

# Initial Environmental Examination

---

April 2014

**IND: Jammu and Kashmir Urban Sector Development Investment Programme (JKUSDIP) — Rehabilitation of Water Supply Network in identified areas within Zone 2, 3, 4 and 5 in Jammu and Up-gradation of Water Supply Network for Reduction of Non-Revenue Water (NRW) for Zone - I (Old Jammu) at Jammu City**

Prepared by Economic Reconstruction Agency, Government of Jammu and Kashmir for the Asian Development Bank.

## **CURRENCY EQUIVALENTS**

(as of 9 April 2014)

Currency unit	–	rupee (INR)
INR1.00	=	\$0.01672
\$1.00	=	INR 59.781

## **ABBREVIATIONS**

ADB	-	Asian Development Bank
ASI	-	Archeological Survey of India
BIS	-	Bureau of Indian Standards
CBD	-	Central Business District
CTE	-	Consent To Establish
CTO	-	Consent To Operate
CPCB	-	Central Pollution Control Board
CPHEEO	-	Central Public Health And Environmental Engineering Organization
CPS	-	Central Pumping Station
DI	-	Ductile Iron
DMA	-	District Metering Area
DSC	-	Design And Supervision Consultancy
EA	-	Executing Agency
EAC	-	Expert Appraisal Committee
EARF	-	Environment Assessment And Review Framework
EC	-	Environmental Clearance
EIA	-	Environmental Impact Assessment
EMP	-	Environment Management Plan
ERA	-	Economic Reconstruction Agency
FI	-	Financial Intermediary
GLSR	-	Ground Level Service Reservoir
GoI	-	Government Of India
GPH	-	Gallon Per Hour
GRM	-	Grievance Redressal Mechanism
HDPE	-	High Density Poly-Ethylene
IA	-	Implementing Agency
IEE	-	Initial Environmental Examination
IST	-	Indian Standard Time
J&K	-	Jammu And Kashmir
JDA	-	Jammu Development Authority
JKUSDIP	-	Jammu And Kashmir Urban Sector Development Investment Programme
JMC	-	Jammu Municipal Corporation
LG	-	Lac Gallon
LHS	-	Left Hand Side
LPCD	-	Liter Per Capita Per Day
MFF	-	Multi –Tranche Financing Facility
ML	-	Million Liter
MLD	-	Million Liter Per Day
MoEF	-	Ministry Of Environment And Forests
MPIRJK	-	Multi-Sectoral Project for Infrastructure Rehabilitation in J&K

MSW	-	Municipal Solid Waste
MT	-	Metric Ton
MTR	-	Month's Total Rainfall
NAAQS	-	National Ambient Air Quality Standards
NH	-	National Highway
NRW	-	Non Revenue Water
OHT	-	Over Head Tank
OM	-	Operations Manual
PIU	-	Project Implementation Unit
PMC	-	Project Management Consultant
PMU	-	Project Management Unit
PM <sub>2.5</sub>	-	Particulate Matter Below 2.5 Micron Particle Size
PM <sub>10</sub>	-	Particulate Matter Below 10 Micron Particle Size
PMC	-	Project Management Consultant
PUC	-	Pollution Under Control
PWD	-	Public Works Department
RCC	-	Reinforced Cement Concrete
REA	-	Rapid Environmental Assessment
RF	-	Resettlement Framework
RHS	-	Right Hand Side
RP	-	Resettlement Plan
ROW	-	Right Of Way
RSPM	-	Respirable Suspended Particulate Matter
SPCB	-	State Pollution Control Board
SPM	-	Suspended Particulate Matter
SPS	-	Safeguards Policy Statement
STP	-	Sewage Treatment Plant
TMP	-	Traffic Management Plan
ToR	-	Terms of Reference
UEED	-	Urban Environmental Engineering Department

### **WEIGHTS AND MEASURES**

cm	-	centimeter
crore	-	100 lac = 10,000,000
cumec	-	cubic meter per second
lac	-	100 thousand = 100,000
Kanal	-	505.39 square meter
km	-	kilometer
kph	-	kilometer per hour
lpd	-	liters per day
m	-	meter
m <sup>2</sup>	-	square meter
mg/l	-	milligrams per liter
mm	-	millimeter
MSL	-	mean sea level
μ	-	10 <sup>-6</sup> meter
μg/m <sup>3</sup>	-	micrograms per cubic meter

**NOTE{S}**

In this report, "\$" refers to US dollars.  
"INR" and "₹" refer to Indian rupees

This initial environmental examination is a document of the borrower. The views expressed herein do not necessarily represent those of ADB's Board of Directors, Management, or staff, and may be preliminary in nature.

In preparing any country program or strategy, financing any project, or by making any designation of or reference to a particular territory or geographic area in this document, the Asian Development Bank does not intend to make any judgments as to the legal or other status of any territory or area.



## **TABLE OF CONTENTS**

I.	INTRODUCTION	1
II.	POLICY, LEGAL, AND ADMINISTRATIVE FRAMEWORK	2
	A. ADB Policy	2
	B. National and State Laws	3
III.	DESCRIPTION OF THE PROJECT	5
	A. Existing Condition	5
	B. On-going Water Supply Improvement Works	7
	C. Proposed Subproject and Components	7
IV.	DESCRIPTION OF THE ENVIRONMENT	9
	A. Physical Resources	9
	B. Ecological Resources	16
	C. Economic Development	17
	D. Social and Cultural Resources	20
V.	ANTICIPATED IMPACTS AND MITIGATION MEASURES	22
	A. Planning and Design Phase	23
	B. Construction Phase	29
	C. Operation and Maintenance Phase	43
	D. Cumulative Environmental Impacts	46
	A. Assessment of No-Go (No Build) Option	49
VI.	INFORMATION DISCLOSURE, CONSULTATION AND PARTICIPATION	50
	A. Public participation during the preparation of the IEE	50
	B. Notification of Potential Interested and Affected Parties	51
	C. Future Consultation and Disclosure	52
VII.	GRIEVANCE REDRESSAL MECHANISM	53
VIII.	ENVIRONMENTAL MANAGEMENT PLAN	54
	A. Institutional Arrangement	55
	B. Capacity Building	57
	C. Environmental Monitoring Programme	79
IX.	ENVIRONMENTAL MANAGEMENT AND MONITORING COST	83
X.	CONCLUSION AND RECOMMENDATIONS	85
<b>APPENDIXES</b>		
1.	Rapid Environmental Assessment (REA) Checklist	87
2.	Water supply improvement work done under ADB loan 1-MPIRJK (Loan 2151-IND)	91
3.	Water supply improvement work being done under Tranche 2 of JKUSDIP	93
4.	Figure Zone Distribution Map of Jammu for NRW Intervention and Rehabilitation Water in Jammu City	95
5.	Public Consultation	96
6.	Photographs of Proposed Sub-project Area	105
7.	Map Depicting Sensitive Location for Monitoring of Air and Noise Quality Parameters	107
6.	Traffic Management Plan	108
7.	Confirmation from Operator of Commercial and Establishment/Shop for Provisions of Temporary Access by Contractor	112

## EXECUTIVE SUMMARY

1. Economic Reconstruction Agency (ERA) has undertaken Jammu and Kashmir Urban Sector Development Investment Program (JKUSDIP), financed by the ADB through Multi-Tranche Financing Facility (MFF). The total estimated cost of the program is about US \$485 millions, out of which \$300 million will be financed by ADB. The primary objective of JKUSDIP is to promote economic development in the State of Jammu and Kashmir (J&K) through expansion of basic services such as water supply, sewerage, sanitation, drainage, solid waste management, urban transport and other municipal functions in Jammu, Srinagar and other important urban centers of the State. JKUSDIP will also strengthen the service delivery capacity of the responsible state urban agencies and urban local bodies through management reform, capacity building and training. The program is to be implemented in 4 to 7 tranches over a period of 8 years. Each tranche constitutes a separate loan. Tranche 1 (Loan 2331-IND) and tranche 2 (Loan 2925-IND) of JKUSDIP are under implementation. One of the subprojects identified under Tranche 3 in JKUSDIP is the rehabilitation of water supply system in Jammu City to improve the water supply system in the area.

2. Subproject Scope. The Jammu City Water Supply Subproject (the subproject) will rehabilitate 287 km of distribution pipelines in zone 2, 3, 4 and 5 and NRW in zone I (33 km) with the following objectives: (i) continue implementation of water loss reduction program to reduce current water loss from 30-45% to 20% resulting in water saving; (ii) improve operational efficiency of the pumping machineries and reduce energy costs as well as operation and maintenance costs in water production; and (iii) provide water in required quantity as per norms in water deficit areas and provide piped water supply in uncovered areas. The preliminary design has taken into consideration the establishment of an efficient water supply system by minimizing water losses due to leakages in pipelines and non revenue connections, augmentation in adequacy of drinking water supply at the user end, minimizing the risks of contamination associated with leakages, enhancing the efficiency of existing tube wells and pumping stations and providing adequate infrastructure facilities for production and storage of water in deficient areas.

3. **Categorization.** Subproject components followed environmental criteria specified in the revised Environmental Assessment and Review Framework (EARF)<sup>1</sup> adopted for the Tranche 2 of JKUSDIP. Jammu City water supply subproject is classified as Environmental Category B as per Asian Development Bank Safeguard Policy Statement (ADB SPS) as no significant impacts are envisioned. This initial environmental examination (IEE) is prepared based on the concept of proposed works of water supply augmentation and following existing legislations of Government of India and Government of Jammu and Kashmir; and requirements of ADB SPS. This IEE and will be updated for any change in the scope after the finalization of the detailed project report (DPR) however already provides (i) basic information about the environmental conditions of the subproject area of influence, (ii) environmental impacts identified and assessed as part of the planning and design process, (iii) recommended actions to reduce those impacts to acceptable levels and to implement these in the environmental management plan (EMP) including who has to implement and monitor implementation of mitigation measures.; and (iv) guidance on how environmental monitoring has to be carried out including observations on- and off-site, document checks, and interviews with workers and beneficiaries.

---

<sup>1</sup> The EARF has been revised in April 2012 to be aligned with ADB's Safeguard Policy Statement 2009. The original EARF was prepared for JKUSDIP in accordance to ADB's Environment Policy 2002. However, with implementation of SPS 2009, the EARF was required to be revised for Tranche 2 and subsequent tranches of JKUSDIP.

4. **Implementation Arrangements.** Economic Reconstruction Agency (ERA) will be responsible for ensuring compliance to environmental requirements of ADB as well as central and state governments. ERA's safeguard unit will monitor the implementation of environmental covenants with the assistance of Project Management Consultants (PMC) and Design and Supervision Consultants (DSC).

5. **Description of the Environment.** The subproject corridor will be on roads right of way (ROW) and in the built-up area of Jammu City. Based on preliminary design and results of environmental assessment it is clear that the alignment of the distribution pipelines will not pass through or adjacent to environmentally sensitive areas such as cultural heritage site, protected area, wetland, buffer zone of protected area and special area for protecting biodiversity. No water courses occur within or adjacent to the pipeline alignment.

6. **Anticipated Impacts.** 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 subproject design or location were not significant. However, minor social impacts (access disruptions) due to construction activities are not avoidable as the residential and commercial establishments exist along the subproject corridor. A resettlement plan has been developed in accordance with ADB SPS 2009 and Indian laws and regulations to address these impacts.

7. Key construction phase impacts identified and addressed in the IEE include: (i) temporary disruption of services during realignment of existing utilities along the corridor; (ii) interference with accesses to properties and businesses due to construction works; (iii) risk of accidents associated with vehicular traffic and transport of materials; (iv) increased volume of construction vehicles on the roads may lead to increased wear and tear of roads in the vicinity of the subproject sites; (v) exposure to increased noise, dust, vibrations; hazardous chemicals (oils and lubricants) and waste materials; (vi) traffic diversions; (vii) management of sites temporarily used for construction activities, including borrow areas, construction camps, etc., and rehabilitation of the sites after completion of temporary use; and (viii) impacts on community health and safety hazards posed to the public, specifically in inhabited areas.

8. 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 infrequent, affecting small areas only.

9. **Environmental Management.** An Environmental Management Plan (EMP) has been developed to provide specific actions deemed necessary to assist in mitigating the environmental impacts, guide the environmentally-sound execution of the subproject, and ensure efficient lines of communication between the implementing agency, project management unit, and contractors. The EMP also provides a pro-active feasible and practical working tool to enable the measurement, reporting and monitoring performance on site. The EMP will be included in the bid documents and will be further reviewed and updated during implementation. The EMP will be included in the contractual clauses and will be made binding on all contractors operating on the site. Non-compliance with, or any deviation from, the conditions set out in this document constitutes a failure in compliance. Any requirements for corrective action will be reported to the ADB.



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

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

12. **Conclusions and Recommendations.** The citizens of Jammu City will be the major beneficiaries of this subproject. With the improved water supply system, they will be provided with a constant supply of better quality water piped into their homes. In addition to improved environmental conditions, the subproject will reduce occurrence of water-related diseases and lose fewer working days due to illness, so their economic status should also improve, as well as their overall health. Therefore the proposed subproject is unlikely to cause significant adverse impacts and net environmental benefits to citizens of Jammu City will be positive. The potential impacts that are associated with design, construction and operation can be mitigated to standard levels without difficulty through proper engineering design provided that the EMP is included in the contract and its provisions implemented and monitored to their full extent.

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



## I. INTRODUCTION

1. Economic Reconstruction Agency (ERA) has undertaken the Jammu and Kashmir Urban Sector Development Investment Program (JKUSDIP), financed by the ADB through Multi-Tranche Financing Facility (MFF). The total estimated cost of the program is about US \$485 millions, out of which \$300 million will be financed by ADB. The primary objective of JKUSDIP is to promote economic development in the State of Jammu and Kashmir (J&K) through expansion of basic services such as water supply, sewerage, sanitation, drainage, solid waste management, urban transport and other municipal functions in Jammu, Srinagar and other important urban centers of the State. JKUSDIP will also strengthen the service delivery capacity of the responsible state urban agencies and urban local bodies through management reform, capacity building and training. The program is to be implemented in 4 to 7 tranches over a period of 8 years. Each tranche constitutes a separate loan. Tranche 1 (Loan 2331-IND) and tranche 2 (Loan 2925-IND) of JKUSDIP are under implementation. One of the subprojects identified under Tranche 3 in JKUSDIP is the rehabilitation of water supply system in Jammu City to improve the water supply system in the area.

2. The Jammu City Water Supply Subproject (the subproject) will rehabilitate 287 km of distribution pipelines in zone 2, 3, 4 and 5 and NRW(33 km) in zone 1 with the following objectives: (i) continue implementation of water loss reduction program to reduce current water loss from 30-45% to 20% resulting in water saving; (ii) improve operational efficiency of the pumping machineries and reduce energy costs as well as operation and maintenance costs in water production; and (iii) provide water in required quantity as per norms in water deficit areas and provide piped water supply in uncovered areas. The preliminary design has taken into consideration the establishment of an efficient water supply system by minimizing water losses due to leakages in pipelines and non revenue connections, augmentation in adequacy of drinking water supply at the user end, minimizing the risks of contamination associated with leakages, enhancing the efficiency of existing tube wells and pumping stations and providing adequate infrastructure facilities for production and storage of water in deficient areas.

3. Subproject components followed environmental criteria specified in the revised Environmental Assessment and Review Framework (EARF)<sup>2</sup> adopted for the Tranche 2 of JKUSDIP. ADB rapid environmental assessment checklist for water supply projects (Appendix 1) was used to screen the subproject for environmental impacts and to determine the scope of environmental assessment required. Results of the assessment show that Jammu City water supply subproject is classified as Environmental Category B as per Asian Development Bank Safeguard Policy Statement (ADB SPS) as no significant impacts are envisioned.

4. This initial environmental examination (IEE) is prepared based on the concept of proposed works of water supply augmentation and reduction of NRW and following existing legislations of Government of India and Government of Jammu and Kashmir; and requirements of ADB SPS. This IEE will be updated for any change in the scope after the finalization of the detailed project report (DPR) however already provides (i) basic information about the environmental conditions of the subproject area of influence, (ii) environmental impacts identified and assessed as part of the planning and design process, (iii) recommended actions to reduce those impacts to acceptable levels and to implement these in the environmental management plan (EMP) including who has to implement and monitor implementation of

---

<sup>2</sup> The EARF has been revised in April 2012 to be aligned with ADB's Safeguard Policy Statement 2009. The original EARF was prepared for JKUSDIP in accordance to ADB's Environment Policy 2002. However, with implementation of SPS 2009, the EARF was required to be revised for Tranche 2 and subsequent tranches of JKUSDIP.

mitigation measures.; and (iv) guidance on how environmental monitoring has to be carried out including observations on- and off-site, document checks, and interviews with workers and beneficiaries.

## II. POLICY, LEGAL, AND ADMINISTRATIVE FRAMEWORK

### A. ADB Policy

5. ADB requires the consideration of environmental issues in all aspects of ADB's operations, and the requirements for environmental assessment are described in ADB's SPS, 2009. This states that ADB requires environmental assessment of all project loans, program loans, sector loans, sector development program loans and loans involving financial intermediaries and private sector loans.

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

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

7. **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.

8. **Public Disclosure.** ADB will post the following safeguard documents on its website so affected people, other stakeholders and the general public can provide meaningful inputs into the project design and implementation:

- (i) For environmental category A projects, draft EIA report at least 120 days before Board consideration;
- (ii) Final or updated EIA and/or IEE upon receipt; and
- (iii) Environmental Monitoring Reports submitted by PMU during project implementation upon receipt.

## B. National and State Laws

9. The implementation of the subprojects will be governed by Government of India (GoI) and State of Jammu and Kashmir environmental acts, rules, regulations, and standards. These regulations impose restrictions on the activities to minimize/mitigate likely impacts on the environment. It is the responsibility of the project executing and implementing agencies to ensure subprojects are consistent with the legal framework, whether national, state or municipal/local. Compliance is required in all stages of the subproject including design, construction, and operation and maintenance.

10. **EIA Notification. The EIA Notification of 2006**, as amended (replacing the EIA Notification of 1994), sets out the requirement for environmental assessment in India. This states that environmental clearance (EC) is required for specified activities/projects, and this must be obtained before any construction work or land preparation (except land acquisition) may commence. The subproject is not listed in the EIA Notification of 2006 "Schedule of Projects Requiring Prior Environmental Clearance" thus EC is not required.

11. **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, 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 subproject having potential to generate sewage or trade effluent will come under the purview of law and will have to obtain Consent to Establish (CTE) from State Pollution Control Board (SPCB) before starting implementation and Consent to Operate (CTO) before commissioning. Discharges shall comply with standards notified by the Central Pollution Control Board. Rehabilitation of water supply distribution network is not included in the lists of activities requiring CTE and CTO however hot mix plants, wet mix plants, stone crushers etc, if installed for construction, shall require CTE and CTO from SPCB.

12. **Air (Prevention and Control of Pollution) Act of 1981, as amended.** Activities having potential to emit air pollutants have to obtain CTE from SPCB before starting implementation and CTO before commissioning the project. Emissions shall comply with standards notified by the Central Pollution Control Board. The occupier of the project/facility has the responsibility to adopt necessary air pollution control measures for abating air pollution. The following require CTE and CTO from SPCB: (i) diesel generators; and (ii) hot mix plants, wet mix plants, stone crushers etc, if installed for construction.

13. **The Noise Pollution (Regulation and Control) Rules, 2000, as amended.** This rule mandates regulation and control of noise generating sources. Since the subproject corridor is located within the city, construction activities and use of heavy machinery and vehicles may increase the ambient noise levels during the construction phase. The occupier of subprojects have to take measures for abatement of noise pollution ensuring that the existing noise levels do not exceed the standards specified under this rule.

14. **Ancient Monuments and Archaeological Sites and Remains Rules of 1959 and J&K Ancient Monuments Preservation (Amendment) Act of 2010.** These laws designate the area within a radius of 100 meters (m) from the "protected property" as "prohibited area" and up to 200m from the boundary of prohibited area as "regulated area". No development activity (including mining operations and construction) is permitted in the "prohibited area" and all development activities likely to damage the protected property are not permitted in the

“regulated area” without prior permission of the Archaeological Survey of India (ASI). Protected property includes the sites, remains, and monuments protected by ASI or the State Department of Archaeology. Some archaeological, historical monuments and religious places like Bahu Fort, Peer Mitha Tomb, Shahi Masjid at Mast Garh and Mubarak Mandi complex are located in Jammu City. However the subproject corridor (pipeline alignments) is beyond the prohibited and regulated areas.

15. **Jammu and Kashmir Preservation of Specified Trees Act of 1969 and Rules of 1969, as amended.** If cutting of scheduled trees is required during preparation of sites, permission will be obtained by ERA from the Sericulture/Revenue Department prior to commencement of construction works.

16. **Jammu and Kashmir Forest Conservation Act, 1997, as amended.** If cutting of forestry trees are required during subproject execution, permission to be obtained by ERA from the forest department prior to commencement of construction works.

17. **Building and Other Construction Workers (Regulation of Employment and Conditions of service) Act of 1996 and Rules 1998, as amended.** This act applies to all the building and other construction activities to which the provisions of Factories Act, 1948 and Mines Act, 1952 do not apply. The J&K State Government, in pursuance of this act, has constituted a Welfare Board of building and other construction workers. This law aims to provide for regulation of employment and conditions of service of the building and other construction workers as also their safety, health and welfare measures in every establishment which employs ten or more workers. This act provides for registration of each establishment within a period of sixty days from the commencement of work and registration of building workers as beneficiaries under this Act. Compliance to provisions of health and safety measures for the construction workers in conformity with International Labour Organization (ILO) convention No.167 concerning safety and health in construction. The contractors engaged for execution of the subproject shall comply with the provisions of this Act.

18. The summary of environmental regulations and mandatory requirements for the proposed subproject is shown in **Table 1**.

**Table 1: Applicable Environmental Regulations**

<b>Applicability of Acts/Guidelines</b>	<b>Compliance Criteria</b>	<b>Responsibility</b>
The EIA notification, 2006 (and its subsequent amendments in 2009) provides for categorization of projects into category A and B, based on extent of impact	The sub project is not covered in the ambit of the EIA notification. As a result, the categorization, and the subsequent environmental assessment and clearance requirements, either from the state or the central Government is not triggered.	NA
The Wildlife Conservation Act, 1972, as amended and J&K Wildlife (Protection) Act 1978, as amended, provide for protection and management of Protected Areas	The wildlife protection act is not applicable to the proposed subproject. All the activities involved in the execution of the subproject will be carried out on the R.O.W of the existing Roads and lanes in the built up area well outside the boundary fence of the wildlife sanctuary. No NOC from wildlife department shall be required in case of this subproject.	NA
- Jammu and Kashmir Forest (Conservation) Act, 1997, as amended. - The Jammu And Kashmir Preservation of Specified Trees Act, 1969 and Rules of 1969, as	Clearance from Forest department for cutting of trees, if any. Based on preliminary design, this act is not applicable and no NOC shall be required as cutting of trees is not envisaged. However to be assessed again during detailed design stage.	If cutting of tree is required based on detailed design, ERA will obtain the clearance.

Applicability of Acts/Guidelines	Compliance Criteria	Responsibility
amended.		
The Ancient Monuments and Archaeological Sites and Remains Act, 1958, and the rules, 1959 provide guidance for carrying out activities, including conservation, construction and reuse in and around the protected monuments.	The subproject area does not fall within the prohibited/ regulated area or is situated close to any such site of archeological importance.	NA
- Water (Prevention and control of pollution) Act, 1974, as amended - Air (prevention and control of pollution) Act, 1981, as amended	Consent to Establish (CTE) and Consent to Operate (CTO) from the J&K SPCB for setting up of hot mix plants, wet mix plants, stone crushers and diesel generators.	To be obtained by the Contractor, prior to construction.
Noise Pollution (Regulation and Control) Rules, 2000, as amended.	Contractors have to take measures for abatement of noise pollution ensuring that the existing noise levels do not exceed the standards specified under this rule.	Contractor
Building and Other Construction Workers (Regulation of Employment and Conditions of service) Act of 1996 and Rules 1998 provide for regulation of employment and conditions of service of the building and other construction workers as also their safety, health and welfare measures in every establishment which employs ten or more workers.	Registration of each establishment within a period of sixty days from the commencement of work and registration of building workers as beneficiaries under this Act. Compliance to provisions of health and safety measures for the construction workers in conformity with ILO convention No.167 concerning safety and health in construction	Contractor

### III. DESCRIPTION OF THE PROJECT

#### A. Existing Condition

19. Population in Jammu City is increasing in range of 2.0-2.2% yearly. The population in Jammu City is estimated to 11, 89,908 (Year 2011). With increase in population and establishment of new colonies in extended parts of Jammu City, the demand of water supply is also increasing.

20. **Source.** Potable water supply distribution system was introduced in the city of Jammu in the year 1934 with surface source as river Tawi. Now the source of water supply to the city of Jammu is surface water from river Tawi and ground water tapped through number of tube wells located throughout the city. Although, river Tawi is a perennial river, flow in the river is lean except in monsoon period. The surface water flow in the river Tawi is used for irrigation and water supply purposes. Only 23 MGD (103 MLD) surface water is reserved for water supply purposes. This limited available water is already tapped at existing water supply head works at Sitlee, Dhountly and Boria (intake well constructed under ADB Loan 2151-IND). Therefore, there is no further availability of surface water from river Tawi. Due to limited availability of surface water from river Tawi, remaining requirement of drinking water is met from the ground water sources (tube wells).

21. The pumping machinery in the existing tube wells is very old and is in use for many years, resulting in their efficiency getting substantially reduced and also requiring frequent repairs. Most of the pumping machineries and electrical devices at central pumping stations have outlived their useful lives; some have been in use for more than 20 years, resulting in frequent breakdowns, low efficiency and reduced discharges.

22. **Distribution Zones.** The Jammu water supply system has been divided into seven water supply zones. Zones 1 to 5 are on the right bank of river Tawi (Jammu west) which comprises of old city and extensions. Zone 6 comprises of left bank of river Tawi (Jammu east) and zone 7 comprises of industrial township of Bari Brahmana. The water supply zones were neither based on the natural topography nor the sources of water supply thus have no hydraulic meaning. Each zone is further divided into sub-zones and each sub-zone is further divided into subzones for water supply management (there are about 59 and 49 isolated sub-subzones in the west and east Jammu respectively). Each sub-subzone has its own tube well(s) or being fed by gravity pipeline from higher level located service reservoirs (GLSRs), overhead tanks and independent distribution network.

23. There is no interconnection between the subzones/sub-subzones. Thus, in some subzones/sub-subzones, the actual water production capacity is exceeding the demand, but water is deficient in the other subzones. Therefore, water supply by tankers on every alternate day with very low rate supply of 30-70 lpcd is common in peripheral areas of Jammu City.

24. **Distribution Network.** Some of the peripheral subzones have no service reservoir facilities, therefore water from tube wells is directly fed to the distribution networks and convey water directly to areas or colonies which are located at varying distances and different elevations. As a consequence, (a) “spaghetti” network has been developed, and (b) the pumps are made to operate at varying heads to reach the tail end of the supply area, resulting in high power consumption and gradual reduction in efficiency of the pumping system over time.

25. Losses in the distribution network within water supply sub-subzones are very high, up to 35-45%: It is a practice that (i) households are allowed to connect directly to the distribution pipelines without service lines; (ii) some households have more than one connection; (iii) flat rate of user charges without household meters; (iv) public taps without valves; and (v) absence of proper maintenance (affords and funds), resulting to very high losses in the distribution network within sub-sub-zones. ADB Loan-2151-IND<sup>3</sup> (Loan-1-Multi-sectoral project for infrastructural rehabilitation in J&K) has been addressing this problem to reduce water losses in the distribution networks, by replacement of worn out leaking distribution pipelines. However, it could cover about half of water supply sub-sub-zones of Jammu City only for replacement of worn out leaking distribution pipelines.

26. Pipeline conditioning survey was carried out. Based on finding of conditioning survey, very old cast iron (CI) pipe lines, all galvanized iron GI pipes and heavily leaking pipe lines are proposed to be replaced with the new pipes. The pipe network modeling (hydraulic modeling) is in progress and additional pipe lines required have been worked out to replace the existing leaking/worn-out pipe line and to improve the terminal pressure. Pipe material has been selected based on technical and economic criteria.

27. Lack of bulk or flow meters in all water production facilities (tube wells, OHTs, water treatment plants and pumping stations) makes it impossible to accurately measure the

---

<sup>3</sup> Under the ADB Loan 2151-IND, Jammu water supply sector has benefited in two main aspects (a) preparation of Jammu Water Supply Master Plan for requirement upto 2036; and (b) immediate improvement investment on (i) reduction of water losses in the rising mains, some distribution sub-subzones and storages facilities; (ii) construction of new water sources (tube wells, water intake); (iii) construction of additional storage capacities; and (iv) providing water tankers to supply water for the areas having no piped distribution system or water deficit areas. The Water Supply Master Plan of Jammu City was prepared in 2007.



production capacities. All calculations were based on the installed/ designed capacities, resulting in high system capacities in figures, but low in actual production.

28. The existing high level of NRW in the city has a severe and direct impact on the ability of utilities to meet this objective and therefore has a negative impact on customers. High physical losses often lead to intermittent supply, either because of limited raw water availability or because of water rationing, which may be needed to reduce supply hours (and therefore hours of water leakage) per day. In addition to substandard service, intermittent supply poses a significant health risk, as contaminated groundwater, or even sewerage, can enter the leaking pipes during supply interruptions and very low pressure periods. The avoidance of this significant public health risk should be reason enough to reduce leakage to enable continuous supply. High leakages also increase flow rates in the pipe network, which can cause unnecessarily high pressure losses that affect customers and often lead to supply interruptions during peak demand hours

## **B. On-going Water Supply Improvement Works**

29. In order to meet the immediate need of improving water supply arising due to growth in population owing to urbanization, various subprojects for improvement in water production and distribution were undertaken by the Public Health Engineering Department (PHED) through State Government resources and by Economic Reconstruction Agency (ERA) under ADB Loan-1-Multi-sectoral project for infrastructural rehabilitation in J&K (MPIRJK) and continues in tranche 2 of J&K urban sector development investment programme(JKUSDIP)

30. The details of works executed under Loan -1(MPIRJK)) are shown in Appendix 2

31. After completion of the improvement works under Loan 1 the net water reaching household will be 185.80 MLD compared to the demand of about 218.83 MLD in the same year. This shows efficiencies of production facilities are much lower than the designed/installed capacities. Thus, rehabilitation/replacement of worn out machineries and electrical devices of tube wells and pumping stations to restore the designed/installed capacities are being undertaken in Tranche 2 of JKUSDIP.

32. The details of works being executed under tranche 2 of JKUSDIP are shown in Appendix 3

33. After completion of the improvement works under Tranche 2 of JKUSDIP the net water reaching household will increase to 275.55 MLD from 185.80 MLD. System losses will be reduced down to 20% from current level of 30-45%and newly constructed facilities will run with 100% of design capacities.This increase in production will be due to rehabilitation and replacement of worn out machineries.

## **C. Proposed Subproject and Components**

34. The major objectives of rehabilitation of water supply system under Tranche 3 are: (i) to continue implementation of water loss reduction program in subzones of zone 2, 3, 4 and 5 ; (ii) to improve operational efficiency of the distribution system by replacement of worn out pipes and reduce energy costs as well as operation and maintenance costs in water production; and (iii) to provide water in required quantity as per norms in water deficit areas and provide piped water supply in uncovered areas. In NRW – zone I, the main objectives are (i) Reduction of non-revenue water, (ii) improve governance and, (iii) augmentation of production capacity and

increase coverage. As part of the NRW programme, laying of new distribution network of around 33 km, regularised and metered house service connections around 3000 nos, refurbishment of existing OHT, improvement in existing clear water mains and improvement in pumping machineries / pump stations are envisaged. Existing house connections will also be transferred from old (abandoned) lines to the newly laid lines. The work of conditioning survey of existing laid distribution pipelines has been completed and verification of pipe size in the areas under this component is being computed and final information will be provided in the DPR. Table 2 provides summary of proposed works under Tranche 3.

**Table 2: The Water Loss Reduction works proposed to be included in tranche 3 of JKUSDIP.**

Component of subproject	Phase	Areas to be covered	Total Command Area (km <sup>2</sup> )	Total Length of Pipe to be Replaced (km)	Total Length of New Pipes (km)	New House Connections (number)
Rehabilitation	III	TalabTillo, Sarwal, New Plot, Janipur, Bhagwati Nagar, Bakshi Nagar, Rajpura, Shakti Nagar, Patoli, Top Sherkhania. (2, 3, 4 and 5 zones).	8.42	265	22	17150*
NRW	I	zone I - city of Jammu	4.40	33	33	3000*
<b>Total 35,000</b>						

\* As the exact number of new houseconnection are not available, this tentative figure was worked out from the population of the zones only and is indicative only.

35. The subproject covers Jammu urban area with an estimated population of 11, 89,908 (2011). The Phase Distribution Map of (III&V) Jammu West is given as **APPENDIX 4**

36. The proposed subproject is expected to have the following benefits:

- (i) rehabilitation of distribution network will result into substantial reduction in water losses in the project area from existing 30 - 45% losses to 20% losses.
- (ii) replacement of worn out pipes will result in appreciable enhancement in running efficiency of distribution system and corresponding energy saving.
- (iii) enhancement of running efficiency of distribution system will result in supply of adequate volume of potable water to the designated areas thereby reducing the problems associated with scarcity of water.

**37. Design Standards.** The design standards adopted under this subproject are from the Manual on Water Supply published by Ministry of Urban Development, Govt. of India. The same criterion is followed by the Public Health Engineering Department (PHED), the line department. Key design features of the proposed subproject are mentioned in the table below.

**38. Design Period.** The design period for distribution network is 30 years and the design period for civil works is also 30 years.

**39. Basis of Design.** The design parameters considered for the proposal under this package are as follows:

**Table 3: Design features of subproject Rehabilitation Water Supply in Jammu**

Design feature	Description
Estimated population for year 2011	1,526,406
Projected population for year 2015	1,847,606
Projected population for year 2030	2,192,081
Projected population for year 2045	3,675,021
Project area	287 km <sup>2</sup>

40. **Selection of pipe material.** A comparative technical and economic study of various pipe materials was made which revealed that high density poly-ethylene (HDPE) pipes up to 200 mm dia. are best fit for water supply distribution network whereas from 250 mm dia. onwards ductile iron(DI) pipes have an edge over HDPE pipes.

41. **Implementation Schedule.** Proposed construction period of the each component is 24 months. Indicative timeline of subproject is tabulated below.

**Table 4: Implementation Schedule**

Activity	Time
Acceptance of safeguard documents	Nov 2013
Acceptance of the SAR	Nov 2013
Completion of Detailed Project Report (DPR)	Dec 2013
Acceptance of updated safeguard documents based on DPR	Nov 2013
Invitation for bids	Nov 2013
Contract award	May2014
Commencement of work	June 2014
Completion of contract	Dec 2016

#### IV. DESCRIPTION OF THE ENVIRONMENT

##### A. Physical Resources

42. **Administrative Boundaries.** The subproject sites are located in the built-up area of Jammu City. Jammu, the winter capital of Jammu and Kashmir, is situated at an average altitude of 312m above mean sea level (msl) in the foothills of Shivaliks. The location map is given as APPENDIX 5. Jammu District is bounded in the north and north east by the Reasi and Udhampur districts; in the east and south east by Udhampur district and Samba district; in the south and west by international border with Pakistan; in the North West by district Rajouri. The entire district can be divided into two distinct portions. The area forming north of Jammu-Chhamb road and Jammu-Pathankot road which is known as *Kandi* area is comparatively under-developed and is mostly rainfed. The area south of these roads is largely fed by canal and tube wells for irrigation purposes and is relatively more prosperous.

43. River Tawi flows through the city and divides it into two parts. The old city is situated on the right bank of the River. Areas on left bank of Tawi are relatively newly developed. Jammu City is located between 32o 36' to 32o 48' North latitudes and 74o 48' to 57o 30' East longitude with a total municipal area of approximately 112 sq. km. and total Jammu Development Authority (JDA) area of approximately 287 sq. km. It is well connected by air, railways and road with other states of India.

44. **Topography.** The topography of the city is from plain to undulating. Jammu City falls in the sub Himalayan Region (lower Shivalik). The city is divided into two parts by river Tawi. First

the plain part (south of Tawi river), where elevation varies from 280 to 310 m above msl and Second the old city on lower reaches of Shivalik having an altitude of 307 to 450 m above msl.

45. **Surface Water.** During rains, the storm water flows through the existing drains and finally discharge into river Tawi, which is a major left bank tributary of river Chenab. The river divides Jammu City into eastern and western parts. The river originates from Kali Kundi glacier and area adjoining south-west of Bhadarwah in Doda district (J&K), at an elevation of about 4000m. According to Central Water Commission (CWC), Jammu the discharge of river Tawi is minimum during January-February and maximum during August. Execution of proposed subproject is not expected to have any impact of the any of the surface water resources of the area.

46. **Geohydrology and Groundwater.** Ground water in Jammu occurs mostly under water table (phreatic or unconfined) conditions in major parts of the city. In the western part of Jammu City (on right bank of river Tawi) the depth of water level in the tube wells is ranging from 3.60m (Waziranwali Gali, Bohri) to 91.00m (Keran, Kamal Nagar) below ground level. Whereas, in eastern part of the Jammu City (on left bank of river Tawi) the depth of water level in the tube wells is ranging from 7.55m (in Babliana area) to 92.80m (Channi Himmat Sector-1A) below ground level.

47. The area of Jammu has surplus exploitable ground water potential as per hydro-geological assessment study carried out by Central Ground Water Board (CGWB) and Project Management Consultant of ADB loan 2151-IND (MPIRJK)(2007). It has been indicated in the reports that the present ground water extraction in the area is only 17.62% of the total available potential; and the area thus lies in the safe category of ground water development. Execution of proposed subproject is not expected to have any impact on the ground water resources of the area.

48. **Drainage.** Jammu City is located on a plain to undulating terrain and the drainage system of the city relies on gravity. Out of the total primary drainage network of 132 km length in Jammu City, 51 km length of primary drains are lined and the remaining 81 km are unlined channels. Following the master plan recommendations, part of drainage rehabilitation and improvement works has been taken up under ADB Loan 1 (MPIRJK) by J&K Economic Reconstruction Agency (ERA) and by the Urban Environmental Engineering Department (UEED) under their ongoing schemes. Some of the remaining drainage works are proposed under Tranche 2 of JKUSDIP.

49. As per storm water drainage master plan, Jammu City is divided into five drainage zones. The details of the drainage zones are as below:

50. **Zone- I:** This zone includes the areas like Pratap Garh, Shalamar, Karan market, Rehari, Krishna Nagar, Peerkho, Rajindra Nagar, Christian Colony, Chand Nagar, Shiv Nagar, Shakti Nagar, Panjirthi, etc. Major drains under this zone are Gandha nallah (length 3.2 km), Rehari nallah, Krishna Nagar nallah (length 3.5 km), Peerkho nallah (length 0.95 km), Rajindra Nagar nallah (length 1.7 km), Jogi Gate nallah (length 0.48 km), Chand Nagar nallah (length 0.5 km), Shiv Nagar nallah (length 0.7 km) , Shakti Nagar nallah (length 0.5 km) and Panjirthi nallah (length 1.5 km)

51. **Zone- II:** This zone includes the areas like Nanak Nagar, Trikuta Nagar, Shastri Nagar, Sanjay Nagar, Nai Basti, Rampura, Bikram Chowk, Channi Himmat, etc. Major drains under this zone are Landoichoi main nallah (15.4km), Landoichoi nallah T-2 (6.3 km), Landoichoi nallah T-

3 (3.3 km), Nai Basti (Rampura ) nallah (1.0 km), Bikram Chowk nallah (1.5 km), University to Bikram Chowk nallah (1.7 km), Channi Himmat main nallah (1.77km) and T4 (Landoi choi) nallah (4.93 km).

52. **Zone –III:** This zone includes the areas like Ban Talab, Chenore, Roop Nagar, Om Nagar, Patoli, Janipur, Basant Nagar, Paloura, Subash Nagar, Bhawani Nagar, Rajpura, etc. Major drains under this zone are Ban Talab Chinore nallah (9.3km), Roopnagar nallah (7.66 km), Om Nagar nallah (4.9km), Patoli nallah (4.3), Janipur nallah (9.9 km), Basant Nagar nallah (0.75 km), Paloura nallah (4.0 km), Subash Nagar nallah (1.4 km), Bhawani Nagar nallah (4.2 km) and Rajpura nallah (0.8 km).

53. **Zone –IV:** This zone includes the areas like Gangyal, Digiana, Trikuta Nagar Extension, Preet Nagar, Dilli, Sainik Colony, Matto Colony, Kalu Chak, etc. Major drains under this zone are Gangyal nallah (8.2 km), Digiana nallah (3.0 km), Ashram nallah (3.5 km), Dilli nallah (2.5 km), Sainik Colony nallah (6.0 km) and Kalu chak nallah (7.5km).

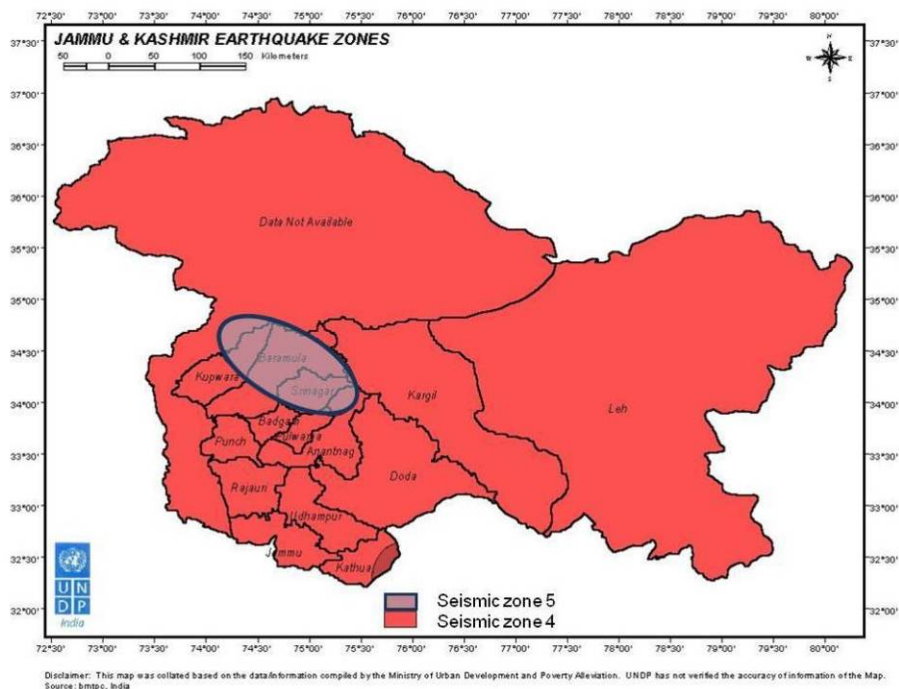
54. **Zone –V:** This zone includes the areas like Narwal, Ratnu Chak, Suhaora, Darap, Sher Garh, Rakh Rajpur, Jarate Chak, Chuthe Chak, Basi Khurd, etc. Major drains under this zone are Balole nallah & Tributaries (12 km), Pati Khad & Tributaries (8 km), Tarore Khad (6 km), Kalk nallah and Tributaries (7 km) and Devika nallah and Tributaries (5 km).

55. **Natural Hazards.** The Indian subcontinent has a history of devastating earthquakes. The major reason for the high frequency and intensity of the earthquakes is that India is driving into Asia at a rate of approximately 47 mm/year. Geographical statistics of India show that almost 54% of the land is vulnerable to earthquakes. The latest version of seismic zoning map of India given in the earthquake resistant design code of India [IS 1893 (Part 1) 2002] assigns four levels of seismicity for India in terms of zone factors. In other words, the earthquake zoning map of India divides India into 4 seismic zones (Zone 2, 3, 4 and 5) unlike its previous version which consisted of five or six zones for the country. According to the present zoning map, Zone 5 expects the highest level of seismicity whereas Zone 2 is associated with the lowest level of seismicity.

56. The state of Jammu and Kashmir is the western most extension of the Himalayan mountain range in India. Here it comprises of the Pir Panjal, Zaskar, Karakoram and Ladakh ranges. The Main Boundary Thrust (MBT) underlies the Pir Panjal Range and is known as the Panjal Thrust in the region. The Zaskar ranges which are part of the Great Himalayan range are underlain by the Zaskar Thrust. The Kashmir Valley lies between the Pir Panjal and the Zaskar thrusts, making it very vulnerable to earthquakes. Other northern parts of Jammu & Kashmir are heavily faulted. Along the Zaskar and the Ladakh ranges runs a North West (NW) – South East (SE) trending strike-slip fault, the longest in the Jammu & Kashmir area. Apart from the routine small tremors, moderate to large earthquakes have hit nearly all parts of the state. However, it must be stated that proximity to faults does not necessarily translate into a higher hazard as compared to areas located farther away, as damage from earthquakes depends on numerous factors such as subsurface geology as well as adherence to the building codes.

57. Keeping in view the maximum credible earthquake magnitudes in the region, the subproject area (in Jammu) is classified in Zone-IV as per the Bureau of Indian Standards (BIS) Code of Practice (IS-1893-2002). These maximum credible earthquake magnitudes represent the largest earthquakes that could occur on the given fault, based on the current understanding of the regional geo-tectonics.

The earthquake zonation map of Jammu and Kashmir is given in Figure-1 on next page:



**Figure-1: Jammu and Kashmir earthquake zones.**

58. **Floods.** Owing to its topography and presence of natural drainage in the form of river Tawi and other natural as well as artificial drains, incidence of any major flooding has not been recorded in the Jammu City. The volume of water received by river Tawi during rains does not cause flooding in Jammu City owing to large capacity of the river channel and elevation difference between the level of subproject area and river bed.

59. **Geology and Geomorphology.** The Geology of the territories of Jammu, Kashmir and Ladakh have been divided into three different structural Zones: (i) the Panjal; (ii) Zaskar; and (iii) the Tertiary Groups. These three geological divisions form the basis of the physical divisions of the State. The Panjal forms the outer plain, the outer hills and the middle mountains. The Zaskar includes the whole of the eastern region from Spiti and Lahol to the lofty Karakoram mountains in the north. The Tertiary Groups include the valley of Kashmir and other river valleys.

60. Geologically, the area can be explained as the northern hilly area underlain by the Shivalik rocks and the southern outer plain area underlain by the sediments of recent and Sub-Recent times, laid down by the present day streams of the area.

- (i) **Northern Hill Area:** Hills constitute about 37% of the total geographical area of the district. The terrain is rugged with strike valleys and dissected ridge slopes. Altitude of the area varies roughly between 400 and 700m above mean sea level. Major physiographic slope is towards the southwestern direction i.e. towards the outer plain area. The major rivers flowing through the hilly area of the district viz. Basantar, Jammu Tawi, Chenab and Munawar Tawi have their origin quite to the

north of the district limits. These rivers act as major drainage lines in the area and enter outer plains of the district south of the outer most Shivalik hills.

- (ii) **Southern Outer Plains:** These are located at the foot of the outer most Shivalik hills and have an altitude varying between 280 and 400m above mean sea level. Innumerable seasonal drains traverse the area. These streams are boulder laden and have broad shallow channels, having water only for short time after the rains. The plains can further be divided into two parts the '*Kandi*' in the north and the '*Sirowal*' in the south, towards Pakistan border.

61. The geological succession occurring in the area is presented in **Table 5** below.

**Table 5: Geological Succession of Jammu district**

	Geological Horizon	Lithology	Age
	Alluvium, fan, terrace deposits ( <i>Kandi</i> and <i>Sirowals</i> )	Heterogeneous clastic sediments	Sub-recent to Recent
Upper Shivaliks	Boulder bed stage	Conglomerates sand stones with intercalations of red clays	Lower to Middle Pleistocene.
	Pinjor stage	Coarse sandstone, sand rock and massive sandstone beds.	Lower Pleistocene
	Tatrot stage	Sandstone drab clays alternative beds.	Upper Pliocene
Middle Shivaliks	Dhokpathan stage	Sandstone & shale with isolated sand nodules	Lower Pliocene
	Nagri stage	Sandstones & Shale, Hard & compact	Upper Miocene
Lower Shivaliks	Chingi stage	Bright red shale and sandstones	Middle Miocene
	Kamlial stage	Hard red sandstones & shale with pseudo conglomerates	Middle to lower Miocene

Source: Central Ground Water Board - Ground water information booklet, Jammu district

62. **Soils.** Two types of soils are mainly observed in the Jammu City and its adjoining areas namely mountainous soil and loamy soil. Mountainous soil is brown in colour, medium in available nitrogen and potash and deficient in available phosphorous. The soil reaction is slightly acidic to neutral and texture in general varies from loam to sandy loam except in low valley areas being heavy textured. The proposed alignment of subproject is located within Jammu City, which primarily comprises of alluvial deposits which generally include silty-clay or clayey-silt type soil in intermixed layers with potential seams of fine to coarse sand.

63. **Climate.** The climate of the area is subtropical with hot and dry climate in summer and cold climate in winters. May and June are the hottest months while December and January are the coldest.

64. **Temperature.** May and June are the hottest months while December and January are the coldest. In Jammu district the temperature varies from cold in winter with minimum temperature touching even 0.9 degree Celsius to heat wave in summers when the temperature shoots upto 46 degree Celsius. (J&K Official Website: [www.http://jammu.nic.in/district/aboutjammu.asp](http://jammu.nic.in/district/aboutjammu.asp)).

65. **Rainfall.** The rainy season usually starts from the end of June or the beginning of July. Average annual rainfall in the district Jammu is about 1052 mm<sup>4</sup>. The rainfall data for district Jammu for seven years (from 2006 to 2012) is presented in the Table 6.

<sup>4</sup> Source: Central Ground Water Board - Ground water information booklet, Jammu district.

**Table 6: Rainfall Data of District Jammu (Month's Total Rainfall in mm).**

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2006	70.8	4.2	44.6	10.7	16.1	150.2	379.9	269.4	123.8	56.0	7.0	32.4
2007	0.0	95.9	243.6	3.0	28.0	185.2	274.0	333.0	42.4	0.0	3.7	8.9
2008	98.0	23.4	2.2	56.4	42.8	228.2	384.9	225.8	20.0	21.1	0.0	20.3
2009	69.5	34.1	15.6	41.1	11.6	18.6	244.4	273.4	26.1	7.2	4.2	0.6
2010	7.5	26.9	4.9	6.2	39.1	67.0	272.9	586.1	84.4	31.5	2.6	52.8
2011	9.4	74.9	57.7	19.9	24.3	317.4	371.4	468.2	89.2	11.5	0.1	0.5
2012	102.4	35.9	20.0	48.6	9.5	7.9	268.9	512.0	204.6	1.3	4.0	62.4

Source: Hydromet Division, India Meteorological Department

66. **Air Quality.** The sub project area is mostly urban area. Vehicular traffic is the major contributor for environmental pollution. The subproject sections pass through built-up area with residential, commercial and institutional establishments. The ambient air quality data with respect to RSPM (PM<sub>10</sub>), SO<sub>2</sub> and NO<sub>2</sub> was measured at specified sites in project area and the results are presented in Table 7 and 8 below. The data was collected during October, 2012, February 2013 and September 2013 by the Environmental Monitoring Laboratory of ERA. The sampling was conducted by using the High Volume Air Sampler "Envirotech APM 460BL" with gas assembly APM 411TE. The sampling was done for 8 hours during the peak traffic hours.

**Table 7: Ambient Air Quality Data at Various Locations in October 2012**

S.No.	Site /Location	Site Type	Date of sampling	Parameters		
				RSPM (PM <sub>10</sub> ) <sup>5</sup> (µg/m <sup>3</sup> )	SO <sub>2</sub> (µg/m <sup>3</sup> )	NO <sub>2</sub> (µg/m <sup>3</sup> )
1	Rehari Colony	Residential, Rural and other area	06-10-2012	155.76	13.70	28.08
2	Lower Shiv Nagar	Residential, Rural and other area	09-10-2012	112.76	15.06	24.49
3	Near Sarwal Hospital	Residential, Rural and other area	10-10-2012	102.23	19.98	38.77
4	Lakkarmandi at Janipur	Residential, Rural and other area	13-10-2012	103.19	13.27	21.17
	<b>NAAQ Standards<sup>6</sup></b>			<b>100</b>	<b>80</b>	<b>80</b>

NAAQS= National ambient air quality standards of Government of India; NO<sub>2</sub>= Nitrogen dioxide; PM<sub>10</sub>= Particulate matter below 10µ particle size; RSPM= Respirable suspended particulate matter; SO<sub>2</sub>= Sulphur dioxide

**Table 8: Ambient Air Quality Data at Various Locations in the Month of February, September and November 2013**

S.No.	Site /Location	Site Type	Date of sampling	Parameters		
				RSPM (PM <sub>10</sub> ) <sup>5</sup> (µg/m <sup>3</sup> )	SO <sub>2</sub> (µg/m <sup>3</sup> )	NO <sub>2</sub> (µg/m <sup>3</sup> )
1	Lower Shiv Nagar	Residential, Rural and other area	02-02-2013	117.18	24.06	40.46
2	Upper Shiv Nagar	Residential, Rural and other area	06-02-2013	96.85	09.32	20.05
3	Naseeb Nagar	Residential, Rural and other area	07-02-2013	93.20	10.96	24.73
4	Vikas Nagar	Residential, Rural and other area	8-02-2013	97.71	15.35	25.40
5	Near Govt. Medical College, Jammu	Residential, Rural and other area	13-09-2013	69.44	38.77	20.83
6	Panjithirhi Chowk	Residential, Rural and other	19-11-2013	85.31	22.87	43.55

<sup>5</sup> PM<sub>2.5</sub> will be provided later as the equipment to measure PM<sub>2.5</sub> is not yet available. The requisite equipment shall be procured and the baseline data shall be again generated for all parameters before start of works on the proposed sub-project

<sup>6</sup> National Ambient Air Quality Standards (NAAQS), Government of India published in Gazette of India, Extraordinary, Part-II, Section-3, Subsection-i vide no. G.S.R. 826(E), dated 16<sup>th</sup> September 2009



S.No.	Site /Location	Site Type	Date of sampling	Parameters		
				RSPM (PM <sub>10</sub> ) (µg/m <sup>3</sup> )	SO <sub>2</sub> (µg/m <sup>3</sup> )	NO <sub>2</sub> (µg/m <sup>3</sup> )
		area				
	<b>NAAQ Standards</b>			<b>100</b>	<b>80</b>	<b>80</b>

NAAQS= National ambient air quality standards of Government of India; NO<sub>2</sub>= Nitrogen dioxide; PM<sub>10</sub>= Particulate matter below 10µ particle size; RSPM= Respirable suspended particulate matter; SO<sub>2</sub>= Sulphur dioxide

67. The result of the tests concludes that the values obtained for NO<sub>2</sub> and SO<sub>2</sub> are within the permissible limits at all the sites, similarly, the values of Respirable suspended particulate matter (PM<sub>10</sub>) were also within the permissible limit at five sites. However, the values of PM<sub>10</sub> recorded at remaining five sites remained higher than the permissible limits as stipulated under National Ambient Air quality Standards. The higher RSPM values at these sites are due to movement of traffic in the vicinity of these sites.

68. The National Ambient Air Quality Standards have been revised by Ministry of Environment and Forests, Government of India on 16th September 2009, wherein the Respirable Suspended Particulate Matter (RSPM) has been further divided into PM<sub>10</sub> and PM<sub>2.5</sub>. The air quality monitoring equipment presently available with J&K ERA can measure the total particulate matter below 10µ particle size (i.e. PM<sub>10</sub>). However, separate values for PM<sub>2.5</sub> cannot be determined. The requisite equipment shall be procured by ERA for measurement of PM<sub>2.5</sub> and baseline data shall be generated for all parameters before start of works on the proposed subproject. Procurement of equipments for environmental monitoring laboratories of ERA shall be an independent exercise and shall not be a part of this subproject.

69. **Ambient Noise Levels.** The subproject sections pass through built-up area with residential, commercial and institutional establishments and significant volume of traffic pass through these sections causing frequent traffic jams in the area. Heavy traffic movement in the subproject area is considered to be the major cause of noise pollution. The existing noise levels at various locations have been presented as baseline data in **Table-9 and 10**. The noise levels were monitored during day time in October 2012, February 2013 and September 2013 by the Environmental Monitoring Laboratory of J&K ERA.

**Table -9: Ambient Noise Quality Data at Varions Locations in October 2012**

S.No.	Site/ Location	Date of sampling	Site type	Day time noise levels dB(A) L <sub>eq</sub>	Noise quality standards <sup>7</sup> (dB(A) L <sub>eq</sub> )
1	Rehari Colony	06-10-2012	Residential, Rural and other area.	69.2	55
2	Lower Shiv Nagar	09-10-2012	Residential, Rural and other area.	54.9	55
3	Near Sarwal Hospital	10-10-2012	Residential, Rural and other area.	64.6	55
4	Lakkarmandi at Janipur	13-10-2012	Residential, Rural and other area.	57.2	55

dB(A) L<sub>eq</sub> = the time weighted average of the level of sound in decibels on scale A which is relatable to human hearing.

<sup>7</sup> Standards specified in the schedule of Noise Pollution (Regulation And Control) Rules, 2000 of Government of India. The Principal Rules were published in the Gazette of India, vide S.O. 123(E), dated 14.2.2000 and subsequently amended vide S.O. 1046(E), dated 22.11.2000, S.O. 1088(E), dated 11.10.2002, S.O. 1569 (E), dated 19.09.2006 and S.O. 50 (E) dated 11.01.2010 under the Environment (Protection) Act, 1986.

**Table -10: Ambient Noise Quality Data at Various Locations February ,September and November 2013**

S.No.	Site/ Location	Date of sampling	Site type	Day time noise levels dB(A) $L_{eq}$	Noise quality standards (dB(A) $L_{eq}$ )
1	Lower Shiv Nagar	02-02-2013	Residential, Rural and other area.	69.5	55
2	Upper Shiv Nagar	06-02-2013	Residential, Rural and other area.	59.9	55
3	Naseeb Nagar	07-02-2013	Residential, Rural and other area.	59.7	55
4	Vikas Nagar	8-02-2013	Residential, Rural and other area	62.8	55
5	Near Govt. Medical College	13.09.2013	Residential, Rural and other area	72.6	55
6	Panjthirthii Chowk	19-11-2013	Residential, Rural and other area	72.6	55
7	Jullaka Mohalla	19-11-2013	Residential, Rural and other area	56.3	55

dB(A)  $L_{eq}$  = the time weighted average of the level of sound in decibels on scale A which is relatable to human hearing.

70. On comparison of noise quality data with the limits specified for different types of the areas in the ambient noise quality standards (under schedule to the Noise Pollution (Regulation And Control) Rules, 2000 of Government of India) it is evident that the noise values at all of the sites except one are higher than the permissible standards during day time. This may be attributed to the commercial activities and traffic movement coupled with frequent traffic jams and blowing of horns in the subproject corridor.

71. Execution of the proposed subproject shall be done during day time only, therefore ruling out the possibility of any noise pollution during night time. In case, any works are to be carried out during night time then the baseline data shall be generated prior to start of any such work.

## **B. Ecological Resources**

72. **Terrestrial ecology and Biodiversity.** No sensitive ecological areas are located along the subproject corridor.

73. **Forest Areas and Trees.** The subproject is located within Jammu City and there is no forest within or adjacent to the subproject corridor. Based on preliminary design, this act is not applicable as cutting of trees is not envisaged. However it would be assessed again during detailed design stage.

74. **Wild fauna.** No wild animals are reported in and around the subproject corridor.

75. **Rare or Endangered Species.** No rare or endangered animal or plant species are reported in the subproject area of influence.

76. **Protected Area.** There is no protected area within subproject corridor. However the boundary of Ramnagar wildlife sanctuary is located at 0.03 km distance from the periphery of the proposed subproject (from distribution laterals). The area of Ramnagar wild life sanctuary is spread over 31.50 Sq.km and is roughly wedge shaped, located in the kar Nalla which drains into river Tawi. It lies between 32°44'.37" to 32°47'.32" north latitude and 74°50'.45" to 74°53'.37" east longitude. The common wild life like Deer, Leopard, Black bear, Nilgai, Sambar, Barking Deer, Porcupine are present in the zoo maintained by wildlife department in the

sanctuary. Among the birds, peacock, chukar partridge, owl, Pariah kite, eagle, vulture, fruit bat, black drongo, red jungle fowl, etc. are reported in the Ramnagar sanctuary. This protected area is not a sensitive habitat of any of these wild species and they are found in the other parts of the state also.

77. The localities of High Court and some part of Newplot area falling in the zone III of the subprojects are in the proximity to the sanctuary. Chainlink fence and at some places a wall, completely shields the sanctuary from this built up residential area. All the activities involved in the execution of the subproject will be carried out on the R.O.W of the existing Roads and lanes in the built up area well outside the boundary fence of the wildlife sanctuary. The length of the pipeline which is to be replaced in this area of subproject is about 15 km. The activities proposed under this subproject are not expected to have any impact on the wildlife sanctuary. Special care shall be taken while executing the work adjacent to the wildlife sanctuary. The work shall be completed in shortest possible time and to avoid disturbance due to noise and vibration of the machinery, it shall be done manually.

78. **Fisheries.** The aquatic biology of river Tawi comprises of phytoplanktons (eg. *Diatoma elongatum*, *Pediastrum duplex*, *Tetradion minimum*, *Nitzschia palea*, *Gomphonema gracile*, *Gomphonema constrictum*, *Navicula cupoidata*, *Cymbella tumida*, *Pediastrum tetras*, *Oedogonium vulgare*, *Oscillatoria curviceps*, *Anabaena spiroides*.etc.), zooplanktons (*Polyarthra vulgaris*, *Cyclops ladakanus*, etc), and benthos (*Chironomus* sp., *Tubifex* sp., etc), besides macro-fauna like small crustaceans, amphibians, fish and insects. The common fish species in river Tawi include *Garra gotyla*, *Garra lamta*, *Labeo dero*, *Labeo bata*, *Glyptothorax* sp., *Glyptosternum* sp., *Barilius vagra*, *Barilius bendelisis*, *Puntius conchonus*, *Puntius ticto*, *Puntius sophore*, *Oreochromis mossambicus*, *Channa punctatus*, *Channa gachua*, *Channa orientalis*, *Heteropneustes fossilis*, *Clarias batrachus*, etc. No fishing activity has been observed in river Tawi. However, there is no anticipated impact on the aquatic ecology of river Tawi as the works will be conducted in areas not adjacent to the river.

### C. Economic Development

79. Jammu and Kashmir's economy is predominantly dependent on agriculture and allied activities. Directly and indirectly, it supports about 80 per cent of the population besides contributing nearly 60 per cent of the state revenue, which adequately explains the over-dependency of the population on agriculture. The overall economic growth of the state depends largely on the progress of agricultural sector.

80. The state is divided into three agro-climatic zones: Jammu, Kashmir and Ladakh; each has its own specific geo-climatic condition, which determines the cropping pattern and productivity. Rice is the chief crop of Kashmir zone, followed by maize, barley and wheat. Jammu region dominates both in maize and wheat production. In the Ladakh region, barley is the major cereal crop followed by wheat. The production of three important food crops, namely, rice, maize and wheat, contributes a major portion of the foodgrain in the state and accounts for about 84 percent of the total cropped area; the balance 16 per cent is shared by inferior cereals and pulses. Nearly 75 per cent of the country's temperate fruits, mainly apples, are grown in the state.

81. Agricultural exports from Jammu and Kashmir include apples, barley, cherries, corn, millet, oranges, rice, kidney beans, peaches, pears, saffron, sorghum, vegetables, and wheat, while manufactured exports include handicrafts, rugs, and shawls.

82. Horticulture also plays a vital role in the economic development of the state. With an annual turnover of over INR 300 crore, apart from foreign exchange of over INR 80 crore, this sector is the next biggest source of income in the state's economy. Horticultural produce from the state includes apples, apricots, cherries, pears, plums, almonds and walnuts.

83. **Land use Pattern.** Jammu is known as a city of temples and is the summer capital of Jammu and Kashmir State. The proposed land use distribution of Jammu City as per the master Plan (2001-2021) is given in the **Table 11** below.

**Table 11: Jammu Local Area Land Use Distribution – Proposed**

Sl. No.	Land use	Proposed land use (2021)	
		Area (ha.)	% of Developed area
1	Residential	12000	41.7
2	Commercial	487	1.7
3	Industry	521	1.8
4	Open spaces	4462	15.5
5	Transportation	3178	11.0
6	Utilities	50	0.2
7	Government	2277	7.9
8	Institutional	817	2.8
9	Agriculture and water bodies	5000	17.4
	<b>Total Developed area (ha)</b>	<b>28,792</b>	<b>100</b>

Source: Jammu Master Plan 2001 -2021

84. The land use in the project corridor comprises of built up area and transportation area. The built up areas consist of residential complexes, government/private offices and buildings, educational institutes, religious places and commercial establishments such as shops, hotels, restaurants, etc. The transportation area constitutes of existing roads in the subproject area.

85. **Commercial Activities.** The predominant activities in the impact zone are of mixed type including, government departments, hotels, restaurants, banquet halls, shops, educational institutions, as well as residential houses. Varied types of commercial activities in the form of wholesale, retail or small scale services are carried out in the areas around the subproject sites.

86. **Industrial Development.** In Jammu district a number of industrial areas are being developed. The information available with the Jammu and Kashmir Industries Department regarding various industrial areas is given in Table-12. The majority of industries in Jammu district are small-scale units. The dominant units belong to general engineering, food-stuff, textiles, etc.

**Table-12: Industrial Areas in Jammu District with Number of Units and Land Area.**

	Location	Number of Units	Land under industrial area (in Kanal)
1.	Digiana	106	137.09
2.	Jammu Cantonment	34	96
3.	Bari Brahmana Industrial Complex	464	6152
4.	Gangyal	336 (units have been allotted land)	988
5.	Birpur	156 (units have been allotted land)	306
6.	Akhnoor	21	--

1 Kanal = 505.39 m<sup>2</sup>

Source: Official website of J&K Industries Department.

87. **Agriculture.** The outskirts of Jammu City are bordered with agricultural fields. Ranbir canal brings water to these agricultural fields from Chenab River through the Jammu City. The Basmati rice of Jammu (cultivated in Ranbir Singh Pura of Jammu district) is very famous and is exported to various countries. However, no agricultural activities are carried out in the subproject impact zone.

88. **Infrastructure Facilities.** Since, the subproject is spread over major portions of Jammu City; the infrastructure facilities like schools, hospitals, colleges, electricity and communication in the subproject area are satisfactory.

89. During execution of the proposed subproject, there will be no impact on the main building of any department/ facility, therefore no impact on any educational, administrative or medical service is anticipated.

90. **Water supply.** Potable water supply distribution system was introduced in the city of Jammu in the year 1934 with surface source as river Tawi. Now the source of water supply to the city of Jammu is surface water from river Tawi and ground water tapped through number of tube wells located throughout the city.

91. Population in Jammu City is increasing in range of 2.0-2.2% yearly. The population in Jammu City is 1,189,908 (Year 2011). The gross water demand with permissible transmission and distribution losses of 20% and the net water demand in the Jammu City are given in Table 13 below.

**Table 13: Water Demand in Project Area**

Year	Estimated population	Net domestic water demand @ 135 lpcd, and 10% demand of institutions (MLD)	Gross water demand @ 135 lpcd + 15% distribution losses + 5% transmission losses and 10% demand of institutions (MLD)
2011	1189908	176.7	220.88
2015	1,347,606	200.12	250.15
2030	2,192,081	325.52	406.90
2045	3,675,021	545.74	682.18

lpcd= liter per capita per day; MLD= million liter per day. \* data based on census of 2011

Note – Source Draft SAR

92. **Water source:** Although, river Tawi is a perennial river, flow in the river is lean except in monsoon period. The surface water flow in the river Tawi is used for irrigation and water supply purposes. Only 23 MGD (103 MLD) surface water is reserved for water supply purposes. This limited available water is already tapped at existing water supply head works at Sitlee, Dhountly and Boria (intake well constructed under ADB Loan 1(MPIRJK)). Therefore, there is no further availability of surface water from river Tawi. Due to limited availability of surface water from river Tawi, remaining requirement of drinking water is met from the ground water sources (tube wells).

93. **Ground water** in Jammu City occurs mostly under water table (Phreatic or Unconfined). The area of Jammu has surplus exploitable ground water potential as per hydro-geological assessment study carried out by Central Ground Water Board (CGWB) and Project Management Consultant of ADB loan 1(MPIRJK) (2007). It has been indicated in the reports that the present ground water extraction in the area is only 17.62% of the total available potential; and the area thus lies in the safe category of ground water development. Thus tube

well is a viable option that can be exploited suitably to cater the present growing demand of Jammu City.

94. **Sewerage System.** The western part of the Jammu City (old city on right bank of river Tawi) earlier had no systematic sewerage system in place and only a few areas were being catered by a 10 MLD sewage treatment plant (STP) at Gole, Bhagwati Nagar. Now proper sewerage network is being established in this part of the city by Urban Environmental Engineering Department (UEED) and Economic Reconstruction Agency and two new sewage treatment plants with 27 MLD capacities (UEED) and 30 MLD capacity (ERA) are being constructed for proper sewerage management. The sewerage network and STP construction by ERA are being carried out under ADB loan 2331-IND (Tranche-1 of JKUSDIP). At the moment, no user charges are levied by the Authority. But in the long run some user charges will be levied from every catered house hold to ensure operational efficiency of this vital public system. No separate sewerage system has been established in eastern part of the Jammu City (on left bank of river Tawi) which contains newly developed and developing areas of the city.

95. **Solid Waste.** Jammu City has been divided in two zones and 71 administrative wards for the purpose of civic administration including sanitation. The sanitation work of each ward is looked after by the Sanitation Officer, Assistant Sanitation Officers, Sanitary Inspectors and Sanitary Supervisors. There is multiple layer arrangement of supervision. Every layer of supervisor is meant for supervising the work of sanitary worker.

96. As per the Solid Waste Management Master Plan of Jammu City, average waste generation from residential areas was 298.675 grams per capita per day in 2006 and the total waste from Municipal area was estimated to be 221 metric ton (MT) per day in 2006, which was likely to be increased to 282 MT by 2011, 361 MT by 2016, 460 MT by 2021 and 587 MT by 2026. The waste generation from entire JDA (Jammu Development Authority) area was estimated to be 317MT; 409MT; 528MT; 681 MT and 880 MT in respective years of 2006, 2011, 2016, 2021 and 2026.

97. **Transportation.** Jammu City is well connected with rest of India by air, rail and road. National Highway - 1A connects Ambala to Srinagar via Jammu. The road network available within Jammu City caters to the intra-city traffic.

#### **D. Social and Cultural Resources**

98. **Demography.** Jammu and Kashmir has a Muslim majority population. Though Islam is practiced by about 67% of the population of the state and by 97% of the population of the Kashmir valley, the state has large communities of Buddhists, Hindus and Sikhs. In totality, the Muslims constitute 67% of the population, the Hindus about 30%, the Buddhists 1%, and the Sikhs 2% of the population. The demographic status of Jammu and Kashmir is given in Table-14.

**Table-14: Demographic status of Jammu and Kashmir**

Division	Population	% Muslim	% Hindu	% Sikh	% Buddhist and other
Kashmir (53.9%)	6763871	97.16%	1.84%	0.88%	0.11%
Jammu (43.7%)	5483881	30.69%	65.23%	3.57%	0.51%
Ladakh (2.3%)	288624	47.40%	6.22%	—	45.87%
<b>Jammu and Kashmir</b>	<b>12548926</b>	<b>66.97%</b>	<b>29.63%</b>	<b>2.03%</b>	<b>1.36%</b>
<b>Statistics calculated from the 2011 Census of India</b>					

99. In Jammu and Kashmir, the principal spoken languages are Kashmiri, Urdu, Hindi, Dogri, Pahadi, Balti, Ladakhi, Gojri, Shina and Pashto. However, Urdu written in the Persian script is the official language of the state.

100. Health and Educational Facilities. Since the subproject sectors are situated in Jammu City. The infrastructure facilities like schools, hospitals, colleges, electricity and communication in the subproject area are satisfactory.

101. The health care facilities are provided by both government and privately owned hospitals. Prominent among them are Government Medical College Hospital, Shri Maharaja Gulab Singh (SMGS) Hospital, Acharaya Shri Chandra College of Medical Sciences and Hospital, catering to the health care needs of major part of the state. The Government Medical College is being expanded with a Super-Speciality facility on the pattern of All India Institute of Medical Sciences (AIIMS), New Delhi. Apart from these, a number of private nursing homes are scattered throughout Jammu City.

102. Notable higher education or research institutes in Jammu include Government Medical College; Acharaya Shri Chandra College of Medical Sciences; Indira Gandhi College for Dental Sciences, Government College of Engineering and Technology and a number of Government and private Degree Colleges. University-level education is provided by University of Jammu; Sher-e-Kashmir University of Agricultural Sciences and Technology, Jammu; Shri Mata Vaishno Devi University; Baba Ghulam Shah Badshah University and Central University of Jammu.

103. History, Culture, and Tourism. The Constitution of India does not allow people from regions other than Jammu and Kashmir to purchase land in the state. Jammu's Dogra culture and tradition is much similar to that of neighboring Punjab and Himachal Pradesh. Traditional Punjabi festivals such as Lohri and Baisakhi are celebrated with great zeal and enthusiasm throughout the region.

104. After Dogras, Gujjars form the second-largest ethnic group in Jammu. Known for their semi-nomadic lifestyle, Gujjars are also found in large numbers in the Kashmir valley. Similar to Gujjars, Gaddis are primarily herdsmen who hail from the Chamba region in Himachal Pradesh. Gaddis are generally associated with emotive music played on the flute. The Bakkarwals found both in Jammu and the Vale of Kashmir are wholly nomadic pastoral people who move along the Himalayan slopes in search for pastures for their huge flocks of goats and sheep.

105. There are no archeological or historical monuments in the immediate vicinity of project site. The monuments protected by State in Jammu are Bahu Fort, Peer Mitha Tomb at Peer Mitha, Mast Garh Shahi Masjid, Mubarak Mandi complex, Royal Bowli at Nandini and Mosque at Chak Jaffer. Of these, Peer Mitha Tomb is the nearest with a distance of about 1.31 km from the outer periphery of the subproject area. The Monuments protected by Archeological Survey of India are Fort at Akhnoor and Remains of Ancient Site (Pambaran) at Ambaran, Akhnoor. No such protected monument is located in the close vicinity of the proposed subproject corridor. The distance of protected monuments/sites from the outer periphery of subproject corridor has been presented in Table-15.

**Table-15: Distance of protected monuments/sites from the outer periphery of subproject corridor**

A. State Protected monument/site	Distance from outer periphery of subproject corridor (in km)
• Bahu Fort	2.48
• Peer Mitha Tomb, Peer Mitha	1.31
• Shahi Mosque, Mast Garh	1.50
• Mubarak Mandi Complex	1.50
• Mosque at Chak Jaffer	8.7
• Royal Bowli at Nandini	13.50
<b>B. Archaeological Survey of India Protected Sites</b>	
• Fort at Akhnoor	16.11
• Remains of Ancient site (Pambaran) at Ambaran, Akhnoor	13.87

106. Jammu is known as ‘City of Temples’ and as such it is a famous tourist place. Every year a large number of pilgrims enter city to visit the temples. Roughly 7-10 million pilgrims visit Mata Vaishno Devi (about 50 Km from Jammu) and about 0.4 million pass through Jammu every year for Amarnath temple (which is in Srinagar). Besides, tourists also visit Bahu Fort (in Jammu City around 1.02 Km from outer periphery of subproject area), Raghunath temple (around 0.75 Km from outer periphery of subproject area), Mansar lake (around 62 Km from Jammu), Surinsar lake (around 35 Km from Jammu). Apart from these, a number of other shrines and temples are situated in Jammu City. The implementation of the subproject shall have no impact on any such site.

107. **Sensitive Environmental Receptors.** The sensitive environmental receptors existing along the alignment of proposed subproject include religious places, educational institutions, health care centres, community property resources, etc. The subproject i.e. laying of new and replacement of worn out pipes is spread over a large area in Jammu City. The nature and scope of activities will involve excavation followed by laying of pipeline, testing, backfilling and road restoration. The implementation of this component is not expected to have significant impact on any sensitive environmental receptor located in vicinity of the construction sites. However, all receptors likely to suffer temporary access disruption for a short period during implementation would be provided temporary access keeping in view the nature and location of the receptor.

108. All the sensitive environmental receptors existing along the subproject sites shall be properly supervised during the subproject execution stage so as to avoid and minimise any negative impact. As such, these sites may face the minor impacts of temporary disruption of access and increased air and noise pollution during execution of the proposed subproject. During finalization of design, all the sensitive receptors are to be saved judiciously.

## V. ANTICIPATED IMPACTS AND MITIGATION MEASURES

109. As the DPR of the current subproject has not been prepared yet, the present IEE report assesses the impacts of the proposed activities on various environmental attributes of the subproject site mostly based on the concepts. This IEE will be updated during detailed design phase.

110. **Methodology.** Issues for consideration have been raised by the following means: (i) input from interested and affected parties; (ii) desktop research of information relevant to the proposed subproject; (iii) site visit and professional assessment by environment specialist



engaged by the implementing agency; and (iv) evaluation of proposed design scope and potential impacts based on the environment specialist's past experience.

111. The methodology used to rate the impacts was qualitative. Each category was divided into a number of different levels. These levels were then assigned various criteria as indicated in Table-16:

**Table-16: Summary of Quantifiers and Qualifiers Used for Assessment Purposes**

Duration (time-scale)	Short-term	Impact restricted to construction (0-2 year).
	Medium-term	Impact will continue throughout operation (3-30 years for storage facilities and distribution network and 3-15 years for pumping machinery).
	Long-term	Impacts will exist beyond the life of the water supply system (>30 years for storage facilities and distribution network and >15 years for pumping machinery)
	Permanent	Impacts will have permanent potential
Geographic spatial scale	Site	The impact will be limited to within the site boundaries.
	Local	The impact will affect surrounding areas.
	Regional	The impact will affect areas far beyond the site boundary but limited to the State of Jammu and Kashmir.
Significance rating pre / post-mitigation (positive / negative)	Low	The impact will have a minimal effect on the environment.
	Medium	The impact will result in a measurable deterioration in the environment.
	High	The impact will cause a significant deterioration in the environment.
Mitigation	n/a	No mitigation necessary.
	Full	Full mitigation/reversal of the impact is possible.
	Partial	Only partial mitigation/reversal of the impact is possible
	None	No mitigation or reversal of the impact is possible
Degree of Certainty	Definite	√ (>90%)
	Probable	(>70%)
	Possible	(>40%)
	Unsure	(<40%)

### A. Planning and Design Phase

112. Planning principles and design considerations have been reviewed and incorporated into the site planning process whenever possible. The concepts considered in design of the proposed water supply subproject are: (i) no involuntary land acquisition; (ii) substantial reduction of water losses in subproject area; (iii) most suitable construction methodology; and (iv) site constraints.

113. ERA will ensure works will be conducted in minimal possible period (maximum of 2 days for every 30 meter of pipe length) and impacts will be mitigated through good construction practices.

114. Salient design features are presented in **Table-17**.

**Table-17: Salient design features of the subproject.**

Parameter	Design Consideration
Location	Replacement of worn out distribution pipes-component is located in western part of Jammu City.
Climatic Conditions	Rainfall and its run off in the subproject area may cause disruption/damage to works under execution and public inconvenience. Furthermore, climatic conditions play an important role during dispersion of noise and air pollutants. Seasonal climatic conditions have been considered for scheduling of construction activities.

Parameter	Design Consideration
Air Quality <sup>8</sup>	During Construction phase some emissions of dust are anticipated during various transportation, excavation and construction activities. Certain volumes of dust and gaseous emissions will also be generated during the construction period from construction machineries like excavators, vehicles engaged in transportation of construction materials, etc. Pollutants of primary concern at this stage include Respirable Suspended Particulate Matter (PM <sub>10</sub> and PM <sub>2.5</sub> ) and gaseous emissions. However, transportation of construction materials will be confined to adequate trips per day depending upon extent of construction activity. Proper mitigation methods will be adopted to control obnoxious gases and dust generated, if any.
Drainage and hydrology	The subproject components are not expected to have any negative impact on the drainage and hydrology of the area. Runoff from the subproject will produce a highly variable discharge in terms of volume and quality and in most instances will have no discernable environmental impact. The area of Jammu has surplus exploitable ground water potential as per hydro-geological assessment study carried out by Central Ground Water Board (CGWB) and Project Management Consultant of ADB loan 2151-IND (2007). It has been indicated in the reports that the present ground water extraction in the area is only 17.62% of the total available potential; and the area thus lies in the safe category of ground water development.
Ecological diversity	The subproject is situated within an existing built up area of Jammu City. No areas of ecological diversity occur within the subproject location. Due to the nature and locality of the subproject, it is unlikely to have any impacts on biodiversity within the area.
Land use and livelihoods	The land use in the project corridor comprises of built up area and transportation area. The built up areas consist of residential complexes, government/private offices and buildings, educational institutes, religious places and commercial establishments such as shops, hotels and restaurants. The transportation area constitutes of existing roads in the subproject area.  The key efforts undertaken to minimize impacts are: (i) before the preparation of engineering design, a detailed survey of the properties was conducted with regard to their ownership with the objective that minimum proprietary land is utilized for the subproject; (ii) aligning water supply pipelines in commercial areas wherever possible to avoid any physical displacement or temporary impact.  The subproject will not involve any involuntary land acquisition..
Traffic flow and access	Due to the location and nature of the subproject, there will be interference with accesses to the adjoining properties. A Traffic Management Plan ( <b>Appendix 1 to EMP</b> ) has been developed to provide vehicle and pedestrian access and maintain community linkages. A communications strategy is of vital importance in terms of accommodating traffic during road closure. 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, road signages, etc. The implementation of the road detours will also be dependent on advance road signages indicating the road detour and alternative routes. ERA will coordinate with the traffic police for the implementation of the Traffic Management Plan.
Infrastructure and services	There are a number of existing infrastructure and services (roads, telecommunication lines, power lines and various pipelines) within the vicinity of the subproject. To mitigate the adverse impacts due to relocation of the utilities, DSC will (i) identify and include locations and operators of these utilities in the detailed design documents to prevent unnecessary disruption of services during construction phase; and (ii) require construction

<sup>8</sup> Roadside pollution is often localized and generally only affects a narrow band of roads along the sides of the road. The major source of roadside pollutants is vehicle exhaust emissions. Other pollution sources emanate from combustion of hydrocarbon fuels in air producing carbon dioxide (CO<sub>2</sub>) and secondary pollutants such as hydrocarbons (HC), nitrogen oxides (NO<sub>x</sub>), carbon monoxide (CO) and sulphur dioxide (SO<sub>2</sub>). Emissions depend on the volume of traffic, the type of vehicle (including age, technology, and maintenance levels of the vehicle), fuel consumption and quality, engine temperature and road geometry. The highest emission rates are encountered in congested, slow moving traffic, and whenever vehicles shift gears, decelerate, accelerate or travel over steep gradients. There is also a tendency for emission rates to increase at high speeds.

Parameter	Design Consideration
	contractors to prepare a contingency plan.
Noise and vibrations	During construction phase, some noise and vibration will be generated from the various construction activities like construction works, operation of construction equipment and vehicles engaged in transportation of construction materials. However, these will be confined to the work sites only and will be temporary in nature occurring mostly during daytime.
Aesthetics, landscape character, and sense of place <sup>9</sup>	The subproject is considered to be compatible with the surrounding landscape and is not expected to negatively impact the existing visual quality or landscape character of the area.

115. Based on transect walks and confirmation from project preparation civil engineers, there will be no permanent or temporary land acquisition, or impacts on permanent structures and other assets. However it is estimated that there would be potential temporary impacts in terms of access inconvenience for some shops/business establishments, residential households and institutions. Keeping in view the nature of work proposed during laying of these pipelines civil engineers have confirmed that the maximum number of days for which access to those properties will be temporarily affected due to construction activity will be 2 days. Where access cannot be ensured, there can be potential for temporary income loss for businesses/shops. The transect walk was used as a basis to estimate possible income losses. A resettlement plan was prepared according to the requirements of ADB SPS to address these impacts.

116. There is much scope to minimize access impacts on shops through proper planning and implementation of mitigation measures to a level which will not affect income. In case of disruption of access to the shops, the contractor will provide assistance through provision of planks etc. to continue the business during the construction period. As per the contract provisions, the contractor will be required to restore the road to its original condition and cover the trenches with concrete slabs/steel plates with slopes to provide access. There will be no impacts on residential structures other than possible temporary access disruptions. The institutions mostly include educational institutions, religious places, banks and other Government offices. In case of institutions additional mitigation measures such as not conducting work during special days which involve large gatherings should be undertaken during construction. Thus execution of proposed subproject will not involve impact on any land conversion or acquisition. Apart from some minor temporary changes, there shall not be any significant change in the land use of the subproject area. The Confirmation will be obtained from Operator of Commercial establishment/shop for provision of temporary Access by Contractor and the format for the same is given as the appendix to EMP 2.

117. The table 18 outlines potential impacts gleaned from a process that included a review of available documentation, ground-verified during the site visit, i.e. how, where and when the

<sup>9</sup> Aesthetics refer to the visual quality of an area as imparted by the physical properties of an area, such as scale, colour, texture, landform, level of enclosure, and in particular, the land use occurring within an area. Landscape character refers to an area's intrinsic appeal and is not dependent on its visual quality but rather on its specific situation as determined by the following: its level of accessibility or remoteness, level of naturalness, lack of disturbance, current and potential use, rarity, cultural or historic importance, and potential value to people. The landscape character determines the extent of visual compatibility of the water supply structures with its immediate surroundings. Impacts are not restricted to the vicinity but the entire view shed (area from where the infrastructure will be visible). The spirit, or sense of place (Genius Loci), can be defined as the extent to which a person can recognise or recall a place as being distinct from other places and as having a vivid, or unique, or at least a recognizable character. It indicates the intrinsic value that a community places on the aesthetic, therapeutic or emotional qualities and character of an area. Aesthetics, landscape character and sense of place are all subjective concepts that are often influenced by individuals' perceptions.

proposed development could interact and affect the environment significantly, and details what mitigation measures may be taken to counteract these impacts.

**Table-18 Summary of Anticipated Potential Environmental Impacts during Planning and Design Stage**

Environmental Aspect	Summary of Implications and Mitigation		Assessment of Environmental Impacts				
	Potential Impacts	Mitigation	Significance before Mitigation	Geographic Spatial Scale	Duration	Mitigation	Significance After Mitigation
Existing Situation	<ul style="list-style-type: none"> <li>There is acute shortage of potable water in many water deficient areas of Jammu City.</li> <li>Newly established settlements lack adequate infrastructure for water production, storage and supply.</li> <li>The distribution pipelines are worn out and as a result the leakages are persistent with loss of pressure at user end.</li> <li>Leakages in distribution system result in contamination and consequent reduction in water quality.</li> <li>Losses in the distribution network within water supply zones and sub-subzones is very high, up to 35-45%:</li> <li>(i) Households are allowed to connect directly to the distribution pipelines without service lines;</li> <li>) Some households have more than one water connection;</li> <li>Flat rate of user charges without household meters; (</li> <li>Public taps without valves; and Absence of proper maintenance (resources and funds), resulting to very high losses in the distribution network within sub-sub-zones.</li> </ul>	<ul style="list-style-type: none"> <li>The subproject will improve the overall water supply system of the area in a safe and efficient manner by providing strengthening of distribution network (lying of new and replacement of wornout pipelines) and reducing water losses.</li> <li>The proposed NRW programme will bring reduction of non-revenue water, (ii) improve governance and, (iii) augmentation of production capacity and increase coverage.</li> </ul>	High ( - )	Site/Local	Medium-term	Full Mitigation Definite	High ( + )
Planning initiatives	<ul style="list-style-type: none"> <li>Planning initiatives have been identified as:</li> <li>Establishment of an efficient water supply system in the area.</li> <li>Ensuring adequate potable water supply to the user end.</li> <li>Enhancing the water</li> </ul>	<ul style="list-style-type: none"> <li>The subproject will improve the water supply system in the area in a safe and efficient manner. This will allow for the planning initiatives to be realized.</li> </ul>	High ( - )	Site/Local	Medium-term	Full mitigation definite	High ( + )

Environmental Aspect	Summary of Implications and Mitigation		Assessment of Environmental Impacts				
	Potential Impacts	Mitigation	Significance before Mitigation	Geographic Spatial Scale	Duration	Mitigation	Significance After Mitigation
	production and storage capacity of the water deficient areas. <ul style="list-style-type: none"> <li>• Strengthening of distribution network so as to minimize the water losses.</li> <li>• Minimize the non revenue water losses.</li> </ul>						
Identification of water supply needs and demands	<ul style="list-style-type: none"> <li>• The ERA vision is to provide safe, reliable, effective and efficient water supply system which will best meet the needs of the people at improving levels of service in a way which supports government strategies for economic and social development, whilst being environmentally and economically sustainable.</li> </ul>	<ul style="list-style-type: none"> <li>• By rehabilitating the distribution network, the water deficient areas will receive adequate potable water.</li> </ul>	High ( - )	Local	Medium-term	Full mitigation definite	High ( + )

## B. Construction Phase

118. Table-19 presents an indication of what activities and facilities are likely to be undertaken during construction of the subproject, including the associated inputs and outputs.

**Table-19: Summary of Activities and Facilities, Resource Use, and Produced Outputs during Construction Phase**

Activities and Facilities	Inputs/Resource Use	Outputs/Waste Production
<ul style="list-style-type: none"> <li>• Construction camp and its associated facilities (including lay-down areas)</li> <li>• Storage camps and lay-down areas</li> <li>• Source of water</li> <li>• Vegetation clearance</li> <li>• Movement of construction staff, equipment and materials</li> <li>• Importation of selected materials for construction.</li> <li>• Temporary detours</li> <li>• Noise and vibrations</li> <li>• Dust suppression</li> <li>• Waste production and temporary storage/disposal i.e. used fuels, waste concrete and bitumen, spoil materials and general waste</li> <li>• Use of bitumen/asphalt</li> <li>• Erosion prevention</li> <li>• Rehabilitation of disturbed areas</li> <li>• Interaction between construction workforce and local communities</li> <li>• Management of the passing pedestrians and points of congestion</li> <li>• Implementation of the Resettlement Plan prior to start of construction</li> <li>• Reminders to affected people of construction with timeframes</li> </ul>	<ul style="list-style-type: none"> <li>• Bitumen</li> <li>• Chemical additives used in concrete</li> <li>• Paving blocks</li> <li>• Aggregate (sand and stone)</li> <li>• Gravel (fill material and selected material for sub-base and base layers)</li> <li>• Water               <ul style="list-style-type: none"> <li>– Drinking, cooking and sanitation at construction camps</li> <li>– Water for dust suppression</li> <li>– Water applied to base and sub-base layers during compaction</li> <li>– Water for application to sub-base and base layers prior to compaction</li> </ul> </li> <li>• Petrochemicals</li> <li>• Other chemicals/lubricants/paints</li> <li>• Construction vehicles, machinery and equipment</li> <li>• Temporary energy supply to construction camps</li> <li>• Labour               <ul style="list-style-type: none"> <li>– Recruitment of construction workforce</li> <li>– Skills training</li> </ul> </li> <li>• Public movement control               <ul style="list-style-type: none"> <li>– need barriers (not just danger tape) to protect people from trenches during construction</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Old asphalt (removed from road carriageway during laying of pipelines)<sup>10</sup></li> <li>• Waste concrete and other construction rubble</li> <li>• Waste bitumen<sup>11</sup></li> <li>• Used fuels, lubricants, solvents and other hazardous waste</li> <li>• General waste               <ul style="list-style-type: none"> <li>– Contaminated soil</li> <li>– Soil contaminated with bitumen</li> <li>– Soil contaminated with petrochemicals (i.e. oils and lubricants) and other chemicals</li> </ul> </li> <li>• Sewage and grey water (temporary construction camp sanitation)</li> <li>• Spoil material (excess soil removed during excavations)</li> <li>• Noise and vibrations (construction vehicles and machinery)</li> <li>• Lighting at construction camps, equipment yards and lay-down areas</li> <li>• Plant material removed from servitude/right-of-way during vegetation clearance</li> <li>• Smoke and fumes               <ul style="list-style-type: none"> <li>– Burning of waste</li> <li>– Burning of vegetation cover</li> <li>– Fires used for cooking and space heating (construction camps)</li> <li>– Vehicle exhaust emissions</li> </ul> </li> </ul>

119. The table 20 (**Table-20**) outlines potential impacts during the construction phase gathered from a process that included a review of available documentation, verified during the site visit, i.e. how, where and when the proposed development can interact and affect the

<sup>10</sup> The water supply rehabilitation works affecting roads may involve the stripping and demolition of old asphalt layers. Ideally, old asphalt shall be reused during construction of the new road in order to avoid large quantities of waste being produced. However, depending on the availability and cost of virgin aggregate in the area through which the road is aligned, reusing the old asphalt may be more costly than using virgin aggregate.

<sup>11</sup> Bitumen has relatively low levels of polycyclic aromatic hydrocarbons (PAHs) and is largely inert. However, certain other potentially hazardous chemical may be added to the bitumen or to the aggregate during the construction process in order to render the compound more workable. The objective is to use the least hazardous chemicals available and to locate asphalt plants, aggregate stockpiles and mixing areas where they do not pose a significant environmental risk.

environment significantly, and details what mitigation measures may be taken to counteract these impacts.



**Table-20: Summary of Anticipated Potential Environmental Impacts during Construction Phase**

Environmental Aspect	Summary of Implications and Mitigation	Assessment of Environmental Impacts					
	Potential Impacts	Mitigation	Significance before Mitigation	Geographic Spatial Scale	Duration	Mitigation	Significance After Mitigation
Climate	<ul style="list-style-type: none"> <li>The nature and intensity of rainfall events in an area, has implications for storm water management.</li> <li>Smoke from burning activities could be wider spread on windy days especially when dust could be blown off site.</li> </ul>	<ul style="list-style-type: none"> <li>Seasonal climatic variations will be considered during scheduling of construction activities in the area.</li> <li>Excavations and other clearing activities will only be done during agreed working times and permitted weather conditions.</li> <li>Storm water control during construction phase as per the method approved by the Engineer.</li> <li>Seeding of topsoil and subsoil to prevent wind and water erosion of soil surfaces.</li> <li>No open fires permitted on site</li> </ul>	Low ( - )	Site	Short-term	Full Mitigation Probable	Low ( - )
Air Quality	<ul style="list-style-type: none"> <li>Sensitive receptors (e.g. health facilities, educational institutions, religious places) may be affected temporarily by increased traffic and related impacts during the construction phase.</li> <li>Fugitive dust can also impact roadside air quality during construction. Exhaust fumes from construction machinery, and potential smoke from cooking fires.</li> <li>Burning of waste and cleared vegetation.</li> <li>Odors from use of toilet 'facilities' other than provided facilities.</li> </ul>	<ul style="list-style-type: none"> <li>Ensure compliance with the Air Act.</li> <li>Ensure compliance with emission standards.</li> <li>Guidelines that deal with the control of air pollution on site have been outlined in the Environmental Management Plan (EMP).</li> <li>Monitoring of air pollution levels in potential problem areas will be undertaken.</li> <li>Management (including storage, transport, handling and disposal) of hazardous substances used during construction.</li> <li>Dust control measures have been included in the EMP.</li> <li>Dust generating construction activities will be avoided during strong winds.</li> </ul>	High ( - )	Local	Short-term	Partial Mitigation Probable	Medium (-)

Environmental Aspect	Summary of Implications and Mitigation	Assessment of Environmental Impacts					
	Potential Impacts	Mitigation	Significance before Mitigation	Geographic Spatial Scale	Duration	Mitigation	Significance After Mitigation
		<ul style="list-style-type: none"> <li>• Soil loads in transit will be kept covered.</li> <li>• Stockpiles of soil will be kept covered or have suitable dust palliative applied such as water.</li> <li>• A suitable dust palliative (water) will be applied if dust levels rise above acceptable levels.</li> <li>• Regular servicing of the vehicles off site in order to limit gaseous emissions.</li> <li>• No open fires permitted on site.</li> <li>• Temporary toilet facilities will be provided on site and will be maintained on a daily basis.</li> </ul>					
Geology	<ul style="list-style-type: none"> <li>• Strong water flows into open excavations may occur, causing damage to structures.</li> <li>• Flow of storm water distributed area and stockpiles of excavated earth may result into erosion of the soil.</li> <li>• Contamination from spillage of petroleum products, spent engine oil and oil leaks from construction vehicle maintenance taking place on site.</li> <li>• Contamination through use of toilet 'facilities' other than provided facilities.</li> </ul>	<ul style="list-style-type: none"> <li>• Adequate arrangements shall be put in place for diversion of storm water within the existing drains so as to avoid impacts on construction sites during construction period.</li> <li>• Rehabilitate all sites used during construction including construction camps, stockpile area, temporary access and hauling routes, as soon as possible after the disturbance has ceased.</li> <li>• Contractor to exercise strict care in the disposal of construction waste, with proof of disposal at an approved site provided after offloading each waste load and this is logged/registered.</li> <li>• Contaminated water will be contained and disposed off site at an approved disposal site (the</li> </ul>	Medium ( - )	Site	Short-term	Full Mitigation Probable	Low ( - )

Environmental Aspect	Summary of Implications and Mitigation	Assessment of Environmental Impacts					
	Potential Impacts	Mitigation	Significance before Mitigation	Geographic Spatial Scale	Duration	Mitigation	Significance After Mitigation
		<p>site to be identified by contractor and approved by Engineer).</p> <ul style="list-style-type: none"> <li>The contractor will dispose of waste from the oil interceptors at approved disposal site (the site to be identified by contractor and approved by Engineer).</li> <li>Cement, concrete and chemicals will be mixed on a concrete plinth and provisions will be made to contain spillages or overflows into the soil.</li> <li>No vehicle maintenance to be allowed on site.</li> <li>If oil spills occur the contaminated soil will be disposed of at approved disposal site (the site to be identified by contractor and approved by Engineer).</li> <li>Temporary toilet facilities will be provided by contractor on site and maintained on a daily basis.</li> <li>Topsoil and subsoil will be protected from contamination.</li> <li>Subsoil and overburden in all construction and lay down areas to be stockpiled separately and returned for backfilling in the correct soil horizon order.</li> </ul>					
Drainage and hydrology	<ul style="list-style-type: none"> <li>The proposed development is situated within an existing built up area where drainage infrastructure already exists. No water courses, wetlands or estuaries occur within the subproject location. Due to the nature and locality of</li> </ul>	<ul style="list-style-type: none"> <li>The site surface to be engineered and shaped in such a way that rapid and efficient evacuation of runoff is achieved.</li> <li>Provide containment areas for potential pollutants at construction camps, refueling, depots, concrete batching plants,</li> </ul>	Low ( - )	Site	Short-term	Full Mitigation Probable	Low ( + )

Environmental Aspect	Summary of Implications and Mitigation	Assessment of Environmental Impacts					
	Potential Impacts	Mitigation	Significance before Mitigation	Geographic Spatial Scale	Duration	Mitigation	Significance After Mitigation
	the subproject there is unlikely to have any significant impacts on water resources within the immediate area.	etc. <ul style="list-style-type: none"> <li>Waste management practices will be implemented.</li> <li>The transport, storage, handling and disposal of hazardous substances will be controlled and managed.</li> </ul>					
Biodiversity Fauna and Flora	<ul style="list-style-type: none"> <li>The proposed development is situated within an existing built up area. No areas of ecological diversity occur within the subproject location. Due to the nature and locality of the subproject there is unlikely to have any significant impacts on biodiversity within the area.</li> <li>The proposed rehabilitation of water supply system will not involve cutting of trees.</li> </ul>	<ul style="list-style-type: none"> <li>Adequate care shall be taken during construction of excavation pits for laying pipes to avoid any impact on the existing trees.</li> </ul>	Low ( - )	Site	Short-term	Full Mitigation Probable	Low ( + )
Land Uses	<ul style="list-style-type: none"> <li>Due to the location and nature of the subproject, there will be interference with access at some places.</li> <li>Existing public transport facilities and operations will be affected by the road closure and detours at some pipeline laying sites.</li> <li>There may be temporary disruptions to health services, education services, local businesses, transport services, pedestrian movements, due to traffic and construction related noise, visual, and air pollution.</li> </ul>	<ul style="list-style-type: none"> <li>ERA has consulted with various interested and affected parties, departments, etc. within the area and will be continued during the construction phase.</li> <li>Critical roads (e.g. in front of health facilities) will have a sign of "Keep Clear".</li> <li>The Contractor will make provisions for vehicle and pedestrian access to maintain community linkages.</li> <li>Consult with local departments, organizations, etc regarding location of construction camps, access and hauling routes and other likely disturbances during construction.</li> <li>Provide clear and realistic</li> </ul>	High ( - )	Local	Short-term	Partial Mitigation Probable	Medium ( - )

Environmental Aspect	Summary of Implications and Mitigation	Assessment of Environmental Impacts					
	Potential Impacts	Mitigation	Significance before Mitigation	Geographic Spatial Scale	Duration	Mitigation	Significance After Mitigation
		<p>information regarding detours and alternative accesses for local communities and businesses in order to prevent unrealistic expectations.</p> <ul style="list-style-type: none"> <li>• Provide clear and realistic information regarding employment opportunities and other benefits for local communities in order to prevent unrealistic expectations.</li> <li>• Make use of local labor, materials, goods and services as far as possible.</li> <li>• Provide walkways and metal sheets where required to maintain access for people and vehicles.</li> <li>• Increase workforce in front of critical areas such as educational institutions, places of worship, business establishments and health facilities to shorten the duration of impacts.</li> <li>• Consult businesses and institutions regarding operating hours and factor this in work schedules.</li> <li>• Provide sign boards for pedestrians to inform nature and duration of construction works and contact numbers for concerns/complaints.</li> </ul>					
Infrastructure and Services	<ul style="list-style-type: none"> <li>• There is likely to have temporary disruption of infrastructure and services during the proposed rehabilitation of water supply system.</li> <li>• There are a number of existing infrastructure and</li> </ul>	<ul style="list-style-type: none"> <li>• Utility shifting will be undertaken prior to commencing construction works.</li> <li>• Keep construction related disturbances to a minimum.</li> <li>• Consult with affected service providers regarding</li> </ul>	Medium ( - )	Local	Short-term	Full Mitigation Probable	Low ( - )

Environmental Aspect	Summary of Implications and Mitigation	Assessment of Environmental Impacts					
	Potential Impacts	Mitigation	Significance before Mitigation	Geographic Spatial Scale	Duration	Mitigation	Significance After Mitigation
	services (roads, telecommunication lines, power lines and various pipelines) within the vicinity of the subproject area.	<p>impacts on access to infrastructure and services and alternatives.</p> <ul style="list-style-type: none"> <li>Consult with affected communities or businesses prior to foreseeable disruptions, for example notifying residents of a temporary interruption of water supply.</li> <li>Provide backup or alternative services during construction-related disruptions, for example by providing generators for power supply.</li> <li>Provide access points to infrastructure and services.</li> <li>Monitor complaints by the public.</li> </ul>					
Traffic	<ul style="list-style-type: none"> <li>Increased volume of construction vehicles on the roads may lead to increased wear and tear of roads in the vicinity of the subproject sites.</li> <li>Road safety concerns due to slow moving construction vehicles.</li> <li>Traffic flow within the vicinity will be affected.</li> <li>The temporary road closure will result in a decrease in overall network performance in terms of queuing delay, travel times/ speeds.</li> <li>The road closure will impact on a public transport operations and routing.</li> <li>Pedestrian movements will be affected by the road closure.</li> </ul>	<ul style="list-style-type: none"> <li>Traffic will be rerouted and roads will be closed according to the Traffic Management Plan (TMP). The objective of the TMP is to ensure safety of all the road-users along the work zone and to address: (i) protection of work crews from hazards associated with moving traffic; (ii) mitigation of adverse impact to the road capacity and delays to the road-users; (iii) maintenance of access to adjoining properties; and (iv) issues that may delay the subproject works.</li> <li>Negotiations with privately-owned public transport operators regarding the affected public transport facilities and routing.</li> <li>'Clear roads' signs will be erected for the full length of the</li> </ul>	High ( - )	Site/Local	Short-term	Partial Mitigation Probable	Medium ( - )

Environmental Aspect	Summary of Implications and Mitigation	Assessment of Environmental Impacts					
	Potential Impacts	Mitigation	Significance before Mitigation	Geographic Spatial Scale	Duration	Mitigation	Significance After Mitigation
		<p>construction period at the work sites. Provide sign boards for pedestrians to inform nature and duration of construction works and contact numbers for concerns/complaints.</p> <ul style="list-style-type: none"> <li>The City Traffic Police will be available on site in the monitoring of traffic in the early stages of the operations during road closure.</li> <li>A traffic monitoring strategy will be implemented. This would include carrying out of traffic counts and onsite visits. Traffic monitoring during early stages of the road closure will be necessary to address: <ul style="list-style-type: none"> <li>Adjustments to traffic signal settings, signs and markings</li> <li>Adjustments to accommodation of pedestrians</li> <li>Adjustments necessary to public transport operators.</li> </ul> </li> <li>A communications strategy is of vital importance in terms of accommodating traffic during road closure. The road closure together with the proposed detour will be communicated via advertising, pamphlets, radio broadcasts, road signage, etc. The implementation of the road detour is also dependent on advance road signage indicating the road detour and alternative routes.</li> <li>Construction routes clearly defined.</li> <li>Access of all construction</li> </ul>					

Environmental Aspect	Summary of Implications and Mitigation	Assessment of Environmental Impacts					
	Potential Impacts	Mitigation	Significance before Mitigation	Geographic Spatial Scale	Duration	Mitigation	Significance After Mitigation
		<p>and material delivery vehicles will be strictly controlled.</p> <ul style="list-style-type: none"> <li>• Enforcement of speed limits.</li> <li>• Deliveries will not be allowed during peak traffic hours.</li> </ul>					
Health and Safety	<ul style="list-style-type: none"> <li>• Danger of construction related injuries.</li> <li>• Open fires in construction camp can result in accidents.</li> <li>• Safety of workers and general public must be ensured.</li> <li>• Poor waste management practices and unhygienic conditions at temporary ablution facilities can breed diseases.</li> <li>• Standing water due to inadequate storm water drainage systems and inadequate waste management practices, pose a health hazard by providing breeding grounds for disease vectors such as mosquitoes, flies and snails.</li> <li>• The use of hazardous chemicals in construction can pose potential environmental, health and safety risks.</li> <li>• The laying of pipelines may involve the stripping and demolition of old asphalt layers.</li> <li>• Road safety may be affected during construction, especially when traffic is detoured.</li> </ul>	<ul style="list-style-type: none"> <li>• Implement good housekeeping practices at the construction camp.</li> <li>• Strict health and safety measures to be implemented and audited on a regular basis.</li> <li>• Secure enclosed construction site.</li> <li>• Hiring of reputable contractors.</li> <li>• Provide warning signs of hazardous working areas.</li> <li>• Excavations to be clearly demarcated and barriers (not just danger tape) erected to protect pedestrians from open trenches.</li> <li>• Workers will be thoroughly trained in using dangerous equipment.</li> <li>• Workers have the right to refuse work in unsafe conditions.</li> <li>• Undertake waste management practices.</li> <li>• Control speed and movement of construction vehicles.</li> <li>• Improved signage, speed control, walkways and crossings will reduce safety risks due to construction.</li> <li>• Exclude public from the site.</li> <li>• Ensure all workers are</li> </ul>	High ( - )	Site and Local	Short-term	Partial Mitigation Possible	Low ( - )



Environmental Aspect	Summary of Implications and Mitigation	Assessment of Environmental Impacts					
	Potential Impacts	Mitigation	Significance before Mitigation	Geographic Spatial Scale	Duration	Mitigation	Significance After Mitigation
		<p>provided with and use Personal Protective Equipment. Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas;</p> <ul style="list-style-type: none"> <li>• Ensure that qualified first-aid can be provided at all times. Equipped first-aid stations shall be easily accessible throughout the site;</li> <li>• Provide medical insurance coverage for workers;</li> <li>• Provide clean eating areas where workers are not exposed to hazardous or noxious substances;</li> <li>• 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;</li> <li>• Ensure moving equipment is outfitted with audible back-up alarms;</li> <li>• 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.</li> </ul>					
Noise and	• Sensitive receptors	• Locate concrete batching,	High ( - )	Site and	Short-	Partial	Medium ( - )

Environmental Aspect	Summary of Implications and Mitigation	Assessment of Environmental Impacts					
	Potential Impacts	Mitigation	Significance before Mitigation	Geographic Spatial Scale	Duration	Mitigation	Significance After Mitigation
Vibrations	<p>(health facilities, educational institutions, religious places) may be affected temporarily by increased traffic and related impacts.</p> <ul style="list-style-type: none"> <li>• Use of heavy vehicles and equipment may generate high levels of noise.</li> <li>• Vibrations resulting from bulk earthworks and other construction activities may create significant disturbances to nearby people and businesses.</li> <li>• Disturbance from afterhours work.</li> </ul>	<p>asphalt, crushing plants, laydown areas and construction camps away from sensitive receptors.</p> <ul style="list-style-type: none"> <li>• Restrict construction activities to reasonable working hours where near sensitive receptors.</li> <li>• Keep adjacent landowners informed of unusually noisy activities planned.</li> <li>• Regulate roadworthiness of vehicles.</li> <li>• Ensure that machinery is in a good state of maintenance.</li> <li>• Silencers must be fitted and maintained to all machinery on site.</li> <li>• Monitor noise levels in potential problem areas.</li> </ul>		Local	term	Mitigation Probable	
Aesthetics, Landscape Character, and Sense of Place	<p>The presence of heavy duty vehicles and equipment, temporary structures at construction camps, stockpiles, may result in impacts on aesthetics and landscape character.</p>	<ul style="list-style-type: none"> <li>• Storage areas will be properly fenced off.</li> <li>• All domestic solid waste will be collected from a central point of disposal and fed into the city waste collection system.</li> <li>• Contractor to exercise strict care in disposing construction waste, with proof of disposal at the approved site provided after offloading each waste load and this to be logged/registered.</li> <li>• Identification of suitable waste disposal site with enough capacity to hold additional waste to be produced by the proposed construction activities.</li> <li>• Use of recycled material is encouraged.</li> <li>• Guidelines regarding</li> </ul>	Medium ( - )	Site and Local	Short-term	Partial Mitigation Definite	Low ( - )

Environmental Aspect	Summary of Implications and Mitigation	Assessment of Environmental Impacts					
	Potential Impacts	Mitigation	Significance before Mitigation	Geographic Spatial Scale	Duration	Mitigation	Significance After Mitigation
		<p>management of waste on site have been outlined in the EMP.</p> <ul style="list-style-type: none"> <li>Retain mature trees on and around the site where possible.</li> <li>Cluster construction activities on site on a specific area to avoid "sprawl".</li> <li>Unwanted material and litter will be removed on frequent basis.</li> </ul>					
Workers Conduct	<ul style="list-style-type: none"> <li>Construction workers on site disrupting adjacent land uses by creating noise, generating litter, and possible loitering.</li> </ul>	<ul style="list-style-type: none"> <li>Ensure strict control of laborers, minimizing working hours to normal working times, control littering, and ensure no overnight accommodation is provided.</li> </ul>	Low ( - )	Local	Short-term	Full Mitigation Definite	Low ( - )
Employment Generation	<ul style="list-style-type: none"> <li>The subproject will provide employment opportunities for local people during construction.</li> <li>Expectations regarding new employment will be high especially among the unemployed individuals in the area.</li> <li>Laborers gathering at the site for work can be a safety and security issue, and must be avoided.</li> <li>The training of unskilled or previously unemployed persons will add to the skills base of the area.</li> </ul>	<ul style="list-style-type: none"> <li>The use of labor intensive construction measures will be used where appropriate.</li> <li>Employ local (unskilled) labor if possible.</li> <li>Training of labor to benefit individuals beyond completion of the subproject.</li> <li>Recruitment of labors will take place offsite.</li> </ul>	Medium (+)	Local	Short-term	Partial Mitigation Probable	High ( + )
Archaeological and Cultural Characteristics	<ul style="list-style-type: none"> <li>The proposed development will not require demolition of structures or Archeological Survey of India (ASI)- or state-protected monuments and buildings.</li> </ul>	<ul style="list-style-type: none"> <li>Ensure that construction staff members are aware of the likelihood of heritage resources being unearthed and of the scientific importance of such discoveries.</li> </ul>	Low ( - )	Local	Short-term	Full Mitigation Definite	Low ( - )

Environmental Aspect	Summary of Implications and Mitigation	Assessment of Environmental Impacts					
	Potential Impacts	Mitigation	Significance before Mitigation	Geographic Spatial Scale	Duration	Mitigation	Significance After Mitigation
		<ul style="list-style-type: none"> <li>• ASI or the State Department of Archaeology will be contacted if any graves be discovered and all activities will be ceased until further notice.</li> <li>• ASI or the State Department of Archaeology will be contacted if any heritage resources or objects, defined in the Act, be discovered and all activities will be ceased until further notice.</li> <li>• Any heritage object found will not be moved without prior consultation with ASI or the State Department of Archaeology and all activities will be ceased immediately.</li> <li>• No structures older than 100 years will be allowed to be demolished, altered or destructed without a permit from ASI or the State Department of Archaeology.</li> </ul>					

### C. Operation and Maintenance Phase

120. Table-21 presents an indication of what activities and facilities are likely to be undertaken during operation and maintenance of the subproject, including the associated inputs and outputs.

**Table-21: Summary of Activities and Facilities, Resource Use, and Produced Outputs during Operation and Maintenance Phase**

Activities and Facilities	Inputs/Resource Use	Outputs/Waste Production
<ul style="list-style-type: none"> <li>• Signages</li> <li>• Safety barriers</li> <li>• Lighting</li> <li>• Noise and vibrations</li> <li>• Litter collection</li> <li>• Maintenance activities               <ul style="list-style-type: none"> <li>– Repairing and maintenance of pipelines, pumps and machinery,</li> <li>– Maintenance of distribution networks</li> </ul> </li> <li>• Eradication and control of invasive vegetation species</li> <li>• Auxiliary activities and Infrastructure               <ul style="list-style-type: none"> <li>– Markets and shops</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Manual de-weeding for eradication and control of invasive vegetation species</li> <li>• Labor</li> <li>• Vehicles and equipment used for inspections and maintenance</li> <li>• Aggregate and other material used during repairing of pipelines, machinery</li> </ul>	<ul style="list-style-type: none"> <li>• Vehicle exhaust emissions</li> <li>• Dust</li> <li>• Potential for water resource contamination</li> <li>• Visual exposure of water supply infrastructure</li> <li>• Waste/worn out material removed during maintenance</li> <li>• Noise and vibrations</li> <li>• Lighting</li> </ul>

121. The following table (**Table-22**) outlines potential impacts during the operation and maintenance phase gathered from a process that included a review of available documentation, verified during the site visit, i.e. how, where and when the proposed development can interact and affect the environment significantly, and details what mitigation measures may be taken to counteract these impacts

**Table-22: Summary of Anticipated Potential Environmental Impacts During Operation and Maintenance Phase**

Environmental Aspect	Summary of Implications and Mitigation		Assessment of Environmental Impacts				
	Potential Impacts	Mitigation	Significance before Mitigation	Geographic Spatial Scale	Duration	Mitigation	Significance After Mitigation
Climate	<ul style="list-style-type: none"> <li>The corrosive nature of climatic conditions may impact the water supply infrastructure.</li> </ul>	<ul style="list-style-type: none"> <li>Regular maintenance of the water supply infrastructure.</li> </ul>	Low ( - )	Site	Medium-term	Partial Mitigation Probable	Low ( + )
Geology	<ul style="list-style-type: none"> <li>Unattended leakages of pipelines and seepage of water under the ground may cause collapse of side walls of nearby structures.</li> </ul>	<ul style="list-style-type: none"> <li>Regular monitoring and maintenance of the water supply infrastructure.</li> </ul>	Low ( - )	Site	Long-term	Full Mitigation Possible	Low ( - )
Land Uses	<ul style="list-style-type: none"> <li>With rehabilitation of water supply system, the presently water scarce areas can be put to their utmost possible use.</li> <li>The proposed project is expected to facilitate an integrated development approach to the area thereby improving the overall quality of life.</li> <li>The proposed development is expected to bring about positive economic benefits in the medium- to long- term.</li> <li>Local businesses and educational facilities, etc. are likely to benefit from the subproject.</li> </ul>	<ul style="list-style-type: none"> <li>Regular maintenance and monitoring of the water supply infrastructure so as to ensure that its functional capacity and efficiency does not reduce.</li> </ul>	High ( + )	Site and Local	Long-term	Full Mitigation Possible	High ( + )
Health and Safety	<ul style="list-style-type: none"> <li>Improvement of water supply system is expected to significantly enhance the quantity and quality of the supplied water.</li> <li>Reduction in leakages will ensure adequate supply of potable drinking water minimizing contamination risks with corresponding reduction in health risks to the citizens.</li> </ul>	<ul style="list-style-type: none"> <li>Undertake regular monitoring and maintenance of water supply infrastructure.</li> </ul>	High ( + )	Local	Long-term	Partial Mitigation Probable	High ( + )
Aesthetics, Landscape Character, and Sense of Place	The subproject is considered to be compatible with the surrounding landscape and is not likely to impact negatively on the existing visual quality or landscape character of the area; rather it is expected to improve the general environment through adequate	<ul style="list-style-type: none"> <li>Monitor housekeeping, littering and illegal dumping.</li> </ul>	Low ( + )	Site and Local	Long-term	Partial Mitigation Probable	Medium ( + )

Environmental Aspect	Summary of Implications and Mitigation		Assessment of Environmental Impacts				
	Potential Impacts	Mitigation	Significance before Mitigation	Geographic Spatial Scale	Duration	Mitigation	Significance After Mitigation
	supply of potable water in the subproject area.						

#### **D. Cumulative Environmental Impacts**

122. The table-23 presents the cumulative impacts which are impacts that result from the incremental impact of the subproject activity on a common resource when added to the impacts of other past, present, or reasonably foreseeable future activities. The cumulative impact assessment (CIA) examined the interaction between the project's residual effects (i.e., those effects that remain after mitigation measures have been applied) and those associated with other past, existing and reasonably foreseeable future projects or activities. The interaction of residual effects associated with multiple projects and/or activities can result in cumulative impacts, both positive and negative. The project's potential cumulative effects were considered with respect to Valued Components (VCs) in the categories of environmental and socio-economic in four areas:

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

123. The project has identified the VCs as water quality, noise, traffic management, social-economic and socio-community, and human health. Work on sewerage system is underway in some part of the project corridor funded under tranche 1 of JKUSDIP and the same shall be completed before commencement the proposed water supply subproject therefore ruling out any cumulative effect. Thus there are no foreseeable projects that will overlap with this project. The spatial boundary of the project is the area along the pipe alignment, The temporal boundary can be considered as the whole Jammu City.

124. There will be significant reduction in water losses due to worn out transmission lines and the rationalization and reorganization of water supply system resulting into minimization of non revenue water losses. Given the adequacy of the sources, there are no significant cumulative negative impacts expected on the future water supply.

125. Air quality effects will occur during construction. Consequently, although emissions of common air contaminants and fugitive dust may be elevated in proximity to active work sites, this impact will be short-term and localized to the immediate vicinity of the alignment. Greenhouse Gas (GHG) emissions may increase as a result of project activities (i.e., vehicle and equipment operation, concrete production, disposal of excavated material, landfilling of residual wastes). Given the project's relatively minor contribution to common air contaminants and GHG emissions during construction, the overall significance rating of both these potential residual effects is considered to be negligible.

126. Noise levels during construction in the immediate proximity of most work sites are expected to increase. The duration of this exposure will be relatively brief. This exposure represents a temporary, localized, adverse residual effect of low to moderate significance for affected receptors. While building damage due to ground vibrations is unlikely, there may annoyance to spatially located receptors during construction.

127. Land use/traffic management concerns will occur spatially during construction. Site-specific mitigation measures will be implemented to address temporary disruptions to land use and access, traffic delays and detours, parking modifications, and increased volumes of



construction-related traffic. Traffic movement along the alignment will be restored once construction is completed. Since the project will be rehabilitation of existing pipelines only, it will not conflict with existing or planned land use. However, following improvement in infrastructures and services, added residential developments, commercial and business facilities and increased densities are expected to develop and enhance the project area. This can be considered a long-term cumulative benefit of the project.

128. Upon completion of the project, the socio-community will benefit from improved water supply system. This is considered a long-term cumulative benefit. No adverse residual effects to human health will occur as a result of project construction or operation. While exposure to elevated noise levels and fugitive dust and common air pollutants will occur in proximity to project work sites during construction, due to their short-term, localized nature, these effects are expected to be minor and insignificant with no measurable effects on human health. Therefore the project will benefit the general public by contributing to the long-term improvement of water supply system and community livability in Jammu City.

**Table-23: Summary of Anticipated Potential Cumulative Environmental Impacts**

Environmental Aspect	Assessment of Environmental Impacts					
	Potential Impacts	Significance before Mitigation	Geographic Spatial Scale	Duration	Mitigation	Significance After Mitigation
Significant reduction in water losses due to worn out transmission lines and NRW Programme	<ul style="list-style-type: none"> <li>Laying of new rising mains and distribution mains and replacement of wornout pipelines shall ensure significant reduction in water losses.</li> <li>This will also reduce the health risks associated with contamination of water due to leakages in water supply pipelines.</li> </ul>	High ( - )	Site/Local	Long-term	Full Mitigation Probable	High ( + )
The rationalization and reorganization of water supply system	<ul style="list-style-type: none"> <li>It is important to provide better water supply facilities so as to ensure adequate supply of potable water to the user end.</li> <li>The proposal for rehabilitation of water supply facilities goes a long way in achieving some of the goals of a good urban water supply system.</li> </ul>	High ( - )	Site/Local	Long-term	Full Mitigation Definite	High ( + )
Minimization of non revenue water losses	<ul style="list-style-type: none"> <li>By replacement of the old leaky network, the current water loss will be reduced to a great extent..</li> </ul>	Medium ( - )	Site/Local	Long-term	Full Mitigation Definite	Medium ( + )
Landuse	<ul style="list-style-type: none"> <li>It is expected that improvement in the water supply system of the water deficient areas will act as a catalyst for overall development of the area.</li> </ul>	High ( - )	Site/Local	Long-term	Partial Mitigation Definite	High ( + )

### A. Assessment of No-Go (No Build) Option

129. The table-24 outlines potential impacts associated with the “No-Go” option. The No-Go option involves no additional commitment of resources. If No Go option is chosen then the residents of the subproject areas will continue facing health risks owing to degradation in water quality due to leakages in pipelines and the water deficient areas shall continue facing the same impacts and their development shall be hindered. In addition to this there shall be deterioration in the sanitation of the area as it largely depends on availability of water supply. No impact is envisaged on the sensitive receptors, air and noise quality. Thus choosing the No-Go option has the same effect as if the decision never occurred. In view of these finding it is recommended that the No Go shall not be adopted and the proposed project shall be taken up.

130. So, finally it can be concluded that the subproject shall proceed with adherence to the EMP provisions to mitigate and minimize the impacts.

**Table-24: Summary of Anticipated Potential Environmental Impacts of the No Build Options**

Environmental Aspect	Summary of Implications and Mitigation		Assessment of Environmental Impacts				
	Potential Impacts	Mitigation	Significance before Mitigation	Geographic Spatial Scale	Duration	Mitigation	Significance After Mitigation
Climate	• No obvious impacts	• n/a					
Air Quality	• Will remain the same • No impacts on sensitive receptors during construction	• None	Medium ( - )	Local	Long-term		Medium ( - )
Geology	• No obvious impacts	• n/a					
Drainage and hydrology	• No obvious impacts	• n/a					
Land Use	• The water deficient areas shall continue facing the same impacts and their development shall be hindered.	• None	High ( - )	Local	Long-term		High ( - )
Traffic	• No obvious impact	• n/a					
Health and Safety	• Subproject areas will continue facing health risks owing	• None	High ( - )	Local	Long-term		High ( - )

Environmental Aspect	Summary of Implications and Mitigation		Assessment of Environmental Impacts				
	Potential Impacts	Mitigation	Significance before Mitigation	Geographic Spatial Scale	Duration	Mitigation	Significance After Mitigation
	to degradation in water quality due to leakages in pipelines.						
Noise Pollution	<ul style="list-style-type: none"> <li>Noise pollution will remain the same.</li> <li>No impacts on sensitive receptors during construction.</li> </ul>	<ul style="list-style-type: none"> <li>None</li> </ul>	Medium ( - )	Local	Long-term		Medium ( - )
Aesthetics, Landscape Character and sense of place	<ul style="list-style-type: none"> <li>Likely to deteriorate as sanitation of the area depends largely on availability of water supply.</li> </ul>	<ul style="list-style-type: none"> <li>None</li> </ul>	Medium ( - )	Local	Long-term		Medium ( - )

## VI. INFORMATION DISCLOSURE, CONSULTATION AND PARTICIPATION

### A. Public participation during the preparation of the IEE

131. The public participation process included identifying interested and affected parties (stakeholders); informing and providing the stakeholders with sufficient background and technical information regarding the proposed development; creating opportunities and mechanisms whereby they can participate and raise their viewpoints (issues, comments and concerns) with regard to the proposed development; giving the stakeholders feedback on process findings and recommendations; and ensuring compliance to process requirements with regards to the environmental and related legislation. Janipur, Ploura, Patoli, Rehari, Subash Nagar, Bakshi Nagar and Bhagwati Nagar are the localities where public consultation was conducted during preparatory stage.

132. The following methodologies have been used for carrying out public consultation:

- (i) Local communities, individuals affected and owners and employees of affected commercial establishments who are directly or indirectly affected were given priority while conducting public consultation.
- (ii) Walk-through informal group consultations in the proposed subproject area.

- (iii) The local communities had been informed through public consultation with briefing on project interventions including its benefits.
- (iv) The environmental concerns and suggestions made by the participants were listed out, discussed and suggestions were accordingly incorporated in the EMP.

133. Different techniques of consultation with stakeholders were used during project preparation (interviews, public meetings, group discussions, Focus Group Discussions etc). Questionnaire was designed and environmental information was collected. Apart from this, a series of public consultation meetings will be conducted during the subproject DPR preparation. Various forms of public consultations (consultation through adhoc discussions on site) will also be used to discuss the subproject and involve the community in planning the subproject design and mitigation measures. These activities will be continued throughout the implementation process of the project.

## **B. Notification of Potential Interested and Affected Parties**

134. The interested and affected parties were identified during the course of initial environmental examination. Key methods employed included individual interviews, field level observations, community consultations and discussions, interviews through a predrafted interview schedule. Key respondents included project affected persons who only include owners of houses/residences and commercial shops/establishments, etc. who will suffer temporary access disruptions during subproject implementation due to the laying of pipelines, shopkeepers/businessmen from the project area in addition to daily commuters consulted randomly. In addition to a number of informal consultations conducted regularly in the project corridor, people, selected on a stratified basis to ensure diversified representation, were formally interviewed with the help of an interview schedule. Issues discussed and feedback received is given in **Table-25**. The records of public consultations are annexed as **Appendix 5**.

**Table-25: Summary of Anticipated Potential Environmental/Social concerns**

<b>Concerns raised/ issues discussed</b>	<b>Reply provided</b>
General perception about the project and the awareness about the proposed project	Most of the people consulted were aware about the proposed subproject as ample information for the same has been disseminated during similar subprojects executed by J&K ERA under its earlier loan from ADB and by other line departments. The general perception about the proposed project is good. They agreed to the proposed project and emphasized the need of good and uninterrupted water supply to their houses.
Support of local people for the proposed project?	Local people will support the implementing agency in the project activities. They expressed that this project will be beneficial to them as now they are facing various problems due to lack of proper water supply. People will give their fullest support to the project, because this project will be a benefit to them.
Prior information about the project is required	People requested to make aware them through a leaflet or prior announcement before start project work in the area. This will be done by through ERA and PIU. Prior to the implementation, the schedule will be published and discussed with local people.
They had bad experience with the government infrastructure improvement projects. According to their previous experience, most of the local road development projects were not completed at a satisfactory level Previously contractors had damaged the roads to lay pipes however they had not	This project being an external funded project will be completed within the stipulated time and there is special mechanism to ensure the quality of works done. The restoration of the road is the sole responsibility of the contractor and is included in the project cost. As the pipelines are laid through the existing roads, the possibilities of damages are nil. However, damages if any occurred to the compound walls will be repaired by the contractor at his own cost. ERA is having a special GRC and mechanism and public can point out any of these type of issues at

Concerns raised/ issues discussed	Reply provided
repaired these roads. This issue should not be in this project. If the houses or compound walls are damaged, then these should be repaired by the project itself	any time which will be considered seriously.
Loss of community life like any market places or community activities to be affected	There will be no impact on community life. If there are minor temporary impacts, people will bare these impacts.
Resettlement and land acquisition	There are no land acquisitions identified. There will be only temporary impacts.
Will the project sitting adversely impact the water or soil resource in the locality	There will be no such adverse impacts on water or soil resource due to the proposed project.
NRW programme will disconnect water to households having more than one water connection	The ultimate aim of NRW programme is to reduce non revenue water in Jammu city water supply system. Reducing NRW will make more water available and enable water utilities to increase coverage, including to poor communities.
At present there is flat rate of user charges without sufficient household meters nin Jammy city. There is total absence of proper maintenance (resources and funds), resulting to very high losses in the distribution network within sub-sub-zones.	If a large proportion of water that is supplied is lost, meeting consumer demands is difficult. Since this water yields no revenue, heavy losses also make it harder to keep water tariffs at a reasonable and affordable level. The proposed pilot NRW programme will address all these issues.

### C. Future Consultation and Disclosure

135. The public consultation and disclosure program with all interested and affected parties will remain a continuous process throughout the subproject implementation and shall include the following:

#### 1. Consultation during detailed design

136. Focus-group discussions with affected persons and other stakeholders to hear their views and concerns will be done during DPR preparation so that these can be addressed in subproject design wherever necessary. Regular updates on the environmental component of the subproject will be kept available at the PMU office of ERA.

137. ERA will conduct information dissemination sessions at important locations in the subproject area and solicit the help of the local community leaders/prominent citizens to encourage the participation of the people to discuss various environmental issues.

138. The PMU, with assistance of DSC/PMC will conduct information dissemination sessions in the subproject area. During EMP implementation DSC, PMC and PMU shall organize public meetings and will apprise the communities about the progress on the implementation of EMP in the subproject works.

139. Structured consultation meetings with the institutional stakeholders (government bodies and NGOs) to discuss and approve key aspects of the project

#### 2. Consultation during construction

140. Public meetings with affected communities (if any) and other stakeholders to discuss and plan work programs and allow issues to be raised and addressed once construction will be held; and

141. Small-scale meetings to discuss and plan construction work with local communities to reduce disturbance and other impacts, and provide a mechanism through which stakeholders can participate in subproject monitoring and evaluation.

### **3. Project disclosure**

142. A communications strategy is of vital importance in terms of accommodating traffic during road closure, if any. Local communities will be continuously consulted regarding location of construction camps, access and hauling routes and other likely disturbances during construction. The public will be informed well in advance (30 days and again 1 day before start of excavation works). The road closure, if any, together with the proposed detours will be communicated via advertising, pamphlets, road signages, etc. Public information campaigns via newspaper/radio/TV, etc. wherever required, to explain the subproject details to a wider population. Public disclosure meetings at key project stages to inform the public of progress and future plans.

143. For the benefit of the community the relevant information in the IEE will be translated in the local language and made available at: (i) ERA office; (ii) District Magistrate Office; and, (iii) PMU/PIU. This will also upload in the website of ERA. It will be ensured that the hard copies of IEE are kept at such place which are conveniently accessible to citizens as a means to disclose the document and at the same time creating wider public awareness. Electronic version of the IEE will be placed in the official website of the ERA and the official website of ADB after approval of the IEE by ADB. The PIU will issue Notification on the locality-wise start date of implementation of the subproject. The notice will be issued by the PIU in local newspapers one month ahead of the implementation works. Copies of the IEE will be kept in the PMU/PIU office and will be provided to any person willing to consult the IEE.

## **VII. GRIEVANCE REDRESSAL MECHANISM**

144. Redressal of grievances shall be the responsibility of ERA. In this regard an efficient Grievance Redressal Mechanism is already kept in place which will assist the affected persons in resolving queries and complaints. The Grievance Redressal Mechanism follow the following approach:

145. If the affected person has any complaint or grievance, he/she is free to lodge his/her complaint with the Project Manager, PIU, JKUSDIP, ERA who will make efforts to address the complaint on ground level itself. The Project Manager will make efforts to redress the grievance within one week from the receipt of the grievance.

146. In case the affected person is not satisfied or his grievance is not redressed he can take the matter to Director Safeguards who will ensure that grievance is redressed within two weeks. If Director Safeguards cannot resolve the complaint or the affected person is not satisfied with resolution/ decision, he/she can take the matter to the Chief Executive Officer of ERA. Affected persons, at any moment of time are free to approach the court of law at their own will and expenses. Besides the grievance redressal mechanism of the subproject, state has online grievance monitoring system known as 'Awaz-e-Awam' through which affected persons can also lodge their complaints. The affected persons can lodge their complaints online at <http://www.jkgrievance.nic.in>.

147. Apart from the above detailed mechanism for the grievances received at the level of ERA, the provision shall be kept in the EMP of the subproject wherein the contractor will depute one Environmental Safeguard Officer who shall be responsible for implementation of EMP, reporting and grievance redressal on day-to-day basis. The grievances/complaints received at the level of contractor shall be recorded on the Complaints Register and the same shall be forwarded to the DSC (Engineer of the Contract) within 48 hours along with the details of action taken to redress the grievance. The Team Leader of DSC shall immediately try to resolve the issues and forward the details to the Project Manager of PIU. If the action taken by Contractor and DSC is found to be inadequate, then necessary instructions shall be issued by the Project Manager, PIU for implementation of rectification measures. Project Manager PIU shall report the matter to Director Safeguards along with the details on action taken. In order to facilitate the public in general to approach the authorities, in case of grievances/complaints, information boards with contact details of Contractor, Team Leader of DSC, Assistant Project Manager of PIU, Deputy Project Manager of PIU and Project Manager of PIU shall be displayed at all the subproject sites.

### **VIII. ENVIRONMENTAL MANAGEMENT PLAN**

148. The EMP will be updated during detailed design stage. The EMP will guide the environmentally-sound construction of the subproject and ensure efficient lines of communication between the DSC (Engineer), contractors, and PIU/ PMU/ PMC. The EMP identifies three phases of development as: (i) site establishment and preliminary activities; (ii) construction phase; and (iii) post construction/operational phase.

149. The purpose of the EMP is to ensure that the activities are undertaken in a responsible non-detrimental manner with the objectives of: (i) providing a pro-active, 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 subproject; (iii) detailing specific actions deemed necessary to assist in mitigating the environmental impact of the subproject; and (iv) ensuring that safety recommendations are complied with.

150. A copy of the EMP must be kept onsite during the construction period at all times. 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. It shall be noted that the Supreme Court of India<sup>12</sup> mandates that those responsible for environmental damage must pay the repair costs both to the environment and human health and the preventive measures to reduce or prevent further pollution and/or environmental damage. (The polluter pays principle).

151. The Contractor is deemed not to have complied with the EMP if:

- (i) within the boundaries of the site, site extensions and haul/ access roads there is evidence of contravention of clauses;
- (ii) if environmental damage ensues due to negligence;

---

<sup>12</sup> Writ petition no 657 of 1995. The Supreme Court, in its order dated 4 February 2005, that "The Polluter Pays Principle means that absolute liability of harm to the environment extends not only to compensate the victims of pollution, but also to the cost of restoring environmental degradation. Remediation of damaged environment is part of the process of sustainable development."



- (iii) the contractor fails to comply with corrective or other instructions issued by the Engineer/PMU/PIU within a specified time; and
- (iv) the Contractor fails to respond adequately to complaints from the public.

#### **A. Institutional Arrangement**

152. The subproject will be implemented and monitored by the Project Implementation Unit (PIU) of ERA, which will be supported by Design and Supervision Consultant (Engineer) and overall management support shall be provided to ERA by Project Management Consultants (PMC). ERA will be the executing agency.

153. The Safeguard unit of ERA in PMU will monitor the implementation of environmental covenants with assistance of Engineer (DSC) and PMC.

154. ERA shall be responsible for ensuring compliance to environmental requirements of the ADB as well as central/state governments and reporting the same to ADB. An Environmental Management Plan (EMP) will be a part of contract with the civil works contractors engaged for execution of the works. The supervision and implementation of EMP shall be the responsibility of DSC with ERA as monitoring agency (with assistance of PMC). All the statutory environmental clearances (at national, state and local levels) if required (by ERA or by the civil works contractor) for the implementation of the subproject would be obtained in compliance with the national, state and local laws and regulations and in accordance with ADB's environmental policy and guidelines.

##### **1. ERA (PMU and PIU). This agency:**

- (i) complies with all applicable legislation and is conversant with the requirements of the EMP;
- (ii) assesses all activities requiring special attention as specified and/or requested by the Engineer (DSC) and/or Safeguards Unit of ERA for the duration of the Contract;
- (iii) ensures that the Contractor conducts all activities in a manner that minimizes disturbance to directly affected residents and the public in general, as advised by the Engineer and/or Safeguards Unit of ERA ;
- (iv) may, on the recommendation of the Engineer and/or Safeguards Unit of ERA, through the Executing Agency order the Contractor to suspend any or all works on site if the Contractor or his subcontractor/ supplier fail to comply with the said environmental specifications.

##### **2. Project Management Consultants (PMC). This agency:**

- (i) is conversant with the requirements of the EMP and all applicable legislation.
- (ii) monitors the implementation of EMP on site and recommends requisite measures in case of non-compliances to ERA.
- (iii) conducts monitoring through environmental monitoring laboratory in consultation with Safeguards Unit of ERA and the Engineer.

##### **3. The Engineer (DSC). This agency:**

- (i) complies with all applicable legislation and is conversant with the requirements of the EMP;

- (ii) arranges information meetings for and consults with interested and affected parties about the impending construction activities;
- (iii) maintains a register of complaints and queries by members of the public at the site office. This register is forwarded to the Project Manager of PIU on weekly basis.
- (iv) enforces and monitors compliance with the requirements of EMP on site;
- (v) assesses the Contractor's environmental performance in consultation with the Environmental Expert (of DSC) ;
- (vi) documents in conjunction with the Contractor, the state of the site prior to commencing construction activities.

**4. Environmental Expert of Engineer (DSC). This individual:**

- (i) briefs the Contractor on the requirements of the environmental specification and/ or EMP, as applicable;
- (ii) advises the Engineer on the interpretation, implementation and enforcement of the environmental specifications and other related environmental matters;
- (iii) monitors and reports on the performance of the contractor/project in terms of environmental compliance with the EMP to the Engineer and ERA; and
- (iv) provides technical advice relating to environmental issues to the Engineer.
- (v) Inspection and reporting of contractor activities to ensure effective implementation of the EMP.
- (vi) Issuing corrective action, requests and conduct follow up inspections and evaluation.
- (vii) Reporting any exceptions to the ERA.

**5. The Contractor. This individual/agency:**

- (i) complies with all applicable legislation, is conversant with the requirements of the EMP, and briefs staff about the requirements of same;
- (ii) ensures any sub-contractors/ suppliers, who are utilized within the context of the contract, comply with the environmental requirements of the EMP. The Contractor will be held responsible for non-compliance on their behalf;
- (iii) supplies method statements for all activities requiring special attention as specified and/or requested by the Engineer or Environmental Expert (of Engineer) during the duration of the Contract;
- (iv) provides environmental awareness training to staff;
- (v) bears the costs of any damages/ compensation resulting from non-adherence to the EMP or written site instructions;
- (vi) conducts all activities in a manner that minimizes disturbance to directly affected residents and the public in general, and foreseeable impacts on the environment.
- (vii) ensures that the Engineer is informed in a timely manner of any foreseeable activities that will require input from the Environmental Expert (of Engineer).
- (viii) appoints one full time Environmental Safeguard Officer for implementation of EMP, community liaison, reporting and grievance redressal on day to day basis.
- (ix) receives complaints/grievances from the public, immediately implements the remedial measures and reports to the Engineer (DSC) within 48 hours.

## B. Capacity Building

155. Training and orientation programmes shall be organized by the Environmental Experts of Engineer (DSC), PMC and ERA for the contractors, laborers, and technical and office staff of the contractors, site engineers of DSC and the relevant staff of the PIU for building their capacity with regards to principles and procedures of environmental management, pollution abatement measures, health and safety measures, grievance redressal mechanism and implementation of EMP.

156. The Contractor will be required to conduct environmental awareness and orientation of workers prior to deployment to work sites. The suggested outline of the training program is presented in **Table: 26**.

**Table 26: Indicative Capacity Building and Training Program**

Description	Contents	Schedule	Participants	Number of programs during project implementation
<b>Program 1</b> Orientation Workshop	ADB Safeguards Policy Statement National and State Environmental Laws and Regulations Identification of impacts and mitigation measures, Implementation of Environmental Management Plan (EMP) and monitoring requirements Incorporation of EMP into the project design and contracts	1 day	ERA officials PMC staff DSC staff	One
<b>Program 2</b> Orientation Program / Workshop for Contractors and Supervisory staff	Environmental issues during construction Implementation of EMP Monitoring of EMP implementation Reporting Requirements Health and Safety Measures	1 day	PIU engineers DSC staff Contractor's staff	Two

157. Table-27 outlines the site establishment and preliminary activities.

**Table-27: Site Establishment and Preliminary Activities**

	Activity	Management/Mitigation	Responsible for Monitoring	Frequency	Monitoring Indicators	Cost and Sources of Funds
1.	Legislation, permits and agreements	In all instances, ERA, service providers, contractors and consultants must remain in compliance with relevant local and national legislation.	All	Prior to moving onto site and during construction	Compliance certificate	NA
		Proof of compliance to Air Act must be forwarded by the contractor to PMU/PIU (in relation to hot mixing, batch mix plants, stone crushers, diesel generators, etc.)	Engineer	Prior to moving onto site and during construction	Compliance certificate	Engineering Design and Cost
		A copy of the EMP must be kept on site during the construction period	Environmental Expert or Engineer (EE)	At all times	EMP	Engineering Design and Cost
2.	Access to site <sup>13</sup>	Access to site will be via existing roads. The Contractor will need to ascertain the existing width and condition of the roads and repair damage due to construction.	Engineer	Prior to moving onto site and during construction	Report from contractor	Engineering Design and Cost
		The Local Traffic Police Department shall be involved in the planning stages of the road closure and detour and shall be available on site for the monitoring of traffic in the early stages of the operations during road closure.	Engineer	Prior to moving onto site	Traffic Management Plan/Report prepared in consultation with Local Traffic Police Department	Engineering Design and Cost
		The Local Traffic Department must be informed at least a week in advance if the traffic in the area will be affected.	Engineer	Prior to moving onto site	Report prepared in consultation with Local Traffic Police Department	NA
		The location of all affected services and servitudes must be identified and confirmed.	Engineer	Prior to moving onto site	Site visit report	NA
		All roads for construction access must be planned and approved by the Engineer and its Environmental Expert ahead of construction activities. They shall not be created on an ad-hoc basis.	Engineer	Prior to moving onto site and during construction.	Approval letter from engineer	NA
		No trees, shrubs or groundcover may be removed or vegetation stripped without the prior permission	Engineer/EE	Before and during construction.	Site visit report	NA

<sup>13</sup> Access to site and traffic management shall be done in accordance to the directions of Engineer and the Traffic Management Plan guidelines (**Appendix-1 to EMP**).

	Activity	Management/Mitigation	Responsible for Monitoring	Frequency	Monitoring Indicators	Cost and Sources of Funds
		of the Engineer/Environmental Expert.				
		Agreed turning areas for haulage vehicles are to be formalized and used by the Contractor. No turning manoeuvres other than at the designated places shall be permitted.	Engineer	Prior to moving onto site.	Site visit report	NA
		Contractors shall construct formal drainage for all temporary haulage roads in the form of side drains to prevent erosion and discharge of run-off.	Engineer	Prior to moving onto site.	Newly constructed side drains for temporary haulage roads/ site visit report	Engineering Design and Cost
3.	Setting up of construction camp <sup>14</sup>	Choice of site for the Contractor's camp requires the Engineer's permission and must take into account location of local residents, businesses and existing land uses, including flood zones and slip / unstable zones. A site plan must be submitted to the Engineer for approval.	Engineer and EE	During surveys and preliminary investigations and prior to moving onto the site	Approved site plan	Engineering Design and Cost
		The construction camp may not be situated on a floodplain or on slopes greater than 1:3.	Engineer and EE	During surveys and preliminary investigations and prior to moving onto the site	Approved site plan	Engineering Design and Cost
		If the Contractor chooses to locate the camp site on private land, he must get prior permission from both the Engineer and the landowner.	Engineer	During site establishment and ongoing – weekly inspections	Approved site plan and permission letter from Engineer/land owner.	Engineering Design and Cost
		Cut and fill must be avoided where possible during the set up of the construction camp.	Engineer	During site set-up	Approved site plan	Engineering Design and Cost
		The camp must be properly fenced off and secured	Engineer	During site establishment and ongoing –weekly inspections	Weekly site visit report	Engineering Design and Cost
		The Contractor shall make adequate provision for temporary toilets for the use of their employees during the Construction Phase. Such facilities, which shall comply with local authority regulations, shall be maintained in a clean and hygienic condition. Their use shall be strictly enforced.	Engineer	During site establishment and ongoing – weekly inspections	Availability of toilets	Covered Under Engineering Design and Cost
		Under no circumstances may open areas or the surrounding bushes be used as a toilet facility.	Engineer	Ongoing	Availability of toilets /increase awareness	Covered Under

<sup>14</sup> Careful planning of the construction camp can ensure that time and costs associated with environmental management and rehabilitation are reduced.

	Activity	Management/Mitigation	Responsible for Monitoring	Frequency	Monitoring Indicators	Cost and Sources of Funds
					about health hygiene and sanitation among workers	Engineering Design and Cost
		Bins and / or skips shall be provided at convenient intervals for disposal of waste within the construction camp.	Engineer	During site set-up and ongoing	Availability of bins and skips	Covered Under Engineering Design and Cost
		Bins shall have liner bags for efficient control and safe disposal of waste	EE	Ongoing	liner bags in bins	Engineering Design and Cost
		Recycling and the provision of separate waste receptacles for different types of waste shall be encouraged.	EE	During site set-up and ongoing	Availability of separate bins for biodegradable/plastic wastes	Engineering Design and Cost
4.	Establishing equipment lay-down and storage area <sup>15</sup>	Choice of location for equipment lay-down and storage areas must take into account prevailing winds, distances to adjacent land uses, general onsite topography and water erosion potential of the soil. Impervious surfaces must be provided where necessary.	EE	During site set-up	Site visit report of EE and report from contractor regarding storage area	Engineering Design and Cost
		Storage areas shall be secure so as to minimize the risk of crime. They shall also be safe from access by children / animals etc.	EE	During site set-up	Site visit report of EE and security in the storage area	Engineering Design and Cost
		It is very important that the proximity of residents, businesses, schools, etc. is taken into account when deciding on storage areas for hazardous substances or materials. Residents living adjacent to the construction site must be notified of the existence of the hazardous storage area.	EE	During site set-up	Site visit report of EE, consultation with locals	Engineering Design and Cost
		Equipment lay-down and Storage areas must be designated, demarcated and fenced if necessary.	EE	During site set-up	Site visit report of EE /Provision of fencing	Engineering Design and Cost
		Fire prevention facilities must be present at all storage facilities.	EE	During site set-up	Availability of fire extinguishing facilitates / Site visit report of EE	Engineering Design and Cost
		Proper storage facilities for the storage of oils, paints, grease, fuels, chemicals and any	EE	During site set-up and ongoing	Method of statement approved by	Engineering Design and

<sup>15</sup> Storage areas can be hazardous and unsightly and can cause environmental pollution if not designed and managed carefully.

	Activity	Management/Mitigation	Responsible for Monitoring	Frequency	Monitoring Indicators	Cost and Sources of Funds
		hazardous materials to be used must be provided to prevent the migration of spillage into the ground and groundwater regime around the temporary storage areas. These pollution prevention measures for storage shall include a bund wall high enough to contain at least 110% of any stored volume. The Contractor shall submit a method statement to the Engineer for approval			Engineer and Site visit report of EE	Cost
		These storage facilities (including any tanks) must be on an impermeable surface that is protected from the ingress of storm water from surrounding areas in order to ensure that accidental spillage does not pollute local soil or water resources.	EE	During site set-up and ongoing	Presence of impermeable surface and site visit report of EE	Engineering Design and Cost
		Fuel tanks must meet relevant specifications and be elevated so that leaks may be easily detected.	EE	During site setup and monitored	Report from contractor on fuel tank specification and presence of Elevated fuel tanks	Engineering Design and Cost
		Material safety data sheets (MSDSs) shall be readily available on site for all chemicals and hazardous substances to be used on site. Where possible and available, MSDSs shall additionally include information on ecological impacts and measures to minimize negative environmental impacts during accidental releases or escapes.	Engineer and Contractor	Ongoing	Readily available Material safety data sheets with sufficient information on mitigation measures	Engineering Design and Cost
		Staff dealing with these materials / substances must be aware of their potential impacts and follow the appropriate safety measures. The contractor must ensure that its staff are made aware of the health risks associated with any hazardous substances used, have been provided with the appropriate protective clothing/equipment in case of spillages or accidents and have received the necessary training.	EE and Contractor	Ongoing	Awareness among workers on safety measures / Availability of protective clothing/equipments	Engineering Design and Cost
		Contractors shall submit a method statement and plans for the storage of hazardous materials and emergency procedures.	Engineer and EE	Prior to establishment of storage area	Report from Contractor on hazardous materials and emergency procedures.	Engineering Design and Cost
5.	Materials management –	Contractors shall prepare a source statement indicating the sources of all materials (including	Engineer and EE	On award of contract	Report from Contractor and	Engineering Design and

	Activity	Management/Mitigation	Responsible for Monitoring	Frequency	Monitoring Indicators	Cost and Sources of Funds
	sourcing <sup>16</sup>	topsoil, sands, natural gravels, crushed stone, asphalt, clay liners, etc), and submit these to the Engineer for approval prior to commencement of any work.			approval letter from Engineer	Cost
		Where possible, a signed document from the supplier of natural materials shall be obtained confirming that they have been obtained in a sustainable manner and in compliance with relevant legislation.	EE	On receipt of natural materials	Confirmation letter from supplier	Engineering Design and Cost
		Where materials are borrowed (mined), proof must be provided of authorization to utilize these materials from the landowner/material rights owner and the Department of Geology and Mining.	EE	On receipt of borrowed (mined) materials	Approval letter from Department of Geology and Mining/land owner/owner	Engineering Design and Cost
6.	Education of site staff on general and environmental conduct <sup>17</sup>	Ensure that all site personnel have a basic level of environmental awareness training.	EE and Contractor	During staff induction and ongoing	Awareness among site personals/ records of training conducted	Engineering Design and Cost
		Staff operating equipment (such as excavators, loaders, etc.) shall be adequately trained and sensitized to any potential hazards associated with their task.	EE and Contractor	During staff induction, followed by ongoing monitoring	Awareness among site personals/ records of training conducted	Engineering Design and Cost
		No operator shall be permitted to operate critical items of mechanical equipment without having been trained by the Contractor.	EE and Contractor	During staff induction, followed by ongoing monitoring	Awareness among site personals/ records of training conducted	Engineering Design and Cost
		All employees must undergo safety training and wear the necessary protective equipments and clothing.	EE and Contractor	During staff induction, followed by ongoing monitoring	Awareness among site personals/ records of training conducted	Engineering Design and Cost
		A general regard for the social and ecological well-being of the site and adjacent areas is expected of the site staff. Workers need to be made aware of the following general rules: <ul style="list-style-type: none"> <li>• no alcohol/drugs on site;</li> <li>• prevent excessive noise;</li> <li>• construction staff are to make use of the</li> </ul>	EE and Contractor	During staff induction, followed by ongoing monitoring	Awareness among site personals/ records of training conducted	Engineering Design and Cost

<sup>16</sup> Materials must be sourced in a legal and sustainable way to prevent offsite environmental degradation.

<sup>17</sup> These points need to be made clear to all staff on site before the subproject begins.



	Activity	Management/Mitigation	Responsible for Monitoring	Frequency	Monitoring Indicators	Cost and Sources of Funds
		<p>facilities provided for them, as opposed to ad hoc alternatives (e.g. fires for cooking, the use of surrounding bushes as a toilet facility);</p> <ul style="list-style-type: none"> <li>• no fires permitted on site;</li> <li>• trespassing on private/commercial properties adjoining the site is forbidden;</li> <li>• other than pre-approved security staff, no workers shall be permitted to live on the construction site; and</li> <li>• No worker may be forced to do work that is potentially dangerous or that he/she is not trained to do.</li> </ul>				
6.	Social impacts <sup>18</sup>	Open liaison channels shall be established between the site owner, the developer, operator, the contractors and interested and affected parties such that any queries, complaints or suggestions can be dealt with quickly and by the appropriate person(s).	Contractor and EE	Prior to moving onto site and ongoing	Complaints from public and mechanism to deal with grievance	Engineering Design and Cost
		Advance road signage indicating the road detour and alternative routes. Provide sign boards for pedestrians to inform nature and duration of construction works and contact numbers for concerns/ complaints.	Engineer and EE	Prior to moving onto site and ongoing	Presence of advance road signage/ advance notice to public	Engineering Design and Cost
		Storage facilities, elevated tanks and other temporary structures on site shall be located such that they have as little visual impact on local residents as possible.	Engineer and EE	During surveys and preliminary investigations and site set-up.	Visual aesthetics of the site	NA
		In areas where the visual environment is particularly important (e.g. along commercial/ tourism routes) or privacy concerns for surrounding buildings exist, the site may require screening. This could be in the form of shade cloth, temporary walls, or other suitable materials prior to the beginning of construction.	Engineer and EE	During surveys and preliminary investigations and site set-up.	Site visit report	Engineering Design and Cost
		Special attention shall be given to the screening of highly reflective materials on site.	EE	During site set-up	Site visit report	NA
7.	Noise impacts	Construction vehicles are to be fitted with standard silencers prior to the beginning of construction.	Contractor	Prior to moving onto site and ongoing	Report from contractor	Engineering Design and

<sup>18</sup> It is important to take notice of the needs and wishes of those living or working adjacent to the site. Failure to do so can cause disruption to work.

	Activity	Management/Mitigation	Responsible for Monitoring	Frequency	Monitoring Indicators	Cost and Sources of Funds
						Cost
		Equipment that is fitted with noise reduction facilities (e.g. side flaps, silencers, etc) will be used as per operating instructions and maintained properly during site operations	Contractor	Ongoing	Presence of noise reduction facilities in the construction equipments, noise test results	Engineering Design and Cost
8.	Dust/air pollution <sup>19</sup>	Vehicles travelling along the access roads must adhere to speed limits to avoid creating excessive dust.	EE	Ongoing	Report from EE	NA
		Camp construction / haulage road construction – areas that have been stripped of vegetation must be dampened periodically to avoid excessive dust.	EE	Ongoing – more frequently during dry and windy conditions	Dampening of camps and haulage roads, Air quality results	Engineering Design and Cost
		The Contractor must make alternative arrangements (other than fires) for cooking and / or heating requirements. LPG gas cookers may be used provided that all safety regulations are followed.	Engineer	Ongoing	Arrangements for alternate fuel for cooking	Engineering Design and Cost
9.	Soil erosion	The time that stripped areas are left open to exposure shall be minimised wherever possible. Care shall be taken to ensure that lead times are not excessive.	Engineer and EE	Throughout the duration of the subproject.	Report from EE	NA
		Wind screening and storm water control shall be undertaken to prevent soil loss from the site.	Engineer and EE	During site set-up	Measures to control soil loss	Engineering Design and Cost
		Procedures that are in place to conserve topsoil during the construction phase of the subproject are to be applied to the set up phase. i.e. topsoil is to be conserved while providing access to the site and setting up the camp.	Engineer and EE	Daily monitoring during site set-up	Topsoil conservation measures	Engineering Design and Cost
10.	Storm water <sup>20</sup>	To prevent storm water damage, the increase in storm water run-off resulting from construction activities must be estimated and the drainage system assessed accordingly.	Engineer	During surveys and preliminary Investigations.	Provision of drainage system and report from EE, Water quality test results	Engineering Design and Cost
		Scheduling of works to be done in accordance to the climatic conditions and the works to be carried out during dry periods so as to avoid any losses due to storm water during rains.	Engineer	During site setup and ongoing.	Work schedules	NA

<sup>19</sup> Establishment of the camp site, and related temporary works can reduce air quality.

<sup>20</sup> Serious financial and environmental impacts can be caused by unmanaged storm water.

	Activity	Management/Mitigation	Responsible for Monitoring	Frequency	Monitoring Indicators	Cost and Sources of Funds
11.	Water quality <sup>21</sup> .	Storage areas that contain hazardous substances must be bounded with an approved impermeable liner.	Engineer	During site setup.	impermeable liner bounding storage areas	Engineering Design and Cost
		Spills in bounded areas must be cleaned up, removed and disposed of safely from the bounded area as soon after detection as possible to minimise pollution risk and reduced bounding capacity.	Engineer and EE	During site setup.	Proper management of spills in bounded areas	Engineering Design and Cost
		A designated, bounded area is to be set aside for vehicle washing and maintenance. Materials caught in this bounded area must be disposed of to a suitable waste site or as directed by the Engineer	Engineer and EE	During site setup.	Bounded area for washing and maintenance of vehicles	Engineering Design and Cost
		Provision shall be made during set up for all polluted runoff to be treated to the Engineer's approval before being discharged into the storm water system. (This will be required for the duration of the project.)	Engineer and EE	During site setup and to be monitored weekly	Water quality test results, Provision for all polluted runoff	Engineering Design and Cost
12.	Conservation of the natural environment <sup>22</sup>	No vegetation may be cleared without prior permission from the Engineer.	Engineer and EE	During site setup and ongoing.	Approval letter from Engineer	NA
		Trees that are not to be cleared shall be marked beforehand with danger tape. The Environmental Expert of Engineer (DSC) must be given a chance to mark vegetation that is to be conserved before the Contractor begins clearing the site.	Engineer and EE	During site set-up	Markings with danger tape / report from EE	Engineering Design and Cost
		Care must be taken to avoid the introduction of alien plant species to the site and surrounding areas. (Particular attention must be paid to imported material).	EE	Ongoing in camp Site, construction sites	Site visit report of EE	NA
13.	Set-up of waste management procedure	The excavation and use of rubbish pits on site is forbidden.	EE	Ongoing	Site visit report of EE	Engineering Design and Cost
		Burning of waste is forbidden.	EE	Ongoing	Site visit report of EE	NA
14.	Cultural environment	Prior to the commencement of construction, all staff need to know what possible archaeological or historical objects of value may look like, and to	EE	During site set-up And ongoing.	Awareness of staff	Engineering Design and Cost

<sup>21</sup> Incorrect disposal of substances and materials and polluted run-off can have serious negative effects on groundwater quality.

<sup>22</sup> Alien plant encroachment is particularly damaging to natural habitats and is often associated with disturbance to the soil during construction activities. Care must be taken to conserve existing plant and animal life on and surrounding the site.

	Activity	Management/Mitigation	Responsible for Monitoring	Frequency	Monitoring Indicators	Cost and Sources of Funds
		notify the Engineer/Contractor shall such an item be uncovered.				
15.	Security and safety	Lighting on site is to be set out to provide maximum security and to enable easier policing of the site, without creating a visual nuisance to local residents or businesses.	Engineer	During site set-up	Site visit report of EE	NA
		Material stockpiles or stacks, such as, pipes must be stable and well secured to avoid collapse and possible injury to site workers / local residents.	Engineer and EE	Ongoing	Stability of stockpiles, stacks & pipes/ Site visit report of EE	NA
		Flammable materials shall be stored as far as possible from adjacent residents / businesses.	Engineer and EE	Ongoing	Storage area of flammable materials	NA
		All interested and affected parties shall be notified in advance of any known potential risks associated with the construction site and the activities on it. Examples are: <ul style="list-style-type: none"> <li>• stringing of power lines</li> <li>• earthworks / earthmoving machinery on steep slopes above houses / infrastructure</li> <li>• risk to residences along haulage roads / access routes</li> </ul>	Engineer and EE	24 hours prior to activity in question	Advance notice to PAPs	Engineering Design and Cost

DSC = Design and Supervision Consultant; EE = Environmental Expert of DSC/Engineer; PAPs –Project affected persons

**Table 28: Management of Construction and Workforce Activities**

	Activity	Management/Mitigation	Responsible for Monitoring	Frequency	Monitoring Indicators	Cost and Sources of Funds
1.	Access to site	Contractors shall ensure that all side drains and scour check walls on access and haul roads are functioning properly and are well maintained.	Engineer	Weekly and after heavy rains.	Site visit report of EE	Engineering Design and Cost
		Contractors shall ensure that access roads are maintained in good condition by attending to potholes, corrugations and storm water damage as soon as these develop.	Engineer	Weekly inspection.	Condition of access roads / Site visit report of EE	Engineering Design and Cost
		If necessary, staff must be employed to clean surfaced roads adjacent to construction sites where materials have been spilt.	Contractor	When necessary	Condition of roads / Site visit report of EE	Engineering Design and Cost
		Unnecessary compaction of soils by heavy vehicles must be avoided; construction vehicles must be restricted to demarcated access, haulage routes	Contractor	Ongoing monitoring.	Site visit report of EE	NA

	Activity	Management/Mitigation	Responsible for Monitoring	Frequency	Monitoring Indicators	Cost and Sources of Funds
		and turning areas.				
		Cognizance of vehicle weight / dimensions must be taken when using access constructed out of certain materials. e.g. paved surfaces / cobbled entranceways.	Engineer	Ongoing monitoring.	Site visit report of EE	NA
3.	Execution of work near wildlife sanctuary	<p>No person involved in the execution of the subproject must:</p> <ul style="list-style-type: none"> <li>destroy, exploit or remove wildlife or forest produce from the sanctuary or damage or divert the habitat of any wild animal</li> <li>set fire or kindle any fire, or leave any fire burning in such manner as to endanger the sanctuary</li> <li>enter the sanctuary with any weapon</li> <li>use or carry chemicals, explosives or any other substances which may cause injury to or endanger any wild life in the sanctuary</li> <li>Involve in trade or commerce in wild animals, animal articles and trophies derived from wild species.</li> <li>accept any wild animal or any animal article, or any specified plant or part or derivative thereof, for transportation</li> </ul>	Engineer	Ongoing monitoring.	Site visit	NA
2.	Maintenance of construction camp and work site	The Contractor must monitor and manage drainage of the camp site to avoid standing water and soil erosion.	Engineer	Ongoing monitoring.	Condition of camp site/ Site visit report of EE	Engineering Design and Cost
		Run-off from the camp site must not discharge into neighbours' properties or protected area.	Engineer	Ongoing monitoring.	Condition of camp site/ Site visit report of EE	NA
		Toilets are to be maintained in a clean state and shall be moved to ensure that they adequately service the work areas.	Contractor	Weekly inspection	Condition of toilets in camp site/ Site visit report of EE	Engineering Design and Cost
		The Contractor is to ensure that open areas or the surrounding bushes are not being used as toilet facility.	Contractor	Weekly inspection	Site visit report of EE/ availability of enough toilets	Engineering Design and Cost
		The Contractor shall ensure that all litter is collected from the work and camp areas daily.	Contractor	Ongoing monitoring.	Proper collection system for litters	
		Bins and/or skips shall be emptied regularly and waste shall be disposed of at the pre-approved site. Waybills for all such disposals are to be kept by the	Contractor and Engineer	Weekly inspection	Proper waste management facility/ Site visit report of EE	Engineering Design and Cost

	Activity	Management/Mitigation	Responsible for Monitoring	Frequency	Monitoring Indicators	Cost and Sources of Funds
		Contractor for review by the Engineer/EE.				
		Eating areas shall be regularly serviced and cleaned to ensure the highest possible standards of hygiene and cleanliness.	Contractor	Daily monitoring.	General cleanliness at eating areas/ Site visit report of EE	Engineering Design and Cost
		The Contractor shall ensure that his camp and working areas are kept clean and tidy at all times.	Contractor and Engineer	Weekly monitoring	General cleanliness at camp/working areas/ Site visit report of EE	Engineering Design and Cost
3.	Staff conduct	The Contractor must monitor the performance of construction workers to ensure that the points relayed during their induction have been properly understood and are being followed. If necessary, the EE and/or a translator shall be called to the site to further explain aspects of environmental or social behaviour that are unclear.	Contractor and Engineer	Ongoing monitoring.	Report on performance of workers on environmental or social behaviour from contractor/ Site visit report of EE	NA
		The rules that are explained in the worker conduct section, must be followed at all times	Contractor and Engineer	Ongoing monitoring.	General behavior of works/ Site visit report of EE	NA
4.	Dust and air pollution <sup>23</sup>	Vehicles travelling to and from the construction site must adhere to speed limits so as to avoid producing excessive dust.	Engineer	Ongoing monitoring.	Site visit report of EE	NA
		A speed limit of 30km/hr must be adhered to on all dirt roads.	Engineer	Ongoing monitoring.	Site visit report of EE	NA
		Access and other cleared surfaces including backfilled tranches must be dampened whenever possible and especially in dry and windy conditions to avoid excessive dust.	Engineer	Ongoing monitoring.	Dampening of access and cleared surfaces/ Site visit report of EE	Engineering Design and Cost
		Where dust is unavoidable in residential or commercial areas, screening will be required utilizing wooden supports and shade cloth.	Engineer	As directed by the engineer.	Provision of screens to minimize dust / Site visit report of EE, air quality results	Engineering Design and Cost
		Vehicles and machinery are to be kept in good working order and to meet manufacturers specifications for safety, fuel consumption, etc.	Contractor	Ongoing monitoring.	Site visit report of EE/ conditions of vehicles	Engineering Design and Cost
		Should excessive emissions be observed, the Contractor is to have the equipment seen to as soon as possible.	Engineer	As directed by the engineer.	Site visit report of EE/ observation on emissions, air quality results	Engineering Design and Cost
		No fires are allowed on site except for the burning of firebreaks.	Engineer	Ongoing monitoring.	Site visit report of EE	NA

<sup>23</sup> Main causes of air pollution during construction are dust from vehicle movements and stockpiles, vehicle emissions and fires.

	Activity	Management/Mitigation	Responsible for Monitoring	Frequency	Monitoring Indicators	Cost and Sources of Funds
5.	Soil erosion	Once an area has been cleared of vegetation, the top layer (normally 150mm) of soil shall be removed and stockpiled in the designated area.	Contractor	Ongoing monitoring.	Site visit report of EE	Engineering Design and Cost
		The full length of the works shall not be stripped of vegetation prior to commencing other activities. The time that stripped areas are exposed shall be minimized wherever possible.	Engineer and Contractor	Ongoing monitoring.	Scheduling of works/ Site visit report of EE	Engineering Design and Cost
		Top soiling and revegetation shall commence immediately after the completion of an activity and at an agreed distance behind any particular work front.	Contractor	As each activity is completed.	Topsoiling and revegetation / Site visit report of EE	Engineering Design and Cost
		Storm water control and wind screening shall be undertaken to prevent soil loss from the site.	Engineer	Ongoing monitoring.	Provision of Storm water control and wind screening	Engineering Design and Cost
		Sediment fence or Sand Bags shall be provided in the path of the runoff from the disturbed area and stockpiles to stop the flow of sediments from entering the drains.	Engineer	Ongoing monitoring	Provision of sediments fence/sand bags.	Engineer Design and Cost
		Side tipping of spoil and excavated materials shall not be permitted – all spoil material shall be disposed of as directed by the Engineer.	Engineer	Ongoing monitoring.	Disposal system of spoils/ Storm water control and wind screening	Engineering Design and Cost
		Battering of all banks shall be such that cut and fill embankments are no steeper than previous natural slopes unless otherwise permitted by the Engineer. Cut and fill embankments steeper than previous ground levels shall be revegetated immediately on completion of trimming or shall be protected against erosion using bioengineered stabilization measures.	Engineer and Contractor	As the cut and fill activity is completed.	Observation Battering of all banks and revegetation on embankments/Site visit report of EE	Engineering Design and Cost
		All embankments, unless otherwise directed by the Engineer, shall be protected by a cut off drain to prevent water from cascading down the face of the embankment and causing erosion.	Engineer	Immediately after the creation of the embankment/stripping of vegetation.	Provision of cutoff drain at embankments / Site visit report of EE	Engineering Design and Cost
6.	Storm water	The Contractor shall not in any way modify nor damage the banks or bed of streams, rivers, wetlands, other open water bodies and drainage lines adjacent to or within the designated area, unless required as part of the construction project specification. Where such disturbance is unavoidable, modification of water bodies shall be kept to a minimum in terms of:	Contractor	Ongoing monitoring.	Disturbance to adjacent water bodies/wetlands/Site visit report of EE, water quality results	Engineering Design and Cost

	Activity	Management/Mitigation	Responsible for Monitoring	Frequency	Monitoring Indicators	Cost and Sources of Funds
		<ul style="list-style-type: none"> <li>removal of riparian vegetation</li> <li>opening up of the stream channel</li> </ul>				
		Earth, stone and rubble is to be properly disposed of so as not to obstruct natural water pathways over the site i.e. these materials must not be placed in storm water channels, drainage lines or rivers.	Engineer	Monitoring throughout the duration of the project.	Proper disposal of earth, stone and rubble	Engineering Design and Cost
		There shall be a periodic checking of the site's drainage system to ensure that the water flow is unobstructed.	Engineer and Contractor	Monthly inspection.	Drainage system in the site / Site visit report of EE	Engineering Design and Cost
		The use of high velocity storm water pipelines shall be avoided in favour of open, high friction, semi-permeable channels wherever feasible.	Engineer and Contractor	As directed by the engineer	Condition of storm water pipes/ Site visit report of EE	Engineering Design and Cost
		Storm water outfalls shall be designed to reduce flow velocity and avoid stream bank and soil erosion.	Engineer and Contractor	As directed by the engineer	Condition of storm water pipes/ Site visit report of EE	Engineering Design and Cost
		During construction, un-channelled flow must be controlled to avoid soil erosion. Where large areas of soil are left exposed, rows of straw / hay or bundles of cut vegetation shall be dug into the soil in contours to slow surface wash and capture eroded soil. The spacing between rows will be dependent on slope.	Engineer and Contractor	As surfaces become exposed.	Site conditions / Site visit report of EE	Engineering Design and Cost
		Where surface run-off is concentrated (e.g. along exposed roadways/tracks), flow shall be slowed by contouring with hay bales or bundled vegetation generated during site clearance operation. If the area must be used for construction vehicles, berms may be used instead. The berms must be at least 30 cm high and well compacted. The berms shall channel concentrated flow into detention ponds or areas protected with hay bales for flow reduction and sediment capture.	Engineer and Contractor	Ongoing monitoring.	Condition of surface run off – mechanism to slow down the flow/ Condition of storm water pipes/ Site visit report of EE	Engineering Design and Cost
7.	Water quality <sup>24</sup>	Mixing / decanting of all chemicals and hazardous substances must take place either on a tray or on an impermeable surface. Waste from these shall then be disposed of to a suitable waste disposal	Contractor and Engineer	Regular monitoring (refer to the environmental monitoring program)	Disposal mechanism of hazardous substances / Site visit report of EE, Water quality test results	Engineering Design and Cost

<sup>24</sup> Water quality is affected by the incorrect handling of substances and materials. Soil erosion and sediment is also detrimental to water quality. Mismanagement of polluted run-off from vehicle and plant washing and wind dispersal of dry materials into rivers and watercourses are detrimental to water quality.



	Activity	Management/Mitigation	Responsible for Monitoring	Frequency	Monitoring Indicators	Cost and Sources of Funds
		site.				
		Every effort shall be made to ensure that any chemicals or hazardous substances do not contaminate the soil or ground water on site.	Contractor	Regular monitoring (refer to the environmental monitoring program)	Site visit report of EE, Water quality test results	Engineering Design and Cost
		Care must be taken to ensure that run-off from vehicle or plant washing does not enter the surface/ground water. Wash water must be passed through a three-chamber oil-grease trap prior to being discharged as effluent.	Contractor	Regular monitoring (refer to the environmental monitoring program)	Provision to manage runoff from vehicle and plant washing/ Site visit report of EE	Engineering Design and Cost
		Site staff shall not be permitted to use any stream, river, other open water body or natural water source adjacent to or within the designated site for the purposes of bathing, washing of clothing or for any construction or related activities. Municipal water (or another source approved by the Engineer) shall instead be used for all activities such as washing of equipment or disposal of any type of waste, dust suppression, concrete mixing, compacting etc.	Contractor	Regular monitoring (refer to the environmental monitoring program)	Site visit report of EE, Water quality test results	Engineering Design and Cost
		Emergency contact numbers of the SPCB shall be referred to in order to deal with spillages and contamination of aquatic environments.	Engineer and Contractor	As necessary	Display of contact numbers/ Site visit report of EE	Engineering Design and Cost
8.	Conservation of natural environment	As the work front progresses the Contractor is to check that vegetation clearing has the prior permission of the Engineer.	Engineer	Ongoing monitoring.	Permission from the engineer	Engineering Design and Cost
		Only trees that have NOT been marked beforehand are to be removed, if cutting of trees is required.	Contractor	Ongoing monitoring.	Site visit report of EE	Engineering Design and Cost
		Gathering of firewood, fruit, plants, crops or any other natural material on site or in areas adjacent to the site is prohibited.	Contractor	Ongoing monitoring.	Site visit report of EE / provision of alternate fuel to works	Engineering Design and Cost
		The hunting of birds and animals on site and in surrounding areas is forbidden.	Contractor	Ongoing monitoring.	Site visit report of EE	Engineering Design and Cost
		Immediate revegetation of stripped areas and removal of aliens by de-weeding must take place. This significantly reduces the amount of time and money that must be spent on alien plant management during rehabilitation.	Contractor	Ongoing monitoring.	revegetation of stripped areas/ Site visit report of EE	Engineering Design and Cost
		Alien vegetation encroachment onto the site as a result of construction activities must be controlled during construction.	Contractor	Twice-monthly monitoring.	Site visit report of EE	Engineering Design and Cost

	Activity	Management/Mitigation	Responsible for Monitoring	Frequency	Monitoring Indicators	Cost and Sources of Funds
		Where possible, cleared indigenous vegetation shall be kept in a nursery for use at a later stage in the site rehabilitation process.	Contractor	As the work front progresses.	Site visit report of EE	Engineering Design and Cost
9.	Materials management	Stockpiles shall not be situated such that they obstruct natural water pathways.	Engineer and Contractor	Location as directed by the engineer	Location of stock piles/ Site visit report of EE	Engineering Design and Cost
		Stockpiles shall not exceed 2m in height unless otherwise permitted by the Engineer.	Engineer	Location as directed by the engineer	Height of stock piles/ Site visit report of EE	Engineering Design and Cost
		If stockpiles are exposed to windy conditions or heavy rain, they shall be covered either by vegetation or cloth, depending on the duration of the project. Stockpiles may further be protected by the construction of berms or low brick walls around their bases.	Contractor	As necessary	covering of stock piles/ Site visit report of EE	Engineering Design and Cost
		Stockpiles shall be kept clear of weeds and alien vegetation growth by regular de-weeding.	Contractor	Monthly monitoring	condition of stock piles/ Site visit report of EE	Engineering Design and Cost
		All concrete mixing must take place on a designated, impermeable surface.	Contractor	Ongoing monitoring.	Site conditions/ Site visit report of EE	Engineering Design and Cost
		No vehicles transporting concrete to the site may be washed on site.	Contractor	Ongoing monitoring.	Site conditions/ Site visit report of EE	Engineering Design and Cost
		No vehicles transporting, placing or compacting asphalt or any other bituminous product may be washed on site.	Contractor	Monthly monitoring.	Site conditions/ Site visit report of EE	Engineering Design and Cost
		Lime and other powders must not be mixed during excessively windy conditions.	Contractor	As necessary	Site conditions/ Site visit report of EE	Engineering Design and Cost
		All substances required for vehicle maintenance and repair must be stored in sealed containers until they can be disposed of / removed from the site.	Contractor	Ongoing monitoring.	Site conditions/ Site visit report of EE	Engineering Design and Cost
		Hazardous substances / materials are to be transported in sealed containers or bags.	Engineer and Contractor	Ongoing monitoring	Site conditions/ Site visit report of EE	Engineering Design and Cost
		Spraying of herbicides / pesticides shall not take place under windy condition.	Contractor	As necessary.	Site conditions/ Site visit report of EE	Engineering Design and Cost
10.	Waste management	Refuse must be placed in the designated skips / bins which must be regularly emptied. These shall	Contractor	Ongoing monitoring.	SWM collection and management system,	Engineering Design and

	Activity	Management/Mitigation	Responsible for Monitoring	Frequency	Monitoring Indicators	Cost and Sources of Funds
		remain within demarcated areas and shall be designed to prevent refuse from being blown out by wind.			Site conditions/ Site visit report of EE	Cost
		In addition to the waste facilities within the construction camp, provision must be made for waste receptacles to be placed at intervals along the work front.	Contractor	Ongoing monitoring.	Provision for waste receptacles along the work front./ Site visit report of EE	Engineering Design and Cost
		Littering on site is forbidden and the site shall be cleared of litter at the end of each working day.	Contractor	Ongoing monitoring.	Site conditions/ Site visit report of EE	Engineering Design and Cost
		Recycling is to be encouraged by providing separate receptacles for different types of wastes and making sure that staff is aware of their uses.	Contractor	Ongoing monitoring.	Collection system of SWM/Awareness of staff / Site visit report of EE	Engineering Design and Cost
		All waste must be removed from the site and transported to a disposal site or as directed by the Engineer. Waybills proving disposal at each site shall be provided for the Engineer's inspection.	Engineer and Contractor	Checked at each site meeting.	SWM disposal systems/ waybills/ Site visit report of EE	Engineering Design and Cost
		Construction rubble shall be disposed of in pre-agreed, demarcated spoil dumps that have been approved by the Engineer, or at disposal sites.	Engineer and Contractor	Ongoing monitoring.	Construction rubble management/ / Site visit report of EE	Engineering Design and Cost
		Waste from toilets shall be disposed of regularly and in a responsible manner. Care must be taken to avoid contamination of soils and water, pollution and nuisance to adjoining areas.	Contractor	Weekly monitoring.	Septic tank for toilets/ / Site visit report of EE	Engineering Design and Cost
		Hazardous waste disposal must be carried out by the Contractor in a responsible manner at approved site. Waybills for this shall be provided.	Contractor and Engineer	Ongoing monitoring.	Hazardous waste disposal systems/ waybills/ Site visit report of EE	Engineering Design and Cost
		A sump (earth or other) must be created for concrete waste. This is to be de-slugged regularly and the cement waste is to be removed to the approved disposal site.	Engineer and Contractor	Ongoing monitoring.	Management of concrete waste / Site visit report of EE	Engineering Design and Cost
11.	Social impacts <sup>25</sup>	Contractor's activities and movement of staff to be restricted to designated construction areas.	Engineer	Ongoing.	Site visit report of EE	NA
		Should the construction staff be approached by members of the public or other stakeholders, they shall assist them in locating the Engineer or Contractor, or provide a number on which they may contact the Engineer or Contractor.	Engineer and Contractor	Ongoing monitoring.	Interaction and record of grievance from public	NA

<sup>25</sup> Regular communication between the Contractor and the interested and affected parties is important for the duration of the contract.

	Activity	Management/Mitigation	Responsible for Monitoring	Frequency	Monitoring Indicators	Cost and Sources of Funds
		The conduct of the construction staff when dealing with the public or other stakeholders shall be in a manner that is polite and courteous at all times. Failure to adhere to this requirement may result in the removal of staff from the site by the Engineer.	Engineer	Ongoing monitoring.	Report from contractor	NA
		Disruption of access for local residents, commercial establishments, institutions, etc. Must be minimized and must have the Engineer's permissions.	Engineer	Ongoing monitoring.	Record of grievance from public	NA
		Provide walkways and metal sheets where required to maintain access for people and vehicles.	Contractor	Ongoing monitoring	Provision of walkways and metal sheets	NA
		Increase workforce in front of critical areas such as educational institutions, places of worship, business establishment and health care establishments to shorten the duration of impacts.	Contractor	Ongoing monitoring		NA
		Consult businesses and institutions regarding operating hours and factoring this in work schedules.	Engineer and Contractor	At least 1 week prior to the activity taking place.	Schedule of work/ report of EE	Engineering Design and Cost
		The Contractor is to inform public in writing of disruptive activities well in advance (30 days and again 1 day before start of excavation of works). This can take place by way of leaflets placed in the pick boxes giving the Engineer's and Contractor's details or other method approved by the Engineer. Provide sign boards for pedestrians to inform nature and duration of construction works and contact numbers for concerns/complaints.	Engineer and Contractor	At least 24 hrs prior to the activity taking place.	Advance notice issued to public/ report of EE	Engineering Design and Cost
		The project contractor will ensure that there is provision of alternate access to business establishments during the construction so that there is no closure of these shops or any loss of clientage.	Engineer and Contractor	Ongoing monitoring	Provision of alternate access to business establishments / report of EE	Engineering Design and Cost
		Contractor shall submit to Engineer the confirmation obtained from the business/shop owner that such access was provided during project execution on the specified format titled <b>"Confirmation from Operator of Commercial establishment/shop for provision of temporary Access by Contactor"</b> . This format has been appended as <b>Appendix-2 to EMP</b> .	Engineer	On completion of works at each site	Confirmation from Operator of Commercial establishment/shop for provision of temporary Access by Contactor	Engineering Design and Cost
		Lighting on the construction site shall be pointed	Engineer	Ongoing monitoring.	Lighting at site/ report of	Engineering

	Activity	Management/Mitigation	Responsible for Monitoring	Frequency	Monitoring Indicators	Cost and Sources of Funds
		downwards and away from oncoming traffic and nearby houses.			EE	Design and Cost
		The site must be kept clean to minimize the visual impact of the site.	Engineer	Weekly monitoring.	Cleanliness and visual aesthetics/ report of EE	Engineering Design and Cost
		If screening is being used, this must be moved and re-elected as the work front progresses.	Engineer	Ongoing monitoring.	visual aesthetics/ report of EE	Engineering Design and Cost
		Machinery and vehicles are to be kept in good working order for the duration of the project to minimize noise nuisance to neighbours.	Contractor	Ongoing monitoring.	Noise of vehicles/ conditions of vehicles/ visual aesthetics/ report of EE	Engineering Design and Cost
		Notice of particularly noisy activities must be given to residents / businesses adjacent to the construction site. Examples of these include: <ul style="list-style-type: none"> <li>noise generated by jackhammers, diesel generator sets, excavators, etc.</li> <li>drilling</li> <li>dewatering pumps</li> </ul>	Engineer and Contractor	At least 24 hrs prior to the activity taking place.	Advance notice to public visual aesthetics/ report of EE	Engineering Design and Cost
		Noisy activities must be restricted to the times given in the Project Specification or General Conditions of Contract.	Engineer	Ongoing monitoring.	Scheduling of activities / visual aesthetics/ report of EE	Engineering Design and Cost
		The Engineer and Contractor are responsible for ongoing communication with those people that are interested in / affected by the project.	Engineer and Contractor		Communication records with locals/ report of EE	Engineering Design and Cost
		A complaints register (refer to the Grievance Redressal Mechanism) shall be housed at the site office. This shall be in carbon copy format, with numbered pages. Any missing pages must be accounted for by the Contractor. This register is to be tabled during monthly site meetings.	Contractor and Engineer	Monthly monitoring.	Complaints register / report of EE	Engineering Design and Cost
		Interested and affected parties' need to be made aware of the existence of the complaints book and the methods of communication available to them.	Engineer and Contractor	Ongoing monitoring.	Awareness of locals about the project and GRM	Engineering Design and Cost
		Queries and complaints are to be handled by: - documenting details of such communications <ul style="list-style-type: none"> <li>submitting these for inclusion in complaints register</li> <li>bringing issues to Engineer's attention immediately</li> <li>taking remedial action as per Engineer's</li> </ul>	Contractor	Ongoing monitoring.	Complaints register / report of EE	Engineering Design and Cost

	Activity	Management/Mitigation	Responsible for Monitoring	Frequency	Monitoring Indicators	Cost and Sources of Funds
		instruction				
		Selected staff are to be made available for formal consultation with the interested and affected parties in order to: <ul style="list-style-type: none"> <li>• explain construction process</li> <li>• answer questions</li> </ul>	Contractor	Ongoing monitoring.	Record of consultations	Engineering Design and Cost
		Contractor shall immediately take the necessary remedial action on any complaint/grievance received by him and forward the details of the grievance along with the action taken to Engineer within 48 hours of receipt of such complaint/grievance.	Engineer	Ongoing monitoring	Complaints register / report of EE/ record of corrective action taken	Engineering Design and Cost
12.	Cultural environment	All the staff and labourers of the Contractor be informed about the possible items of historical or archaeological value which include old stone foundations, tools, clayware, jewellery, remains, fossils etc.	Engineer and EE	As required.	Awareness of workers	Engineering Design and Cost
		If something of this nature be uncovered, ASI or State Department of Archaeology shall be contacted and work shall be stopped immediately.	Engineer and EE	As required.	Awareness of workers	Engineering Design and Cost
13.	Environment Safeguard Officer	Contractor shall appoint one Environment Safeguard Officer who shall be responsible for assisting contractor in implementation of EMP, community liaison, consultations with interested/affected parties, reporting and grievance redressal on day-to-day basis.	Engineer and EE	Person to be appointed before start of construction activities and remain available through the project duration.	Appointment and work record of ESO by contractor/ report of EE	Engineering Design and Cost

ASI = Archaeological Survey of India; EE = Environmental Expert of Engineer (DSC); SPCB= State Pollution Control Board

**Table 29: Post Construction Activities**

	Activities	Management/Mitigation	Responsible for Monitoring	Frequency	Monitoring Indicators	Cost and Sources of Funds
1.	Construction camp	All structures comprising the construction camp are to be removed from site or handed over to the property owner/ community as per mutual agreement (if established on private/community land).	Engineer	Subproject completion	Condition of the site / report of EE	Engineering Design and Cost
		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.	Engineer	Subproject completion	Condition of the site / report of EE	Engineering Design and Cost
		All hardened surfaces within the construction camp	Engineer	Subproject completion	Condition of the	Engineering

	Activities	Management/Mitigation	Responsible for Monitoring	Frequency	Monitoring Indicators	Cost and Sources of Funds
		area shall be ripped, all imported materials removed, and the area shall be top-soiled and re-grassed using the guidelines set out in the revegetation specification that forms part of this document.			site / report of EE	Design and Cost
		The Contractor must arrange the cancellation of all temporary services.	Engineer	Subproject completion	report of EE	NA
2.	Vegetation	All areas that have been disturbed by construction activities (including the construction camp area) must be cleared of alien vegetation.	Engineer	Subproject completion	Condition of the site / report of EE	Engineering Design and Cost
		Trees cut from the project site shall be compensated with a compensatory afforestation	Engineer	Subproject completion	Replanted trees/ record of afforestation/ report of EE	Engineering Design and Cost
		All vegetation that has been cleared during construction is to be removed from site or used as much as per the revegetation specification, (except for seeding alien vegetation).	Engineer	Subproject completion	Condition of the site / report of EE	Engineering Design and Cost
		The Contractor is to water and maintain all planted vegetation until the end of the defects liability period and is to submit a method statement regarding this to the Engineer.	Engineer	Subproject completion	Condition of the replanted vegetation / report of EE	Engineering Design and Cost
3.	Land rehabilitation	All surfaces hardened due to construction activities are to be ripped and imported materials thereon removed.	Contractor	Subproject completion	Condition of the site / report of EE	Engineering Design and Cost
		All rubble is to be removed from the site to an approved disposal site. Burying of rubble on site is prohibited.	Contractor	Subproject completion	Condition of the site / report of EE	Engineering Design and Cost
		The site is to be cleared of all litter.	Contractor	Subproject completion	Condition of the site / report of EE	Engineering Design and Cost
		Surfaces are to be checked for waste products from activities such as concreting or asphaltting and cleared in a manner approved by the Engineer.	Contractor	Subproject completion	Condition of the site / report of EE	Engineering Design and Cost
		All embankments are to be trimmed, shaped and replanted to the satisfaction of the Engineer.	Engineer and Contractor	Subproject completion	Condition of the embankments/ report of EE	Engineering Design and Cost
		Borrow pits are to be closed and rehabilitated in accordance with the pre-approved management plan for each borrow pit. The Contractor shall liaise with the Engineer regarding these requirements.	Engineer	Subproject completion	Rehabilitation of borrow pits/ report of EE	Engineering Design and Cost
		The Contractor is to check that all watercourses are	Contractor	Subproject completion	Condition of the	Engineering

	Activities	Management/Mitigation	Responsible for Monitoring	Frequency	Monitoring Indicators	Cost and Sources of Funds
		free from building rubble, spoil materials and waste materials.			water courses/ report of EE	Design and Cost
4.	Materials and infrastructure	Fences, barriers and demarcations associated with the construction phase are to be removed from the site unless stipulated otherwise by the Engineer.	Engineer	Subproject completion	Restoration of the site/ report of EE	Engineering Design and Cost
		All residual stockpiles must be removed to spoil or spread on site as directed by the Engineer.	Engineer	Subproject completion	Restoration of the site/ report of EE	Engineering Design and Cost
		All leftover building materials must be returned to the depot or removed from the site.	Contractor	Subproject completion	Restoration of the site/ report of EE	Engineering Design and Cost
		The Contractor must repair any damage that the construction work has caused to neighbouring properties.	Contractors	As directed by the Engineer.	report of EE	Engineering Design and Cost
5.	General	A meeting is to be held on site between the Engineer, EE and the Contractor to approve all remediation activities and to ensure that the site has been restored to a condition approved by the Engineer.	Engineer and EE	On completion of the construction and maintenance phases	MOM/report of the EE	NA
		Temporary roads must be closed and access across these blocked.	Engineer and EE	On completion of construction	Report of the EE	NA
		Access or haulage roads that were built across watercourses must be rehabilitated by removing temporary bridges and any other materials placed in/or near to watercourses. Revegetation of banks or streambeds must be as necessary to stabilize these and must be approved by the Engineer.	Engineer and Contractor	On completion of construction	Rehabilitation of haulage roads/report of the EE	NA
		All areas where temporary services were installed are to be rehabilitated to the satisfaction of the Engineer	Engineer and Contractor	On completion of construction	Rehabilitation of sites/report of the EE	NA

EE = Environmental Expert of Engineer (DSC)



### C. Environmental Monitoring Programme

158. Table-30 outlines the environmental monitoring program to ensure implementation of the management and mitigation measures specified in the EMP. The table shall be read within the context of the body of the entire EMP.

**Table-30: Environmental Monitoring Program**

Aspect	Parameter	Standards	Location	Duration / frequency	Implementation	Supervision	Cost and Source of Funds
1. Site establishment and preliminary activities							
Legislation, permits and agreements	Consent for Establishment and Consent to Operate (in relation to hot mixing, wet mixing, batching plant, stone crushers, and diesel generators, etc.)	Air Act Water Act Noise Act	-	Prior to moving onto site and during construction	Contractor	Engineer/EE/PMU/PMC	These consents are to be obtained by contractor on his own cost.
	Copy of EMP	EARF and ADB SPS	Subproject site, offices, website, library, etc.	At all times	Contractor, Engineer and EE	PMU/PMC	Engineering Design and Cost
Access to site	Existing conditions	EMP	All access and haul roads	Prior to moving onto site	Engineer, EE and Contractor	PMU/PMC	Engineering Design and Cost
	Road closures and traffic rerouting	Traffic management plan and EMP	All affected roads	One week in advance of the activity	Engineer and EE	PMU/PMC	Engineering Design and Cost
	Notifications and road signages	Traffic management plan and EMP	All affected roads	One week in advance of the activity	Engineer and EE in coordination with the Contractor and Traffic Police	PMU/PMC	Engineering Design and Cost
Construction camp	Approval of location and facilities	EMP	As identified	Prior to moving onto site	Contractor with the Engineer and EE	PMU/PMC	Engineering Design and Cost
Equipment lay-down and storage area	Approval of location and facilities	EMP	As identified	Prior to moving onto site and during site set-up	Contractor with the Engineer and EE	PMU/PMC	Engineering Design and Cost
Materials management – sourcing	Approval of sources and suppliers	EMP	As identified	Prior to procurement of materials	Contractor with the Engineer and EE	PMU/PMC	Engineering Design and Cost
Education of site staff	Awareness level training - Environment - Health and safety	EMP and records	-	During staff induction, followed by schedule as determined	Contractor with the Engineer and EE	PMU/PMC	Engineering Design and Cost
Social impacts	Public consultations, information	EARF, ADB SPS and EMP	Subproject site	Prior to moving onto site and	Contractor with the Engineer, EE, PIU/PMC	PMU	Engineering Design and Cost

Aspect	Parameter	Standards	Location	Duration / frequency	Implementation	Supervision	Cost and Source of Funds
	disclosure, communication strategy			ongoing			
	GRM register	EMP	Subproject site	Prior to moving onto site and ongoing	Contractor with the Engineer, EE, PIU	PMU/PMC	Engineering Design and Cost
Noise quality	Baseline data for noise level in dB(A) $L_{eq}$	National noise standards	Once before start of construction works at 4 sensitive sites, and 3 pipe replacement sites as per the locations identified in Map attached in Appendix 7.	Once prior to site set-up	Contractor	Engineer/ EE/ PMU/PMC	Engineering Design and Cost
Air quality	Baseline ambient data for particulate matters 10 and 2.5 ( $PM_{10}$ , $PM_{2.5}$ ), sulfur dioxide ( $SO_2$ ), nitrogen dioxide ( $NO_2$ )	National ambient air quality standards	Once before start of construction works at 4 sensitive sites, and 3 pipe replacement sites as per the locations identified in Map attached in Appendix 7.	Once prior to site set-up	Contractor	Engineer/ EE/ PMU/PMC	Engineering Design and Cost
Soil erosion	Soil erosion management measures	EMP	As identified by the engineer	During site set-up and throughout the duration of the subproject	Contractor with the Engineer and EE	PMU/PMC	Engineering Design and Cost
Stormwater	Stormwater management measures	EMP	As identified by the engineer	During site set-up and throughout the duration of the subproject	Contractor with the Engineer and EE	PMU/PMC	Engineering Design and Cost
Conservation of natural environment	Existing conditions	EMP	Subproject sites	Prior to site set-up	Contractor with Engineer and EE	PMU/PMC	Engineering Design and Cost
Waste management procedure	Disposal sites	EMP	As determined	Prior to site set-up and ongoing throughout the subproject	Contractor with Engineer and EE	PMU/PMC	Engineering Design and Cost
Cultural environment	Chance finds	ASI Act and EMP	As determined	Prior to site set-up and ongoing	Contractor with Engineer and EE	PMU/PMC	Engineering Design and Cost

Aspect	Parameter	Standards	Location	Duration / frequency	Implementation	Supervision	Cost and Source of Funds
				throughout the subproject			
2. Construction phase							
Access to site	Qualitative characteristics	Pre-subproject condition and EMP	All access and haul roads	Refer to EMP (table on management of construction and workforce activities)	Contractor	Engineer	Engineering Design and Cost
Construction camp	Qualitative characteristics	Pre-subproject condition and EMP	Camp site	Prior to site set-up and ongoing throughout the subproject	Contractor	Engineer	Engineering Design and Cost
Staff conduct	Site records (accidents, complaints)	EMP	Subproject sites	Ongoing	Contractor	Engineer	Engineering Design and Cost
Air quality	PM <sub>10</sub> , PM <sub>2.5</sub> , SO <sub>2</sub> , NO <sub>2</sub>	National ambient air quality standards	4 sensitive locations near construction sites and 3 locations near pipe replacement sites as per the locations identified in Map attached in Appendix 7.	Once in every six months at sensitive locations and once in three months at pipe replacement sites during subproject execution	Contractor	Engineer/ EE/ PMU/PMC	Engineering Design and Cost
Water Quality	pH, BOD, COD, TDS, Pb, Oil & Grease, Detergents and Faecal Coliforms for Surface water.	Indian standards for Inland Surface Water (IS: 2296, 1982)	Once in six months from two locations in the network as specified by the Engineer (DSC).	Once in 6 months for one year	Contractor	Engineer/ EE/ PMU/PMC	Engineering Design and Cost
Soil erosion	Soil erosion management measures	EMP	Subproject sites	Ongoing	Contractor	Engineer	Engineering Design and Cost
Storm water	Soil erosion management measures	EMP	Subproject sites	Ongoing	Contractor	Engineer	Engineering Design and Cost
Conservation of natural resources	Vegetation conditions	EMP	Subproject sites	Ongoing	Contractor	Engineer	Engineering Design and Cost
Materials management	Qualitative characteristics	EMP	Subproject sites	Ongoing	Contractor	Engineer	Engineering Design and Cost
Waste	Qualitative	EMP	Subproject	Ongoing	Contractor	Engineer	Engineering

Aspect	Parameter	Standards	Location	Duration / frequency	Implementation	Supervision	Cost and Source of Funds
management	characteristics		sites				Design and Cost
	Disposal manifests	EMP	Subproject sites	Ongoing	Contractor	Engineer	Engineering Design and Cost
Social impacts	Public consultations, information disclosure, communication strategy	EARF, ADB SPS and EMP	Subproject sites	Ongoing	Contractor with the Engineer, EE, PIU	PMU/PMC	Engineering Design and Cost
	GRM register	EMP	Subproject sites	Ongoing	Contractor with the Engineer, EE, PIU	PMU/PMC	Engineering Design and Cost
Cultural environment	Chance finds	ASI Act and EMP	Subproject sites	Ongoing	Contractor	Engineer	Engineering Design and Cost
Noise quality	Noise level in dB(A) $L_{eq}$	National noise standards	4 sensitive locations near construction sites, and 3 locations near pipe replacement sites as per the location identified Map attached in Appendix 7	Once in every six months at sensitive locations and once in three months at pipe replacement sites during subproject execution	Contractor	Engineer/ EE/ PMU/PMC	Engineering Design and Cost
<b>3. Post-construction activities</b>							
Construction camp	Pre-existing conditions	EMP	Construction camp	Subproject completion	Contractor	Engineer	Engineering Design and Cost
Vegetation	Pre-existing conditions	EMP	Subproject sites	Subproject completion	Contractor	Engineer	Engineering Design and Cost
Land rehabilitation	Pre-existing conditions	EMP	Subproject sites	Subproject completion	Contractor	Engineer	Engineering Design and Cost
Materials and infrastructure	Pre-existing conditions	EMP	Subproject sites	Subproject completion	Contractor	Engineer	Engineering Design and Cost
General	Records	EMP	Subproject sites	Subproject completion	Contractor with Engineer and EE	PMU/PMC	Engineering Design and Cost
<b>4. Defect liability period</b>							
Water Quality	pH, BOD, COD, TDS, Oil & Grease, Detergents Faecal Coliforms, Total hardness, Sulphate, Chloride, Fe,	Indian standards for Inland Surface Water (IS: 2296, 1982) and for Drinking water (IS: 10500, 1991)	Once in six months from two locations in the network as specified by the Engineer (DSC).	Once in 6 months for one year	Contractor	Engineer/ EE/ PMU/PMC	Engineering Design and Cost

Aspect	Parameter	Standards	Location	Duration / frequency	Implementation	Supervision	Cost and Source of Funds
Noise quality	and Pb Noise level in dB(A) $L_{eq}$	As per national noise standards	Once at 10 sensitive locations as per the location identified Map attached in Appendix 7	Once in 6 months for one year	Contractor	Engineer/ EE/ PMU/PMC	Engineering Design and Cost
<b>4. Operation and maintenance period</b>							
Water Quality	pH, BOD, COD, TDS, Oil & Grease, Detergents, Faecal Coliforms, Total hardness, Sulphate, Chloride, Fe, and Pb	Indian standards for Inland Surface Water (IS: 2296, 1982) and for Drinking water (IS: 10500, 1991)	From the selected locations in the distribution network	Once in 6 months for one year	Public Health Engineering Department	Engineer	O&M cost of Public Health Engineering Department

EE= Environmental Expert of Engineer (DSC).

## IX. ENVIRONMENTAL MANAGEMENT AND MONITORING COST

159. The Contractor's cost for site establishment, preliminary activities, construction, and defect liability activities will be incorporated into the contractual agreements, which will be binding on him for implementation. The air quality, water quality and noise level monitoring of construction and defect liability phases will be conducted by the contractor.

160. The operation phase mitigation measures are again of good operating practices, which will be the responsibility of implementing agency Public Health Engineering Department. Water quality monitoring is required during the operation and maintenance phase that will be conducted by the environmental laboratory of ERA but the cost has to be managed by Public Health Engineering Department.

161. The activities identified in environmental monitoring program mainly includes site inspections and informal discussions with workers and local people and this will be the responsibility of PMU and PMC with the assistance of DSC, costs of which are part of project management.

162. Table-31 presents the estimated cost to implement the EMP.

**Table-31: Indicative Cost for EMP Implementation**

Component	Description	Number	Cost per Unit (INR)	Cost (INR)	Source of Funds
Legislation, Permits and Agreements	Consent to Establish and Consent to Operate for plants and machinery of the contractor.	As required	Not Applicable	Not Applicable	These consents are to be obtained by contractor on his own cost.
Public consultations and	Information disclosure and consultations	As required	Lump sum	300,000	Part of the project cost.

Component	Description	Number	Cost per Unit (INR)	Cost (INR)	Source of Funds
information disclosure	during preconstruction and construction phase.				
Providing access to commercial establishments and properties.	Providing access, in case of access disruptions, to affected properties.	As per requirement	Contractor's liability	Not applicable	Covered under engineering cost
Dust Suppression at subproject sites	Application of dust suppression measures during construction phase.	As required	Lump sum	10,00,000	Covered under engineering design and cost
Protection measures against noise pollution	Construction of noise walls (as per requirement)	As required	Lump sum	2,50,000	Covered under engineering design and cost
Traffic management	Safety Signboards, delineators, traffic regulation equipments, flagman, temporary diversions, etc	Wherever required throughout subproject corridor	Contractor's liability	Not applicable	Covered in engineering cost
Capacity building	Program 1 covering ERA officials, PMC and DSC staff	One program	60,000	60,000	Covered under project cost
	Program 2 covering staff of PIU, DSC and contractor	Two programs	10,000	20,000	
Baseline Monitoring	Site preparation and preliminary activities				
Air	Once before start of construction works at 4 sensitive locations near construction sites, and 3 locations near pipe replacement sites	7 samples	7,000 per sample	49,000	Covered under engineering design and cost
Noise	Once before start of construction works at 4 sensitive locations near construction sites, and 3 locations near pipe replacement sites	7 samples	1,000 per sample	7,000	Covered under engineering design and cost
Construction Monitoring					
Air	Once in six months at 4 sensitive locations near construction sites, (for two years)	40 samples	7,000 per sample	2,80,000	Covered under engineering design and laboratory cost
	Once in three months at 3 locations near pipe replacement sites				
Noise	Once in six months at 4 sensitive locations near construction sites, (for two years)	40 samples	1,000 per sample	40,000	Covered under engineering design and laboratory cost

Component	Description	Number	Cost per Unit (INR)	Cost (INR)	Source of Funds
	Once in three months at 3 locations near pipe replacement sites				
Water	Once in six months near the construction camps/labor camps for two years	8	5,000 per sample	40,000	Covered under engineering design and cost
Any unanticipated impact due to subproject implementation	Mitigation of any unanticipated impact arising during construction period	Lump sum	2,00,000	2,00,000	Covered under project cost
Defect Liability Period (6 months)					
Air	Once at 4 sensitive locations near construction sites and 6 locations near pipe replacement sites	10 samples	7,000 per sample	70,000	Covered under engineering design and cost
Noise	Once at 4 sensitive locations near construction sites and 6 locations near pipe replacement sites	10 samples	1,000 per sample	10,000	Covered under engineering design and cost
Water	Once in six months from two locations in the distribution network	4 samples	5,000 per sample	20,000	Cost Covered under Laboratory cost
Any unanticipated impact due to subproject implementation	Mitigation of any unanticipated impact arising during defect liability period.	Lump sum	5,00,000	5,00,000	Covered under project cost
<b>Total</b>					<b>2786000.00</b>

## X. CONCLUSION AND RECOMMENDATIONS

163. The process described in this document has assessed the environmental impacts of all elements of the proposed subproject based on the concept for rehabilitation of water supply system and NRW programme in Jammu City under Tranche 3. Potential negative impacts were identified in relation to pre-, construction and operation of the improved infrastructure, but no environmental impacts were identified as being due to either the subproject design or location. Mitigation measures have been developed to reduce all negative impacts to acceptable levels. These were discussed with specialists responsible for the engineering aspects, and as a result some measures have already been included in the designs for the infrastructure. This means that the number of impacts and their significance has already been reduced by amending the design.

164. The public participation processes undertaken during IEE preparation ensured stakeholders are engaged during the preparation of the design documents. The planned information disclosure measures and process for carrying out consultation with affected people will facilitate their participation during project implementation. The general perception of the public is that the sub project will improve the quality of urban life

165. The subproject'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 guide the environmentally-sound construction of the subproject and ensure efficient lines of communication between the DSC (Engineer), contractors, PIU and PMU/PMC. The EMP will (i) ensure that the activities are undertaken in a responsible non-detrimental manner; (ii) provide a pro-active, feasible and practical working tool to enable the measurement and monitoring of environmental performance on site; (iii) guide and control the implementation of findings and recommendations of the environmental assessment conducted for the subproject; (iv) detail specific actions deemed necessary to assist in mitigating the environmental impact of the subproject; and (v) ensure that safety recommendations are complied with.

167. A copy of the EMP will be kept on site during the construction period at all times. The EMP will be made binding on all contractors operating on the site and will be included within the Contractual Clauses. Non-compliance with, or any deviation from, the conditions set out in this document constitutes a failure in compliance.

168. The subproject is unlikely to cause significant adverse impacts. The potential adverse impacts that are associated with design, construction, and operation can be mitigated to standard levels without difficulty through proper engineering design and the incorporation or application of recommended mitigation measures and procedures.

169. Although there will be no need to acquire land or relocated people, roadside businesses may lose some income as access will be difficult for customers when water pipes are installed nearby. However access loss can be mitigated by providing alternate access during construction. ADB policy on Involuntary Resettlement requires that no-one should be worse off as a result of an ADB-funded project, so a Resettlement Plan has been prepared to mitigate any potential income loss due to temporary impact on access.

170. The proposed subproject will address the existing low service coverage levels and increased demand for piped water supply by reducing the NRW and increasing the efficiency of water supply.

171. There is only limited opportunities to provide environmental enhancements in this subproject, but certain measures will be included in the DPR.

172. Therefore, as per ADB SPS, the subproject is classified as Environmental Category B and does not require further Environmental Impact Assessment.

173. The project site is devoid of any major environmental sensitivity. There are no endangered, rare or threatened species of flora or fauna within the influence zones of the sub project.

174. Though the subproject site is adjacent to a wildlife sanctuary none of the site fall within wild life sanctuary, and ecologically sensitive area and is unlikely to create any impact on the sanctuary. It is recommended that the project may proceed as planned subject to implementation of the EMP as incorporated in this IEE



**APPENDIX 1: Rapid Environmental Assessment (REA) Checklist**

Screening questions	Yes	No	Remarks
Project siting Is the project area			
Densely populated?			Jammu City is densely populated.
Heavy with development activities?			The area comprises of residential structures, commercial establishments and Army installations. The developmental activities such as construction works are ongoing at an average pace.
Adjacent to or within any environmentally sensitive areas?			There is no protected area within subproject corridor. However boundary of Ramnagar wildlife sanctuary is located at 0.03m distance from the periphery of the proposed subproject (from distribution laterals). The protected area shall be free from any impact from the proposed subproject. All the activities involved in the execution of the subproject will be carried out on the R.O.W of the existing Roads and lanes in the built up area well outside the boundary fence of the wildlife sanctuary.
Cultural heritage site			None of the subproject component sites are within or adjacent to any cultural heritage site. The archaeologically protected monument closest to sub project area is 'Peer Mitha tomb' is away from outer periphery of sub project area.
Protected area			None of the subproject component sites are within or adjacent to any protected area.
Wetland			Not applicable
Mangrove			Not applicable
Estuarine			Not applicable
Buffer zone of protected area			None of the subproject component sites are within or adjacent to buffer zone of protected area.
Special area for protecting biodiversity			None of the subproject component sites are in special area for protecting biodiversity.
Bay			Not applicable
Potential environmental impacts Will the project cause...			
Pollution of raw water supply from upstream wastewater discharge from communities, industries, agriculture, and soil erosion runoff?			No such impact is anticipated. Exploitation of surface water sources is not in the scope of the subproject.
Impairment of historical/cultural monuments/areas and loss/damage to these sites?			No historical/cultural/ monuments/ areas exist within or in close vicinity of the subproject components. Hence no such impacts are anticipated. The archaeologically protected monument closest to sub project area is 'Peer Mitha tomb' is 0.36 km away of sub project area
Hazard of land subsidence caused by excessive ground water pumping?			Excessive ground water pumping shall not be involved. Water will be tapped according to the yield of the bore wells.
Social conflicts arising from displacement of communities?			No such impact is anticipated as the subproject will not involve any displacement of population.
Conflicts in abstraction of raw water for water supply with other beneficial water uses for surface and ground waters?			No such conflicts are anticipated. Abstraction of surface water for distribution is not proposed under this subproject. The ground water is not being tapped for any other purpose except drinking in the project area.

Screening questions	Yes	No	Remarks
Unsatisfactory raw water supply (e.g. excessive pathogens or mineral constituents)?			Ground water obtained from the tube wells is normally free from pathogens and will be supplied after disinfection. Regular water quality monitoring is carried out by the line department (PHED) to minimize threat to public health. Further, the tube wells will be deep and sufficiently away from any possible source of ground water contamination.
Delivery of unsafe water to distribution system?			Not anticipated. Proper care shall be taken during designing so that such situation does not arise.  Overhead tanks will supply disinfected water to distribution network.  The line department (PHED) has a well-established system of water quality monitoring at reservoirs and also at the user end.
Inadequate protection of intake works or wells, leading to pollution of water supply?			No such situation is anticipated in present case as raw water withdrawal is proposed from ground.
Over pumping of ground water, leading to salinization and ground subsidence?			No such impact is anticipated. The ground water abstraction has been planned after ensuring adequate availability in the ground water aquifer for withdrawal. The area of Jammu has surplus exploitable ground water potential as per hydro-geological assessment study carried out by Central Ground Water Board (CGWB) and Project Management Consultant of ADB loan 2151-IND (2007). It has been indicated in the reports that the present ground water extraction in the area is only 17.62% of the total available potential; and the area thus lies in the safe category of ground water development.
Excessive algal growth in storage reservoir?			The storage reservoirs will be covered on top and shall be regularly disinfected, hence no algal growth in the reservoirs is anticipated.
Increase in production of sewage beyond capabilities of community facilities?			No such impact is anticipated. Sewage volumes shall undoubtedly increase but this increase will not be beyond the existing and proposed community facilities. Construction of Sewerage system with treatment facilities is in progress in the Project area and will be in operation at the time of the completion of proposed water supply subproject. Sewerage Subproject under Loan 2331-IND (Tranche 1-JKUSDIP) funded by ADB covers more than half of the project area and rest is covered under UEED project.
Inadequate disposal of sludge from water treatment plants?			Water treatment plants shall not be involved in this subproject. Hence, no such impact is anticipated.
Inadequate buffer zone around pumping and treatment plants to alleviate noise and other possible nuisances and protect facilities?			The existing pumping stations are away from the human settlements and are already screened by proper enclosures. No treatment plant is proposed under subproject.
Impairments associated with transmission lines and access roads?			Temporary impairments with transmission lines and access roads are anticipated during laying of new and replacement of worn out pipes in the subproject area.

Screening questions	Yes	No	Remarks
Health hazards arising from inadequate design of facilities for receiving, storing, and handling of chlorine and other hazardous chemicals.			No such impact is anticipated. Chlorine gas is not planned to be used for disinfection. Currently, bleaching powder is being used for disinfection of drinking water.
Health and safety hazards to workers from the management of chlorine used for disinfection and other contaminants?			No such impact is anticipated.
Dislocation or involuntary resettlement of people?			There is no dislocation or involuntary resettlement of people. No damage to the existing properties is anticipated.  However, minor access disruptions to few commercial and residential establishments is anticipated during the execution of civil works. This shall be temporary and site specific in nature coinciding with the duration of works.
Disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups?			No such impact is anticipated.
Noise and dust from construction activities?			Minor noise and dust from construction activities is anticipated which shall be localized and temporary in nature coinciding only with the duration of construction activities.
Increased road traffic due to interference of construction activities?			Slight increase in road traffic due to movement of construction vehicles can be anticipated. But, this shall be temporary in nature with negligible impact. This will be limited to construction phase only and the works will be carried out during lean traffic periods. This will ensure no adverse impact due to construction traffic.
Continuing soil erosion/silt runoff from construction operations?			No soil erosion is anticipated. Trenches will be filled back and restored to original conditions after completion of day's work. The land below overhead tanks will be leveled properly after completion of construction works.
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?			Only disinfected water will be supplied to the consumers. The PHE department has a well established system of regular collection and analysis of water samples for preventing any such impact.
Delivery of water to distribution system, which is corrosive due to inadequate attention to feeding of corrective chemicals?			No such impact is anticipated. The raw ground water is found to be non-corrosive in nature. However, prescribed amounts of corrective chemicals are used by PHED for disinfections to avoid any such impacts.
Accidental leakage of chlorine gas?			Not applicable. Bleaching powder is being used for disinfection of water instead of chlorine gas.
Excessive abstraction of water affecting downstream water users?			No such impact is anticipated as water source for the subproject is ground water.
Competing uses of water?			Ground water is not used for any other purpose except for drinking water supply in the project area.
Increased sewage flow due to increased water supply			A slight increase in sewage flow is anticipated due to increase in water supply. However, the additional volume of water finding its way into sewage shall be beneficial, as it shall dilute the actual concentration of contaminants.

Screening questions	Yes	No	Remarks
Increased volume of sludge (wastewater from cooking and washing) and sludge from wastewater treatment plant			A slight increase in the volume of sludge is expected due to increased water supply. However, the actual concentration of contaminants shall get diluted with this increase in water supply.
Large population influx during project construction and operation that causes increased burden on social infrastructure and services (such as water supply and sanitation systems)?			No such impact is envisaged.
Social conflicts if workers from other regions or countries are hired?			No such conflicts are anticipated. Preference will be given to local laborers and migratory labour shall be employed in unavoidable circumstances only.
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?			No such impact is anticipated.
Community safety risks due to both accidental and natural hazards, especially where the structural elements or components of the project are accessible to members of the affected community or where their failure could result in injury to the community throughout project construction, operation and decommissioning?			No such impact is anticipated, in case of the proposed subproject, as the structural elements of the subproject are away from community habitations.

Climate change and disaster risk questions The following questions are not for environmental categorization. They are included in this checklist to help identify potential climate and disaster risks.	Yes	No	Remarks
Is the Project area subject to hazards such as earthquakes, floods, landslides, tropical cyclone winds, storm surges, tsunami or volcanic eruptions and climate changes?			The area is not subject to floods, landslides, tropical cyclone winds, storm surges, tsunami or volcanic eruptions and localized climate changes. However, the subproject area falls in seismic zone-IV as per seismic zone map of India.
Could changes in temperature, precipitation, or extreme events patterns over the Project lifespan affect technical or financial sustainability (e.g., changes in rainfall patterns disrupt reliability of water supply; sea level rise creates salinity intrusion into proposed water supply source)?			No
Are there any demographic or socio-economic aspects of the project area that are already vulnerable (e.g. high incidence of marginalized populations, rural-urban migrants, illegal settlements, ethnic minorities, women or children)?			No
Could the project potentially increase the climate or disaster vulnerability of the surrounding area (e.g., by using water from a vulnerable source that is relied upon by many user groups, or encouraging settlement in earthquake zones)?			No

**APPENDIX 2:WATER SUPPLY IMPROVEMENT WORK DONE UNDER ADB LOAN 1 –  
MPIRJK (Loan 2151-IND)**

**Improvement Works Done Under ADB Loan 2151-IND**

	<b>Component</b>	<b>Number</b>	<b>Capacity</b>	<b>Locations</b>
1	Construction of new tube wells	55	21.36 MGD or 97.08 MLD	<p><b>Left bank: 23 tube wells:</b> Sainik Colony Sector – C, Sainik Colony Sector – G, Sanjay Nagar, Adarsh Enclave, Gangyal, Deep Nagar, Apna Vihar, Kunjwani, Balmiki Nagar, Nanak Nagar Sector – 8, K.C. Colony, Jamwal Residency, Babliana, Digiana, Nakrian, Channi Himmat, Narwal Procurement Division, Lakshmi Narayan Mandir at Gandgi Nagar, Sector D Sainik colony, Greater Kailash, PHED complex Dilli, Sidhra and Trikuta Nagar Sector – 5.</p> <p><b>Right bank: 32 tube wells:</b> JDA Park Indira Vihar, Science College – I, Science College – II, Science College – III, Bua Datti Mandir at Paloura, CPS Rajpura Mangotrian, Agricultural Complex, Play Ground Government Medical College, Waziron wali Gali, Bohri, Dental College, Gole (Shamshan Ghat), Relief Commissioner Complex, Rehari Park, Himmat Colony at Gole, Kabir Colony at B.C.Road, Camp Gole Gujral, Roop Nagar Stage – II, CPS Bantalab, CPS Muthi, CPS Muthi Goan, Suryavanshi Nagar, Poonch Colony Bantalab, Durga Nagar, Dharmal, Dream Land Colony, Rajinder Nagar, Keran, Kamla Nagar, PHE Station Barnai, Patoli Brahamana, Lower Muthi Lale-da-bagh, Lower Barnai, Qasim Nagar, Roop Nagar Park.</p>
2	Laying new raising mains	161 km		The subproject included replacement of old leaking rising mains and laying of rising mains for new tube wells in both eastern as well as western parts of Jammu City.
3	Redevelopment of existing less discharge or defunct tube wells	38	5.16 MGD or 23.44 MLD	This is increased production capacity of the existing tube wells. This component was spread over Jammu City in both eastern and western parts.
4	Construction of new OHTs	43	71.5 LG	<p><b>Left bank, 21 OHTs:</b> PHE Complex at Shastri Nagar, Tube Well No. 9 at Gandhi Nagar, PHE Complex at Channi Himmat, Tube Well No. 1at Gandhi Nagar, PHE Complex Rail Head, PHE Complex Trikuta Nagar, D/C Block Gandhi Nagar, Nanak Nagar Sector – 7, R &amp; B Guest House, Sainik Colony Sector C, Thangar, Sainik Colony Sector A, Old Bandhu Rakh, Sainik Colony Sector F, Ajit Nagar, Dashmesh Nagar, Uttam Nagar, Babliana, Apna Vihar, Sanik Colony C and Langer.</p> <p><b>Right bank, 22 OHTs:</b> Ram Mandir at Bakshi Nagar, Parade, Amar Colony, Sarwal, Idd Gah at Residency Road , Roop Nagar Stage-II, Suryavanshi Vihar, Roop Nagar Stage-III, JDA Park at Indira Vihar, Ranjeet Pura, Rajpura , Relief Commissioner Office, Puran Nagar, Tomal, Resham Ghar, Janipur Stage-IV, Paloura Top, Agricultural Complex, Dharmal, Muthi Village and Muthi Tube well No 5.</p>
5	Construction of new ground level service reservoirs (GLSRs)	16	25.5 LG	<p><b>Left Bank: (9 GLSRs)</b> Channi Himmat, Boria Pumping Station, PHE Complex Narwal, Tube Well No. 1, Gandhi Nagar, Dodhi Gujar, Sainik Colony Sector F/G, Nawabad near B.N.College, PHE Procurement Division, Qasim Nagar (Bahu Top)</p> <p><b>Right bank: (8 GLSRs)</b> CPS Muthi, Roop Nagar Stage-II, Relief Commissioner Office, Sitlee, Company Bagh, New Plot, Parade and CPS Bantalab</p>
6	Construction of new water intake structure	1	1.8 MGD	Construction of new water intake structure on river Tawi at Boria on left bank of river Tawi.

1. Water supply improvement works under this loan included: (i) preparation of master plan; (ii) rehabilitation of water treatment plants; (iii) rehabilitation of tube wells; (iv) rehabilitation/replacement of distribution network in 24 out of 50 subzones; (v) conversion of subzones to district metering areas (DMAs); (vi) Maintaining an adequate potable water supply through rehabilitation as well as construction of new OHTs, GLSRs and Tubewells and by providing additional backup facilities as water tankers to the (vii) Improving upon the efficiency of infrastructure by replacement of worn out machinery and adequate power back up. After completion of the improvement works the net water reaching household will be 185.80 MLD compared to the demand of about 218.83 MLD in the same year.

2. The work under this loan was divided into different contract packages. Except two packages- one construction of OHT/GLSR and second replacement of distribution network, work in all contract packages is complete. Status of the different contract packages under this loan is given in table below

**Status of Completion of Water Supply Work Done Under ADB Loan 1-MPIRJK**

<b>(i) Contracts Completed</b>		
1.	Replacement of old and laying of new rising main <b>(Phase I)</b>	M/S Electrosteel Casting Ltd.
2.	Replacement of old and laying of new rising main <b>(Phase II)</b>	M/S Electrosteel Casting Ltd.
3.	Construction of 22 Tube wells on East of Jammu	M/s Hanuman Tube Well
4.	Construction of intake well ,GLSR, OHT, Pumping Stn. in <b>East</b> of Jammu <b>(LOT 1)</b>	M/S SMS Prayawaran Ltd.
5.	Construction of GLSR, OHT in <b>WEST</b> of Jammu <b>(2)</b>	M/S Maverick Dev. & Col. Pvt Ltd
6.	Construction of GLSR, OHT in <b>WEST</b> of Jammu <b>( 3)</b>	M/S Ch. Jagar Singh & Janak Raj Gupta
7.	Construction of Tube Wells , Installation of Mechanical and Electrical Equipment and civil works under Jammu city water supply Rehabilitation programme. <b>LOT- 1, 2, 3 &amp; 4)</b>	M/s Gurnam Singh &
8.	Construction of Tube Wells , Installation of Mechanical and Electrical Equipment and civil works under Jammu city water supply Rehabilitation programme. <b>LOT- 4)</b>	M/s Open Survey World.
9.	Re-Development of 38 tube wells	M/s Shiv Drillers
10.	Laying New Rising Mains in various Parts of Jammu West <b>( Phase - III)</b>	M/S Pratibha Industries
11.	Construction of intake well ,GLSR, OHT, Pumping Stn. in <b>East</b> of Jammu <b>(Lot 2)</b>	M/S Prabhu Dayal Kanojiya
12.	Construction of GLSR, OHT in <b>WEST</b> of Jammu <b>(LOT 1)</b>	M/S Prabhu Dayal Kanojiya.
13.	Replacement of Worn out Pipes in Jammu City, <b>Phase II</b>	M/S SMS Prayawaran Ltd.
14.	Construction of civils work of 6 Tube Wells in Jammu – Lot-2	M/s Open Survey World.
15.	Construction of 6 Tube Wells installation & commissioning of Mechanical / Electrical Equipment in Jammu Lot - 1	M/s Hanuman Tube Well
<b>(ii) Contracts Under Execution</b>		
16.	Construction of intake well ,GLSR, OHT, Pumping Stn. in <b>East</b> of Jammu <b>(Lot 3)</b>	M/s Modern Constructions Pvt
17.	Replacement of Worn out Pipes in Jammu City, <b>Phase I</b>	M/s Modern Constructions Pvt

### APPENDIX 3: WATER SUPPLY IMPROVEMENT WORK BEING DONE UNDER TRANCHE 2 OF JKUSDIP

1. The Components of water supply work under tranche 2 of JKUSDIP involves rehabilitation of distribution pipeline in 5 subzones of Phase – IV (about 67 km), laying of new rising mains from proposed tube wells to over head tanks / ground level service reservoirs (Total length 14.8 km), rehabilitation and replacement of worn out pumping machinery and electrical equipment at pumping stations and tube wells, construction of 19 tube wells, and 10 overhead tanks in water deficit areas of Jammu city and installation of 8000 house connections.

2. After completion of the improvement works under Tranche 2 of JKUSDIP the net water reaching household will increase to 275.55 MLD from 185.80 MLD. System losses will be reduced down to 20% from current level of 30-45% and newly constructed facilities will run with 100% of design capacities. This increase in production will be due to rehabilitation and replacement of worn out machineries. This work is divided into four contract packages out of which work on two had commenced. Details of each component is given in table below:

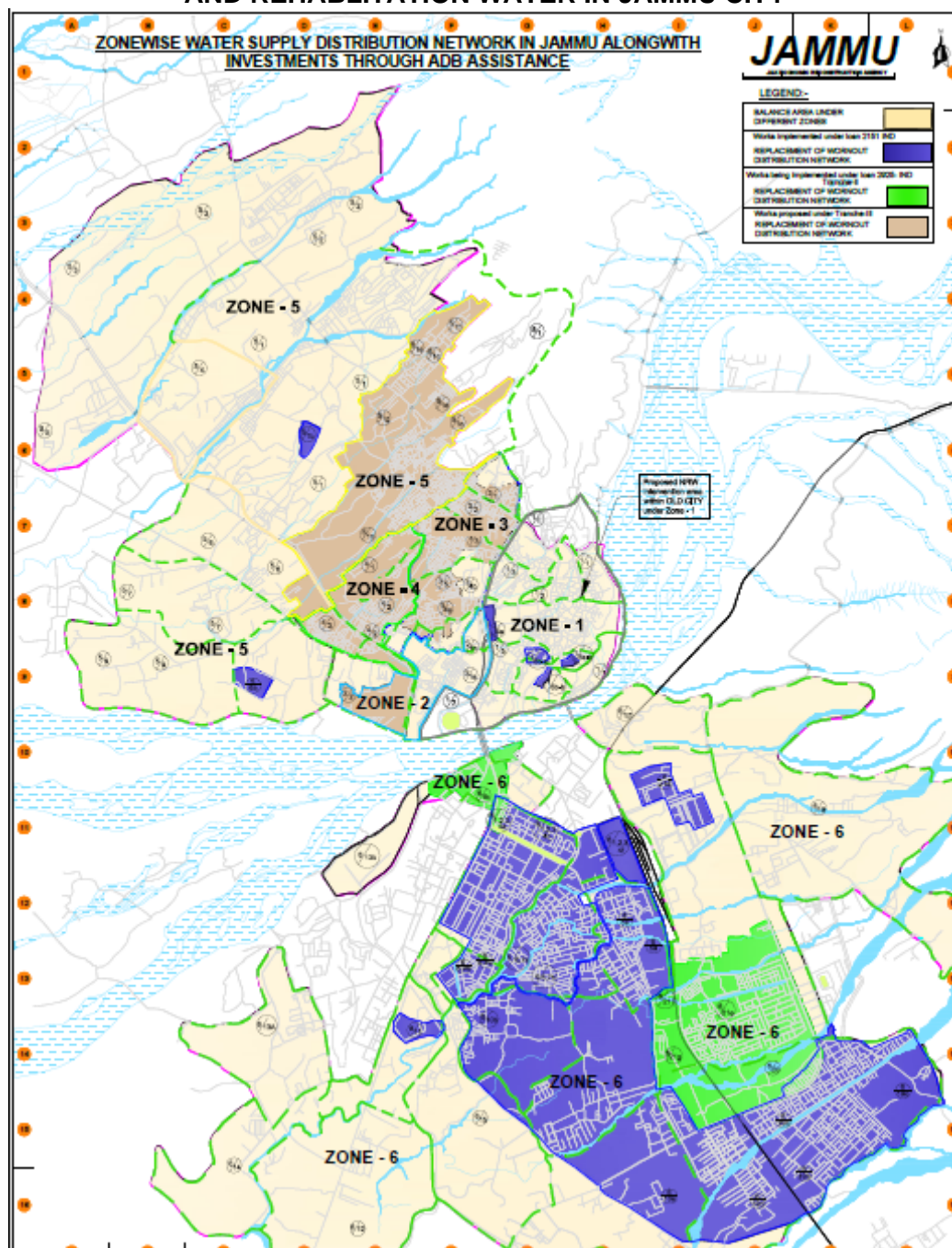
**Improvement Works Done Under ADB Loan 2925-IND (Tranche 2)**

S. No.	Works being implemented	Quantity	Capacity	Contractor	progress	Location
1	i) Construction of new tube wells	19	4.14 MGD or 18.84 MLD	Contractor: M/s Hanuman Tube Wells Co.	Work commenced on 01.07.2013	<b>Left bank: 12 tube wells:</b> CPS Narwal, Fruit Market, Channi Himmat Sector-2, Channi Himmat Sector-1, Channi Kamala, Malik Market, Sainik Colony Sector-F, Sainik Colony Sector-G, Ambika Colony, D/C Block Gandhi Nagar, Bandhu Rakh and Nai Basti. Total production of tube wells is 11.20 MLD. <b>Right bank: 07 tube wells:</b> Bakshi Nagar, New Plot, Bathing Ghat at Lohan, Paloura, Tali Morh, Janipur (Missionary of charity), Wazarat road, Park Near Raina Academy (Paloura) and Bantalab (Rajender park, phase-I). Total production of tube wells is 7.64 MLD.
	ii) Laying new raising mains		9500 m			Under Lot-I on Left bank side 6050 m and under Lot-II on right bank side 3450 m
2	Construction of new OHTs	10	7.27 ML	M/s SMS Paryavaran Limited	Work Started	<b>Left bank: 06 over head tanks:</b> Nai Basti, Gandhi Nagar in Block-A, Sector-7 in Channi Himmat, Delli Fruit Market, Sector-D in Sainik colony. Total storage capacity is 4.09 ML, 3624m <b>Right bank: 04 over head tanks :</b> Illrd Stage in paloura, EWS Sector-1 in Roop Nagar, Baba Kalakh Nath Temple in Rajinder Nagar, JDA Phase-1 in Bantalab.

S. No.	Works being implemented	Quantity	Capacity	Contractor	progress	Location
						Total storage capacity is 3.18 ML, 2504m
	ii) Laying new raising mains		7353 m			Both banks of Tawi river as mentioned in 2 (i)
3	Rehabilitation/ Replacement of worn-out pipes and strengthening of distribution network Phase-IV		115.944 km (Length)			Rehabilitation/ Replacement of worn-out pipes and strengthening of distribution in 4 areas (sub zones under zone-6) such as Channi Himmat, Channi Rama, Delli and Vikram Chowk. Total 4.72 Sq.km area
4	Rehabilitation/ Replacement of worn-out machinery	06 38 07 45 32 05 19 12 02				Jammu city (East and West) <b>Description of Items.</b> Vertical non-clog, submersible pump set (Raw water) ii) Vertical submersible pump set iii) Vertical turbine pump set iv) Horizontal centrifugal pump sets v) Multi stage Horizontal centrifugal pump sets vi) Chain pulley (Tube wells) vii) LT-Stabilizer and related accessories APFC panel with contactor switching 2.5 MVA outdoor type HT AVR
5	Installation of 8000 Water Meters in Gandhi Nagar & Shastri Nagar at Jammu.	8000				Procurement & Installation of 8000 Water Meters and related works in Gandhi Nagar & Shastri Nagar areas of Jammu.



# APPENDIX 4: FIGURE-ZONE DISTRIBUTION MAP OF JAMMU FOR NRW INTERVENTION AND REHABILITATION WATER IN JAMMU CITY



## APPENDIX 5: PUBLIC CONSULTATION

### **Sub Project: Rehabilitation of water supply system in Jammu City under Zone 2, 3, 4 and 5 and NRW in zone I.**

1. Various issues related to the proposed subproject were discussed at various locations throughout the subproject corridor. Discussions were held with the parties directly and indirectly affected by the subproject execution as well as the general public of the subproject area. The problems faced by them along with their suggestions/concerns were recorded and the same have been given due consideration during formulation of the project design, IEE and EMP. The participants, in general were in favor of the upcoming subproject. However, they were concerned about the temporary problems which are expected to arise during construction stage such as traffic related issues, loss of access and increase in air pollution due to dust emissions. People are ready to extend all types of support during execution of the project. The details of the public consultation are detailed below:

#### **Issues discussed**

- (i) Awareness and extent of knowledge about the subproject.
- (ii) Information on the benefits of the subproject in terms of economic and environmental enhancement.
- (iii) Information on perceived benefits from the proposed subproject including augmentation in water supply, reduction in water losses, enhanced quality of the potable water, etc.
- (iv) Information on perceived losses from the proposed subproject during execution stage in terms of temporary disturbance in traffic, loss of access to residences, commercial establishments/shops, institutions, etc. and increase in air and noise pollution, etc. during construction.
- (v) Presence of any historical/cultural site in the vicinity.
- (vi) Presence of any protected area/wetland in or adjoining the construction site.
- (vii) Information on economic development in terms of creation of an important urban facility and generation of direct employment during the execution of the subproject.

2. Summary of public consultation dated 06-09-2013, 10-09-2013 and 19-11-2013 at different locations in the subproject area

S.No.	Issues Discussed	Feedback received	Remarks
1	Problems faced due to absence of the proposed facility under the subproject	<ul style="list-style-type: none"> <li>• The quality and quantity of the water supplied at present is not adequate.</li> <li>• The water supply lines have degraded which requires immediate replacement. It is also resulting in leakages and water losses.</li> <li>• Due to worn out pipelines, leaking is a persistent problem which results in contamination of water and loss of pressure at the user end.</li> <li>• Relatively higher areas don't get regular water supply and they face scarcity of water especially in summers.</li> <li>• There is acute shortage of water supply in the newly established settlements.</li> </ul>	The participants in general were of the view that the proposed rehabilitation is the need of the hour and welcomed the subproject and ensured their full support.

S.No.	Issues Discussed	Feedback received	Remarks
		<ul style="list-style-type: none"> <li>All the areas don't get water supply at par with each other.</li> <li>New settlements mostly in the peripheries of the city lack proper water supply</li> <li>In some areas, people have to rely on supply of portable water through tankers (both government and private).</li> </ul>	
2	Awareness and extent of knowledge about the subproject	Generally, most of the people consulted were well aware about the proposed subproject as ample information for the same has been disseminated during similar subprojects executed by J&K ERA under its earlier loan from ADB and by other line departments.	Public consultation in different forms like one to one consultation, circulations of questionnaire, group discussions, etc. need to be a continuous process and EA will ensure this process throughout the project execution.
2	Information on the perceived benefits of the subproject in terms of economic and environmental enhancement	<p>General benefits perceived by the people are summarized as follows:</p> <ul style="list-style-type: none"> <li>Improvement in the water supply scenario will solve the issues and problems related to the unsatisfactory quantity and quality of the water supplied.</li> <li>It is hoped that adequate provisions will be made for satisfactory and standardized filtration and purification of the water which will be supplied in future.</li> <li>The improvement in the water supply will provide safety to the people as they will be not at the risk of water borne diseases.</li> <li>Replacement of worn out pipelines will address the problems of water losses and contamination.</li> <li>Areas on higher elevation and new settlements will get highly benefited with the proposed subproject.</li> <li>The replacement of worn out machinery and replacement of old pipelines will increase their efficiency and production.</li> <li>Proposed infrastructure will ensure overall health and hygiene of the people in the subproject area.</li> </ul>	<p>People impacted directly or indirectly due to subproject implementation should be adequately compensated. During implementation, maximum efforts should be made to minimize hindrances of public access by providing alternative access to roads, streets and homes. The work should be carried out at a fast pace so that the duration of access disruption is minimized.</p> <p>People suggested an efficient operation and maintenance system after the completion of the project.</p>
4	Information on perceived losses from the proposed subproject during execution stage in terms of disruptions in traffic, temporary access disruptions during execution and air and noise pollution, etc.	People opined that potential temporary impacts of access disruption for residences, shops/commercial establishments, and institutions, etc. should be mitigated through good construction practices and an effective environment and contractors construction plan which should ensure providing walkways and metal sheets to maintain access across trenches, increasing the workforce in front of shops/commercial establishments, consulting business and institutions regarding operating hours and factoring this in work schedules, providing advance information on works to be	Effective mitigation measure should be in place so that problems related to traffic disruptions; air and noise pollution are minimized.

S.No.	Issues Discussed	Feedback received	Remarks
		undertaken including appropriate signages etc.	
5	Presence of any historical/cultural site in the vicinity	There is no historical/cultural site in the corridor of the subproject.	However there are some sensitive receptors which include few educational institutions, health centers, religious places etc. in the project area for which proper mitigation measures relevant to the location and nature of the receptor will be kept in place during project execution and same will be part of EMP.
6	Presence of any protected area/wetland in or adjoining the construction site.	There is no protected area in the corridor of the subproject.	
8	Information on economic development in terms of reduction in problems due to inefficient water supply system and generation of direct employment during the execution of subproject	People were well aware about the benefits of the subproject which proposes rehabilitation of the water supply system in Jammu City. It will ensure efficient water supply facility thereby an overall healthy environment, health and hygiene in the subproject area and reduce many problems faced at this stage and indirect economic benefits thereof. In addition, people at large were aware about the fact that during the execution of subproject a large number of skilled/semi-skilled/unskilled people shall get employment and thus were in favor of construction works.	
9	How the subproject will address the existing low service coverage levels in the city and increased demand for piped water supply	For Jammu city, reducing NRW is one of the first option to pursue while addressing low service coverage levels and increased demand for piped water supply. Expanding water networks without addressing water losses will only lead to a cycle of waste and inefficiency and hence the current NRW programme is evolved.	

## List of participants

### Public Consultation Attendance Slip

Sub-project Name: Replacement of worn out watersupply pipelines  
covering phase III and Phase V in Jammu

Date: 29/12/13 Venue: New Plot Lik Rd, Mandir More, Jammu

Sl. No	Name	Address/phone	Signature
1.	Mohinder Gupta	Hans no. 30, Sargwal, Mandir More, J.	Mohinder Gupta
2.	Amrik Singh	R/o Sargwal chowk 9465170577	Amrik Singh
3.	Vikas Sharma	R/o Sargwal chowk 9796654860	Vikas Sharma
4.	Rakesh Kumar	R/o Sargwal 2874104	Rakesh Kumar
5.	Rajesh Mengi	R/o Vikas Nagar 9419351923	Rajesh Mengi
6.	Jugal Kushan	R/o Sargwal	Jugal Kushan
7.	Jagdish By Store	R/o Sargwal	Jagdish By Store
8.	Rakesh Gupta	R/o 426 Sargwal chowk	Rakesh Gupta
9.	Anam Kapoor	R/o Sargwal chowk	Anam Kapoor
10.	Jagannath	R/o Sargwal chowk	Jagannath
11.	Vijay Kumar	R/o Jammu	Vijay Kumar
12.	Assem Grandota	R/o Jammu.	Assem Grandota
13.	Mamaji Gupta	R/o Jammu	Mamaji Gupta
14.	Arvind Gupta	R/o Jammu.	Arvind Gupta

## Public Consultation Attendance Slip

Sub-project Name: Replacement of worn out watersupply pipelines  
covering phase III and Phase V in Jammu

Date: 7/7/2013 Venue: - New Plot Link Road / Sarawal

Sl. No	Name	Address/phone	Signature
①	Rabesh Gupta	39 Sarawal Gali	
②	Anu Aggarwal	Sarawal	
③	Naveen Kumar	R/O Sarawal MOB-94196-51722	
④	Pati Pilak Raj Chogga	R/O Sarawal 2460169	
⑤	Ramam Gupta	R/O Rehman Chogga	
⑥	B. K. Gupta	R/O Q. NO. 104 Sarawal Jammu	
⑦	Prince Gupta	R/O Sarawal Q. NO-29	
⑧	Ashok Kumar	R/O Kote Balwal	
⑨	VICTOR GUPTA	R/O Sarawal	
⑩	Rajul Gupta	R/O Sarawal	
⑪	B. (Indian Christ)	R/O Sarawal	
⑫	Jyoti Kela	R/O Sarawal	
⑬	Vijay Kumar	R/O Sarawal 94196 31771	
⑭	Madan Panday	R/O Sarawal 99063715	



**Summary of outcomes:**

1. The various issues related to proposed subproject have been discussed at various locations throughout the subproject corridor.
2. Some of the local people are aware about the upcoming work. Most of the people are in favors of the upcoming subproject.
3. The quality and quantity of the water supplied at present is not adequate.
4. The water supply lines have degraded which requires immediate replacement. It is also resulting in leakages and water losses.
5. Due to worn out pipelines, leaking is a persistent problem which results in contamination of water and loss of pressure at the user end.
6. Relatively higher areas don't get regular water supply and they face scarcity of water especially in summers.
7. There is acute shortage of water supply in the newly established settlements.
8. All the areas don't get water supply at par with each other.
9. New settlements, mostly in the peripheries of the city, lack proper water production and water storage infrastructure.
10. In some areas people have to rely on supply of potable water through tankers (both government and private).
11. Improvement in the water supply scenario will solve the issues and problems related to the unsatisfactory quantity and quality of water supplied.
12. The improvement in the water supply will provide safety to the people as they will be not at the risk of water borne diseases.
13. Replacement of worn out pipelines will address the problems of water losses and contamination.
14. The replacement of the worm out machinery in the existing pumping stations and tube wells will increase their efficiency and production
15. Proposed project will ensure overall health and hygiene of the people in the subproject area.
16. Public desired for implementation of better measures to reduce noise, dust and air pollution during the construction phase.
17. Provision of temporary access, during construction, to properties affected should be provided.
18. People also wished that local people especially skilled and unskilled people be given opportunities during the project tenure in different construction activities.
19. People expected that their all problems shall be addressed and solutions for them shall be implemented during the subproject execution.
20. People are ready to extend all types of support during execution of the subproject.
21. People suggested that adequate safety measures should be in place during the execution of civil works.
22. ERA reiterated its commitment that the requisite environmental management measures shall be incorporated in EMP and public consultation shall be a regular process during all stages of the subproject to solve any issues arising out of the proposed works.

**Representative Photographs of Public Consultation conducted in proposed Sub-project corridor**











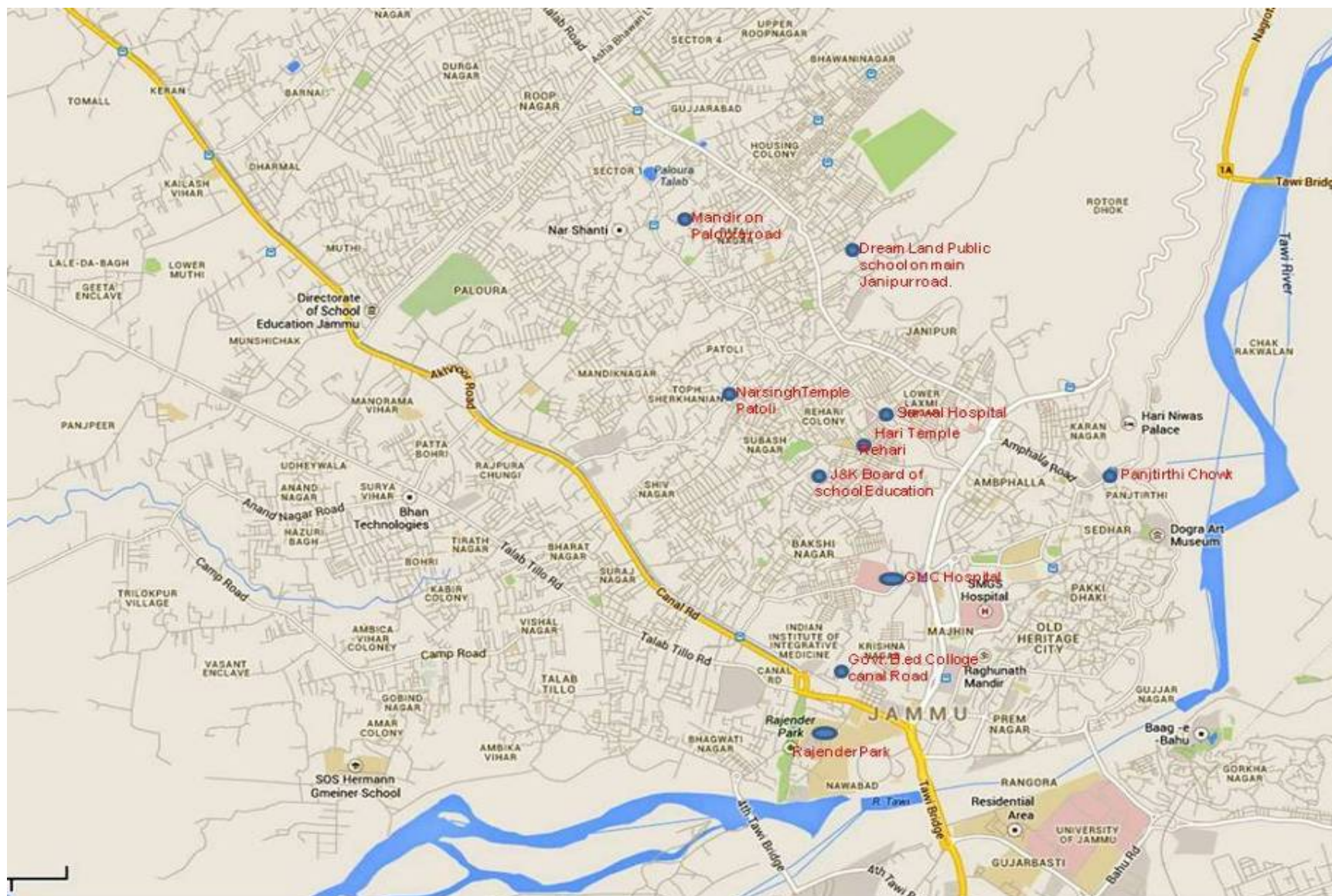
## APPENDIX 6: PHOTOGRAPHS OF PROPOSED SUB-PROJECT AREA







# APPENDIX 7: MAP DEPICTING SENSITIVE LOCATION FOR MONITORING OF AIR AND NOISE QUALITY PARAMETERS



## **APPENDIX 8: TRAFFIC MANAGEMENT PLAN**

1. The following one is a draft guideline for TMP which is to be finalized before implementation in consultation with the line departments and DSC.

2. The contractor shall at all times carry out work on the road in manner creating least interference to the flow of traffic with the satisfactory execution. For all works involving improvements to the existing state highway, the contractor shall, in accordance with the directives of the EA, provide and maintain, during execution of the work, a passage for traffic either along a part of the existing carriageway under improvement, or along a temporary diversion constructed close to the state highway. The contractor shall take prior approval of the EA regarding traffic arrangements during construction.

### **Objectives of Traffic Management Plan**

3. The main objective of this TMP is to ensure the safety of all the road-users along the work zone and to address the following issues:

- (i) Safety of pedestrians, bicyclists and motorists travelling through the work zone.
- (ii) Protection of work force engaged in construction from dangers associated with moving traffic.
- (iii) Mitigation of the adverse impact to the road capacity and delays to the road users.
- (iv) Maintenance of access to the adjoining properties.
- (v) Any other issues that may delay the project works.

### **Analyze the impacts due to construction**

- (i) Consultation with local community, business community members, Traffic Police, Line Departments, etc. regarding the mitigation measures necessary during laying of pipelines.
- (ii) Determination of maximum number of days for which traffic diversion is required.
- (iii) Determine if additional traffic control or temporary improvements are needed along the detour links.
- (iv) Consider how access of materials is provided to the worksite.
- (v) Develop a notification program to the public so that the diversion on other adjoining roads is not a surprise for road users.

### **A. ENSURING TRAFFIC SAFETY AND CONTROL**

4. Where subject to the approval of the Engineer the execution of the works requires temporary closure of road traffic use, the contractor shall provide and maintain temporary traffic diversions. The diversions shall generally consist of 200 mm thickness of gravel 4.5 meters wide laid directly upon natural ground and where any additional earthworks are required for this purpose that will be provided under the appropriate payment items.

5. Where the execution of the works requires single-lane operation on public road, the contractor shall provide and maintain all necessary barriers, warning signs and traffic control signals to the approval of the Engineer.

6. With the exception of temporary traffic arrangements or diversions required within the first 4 weeks of the Contract, the contractor shall submit details of his proposals to the Engineer for approval no less than 4 weeks prior to the temporary arrangement or diversion being required. Details of temporary arrangements or diversions for approval as soon possible after the date of the Letter of Acceptance.

7. The colour, configuration, size and location of all traffic signs shall be in accordance with the code of practice for road sign. In the absence of any detail or for any missing details, the signs shall be provided as directed by the ERA/DSC

8. The contractor shall take all necessary measures for the safety of traffic during construction and provide, erect and maintain such barricades, including signs, marking, flags, lights and flagmen as may be required by the Engineer for the formation and protection of traffic approaching or passing through the section of the road under improvement. Before taking up any construction, an agreed phased programme for the diversion of traffic or closer of traffic on the road shall be drawn up in consultation with the ERA.

9. At the points where traffic is to deviate from its normal path (whether on temporary diversion or part width of the Carriageway) the lane width path for traffic shall be clearly marked with the aid of pavement markings, painted drums or a similar device to the directions of the ERA. At night, the passage shall be delineated with lanterns or other suitable light source.

10. One-way traffic operation shall be established whenever the traffic is to be passed over part of the carriageway inadequate for two-lane traffic. This shall be done with the help of temporary traffic signals or flagmen kept positioned on opposite sides during all hours. For regulation of traffic, the flagmen shall be equipped with red and green flags and lanterns/lights.

11. On both sides, suitable regulatory / warnings signs as approved by the ERA/DSC shall be installed for the guidance of road users. On each approach, at least two signs shall be put up, one close to the point where transition of carriageway begins and the other 120 m away. The signs shall be of design and of reflectory type, if so directed by ERA/DSC.

12. Upon completion of the works for which the temporary traffic arrangements or diversions have been made, the contractor shall remove all temporary installations and signs and reinstate all affected roads and other structures or installations to the conditions that existed before the work started, as directed by the Engineer.

## **B. MAINTENANCE OF DIVERSIONS AND TRAFFIC CONTROL DEVICES**

13. Signs, lights, barriers and other traffic control devices, as well as the riding surface of diversion shall be maintained in a satisfactory condition till such time they are required as directed by the SE. The temporary traveled way shall be kept free of dust by frequent applications of water, if necessary. The signages and devices include the following:

- (i) Barricading
- (ii) Men at work
- (iii) Keep Left
- (iv) Go slow
- (v) Flag men
- (vi) Narrow signs
- (vii) Lantern(Amber Blinker)

- (viii) Traffic control Lights
- (ix) Cones

14. Safety jackets and helmets should be provided to all the workers/ Engineers working on the road.

15. Fixed movable solid barricades must be placed between the workmen and traffic or pedestrian and traffic.

16. All the safety signs should be according to IRC: 67 and IRC: SP: 55: 2001

### **Public awareness and notifications**

17. As expected, there will be travel delays during the laying of pipelines but with proper mitigation measures its scale can be reduced if proper coordination is ensured between various utility service providers and traffic management agencies. Awareness campaign and the prior notification for the public will be a continuous activity which the project authorities will pursue to compensate for traffic delays and also to allow sufficient time for the public and residents to digest the changes to their travel plans. ERA will notify the public about the road blocks and traffic diversion through the print and radio media.

### **Proposed traffic management measures**

18. The traffic management and diversion measures will rely on providing detours/alternate approaches through existing alternate roads, in case, where road closure is required. Public will be informed of the alternate approach roads in advance. Proper barricading will be arranged for the execution of the works. Traffic management measures have to be finalized in the corridor. If the need for road closure/detours arises at any other spot, during subproject execution, then suitable TMP these guidelines shall be prepared and implemented.

### **Traffic Monitoring Strategy**

19. Traffic monitoring strategy that will be implemented during the construction of the subproject is as follows:

- (i) **On-site visits and monitoring.** On site visits will be carried out through relevant government authorities as required by project implementation unit (PIU)/ consultants/ other agencies, if any, relevant during the phase of construction for monitoring of vehicles that are diverted as part of the TMP.
- (ii) **Adjustments to traffic signal settings.** For the subproject, temporary traffic control will be used to direct traffic around work zones during the working phase as given below:
  - Different traffic signals in the form of cones, advanced warning signs, and flagmen, will be used during the construction phase.
  - All workers exposed to traffic must be attired in bright, contrasting, highly visible upper body garments, similar to flagmen.
  - Provisions for the movement of emergency vehicles in or around the construction site.



**(iii) Pedestrian accommodation.** Every effort will be made to separate the movement of pedestrians from both the worksite activity and the adjacent traffic. Following steps will be adopted to accommodate pedestrians:

- Provide pedestrian information throughout the construction period in the form of clearly defined advanced warning signages.
- Clearly define transition to pedestrian detour routes or alternate walking paths.
- Barriers and channelizing devices should be visible to pedestrians.
- Clearly separate the work area from pedestrians.

**(iv) Pedestrian protection**

- Positive protection to separate vehicles from pedestrians and pedestrians from work area.
- Use channelizing devices to delineate the route (must be detectable).
- Protect pedestrians from vehicular traffic (positive protection).
- Protect pedestrians from hazards such as excavated pits, holes, cracks and debris.
- Advanced signages will be placed at intersections.

**(v) Adjustments necessary to public transport operators. Different diversions will be used as** part of traffic management plan in order to provide a smooth functioning of traffic during construction phase of the subproject. However, small adjustments will be necessary which are provided as follows:

- Following of diversions will increase the length of the travel therefore adjustments in terms of early departure are required from public transport operators.
- Adjustments in terms of speed at or near construction sites.
- Lane driving and avoidances of overtaking.
- Following of No Parking zones.
- Avoidance of unnecessary halting of vehicles

**APPENDIX 9: CONFIRMATION FROM OPERATOR OF COMMERCIAL  
ESTABLISHMENT/SHOP FOR PROVISION OF TEMPORARY ACCESS BY CONTACTOR**

Name of Subproject : \_\_\_\_\_

Name of Contractor : \_\_\_\_\_

Name of the Affected Person : \_\_\_\_\_

Nature of Establishment : \_\_\_\_\_

Location of Establishment : \_\_\_\_\_

Nature of Access Disruption : \_\_\_\_\_

Nature of Alternate Access : \_\_\_\_\_

Provided by Contractor : \_\_\_\_\_

Duration & Date of Disruption: \_\_\_\_\_ days from \_\_\_\_\_ to \_\_\_\_\_

I hereby confirm that access disruption caused to my property as per the duration and the dates mentioned above was effectively mitigated by provision of alternate access by contractor. Provision of alternate access ensured no closure or loss of clientage to my commercial establishment.

**Signature of Affected person**

**Signature of Contractor's representative**

---