

129. Awareness on grievance redress procedures will be created through Public Awareness Campaign with the help of print and electronic media. The Safeguards Officer of RPMU 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.

130. 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 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.

A. Grievance Redressal Process

131. There will be several tiers for grievance redress process (Figure 10). 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 MCC responsible for addressing resettlement/social issues. Resident engineer and the MCC will assist in resolving the issues. Name, designation and contact number of personnel responsible for grievance redress at MCC and RPMU, will be posted at Contractor's and PMDCSC's site office in full visibility of public. Grievances of immediate nature should be resolved at site/ within MCC/PIU level within 15 days of registration of grievances.

132. All the grievances that cannot be resolved at MCC/PIU within 15 days will be forwarded to the grievances redress committee (GRC) headed by Deputy Project Director, RPMU at Subdivision level who will review and resolve within 15 working days of grievance being registered with assistance of the concerned implementing agency/ULB personnel if required. The grievances of critical nature and those cannot be resolved at GRC level should be referred to District Level Implementation Committee (DLIC) set up at district level headed by Deputy Commissioner who will review the grievances and 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 Safeguards Officer and circulated to DLIC members at least a week prior to scheduled meeting. The decision taken at the DLIC level will be communicated to the complainant by Safeguards Officer, RPMU through ULB/PIU.

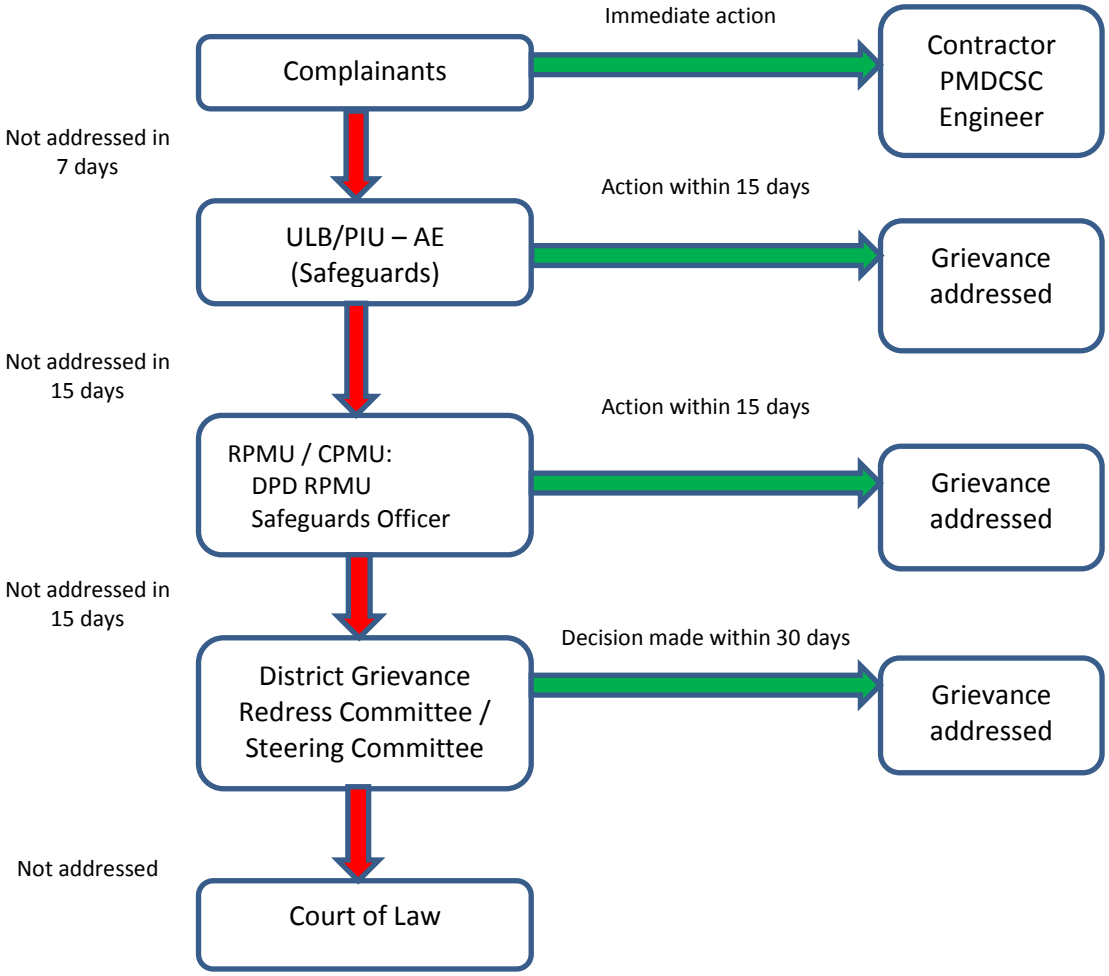
133. For any issues that remain unresolved by the GRC it is referred to DLIC at the District Level, and if the decisions taken at such meetings are not acceptable, the complainants /displaced persons can approach the court of law as per Government of Karnataka legal procedure.

B. Grievance Redress Committee Composition and Selection of Members

134. The GRC for the project will be headed by a Special Land Acquisition Officer/Assistant Commissioner of the concerned sub-Division as Chairman of the sub Division with members as follows: (i) ULB Commissioners/Chief Officer of the concerned ULB towns, (ii) Deputy Project Director as member Secretary and Convener, (iii) PMDCSC Engineer, (iv) Affected Community member/NGO, and (v) Safeguards Officer RPMU KIUWMIP Mangalore member and will shoulder responsibility of keeping records of grievances/ complaints in details. Safeguards Officer of RPMU will be responsible for coordinating with all GRC members and the DPs for grievance redressal. The grievances of critical nature and those cannot be resolved at Divisional level should be referred to DLIC set up at District level they will determine the merit of each grievance and attempt to resolve the same within a month from the date of lodging of complaints. The decision of DLIC is final and cannot be contested in any other forum except in the Courts of Law.

135. The affected person can also use the ADB Accountability Mechanism through directly contact (in writing) to the Complaint Receiving Officer (CRO) at ADB headquarters or to ADB Indian Resident Mission. The complaint can be submitted in any of the official languages of ADB's DMCs. The ADB Accountability Mechanism information will include in the project information document (PID) to be distributed to the affected communities, as part of the project GRM.

Figure 10: Grievance Redress Process



AE = Assistant Engineer, CPMU = Central Program Management Unit, DPD = Deputy Project Director, PIU = Program Implementation Unit, PMDCSC = Project Management Design and Construction Supervision Consultant, RPMU = Regional Program Management Unit, ULB = urban local body.

136. **Record Keeping**. Records of all grievances received, including contact details of complainant, date the complaint was received, nature of grievance, agreed corrective actions and the date these were effected and final outcome will be kept by PIU (with the support of PMDCSC) and submitted to PMU.

137. **Information dissemination methods of the grievance redress mechanism**. The PIU, assisted by PMDCSC/Public Communication, Awareness, Resettlement and Rehabilitation CAPRRC will be responsible for information dissemination to affected persons and general public in the project area on grievance redress mechanism. Public awareness campaign will be conducted to ensure that awareness on the project and its grievance redress procedures is generated. The campaign will ensure that the poor, vulnerable and others are made aware of grievance redress procedures and entitlements per agreed entitlement matrix including. whom to contact and when, where/ how to register grievance, various stages of grievance redress process, time likely to be taken for redress of minor and major grievances, etc. Grievances received and responses provided will be documented and reported back to the affected persons. The number of grievances recorded and resolved and the outcomes will be displayed/disclosed in the PIU,

offices, ULB notice boards and on the web, as well as reported in the semi-annual environmental and social monitoring reports to be submitted to ADB.

138. **Periodic Review and Documentation of Lessons Learned.** The PMU will periodically review the functioning of the GRM and record information on the effectiveness of the mechanism, especially on the PIU's ability to prevent and address grievances.

139. **Costs.** All costs involved in resolving the complaints (meetings, consultations, communication and reporting/information dissemination) will be borne by the respective PIU. Cost estimates for grievance redress are included in resettlement cost estimates.

140. **Country Legal Procedure**. An aggrieved person shall have access to the country's legal system at any stage, and accessing the country's legal system can run parallel to accessing the GRM and is not dependent on the negative outcome of the GRM.

141. **ADB's Accountability Mechanism.** In the event that the established GRM is not in a position to resolve the issue, the affected person can also use the ADB Accountability Mechanism through directly contacting (in writing) the Complaint Receiving Officer (CRO) at ADB headquarters or the ADB India Resident Mission. The complaint can be submitted in any of the official languages of ADB's developing member countries. Before submitting a complaint to the Accountability Mechanism, it is recommended that affected people make a good faith effort to resolve their problems by working with the concerned ADB operations department (in this case, the resident mission). Only after doing that, and if they are still dissatisfied, they could approach the Accountability Mechanism. The ADB Accountability Mechanism information will be included in the project-relevant information to be distributed to the affected communities, as part of the project GRM.

VIII. ENVIRONMENTAL MANAGEMENT PLAN

A. Environmental Management Plan

142. The environmental management plan (EMP) aims to ensure that the activities are undertaken in a responsible, non-detrimental manner with the objectives of: (i) providing a proactive, feasible, and practical working tool to enable the measurement and monitoring of environmental performance on-site; (ii) guiding and controlling the implementation of findings and recommendations of the environmental assessment conducted for the project; (iii) detailing specific actions deemed necessary to assist in mitigating the environmental impact of the project; and (iv) ensuring that safety recommendations are complied with.

143. The contractor will be required to submit to PIU, for review and approval, a site environmental management plan (SEMP) including (i) proposed sites/locations for construction work camps, storage areas, hauling roads, lay down areas, disposal areas for solid and hazardous wastes; (ii) specific mitigation measures following the approved EMP; and (iii) monitoring program as per SEMP. No works are allowed to commence prior to approval of SEMP.

144. A copy of the updated EMP/SEMP must be kept on work sites at all times. The EMP will be included in the bid documents and will be further reviewed and updated during implementation. The EMP will be made binding on all contractors operating on the site and will be included in the contractual clauses. Non-compliance with, or any deviation from, the conditions set out in this document constitutes a failure in compliance.

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

146. Tables 14 to 16 show the potential adverse environmental impacts, proposed mitigation measures, responsible parties, and estimated cost of implementation for 24x7 water supply distribution network. This EMP will be included in the bid documents and will be further reviewed and updated during implementation. Table 17 shows the environmental monitoring plan to be implemented during project implementation and operation.

Table 14: Environmental Management Plan for Anticipated Impacts – Pre-Construction

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation	Monitoring of Mitigation	Cost and Source of Funds
Submission of updated environmental management plan (EMP)/site environmental plan (SEP); EMP implementation and reporting	Unsatisfactory compliance to EMP	(i) Appoint Safeguards (Environmental, Health and Safety or EHS) Engineer to ensure EMP implementation; (ii) Submission of updated EMP/site-specific environmental management plan (SEMP); and (ii) Timely submission monthly of monitoring reports including documentary evidence on EMP implementation such as photographs.	Contractor	(i) mobilization of EHS engineer, (ii) submission of SEMP prior to start of works, and (iii) submission of monthly reports	Contractor cost
Trees on project sites	Tree cutting	(i) Removal of trees avoided by adopting to site condition and with appropriate layout design (e.g., overhead tank or OHT sites at Santoshanagars, Kodypada, Nekkilagudda); contractor to maintain this at OHT sites, (ii) For any tree cutting that may be required, obtain prior permission from Forest Department; and (iii) Plant and maintain 10 trees for each tree that is removed.	Contractor in collaboration with Mangalore City Corporation (MCC)/Program Implementation Unit (PIU)	(i) Layout plan of OHTs, (ii) tree cutting/pruning permission, and (iii) Compensatory tree plantation as part of the project	Cost for implementation of mitigation measures responsibility of contractor.
Utilities	Telephone lines, electric poles and wires, water lines within proposed project area	(i) Identify and include locations and operators of these utilities in the detailed design documents during design validation phase and preconstruction phase to prevent unnecessary disruption of services during construction phase, (ii) Conduct detailed site surveys with the construction drawings and discuss with the	Contractor in collaboration with MCC/PIU	(i) List of affected utilities and operators; and (ii) Bid document to include requirement for a contingency plan for service interruptions (example provision of water if	No cost required. Mitigation measures are part of terms of reference (TOR) of Program Management Unit (PMU), design engineers, and

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation	Monitoring of Mitigation	Cost and Source of Funds
		respective agencies before ground clearance, and (ii) Require construction contractors to prepare a contingency plan to include actions to be done in case of unintentional interruption of services.		disruption is more than 24 hours), spoil management plan, and traffic management plan.	supervising consultants.
Social and Cultural Resources – Chance finds	Ground disturbance can uncover and damage archaeological and historical remains	(i) Create awareness among the workers and supervisors about the chance finds during excavation work; (ii) Stop work immediately if any finds are suspected to allow further investigation, and (iii) Inform archaeological agencies promptly if a find is suspected, and take any action they require to ensure its removal or protection in situ.	Construction Contractor and Project Management Design, Construction and Supervision Consultant (PMDCSC)	Chance Finds Protocol	No cost required.
Construction work camps, hot mix plants, stockpile areas, storage areas, and disposal areas.	Disruption to traffic flow and sensitive receptors	(i) Prioritize areas within or nearest possible vacant space in the project location; (ii) If it is deemed necessary to locate elsewhere, consider sites that will not promote instability and result in destruction of property, vegetation, irrigation, and drinking water supply systems; (iii) Do not consider residential areas; (iv) Take extreme care in selecting sites to avoid direct disposal to water body which will inconvenience the community; and	Contractor to determine locations prior to beginning of construction works and to be reviewed and approved by PIU	(i) List of selected sites for construction work camps, hot mix plants, stockpile areas, storage areas, and disposal areas; and (ii) Written consent of landowner/s (not lessee/s) for reuse of excess spoils to agricultural land.	No cost required.

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation	Monitoring of Mitigation	Cost and Source of Funds
		(v) For excess spoil disposal, ensure (a) site shall be selected preferably from barren, infertile lands. In case agricultural land needs to be selected, written consent from landowners (not lessees) will be obtained; (b) debris disposal site shall be at least 200 m away from surface water bodies; (c) no residential areas shall be located within 50 m downwind side of the site; and (d) site is minimum 250 m away from sensitive locations like settlements, ponds/lakes or other water bodies.			
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.	(i) Use quarry sites and sources permitted by Mines and 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; and (iv) Submit on a monthly basis documentation of sources of materials to PMDCSC.	Contractor to prepare list of approved quarry sites and sources of materials with the approval of PMDCSC	(i) List of approved quarry sites and sources of materials; and (ii) Bid document to include requirement for verification of suitability of sources and permit for additional quarry sites if necessary.	No cost required. Mitigation measures are part of TOR of PMU, design engineers, and supervising consultants.
Consents, permits, clearances, No Objection Certificates (NOCs), etc.	Failure to obtain necessary consents, permits, NOCs, etc can result to design revisions and/or stoppage of works	(i) Obtain all necessary consents, permits, clearance, NOCs, etc. prior to start of civil works; (ii) Acknowledge in writing and provide report on compliance all obtained consents, permits, clearance, NOCs, etc.; and	ULB/PIU and PMDCSC	Incorporated in final design and communicated to contractors.	No cost required. Cost of obtaining all consents, permits, clearance, NOCs, etc. prior to start of civil works responsibility of PMU.

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation	Monitoring of Mitigation	Cost and Source of Funds
		(iii) Include in detailed design drawings and documents all conditions and provisions if necessary.			Mitigation measures are part of TOR of PMU, design engineers, and supervising consultants.
Method statement	Use of approved construction practices to minimize construction impacts	Method Statement should be in a Table format with appended site layout map and cover the following: (i) Work description; (ii) Number of workers (skilled and unskilled); (iii) Details of plant, equipment and machinery, vehicles; (iv) Work duration (total, and activity-wise, for example for pipe laying, from excavation to road resurfacing/testing); (v) PPE (helmet, gloves, boots, etc) details for each type of work; (vi) Details of materials at each site (type and quantity); (vii) 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). (viii) Construction waste/debris generated (details and quantity); (ix) Detail the sequence of work process (step-by-step)	Contractor to prepare method statement for review and approval by PMDCSC / PIU prior to start of work.	Review of method statement and implementation of work	No cost required.

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation	Monitoring of Mitigation	Cost and Source of Funds
		including specific details of each work; (x) Contractor's supervision and management arrangements for the work; (xi) Emergency: Designate (a) responsible person on site, and (b) first aider; (xii) Typical site layout plan including pipe trenching, placement of material, excavated earth, barricading; and (xiii) The pipelines are to be laid along the roads. 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.			

Table 15: Environmental Management Plan for Anticipated Impacts – Construction

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation	Cost and Source of Funds
Environmental Management Plan (EMP) Implementation Training	Impacts on the environment, workers, and community due to improper implementation of EMP	(i) Project manager and all key workers will be required to undergo EMP implementation including spoils management, Standard operating procedures (SOP) for construction works; occupational health and safety (OHS), core labor laws, applicable environmental laws, etc.; and	Construction Contractor/ Program Implementation Unit (PIU)/ Project Management Design, Construction and Supervision	(i) Certificate of Completion (Safeguards Compliance Orientation), (ii) Posting of Certification of Completion at worksites, and	Cost of EMP Implementation Orientation Training to contractor is responsibility of PMU. Other costs responsibility of contractor.

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation	Cost and Source of Funds
		(ii) appointment of Environment, Health and Safety (EHS) Engineer by contractor prior to start of work.	Consultant (PMDCSC)	(iii) Posting of EMP at worksites.	
Air Quality	Emissions from construction vehicles, equipment, and machinery used for installation of pipelines resulting to dusts and increase in concentration of vehicle-related pollutants such as carbon monoxide, sulfur oxides, particulate matter, nitrous oxides, and hydrocarbons.	(i) Consult with PIU/PMDCSC 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) Use tarpaulins to cover sand and other loose material when transported by trucks; (iv) Clean wheels and undercarriage of vehicles prior to leaving construction site; and (v) Fit all heavy equipment and machinery with air pollution control devices which are operating correctly.	Construction Contractor	(i) Location of stockpiles, (ii) Complaints from sensitive receptors, (iii) Heavy equipment and machinery with air pollution control devices, and (iv) Certification that vehicles are compliant with Air Act.	Cost for implementation of mitigation measures responsibility of contractor.
Surface water quality	Mobilization of settled silt materials, and chemical contamination from fuels and lubricants during installation of pipelines can contaminate nearby surface water quality.	(i) Avoid stockpiling of earth fill especially during the monsoon season unless covered by tarpaulins or plastic sheets; (ii) Laying of pipelines during dry season and closing of all trenches before rainy season and avoid any chances of collecting the water in the trenches or pumping; (iii) Prioritize re-use of excess spoils and materials in the construction works. If spoils will be disposed, consult with Implementing Agency on	Construction Contractor	(i) Areas for stockpiles, storage of fuels and lubricants and waste materials; (ii) Number of silt traps installed along trenches leading to water bodies; (iii) Records of surface water quality inspection; (iv) Effectiveness of water management measures; and	Cost for implementation of mitigation measures responsibility of contractor.

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation	Cost and Source of Funds
		designated disposal areas (Appendix 6); (iv) Install temporary silt traps or sedimentation basins along the drainage leading to the water bodies; (v) Provide temporary bunds for stockpiles and materials; (vi) Place storage areas for fuels and lubricants away from any drainage leading to water bodies. Storage structure should consider 110% capacity bund; (vii) Dispose any wastes generated by construction activities in designated sites; and (viii) Conduct surface quality inspection and monitoring.		(v) No visible degradation to nearby drainages, nallahs or waterbodies due to civil works.	
Noise Levels	Increase in noise level due to earth-moving and excavation equipment, and the transportation of equipment, materials, and people	(i) Plan activities in consultation with PIU/PMDCSC 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); (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	Construction Contractor	(i) Complaints from sensitive receptors; (ii) Use of silencers in noise-producing equipment and sound barriers; and (iii) Equivalent day and night time noise levels (See Appendix 3 of this IEE).	Cost for implementation of mitigation measures responsibility of contractor.

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation	Cost and Source of Funds
		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; (vi) Maintain maximum sound levels not exceeding 80 A-weighted decibels (dbA) when measured at a distance of 10 m or more from the vehicle/s; and (vii) Horns should not be used unless it is necessary to warn other road users or animals of the vehicle's approach.			
Landscape and aesthetics	Impacts due to excess excavated earth, excess construction materials, and solid waste such as removed concrete, wood, packaging materials, empty containers, spoils, oils, lubricants, and other similar items.	(i) Prepare and implement spoils management plan; (ii) Avoid stockpiling of excess excavated soils; (iii) Coordinate with MCC for beneficial uses of excess excavated soils or immediately dispose to designated areas; (iv) Recover used oil and lubricants and reuse or remove from the sites; (v) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas; (vi) Remove all wreckage, rubbish, or temporary structures	Construction Contractor	(i) Complaints from sensitive receptors; (ii) Worksite clear of hazardous wastes such as oil/fuel; and (iii) Worksite clear of any excess excavated earth, excess construction materials, and solid waste such as removed concrete, wood, packaging materials, empty containers.	Cost for implementation of mitigation measures responsibility of contractor.

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation	Cost and Source of Funds
		which are no longer required; and (vii) Request PMU/PMDCSC to report in writing that the necessary environmental restoration work has been adequately performed before acceptance of work.			
Existing Infrastructure and Facilities	Disruption of service and damage to existing infrastructure at specified project location	(i) Obtain from PMU/PMDCSC the list of affected utilities and operators if any; (ii) Prepare a contingency plan to include actions to be done in case of unintentional interruption of service; and (iii) The public should be given notice at least three days in advance and any accidental breaking should be rectified immediately.	Construction Contractor	Existing Utilities Contingency Plan	Cost for implementation of mitigation measures responsibility of contractor.
Accessibility	Traffic problems and conflicts near project locations and haul road	(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 minimize disturbance to the traffic movement; (iv) Schedule transport and hauling activities during non-peak hours;	Construction Contractor	(i) Traffic route during construction works including number of permanent signages, barricades and flagmen on worksite (Appendix 7); (ii) Complaints from sensitive receptors; and (iii) Number of signages placed at project location.	Cost for implementation of mitigation measures responsibility of contractor.

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation	Cost and Source of Funds
		(v) Do not close the road completely, allow traffic to move on one line; (vi) Plan transportation routes so that heavy vehicles do not use narrow local roads, except in the immediate vicinity of delivery sites; (vii) In unavoidable circumstances of road closure, provide alternative routes, and ensure that public is informed about such traffic diversions; (viii) 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. (ix) Keep the site free from all unnecessary obstructions; (x) Drive vehicles in a considerate manner; and (xi) Prepare a Traffic Management Plan – a template is provided for reference at Appendix 7.			
Socio-Economic – Income.	Impede the access of residents and customers to nearby shops	(i) Prepare and implement spoils management plan; (ii) Leave spaces for access between mounds of soil;	Construction Contractor	(i) Complaints from sensitive receptors; (ii) Spoils management plan; and	Cost for implementation of mitigation measures responsibility of contractor.

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation	Cost and Source of Funds
		(iii) Provide walkways and metal sheets where required for people; (iv) Increase workforce in front of critical areas such as institutions, place of worship, business establishment, hospitals, and schools; (v) Consult businesses and institutions regarding operating hours and factoring this in work schedules; and (vi) Provide sign boards for pedestrians to inform nature and duration of construction works and contact numbers for concerns/complaints.		(iii) Number of walkways, signages, and metal sheets placed at project location.	
Socio cultural resources	Disturbance to socio cultural resources (religious, educational, health care etc.,), access disruptions etc.,	(i) No material should be stocked close to these areas; 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	Construction Contractor	(i) Visual site observations, and (ii) Public complaints.	Cost for implementation of mitigation measures responsibility of contractor.

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation	Cost and Source of Funds
		risks and construction work, mitigation measures in place, entry restrictions and do's and don'ts; and (vi) Implement all measures suggested elsewhere in this report – dust and noise control, public safety, traffic management, strictly at the sites.			
Socio-Economic - Employment	Generation of contractual employment and increase in local revenue	(i) Employ local labor force to the maximum extent, if manpower is available; and (ii) Comply with labor laws.	Construction Contractor	(i) Employment records, (ii) Records of sources of materials, and (iii) Compliance to core labor laws (See appendix 2 of this IEE).	Cost for implementation of mitigation measures responsibility of contractor.
Occupational Health and Safety	Occupational hazards which can arise during work	(i) Comply with all national, state and local core labor laws (See Appendix 2 of this IEE); (ii) Develop and implement site-specific OHS Plan, and include in the Construction Management plan. The OHS plan will include measures such as: (a) excluding public from the site; (b) ensuring all workers are provided with and use personal protective equipment like helmet, gumboot, safety belt, gloves, nose mask and ear plugs; (c) OHS Training for all site personnel; (d) documented procedures to be followed for all site activities; and (e) documentation of work-related accidents;	Construction Contractor	(i) Site-specific OH&S Plan; (ii) Equipped first-aid stations; (iii) Medical insurance coverage for workers; (iv) Number of accidents; (v) Supplies of potable drinking water; (vi) Clean eating areas where workers are not exposed to hazardous or noxious substances; (vii) Record of H&S orientation trainings; (viii) Personal protective equipment; (ix) % of moving equipment outfitted	Cost for implementation of mitigation measures responsibility of contractor.

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation	Cost and Source of Funds
		(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&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;		with audible back-up alarms; (xi) permanent sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal; and (xii) Compliance to core labor laws (See appendix 2 of this IEE)	

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation	Cost and Source of Funds
		(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; (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; and (xiv) Overall, the contractor should comply with IFC EHS Guidelines on OHS.			
Community Health and Safety.	Traffic accidents and vehicle collision with pedestrians during material and waste transportation	(i) Provide hard barricading for all deep excavations that may require especially for pipe lines; 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;	Construction Contractor	(i) Traffic Management Plan; and (ii) Complaints from sensitive receptors.	Cost for implementation of mitigation measures responsibility of contractor.

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation	Cost and Source of Funds
		(iii) Liaise with MCC in identifying risk areas on route cards/maps; (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; and (vi) Overall, the contractor should comply with IFC EHS Guidelines Community Health and Safety.			
Work Camps and worksites	Temporary air and noise pollution from machine operation, water pollution from storage and use of fuels, oils, solvents, and lubricants Unsanitary and poor living conditions for workers	(i) Consult with PIU before locating workers camps/sheds, and construction plants; as far as possible located at least 200 m from residential areas; (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	Construction Contractor	(i) Complaints from sensitive receptors; and (ii) Drinking water and sanitation facilities for employees.	Cost for implementation of mitigation measures responsibility of contractor.

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation	Cost and Source of Funds
		quantities (supply of 60 lpcd - 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; (xi) Report in writing that the camp has been vacated and restored to pre-project conditions before acceptance of work; and (xii) The work camp details should be included in the Construction Management Plan.			

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation	Cost and Source of Funds
Social and Cultural Resources	Risk of archaeological chance finds	(i) Create awareness among the workers and supervisors about the chance finds during excavation work; (ii) Stop work immediately if any finds are suspected to allow further investigation; (iii) Inform archaeological agencies promptly if a find is suspected, and take any action they require to ensure its removal or protection in situ; and (iv) Adjacent to important religious sites, undertake excavation and construction work in such a way that no structural damage is caused to the building.	Construction Contractor	Records of chance finds	Cost for implementation of mitigation measures responsibility of contractor.
Submission of EMP implementation report	Unsatisfactory compliance to EMP	(i) Appointment of EHS engineer to ensure EMP implementation; and (ii) Timely submission of monitoring reports including pictures.	Construction contractor	Availability and competency of appointed EHS engineer Monthly report	Cost for implementation of mitigation measures responsibility of contractor.
Post-construction clean-up	Damage due to debris, spoils, excess construction materials	(i) Remove all spoils wreckage, rubbish, or temporary structures (such as buildings, shelters, and latrines) which are no longer required; (ii) All excavated roads shall be reinstated to original condition; (iii) All disrupted utilities restored; (iv) All affected structures rehabilitated/compensated; (v) The area that previously housed the construction camp	Construction Contractor	PMU/PMDCSC report in writing that (i) worksite is restored to original conditions; (ii) camp has been vacated and restored to pre-project conditions; (iii) all construction related structures not relevant to O&M are removed; and (iv) worksite	Cost for implementation of mitigation measures responsibility of contractor.

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation	Cost and Source of Funds
		is to be checked for spills of substances such as oil, paint, etc. and these shall be cleaned up; (vi) All hardened surfaces within the construction camp area shall be ripped, all imported materials removed, and the area shall be topsoiled and regrassed using the guidelines set out in the revegetation specification that forms part of this document; (vii) The contractor must arrange the cancellation of all temporary services; and (viii) Request PMU/PMDCSC to report in writing that worksites and camps have been vacated and restored to pre-project conditions before acceptance of work.		clean-up is satisfactory.	

Table 16: Environmental Management Plan for Anticipated Impacts – Operation

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation	Cost and Source of Funds
Check for blockage and leakage problems reducing the water losses	It may affect the water supply system	Effectiveness of leak detection and water auditing to reduce the water losses	Operation and maintenance (O&M) Contractor/ Mangalore City Corporation (MCC)	MCC	MCC cost
Repair works during O&M	Local disturbances during maintenance work	- Contractor shall inform shopkeepers, residents and road users of repair works in advance.	O&M Contractor/ MCC	MCC	MCC cost

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation	Cost and Source of Funds
		- If trenches are dug to locate and repair leaks or remove and replace lengths of pipe or illegal connections, the removed material will be replaced in the trench so there will be no waste. The refilled trench shall be re-compacted and brought to the original condition as soon as the repair works are over. Works shall be completed quickly at sensitive areas. - Proper access shall be provided to the residents during the repair works - If any major maintenance works is to be taken up contractor shall prepare and operate H&S plan to protect workers and public. Contractor may request police to divert traffic if necessary.			
Increase of sewage	Increased quantity of sewage leads to open area/drain and creates health problems	- Upgrade the sewerage system, where required, to meet the increased demand	MCC	Karnataka Urban Infrastructure Development and Finance Corporation (KUIDFC)/ Government of Karnataka	MCC cost

Table 17: Environmental Monitoring Plan

Monitoring Field	Monitoring Location	Monitoring Parameters	Frequency	Responsibility	Cost
Pre-construction and Construction					
Construction disturbances, nuisances,	All work sites	Implementation of dust control, noise control,	Weekly during construction	Supervising staff and safeguards specialists of Project Management	Part of PIU and PMDCSC TOR

Monitoring Field	Monitoring Location	Monitoring Parameters	Frequency	Responsibility	Cost
public and worker safety,		traffic management, and safety measures.		Design, Construction and Supervision Construction (PMDCSC) and Program Implementation Unit (PIU)	
Ambient air quality	10 points (monitoring points to be identified prior to start of construction covering representing all work sites)	particulate matter 10 micrometers or less in diameter (PM_{10}), particulate matter 2.5 micrometers or less in diameter ($PM_{2.5}$), Sulphur Oxide (SO_x), Nitrogen Oxide (NO_x) Monitoring method as prescribed by Central Pollution Control Board (CPCB)	Once before start of construction Quarterly (yearly 4-times) during construction	Contractor	Cost of monitoring 10x15x5000 = ₹750,000
Noise Level	10 points (monitoring points to be identified prior to start of construction covering representing all work sites)	Noise level Day and night time noise (dBA) Monitoring method as prescribed by CPCB	Once before start of construction Quarterly (yearly 4-times) during construction	Contractor	10x15x2500 = ₹375,000
Water Quality	4 monitoring sites (monitoring points to be identified, in surface water bodies/rivers/stream that receive runoff from work area identified, prior to start of construction)	CPCB standard parameters	Once before start of construction Quarterly (yearly 4-times) during construction	Contractor	4x15x10,000 = ₹600,000
Operation					
Monitoring of raw and treated water quality	Source, inlet and outlet of water treatment plant (WTP)	Drinking water parameters	Quarterly	MCC through accredited lab/Karnataka State Pollution Control Board (KSPCB).	MCC operating costs

B. Institutional Arrangements

147. **Executing Agency.** KUIDFC is the executing agency responsible for the overall technical supervision and execution of all subprojects funded under the investment program. Implementation activities is overseen by Program Management Unit (PMU) established in its head office at Bangalore exclusively for KIUWMIP. PMU is supported by Regional PMU (RPMU) established in Mangalore headed by Deputy Project Director, to support and monitor implementation in PIUs of Tranche 2 program towns. PMU and RPMU are staffed with technical, administrative and financial officials, including safeguards specialists, to manage and monitor program implementation.

148. **Implementing Agency**. The implementing agencies are the respective ULBs, in this case City Corporation of Mangalore. Program Implementation Units (PIUs) are set up in each program ULB for implementation of day-to-day activities in the field.

149. Other than the above institutional setup, District Level Implementation Committee (DLIC) will be set up in each district to monitor implementation of subprojects and institutional reforms. The DLIC shall consist of Deputy Commissioner of District (DPD), DPD RPMU, Municipal Commissioners'/Chief Officers of ULB and PMDCSC.

150. For the government-funded bulk water supply project, KUIDFC will be the executing agency, and MCC will be the implementing agency responsible for implementation.

151. **Safeguards Implementation**. A Safeguards Compliance and Monitoring Unit (SCMU), established in the PMU directly under the KIUWMIP Task Manager (Project Director), will have the overall responsibility of ensuring compliance with ADB SPS. SCMU is staffed with a Safeguards Compliance and Monitoring Officer (SCMO) with overall responsibility for environmental and social safeguards, and two safeguards specialists–Assistant Executive Engineer (AEE–Environment), and Social Development Officer (SDO), responsible respectively for environment and social safeguards. The SCMU will ensure that all subprojects comply with environmental safeguards. In each regional office in Mangalore and Davangere, a Safeguards Officer will assist in and coordinate safeguard tasks. For enhancing the monitoring role of environmental safeguards, KUIDFC will consider assigning the environmental officers at the regional officers in implementation stage. In each PIU, an Assistant Engineer (safeguards) will coordinate the safeguard tasks at PIU/town level. For Tranche 2, PIUs are established at Kundapura, Mangalore, Puttur, and Udupi. A Project Management, Design and Construction Supervision Consultant (PMDCSC) will assist PMU and PIUs in the implementation of the entire investment program including compliance with the EARF and resettlement framework. PMDCSC is stationed in Mangalore with the field teams in each of the PIUs. PMDCSC team includes an Environmental Specialist and a Social Development Specialist to prepare, implement and monitor all safeguard activities and ensure safeguards compliance. At the civil works stage, Contractor staff will include Safeguards/Environment, Health and Safety (EHS) engineer to supervise and report on EMP implementation.

152. The responsibility fulfilling environmental requirements of Government of India/Government of Karnataka and conducting required level of environmental assessment as per ADB guidelines lies with the PIUs/implementing agency, i.e., MCC. Consultant Team will assist the MCC in this regard.

153. The mitigation measures identified through IEEs and EMP will be incorporated into the investment program implementation cycle. Mitigation measures, which are to be implemented by

the Contractor, shall form part of the Contract Documents. The other mitigation measures will be implemented by the implementing agency/PIU/PMU as specified in the IEE. During the construction phase, PIU with the support of consultant team will monitor the implementation of the EMP and report to the PMU. 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.

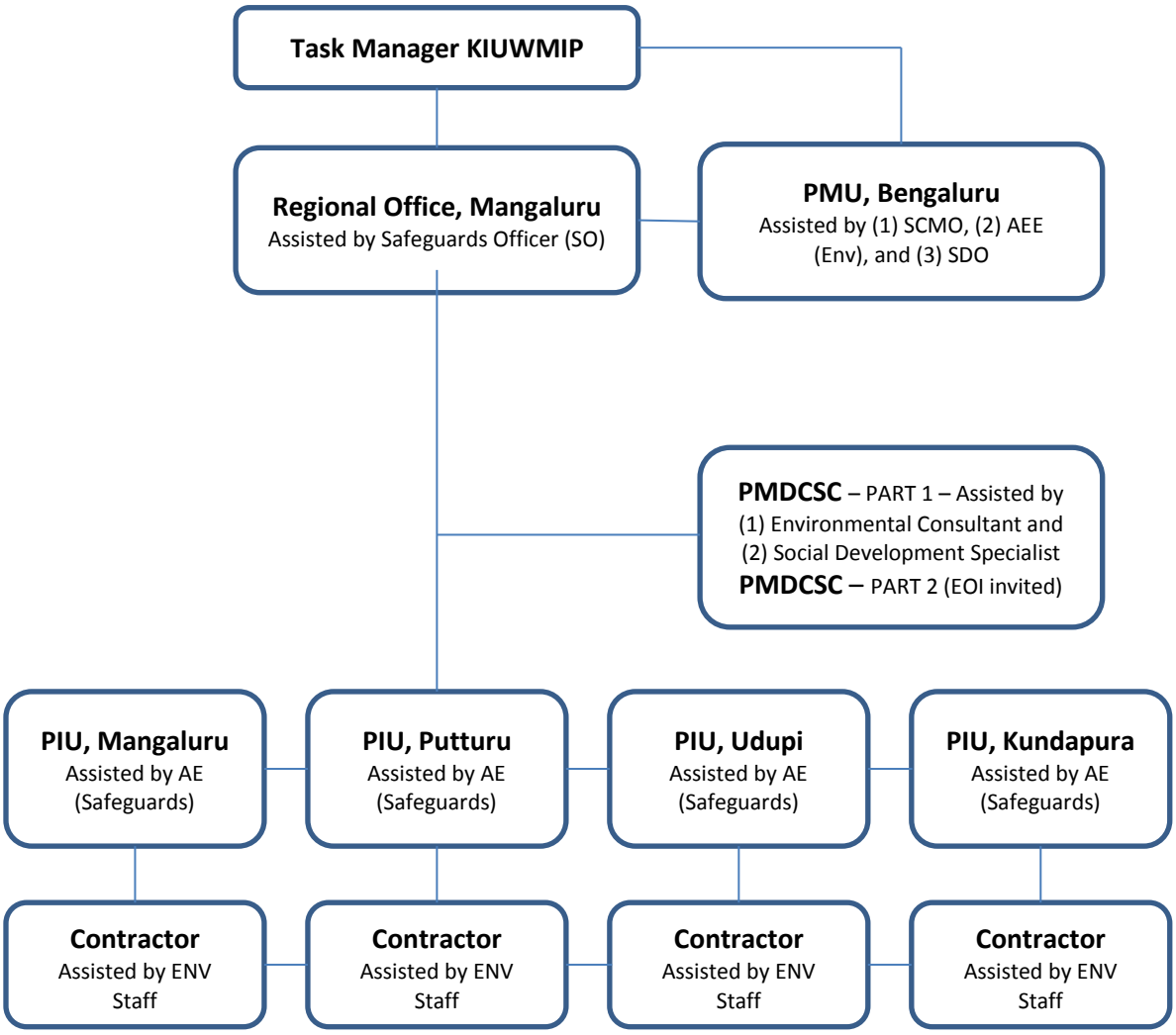
154. **Consultant Support**. A consultant team (Project Management, Design and Supervision Consultant), based in Mangalore and with field teams in Tranche 2 programs towns will assist PIUs, RPMU and PMU in day-to-day implementation of the investment program. PMDCSC will be involved in all activities including in project planning, preparation, design of subproject and cost estimates, co-ordination, procurement, technical guidance, construction supervision, contract management, safeguards implementation and monitoring, capacity development and training etc., PMDCSC includes an Environmental Specialist consultant to implement the subprojects in compliance with EARF, and will be responsible for all safeguards tasks – preparation, implementation, monitoring and reporting. In each program town, a field team of PMDCSC will be mobilized and will include an Environmental Engineer for day-to-day implementation and monitoring of EMP implementation, and also to assist Environmental Specialist of PMDCSC.

155. **Contractor**. The contractor shall appoint one Safeguards (EHS) Engineer who will be responsible on a day-today basis for (i) ensuring implementation of EMP; (ii) coordinating the CSS and environment specialists (all levels); (iii) community liaison, consultation with interested/affected parties and grievance redressal; and (iv) reporting.

156. KUIDFC will ensure that bidding and contract documents include specific provisions requiring contractors to comply with all: (i) applicable labor laws and core labor standards on (a) prohibition of child labor as defined in national legislation for construction and maintenance activities, (b) equal pay for equal work of equal value regardless of gender, ethnicity or caste, and (c) elimination of forced labor; and (ii) the requirement to disseminate information on sexually transmitted diseases including HIV/AIDS to employees and local communities surrounding the project sites.

157. The following Figure 11 and Table 18 summarizes the institutional responsibility of environmental safeguards at all stages of the project.

Figure 11: Environmental Safeguard Implementation Arrangements



AE = Assistant Engineer, ENV = environment, EOI = expression of interest, KIUWMIP = Karnataka Integrated Urban Water Management Investment Program, PMDCSC = Project Management Design, Construction and Supervision Consultant, PIU = program implementation unit, SCMO = Safeguards and Community Mobilization Officer, SDO = Social Development Officer.

Table 18: Institutional Roles and Responsibilities

Responsible Agency	Responsibility		
	Pre-Construction Stage	**Construction Stage**	**Post-Construction**
Task Manager	(i) Review rapid environmental assessment (REA) checklists and assign categorization based on ADB Safeguard Policy Statement (SPS); (ii) Review and approve environmental impact assessment (EIA)/initial environmental examination (IEE); (iii) Submit EIA/IEE to ADB for approval and disclosure in ADB website; (iv) Ensure approved IEEs are disclosed in Karnataka Urban Infrastructure Development and Finance Corporation (KUIDFC) website and summary posted in public areas accessible and understandable by local people; (v) Ensure environmental management plans (EMPs) are included in the bid documents and contracts; (vi) Organize an orientation workshop for	(i) Task Manager is responsible for over-all environmental safeguards compliance of the project, (ii) Review and submit to ADB semi-annual monitoring reports, (iii) Review and submit Corrective Action Plans to ADB, (iv) Organize capacity building programs on environmental safeguards, (v) Coordinate with national and state level government agencies, and (vi) Assist in addressing any grievances brought about through the Grievance Redress Mechanism in a timely manner as per the IEEs.	Compliance monitoring to review the environmental performance of project component, if required and as specified in EMP
Assistant Executive Engineer (Environment)	Program Management Unit (PMU), urban local bodies (ULBs)/City Municipal Councils (CMCs), and all staff involved in the project implementation on (a) ADB SPS; (b) Government of India national, state, and local environmental laws and regulations; (c) core labor standards; (d) occupational health and safety (OHS); and (e) EMP implementation especially spoil management, working in congested areas, public relations and ongoing consultations, grievance redress, etc.; (vii) Assist in addressing any grievances brought about through the grievance redress mechanism in a timely manner as per the IEEs;	(i) Assist in the preparation of semi-annual monitoring reports; (ii) Monitor and ensure compliance of EMPs as well as any other environmental provisions and conditions; (iii) If necessary prepare Corrective Action Plan and ensure implementation of corrective actions to ensure no environmental impacts; (iv) Organize capacity building programs on environmental safeguards at regional / divisional level; (v) Coordinate with regional level government agencies	Compliance (Appendix 10) to review the environmental performance of project component, if required and as specified in EMP

Responsible Agency	Responsibility		
	Pre-Construction Stage	**Construction Stage**	**Post-Construction**
	(viii) Organize an induction course for the training of contractors preparing them on EMP implementation, environmental monitoring requirements related to mitigation measures; and taking immediate actions to remedy unexpected adverse impacts or ineffective mitigation measures found during the course of implementation; (ix) Ensure compliance with all government rules and regulations regarding site and environmental clearances as well as any other environmental requirements; (x) Assist PMU, PIUs, and project nongovernment organizations (NGOs) to document and develop good practice construction guidelines to assist the contractors in implementing the provisions of IEE; and (xi) Assist in the review of the contractors' implementation plans to ensure compliance with the IEE.	(vi) Assist in addressing any grievances brought about through the Grievance Redress Mechanism in a timely manner as per the IEEs; (vii) Assist in overseeing implementation of the EMP during construction including environmental, health and safety monitoring of contractors; and (viii) Coordinate with the General Manager, environmental Experts, ULBs/CMCs, NGOs, consultants and contractors on mitigation measures involving the community and affected persons and ensure that environmental concerns and suggestions are incorporated and implemented.	
Safeguards Officer	(i) Coordinate public consultation and information disclosure; (ii) Liaise with local offices of regulatory agencies in obtaining clearances/ approvals; (iii) Assist PMU for clearances obtained at state level; (iv) Review and approve contractors' updated EMPs; (v) Take necessary action for obtaining rights of way; (vi) Inform affected persons on: (a) project cutoff date; (b) public notice for schedule of land acquisition / occupation; (c) entitlement matrix; and	(i) Oversee day-to-day implementation of EMP by contractors, including compliance with all government rules and regulations; (ii) Ensure continuous public consultation and awareness; (iii) Coordinate grievance redress process and ensure timely actions by all parties; and (iv) Review monthly contractors' EMP monitoring reports.	(i) Review and forward quarterly monitoring reports to PMU; (ii) Inform PMU of unanticipated impacts and formulate corrective action plan; (iii) Recommend issuance of work - construction work completion certification of the contractor upon verification of satisfactory post-construction clean-up; (iv) Take corrective actions when necessary to ensure no adverse impacts; and (v) Submit monthly social and environmental monitoring reports to PMU.

Responsible Agency	Responsibility		
	Pre-Construction Stage	**Construction Stage**	**Post-Construction**
	(d) compensation packages against different categories of loss and tentative schedule of land clearing / acquisition for starts of civil works activities; and (vii) Coordinate valuation of assets such as land, trees of various species, etc.		
MCC/PIU	(i) Conduct initial environmental assessment for proposed project using REA checklists and submit to PMU; (ii) Prepare EIA/IEE based on categorization and submit to PMU for approval; (iii) Ensure IEE is included in bid documents and contract agreements. Ensure cost of EMP implementation is provided; (iv) Disclose approved EIAs/IEEs; (v) Obtain all necessary clearances, permits, consents, NOCs, etc. Ensure compliance to the provisions and conditions; (vi) EMP implementation regarding sites for disposal of wastes, camps, storage areas, quarry sites, etc.; and (vii) Ensure contractors undergo EMP implementation orientation prior to start of civil works.	(i) Ensure EMP implementation is included in measuring works carried out by the contractors and certifying payments; (ii) Ensure Corrective Action Plan is implemented; (iii) Conduct public awareness campaigns and participation programs; (iv) Prepare monthly reports; and (v) Address any grievances brought about through the Grievance Redress Mechanism in a timely manner as per the IEEs.	(i) Conducting environmental monitoring, as specified in the EMP, and (ii) Issuance of clearance for contractor's post-construction activities as specified in the EMP.
Consultant Environment Specialist at Mangalore City Corporation (MCC)/PIU level Construction Consultant Specialist at MCC/PIU level	(i) Assist ULBs/CMCs in preparation of REA checklists and EIAs/IEEs; (ii) Assist ULBs/CMCs in obtaining all necessary clearances, permits, consents, NOCs, etc. Ensure provisions and conditions are incorporated in the IEE and detailed design documents; (iii) Assist in ensuring IEE is included in bid documents and contract agreements. Assist in determining	(i) Monitor EMP implementation, (ii) Recommend corrective action measures for non-compliance by contractors, (iii) Assist in the review of monitoring reports submitted by contractors, (iv) Assist in the preparation of monthly reports, and	(i) Assist in the inspection and verification of contractor's post-construction activities.

Responsible Agency	Responsibility		
	Pre-Construction Stage	**Construction Stage**	**Post-Construction**
	adequacy of cost for EMP implementation; (iv) Assist in addressing any concern related to IEE and EMP; and (v) Assist in summarizing IEE and translating to language understood by local people.	(v) Assist in addressing any grievances brought about through the Grievance Redress Mechanism in a timely manner as per the IEEs.	
Contractors	(i) Ensure EMP implementation cost is included in the methodology; (ii) Undergo EMP implementation orientation prior to award of contract; (iii) Provide EMP implementation orientation to all workers prior to deployment to worksites; (iv) Seek approval for camp sites and sources of materials; and (v) Ensure copy of IEE is available at worksites. Summary of IEE is translated to language understood by workers and posted at visible places at all times.	(i) Implement EMP; (ii) Implement corrective actions, if necessary; (iii) Prepare and submit monitoring reports including pictures to MCC; (iv) Comply with all applicable legislation, is conversant with the requirements of the EMP; (v) Brief his staff, employees, and laborer about the requirements of the EMP and provide environmental awareness training to staff, employees, and laborers; (vi) Ensure any sub-contractors/ suppliers who are utilized within the context of the contract comply with all requirements of the EMP. The Contractor will be held responsible for non-compliance on their behalf; (vii) Bear the costs of any damages/compensation resulting from non-adherence to the EMP or written site instructions; (viii) Ensure that ULBs/CMCs and PMDCSC are timely informed of any foreseeable	(i) Ensure EMP post-construction requirements are satisfactorily complied (ii) Request certification from ULBs/CMCs

Responsible Agency	Responsibility		
	Pre-Construction Stage	**Construction Stage**	**Post-Construction**
		activities related to EMP implementation; and (ix) Address any grievances brought about through the Grievance Redress Mechanism in a timely manner as per the IEEs	

C. Training Needs

158. The following Table 19 presents the outline of capacity building program to ensure EMP implementation. The estimated cost (under PMU cost) is ₹225,000 (excluding trainings of contractors which will be part of EMP implementation cost during construction) to be covered by the project's capacity building program. The detailed cost and specific modules will be customized forth available skill set after assessing the capabilities of the target participants and their requirements of the project.

Table 19: Outline of Capacity Building Program on Environmental Management Plan Implementation

Description	**Target Participants**	**Estimate** (Lump sum) (₹)	**Cost and Source of Funds**
1. Introduction and sensitization to environment issues (1 day) - ADB Safeguards Policy Statement - Government of India and Karnataka applicable safeguard laws, regulations and policies including but not limited to core labor standards, occupational health and safety (OHS), etc - Incorporation of environmental management plan (EMP) into the project design and contracts - Monitoring, reporting and corrective action planning	All staff and consultants involved in the project	15,000	Program Management Unit (PMU) cost
2.EMP implementation (3 days) - Roles and responsibilities - OHS planning and implementation - Wastes management (water, hazardous, solid, excess construction materials, spoils, etc.) - Working in congested areas, - Public relations - Consultations - Grievance redress - Monitoring and corrective action planning - Reporting and disclosure - Post-construction planning	All staff and consultants involved in the project All contractors prior to award of contract	75,000	PMU cost
3. Plans and Protocols (3 days) - Construction site standard operating procedures (SOP) - Site-specific EMP - Traffic management plan - Spoils management plan - Waste management plan - Chance find protocol - O&M plans - Post-construction plan	All staff and consultants involved in the project All contractors prior to award of contract or during mobilization stage.	100,000 35,000	PMU cost Contractors cost as compliance to contract provisions on EMP implementation (refer to EMP tables)
4. Experiences and best practices sharing - Experiences on EMP implementation - Issues and challenges	All staff and consultants involved in the project All contractors	35,000	PMU Cost

Description	Target Participants	Estimate (Lump sum) (₹)	Cost and Source of Funds
- Best practices followed	All NGOs		
5. Contractors Orientation to Workers on EMP implementation (OH&S, core labor laws, spoils management, etc)	All workers (including manual laborers) of the contractor prior to dispatch to worksite	40,000	Contractors cost as compliance to contract provisions on EMP implementation (refer to EMP tables)
Total cost for Capacity Building Program on EMP implementation		**300,000**	

PMU cost ₹225,000
Contractor Cost ₹75,000
Total cost ₹300,000

D. Monitoring and Reporting

159. Prior to commencement of the work, the contractor will submit a compliance report to MCC ensuring that all identified pre-construction environmental impact mitigation measures as detailed in the EMP will be undertaken. MCC with the assistance of the environmental consultant will review the report and thereafter ULB will allow commencement of works.

160. During construction, results from internal monitoring by the contractor will be reflected in their weekly EMP implementation reports to the Resident Engineer. These weekly reports will be retained in PMDCSC for reference. Resident Engineer will review and advise contractor for corrective actions if necessary. Monthly report summarizing compliance and corrective measures taken will be prepared by Resident Engineer to be reviewed and endorsed by ULB and consolidated monthly report will be submitted to PMU. Based on monthly reports, PMU will review and submit SEMR to ADB for concurrence (twice a year) EMP implementation progress report (Appendix 9). Once concurrence from the ADB is received the report will be disclosed in the KUIDFC /ULB website.

161. ADB will review project performance against the KUIDFC's commitments as agreed in the legal documents. The extent of ADB's monitoring and supervision activities will be commensurate with the project's risks and impacts. Monitoring and supervising of environmental and social safeguards will be integrated into the project performance management system. ADB's monitoring and supervision activities are carried out on an on-going basis until a Project Completion Report (PCR) is issued. ADB issues a PCR within 1-2 years after the project is physically completed and in operation.

E. Environmental Management Plan Implementation Cost

162. Most of the mitigation measures require the contractors to adopt good site practice, which should be part of their normal procedures already, so there are unlikely to be major costs associated with compliance. Regardless of this, any costs of mitigation by the construction contractors or consultants are included in the budgets for the civil works and do not need to be estimated separately here.

163. Mitigation that is the responsibility of MCC will be provided as part of their management of the project, so this also does not need to be duplicated here. Cost for the capacity building program is included as part of the project. The EMP cost includes the cost for providing water

supply and sanitation facilities for the workers. In addition to this, hard barricades need to be provided at the work sites to prevent any entry of the public or animals into the worksite and to prevent any possible accidents. Following Table 20 presents the environmental management cost of the subproject.

Table 20: Environmental Management Cost

	Particulars	Stages	Unit	Quantity	Rate	Cost (₹)	Costs Covered By
A	**Implementation Staff**						
1	EHS Engineer	Construction	Per month	42	30,000	1,260,000	Civil works contract
B	**Monitoring Measures**						
1	Air quality monitoring	Pre-construction and Construction (pipe laying and OHTs areas)	Per sample	150	5,000	750,000	Civil works contract
2	Noise levels monitoring	Pre-construction and Construction (pipe laying and OHTs areas)	Per sample	150	2,500	375,000	Civil works contract
3	Water quality	Pre-construction, Construction and Operation (treated water, supply water)	Per sample	60	10,000	600,000	Civil works contract
	Subtotal (B)					1,725,000	
C	**Capacity Building**						
1	Introduction and sensitization to environment issues	Pre-construction	Lump sum			15,000	PMU
2	EMP implementation	Construction	Lump sum			75,000	PMU
3	Plans and Protocols	Construction	Lump sum			100,000	PMU
			Lump sum			35,000	Civil works contract
4	Experiences and best practices sharing	Construction/Post-Construction	Lump sum			35,000	PMU
5	Contractors Orientation to Workers on EMP implementation (OHS, core labor laws, spoils management, etc.)	Prior to dispatch to worksite	Lumpsum			40,000	Civil works contract
	Subtotal (C)					300,000	
D	**Civil Works**						
1	Construction of shelters for workers.	Construction	Lump sum			300,000	Civil works contract
2	Providing Water Supply Facility for the workers	Construction	Lump sum			200,000	Civil works contract
3	Providing Sanitation Facility for the workers	Construction	Lump sum			200,000	Civil works contract
4	Barricades at the worksite (MS Sheet of 20 gauge of	Construction	Per unit	10	15,000	150,000	Civil works contract

	Particulars	Stages	Unit	Quantity	Rate	Cost (₹)	Costs Covered By
	size 5 x 3 meters, having vertical support by mild steel flat (65 mm x 65 mm x 6 mm) along the sides and at 1.5 m and 3.5m, horizontal support by MS flat (65 mm x 65 mm x 6 mm) along the sides and at the center, supported by 50 mm MS hollow pies of 4 meter height at the ends and at the center.						
5	Retro reflectorized Traffic Signs as per IRC:67, M 15 grade, 80 x 60 mm rectangular; fixed over Aluminum sheeting supported on MS angle iron.	Construction	Per unit	6	3,500	21,000	Civil works contract
6	Retro reflectorized Traffic Signs as per IRC:67, M 15 grade, 60 x 60 mm square; fixed over Aluminum sheeting supported on MS angle iron.	Construction	Per unit	6	3,000	18,000	Civil works contract
	Subtotal (D)					889,000	
	Total (A+B+C+D)					**4,174,000**	

PMU cost - ₹225,000
Contractor Cost - ₹3,949,000
Total - ₹3,664,000

IX. CONCLUSION AND RECOMMENDATIONS

164. The process described in this document has assessed the environmental impacts of all elements of the Mangalore Water Supply subproject proposed under KUIWMIP Tranche 2. All potential impacts were identified in relation to pre-construction, construction, and operation phases. Planning principles and design considerations have been reviewed and incorporated into the site planning process whenever possible. Subproject is unlikely to have any significant impacts in relation to design or location.

165. Subproject components are located in Mangalore urban area. Except one OHT site, all the sites selected for OHTs, GLSRs and pumping stations are government owned. Nekkilagudda OHT site is privately owned and it is proposed to procure this site at market rate via negotiated settlement to avoid any resettlement and rehabilitation impacts. There are no ecologically-sensitive areas such as protected areas, wetlands, mangroves, or estuaries in or near the subproject locations. Mangaladevi Temple in Mangalore is a protected monument, however, this is not located within the project impacted area. The components of bulk water supply project, implemented under the government fund, are mostly located within the existing project facilities; the new pipelines are proposed along the roads within the ROW, and of the six OHTs proposed, five are in private lands, while one is in government and falls in the coastal regulation zone (CRZ).

166. The Netravati River, a perennial and important river, is the source of Mangalore's water supply. The river flows throughout the year, which is higher during monsoon, and leaner during summers. A vented dam was constructed in 1993 across the river at Thumbe to provide adequate and continuous water supply throughout the year. To meet the increasing water demand of Mangalore, another dam construction was started in 2010, and commissioned in 2016 just downstream of the vented dam, with increased height and storage capacity to meet future needs. The dam at Thumbe is supplemented by an upstream power project dam, constructed across the same river at Shamboor. There is an agreement between MCC and AMR Power Project, according to which no power is to be generated during lean flow season of river (January – May/June), and water stored in AMR power Project dam is released to Thumbe Dam for Mangalore water supply. The combined water availability is adequate to meet the lean season demand of Mangalore. The bulk water project proposed under AMRUT utilizes water from the existing dams, and does not involve any source augmentation components. Water quality of river is suitable for drinking water supply after conventional treatment.

167. No significant impacts are anticipated either due to location or design of the subproject as the sites are selected and fixed ensuring components are not located in ecologically-sensitive areas. However, due to the project sites being in urban areas and nature of open cut method for pipe-laying works, unavoidable impacts include (i) health and safety hazards to workers during construction and operation; (ii) noise and dust from construction activities; (iii) increased road traffic due to interference of construction activities; (iv) soil erosion/silt runoff from construction waste soils;[12] and (v) increased sewage flow due to increased water supply. These impacts during construction and operation can be mitigated through good and high-quality construction and operation and maintenance (O&M) practices. In the operational phase, all facilities and infrastructure will operate with routine maintenance, which should not affect the environment. Facilities will need to be repaired from time to time, but environmental impacts will be much less than those of the construction period as the work will be affecting small areas only.

[12] Quantity of waste soil to be generated from pipelaying works and OHT, GLSR and pumping station excavation is estimated as 365,669 cubic meter (m3). Based on discussions with design engineers and PMDCSC, 90-95% of the waste soil will be utilized for refill and remaining soil (18,250-36,500 m3) will need to be disposed-off safely.

168. 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 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).

169. The public participation processes undertaken during project design ensured stakeholders are engaged during the preparation of the IEE. The planned information disclosure measures and process for carrying out consultation with affected people will facilitate their participation during project implementation.

170. The project's grievance redressal mechanism will provide the citizens with a platform for redressal of their grievances, and describes the informal and formal channels, time frame, and mechanisms for resolving complaints about environmental performance. The EMP will assist the PMU, PIU, PMDCSC and contractors in mitigating the environmental impacts, and guide them in the environmentally sound execution of the proposed project. The EMP will also ensure efficient lines of communication between the implementing agency, project management unit, and contractors.

171. The citizens of the Mangalore will be the major beneficiaries of this subproject as the environmental condition and over-all health of the community will be improved. With the improved system, the currently uncovered households will be provided with a constant supply of better quality water, piped into their homes.

172. The Mangalore Water Supply System 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.

173. Based on the findings of the IEE, there are no significant impacts and the subproject as category "B" is confirmed. No further study or detailed environmental impact assessment (EIA) is required to comply with ADB SPS (2009). This IEE is prepared based on detailed engineering design and needs to be updated in future (during design validation, preconstruction and construction phases) for changes in project components, design, locations or construction processes.

174. Environmental clearance requirement per Government of India Environmental Impact Assessment Act and its Notifications are not applicable to this subproject. No environment-related statutory clearance or permissions required for the subproject.

RAPID ENVIRONMENTAL ASSESSMENT CHECKLIST

Mangalore Water Supply Subproject – 24 x 7 Water Supply Distribution network for Mangalore

Screening Questions	Yes	No	Remarks
A. PROJECT SITING Is the project area…			
▪ Densely populated?	✓		Mangalore is the largest urban centre of coastal Karnataka and the 4th largest city in Karnataka in terms of area and population.
▪ Heavy with development activities?	✓		Mangalore, being the chief port of State of Karnataka, comprises industrial, commercial, agricultural processing and port-related activities. No negative impacts are envisaged as infrastructure will be established on government land and pipes will be constructed on ROW. Minimal road disruption is likely. Measures like best activity scheduling, traffic management, etc. will be employed to minimize the impact to acceptable levels.
▪ Adjacent to or within any environmentally sensitive areas?			
• Cultural heritage site	✓		Mangaladevi Temple is an ASI-protected monument in Mangalore. However, this is located outside the project impacted area; there are no works proposed in or close to the monument
• Protected area		✓	
• Wetland		✓	
• Mangrove		✓	
• Estuarine		✓	
• Buffer zone of protected area		✓	
• Special area for protecting biodiversity		✓	
• Bay		✓	
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?		✓	Not anticipated.
▪ impairment of historical/cultural monuments/areas and loss/damage to these sites?		✓	Mangaladevi Temple is an ASI-protected monument in Mangalore. However, this is located outside the project impacted area; there are no works proposed in or close to the monument
▪ hazard of land subsidence caused by excessive ground water pumping?		✓	Not applicable.
▪ social conflicts arising from displacement of communities?		✓	Not applicable.

Screening Questions	Yes	No	Remarks
▪ conflicts in abstraction of raw water for water supply with other beneficial water uses for surface and ground waters?		✓	Not anticipated. Groundwater will not be used. Mangalore water source is from the existing dam built by KUWSDB for the city's water supply system. Additional 10 MLD abstraction due to government-funded intake improvement is within the existing dam's design capacity and therefore, no source related impacts is envisaged.
▪ unsatisfactory raw water supply (e.g. excessive pathogens or mineral constituents)?		✓	Raw water will be treated prior to distribution. Water quality is required to meet the Indian Standards for Drinking Water/IFC EHS Guideline (most stringent)
▪ delivery of unsafe water to distribution system?		✓	Not anticipated. KIUWMIP Project 2 will provide treated water through new and rehabilitated network to prevent leakages and contamination.
▪ inadequate protection of intake works or wells, leading to pollution of water supply?		✓	Not anticipated. Design proposes housing for intake wells. OHTs will be secured and accessible to only authorized persons.
▪ over pumping of ground water, leading to salinization and ground subsidence?		✓	Not applicable
▪ excessive algal growth in storage reservoir?		✓	Not anticipated. OHTs will be fully enclosed. Water will only be stored for a short period of time.
▪ increase in production of sewage beyond capabilities of community facilities?	✓		KIUWMIP Project 2 includes improvements in the sewerage systems due to anticipated increase of wastewater induced by improved water supply.
▪ inadequate disposal of sludge from water treatment plants?		✓	Not anticipated. WTP rehabilitation and proposed new WTP include sludge management plan.
▪ inadequate buffer zone around pumping and treatment plants to alleviate noise and other possible nuisances and protect facilities?		✓	Not anticipated. The new WTP under Government of Karnataka will include a green belt area. Trees with thick canopy will be planted in order to reduce the noise levels reaching the nearby surroundings. The pumps will be within a building so chances of noise spread outside WTP are not anticipated.
▪ impairments associated with transmission lines and access roads?	✓		Anticipated during construction activities. However, impacts are temporary and short in duration. The EMP includes measures to mitigate impacts.
▪ health hazards arising from inadequate design of facilities for receiving, storing, and handling of chlorine and other hazardous chemicals.		✓	Not anticipated. Chlorine dosing will be done through chlorinators. The EMP will include measures as per World Bank's EHS Guidelines and Government of India's Manufacture, Storage and Import of Hazardous Chemical (MSIHC) Rules, 1989 and its amendment in 2010.
▪ health and safety hazards to workers from handling and management of chlorine used for disinfection, other contaminants, and biological and	✓		Personal protective equipment will be provided to workers. Regular training will also be conducted to ensure that workers are aware of construction hazards and risks of chemicals during O&M. The EMP will include measures

Screening Questions	Yes	No	Remarks
physical hazards during project construction and operation?			per Government of India's MSIHC rules, 1989 and its amendment in 2010 and IFC EHS Guidelines (most stringent).
▪ dislocation or involuntary resettlement of people?		✓	Not anticipated. There are no habitations at the project sites. Temporary impacts are anticipated due to construction activities affecting shopkeepers/businesses in the area. A Resettlement Plan following the Resettlement Framework and ADB SPS has been prepared.
▪ disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?		✓	Not anticipated.
▪ noise and dust from construction activities?	✓		Anticipated during construction activities. However, impacts are temporary and short in duration. The EMP includes measures to mitigate impacts.
▪ increased road traffic due to interference of construction activities?	✓		Anticipated during construction activities. However, impacts are temporary and short in duration. The EMP ensures measures are included to mitigate impacts. Construction contractors will be required to coordinate with local traffic police.
▪ continuing soil erosion/silt runoff from construction operations?	✓		Anticipated during construction activities. However, impacts are temporary and short in duration. The EMP ensures measures are included to mitigate impacts. Construction contractors will be required to include silt traps or channelization where required.
▪ 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?		✓	A qualified contractor with required experience is proposed to be selected through a competitive bidding process to ensure prudent industry standards for delivery of wholesome water to the customers. The Contractor shall prepare an O&M manual for approval of the Employer and training will be given to the staff operating the plant to ensure proper O&M.
▪ delivery of water to distribution system, which is corrosive due to inadequate attention to feeding of corrective chemicals?		✓	Not anticipated.
▪ accidental leakage of chlorine gas?		✓	Not anticipated.
▪ excessive abstraction of water affecting downstream water users?		✓	Not anticipated. The flows in the source rivers are high and extraction will have negligible effect on other water users. This has been confirmed through hydrological studies.
▪ Competing uses of water?		✓	Not anticipated.
▪ increased sewage flow due to increased water supply	✓		Government of Karnataka is in the process of planning the new sewerage system. KIUWMIP supports sewage and sanitation improvements.
▪ increased volume of sullage (wastewater from cooking and washing) and sludge from wastewater treatment plant	✓		Government of Karnataka is in the process of planning the new sewerage system. KIUWMIP supports sewage and sanitation improvements.

Screening Questions	Yes	No	Remarks
▪ large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?		✓	The contractors will hire locally available workers and as such large influx of population is not anticipated.
▪ social conflicts if workers from other regions or countries are hired?		✓	No social conflicts anticipated as there is availability of local laborers.
▪ 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?		✓	There will be no storage and transport of explosives in the project. Fuel and other chemicals will be stored with due care and necessary permissions will be obtained from authorities for storing and handling at project site.
▪ 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?		✓	No such community risks anticipated as project facilities planned near River bank which is reasonably away from residential areas.

ENVIRONMENTAL AND LABOR RELATED LEGISLATIONS IN INDIA

A. Environmental Related Legislations

1. The Water (Prevention and Control of Pollution) Act, 1974, amended 1988
2. The Water (Prevention and Control of Pollution) Rules, 1975
3. The Water (Prevention and Control of Pollution) Cess Rules, 1971
4. The Air (Prevention and Control of Pollution) Act 1981, amended 1987
5. The Air (Prevention and Control of Pollution) Rules, 1982
6. The Environment (Protection) Act, 1986, amended in 1991 and including the following Rules/Notification issued under this Act
7. The Environment (Protection) Rules, 1986, including amendments
8. The Solid Wastes Management Rules, 2016
9. The Hazardous Wastes (Management and Handling) Rules, 1989
10. The Bio-Medical Waste (Management and Handling) Rules, 1998
11. Noise Pollution (Regulation and Control) Rules, 2000,
12. Wild Life (Protection) Amendment Act, 2002
13. Environmental Impact Assessment Notification, 2006
14. Environmental Standards of Central Pollution Control Board (CPCB)
15. The Indian Wildlife (Protection) Act, 1972, amended 1993
16. The Wildlife (Protection) Rules, 1995
17. The Indian Forest Act, 1927
18. Forest (Conservation) Act, 1980, amended 1988
19. Forest (Conservation) Rules, 1981 amended 1992 and 2003
20. Guidelines for Diversion of Forest Lands for Non-Forest Purpose under the Forest (Conservation) Act, 1980
21. Ancient Monuments and Archaeological Sites and Remains Act 1958
22. Ancient Monuments and Archaeological Sites and Remains Rules 1959
23. Government of India Notification of 1992 under the above-stated Rules
24. Coastal Regulation Zone (CRZ) Notification from MoEF.

2. Salient Features of Major Labour Laws in India

Including Amendments Issued from Time to Time Applicable to Establishments Engaged in Construction of Civil Works

(i) Workmen Compensation Act, 1923 - The Act provides for compensation in case of injury by accident arising out of and during the course of employment.

(ii) Payment of Gratuity Act, 1972 - Gratuity is payable to an employee under the Act on satisfaction of certain conditions on separation if an employee has completed 5 years' service or more or on death at the rate of 15 days wages for every completed year of service. The Act is applicable to all establishments employing 10 or more employees.

(iii) Employees' PF and Miscellaneous Provisions Act, 1952 - The Act provides for monthly contributions by the employer plus workers @10 % or 8.33 %. The benefits payable under the Act are:

- (a) Pension or family pension on retirement or death as the case may be;
- (b) deposit linked insurance on the death in harness of the worker; and
- (c) payment of PF accumulation on retirement/death etc.

(iv) Maternity Benefit Act, 1951 - The Act provides for leave and some other benefits to women employees in case of confinement or miscarriage etc.

(v) Contract Labor (Regulation and Abolition) Act, 1970 - The Act provides for certain welfare measures to be provided by the Contractor to contract labor and in case the Contractor fails to provide, the same are required to be provided by the Principal Employer by Law. The principal employer is required to take Certificate of Registration and the Contractor is required to take a License from the designated Officer. The Act is applicable to the establishments or Contractor of principal employer if they employ 20 or more contract labor.

(vi) Minimum Wages Act, 1948 - The employer is supposed to pay not less than the Minimum Wages fixed by appropriate Government as per provisions of the Act if the employment is a scheduled employment. Construction of Buildings, Roads, Runways are scheduled employment.

(vii) Payment of Wages Act, 1936 - It lays down as to by what date the wages are to be paid, when it will be paid and what deductions can be made from the wages of the workers.

(viii) Equal Remuneration Act, 1979 - The Act provides for payment of equal wages for work of equal nature to Male and Female workers and not for making discrimination against Female employees in the matters of transfers, training and promotions etc.

(ix) Payment of Bonus Act, 1965 - The Act is applicable to all establishments employing 20 or more workmen. The Act provides for payments of annual bonus subject to a minimum of 8.33% of wages and maximum of 20 % of wages to employees drawing ₹3,500/- per month or less. The bonus to be paid to employees getting ₹2,500/- per month or above up to ₹3,500/- per month shall be worked out by taking wages as ₹2,500/- per month only. The Act does not apply to certain establishments. The newly set up establishments are exempted for five years in certain circumstances. Some of the State Governments have reduced the employment size from 20 to 10 for the purpose of applicability of the Act.

(x) Industrial Disputes Act, 1947 - The Act lays down the machinery and procedure for resolution of industrial disputes, in what situations a strike or lock-out becomes illegal and what are the requirements for laying off or retrenching the employees or closing down the establishment.

(xi) Industrial Employment (Standing Orders) Act, 1946 - It is applicable to all establishments employing 100 or more workmen (employment size reduced by some of the States and Central Government to 50). The Act provides for laying down rules governing the conditions of employment by the employer on matters provided in the Act and get the same certified by the designated Authority.

(xii) Trade Unions Act, 1926 - The Act lays down the procedure for registration of trade unions of workmen and employees. The trade unions registered under the Act have been given certain immunities from civil and criminal liabilities.

(xiii) Child Labor (Prohibition and Regulation) Act, 1986 - The Act prohibits employment of children below 14 years of age in certain occupations and processes and provides for regulation of employment of children in all other occupations and processes. Employment of child labor is prohibited in Building and Construction Industry.

(xiv) Inter-State Migrant Workmen's (Regulation of Employment and Conditions of Service) Act, 1979 - The Act is applicable to an establishment which employs 5 or more inter-state migrant workmen through an intermediary (who has recruited workmen in one state for employment in the establishment situated in another state). The inter-state migrant workmen, in an establishment to which this Act

becomes applicable, are required to be provided certain facilities such as housing, medical aid, traveling expenses from home up to the establishment and back, etc.

The Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996 and the Cess Act of 1996 - All the establishments who carry on any building or other construction work and employ 10 or more workers are covered under this Act. All such establishments are required to pay Cess at rate not exceeding 2% of the cost of construction as may be notified by the Government. The employer of the establishment is required to provide safety measures at the building or construction work and other welfare measures, such as canteens, first-aid facilities, ambulance, housing accommodation for workers near the workplace etc. The employer to whom the Act applies has to obtain a registration certificate from the Registering Officer appointed by the Government

APPLICABLE AMBIENT AIR QUALITY AND NOISE STANDARDS

Table 1: Applicable Ambient Air Quality Standards

Parameter	Location[a]	Applicable Standards Per ADB SPS[e] ($\mu g/m^3$)
PM_{10}	Industrial Residential, Rural and Other Areas	20 (Annual) [c] 50 (24-hr) [c]
	Sensitive Area	20 (Annual) [c] 50 (24-hr) [c]
PM_{25}	Industrial Residential, Rural and Other Areas	10 (Annual) [c] 25 (24-hr) [c]
	Sensitive Area	10 (Annual) [c] 25 (24-hr) [c]
SO_2	Industrial Residential, Rural and Other Areas	50 (Annual) [b] 20 (24-hr) [c] 500 (10-min) [c]
	Sensitive Area	20 (Annual) [b] 20 (24-hr) [c] 500 (10-min) [c]
NO_2	Industrial Residential, Rural and Other Areas	40 (Annual) [b] 80 (24-hr) [b] 200 (1-hr) [c]
	Sensitive Area	30 (Annual) [b] 80 (24-hr) [b] 200 (1-hr) [c]
CO	Industrial Residential, Rural and Other Areas	2,000 (8-hr) [b] 4,000 (1-hr) [b] 100,000 (15-min)[d]
	Sensitive Area	2,000 (8-hr) [b] 4,000 (1-hr) [b] 100,000 (15-min)[d]
Ozone (O_3)	Industrial Residential, Rural and Other Areas	100 (8-hr) [b] 180 (1-hr) [b]
	Sensitive Area	100 (8-hr) [b] 180 (1-hr) [b]
Lead (Pb)	Industrial, Residential, Rural and Other Areas	0.5 (Annual) [b] 1.0 (24-hr) [b]
	Sensitive Area	0.5 (Annual) [b] 1.0 (24-hr) [b]
Ammonia (NH_3)	Industrial Residential, Rural and Other Areas	100 (Annual) [b] 400 (24-hr) [b]
	Sensitive Area	100 (Annual) [b] 400 (24-hr) [b]
Benzene (C_6H_6)	Industrial Residential, Rural and Other Areas	5 (Annual) [b]
	Sensitive Area	5 (Annual) [b]
Benzo(o)pyrene (BaP) particulate phase only	Industrial Residential, Rural and Other Areas	0.001 (Annual) [b]
	Sensitive Area	0.001 (Annual) [b]
Arsenic (As)	Industrial Residential, Rural and Other Areas	0.006 (Annual) [b]
	Sensitive Area	0.006 (Annual) [b]
Nickel (Ni)	Industrial Residential, Rural and Other Areas	0.02 (Annual) [b]
	Sensitive Area	0.02 (Annual) [b]

[a] Sensitive area refers to such areas notified by the India Central Government.

[b] Notification by Ministry of Environment and Forests, Government of India Environment (Protection) Seventh Amendment Rules, 2009
[c] WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide. *Global update 2005*. WHO. 2006
[d] Air Quality Guidelines for Europe Second Edition. WHO 2000.
[e] Per ADB SPS, the government shall achieve whichever of the ambient air quality standards is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, the executing agency of the government will provide full and detailed justification for any proposed alternatives that are consistent with the requirements presented in ADB SPS.

Table 2: Applicable Ambient Noise Standards

Receptor/ Source	Applicable Standards Per ADB SPS[c] (dBA)	
	Day time	Night time
Industrial area	70[b]	70[b]
Commercial area	65[a]	55[a]
Residential Area	55[a]	45[a]
Silent Zone	50[a]	40[a]

[a] Noise Pollution (Regulation and Control) Rules, 2002 as amended up to 2010.
[b] Guidelines for Community Noise. WHO. 1999
[c] Per ADB SPS, the government shall achieve whichever of the ambient air quality standards is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, the executing agency of the government will provide full and detailed justification for any proposed alternatives that are consistent with the requirements presented in ADB SPS.

APPLICABLE STANDARDS FOR DISCHARGE OF ENVIRONMENTAL POLLUTANTS (EFFLUENT)

Pollutants	Units	Applicable Standard per ADB SPS [a, b, c]
pH	pH	6 – 9 [b]
BOD	mg/l	20 [a]
COD	mg/l	125 [b]
Total nitrogen	mg/l	10 [b]
Total phosphorus	mg/l	2 [b]
Oil and grease	mg/l	10 [b]
Total suspended solids	mg/l	<50 [a]
Total coliform bacteria	MPN b / 100 ml	400a [b]

[a] Environment (Protection) Amendment Rules, 2017

[b] Health-based guideline values

[c] Per ADB SPS, the government shall achieve whichever of the ambient air quality standards is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, the executing agency of the government will provide full and detailed justification for any proposed alternatives that are consistent with the requirements presented in ADB SPS.

APPLICABLE DRINKING WATER STANDARDS

Group	Parameter	Unit	Applicable Standards Per ADB SPS [a, c, d]
	Parameter		
Physical	Turbidity	NTU	1 (5) [a]
	pH		6.5 – 8.5 [a]
	Color	Hazen units	5 (15) [a]
	Taste and Odor		Agreeable [a]
	TDS	mg/l	500 (2,000) [a]
	Iron	mg/l	0.3 [a]
	Manganese	mg/l	0.1 (0.3) [a]
	Arsenic	mg/l	0.01 [a]
	Cadmium	mg/l	0.003 [a]
	Chromium	mg/l	0.05 [a]
	Cyanide	mg/l	0.05 [a]
	Fluoride	mg/l	1 (1.5) [a]
	Lead	mg/l	0.01 [a]
	Ammonia	mg/l	0.5 [a]
Chemical	Chloride	mg/l	250 (1,000) [a]
	Sulphate	mg/l	200 (400) [a]
	Nitrate	mg/l	45 [a]
	Copper	mg/l	0.05 (1.5) [a]
	Total Hardness	mg/l	200 (600) [a]
	Calcium	mg/l	75 (200) [a]
	Zinc	mg/l	5 (15) [a]
	Mercury	mg/l	0.001 [a]
	Aluminum	mg/l	0.1 (0.3) [a]
	Residual Chlorine	mg/l	0.2 [a]
Micro Germs	E-coli	MPN/100ml	Must not be detectable in any 100 ml sample [a]
	Total Coliform	MPN/100ml	

[a] Bureau of India Standard 10200: 2012.
[b] Health-based guideline values.
[c] Per ADB SPS, the government shall achieve whichever of the ambient air quality standards is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, the executing agency of the government will provide full and detailed justification for any proposed alternatives that are consistent with the requirements presented in ADB SPS.
[d] Figures in parenthesis are maximum limits allowed in the absence of alternate source.

SAMPLE OUTLINE SPOILS (CONSTRUCTION WASTE) MANAGEMENT PLAN

- The Spoil Management Plan should be site specific and be part of the monthly Construction Management Plan.
- The contractor, in consultation with the PIU, has to find out appropriate location/s for the disposal of the excess soil generated. The spoils should be deposited only at these sites.
- Further precautions need to be taken in case of the contaminated spoils
- The vehicle carrying the spoil should be covered properly.
- The spoils generating from each site should be removed on the same day or immediately after the work is complete. The site / road should be restored to the original condition.

I. Spoils information

The spoil information contains the details like (i) the type / material; (ii) potential contamination by that type; (iii) expected volume (site/component specific); and d) spoil classification, etc.

II. Spoils management

The Spoil Management section gives the details of (i) transportation of spoil; (ii) disposal site details; (iii) precautions taken; (iv) volume of contaminated spoil, if present; and (v) suggested reuse of disposal of the spoil

III. Documentation

The volume of spoil generated (site specific, date wise), site disposed, reuse / disposal details should be documented properly.

TRAFFIC MANAGEMENT PLANNING

A. Principles for Traffic Management Planning around the Water Pipes Construction Sites

One of the prime objectives of this traffic management plan (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 Traffic Management Planning

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; and
(viii) Make appropriate accommodation for abutting property owners, residents, businesses, emergency services, railroads, commercial vehicles, and transit operations.

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:

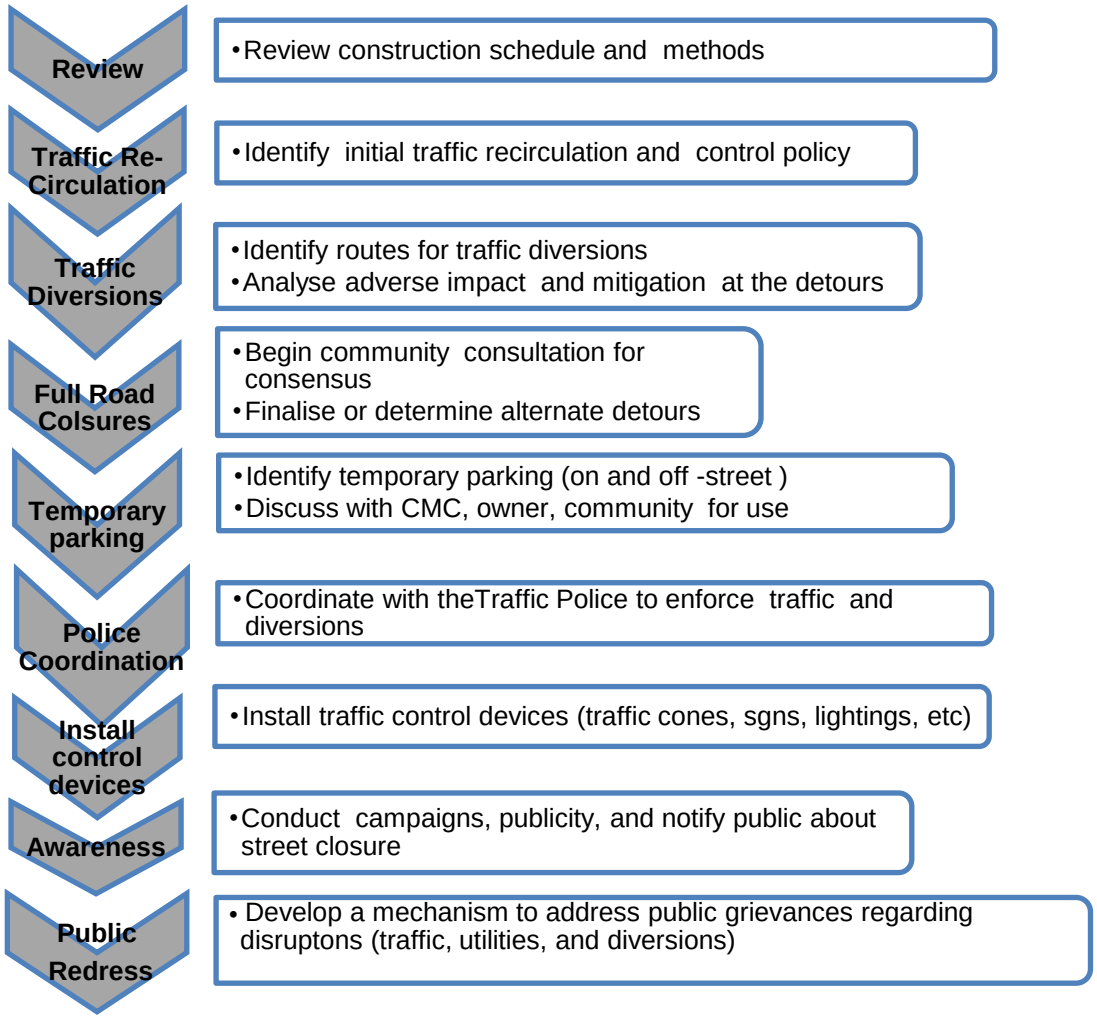
Apart from the capacity analysis, a final decision to close a particular street and divert the traffic should involve the following steps:

(i) Approval from the Mangalore Corporation / 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.

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 A7.1: Policy Steps for the Traffic Management Planning



D. Public Awareness and Notifications

As per discussions in the previous sections, there will be travel delays during the constructions, as is the case with most construction projects, although 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.

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.

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.

It may be necessary to conduct the awareness programs/campaigns on road safety during construction.

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:

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

Procedures for installing traffic control devices at any work zone vary, depending on road configuration, location of the work, construction activity, duration, traffic speed and volume, and pedestrian traffic. Work will take place along major roads, and the minor internal roads. As such, the traffic volume and road geometry vary. The main roads carry considerable traffic; internal roads in the new subproject sites and alignments are wide but in old City roads very narrow and carry considerable traffic. However, regardless of where the construction takes place, all the work zones should be cordoned off, and traffic shifted away at least with traffic cones, barricades, and temporary signs (temporary “STOP” and “GO”).

Figure A7.2 to Figure A7.12: illustrates a typical set-up for installing traffic control devices at the work zone of the area, depending on the location of work on the road way, and road geometrics:

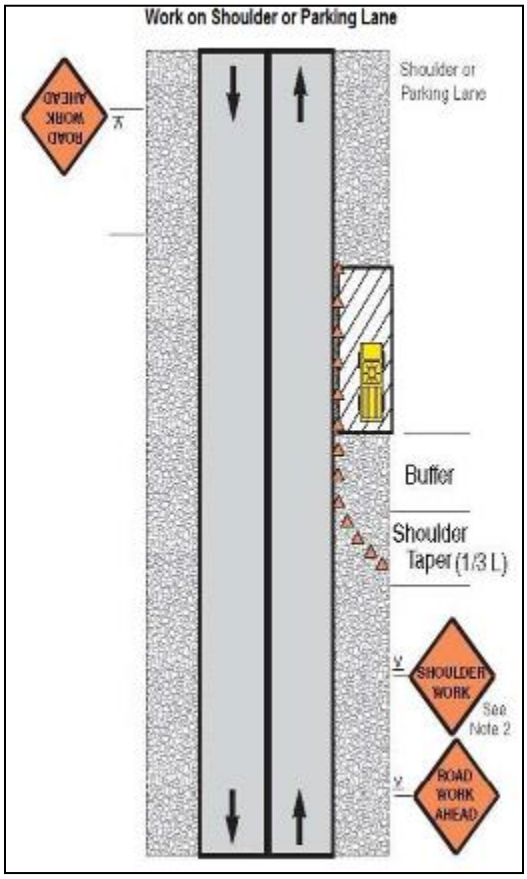
- Work on shoulder or parking lane
- Shoulder or parking lane closed on divided road
- Work in Travel lane
- Lane closure on road with low volume
- Lane closure on a two-line road with low volume (with yield sign)
- Lane closure on a two-line road with low volume (one flagger operation)
- Lane closure 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

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.

Traffic police should regulate traffic away from the work zone and enforce the traffic diversion result from full street closure in certain areas during construction. Flaggers/ personnel should be equipped with reflective jackets at all times and have traffic control batons (preferably the LED type) for regulating the traffic during night time.

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 A7.2 and Figure A7.3: Work on Shoulder or Parking Lane and Shoulder or Parking Lane Closed on Divided Road



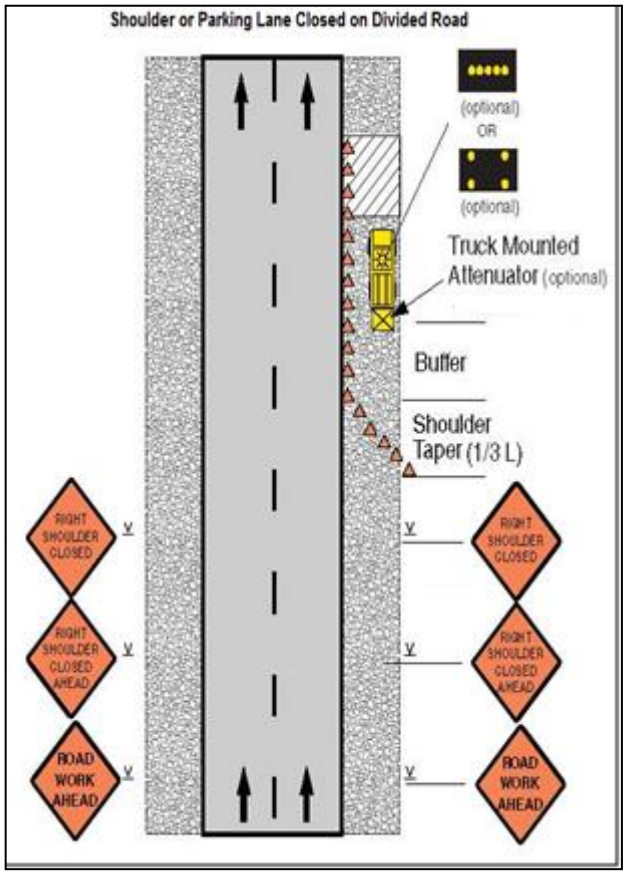
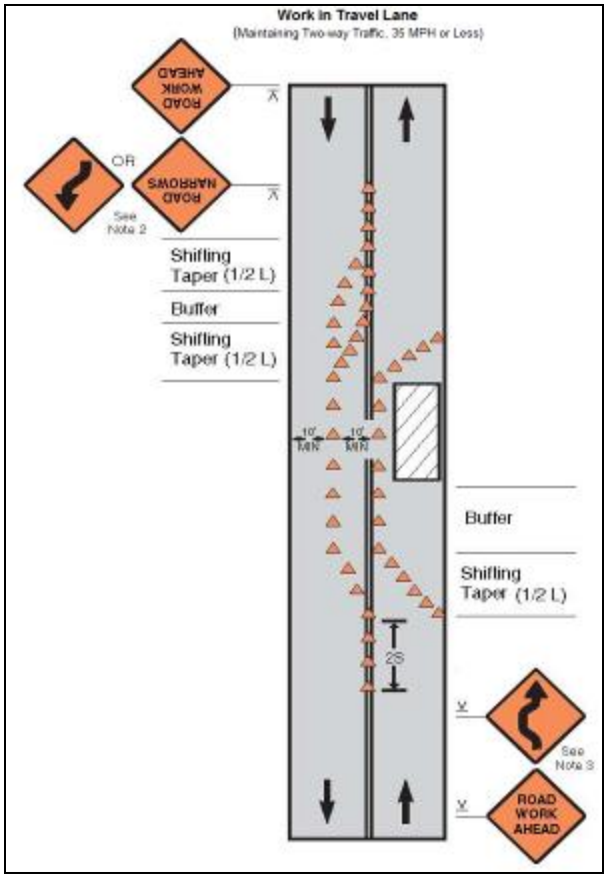


Figure A7.4 and Figure A7.5: Work in Travel Lane and Lane Closure on Road with Low Volume



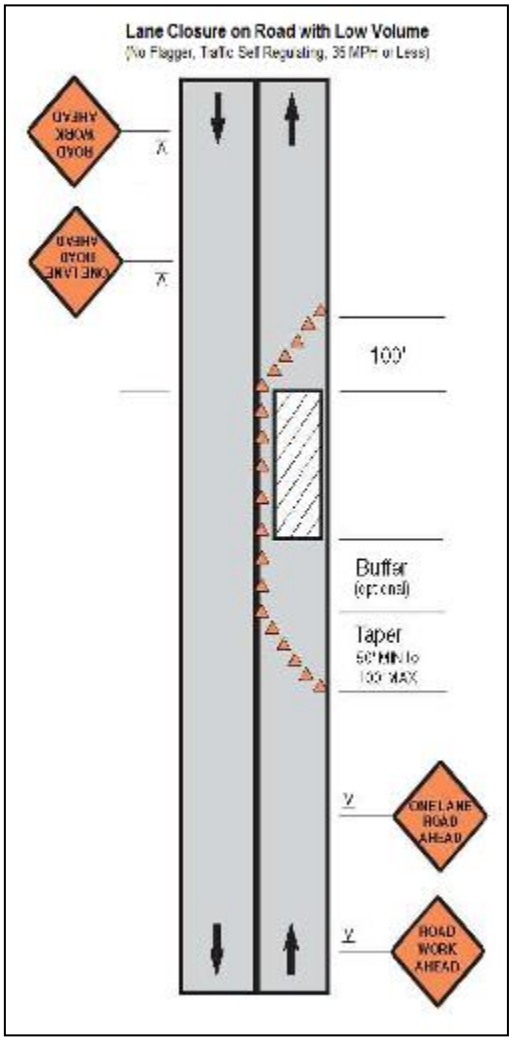
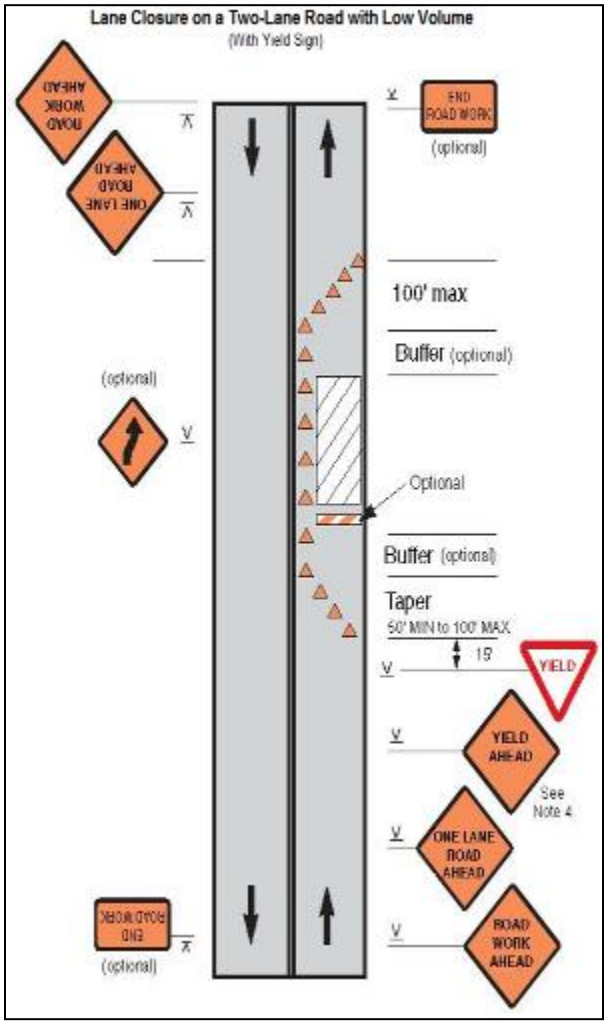


Figure A7.6 and Figure A7.7: Lane Closure on a Two-Line Road with Low Volume (with yield sign) and Lane Closure on a Two-Line Road with Low Volume (one flagger operation)



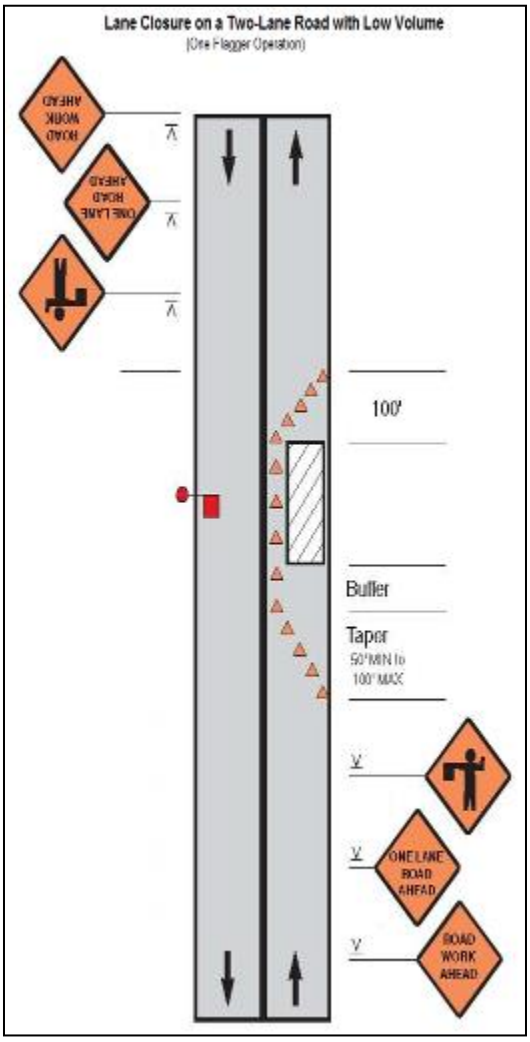
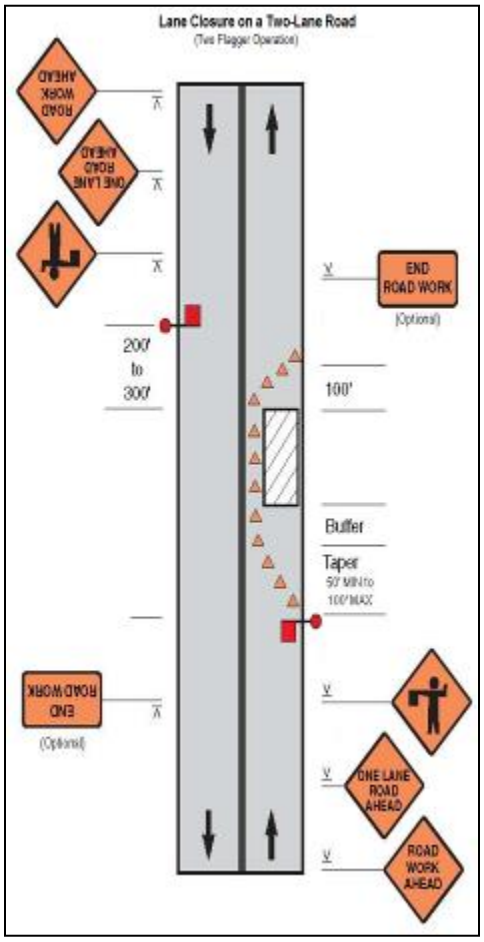


Figure A7.8 and Figure A7.9: Lane Closure on a Two-Lane Road (two flagger operation) and Lane Closure on a Four-Lane Undivided Road



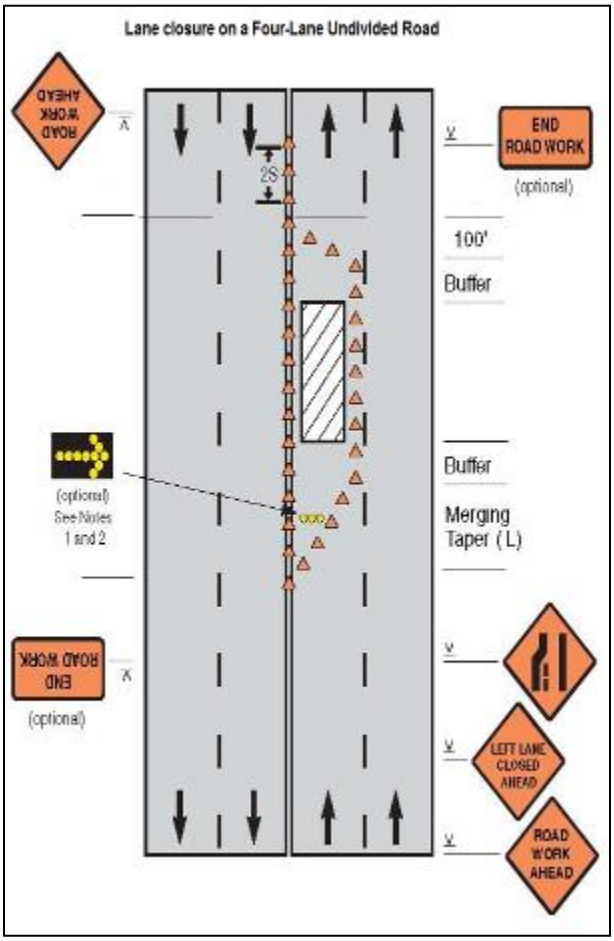
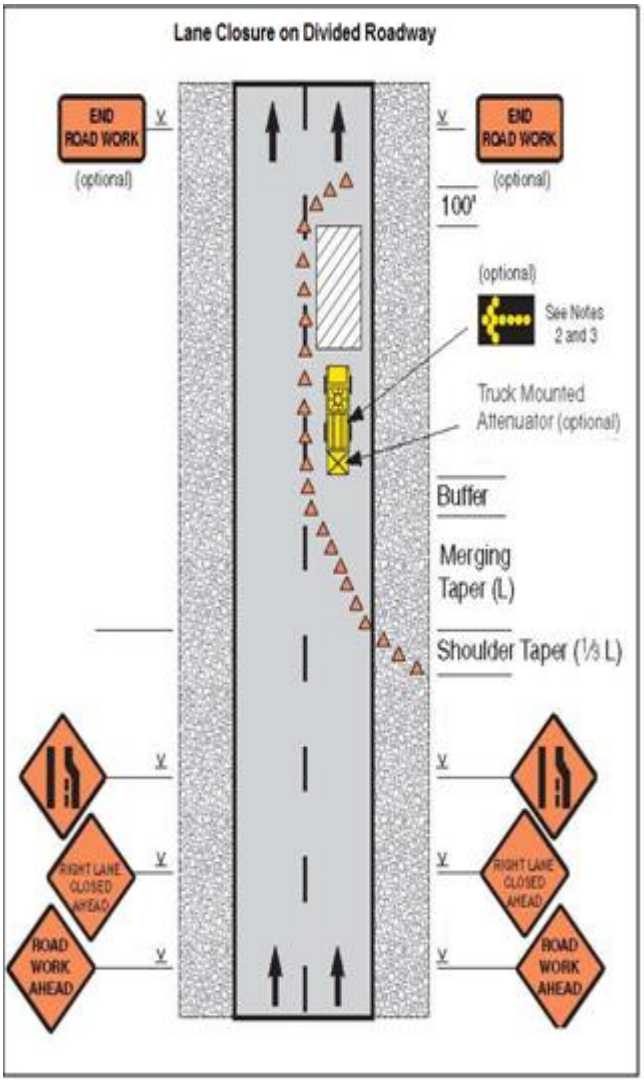


Figure A7.10 and Figure A7.11: Lane Closure on Divided roadway and Half Road Closure on Multi-Lane Roadway



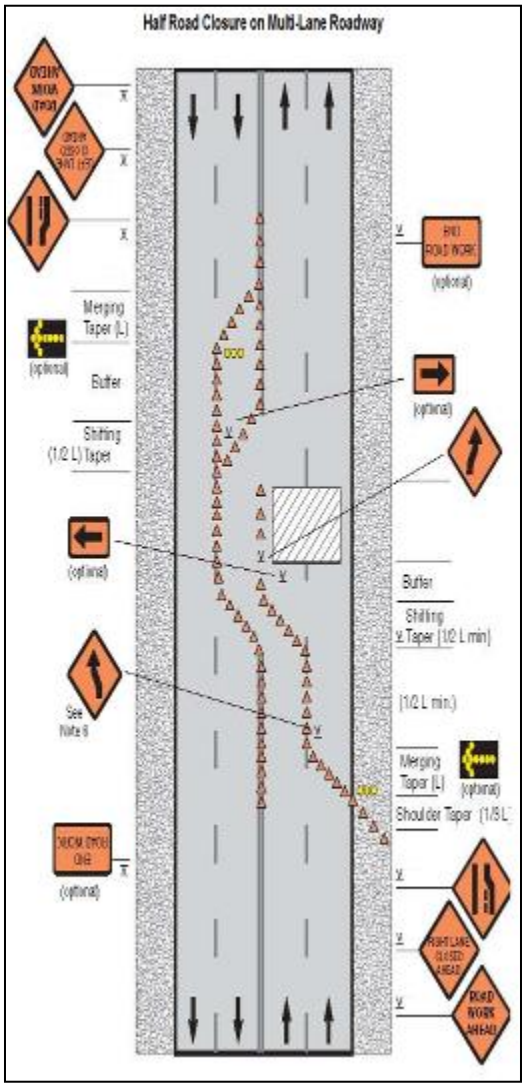
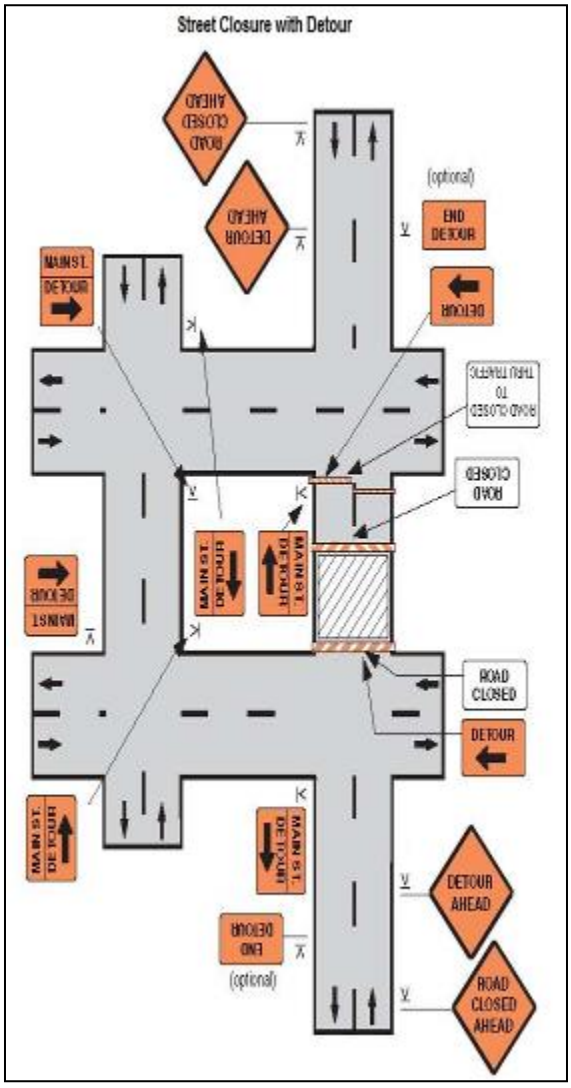


Figure A7.12: Street Closure with Detour



STAKEHOLDER CONSULTATION MEETINGS IN MANGALORE

Name of the ULB: City Corporation, Mangalore

Project components: 24x7 water supply for Mangalore City
Water supply subproject: Laying of water supply distribution network and construction of overhead tanks in Mangalore City

Date: 20 October 2016

Public consultation was conducted in the surrounding areas of all 14 proposed OHTs' construction sites and also distribution network areas. It was observed that there were no social safeguards issues in those areas. However, during construction, focus will be given for RPF of ADB to address the social safeguards issues if any.

Photographs of public consultation: Public consultation:

Public consultation conducted along with the Ward Councilor Mrs. Kavitha in Mulihithlu area


Public Consultation conducted along with Ward Councilor Mrs Rathikala in Morgansgate



Public consultation conducted along with Ward Councilor Mr. Rajaneesh-


Public consultation conducted along with Ward Councilor Mrs. Jayanthi Achar


Public consultation conducted along with Ward Councilor Mr. Abdul Azeez

Public Consultation along with Ward Councilor Mr. Radhakrishna

Participants of Consultation Meetings

No.	Name and Address of the Person Consulted	Contact No.	Issues Discussed	Contacted Person is the Beneficiary of the Proposed Project Yes/No	Proposed Project Cause Any Social Issue? Yes/ No (If Yes provide details)	Suggestions for the proposed project
1.	Mr. Owen Colaco S/o. Late Hubert Colaco, Upper Bendoor, Mangaluru-575002	0824-2218328	Laying of water supply pipeline.	Yes	No	Satisfied with the sub-project implementation.
2.	Mrs. Saly David Queens Beauty Parlour, 'Sripriya', Upper Bendoor, Mangaluru.	8762707095	Laying of water supply pipeline.	Yes	No	Satisfied with the sub-project implementation.
3.	Mr. Umesh, Cherry Square,	9449040343	Laying of water	Yes	No	Satisfied with the proposed

No.	Name and Address of the Person Consulted	Contact No.	Issues Discussed	Contacted Person is the Beneficiary of the Proposed Project Yes/No	Proposed Project Cause Any Social Issue? Yes/ No (If Yes provide details)	Suggestions for the proposed project
	Upper Bendoor, Mangaluru.		supply pipeline.			subproject implementation.
4.	Dr. Rama JS SCS Hospital, Upper Bendoor, Mangaluru	0824-2881161(DL), 2881100, 2225201-4	Works need to be carried out without causing any disturbance to the functioning of the hospital.	Can't say until the implementation	-	Project needs to be completed without breaks and without causing inconvenience to the functioning of the hospital.
5.	Mr. Purandar Bheema Jewellers, Upper Bendoor, Mangaluru	9845853887	Laying of water supply pipeline.	Yes	No	Satisfied with the proposed subproject implementation.
6.	Mr. Harish Kamath, Hoisala Dayana Complex, Co-operative Society, Upper Bendoor, Mangaluru	9448360657	Laying of water supply pipeline.	Yes	No	Satisfied with the subproject (proposed) implementation. Prior information need to be provided before starting of civil work.
7.	Mr.Srikanth Kamath, M/s. U. Subrayak Nayak Automobile Engineers, Upper Bendoor, Mangaluru-575002	9591659297	Laying of water supply pipeline.	Yes	No	Satisfied with the proposed subproject implementation.
8.	Mr. Sathish Karkera, Bharath Co-operative Bank (Mumbai) Limited, Upper Bendoor, Mangaluru-575002	0824-4280111	Laying of water supply pipeline.	Yes	No	Satisfied with the proposed subproject implementation.
9.	Mr. Surendra Gogas, Upper Bendoor, Mangaluru-575002	9738968735	Laying of water supply pipeline.	Yes	No	Satisfied with the proposed subproject implementation.

No.	Name and Address of the Person Consulted	Contact No.	Issues Discussed	Contacted Person is the Beneficiary of the Proposed Project Yes/No	Proposed Project Cause Any Social Issue? Yes/ No (If Yes provide details)	Suggestions for the proposed project
10.	P. Anantharam Rai, Prop. Rai and Rai, Upper Bendoor, Mangaluru-575002	0824-2218818	Laying of water supply pipeline.	Yes	No	Satisfied with the proposed subproject implementation.
11.	Mrs. Lakshmi, Underground Yenapoya Chamber, Balmatta, Mangaluru-575002	0824-4269907	Laying of water supply pipeline.	Yes	No	Satisfied with the proposed subproject implementation.
12.	Mrs. Shalini Rodrigues, Ave Maria Tours & Travels, Balmatta, Mangaluru-575002	0824-2211555	Laying of water supply pipeline.	Yes	No	Satisfied with the proposed subproject implementation.
13.	Mr. Kamalaksha, Froth on top, Balmatta Road, Mangaluru-575002	0824-4256855, 9972506855	Laying of water supply pipeline.	Yes	No	Satisfied with the proposed subproject implementation
14.	Mr. Mohan, Winegate, Balmatta, Mangaluru-575002	9916430033	Laying of water supply pipeline.	Yes	No	Satisfied with the proposed subproject implementation
15.	Mr. Sudhakar, Sri. Durga, Balmatta, Mangaluru-575002	9448570941	Laying of water supply pipeline.	Yes	No	Satisfied with the proposed subproject implementation.
16.	Mr. Udaya Shetty, Spectra Surgicals, Balmatta, Mangaluru-575002	0824-2441892	Laying of water supply pipeline.	Yes	No	Satisfied with the proposed subproject implementation.
17.	Mr. Chandrahasa, Time Square, Balmatta, Mangaluru-575002	9008892696	Laying of water supply pipeline.	Yes	No	Satisfied with the proposed subproject implementation.
18.	Mr. Shivaraj, Mathias Aluminium System (P) Ltd, Saldanha Providence, Balmatta, Mangaluru	0824-2440141 9663564945	Laying of water supply pipeline.	Yes	No	Satisfied with the proposed subproject implementation.
19.	Mr. Praveen Chandra, Panchami Electricals Pvt Ltd, Saldanha	0824-2442241	Laying of water	Yes	No	Satisfied with the proposed

No.	Name and Address of the Person Consulted	Contact No.	Issues Discussed	Contacted Person is the Beneficiary of the Proposed Project Yes/No	Proposed Project Cause Any Social Issue? Yes/ No (If Yes provide details)	Suggestions for the proposed project
	Providence, Balmatta, Mangaluru-575001		supply pipeline.			subproject implementation.
20.	Mr. Guru, Maplex Plot No.15-6-305, Ground Floor, Saldanha Providence, Balmatta, Mangaluru-575001	0824-2445889, 9591920909	Laying of water supply pipeline.	Yes	No	Satisfied with the proposed subproject implementation. Restoration work should be taken up without any delay.
21.	Mrs. Smrithi, RBC Bank, Hampankatta, Mangaluru	9844773895, 0824-4259677/577	Laying of water supply pipeline.	Yes	No	Satisfied with the proposed subproject implementation.
22.	Mr. Umesh K, CEO, Teacher's Co-operative Society, Hampankatta, Mangaluru-575001	9980770016	Laying of water supply pipeline.	Yes	No	Satisfied with the proposed subproject implementation.
23.	Mrs. Ishrath, Flyking, Hampankatta, Mangaluru-575001	7090798803	Laying of water supply pipeline.	Yes	No	Satisfied with the proposed subproject implementation.
24.	Dr. D.B. Mehtha, Maximus Commercial Complex, Hampankatta, Mangaluru-575001	9972515841	Laying of water supply pipeline.	Yes	No	Satisfied with the proposed subproject implementation.
25.	Mr. Raghavendra, Hotel Brigade Royal, Hampankatta, Mangaluru-575001	9538346262	Laying of water supply pipeline.	Yes	No	Satisfied with the proposed subproject implementation.
26.	Mr. Narendra Maroli, New Hero Mens Wear, Manasa Tailor, Hampankatta, Mangaluru-575002	9845119608	Laying of water supply pipeline.	Yes	No	Satisfied with the proposed subproject implementation.
27.	Mr. Abdul Sathar, Goodies Arbian Taste, Hampankatta, Mangaluru-575001	9895215832	Laying of water supply pipeline.	Yes	No	Satisfied with the proposed subproject implementation.

No.	Name and Address of the Person Consulted	Contact No.	Issues Discussed	Contacted Person is the Beneficiary of the Proposed Project Yes/No	Proposed Project Cause Any Social Issue? Yes/ No (If Yes provide details)	Suggestions for the proposed project
28.	Mr. Karunakara Shetty, Manipal Industries Ltd, LHH Road, Hampankatta, Mangaluru-575001	9945992559, 0824-2426464	Laying of pipeline for water supply.	Yes	No	Satisfied with the proposed subproject implementation.
29.	Mr. H.D Suvarna, Mangala Jyothi LHH Road, Hampankatta, Mangaluru-575001	0824-2421052	Laying of pipeline for water supply.	Yes	No	Satisfied with the proposed subproject implementation.
30.	Mr. Deril Lasrado, Senior Manager, MCC Bank, Head Office, Hampankatta, Mangaluru-575001	0824-2424306	Laying of pipeline for water supply.	Yes	No	Satisfied with the proposed subproject implementation.
31.	Mr. Glinto Jose Alukkas Jewellers, Hampankatta, Mangaluru-575001	0824-2422551, 9343441000	Laying of pipeline for 24 x 7 water supply.	Yes	No	Satisfied with the proposed subproject implementation.
32.	Mr. Shekara, Souza Silk and Sarees, LHH Road, Hampankatta, Mangaluru-575001	0824-2980361	Laying of pipeline for 24 x 7 water supply.	Yes	No	Satisfied with the proposed subproject implementation.
33.	Mr. Srinivas Apsara Textiles, LHH Road , Hampankatta, Mangaluru-575001	0824-2424387	Laying of pipeline for 24 x 7 water supply.	Yes	No	Satisfied with the proposed subproject implementation.
34.	Mr. Omprakash Polo Fashion, LHH Road , Hampankatta, Mangaluru-575001	7388486490	Laying of pipeline for 24 x 7 water supply.	Yes	No	Satisfied with the proposed subproject implementation.
35.	Mr.Suresh, Big Cotton Bazar, LHH Road , Hampankatta, Mangaluru-575001	9741474531	Laying of pipeline for 24 x 7 water supply.	Yes	No	Satisfied with the proposed subproject implementation.
36.	Mr. Haris, Belt centre (Small shop),	8867577435	Laying of water supply pipeline	Yes	No	Satisfied with the proposed subproject implementation.

No.	Name and Address of the Person Consulted	Contact No.	Issues Discussed	Contacted Person is the Beneficiary of the Proposed Project Yes/No	Proposed Project Cause Any Social Issue? Yes/ No (If Yes provide details)	Suggestions for the proposed project
	LHH Road , Hampankatta, Mangaluru-575001		under 24 x 7 water supply project			
37.	Mr. Hussain, Footwear shop (Small shop), LHH Road , Hampankatta, Mangaluru-575001	9945619141	Laying of water supply pipeline	Yes	No	Satisfied with the proposed subproject implementation.
38.	Mr. Lokesh, Prop. Mohammed, Lucky Juice Centre (Small shop), LHH Road , Hampankatta, Mangaluru-1	9845353270	Laying of water supply pipeline	Yes	No	Satisfied with the proposed subproject implementation.
39.	Mr. Deepak, Readymade Cloth Sales Shop (Small shop), Hampankatta, Mangaluru-1	9980327097	Laying of water supply pipeline	Yes	No	Satisfied with the proposed subproject implementation.
40.	Mr.Nagesh, Petty shop, M.V. Shetty Store, Hampankatta, Mangaluru-1	0824-2447970	Laying of water supply pipeline	Yes	No	Satisfied with the proposed subproject implementation.
41.	Mr. Santhosh, Prop. Praveen Prabhu, Sugarcane Juice Centre, Hampankatta, Mangaluru-1	9743109829	Laying of water supply pipeline	Yes	No	Satisfied with the proposed subproject implementation.
42.	Mr. Vikesh, Bata Hampankatta, Mangaluru-1	9844542266	Laying of water supply pipeline	Yes	No	Satisfied with the proposed subproject implementation.
43.	Mr. Karunakar, My Mobile Life, LHH Road, Hampankatta, Mangaluru-1	9945471252	Laying of water supply pipeline	Yes	No	Satisfied with the proposed subproject implementation.
44.	Mrs. Anitha Sujirkars Silk Nikethan, Hampankatta, Mangaluru-1	0824-2440126	Laying of water supply pipeline	Yes	No	Satisfied with the proposed subproject implementation.

No.	Name and Address of the Person Consulted	Contact No.	Issues Discussed	Contacted Person is the Beneficiary of the Proposed Project Yes/No	Proposed Project Cause Any Social Issue? Yes/ No (If Yes provide details)	Suggestions for the proposed project
45.	Mr. Sathish Nayak, Kalanikethan, Hampankatta, Mangaluru-1	9880307126	Laying of water supply pipeline	Yes	No	Satisfied with the proposed subproject implementation.
46.	Mr.Sudhesh Sujirkars Fashion House, Hampankatta, Mangaluru-1	0824-2440422	Laying of water supply pipeline	Yes	No	Satisfied with the proposed subproject implementation.
47.	Mr.Nawaz, Fashion Foot wear, Hampankatta, Mangaluru-575001	9035023387	Laying of water supply pipeline	Yes	No	Satisfied with the proposed subproject implementation.
48.	Mr.Dinesh Nayak Sujirkars Silk Nikethan Next, Hampankatta, Mangaluru-1	9343532707	Laying of water supply pipelines	Yes	No	Satisfied with the proposed subproject implementation.
49.	Mr. Ibrahim, Boot Bazar, Hampankatta, Mangaluru-575001	9343344966	Laying of water supply pipeline	Yes	No	Satisfied with the proposed subproject implementation.
50.	Mr. Yashwanth, Rathna's Winegate, Hampankatta, Mangaluru-1	0824-2424050 9916104466	Laying of water supply pipeline	Yes	No	Satisfied with the proposed subproject implementation.
51.	Mr.Saleem, Petty Shop, Next to Rathna's Winegate, Hampankatta, Mangaluru-1	8277555551	Laying of water supply pipeline	Yes	No	Satisfied with the proposed subproject implementation.
52.	Mr. Devendra, Sri.Durgaparameshwari Saree Zari works, Hampankatta, Mangaluru-1	9663557269	Laying of water supply pipeline	Yes	No	Satisfied with the proposed subproject implementation.
53.	Mr.Riyaz Ahmmed, Mobile Signal, Hampankatta, Mangaluru-1	7090803898	Laying of water supply pipeline	Yes	No	Satisfied with the proposed subproject implementation.
54.	Mr. Prabhakar, Flower Vendor, Hampankatta, Mangaluru-1	9900713087	Laying of water supply pipeline	Yes	No	Satisfied with the proposed subproject implementation.

No.	Name and Address of the Person Consulted	Contact No.	Issues Discussed	Contacted Person is the Beneficiary of the Proposed Project Yes/No	Proposed Project Cause Any Social Issue? Yes/ No (If Yes provide details)	Suggestions for the proposed project
55.	Mr. Silin Payas, Flower Vendor, Hampankatta, Mangaluru-1	9611945679				
56.	Mrs. Aggibai, Flower Vendor, Hampankatta, Mangaluru-1					
57.	Mrs. Marhubai, Flower Vendor, Hampankatta, Mangaluru-1	9448177543				
58.	Lilli Pais, Flower Vendor, Hampankatta, Mangaluru-1					
59.	Karnataka Bank, Hampankatta Branch, Mangaluru-575001	0824-2229842/43/69	Laying of water supply pipeline	Yes	No	Satisfied with the proposed subproject implementation.
60.	Mr.Hemanth, Flower Vendor, Opp.Central Talkies, Clock Tower, Mangaluru-1	7090747129	Laying of water supply pipeline	Yes	No	Satisfied with the proposed subproject implementation.
61.	Mr.Sachin, Flower Vendor, Opp.Central Talkies, Clock Tower, Mangaluru-1	9980271557	Laying of water supply pipeline	Yes	No	Satisfied with the proposed subproject implementation.
62.	Mr.Suresh, Flower Vendor, Opp.Ladygoschen Hospital, Mangaluru-1	8147761433	Laying of water supply pipeline	Yes	No	Satisfied with the proposed subproject implementation.
63.	Mr. Mahesh, N.R Communications, Petty Shop, Nehru Maidan, Backside gate, Mangaluru-1	7026331099	Laying of water supply pipeline	Yes	No	Satisfied with the proposed subproject implementation.
64.	Mr. Shanil A1 Communications, Cell Phone Recharge and Spare Parts Selling Shop,(Petty	8310595288	Laying of water supply pipeline	Yes	No	Satisfied with the proposed subproject implementation.

No.	Name and Address of the Person Consulted	Contact No.	Issues Discussed	Contacted Person is the Beneficiary of the Proposed Project Yes/No	Proposed Project Cause Any Social Issue? Yes/ No (If Yes provide details)	Suggestions for the proposed project
	Shop), Nehru Maidan, Mangaluru-1					
65.	Mr. Gajendra, S.H.K Communications, (Petty Shop) Cell Phone Recharge and Repair services, Nehru Maidan, Mangaluru-575001	9900257383	Laying of water supply pipeline	Yes	No	Satisfied with the proposed subproject implementation.
66.	Mr. Divakara Shetty, Samruddi Apartments, Ganesh Garden Road, (Lobo Lane), Kadri, Mangaluru-575003	9483214373 9008318284 (Mohandas Alva)	Laying of water supply pipeline	Yes	No	Satisfied with the proposed subproject implementation.
67.	Mrs. Muktha R. Hegde, "Susheela", Ganesh Garden, Kadri, Mangaluru-575003	0824-2443416	Laying of water supply pipeline	Yes	No	Satisfied with the proposed subproject implementation.
68.	Mr. Farhan, Diners Paradise, Opp.City Hospital, Kadri, Mangaluru-575003.	0824-4256800	Laying of water supply pipeline	Yes	No	Satisfied with the proposed subproject implementation.
69.	Ms.Ashwitha, ASH Computers, No.15/9/470/1, Manjunath Towers, Opp.City Hospital, Kadri, Mangaluru-575003.	9902519895 9886819895	Laying of water supply pipeline	Yes	No	Satisfied with the proposed subproject implementation.
70.	Mr.Sampath, Heritage, Praveen Plaza Complex, Near City Hospital, Kadri, Mangaluru-575003.	0824-4261768	Laying of water supply pipeline	Yes	No	Satisfied with the proposed subproject implementation.
71.	Mr.Naveen Hegde, Manager, Tejaswini Hospital, Kadri, Mangaluru-575003.	0824-2880100	Laying of water supply pipeline	Yes	No	Satisfied with the proposed subproject implementation.

No.	Name and Address of the Person Consulted	Contact No.	Issues Discussed	Contacted Person is the Beneficiary of the Proposed Project Yes/No	Proposed Project Cause Any Social Issue? Yes/ No (If Yes provide details)	Suggestions for the proposed project
72.	Mr.Mohan Rai, Nandini Milk Parlour, Kadri Kambla, Mangaluru-575003.	9632554547	Laying of water supply pipeline	Yes	No	Satisfied with the proposed subproject implementation.
73.	Mr.Chandrashekar, 3-31-27-27, Prema Nivasa, Kadri Kambla, Mangaluru-575003.	9448215323	Laying of water supply pipeline	Yes	No	Satisfied with the proposed subproject implementation.
74.	Mr.Francis Dsouza, Hotel Pranam, Bejai Church Road, Bejai, Mangaluru-575004.	8197137829	Laying of water supply pipeline	Yes	No	Satisfied with the proposed subproject implementation.
75.	Mr.Michael, Hotel Andra House, Bhavani Complex, Bharathi Nagar, Bejai, Mangaluru-575004.	8861949234	Laying of water supply pipeline	Yes	No	Satisfied with the proposed subproject implementation.
76.	Mr. Pradeep Mayya, Automatrix, TATA Dealer, Manjusha, Bejai, Mangaluru-575004.	9845496877	Laying of water supply pipeline	Yes	No	Satisfied with the proposed subproject implementation.
77.	Mr. Lancy Rodrigues, Bata Showroom, Beetel Archade, Bejai, Mangaluru-575004.	0824-4265058	Laying of water supply pipeline	Yes	No	Satisfied with the proposed subproject implementation.
78.	Mrs. Sujatha, Vinaya Farm, Regal Tower, Bejai, Mangaluru-575004.	9686813030	Laying of water supply pipeline	Yes	No	Satisfied with the proposed subproject implementation.
79.	Mrs. Kasthuri, Near Officers Club, Near OHT (Proposed), Ladyhill, Mangaluru	8880440362	Laying of water supply pipeline	Yes	No	Satisfied with the proposed subproject implementation.
80.	Mrs.Vathsala, New Shine, St.Agnes College Road, Bendoor, Mangaluru-575002	9731924951	Laying of water supply pipeline	Yes	No	Satisfied with the proposed subproject implementation.
81.	Mr.Joseph Pinto, Hill Road Stores, Near St.Agnes College,	9741376970	Laying of water	Yes	No	Satisfied with the proposed

No.	Name and Address of the Person Consulted	Contact No.	Issues Discussed	Contacted Person is the Beneficiary of the Proposed Project Yes/No	Proposed Project Cause Any Social Issue? Yes/ No (If Yes provide details)	Suggestions for the proposed project
	Bendoor, Mangaluru-575002.		supply pipeline			subproject implementation.
82.	Umesh Bhat, Bhadrakali Temple, Near Padavu High School, Vivekananda Road, Padavu, Mangaluru-575002.	9880837689	Laying of water supply pipeline	Yes	No	Satisfied with the proposed subproject implementation.
83.	Mr.Ibrahim, Fruit Vendor, Opp. Darshan Comforts, Yeyyadi, Mangaluru.	9535909048	Laying of water supply pipeline	Yes	No	Satisfied with the proposed subproject implementation.
84.	Mr. Ashok, Petty Shop, (Mobile Recharge Shop), Yeyyadi, Konchady, Near Ramashrama PUC College, Mangaluru	9590372013	Laying of water supply pipeline	Yes	No	Satisfied with the proposed subproject implementation.
85.	Mr. Harish, Jewellery Shop, 7th Block, Near Govt Junior College, Krishnapura, Surathkal	9844993912	Laying of water supply pipeline and construction of OHT	Yes	No	Satisfied with the proposed subproject implementation.
86.	Mr. Chandra, S/o. Lakkayya Divya Nilaya, Meenakaliya, Baikampady	9740147689	Construction of OHT	Yes	No	Satisfied with the proposed subproject implementation.
87.	Mr.Sadashiva, Chaithra Niwas, Meenakaliya, Baikampady	9448084323	Construction of OHT	Yes	No	Satisfied with the proposed subproject implementation.

SEMI-ANNUAL ENVIRONMENTAL MONITORING REPORT TEMPLATE

I. INTRODUCTION

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

Name	Designation/Office	Email Address	Contact Number
1. Program Management Unit			
2. Program Implementation Units			
3. Consultants			

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

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

[a] If on-going construction, include %physical progress and expected date of completion.

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

Package No.	Subproject Name	Statutory Environmental Requirements[a]	Status of Compliance[b]	Validity if obtained	Action Required	Specific Conditions that will require environmental monitoring as per Environment Clearance, Consent/Permit to Establish[c]

[a] Specify (environmental clearance? Permit/consent to establish? Forest clearance? Etc.)

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

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

Note: All statutory clearance/s, no-objection certificates, permit/s, etc. should be obtained prior to award of contract/s. Attach as appendix all clearance obtained during the reporting period. If already reported, specify in the "remarks" column.

III. COMPLIANCE STATUS WITH ENVIRONMENTAL LOAN COVENANTS

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

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

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

Package-wise Implementation Status

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

- Identify the role/s of Safeguards Team including schedule of on-site verification of reports submitted by consultants and contractors.
- For each package, provide name/s and contact details of contractor/s' nodal person/s for environmental safeguards.
- Include as appendix all supporting documents including **signed** monthly environmental site inspection reports prepared by consultants and/or contractors.
- With reference to approved EMP/site-specific EMP/construction EMP, complete the table below
- Provide the monitoring results as per the parameters outlined in the approved EMP (or site-specific EMP/construction EMP when applicable).
- In addition to the table on EMP implementation, the main text of the report should discuss in details the following items:

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

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

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

Summary of Environmental Monitoring Activities (for the Reporting Period)

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

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

Overall Compliance with CEMP/ EMP

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

CEMP = construction environmental management plan, EMP = environmental management plan.

V. APPROACH AND METHODOLOGY FOR ENVIRONMENTAL MONITORING OF THE PROJECT

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

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

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

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

Air Quality Results

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

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

Water Quality Results

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

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

Noise Quality Results

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

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

VII. SUMMARY OF KEY ISSUES AND REMEDIAL ACTIONS

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

VIII. APPENDIXES

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

SAMPLE ENVIRONMENTAL SITE INSPECTION REPORT

Project Name
Contract Number

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

WEATHER CONDITION:
_____

INITIAL SITE CONDITION: _____

CONCLUDING SITE CONDITION:

Satisfactory _____ Unsatisfactory _____ Incident _____Resolved _____ Unresolved _____

INCIDENT:
Nature of incident:
_____

Intervention Steps:
_____

Incident Issues

Resolution

Project Activity Stage	Survey	
	Design	
	Implementation	
	Pre-Commissioning	
	Guarantee Period	

Inspection

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

Site Restored to Original Condition Yes ☐ No ☐

Signature
_____

Sign off

_____ _____

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

SAMPLE CHECKLIST FOR CONSTRUCTION SAFETY

Sl. No.	Safety Issues	Yes	No	Non-Compliance	Corrective Action	Penalty	Remarks
1	Appointment of qualified EHS engineer						
2	Approval for construction safety management plan by the PMDCSC						
3	Approval for traffic management/control plan in accordance with IRC: SP: 55-2001						
4	Maintenance of the existing road stretches handed over to the contractor.						
5	Provision of temporary traffic barriers/barricades/caution tapes in construction zones						
6	Provision of traffic signboards						
7	Provision for flags and warning lights						
9	Providing plastic crash barrier						
10	Provision of adequate staging, form work, and access (ladders with handrail) for works at a height of more than 3 m						
11	Provision of adequate shoring / bracing/barricading/lighting for all deep excavations of more than 3 m depth.						
12	Demarcations (fencing, guarding, and watching) at construction sites						
13	Provision for sufficient lighting, especially for night time work						
14	Arrangements for controlled access and entry to construction zones						
15	Safety arrangements for road users/pedestrians						
16	Arrangements for detouring traffic to alternate facilities						
17	Regular inspection of work zone traffic control devices by authorized contractor personnel						
18	Construction workers' safety - Provision of personnel protective equipment						
19	A. Helmets						
	B. Safety shoes						
	C. Dust masks						
	D. Hand gloves						

Sl. No.	Safety Issues	Yes	No	Non-Compliance	Corrective Action	Penalty	Remarks
	E. Safety belts						
	F. Reflective jackets						
	G. Earplugs for labor						
20	Workers employed on bituminous works, stone crushers, concrete batching plants, etc. provided with protective goggles, gloves, gumboots, etc.						
21	Workers engaged in welding work shall be provided with welder protective shields						
22	All vehicles are provided with reverse horns.						
23	All scaffolds, ladders, and other safety devices shall be maintained in safe and sound condition.						
24	Regular health check-up for labor/ contractor's personnel						
25	Ensuring sanitary conditions and all waste disposal procedures and methods in the camps.						
26	The contractor shall provide adequate circuit for traffic flow around construction areas, control speed of construction vehicles through road safety and training of drivers, provide adequate signage, barriers, and flag persons for traffic control						
27	Provision of insurance coverage for the contractor's personnel						

Contractor Consultant

ENVIRONMENTAL AUDIT OF THE EXISTING WATER TREATMENT PLANT IN MANGALORE

I. Introduction

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 KIUWMIP with environmental legislation; (ii) improve environmental performance through monitoring the effectiveness of the management system; and (iii) increase the Mangalore CC's knowledge of itself and its activities, thus increasing its ability to continually improve and minimize future potential liabilities.

The environmental audit was carried out for the existing WTP. In Mangalore at three different locations water treatment being done. 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 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.

II. Description of Existing Water Treatment Plant at Mangalore

Water Treatment Plant at Ramalkatte (KUDCEMP)

Location	Mangalore City Latitude:12°50'N Longitude:74°47'E
Start of operation (year)	2009
Owned by	City Corporation, Mangalore
Contact person and designation	Mr. Naresh Shenoy Assistant Executive Engineer +919448502777
Capacity	80 million liters per day (MLD)
Water supply source	River Nethravathi, (intake well is 17 kilometers [km] from Mangalore)
Water treatment process	Technology: The treatment process is conventional, and has following units: Cascade Aerator, Raw Water Channel with Parshall Flume or continuous flow measurement, Coagulant & Flocculent chemical make up tanks, Flash Mixing tank, flocculator , Tube settlers ,ten sand filters, Chlorination system and Clear water Sump & pump house.
	Materials: All civil structures are made of reinforced cement concrete, and mechanical units like the of HYSD 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 Lime) are added to the water, and mixed in the flash mixer tank, and then flows into flocculator then to

	Tubesetler and Clarified water flows into sand filters (six numbers) 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. -the untreated backwash and sludge flushing ultimately reaches and disposed off into drain.
Chlorination system	Chlorine dosage system is properly working; there are proper safety precautions in place. Chlorine cylinders (900 kg tonners) are used which is placed at one side of the room. safety systems like leak detection or emergency alarm or lime slurry pit available in the facility. Operators are aware of safety measures or actions to be performed during any emergency.

Water Treatment Plant at Ramalkatte 1974 Scheme

Location	Mangalore City Latitude:12°50'N Longitude:74°47'E
Start of operation (year)	1974
Owned by	City Corporation, Mangalore
Contact person and designation	Mr. Naresh Shenoy Assistant Executive Engineer +919448502777
Capacity	81.7 million liters per day (MLD)
Water supply source	River Nethravathi, (intake well is 17 kilometers [km] from Mangalore)
Water treatment process	Technology:The treatment process is conventional, and has following units: Cascade Aerator, Raw Water Channel with Parshall Flume or continuous flow measurement, Coagulant & Flocculent chemical make up tanks, Flash Mixing tank, Clariflocculator ,Chlorination system and Clear water Sump & pump house.
	Materials: All civil structures are made of reinforced cement concrete, and mechanical units like the of HYSD 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 Lime) are added to the water, and mixed in the flash mixer tank, and then flows into clariflocculator then and Clarified water pumped to the city for filtration
Backwash water and sludge management	- the settled sludge from the bottom of the clarifier tank is periodically flushed into the drains.

Filtration Plant at Bendoor 1974 Scheme	Clarified water flows into sand filters (4 numbers) 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	-50% of filter backwash water is let into open drains and another 50% water used by Horticulture Department for gardening purpose. -there is no recycling of backwash into inlet - the settled sludge from the bottom of the Filter bed is periodically flushed into the drains.
Chlorination system	Chlorine dosage system is not properly working; there are no safety precautions in place. Chlorine cylinders (900 kg tonners) are used which is placed at one side of the room. 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.
Filtration Plant at Panambur 1974 Scheme	Clarified water flows into sand filters (4 numbers) 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. -the untreated backwash and sludge flushing ultimately reaches and disposed off into drain.
Chlorination system	Chlorine dosage system is not properly working; there are no safety precautions in place. 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.