

Initial Environmental Examination

April 2012

IND: Jammu and Kashmir Urban Sector
Development Investment Program — Jammu City
Drainage Subproject (Channi)

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

ABBREVIATIONS

ADB	- Asian Development Bank
ASI	- Archeological Survey of India
CBD	- Central Business District
CTE	- Consent to Establish
CTO	- Consent to Operate
DSC	- Design and Supervision Consultancy
CPCB	- Central Pollution Control Board
CPHEEO	- Central Public Health and Environmental Engineering Organization
DP	- Displaced Person
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
Gol	- Government of India
GRM	- Grievance Redressal Mechanism
IA	- Implementing Agency
IEE	- Initial Environmental Examination
IST	- Indian Standard Time
J and K	- Jammu and Kashmir
JDA	- Jammu Development Authority
JKUSDIP	- Jammu and Kashmir Urban Sector Development Investment Programme
JMC	- Jammu Municipal Corporation
LHS	- Left Hand Side
MFF	- Multi –Tranche Financing Facility
MLD	- Million liter per day
MoEF	- Ministry of Environment and Forests
MSW	- Municipal Solid Waste
MT	- Metric ton
MTR	- Month's Total Rainfall
NAAQS	- National Ambient Air Quality Standards
NH	- National Highway
OM	- Operations Manual
PIU	- Project Implementation Unit
PMU	- Project Management Unit
PM _{2.5}	- Particulate Matter below 2.5 micron particle size
PM ₁₀	- Particulate Matter below 10 micron particle size
PSC	- Project Support 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 lakhs = 10,000,000
Cumec	-	Cubic meter per second
lakh	-	100 thousand = 100,000
Kanal	-	505.39 square meter
km	-	Kilometer
kph	-	Kilometer per hour
lpd	-	liters per day
m	-	Meter
mg/l	-	milligrams per liter
mm	-	Millimeter
MSL	-	Mean sea level
μ	-	10^{-6} meter
$\mu\text{g}/\text{m}^3$	-	micrograms per cubic meter

NOTE{S}

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

‘nallah’ refers to ‘drain’

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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.

2. The primary objective of JKUSDIP is to promote economic development in the State of Jammu and Kashmir (J and 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

3. The program is to be implemented in 4 to 7 tranches over a period of 8 years. Each tranche constitutes a separate loan. Tranche I (Project-1) of JKUSDIP (Loan 2331-IND) is under implementation. One of the subprojects identified under Tranche 2 (Project-2) JKUSDIP is the Rehabilitation and Channelization of Storm Water Drains at Channi Himmat in Jammu City to improve drainage system in the area.

4. The major objectives of rehabilitation of drains in Channi Himmat area of Jammu City are: (i) establishment of an efficient drainage system and preventing erosion of existing drains; (ii) substantial reduction of water logging and flooding in sub-project area; (iii) improvement of local environment to reduce health risks to the citizens; and (iv) improved long-term drainage management in the Jammu City. The proposed subproject is expected to have the following benefits:

- (i) There will be substantial increase of discharge capacity of storm water drains in subproject area.
- (ii) By constructing/rehabilitating the secondary drains, the low lying areas in the subproject corridor can get rid of frequent flooding and water logging.
- (iii) Reconstructing and strengthening of side walls and improvement in bed of the drains will prevent erosion of drains and damage to the private property.
- (iv) Significant reduction in flooding and water logging will result into corresponding reduction in health risks to the citizens and access related problems during rains.
- (v) This will also improve the visual quality and landscape character of the area.

5. The legal framework and principles adopted for addressing environmental issues in the proposed subproject have been guided by the existing legislation and policies of the Government of India, Government of Jammu and Kashmir, Asian Development Bank and the Revised Environmental Assessment and Review Framework (EARF)¹ adopted for the Tranche 2 of JKUSDIP.

¹ The EARF has been revised 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.

6. Indian laws and the ADB Safeguard Policy Statement (SPS) require that environmental impacts of development projects are identified and assessed as part of the planning and design process, and that action is taken to reduce those impacts to acceptable levels.

7. The subproject comprises of (i): construction of both side walls of Channi Himmat drain (length 1.19km); (ii) construction of reinforced cement concrete (RCC) drain with plane cement concrete (PCC) bedding for R1 and R2 drains (length 6.32km); (iii) construction of RCC box drain (length 0.33km); (iv) construction of PCC bedding (length 1.27km); (v) construction of six culverts and (vi) construction of online drain water treatment facility (capacity 20 MLD).

8. The subproject site is located in the built-up area of Jammu City, the winter capital of Jammu and Kashmir. It is situated at an average altitude of 312m² above mean sea level in the foothills of lower Shivaliks. The existing condition of drains in the area is a barrier to optimum development and growth of the area. The subproject site is not within or adjacent to environmentally sensitive areas such as cultural heritage site, protected area, wetland, buffer zone of a protected area and special area for protecting biodiversity. No water courses occur within the subproject corridor, however, the drains of the subproject area ultimately discharge into river Tawi.

9. The design of proposed subproject has taken into consideration the establishment of an efficient drainage system and preventing erosion of existing drains, substantial reduction of water logging and flooding in sub-project area and improvement of local environment to reduce health risks to the citizens. 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, temporary social impacts, due to access problems during subproject execution, are not avoidable as the residential and commercial establishments exist along the subproject corridor. Apart from this, the construction of waste water treatment facility based on Waste Stabilization Pond technology shall require acquisition of 10.5 ha of government land (in possession of Floriculture Department) at Indira Nagar (Bhor Camp). A total of 1164 non fruit bearing trees are present on this land, however, only 22 trees shall be required to be removed for construction of the proposed waste water treatment facility while as rest will remain intact. A Resettlement Plan has been developed in accordance with ADB SPS 2009 and Indian laws and regulations.

10. Anticipated impacts during the construction period include temporary disruption of services during realignment of existing utilities along the corridor; temporary closure of roads for construction of culverts; cutting of trees; interference with accesses to properties and businesses due to construction works; risk of accidents associated with vehicular traffic and transport of materials; increased volume of construction vehicles on the roads may lead to increased wear and tear of roads in the vicinity of the proposed site; and exposure to increased noise, dust, vibrations; hazardous chemicals (oils and lubricants) and waste materials. 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 proposed subproject, and ensure efficient lines of communication between the implementing agency, project management unit, and contractors. The EMP also

² Source: Central Ground Water Board (Ground Water Information Booklet Jammu District, Jammu & Kashmir).

provides a pro-active feasible and practical working tool to enable the measurement and monitoring performance on site.

11. Anticipated impacts during operation and maintenance include improvement in drainage system and healthy environment; the increased carrying capacity of the drains shall accommodate the storm water flow during rains; prevention of erosion of drains and damage to the private property; significant reduction in flooding and water logging in the subproject area; improvement of local environment to reduce health risks to the citizens; with rehabilitation of drains, the flooding and water logging prone areas can be put to their utmost possible use and improvement in the general environment and aesthetic character of the area by significantly reducing the flooding and water logging. In general, rehabilitation of the drainage system shall provide broader impetus for the redevelopment of the surrounding areas and the Jammu City as a whole.

12. 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. The IEE includes the activities undertaken during project design to engage the stakeholders; and planned information disclosure measures and process for carrying out consultation with affected people and facilitating their participation during project implementation.

13. The subproject's Grievance Redressal Mechanism provides 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.

14. Therefore, as per ADB SPS, the subproject is classified as environmental Category B and does not require further Environmental Impact Assessment. As per Indian laws, the proposed subproject does not require an Environmental Clearance.

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 and 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.

2. The program is to be implemented in 4 to 7 tranches over a period of 8 years. Each tranche constitutes a separate loan. Tranche I (Project-1) of JKUSDIP (Loan 2331-IND) is under implementation. One of the subprojects identified under Tranche 2 (project-2) of JKUSDIP is the Rehabilitation and Channelization of Storm Water Drains at Channi Himmat in Jammu City to improve drainage system in the area.

3. The major objectives of rehabilitation of drains in Channi Himmat area of Jammu City are: (i) establishment of an efficient drainage system and preventing erosion of existing drains; (ii) substantial reduction of water logging and flooding in sub-project area; (iii) improvement of local environment to reduce health risks to the citizens; and (iv) improved long-term drainage management in the Jammu City. The proposed subproject is expected to have the following benefits:

- (i) There will be substantial increase of discharge capacity of storm water drains in subproject area.
- (ii) By constructing/rehabilitating the secondary drains, the low lying areas in the subproject corridor can get rid of frequent flooding and water logging.
- (iii) Reconstructing and strengthening of side walls and improvement in bed of the drains will prevent erosion of drains and damage to the private property.
- (iv) Significant reduction in flooding and water logging will result into corresponding reduction in health risks to the citizens and access related problems during rains.
- (v) This will also improve the visual quality and landscape character of the area.

4. The legal framework and principles adopted for addressing environmental issues in the proposed subproject have been guided by the existing legislation and policies of the Government of India, Government of Jammu and Kashmir, Asian Development Bank and the Environmental Assessment Review Framework (EARF) adopted for Tranche 2 of JKUSDIP. ADB requires the consideration of environmental issues in all aspects of the Bank's operations, and the requirements for environmental assessment are described in ADB's Safeguard Policy Statement (SPS), 2009. According to the SPS, environmental assessment is required for all subprojects under a MFF modality.

5. An environmental assessment using ADB's Rapid Environmental Assessment (REA) Checklist for Sewage Treatment (**Appendix 1**) was conducted for the proposed rehabilitation and channelization of storm water drains at Channi Himmat in Jammu City. The subproject

comprises of (i): construction of reinforced cement concrete (RCC) for both side walls of Channi Himmat drain (length 1.19km); (ii) construction of RCC drain with plane cement concrete (PCC) bedding for drains R1 and R2 (length 6.32km); (iii) construction of RCC box drain (length 0.33km); (iv) Construction of PCC bedding (length 1.27km); (v) construction of six culverts and (vi) construction of online drain water treatment facility (capacity 20 million liter per day [MLD]). Results of the assessment show that the proposed development is unlikely to cause significant adverse impacts. Thus this Initial Environmental Examination (IEE) report has been prepared in accordance to ADB SPS's requirements for environment Category B projects.

6. The IEE has been prepared to meet the following objectives:

- (i) to provide critical facts, significant findings, and recommended actions;
- (ii) to present the national and local legal and institutional framework within which the environmental assessment has been carried out;
- (iii) to provide information on the existing geographic, ecological, social and temporal context including associated facilities within the subproject's area of influence;
- (iv) to assess the subproject's likely positive and negative direct and indirect impacts to physical, biological, socio-economic and physical cultural resources in the subproject's area of influence;
- (v) to identify mitigation measures and any residual negative impacts that cannot be mitigated;
- (vi) to describe the process undertaken during project design to engage stakeholders and the planned information disclosure measures and the process for carrying out consultation with affected people and facilitating their participation during project implementation;
- (vii) to describe the subproject's grievance redressal mechanism for resolving complaints about environmental performance;
- (viii) to present the set of mitigation measures to be undertaken to avoid, reduce, mitigate or compensate for adverse environmental impacts;
- (ix) to describe the monitoring measures and reporting procedures to ensure early detection of conditions that necessitate particular mitigation measures; and
- (x) to identify who is responsible for carrying out the mitigation and monitoring measures.

II. POLICY, LEGAL, AND ADMINISTRATIVE FRAMEWORK

1. ADB Policy

7. 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.

8. **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.

9. **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.

10. **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.

2. National and State Laws

11. 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.

12. **EIA Notification.** The GoI 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. Projects are categorized as A or B depending on the scale of the project and the nature of its impacts. Category A projects require Environmental Clearance from the National Ministry of Environment and Forests (MoEF). Category B projects require

environmental clearance from the State Environment Impact Assessment Authority (SEIAA). The proposed subproject is not listed in the EIA Notification of 2006 "Schedule of Projects Requiring Prior Environmental Clearance" thus EC is not required.

13. 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 Project having potential to generate sewage or trade effluent will come under the purview of this Act, its rules and amendments. Such projects have to obtain Consent to Establish (CTE) under Section 25/26 of the Act from State Pollution Control Board (SPCB) before starting implementation and Consent to Operate (CTO) before commissioning. The Water Act also requires the occupier of such subprojects to take measures for abating the possible pollution of receiving water bodies. The rehabilitation of drains is not included in the lists of activities requiring CTE and CTO under the Water Act. However, the establishment and operation of waste water treatment facility shall require CTE and CTO from SPCB. The consent to establish shall be obtained by J and K ERA through Urban Environmental Engineering Department (UEED) from SPCB prior to commencement of construction activities and CTO shall be obtained prior to commissioning of the waste water treatment facility. The treated effluent shall comply with standards notified by the Central Pollution Control Board.

14. Air (Prevention and Control of Pollution) Act of 1981, as amended. The subprojects having potential to emit air pollutants into the atmosphere have to obtain CTE under Section 21 of the Air (Prevention and Control of Pollution) Act of 1981 from SPCB before starting implementation and CTO before commissioning the project. 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. Emissions and discharges shall comply with standards notified by the Central Pollution Control Board.

15. The Noise Pollution (regulation and control) rules, 2000, as amended. Since the subproject corridor is located within the city, the construction activity and use of heavy machinery and vehicles may increase the ambient noise levels during the construction phase. It is considered necessary to regulate and control noise producing and generating sources with the objective of maintaining the ambient air quality standards in respect of noise. 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 the Noise Pollution (regulation and control) rules, 2000, as amended.

16. Ancient Monuments and Archaeological Sites and Remains Rules of 1959 and J and K Ancient Monuments Preservation (Amendment) Act of 2010. The Act and Rules designate the area within a radius of 100 meters (m) from the "protected property" as "prohibited area" and upto 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 location of the subproject site is beyond the prohibited and regulated areas.

17. **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.

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

19. **Building and Other Construction Workers (Regulation of Employment and Conditions of service) Act of 1996 and Rules 1998, as amended.** The Government of India has enacted this Act and is also applicable to the state of J and K. 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 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 to the provisions of this Act.

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

Table 1: Applicable Environmental Regulations

Applicability of Acts/Guidelines	Compliance Criteria
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 this is not covered either under Category A or Category B of the 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.
The Wildlife Conservation Act, 1972, as amended and J and K Wildlife (Protection) Act 1978, as amended, provide for protection and management of Protected Areas	Clearance from state and national wildlife boards, Central Empowered Committee of Hon'ble Supreme Court of India and the State Wildlife Department, as applicable. The wildlife protection act is not applicable to the proposed subproject.
Jammu and Kashmir Forest (Conservation) Act, 1997, as amended.	Clearance from Forest department for cutting of trees, if any. To be obtained by PIU prior to construction.
The Ancient Monuments and Archaeological Sites and Remains Act, 1958, and the rules, 1959 provide guidance for carrying out activities, including	Permission from the Archeological Survey of India for carrying out any construction activities within the prohibited and regulated areas of the ancient

Applicability of Acts/Guidelines	Compliance Criteria
conservation, construction and reuse in and around the protected monuments.	monuments and archeologically protected sites. The sub-project area does not fall within the prohibited/ regulated area or is situated close to any such site of archeological importance.
Water (Prevention and control of pollution) Act, 1974, as amended Air (prevention and control of pollution) Act, 1981, as amended and Noise Pollution (Regulation and Control) Rules, 2000, as amended.	Consent to establish (CTE) and Consent to operate (CTO) for waste water treatment facility from J and K SPCB. To be obtained by J&K ERA through Urban Environmental Engineering Department (UEED) prior to commencement of construction activities and prior to commissioning. Consent to Establish (CTE) and Consent to Operate (CTO) from the J and 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.
The Jammu And Kashmir Preservation of Specified Trees Act, 1969 and Rules of 1969, as amended.	Permission from Forest/ Revenue Department /Concerned Deputy Commissioner for cutting of scheduled trees. This act shall not be applicable as the cutting of scheduled trees is not envisaged.
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

III. DESCRIPTION OF THE PROJECT

A. Existing Condition

21. As per storm water drainage master plan, Jammu City is divided into five drainage zones. Zone-I and III are in west Jammu (right bank of river Tawi) whereas Zone-II, IV and V cover areas of east Jammu (left bank of river Tawi). Surface water run-off from these basins is collected in the various storm water drains and channels which ultimately discharge into the river Tawi.

22. 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. In addition to such primary drains, there are substantial lengths of secondary and tertiary drains/ deep drains. Following the master plan recommendations, part of drainage rehabilitation and improvement works have been taken up under ADB Loan 2151-IND by J and 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 – II of JKUSDIP.

23. Some of the existing primary, secondary and tertiary drains in Jammu City are choked up due to improper sections, slope etc. and improper maintenance. Most of the drains in Jammu are wide at upstream where habitation is less. But, as the drains move downstream, width of

drains gets reduced. This causes silt deposition in upstream areas and flooding in downstream areas.

24. Due to lack of proper secondary drains and unlined primary drainage channels, poor slope and poor bed condition of drains, etc, carrying capacities of primary drains are reduced, due to which several areas of Jammu City experience frequent flooding and water logging. This situation of flooding adversely impacts environmental condition, creates unhygienic living conditions to the citizens and increased health hazards. Existing condition of drains is a barrier to optimum development and growth of the area.

25. The drains of the subproject area also exhibit same problems thereby retarding the overall development potential of the area. The proposed subproject is for rehabilitation of main Channi Himmat drain falling in drainage zone 2 and secondary drains of Channi Himmat area falling in drainage zone 4 located on the East of Jammu City (on the left bank of river Tawi). The subproject also includes proposal for online treatment of drain water by providing suitable treatment arrangement. The subproject has a total catchments area of about 120 hectares and has a current beneficiary population of about 40,000.

26. Considering the existing deteriorated condition of the drains in subproject area and other associated problems, there is a stringent need for rehabilitation of the drainage system with enhanced discharge capacity. The BOD values (analyzed by J and K SPCB in 2010 and 2011) of drain water before outfall into river Tawi have been observed to be much less than the specified limits (i.e. 30 mg/l) and hence no treatment facility is required at present. However, the ADB review mission (October 2011) suggested that some treatment facility should be proposed for bringing down the BOD level which may increase in future with the growing population in the catchment of these drains. In view of this suggestion, waste water treatment facility has been conceptualized based on 'Waste Stabilization Pond Technology' at Indira Nagar (Bhor Camp) at a distance of about 10 km upstream of the outfall of the drain into river Tawi.

B. Proposed Subproject and Components

27. The sub-project area is located in the eastern part of Jammu City. The major objectives of rehabilitation and channelization of storm water drains in Channi Himmat area of Jammu City are:

- (i) establishment of an efficient drainage system and preventing erosion of existing drains;
- (ii) substantial reduction of water logging and flooding in sub-project area;
- (iii) improvement of local environment to reduce health risks to the citizens; and
- (iv) improved long-term drainage management in the Jammu City.

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

- (i) There will be substantial increase of discharge capacity of storm water drains in subproject area.
- (ii) By constructing/rehabilitating the secondary drains, the low lying areas in the subproject corridor can get rid of frequent flooding and water logging.

- (iii) Reconstructing and strengthening of side walls and improvement in bed of the drains will prevent erosion of drains and damage to the private property.
- (iv) Significant reduction in flooding and water logging will result into corresponding reduction in health risks to the citizens and access related problems during rains.
- (v) This will also improve the visual quality and landscape character of the area.

29. The survey and assessment undertaken during appraisal of the subproject indicates that Resettlement and Involuntary Resettlement (IR) impacts are minimal. Since, the subproject proposes to rehabilitate the existing drains, therefore sufficient government land within existing ROW is available throughout the length of these drains hence **“No acquisition of private land”** is required for rehabilitation of drains. However, acquisition of 10.5 ha of government land (in possession of Floriculture Department) with 1164 existing trees in this land shall be required for construction of waste water treatment facility at Indira Nagar (Bhor Camp). Out of 1164 trees, only 22 trees are required to be removed for construction of the waste water treatment facility.

30. The proposed subproject comprises of (i): construction of RCC walls for both side of Channi Himmat drain (length 1.19km); (ii) construction of RCC drain with PCC bedding for R1 and R2 drains (length 6.32km); (iii) construction of RCC box drain (length 0.33km); (iv) construction of PCC bedding (length 1.27km); (v) construction of six major culverts and (vi) construction of online drain water treatment facility (capacity 20 MLD).

31. **Table 2** shows the components of the subproject based on the present proposals which are expected to be substantially correct, although certain details may change as development of the subproject progresses.

Table 2: Description of the Proposed Storm water drainage subproject in Jammu City.

Component	Function	Description	Location
General	Conveyance of storm water in safe manner without causing any destruction in rainy season and dry-weather flow in other seasons with self cleansing velocity.	Lined Trapezoidal/ rectangular RCC section (both sides and bed) with cross slope.	Located in eastern part of Jammu City. Starts from by-pass road near Green Belt and discharges into Gangyal/ Digiya/ Ashram/ T4 drains.
RCC wall	To retain the side earth and prevent seepages, soil erosion and flooding.	Length 1190 m	For R3 drain
		Length 6300 m	For R1 and R2 drains
RCC/PCC Bed	To prevent scouring of the bed and provide self cleansing velocity.	Length 1272 m	For R3 drain
		Length 6487 m	For R1 and R2 drains
RCC box drain	Drain is to be covered with RCC slab for smooth plying of the traffic over the drain.	Length 0.335 km	In R3 drain from chainage 1440 - 1775
Culvert	For providing passage to the safe movement of the vehicular traffic and pedestrians.	Six major Box culverts	On Channi Himmat drain (R3)
20 MLD online water treatment facility	Treatment of waste water before outfall into river Tawi.	Pumping station and 24 waste stabilization ponds	Indira Nagar (Bhor Camp)

RCC= Reinforced Cement Concrete; PCC= Plain Cement Concrete

32. The design standards adopted under this subproject are from the Indian Manual of Sewerage published by ministry of Urban Development, Government of India. The same criteria

are followed by the Urban Environmental Engineering Department (UEED), the line department. Design criteria adopted has been agreed by UEED. The main design features are summarized in **Table 3** below.

Table 3: Design features of the subproject

Design features	Description
Total Length	Drain R1 = 3287m Drain R2 = 3201m Drain R3 = 1775m Total = 8263 m
Average design width	For Drain R1 = 0.80 m For Drain R2 = 0.60 m For Drain R3 = 2.75 m
Average design depth	Drain R1 = 0.60 m Drain R2 = 0.60m Drain R3 = 1.0 m
Average design discharge	Drain R1 = 1.75 cumec. Drain R2 = 1.25 cumec. Drain R3 = 3.25 cumec.
Online Drain Water Treatment facility	Waste water pumping station = 1 no. Waste stabilization ponds = 24 no. Dimension of each pond = 25m X 100m X 2.5m Effective depth of ponds = 1.5m
Sludge Management	The removal of completely digested sludge from the waste stabilization ponds shall be required once in five years and the same shall be used as manure.
Life Span	30 years

cumec= cubic meter per second

C. Implementation Schedule

33. The implementation schedule of all components of the subproject is given in **Table-4** below:

Table-4: Implementation schedule of the subproject

Procurement Activity	Tentative Time Schedule
Acceptance of the SAR	February 2012
Invitation for bids	April 2012
Contract award	September 2012
Commencement of contract	October 2012
Completion of contract	September 2014
Total number of months for construction	24

IV. DESCRIPTION OF THE ENVIRONMENT

A. Physical Resources

1. Administrative Boundaries

34. 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. 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.

35. 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 32° 36' to 32° 48' North latitudes and 74° 48' to 57° 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.

2. Topography, Drainage, and Natural Hazards

36. **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 (subproject corridor is situated in this area) and Second the old city on lower reaches of Shivalik having an altitude of 307 to 450 m above msl.

37. **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 2151-IND by J and 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 – II of JKUSDIP.

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

- Zone- I: This zone includes the areas like Pratap Garh, Shalamar, Karan market, Rehari, Krishna Nagar, Peekho, Rajindra Nagar, Christian Colony, Chand Nagar, Shiv Nagar, Shakti Nagar, Panjtirthi, etc. Major drains under this zone are Gandha nallah (length 3.2 km), Rehari nallah, Krishna Nagar nallah (length 3.5 km), Peekho 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 Panjtirthi nallah (length 1.5 km)

- 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).

- 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).

- 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).

- 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).

39. **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.

40. The state of Jammu & 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.

41. 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.

42. The earthquake zonation map of Jammu and Kashmir is given in **Figure-1** below:

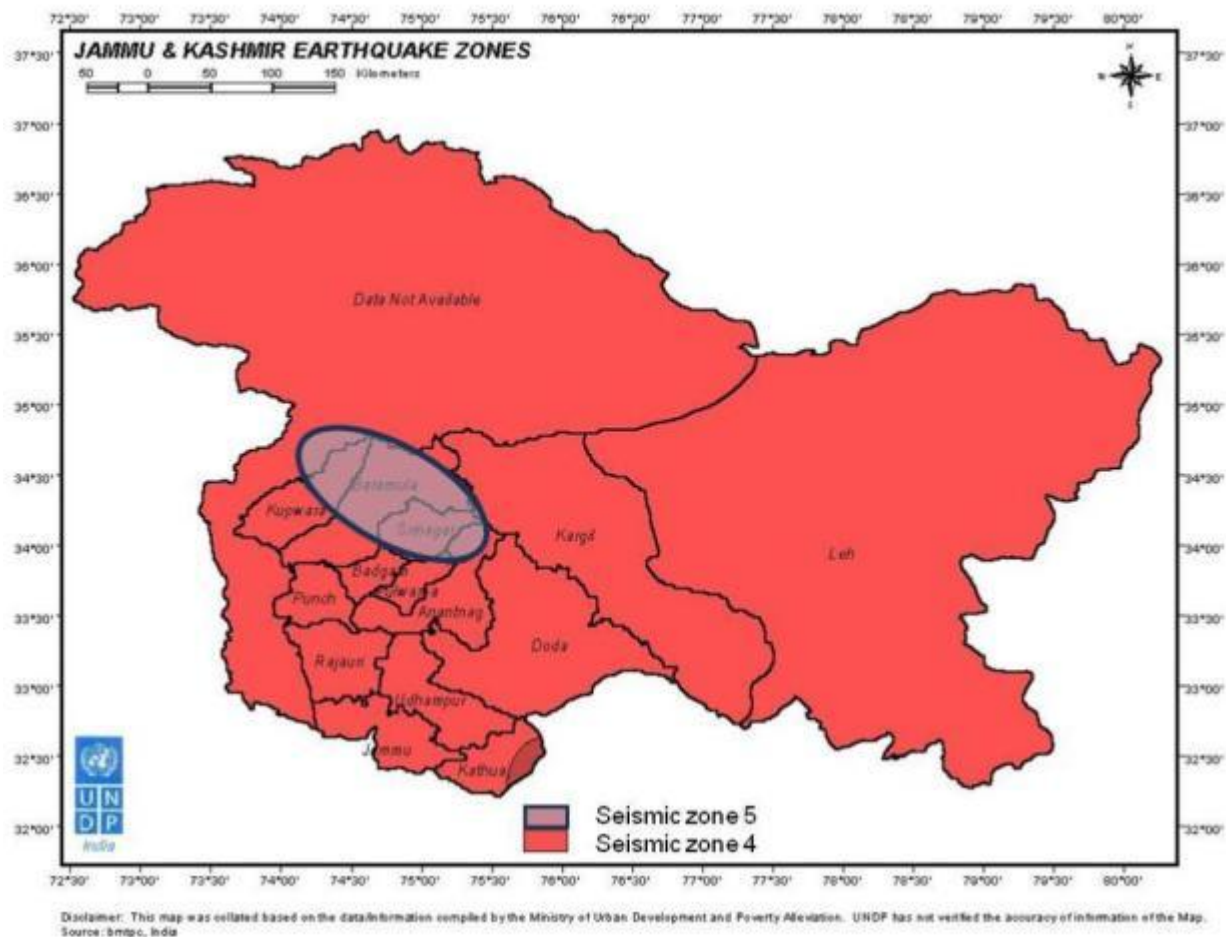


Figure-1: Jammu and Kashmir earthquake zones.

43. **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.

44. However, in the subproject area, flooding is usually observed during rains in the low lying areas which is mainly due to inadequate discharge capacity of the drains coupled with other reasons like damaged side walls and bed, choking of drains due to silt and solid waste. Flooding and water logging in low lying areas in the subproject corridor causes access problems, damage to property of the residents and also increases the risks to health of citizens.

45. As per storm water drainage master plan, Jammu city is divided into five drainage zones. In order to make the drainage more efficient, different drainage projects in Jammu city were undertaken under Multi Sector Project for Infrastructure Rehabilitation in J and K (Loan 2151-IND) and rehabilitation of drainage in some more areas has been proposed under tranche-2 of JKUSDIP.

3. Geology, Geomorphology and Soils

46. **Geology and Geomorphology.** The Geology of the territories of Jammu, Kashmir and Ladakh have been divided into three different structural Zones:

- The Panjal
- The Zaskar
- The Tertiary Groups

47. 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.

48. Jammu borders Kashmir to the north, Ladakh to the east and Himachal Pradesh and Punjab to the south. In the west, it borders the Pakistan. Sandwiched between the Vale of Kashmir to the north and the Daman Koh Plains to the south, the Shivalik Range comprises most of the region of Jammu. The Pir Panjal Range, the Trikuta Hills and the low-lying Tawi River basin add beauty and diversity to the terrain of Jammu. The Pir Panjal range separates Jammu from the Kashmir valley.

49. District Jammu falls in sub-mountainous region at the foothills of the Himalayas. Shivalik range rises gradually in the northern part of the district and merges with the Indo-Gangetic plains in the south. 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 rain-fed. The area south of these roads is largely fed by canal and tube wells for irrigation purposes and is relatively more prosperous.

50. The *Kandi* tract has got steep topographic slopes ranging between 1:90 and 1:120. General altitude of the *Kandi* ranges between 320 to 400 m above the mean sea level. Water levels are deep, resulting into very less number of ground water structures i.e. dug wells and tube wells. The *Kandi* imperceptibly merges with the *Sirowal* southwards. The *Sirowal* tract occupies the southern plainest tract of the district. Topographic gradient is reduced and becomes very gentle i.e. 1:250 to 1:300.

51. 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 Sub-Recent times, laid down by the present day streams the area.

1. 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 Siwalik Hills.

2. 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.

52. 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

53. **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.

4. Climate

54. 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.

55. **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: <http://www.jammu.nic.in/district/aboutjammu.asp>).

56. **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 mm³. The rainfall data for district Jammu for five years (from 2006 to 2010) is presented in the **Table-6**.

Table-6: Rainfall data of district Jammu (month's total rainfall in mm).

Year	Jan.	Feb.	March	April	May	June	July	August	Sept.	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

Source: Hydromet Division, India Meteorological Department

5. Air Quality

57. 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 (PM₁₀), SO₂ and NO₂ was measured at specified sites and the results are presented in **Table-7** below. The data was collected during the month of November, 2010 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

S.No.	Site /Location	Site Type	Parameters		
			RSPM (PM ₁₀) ⁴ (µg/m ³)	SO ₂ (µg/m ³)	NO ₂ (µg/m ³)
1	Jodhamal Public School (play ground site)	Institutional	89.79	13.82	26.38
2	Channi Himmat below Ritz menor	Commercial / Residential	65.68	15.10	34.34
3	Channi Rama near Bathindi morh	Residential	103.26	17.15	47.82

³ Source: Central Ground Water Board - Ground water information booklet, Jammu district.

⁴ PM_{2.5} will be provided later as the equipment to measure PM_{2.5} 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.

4.	Trikuta Nagar near Jai Durga mandir	Residential	108.69	15.91	32.35
	NAAQ Standards⁵		PM₁₀ = 100	80	80

NAAQS= National ambient air quality standards of Government of India; NO₂= Nitrogen dioxide; PM₁₀= Particulate matter below 10µ particle size; RSPM= Respirable suspended particulate matter; SO₂= Sulphur dioxide

58. The result of the tests concludes that the values obtained for NO₂ and SO₂ are within the permissible limits at all the sites, however, at two spots the values for RSPM are above the NAAQ standard set by the CPCB India. The primary reason for this is the heavy traffic plying in the vicinity of all the selected sites.

59. 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 PM₁₀ and PM_{2.5}. The air quality monitoring equipment presently available with J and K ERA can measure the total particulate matter below 10µ particle size (i.e. PM₁₀). However, separate values for PM_{2.5} cannot be determined. The requisite equipment shall be procured by ERA for measurement of PM_{2.5} 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.

6. Ambient noise levels

60. The subproject sections pass through built-up area with residential, commercial and institutional establishments and significant volume of traffic pass through these sections. Heavy traffic movement in the sub-project 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 - 8**. The noise levels were monitored during day time in November 2010 by the Environmental Monitoring Laboratory of J&K ERA.

Table -8: Ambient noise quality data at various locations

S.No.	Site/ Location	Site type	Day time noise levels dB(A) L _{eq}	Noise quality standards ⁶ (dB(A) L _{eq})
1.	Jodhamal Public school	Silence zone	56.2	50
2.	Channi Himmat below Ritz menor	Commercial	63.8	65
3.	Channi Rama near Bathindi morh	Residential	68.2	55
4.	Trikuta nagar near Jai Durga mandir	Residential	63.7	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.

⁵ 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 16th September 2009.

⁶ 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.

61. 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 three spots during day time are higher than the permissible standards. This may be attributed to the heavy traffic movement in the area.

62. Execution of the proposed sub-project 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.

7. Water Resources

i. Surface Water

63. During rains, the storm water flows through the existing drains and discharge into Balol nallah (drain) which finally discharges 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.

64. The final discharge of the drains of subproject area is in river Tawi. In order to assess the impact of drain water on water quality of river Tawi, the water quality analysis was carried out to ascertain the level of contamination, especially the organic load (Biochemical Oxygen Demand). The water quality analysis was got done through State Pollution Control Board (SPCB) in the months of August, October and December 2010 and the results of same are presented in the **Table –9**.

Table-9: Water quality data of Balol drain and river Tawi conducted by SPCB in 2010

S. No.	Name of site	Sampling date	pH	TDS (mg/l)	Turbidity (NTU)	DO (mg/l)	COD (mg/l)	BOD (mg/l)
1.	River Tawi 500m upstream of outfall of Balol drain	31.08. 2010	8.70	150	525	6.0	11.2	2.0
		05.10. 2010	8.95	160	5.0	7.2	12.0	1.5
		22.12. 2010	9.25	160	5.0	16.0	5.8	2.4
2.	River Tawi 500m down-stream of outfall of Balol drain	31.08. 2010	8.20	200	856	5.2	14.84	2.05
		05.10. 2010	8.50	230	52	6.2	17.0	2.8
		22.12. 2010	7.65	300	12.0	8.3	8.0	3.0
3.	Balol drain before its outfall into river Tawi	31.08. 2010	7.95	220	520	5.8	77	24.0
		05.10. 2010	8.20	410	156	3.1	21.0	5.2
		22.12. 2010	7.40	350	14.0	6.1	5.0	2.5

BOD= Biochemical Oxygen Demand; COD= Chemical Oxygen Demand; DO= Dissolved Oxygen; COD= Chemical Oxygen Demand; NTU= Nephalo Turbidity Unit; TDS =Total Dissolved Solids.

65. The water quality analysis was again carried out for drains of the area and river Tawi through the Jammu and Kashmir State Pollution Control Board in June 2011. The results of this sampling are given in **Table -10** below:

Table -10: Water quality data of drains and river Tawi conducted by SPCB in 2011

S. No.	Parameter	S-01	S-02	S-03	S-04	S-05	S-06	S-07	S-08	S-09	S-10
	Date of Sampling	24-06-11	24-06-11	24-06-11	23-06-11	23-06-11	23-06-11	23-06-11	23-06-11	23-06-11	24-06-2011
1.	Temperature (°C)	32.2	30.3	30.1	33	33	33	29.80	33	29.8	29.6
2	Dissolved Oxygen (mg/l)	BDL	BDL	BDL	11.7	BDL	2.1	5.7	4.5	5.2	BDL
3.	pH	7.90	7.65	7.50	8.30	7.60	7.62	7.91	7.6	7.89	7.7
4.	Conductivity	863	929	976	363.0	1053	663	247	465	455	683
5.	BOD (mg/l)	58	43	41	4.1	47	14	6.5	7.8	8.3	56
6.	Nitrate-N(mg/l)	0.7	0.5	0.20	0.37	1.24	0.37	0.62	0.76	0.69	0.5
7.	Nitrite-N (mg/l)	0.21	0.17	0.13	0.163	0.10	0.192	0.429	0.434	0.306	0.07
8.	Turbidity (NTU)	20	37	65	45	47	47	97	4.5	139	32
9.	TDS (mg/l)	620	650	620	250	750	470	160	310	300	470
10	Ammonia-N	4.37	15.40	15.4	0.707	15.48	3.46	1.15	2.37	3.07	4.8
11	Phosphate- P (mg/l)	1.09	0.80	3.7	0.133	3.75	0.160	0.168	0.569	0.546	1.2
12	COD (mg/l)	154	161	115	14	100	54	22	26	37	106
13	Total Alkalinity(mg/l)	480	440	440	196	408	312	172	240	240	260
14	Hardness as CaCO ₃ (mg/l)	326	334	314	146	370	244	96	170	166	166
15	Calcium as CaCO ₃ (mg/l)	126	106	60	110	130	84	80	70	120	90
16	Magnesium as MgCO ₃ (mg/l)	206	228	254	36	240	160	16	100	46	76
17	Chloride (mg/l)	55	59	68.5	22.50	98.5	52.5	15.5	26.5	32	47.5
18	Sulphate (mg/l)	82.7	26.90	92.8	32.53	134.47	49.84	34.64	14.62	27.54	89.3

BDL= Below Detection Limit

Source: J&K State Pollution Control Board

Site codes:**S-01** – Gangyal drain, 100m upstream of its confluence with Ashram and Digiana drain.**S-02** – Ashram drain 100m before its confluence with Digiana drain.**S-03** – Digiana drain, 100m before its confluence with Ashram drain.**S-04** – Balol drain, 300m upstream of outfall of Gangyal drain.**S-05** – Gangyal drain, 100m upstream of its outfall into Balol drain.**S-06** – Balol drain, 300m downstream after the outfall of Gangyal drain.**S-07** – River Tawi, 500m upstream before the outfall of Balol drain.**S-08** – River Tawi, 500m downstream after the outfall of Balol drain.**S-09** – Balol drain, 100m upstream before its outfall into river Tawi**S-10** – Channi Himmat drain in front of Railway Crossing66. The site map of sampling locations is given in **Figure-2**.

67. The road side drains i.e. R1 (left and right hand side) and R2 (left and right hand side) have very small water flow and these ultimately discharge into Ashram, Digiana and Gangyal drains. Due to this reason, the water quality of Ashram, Digiana and Gangyal drains has been taken up to establish the baseline scenario in the project area.

68. The water quality analysis results show that the values of BOD are high in the individual drains (Ashram, Digiana and Gangyal drains) before their confluence with Balol drain. Balol

drain itself shows high BOD value before the outfall of Gangyal drain (formed after the confluence of Ashram, Digiana and Gangyal drains) into it, which further raises its BOD value.

69. However, Balol drain after outfall of Gangyal drain, travels a distance of about 10 km before its outfall into river Tawi, which serves as revival zone and reduces the organic load of the drain water by enrichment of dissolved oxygen. Ultimately, before the outfall of Balol into river Tawi the BOD value gets sufficiently reduced to the levels which are within permissible limits.

70. These results reveal that the BOD values for Balol drain before its outfall into river Tawi are within permissible limit (i.e. 30mg/l) prescribed for discharge into inland surface water bodies, therefore, as of now, there is no requirement for water treatment measures. However, a proposal for online treatment of drain water by providing suitable treatment arrangement has been included in the subproject.

71. The sediment quality of drains, from the contamination of heavy metals point of view, has also been assessed. The analysis of sediment was taken up through National Accreditation Board for Testing and Calibration Laboratories (NABL) accredited laboratory at Noida. The analysis results of sediment samples are given in **Table -11** below:

Table -11: Test results of sediment samples of the drains

S. No.	Parameter	SD-01	SD-02	SD-03	SD-04	Standard as per Hazardous waste Management, Handling and Transboundary Movement Rules 2008 (mg/kg)
1	Arsenic (as As) in mg/kg	ND	ND	ND	ND	50.0**
2	Cadmium (as Cd) in mg/kg	ND	ND	ND	ND	50.0**
3	Chromium (as Cr) in mg/kg	1.9	5.4	5.3	12.9	50.0**
4	Copper (as Cu) in mg/kg	5.4	5.3	17.5	36.7	5000.0*
5	Lead (as Pb) in mg/kg	3.6	3.4	10.2	40.6	5000.0*
6	Mercury (as Hg) in mg/kg	ND	ND	ND	ND	50.0**
7	Molybdenum (as Mo) in mg/kg	ND	ND	ND	ND	5000.0*
8	Nickel (as Ni) in mg/kg	7.2	6.8	8.3	15.5	5000.0*
9	Selenium (as Se) in mg/kg	ND	ND	ND	ND	50.0 **
10	Zinc (as Zn) in mg/kg	10.0	17.8	40.7	149.7	20000.0***
11	Potassium in mg/kg	10.6	12.5	10.0	46.9	--
12	Phosphate in mg/kg	0.4	0.5	0.548	1.9	20000.0***
13	Total Kjeldahl Nitrogen (in %)	0.13	0.1	0.035	0.34	50000.0****

ND= Not Detected, All concentrations are in mg/kg except Total Kjeldahl Nitrogen, which is in %.

Source: AES Laboratory, Noida (NABL accredited laboratory)

*Standard as per "Hazardous waste Management, Handling and Transboundary Movement Rules 2008, Schedule – II, Class B.

** Standard as per Hazardous waste Management, Handling and Transboundary Movement Rules 2008, Schedule – II, Class A.

*** Standard as per Hazardous waste Management, Handling and Transboundary Movement Rules 2008, Schedule – II, Class C.

**** Standard as per Hazardous waste Management, Handling and Transboundary Movement Rules 2008, Schedule – II, Class D.

Site codes:

SD-01 – Sainik Colony drain before NH-1 (This drain has been dropped from the present proposal).

SD-02 – R2 drain composite sample of left hand side (LHS) and right hand side (RHS).

SD-03 – R1 drain composite sample of left hand side (LHS) and right hand side (RHS).

SD-04 – Channi Himmat drain before its outfall.

72. The sampling locations have been shown in **Figure-2**. On comparison of the sediment test results with the standards specified under Hazardous waste Management, Handling and Transboundary Movement Rules 2008, it is evident that the concentration levels of all the parameters are much below the limits for disposal on land. Therefore, there is no requirement of any special mitigation measures. However, in order to avoid occupational health risks, if any, to the workers, necessary mitigation measures during construction phase shall be implemented as under:

- **Excavation:** Drainage sediments will be removed mechanically by excavator. Then it will be stockpiled near the drain for atleast 1 to 2 days for partial drying to ease transportation and avoid unnecessary spillage along transportation route.
- **Collection:** After this, the sediment will be loaded on tipper truck by pay loader or manually (particularly at narrow area where equipment movement is not possible). During transfer of sediment, workers should use personal protective equipments like hand gloves, gumboots, nasal mask, etc. to avoid direct contact with the sediments.
- **Disposal:** Since, level of heavy metals in drainage sediment is much less than the standards specified under Hazardous waste Management, Handling and Transboundary Movement Rules 2008 the sludge can be utilized for filling up low lying area and away from water bodies. There is no need for disposal of sediment in specially designated hazardous waste disposal site.

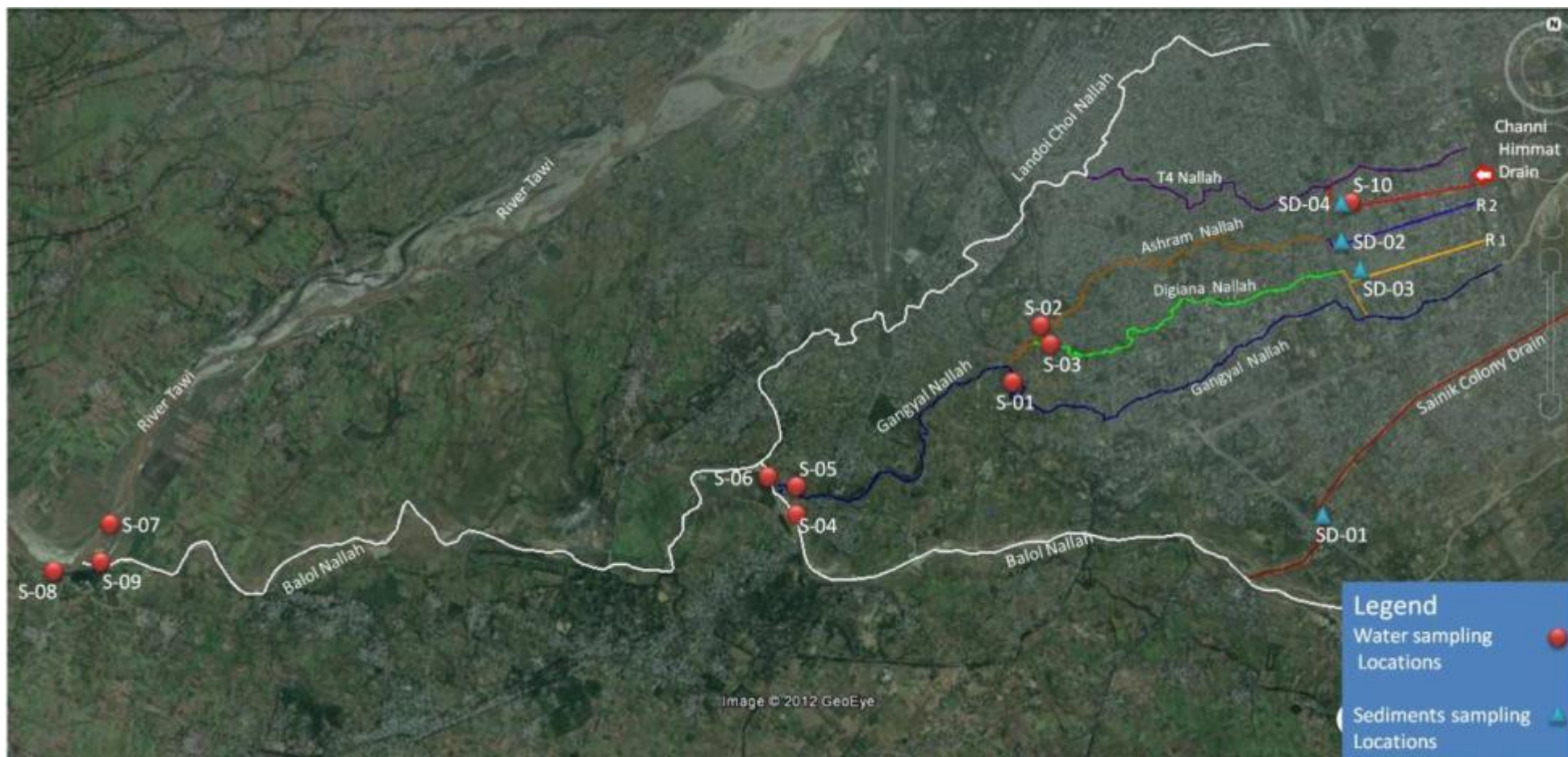


Figure-2: Water and sediment sampling locations

ii. **Geohydrology and Groundwater**

73. 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 where the subproject area lies) 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.

74. Public water supply is the major source of potable water for the settlements throughout the project area. Execution of proposed subproject is not expected to have any impact on the ground water resources of the area.

B. Ecological Resources

75. **Terrestrial Ecology and Biodiversity.** Since, the subproject stretch is located within built-up area of Jammu City, no sensitive ecological areas are located along the subproject corridor.

76. **Forest Areas and Trees.** The subproject is located within Jammu City and there is no forest within or adjacent to the subproject corridor. However, a total of 15 private trees (2 fruit bearing and 13 non-fruit bearing) are required to be removed for rehabilitation of the drains. The cost for cutting of fruit bearing trees has been evaluated by the Horticulture Department whereas the cost for cutting of non fruit bearing trees has been evaluated by the forest department. Apart from this, the construction of waste water treatment facility at Indira Nagar (Bhor Camp) shall require removal of 22 non fruit bearing trees. All possible efforts shall be made to avoid unnecessary cutting of these trees.

77. The cutting of non-forestry trees does not require replantation, however, compensatory afforestation at the rate of 1:2 (i.e. planting two trees for each tree cut) shall be carried out after completion of the proposed subproject by any concerned state department (like social forestry/ horticulture/ floriculture). The trees identified for cutting in the subproject corridor do not belong to any of the threat categories as specified by IUCN (International Union for Conservation of Nature and Natural Resources) and BSI (Botanical Survey of India).

78. **Wild fauna.** No wild animals are reported in and around the subproject corridor as the same is located in the city area and there is no forest close to the subproject site.

79. **Rare or Endangered Species.** No rare or endangered animal or plant species are reported in the subproject impact zone. The trees which are required to be removed for execution of the subproject are not endangered.

80. **Protected Area.** There is no protected area within or in close vicinity of the subproject corridor. The outer boundary fencing of Ramnagar wildlife sanctuary is located more than 7 km away from the periphery of the proposed subproject. The area falling between the wildlife sanctuary and the outer periphery of the proposed subproject constitutes of Jammu City which is a fully urban area.

81. **Fisheries.** The aquatic biology of river Tawi comprises of phytoplanktons (eg. *Diatoma elongatum*, *Pediustrum duplex*, *Tetraedron minimum*, *Nitzschia palea*, *Gomphonema gracile*, *Gomphonema constrictum*, *Navicula cupsidata*, *Cymbella tumida*, *Pediastrum tetras*, *Oedogonium vulgare*, *Ocsillatoria curviceps*, *Anabaena spiroides*.etc.), zooplanktons (*Polyartha vulgaris*, *Cyclops ladakanus*, etc), and benthos (*Chironmus* 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 conchoni*, *Puntius ticto*, *Puntius sophore*, *Oreochromis mossambicus*, *Channa punctatus*, *Channa gachua*, *Channa orientalis*, *Heteropneustes fossilis*, *Clarias batarachus*, etc. No fishing activity has been observed in river Tawi which is the ultimate receiving water body of all the storm water drains of the subproject area. Further, no impact of the proposed subproject is anticipated on the aquatic ecology of river Tawi.

C. Economic Development

82. 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.

83. 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.

84. 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.

85. 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.

86. **Land use Pattern.** Jammu is known as a city of temples and is the summer capital of Jammu and Kashmir state. The proposed landuse distribution of Jammu City as per the master Plan (2001-2021) is given in the **Table –12** below.

Table –12: 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
	Total Developed area (ha)	28,792	100

Source: Jammu Master Plan 2001 -2021

87. 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.

88. The survey and assessment undertaken during appraisal of the subproject indicates that Resettlement and Involuntary Resettlement (IR) impacts are minimal. Since the subproject proposes to rehabilitate the existing drains therefore sufficient government land within existing ROW is available throughout the length of these drains hence **“No acquisition of private Land”** is required. All IR impacts are temporary in nature. Negative impacts in the subproject are on a total of 46 affected persons/shops who will have impact in terms of temporary loss of access during the construction while as 01 affected person (Encroacher) will lose 01 guard room, 13 non-fruit bearing trees and 02 fruit-bearing trees on the existing ROW. Out of 46 affected persons suffering access disruption 05 will have impact on the staircases constructed over the drain also; however this will not have any impact on their main commercial structure. However, for proposed waste water treatment facility, 10.5 ha of government land in possession of Floriculture Department will be required. Thus, execution of the subproject shall involve conversion of 10.5 ha of presently open government land into public utility landuse.

89. **Commercial Activities.** The subproject area is located in Jammu City and 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 this area.

90. Detailed design data shows that the available ROW is sufficient for the proposed rehabilitation. The improvement works will be carried out within the ROW of drains and also in road shoulders particularly in the side through which the present drainage line passes through. The maximum required width, on an average, during the construction of different categories of drains (primary, secondary and tertiary) is 3m. However, to accommodate the construction space in case of R2 and R3 drain at certain locations some business activities may be temporarily affected due to disruption in access. In these chainages temporary impact in terms of potential access loss to some commercial establishments/shops has been found during transact walk. Two categories of likely temporary impacts have been found during the transact walk. Those are: 1] Temporary disruption of business during civil construction work due to

temporary blocking of access and working space; and 2] Demolition of stair cases of shops on encroached portion of the drain and temporary blocking of access. There are no other encroachers or squatters or kiosks who were found during the transact walk or through the engineering survey who are occupying or utilizing the ROW for business or residential purposes. An estimated 30 affected persons (shops/business establishments) from R2 drain and 16 affected persons (shops/business establishments) from R3 drain shall be temporarily impacted in terms of disruption in access due to the proposed improvements. No temporary impact in case of R1 drain has been found.

91. Potential temporary impacts of access disruption for all these shops/commercial establishments can be mitigated through good construction practices which will be the responsibility of construction contractors. Measures are identified which include: (i) providing walkways and metal sheets to maintain access across trenches, (iii) increasing the workforce in front of shops/commercial establishments, (iv) consulting business and institutions regarding operating hours and factoring this in work schedules, (v) providing advance information on works to be undertaken including appropriate signages etc. The project contractor will ensure that there is provision of alternate access during the construction so that there is no closure of these shops or any loss of clientage. A format titled **“Confirmation from Operator of Commercial establishment/shop for provision of temporary Access by Contactor”** has been developed which is also part of Environmental Management Plan and as per which it would be responsibility of contractor to provide alternate access to the shops/commercial establishments to the satisfaction of the person affected. The format is appended as **Appendix-1 to EMP**.

92. In case, the loss of access to the shops during the construction is not effectively mitigated by provision of alternate access by project contractors same may cause temporary loss of income during the construction for which provision for livelihood allowances have been made in the resettlement plan. There could be temporary disruption of business for certain number of days for which affected persons will be provided assistance for this transitional period on a case-to-case basis as per the provisions of the Entitlement Matrix in agreed resettlement framework. A lump sum budgetary provision has been kept in the Resettlement plan for same. The payment of assistance will be made for days of closure, and will be subject to the production of requisite documents⁷ in support of the claim. Cash assistance will be released after proper verification of documents.

93. A detailed Resettlement Plan has been prepared for rehabilitation and resettlement of parties affected by execution of proposed subproject.

94. The proposed rehabilitation of existing storm water drains will provide better drainage facilities to various areas and shall also improve the environmental and aesthetic conditions in Jammu City.

95. **Industrial Development.** In Jammu district a number of industrial areas are being developed. The information available with the Jammu and Kashmir Industries Department

⁷ Income certificate or income tax return certificate or any other document proving their income from affected commercial establishment.

regarding various industrial areas is given in **Table-13**. The majority of industries in Jammu district are small-scale units. The dominant units belong to general engineering, food-stuff, textiles, etc. However, such units have not been recorded in the immediate vicinity of the subproject corridor.

Table-13: Industrial areas in Jammu district with number of units and land area.

S. No.	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 m²

Source: Official website of Jand K Industries Department.

96. **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.

97. **Infrastructure Facilities.** Since, the subproject is situated in the heart of Jammu City. The infrastructure facilities like schools, hospitals, colleges, drinking water supply system, electricity and communication in the subproject area are satisfactory.

98. 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.

99. **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. 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 Tawi river. Due to limited availability of surface water from river Tawi, remaining requirement of drinking water is met from the ground water sources (tube wells). Ground water is main source for extended parts of Jammu City and part of the city areas located at higher elevations. Independent, isolated small water supply systems have been developed from time to time for these areas, which includes local productions (tube wells), storages (overhead tanks) and distribution networks.

100. 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 areas on left bank of river Tawi (Jammu East) and zone 7

comprises of industrial township of Bari Brahmana. Each zone is further divided into sub-zones and each sub-zone is further divided into sub-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, overhead tanks and independent distribution network. Various water supply improvement works (production, storage and distribution) have been undertaken under Multisector project for Infrastructure Rehabilitation in J and K (ADB Loan 2151-IND) and the remaining are proposed to be undertaken in future loans under JKUSDIP.

101. **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 capacity (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.

102. **Drainage.** As per storm water drainage master plan, Jammu City is divided into five drainage zones. Zone-I and III are in west Jammu (right bank of river Tawi) whereas Zone-II, IV and V cover areas of east Jammu (left bank of river Tawi). Surface water run-off from these basins is collected in the various storm water drains and channels which ultimately discharge into the river Tawi. The drainage zones of Jammu City are depicted in **Figure-3**. The map of major drains and drainage zones of Jammu City is given in **Appendix - 3**.

103. The details of the drainage zones are as below:

- 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, Panjtirthi, 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 Panjtirthi nallah (length 1.5 km).
- 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).
- 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).

- 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).

- 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 and Tributaries (12 km), Pati Khad and Tributaries (8 km), Tarore Khad (6 km), Kalk nallah and Tributaries (7 km) and Devika nallah and Tributaries (5 km).

104. 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. In addition to such primary drains, there are substantial lengths of secondary and tertiary drains/ deep drains. Following the master plan recommendations, part of drainage rehabilitation and improvement works have been taken up under ADB Loan 2151-IND by J and K Economic Reconstruction Agency (ERA) and by the UEED under their ongoing schemes. Some of the remaining drainage works are proposed under Tranche – II of JKUSDIP.

105. Some of the existing primary, secondary and tertiary drains in Jammu City are choked up due to improper sections, slope etc. and improper maintenance. Most of the drains in Jammu are wide at upstream where habitation is less. But, as the drains move downstream, width of drains gets reduced. This causes silt deposition in upstream areas and flooding in downstream areas.

106. Due to lack of proper secondary drains and unlined primary drainage channels, poor slope and poor bed condition of drains, etc, carrying capacities of primary drains are reduced, due to which several areas of Jammu City experience frequent flooding and water logging. This situation of flooding adversely impacts environmental condition, creates unhygienic living conditions to the citizens and increased health hazards.

107. The proposed subproject is for rehabilitation of main Channi Himmat drain falling in drainage zone 2 and secondary drains of Channi Himmat area falling in drainage zone 4 located on the East of Jammu City (on the left bank of river Tawi). The subproject also includes proposal for online treatment of drain water by providing suitable treatment arrangement keeping in view any future requirements. The subproject has a total catchments area of about 120 hectares and has a current beneficiary population of about 40,000 .

108. The subproject area includes

Channi Himmat main drain (R3)

Secondary Drains of Channi Himmat sector 3 and main road (R2)

Secondary Drains of Channi Himmat sector 4, 5, 6 (R1)

109. The sub-project area is situated at a relatively flatter terrain and includes Channi Himmat drain and secondary drains of Channi Himmat area. The total duration of water logging in these

areas is about 30 hrs / year⁸ during rainy days. Moreover water logging in low lying area such as sector 3 and 4 of Channi Himmat is upto 2-3 hours⁹ during each heavy rain.

110. All drains of Zone 2 and 4 (Jammu East) discharge into Balol drain which ultimately discharges into River Tawi. Dry weather effluent quality analysis of drains was conducted in order to ascertain the level of contaminants (mainly organic load) at the outfall of the major drains and Balol drain. Though, the BOD value of dry weather effluent at the ultimate discharge point in River Tawi is within the permissible limit of 30 mg/l as per Government of India standards, yet the provision for online treatment process has been made under this subproject which will take care of dry weather flow of all drains which are proposed to be rehabilitated under two sub-projects of Tranche - II of JKUSDIP.

111. The total catchment area considered for drainage under the subproject is about 120 hectares of Channi Himmat area. The existing land use showing built-up area in each category, coefficient of runoff and average runoff quantity is shown in **Table -14**.

Table -14: Land use, built up area, average runoff of Subproject area

Land use	Total built up area (hectares)	Coefficient of runoff	Average rainfall (mm/hr)	Average runoff (cumec)
Apartment dwelling areas	21	0.65 - 0.7	42	1.89
Downtown areas	1	0.9	42	0.13
Hilly/forest/open area steep slope	32	0.35	42	1.47
Industrial	1	0.5	42	0.11
Multi unit detached	5	0.6-0.7	42	0.15
Neighborhood areas	3	0.7	42	0.38
Park, cemeteries, woodlands	3	0.25	42	0.12
Play grounds, open areas	13	0.35	42	0.66
Single family areas	24	0.5	42	1.56
Streets	17	0.9	42	1.97
Total	120			8.44

Cumec = cubic meter per second

112. **Calculation of runoff quantity.** Runoff has been calculated based upon the catchment area, rainfall intensity, and coefficient of runoff by using rational method which is widely used. Catchment area is calculated from the contour map for each drain based on demarcation of catchment boundary. Rainfall intensity is calculated from the analysis of rainfall data given by Indian Meteorological Department of State for the Jammu City. Weighted coefficient of runoff is calculated from the land use map of Jammu City. Based on the above parameters, the average and critical runoff for various areas of subproject area has been calculated and given in **Table - 15**.

⁸ Source: Public consultation with people living in the water logging areas

⁹ Source: Public consultation with people living in the water logging areas

Table -15: Area wise estimated runoff quantity

	Name of drain/location	Drainage zone	Catchment area	Average rainfall	Critical rainfall	Weighted coefficient of runoff	Average runoff	Critical runoff
			hectare	mm/hr	mm/hr	(C)	Cumec	Cumec
1	Channi Himmat main drain (R3)	2	60	42	56	0.62	4.34	5.79
2	Channi Himmat sector 3 and main road drain (R2)	4	40	42	56	0.62	2.89	3.86
3	Channi Himmat sector 4, 5, 6 drain (R1)	4	20	42	56	0.62	1.45	1.93
	Total		120				8.68	11.58

113. **Water logging period / Inundation period.** During the rainy season, due to poor drainage and lack of secondary drainage system, lower stretches of the subproject area experience frequent flooding and water logging. The main affected areas are sector 3 and 4 of Channi Himmat. **A case study** given in **Table-16** shows calculation for the water logged area of Channi Himmat drain R2 before and after rehabilitation.

Table -16: Water logging / Inundation period for the area of Channi Himmat drain R2, before and after rehabilitation

S. No.	Description	Value
Existing condition		
1.	Area (in ha)	40
2.	Coefficient of runoff	0.62
3.	Average rainfall, mm/hr.	42
4.	Average runoff, cum/hr.	10416
5.	Peak rainfall, mm/hr.	56
6.	Peak runoff, cum/hr	13888
7.	Avg. quantity of runoff*, cum	3124.80
8.	Peak quantity of runoff*, cum	4166.40
9.	Width of drain. 0.6 m on each side of road	1.20
10.	Depth of drain, m.	0.60
11.	Velocity, m/sec	0.6
12.	Current discharge capacity, cum/sec	0.432
13.	Water logging time, hrs	9644 sec. or 2.7 hr**
Proposed drain		
15	Width , 1.25m on each side of road	2.50
16	Depth , m	1.0
17	Velocity , m/sec	1.25
18	Discharge capacity after rehabilitation , cum/sec	3.125
19	Water logging time, hr	1333.25 sec or 0.37 hr

* Duration of rainfall is considered as 18 minutes as per CPHEEO manual on sewerage.

** During public consultation, it was told that the water logging time of big rains could be 2-3 hours;

114. Based on above calculations, assuming there will be 10 big rains during monsoon season in Jammu City, each rain will cause about 0.37 hour water logging. The total anticipated water logging time would be $10 \times 0.37 = 3.7$ hours/year after rehabilitation works are completed.

115. Condition of the drains, problems and proposed improvements are shown in **Table-17** below.

Table -17: Condition of the drains, problems and proposed improvements

Drainage Zone	Name of drain	Condition of existing drain and problems	Proposed improvements	Involuntary resettlement impacts
2	Channi Himmat sector 1 and 2 and Channi kamala nallah / Channi Himmat main nallah (R3)	<p>The open nallah starts from Sector 1 in Channi Himmat and runs parallel with the Thangar nallah. The nallah is about 2 to 3 m wide at the beginning point with stone crated walls.</p> <p>Nallah have no pacca side walls and no lining in the bed. There is no proper bed slope in the nallah, Growth of weed also has choked up the nallah along its course. Flooding is regular feature in the downstream portion of the nallah during the rainy season.</p>	<p>Construction of side walls at stretches where there is no side wall for approximate length of 1200 m (both sides), repair and strengthening of existing side walls is not required.</p> <p>Construction of nallah bed with required slope for 1300 m length.</p> <p>Construction of culverts</p> <p>Construction of RCC box drain 330m</p> <p>Improving the slope and bed condition will result in smooth flow, optimum velocity and increase in hydraulic capacity of nallah.</p>	<p>The nallah is existing on Government land and sufficient land is available for construction of walls, bed etc. Hence no land acquisition or involuntary resettlement is involved and no permanent impacts are envisaged.</p> <p>The temporary impact will only be on 1 structure of 04 sq. m used as security guard room, 13 non- fruit-bearing trees and 2 fruit -bearing trees on encroached Government land belonging to 01 affected person. However an estimated 16 affected persons owning shops/business establishments shall be temporarily impacted due to the proposed improvements only in terms of loss of access. This may result in disruption in some business activities temporarily.</p> <p>There are two categories of likely temporary impacts found during the transact walk. Those are: 1] Temporary disruption of business in terms of impact on access during civil construction work due to temporarily blocking of access and working space; and 2] Demolition of 6 stair cases (69 sq.m) on encroached portion of the drain and temporary blocking of access.</p> <p>No other encroachers or squatters or kiosks were found during the transact walk or through the engineering survey who are occupying or utilizing the ROWs for business or residential purposes.</p>
4	Channi Himmat sector 4, 5, 6 nallah / Channi	The origin of secondary open drain starts at plot number 249, sector 6 in Channi Himmat. The walls are damaged in most of	Construction of RCC drains with PCC bedding for approximate length of 1650m	The drain is existing on Government land and sufficient land is available for construction of walls, bed etc.

Drainage Zone	Name of drain	Condition of existing drain and problems	Proposed improvements	Involuntary resettlement impacts
	Himmat sector 4, 5, 6 drain (R1)	the stretches and the section of the drains is inadequate to accommodate the storm water. Drain bed is not lined, therefore no smooth flow in the drains. Causing water logging /inundation and flooding in the area. The lateral concrete drains in this locality are well connected to this drain.	(each side). Construction of culverts. Training the flow and improving the drains condition by construction of bed and construction of new RCC drains will enhance the hydraulic capacity of drains thus overcoming the flooding problem.	Hence no land acquisition or involuntary resettlement is involved and no permanent impacts are envisaged. Transect walks taken along the drain have confirmed no potential access disruptions to any commercial establishment /shop. No other encroachers or squatters or kiosks were found during the transact walk or through the engineering survey who are occupying or utilizing the ROWs for business or residential purposes.
4	Channi Himmat Sector 3 and Channi Himmat main road nallah / Channi Himmat Sector 3 and main road drain (R2)	The secondary open drain starts at junction point of sector 5 and 6 in Channi Himmat and running along the Channi Himmat main Road. This drain merges into another secondary drain of Channi Himmat sector 4, 5, 6 (above said drain) at sector 3. The drain walls are damaged. Drain bed is not lined, therefore no smooth flow in the drains. It causes water logging/inundation and flooding in the area. The branch drains in this locality are well connected to this drain.	Construction of RCC drain with PCC bedding at stretches for approximate length of 1550m each side Construction of culverts. Training the flow and improving the drain condition by construction of bed and construction of new RCC drains will enhance the hydraulic capacity of drains and overcome the flooding problem	The drain is existing on Government land and sufficient land is available for construction of walls, bed etc. Hence no land acquisition or involuntary resettlement is involved and no permanent impacts are envisaged. However an estimated 30 affected persons owning 30 shops shall be temporarily impacted due to the proposed improvements only in terms of loss of access during the construction. This may result in disruption of some business activities temporarily. No other encroachers or squatters or kiosks were found during the transact walk or through the engineering survey who are occupying or utilizing the ROWs for business or residential purposes.
Online Drain Water Treatment facility	Digiana, Gangyal, Ashram, Thangar (T4), Tributary of Thangar (TT4), Channi Himmat	The BOD values (analysed by J and K SPCB in 2010 and 2011) of drain water before outfall into river Tawi have been observed to be much less than the specified limits (i.e. 30 mg/l) and hence no treatment facility is required at present. However, the ADB review mission	The proposed waste water treatment facility shall be able to meet out the future requirement as and when the need arises.	No acquisition of private land is required, neither will the component result in any IR impacts. However, acquisition of 10.5 ha of government land (in possession of Floriculture Department) at Indira Nagar (Bhor Camp) with 1164 trees existing on

Drainage Zone	Name of drain	Condition of existing drain and problems	Proposed improvements	Involuntary resettlement impacts
	Drains	(October 2011) suggested that some treatment facility should be proposed for bringing down the BOD level which may increase in future with the growing population in the catchment of these drains. In view of this suggestion, waste water treatment facility has been conceptualized based on 'Waste Stabilization Pond Technology' at Indira Nagar (Bhor Camp) at a distance of about 10 km upstream of the outfall of the drain into river Tawi.		this land. Out of these 1164 trees, only 22 trees are required to be removed for construction.

116. **Subproject components – Indicative output.** The works under this proposed subproject will consist of following civil works:

1.	New construction of both side RCC walls of Channi Himmat Nallah.	1.19 km
2.	New Construction of RCC drain with PCC bedding for drains R1 and R2	6.32 km
3.	New construction of RCC box drain	0.33 km
4.	Plain Cement Concrete bedding	1.27 km
5.	Culverts	6 Nos.
6.	Construction of online treatment process	20 MLD

117. The major objectives of the sub-project are to ensure:

- Establishment of an efficient drainage system and preventing erosion of existing drains;
- Substantial reduction of water logging and flooding in sub-project area;
- Improvement of local environment to reduce health risks to the citizens.
- improved long-term drainage management in the Jammu City

118. The benefits of the sub project are as below:

- There will be substantial increase of discharge capacity of storm water drains in subproject area.
- By constructing/rehabilitating the secondary drains, the low lying areas in the subproject corridor can get rid of frequent flooding and water logging.
- Reconstructing and strengthening of side walls and improvement in bed of the drains will prevent erosion of drains and damage to the private property.
- Significant reduction in flooding and water logging will result into corresponding reduction in health risks to the citizens and access related problems during rains.
- This will also improve the visual quality and landscape character of the area.

119. The alignment of drains to be rehabilitated under the proposed subproject is depicted in **Figure-4**.

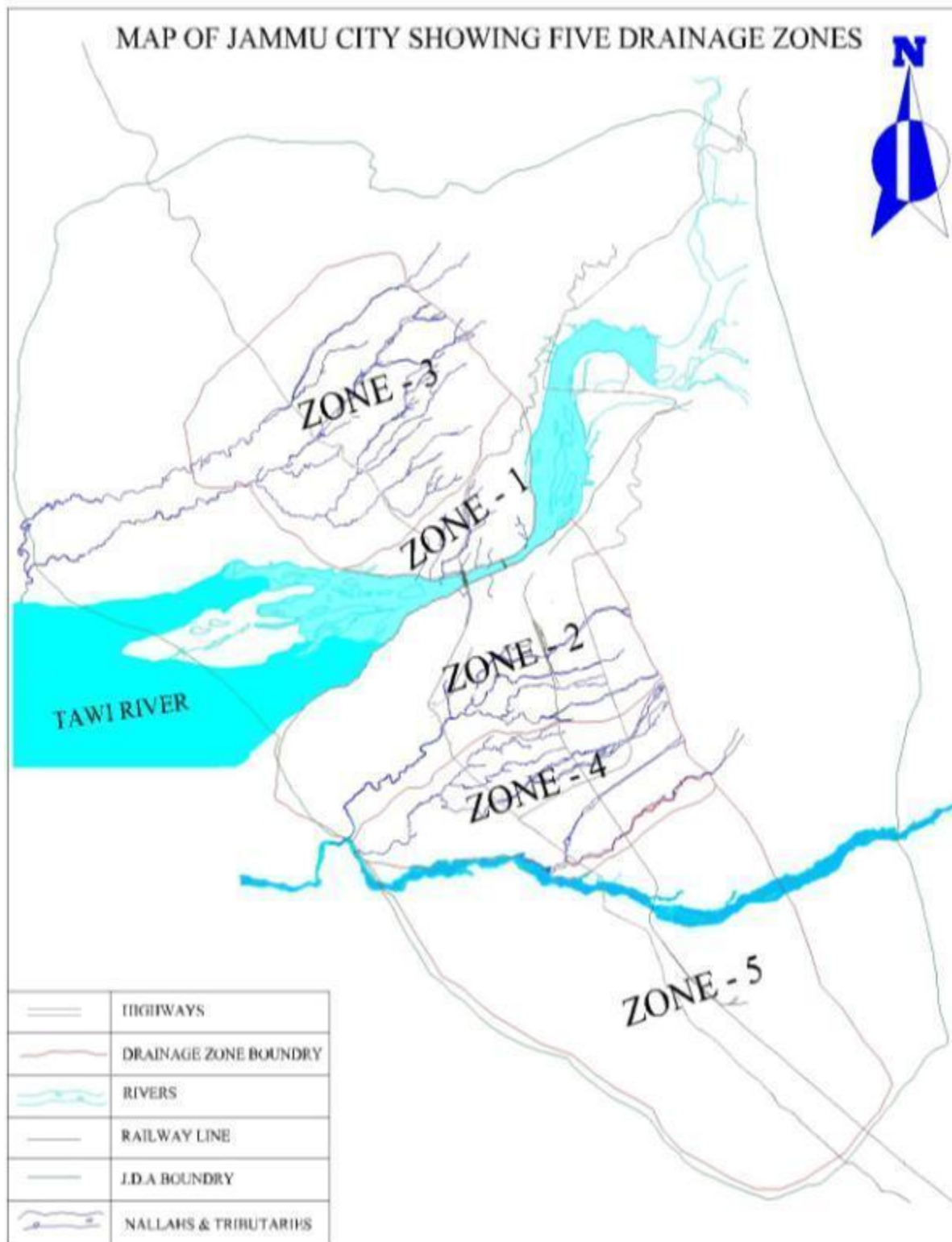


Figure-3: The drainage zones of Jammu City

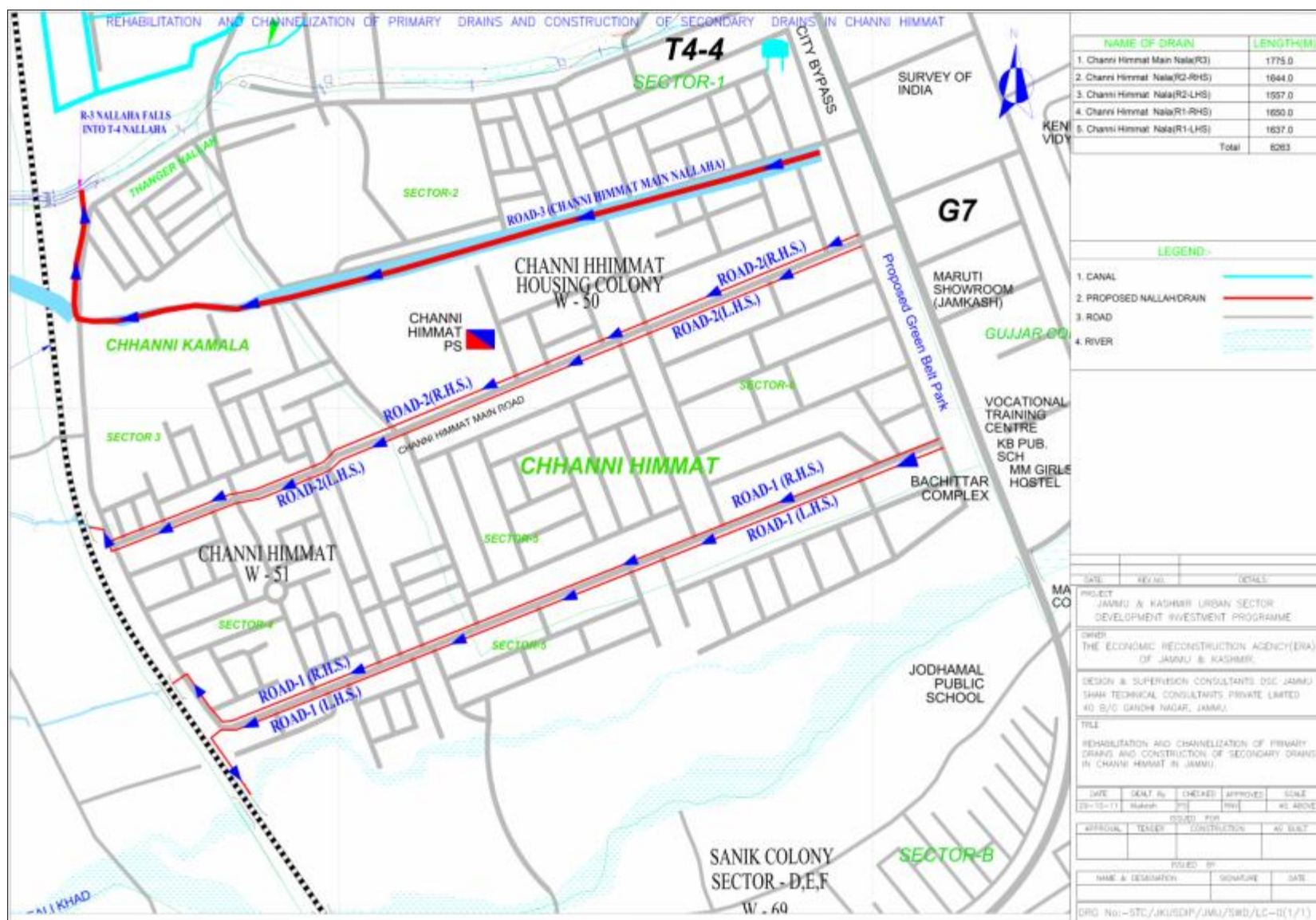


Figure-4: The alignment of drains to be rehabilitated under the proposed subproject

120. **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.

121. 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.

122. **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

123. **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-18**.

Table-18: Demographic status of Jammu and Kashmir

Division	Population	% Muslim	% Hindu	% Sikh	% Buddhist and other
Kashmir (53.9%)	5,476,970	97.16%	1.84%	0.88%	0.11%
Jammu (43.7%)	4,430,191	30.69%	65.23%	3.57%	0.51%
Ladakh (2.3%)	236,539	47.40%	6.22%	—	45.87%
Jammu and Kashmir	10,143,700	66.97%	29.63%	2.03%	1.36%

Statistics calculated from the 2001 Census India District Profiles

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

125. **Health and Educational Facilities.** Since the subproject sectors are situated in Jammu City. The infrastructure facilities like schools, hospitals, colleges, drinking water supply system, electricity and communication in the subproject area are satisfactory.

126. 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.

127. 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.

128. **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.

129. 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 herdsman 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.

130. 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, Bahu Fort is the nearest with a distance of about 4.27 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-19**.

Table-19: Distance of protected monuments/sites from the outer periphery of subproject corridor

S. No	A. State Protected monument/site	Distance from outer periphery of subproject site (in Kilometers)
1.	Bahu Fort	4.27
2.	Peer Mitha Tomb, Peer Mitha	5.34
3.	Shahi Mosque, Mast Garh	5.40
4.	Mubarak Mandi Complex	5.76
5.	Mosque at Chak Jaffer	15.97
6.	Royal Bowli at Nandini	19.60
	B. Archaeological Survey of India Protected monument/site	
7.	Fort at Akhnoor	26.49
8.	Remains of Ancient site (Pambaran) at Ambaran, Akhnoor	26.26

131. 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 4.27 Km from outer periphery of subproject area), Raghunath temple (around 4.92 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.

132. **Sensitive Environmental Receptors.** The sensitive environmental receptors existing along the alignment of proposed sub-project include religious places, educational institutions, health care centres, community property resources, etc. The details of the existing sensitive environmental receptors are given in the **Table-20** below.

Table –20: Sensitive environmental receptors along the sub-project alignment

S.No	Name of sensitive receptor	Distance from the edge of proposed alignment (m)		Chainage (m)
		LHS	RHS	
	Drain- R1			
1.	Green Belt Park	-	-	0
2.	Clinic (Dr. C. D. Gupta)		0	500
3.	Public Park	20		810
4.	Coaching Institute (Kohli IIT)	0		820
5.	Coaching Institute (SMC)	0		880
6.	Super Speciality Dental Clinic	0		1200
	Drain- R2			
7.	Public Park (under construction)	-	-	0
8.	Mediades Nursing Home		0	130
9.	Temple		0	200
10.	Temple		30	530
11.	Lal Path Laboratory		0	550
12.	Nidaan Diagnostics	0		600
13.	Private Clinic (Dr. Anil Sharma)	0		670
14.	Matrix Institute	30		772
15.	Homoeopathic Clinic (Dr. Raj Kumar)	0		850
16.	Mosque (Masjid Shreef Qadeem)	80		910
17.	Clinic (Dr. Rajesh Gupta)	80		910
18.	Bal Bharti Public High School		30	930
19.	Dental Clinic (Dr. Ramesh Khajuria)		0	1220
20.	Bone and Joint Clinic/Apollo Physiotherapy Centre		0	1230
	Diversion of Drain- R2 on Right Side			
21.	Dental Clinic	20		1600
22.	Temple (Gouri Shankar)		0	1750
	Drain R-3 (Channi Nalla)			
23.	Public Park (under construction)	-	-	0
24.	Public Park	0		180
25.	Gurudwara		20	180
26.	United Public High School	70		946
27.	Temple (Ram Mandir)		100	1146
28.	Government Girls Middle School, Channi.		30	1146
29.	Public Park	10		1146
30.	Krishna Tution Centre	30		1220
31.	Ved Chuni Lal Ayurvedic Clinic		15	1270
32.	Banayan Tree (worship place)		10	1270
33.	Public Park (under construction)	0		1415
34.	Temple	30		1513

LHS= left hand side, RHS= right hand side

133. The above listed sensitive environmental receptors have been identified for proper supervision during the subproject execution stage so as to avoid and minimise any negative impact. During finalization of design all the sensitive receptors are saved judiciously. As such, these sites may face the minor impacts of increased air and noise pollution during execution of the proposed subproject.

V. ANTICIPATED IMPACTS AND MITIGATION MEASURES

134. The present report assesses the impacts of the proposed activities on various environmental attributes of the subproject site.

135. **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.

136. 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-21**:

Table-21: 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).
	Long-term	Impacts will exist beyond the life of the drainage system (>30 years)
	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%)

137. Categorization of the subproject has been undertaken using ADB's REA Checklist for Sewage Treatment.

Planning and Design Phase

138. 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 drainage subproject are: (i) no land acquisition; (ii) substantial reduction of water logging and flooding in sub-project area; (iii) improvement of local environment to reduce health risks to the citizens (iv) most suitable construction methodology; and (v) site constraints.

139. Salient design features are presented in **Table-22**.

Table-22: Salient design features of the subproject.

Parameter	Design Consideration
Cross Section	Keeping in mind the Rainfall data of previous years, the cross section has been designed to cater for the design discharge of the year 2036. Lined Trapezoidal/rectangular RCC section (both sides and bed) has been considered to be the best option.
Bed Slope	Bed Slope of 1:50 to 1:600 in various sections has been proposed considering the self cleansing velocity and avoiding scouring.
Construction material	For bed PCC in the mix ratio 1:2:4 (M15) is proposed and for walls RCC in the mix ratio 1:1.5:3 (M20) is proposed.
Alignment of drainage	Alignment of proposed works is guided by the existing alignments of the drains and available ROW.
Location	Channi-Himmat drains R1 and R2 start from bye-pass road downstream (near Green Belt) and discharge into Gangyal/Digiyana/Ashram drains. R3 starts from downstream of bye-pass road near hotel Ritz and discharges into T4 drain. The online drain water treatment facility based on Waste Stabilization Pond technology shall be constructed at Indira Nagar (Bhor Camp) within an area of 10.5 ha.
Climatic Conditions	Rainfall and its run off in the subproject area usually cause flooding and water logging resulting into damage to property of the residents, access disruptions and risk to health of the citizens. 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. The rehabilitation of drainage system has been designed to minimize incidence of flooding and water logging in the subproject areas.
Air Quality ¹⁰	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 ₁₀ and PM _{2.5}) 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	Due to lack of proper secondary drains and unlined primary drainage channels, poor slope and poor bed condition of drains, etc., carrying capacities of primary drains are reduced, due to which several areas in the subproject corridor experience frequent flooding and water logging. This situation of flooding adversely impacts environmental

¹⁰ 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 (CO₂) and secondary pollutants such as hydrocarbons (HC), nitrogen oxides (NO_x), carbon monoxide (CO) and sulphur dioxide (SO₂). 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
	condition, creates unhygienic living conditions to the citizens and increased health hazards. Existing condition of drains is a barrier to optimum development and growth of the area. The proposed subproject has been designed to mitigate all these problems.
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. However, the subproject may affect a few trees existing within the ROW of the drains. Permission will be obtained from the Forest and Revenue Department /Concerned Deputy Commissioner prior to start of civil works.
Land use and livelihoods	<p>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, health facilities, religious places and commercial establishments such as shops, hotels and restaurants.</p> <p>The subproject proposes to rehabilitate the existing drains, therefore sufficient government land within existing ROW is available throughout the length of these drains hence “No acquisition of private Land” is required for drain rehabilitation works. All involuntary resettlement (IR) impacts are temporary in nature. Negative impacts in the subproject are on a total of 46 affected persons/shops who will have impact in terms of temporary loss of access during the construction while as 01 affected person (encroacher) will lose 01 guard room, 13 non-fruit bearing trees and 02 fruit-bearing trees on the existing ROW. Out of 46 affected persons suffering access disruption 05 will have impact on the staircases constructed over the drain also; however this will not have any impact on their main commercial structure.</p> <p>The construction of waste water treatment facility at Indira Nagar (Bhor Camp) shall however require acquisition of 10.5 ha of government land (Floriculture Department) with 1164 non fruit bearing trees existing on this land. Out of these 1164 trees, only 22 trees are required to be removed for construction of the waste water treatment facility. This component involves no IR impacts.</p>
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 (Appendix 2 to EMP) 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 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	The subproject is considered to be compatible with the surrounding landscape and is likely to enhance the existing visual quality or landscape character of the area.

Parameter	Design Consideration
character, and sense of place ¹¹	It is expected to improve the general environment and aesthetic character of the area by significantly reducing the incidence of flooding and water logging.
Online Drain Water Treatment Technology	<p>Design Criteria: Influent design BOD = 100 mg/l (assumed) Effluent design BOD = <30 mg/l</p> <p>Technology: Waste Stabilization ponds The completely digested sludge shall be required to be extracted once in five years and the same shall be used as manure in farming.</p> <p>Applicable effluent discharge standards are given in Appendix-4.</p>

140. The following table (**Table-23**) 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 proposed development could interact and affect the environment significantly, and details what mitigation measures may be taken to counteract these impacts.

¹¹ 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 road development with its immediate surroundings. Impacts are not restricted to the road reserve but the entire viewshed (area from where the road development 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.

Table-23: 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"> The drains do not have proper side walls or the walls are damaged. The drain beds are not lined, therefore no smooth flow in the drains. There is no proper bed slope in the drains. Growth of weeds also has choked up various sections of the drains. Various sections of the drains are inadequate to accommodate the storm water causing water logging /inundation and flooding in the downstream areas during rainy season. The water logging and flooding of downstream areas causes loss/damage to property of inhabitants, access problems and poses health risks to the citizens. 	<ul style="list-style-type: none"> The subproject will improve the drainage system of the area in a safe and efficient manner by construction of side walls, drain beds, improvement in slope and carrying capacity, etc. 	High (-)	Site/Local	Medium-term	Full Mitigation Definite	High (+)
Planning initiatives	<p>Planning initiatives have been identified as:</p> <ul style="list-style-type: none"> Establishment of an efficient drainage system and preventing erosion of existing drains; Substantial reduction of water logging and flooding in sub-project area; Improvement of local environment to reduce health risks to the citizens. 	<ul style="list-style-type: none"> The subproject will improve the drainage system of the area in a safe and efficient manner. This will allow for the planning initiatives to be realized. 	High (-)	Site/Local	Medium-term	Full mitigation definite	High (+)
Identification of drainage needs	The ERA vision is to provide safe, reliable, effective and efficient	<ul style="list-style-type: none"> The subproject will substantially increase the 	High (-)	Local	Medium-term	Full mitigation	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
and demands	drainage system which will best meet the needs of the people at improving levels of service and cost in a way which supports government strategies for economic and social development, whilst being environmentally and economically sustainable.	<p>discharge capacity of storm water drains in the area.</p> <ul style="list-style-type: none"> By constructing/ rehabilitating of the secondary drains, the low lying areas will get rid of frequent flooding and water logging. Subproject will ensure considerable reduction in the water logging period during rains. Reduction of flooding and water logging in downstream areas will significantly reduce the health risks to citizens and access related problems during rains. Reconstructing and strengthening of side walls and improvement in bed of the drains will prevent erosion of nallahs and damage to the private property. 				definite	
Online drain water treatment facility	At present, the drain water finally discharging into river Tawi shows BOD values (recorded by SPCB in 2010 and 2011) much below the permissible limits and do not require any kind of treatment. However, keeping in view any future requirement, the waste water treatment facility has been proposed at Indira Nagar (Bhor Camp).	<ul style="list-style-type: none"> The waste water treatment facility aims at treating the drain water through 'waste stabilization pond' technology before discharge into river Tawi. 	Medium (-)	Local	Long Term	Full mitigation definite	Medium (+)

Construction Phase

141. **Table-24** 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-24: 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"> Construction camp and its associated facilities (including lay-down areas) Storage camps and lay-down areas <ul style="list-style-type: none"> Materials and equipment stockpiles Handling and storage of hazardous materials including chemicals additives, gravel, cement, concrete and lubricants Source of water Vegetation clearance Grading Movement of construction staff, equipment and materials Importation of selected materials/base layer construction. <ul style="list-style-type: none"> Construction of a surfaced layout Sub-base and base layers (Excavations, Grading, Importation of fill materials and selected gravel materials for sub-base and base layers, Application of water, Compaction and Disposal of spoil material (excess excavated soil) Construction of wearing course (Asphalt layer, Bitumen seal, Concrete and Paving block) Temporary detours Noise and vibrations Dust suppression Waste production and temporary storage/disposal i.e. used fuels, waste concrete and bitumen, spoil materials and general waste Stabilization of slopes and erosion prevention Use of asphalt/bitumen (and associated storage and mixing areas, chemicals) Concrete batching plant (and associated storage and mixing areas, chemicals) Rehabilitation of disturbed areas 	<ul style="list-style-type: none"> Bitumen Cement Chemical additives used in concrete / asphalt (i.e. retarders) Paving blocks Aggregate (sand and stone) Gravel (fill material for embankments/selected material for sub-base and base layers) Water <ul style="list-style-type: none"> Drinking, cooking and sanitation at construction camps Water for dust suppression Water applied to base and sub-base layers during compaction Water for application to sub-base and base layers prior to compaction Petrochemicals Other chemicals/lubricants/paints Construction vehicles, machinery and equipment Temporary energy supply to construction camps Topsoil used during revegetation and rehabilitation Plant material for re-vegetation (seeds, sods, plant specimens) Materials for slope stabilisation <ul style="list-style-type: none"> Mulch Labour Recruitment of 	<ul style="list-style-type: none"> Old asphalt (removed from road carriageway during road upgrade)¹² Waste concrete and other construction rubble Waste bitumen¹³ Used fuels, lubricants, solvents and other hazardous waste General waste Contaminated soil <ul style="list-style-type: none"> Soil contaminated with bitumen Soil contaminated with petrochemicals (i.e. oils and lubricants) and other chemicals Excavated materials from existing drains Sewage and grey water (temporary construction camp sanitation) Spoil material (excess soil removed during excavations) Noise and vibrations (construction vehicles and machinery) Lighting at construction camps, equipment yards and lay-down areas Plant material removed from servitude/right-of-way during vegetation clearance Smoke and fumes <ul style="list-style-type: none"> Burning of waste

¹² The drainage 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.

¹³ 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.

Activities and Facilities	Inputs/Resource Use	Outputs/Waste Production
<ul style="list-style-type: none"> • Interaction between construction workforce and local communities • Management of the passing pedestrians and points of congestion • Implementation of the Resettlement Plan prior to start of construction • Reminders to affected people of construction with timeframes 	<ul style="list-style-type: none"> • construction workforce <ul style="list-style-type: none"> – Skills training • Public movement control <ul style="list-style-type: none"> – need barriers (not just danger tape) to protect people from trenches during construction 	<ul style="list-style-type: none"> – Burning of vegetation cover – Fires used for cooking and space heating (construction camps) – Vehicle exhaust emissions

142. The following table (**Table-25**) 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 environment significantly, and details what mitigation measures may be taken to counteract these impacts.

Table-25: 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"> The nature and intensity of rainfall events in an area, has implications for storm water management. Smoke from burning activities could be wider spread on windy days especially when dust could be blown off site. 	<ul style="list-style-type: none"> Seasonal climatic variations will be considered during scheduling of construction activities in the area. Excavations and other clearing activities will only be done during agreed working times and permitted weather conditions. Storm water control during construction phase as per the method approved by the Engineer. Seeding of topsoil and subsoil to prevent wind and water erosion of soil surfaces. No open fires permitted on site 	Low (-)	Site	Short-term	Full Mitigation Probable	Low (-)
Air Quality	<ul style="list-style-type: none"> Sensitive receptors (e.g. health facilities, educational institutions, religious places) may be affected temporarily by increased traffic and related impacts during the construction phase. Fugitive dust can also impact roadside air quality during construction. Exhaust fumes from construction machinery, and potential smoke from cooking fires. Burning of waste and cleared vegetation Odors from use of toilet 'facilities' other than provided facilities. 	<ul style="list-style-type: none"> Ensure compliance with the Air Act. Ensure compliance with emission standards. Guidelines that deal with the control of air pollution on site have been outlined in the Environmental Management Plan (EMP). Monitoring of air pollution levels in potential problem areas will be undertaken. Management (including storage, transport, handling and disposal) of hazardous substances used during construction. Dust control measures have been included in the EMP. Dust generating construction activities will be avoided during strong winds. Soil loads in transit will be kept covered. Stockpiles of soil will be kept 	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>covered or have suitable dust palliative applied such as water.</p> <ul style="list-style-type: none"> • A suitable dust palliative (water) will be applied if dust levels rise above acceptable levels. • Regular servicing of the vehicles off site in order to limit gaseous emissions. • No open fires permitted on site. • Temporary toilet facilities will be provided on site and will be maintained on a daily basis. 					
Geology	<ul style="list-style-type: none"> • Strong water flows into open excavations may occur, causing sidewall collapse. • Layers of mixed fill cover natural ground surface in many places. • Contamination from spillage of petroleum products, spent engine oil and oil leaks from construction vehicle maintenance taking place on site. • Contamination through use of toilet 'facilities' other than provided facilities. 	<ul style="list-style-type: none"> • 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. • 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. • 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. • Contaminated water will be contained and disposed off site at an approved disposal site (the site to be identified by contractor and approved by Engineer). • The contractor will dispose of waste from the oil interceptors at approved disposal site (the site to be identified by contractor and approved 	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
		by Engineer). <ul style="list-style-type: none"> Cement, concrete and chemicals will be mixed on a concrete plinth and provisions will be made to contain spillages or overflows into the soil. No vehicle maintenance to be allowed on site. 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). Temporary toilet facilities will be provided by contractor on site and maintained on a daily basis. Topsoil and subsoil will be protected from contamination. Subsoil and overburden in all construction and lay down areas to be stockpiled separately and returned for backfilling in the correct soil horizon order. 					
Drainage and hydrology	<ul style="list-style-type: none"> 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. However, the subproject drains ultimately discharge into river Tawi. Due to the nature and locality of the subproject there is unlikely to have any significant impacts on water resources within the immediate area. 	<ul style="list-style-type: none"> The site surface to be engineered and shaped in such a way that rapid and efficient evacuation of runoff is achieved. Improve existing alignments and drainage systems. Provide containment areas for potential pollutants at construction camps, refueling, depots, concrete batching plants, etc.. Waste management practices will be implemented. The transport, storage, handling and disposal of hazardous substances will be controlled and managed. 	Low (-)	Site	Short-term	Full Mitigation Probable	Low (+)
Biodiversity	<ul style="list-style-type: none"> The proposed 	<ul style="list-style-type: none"> Permission will be obtained 	Low (-)	Site	Short-	Full	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
Fauna and Flora	<p>development is situated within an existing built up area where drainage infrastructure already exists. 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.</p> <ul style="list-style-type: none"> The proposed rehabilitation of drains may however affect a few existing trees within the right of way. The proposed waste water treatment facility may also affect a few existing trees existing at the construction site at Indira Nagar (Bhor Camp). 	<p>from the Forest /Revenue Department /Concerned Deputy Commissioner for cutting of trees prior to start of civil works.</p> <ul style="list-style-type: none"> Compensatory afforestation will be done with locally indigenous species. 			term	Mitigation Probable	
Land Uses	<ul style="list-style-type: none"> Due to the location and nature of the subproject, there will be interference with access at some places. Existing public transport facilities and operations will be affected by the road closure and detours at the culvert construction sites. There will be disruptions to health services, education services, local businesses, transport services, pedestrian movements, due to traffic and construction related noise, visual, and air pollution. 	<ul style="list-style-type: none"> ERA has consulted with various interested and affected parties, departments, etc. within the area and will be continued during the construction phase. Critical roads (e.g. in front of health facilities) will have a sign of "Keep Clear". ERA will make provisions for vehicle and pedestrian access to maintain community linkages. Consult with local departments, organizations, etc regarding location of construction camps, access and hauling routes and other likely disturbances during construction. Provide clear and realistic information regarding detours and alternative accesses for local communities and businesses in order to prevent unrealistic expectations. 	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"> • Provide clear and realistic information regarding employment opportunities and other benefits for local communities in order to prevent unrealistic expectations. • Make use of local labor, materials, goods and services as far as possible. • Provide walkways and metal sheets where required to maintain access across for people and vehicles. • 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. • Consult businesses and institutions regarding operating hours and factoring this in work schedules. • Provide sign boards for pedestrians to inform nature and duration of construction works and contact numbers for concerns/complaints. 					
Infrastructure and Services	<ul style="list-style-type: none"> • There is likely to have temporary disruption of infrastructure and services during the proposed rehabilitation of drains. • There are a number of existing infrastructure and services (roads, telecommunication lines, power lines and various pipelines) within the vicinity of the subproject. 	<ul style="list-style-type: none"> • Utility shifting will be undertaken prior to commencing construction works. • Keep construction related disturbances to a minimum. • Consult with affected service providers regarding impacts on access to infrastructure and services and alternatives. • Consult with affected communities or businesses prior to foreseeable disruptions, for example notifying residents of a temporary severance of water supply. 	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
		<ul style="list-style-type: none"> • Provide backup or alternative services during construction-related disruptions, for example by providing generators for power supply. • Provide access points to infrastructure and services. • Monitor complaints by the public. 					
Traffic	<ul style="list-style-type: none"> • Increased volume of construction vehicles on the roads may lead to increased wear and tear of roads in the vicinity of the subproject site. • Road safety concerns due to slow moving construction vehicles. • Traffic flow within the vicinity will be affected. • The temporary road closure will result in a decrease in overall network performance in terms of queuing delay, travel times/speeds. • The road closure will impact on a public transport operations and routing. • Pedestrian movements will be affected by the road closure. 	<ul style="list-style-type: none"> • 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 the 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. • Negotiations with privately-owned public transport operators regarding the affected public transport facilities and routing. • 'Clear roads' signs will be erected for the full length of the construction period at the culvert construction sites. Provide sign boards for pedestrians to inform nature and duration of construction works and contact numbers for concerns/complaints. • The City Traffic Police will be available on site in the monitoring of traffic in the early stages of the operations during road closure. • A traffic monitoring strategy 	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>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:</p> <ul style="list-style-type: none"> – Adjustments to traffic signal settings, signs and markings – Adjustments to accommodation of pedestrians – Adjustments necessary to public transport operators. • 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. • Construction routes clearly defined. • Access of all construction and material delivery vehicles will be strictly controlled. • Enforcement of speed limits. • Deliveries will not be allowed during peak traffic hours. 					
Health and Safety	<ul style="list-style-type: none"> • Danger of construction related injuries. • Open fires in construction camp can result in accidents. • Safety of workers and general public must be ensured. • Poor waste management practices and unhygienic conditions at temporary ablution facilities can breed diseases. 	<ul style="list-style-type: none"> • Implement good housekeeping practices at the construction camp. • Strict health and safety measures to be implemented and audited on a regular basis. • Secure enclosed construction site. • Hiring of reputable contractors. 	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
	<ul style="list-style-type: none"> • 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. • The use of hazardous chemicals in the construction can pose potential environmental, health and safety risks. • The construction of culverts may involve the stripping and demolition of old asphalt layers. • Road safety may be affected during construction, especially when traffic is detoured. 	<ul style="list-style-type: none"> • Provide warning signs of hazardous working areas. • Excavations to be clearly demarcated and barriers (not just danger tape) erected to protect pedestrians from open trenches. • Workers will be thoroughly trained in using dangerous equipment. • Workers have the right to refuse work in unsafe conditions. • Undertake waste management practices. • Control speed and movement of construction vehicles. • Improved signage, speed control, walkways and crossings will reduce safety risks due to construction. • Exclude public from the site. • Ensure all workers are 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; • Ensure that qualified first-aid can be provided at all times. Equipped first-aid stations shall be easily accessible throughout the site; • Provide medical insurance coverage for workers; • Provide clean eating areas where workers are not exposed to hazardous or noxious substances; • Provide visitor orientation if visitors to the site can gain access to areas where hazardous conditions or substances may be present. Ensure 					

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>also that visitor/s do not enter hazard areas unescorted;</p> <ul style="list-style-type: none"> • Ensure moving equipment is outfitted with audible back-up alarms; • Mark and provide sign boards for hazardous areas such as energized electrical devices and lines, service rooms housing high voltage equipment and areas for storage and disposal. Signage shall be in accordance with international standards and be well known to, and easily understood by workers, visitors, and the general public as appropriate. 					
Noise and Vibrations	<ul style="list-style-type: none"> • Sensitive receptors (health facilities, educational institutions , religious places) may be affected temporarily by increased traffic and related impacts. • Use of heavy vehicles and equipment may generate high levels of noise. • Vibrations resulting from bulk earthworks and other construction activities may create significant disturbances to nearby people and businesses. • Disturbance from afterhours work. 	<ul style="list-style-type: none"> • Locate concrete batching, asphalt, crushing plants, laydown areas and construction camps away from sensitive receptors. • Restrict construction activities to reasonable working hours where near sensitive receptors. • Keep adjacent landowners informed of unusually noisy activities planned. • Regulate roadworthiness of vehicles. • Ensure that machinery is in a good state of maintenance. • Silencers must be fitted and maintained to all machinery on site. • Monitor noise levels in potential problem areas. 	High (-)	Site and Local	Short-term	Partial Mitigation Probable	Medium (-)
Aesthetics, Landscape Character, and Sense of Place	The presence of heavy duty vehicles and equipment, temporary structures at construction camps, stockpiles, may result in impacts on aesthetics and landscape character	<ul style="list-style-type: none"> • Storage areas will be properly fenced off. • All domestic solid waste will be collected from a central point of disposal and fed into the city waste collection system. • Contractor to exercise strict 	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>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.</p> <ul style="list-style-type: none"> • Identification of suitable waste disposal site with enough capacity to hold additional waste to be produced by the proposed construction activities. • Use of recycled material is encouraged. • Guidelines regarding management of waste on site have been outlined in the EMP. • Retain mature trees on and around the site where possible. • Cluster construction activities on site on a specific area to avoid "sprawl". • Unwanted material and litter will be removed on frequent basis. 					
Workers Conduct	<ul style="list-style-type: none"> • Construction workers on site disrupting adjacent land uses by creating noise, generating litter, and possible loitering. 	<ul style="list-style-type: none"> • Ensure strict control of laborers, minimizing working hours to normal working times, control littering, and ensure no overnight accommodation is provided. 	Low (-)	Local	Short-term	Full Mitigation Definite	Low (-)
Employment Generation	<ul style="list-style-type: none"> • The subproject will provide employment opportunities for local people during construction. • Expectations regarding new employment will be high especially among the unemployed individuals in the area. • Laborers gathering at the site for work can be a safety and security issue, and must be avoided. • The training of unskilled or previously unemployed persons will 	<ul style="list-style-type: none"> • The use of labor intensive construction measures will be used where appropriate. • Employ local (unskilled) labor if possible. • Training of labor to benefit individuals beyond completion of the subproject. • Recruitment of labors will take place offsite. 	Medium (+)	Local	Short-term	Partial Mitigation Probable	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
	add to the skills base of the area.						
Archaeological and Cultural Characteristics	<ul style="list-style-type: none"> The proposed development will not require demolition of Archeological Survey of India (ASI)- or state-protected monuments and buildings. 	<ul style="list-style-type: none"> Ensure that construction staff members are aware of the likelihood of heritage resources being unearthed and of the scientific importance of such discoveries. ASI or the State Department of Archaeology will be contacted if any graves be discovered and all activities will be ceased until further notice. 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. 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. 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. 					

Operation and Maintenance Phase

143. **Table-26** 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-26: 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"> • Signages • Safety barriers • Lighting • Storm water drainage system • Cut and fill embankments • Vehicles and pedestrians using the road • Road accidents and breakdowns • Vehicle exhaust emissions • Noise and vibrations • Litter collection • Maintenance activities – Repainting of road markings – Pothole repair, crack sealing and road shoulder repair – Resealing/resurfacing – Safety barriers repairs – Upkeep and repair of stormwater drainage system • Eradication and control of invasive vegetation species • Auxiliary activities and Infrastructure – Markets and shops 	<ul style="list-style-type: none"> • Manual de-weeding for eradication and control of invasive vegetation species • Labor • Vehicles and equipment used for inspections and maintenance • Bitumen and aggregate used during resurfacing/repair of potholes 	<ul style="list-style-type: none"> • Effluent • Sludge • Vehicle exhaust emissions • Dust • Particulates from tires, brake, and road wear • Petrochemical products leaking from vehicles and entering stormwater • Potential for water resource contamination • Hazardous spills during road accidents and breakdowns • Illegal dumping, mainly in open spaces along the roadside • Litter, also entering stormwater system and causing blockages • Visual exposure of drainage infrastructure • Plant material (removed during maintenance of vegetation cover) • Noise and vibrations • Lighting

144. The following table (**Table-27**) 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-27: 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"> The nature and intensity of rainfall events in an area, has implications for storm water management. Siltation and dumping of solid wastes may reduce the carrying capacity of drains causing overflowing and flooding in the low lying areas. 	<ul style="list-style-type: none"> The designed storm water drainage system with adequate carrying capacity will control run-off from the areas. Regular silt clearing and maintenance of the drains. 	Low (-)	Site	Medium-term	Partial Mitigation Probable	Low (+)
Geology	<ul style="list-style-type: none"> Unattended scouring and damage to bed and side walls of the drains may result into seepage of storm water which may cause collapse of side walls and drain bed. 	<ul style="list-style-type: none"> Develop emergency response procedures to deal with the flooding caused due to breach of walls during rains. Regular monitoring and maintenance of the drains. Regular desilting of the drains. 	Medium (-)	Site	Long-term	Full Mitigation Possible	Low (-)
Drainage and hydrology	<ul style="list-style-type: none"> Rehabilitation of drains in the area will have positive impacts both on a site and local context in terms of improvement in drainage system and healthy environment. The increased carrying capacity of the drains shall accommodate the storm water flow during rains. Strengthening of bed and side walls will prevent erosion of drains and damage to the private property. Improved drainage system results in significant reduction in flooding and water logging in the subproject area. Improvement of local environment to reduce health risks to the citizens. 	<ul style="list-style-type: none"> Design of drainage system in line with topographical features of the site will adequately manage the storm water drainage and associated impacts. 	Low (-)	Site and Local	Long-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
Land Uses	<ul style="list-style-type: none"> With rehabilitation of drains, the flooding and water logging prone areas can be put to their utmost possible use. The proposed project is expected to facilitate an integrated development approach to the area thereby improving the overall quality of life. The proposed development is expected to bring about positive economic benefits in the medium- to long- term. Local businesses and educational facilities, etc. along the drains are likely to benefit from the subproject. 	<ul style="list-style-type: none"> Regular maintenance and monitoring of the drains so as to ensure that the drains remain functional and their discharge capacity does not reduce. 	High (+)	Site and Local	Long-term	Full Mitigation Possible	High (+)
Health and Safety	<ul style="list-style-type: none"> Improvement of drainage system is expected to significantly reduce the problems associated with flooding and water logging in the subproject area. Reduction in flooding and water logging will reduce the health risks to the citizens. 	<ul style="list-style-type: none"> Undertake regular maintenance of drains (i.e. desilting and repairing) to avoid risks of side wall collapse and flooding. 	High (+)	Local	Long-term	Partial Mitigation Probable	High (+)
Aesthetics, Landscape Character, and Sense of Place	<ul style="list-style-type: none"> The subproject is considered to be compatible with the surrounding landscape and is likely to enhance the existing visual quality or landscape character of the area. It is expected to improve the general environment and aesthetic character of the area by significantly reducing the flooding and water logging. 	<ul style="list-style-type: none"> Provide waste disposal facilities and enforce anti-littering campaigns. Monitor housekeeping, littering and illegal dumping in and around the drains. 	Low (+)	Site and Local	Long-term	Partial Mitigation Probable	Medium (+)

Cumulative Environmental Impacts

145. **Table-28** 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. Cumulative impacts are identified, predicted in the same level of detail as the impacts discussed above.

Assessment of No-Go (No Build) Option

146. **Table-29** outlines potential impacts associated with the “No-Go” option. The No-Go option involves no additional commitment of resources. Choosing the No-Go option has the same effect as if the decision never occurred.

Table-28: Summary of Anticipated Potential Cumulative Environmental Impacts

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
Significant reduction in flooding and water logging	<ul style="list-style-type: none"> The discharge capacity of the drains shall be increased to accommodate the storm water flow during rains. This will significantly reduce the incidence of flooding and water logging in the subproject area. Reduction in flooding and water logging will reduce health risks to the citizens and access problems during rains. 	<ul style="list-style-type: none"> Refer to tables above 	High (-)	Site/Local	Long-term	Full Mitigation Definite	High (+)
The rationalization and reorganization of drainage system	<ul style="list-style-type: none"> It is important to provide better drainage facilities so as to avoid flooding during rains by establishing a drainage system with sufficient discharge capacity. The proposal for rehabilitation of drains goes a long way in achieving some of the goals of a good urban storm water management system. 	<ul style="list-style-type: none"> Refer to tables above 	High (-)	Site/Local	Long-term	Full Mitigation Definite	High (+)
Enhancement of visual quality	<ul style="list-style-type: none"> The subproject is considered to be compatible with the surrounding landscape and is likely to enhance the existing visual quality or landscape character of the area. 	<ul style="list-style-type: none"> Refer to tables above 	High (-)	Site/Local	Long-term	Full Mitigation Definite	High (+)
Landuse	<ul style="list-style-type: none"> It is expected that improvement in the general environment and aesthetic character of the area will act as a catalyst for overall development of the area by optimum utilization of the presently flooding and water logging prone areas. 	<ul style="list-style-type: none"> Refer to tables above 	High (-)	Site/Local	Long-term	Partial Mitigation Definite	High (+)

Table-29: 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	<ul style="list-style-type: none"> The storm water flow during rains shall continuously degrade the existing storm water drainage system causing increase in incidence of flooding and water logging. This will result in risks to public 	<ul style="list-style-type: none"> 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
	health and deterioration of aesthetic, visual and environmental quality of the area.						
Air Quality	<ul style="list-style-type: none"> Will remain the same No impacts on sensitive receptors during construction 	<ul style="list-style-type: none"> None 	Medium (-)	Local			Medium (-)
Geology	<ul style="list-style-type: none"> No obvious impacts 	<ul style="list-style-type: none"> n/a 					
Drainage and hydrology	<ul style="list-style-type: none"> The lack of proper drainage system, inadequate drain capacity, growth of weeds and improper bed slopes are resulting in incidence of flooding and water logging in the subproject area due to storm water flow during rains . This shall continuously degrade the existing storm water drainage system. 	<ul style="list-style-type: none"> None 	High (-)	Local	Long-term		High (-)
Land Use	<ul style="list-style-type: none"> The areas prone to flooding and water logging shall continue facing the same impacts and cannot be put to their possible optimum use. 	<ul style="list-style-type: none"> None 	High (-)	Local	Long-term		High (-)
Traffic	<ul style="list-style-type: none"> No obvious impact 	<ul style="list-style-type: none"> n/a 					
Health and Safety	<ul style="list-style-type: none"> The incidence of flooding and water logging will continue to result in risks to health and safety of citizens. 	<ul style="list-style-type: none"> None 	High (-)	Local	Long-term		High (-)
Noise Pollution	<ul style="list-style-type: none"> Noise pollution will remain the same. No impacts on sensitive receptors during construction 	<ul style="list-style-type: none"> None 	Medium (-)	Local	Long-term		Medium (-)
Aesthetics, Landscape Character and sense of place	<ul style="list-style-type: none"> Likely to deteriorate as damages to existing drainage system and flooding will continue leading to visual degradation of aesthetics and landscape character. 	<ul style="list-style-type: none"> None 	Medium (-)	Local	Long-term		Medium (-)

VI. INFORMATION DISCLOSURE, CONSULTATION AND PARTICIPATION

A. Public participation during the preparation of the IEE

147. 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.

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

- Local communities, individuals affected and owners/employees of affected commercial establishments who will face temporary access disruptions during the course of execution of the civil works.
- Walk-through informal group consultations along the corridor of the drains proposed to be rehabilitated under the subproject.
- The local communities had been informed through public consultation with briefing on project interventions including its benefits.
- The environmental concerns and suggestions made by the participants were listed out, discussed and suggestions were accordingly incorporated in the EMP.

149. Different techniques of consultation with stakeholders were used during project preparation (interviews, public meetings, group discussions, etc). Questionnaire was designed and environmental information was collected. Apart from this, a series of public consultation meetings were conducted during the subproject preparation. Various forms of public consultations (consultation through adhoc discussions on site) have been used to discuss the subproject and involve the community in planning the subproject design and mitigation measures.

B. Notification of Potential Interested and Affected Parties

150. 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, shopkeepers/businessmen whose shops/commercial establishments will have temporary access disruption during the project execution, in addition to general public of the subproject area. In addition to a number of informal consultations conducted regularly in the project corridor, a total of 13 people, selected on a stratified basis to ensure diversified representation, were formally interviewed with the help of an interview schedule from 02.06.2011 to 14.06.2011. Issues discussed and feedback received along with details of date, time, location and list of participants are given in **Appendix-2**. Communication with interested and affected parties (Iand APs) was by telephone and direct communication in order to obtain the necessary background information to compile this report.

C. Future Consultation and Disclosure

151. 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:

i. Consultation during detailed design

152. Focus-group discussions with affected persons and other stakeholders to hear their views and concerns, 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.

153. 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.

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

ii. Consultation during construction:

155. 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 has started; and

156. 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.

iii. Project disclosure

157. 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, if any, together with the proposed detours will be communicated via road signages, etc. Public disclosure meetings at key project stages to inform the public of progress and future plans.

158. For the benefit of the community the Summary of IEE will be translated in the local language and made available at: (i) ERA office; (ii) District Magistrate Office; and, (iii) PMU/PIU. It will be ensured that the hard copies of IEE are kept at such places 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

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

- 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.
- 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.

160. 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 also lodge their complaints online at <http://www.jkgrievance.nic.in>.

161. 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 sub-project 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 sub-project sites.

VIII. ENVIRONMENTAL MANAGEMENT PLAN

162. 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/ PSC.

The EMP identifies the three phases of development as: (i) Site Establishment and Preliminary Activities; (ii) Construction Phase; and (iii) Post Construction/Operational Phase.

163. The purpose of the EMP is to ensure that the activities are undertaken in a responsible non-detrimental manner with the objectives of: (i) provide a pro-active, feasible and practical working tool to enable the measurement and monitoring of environmental performance on site; (ii) guide and control the implementation of findings and recommendations of the environmental assessment conducted for the subproject; (iii) detail specific actions deemed necessary to assist in mitigating the environmental impact of the subproject; and (iv) ensure that safety recommendations are complied with.

164. A copy of the EMP must 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. It shall be noted that the Supreme Court of India¹⁴ mandates 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).

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

- Within the boundaries of the site, site extensions and haul/ access roads there is evidence of contravention of clauses.
- If environmental damage ensues due to negligence.
- The contractor fails to comply with corrective or other instructions issued by the Engineer/PMU/PIU within a specified time.
- The Contractor fails to respond adequately to complaints from the public.

A. Institutional Arrangement

166. 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 Support Consultants (PSC). ERA will be the executing agency.

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

168. 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

¹⁴ Writ petition no 657 of 1995. The Supreme Court, in its order dated Feb.4, 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."

of DSC with ERA as monitoring agency (with assistance of PSC). 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/local laws and regulations and in accordance with ADB's environmental policy and guidelines.

169. ERA (PMU and PIU)

- Complies with all applicable legislation and is conversant with the requirements of the EMP;
- 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;
- 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 ;
- 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 fails to comply with the said environmental specifications.

170. Project Support Consultants (PSC)

- Conversant with the requirements of the EMP and all applicable legislation.
- Monitors the implementation of EMP on site and recommends requisite measures in case of non-compliances to ERA.
- Conducts monitoring through environmental monitoring laboratory in consultation with Safeguards Unit of ERA and the Engineer.

171. The Engineer (DSC)

- Complies with all applicable legislation and is conversant with the requirements of the EMP;
- Arranges information meetings for and consults with interested and affected parties about the impending construction activities;
- 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.
- Enforces and monitors compliance with the requirements of EMP on site;
- Assesses the Contractor's environmental performance in consultation with the Environmental Expert (of DSC) ;
- Documents in conjunction with the Contractor, the state of the site prior to commencing construction activities.

172. Environmental Expert of Engineer (DSC)

- Briefs the Contractor about the requirements of the Environmental Specification and/ or EMP, as applicable;

- Advises the Engineer about the interpretation, implementation and enforcement of the Environmental Specifications and other related environmental matters;
- Monitors and reports on the performance of the contractor/project in terms of environmental compliance with the EMP to the Engineer and ERA; and
- Provides technical advice relating to environmental issues to the Engineer.

173. **The Contractor**

- Complies with all applicable legislation, is conversant with the requirements of the EMP, and briefs staff about the requirements of same;
- 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;
- 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;
- Provides environmental awareness training to staff;
- Bears the costs of any damages/ compensation resulting from non-adherence to the EMP or written site instructions;
- Conducts all activities in a manner that minimizes disturbance to directly affected residents and the public in general, and foreseeable impacts on the environment.
- Ensures that the Engineer is timely informed of any foreseeable activities that will require input from the Environmental Expert (of Engineer).
- Appoints one full time Environmental Safeguard Officer for implementation of EMP, community liaisoning, reporting and grievance redressal on day to day basis.
- Receives complaints/grievances from public, immediately implements the remedial measures and reports to the Engineer (DSC) within 48 hours.

B. **Capacity Building**

174. Training and orientation programmes shall be organized by the Environmental Experts of Engineer (DSC), PSC and ERA for the contractors, labourers, 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, public consultation and participation, health and safety measures, grievance redressal mechanism and implementation of EMP.

C. **Environmental Mitigation/Management Plan**

175. **Table-30** outlines the site establishment and preliminary activities.

Table-30: Site Establishment and Preliminary Activities

	Activity	Management/Mitigation	Responsible for Monitoring	Frequency
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

	Activity	Management/Mitigation	Responsible for Monitoring	Frequency
		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
		A copy of the EMP must be kept on site during the construction period	Environmental Expert of Engineer (EE)	At all times
2.	Access to Site ¹⁵	Access to site will be via existing roads. The Contractor will need to ascertain the existing condition of the roads and repair damage that shall occur due to construction.	Engineer	Prior to moving onto site and during construction
		The Local Traffic Police Department shall be involved in the planning stages of the road closure and detour and available on site in the monitoring of traffic in the early stages of the operations during road closure.	Engineer	Prior to moving onto site
		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
		The location of all affected services and servitudes must be identified and confirmed.	Engineer	Prior to moving onto site
		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.
		No trees/shrubs/groundcover may be removed or vegetation stripped without the prior permission of the Engineer/Environmental Expert.	Engineer/EE	Before and during construction.
		Agreed turning areas for haulage vehicles are to be formalized and used by the Contractor. No turning maneuvers other than at the designated places shall be permitted.	Engineer	Prior to moving onto site.
		Contractors shall construct formal drainage on all temporary haulage roads in the form of side drains to prevent erosion and point source discharge of run-off.	Engineer	Prior to moving onto site.
3.	Setting up of Construction Camp ¹⁶	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

¹⁵ Access to site and traffic management shall be done in accordance to the directions of Engineer and the Traffic Management Plan (**Appendix-2 to EMP**).

¹⁶ 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
		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
		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
		In most cases, on-site accommodation will not be required. The construction camp can thus be comprised of: <ul style="list-style-type: none"> • site office • ablution facilities • designated first aid area • eating areas • staff lockers and showers (where water and waterborne sewers are available) • storage areas • batching plant (if required) • refueling areas (if required) • maintenance areas (if required) • crushers (if required) 	Engineer	During set-up
		Cut and fill must be avoided where possible during the set up of the construction camp.	Engineer	During site set-up
		The camp must be properly fenced off and secured	Engineer	During site establishment and ongoing – weekly inspections
		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
		Under no circumstances may open areas or the surrounding bush be used as a toilet facility.	Engineer	Ongoing
		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
		Bins shall have liner bags for efficient control and safe disposal of waste	EE	Ongoing
		Recycling and the provision of separate waste receptacles for different types of waste shall be encouraged.	EE	During site set-up and ongoing
4.	Establishing Equipment Lay-	Choice of location for equipment lay-down and storage areas must take into	EE	During site set-up

	Activity	Management/Mitigation	Responsible for Monitoring	Frequency
	down and Storage Area ¹⁷	account prevailing winds, distances to adjacent land uses, general on – site topography and water erosion potential of the soil. Impervious surfaces must be provided where necessary.		
		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
		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
		Equipment lay-down and Storage areas must be designated, demarcated and fenced if necessary.	EE	During site set-up
		Fire prevention facilities must be present at all storage facilities	EE	During site set-up
		Proper storage facilities for the storage of oils, paints, grease, fuels, chemicals and any hazardous materials to be used must be provided to prevent the migration of spillage into the ground and groundwater regime around the temporary storage area(s). 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	EE	During site set-up and ongoing
		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
		Fuel tanks must meet relevant specifications and be elevated so that leaks may be easily detected.	Engineer and Contractor	During site setup and monitored
		Material Safety Data Sheets (MSDSs) shall be readily available on site for all chemicals and hazardous substances to be used on site. Where possible the available, MSDSs shall additionally include information on ecological impacts and measures to minimize negative environmental impacts during accidental	Engineer and Contractor	Ongoing

¹⁷ Storage areas can be hazardous, unsightly and can cause environmental pollution if not designed and managed carefully.

	Activity	Management/Mitigation	Responsible for Monitoring	Frequency
		releases or escapes.		
		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 is made aware of the health risks associated with any hazardous substances used and has been provided with the appropriate protective clothing/equipment in case of spillages or accidents and have received the necessary training.	EE and Contractor	Ongoing
		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
5.	Materials Management – Sourcing ¹⁸	Contractors shall prepare a source statement indicating the sources of all materials (including topsoil, sands, natural gravels, crushed stone, asphalt, clay liners, etc), and submit these to the Engineer for approval prior to commencement of any work.	Engineer and EE	On award of contract
		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
		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
6.	Education of site staff on general and Environmental Conduct ¹⁹	Ensure that all site personnel have a basic level of environmental awareness training.	EE and Contractor	During staff induction and ongoing
		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
		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
		All employees must undergo safety training and wear the necessary protective clothing.	EE and Contractor	During staff induction, followed by ongoing

¹⁸ Materials must be sourced in a legal and sustainable way to prevent offsite environmental degradation.

¹⁹ These points need to be made clear to all staff on site before the subproject begin.

	Activity	Management/Mitigation	Responsible for Monitoring	Frequency
				monitoring
		<p>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:</p> <ul style="list-style-type: none"> • No alcohol / drugs to be present on site; • Prevent excessive noise • Construction staff are to make use of the facilities provided for them, as opposed to ad-hoc alternatives (e.g. fires for cooking, the use of surrounding bush as a toilet facility are forbidden) • No fires to be permitted on site • Trespassing on private / commercial properties adjoining the site is forbidden • Other than pre-approved security staff, no workers shall be permitted to live on the construction site • No worker may be forced to do work that is potentially dangerous or for what he / she is not trained to do 	EE and Contractor	During staff induction, followed by ongoing monitoring
6.	Social Impacts ²⁰	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
		A communications strategy is of vital importance in terms of accommodating traffic during road closure. The road closure together with the proposed detour needs to be communicated via advertising, pamphlets, radio broadcasts, road signage, etc.	Engineer and EE	Prior to moving onto site and ongoing
		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
		Storage facilities, elevated tanks and other temporary structures on site shall be located such that they have as little	Engineer and EE	During surveys and preliminary investigations

²⁰ 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
		visual impact on local residents as possible.		and site set-up.
		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.
		Special attention shall be given to the screening of highly reflective materials on site.	EE	During site set-up
7.	Noise Impacts	Construction vehicles are to be fitted with standard silencers prior to the beginning of construction.	Contractor	
		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	
8.	Dust/Air Pollution ²¹	Vehicles travelling along the access roads must adhere to speed limits to avoid creating excessive dust.	EE	Ongoing.
		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
		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.
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.
		Wind screening and stormwater control shall be undertaken to prevent soil loss from the site.	Engineer and EE	During site set-up
		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
10.	Stormwater ²²	To prevent stormwater 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.

²¹ Establishment of the camp site, and related temporary works can reduce air quality.

²² Serious financial and environmental impacts can be caused by unmanaged stormwater.

	Activity	Management/Mitigation	Responsible for Monitoring	Frequency
		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.
		A drainage diversion plan must be submitted to the Engineer for approval and must include the location and design criteria of any temporary diversion of storm water within the existing drains during construction works.	Engineer and EE	During site setup.
11.	Water Quality ²³ .	Storage areas that contain hazardous substances must be bunded with an approved impermeable liner.	Engineer	During site setup.
		Spills in bunded areas must be cleaned up, removed and disposed of safely from the bunded area as soon after detection as possible to minimise pollution risk and reduced bunding capacity.	Engineer and EE	During site setup.
		A designated, bunded area is to be set aside for vehicle washing and maintenance. Materials caught in this bunded area must be disposed of to a suitable waste site or as directed by the Engineer	Engineer and EE	During site setup.
		Provision shall be made during set up for all polluted run off to be treated to the Engineer's approval before being discharged into the stormwater system. (This will be required for the duration of the project.)	Engineer and EE	During site setup and to be monitored weekly
12.	Conservation of the Natural Environment ²⁴	No vegetation may be cleared without prior permission from the Engineer.	Engineer and EE	During site setup and ongoing.
		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
		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, haulage Areas
13.	Set-up of Waste Management Procedure	The excavation and use of rubbish pits on site is forbidden.	EE	Ongoing
		Burning of waste is forbidden.	EE	Ongoing

²³ Incorrect disposal of substances and materials and polluted run-off can have serious negative effects on groundwater quality.

²⁴ 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
		Prior to commencement of construction, all disposal sites for excavated and construction materials must be identified and made known to the contractors. The contractors shall submit to EE of DSC for approval of the excavated materials management plan. The Engineer and EE must provide orientation on excavated materials management plan to the Contractor.	Engineer, EE and Contractor	Throughout the duration of the subproject.
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 notify the Engineer/Contractor shall such an item be uncovered.	EE	During site set-up And ongoing.
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
		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
		Flammable materials shall be stored as far as possible from adjacent residents / businesses.	Engineer and EE	Ongoing
		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"> • stringing of power lines • earthworks / earthmoving machinery on steep slopes above houses / infrastructure • risk to residences along haulage roads / access routes 	Engineer and EE	24 hours prior to activity in question

DSC = Design and Supervision Consultant; EE = Environmental Expert of DSC/Engineer

176. **Table-31** outlines management of construction activities and workforce.

Table-31: Management of Construction and Workforce Activities

	Activity	Management/Mitigation	Responsible for Monitoring	Frequency
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.
		Contractors shall ensure that access roads are maintained in good condition by attending to potholes, corrugations and stormwater damage as soon as	Engineer	Weekly inspection.

	Activity	Management/Mitigation	Responsible for Monitoring	Frequency
		these develop.		
		If necessary, staff must be employed to clean surfaced roads adjacent to construction sites where materials have been spilt.	Contractor	When necessary
		Unnecessary compaction of soils by heavy vehicles must be avoided; construction vehicles must be restricted to demarcated access, haulage routes and turning areas.	Contractor	Ongoing monitoring.
		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.
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.
		Run-off from the camp site must not discharge into neighbors' properties.	Engineer	Ongoing monitoring.
		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
		The Contractor is to ensure that open areas or the surrounding bush are not being used as a toilet facility.	Contractor	Weekly inspection
		The Contractor shall ensure that all litter is collected from the work and camp areas daily.	Contractor	Ongoing monitoring.
		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 for review by the Engineer/EE.	Contractor and Engineer	Weekly inspection
		The Contractor shall ensure that all litter is collected from the work and camp areas daily.	Contractor	Ongoing monitoring.
		Eating areas shall be regularly serviced and cleaned to ensure the highest possible standards of hygiene and cleanliness.	Contractor	Daily monitoring.
		The Contractor shall ensure that his camp and working areas are kept clean and tidy at all times.	Contractor and Engineer	Weekly monitoring
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 behavior that are unclear.	Contractor and Engineer	Ongoing monitoring.

	Activity	Management/Mitigation	Responsible for Monitoring	Frequency
		The rules that are explained in the worker conduct section, must be followed at all times	Contractor and Engineer	Ongoing monitoring.
4.	Dust and Air Pollution ²⁵	Vehicles travelling to and from the construction site must adhere to speed limits so as to avoid producing excessive dust.	Engineer	Ongoing monitoring.
		A speed limit of 30km/hr must be adhered to on all dirt roads.	Engineer	Ongoing monitoring.
		Access and other cleared surfaces must be dampened whenever possible and especially in dry and windy conditions to avoid excessive dust.	Engineer	Ongoing monitoring.
		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.
		Vehicles and machinery are to be kept in good working order and to meet manufacturers specifications for safety, fuel consumption, etc.	Contractor	Ongoing monitoring.
		Should excessive emissions be observed, the Contractor is to have the equipment seen to as soon as possible.	Engineer	As directed by the engineer.
		No fires are allowed on site except for the burning of firebreaks.	Engineer	Ongoing monitoring.
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.
		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.
		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.
		Stormwater control and wind screening shall be undertaken to prevent soil loss from the site.	Engineer	Ongoing monitoring.
		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.
		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 and Contractor	As the cut and fill activity is completed.

²⁵ 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
		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.		
		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.
6.	Stormwater	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: <ul style="list-style-type: none"> • Removal of riparian vegetation • Opening up of the stream channel 	Contractor	Ongoing monitoring.
		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 stormwater channels, drainage lines or rivers.	Engineer	Monitoring throughout the duration of the project.
		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.
		The use of high velocity stormwater pipelines shall be avoided in favor of open, high friction, semi-permeable channels wherever feasible.	Engineer and Contractor	As directed by the engineer
		Stormwater outfalls shall be designed to reduce flow velocity and avoid streambank and soil erosion.	Engineer and Contractor	As directed by the engineer
		During construction un-channeled 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.
		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	Engineer and Contractor	Ongoing monitoring.

	Activity	Management/Mitigation	Responsible for Monitoring	Frequency
		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.		
		Storage and/or stock-piling of excavated materials and construction wastes will not be allowed for more than two days at any site. A period of one to two days shall be required for drying up of the excavated material so as to avoid spillage of liquid waste along the transportation route. After initial drying up the material must be immediately disposed to approved sites.	Contractor and Engineer	As excavation on existing drains progresses
7.	Water Quality ²⁶	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 site.	Contractor and Engineer	Regular monitoring (refer to the environmental monitoring program)
		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)
		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)
		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)
		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

²⁶ 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
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.
		Only trees that have NOT been marked beforehand are to be removed.	Contractor	Ongoing monitoring.
		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.
		The hunting of birds and animals on site and in surrounding areas is forbidden.	Contractor	Ongoing monitoring.
		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.
		Alien vegetation encroachment onto the site as a result of construction activities must be controlled during construction.	Contractor	Twice-monthly monitoring.
		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.
9.	Materials Management	Stockpiles shall not be situated such that they obstruct natural water pathways.	Engineer and Contractor	Location as directed by the engineer
		Stockpiles shall not exceed 2m in height unless otherwise permitted by the Engineer.	Engineer	Location as directed by the engineer
		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
		Stockpiles shall be kept clear of weeds and alien vegetation growth by regular de-weeding.	Contractor	Monthly monitoring
		All concrete mixing must take place on a designated, impermeable surface.	Contractor	Ongoing monitoring.
		No vehicles transporting concrete to the site may be washed on site.	Contractor	Ongoing monitoring.
		No vehicles transporting, placing or compacting asphalt or any other bituminous product may be washed on site.	Contractor	Monthly monitoring.
		Lime and other powders must not be mixed during excessively windy conditions.	Contractor	As necessary
		All substances required for vehicle maintenance and repair must be stored	Contractor	Ongoing monitoring.

	Activity	Management/Mitigation	Responsible for Monitoring	Frequency
		in sealed containers until they can be disposed of / removed from the site.		
		Hazardous substances / materials are to be transported in sealed containers or bags.	Engineer and Contractor	Ongoing monitoring
		Spraying of herbicides / pesticides shall not take place under windy condition.	Contractor	As necessary.
10.	Waste Management	Refuse must be placed in the designated skips / bins which must be regularly emptied. These shall remain within demarcated areas and shall be designed to prevent refuse from being blown out by wind.	Contractor	Ongoing monitoring.
		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.
		Littering on site is forbidden and the site shall be cleared of litter at the end of each working day.	Contractor	Ongoing monitoring.
		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.
		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.
		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.
		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.
		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.
		A sump (earth or other) must be created for concrete waste. This is to be de-sludged regularly and the cement waste is to be removed to the approved disposal site.	Engineer and Contractor	Ongoing monitoring.
11.	Social Impacts ²⁷	Contractor's activities and movement of staff to be restricted to designated	Engineer	Ongoing.

²⁷ 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
		construction areas.		
		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.
		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.
		Disruption of access for local residents, commercial establishments, institutions, etc. must be minimized and must have the Engineer's permissions.	Engineer	Ongoing monitoring.
		Provide walkways and metal sheets where required to maintain access across for people and vehicles.	Contractor	Ongoing monitoring
		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
		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.
		The Contractor is to inform neighbors in writing of disruptive activities at least 24 hours beforehand. This can take place by way of leaflets placed in the postboxes 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.
		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
		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 "Confirmation from Operator of Commercial establishment/shop for provision of temporary Access by	Engineer	On completion of works at each site

	Activity	Management/Mitigation	Responsible for Monitoring	Frequency
		Contractor ". This format has been appended as Appendix-1 to EMP .		
		Lighting on the construction site shall be pointed downwards and away from oncoming traffic and nearby houses.	Engineer	Ongoing monitoring.
		The site must be kept clean to minimize the visual impact of the site.	Engineer	Weekly monitoring.
		If screening is being used, this must be moved and re-erected as the work front progresses.	Engineer	Ongoing monitoring.
		Machinery and vehicles are to be kept in good working order for the duration of the project to minimize noise nuisance to neighbors.	Contractor	Ongoing monitoring.
		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"> • noise generated by jackhammers, diesel generator sets, excavators, etc. • drilling • dewatering pumps 	Engineer and Contractor	At least 24 hrs prior to the activity taking place.
		Noisy activities must be restricted to the times given in the Project Specification or General Conditions of Contract.	Engineer	Ongoing monitoring.
		The Engineer and Contractor are responsible for ongoing communication with those people that are interested in / affected by the project.	Engineer and Contractor	
		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.
		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.
		Queries and complaints are to be handled by: - documenting details of such communications <ul style="list-style-type: none"> • submitting these for inclusion in complaints register • bringing issues to Engineer's attention immediately • taking remedial action as per Engineer's instruction 	Contractor	Ongoing monitoring.
		Selected staff are to be made available for formal consultation with the interested and affected parties in order to:	Contractor	Ongoing monitoring.

	Activity	Management/Mitigation	Responsible for Monitoring	Frequency
		<ul style="list-style-type: none"> explain construction process answer questions 		
		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
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.
		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.
13.	Environment Safeguard Officer	Contractor shall appoint one Environment Safeguard Officer who shall be responsible for assisting contractor in implementation of EMP, community liaisoning, 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.
14.	Safety of workers	During handling of the excavated materials from drains (sediment/sludge), the contractor will ensure usage of personal protective equipments such as gloves, safety shoes and masks by the construction workers to avoid any possible occupational health hazards due to presence of heavy metals in the sludge and sediments.	Engineer and EE	Ongoing monitoring

ASI = Archeological Survey of India; EE = Environmental Expert of Engineer (DSC)

177. **Table-32** outlines the post-construction activities.

Table-32: Post Construction Activities

	Activities	Management/Mitigation	Responsible for Monitoring	Frequency
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
		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
		All hardened surfaces within the construction camp area shall be ripped,	Engineer	Subproject completion

	Activities	Management/Mitigation	Responsible for Monitoring	Frequency
		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.		
		The Contractor must arrange the cancellation of all temporary services.	Engineer	Subproject completion
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
		Open areas are to be re-planted as per the revegetation specification.	Engineer	Subproject completion
		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
		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
3.	Land Rehabilitation	All surfaces hardened due to construction activities are to be ripped and imported materials thereon removed.	Contractor	Subproject completion
		All rubble is to be removed from the site to an approved disposal site. Burying of rubble on site is prohibited.	Contractor	Subproject completion
		The site is to be cleared of all litter.	Contractor	Subproject completion
		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
		All embankments are to be trimmed, shaped and replanted to the satisfaction of the Engineer.	Engineer and Contractor	Subproject completion
		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
		The Contractor is to check that all watercourses are free from building rubble, spoil materials and waste materials.	Contractor	Subproject completion
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
		All residual stockpiles must be removed to spoil or spread on site as directed by the Engineer.	Engineer	Subproject completion
		All leftover building materials must be	Contractor	Subproject

	Activities	Management/Mitigation	Responsible for Monitoring	Frequency
		returned to the depot or removed from the site.		completion
		The Contractor must repair any damage that the construction work has caused to neighboring properties.	Contractors	As directed by the Engineer.
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
		Temporary roads must be closed and access across these blocked.	Engineer and EE	On completion of construction
		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
		All areas where temporary services were installed are to be rehabilitated to the satisfaction of the Engineer	Engineer and Contractor	On completion of construction

EE = Environmental Expert of Engineer (DSC)

D. Environmental Monitoring Programme

178. **Table-33** 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-33: Environmental Monitoring Program

Aspect	Parameter	Standards	location	duration / frequency	Implementation	Supervision
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/PSC
	Consent to Establish and Consent to Operate for waste water treatment facility from J and K SPCB	Water Act Air Act	Indira Nagar (Bhor Camp)	CTE – prior to commencement of construction and CTO – prior to commissioning.	PIU through Line Department (UEED)	PMU/PSC

Aspect	Parameter	Standards	location	duration / frequency	Implementation	Supervision
	Cutting Permit for Trees	Jammu and Kashmir Forest Conservation Act	-	Prior to moving onto site	Engineer and PIU	PMU/PSC
	Copy of EMP	EARF and ADB SPS	Subproject site, offices, website, library, etc.	At all times	Contractor, Engineer and EE	PMU/PSC
Access to site	Existing conditions	EMP	All access and haul roads	Prior to moving onto site	Engineer, EE and Contractor	PMU/PSC
	Road closures and traffic rerouting	Traffic Management Plan and EMP	All affected roads	One week in advance of the activity	Engineer and EE	PMU/PSC
	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/PSC
Construction camp	Approval of location and facilities	EMP	As identified	Prior to moving onto site	Contractor with the Engineer and EE	PMU/PSC
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/PSC
Materials management – sourcing	Approval of sources and suppliers	EMP	As identified	Prior to procurement of materials	Contractor with the Engineer and EE	PMU/PSC
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/PSC
Social impacts	Public Consultations, Information Disclosure, Communication Strategy	EARF, ADB SPS and EMP	Subproject site	Prior to moving onto site and ongoing	Contractor with the Engineer, EE, PIU/PSC	PMU
	GRM Register	EMP	Subproject site	Prior to moving onto site and ongoing	Contractor with the Engineer, EE, PIU	PMU/PSC
Noise	Baseline Data for noise level in dB(A) L _{eq}	National Noise Standards	Once before start of construction works at three sites as identified by Engineer.	Once prior to site set-up	Contractor	Engineer/ EE/ PMU/PSC
Air quality	Baseline ambient data for particulate	National Ambient Air	Once before start of	Once prior to site set-up	Contractor	Engineer/ EE/

Aspect	Parameter	Standards	location	duration / frequency	Implementation	Supervision
	matters 10 and 2.5 (PM ₁₀ , PM _{2.5}), sulfur dioxide (SO ₂), nitrogen dioxide (NO ₂)	Quality Standards	construction works at three sites as identified by Engineer.			PMU/PSC
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/PSC
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/PSC
Water quality	Baseline qualitative characteristics	EMP As per water quality standards for discharge into inland surface water	Once before start of construction works at three sites as identified by DSC	Once prior to site set-up	Contractor with Engineer and EE	PMU/PSC
Conservation of Natural Environment	Existing conditions	EMP	Subproject sites	Prior to site set-up	Contractor with Engineer and EE	PMU/PSC
Waste management procedure	Disposal sites	EMP	As determined	Prior to site set-up and ongoing throughout the subproject	Contractor with Engineer and EE	PMU/PSC
Cultural environment	Chance finds	ASI Act and EMP	As determined	Prior to site set-up and ongoing throughout the subproject	Contractor with Engineer and EE	PMU/PSC
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
Construction camp	Qualitative characteristics	Pre-subproject condition and EMP	Camp site	Prior to site set-up and ongoing throughout the subproject	Contractor	Engineer

Aspect	Parameter	Standards	location	duration / frequency	Implementation	Supervision
Staff conduct	Site Records (Accidents, Complaints)	EMP	Subproject sites	Ongoing	Contractor	Engineer
Air quality	PM ₁₀ , PM _{2.5} , SO ₂ , NO ₂	National Ambient Air Quality Standards	Three locations near construction sites as specified by the Engineer (DSC).	Once in every three months during subproject execution	Contractor	Engineer/EE/PMU/PSC
Soil erosion	Soil erosion management measures	EMP	Subproject sites	Ongoing	Contractor	Engineer
Stormwater	Soil erosion management measures	EMP	Subproject sites	Ongoing	Contractor	Engineer
Water quality	Qualitative characteristics	EMP and pre-existing conditions As per water quality standards for discharge into inland surface water	Three locations as specified by the Engineer (DSC).	Once in every three months during subproject execution	Contractor	Engineer
Conservation of Natural Resources	Number of trees	Tree-cutting permit and EMP	Subproject sites	Ongoing	Contractor	Engineer
	Vegetation conditions	EMP	Subproject sites	Ongoing	Contractor	Engineer
Materials management	Qualitative characteristics	EMP	Subproject sites	Ongoing	Contractor	Engineer
Waste management	Qualitative characteristics	EMP	Subproject sites	Ongoing	Contractor	Engineer
	Disposal manifests	EMP	Subproject sites	Ongoing	Contractor	Engineer
Social impacts	Public Consultations, Information Disclosure, Communication Strategy	EARF, ADB SPS and EMP	Subproject sites	Ongoing	Contractor with the Engineer, EE, PIU	PMU/PSC
	GRM Register	EMP	Subproject sites	Ongoing	Contractor with the Engineer, EE, PIU	PMU/PSC
Cultural environment	Chance finds	ASI Act and EMP	Subproject sites	Ongoing	Contractor	Engineer
Noise quality	Noise Level in dB(A) L _{eq}	National Noise standards	Three locations near construction sites as specified by the Engineer (DSC).	Once in every three months during subproject execution	Contractor	Engineer/EE/PMU/PSC

Aspect	Parameter	Standards	location	duration / frequency	Implementation	Supervision
3. Post-construction activities						
Construction camp	Pre-existing conditions	EMP	Construction camp	Subproject completion	Contractor	Engineer
Vegetation	Pre-existing conditions	Tree-cutting Permit and EMP	Subproject sites	Subproject completion	Contractor	Engineer
Land rehabilitation	Pre-existing conditions	EMP	Subproject sites	Subproject completion	Contractor	Engineer
Materials and infrastructure	Pre-existing conditions	EMP	Subproject sites	Subproject completion	Contractor	Engineer
General	Records	EMP	Subproject sites	Subproject completion	Contractor with Engineer and EE	PMU/PSC
4. Operation and maintenance (defect liability period)						
Air quality	PM ₁₀ , PM _{2.5} , SO ₂ , NO ₂	National Ambient Air Quality Standards	Once at three locations as specified by the Engineer (DSC).	Once in 6 months	Contractor	Engineer/ EE/ PMU/PSC
Noise quality	Noise Level in dB(A) L _{eq}	As per National Noise standards	Once at three locations as specified by the Engineer (DSC)	Once in 6 months	Contractor	Engineer/ EE/ PMU/PSC
Water Quality	Qualitative characteristics	As per water quality standards for discharge into inland surface water (discharge standards notified under Schedule VI inserted by Rule 2 (d) of the Environment (Protection) Third Amendment Rules, 1993 notified vide G.S.R. 801 (E) dated 31.12.1993)	Once at three locations as specified by the Engineer (DSC)	Once in 6 months	Contractor	Engineer/ EE/ PMU/PSC

EE= Environmental Expert of Engineer (DSC)

E. Environmental Management and Monitoring Cost

179. 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.

180. The operation phase mitigation measures are again of good operating practices, which will be the responsibility of implementing agency (ERA). The air quality, water quality and noise level monitoring during the operation and maintenance phase will be conducted by the environmental laboratory of ERA, therefore there are no additional costs.

181. 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 PSC with the assistance of DSC, costs of which are part of project management.

182. **Table-34** presents the estimated cost to implement the EMP.

Table-34: 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.
	Consent to establish and consent to operate for waste water treatment facility	One	Not Applicable	Not Applicable	To be obtained by the line department (UEED)
Public consultations and information disclosure	Information disclosure and consultations during preconstruction and construction phase.	As required	Lump sum	200,000	
Providing access to commercial establishments and properties.	Providing access, in case of access disruptions, to affected properties.	As required	Contractor's liability	Not applicable	Covered in Engineering cost
Dust Suppression at subproject sites	Application of dust suppression measures during construction phase.	As required	Lump sum	7,00,000	Covered under engineering design and cost
Protection measures against noise pollution	Construction of noise walls (as per requirement)	As required	Lump sum	2,00,000	Covered under engineering design and cost
Traffic management	Safety Signboards, delineators, traffic regulation equipments, flagman, temporary diversions, etc	Wherever required	Not applicable	Not applicable	Covered in engineering cost

Component	Description	Number	Cost per Unit (INR)	Cost (INR)	Source of Funds
Compensation for cutting of 15 trees ²⁸ along the drains	Fruit bearing trees= 2	2 trees	Cost evaluated by Horticulture Department	15,000	Covered in Rehabilitation and Resettlement Cost
(Compensation for tree-cutting with requisite permissions from concerned departments)	Non fruit bearing trees = 13	13 trees	Cost evaluated by Forest Department	6,302	Covered in Rehabilitation and Resettlement Cost
Compensation for cutting of 22 trees at proposed construction site for waste water treatment facility at Indira Nagar (Bhor Camp)	Non fruit bearing trees = 22	22 trees	600/- (tentative) The actual cost to be evaluated by Forest Department	13,200/-	Covered in Rehabilitation and Resettlement Cost
(Compensation for tree-cutting with requisite permissions from concerned departments)					
Compensatory plantation ²⁹ of 74 trees for cutting 37 (15+22) trees (@ 1:2)	Compensatory plantation @ 1:2	74 trees	Lump sum	1,00,000	
Baseline Monitoring	Site preparation and preliminary activities				
Air	Once before start of construction works at 3 sites as identified by DSC.	3	7,000 per sample	21,000	Covered under engineering design and cost
Noise	Once before start of construction works at 3 sites as identified by DSC	3	1,000 per sample	3,000	Covered under engineering design and cost
Water	Once before start of construction works at 3 sites as identified by DSC	3	5,000 per sample	15,000	Covered under engineering design and cost
Construction Monitoring					
Air	Once in three	24	7,000 per	1,68,000	Covered under

²⁸ Compensation for cutting of trees involves cost of requisite permits from the concerned departments and the cost which is required to be paid to the owner of the trees after assessment by Forest/Sericulture/Horticulture Department.

²⁹ Compensatory plantation involves the cost of plantation and maintenance of the trees in a ratio of 1:2 (i.e. planting double the number of trees actually cut).

Component	Description	Number	Cost per Unit (INR)	Cost (INR)	Source of Funds
	months at 3 locations as identified by DSC (for two years)		sample		engineering design and cost
Noise	Once in three months at 3 locations as identified by DSC (for two years)	24	1,000 per sample	24,000	Covered under engineering design and cost
Water	Once in three months at 3 locations as identified by DSC (for two years)	24	5000 per sample	1,20,000	Covered under engineering design and cost
Defects Liability Period					
Air	Once at 3 sites as identified by DSC	3	7,000 per sample	21,000	Covered under engineering design and cost
Noise	Once at 3 sites as identified by DSC	3	1,000 per sample	3,000	Covered under engineering design and cost
Water	Once at 3 sites as identified by DSC	3	5,000 per sample	15,000	Covered under engineering design and cost
Online Treatment Arrangement	Treatment of Drain Water so as to maintain the organic load within permissible limit.	At one location	Lump sum	8,00,00,000	Covered under engineering design and cost
Any unanticipated impact due to subproject implementation	Mitigation of any unanticipated impact arising during construction phase and defect liability period.	As required	Lump sum	15,00,000	
TOTAL (INR)				83124502	
TOTAL (USD)				1768606.4	

Total Cost of EMP implementation = **INR 8,31,24,502/-**

{ Cost of environmental management covered under engineering cost and provisional sum of the subproject = **INR 8,12,90,000/-**

Cost of environmental management covered under rehabilitation and resettlement cost = **INR 34,502/-**

Independent cost of environmental management (not covered under engineering cost and rehabilitation and resettlement cost) = **INR 18,00,000/- }³⁰**

³⁰ These costs are covered works contracts.

IX. CONCLUSION AND RECOMMENDATIONS

183. The process described in this document has assessed the environmental impacts of all elements of the proposed drainage subproject in Channi Himmat, Jammu City. 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.

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

185. 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.

186. 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/PSC. 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.

187. 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.

188. 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.

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

APPENDIX-1
Rapid Environmental Assessment (REA) checklist
SEWAGE TREATMENT
Country/Project Title: India/J&K Urban Sector Development Investment Programme

Sector Division: Urban Drainage

SCREENING QUESTIONS	Yes	No	REMARKS
A. Project Siting Is the project area...			
• Densely populated?	✓		Jammu City is densely populated. The subproject area comprises of eastern part of the city, which is fast emerging as a commercial hub of Jammu division. It supports residential and commercial areas.
• 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?		✓	The subproject corridor is not within or adjacent to any environmentally sensitive area. The nearest environmentally sensitive area is Ram Nagar Wildlife Sanctuary at about 7.0 km distance from the outer periphery of sub project area. The sub project area is in eastern part of Jammu (Left bank of Tawi river) and wildlife sanctuary is in western part.
• Cultural heritage site		✓	The archaeologically protected monument closest to sub project area is 'Bahu Fort' at a distance of about 4.27 km from the outer periphery of sub project area.
• Protected Area		✓	None of the subproject component sites are adjacent to or within any protected area.
• Wetland		✓	None
• Mangrove		✓	Not applicable
• Estuarine		✓	Not applicable
• Buffer zone of protected area		✓	Not applicable
• Special area for protecting biodiversity		✓	None of the subproject component sites are adjacent to or within any special area for protecting biodiversity
• Bay		✓	Not applicable
B. Potential Environmental Impacts Will the Project cause...			
▪ Impairment of historical/cultural monuments/areas and loss/damage to these sites?		✓	No historical/cultural/ monuments/ areas exist in or close vicinity of the subproject components. Hence no such impacts are anticipated.
▪ Interference with other utilities and blocking of access to buildings; nuisance to neighboring areas due to noise, smell, and influx of insects, rodents, etc.?	✓		No significant impact is anticipated. However, during construction there will be minor impacts due to noise, and dust of construction activities. The interference with access to buildings and commercial establishments is anticipated during construction phase. This shall be temporary in nature and shall be restricted to the duration of construction activities at a particular site. No problems of smell, influx of insects, rodents, etc. are

			anticipated due to implementation of sub project. The works will be mainly restricted within the existing storm water drains.
<ul style="list-style-type: none"> Dislocation or involuntary resettlement of people 		✓	<p>A total of 46 affected persons/shops will have impact in terms of temporary loss of access during the construction while as 01 affected person (encroacher) will lose 01 guard room, 13 non-fruit bearing trees and 02 fruit-bearing trees on the existing ROW. No direct impact on the commercial structures losing access temporarily during construction is anticipated. There will be no physical or economic dislocation of any affected person.</p> <p>To mitigate this insignificant impact on 01 encroacher and potential business disruption of 46 affected persons/shops due to temporary disruption in access, a resettlement plan has been prepared under separate cover.</p> <p>Acquisition of 10.5 ha of government land (Floriculture Department) with 1164 trees existing on this land (out of these only 22 trees are required to be cut) shall be required for construction of waste water treatment facility. No IR impacts envisaged from this component.</p>
<ul style="list-style-type: none"> Disproportionate impacts on the poor, women and children, Indigenous Peoples or other vulnerable groups? 		✓	No such impact is anticipated.
<ul style="list-style-type: none"> Impairment of downstream water quality due to inadequate sewage treatment or release of untreated sewage? 		✓	The online drain water treatment facility proposed under this subproject will ensure drain water is treated and comply with applicable standards.
<ul style="list-style-type: none"> Overflows and flooding of neighboring properties with raw sewage? 		✓	No such impact is anticipated. The proposed subproject will reduce the water logging and flooding in the drainage zones.
<ul style="list-style-type: none"> Environmental pollution due to inadequate sludge disposal or industrial waste discharges illegally disposed in sewers? 		✓	Not applicable
<ul style="list-style-type: none"> Noise and vibration due to blasting and other civil works? 	✓		Noise due to operation of machines during civil works is anticipated. This shall be temporary in nature and shall be restricted to the duration of construction activities at a particular site. No blasting activity shall be undertaken.
<ul style="list-style-type: none"> Risks and vulnerabilities related to occupational health and safety due to physical, chemical, and biological hazards during project construction and operation? 	✓		During execution stage, workers may face occupational health and safety related issues if personal protection measures are not used properly. No such impact is anticipated in operation stage.
<ul style="list-style-type: none"> Discharge of hazardous materials into sewers, resulting in damage to sewer system and danger to workers? 		✓	Not applicable as the subproject involves rehabilitation of existing storm water drains.
<ul style="list-style-type: none"> Inadequate buffer zone around pumping and treatment plants to alleviate noise and other possible nuisances, and protect facilities? 		✓	Not applicable. Pumping stations and treatment plants are not involved.
<ul style="list-style-type: none"> Road blocking and temporary flooding due to land excavation during 	✓		Temporary road blocking during construction of culverts shall be there for which proper traffic management and

the rainy season?			diversion arrangements shall be implemented. Due care shall be taken to carry out the works during dry periods to avoid any incidence of temporary flooding in the areas.
▪ Noise and dust from construction activities?	✓		Minor noise and dust from construction activities is anticipated which shall be temporary in nature coinciding only with the duration of construction activities.
▪ Traffic disturbances due to construction material transport and wastes?		✓	The transportation of construction material and wastes shall be site specific and restricted to daily requirements which is not expected to result into traffic disturbances. However, traffic diversion plan, if required, will be prepared by contractor in consultation with Engineer to avoid traffic disturbances.
▪ Temporary silt runoff due to construction?		✓	Temporary silt run off may be there during rainy season. Majority of the works shall be carried out during dry periods to avoid such impacts. To avoid silt flow in drains, during construction, silt fencing arrangements will be provided at the banks of drains.
▪ Hazards to public health due to overflow, flooding, and groundwater pollution due to failure of sewerage system?		✓	Not applicable
▪ Deterioration of water quality due to inadequate sludge disposal or direct discharge of untreated sewage water?		✓	Not anticipated as the proposed subproject envisages rehabilitation of existing storm water drains.
▪ Contamination of surface and ground waters due to sludge disposal on land?		✓	No such impact is anticipated.
▪ Health and safety hazards to workers from toxic gases and hazardous materials which maybe contained in confined areas, sewage flow and exposure to pathogens in untreated sewage and unstabilized sludge?		✓	Not anticipated as there will be construction and rehabilitation of existing open drains. However, the workers shall be provided with personal protective equipments like gum boots, gloves and masks, etc. while working within the drains to avoid any occupational health hazards.
▪ Large population increase during project construction and operation that causes increased burden on social infrastructure (such as sanitation system)?		✓	No such impact is anticipated.
▪ Social conflicts between construction workers from other areas and community workers?		✓	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 construction and operation?		✓	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		✓	No such impact is anticipated in case of the proposed sub-project.

community throughout project construction, operation and decommissioning?			
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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
<ul style="list-style-type: none"> 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 landslides, tropical cyclone winds, storm surges, tsunami or volcanic eruptions and localized climate changes. However, flooding of low lying areas due to overflow of existing drains is there. The sub-project area falls in seismic zone-IV as per seismic zonation map of India.
<ul style="list-style-type: none"> Could changes in precipitation, temperature, salinity, or extreme events over the Project lifespan affect its sustainability or cost? 		✓	No
<ul style="list-style-type: none"> 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
<ul style="list-style-type: none"> Could the Project potentially increase the climate or disaster vulnerability of the surrounding area (e.g., increasing traffic or housing in areas that will be more prone to flooding, by encouraging settlement in earthquake zones)? 		✓	No

Public Consultation

Sub Project: Rehabilitation and Channelization of Storm Water Drains at Channi Himmat in Jammu

Various issues related to the proposed subproject ***“Rehabilitation and Channelization of Storm Water Drains at Channi Himmat in Jammu City”*** were discussed at various locations throughout the alignment of the drains proposed to be rehabilitated under the subproject. 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 in the absence of the proposed facility 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 favour of the proposed rehabilitation. However, they were concerned about the temporary problems which are expected to arise during construction stage such as traffic related issues at certain junctions; temporary loss of access to residences, commercial establishments/shops and few institutions and increase in air pollution due to dust emissions during construction. People are ready to extend all types of support during execution of the project. The details of the public consultation are given below:

Issues discussed

- Awareness and extent of knowledge about the subproject.
- Information on the benefits of the subproject viz a viz proposed urban infrastructure and anticipated economic and environmental enhancement.
- Information on perceived benefits from the proposed subproject including reduction in flooding, water logging, access related issues to residences, shops, etc. faced during rainy season and other problems faced.
- Information on perceived losses from the proposed subproject during execution which only comprise of temporary access disruptions during construction. Additionally, issues related to air, noise, etc., which will be restricted only to construction period, were also discussed.
- Presence of any historical/cultural site in the vicinity, if any.
- Information on trees to be cut and measures to be taken for compensatory plantation.
- Presence of any protected area/wetland in or adjoining the construction site, if any.
- Information on economic and environmental enhancement in terms better drainage system with perceived benefits of better health and hygiene scenario.

Summary of public consultations dated 01.11.2010, 02.06.2011 to 16-06-2011 at different habitations along Nallahs /Drains

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"> In general there is absence of a proper drainage network in the subproject areas. During the rainy season the water from the drains overflows and causes damage to physical assets- houses, commercial structures, roads, etc. in the vicinity of existing drains. During rainy season there is acute water logging in the low lying areas. The overflowed water stagnates at many places which increases the health risks to the citizens. Shopkeepers, students and working class of the area complained that during rainy season they face lot of hardships reaching their destinations. Due to absence of proper drain geometrics there are many safety problems faced by habitants especially children and old aged. 	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.
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 Jand K ERA under ADB Loan-2151-IND 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>People have to face a lot of problems like water logging, flooding, damages to properties due to water seepage and access and commuting related issues in the absence of the proposed facility. General benefits perceived by the people are summarized as follows.</p> <ul style="list-style-type: none"> An efficient drainage network will solve the problems of overflows and water logging especially during rainy days. Many structures will be saved as the land erosion caused by the un-channeled drains will be reduced. People-students, service class, shopkeepers, etc. in general will have lesser problems in reaching 	<p>All those affected due to subproject implementation should be compensated well before taking possession of their assets wherever applicable.</p> <p>During implementation, maximum efforts should be made to minimize hindrances of public access/provide alternative access.</p> <p>The work should be carried out at a fast pace so that in the coming rainy seasons there will be no incidences of water logging and property damage.</p>

		<p>their respective destinations as the problem of acute water logging and flooding in the low lying areas will be mitigated through this subproject.</p> <ul style="list-style-type: none"> • Significant reduction in flooding and water logging is expected to avoid the associated health risks to the citizens. • Rehabilitation of drainage system (especially where no proper drainage system exists) will ensure overall health and hygiene of the people and better aesthetics/ infrastructure in the subproject area. • Reduction in flooding and water logging in low lying areas shall result into optimum development of these areas. 	<p>People suggested an efficient Oand M system to be in place after the completion of the project.</p> <p>Rehabilitated drains should be cleaned periodically to ensure smooth flow all through the year.</p>
4	Information on perceived losses from the proposed subproject during execution stage in terms of disruptions in traffic, temporary access disruptions during execution air and noise pollution etc.	People opined that potential temporary impacts of access disruption for shops/commercial establishments, residences, 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 undertaken including appropriate signages, etc.	Effective mitigation measure should be in place so that problems related to traffic disruptions; air and noise pollution are minimized.
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 environmental 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 flooding and water logging especially in low lying area and generation of direct employment during the execution of the subproject	People were well aware about the benefits of the subproject which proposes an efficient drainage infrastructure in the subproject area. It will ensure an overall healthy environment, health and hygiene in the subproject area and reduced negative impacts on physical assets-	

		houses, commercial structures, roads, etc. in the vicinity of existing drains and indirect economic benefits thereof. In addition, people at large were aware about the fact that during the execution of the subproject a large number of skilled/semi-skilled people shall get employment and thus were in favour of construction works.	
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List of participants

S. No.	Name	Address	Occupation	Date of consultation
1.	Jagjeet Singh	Sec-4, Channi Himmat, Jammu	Private Job	16.06.2011
2.	Jai Gopal	Channi Himmat	General Store (Shop)	08.07.2011
3.	Sarabjeet Singh	Sec-7, Channi Himmat, Jammu	Lecturer	16.06.2011
4.	Kamaljeet Singh	Sec-1, Channi Himmat, Jammu	Consultant	16.06.2011
5.	Inderjeet Singh	Sainik Colony	Self Employed	16.06.2011
6.	Baldev Raj	Sainik Colony	Self Employed	16.06.2011
7.	Kameshwar Chopra	Channi Himmat	Buisness	02.06.2011
8.	Ashok Kumar	Sec-3, Channi Himmat	Shopkeeper	02.06.2011
9.	Mohinder Sharma	Cheese Corner, Channi Himmat, Jammu	Milk Merchant	16.06.2011
10.	Hema Mahajan	32/7, Channi Himmat	Housewife	16.06.2011
11.	V. K. Gupta	269/6, Channi Himmat, Jammu	Retd. Engineer	22.06.2011
12.	Parveen Kumar Gupta	24/7, Channi Himmat, Jammu	Councillor	16.06.2011
13.	Bahadur Singh Salathia	46/1, Sec-D, Sainik Colony, Jammu	ex-servicemen	16.06.2011

One to one consultations have also been carried with the following property owners impacted due to subproject.

S.No.	Name of the owner /shop	Name of the Drain	Side (RHS/ LHS)	Chainage (meter)	Type of Impact
1.	Ajanta Provisional Store	R2	RHS	210	Temporary access
2.	Nidan Diagnostic Lab	R2	LHS	600	Temporary access
3.	Tyre Repair Shop C/o Sahi	R2	LHS	640	Temporary access
4.	Sardari Lal Dogra's Tea Stall	R2	RHS	670	Temporary access
5.	Govind Rams Dhaba(Mobile Shop)	R2	LHS	700	Temporary access
6.	Prashotam Singhs Dhaba	R2	LHS	710	Temporary access
7.	Om Prakash Sharmas Tyre Repairing Shop	R2	LHS	760	Temporary access
8.	Mulk Raj and Sons Grocery Shop	R2	RHS	780	Temporary access
9.	Guru Har kishan Medicare Shop No 7 Sector 2	R2	RHS	800	Temporary access
10.	Gautham medicos	R2	RHS	840	Temporary access
11.	Thapa Chicken and Egg Store	R2	RHS	860	Temporary access
12.	Jai Shankar Pan House	R2	RHS	880	Temporary access
13.	Karan STD Booth	R2	RHS	880	Temporary access
14.	Om Digital Studio Sector 3	R2	RHS	890	Temporary access
15.	Lovely Digital Photo Studio	R2	RHS	895	Temporary access
16.	Jaidata property	R2	RHS	900	Temporary access

S.No.	Name of the owner /shop	Name of the Drain	Side (RHS/ LHS)	Chainage (meter)	Type of Impact
17.	Sharma sweet Shop	R2	RHS	905	Temporary access
18.	Anmol Stationery	R2	RHS	915	Temporary access
19.	Shakti Cement Store	R2	RHS	915	Temporary access
20.	Dinish Building Material	R2	RHS	920	Temporary access
21.	Surya Milk	R2	RHS	925	Temporary access
22.	Aircel Mobile Shop	R2	LHS	945	Temporary access
23.	Big Bakers	R2	LHS	965	Temporary access
24.	Modern Sanitation	R2	RHS	980	Temporary access
25.	Mint leaf Kitchen and Coffee Bar	R2	LHS	1000	Temporary access
26.	Life Spring Beauty Store	R2	RHS	1220	Temporary access
27.	Mahajan Departmental Store	R2	RHS	1270	Temporary access
28.	Sharma General Store	R2	RHS	1320	Temporary access
29.	AGS Fashion Clothing	R2	RHS	1560	Temporary access
30.	Singh Food Junction	R2	RHS	1570	Temporary access
31.	Mr. Ashok Kumar Attri Near PHE complex (Encroacher)	R3	LHS	150-200	1 Guard Room(04 sq.mts); Trees=15 (2 fruit bearing, 13 non fruit bearing) on encroached land
32.	Adequate Fashion Looks c/o Mr. Kamod Sharma	R3	RHS	1543-1538	Access and stair case
33.	Baba's Grocery c/o Mr. Neeraj	R3	RHS	1556-1551	Access and stair case
34.	Vicky Electricals c/o Mr. Vikash Chopra	R3	LHS	1570-1566	Access (but no loss of slab etc.)
35.	G.K. Traders c/o Mr. Kameshwar	R3	LHS	1574-1570	Access (but no loss of slab etc.)
36.	Asian Tour and Travels	R3	LHS	1608-1604	Access
37.	Asian Sanitary c/o Mr. Ajay Gupta	R3	LHS	1612-1608	Access
38.	Mahajan Electricals	R3	LHS	1620-1612	Access
39.	Amarjit Auto Fuel (Petrol Pump) c/o Mr. Amarjit	R3	LHS	1706-1676	In and out access, RCC slab
40.	Assla Automobiles	R3	LHS	1718-1714	Access and stair case
41.	Ankush Auto Works c/o Mr. Kalu	R3	LHS	1722-1718	Access and stair case
42.	Jewel Tea Stall	R3	LHS	1726-1722	Access
43.	Cycle and Tyre repairing shop c/o Mr. Deepak	R3	LHS	1730-1726	Access
44.	Shiva Autoworks	R3	LHS	1734-1730	Access
45.	Ranjeet Drycleaners	R3	LHS	1738-1734	Access
46.	STD/ISD/PCO shop	R3	LHS	1745-1738	Access
47.	N.K. Builders and Consultants	R3	LHS	1755	Access

RHS=right hand side; LHS=Left hand side

Summary:

1. The various issues related to proposed subproject have been discussed at various locations throughout the subproject corridor.
2. People of the subproject area are aware about the upcoming work. Most of the people are in favour of the upcoming subproject.
3. The major problems faced by them are related to flooding and water logging especially during rainy season, problems related to access and commuting during rains

and floods and general health and hygiene related problems due to existing drains which remain choked on and off.

4. An efficient drainage network will solve the problems of overflows and water logging especially during rainy days.

5. Many structures will be saved as the land erosion caused by the unchanneled drains will be reduced.

6. People-students, service class, shopkeepers etc in general will have lesser problems in reaching their respective destinations as the problem of acute water logging in the low lying areas will be mitigated through this subproject.

7. Health risks to citizens will be reduced due to efficient control of waste water logging and flooding in the area.

8. Public desired for implementation of better measures to reduce noise, dust and air pollution during the construction phase.

9. People also wished that local people especially skilled and unskilled people be given opportunities during the project tenure in different construction activities.

10. People expected that their problems shall be addressed and solutions for them shall be implemented during the subproject execution.

11. People are ready to extend all types of support during execution of the subproject.

12. People suggested that adequate safety measures should be in place during the execution of the civil works.



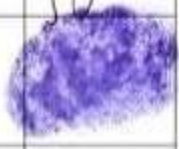
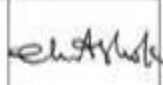
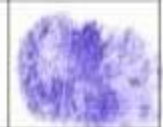





13. ERA reiterated its commitment that the requisite environmental management measures shall be incorporated in EMP and public consultation shall be a regular process during all stages of the subproject to solve any issues arising out of the proposed works.

Signature sheets of the people consulted during consultations.

LIST OF PARTICIPANTS IN PUBLIC CONSULTATION

SUBPROJECT NAME: Rehabilitation and Channelisation of Storm water drains at - Sainik Colony & Channithimal -
 LOCATION OF MEETING/CONSULTATION: Different localities along the Malah drains.
 DATE AND TIME: 11/11/2010 - 10 AM - 12:30 PM.

Sl. No	Name and Address	Occupation	Signature
1	Guldeep Singh	Retd. Army Person Sainik Colony	
2	Narain Singh	"	
3	Ashish Anand	Shopowner & Resident -	
4	Amrit K. Mahajan	Resident - Channithimal -	
5	Mohadev Singh	Resident -	
6	Baldev Gupta	Resident -	
7	Naresh Gupta	"	
8	Kulbhushan Sarma	"	
9	Gayatri Devi	"	
10	Ram Kumar Sharma	"	

Sl. No	Name and Address	Occupation	Signature
11	Bansi lal	Local Resident	
12	Manoj Sharma -	Shop Keeper	
13	Bitloo -	Fruit Seller	
14	Ram Lal gupta	Retailer	
15	Bitloo -	Tenant -	
16	Santosh	Barber	
17	Naresh Kumar	Tenant	
18	Sanjeev Bhatta	Motor Mechanic -	
19	Vinod Kumar	Resident (Business)	
20	Neelan Sharma	Resident (House wife)	

LIST OF PARTICIPANTS IN PUBLIC CONSULTATION

SUBPROJECT NAME: Rehabilitation and Canalization of storm water drains at - Sainik Colony and Champs Himmal -

LOCATION OF MEETING/CONSULTATION: Channi Himmal

DATE AND TIME: 02.06.2011 at 4 PM.

Sl. No	Name and Address	Occupation	Signature
1	Anok Kumar C/o Jewel Tea Stall	Shopkeeper	Anok
2	Deepak Sharma C/o Sharma Cycle works	Cycle work.	Deepak
3	Vijaynath C/o Ranjit Drycleaning	Dry cleaner	Vijaynath
4	Naran Singh (Manager) C/o Amarpat Auto-fuel (Petrol Pump)	Petrol Pump.	.
5	Ashu Gupta C/o Manojan Electricals	Business/Shop	Ashu
6	Ajay Gupta C/o Asian Sundry	Business	Ajay
7	Akshay Gupta C/o Asian Electronics	Business	Akshay
8	Rameshwar C/o G.K. Tenders	Business/Sundry	Rameshwar
9	Mr. Vikas C/o Vikas Electricals	Business/Electric goods.	Vikas
10	Mr. Neeraj C/o Babas Grocery	Business/Grocery	Neeraj
11	Mr. Kamal Sharma C/o Delegate Fashion	Style store cloth shop.	Kamal







LIST OF PARTICIPANTS IN PUBLIC CONSULTATION

SUB-PROJECT NAME: *Rehabilitation of Water Supply System in Jammu City.*

LOCATION OF MEETING/CONSULTATION: *Sector 1, Channi Himmat*

DATE & TIME:

SL. No.	Name and Address	Occupation	Signature
1	Salman, Garhi Nursery,	Nursery,	<i>[Signature]</i>
2	Bake Nursery,	Nursery,	
3	Ankursh, 13/1	Service	<i>[Signature]</i>
4	Importer Nursery, Summit Htg. No. 12.	Nursery operator.	<i>[Signature]</i>
5	Natural Nursery, Kullagi,	Nursery operator.	
6	Mr. M. L. Mahajan Resident of Shop owner	Shop owner at JDA Complex.	<i>[Signature]</i>
7	Mr. H. K. Gupta house - 275, Channi Himmat, Sector 2.	Shop owner at JDA Complex.	<i>[Signature]</i>
8	Dr. H. D. C. Manchada Home No. 27, Sector 1.	Retd. Person.	<i>[Signature]</i>
9	Mr. Abhay. Shop owner at JDA Complex	Business	<i>[Signature]</i>
10	Mr. Faruq Khan Begun Collection	Business at JDA Complex	<i>[Signature]</i>
11	Mr. Sardar Lal Dogra.	Tear stall owner	<i>[Signature]</i>

SL. No.	Name and Address	Occupation	Signature
12	Mr. Govind Ram	Food stall	Shatsredhaan
13	Mr. Purneshottam Singh	Food stall	balaram singh
14	M/s mulkraj & Sons	Provisional store	
15	Mr. Satpal Singh	Stationary store	
16	Mr. Manjeet Singh	Shop	
17	Mr. Zulfikar Akhatar RCM	Business	
18	Mr. Anil Kumar	Business	
19	Mr. Sunil Kumar	Business	
20			





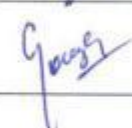
LIST OF PARTICIPANTS IN PUBLIC CONSULTATION

SUB-PROJECT NAME: *Channi Himmat Drainage.*

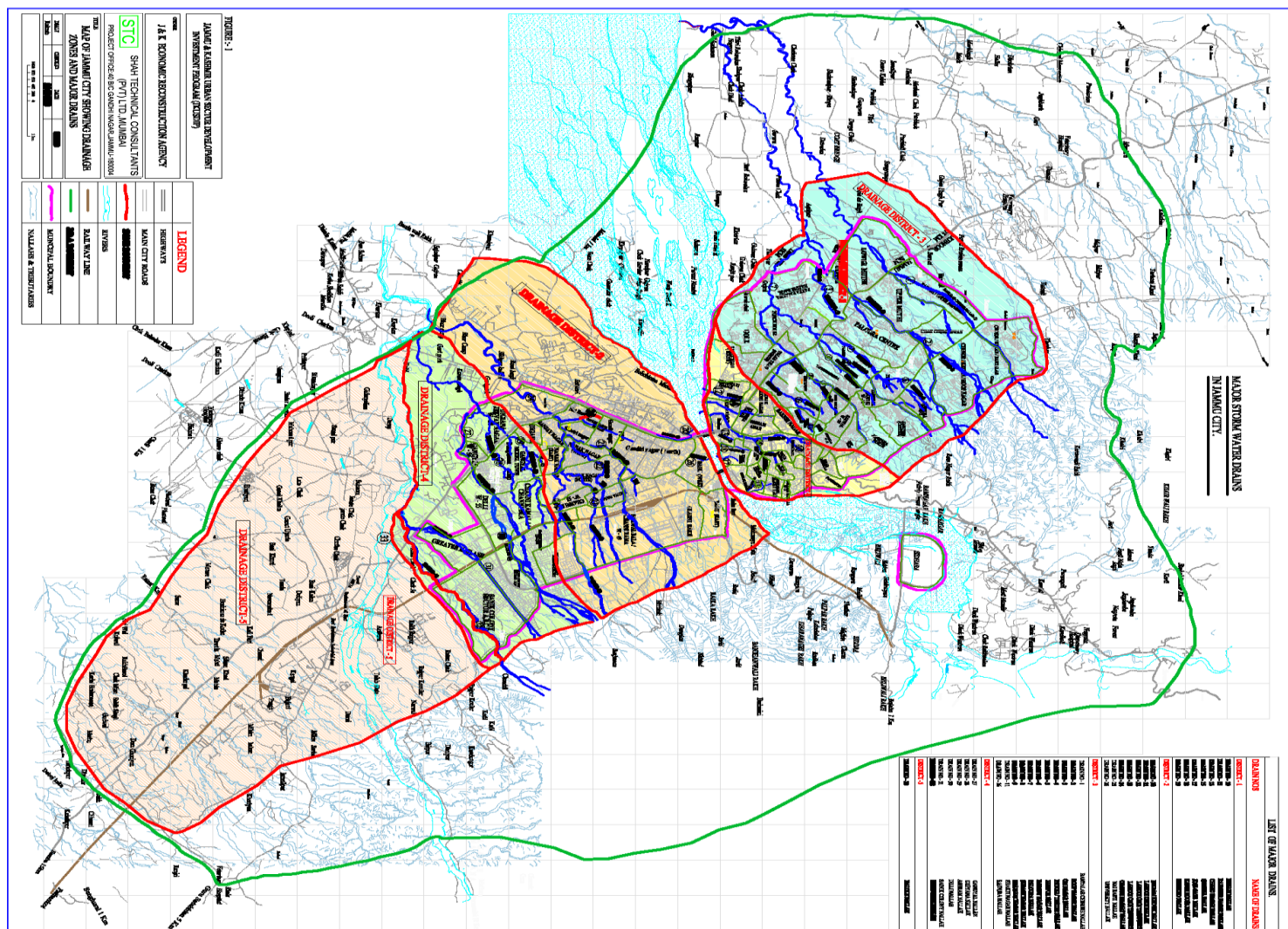
LOCATION OF MEETING/CONSULTATION: *Sector- 1, Channi Himmat.*

DATE & TIME:

SL. No.	Name and Address	Occupation	Signature
1	<i>Mr. M.L. Mahagon</i> <i>Resident & Shop owner</i>	<i>Shop owner</i> <i>RTI Sample X.</i>	<i>[Signature]</i>
2	<i>Mr. [Signature]</i> <i>Sandarlal Jagra</i>	<i>Shop owner</i> <i>(Tee Stall)</i>	<i>[Signature]</i>
3	<i>Mr. Govind Ram</i>	<i>Food stall</i>	<i>[Signature]</i>
4	<i>Mr. Purushottam Singh</i>	<i>Food stall</i>	<i>[Signature]</i>
5	<i>M/S Mulkraj & Sons</i>	<i>Provisional store</i>	<i>[Signature]</i>
6	<i>Mr. Salpal Singh</i>	<i>Stall owner</i>	<i>[Signature]</i>
7	<i>Mr. Madanlal</i> <i>Chicken Shop.</i>	<i>Shop owner</i> <i>Chicken shop.</i>	<i>[Signature]</i>
8	<i>Mr. Shyam Lal</i>	<i>Chicken shop</i> <i>owner</i>	<i>[Signature]</i>
9	<i>Mr. Gulshan Gupta</i>	<i>Shakicant-</i> <i>Store.</i>	<i>[Signature]</i>
10	<i>Mr. Sandarlal</i> <i>Employee at [Signature]</i>	<i>Employee</i>	<i>[Signature]</i>
11	<i>manjit Singh</i>	<i>Shop</i>	<i>[Signature]</i>

SL. No.	Name and Address	Occupation	Signature
12	Mr. Sunil Communication	Business	
13	Mr. Yogesh	Business	
1	Mr. Intiyaz Anshul C/O. RCM	Business	
2	Mr. Anil Kumar	Business	
3	Mr. Yogesh	Business	
4			
5			
6			
7			
8			
9			
10			
11			

Major drains and drainage zones of Jammu City and photographs of the existing drains





Main Drain in Channi Himmat (R3)



Main Drain in Channi Himmat (R3)



Main Drain in Channi Himmat (R3)



Secondary drain at Channi Himmat Sector-6



Secondary drain at Channi Himmat Sector-3

APPENDIX-4

GENERAL STANDARDS FOR EFFLUENTS

(As per Schedule – VI of Environmental (Protection) Third Amendment Rules 1993)³¹

Sl. No.	Parameter	Standards			
		Inland Surface Water	Public Sewers	Land For Irrigation	Marine Coastal Areas
1.	Colour and Odour	*	*	*	*
2.	Suspended Solids, mg/l	100	600	200	(a) For process waste water-100. (b) For cooling water effluent 10% above total suspended matter of influent.
3.	Particle size of suspended solids	Shall pass 850 micron IS sieve	-	-	(a) Flotable solids, max. 3mm. (b) Settleable solids, max. 850 microns
4.	pH value	5.5 – 9.0	5.5 – 9.0	5.5 – 9.0	5.5 – 9.0
5.	temperature	Shall not exceed 5°C above the receiving water temperature	-	-	Shall not exceed 5°C above the receiving water temperature.
6.	Oil and grease, mg/l	10	20	10	20
7.	Total residual chlorine, mg/l	1.0	-	-	1.0
8.	Ammonical nitrogen, mg/l	50	50	-	50
9.	Total Kjeldahl nitrogen (as N, mg/l	100	-	-	100
10.	Free ammonia (as NH ₃), mg/l	5.0	-	-	5.0
11.	Biochemical oxygen demand (5° days at 20 C), mg/l	30	350	100	100
12.	Chemical oxygen demand, mg/l	250	-	-	250
13.	Arsenic (as), mg/l	0.2	0.2	0.2	0.2
14.	Mercury (as Hg), mg/l	0.01	0.01	-	0.01
15.	Lead (as Pb), mg/l	0.1	1.0	-	2.0
16.	Cadmium (as cd), mg/l	2.0	1.0	-	1.0
17.	Hexavalent chromium (as Cr ⁺⁶), mg/l	0.1	2.0	-	1.0
18.	Total chromium (as Cr), mg/l	2.0	2.0	-	2.0
19.	Copper (as Cu), mg/l	3.0	3.0	-	3.0
20.	Zinc (as Zn), mg/l	5.0	15	-	15
21.	Selenium (as Se), mg/l	0.05	0.05	-	0.05
22.	Nickel (as Ni), mg/l	3.0	3.0	-	5.0

³¹ Schedule VI inserted by Rule 2 (d) of the Environment (Protection) Third Amendment Rules, 1993 notified vide G.S.R. 801 (E) dated 31.12.1993.

Sl. No.	Parameter	Standards			
		Inland Surface Water	Public Sewers	Land For Irrigation	Marine Coastal Areas
23.	Cyanide (as Cn), mg/l	0.2	2.0	0.2	0.2
24.	Fluoride (as F), mg/l	2.0	15	-	15
25.	Dissolved phosphates (as P), mg/l	5.0	-	-	-
26.	Sulphide (as S), mg/l	2.0	-	-	5.0
27.	Phenolic compounds (as C ⁶ H ⁵ OH), mg/l	1.0	5.0	-	5.0
28.	Radioactive materials (a) alpha emitters, uc/ml (b) Beta emitters, uc/ml	10-7	10-7	10-8	10-7
		10-6	10-6	10-7	10-6
29.	Bio-assay test	90% survival of fish after 96 hours in 100% effluent	90% survival of fish after 96 hours in 100% effluent	90% survival of fish after 96 hours in 100% effluent	90% survival of fish after 96 hours in 100% effluent
30.	Manganese (as Mn), mg/l	2	2	-	2
31.	Iron (as Fe), mg/l	0.2	0.2	-	0.2
32.	Vanadium (as V), mg/l	0.32	0.2	-	0.2
33.	Nitrate nitrogen, mg/l	10	-	-	20

APPENDIX-1 to EMP

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 and 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

Traffic Management Plan

A traffic management plan (TMP) has been developed to cope with road traffic disruptions likely to be encountered with the commencement of work on drainage Sub project- Rehabilitation and Channelization of Storm Water Drains at Channi Himmat in Jammu.

Objectives of Traffic Management Plan

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.

Operating Policies for TMP**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 construction of culverts.
- 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.

Public awareness and notifications

As expected, there will be travel delays during the construction of culverts 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 projects 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

The subproject is located in a well planned housing colony having well developed road network with sufficient road width and provides for number of alternate approaches. Because of this, it

will be possible to completely block the road, if necessary for some time and divert all the traffic to the alternate approach roads. Public will be informed of the alternate approach roads in advance. Traffic management measures have been planned for three locations on the Channi Nallah (R3 drain) where culverts have been proposed. If the need for road closure/detours arises at any other spot, during subproject execution, then suitable TMP on similar lines shall be prepared and implemented.

- At Chainage 1110 m (**Diversion Map-A**) the new culvert will be constructed after dismantling the old one. During construction, the traffic coming from the north side and going towards Channi Himmat main road-2 (R2) will be diverted towards the culvert on road-3 (R3), upstream of this Chainage, where it will turn right and meet R2. The traffic coming from R2 side will be blocked before the culvert site and will be directed on same detour in opposite direction.
- At Chainage 1440m (**Diversion Map-B**) where culvert is proposed, there is a four sided traffic intersection. Only one of these roads will be blocked for the construction of the culvert. The traffic coming from south side and moving towards Trikuta Nagar will take detour/alternate route via railway crossing – Satyam road route and will continue towards Trikuta Nagar. Rest of the traffic moving in South-North direction will take alternate route via road-3 (R3) running parallel to the upstream section of the drain and after taking two 90° turns will meet the same road some distance ahead of culvert site. The traffic coming from opposite side will take the same detour in opposite direction.
- At Chainage 1775m (**Diversion Map-C**) the culvert is proposed on the road which is one way and caters to the traffic coming from Channi Himmat towards Trikuta Nagar. A parallel road exists which caters to the traffic moving in opposite direction. Only light vehicles are allowed on these roads. During construction of the culvert the traffic coming from Channi Himmat and bound for Trikuta Nagar will be affected. This traffic will take alternate road via railway crossing – Satyam road route and will continue towards Trikuta Nagar thereof.

Traffic Monitoring Strategy

Traffic monitoring strategy that will be implemented during the construction of the sub-project is as follows:

i) On-site visits and traffic counts. 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 sub-project, 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

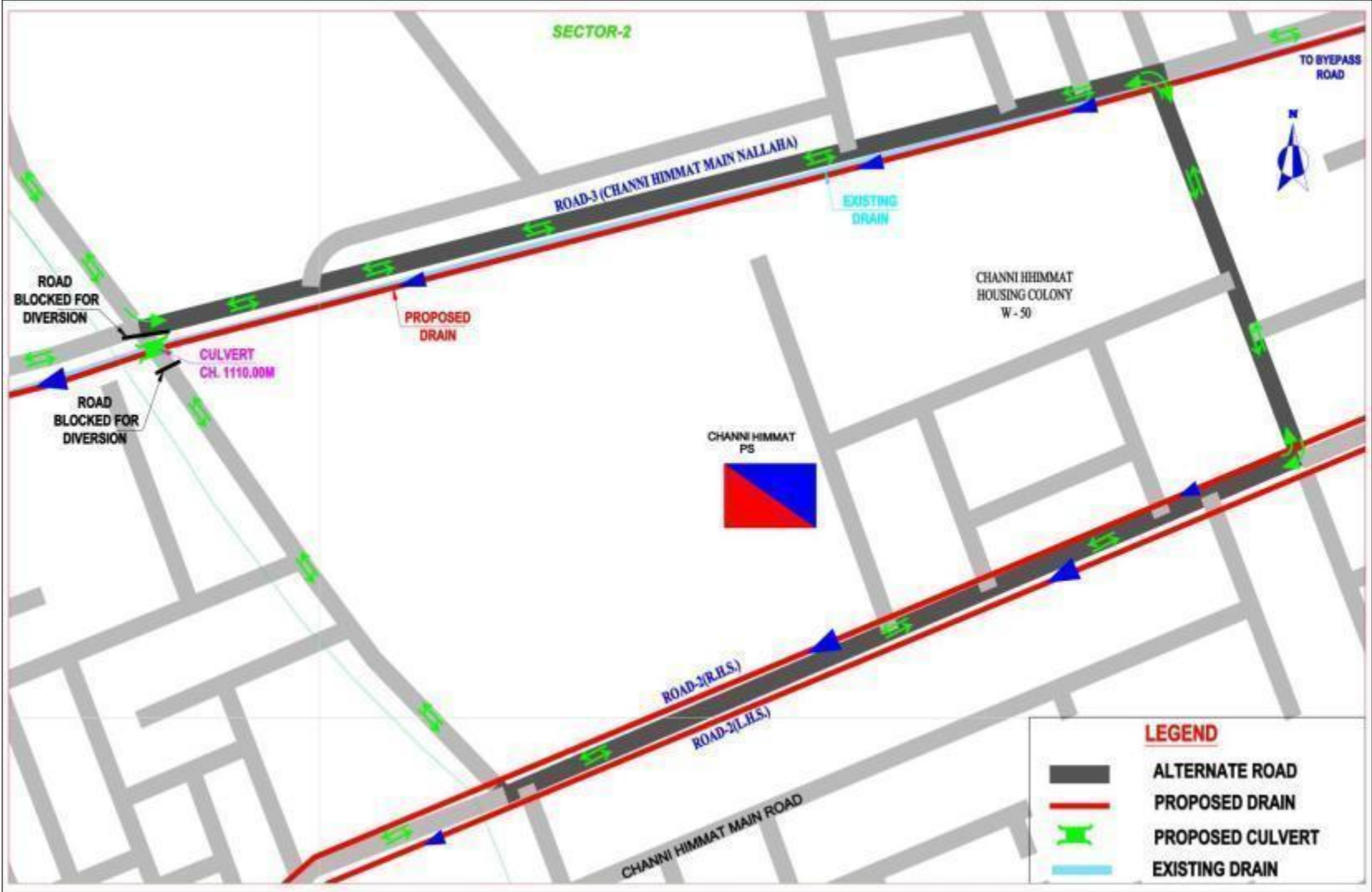
- Positive protection to separate vehicles from pedestrians and pedestrians from work area.
- Use channelizing devices to delineate the route (must be detectable).
- Protect pedestrians from vehicular traffic (positive protection).
- Protect pedestrians from hazards such as excavated pits, holes, cracks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

v) Adjustments necessary to public transport operators:

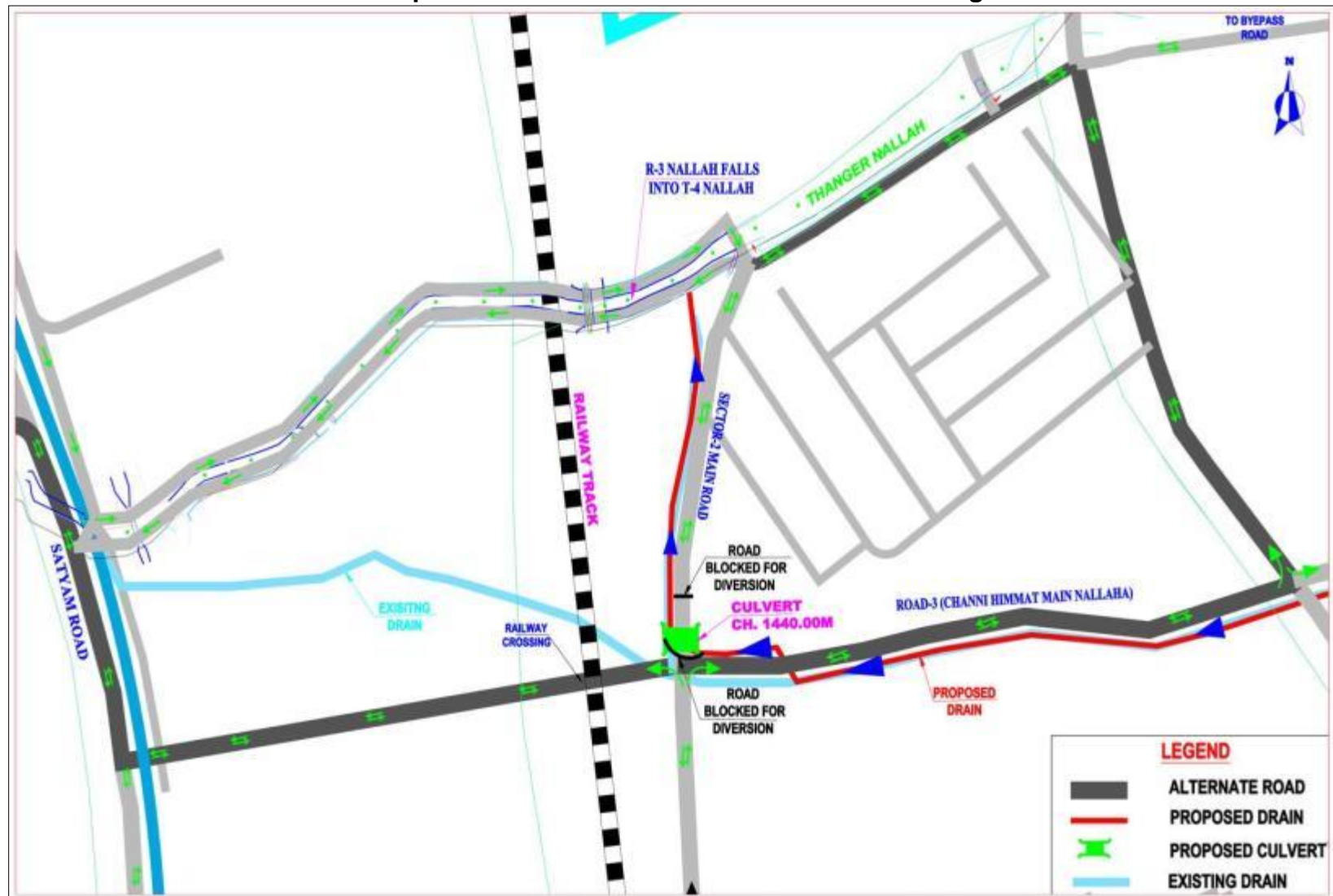
Different diversions will be used as part of traffic management plan in order to provide a smooth functioning of traffic during construction phase of the sub-project. However small adjustments will be necessary which are provided as follows:

- 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.

Diversion Map-A- Diversion Plan for Culvert site at Chainage-1110 m



Diversion Map-B- Diversion Plan for Culvert site at Chainage-1440 m



Diversion Map-C- Diversion Plan for Culvert site at Chainage-1775 m

