

# Initial Environmental Examination

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## **CURRENCY EQUIVALENTS**

(As of 11 May 2018)

Currency unit	–	Indian rupee (₹)
₹1.00	=	\$0.0149
\$1.00	=	₹67.090

## **ABBREVIATIONS**

ADB	–	Asian Development Bank
ASI	–	Archaeological Survey of India
CFE	–	consent for establishment
CFO	–	consent for operation
CMC	–	City Municipal Council
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
IEE	–	initial environmental examination
KHB	–	Karnataka Housing Board
KIUWMIP	–	Karnataka Integrated Urban Water Management Investment Program
KSPCB	–	Karnataka State Pollution Control Board
KUDCEMP	–	Karnataka Urban Development and Coastal Environmental Management Project
KUIDFC	–	Karnataka Urban Infrastructure Development and Finance Corporation
MOEFCC	–	Ministry of Environment, Forest and Climate Change
NGO	–	nongovernment organization
OHT	–	overhead tank
O&M	–	operation and maintenance
PIU	–	project implementation Unit
PMD CSC	–	project management design, construction and supervision consultant
PMU	–	project management unit
PWD	–	Public Works Department
REA	–	rapid environmental assessment
ROW	–	right-of-way
RPMU	–	regional project management unit
SPS	–	Safeguard Policy Statement
ULB	–	urban local body
WTP	–	water treatment plant

### **WEIGHTS AND MEASURES**

dbA	-	A-weighted decibel
m <sup>3</sup>	-	cubic meter
m <sup>3</sup> /h	-	cubic meter per hour
kg	-	kilogram
kl	-	kiloliter
km	-	kilometer
msl	-	mean sea level
m	-	meter
mg/l	-	milligram per liter
mm	-	millimeter
MLD	-	million liters per day
km <sup>2</sup>	-	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. Puttur 24x7 water supply distribution network subproject is one of the subprojects proposed in Tranche 2.

Puttur City is located in Dakshina Kannada District, surrounded by the Western Ghats and the Arabian Sea. There are no protected or eco sensitive areas in or near subproject sites. Due to the city's rapid development, water supply has become insufficient, and has resulted in water scarcity. The first organized water supply system for Puttur was implemented in 1984-1985 using Kumaradhara River as a water source. The ADB funded Karnataka Urban Development and Coastal Environmental Management Project (KUDCEMP) improved the water supply in 2005-2006 also using the Kumaradhara River as its source. To optimally utilize the assets created under KUDCEMP, the subproject proposed in Puttur under tranche 2 of KIUWMIP seeks to provide 24x7 water supply to entire Puttur City Municipal Council (CMC including its peri urban areas).

**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. Puttur City Water Supply Scheme is classified as Environmental Category B as per the SPS as no significant impacts are envisioned. Accordingly, this initial environmental examination (IEE) report has been prepared to assess environmental impacts and provide mitigation and monitoring measures to ensure no significant impacts as a result of the subproject.

**Subproject Scope.** This subproject includes the following components: (i) replacement of two old pumps with new vertical turbine pumps in Jackwell at Nekkilady; (ii) construction of 1.68 kilometer (km) of raw water pumping main (400 millimetre (mm) diameter) from Jackwell to water treatment plant (WTP) at Nekkilady; (iii) construction of 12.42 km clear water main of 400 mm diameter from the proposed new water treatment plant (WTP) at Nekkilady to ground level service reservoir (GLSR) at Tenkila; (iv) construction of new WTP of capacity 8.7 million liters per day (MLD) at Nekkilady; (v) replacement of clear water pumps in existing WTP at Nekkilady; (vi) construction of 5.06 km of clear water feeder mains; (vii) construction of six new overhead tanks (OHTs) – (a) 300 kiloliter (kl) capacity in Zone-2 at Mura Shantinagra, Padnur, (b) 100 KL in Zone-3 at Karmala near Microwave station, (c) 600 kl in Zone-4A at Darbe; (d) 250 kl in zone-5 at Lingadagudda, Kabaka, (e) 200 kl in Zone-6A at Balnad Helipad, and (f) 100 kl zone-8 at BalnadKelyadi, Vitla Road; (viii) construction of two GLSRs - (a) 1,000 kl capacity at Seethigudda, and (b) 2,000 kl at Tenkila; (ix) Intermediate pumping station at Tenkila; (x) booster pumping station at Balnad Helipad; (xi) 29 bulk water meters; (xii) 142.66 km of distribution network to cover 24 x 7 water supply to Puttur city for 8 zones; and (xiii) Replacement of 8,441 existing meters and providing new house service connections of 4,500 for un-covered 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 Project Management Unit (PMU) established in its head office at Bangalore in coordination with its regional office (Regional Project Management Unit or 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 Puttur City Municipal Council (CMC). A project implementation unit (PIU) has been set up for implementation of day-to-day activities in the field. A consultant team, Project Management, Design, and Construction Supervision Consultant (PMDSCS), 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 mostly located in the Puttur urban area except the water intake on Kumaradhra River located at a distance of 12 km from the city. It is one of the major rivers in the Dakshina Kannada District and also a major tributary of the river Netravathi. The confluence points of the rivers Kumaradhara and Nethravathi is at Uppinangadi about 400 m downstream from the vented dam. A new vented dam was constructed under KUDCEMP with a storage capacity of 0.61 million cubic meter (MCM) and a storage spreading of 2,400 m upstream of the vented dam. The area surrounding the intake well is mostly under agriculture. The distance from the jack well to the WTP at Nekkilady is about 2 km with sparsely located houses. All the major components of the subproject sites are located in existing right of ways and government-owned land. There are no protected areas, wetlands, mangroves, or estuaries in or near the subproject location. There are no forest areas within or near Puttur. Traffic management will be necessary during pipe-laying on busy roads.

**Potential environmental impacts.** No significant impacts are anticipated whether due to the location or design of the subproject as the sites are selected and fixed with the consideration that components are not located in environmentally-sensitive areas. All the sites are located in government owned land parcels and all pipelines will be laid along the public roads within the right-of-way (ROW). The GLSR site at Tenkila is under the ownership of Karnataka Housing Board (KHB), a Government of Karnataka agency, which will be purchased from KHB on market rate. The subproject utilizes the existing water source, and the abstraction will remain within its existing design capacity, therefore, no source related impacts is envisaged.

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. These impacts during construction and operation can be mitigated through good and high-quality construction and operations 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.

**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-specific environmental management plan (SEMP), which covers: (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.

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 serve as a binding document 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 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.

Mitigation measures include the following: (i) implementation of a health and safety plan and regular orientation to workers; (ii) use of silencers to minimize noise levels from construction activities, and proper work scheduling during periods when it will least affect sensitive receptors; (iii) water spraying of surroundings to minimize dust; (iv) implementation of a traffic management plan in coordination with local traffic enforcers; (v) reuse of waste soils; and (vi) sewerage system improvement as part of KIUWMIP. Contractors will be providing planks to create access and 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. The views expressed were incorporated into the IEE and in the planning and development of the subproject. The IEE will be made available accessible 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 is proposed and described in the IEE to ensure any public grievances are addressed quickly.

**Permits and Clearances Required.** Environmental Clearance requirement per Government of India Environmental Impact Assessment Notification is not applicable to this subproject. No environment-related statutory clearance or permissions required. Pipeline construction works, in some sections, will require permission from national highway and railway authorities. GLSR site at Tenkila needs to be procured from KHB.

**Monitoring and Reporting.** The PMU, RPMU, PIU, and Consultants will be responsible for monitoring. PMDCSC 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.

**Conclusions and Recommendations.** The citizens of Puttur will be the major beneficiaries of this subproject. In addition to improved environmental conditions, the project will improve the overall health condition of the town. With the improved water supply, they will be provided with a constant supply of better quality water, piped into their homes. The replacement of old distribution lines shall avoid cross contamination and have positive benefit on health by avoiding diseases such as diarrhea and dysentery, resulting in less expenses on healthcare, improve working days and their economic status should also improve, as well as their overall health.

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 the respective urban local bodies (ULBs).

3. The expected outcome will be improved water resource planning, monitoring and service delivery in 24x7 water supply for Puttur City. Project 2 will have 3 outputs: (i) UWSS and sanitation infrastructure expanded and upgraded; (ii) water resource planning, monitoring and service delivery improved; and (iii) institutional capacity of KUIDFC and ULBs strengthened. The IEE is based on an assessment of these components within the project area.

4. **Subproject Scope.** This subproject includes the following components: (i) replacement of two old pumps with new vertical turbine pumps in Jackwell at Nekkilady; (ii) construction of 1.68 kilometer (km) of raw water pumping main (400 millimeter (mm) diameter) from Jackwell to water treatment plant (WTP) at Nekkilady; (iii) construction of 12.42 km clear water main of 400 mm diameter from the proposed new Water Treatment Plant (WTP) at Nekkilday to ground level service reservoir (GLSR) at Tenkila; (iv) construction of new WTP of capacity 8.7 million litres per day (MLD) at Nekkilady; (v) replacement of clear water pumps in existing WTP at Nekkilady; (vi) construction of 5.06 km of clear water feeder mains; (vii) construction of six new overhead tanks (OHTs) – (a) 300 kiloliters (kl) capacity in Zone-2 at Mura Shantinagra, Padnur, (b) 100 kl in Zone-3 at Karmala near Microwave station, (c) 600 kl in Zone-4A at Darbe; (d) 250 kl in zone-5 at Lingadagudda, Kabaka, (e) 200 kl in Zone-6A at Balnad Helipad, and (f) 100 kl zone-8 at BalnadKelyadi, Vitla Road; (viii) construction of two GLSRs - (a) 1,000 kl capacity at Seethigudda, and (b) 2,000 KL at Tenkila; (ix) Intermediate pumping station at Tenkila; (x) booster pumping station at Balnad Helipad, (xi) 29 bulk water meters; (xii) 142.66 km of distribution network to cover 24x7 water supply to Puttur city for 8 zones; and (xiii) Replacement of 8,441 existing meters and providing new house service connections of 4,500 for un-covered households.

### B. Background of 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.<sup>1</sup> Rapid environmental assessment

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<sup>1</sup> 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,

using ADB's rapid environmental assessment (REA) checklist for Water Supply Scheme components were conducted (Appendix 1), and results of the assessments show that Puttur 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 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 Initial Environmental Examination.** IEE is prepared based on detailed engineering design of the subproject. 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 component 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 and ADB SPS, 2009.<sup>2</sup> 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. Puttur is located in Dakshina Kannada District in Karnataka State of India. It is the headquarters of the Puttur Taluk. The City is 52 km from Mangalore and 330 km from Bangalore (Figure 1). The population of the city is 53,061 (Census 2011), the municipality spreads in an area of 36.11 square kilometer (km<sup>2</sup>) and is divided into 27 wards. Geographically, Puttur City is located at a latitude of 12°07'N and longitude of 75°02'E at an average altitude of 87 m above the mean sea level (MSL).

9. The municipal area comprises the surrounding villages Balnad, Padnoor, Kabaka, Bannur, Chikkamudnoor, Kemminje, Arypu and Kasaba. The town is situated in the Western Ghats of South India with a hilly and undulating topography. The northern parts of the city can be characterized as more flat and plain as the southern part. Agricultural activities are concentrated in the low-lying areas, whereas houses are scattered and placed up in the higher areas. The aerial view of the city centre of Puttur is shown below.

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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

<sup>2</sup> 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.

**Figure 1: Aerial View of Puttur**

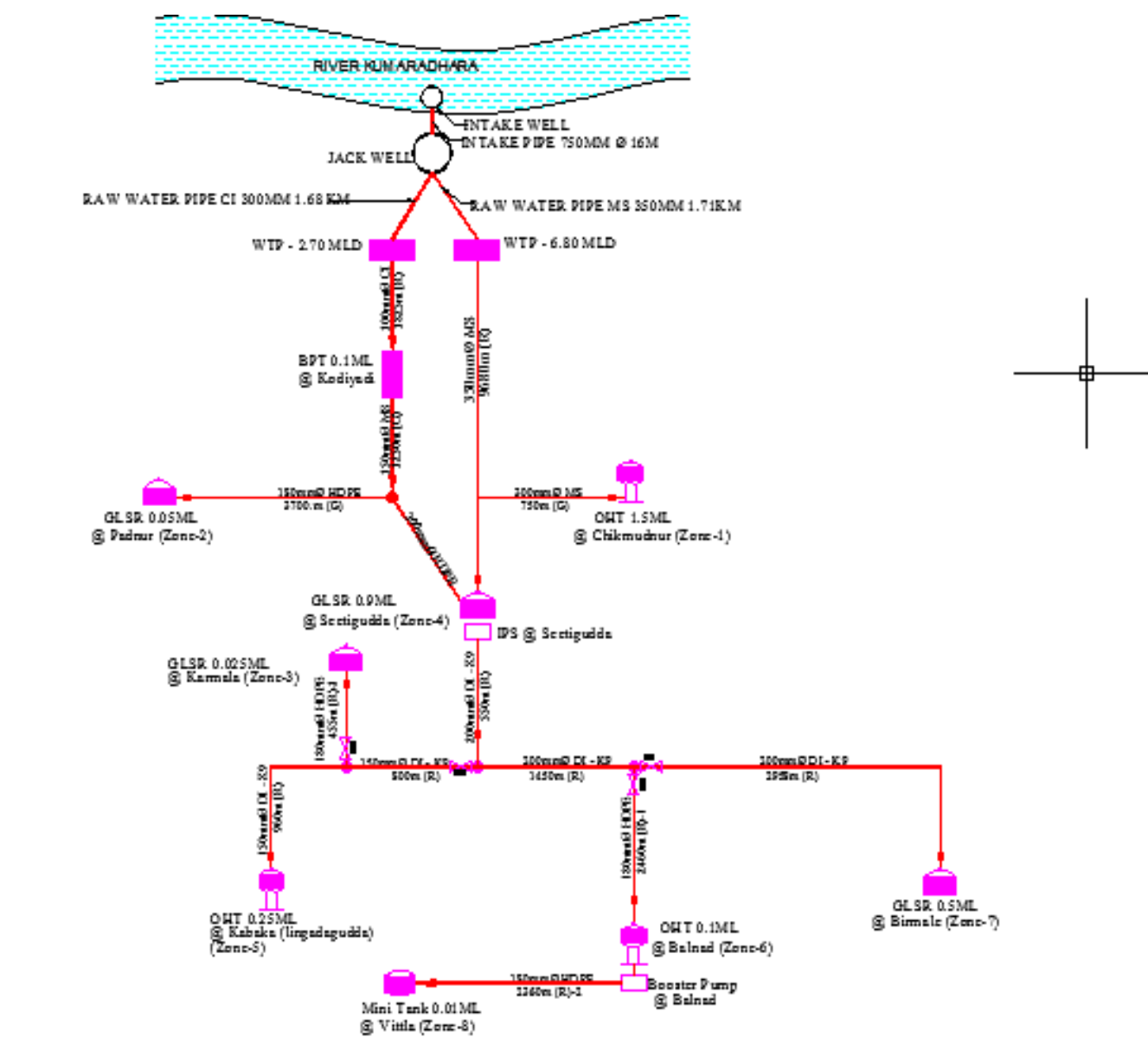


Source: Google Maps.

**A. Need for Infrastructure Improvement in Puttur**

10. At present, Puttur City meets its water supply requirement through surface source. River Kumaradhara is the main surface source of water supply to Puttur. A new vented dam was constructed under KUDCEMP with a storage capacity of 0.61 million cubic meter (MCM) and a storage spreading of 2,400 m upstream the vented dam. Existing water supply system is depicted in Figure 2. Existing vented dam is shown in Figure 3.

Figure 2: Existing Water Supply System in Puttur



**Figure 3: Existing Vented Dam at Nekkilady**



11. A reinforced cement concrete jack well (Figure 4) with a diameter of 8 meter (m) and a depth of 16.7 m was constructed on the Kumaradhara river bank. On top of the jack well, a pump house with a diameter of 10 m and a height of 5 m was built to accommodate the existing pumping system consisting of the motors of the vertical turbine pump sets, panel boards, control equipment, control valves and related piping valves. The Jack Well pumps 15.5 MLD out of the river.

**Figure 4: View of Kumaradhara River Intake**



12. The first pump set was installed in 1984-1985, during the construction of the jack well (Figure 5). During KUDCEMP, the water withdrawal was increased by installing a second pump set. The design life of the first pump set has already expired, while the design life of pump sets installed during KUDCEMP have expired in 2016.



**Figure 5: View of Existing Jack Well and Pump House**



13. The raw water transmission main, laid in 1984-85, transports water from the jack well to the WTP at Nekkilady on the left side of Uppinangadi Road. Diameter of the cast iron (CI) pipe is 300 millimeter (mm) and its length is 1.67 km. The transmission main has outlived its design period, therefore, leakages are imminent. Due to this, the transmission main stopped its operation. Under the KUDCEMP in 2006-2007, a new raw water transmission main from the jack well to the water treatment plant (WTP) was constructed to transport the ultimate water demand of 2026 amounting to 6.8 MLD for a 20-hour pumping time. The raw water transmission main is a MS pipe with a diameter of 350 mm. The main is placed on the right side of Uppinangadi road and is 1.71 km long. Although no flow meters were installed to measure the conveyed and actual consumed water, visual inspections confirmed that the transmission main is in good condition. The existing raw water transmission main is sufficient to meet the demand in 2046.

14. The old WTP that was constructed in 1984-1985 (Figure 6) and designed to treat 2.7 MLD was increased to meet the demand of 3.2 MLD in 2026. This WTP is currently not in a good condition and is not operating.

**Figure 6: View of Old Water Treatment Plant**



15. A WTP was build up during the KUDCEMP adjacent to the existing WTP with tube settlers and treats 6.8 MLD. Presently, the WTP is working satisfactorily. The existing WTP at Nekkilady cannot meet the intermittent demand of 13.5 MLD and also the ultimate demand of 15.5 MLD. Water quality test for drinking water, using Central Public Health and Environmental Engineering Organization (CPHEEO) standards, have been conducted. Two water samples have been extracted at the vented dam before treatment and from the effluent of the Water Treatment Plant.



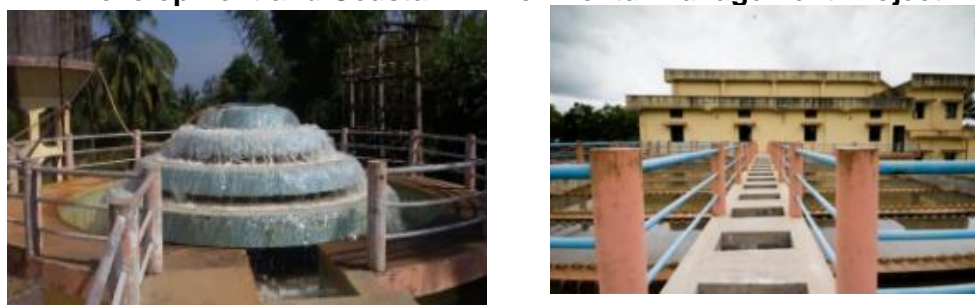
The water quality tests were executed by the National Institute of Technology Karnataka, Surathkal in the Department of Civil Engineering on 19 June 2015.

**Table 1: Water Quality of Kumaradhara River at Intake**

Test Parameters	Unit	Sample Extracted from the Vented Dam	Sample after Water Treatment Plan	Acceptable Upper Limit for Drinking (IS10500-1992)
pH	-	6.88	6.80	6.50-8.50
Total Hardness as CaCO <sub>3</sub>	mg/l	16.00	18.00	300.00
Iron Content, as Fe	mg/l	0.33	0.10	0.30
Chloride, as Cl <sup>-</sup>	mg/l	5.50	6.00	250.00
Nitrate, as NO <sub>3</sub>	mg/l	Not detectable	Not detectable	45.00
Sulfate, as SO <sub>4</sub>	mg/l	Not detectable	Not detectable	200.00
Feacal Coliform	MPN Index /100 ml	32	0	0

16. The clear water pumping station transports the treated water from the WTP to the service reservoirs. The first pumping station was implemented in 1984-1985 on the premises of the WTP and consists of a horizontal split case pump set with two motors (55 kilo watt (kW); one working and one standby) pumping 162 cubic meter per hour (m<sup>3</sup>/h) with a total head of 76 m. In 2006-2007 during the KUDCEMP, the pumping station was uplifted to 289 m<sup>3</sup>/h with 77 m head duty condition by providing one more pump set. Two motors with a power of 90 kW were installed (one working and one standby). The pumps are in good condition due to regular annual municipal maintenance. Studies done on actual discharge from the pumping stations have indicated that the installed pumps are designed to run optimally until 2016. After the replacement in 2016, the next life design cycle will expire in 2031. The clear water pumps do not meet the intermediate water demand in 2031 as they were designed only until 2016 under KUDCEMP.

**Figure 7: View of Water Treatment Plant Constructed under Karnataka Urban Development and Coastal Environmental Management Project**



17. The first clear water transmission main (CWTM) was built in 1984-1985. The clear water was pumped starting from the clear water sump at the water treatment plant to a break pressure tank (BPT) at Kodiyadi with a capacity of 100 kiloliter (kl) in a CI rising main with a diameter of 300 mm and a length of 3,825 m. The clear water is further conveyed from the BPT at Kodiyadi to the GLSR at Seetigudda by a gravity main (total length 5,660 m). After the BPT at Kodiyadi, a gravity main (diameter 180 mm, length 3,700 m) is detoured to convey the water to the GLSR at Padnur in zone 2. The clear water transmission main system was overhauled during the KUDCEMP. A new MS rising main was constructed from the WTP (capacity 6.8 MLD) to the existing ground level service reservoir (GLSR) at Seetigudda. The new rising main has a diameter of 350 mm and a length of 9,680 m. Between the WTP and the GLSR at Seetigudda, another MS pumping main (diameter 300 mm, length 750 m) is detoured to convey the water to the overhead

tank (OHT) at Chikmudnur in zone 1. An intermediate pumping station conveys the water to the reservoirs in zone 3, 5, 6 and 7, because of the higher elevation of the zones to the GLSR at Seetigudda. Only zone 4, which is also the central business district of the town, is directly served by the GLSR at Seetigudda. Zone 8 shows elevations above 234.5 MSL and a scattered population within the zone. Due to this situation, an additional water tank was constructed, which is fed by the OHT at Balnad through an High Density Poly Ethylene (HDPE) pipe (diameter 180 mm, length 2,360 m) with the help of booster pumps. However, the capacity is not sufficient to meet the demand in 2046. The CWTM serving the OHT and GLSRs in zone 1, 2, 3, 4, 5, 6, 7 and 8 are sufficient to convey the water demand by 2046. The CWTM transporting the water from the WTP to the Service Reservoir at Seetigudda is sufficient enough to convey the demand of 2046. Due to highly elevated areas with altitudes as much as +234.65 m above MSL and a scattered population in zone 8, a proposed OHT at Vittla will be served by a rising main coming from the booster pumping station after the proposed OHT at Balnad Helipad. The existing rising main (diameter 180 mm) will be extended to 2,939 m.

18. **Zoning of the Service Area.** The water distribution system of Puttur is divided in eight zones where water is provided for 20 hours. The existing zoning of the water supply system put up under KUDCEMP is not sufficient to meet water demands by 2046. Due to low pressure, some houses at higher altitudes in zone 4 and 6 cannot be supplied in 2046.

19. A detailed assessment of existing situation was carried out, which concludes that the present water production of 6.8 MLD, is insufficient to meet the water demand of Puttur until 2046 per national standards. Besides Puttur, this sub project investment would also need to provide water supply covering four en-route villages located between the WTP and town. The average household size of the town is 4.38, based on ULB data. The present inadequacy in the water supply system, is due to (i) increased water demand; (ii) old and leaking transmission main system, along with weak management system; and (iii) inadequate water treatment facility.

## **B. Description of the Subproject**

20. Following Table 2 shows the various components of this subproject based on the detailed engineering design of the subproject. Subproject sites, layout plans and alignments are shown in Figure 8 to Figure 15.

**Table 2: Proposed Water Supply Subproject Components in Puttur**

<b>Infrastructure</b>	<b>Function</b>	<b>Description</b>	<b>Location</b>
Raw water pumps in existing Jack well	Pumping of Raw water from Jack well	-Replacement of two old pumps with new vertical turbine pumps of capacity 335 m <sup>3</sup> /h, 75 m head (1+1)	Jack well site at Nekkilady
	Standby power supply arrangement for pumping	Procurement of diesel generator of 500 kilovolt-ampere -(kVA)	Jack well site at Nekkilady
Raw water Transmission Main	Conveys raw water to WTP by pumping	1.68 km length 400 mm diameter DI pipe	Pipe will be laid underground from Nekkilady to WTP all along the existing road
Water Treatment Plant	Treats raw water to meet drinking water standards	New 8.7 MLD capacity WTP based on conventional treatment process. The components Include Cascade Aerator Parshall flume Flash mixer Flocculators – 2 units Tube settlers – 2 units Rapid sand filters - 4 beds Chlorination system with safety measures Lime and alum mixing Tanks Clear water sump and pump house Backwash water recirculation and sludge management system (sludge collection, drying beds) – a combined system of adequate capacity for backwash and sludge management will be developed to cater to both new and existing WTPs. This component addresses the issues of concern identified in the environmental audit of existing WTP (Ref Corrective Action Plan, Table 8)	Nekkilady  Adjacent to the existing WTP; sufficient land available within the existing WTP campus to accommodate the new WTP
Clear water Pumps in existing WTP	Pumps clear water to Service reservoirs	Replacement of old pumps within new pumps: 2 pump sets of capacity 325 m <sup>3</sup> /hour and 84 m head (1+1)	Pumps will be installed in the existing clear water pumping station at WTP, Nekkilady
Clear Water Transmission Main	Pumping of clear water from WTP (water treatment plant) to service reservoirs	12.42 km length 400 mm diameter DI pipe	Pipe will be laid underground from Nekkilady to Tenkila GLSR along the public roads within the road right of way
Clear water feeder main	Pumping of clear water from MBR to Service Reservoirs	5.06 km length 180 – 300 mm diameter DI /HDPE) pipes DI pipe of 300 mm diameter – 1.134 km DI Pipe of 200 mm diameter – 2.422 km	Laying of pipes underground along public roads within the ULB area

Infrastructure	Function	Description	Location
		DI Pipe of 150 mm diameter – 0.591 km HDPE pipe of 180 mm – 0.918 km	
Water service reservoirs	Water storage for supply	<p>Six OHTs and two GLSRs of RCC including compound walls at the selected sites:</p> <p><b>OHT</b>  300KL for Zone-2 at Mura Shantinagra, Padnur  100KL for Zone-3 at Karmala near Microwave station  600KL for Zone-4A at CTO, Darbe  250KL for Zone-5 at Lingadagudda, Kabaka  200KL for Zone-6A at Balnad Helipad  100KL for zone-8 at, Balnad Kelyadi, Vitla Road</p> <p><b>GLSR</b>  1,000KL in Zone-4 at Seethigudda  2,000 KL GLSR at Tenkila</p>	<p>Vacant site owned by CMC  Vacant site owned by CMC  Vacant site owned by CMC  Vacant site owned by CMC  Vacant site owned by CMC  Vacant site owned by CMC</p> <p>Vacant site owned by CMC  Proposed GLSR site in Tenkila is owned by Karnataka Housing Board, Government of Karnataka, and it will be purchased through negotiated settlement</p>
Intermediate Pumping Stations (IPS)	To provide adequate pressure in the system for supply	<p>Intermediate pumping station at Tenkila  Pump capacities:  65m<sup>3</sup>/h and 85 m head for zone 3 and 5 (1+1)  82 m<sup>3</sup>/h and 33 m head for zone 4A, (1+1)  119 m<sup>3</sup>/h and 100 m head for zone 6, 6A and 7, (1+1)</p> <p>Booster pumping station at Balnad  Pump capacity 11 m<sup>3</sup>/h and 80 m head (1+1)</p>	<p>Pumping station will be located within Tenkila GLSR site</p> <p>Pumping station will be located within the site identified for Zone 6A OHT at Balnad Helipad</p>
Distribution system	Supply of water from service reservoirs to consumers	<p>142.66 km of pipe lines of diameter 75 mm to 280 mm (HDPE / DI pipes)</p> <p>75 mm – 106.139 km  90 mm – 1.853 km  110 mm – 21.744 km  150 mm (DI) - 2.784 km  160 mm – 2.889 km  200 mm – 1.403 km  250 mm – 0.362 km</p>	<p>In 8 zones within the city limits  Pipes will be laid underground along the roads within the ROW</p>

Infrastructure	Function	Description	Location
		250 mm (DI)- 4.916 km 280 mm – 0.570 km	
Bulk Water Meters	To record data of volume of flow to each Distribution System zones at desired time interval.	29 no.	Bulk meters will be fixed at strategic locations in the pipe line at Jack well point, WTP and service reservoir points
House Service Connections (HSC)	For each house connection will be provided with meters to supply water and record volume of water. W	4,500 new HSC connections  8,441 replacement of existing domestic water meters	In 8 zones for all the houses within the city limits

CMC = City Municipal Council, m<sup>3</sup>/h = cubic meter per hour, DI = ductile iron, GLSR = ground level service reservoir, HDPE = high density polyethylene, HSC = House Service Connections, IPS = Intermediate Pumping Stations, km = kilometer, m = meter, mm = millimeter, MLD = million liters per day, OHT = overhead tank, RCC = reinforced cement concrete, ROW = right-of-way, ULB = urban local body, WTP = water treatment plant.

**Figure 8: Puttur Water Supply Zone Map**



**Figure 9: Layout Plan of Head Works**

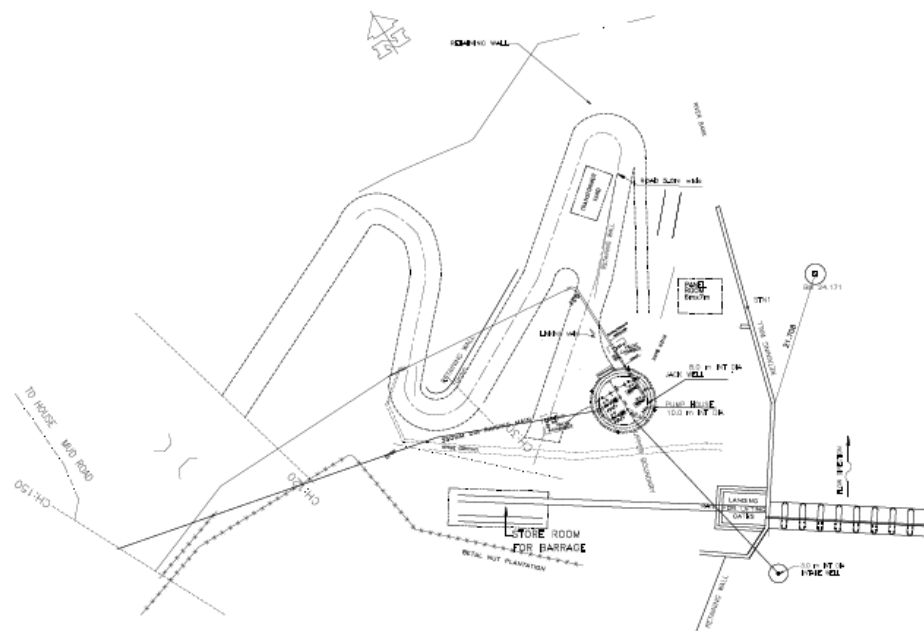


Figure 10: Proposed WTP Layout Plan

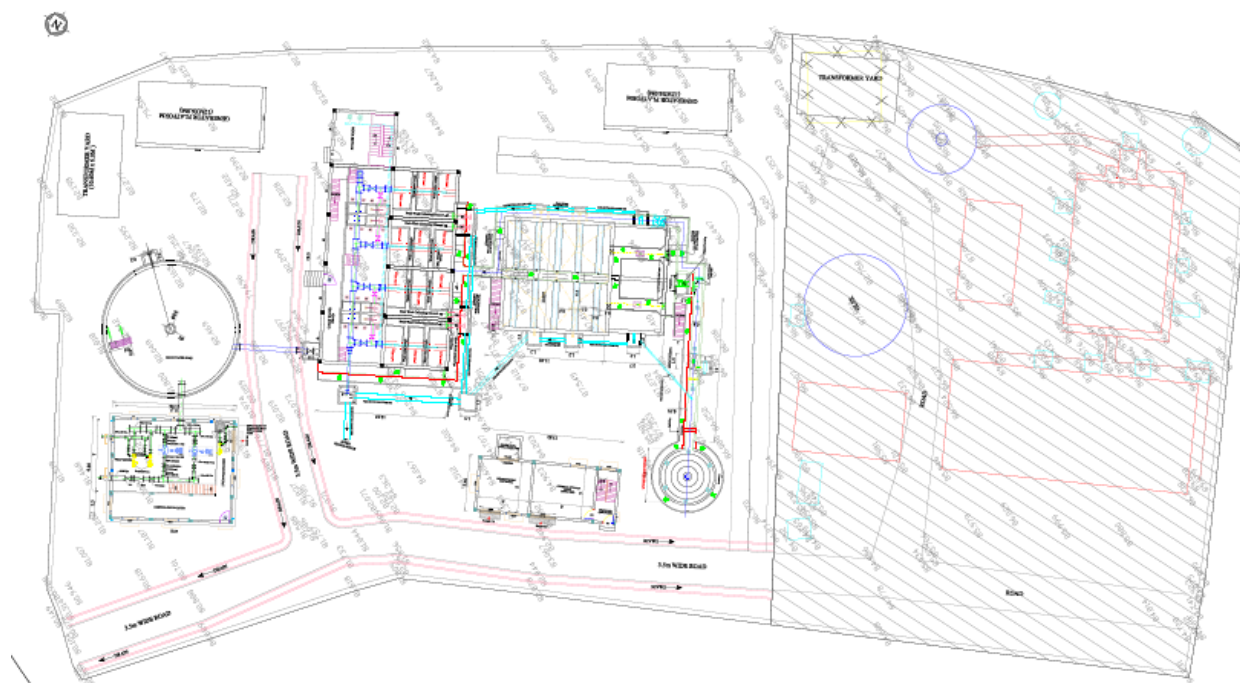
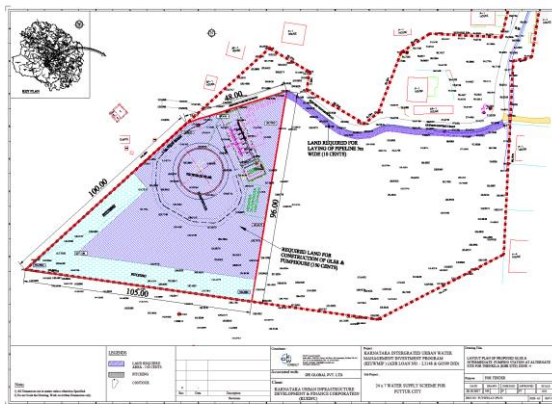


Table 3:

	WTP Location	Capacity (MLD)	Treatment Process	Preliminary Design Stage? (Y/N)	Distance of WTP to nearest receptors in meters	Receiving Water of WTP Discharge	Uses of the receiving water (swimming, boating, fishing, irrigation, others [please specify])
1	Nekkilady , Puttur	8.7	Cascade aerator, Parshall flume, Flash Mixer , Flocculator, Tube settler, Filterhouse, Chlorination,	DPR Approved	85	Not applicable - It is proposed to recirculate backwash and other wastewater in WTP, there is no discharge from WTP	Not applicable



**Figure 11: Proposed Layout of GLSR and IPS at Tenkila**





**Figure 12: Existing and Proposed Clear Water Transmission Lines**

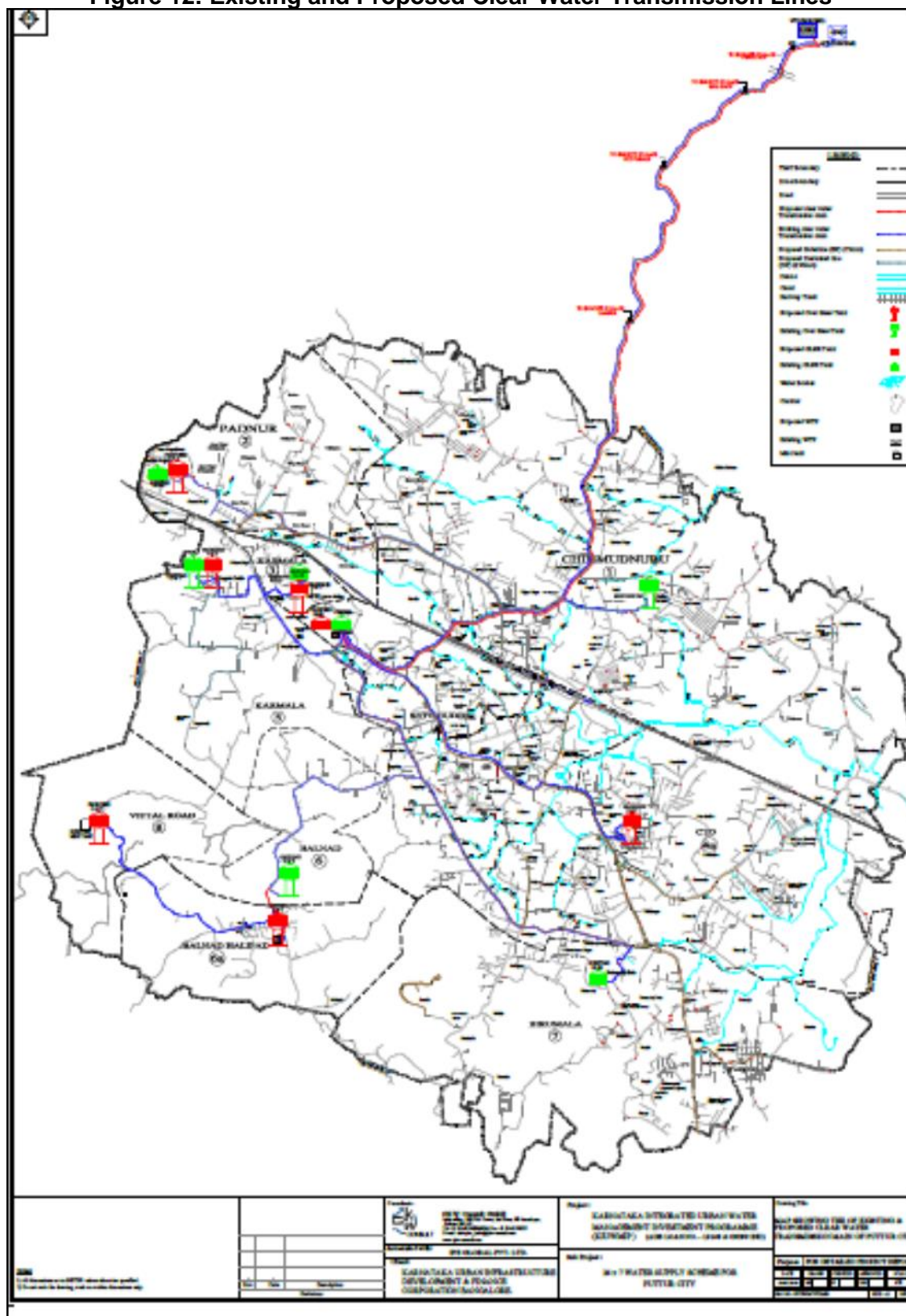
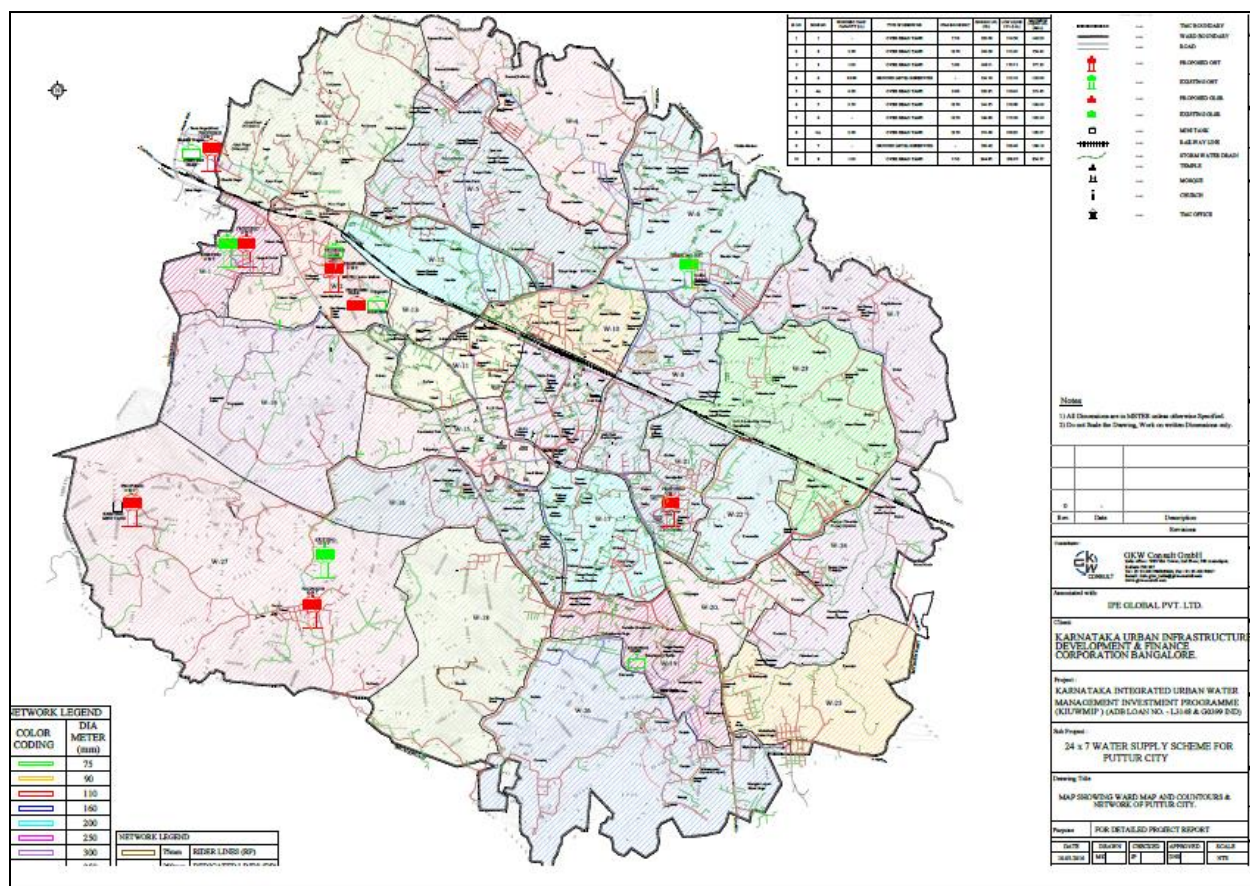
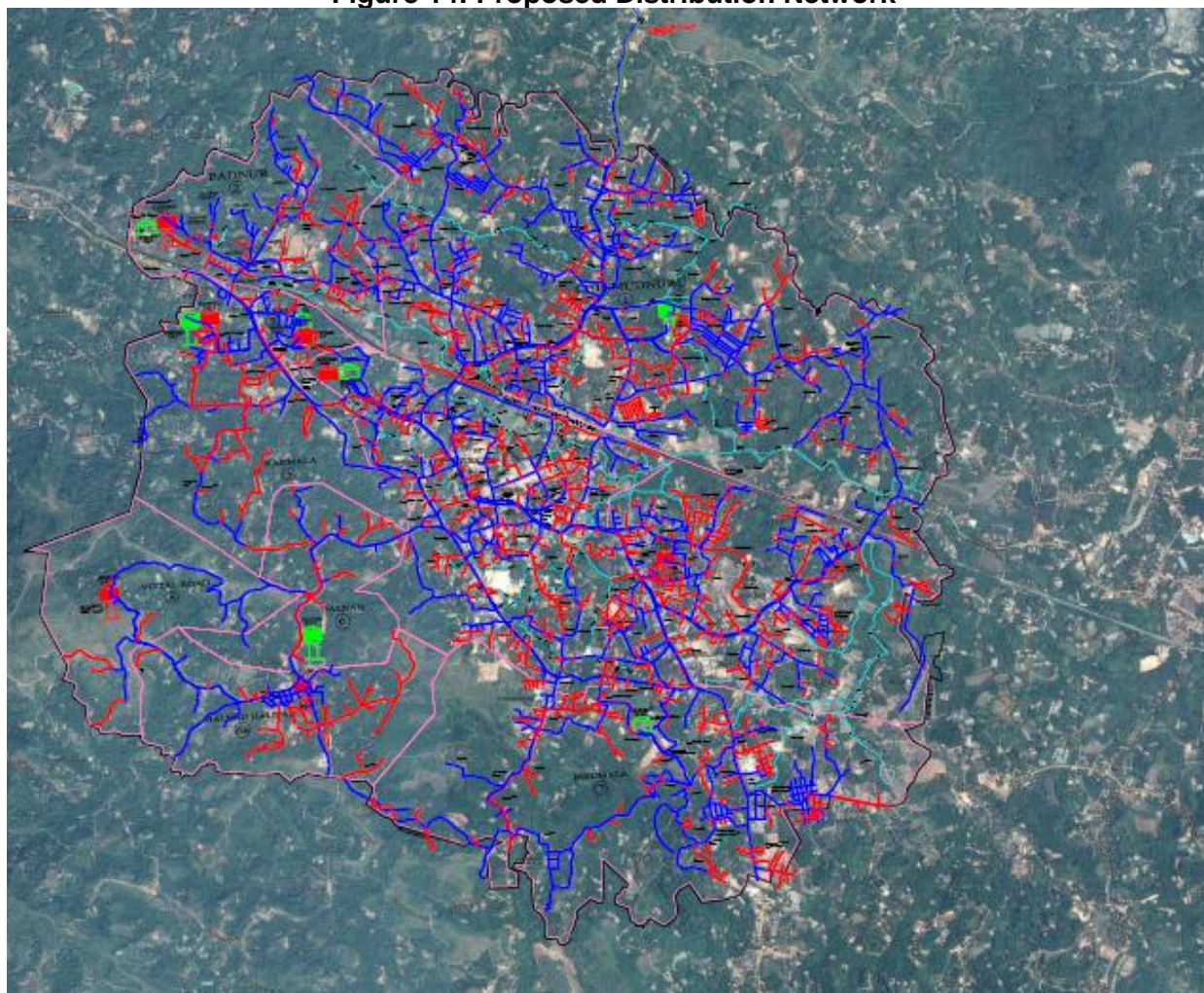


Figure 13: Proposed Water Supply Distribution System





**Figure 14: Proposed Distribution Network**



Source: Google Earth.

### **C. Implementation Schedule**

21. Project implementation schedule is given below. Construction work is likely to start in March-April 2018 and will be completed by March-April 2020.

Completion of Detailed Project Report	October 2017
Tender issue	December 2017
Contract Award	March 2018
Construction Period	24 Months
Operation and Maintenance	8 years (96 months) after construction period

## **III. POLICY AND LEGAL FRAMEWORK**

### **A. ADB Safeguard Policy Statement, 2009**

22. ADB's Safeguard Policy Statement, 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.

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

- (i) Category A: 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

24. The ADB Rapid Environmental Assessment Checklist (<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.

25. ADB has classified this subproject as Category B and following procedure for multitranchise 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.

26. **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.

27. **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 Project Management Unit (PMU) during project implementation upon receipt.

28. 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](http://www.ifc.org/ifcext/enviro.nsf/Content/Environmental%20guidelines)) 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>)

29. 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
- (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.

30. 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 4, 5 and 6 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**

31. The Government of India 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.

32. Category A projects require environmental clearance from the central Ministry of Environment, Forest 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 MOEFCC prepares comprehensive terms of reference (TOR) for the EIA study. On completion of the study and review of the report by the EAC, MOEFCC considers the recommendation of the EAC and provides the environmental clearance if appropriate.

33. 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.

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

35. **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 are listed in Appendix 2. Table 4 below presents a summary of environmental regulations and mandatory requirements applicable to the subproject.

**Table 4: Applicable Environmental Regulations**

Law	Description	Requirement
EIA Notification	The EIA Notification of 2006 and 2009 (replacing the EIA Notification of 1994), set 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 require 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	None of the components in this sub project requires CFE or CFO under this act.

Law	Description	Requirement
	(KSPCB) before starting implementation and Consent for Operation (CFO) before 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. Procure diesel generators (500 KVA) only from approved manufacturers/ suppliers the manufacturer/ supplier shall be registered with the Central Pollution Control Board (CPCB) and shall have valid certificates for "Type Approval" and "Conformity of Production"	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. Contractor shall procure the same. All relevant forms, prescribed fees and procedures to obtain the CFE and CFO can be found in the KSPCB website ( <a href="http://www.kspcb.gov.in">www.kspcb.gov.in</a> ).  Standards for diesel generator sets are provided in Appendix 3
Environment (Protection) Act, 1986 and CPCB Environmental Standards.	Emissions and discharges from the facilities to be created or refurbished or augmented shall comply with the notified standards notified.	Appendix 4 provides applicable standards for ambient air quality and noise.  Appendix 5 provides standards for discharge of effluents  Appendix 4 and 5 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 4 provides applicable noise standard.
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 Archaeological Survey of India (ASI). "Protected property" includes the site, remains, and monuments protected by ASI or the State Department of Archaeology and "construction" means construction of any structure or building.	There are no protected monuments near project area in Puttur. However, 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 Puttur City 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 Puttur City Water Supply Scheme as no wetlands presents in the project 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 Puttur City Water Supply Scheme as none of the project component will have any impact on wildlife or protected areas.
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 Puttur City Water Supply Scheme as there is no forest area within or adjacent to the project area.
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 6 provides drinking water standards  <a href="http://cgwb.gov.in/documents/wq-standards.pdf">http://cgwb.gov.in/documents/wq-standards.pdf</a>
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 Puttur City Water Supply Scheme as there is no forest area within or adjacent to the project area.
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 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.	No Tree cutting envisaged as per the present design. Compensatory plantation as stipulated in the tree cutting permission shall be adhered to if any tree cutting required.



## IV. DESCRIPTION OF THE ENVIRONMENT

### A. Environmental Profile of Puttur

#### 1. Location

36. Puttur is located in Dakshina Kannada District. Geographically, Puttur City is located at a latitude of 12°77' N and longitude of 75°22'E. Puttur has the status of City Municipal Council (CMC). The town is divided into 27 wards and spreading to an area of 36.11 km<sup>2</sup>.

#### 2. Topography, Soil and Geology

37. The town is situated in the Western Ghats of South India with a hilly and undulating topography. The northern parts of the city can be characterized as flat and plain as the southern part. Agricultural activities are concentrated in the low-lying areas, whereas houses are scattered and placed up in the higher areas

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) and plantation crops, viz. crops like 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.

39. They have good infiltration capacity and are well-suited for agriculture due to their fertility. The average Ground Level is 87 m above MSL. As per the seismic zoning map of India, Puttur City falls under the zone III, which is the moderate earth quake risk zone in India.

#### 3. Climate

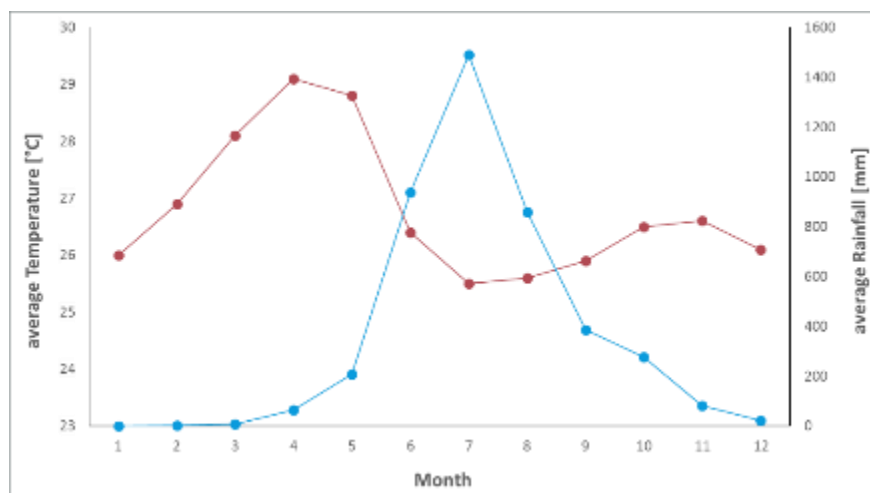
40. The yearly mean temperature is 26.8°C and the total yearly rainfall is 4,329 mm (Climate data.org, 2015) and is comprised in the Table 5 below; The rainfall occurs in monsoon seasons from June to September.

**Table 5: Climate Data of Puttur**

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Average high °C	31.3	31.8	32.7	33.1	32.4	29.3	28.0	28.2	28.8	29.9	30.8	31.2	30.63
Daily mean °C	26	26.9	28.1	29.1	28.8	26.4	25.5	25.6	25.9	26.5	26.6	26.1	26.79
Average low °C	20.8	22.0	23.6	25.2	25.2	23.5	23.0	23.1	23.0	23.2	22.4	21.0	23
Average rainfall mm	0	1	6	63	208	938	1,489	858	386	277	81	22	4,329

°C = degree Celsius, mm = milliliter.

Source: Climate-Data.org. Climate Table of Puttur, Karnataka, India. <https://en.climate-data.org/location/24087/>.

**Figure 15: Average Temperature und Rainfall in Puttur**

Source: Climate-Data.org, 2015.

#### 4. Air Quality

41. The quality of ambient air is assessed based on the distribution of particulate matters, PM 10 and PM 2.5 values in the area per the prevailing statutory stipulations. The baseline PM 10 and PM 2.5 values studied for the region around the river sand blocks range from 41 to 69 and 15 to 37  $\mu\text{g}/\text{m}^3$ , respectively (for a 24-hour period) as against the National Ambient Air Quality Standard (NAAQS) of 100 and 60  $\mu\text{g}/\text{m}^3$ , respectively. The atmospheric  $\text{NO}_2$  and  $\text{SO}_2$  parameters measured in the region range from 17 to 20 and 11 to 14  $\mu\text{g}/\text{m}^3$ , respectively as against the NAAQS standard desirable limits of 80  $\mu\text{g}/\text{m}^3$  each. Other harmful parameters such as Carbon Monoxide (CO), Ozone ( $\text{O}_3$ ), Ammonia ( $\text{NH}_3$ ), Lead (Pb), Nickel (Ni),  $\text{C}_6\text{H}_6$ , Arsenic (As), etc. were found to be below detection level.<sup>3</sup>

#### 5. Ambient Noise Level

42. The average level of Noise measured in river sand block region ranges from 60 to 72 dB during daytime and is well within the noise standards stipulated by Karnataka State Pollution Control Board (footnote 3).

#### 6. Surface Water

43. The water quality for Kumaradhaara River were analyzed and tests were conducted by the National Institute of Technology Karnataka, Surathkal in the Department of Civil Engineering on 19 June 2015 (Appendix 7). As presented in Table 6, all the tested parameters within the stipulated standards.

**Table 6: Surface Water Quality of Kumaradhara Source for Puttur**

Test parameters	Unit	Sample Extracted from the Vented Dam	Acceptable Upper Limit for Drinking (IS10500-1992)
pH	-	6.88	6.50-8.50
Total Hardness as $\text{CaCO}_3$	mg/l	16.00	300.00

<sup>3</sup> Source: Proceedings of the Dakshina Kannada District Sand Monitoring Committee, Mangaluru, Dated 26 August 2014 and 28 August 2014.

Test parameters	Unit	Sample Extracted from the Vented Dam	Acceptable Upper Limit for Drinking (IS10500-1992)
Iron Content, as Fe	mg/l	0.33	0.30
Chloride, as Cl <sup>-</sup>	mg/l	5.50	250.00
Nitrate, as NO <sub>3</sub>	mg/l	Not detectable	45.00
Sulfate, as SO <sub>4</sub>	mg/l	Not detectable	200.00
Total Coliforms most probable number	MPN Index /100 ml	32	0

Cl = Chloride, Fe = Iron, mg/l = milligrams per liter, ml = milliliter, MPN = most probable number, pH = potential of Hydrogen.

44. The pH values in the surface water samples collected from the Netravati River ranges from 6.86 to 7.28. The Total Dissolved Solids (TDS) in the same samples range from 138 to 145. The river water is characterized by low heavy metal content which is below detection limits in the water analyses. The pH values in the ground water samples collected from the region ranges from 6.4 to 7.4. The TDS in the groundwater samples from the region were found to be 64 to 95 ppm. The distribution of Cation and Anion contents in the water samples are within permissible range. There are no unusual or harmful elements detected in the water samples (footnote 5). Seasonal and perennial springs are located in the foothills of hillocks and forests in the district. 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. The rock formations exposed in and around the spring aregneisses traversed by veins of quartz and pegmatite on the southern banks of Badantadkariver. The temperature of water varied from 35°C to 38°C. In the centre of the spring the temperature varies from 37°C to 38°C. The chemical analysis data of spring water shows TDS of 424 ppm, SiO<sub>2</sub>, 80.0 ppm, Cl 60 ppm, HCO<sub>3</sub> 196 ppm, Mg 21 ppm, SO<sub>4</sub> 61 ppm, CaCO<sub>3</sub> 121 ppm, Na 81 ppm, K 7.0 ppm and pH 8.2. (Source: Ground Water Information Booklet for Dakshina Kannada district, Central Ground Water Board South West Region 2012).

## 7. Groundwater

45. The average groundwater development of the district is 66%. The resource estimation reveals that the extent of development is 85% in Puttur taluk. Net ground water availability for future irrigation development as of March 2009 in Puttur taluk is 846 hectare-metre (ha-m) and Sulyataluk is 1970 ha-m. The Categorization is based on stage of groundwater development as well as long-term trend of ground water level indicates that 20% of the area of Puttur taluks are over exploited. Major parts of Puttur (70%) are in 'safe' category. In these areas groundwater development is on a low-key and hence enough scope exists further groundwater development. Groundwater quality in the district is generally good and potable. The specific conductivity of ground water in the district varies from 70-140 micromhos/cm at 25oC. The contamination of groundwater from fertilizers is observed in Puttur. (Source: Ground Water Information Booklet for Dakshina Kannada district, Central Ground Water Board South West Region 2012).

## B. Ecological Resources

46. The subproject components are mostly located in Puttur urban area except the jack well at the water intake on Kumaradhra River, which is outside at a distance of 12 km from the city. There are no protected areas, wetlands, mangroves, or estuaries in or near the subproject location. There are no forest areas within or near Puttur. No new works are proposed in the river. New pumps will be installed in the existing pump house at intake. The area surrounding the intake well is mostly used for irrigation. All the pipelines will be laid along the public roads with in the roads right of way. All these roads, except the raw water alignment from intake to WTP, are

located within the urban area of Puttur town. There are no forests or any eco sensitive areas in the pipeline alignment. No tree cutting is envisaged. Reservoir (OHTs and GLSR) sites are located within the urban area of Puttur town. There are trees of local species in some of the reservoir sites, however, these will be accommodated in the layout plan design, and tree cutting will be avoided as far as possible.

## C. Economic Development

### 1. Industry and Agriculture

47. Puttur is the second largest town in Dakshina Kannada district, which is a largest market for arecanut in Karnataka. Puttur is an agro based town of the Coastal region surrounded by several hillocks with lush green forest situated in the belt of Western ghat which gets heavy rainfall. The Major occupation of the people is agriculture. The crops grown mainly are paddy, areca, coconut, cashew, rubber, cocoa bean, chilli, vanilla, pepper and plantains. In addition, dairy farming, sericulture and horticulture activities supplement the earnings of the people to some extent.

### 2. Transportation

48. Puttur is situated on the Mangalore-Mysore state highway and is 52 km from Mangalore. It is also connected to the national highway NH-48(Mangalore-Bangalore) through Uppinangadi which is 12 km from the city. Puttur railway station falls on the railway line linking Mangalore and Bangalore. It is around 1 km from the town center. The nearest airport is Mangalore International Airport which is around 55 km from Puttur.

## D. Socio Cultural Resources

### 1. Demography

49. Puttur population has grown from 48070 in 2001 to 53,061 in 2011 with a growth rate of 1.04 %. The decadal growth was never steady during the past six decades. The lowest growth rate of 1.04% was observed during 2001- 2011 and the highest was recorded in the decade 1971-1981 with a figure of 7.85 percent. Details of decadal population growth are indicated in Table 7.

**Table 7: Population Growth of Puttur Town**

Year	1961	1971	1981	1991	2001	2011
<b>Population</b>	12,498	17,483	20,103	35,879	48,070	53,061
<b>Population growth rate (%)</b>		3.99	1.50	7.85	3.40	1.04
<b>Population density</b> (population/km <sup>2</sup> )	387.8	542.4	623.7	1,113.2	1,491.5	1646.3

50. The population density of Puttur City was 388 persons/km<sup>2</sup> in the year 1961 and has increased to 1646 persons/km<sup>2</sup> in 2011.

51. **Sex Ratio.** Population of children with age of 0-6 is 5,049 which is 9.52 % of total population of Puttur. Sex Ratio is of 1010 against state average of 973. Child sex ratio is 929 compared to Karnataka state average of 948.

52. **Literacy.** Literacy rate of Puttur is 92.35 percent higher than state average of 75.36 percent. Male literacy is 95.94% while female literacy rate is 88.83.

## 2. History, Culture and Tourism

53. Puttur derived its name from "Puttha" in Tulu, meaning snake nests (ant hills/ mounds inhabited by snakes). Puttur got its name after pearl "Mutthu" in Kannada, Place of pearl "Mutthur" slowly renamed itself to Puttur. The famous myth from centuries ago say that due to the drought, priests were performing rituals with rice as prasad in the Holy pond of Mahalingeshwara temple when, suddenly, the water started coming from all the corners to turn rice into pearls. Majority of the people speak Tulu language, along with other languages like Kannada Havayaka, Konkani, Byari, Kodava, Puttur Malayalam, etc.

54. There is an ancient temple said to be built in 11-12th century where Lord Shiva (popularly known as Puttur Mahalingeshwara) was the main deity. It is said that about 300 years ago, Tippu Sultan, the ruler of Mysore who was fighting against the British, took possession of part of Puttur. A mosque (Juma Masjid Kallega) was built in Puttur at Kalle near Puttur. Later the Kalle was called as Kallega by the local people. This is the oldest mosque of town.<sup>123</sup> Bendru Theertha (Hot Spring): About 15 km from Puttur there is a natural hot water spring (in Tulu language known as Bendru Theertha). It is believed by the local people that the water is said to be more auspicious and a dip in the lake drives away all skin diseases like eczema, allergic rashes and many more ailments. It is situated in a scenic spot by the side of river Seerehole which flows west ward and merges with Arabian Sea. It is the only hot water spring in South India. Beeramale Hill: Beeramale Hill is an attractive tourism spot of Puttur. The height of the Hill is around 1,000 feet from the Sea Level. Sri Vishwakarma Temple is situated on one side of this hill.

55. Shivaram Karanth Balavana is a prominent place in Puttur. K. Shivaram Karanth, Jnanpith Award recipient stayed here for about 40 years. Karanth made most of his literary contributions and cultural endeavours at Balavana. He was a literary giant and most of this literary contribution was published here. Those books earned great name and fame for himself and Puttur. Now Balavana is taken over by the Government of Karnataka and a government appointed committee manages this property. The Balavana is situated about 2 km from Puttur in Parladka.

56. 'Shri Gopalakrishna temple,' situated in Shibara, was built around 300 years ago. Mai De Deus Church is an ancient churches built in 1830 by the Roman Catholic missionaries from Goain Gothic style. This holy church is renovated with elegant architectural beauty. Maril church: A church built in 1999. Peer Mohalla Juma Masjid, Koornadka: Koornadka is very historical place in Puttur at the period of Tippu Sulthan some soldier families settled at this place and they name this place as koor because they are originated from koor which is in Afaganistan(Abu Khan, Sayyed, Sheik Saheb, Patni Wala, Moideen Patan, KoorgSahebfamilies).





57. However, there are no protected (nationally important) monuments or archaeological or historical places in Puttur.




### E. Environmental Settings of Subproject Component Sites

58. There are no environmentally-sensitive feature and no significant physical and cultural resources within or adjacent to the subproject sites. All the subproject 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. GLSR site at Tenkila is owned by a government agency KHB; this is a vacant site and will be purchased from KHB on market rates.





Some sites are covered with shrubs and bushes, and there are small in some reservoir sites. There are no trees in the proposed pipeline alignment along the roads. Photographs of proposed OHT sites are provided in Table 8.




**Table 8: Site Environmental Features**

Subproject Component	Proposed Site Setting	Site Photograph
Up gradation of electro-mechanical equipment' in Jack well at Nekkilady	<p>Works will be conducted within the existing jackwell</p> <p>Diesel generator set has been proposed for the un-interrupted power supply to the Jack well. Diesel generator will be installed within the jackwell compound.</p>	
Laying of raw water transmission of main for 1.68 kilometer (km) from Nekkilady jack well to water treatment plant (WTP) with 400 mm diameter pipe	<p>Pipeline will be laid along the existing roads within the road right-of-way (ROW). Road width in initial stretch (Nekkiladi Dam Road) is about 5.5 m, and in the rest of the alignment it varies from 11 to 12 m (Nekkiladi junction Road, and Puttur-Uppinangadi Road). Pipeline will be laid in the road shoulder, adequate space is available.</p>	
		
Construction of new WTP	<p>Old WTP will be dismantled and the new WTP will be constructed.</p> <p>WTP is located outside town limits, in Nekkilady Village. surrounding land used for school, 50 m away from WTP, and other side is agricultural land.</p>	

Subproject Component	Proposed Site Setting	Site Photograph
		
<p>Laying of 12.42 km clear water transmission main from proposed new WTP to Tenkila master balancing reservoir with 400 mm diameter</p>	<p>Pipeline will be laid along Puttur-Uppinangadi Road within the ROW. Road width varies from 11m to 12m Pipeline will be laid in the road shoulder, adequate space is available.</p>	
<p>Water Service reservoir/ overhead tank (OHT) in Zone-2 at Mura Shantinagra, Padnur</p>	<p>The proposed site for OHT (300 KL) is identified in Padnur, site owned by Puttur CMC. The site is vacant, and covered with shrubs and bushes, and few small trees. Site is not prone for flooding. Access road is available</p>	



Subproject Component	Proposed Site Setting	Site Photograph
Water Service reservoir/OHT in Zone-3, Karmala near Microwave station	The proposed site for OHT (100 kl) is identified in Karmala, site owned by Puttur City Municipal Council (CMC). The site is vacant and there are no trees at the identified location. Site is not prone for flooding. Access road is available	
Water Service reservoir/OHT in Zone-4A, at CTO, Darbe	The proposed site for OHT (600 kl) is identified in Darbe, site owned by Puttur CMC. Site is covered with shrubs, bushes and small trees. Site is not prone for flooding. Access road is available.	
Water Service reservoir/OHT in zone-5, Lingadagudda, Kabaka	The proposed site for OHT (250 kl) is identified in Kabaka, site owned by Puttur CMC. The site is vacant and adjacent to existing old OHT. Site is covered with shrubs and bushes; there are no trees at the identified location. Site is not prone for flooding. Access road is available	
Water Service reservoir/OHT in Zone-6A, Balnad Helipad  Booster pumping station	The proposed site for OHT (200 kl) is identified in Balnad, site owned by Puttur CMC. The site is vacant and there are no trees at the identified location. Site is not prone for flooding. Access road is available  Booster pumping station will also be constructed at this site	

Subproject Component	Proposed Site Setting	Site Photograph
Water Service reservoir/OHT in zone-8, Balnad Kelyadi, Vitla Road	The proposed site for OHT (100 kl) is identified in Balnad Kelyadi, site owned by Puttur CMC. The site is vacant and there are no trees at the identified location. Site is not prone for flooding. Access road is available	
GLSR in Zone-4 at Seethigudda	The proposed site for GLSR (1,000 kl) is in Seethigudda site. Existing GLSR, Seethigudda to be dismantled for construction of new GLSR there are no trees at the identified location. Site is not prone for flooding. Access road is available	
GLSR /MBR at Tenkila  Intermediate pumping station	The proposed site for GLSR (2000 kl) is owned by Karnataka Housing Board, Government of Karnataka. It will be purchased through negotiated settlement. The site is vacant and covered with shrubs and bushes. Site is not prone for flooding. Access road is available.  Intermediate pumping station will also be constructed at this site.	

## V. SCREENING OF POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

### A. Introduction

59. Potential environmental impacts of the proposed infrastructure components are presented in this section. Mitigation measures to minimize / mitigate negative impacts, if any are recommended along with the agency responsible for implementation. Monitoring actions to be conducted during the implementation phase is also recommended to reduce the impact further.

60. As a general practice, an IEE should evaluate impacts due to the pre- construction (location, design), construction and operation phases of the project. Construction and operation are the two activities in which the project interacts physically with the environment, so they are the two activities during which the environmental impacts occur. In assessing the effects of these processes therefore, all potential impacts of the project should be identified, and mitigation is

devised for any negative impacts. Following sections evaluate impacts of the proposed Puttur Water Supply Subproject to be funded under KIUWMIP Tranche 2.

- (i) **Location Impacts.** There are no environmentally-sensitive feature and no significant physical and cultural resources within or adjacent to the subproject sites. All the subproject 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. GLSR site at Tenkila is owned by a government agency KHB; this is a vacant site, and will be purchased from KHB on market rates. Some sites are covered with shrubs and bushes, and there is no notable tree cover in any other sites. There are no trees in the pipeline alignment.
- (ii) **Design Impact.** Includes impacts arising from technology used and method for treatment and pumping facilities, pipelaying works and construction of GLSRs and OHTs.
- (iii) **Construction Impacts.** Includes impacts caused by site clearing, earthworks, machinery, vehicles and workers. Construction site impacts include erosion, dust, noise, traffic congestion and waste production.
- (iv) **O&M Impacts.** Include impacts arising from the operation and maintenance activities of the infrastructure facility. These include routine management of operational waste streams and occupational health and safety issues.

## **B. Pre-Construction Impact**

61. **Location.** These Impacts are associated with planning particularly on the site selection. They include impacts due to encroaching on sensitive areas and impacts on the people who might lose their homes or livelihoods due to the development of the proposed site. In case of water supply lines, no significant impacts are anticipated since the laying of water line will be along the already built up area. Out of eight new service reservoirs has been proposed, all are in government lands. There is a need to procure one government land for construction of GLSR at Tenkila from KHB, a Government of Karnataka agency.

62. Proposed subproject sites are carefully selected to avoid encroachment into sensitive areas and minimize the impacts on people livelihoods and homestead.

63. 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 city, will not cause direct impact on biodiversity values.

64. The Puttur CMC should obtain all necessary clearances before the starting of the work. The applicable clearances are given as Appendix 8. The clear water rising main crosses railway over bridge in one location at Chainage 140/400 near Kabaka Puttur railway station at Bolwar. The rider lines passes along NH-275 for a length of 5.82 Kms. The Puttur CMC should obtain necessary clearances before the starting of the work. The locations are shown in Figure 16. For Water distribution network clearances required is parallel to NH-275 for rider lines as proposed. For transmission main, Railway crossing at chainage 140/400 at Bolwar near Kabaka Puttur railway station is required and both are under process.

65. **Tree Cutting at Project Sites.** All sites are carefully selected, and layouts designed to minimize the tree cutting. There are few trees at some project sites (e.g., Padnur), which need to

be cut for the OHT construction. Pipelines are proposed along the roads, at some places there are trees, however, no tree cutting is envisaged for laying pipelines. Following measures need to be implemented to further minimize and/or compensate for the loss of tree cover during design validation and preconstruction phase:

- (i) Further minimize, if possible, removal of trees by adopting to site condition and with appropriate layout design and pipeline alignment, wherever there are trees on the selected sites or pipe alignments;
- (ii) For any tree cutting that may be required at other sites, obtain prior permission from Forest Department; and
- (iii) Plant and maintain 10 trees for each tree that is removed.



[illegible]

construction machineries. To mitigate the adverse impacts due to relocation of the utilities, implementing agency will:

- (i) Identify and include locations and operators of these utilities in the detailed design documents during design validation 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 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.

**67. 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. The subproject is likely to generate soil from excavations, which needs to be disposed safely.

**68. Construction Debris.** Subproject requires dismantling of an old WTP and a GLSR to make way for the proposed new WTP and GLSR respectively. This will generate considerable quantities of construction debris. Following measures should be implemented for disposal of debris:

- (i) Project Implementation Unit (PIU) shall identify a debris disposal site in consultation Puttur CMC adhering to the criteria given above.
- (ii) Priority shall be to reuse the debris for any beneficial purpose, such as road construction, and material such as iron, wood etc., shall be salvaged for reuse
- (iii) Debris should be removed from construction area.
- (iv) Debris should be covered with tarpaulin sheets during the transportation.
- (v) Debris transportation should not be done during the peak hours and should avoid narrow and heavy traffic routes.

**69. 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 be located away from population centers, drinking water intakes and streams, cultivable lands, and natural drainage systems; and in structurally stable areas even if some distance from construction activities.

70. For Puttur subproject, the quarry material required will be sand and stone aggregate, and the nearest quarries are near Panemangalore- and Modentar, Alankar 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.

71. **Design of the Proposed Components.** The Central Public Health and Environmental Engineering Organization (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.

72. However, in order to maintain unanimity in the design period and design population, 2046 is 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.

73. **Source Sustainability.** The water source for Puttur is Kumaradhara river. The water intake is located at a distance of 12 km from the city. Current withdrawal from river is 6.8 MLD and the additional withdrawal required to meet the ultimate design year 2046 demand is 8.7 MLD. Therefore, a total of 15.5 MLD water will be abstracted from the river to meet the city and enroute villages demand of 2046. According to the field observations and available data (Appendix 9), the water source Kumaradhara river is sufficient and reliable to meet the water demand of Puttur in 2046. It is one of the major rivers in Dakshina Kannada District and also a major tributary of River Netravathi. River is almost perennial, however, the flow reduces considerably during the summer season. A vented dam was constructed across Kumaradhara, at about 400 m upstream of confluence point of the river Kumaradhara and Netravati, under the ADB funded KUDCEMP. This is a small vented dam with a storage capacity of 0.61million cubic meter (MCM). The water impoundment is confined to the river course only, and spreads up to about 2,400 m upstream of the dam. Considering 20% losses, the actual available water quantity is 0.489 MCM. This storage capacity is sufficient to meet the demand especially in the summer time. From the ULB sources it is mentioned that the River Kumaradhara is perennial river and water flow is always there since last 25 years there is no shortage of water in the river. As the project will utilize an existing dam, within its capacity, no impacts envisaged on downstream flow, aquatic life etc., due to the project.

74. **River water Quality:** There are no major pollution sources like industries in the upstream side of the intake. Most of the villages and towns, however, along the river in general discharge domestic wastewater into the river without any treatment, although there is no such notable disposal point in the proximity of the intake. A grab sample was collected from the intake and tested for quality, and is found to be fit for drinking after conventional treatment and disinfection. The raw water will be treated to drinking water standards and supplied to the consumers.

75. **Water Treatment Plant.** The pipeline from pumping station will reach, to a new cascade aerator, from where the water will be conveyed through the raw water channel to the flash mixer, then to flocculator and then to the Tube Settler. Clarified water then leads to Filter House. Filtered water collected in new clear water reservoir. Additional structures are proposed to house chemical treatment processes as the existing chemical house will be utilized for chemical dosing in both the existing and upgraded plant. Back wash water from existing and proposed filter houses and sludge from flocculator and tube / plate settlers leads to Centrifuge. The dried sludge powder can be dumped within WTP site. The recirculation requires additional pumps and O and M cost.



76. Environmental audit of the existing WTP has been conducted during the draft IEE preparation to assess the compliance with environmental legislation and current environmental performance. This audit identified certain issues of concern in chlorine handling and application, and management of backwash and sludge generated from the treatment process. An action plan is suggested in the following Table 8 to ensure the compliance. The actions required are already considered and additional infrastructure and budget required have been included in the subproject, and are part of contractor scope of work.. Environmental Audit report is presented in Appendix 10.

**Table 9: Corrective Action Plan for Environmental Compliance of Existing WTP**

<b>Concern</b>	<b>Action Required</b>	<b>Timeline</b>	<b>Responsible Agency and Funding Source</b>
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 subproject	Puttur CMC;  Improvements required for backwash and sludge management already included in the present subproject under KIUWMIP
Poor handling of chlorination system and lack of safety measures	Improvements to chlorination already included in the subproject.	Same as above	Puttur CMC  Improvements required for chlorination system is already included in the present subproject under KIUWMIP

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

78. The average dose of chlorine for pre-chlorination will be about 4mg/l and that for post-chlorination will be about 3 mg/l. With the present water supply 6.8 MLD, about 25 kg of chlorine is consumed daily. This which will increase to 50 kg per day with the augmented capacity of 15.5 MLD. Chlorine cylinders (called tonners, with capacity about 900 kg) will be procured from nearest manufacturing unit and stored at the site.

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

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

- (vii) Provide training to the staff in safe handling and application of chlorine; this shall be included in the contract of Chlorinator supplier;
- (viii) Develop an emergency response system for events like chlorine leakage; and
- (ix) Supplier of Chlorinator equipment shall provide standard operating manual for safe operation and as well as maintenance and repairs; preferably these shall be provided both in English and Kannada Languages.

80. **Energy Efficiency.** Owing to higher elevation of the town to that of intake at Nekkilady, the energy intensive pumping could not be avoided. The raw water from the intake will be pumped to WTP, and from the WTP treated water will be pumped to GLSR. From GLSR at highest point, water is supplied by gravity to the consumers. Energy efficient pumps and motors will be procured and used.

81. **Social and Cultural Resources – Chance Finds.** Any work involving ground disturbance can uncover and damage archaeological and historical remains. 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;
- (i) Stop work immediately if any finds are suspected to allow further investigation; and
- (ii) Inform archaeological agencies promptly if a find is suspected and take any action they require to ensure its removal or protection in situ.

### C. Construction Impacts

82. The civil works for pipe line network projects include earth work excavation for pipeline trenches, pipe laying, installing valves, flow meters and data loggers, shifting of public utilities (if required) and providing house connections. Earth work 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. Pipes will be handled and laid in the trenches with utmost precaution so as not to damage existing utilities and cables. Once they are laid, pipes will be joined as per specification and then tested for any cracks or 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. Table 9 shows the details of construction activities involved in the subproject.

**Table 10: 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.	Around 110,180 m <sup>3</sup> . of soil is excavated and 90-95% will be utilized for refill and remaining soil need to be disposed off.
	A bed of sand of 100 mm thick will be prepared at the bottom and pipes will be placed and joined. Excavated soil will be replaced and compacted. Where the pipes are laid in the roadway, handheld	This excess soil shall be used for filling if required or stored/ dumped in approved debris disposal site.

Component	Construction method	Likely waste generated
	<p>pneumatic drill will be used to break the road surface.</p> <p>Construction activity will be conducted along the roads in the town and will cover most part of the town. The work will be conducted by a team of 5 workers at each site</p>	
Water treatment plant and water reservoirs	Excavation, compaction and consolidation of earth, bar bending, concreting, staging and finishing work etc.	Soil will be excavated for foundations and underground tanks, part of this soil will be reused at sites for levelling and filling, and rest of the soil needs to be disposed off safely

m<sup>3</sup> = cubic meter, dia = diameter, m = meter, mm = millimeter.

84. Although construction of the pipelines involve quite simple techniques of civil work, the invasive nature of excavation and the subproject locations in the built-up areas of Puttur City, where there are a variety of human activities, will result to impacts to the environment and sensitive receptors such as residents, businesses, and the community in general. These anticipated impacts are temporary and for a short duration.

85. Physical impacts will be reduced by the method of working and scheduling of work, whereby the project components will be (i) constructed by small teams working at a time; 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.

86. While trenching at densely populated areas like market place or layouts, or roads with heavy traffic, additional care has to be taken. Hard barricade should be mandatorily provided along with caution board and traffic diversion boards. Some of the densely populated area identified at Puttur are Neharu Nagara, Darbe, Bolwar, Nellikatte, Parlodka, Kemmai, Krishnanagra, Bannur. Except these Bustand road, Kemmai road, darbe road, Court road, Vivekananada Nagara road, Uppinangadi Road, Bypass road, all other roads are narrow and/or located in busy commercial area. Therefore, full closure will be required in those stretches.

87. Prior to the start of work, contractor should prepare a site-specific Construction Management Plan, which should be submitted every month before works start. The Construction Management Plan will include the method statement for construction works, Utility Management and Contingency Plan, Traffic Management Plan, Work camp and Labour Camp details, Safety measures taken for the workers and the public.

88. 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) Personal Protection Equipment (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) including specific details of each work;
- (x) Contractor's supervision and management arrangements for the work;
- (xi) Emergency: Designate (i) responsible person on site, and (ii) first aider;
- (xii) Typical site layout plan including pipe trenching, placement of material, excavated earth, barricading etc.;
- (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; and
- (xiv) The following should be included in the site layout plan:
  - Barricade/security personnel at the site to prevent entry/trespassing of pedestrian/vehicles into the work zone;
  - Location of temporary stockpiles and provision of bunds;
  - Separation of stockpiles areas with workers/vehicle movement paths to avoid disturbing the stockpiled soil;
  - Wetting of soil to arrest dust generation by spraying water; and
  - 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.

83. 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.

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

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

90. **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. Dismantling of old WTP structures is required at the WTP for construction new WTP units. Dismantling activity will generate considerable dust, and as the WTP is located in the town, impacts will be significant. Proper measures to contain dust within the site is a must. 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) Enclose the area with dust screens of sufficient height during the dismantling work; employ proper construction methods limiting the dust generation;
- (iv) Bring materials (aggregates, sand, etc., gravel) as and when required;
- (v) Use tarpaulins to cover sand and other loose material when transported by vehicles;
- (vi) Clean wheels and undercarriage of vehicles prior to leaving construction site; and
- (vii) 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.

91. **Noise Levels.** The soils are deep in the subproject area and therefore activities like rock cutting/blasting that generate high noise are not anticipated. In isolated areas where a hard stratum is encountered (especially for deep pipe lines in some locations 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 equivalent noise of 82-98 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. Dismantling activity at the WTP will also produce considerable noise. 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) Properly enclose the dismantling area with temporary noise barriers;

- (vii) Maintain maximum sound levels not exceeding 80 decibels (dbA) when measured at a distance of 10 m or more from the vehicle/s; and
- (viii) Horns should not be used unless it is necessary to warn other road users or animals of the vehicle's approach.

92. **Surface Water Quality.** There is no construction in river. Puttur town receives high rainfall (4,329 mm). The southwest monsoon winds bring rainfall from June to September while the northeast monsoon winds deliver rainfall from October to December. Excavation will be avoided during the monsoon season, thereby no foreseen impact on drainage and surface water quality. In unavoidable cases of excavation during monsoons, there may be temporary impacts like flooding of construction sites, mixing of construction waste and material within the runoff, etc. This may lead to silting and blockage of drains and water bodies. 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) 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 and dispose as per the Spoil Management Plan (sample outline of Spoil Management Plan provided in Appendix 11);
- (iii) Install temporary silt traps or sedimentation basins along the drainage leading to the water bodies;
- (iv) Provide temporary bunds for stockpiles and materials; Place storage areas for fuels and lubricants away from any drainage leading to water bodies. Storage structure should consider 110% capacity bund;
- (v) Dispose any wastes generated by construction activities in designated sites; and
- (vi) Conduct surface quality inspection and monitoring.

93. **Groundwater.** Subproject activities do not interfere with groundwater regimes no groundwater abstraction is proposed nor will the activities affect groundwater quality.

94. 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.

95. **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. Dismantling activity at the WTP will produce significant quantities of construction waste and debris. 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 ULB/CMC 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.

96. **Accessibility.** Transport infrastructure will be affected by the pipe laying work. Excavated soil will make narrow streets even less passable. In instances where there is no available land to lay pipes on, road excavation may be done along the main roads, disrupting traffic. Very narrow streets may have to be closed to traffic to give way to excavation works. 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;
- (xi) Prepare a Traffic Management Plan – a template is provided for reference at Appendix 12; and
- (xii) Where ever road width is insufficient, there will be temporary loss of access during pipelaying. Under those circumstances, contractor can adopt the following measures:
  - Inform the affected local population two days in advance about the work schedule
  - Plan and execute the work in such a way that the period of disturbance/ loss of access is minimum; and
  - Provide pedestrian access in all the locations until normalcy is restored.

97. **Impacts on Social Sensitive Areas.** Since works will be conducted in an urban area where there are sensitive areas like schools, hospitals and religious centers, trench excavation



activities can create nuisance and health hazard to children and people with ailments. Proposed mitigation measures aim to minimize the impact in all areas. However, special attention is necessary for these locations. The following measures shall be implemented within a 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 etc., 2 weeks prior to the work; conduct a 30-minute awareness program on nature of work, likely disturbances and risks and construction work, mitigation measures in place, entry restrictions and dos and don'ts; and
- (vi) Implement all measures suggested elsewhere in this report – dust and noise control, public safety, traffic management, strictly at the sites.

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

- (i) Leave space for access between mounds of excavated soil;
- (ii) Provide wooden planks/footbridges for pedestrians and metal sheets for vehicles to allow access across trenches to premises where required;
- (iii) Consult affected businesspeople to inform them in advance when work will occur
- (iv) Address livelihood issues, if any; implement the Resettlement Plan 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.

99. **Socio-Economic-Employment.** Manpower will be required during the construction period 24 months. This can result to generation of contractual employment and increase in local revenue. Thus, potential impact is positive and long-term. The construction contractor will be required to employ local labor force to the maximum extent, if manpower is available.

100. **Occupational Health and Safety.** Workers need to be mindful of the occupational hazards which can arise from working in height and excavation works. Dismantling work also

poses considerable risk. 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<sup>4</sup> 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 health and safety 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 (this can be downloaded from <http://www1.ifc.org/wps/wcm/connect/9aef2880488559a983acd36a6515bb18/2%2Boccupational%2Bhealth%2Band%2Bsafety.pdf?MOD=AJPERES>).

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<sup>4</sup> 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.

101. **Community Health and Safety.** Hazards posed to the public, specifically in high-pedestrian areas may include traffic accidents and vehicle collision with pedestrians. In most of the cases location of project sites are along the road ways, hence safety risk to community is to be considered. The 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 (>1m); 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 implementing agency/Puttur CMC 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 (this can be downloaded from <http://www1.ifc.org/wps/wcm/connect/dd673400488559ae83c4d36a6515bb18/3%2Bcommunity%2Bhealth%2Band%2Bbsafety.pdf?MOD=AJPERES>)

102. **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.

103. The construction contractor will be required to comply with the following. Overall, the contract should follow the IFC EHS guidelines specific to workers accommodation (this can be downloaded from [http://www1.ifc.org/wps/wcm/connect/topics\\_ext\\_content/ifc\\_external\\_corporate\\_site/ifc+sustainability/publications/publications\\_gpn\\_workers\\_accommodation](http://www1.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/ifc+sustainability/publications/publications_gpn_workers_accommodation)).

- (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 refuse;
- (iv) The camp site should be adequately drained to avoid the accumulation of stagnant water;
- (v) Provide water and sanitation facilities; water, meeting Indian drinking water standards shall be provided, in adequate quantities (supply of 60- 80 LPCD); all water storage structures must be cleaned regularly and covered properly to avoid any contamination;
- (vi) Provide separate facilities for men and women; sanitary facilities shall be properly build and well maintained; toilet and bath facilities should be provided on basis of 1 per 15 or less persons;
- (vii) Train employees in the storage and handling of materials which can potentially cause soil contamination;

- (viii) Recover used oil and lubricants and reuse or remove from the site;
- (ix) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas;
- (x) Remove all wreckage, rubbish, or temporary structures which are no longer required;
- (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.

104. **Social and Cultural Resources.** Chance Finds. Subproject area is not a potential archaeological area and therefore no impacts envisaged. 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.

105. **Debris disposal:** Prior to the commencement of works, contractor shall identify a debris disposal site in consultation with the Puttur CMC 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.

#### **D. Operational and Maintenance Impacts**

106. Operation and Maintenance of the water supply system will be carried out by Puttur CMC. The system has a design life of 30 years, during which it 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.

107. Recurrence of pipe bursting and leakage problems can be managed through leak detection and water auditing surveys. Puttur CMC will be required to ensure that leakage rectification is done at the shortest possible time.

108. 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.

109. Repair works could cause some temporary disruption of activities at locations of social and cultural importance such as schools, hospitals, churches, tourist sites etc., so the same precautions as employed during the construction period should be adopted. ULB/CMC needs to:

- (i) Identify any buildings at risk from vibration damage and avoiding any use of pneumatic drills or heavy vehicles in the vicinity;
- (ii) Complete work in these areas quickly; and
- (iii) Consult the custodians of important buildings, cultural and tourism authorities and local communities in advance of the work to identify and address key issues, and avoid working at sensitive times, such as religious and cultural festivals.

110. The citizens of Puttur City will be the major beneficiaries of the improved water supply, as they will be provided with a constant supply of better quality water, piped into their homes. In addition to improved environmental conditions, the project will improve the over-all health condition of the town.

## **E. Cumulative Impacts**

111. 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 Puttur, by improving raw water supply via replacement of pumping systems, creation of new treatment facility, water transmission and storage infrastructure, and distribution lines in currently uncovered areas, and to improving water distribution lines in the presently covered areas. Subproject do not include any creation or new or augmentation of existing water source. Water abstraction from Kumaradhara, the source of water supply to Puttur, will remain within its existing design capacity, and therefore no 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**

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

- (i) Residents, shopkeepers and businesspeople near the work sites;
- (ii) Public representatives and prominent citizens of the town;
- (iii) Puttur City Municipal Council; and
- (iv) KUIDFC, Government of Karnataka.

113. Secondary stakeholders are:

- (i) Other concerned government institutions (utilities, regulators, etc.)
- (ii) Nongovernment organizations (NGOs) and community-based organizations (CBOs) working in the affected communities;

- (iii) Other community representatives (prominent citizens, religious leaders, elders, women's groups);
- (iv) The beneficiary community in general; and
- (v) ADB as the funding agency.

## **B. Consultation and Disclosure up to Date**

114. 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.

115. A public consultation workshop was conducted on 28 June 2016 in Puttur to discuss the proposed project and likely environmental issues and mitigation measures. Key stakeholders – public representatives, officials from various agencies, district level officers, from each project town, including Puttur, were participated in the workshop. Details of this consultation meeting is appended at Appendix 13.

116. Various meetings held in Puttur for the subproject, which included (i) elected representatives of ULB consultation held on 6 March 2015 and passed a resolution indicating the need of project, (ii) General Body meeting with all elected members/ Councilors meeting held on 3 November 2015, (iii) Member of Legislative Assembly (MLA) held consultation meeting on 13 June 2016, (iv) site visit to all sites and consultation with local nearby residents. The details of the stakeholder's consultations are presented below.

**Table 11: Stakeholder Consultations**

No.	Date	Meeting Location	Meeting headed by	Meeting attend by	Remarks
1	06 March 2016	Council Hall, City Municipal Council (CMC), Puttur	President Puttur CMC, Commissioner CMC	Jayaprakash T, Praveen Rego, Sudheer	Presentation of Inception Report
2	01 March 2016	Council Hall, CMC, Puttur	President Puttur CMC, Commissioner CMC	Jayaprakash T, Praveen Rego, Sudheer	Presentation of PDR Tranche-II
3	28 June 2016	Town Hall Puttur	President CMC Puttur, MLA Puttur	Deputy Project Director (DPD), RagavendraKudva, Praveen Rego, Jayaprakash T, Sudheer, Public Works Department Engineers, KUWS & DB Engineers, NRIs, Publics	Public workshop on Detailed Project Report (DPR)
4	30 June 2016	Council Hall, CMC, Puttur	President CMC Puttur, MLA Puttur	Jayaprakash T, Praveen Rego, Sudheer	Presentation of DPR Tranche-II

### C. Future Consultation and Disclosure

117. Executive agency and implementing agency shall extend and expand the consultation and disclosure process significantly during implementation of the Investment Program.

118. **Consultation during Construction.** Prior to start of construction, PIU will conduct meaningful<sup>5</sup> consultation 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 also 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.

<sup>5</sup> 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.



119. **Project Disclosure.** Executive summary of the IEE will be translated in Kannada and made available at the offices of PMU, Regional Project Management Unit (RPMU), PIU, and Puttur CMC 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.

120. 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 plans. 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.

121. 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 town 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 towns, informing the public of their availability, and providing a mechanism through which comments can be made.

122. 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. Documents will also be available on the websites of KUIDFC and Puttur CMC.

## **VII. GRIEVANCE REDRESS MECHANISM**

123. 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.

124. 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.

125. 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.

126. 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 Safeguards 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**

127. There will be several tiers for grievance redress process (Figure 17). Simple grievances for immediate redress will first be resolved at site by Contractor. If unaddressed for up to 7 days the complainants may go to PIU officer in ULB responsible for addressing resettlement/social issues. Resident engineer and the ULB will assist in resolving the issues. Name, designation and contact number of personnel responsible for grievance redress at ULB and RPMU, will be posted at Contractor's and PMDCSC's site office in full visibility of public. Grievances of immediate nature should be resolved at site/ within ULB/PIU level within 15 days of registration of grievances.

128. All the Grievances that cannot be resolved at ULB/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 PIU/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 SO 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 Safeguard Officer, RPMU through ULB/PIU

129. 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 per Government of Karnataka legal procedure.

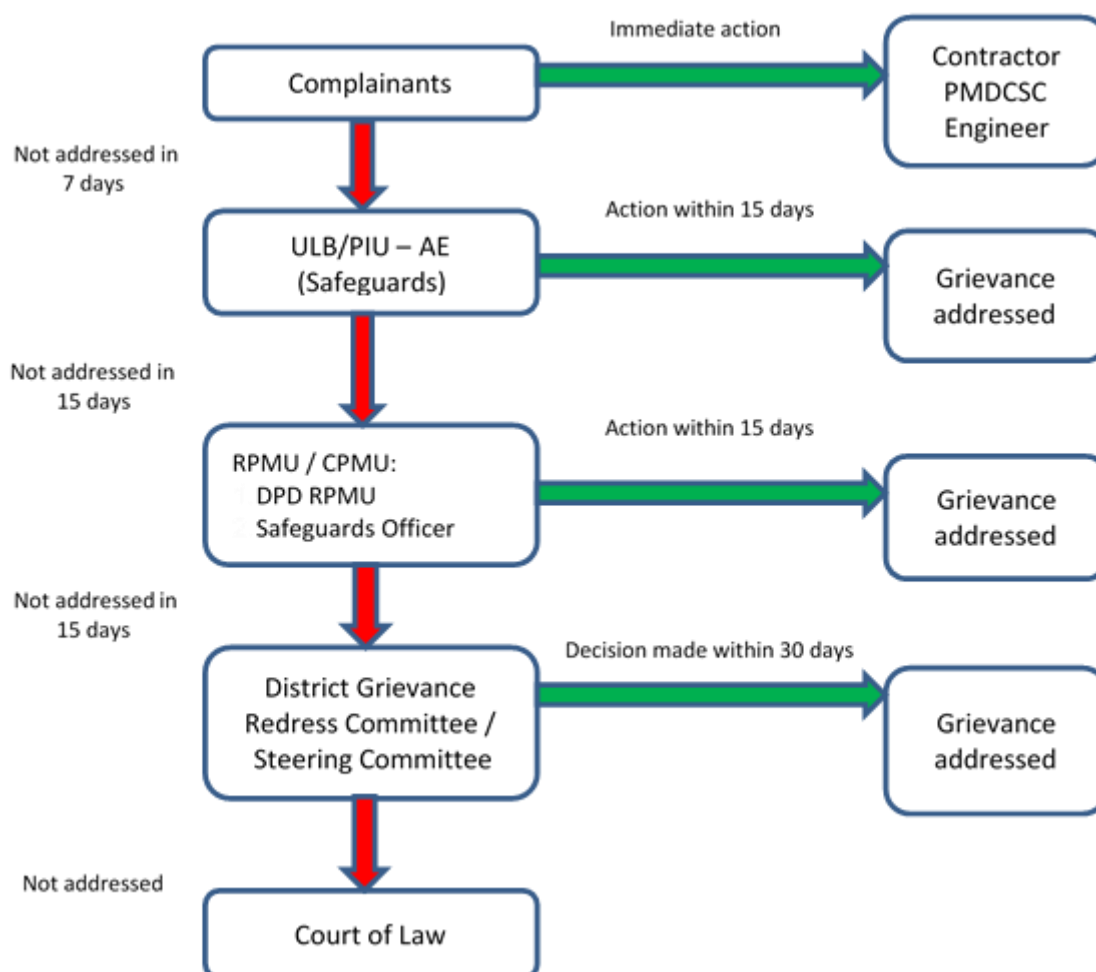
#### **B. Grievance Redress Committee Composition and Selection of Members**

130. 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. Safeguard Officer of RPMU will be responsible for coordinating with all GRC members and the displaced persons 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.

131. The affected person also can 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 (INRM). The complaint can be submitted in any of the official languages of ADB's DMCs. The ADB Accountability Mechanism information will include in the PID to be distributed to the affected communities, as part of the project GRM.

**Figure 17: Grievance Redress Process**



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

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

133. **Information Dissemination Methods of the Grievance Redress Mechanism.** The PIU, assisted by PMDCSC/CAPRRRC 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.

134. **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.

135. **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.

136. **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.

137. **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 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**

138. The purpose of the Environmental Management Plan (EMP) is 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.

139. The contractor will be required to submit to PIU, for review and approval, a site-specific 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.

140. A copy of the SEMP/updated EMP 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.

141. 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.

142. Tables 11 to 13 show the potential adverse environmental impacts, proposed mitigation measures, responsible parties, and estimated cost of implementation for the subproject. This EMP will be included in the bid documents and will be further reviewed and updated during implementation. Table 14 shows the Environmental Monitoring Plan to be implemented during project implementation and operation.

**Table 12: Environmental Management Plan for Anticipated Impacts –Pre-Construction**

<b>Field</b>	<b>Anticipated Impact</b>	<b>Mitigation Measures</b>	<b>Responsible for Implementation</b>	<b>Monitoring of Mitigation</b>	<b>Cost and Source of Funds</b>
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/SEMP; and (iii) Timely submission monthly of monitoring reports including documentary evidence on EMP implementation such as photographs.	Contractor	Mobilization of Environment, Health and Safety (EHS) engineer (ii) Submission of EMP prior to start of works (iii) Submission of monthly reports .	Contractor cost
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 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.	Contractor in collaboration with Puttur City Municipal Council (CMC)	(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 disruption is more than 24 hours), spoil management plan, and traffic management plan.	No cost required.  Mitigation measures are part of term of reference (TOR) of Project Management Unit (PMU), design engineers, and supervising consultants.
Trees on project sites	Tree cutting	(i) Further minimize removal of trees, if possible, by adopting to site condition and with appropriate layout design and pipeline alignments, wherever there are trees on the selected sites;	Puttur CMC/PIU	(i) Layout plan of overhead tanks (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.

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation	Monitoring of Mitigation	Cost and Source of Funds
		(ii) For any tree cutting that may be required at other sites, obtain prior permission from Forest Department; and (iii) Plant and maintain 10 trees for each tree that is removed.			
Social and Cultural Resources	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.	Contractor, PIU and Project Management Design, Construction and Supervision Consultant (PMD CSC)	Implementation of chance find measures	Cost for implementation of mitigation measures responsibility of contractor.
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 (v) For excess spoil disposal, ensure (a) site shall be selected preferably from barren, infertile	Contractor to determine locations prior to beginning of construction works and to be reviewed and approved by PIU/PMD CSC	(i) List of selected sites for construction work camps, hot mix plants, stockpile areas, storage areas, and disposal areas. (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
		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.			
Debris disposal	Impacts due to improper disposal of debris	<p>(i) PIU shall identify a debris disposal site in consultation Puttur CMC adhering to the criteria; and</p> <p>(ii) Priority shall be to reuse the debris for any beneficial purpose, such as road construction, and material such as iron, wood, etc., shall be salvaged for reuse</p> <p>The following measures should be considered for disposal of surplus/waste soil:</p> <p>(i) The excavated soil Debris should be removed from construction area at the earliest for beneficial reuse such as land raising/filling of excavated areas;</p> <p>(ii) Debris Soil should be covered with tarpaulin sheets during the transportation; and</p> <p>(iii) Soil Debris transportation should not be done during the peak hours and should be avoid narrow and heavy traffic routes</p>	PIU and Contractor to determine locations prior to beginning of construction works.	List of selected sites for disposal	Cost for implementation of mitigation measures responsibility of contractor.



Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation	Monitoring of Mitigation	Cost and Source of Funds
		and important religious or tourist sites.			
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) Prioritize sites already permitted by the Mining Department; (ii) If other sites are necessary, inform construction contractor that it is their responsibility to verify the suitability of all material sources and to obtain the approval of PMU; and (iii) If additional quarries will be required after construction is started, inform construction contractor to obtain a written approval from PMU.	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.
Structural and seismic stability of storage reservoirs (OHTs or GLSRs) is to be ensured for the safety of people working in and living around these structures.	The failure of the storage structures can be catastrophic.	The design shall incorporate seismicity of the place and all other safety factors. All care shall be taken to ensure a safe and structurally sound construction.	PIU and PMDCSC	Incorporated in final design and communicated to contractors.	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 (iii) Include in detailed design drawings and documents all conditions and provisions if necessary.	Puttur CMC/PIU	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.  Mitigation measures are part of TOR of

Field	Anticipated Impact	Mitigation Measures	Responsible for Implementation	Monitoring of Mitigation	Cost and Source of Funds
					PMU, design engineers, and supervising consultants.
Method statement	Use of approved construction practices to minimize construction impacts	<p>Method Statement should be in a Table format with appended site layout map and cover the following:</p> <ul style="list-style-type: none"> <li>(i) Work description;</li> <li>(ii) Number of workers (skilled and unskilled);</li> <li>(iii) Details of plant, equipment and machinery, vehicles;</li> <li>(iv) Work duration (total, and activity-wise, for example for pipe laying, from excavation to road resurfacing/testing);</li> <li>(v) Personal Protection Equipment (helmet, gloves, boots, etc.) details for each type of work;</li> <li>(vi) Details of materials at each site (type and quantity);</li> <li>(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.);</li> <li>(viii) Construction waste/debris generated (details and quantity);</li> <li>(ix) Detail the sequence of work process (step-by-step) including specific details of each work;</li> </ul>	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
		(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, etc.; 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 13: 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 (SOPs) for construction works; occupational health and safety (OHS), core labor laws, applicable environmental laws, etc.; and (ii) appointment of Environment, Health and Safety (EHS) Engineer by contractor prior to start of work	Construction Contractor/ Program Implementation Unit (PIU)/ Project Management Design, Construction and Supervision Consultant (PMDSC)	(i) Certificate of Completion (Safeguards Compliance Orientation); (ii) Posting of Certification of Completion at worksites; and (iii) Posting of EMP at worksites	Cost of EMP Implementation Orientation Training to contractor is responsibility of Program Management Unit (PMU).  Other costs responsibility of contractor.

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation	Cost and Source of Funds
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, Sulphur 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) Enclose the area with dust screens of sufficient height during the dismantling work; employ proper construction methods limiting the dust generation; (iv) Use tarpaulins to cover sand and other loose material when transported by trucks; (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.	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) Prepare and implement a spoils management plan as the part of the Construction Management Plan; (ii) Avoid stockpiling of earth fill especially during the monsoon season unless covered by tarpaulins or plastic sheets; (iii) Install temporary silt traps or sedimentation basins along the drainage leading to the water bodies; (iv) Place storage areas for fuels and lubricants away from any drainage leading to water bodies. Storage structure should consider 110% capacity bund;	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 (v) No visible degradation to nearby drainages, nallahs or	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) Dispose any wastes generated by installation of pipeline in designated sites; and (vi) Conduct surface quality inspection according to the Environmental Management Plan (EMP).		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) Horns should not be used unless it is necessary to warn other road users or animals of the vehicle's approach; (iii) Minimize noise from construction equipment by using vehicle silencers, fitting jackhammers with noise-reducing mufflers, and portable street barriers the sound impact to surrounding sensitive receptor; (iv) Properly enclose the dismantling area with temporary noise barriers; and (v) Maintain maximum sound levels not exceeding 80 decibels (dbA) when measured at a distance of 10 m or more from the vehicle/s.	Construction Contractor	(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 4 of this IEE).	Cost for implementation of mitigation measures responsibility of contractor.
Landscape and aesthetics	Impacts due to excess excavated earth, excess construction and demolition materials and solid waste such as removed concrete, wood, packaging materials, empty	(i) Prepare and implement spoils management plan; (ii) Avoid stockpiling of excess excavated soils; (iii) Coordinate with Puttur CMC for beneficial uses of excess excavated soils or immediately dispose to designated areas;	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,	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
	containers, spoils, oils, lubricants, and other similar items. C & D materials after dismantling of the old WTP and old GLSR are identified	(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 which are no longer required; and (vii) Request PIU/PMDCSC to report in writing that the necessary environmental restoration work has been adequately performed before acceptance of work.  C & D materials after dismantling of the old WTP and old GLSR shall be managed as per C & D Rules 2016,		and solid waste such as removed concrete, wood, packaging materials, empty containers.	
Existing Infrastructure and Facilities	Disruption of service and damage to existing infrastructure at specified project location	(i) Obtain from PIU/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.
Ecological Resources – Terrestrial	Loss of vegetation and tree cover	Minimal tree cutting is envisaged as part of this sub project. to safeguard any tree removal, following measures to be implemented; (i) Minimize removal of vegetation and disallow cutting of trees;	Construction Contractor	PMU/PMDCSC to report in writing the no of trees cut and planted.	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
		(ii) If tree-removal will be required, obtain tree-cutting permit from the Forest Department; and (iii) Plant two native trees for every one that is removed.			
Accessibility	Traffic problems and conflicts near project locations and haul road	<p>Traffic Management Plan (TMP) should be part of the Construction Management Plan.</p> <p>(i) Plan transportation routes so that heavy vehicles do not use narrow local roads, except in the immediate vicinity of delivery sites;</p> <p>(ii) Schedule transport and hauling activities during non-peak hours;</p> <p>(iii) Locate entry and exit points in areas where there is low potential for traffic congestion;</p> <p>(iv) Keep the site free from all unnecessary obstructions;</p> <p>(v) Drive vehicles in a considerate manner;</p> <p>(vi) Coordinate with Traffic Police for temporary road diversions and with for provision of traffic aids if transportation activities cannot be avoided during peak hours;</p> <p>(vii) Notify affected sensitive receptors 2 days in advance by providing sign boards informing nature and duration of construction works and contact numbers for concerns/complaints;</p> <p>(viii) Plan and execute the work in such a way that the period of disturbance/ loss of access is minimum; and</p> <p>(ix) Provide pedestrian access in all the locations until normalcy is restored.</p>	Construction Contractor	<p>(i) Traffic route during construction works including number of permanent signages, barricades and flagmen on worksite (refer outline TMP is provided in Appendix 12);</p> <p>(ii) Complaints from sensitive receptors; and</p> <p>(iii) Number of signages placed at project location.</p>	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
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; (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.	Construction Contractor	(i) Complaints from sensitive receptors; (ii) Spoils management plan; and (iii) Number of walkways, signages, and metal sheets placed at project location.	Cost for implementation of mitigation measures responsibility of contractor.
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 (iii) Comply with core labor laws	Construction Contractor	(i) Employment records; and (ii) 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 occupational health and safety (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	Construction Contractor	(i) Site-specific OHS Plan; (ii) Equipped first-aid stations; (iii) Medical insurance coverage for workers; (iv) Number of accidents; (v) Supplies of potable drinking water;	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
		<p>personal protective equipment like helmet, gumboot, safety belt, gloves, nose mask and ear plugs;</p> <p>(c) OHS Training for all site personnel; (d) documented procedures to be followed for all site activities; and (e) documentation of work-related accidents;</p> <p>(iii) Ensure that qualified first-aid can be provided at all times. Equipped first-aid stations shall be easily accessible throughout the site;</p> <p>(iv) Provide medical insurance coverage for workers;</p> <p>(v) Secure all installations from unauthorized intrusion and accident risks;</p> <p>(vi) Provide supplies of potable drinking water;</p> <p>(vii) Provide clean eating areas where workers are not exposed to hazardous or noxious substances;</p> <p>(viii) Provide health and safety 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;</p> <p>(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;</p> <p>(x) Ensure the visibility of workers through their use of high visibility</p>		<p>(vi) Clean eating areas where workers are not exposed to hazardous or noxious substances;</p> <p>(vii) record of health and safety orientation trainings;</p> <p>(viii) personal protective equipment;</p> <p>(ix) % of moving equipment outfitted with audible back-up alarms;</p> <p>(x) 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</p> <p>(xi) Compliance to core labor laws (See Appendix 2 of this IEE).</p>	

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation	Cost and Source of Funds
		<p>vests when working in or walking through heavy equipment operating areas;</p> <p>(xi) Ensure moving equipment is outfitted with audible back-up alarms;</p> <p>(xii) Mark and provide sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment, and areas for storage and disposal. Signage shall be in accordance with international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate; and</p> <p>(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.</p>			
Community Health and Safety.	Traffic accidents and vehicle collision with pedestrians during material and waste transportation	<p>(i) Plan routes to avoid times of peak-pedestrian activities.</p> <p>(ii) Liaise with PIU/PMDCSC in identifying high-risk areas on route cards/maps.</p> <p>(iii) Maintain regularly the vehicles and use of manufacturer-approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure.</p> <p>(iv) Provide road signs and flag persons to warn of on-going trenching activities.</p>	Construction Contractor	<p>(i) Traffic Management Plan; and</p> <p>(ii) Complaints from sensitive receptors.</p>	Cost for implementation of mitigation measures responsibility of contractor.
Work Camps and worksites	Temporary air and noise pollution from machine operation,	(i) Consult with PIU before locating workers camps/sheds, and construction plants; as far as	Construction Contractor	(i) Complaints from sensitive receptors;	Cost for implementation of mitigation measures

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation	Cost and Source of Funds
	<p>water pollution from storage and use of fuels, oils, solvents, and lubricants</p> <p>Unsanitary and poor living conditions for workers.</p>	<p>possible located at least 200 m from residential areas;</p> <p>(ii) Minimize removal of vegetation and disallow cutting of trees;</p> <p>(iii) Living facilities shall be built with adequate materials, and should be in good condition and free from rubbish and other refuge;</p> <p>(iv) The camp site should be adequately drained to avoid the accumulation of stagnant water;</p> <p>(v) Provide water and sanitation facilities; water, meeting Indian drinking water standards shall be provided, in adequate quantities (supply of 60- 80 LPCD); all water storage structures must be cleaned regularly and covered properly to avoid any contamination;</p> <p>(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;</p> <p>(vii) Train employees in the storage and handling of materials which can potentially cause soil contamination;</p> <p>(viii) Recover used oil and lubricants and reuse or remove from the site;</p> <p>(ix) Manage solid waste according to the following preference hierarchy: reuse, recycling and disposal to designated areas;</p>		(ii) Drinking water and sanitation facilities for employees.	responsibility of contractor.

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation	Cost and Source of Funds
		(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.			
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.	Construction Contractor	PIU/PMDSC report in writing that (i) worksite is restored to original conditions; (ii) camp has been vacated and restored to	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) All disrupted utilities restored; (iv) All affected structures rehabilitated/compensated; (v) The area that previously housed the construction camp is to be checked for spills of substances such as oil, paint, etc. and these shall be cleaned up; (vi) All hardened surfaces within the construction camp area shall be ripped, all imported materials removed, and the area shall be top soiled and regressed 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.		pre-project conditions; and (iii) all construction related structures not relevant to O&M are removed; and (iv) worksite clean-up is satisfactory.	

**Table 14: Environmental Management Plan for Anticipated Impacts – Operation**

<b>Field</b>	<b>Anticipated Impact</b>	<b>Mitigation Measures</b>	<b>Responsible for Mitigation</b>	<b>Monitoring of Mitigation</b>	<b>Cost and Source of Funds</b>
Operation & Maintenance of 24x7 Water supply system and WTP	Poor quality of supply water due to improper maintenance	ULB shall ensure that all water supply pipelines are maintained well and water is treated to the required Drinking Water Standards	Operator/ Puttur CMC	Puttur CMC	CMC cost
Water Quality Monitoring	Non-availability of potable water for drinking	Treated water shall be tested for drinking water quality standards – parameters on regular basis and residual chlorine, E-coli to be tested at consumer end point.	Operator/ Puttur CMC	Puttur CMC	CMC cost
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	Operator / Puttur CMC	Puttur CMC	CMC cost
Asset management	Reduction in NRW Increased efficiency of the system	Preparation of O&M Manual	Operator / Puttur CMC	Puttur CMC	CMC cost
Emergency Response Plan	Non-availability of Emergency Response Plan affects water supply system	An Emergency Response Plan for emergencies such as indications of terrorism or acts of terrorism; Major disasters such as earthquakes, fires, flood, or explosion and Catastrophic incidents that leave extraordinary levels of mass casualties, damage, and disruption severely affecting the population, infrastructure, environment, economy, etc. Emergency Response Plan shall be prepared to address the eight core elements such as System Specific Information; Community Water System - Roles and Responsibilities; Communication Procedures: Who, What and When; Personnel Safety; Identification of alternate water sources in emergencies; Replacement equipment and chemical supplies; Property protection and Water sampling and Monitoring Appropriate safety measures like fencing, notice boards to prevent entry of unauthorized persons shall be provided	Operator / Puttur CMC	Puttur CMC	CMC cost

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation	Cost and Source of Funds
		All guide and hand railings shall be maintained in a safe and firm condition with WTP to ensure the safety of Personnel working at the plant.			
Health and Safety during O&M period	Impact on human health and safety issues	<p><b>Precautionary Working Practices:</b></p> <p>When working with pipes and fittings on site, ensure that they are protected from contamination by storing off the ground, capping the ends of pipes and liners, and keeping fittings in wrappings until the time of use. Excavate trenches to below the pipe level to provide a sump, and keep as dry as possible to prevent water entering a pipe or fitting.</p> <p>Ensure that sealing materials and lubricants are clean and certified as suitable for contact with potable water supplies.</p> <p>If a part of the distribution system has been taken out of service for an extended period, treat it as a potentially contaminated new installation. Apply the flushing, disinfection and microbiological sampling procedures that are normally applied to new installations.</p> <p>As far as is practicable, if general purpose or specialized vehicles are used for water supply construction and repair duties, do not use those vehicles for other duties where contamination may be prevalent (e.g. sewerage work).</p> <p>Employees and contractors involved in restricted operations should be trained in the hygienic implications of their work and basic hygienic practices. This training should include details of the personal symptoms that indicate a potential waterborne disease. All staff (employees and contractors) should be encouraged to report such symptoms without prejudice to their employment prospects.</p> <p>Employers should provide adequate toilet and washing facilities to maintain personal hygiene. Wastes from portable or temporary arrangements should be disposed of without risk to water supplies or the environment.</p>	Operator /Puttur CMC	Puttur CMC	CMC cost

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation	Cost and Source of Funds
		<p><b>Cleaning and Disinfection Procedures:</b>  Before putting into service new, repaired, rehabilitated or modified water main carrying potable water, the main must first be cleaned, disinfected, flushed and sampled to ensure that it is free from contamination.</p> <p>Contractors and his employees involved in restricted operations should be trained in the hygienic implications of their work and basic hygienic practices. This training should include details of the personal symptoms that indicate a potential waterborne disease. All staff should be encouraged to report such symptoms without prejudice to their employment prospects.</p> <p>Employees should be provided with adequate toilet and washing facilities to maintain personal hygiene. Wastes from portable or temporary arrangements should be disposed of without risk to water supplies or the environment.</p> <p><b>Handling Chlorine gas cylinders during O&amp;M period:</b>  <b>Technical precautions:</b>  Ventilate chlorine rooms adequately.  Use only suitable and tested chlorine gas equipment.  Use only approved gas warning equipment and water spraying equipment (external operation).  Ensure that there are short escape routes into the open. (Escape doors must open outwards.)  Renew the connection seal every time the chlorine cylinders are exchanged.</p> <p><b>Handling Chlorine cylinders:</b>  Proper training shall be given to the staff handling Chlorine gas cylinders and be repeated at least once a year. Only trained and designated staff shall handle gas cylinders containing chlorine.  Chlorine cylinders shall be stored with the valve cap attached securely together, with a suitable seal and the protecting cap on. Filled and empty gas cylinders should be stored separately.</p>			



Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation	Cost and Source of Funds
		<p>To prevent heating of the chlorine cylinders, they should be kept out of direct sunlight.</p> <p>Valves on chlorine gas cylinders should be operated by hand without use of force. Valves of filled or empty chlorine cylinders should always be closed securely with the correct cap.</p> <p>It is advised to store chlorine gas cylinders in an adequately ventilated room and ensure short escape routes into the open air.</p> <p>Operating instructions Material safety Data Sheet (MSDS) shall be displayed in accordance with the regulations on hazardous substances.</p> <p>When exchanging chlorine cylinders and performing vacuum and pressure tests, suitable breathing mask with filter like full face mask shall be used along with protective gloves and shoes.</p> <p><b>Procedure in the case of Emergency:</b></p> <p>Proceed according to Emergency plan and inform the concerned authority immediately</p> <p>If leakage of chlorine gas cannot be controlled using the water spray equipment, call the fire brigade immediately</p> <p>If the chlorine concentration is above the maximum workplace concentration level (0.5 ppm), use suitable compressed air breathing apparatus and a protective chemical suit.</p> <p><b>First Aid:</b></p> <p>Persons who have inhaled chlorine gas shall be moved to a site with fresh air and they require immediate medical attention.</p> <p>If the injured persons are breathless, artificial respiration is necessary. Otherwise, they should be made to inhale nebulized dexamethasone.</p> <p>If chlorine comes into contact with eyes or skin, it should be rinsed off immediately with plenty of water and consult doctor.</p> <p>Contaminated clothing should be removed immediately.</p>			

Field	Anticipated Impact	Mitigation Measures	Responsible for Mitigation	Monitoring of Mitigation	Cost and Source of Funds
Repair works during O&M of distribution network	Local disturbances during maintenance work	Contractor shall inform shopkeepers, residents and road users of repair works in advance. 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 health and safety plan to protect workers and public. Contractor may request police to divert traffic if necessary.	Operator / Puttur CMC	Puttur CMC	CMC cost
Grievance redressal during O&M	Non attending of grievances affect water supply system	Appropriate registers shall be maintained to record complaints and Junior Engineer/s from ULB shall be assigned to track follow up action to ensure that the complaint is addressed in a timely manner by the contractor. If the complaint is such that it cannot be dealt with at his level, it can be referred to higher authority to take the required decision and followed up with the contractor for the compliance. Concerned engineer from ULB shall do frequent vigilant checks at the areas from where maximum complaints have been received.	Operator / Puttur CMC	Puttur CMC	-
Increase of sewage	Increased quantity of sewage leads to open area/drain and creates health problems	Develop a comprehensive sewerage system	CMC, Puttur	KUIDFC / Government of Karnataka	CMC cost

**Table 15: Environmental Monitoring Plan**

Sample	Site/s	Responsibility	Parameter to Monitor	Frequency	Cost (₹)
Ambient air quality	112 points Six overhead tank (OHT) locations viz., Mura Shantinagra - Padnur, Karmala near Microwave station, CTO-Darbe, Lingadagudda-Kabaka, Balnad Helipad, BalnadKelyadi -Vitla Road, and one GLSR at Seethigudda and remaining five points for pipeline works. (shall be selected during construction)	Contractor	SPM, RSPM, SO <sub>x</sub> , NO <sub>x</sub> Day and night time noise (dBA) Monitoring method as prescribed by Central Pollution Control Board	Once before start of construction Quarterly (yearly 4-times) during construction period of 24 months – 9 times	₹5000 per sample – sum ₹540,000 for 108 samples
Noise Level	112 points. Six OHT locations viz., Mura Shantinagra - Padnur, Karmala near Microwave station, CTO-Darbe, Lingadagudda-Kabaka, Balnad Helipad, BalnadKelyadi - Vitla Road, and one GLSR at Seethigudda and remaining five points during execution of pipeline works. during construction)	Contractor	Noise level	Once before start of construction Quarterly (yearly 4-times) during construction period of 24 months – 9 times	₹2500 per sample - ₹270,000 for 108 samples
Surface Water Quality	2 points in nearest water bodies/ rivers that are on the downstream side of work sites (exact points to be selected during implementation)	Contractor	River Water quality – standard parameters	Once before start of construction Quarterly (yearly 4-times) during construction	14 samples (@ 2 points in 18 months) x 10000 = ₹140,000
<b>Operation Stage</b>					
Source (raw) water quality	Intake in Tungabhadra River	Contractor/ operation and maintenance (O&M) Operator	Water quality parameters (all including pesticides, heavy metals)	Once prior to start of operation and monthly during operation	12 measurements per year x 12000 = ₹144,000
Treated water quality	At the water treatment plant (WTP) outlet	Contractor/ O&M Operator	All Drinking water parameters	Monthly once during operation	Operating costs (water quality will be tested at the internal laboratory to be established in the project at WTP)
Supplied water at consumer end	Consumer end- random sampling in all zones (at least 1 sample from 1 zone/ward)	Contractor/ O&M Operator	All Drinking water parameters	Monthly once during operation	Operating costs (water quality will be tested at the internal laboratory to be established in the project at WTP)

₹ = Indian rupee, NO<sub>x</sub> = Nitrogen oxide, O&M = operation and maintenance, OHT = overhead tank, RSPM = Respirable Suspended Particulate Matter, SO<sub>x</sub> = Sulphur oxide, WTP = water treatment plant.

## B. Institutional Arrangements

143. **Executing Agency.** KUIDFC is the executing agency responsible for overall technical supervision and execution of all subprojects funded under the Investment Program. Implementation activities is overseen by Project 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.

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

145. 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, Deputy Project Director (DPD) RPMU, Municipal Commissioners'/Chief Officers of ULB and PMDCSC.

146. **Safeguards Implementation.** 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 (PMDSC) will assist PMU and PIUs in the implementation of the entire investment program including compliance with the EARF and RF. 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.

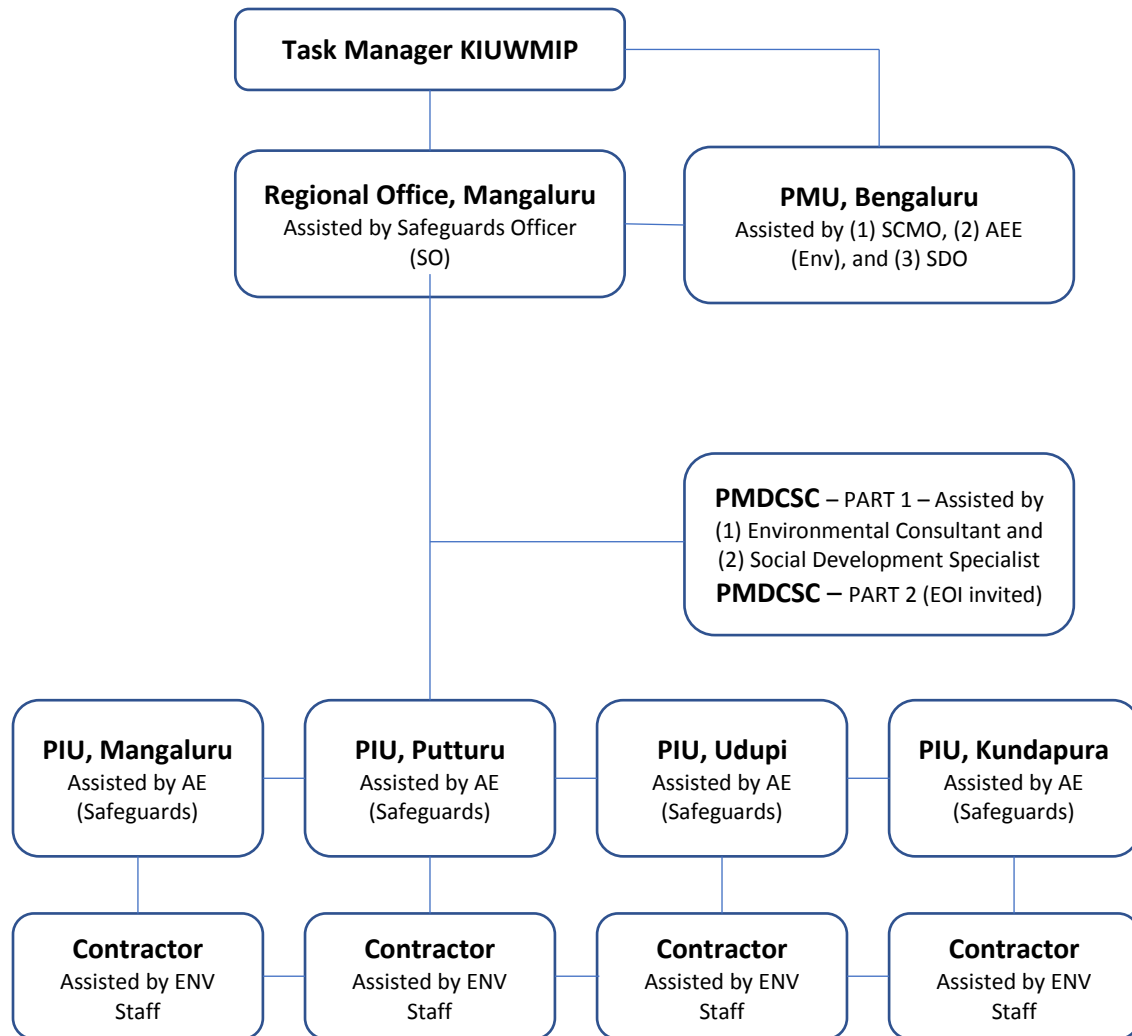
147. The responsibility fulfilling environmental requirements of Government of India and Government of Karnataka and conducting required level of environmental assessment as per ADB guidelines lies with the PIUs/ implementing agency, i.e. Puttur CMC. Consultant Team will assist the CMC in this regard.

148. 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 IA/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.

149. **Consultant Support.** A consultant team (Project Management, Design and Supervision Consultant), based in Mangalore and with field teams in tranche 2 program 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.

150. **Contractor.** The contractor shall appoint a Safeguards (EHS) Engineer who will be responsible on day-to-day implementation at field level, for (i) preparation of SEMP with inputs from technical team and ensuring implementation of SEMP/EMP; (ii) Coordinating the PMDCSC and environment specialists (all levels); (iii) community liaison, consultation with interested/affected parties and grievance redressal; and (iv) reporting.

151. 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, on (b) equal pay for equal work of equal value regardless of gender, ethnicity or caste, and on (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. The following Figure 18 and Table 16 summarizes the institutional responsibility of environmental safeguards at all stages of the project.

**Figure 18: Environmental Safeguard Implementation Arrangements**

AE = Assistant Engineer, ENV = environment, KIUWMIP = Karnataka Integrated Urban Water Management Investment Program, PIU = Project Implementation Unit, PMDCSC = Project Management Design and Construction Supervision Consultant, SCMO = safeguards and community mobilizer officer, SDO = Social Development Officer.

**Table 16: 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;	(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)	(v) Ensure environmental management plans (EMPs) are included in the bid documents and contracts; (vi) Organize an orientation workshop for Project 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), (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; (viii) Organize an induction course for the training of contractors preparing them on EMP implementation,	(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; (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,	Compliance monitoring 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
	<p>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.</p> <p>(ix) Ensure compliance with all government rules and regulations regarding site and environmental clearances as well as any other environmental requirements;</p> <p>(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</p> <p>(xi) Assist in the review of the contractors' implementation plans to ensure compliance with the IEE.</p>	<p>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.</p>	
Safeguards Officer	<p>Coordinate public consultation and information disclosure</p> <p>Liaise with local offices of regulatory agencies in obtaining clearances/approvals</p> <p>Assist PMU for clearances obtained at state level</p> <p>Review and approve contractors' updated EMPs</p> <p>Take necessary action for obtaining rights of way</p> <p>Inform affected persons on: (a) project cutoff date; (b) public notice for schedule of land acquisition/occupation; (c) entitlement matrix; (d) compensation packages against different categories of loss and tentative schedule of land clearing/acquisition for starts of civil works activities</p>	<p>Oversee day-to-day implementation of EMP by contractors, including compliance with all government rules and regulations</p> <p>Ensure continuous public consultation and awareness</p> <p>Coordinate grievance redress process and ensure timely actions by all parties</p> <p>Review monthly contractors' EMP monitoring reports</p>	<p>Review and forward quarterly monitoring reports to PMU</p> <p>Inform PMU of unanticipated impacts and formulate corrective action plan</p> <p>Recommend issuance of work completion certification to the contractor upon verification of satisfactory post-construction clean-up</p> <p>Take corrective actions when necessary to ensure no adverse impacts</p> <p>Submit monthly social and environmental monitoring reports to PMU</p>



Responsible Agency	Responsibility		
	Pre-Construction Stage	Construction Stage	Post-Construction
	Coordinate valuation of assets such as land, trees of various species, etc.		
Puttur CMC	(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. (ii) Issuance of clearance for contractor's post-construction activities as specified in the EMP.
Consultant Environment Specialist at Puttur CMC level  Resident Engineer at Puttur CMC level	(i) Assist Puttur CMC in preparation of REA checklists and EIAs/IEEs; (ii) Assist Puttur CMC 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 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.	(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 (v) Assist in addressing any grievances brought about through the Grievance Redress Mechanism in a timely manner as per the IEEs.	(i) Assist in the inspection and verification of contractor's post-construction activities.

Responsible Agency	Responsibility		
	Pre-Construction Stage	Construction Stage	Post-Construction
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) Mobilize Safeguards (EHS) Engineer; (ii) prepare SEMP and implement SEMP/EMP and corrective actions if necessary; (iii) Prepare and submit monitoring reports including pictures to ULB/CMC; (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 Puttur CMC and PMDCSC are timely informed of any foreseeable activities related to EMP implementation; and (vi) Address any grievances brought about through the Grievance Redress Mechanism in a timely manner as per the IEEs.	(i) Ensure EMP post-construction requirements are satisfactorily complied (ii) Request certification from ULBs/CMCs

## C. Training Needs

152. Table 17 presents the outline of capacity building program to ensure EMP implementation. The estimated cost is ₹85,000.00 (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 for the available skill set after assessing the capabilities of the target participants and the requirements of the project.

**Table 17: Outline of Capacity Building Program for Environmental Management Plan**

<b>Description</b>	<b>Target Participants</b>	<b>Estimate (₹) (Lump sum)</b>	<b>Cost and Source of Funds</b>
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, OHS, etc. - Incorporation of EMP into the project design and contracts - Monitoring, reporting and corrective action planning	All staff and consultants involved in the project	10,000	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	25,000	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.	25,000  25,000	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 All NGOs	25,000	PMU Cost

<b>Description</b>	<b>Target Participants</b>	<b>Estimate (₹) (Lump sum)</b>	<b>Cost and Source of Funds</b>
- Best practices followed			
5. Contractors Orientation to Workers on EMP implementation (OHS, core labor laws, spoils management, etc.)	All workers (including manual laborers) of the contractor prior to dispatch to worksite	10,000	Contractors cost as compliance to contract provisions on EMP implementation (refer to EMP tables)
Total cost for Capacity Building Program on EMP Implementation		120,000	

PMU Fund	₹ 85,000
Contractor Cost	₹ 35,000
Total cost for Capacity Building Program	₹120,000

#### **D. Monitoring and Reporting**

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

154. 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.

155. Based on monthly reports and measurements, PMU will draft, review, and submit to ADB, 6-monthly (twice a year) EMP implementation progress report (Appendix 14). Once concurrence from the ADB is received the report will be disclosed in the KUIDFC and Puttur CMC website.

156. 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.

157. 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**

158. 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. Mitigation that is the responsibility of Puttur 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.

**Table 18: Cost Estimates to Implement the Environmental Management Plan**

No.	Particulars	Stages	Unit	Number	Rate	Cost (₹)	Costs Covered By
<b>A</b>	<b>Implementation Staff</b>						
1	EHS Engineer	Construction	Per month	24	30,000	720,000	Civil works contract
<b>B.</b>	<b>Monitoring Measures</b>						
1	Air quality monitoring	Construction	Per location	9x12	5000	540,000	Civil works contract
2	Noise levels monitoring	Construction	Per location	9x12	2500	270,000	Civil works contract
	Sub Total					810,000	
<b>C</b>	<b>Capacity Building</b>						
1	Introduction and sensitization to environment issues	Pre-construction	lump sum			10,000	PMU
2	EMP implementation	Construction	lump sum			25,000	PMU
3	Plans and Protocols	Construction	lump sum			25,000	PMU
			lump sum			25,000	Civil works contract
4	Experiences and best practices sharing	Construction/Post-Construction	lump sum			25,000	PMU
5	Contractors Orientation to Workers on EMP implementation	Prior to dispatch to worksite	Lump sum			10,000	Civil works contract
	Subtotal (B)					1,20,000	
<b>D</b>	<b>Civil Works</b>						
	Construction of shelters for workers.	Construction	Lump sum			4,00,000	Civil works contract
	Providing Water Supply Facility for the workers	Construction	Lump sum			1,00,000	Civil works contract
	Providing Sanitation Facility for the workers	Construction	Lump sum			1,00,000	Civil works contract
	Barricades at the worksite (MS Sheet of 20 gauge of size 5 x 3 meters, having vertical support by MS flat (65 x 65 x 6 mm) along the sides and at 1.5 m and	Construction	Per unit			5,25,000	Civil works contract

No.	Particulars	Stages	Unit	Number	Rate	Cost (₹)	Costs Covered By
	3.5m, horizontal support by MS flat (65 x 65 x 6 mm) along the sides and at the center, supported by 50mm MS hollow pipes of 4 meter height at the ends and at the center.						
	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			18,000	Civil works contract
	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			7500	Civil works contract
	Sub Total (D)					1,150,500	
	<b>Total (A+B+C+D)</b>					<b>2,800,500</b>	

159. The air and noise quality monitoring will be done near to sensitive receptors like hospitals, educational institutions and major junctions. The total cost to implement EMP for water supply system is ₹2,800,500.

PMU Fund	₹85,000
Contractor Cost	₹2,715,500
<b>Total</b>	<b>₹2,800,500</b>

## IX. CONCLUSION AND RECOMMENDATIONS

160. The process described in this document has assessed the environmental impacts of all elements of the Puttur Water Supply System project. 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; thus, environmental impacts as being due to the project design or location were not significant.

161. The subproject components are located in Puttur urban area and surroundings. Intake is located outside the town in River Kumaradhara. However, no new works are proposed in the river, except replacement pumps in the existing jack well. No private land is required for this subproject. There are no environmentally-sensitive areas such as protected areas, wetlands, mangroves, or estuaries in or near the subproject locations. Subproject do not include any source augmentation interventions. The existing source – Kumaradhara River will provide water supply for the subproject, and the abstraction will be within the existing design capacity. Existing vented dam across the river has adequate capacity meet the demand. Environmental audit has been conducted for existing WTP, accordingly, it is proposed to develop backwash recirculation and

sludge management facilities with required capacity in this subproject to meet the requirements of both the existing and proposed WTPs.

162. No significant impacts are anticipated whether due to location or design of the subproject as the sites are selected and fixed ensuring components are not located in environmentally-sensitive areas. 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;<sup>6</sup> 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 operations 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.

163. Mitigation will be assured by a program of environmental monitoring conducted during construction and operation to ensure that all measures are implemented, and to determine whether the environment is protected as intended. This will include observations on- and off-site, document checks, and interviews with workers and beneficiaries, and any requirements for remedial action will be reported to the PIU/PMU. There will also be longer-term surveys to monitor the expected improvements in the quality of domestic water and the health of the population. There will also be regular and periodic monitoring surveys for quality of water (at intake, reservoirs and at consumer end).

164. 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.

165. 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.

166. 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.

167. The citizens of Puttur 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 water supply, they will be provided with a constant supply of better quality water, piped into their homes. The replacement of old distribution lines shall avoid cross contamination and have positive benefit on health by avoiding diseases such as diarrhea and dysentery, resulting in less expenses on healthcare, improve working days and their economic status.

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<sup>6</sup> Quantity of waste soil to be generated from pipelaying works and OHT excavation is about 154,763 cubic meter (m<sup>3</sup>). Based on discussions with design engineers and PMDCSC, 90-95% of the waste soil will be utilized for refill and remaining soil (~15,476 m<sup>3</sup>) will need to be disposed-off safely.

168. The Puttur 24x7 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.

169. Based on the findings of the IEE, the classification of the Project as Category “B” is confirmed, and no further special study or detailed EIA needs to be undertaken to comply with ADB SPS (2009). This IEE is prepared based on detailed engineering design needs to be updated in future (during design validation, preconstruction and construction phases) for changes in project components, design, locations or construction processes.

170. 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.



## RAPID ENVIRONMENTAL ASSESSMENT CHECKLIST

### Puttur 24 x 7 Water Supply Subproject– 24x7 Water Supply System in Puttur

SCREENING QUESTIONS	Yes	No	REMARKS
Project Siting Is the project area			
Densely populated?	x		Subproject activities are limited to part of the city namely Nekkiladay, Seethigudda, Mura Shantinagra, Padnur, Karmala near Microwave station, CTO, Darbe, Lingadagudda, Kabaka, Balnad Helipad, BalnadKelyadi, Vitla Road, and surroundings. The distribution network will extend to the entire city including the densely populated areas. There are no major negative impacts envisaged, because water supply network will be located in unused government lands alongside the existing roads and can be constructed without causing disturbance to houses and commercial establishments. In narrow streets, disruption to road users is likely, and measures like best activity scheduling/ traffic management, alternative routes, and prior information to road users, houses and shops will minimize the impact to acceptable levels. The construction of the new overhead storage reservoir site is located on the outskirts
Heavy with development activities?	x		Puttur is a developing town; urban expansion is considerable.
Adjacent to or within any environmentally sensitive areas?		x	
Cultural heritage site		x	
Protected Area		x	
Wetland		x	
Mangrove		x	
Estuarine		x	
Buffer zone of protected area		x	
Special area for protecting biodiversity		x	
Bay		x	
Potential Environmental Impacts Will the Project cause			
Pollution of raw water supply from upstream wastewater discharge from communities, industries, agriculture, and soil erosion runoff?		x	Subproject will utilize the existing surface sources; no source improvement / augmentation proposed in the subproject
Impairment of historical/cultural monuments/areas and loss/damage to these sites?		x	There is no historical / cultural monument in the project location.
Hazard of land subsidence caused by excessive ground water pumping?		x	No ground water source will be used for this project.

SCREENING QUESTIONS	Yes	No	REMARKS
▪ Social conflicts arising from displacement of communities?		x	The subproject for Puttur City Water Supply Scheme requires eight lands, all are government land and one government land for construction of GLSR is to be procured. Action initiated to buy the land.
▪ Conflicts in abstraction of raw water for water supply with other beneficial water uses for surface and ground waters?		x	No source improvement/ augmentation proposed in the subproject
▪ Unsatisfactory raw water supply (e.g. excessive pathogens or mineral constituents)?		x	Subproject involves supply of treated water.
▪ Delivery of unsafe water to distribution system?		x	Subproject involves distribution of treated water supplies
▪ Inadequate protection of intake works or wells, leading to pollution of water supply?		x	Subproject will utilize the existing surface sources; no source improvement/augmentation proposed in the subproject
▪ Over pumping of ground water, leading to salinization and ground subsidence?		x	No ground water is proposed to be abstracted.
▪ Excessive algal growth in storage reservoir?		x	Regular cleaning of storage reservoir shall be ensured to avoid algal growth in the reservoir
▪ Increase in production of sewage beyond capabilities of community facilities?		x	Sewerage system of adequate capacity including treatment is being proposed under the KIUWMIP
▪ Inadequate disposal of sludge from water treatment plants?		x	
▪ Inadequate buffer zone around pumping and treatment plants to alleviate noise and other possible nuisances and protect facilities?		x	
▪ Impairments associated with transmission lines and access roads?	x		Anticipated during construction activities. However, impacts are temporary and short in duration. The EMP includes measure to mitigate impacts.
▪ Health hazards arising from inadequate design of facilities for receiving, storing, and handling of chlorine and other hazardous chemicals.		x	Subproject includes chlorine dispersion tank near chlorination unit.
▪ Health and safety hazards to workers from the management of chlorine used for disinfection and other contaminants?		x	Subproject include chlorine dispersion tank near chlorination unit.
▪ Dislocation or involuntary resettlement of people	x		There may be temporary disturbance to business and squatters/vendors during construction. A resettlement plan shall mitigate/compensate these impacts.
▪ disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?		x	Not applicable

SCREENING QUESTIONS	Yes	No	REMARKS
▪ noise and dust from construction activities?	x		Short term impact on air quality due to dust generation during construction activities is anticipated. Appropriate dust suppression measures will be taken to minimize dust generation due to construction activities at site. No significant increase in noise level is anticipated due to construction. All equipment and machineries will conform to the Statutory norms.
▪ Increased road traffic due to interference of construction activities? Proper traffic management and planning will be ensured during construction	x		Proper traffic management and planning will be ensured during construction.
▪ continuing soil erosion/silt runoff from construction operations?	x		Construction activities (pipe laying, etc.) on hill slopes may increase the chance of land slide and soil erosion. Careful stacking of excavated materials will be ensured to avoid slippage and erosion especially on hill slopes (GLSR site). Construction work during monsoon shall be carried out with due care so that silt run off due to construction operation is prevented. No construction will be allowed during rains.
▪ delivery of unsafe water due to poor O&M treatment processes (especially mud accumulations in filters) and inadequate chlorination due to lack of adequate monitoring of chlorine residuals in distribution systems?		x	Trained and skilled staff will be deployed for O&M. Also, quality of treated water will be regularly monitored through water sample testing to ensure delivery of safe water to consumers
▪ delivery of water to distribution system, which is corrosive due to inadequate attention to feeding of corrective chemicals?		x	High Density Poly Ethylene pipes will be used for distribution system and are non-corrosive in nature.
▪ accidental leakage of chlorine gas?		x	Subproject include chlorine dispersion tank near chlorination unit.
▪ Excessive abstraction of water affecting downstream water users?		x	Subproject will utilize the existing surface sources; no source improvement / augmentation proposed in the subproject.
▪ competing uses of water?		x	Not applicable.
▪ increased sewage flow due to increased water supply	x		Sewerage system of adequate capacity including treatment is being proposed under KIUWMIP
▪ increased volume of sullage (wastewater from cooking and washing) and sludge from wastewater treatment plant	x		Sewerage system of adequate capacity including treatment is being proposed under KIUWMIP
▪ large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?		x	No such impact anticipated as the import of workforce will be limited to skilled workers; local communities in the vicinity of the project would be employed as much as possible.
▪ social conflicts if workers from other regions or countries are hired?		x	Not anticipated as local communities within the project vicinity will be employed as much as possible.

SCREENING QUESTIONS	Yes	No	REMARKS
▪ risks to community health and safety due to the transport, storage, and use and/or disposal of materials such as explosives, fuel and other chemicals during operation and construction?		x	Not applicable. Construction will not involve use of explosives and chemicals.
▪ community safety risks due to both accidental and natural hazards, especially where the structural elements or components of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning.		x	Operational area will be clearly demarcated and access will be controlled. Only workers and project concerned members will be allowed to visit the operational sites

## **ENVIRONMENTAL AND LABOUR RELATED LEGISLATIONS IN INDIA**

### **1. 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; and
- (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.

## CENTRAL POLLUTION CONTROL BOARD STANDARDS FOR DIESEL GENERATOR SETS

### Standards for Diesel Generator Sets: Stack Height

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

$$H = h + 0.2 \times \text{KVA}$$

H = Total height of stack in metre

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

KVA = Total generator capacity of the set in KVA

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

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

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

### PART-E Noise Standards

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

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



## APPLICABLE AMBIENT AIR QUALITY AND NOISE STANDARDS

**Table 1: Applicable Ambient Air Quality Standards**

Parameter	Location <sup>a</sup>	Applicable Standards Per ADB SPS <sup>e</sup> (µg/m <sup>3</sup> )
PM <sub>10</sub>	Industrial Residential, Rural and Other Areas	20 (Annual) <sup>c</sup> 50 (24-hr) <sup>c</sup>
	Sensitive Area	20 (Annual) <sup>c</sup> 50 (24-hr) <sup>c</sup>
PM <sub>25</sub>	Industrial Residential, Rural and Other Areas	10 (Annual) <sup>c</sup> 25 (24-hr) <sup>c</sup>
	Sensitive Area	10 (Annual) <sup>c</sup> 25 (24-hr) <sup>c</sup>
SO <sub>2</sub>	Industrial Residential, Rural and Other Areas	50 (Annual) <sup>b</sup> 20 (24-hr) <sup>c</sup> 500 (10-min) <sup>c</sup>
	Sensitive Area	20 (Annual) <sup>b</sup> 20 (24-hr) <sup>c</sup> 500 (10-min) <sup>c</sup>
NO <sub>2</sub>	Industrial Residential, Rural and Other Areas	40 (Annual) <sup>b</sup> 80 (24-hr) <sup>b</sup> 200 (1-hr) <sup>c</sup>
	Sensitive Area	30 (Annual) <sup>b</sup> 80 (24-hr) <sup>b</sup> 200 (1-hr) <sup>c</sup>
CO	Industrial Residential, Rural and Other Areas	2,000 (8-hr) <sup>b</sup> 4,000 (1-hr) <sup>b</sup> 100,000 (15-min) <sup>d</sup>
	Sensitive Area	2,000 (8-hr) <sup>b</sup> 4,000 (1-hr) <sup>b</sup> 100,000 (15-min) <sup>d</sup>
Ozone (O <sub>3</sub> )	Industrial Residential, Rural and Other Areas	100 (8-hr) <sup>b</sup> 180 (1-hr) <sup>b</sup>
	Sensitive Area	100 (8-hr) <sup>b</sup> 180 (1-hr) <sup>b</sup>
Lead (Pb)	Industrial, Residential, Rural and Other Areas	0.5 (Annual) <sup>b</sup> 1.0 (24-hr) <sup>b</sup>
	Sensitive Area	0.5 (Annual) <sup>b</sup> 1.0 (24-hr) <sup>b</sup>
Ammonia (NH <sub>3</sub> )	Industrial Residential, Rural and Other Areas	100 (Annual) <sup>b</sup> 400 (24-hr) <sup>b</sup>
	Sensitive Area	100 (Annual) <sup>b</sup> 400 (24-hr) <sup>b</sup>
Benzene (C <sub>6</sub> H <sub>6</sub> )	Industrial Residential, Rural and Other Areas	5 (Annual) <sup>b</sup>
	Sensitive Area	5 (Annual) <sup>b</sup>
Benzo(o)pyrene (BaP) particulate phase only	Industrial Residential, Rural and Other Areas	0.001 (Annual) <sup>b</sup>
	Sensitive Area	0.001 (Annual) <sup>b</sup>
Arsenic (As)	Industrial Residential, Rural and Other Areas	0.006 (Annual) <sup>b</sup>
	Sensitive Area	0.006 (Annual) <sup>b</sup>
Nickel (Ni)	Industrial Residential, Rural and Other Areas	0.02 (Annual) <sup>b</sup>
	Sensitive Area	0.02 (Annual) <sup>b</sup>

<sup>a</sup> Sensitive area refers to such areas notified by the India Central Government.

<sup>b</sup> Notification by Ministry of Environment and Forests, Government of India Environment (Protection) Seventh Amendment Rules, 2009

<sup>c</sup> WHO Air quality guidelines for particulate matter, ozone, nitrogen dioxide and sulfur dioxide. *Global update 2005*. WHO. 2006

<sup>d</sup> Air Quality Guidelines for Europe Second Edition. WHO 2000.

<sup>e</sup> 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 <sup>c</sup> (dBA)	
	Day time	Night time
Industrial area	70 <sup>b</sup>	70 <sup>b</sup>
Commercial area	65 <sup>a</sup>	55 <sup>a</sup>
Residential Area	55 <sup>a</sup>	45 <sup>a</sup>
Silent Zone	50 <sup>a</sup>	40 <sup>a</sup>

<sup>a</sup> Noise Pollution (Regulation and Control) Rules, 2002 as amended up to 2010.

<sup>b</sup> Guidelines for Community Noise. WHO. 1999

<sup>c</sup> 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 <sup>a, b, c</sup>
pH	pH	6 – 9 <sup>b</sup>
BOD	mg/l	20 <sup>a</sup>
COD	mg/l	125 <sup>b</sup>
Total nitrogen	mg/l	10 <sup>b</sup>
Total phosphorus	mg/l	2 <sup>b</sup>
Oil and grease	mg/l	10 <sup>b</sup>
Total suspended solids	mg/l	<50 <sup>a</sup>
Total coliform bacteria	MPN b / 100 ml	400a <sup>b</sup>

<sup>a</sup> Environment (Protection) Amendment Rules, 2017.

<sup>b</sup> Health-based guideline values.

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

<sup>a</sup> Bureau of India Standard 10200: 2012.

<sup>b</sup> Health-based guideline values.

<sup>c</sup> 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.

<sup>d</sup> Figures in parenthesis are maximum limits allowed in the absence of alternate source.

# WATER QUALITY TEST RESULTS OF KUMARADHARA RIVER, PUTTUR



NATIONAL INSTITUTE OF TECHNOLOGY KARNATAKA, SURATHKAL  
P.O. SRINIVASNAGAR - 575 025

DEPARTMENT OF CIVIL ENGINEERING

Date : 19.06.2015

## TEST REPORT ON WATER SAMPLES

Ref : Letter No. 23-35-00020/05-15/111 dated 16.06.2015 of Tenn Leader, CKW Consult GmbH, WBVHA Towers, 11 Floor, 580, Anandapur, Kolkata-700 107.

Sample No. 1: Mangalore Dam site, Tumbe (Before treatment)

Sample No. 3: Puttur Dam site, (Before treatment)

Sample No. 2: Mangalore WTP-treated

Sample No. 4: Puttur WTP-treated

### SAMPLING WAS DONE BY THE PARTY

Sl. No.	Test parameter	Result Unit	RESULT				Acceptable Upper Limit for Drinking (IS10500-1992)
			Sample No. 1	Sample No. 2	Sample No. 3	Sample No. 4	
	pH		7.09	6.74	6.88	6.8	From 6.50-8.50
	Total Hardness, as CaCO <sub>3</sub>	mg/L	23	22	16	18	300.00
	Iron Content, as Fe	mg/L	0.38	0.14	0.33	0.1	0.30
	Chloride, as Cl <sup>-</sup>	mg/L	6.5	7	5.5	6	250.00
	Nitrate, as NO <sub>3</sub>	mg/L	N.D.	N.D.	N.D.	N.D.	45.00
	Sulfate, as SO <sub>4</sub>	mg/L	N.D.	N.D.	N.D.	N.D.	200.00
	Most Probable Number	MPN Index /100ml	39	Nil	32	Nil	Nil

(N.D. : Not Detectable)

REPORT : Provided water samples 1 & 3 are found not suitable for drinking purposes.

(B. MANU)  
FACULTY MEMBER  
DEPT. OF CIVIL ENGG.



(K. N. LOKESH)  
PROF. AND HEAD  
DEPT. OF CIVIL ENGG.

**LIST OF CLEARANCES REQUIRED**

<b>No.</b>	<b>Permission</b>	<b>Water Supply Network</b>	<b>Responsibility</b>
1	KSPCB	NA	NA
2	National Highways / PWD	Parallel to NH-275 rider lines are proposed. Clearance required for distribution package  Clear Water rising Main of 400 mm dia DI pipe passes all along Highway for 2051 m require permission from NH.	ULB/PIU
3	Railway	Railway crossing at chainage 140/400 at Bolwar near Kabaka Puttur railway station for transmission main component	ULB/PIU
4	Utilities (HESCOM, BSNL)	Clearance Required, if crossing	ULB/PIU
5	Labour License	License Required.	Contractor
6	Forest	NA	NA

## ANALYSIS OF KUMARADHARA RIVER DISCHARGES

1. There is no gauging station on river Kumaradhara. The confluence point of Kumaradhara and Nethravathi rivers is at Uppinangadi which is about 400 m downstream from the barrage site. There are two river gauging stations established on Nethravathi River for monitoring the discharge in the river. Index map (Drawing no. 1) showing the barrage site and its catchment area is enclosed. The Water Resource Development Dept. of GOK monitors the gauging station on upstream of confluence point. The Central Water Commission (CWC) Department monitors the gauging station at Bantwal, which is about 20 KM on down stream of confluence point.

2. Discharge data has been collected for both the gauging stations for studying the quantum of water available during summer period. Data for upstream gauging station is available from 1996 to 2002, whereas for downstream gauging station data is available from 1990 to 1998. For the remaining period from 1999 to 2002 the data of downstream gauging station has not yet been compiled by CWC and hence could not be obtained. In this, the daily discharge data is available from 1990 to 1995 and 10 days average discharge data from 1996 onwards, as the CWC has discontinued publishing daily discharge data from 1996 onwards. The minimum and maximum discharges recorded at Bantwal gauging station for 1990 to 1998 are given in the table 1.

**Table A9.1: Min and Max Daily Discharges of River Nethravati at Bantwal in Cumecs**

Year		March	April	May
1990	Min	0.514	.121	0.05
	Max	4.099	1.19	251.8
1991	Min	0.632	0.637	1.381
	Max	5.5	6.595	15.96
1992	Min	0.769	0.507	58.35
	Max	4.632	1.54	1.36
1993	Min	3.995	3.379	1.688
	Max	5.847	4.141	25.24
1994	Min	6.064	5.935	7.783
	Max	6.095	7.874	20.74
1995	Min	1.23	0.57	2.683
	Max	7.22	4.507	171.6
1996	Min	.836	1.486	1.084
	Max	2.888	6.495	1.988
1997	Min	1.421	0.76	1.386
	Max	4.5	2.87	5.546
1998	Min	2.334	1.315	0.885
	Max	7.63	3.307	4.606

3. The flow data from upstream gauging station is not available for this period of 1990-98. As such the flow in the Kumaradhara River during the above lean period cannot be established. However, there will be considerable reduction in the flow of Kumaradhara. The flow patterns vary to a considerable extent as indicated in Table A9.1.

4. For water supply schemes the percentage of dependability has to be 100 %. The estimated water demand for Puttur town for next 25 years is around 9.5 mld corresponding to 0.11 cumecs. Atleast twice the requirement is to be ensured, since water is drawn from particular location of river where there is no collection of water from the entire cross sectional area of river. The width of the water is about 200 m with formation of channels within the river bed with

obstructions. So, it is clear that some barrier is necessary to divert the flow towards the intake well.

5. As per the river gauge data at Bantwal a minimum discharge of 0.05 Cumecs has been recorded on 6 May 1990. The discharge at Bantwal gauging station is the cumulative discharges of Nethravathi and Kumaradhara rivers. Hence the flow in Kumaradharariver has to be arrived at after deducting the discharges in upstream of Nethravathi river. This will be very much less than the observed discharges at Bantwal. From the daily discharge data at Bantwal during the year 1990, the number of days falling short of the required discharge of 0.22 Cumecs is 21 days. Detailed analysis showing daily discharge is shown in table 2. This could be more on worst rainfall year as well as the lift irrigation demand is considered.

6. Catchment area of Nethravati river at Bantwal gauging station is 3,300 km<sup>2</sup> and in Kumaradharariver at Barrage site is 1,930 km<sup>2</sup>. In the absence of gauge data of Kumaradharariver at barrage site, the probable discharge is estimated at 60 % of the discharge of Netravathi based on proportional catchment area. The short fall in discharge requirement at the barrage site works out to 24 days. Details showing daily discharge and shortfall is enclosed for reference.



## ENVIRONMENTAL AUDIT OF THE EXISTING WATER TREATMENT PLANT IN PUTTUR

### 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 PutturCMC'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. 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 Puttur

Location	Puttur Town Latitude:12°77'N Longitude:75°22'E
Start of operation (year)	2005-2006
Owned by	CMC Puttur
Contact person and designation	Mr. Thulasidas Junior Engineer +9194492209204
Capacity	6.8 million liters per day (MLD)
Water supply source	River Kumaradhara, (intake well is 12km from Puttur)
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, Tube Settler including a flocculation zone in the center, Four sand filters, Chlorination system and Clear water Sump.  Materials: All civil structures are made of reinforced cement concrete, and mechanical units like the of mild steel.  Process: the water from raw water pumping main enters into the inlet, and the first unit is cascade aerator. After aeration water passes through Parshall flume, where flow is measured. Coagulant and flocculent chemicals (alum and Lime) are added to the water, and mixed in the flash mixer tank, and then flows into flocculator and tube settler and 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 River Kumaradhara.
Chlorination system	Chlorine dosage system is not proper; there are no safety precautions in

	<p>place.</p> <p>Chlorine cylinders (900 kg tonners) are placed haphazardly at the facility; the dosage system is not properly functional; no safety systems like leak detection or emergency alarm or lime slurry pit available in the facility. Operators are not aware of safety measures or actions to be performed during any emergency.</p>
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### **SAMPLE OUTLINE SPOIL 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 a) The type / material, b) Potential contamination by that type, c) Expected volume (site / component specific), d) Spoil Classification etc.

#### **II. Spoils management**

The Spoil Management section gives the details of a) Transportation of spoil b) disposal site details c) Precautions taken d) Volume of contaminated spoil, if present, d) 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 PLAN**

### **A. Principles for Traffic Management Plan Around the Water Pipes Construction Sites**

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

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

### **B. Operating Policies for Traffic Management Plan**

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

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

3. **Figure A2 to Figure A12** illustrates the operating policy for TMP for the construction of water pipes and the sewers along various types of roads.

### **C. Analyze the Impact due to Street Closure**

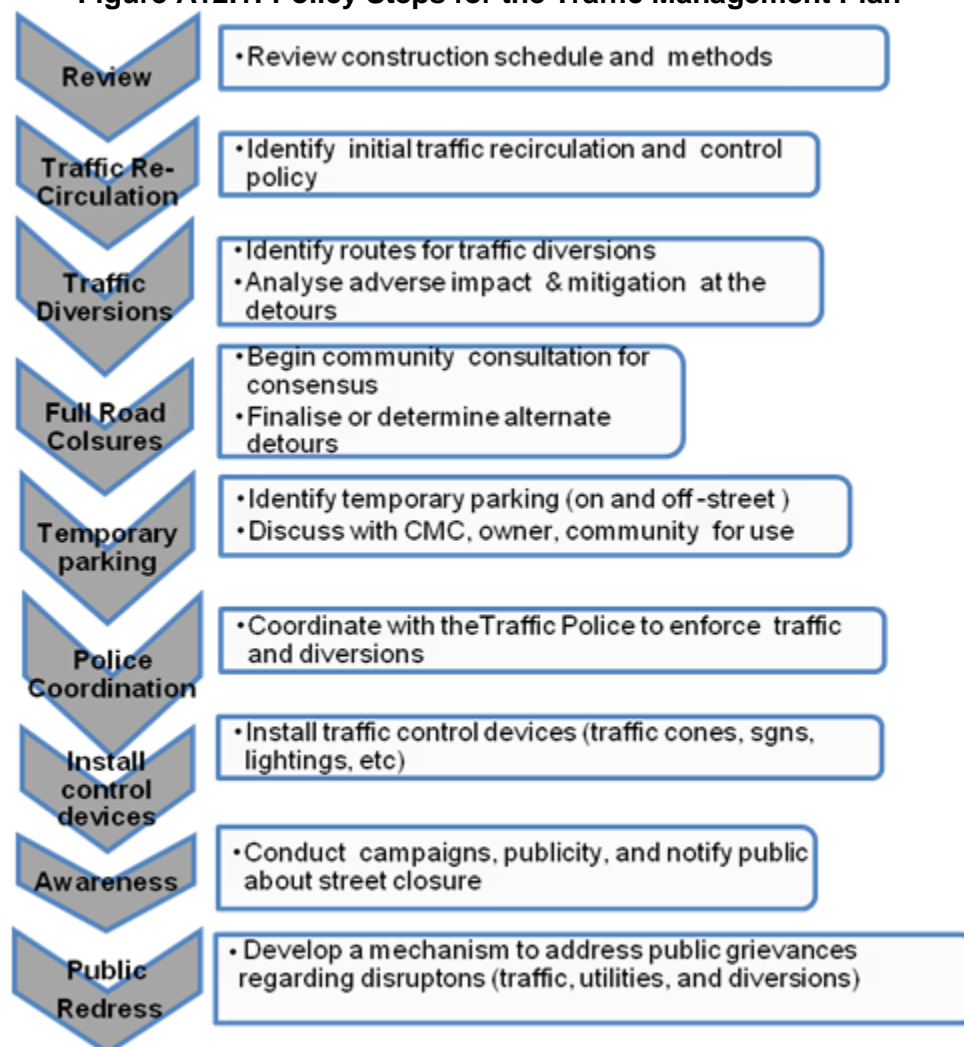
4. Apart from the capacity analysis, a final decision to close a particular street and divert the traffic should involve the following steps:

- (i) Approval from the Puttur City 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.

5. If full road-closure of certain streets within the area is not feasible due to inadequate capacity of the Detour Street or public opposition, the full closure can be restricted to weekends with the construction commencing on Saturday night and ending on Monday morning prior to the morning peak period.

**Figure A12.1: Policy Steps for the Traffic Management Plan**



#### **D. Public awareness and notifications**

6. 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.

7. The awareness campaign and the prior notification for the public will be a continuous activity which the project will carry out to compensate for the above delays and minimize public claims as result of these problems. These activities will take place sufficiently in advance of the time when the roadblocks or traffic diversions take place at the particular streets. The reason for this is to allow sufficient time for the public and residents to understand the changes to their travel plans. The project will notify the public about the roadblocks and traffic diversion through public notices, ward level meetings and city level meeting with the elected representatives.

8. 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 behavior along the work zones; and
- (iii) Reduced speeds enforced at the work zones and traffic diversions.

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

10. The campaign will cater to all types of target groups i.e. children, adults, and drivers. Therefore, these campaigns will be conducted in schools and community centers. In addition, the project will publish a brochure for public information. These brochures will be widely circulated around the area and will also be available at the PIU, and the contractor's site office. The text of the brochure should be concise to be effective, with a lot of graphics. It will serve the following purpose:

- (i) Explain why the brochure was prepared, along with a brief description of the project;
- (ii) Advise the public to expect the unexpected;
- (iii) Educate the public about the various traffic control devices and safety measures adopted at the work zones;
- (iv) Educate the public about the safe road user behavior 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**

11. 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

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

13. **Figure A2 to Figure A12:** illustrates a typical set-up for installing traffic control devices at the work zone of the area, depending on the location of work on the road way, and road geometrics:

- Work on shoulder or parking lane
- Shoulder or parking lane closed on divided road
- Work in Travel lane
- Lane closure on road with low volume
- Lane closure on a two-line road with low volume (with yield sign)
- Lane closure on a two-line road with low volume (one flagger operation)
- Lane closure on a two lane road (two flagger operation)
- Lane closure on a four lane undivided Road
- Lane closure on divided roadway
- Half road closure on multi-lane roadway
- Street closure with detour

14. 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.

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

16. In addition to the delineation devices, all the construction workers should wear fluorescent safety vests and helmets in order to be visible to the motorists at all times. There should be provision for lighting beacons and illumination for night constructions.

**Figure A2 & A3: Work on shoulder or parking lane & Shoulder or parking lane closed on divided road**

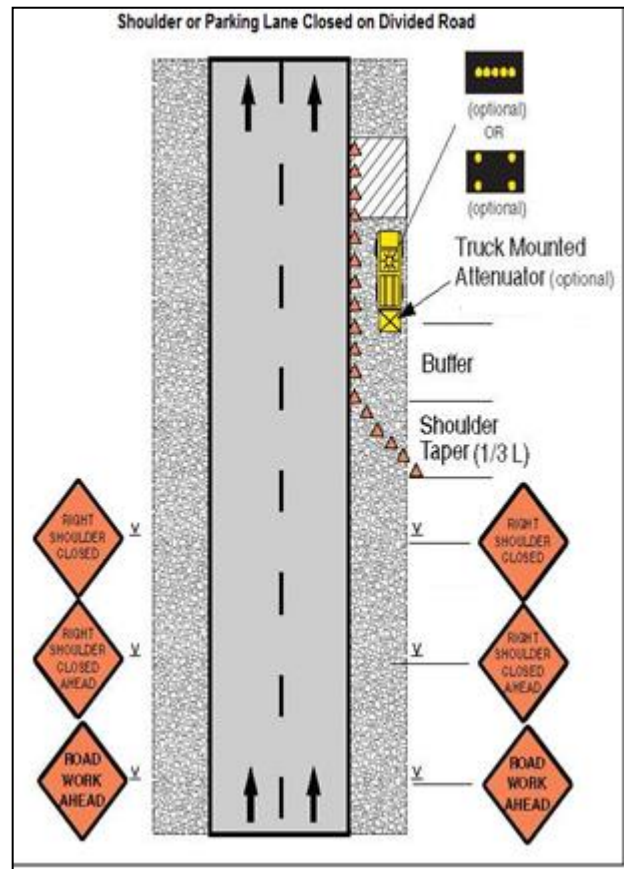
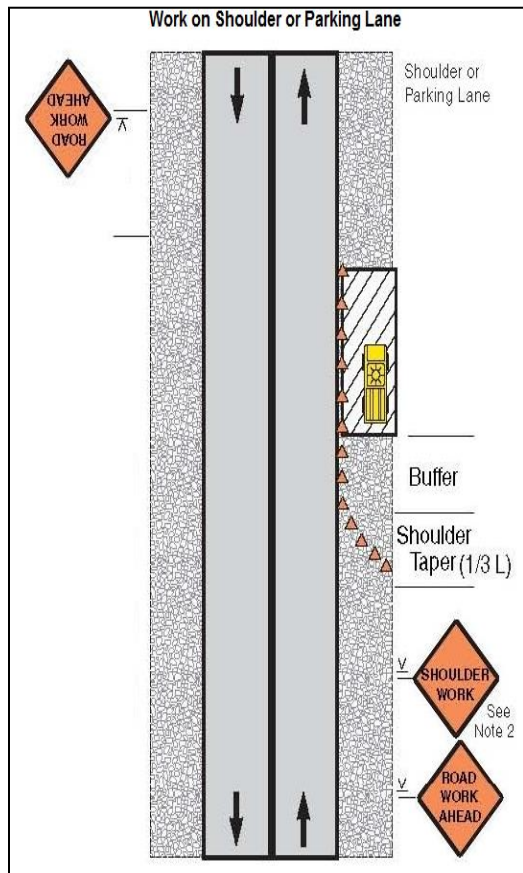
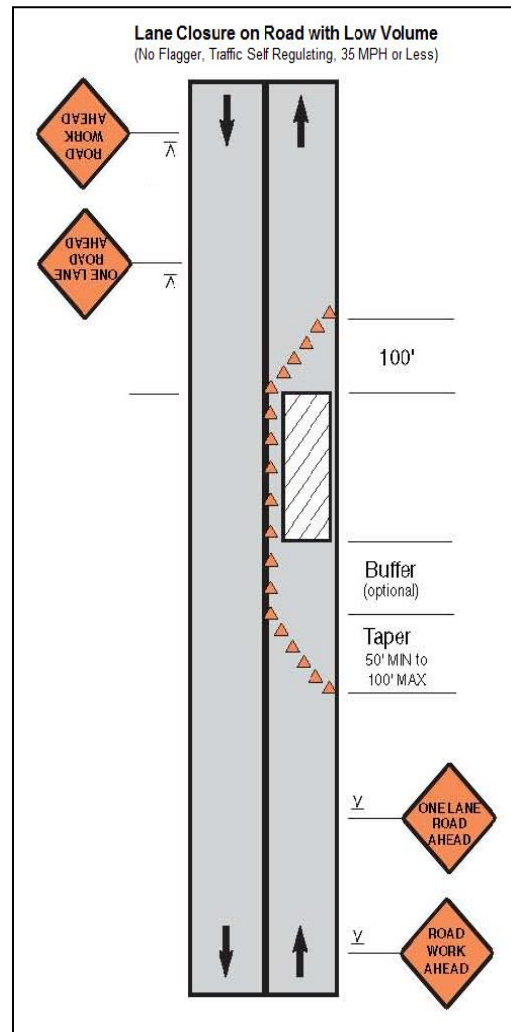
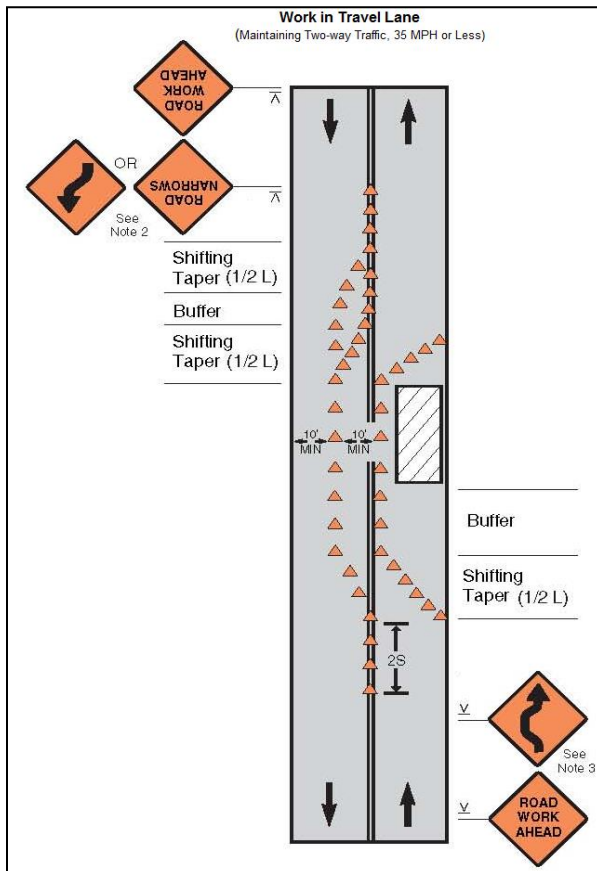
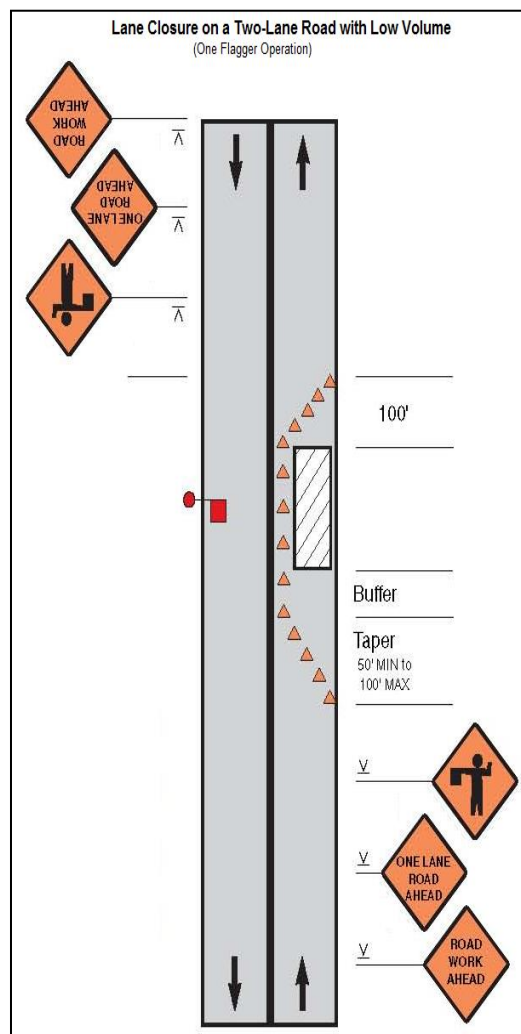
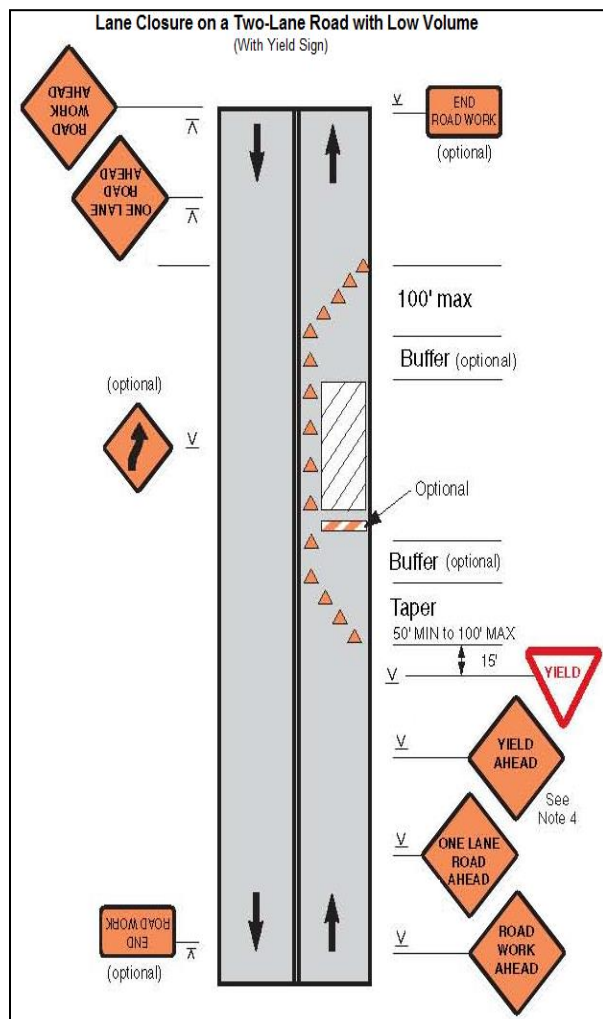




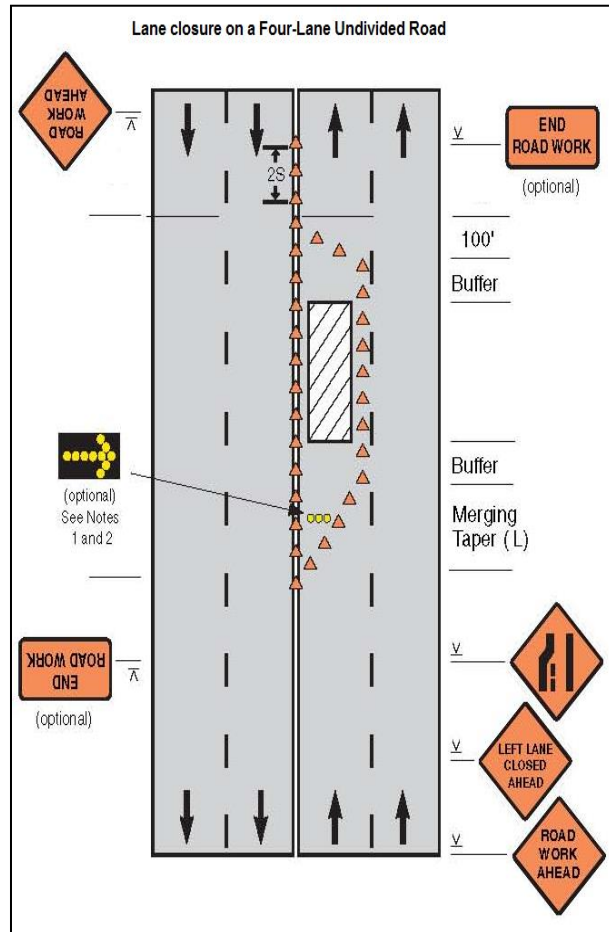
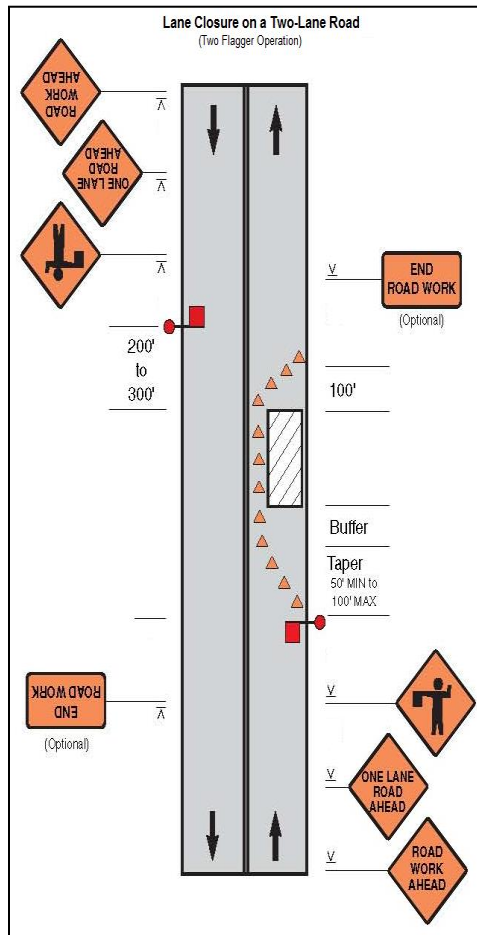
Figure A4 and A5: Work in Travel Lane &amp; Lane Closure on Road with Low Volume



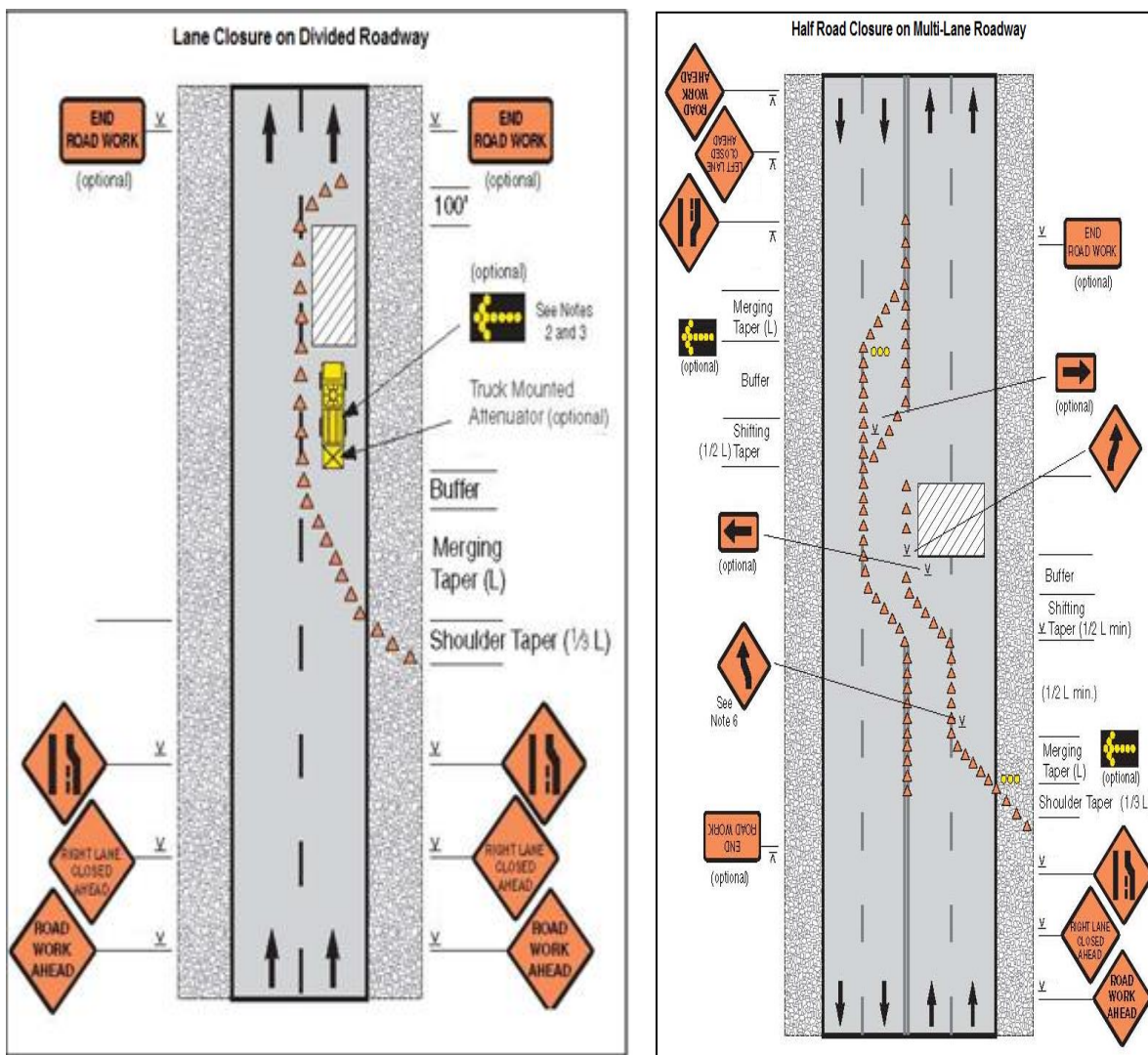
**Figure A6 and A7: Lane Closure on a Two-Line Road with Low Volume (with yield sign) and Lane Closure on a Two-Line Road with Low Volume (one flagger operation)**



**Figure A8 and A9: Lane closure on a Two-Lane Road (two flagger operation) and Lane Closure on a Four-Lane Undivided Road**



**Figure A10 and A11: Lane Closure on Divided Roadway and Half Road Closure on Multi-Lane Roadway**





## MINUTES OF THE STAKEHOLDER CONSULTATION MEETING

### A. Public Workshop on Detailed Project Report at Town Hall Puttur on 28 June 2016

The meeting was attended by key stakeholders from Puttur CMC including public/elected representatives, ULB officials, officials from other line departments and executing agency KUIDFC, and non-government organizations (NGOs)/community-based organizations (CBOs). The meeting was chaired by Commissioner CMC.

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

Minutes of Meeting enclosed.

#### Meeting Session

- Consultant Engineers presented 24x7 water supply project report to the meeting.
- Publics informed and suggested CMC, that ADB-1 stage, KUDCEMP is a failure in Puttur, hence it is better to confirm the success of the scheme before implementation of ADB-2.
- Publics suggested to Puttur CMC to consider rain water harvesting.
- Publics suggested Puttur CMC, while executing the works all CMC council members should check the work in site.
- Publics requested to consider role of public in this project.
- Member of the Legislative assembly suggested to consult PWD / NH/ railway department before implementation.
- President, CMC Puttur, stated that to make success of this project, it is decided to place project report in front of public and get approval from public itself.
- Commissioner, Puttur CMC offered help to resolve issues of water supply and to finalize the proposals to improve water systems.
- Commissioner, Puttur CMC, promised support and coordination during project implementation.
- CMC Commissioner suggested that Maps or drawings showing the proposals to be placed in public places while executing the works.



Public Workshop in Puttur Town Hall on Detailed Project Report (DPR)



Public Workshop in Puttur Town Hall on DPR





Public Workshop in Puttur Town Hall on DPR



Public Workshop in Puttur Town Hall on DPR

**B. Stakeholder Consultation at Various Sites in Puttur**



Site inspection @ Seethigudda by Assistant Commissioner, Puttur

**C. Stakeholder Consultation with Elected Representatives**



Inception Report Approval Meeting @ Council Hall Puttur CMC



Preliminary Design Report Approval Meeting @ Council Hall Puttur CMC



Preliminary Design Report Approval Meeting @ Council Hall Puttur CMC



Preliminary Design Report Approval Meeting @ Council Hall Puttur CMC



Public Workshop in Puttur Town Hall on DPR



Public Workshop in Puttur Town Hall on DPR





Public Workshop in Puttur Town Hall on DPR



Public Workshop in Puttur Town Hall on DPR

## MONITORING AND REPORTING FORMATS

### SEMI-ANNUAL ENVIRONMENTAL MONITORING REPORT

#### I. INTRODUCTION

- Overall project description and objectives
- Environmental category as per ADB Safeguard Policy Statement, 2009
- Environmental category of each subproject as per national laws and regulations
- Project Safeguards Team

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

- Overall project and sub-project progress and status
- 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) <sup>a</sup>	Contract Status (specify if under bidding or contract awarded)	On-going Construction	
				%Physical Progress	Expected Completion Date

<sup>a</sup> If on-going construction, include %physical progress and expected date of completion.



- 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).
- Confirm if any dust was noted to escape the site boundaries and identify dust suppression techniques followed for site/s.
- Identify muddy water was escaping site boundaries or muddy tracks were seen on adjacent roads.
- 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;
- Identify designated areas for concrete works, chemical storage, construction materials, and refueling. Attach photographs of each area.
- Confirm spill kits on site and site procedure for handling emergencies.
- Identify any chemical stored on site and provide information on storage condition. Attach photograph.
- Describe management of stockpiles (construction materials, excavated soils, spoils, etc.). Provide photographs.
- Describe management of solid and liquid wastes on-site (quantity generated, transport, storage and disposal). Provide photographs.
- Provide information on barricades, signages, and on-site boards. Provide photographs.
- Provide information on
- 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)<sup>a</sup>**

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

<sup>a</sup> Attach Laboratory Results and Sampling Map/Locations

**Overall Compliance with CEMP/EMP**

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

**V. APPROACH AND METHODOLOGY FOR ENVIRONMENTAL MONITORING OF THE PROJECT**

- 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/m <sub>3</sub>	SO2 µg/m <sub>3</sub>	NO2 µg/m <sub>3</sub>

Site No.	Date of Testing	Site Location	Parameters (Monitoring Results)		
			PM10 µg/m <sub>3</sub>	SO2 µg/m <sub>3</sub>	NO2 µg/m <sub>3</sub>

**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)
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			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 <sub>eq</sub> (dBA) (Government Standard)	
			Day Time	Night Time

Site No.	Date of Testing	Site Location	LA <sub>eq</sub> (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.

### 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 \_\_\_\_\_

Position \_\_\_\_\_

Name \_\_\_\_\_

Position \_\_\_\_\_