



RAWALPINDI DEVELOPMENT AUTHORITY

TRANSACTION ADVISORY SERVICES FOR LAI EXPRESSWAY PROJECT ON PUBLIC PRIVATE PARTNERSHIP MODE



ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

JANUARY 2022



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Transaction Advisory Services for Lai Expressway Project

PRELIMINARY ENVIRONMENTAL ASSESSMENT REPORT

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LIST OF ABBREVIATIONS

ADT	Average Daily Traffic
ASP	Activated Sludge Process
APs	Affected Persons
ALGAS	Asia Least Cost Greenhouse Gases Abatement Strategy
ASP	Activated Sludge Process
BOD	Biological Oxygen Demand
CDA	Capital Development Authority
CDM	Clean Development Mechanism
CEO	Cantonment Executive Officer
CO	Carbon Monoxide
COI	Corridor of Impact
DG	Directorate General
DRR	Disaster Rehabilitation and Resilience
DNA	Designated National Authority
dB(a)	Decibels
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPA	Environment Protection Agency
EPD	Environment Protection Department
EMMM	Environmental Mitigation and Management Matrix
FFD	Fire Fighting Department
GoP	Government of Pakistan
GHG	Greenhouse Gases
IUCN	International Union for Conservation of Nature
LARP	Land Acquisition and Resettlement Plan
LAA	Land Acquisition Act
MBT	Main Boundary Thrust
MSL	Mean Sea Level
MDGs	Millennium Development Goals
NCS	National Conservation Strategy
NDMA	National Disaster Management Authority
NEP	National Environmental Policy
NESPAK	National Engineering Services Pakistan (Pvt.) Limited
NEQS	National Environmental Quality Standards
NOCs	No Objection Certificates
NPO	No Project Option
O&D	Origin and Destination
OHSAS	Occupation Health and Safety Assessment Series
O&M	Operation & Maintenance
PAPs	Project Affected Persons
PD	Project Director
PEPA	Pakistan Environmental Protection Act
PEPC	Pakistan Environmental Protection Council
PEQS	Punjab Environmental Quality Standards
PPP	Punjab Public Private Partnership
PGA	Peak Ground Acceleration
PPE	Personnel Protective Equipment



RDA	Rawalpindi Development Authority
RWMC	Rawalpindi Waste Management Company
RWASA	Rawalpindi Water and Sanitation Agency
ROW	Right of Way
SC	Supervisory Consultant
SOPs	Standard Operating Procedures
STP	Sewage Treatment Plan
TMA	Tehsil Municipal Administration
VOC	Volatile Organic Compounds
WASA	Water and Sanitation Agency
WSP	Waste Stabilization Ponds



EXECUTIVE SUMMARY

ES-1 INTRODUCTION

Rawalpindi Development Authority (RDA) is planning to implement the proposed project comprising two components i.e. (i) 16-km-long expressway from Soan River near High Court to Katarian Bridge and further connected to 10th Avenue to provide alternative traffic route between the twin cities, Rawalpindi and Islamabad and (ii) construction of trunk sewer on both sides of Nullah Lai along with Sewage Treatment Plant (STP). To address the environmental and social impacts of the proposed project and to comply with the national environmental guidelines and Punjab Environmental Protection Act (Amended), 2012, the Environmental Impact Assessment (EIA) Report has been prepared, which will be further updated on the basis of final design.

As per Pak-EPA (Review of IEE and EIA) Regulations, 2000, the proposed project falls under Category 'D' (Transportation) and Category 'G' (Waste Disposal) of Schedule II, which requires an EIA study before the commencement of construction activities. According to the Pak-EPA Regulations, 2000 a separate EIA, study is required for the both project components i.e. Lai Expressway and Trunk Sewer and STP. However, at this stage a combined EIA study is being conducted for both components, but at the time of Project implementation a separate Environmental Impact Assessment (EIA) study would be carried out for the proposed Lai Expressway and Trunk Sewer and STP

This EIA study covers the environmental impacts of the proposed Lai Expressway and Trunk Sewer and STP comprising physical, ecological and socio-economic aspects. A minimum strip of 70 to 80 m was delineated as Right of Way (ROW) in which direct impacts of the proposed components are envisaged due to the implementation. However, for indirect impact related to physical, ecological and social domains, a COI of 25 m on each side of the proposed Project Area was considered as project corridor or COI.

ES-2 PROJECT DESCRIPTION

The Lai Expressway will serve both the residents of Rawalpindi and Islamabad; however, the main objective of this Expressway is to share the ever-increasing pressure and burden of increasing traffic load of Rawalpindi city. It will be a signal free road with an average speed of 50 kph. The proposed Project comprises development of access-controlled, four lane (2x2) Expressway and channelization of Nullah Lai along with Trunk Sewer at its both banks and STP. As mentioned earlier, the project comprises mainly two (02) components.

Component-I: The proposed Lai Expressway involves the construction of three (03) interchanges including the first at start point on G.T Road, second at Ammar Chowk and third at Katarian Bridge (IJP Road), eight (08) flyovers and two (02) underpasses on the expressway. The Project would ease the traffic congestion on GT Road, Murree Road and Airport Road.

Component-II: It includes the installation of Trunk Sewer and STP to develop a better sewerage system along Nullah Lai to meet the present and future requirements of efficient and effective service delivery. Trunk sewers will be laid along both banks of Nullah Lai to cater the sewage flow from adjoining areas. Right bank of the Project Area will be served by a RCC trunk sewer line ranging from 42” to 72” diameter and conduit of 2.5m x 2.5m having length of 10500m & 8200m respectively whereas left bank of the Project Area will also be served by a RCC trunk sewer line ranging from 36” to 66” diameter and conduit of 2.0m x 1.5m having length of 7700m & 11000m respectively. Furthermore, a RCC Conduit of 3.0m x 3.0m is proposed to be constructed from Soan Adda to STP, which will cater the flow from preceding conduits along both sides of Nullah Lai.

Land required for the construction of Lai Expressway including interchanges is about 1,711 kanals whereas 675 acres of land has been acquired by the RDA for the construction of STP. The estimated total cost of the proposed Project is Rs. 85 Billion while the cost of the construction works is Rs. 62.5 Billion.

ES-3 PROJECT ALTERNATIVES

Project alternatives for each project component were considered which are summarized below:

I. LAI EXPRESSWAY (COMPONENT-I)

I. No Project Option

No project option means no project will be implemented to resolve the issues arising due to increase in growth of traffic in Rawalpindi and Islamabad Cities which has put tremendous pressure on infrastructure of the city, particularly the road network. Statistics mentioned in the report shows that the traffic volumes on roads and intersections have reached saturation point mainly due to rapidly growing population of the cities which emphasis for the development of proposed Lai Expressway Project.

II. Expressway Route Alignment

Two (02) route options considered for the construction of Lai Expressway are as follows:

- **Option-A:** Construction of Lai Expressway from Soan River near High Court to Katarian Bridge and further connected to 9th Avenue (approx. 19 km); and
- **Option-B:** Construction of Lai Expressway from Soan River near High Court to Katarian Bridge and further connected to 10th Avenue (approx. 16 km).

A team of experts comprising an Environmental Scientist, Ecologist and Sociologist visited the above-mentioned routes by making physical, ecological and social observations at the site. Option-B was considered an environmental friendly option after comparing its impacts with the Option-A.

II. TRUNK SEWER AND STP (COMPONENT-II)

i. No Project Option

No project option means no project will be implemented to resolve the issues arising due to the absence of adequate sewerage system in the study area to meet the present needs of overflowing sewers that ultimately discharge into the Lai Nullah, the main drain passing through the city due to the lack of a proper sewerage network that has worsened conditions, especially for poor people living in low-lying areas. Therefore; this option is not feasible in terms of environmental and social economic aspects.

ii. Sewer Route Alignment

Trunk sewers will be laid along both banks of Nullah Lai to cater the sewage flow from adjoining areas starting from Katarian Bridge to Soan River near High Court. These trunk sewers will be further connected with STP through outfall conduit. Two (02) alternate options considered for outfall conduit are provided below:

- **Option-A:** Conduit will be constructed along the Adiala Road up to STP (approx. 14 km).
- **Option-B:** Conduit will be constructed along the Soan River up to STP (approx. 18 km).

Environmental and Social Team also visited the above-mentioned routes by making physical, ecological and social observations at the site. Option-B was considered an environmental friendly option after comparing its impacts with the Option-A.

iii. Technological Alternatives

Different treatment technologies are studied for the treatment of wastewater and these technologies range from relatively simple low-cost options like Waste Stabilization Ponds (WSP) to highly mechanized and costly systems, for instance the Activated Sludge Process (ASP). The choice between the various options depends upon the following factors: (i) the effluent standards to be achieved; (ii) the capital and maintenance cost of each option and (iii) institutional capacity available to run an option. Various technological alternatives are also considered for STP includes i) Waste stabilization Pond System; ii) Activated Sludge Process; iii) Aerated Lagoons; iv) Trickling Filter Process; and v) Oxidation Ditch. Activated Sludge Process is being used for the treatment of wastewater in STP.

ES-4 DESCRIPTION OF THE ENVIRONMENT

Baseline conditions of the project environment are listed below:

I. PHYSICAL ENVIRONMENT

The metropolitan area of Islamabad-Rawalpindi lies between longitude 72°45' and 73°30' E and latitude 33°30' and 33°50' N in the Islamabad and Rawalpindi District of the Punjab with

general height varies from 457 to 1,604 m above the mean sea level (msl). The terrain in the metropolitan area of Islamabad-Rawalpindi consists of plains and mountains whose total relief exceeds 1,175 m. The soil in the study area varies from sandy loam to sandy clay loam, silty and loamy. The Project Area falls in Seismic Zone 2B of Pakistan (low to moderate damage), and Peak Ground Acceleration (PGA) from 0.16 to 0.24g. The geological structure and stratigraphy of the Islamabad-Rawalpindi area is very complex due to the convergence of the Pakistan-India and Eurasian Tectonic Plates. The sedimentary rocks exposed in the twin cities date from the Middle Jurassic to the Quaternary. Three structural zones can be pointed out in the study area namely 1) Mountainous Margalla Hills in the north; 2) South of the Margalla Hills; and 3) Southernmost area.

The Project Area has moderate to extreme climate conditions, with hot summers and cold winters. The summer starts from April and lasts till September, with mean minimum and maximum temperature ranges from 28°C to 42°C. The winter season lasts from November to March, with mean minimum and mean maximum temperature ranges from 3°C to 18 °C.¹ The Project Area receives rains in all the seasons but monsoon rain is pronounced and constitutes a definite rainy season between the month of July and September. The average rainfall is about 1,172 mm per year.

The land use of the study area is mainly residential and commercial covered by educational institutions, health facilities, religious sites (mosques, graveyards and shrines), recreational amenities, surface water bodies, tubewells, wells, and road side green belt. The municipal water supply is the main source of water supply in the study area. Depth of groundwater table ranges from 15 to 20 meters. The different surface water resources present in and around the Islamabad and Rawalpindi jurisdictions are Soan River; Kurang River; Rawal Lake or Rawal Dam; Simly Dam; Khanpur Dam; and Nullah Lai².

II. ECOLOGICAL ENVIRONMENT

The climate of twin cities has a typical version of humid subtropical climate, with five seasons. Islamabad is known as a relatively clean, calm and green city by Pakistan standards. Floristic composition of the forests in Islamabad consists of low branching small evergreen trees with varying densities. Some of these tree species are thorny. Dominant tree species include Phulai (*Acacia modesta*), Wild olive (*Olea ferruginea*), Hopbush (*Dodonaea viscosa*), Black berries (*Monothea buxifolia*), *Reptonia buxifolia*, Beri (*Zizyphus mauritiana*), Royle's Spike Thorn (*Gymnosporia royleana*), Baikarh (*Adhatoda vasica*), Zebrawood (*Pistacia integerrima*), *Tecoma undulate*, and Capparis decidua on drier slopes. The present condition shows that a large amount of paper mulberry (*Broussonetia papyrifera*) is present along expressway component while Phulahi (*Acacia modesta*), sufaida (*Eucalyptus camaldulensis*), Dharek (*Melia azedarach*), Shisham (*Dalbergia sissoo*) and mulberry (*Morus alba*) were also present there. Moreover, it was observed that a huge number of tree species falling in all the project alignment except Outfall Conduit Option-A which passes through structures and populated areas. All these vegetation is in good

¹Meteorological Data for Islamabad (1981-2010)

² Nestle Water Factory Islamabad Study (2016), Constructive Critical Review of Hydrogeological Reports.



condition supporting the compactness of soil along the nullah Lai. Most of the vegetation will be disturbed during the construction activities of the project.

Fauna of the tract consists of mammals, reptiles, amphibians and birds. In the Project Area, the most common cause of population decline of mammals and amphibians is habitat destruction due to rapid growth of urbanization. It means that due to urbanization, suitable habitat has been lost due to which the current situation of homeland amphibians has been declined. Moreover, Islamabad and other Regions of Pakistan support a good variety of reptiles so far. Avifauna of the Project Area consists of different partridges, seasonal ducks and migratory Quail. Grey partridges are common and Duck are found along the rivers and marshes. Grey Geese (*Anser anser*) are found in the Soan Valley. In addition to these birds Red-vented Bulbul (*Pycnonotus cafer*), Asian Koel (*Eudynamys scolopacea*), Rose ringed parakeet (*Psittacula krameri*) and Rock Dove (*Columba livia*) are also part of the Project Area.

III. SOCIOECONOMIC ENVIRONMENT

A sample of 60 respondents was taken on the basis of random sampling technique, which included shop keepers, pedestrians, drivers, hospital management, students, etc. The purpose of this survey was to get response about the perceived impacts and preferences towards the project implementation. Socioeconomic survey was conducted in the surrounding areas of nullah Lai namely Dughal, Dokh Dalaal, Ghorakhpuar, Jabbar, Dokh Charag Din, Gulshan Colony, New Pagwari, Kachai Abaddi and Soan Adda etc. Total 60 respondents were contacted, comprising of 100% males. Mostly respondents were mature enough to give their opinion about the construction of Lai Expressway and foresee its impacts. Significant number of the respondents i.e. 97% were reported their religion Islam and 3% were Christian. 67% respondents favored the construction of this project keeping in view its importance. Educational and health facility was the most desired need.

ES-5 STAKEHOLDER CONSULTATIONS

The consultation process was carried out in accordance with the requirements of Pakistan Environmental Assessment Procedures. The objectives of this process were to share information with stakeholders and understand their concerns. Focused group discussion, scoping sessions, formal group meetings and informal group meetings were held with residents, passengers, business/ shop owners, pedestrians and vendors. Departmental consultations were conducted with Environmental Protection Department (EPD) Rawalpindi, Pak-EPA, RDA, Fisheries Department, Forest Department, Social Welfare Department, Capital Development Authority (CDA), Wildlife Department and Parks and Horticulture Authority (PHA), Rawalpindi.

The most commonly raised concerns during the meetings regarding the proposed project were; air pollution and dust, noise and traffic problem, problems in travelling, chances of accidents during construction period, demolition of residential and commercial structures of encroachers and squatters, payment to project affectees, prioritization of local labour for construction works, etc.



ES-6 POTENTIAL ENVIRONMENTAL IMPACTS AND MITIGATIONS

In broader spectrum, the project activities could be categorized in the three phases: 1) Planning & Design Phase; 2) Implementation & Construction Phase; and 3) Operations & Maintenance Phase for both project components. Phase-wise summary of adverse potential impacts due to proposed Project is given below:

I. DESIGN & PLANNING PHASE

- i. **Permanent Land Acquisition:** The proposed Project will involve about 1,711 kanals of land for the construction of Lai Expressway whereas about 675 acres of land has already been acquired by RDA for the construction of STP.

Mitigations: The Land Acquisition Act (LAA), 1894 is the core legislation for the acquisition of private land for development Project. Therefore, land should be acquired in the light of LAA, 1894.

- ii. **Socio-economic Environment:** During the planning and design phase of the Project, it is anticipated that there will not be any potentially significant adverse impact on the socio-economic environment.

Mitigations: No mitigation measures are required except good engineering practices to avoid and reduce these low adverse impacts.

II. CONSTRUCTION PHASE

- i. **Waste Generation at Construction Site:** The construction waste will include wastewater, oil spillage from machinery and solid waste (damaged or spoiled materials, temporary and expendable construction materials etc.). The handling and storage of oil and other hazardous waste will be a source of environmental pollution during the excavation and foundation activities.

Mitigation: Waste Management Plan will be developed to implement an efficient and responsive waste management system during construction phase.

- ii. **Impact on Water Resources:** Surface water resources e.g. Nullah Lai, Soan River, etc. may get contaminated by the fuel and chemical spills, or by solid waste and effluents generated by the kitchens and toilets at the construction camp sites. Moreover, runoff from the chemical storage areas may also contaminate the surface water bodies.

Mitigation: As a mandatory step, all the effluents should be disposed as per the requirements of NEQS and PEQS. Moreover, to reduce the risk of surface and groundwater contamination, good management practices will be adopted to ensure that fuels, chemicals, raw sewage and wastewater effluent are disposed of in a controlled manner.

- iii. **Ambient Air Quality & Noise:** Airborne dust from access road construction and use, wind erosion of material stockpiles, emissions from vehicles and construction equipment have potential of adverse impact on sensitive receptors in the Project Area. Noise generated by the construction machinery during the construction stage is likely to affect the COI particularly the sensitive receptors like nearby schools, houses, etc.

Mitigations: All the air quality management steps will be ensured during the construction phase such as use of fabric filters or wet scrubbers at batching plants, proper tuning of vehicles, regular sprinkling of water on dusty tracks, compliance of NEQS & PEQS at site. Noise generating activities are allowed from 9 am to 5 pm during day time to avoid disturbance to humans as well as fauna.

- iv. **Traffic Issues:** The proposed construction activities and movement of heavy project vehicles for construction material supply may arise traffic problems for the commuters and transporters travelling to the proposed areas. The problems will include traffic jams and inconvenience to the public passing through the Project Area. The movement of vehicles along the haulage routes will cause soil erosion, debris flow, dust emissions etc.

Mitigations: A site-specific Traffic Management Plan will be implemented to avoid traffic accidents, jams/public inconvenience.

- v. **Occupational Health and Safety:** Occurrence of accidents / incidents during the construction stage is a common phenomenon and workers as well as locals will be more prone to serious accidents.

Mitigations: Safety precautions for the construction workers, Training of workers in construction safety procedures and use of Personnel Protective Equipment (PPE) will mitigate this impact.

- vi. **Community Health and Safety:** The construction activities and vehicular movement at construction sites may result in roadside accidents deteriorate quality of groundwater and surface water resources, dust emission, noise and vibrational issues and spread of different transmittable diseases due to outside labour.

Mitigations: Proper control on construction activities, restrict entry of labors with different transmittable diseases, control on dust emission, noise and vibration pollution and create awareness about road safety will be ensured.

- vii. **Impact in Flora:** About 687 mature, sub-mature, pole crop and saplings of different tree/plants species will be disturbed during the construction phase of the project in different components of the project. Approximately 309 trees/plants will be affected due to construction of STP and 378 trees/plants due to expressway road construction. However, no significant trees/plants were found at Option-A of Outfall Conduit of the Project Area and immediate sites.

Mitigations: Mitigation measures are provided as a part of EMP.

- viii. **Impact on Fauna:** Some animals particularly reptiles may get killed during the earthworks operations. Moreover, the movements of the mammals and reptiles will be restricted during the construction phase.

Mitigation: No hunting, toxic release to water bodies will be allowed. Contractors' staff would be trained and watched.

- ix. **Social Issues:** Proposed Lai Nullah Expressway route and its interchanges may disturb some adjacent Graveyards of Rawalpindi which increases the social sensitivity of the Project Area.

Mitigations: Graveyards and other sensitive receptors should be avoided during construction phase to avoid social disturbance in the Project Area.

- x. **Relocation of Private/Public Infrastructure:** Due to the proposed project in construction phase, private infrastructure, public utilities affected may create disruption of public services and economics. About 540 number of different structures including, residential, commercial, mosques, etc. need to be demolished (fully/partially) for the construction of proposed Lai Nullah Expressway resulting huge socioeconomic disturbance in the Project Area.

Mitigation Measures: Incorporate technical design features to minimize effects on private infrastructure and all public utilities likely to be affected by the proposed Project. Contractor should obtain NOCs from concerned Departments well ahead of the commencement of construction.

III. OPERATION & MAINTENANCE PHASE

- i. **Ambient Air Quality:** Air quality will improve in the short term due to improved road condition and reduced travel time thereby causing less fuel consumption. However, operation of sewerage scheme and STP will result in generation of gases including H₂S and CH₄ (due to anaerobic conditions).

Mitigations: Mitigation measures are provided as part of EMP of this report.

- ii. **Noise:** Noise will be generated due to movement of traffic and use of pressure horns which may cause psychological and physiological impacts on the surrounding population. Due to the operation of proposed STP, noise and vibration may produce from the running of pumping machinery and standby generators which will be a constant source of nuisance to the local population.

Mitigations: Concrete or wood acoustic insulation barrier will act as noise barriers, tree plantation (proposed along both sides of the Expressway) will also help to curtail noise, the pressure horns will be banned on the Expressway, Enforcement and

penalties against traffic rules violators, etc. Regular maintenance of vibrating parts of STP through a well-coordinated operation and maintenance procedure which consists of checking periodically all parts of the pumping machinery, its oiling to remove friction, replacement in case of malfunctioning and periodic noting of noise levels, etc.

- iii. **Traffic Safety:** Enhanced vehicular movement and speed in the long run may result in road safety issues like traffic accidents. The high-speed vehicles may result in road safety issues like traffic accidents.

Mitigations: Mitigation measure will include strict enforcement of speed limits, installation of speed guns and channelization of traffic with respect to categories (heavy vehicle traffic and light vehicle traffic) and enforcement of penalties for the violators.

- iv. **Odor:** The operation of STP might results in generation of odor which causes nuisance to the residential community in the surroundings of the STP and the people passing by this area for schools, mosque and shops.

Mitigations: Mitigation measures are provided as part of EMP of this report.

- v. **Solid Waste:** Domestic and hazardous wastes would be generated during cleaning and maintenance facilities of Trunk Sewer and during operation of STP. Hazardous waste will be present in the form of sludge.

Mitigations: The sludge removed from the sewers should not be left openly on the roads. It may be recycled as fertilizer, Regular inspection and maintenance should be schedule and implemented to ensure removal of solid waste and sludge when accumulated, etc. Further mitigation measures are provided in EMP of this report.

- vi. **Health and Safety of Workers:** The operation of the proposed trunk sewer and STP may cause some negative impacts on health and safety of workmen. The sewer cleaning staff may be exposed to waterborne communicable diseases if precautionary measures are not adopted.

Mitigations: All operation and maintenance staff will be trained in hygienic procedures designed to avoid infection from wastewater, and health and safety procedures against any exposure to hazardous gases, gas detector will be used to indicate the presence of any hazardous gas before the entry of workers into the sewer for cleaning purposes, etc.

ES-7 ENVIRONMENTAL MANAGEMENT PLAN

Relevant components of Environmental Management Plan (EMP) which have been discussed in the report are institutional requirements, training and capacity building, mitigation and monitoring program, EMP cost. Annual estimated cost for EMP is about 53.36 million whereas compensation and resettlement cost is not included in this cost.



ES-8 CONCLUSION

The report provides conclusions based on the impacts assessed and the mitigation measures suggested. The implementation of the proposed project will have many positive impacts for the twin cities. Apart from the positive impacts of the project, the proposed Project will also have potential adverse environmental and social impacts during the construction and operational phases. Most of these adverse impacts during construction are of a temporary nature. These potential impacts can be avoided or mitigated by adopting suitable mitigation or remedial measures as mentioned in this report.

In order to minimize, avoid or reduce the potential adverse impact appropriate mitigation and remedial measures have been suggested against each identified impact. Efforts are made to propose economical and sustainable mitigation and remedial measures which can be easily implemented. An EMP has also been developed to provide proper framework for the implementation of the suggested mitigation measures. This includes the identification of the major stakeholders, roles and responsibilities along with the resource requirements.

As a conclusion of the study, the proposed Project has potential adverse environmental impacts therefore, an EIA Study of each component needs to be conducted during detailed design phase of the Project. Furthermore, a comprehensive Land Acquisition and Resettlement Plan (LARP) Study also needs to be conducted especially for Component-I (Lai Expressway) of the proposed Project.

1 INTRODUCTION

1.1 PREAMBLE

Rawalpindi Development Authority (RDA) is planning to implement the proposed project comprising two components i.e. (i) 16-km-long expressway from Katarian Bridge to Soan River near High Court and further connected to 10th Avenue to provide alternative traffic route between the twin cities, Rawalpindi and Islamabad and (ii) construction of trunk sewer on both sides of Nullah Lai along with Sewage Treatment Plant (STP). To address the environmental and social impacts of the proposed project and to comply with the national environmental guidelines and Punjab Environmental Protection Act (Amended), 2012, the present Environmental Impact Assessment (EIA) Report has been prepared, which will be further updated on the basis of final design.

1.2 PROJECT BACKGROUND

1.2.1 Component-I: Construction of Lai Expressway

Rawalpindi commonly known as Pindi is a city in the Punjab province of Pakistan. Rawalpindi is adjacent to Pakistan's capital of Islamabad, and the two are jointly known as the "twin cities" on account of strong social and economic links between the cities. Rawalpindi is the third-largest city in Pakistan with a population of 3.2 million, while the larger Islamabad Rawalpindi metropolitan area is the country's third-largest metropolitan area.

Growth in twin cities has put tremendous pressure on infrastructure of the cities, particularly road network. The traffic volume on the roads, streets and intersections have reached saturation point mainly on Murree Road, which is the main artery linking Rawalpindi to Islamabad due to rapidly growing population of the cities. The high population has resulted in a tremendous traffic load especially on commercial, educational and government sector activities in the cities and as result long traffic queues and traffic jams are common sight on the roads.

In order to address the above issues in twin cities, RDA has proposed to establish a signal free expressway from Soan River to Katarian supported by interchanges, flyovers and fences on either bank of Lai Nullah to provide an alternative route to the residents of Islamabad and Rawalpindi for the mobilization purposes.

1.2.2 Component-II: Construction of Trunk Sewer and Sewage Treatment Plan (STP)

Rawalpindi is a functional hub and third largest city in Pakistan. Because of urbanization, the migrant population has swelled manifold over last decades. Due to influx of migrants, the existing sewerage system has become depleted which is unable to meet present needs.

The existing sewerage system only covers about 30% of the city area that includes Satellite Town and Khayabn-e-Sir Syed with no sewage treatment facilities³. In the remaining 70% of the city, raw sewage is discharged to street-side drains which ultimately discharge into the Lai Nullah, the main drain passing through the city. Lack of a proper sewerage network, sewage disposal, and treatment has worsened conditions, especially for poor people living in low-lying areas. Heavy rains also cause extensive local flooding and storm water mixes with raw sewage, spreading contamination throughout the neighborhood while low-lying areas remain flooded for a long time. Most of the existing drains in the city have been encroached upon, which has further deteriorated the situation. The storm water channels carrying the untreated sewage of Islamabad and Rawalpindi are virtually sludge carriers that ultimately discharge into nearby Soan River, affecting aquatic life and agriculture. All these factors have seriously affected (i) drinking water quality; (ii) open water storage reservoirs are being contaminated with the discharge of uncontrolled and untreated sewage; (iii) defective, old, leaking water pipelines that run alongside the sewerage system receive sewage at leaking points; (iv) groundwater sources become contaminated by percolation of sewage because of the inadequate sewerage system; and (v) discharge of untreated sewage from Islamabad in Lai Nullah has contaminated all the tube wells located along this drain. In addition to that, there are 12 more nullahs which are disposed of into Nullah Lai.

Nullah Lai

Nullah Lai is rain water fed natural stream flowing through the city of Rawalpindi. The Nullah Lai basin is located in the northern part of Rawalpindi, with a catchment area of 239.8 km². It has a length of about 30 km, stretching from the upper reaches which comprise the Federal Capital City Islamabad, at its north-western edge, to the lower reaches which hold the Rawalpindi District, Punjab Province, in its south-eastern edge⁴. The Nullah Lai has six major tributaries, three originating in the foothills of Islamabad in the higher plain area; it then flows down through the lower lying city of Rawalpindi, where another three tributaries join the Nullah. The current land use in the Nullah Lai basin is 38.6 % of residential and 14.2 % of agricultural areas, 14.8 % of forest and the rest are grass and bare land surfaces.

In the light of above mentioned scenario, RDA has proposed to construct a trunk sewer on both sides of Nullah Lai for sewage collection and its disposal, and STP along with Lai Expressway to meet the present and future requirements of efficient and effective service delivery of sewerage and effluent disposal.

1.3 THE PROPONENT AND TA CONSULTANT

The Proponent and Executing Agency of the proposed project is Rawalpindi Development Authority (RDA) whereas National Engineering Services Pakistan (Pvt.) Limited (NESPAK) is a TA Consultant for the proposed Project. The contact details of Proponent and TA Consultant are given as under:

³ ADB, 2005. Technical Assistance to the Islamic Republic of Pakistan for Rawalpindi Environmental Improvement Project. Manila

⁴ Lai Nullah Basin Flood Problem Islamabad – Rawalpindi Cities, Ahmed Kamal (2013)

a) Proponent's Contact Address

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Telephone No.: + 92-051-5555490-2

b) TA Consultant's Contact Address

National Engineering Services Pakistan Private Limited (NESPAK)
Geotechnical and Geoenvironmental Engineering Division (GT&GE),
NESPAK House 1-C, Block – N, Model Town Extension, Lahore
Tel: +92-42-99090000

1.4 NATURE, SIZE AND LOCATION OF THE PROJECT AREA

1.4.1 Nature

As mentioned earlier, the proposed project involves establishment of two components i.e. (i) construction of Lai Expressway along both banks of the Nullah Lai (linear work); and (ii) construction of trunk sewer on both sides of Nullah Lai and STP (linear and non-linear work) to combat issues of traffic in Rawalpindi and Islamabad cities, and sewerage disposal problems in Rawalpindi city.

1.4.2 Size and Location of the Project Area

Component-I: Construction of Lai Expressway

The proposed project component mainly lies within Rawalpindi. The proposed alignment for Lai Expressway is of approximately 16 km length. It starts from National Highway (N-5) near Sawan Lorry Adda, traverses along the Nullah with its end point on 10th Avenue near Katarian. The alignment crosses various existing roads/bridges including Bridge connecting Ayub Park road with Scheme-III, Bridge at Ammar Chowk, Bridge connecting Rashid Minhas Road with Dohk Chiragh Din, Railway Line (Rawalpindi – Lahore Main Line), Bridge on Murree Road, Bridge connecting Gawal Mandi with Gordon College Road, Bridge connecting Fawara Chowk with Railway Station, Bridge connecting Fawara Chowk with Ratta Amral & Railway Colony, Bridge connecting Westridge and Dhok Ratta with Hamilton Road, Bridge connecting Chungi # 4 with Pir Wadhai Road, Bridge connecting Chungi # 4 with Syed Khayaban-e-Sir Syed road, Bridge connecting Mohallah Raja sultan with Khayaban-e-Sir Syed Road and Bridge on I.J.P Road. The location map of the proposed route alignment is shown in **Figure 1.1**.

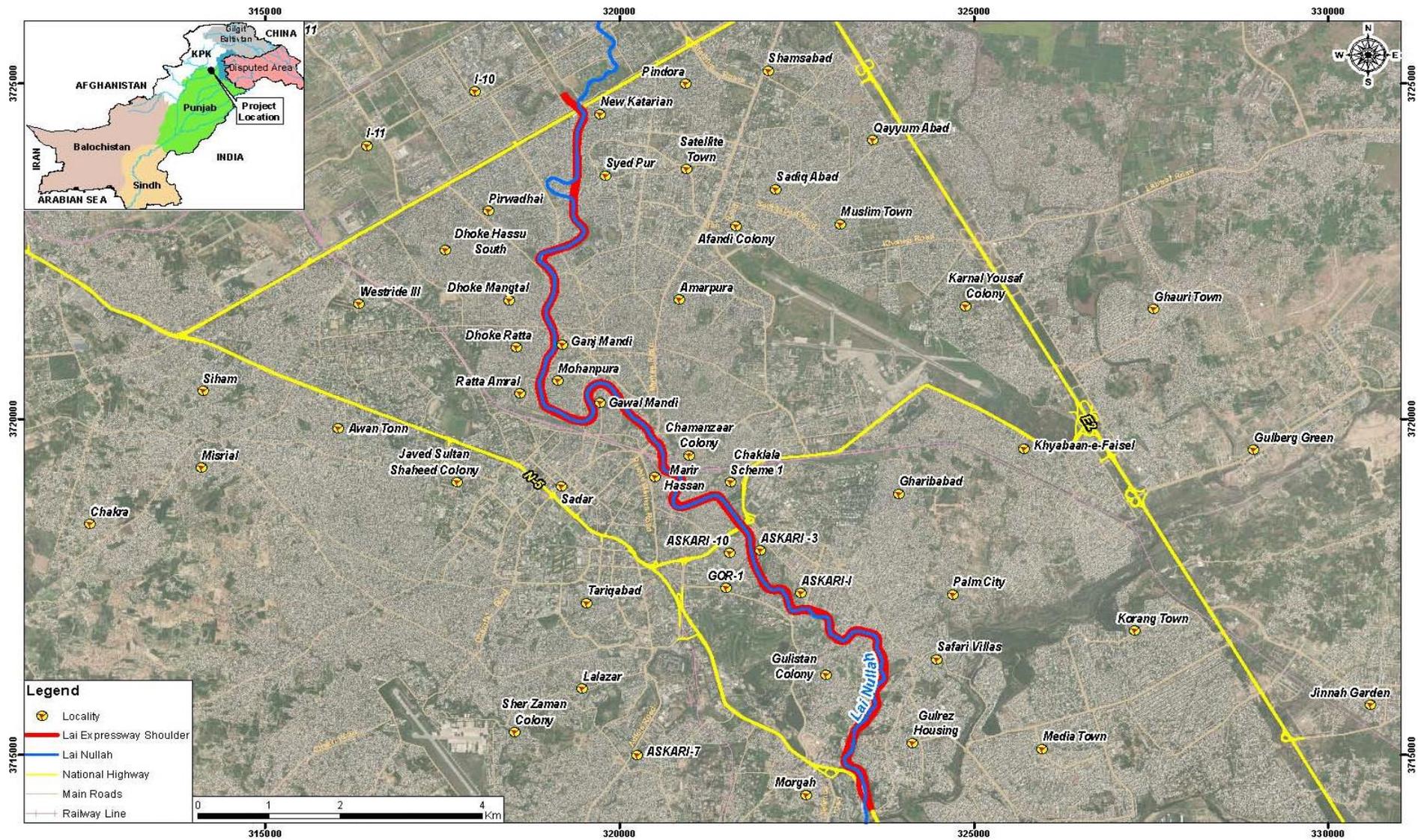
Component-II: Construction of Trunk Sewer and STP

The proposed project component lies within Rawalpindi city. The trunk sewer will be laid on both banks of the Nullah Lai to carry storm water and wastewater disposed of directly and indirectly from the residential areas, industries and drains into the Nullah Lai without any treatment. The approximate length of trunk sewer is 16 km with carrying capacity of about 250 cusecs. The right side of the Project Area will be served by a RCC trunk sewer line

ranging from 42” to 72” diameter and will caters the sewage flow from new Katarian, Mohalla Raja Sultan, Mehmood Abad, Gulshan Abad, Millat Colony, Naya Mohalla, Moti Mahal, Soan Adda, Agha Sahi, Satellite Town and other small towns located nearby, and left side of the area will also be served by a RCC trunk sewer line with diameter ranging from 36” to 66” and will caters the sewage flow from Khayaban-e-Sir Syed, Western Side of Niki Lai, Cantonment Area, Soan Adda and other small towns located nearby this reach.

The STP will be constructed over an area of 675 acres near Jabbar village on Adiala-Rawat Link Road on the left bank of Soan River. The trunk sewer will be connected to the STP through an RCC Conduit of 3.0 m × 3.0 m which will cater the flow from preceding conduits along both sides of Nullah Lai.

The location map of the proposed trunk sewer and STP is shown in **Figure 1.2**.



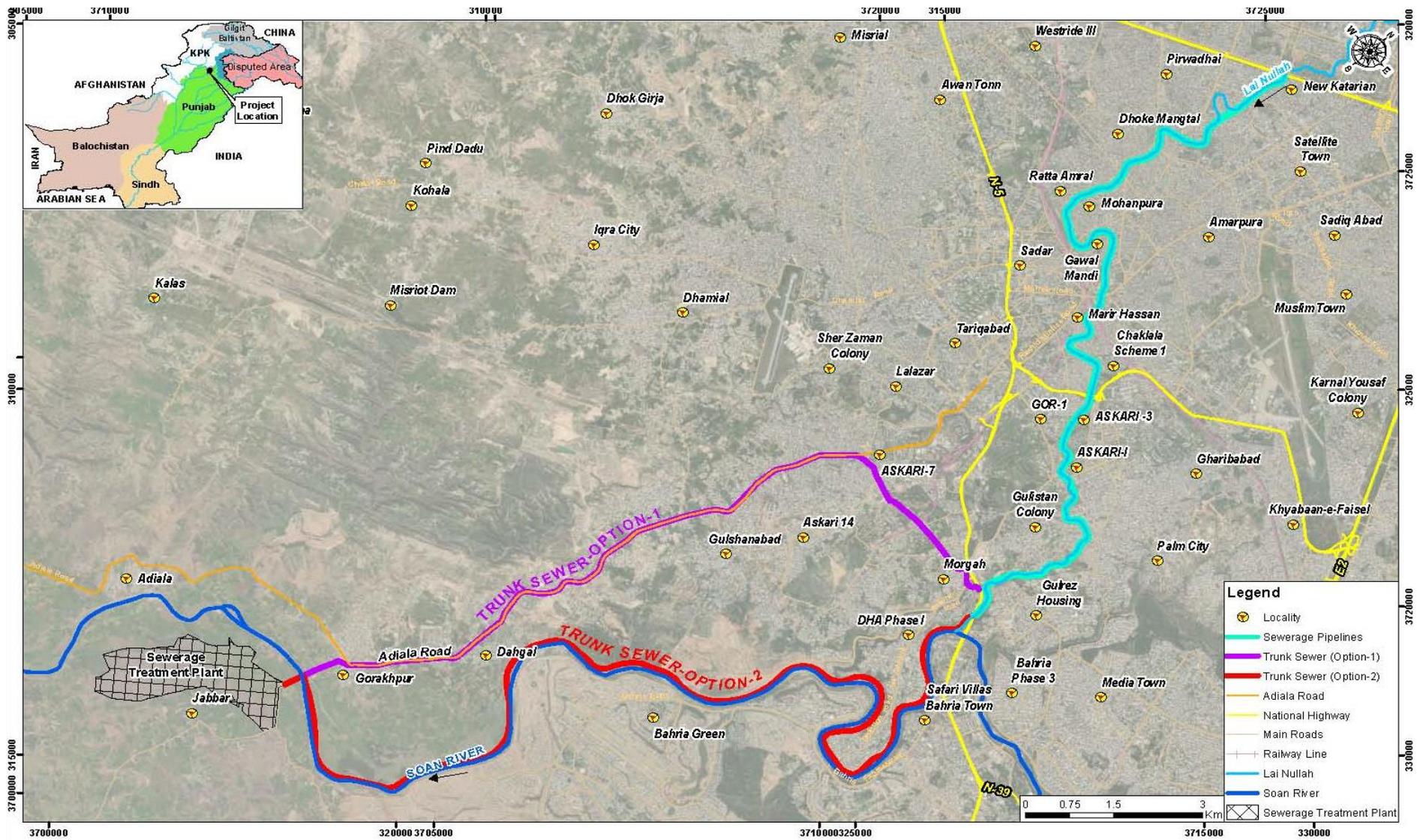


Figure 1.2: Location Map of the Trunk Sewer and STP (Component-II)

1.5 SCOPE OF EIA STUDY

The scope of the EIA Study is as follows:

- Review of all relevant existing data, studies, reports and drawings;
- Review of all applicable national and local guidelines, laws, and policies;
- Collection of baseline data related to physical, ecological, social, and cultural environmental aspects;
- Analysis of alternatives;
- Public consultation with stakeholders;
- Identification, evaluation and categorization of the potential significant bio-physical and socio-economic impacts on the local environment during the construction and operational stages of the proposed project;
- Recommend appropriate mitigation measures for the identified adverse impacts and monitoring plans to address them;
- Preparation of an Environmental Management Plan (EMP); and
- To provide recommendations to the decision makers regarding further actions.

1.6 PURPOSE OF THE REPORT

The purpose of this EIA Report is to assess whether or not significant adverse environmental and social impacts are anticipated and to suggest mitigation and remedial measures to make the proposed Project environmental friendly and sustainable during the construction and operational stages of the Project. In order to implement the proposed mitigation measures, an EMP with cost estimates has been developed. EMP also provides the environmental management capability.

1.7 EXTENT OF THE EIA STUDY

As per Pak-EPA (Review of IEE and EIA) Regulations, 2000, the proposed project falls under Category “D” (Transportation) and Category “G” (Waste Disposal) of Schedule II, which requires an EIA study before the commencement of construction activities.

According to the Pak-EPA Regulations, 2000 a separate EIA, study is required for the both project components i.e. Lai Expressway and Trunk Sewer and STP. However, at this stage a combined EIA Study is being conducted for both components, but at the time of Project implementation a separate Environmental Impact Assessment (EIA) Study would be carried out for the proposed Lai Expressway and Trunk Sewer and STP.

This EIA study covers the environmental impacts of the proposed Lai Expressway and Trunk Sewer and STP comprising physical, ecological and socio-economic aspects. A minimum strip of 70 to 80 m was delineated as Right of Way (ROW) in which direct impacts of the proposed components are envisaged due to the implementation. However, for indirect impact related to physical, ecological and social domains, a COI of 25 m on each side of the proposed Project Area was considered as project corridor or COI.

1.8 STUDY APPROACH AND METHODOLOGY

1.8.1 Study Approach

The present study has been conducted in accordance with Pakistan Environmental Assessment Guideline, Punjab Environment Protection Act (PEPA), 2012 and Pakistan Environmental Protection Agency (Review of IEE and EIA) Regulations, 2000. The main purpose of this approach was to obtain a fair impression on the people's perceptions of the proposed project and its environmental and social impacts. The discussions were also held with stakeholders including government officials, community representatives, women and a wide range of inhabitants and affectees of the Project Area.

1.8.2 Methodology

The following methodology was adopted for carrying out the EIA study of the proposed Project:

i) Orientation

Meetings and discussions were held among the members of the EIA Consulting Team. This activity was aimed at achieving a common ground of understanding of various issues of the proposed study.

ii) Planning for Data Collection

Subsequent to the concept clarification and understanding obtained in the preceding step, a detailed data acquisition plan was developed for the internal use of the EIA Consulting Team. The plan included; identification of specific data requirements and their sources; determination of time schedules and responsibilities for their collection; and indication of the logistics and other supporting needs for the execution of the data acquisition plan.

iii) Data Collection

In this step, primary and secondary data was collected through field observations, concerned departments, and published materials to establish baseline profile for physical, biological and socio-economic conditions. These activities are as under:

- Site Reconnaissance;
- Literature Review;
- Desk Study;
- Public Consultations; and
- Field Observations and Studies.

iv) Review of Environmental Laws and Institutional Requirements

All applicable national and international laws, legislations, guidelines and treaties were reviewed relevant to the proposed project components.



v) Delineation of Corridor of Impact (COI)

COI/Study Area include the actual ROW as well as the area in the surroundings in which positive and adverse impacts may be foreseen due to the implementation of the proposed Project. The COI for the proposed project was taken as 25 m on both sides of the study area to anticipate adverse impacts. Index maps regarding COI/Study Area of both components are shown as **Figures 1.3, 1.4 & 1.5** whereas their detailed maps are provided as **Annex-I & II**.

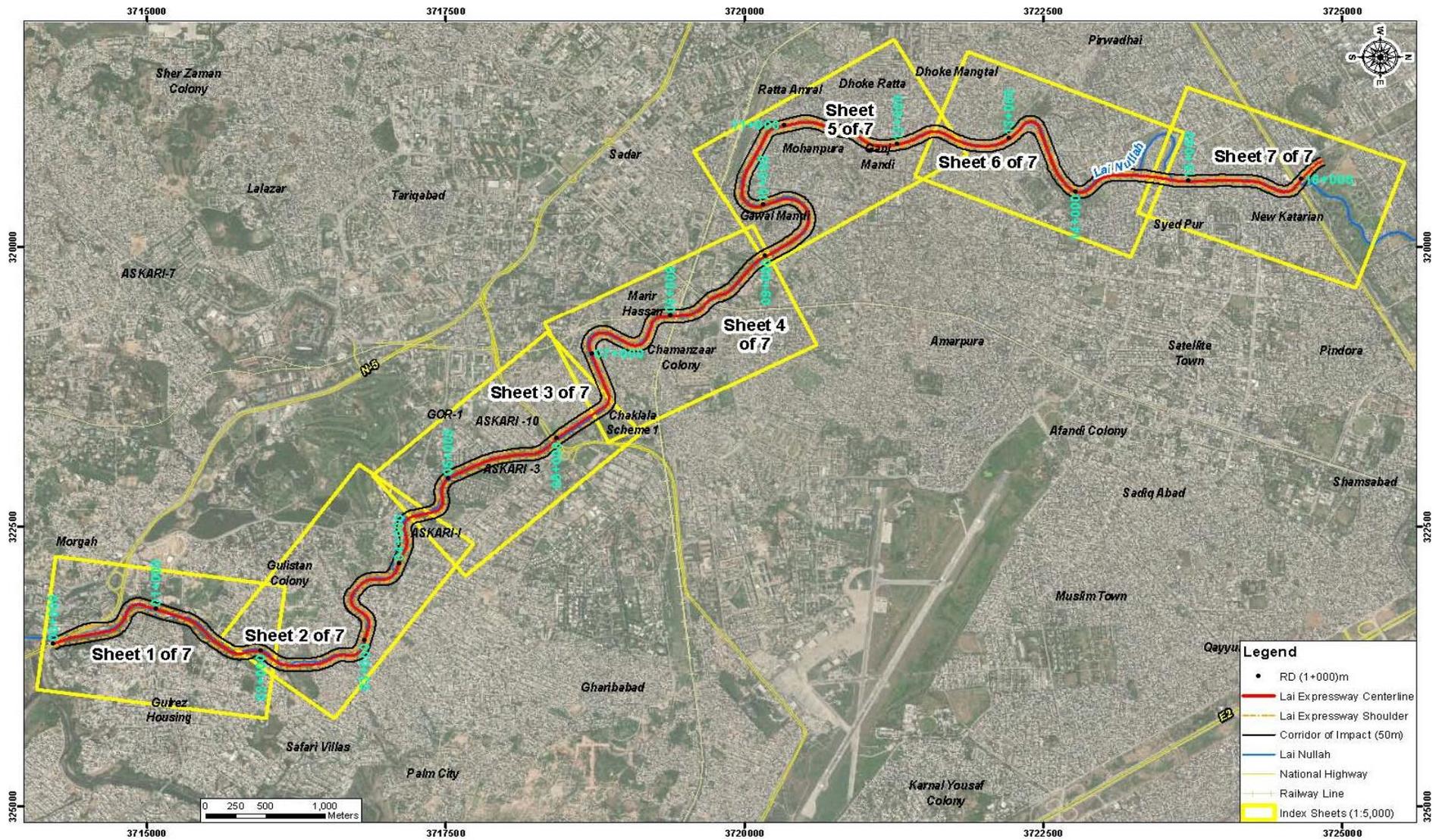


Figure 1.3: COI Map of the Lai Expressway (Component-I)

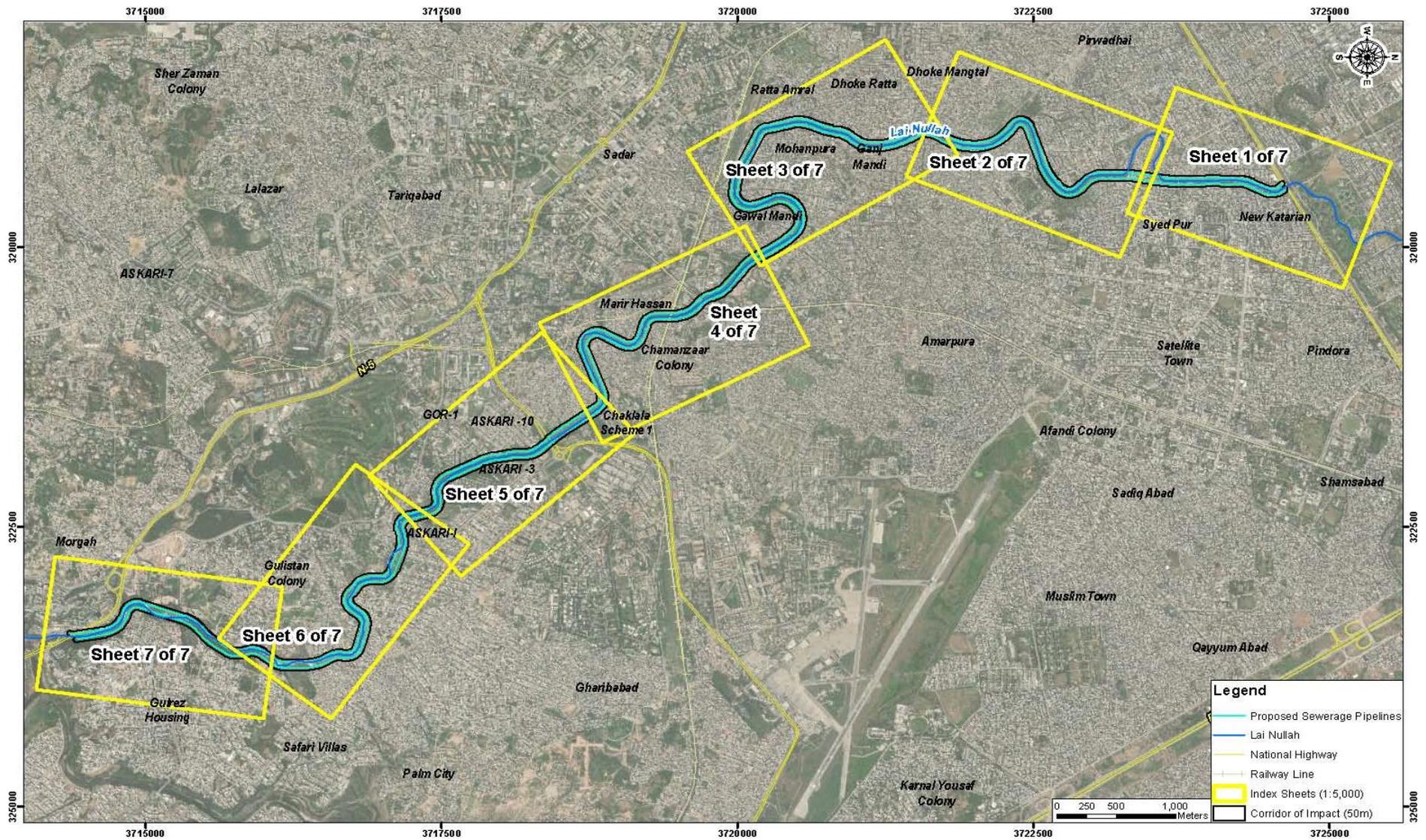


Figure 1.4: COI Map of the Trunk Sewer (Component-II)

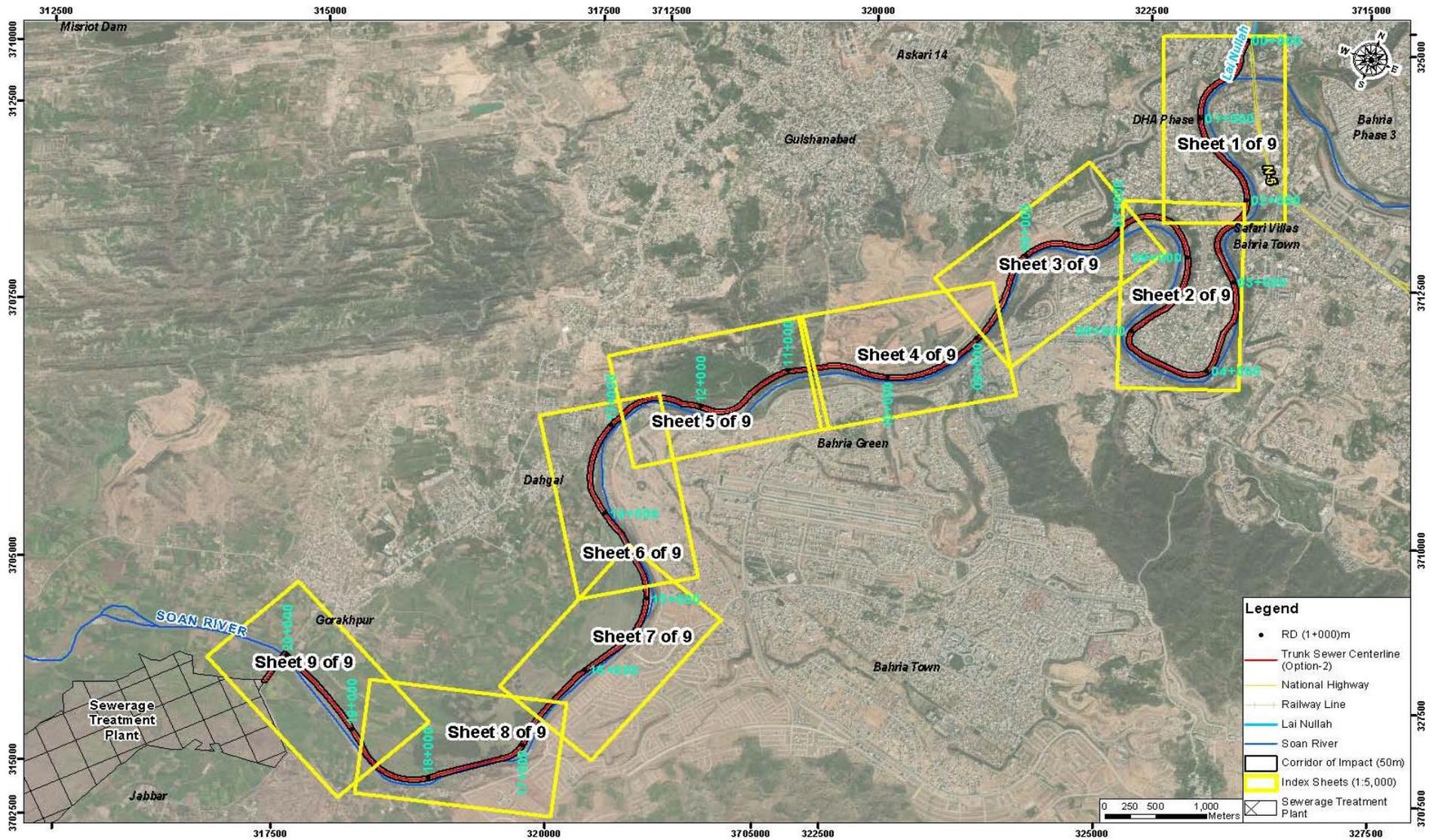


Figure 1.5: COI Map of Outfall Conduit Option-2 and STP (Component-II)

vi) Survey of COI

A team of Environmental Scientist, Ecologist and Sociologist carried out the environmental and social survey of the COI to familiarize themselves with the local conditions and the environmental settings. During the survey, the information regarding the topography, soils, rock, surface water, groundwater, flora and fauna, wetlands, forested areas, social settings and villages/towns along the COI was observed.

vii) Analysis of Alternatives

The analysis of different alternatives was carried out during the selection of the most feasible route for Lai Expressway, and Trunk Sewer and STP to select the most viable route keeping in view the environmental, economic and social constraints.

An analysis was carried out in consideration of technical and environmental aspects. The following alternatives were considered for the Project:

- No Project Option (NPO);
- Route Alignment Alternatives; and
- Design and Technology Alternatives.

viii) Environmental Baseline Survey of the Project

Detailed environmental and social survey was carried out within the COI. Prior to the start of field activities, comprehensive checklists, proformas and maps were developed covering the following main parameters:

Physical Environment

Information was gathered on the existing physical environment, particularly as related to geology, topography, soil, hydrology and drainage, water quality, air quality and noise of the Project Area.

Geology, Topography, Soils

A review of relevant literature on the geology, topography and soil in the Project Area was conducted.

Hydrology and Drainage

A literature review was conducted to identify the components of the hydrological cycle that are likely to impact on the project and the possible impacts that the project could have on the hydrologic cycle. Field assessments were conducted that include determination and verification of all the existing inflows into the drains, assessment of drainage issues, interviews with local community members, and round-table discussions with stakeholders.

Air Quality

Ambient air quality measurements are essential to provide a description of the existing conditions, to provide a baseline against which changes can be measured and to assist in the determination of potential impacts of the proposed construction on air quality conditions. Ambient air quality was continuously monitored for Carbon Monoxide (CO), Sulphur Dioxide (SO₂), Nitrogen Oxides (NO_x) and Particulate Matter (PM₁₀), for 24 hours by a certified laboratory at different locations of the Project Areas.

Noise

Noise level readings were monitored for 24 hours continuously on hourly basis at different locations of the Project Areas by a certified laboratory.

Water Quality

The objective of the water quality sampling is to determine water quality situation before construction. It has been observed that the surface water and groundwater are the most important environmental variables to be affected in this project. The extent of surface water and groundwater contamination in the Project Area was assessed based on the test results of chemical and microbiological parameters for surface and groundwater.

Biological Environment

The status of the flora and fauna of the study area; determined by an ecological survey, review of literature relevant to the study area, and an assessment of terrestrial environment.

Flora

The vegetative communities in the Project Area identified and classified into community types. Identification carried out of dominant tree species, assessment of stage of growth (mature or sapling) and assessment of canopy cover.

Fauna

Information on fauna gathered from existing literature on reported species as well as observations in the field.

Socio-Cultural Environment

The consultants utilized a combination of desk study, field investigations, census data, structured interviews, maps, and reports to generate the data required for description of the existing social environment and assessment of the potential impact of the construction of the proposed project. Data was gathered on the following aspects of the social environment:

- Land use and Municipal Status;

- Traffic, Transportation and Access Roads;
- Demographics;
- Livelihoods;
- Poverty;
- Education;
- Health;
- Social Setup;
- Community Facilities;
- Solid Waste Management;
- Proposed Developments;
- Recreational Activities; and
- Archaeological and Cultural Heritage.

ix) Stakeholder Consultations

The Consultant identified Project stakeholders and held meetings with them during the surveys to receive feedback on the expected environmental issues related to the Project impacts and suggested mitigation measures. Meetings were carried out with the Project affectees, relevant departments including Wildlife, Fisheries, Forest, Environment Department, etc. to discuss the issues/constraints and get their views and feedback to mitigate the potential environmental impacts associated with the implementation and operation of the Project.

x) Impact Assessment and Mitigation Measures

A logical and systematic approach was adopted for impact identification and assessment. The process began during the screening and continued through scoping which identified the key issues and classified them into different categories. The tools, which were used for impact assessment, are:

- Checklists;
- Matrices; and
- Overlays.

Identification of potential environmental and social impacts in terms of their nature, magnitude, extent, location, timing and duration were carried out. The impacts were correlated to the Project location, design stage, construction stage and operation stage. Based on the impacts prediction methods and as a result of public/stakeholder consultations, the Consultants screened the adverse environmental impacts for inclusion in the mitigation measures and EMP. The same process was followed for the identification of social impacts. Public consultations (which provided feedback of the impacts from the stakeholder's viewpoint) were used to screen out the insignificant impacts. Matrices and overlays were used for the evaluation of temporal and spatial impacts respectively.

The Consultants proposed practicable, economically feasible and socially acceptable mitigation measures for the significant adverse environmental and social impacts. These measures were based on exploring the ways to achieve the Project objectives causing least disturbance to the existing environment.

xi) Environmental Management Plan

An Environmental Management Plan (EMP) has been prepared to ensure the adequacy and effectiveness of the proposed protocol by clearly identifying the roles and responsibilities of the agencies responsible for implementation, monitoring and auditing of EMP activities, existing and suggested framework, necessary approvals, training needs and the required further studies. EMP also include organizational setup, a monitoring mechanism, monitoring plan, environmental and social parameters to be monitored with their frequency. Similarly, costs for environmental monitoring and social component/social mitigation measures were also included as part of the EMP. Environmental monitoring, evaluation, auditing and reporting mechanism were also proposed in the EMP.

xii) Conclusions and Recommendations

Based on the baseline conditions, identified impacts and suggested mitigation measures and proposed environmental cost, conclusions are made. Based on the conclusions, recommendations regarding the future plan of action and outcome of the EIA report are provided.

1.9 STRUCTURE OF THE REPORT

Section 1 “**Introduction**” briefly presents the project background, project location, size & nature, objectives, methodology and need of the EIA study.

Section 2 “**Policy, Legal and Administrative Framework**” comprises policy guidelines, statutory obligations and roles of institutions concerning EIA study of the proposed Project.

Section 3 “**Project Description and Alternatives**” furnishes information about the studied alternatives, location of the proposed Project, cost and size of the project, its major components and alternatives considered for the proposed project to select at the preferred alternative for detailed environmental assessment.

Section 4 “**Description of the Environment**” establishes baseline conditions for physical, biological and socio-economic conditions prevalent in the Project Area.

Section 5 “**Stakeholder Consultations**” identifies the main stakeholders and their concerns raised through scoping sessions, and deals with the measures to mitigate the social impacts.

Section 6 “**Screening of Potential Environmental Impacts & Mitigation Measures**” identifies, predicts and evaluates impacts of the project activities during the design, construction and operation stages and deals with the measures proposed to mitigate potential environmental impacts of the proposed project.

Section 7 “**Environmental Management Plan**” outlines institutional arrangements for the implementation of the proposed mitigation measures, training needs of the staff for

implementation of the mitigation measures, monitoring requirements, environmental and social management cost.

Section 8 “**Conclusion and Recommendations**” provides the major conclusions in the light of the available Project plans, field surveys and impacts assessment; mitigation measures; and necessary recommendations.

1.10 DESIGNATED STAFF AND THEIR RESPONSIBILITIES

A multidisciplinary team was formulated to conduct the EIA study. The name of team members, their roles and responsibilities are presented in **Table 1.1**.

Table 1.1: Roles and Responsibilities of EIA Study Team

Sr. No.	Name	Designation	Responsibilities
1.	Mr. Muhammad Shariq Ahmed	Chief Engineer / Head ERSD Section	Responsible for liaison with the Client and relevant stakeholders, technical guidance and input for preparing the EIA report and ensuring the quality of work, documents and deliverables.
2.	Mr. Aashar Habib	Sr. Environmental Scientist / Team Leader	Responsible for review of previously conducted environmental studies in the Project Area, conducted baseline surveys basing upon environmental assessment checklist, monitor the data collection strategies to be adopted during field surveys, identify potential environmental and social impacts within proposed Study Area; prepare field notes and minutes of meetings, stakeholder and departmental consultations with relevant departments, assessment of impacts on physical environment resources, propose applicable mitigation measures for identified significant environmental impacts, prepare EMP and estimated environmental cost and assistance in preparing EIA report.
3.	Ms. Shehnila Hanif	Sr. Environmental Scientist	Responsible for review of previously conducted environmental studies in the Project Area, monitor the data collection strategies to be adopted during field surveys, identify potential environmental and social impacts within proposed study area, assessment of impacts on physical environment resources, propose applicable mitigation measures for identified significant environmental

Sr. No.	Name	Designation	Responsibilities
			impacts and preparation of EIA report.
4.	Mr. Malik Pervaiz Akhtar	Sociologist	Responsible for preparing social survey tool, collection of socio-economic data for baseline, meeting with local people and relevant stakeholders for noting their concerns and comments, identification of potential impacts on socio-economic environment, and proposal for mitigation measures for adverse social impacts.
5.	Mr. Nasir Ali	Ecologist	Responsible for site survey and collection of baseline data for ecological parameters, evaluation of potential significant impacts of the project on flora and fauna of the Project Area and proposal for mitigation measures for the same, and preparation of tree plantation plan.
6.	Ms. Ridha Kamran	Jr. Environmental Scientist	Responsible for review of previously conducted environmental studies in the Project Area, review of procedures, guidelines, legal and policy framework, analysis of alternatives for the selection of most suitable option for the implementation of the proposed project components, establishment of baseline for physical parameters and preparation of EIA report.



2 POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

2.1 GENERAL

This section provides an overview of the policy, legal, and administrative framework that apply to the proposed project to control environmental and social constraints during construction and operational phase. The proposed project is anticipated to comply with all relevant policies, laws, guidelines, acts and legislations of Pakistan / Punjab and other related environmental aspects.

2.2 BACKGROUND OF ENVIRONMENTAL LAWS IN PAKISTAN / NATIONAL POLICY AND LEGAL FRAMEWORK

The Ministry of Climate Change is the responsible authority for environmental protection policy making in Pakistan.

The Pakistan National Conservation Strategy (NCS) that was approved by the federal cabinet in March 1992 is the principal policy document on environmental issues in the country (EUAD/IUCN, 1992). The NCS outlines the country's primary approach towards encouraging sustainable development, conserving natural resources, and improving efficiency in the use and management of resources. The NCS has 68 specific programs in 14 core areas in which policy intervention is considered crucial for the preservation of Pakistan's natural and physical environment.

Prior to the adoption of the 18th Constitutional Amendment, the Pakistan Environmental Protection Act (PEPA), 1997 was the governing law for environmental conservation in the country. Under PEPA, 1997 the Pakistan Environmental Protection Council (PEPC) and Pak EPA were primarily responsible for administering PEPA, 1997. Post adoption of the 18th Constitutional Amendment in 2011, the subject of environment was devolved and the provinces have been empowered for environmental protection and conservation.

2.3 REGULATIONS FOR ENVIRONMENTAL ASSESSMENT, PAKISTAN EPA

Under Section 12 (and subsequent amendment) of the PEPA (1997), a project falling under any category specified in Schedule I of the IEE/EIA Regulations (SRO 339 (10/2000)), requires the proponent of the project to file an IEE with the concerned provincial EPA. Projects falling under any category specified in Schedule II require the proponent to file an EIA with the concerned provincial agency, which is responsible for its review and accordance of approval or request any additional information deemed necessary.

2.4 PUNJAB ENVIRONMENTAL PROTECTION ACT (AMENDED), 2012 AND AMENDMENT, 2017

Post adoption of the 18th Constitutional Amendment in 2011, the Punjab Government amended PEPA, 1997 as Punjab Environmental Protection Act (Amended), 2012, and



Amendment, 2017 and now Punjab Environment Protection Agency (Punjab-EPA) is responsible for ensuring the implementation of provisions of the Act in Punjab territorial jurisdiction along compliance with the PEQS, and in establishing monitoring and evaluation systems.

Under Clause 12 of Punjab Environmental Protection Act (Amended), 2012, and Amendment, 2017, entails the provision of filing an initial environmental examination or environmental impact assessment (where the project is likely to cause an adverse environmental effect) and obtaining environmental approval from the Agency, in respect thereof before the construction of the proposed project.

As proposed project fall in the jurisdiction of Islamabad and Rawalpindi District therefore Rawalpindi Development Authority (RDA), as implementing agency will ensures the execution of Pakistan Environmental Protection Act (PEPA), 1997 and Punjab Environmental Protection Act (Amended), 2012 and Amendment, 2017 during design, construction and operational phases of the project.

2.5 REGULATORY CLEARANCES, PUNJAB EPA

In accordance with provincial regulatory requirements, an IEE/EIA satisfying the requirements of the Punjab Environmental Protection Act (Amended), 2012 and Amendment, 2017 is to be submitted to Punjab Environmental Protection Agency (Punjab-EPA) for review and approval, and subsequent issuance of NOC before the commencement of construction of proposed project.

2.6 GUIDELINES FOR ENVIRONMENTAL ASSESSMENT, PAKISTAN EPA

The Pak-EPA has published a set of environmental guidelines for conducting environmental assessments and the environmental management of different types of development projects. The guidelines that are relevant to the proposed project are listed below:

- Guidelines for the Preparation and Review of Environmental Reports, Pakistan, EPA 1997;
- National Environmental Guidelines Policy and Procedures for the Filing, Reviewing and Approval of Environmental Assessments, 2000;
- Sectoral Guidelines: (Roads and Sewerage), Pakistan Environmental Assessment Procedures, Pakistan Environmental Protection Agency, October 1997;
- Guidelines for Sensitive and Critical Areas - Pak-EPA, 1997;
- Guidelines for Public Consultations; Pakistan EPA May, 1997.

2.7 PUNJAB ENVIRONMENTAL QUALITY STANDARDS (PEQS), 2016

In exercise of the powers conferred under clause (c) of sub-section (1) of section 4 of the Punjab Environmental Protection Act, 2012 (XXXIV of 1997), the Environmental Protection Council has approved the Punjab Environmental Quality Standards (PEQS), 2016. They endow information on the permissible limits for discharges of municipal and industrial

effluent parameters and industrial gaseous emissions in order to regulate environmental pollution. The quality standards for Ambient Air, Noise, Drinking Water and Discharge of Municipal Effluents into Inland Waters and Sewage Treatment are discussed in **Table 2.1, 2.2, 2.3 and 2.4.**

Table 2.1 : Ambient Air Quality Standards

Sr. No.	Pollutant	PEQS, 2016	
		Time-Weighted Average	Concentration Standard
1	Sulfur Dioxide (SO ₂)	Annual Average	80 µg/m ³
		24 Hours	120 µg/m ³
2	Nitrogen Oxide (NO)	Annual Average	40 µg/m ³
		24 Hours	40 µg/m ³
3	Nitrogen Dioxide (NO ₂)	Annual Average	40 µg/m ³
		24 Hours	80 µg/m ³
4	Ozone (O ₃)	1 Hour	130 µg/m ³
5	Suspended Particulate Matters (SPM)	Annual Average	360µg/m ³
		24 Hours	500 µg/m ³
6	PM ₁₀	Annual Average	120 µg/m ³
		24 Hours	150 µg/m ³
7	PM _{2.5}	Annual Average	15 µg/m ³
		24 Hours	35 µg/m ³
		1 Hour	15 µg/m ³
8	Lead (Pb)	Annual Average	1 µg/m ³
		24 Hours	1.5 µg/m ³
9	Carbon Monoxide (CO)	8 Hours	5 mg/m ³
		1 Hour	10 mg/m ³

Table 2.2: Noise Quality Standards

Sr. No.	Category of Area	PEQS, 2016	
		Day Time	Night Time
		(db)	(db)
1	Residential Area	55	45
2	Commercial Area	65	55
3	Industrial Area	75	65
4	Silence Zone	50	45

Table 2.3: Drinking Water Quality Standards

Sr. No.	Parameters	PEQS, 2016	WHO
		(mg/l)	(mg/l)
A) CHEMICAL PARAMETERS			
1	Aluminum (Al)	≤ 0.2	0.2
2	Ammonium (NH ₃)	-	1.5
3	Antimony (Sb)	≤ 0.005	0.02
4	Arsenic (As)	≤ 0.05	0.01

Sr. No.	Parameters	PEQS, 2016	WHO
		(mg/l)	(mg/l)
5	Barium (Ba)	0.7	0.7
6	Boron (B)	0.3	0.3
7	Cadmium (Cd)	0.01	0.003
8	Chloride (Cl)	< 250	250
9	Chromium (Cr)	≤ 0.05	0.05
10	Copper (Cu)	2	2
11	Cyanide (CN)	≤ 0.05	0.07
12	Fluoride (F)	≤ 1.5	1.5
13	Iron (Fe)	-	0.3
14	Lead (Pb)	≤ 0.05	0.01
15	Manganese (Mn)	≤ 0.5	0.5
16	Mercury (Hg)	≤ 0.001	0.001
17	Molybdenum (Mo)	-	0.07
18	Nickel (Ni)	≤ 0.02	0.02
19	Nitrate (NO ₃)	≤ 50	50
20	Nitrite (NO ₂)	≤ 3	3
21	Selenium (Se)	0.01	0.01
22	Residual Chlorine	0.2-0.5	-
23	Zinc (Zn)	5.0	3.0
B) PHYSICAL PARAMETERS			
24	Color	≤ 15 TCU	≤ 15 TCU
25	Taste	Non-Objectionable/ Acceptable	Non-Objectionable/ Acceptable
26	Odour	Non-Objectionable/ Acceptable	Non-Objectionable/ Acceptable
27	Turbidity	< 5 NTU	< 5 NTU
28	Total hardness	< 500 mg/l	-
29	TDS	< 1000	< 1000
30	pH	6.5-8.5	6.5-8.5
C) BIOLOGICAL PARAMETERS			
31	E-Coli	Must not be detectable in any 100 ml sample	Must not be detectable in any 100 ml sample
32	Total Coliforms	Must not be detectable in any 100 ml sample	Must not be detectable in any 100 ml sample

Table 2.4: Municipal Effluents into Inland Waters and Sewage Treatment Standards

Sr. No.	Parameters	Discharge into Inland Waters	Discharge into Sewage Treatment
		PEQS, 2016	PEQS, 2016
		(mg/l)	(mg/l)
1	Temperature	≤ 30°C	≤ 30°C
2	pH value (H ⁺)	6-9	6-9

Sr. No.	Parameters	Discharge into Inland Waters	Discharge into Sewage Treatment
		PEQS, 2016	PEQS, 2016
		(mg/l)	(mg/l)
3	Biochemical Oxygen Demand (BOD ₅)	80	250
4	Chemical Oxygen Demand (COD)	150	400
5	Total Suspended Solids (TSS)	200	400
6	Total Dissolved Solids (TDS)	3500	3500
7	Oil & Grease	10	10
8	Phenolic Compounds (as Phenols)	0.1	0.3
9	Chloride (as Cl ⁻)	1000	1000
10	Fluoride (as F ⁻)	10	10
11	Cyanide (as CN ⁻)	1.0	1.0
12	Anionic detergents (as MBAS)	20	20
13	Sulphate (as SO ₄ ²⁻)	600	1000
14	Sulphide (as S ²⁻)	1.0	1.0
15	Ammonia (NH ₃)	40	40
16	Pesticides	0.15	0.15
17	Cadmium	0.1	0.1
18	Chromium (trivalent and hexavalent)	1.0	1.0
19	Copper	1.0	1.0
20	Lead	0.5	0.5
21	Mercury	0.01	0.01
22	Selenium	0.5	0.5
23	Nickel	1.0	1.0
24	Silver	1.0	1.0
25	Total Toxic Metals	2.0	2.0
26	Zinc	5.0	5.0
27	Arsenic	1.0	1.0
28	Barium	1.5	1.5
29	Iron	8.0	8.0
30	Manganese	1.5	1.5
31	Boron	6.0	6.0
32	Chlorine	1.0	1.0

2.8 OTHER ENVIRONMENT RELATED LEGISLATIONS

2.8.1 Acts

a) Pakistan Climate Change Act, 2017

This act aims to meet obligations under international conventions relating to climate change and to provide for adoption of comprehensive adaptation and mitigation policies, plans, programs, projects and other measures required to address the effects of climate change and for matters connected herewith and ancillary thereto. This act will not accelerate because proposed project will be abridged the emission of hydrogen sulphide and greenhouse gases from the Nullah Lai.

b) Land Acquisition Act (LLA), 1894 Including Later Amendments

The Land Acquisition Act, 1894, is a “law for the acquisition of land needed for public purposes and for construction and for determining the amount of compensation to be paid on account of such acquisition”. The exercise of the power of acquisition has been limited to public purposes. The principles laid down for the determination of compensation, as clarified by judicial pronouncements made from time to time, reflect the anxiety of the law-giver to compensate those who have been deprived of property, adequately. The land needed for the construction of development projects will be acquired under normal conditions based on prevailing market prices or negotiated prices between RDA and the owners of land. Section 17(4) of the LAA will not be used in the absence of an emergency. Instead, the land will be purchased under willing-seller willing-buyer deal at agreed upon market rates and the seller will have the option not to sell the land, in case an acceptable deal for both the parties is not reached. This act will be elicited as proposed project may involve permanent acquisition of land for the construction of Lai Expressway and STP, and temporary acquisition of land in the Project Area for the construction camps.

c) Canal and Drainage Act, 1873

This act entails provisions for the prevention of pollution of natural or man-made water bodies. This act provides the provision that prohibits the discharge of any solid or liquid matter or combination of both from any source into any river, canal and drainage including natural Channel (Sec 59 A (4), save disposal of discharges without harming the natural environment of receiving water body as well as corrupting and fouling of water channel so as to render it unfit for the purpose for which it is ordinarily used (Sec 70 (8)). Any person who fails to follow the provisions shall be incurred with the penalty provided under the act. This act will be triggered if construction waste (liquid and solid) disposed into nearby canal and open drains directly.

d) Punjab Municipal Water Act, 2014

The basic aim of the act is to recognize, regulate and manage present and future municipal water supply and sanitation services and to establish rights of access to basic water supply and basic sanitation, and to ensure conservation of water resources in the Province. This act will be elicited if there is misappropriation of water supply during construction activities.

e) Fisheries Act, 1897

This act aims at the protection of fish in water bodies by rules of State Government. This act will not be triggered as no species of fish is present in water bodies of the proposed Project Area.

f) Protection of Trees and Brushwood Act, 1949

This act prohibits cutting or lopping of trees and brushwood without permission of the Forest Department. The Forest Department will be approached for permission to cut trees along the proposed project site.

g) Cutting of Trees (Prohibition) Act, 1975

This act forbids cutting of trees without acquiescence of the Forest Department. The act mentioned in section “g, and h” will be stimulated if tree cutting involved during construction phase of the proposed project.

h) Punjab Forest Act (Amended), 2010

The act empowers the provincial forest departments to declare any forest area as reserved or protected. It empowers the provincial forest departments to prohibit the clearing of forest for cultivation, grazing, hunting, removing forest produce, quarrying and felling, lopping and topping of trees, branches in reserved and protected forests. The proposed project is urban in nature and thus no protected forest is situated in and around the Project Area.

i) The Punjab Wildlife (Protection, Preservation, Conservation & Management) Act, 1974

This act provides for the protection, preservation, conservation and management of wildlife in the Province of Punjab. This act defines the wildlife sanctuary, game reserves, protected areas and national parks. It also defines the rules and responsibilities of the relevant authorities and the relevant personnel to protect the ecological resources. It also describes the penalties and punishments on offenses against the sections given in the act. This act will not be violated because no wildlife species exists in the proposed Project Area.

j) The Antiquities Act, 1975

The Antiquities Act, 1975, administered by the Provincial Government, is aimed at safeguarding the preservation of cultural heritage, destruction, damage or defacement of antiquities and it is an offence under the act. This act will not be triggered as no antiquities are present in and around the proposed project route.

k) The Punjab Heritage Foundation Act, 2005

This act entails preservation, conservation, maintenance and rehabilitation of the Punjab Heritage through various means, including technical or financial assistance and to create



awareness among the people for preservation of the Punjab Heritage. This act will not be triggered as no heritage sites are present in and around the proposed project route.

l) The Punjab Polythene Bag Rules, 2004

This rule prohibits the manufacturing, sale, use and import of polythene bags that is below 15 micron thickness. This rule will be elicited if polythene bags with more than 15 micron thickness used during construction activities.

m) National Clean Air Act, 2000

The act aims to control vehicular emissions, pollution from industry, and indoor air pollution in rural and urban areas. This act will be trigger if vehicles and machinery used for construction activities emanates air pollutants above the permissible limit.

n) Seismic Building Code of Pakistan 2007

This code stipulates the minimum requirements for seismic safety of building and structures and the provisions of the Building Code of Pakistan (Seismic Provisions-2007) shall apply for engineering design of buildings, like structures and related components.

Construction of buildings in defilement of the Building Code shall be considered as violation of professional engineering work specified under clause (XXV) of section 2 of the act. This Code is applicable to the proposed project as it includes the formation of structures.

o) The Parks and Horticulture Authority Act, 2012

This act entails regulation, development, and maintenance of public parks, green belts and green areas in the Punjab; regulation of billboards, sky signs and outdoor advertisements; to promote open and unrestricted views of the Punjab. This act will be triggered if green belts along the proposed project route are affected during construction phase.

p) Handling of Hazardous Substances, PEPA, 2000

Subject to the provisions of this act, no person shall generate, collect, consign, transport, treat, dispose of, store, handle or import any hazardous substance except under a license issued by the Federal Agency and in such manner as may be prescribed; or in accordance with the provisions of any other law for the time being in force, or of any international treaty, convention, protocol, code, standard, agreement or other instrument to which Pakistan is a party customary under sub- clause (a) and (b) of clause 13. This act will be trigger during construction and operation phases for handling, management and disposal of hazardous waste.

q) Punjab Environmental Protection (Motor Vehicles) Rules, 2013

Subject to the provisions of this act, and the rules and regulations, no person shall operate a motor vehicle from which air pollutants and noise are being emitted in an amount,

concentration or level which is in excess of the Punjab Environmental Quality Standards, or where applicable the standards established under clause (g) of subsection (1) of section 6 of the act. This act will be elicited during construction and operational phase due to use of motor vehicles that produces air pollutants and noise.

r) Labor and Health and Safety Legislation

The Constitution of Pakistan contains a range of provisions with regards to labor rights, in particular:

- Article 11 of the Constitution prohibits all forms of slavery, forced labor and child labor;
- Article 17 provides for a fundamental right to exercise the freedom of association and the right to form unions;
- Article 25 lays down the right to equality before the law and prohibition of discrimination on the grounds of sex alone; and
- Article 37(e) makes provision for securing just and humane conditions of work, ensuring that children and women are not employed in vocations unsuited to their age or sex, and for maternity benefits for women in employment.

Labor law is controlled at both provincial and national levels with compulsory employment agreements containing the terms set out by the labor laws. There are various laws containing health and safety requirements including: Mines Act 1923; Factories Act 1934; Factories Rules; Hazardous Occupations Rules 1963; Provincial Employees Social Security Ordinance 1965; and Workmen's Compensation Act 1923. This legislation will be triggered during project implementation stage as project involves hiring of labors.

s) ISO 18001 Occupation Health and Safety Assessment Series (OHSAS)

OHSAS 18001 is an Occupation Health and Safety Assessment Series for health and safety management systems to help organizations to control occupational health and safety risks. The OHSAS specifications are applicable to any institute that desires to establish an OH&S management system to eradicate or reduce risk to employees and other interested parties who may be exposed to the risks allied with the project activities. The construction of the proposed project may involve various health and safety issues to construction labour, therefore these ISO 18001 guidelines will be applicable and pertinent. This series will be elicited during construction and operational phase to ensure health and safety of workers associated with the project activities.

t) The Punjab Occupational Safety and Health Act, 2019

This act entails provision of occupational safety and health of the workers at workplace and to protect them against risks arising out of the occupational hazards; to promote safe and healthy working environment catering to the physiological and psychological needs of the employees at workplace. The act will be triggered during construction and operational phase to ensure health and safety of workers at workplace associated with the project activities.

u) Punjab Restriction on Employment of Children Act, 2016

According to the sub-section 11(a) of this act, an occupier who employs or permits a child (person under the age of 15 years) to work in an establishment shall be liable to punishment with imprisonment for a term which may extend to six months, but which shall not be less than seven days, and a mandatory fine between 10,000 to 50,000 rupees. This act will be trigger if contract higher skilled and unskilled labour under the age of 15 during construction phase of the proposed project.

v) Punjab Protection of Women Against Violence Act, 2016

This act counters gender-based discrimination, violence against women, and economic and social empowerment of women. This act will be entail if gender based violence observed in the Project Area during construction phase.

w) Disaster Management Act, 2010

The act is administered by federal government which provides guidelines for the provision of disaster management plans, offer necessary technical assistance to the Provincial Governments and Provincial Authorities as well for preparing their disaster management plans in case of any mishap. This act is valid to the subject project in case of any unseen situation.

2.8.2 Regulations, Standards and Guidelines

a) Pakistan Environmental Protection Agency Review of IEE and EIA Regulations, 2000

The Regulation classifies projects on the basis of expected degree of adverse environmental impacts and lists them in two separate schedules. The Schedule I list projects that may not have significant environmental impacts and therefore require an IEE. The Schedule II list projects of potentially significant environmental impacts requiring an EIA. The Regulations also require that all projects located in environmentally sensitive areas require preparation of an EIA. It also lists Projects not requiring either an EIA or an IEE.

b) Sectorial Guidelines, 1997

Pakistan Environmental Assessment Procedure deals with general guidelines as well as the sectoral guidelines for the environmental assessment studies. "Sectoral guidelines for construction of roads and sewerage schemes" are used as a reference in this document.

c) Environmental Assessment Guidelines for Punjab Public Private Partnership (PPP) Projects, 2018

These guidelines provide methodology for carrying out environmental assessments of the projects to be implemented under PPP mode. The guidelines are used as a reference for preparing EIA of the proposed project.

d) Pakistan Penal Code, 1860

It authorizes fines, imprisonment or both for voluntary corruption or fouling of public springs or reservoirs so as to make them less fit for ordinary use.

e) Hazardous Substance Rules, 2003

Hazardous Substance Rules, 2003 deals with handling, storage, transportation and health & safety procedures to be followed in the workplace. These rules deal with generation and handling of any kind of hazardous substance (solid, liquid & gas) as listed in Schedule I of the rules. These Rules provide Safety plan, waste management plan, transportation of hazardous materials procedures as well as reporting mechanism in case of any accident. Under these rules a license has to be taken from Federal/Provincial Agency for handling and transportation of hazardous material (Schedule II of Rules).

The contractor for handling hazardous waste shall be the licensed contractor. Contravene to any of these rules may cause cancellation of the license by Federal/Provincial Agency as the case may be.

f) Solid Waste Management Guidelines, 2005

Guidelines for Solid Waste Management have been issued as a draft by the Pakistan Environmental Protection Agency in coordination with JICA and UNDP in 2005. These guidelines explain the waste generation, discharge and composition. The handling, transportation and final disposal of waste generated during construction and operation phase of the proposal project should be done in view of these guidelines.

2.8.3 Policies and Plans

a) National Environmental Policy (NEP), 2005

NEP is the primary policy of Government of Pakistan addressing environmental issues. The broad Goal of NEP is, “to protect, conserve and restore Pakistan’s environment in order to improve the quality of life of the citizens through sustainable development”. The NEP identifies a set of sectoral and cross-sectoral guidelines to achieve its goal of sustainable development. It also suggests various policy instruments to overcome the environmental problems throughout the country.

b) National Climate Change Policy, 2012

The National Climate Change Policy was approved by the Federal Cabinet on September 26, 2012. With an overall goal, 'to ensure that climate change is mainstreamed in the economically and socially vulnerable sectors of the economy and to steer Pakistan towards climate resilient development', the Policy puts forward comprehensive policy objectives of sustained economic growth, integration of climate change into inter-related national policies, pro-poor gender sensitive adaptation and cost-effective mitigation, water, food and energy security, Disaster Rehabilitation and Resilience (DRR), effective decision making and coordination, creating awareness, building capacities, and conservation of natural resources and long term sustainability. It also seeks effective use of financial opportunities, and public and private sector investment in adaptation measures.

c) Punjab Public Private Partnership (PPP) Policy, 2009

The PPP Policy aims to include the promotion of social development and inclusive economic growth, protection of environment and interests of all stakeholders, which the policy aims to achieve by complying with relevant laws and regulations of Punjab and Pakistan and ensuring fairness, transparency and access to information. Prior to submitting PPP proposals, the policy requires undertaking feasibility studies (including environment and social impact assessments), obtaining the necessary approvals from Punjab Environment Protection Agency (PEPA) for IEEs and EIAs and acquiring land using the Punjab Land Acquisition Rules 1983 and Pakistan's Land Acquisition Act of 1894. This policy is applicable, as the proposed project will be implemented under PPP mode,

d) Biodiversity Action Plan

The plan recognizes EIA/IEE as an effective tool for identifying and assessing the effects of a proposed operation on biodiversity.

e) National Water Policy

The National Water Policy aims at efficient management and conservation of existing water resources, optimal development of potential water resources, steps to minimize time and cost overruns in completion of water sector projects, improving urban water management by increasing system efficiency and reducing non-revenue water through adequate investments to address drinking water demand, sewage disposal, handling of wastewater and industrial effluents; equitable water distribution in various areas and canal commands, measures to reverse rapidly declining groundwater levels in low-recharge areas, increased groundwater exploitation in high-recharge areas, effective drainage interventions to maximize crop production, improved flood control and protective measures, steps to ensure acceptable and safe quality of water, minimization of salt build-up and other environmental hazards in irrigated areas, institutional reforms to make the managing organizations more dynamic and responsive.

f) National Drinking Water Policy

The National Drinking Water Policy provides a framework for addressing the key issues and challenges facing Pakistan in the provision of safe drinking water to the people. Drinking water is the constitutional responsibility of the provincial governments and the specific provision function has been devolved to specially created agencies in Cities, Towns and Tehsil Municipal Administrations under the Local Government Ordinance 2001.

g) Operational Strategy for CDM, 2006

The Operational Strategy for CDM has been developed to fulfil the requirements of establishing a Designated National Authority (DNA) and ensuring transparent, participatory and effective management of CDM process in the country. The strategy describes the functions and powers of the DNA and the national approval process. It builds on preliminary studies for initial projects including Asia Least Cost Greenhouse Gases Abatement Strategy (ALGAS) and Pakistan's Initial Communication on Climate Change which provides a general framework for operating CDM in Pakistan.

2.8.4 International Conventions

a) United Nation Framework Convention on Climate Change (UNFCCC) Amended, 2015

The objective of the Convention is to stabilize greenhouse gas concentrations "at a level that would prevent dangerous anthropogenic (human induced) interference with the climate system." Such a level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner.

b) Kyoto Protocol (Amended), 2012

The Kyoto Protocol aimed to reduce carbon dioxide (CO₂) emissions and the presence of Greenhouse Gases (GHG) in the atmosphere.

c) Paris Agreement, 2015

The Paris Agreement's central goal is to strengthen the global response to the threat of climate change by keeping a global temperature rise this century well below two degrees Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even further to one and half degrees Celsius. Additionally, the agreement aims to increase the ability of countries to deal with the impacts of climate change, and at making finance flows consistent with a low GHG emissions and climate-resilient pathway.

The implementation of the proposed project will reduce the emission of greenhouse gases (GHG) and hydrogen sulphide in the atmosphere from the Nullah Lai due to the construction of the sewerage system.

d) The Convention on Conservation of Migratory Species of Wild Animals

The Convention requires countries to take action to avoid endangering migratory species. The term "migratory species" refers to the species of wild animals, a significant proportion of whose members cyclically and predictably cross one or more national jurisdictional boundaries. The parties are also required to promote or cooperate with other countries in matters of research on migratory species. There are no endangered species of plant life or animal life in the vicinity of the Project Area.

e) Basel Convention, 1994

In 1994, Pakistan signed Basel Convention that restricts trans-boundary movements of "Hazardous Waste and their Disposal" with aim to protect human health and surrounding environment by minimizing the use of hazardous waste production. The proposed project will not be necessitating the endowment of this convention.

f) International Union for Conservation of Nature and Natural Resources Red List, 2000

This enlists wildlife species experiencing various levels of threats internationally. Some of the species indicated in the IUCN red list are also present in the wetlands of Pakistan. However, no wildlife species experiencing various levels of threats are present in and around the surroundings of Project Area.

g) Ramsar Convention on Wetlands of International Importance, 1971

The Ramsar Convention is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. The convention is an international treaty for the conservation and sustainable utilization of wetlands. It is the only global environmental treaty that deals with a particular ecosystem. No Ramsar Site is present in and around the proposed Project Area.

h) Millennium Development Goals (MDGs)

The Millennium Development Goals (MDGs) were adopted in the General Assembly of the United Nations in the year 2000 by all the countries of world and the world's leading developmental institutions. The MDGs that will prevail for the proposed project are as follows:

- Promote Gender Equality and Empower Women: The contractor during construction phase will be responsible to hire women for construction activities to elude gender discrimination and to promote women empowerment.
- Combat HIV/AIDS Malaria and Other Diseases: Contractor will be responsible to conduct medical surveillance of the workers before hiring to combat HIV/AIDS Malaria and other diseases.



- Ensure Environmental Sustainability: Contractor will be responsible to ensure environmental sustainability of the proposed Project Areas by ensuring implementation of EMP to mitigate adverse environmental impacts from construction activities during construction phase.

2.9 ADMINISTRATIVE FRAMEWORK

2.9.1 Rawalpindi Development Authority (RDA)

RDA is responsible for ensuring that the project complies with the laws and regulations controlling the environmental concerns of Lai Expressway, Sewerage system and STP construction and operation, and that all preconstruction requisites, such as permits and clearances are met.

RDA is a directorate of Rawalpindi Water and Sanitation Agency (RWASA). Therefore, RWASA is legally bound to provide assistance to RDA in the establishment of Sewerage system and STP by ensuring compliance with the laws and regulations controlling the environmental concerns.

2.9.2 Punjab Environmental Protection Agency (Punjab-EPA)

Pakistan Environmental Protection Agency is meant for the enforcement of environmental laws in Pakistan. They have delegated powers to provincial environmental protection agencies for review, approval and monitoring of environmental examination/assessment projects. As the proposed Project also falls in Rawalpindi District therefore Punjab-EPA will be responsible as well for reviewing the report, issuing environmental approval and overall/broad based monitoring of the proposed project activities.



3 PROJECT DESCRIPTION AND ALTERNATIVES

3.1 GENERAL

This Chapter provides an overview of the proposed Project, project components, design considerations, construction procedures, and operation and maintenance activities. The Lai Expressway will serve both the residents of Rawalpindi and Islamabad; however, the main objective of this Expressway is to share the ever-increasing pressure and burden of increasing traffic load of Rawalpindi city. It will be a signal free road with an average speed of 50 kph. The proposed Project comprises development of access-controlled, four lane (2x2) Expressway and channelization of Nullah Lai along with Trunk Sewer at its both banks and STP.

3.2 OBJECTIVES OF THE PROJECT

The 16-km-long expressway from Soan River Bridge to Katarian Bridge (further connected with 10th Avenue) is planned to achieve alternative traffic route between the twin cities, Rawalpindi and Islamabad. This expressway besides eliminating environmental pollution caused by open sewerage in Lai Nullah, will also help in boosting economic activity along its sides.

The basic aim of the project is to provide an alternative route between Rawalpindi and Islamabad and construct a flood channel. This project will also be helpful in saving the citizens of Rawalpindi from the situation of floods.

The project will alleviate the sufferings of twin cities by:

- Reducing traffic congestion, time delays and transportation cost by diverting traffic load from Murree Road and the other existing routes to the Expressway;
- Providing an alternative corridor to connect Rawalpindi to Islamabad;
- Increasing capacity of the Nullah Lai to minimize flood risks; and
- Prevent solid waste disposal practice in the Nullah Lai.

3.3 LOCATION AND ACCESSIBILITY OF THE PROJECT AREA

The proposed project mainly lies within Rawalpindi. The proposed alignment for Lai Expressway is of approximately 16 km length. It starts from National Highway (N-5) near Sawan Lorry Adda, traverses along the Nullah with its end point on 10th Avenue near Katarian.

The alignment crosses various existing roads/bridges including Bridge connecting Ayub Park road with Scheme-III, Bridge at Ammar Chowk, Bridge connecting Rashid Minhas Road with Dohk Chiragh Din, Railway Line (Rawalpindi – Lahore Main Line), Bridge on Murree Road, Bridge connecting Gawal Mandi with Gordon College Road, Bridge connecting Fawara Chowk



with Railway Station, Bridge connecting Fawara Chowk with Ratta Amral & Railway Colony, Bridge connecting Westridge and Dhok Ratta with Hamilton Road, Bridge connecting Chungi # 4 with Pir Wadhai Road, Bridge connecting Chungi # 4 with Syed Khayaban-e-Sir Syed road, Bridge connecting Mohallah Raja sultan with Khayaban-e-Sir Syed Road and Bridge on I.J.P Road.

As already mentioned, trunk sewer will be laid on both banks of the Nullah Lai so Component-II Project Area can be accessed in similar way of Component-I. The site of STP is located almost 18 km away from Soan Adda near Jabbar village on Adiala-Rawat Link Road on the left bank of Soan River. The Project Area accessibility map is shown in **Figure 3.1**.

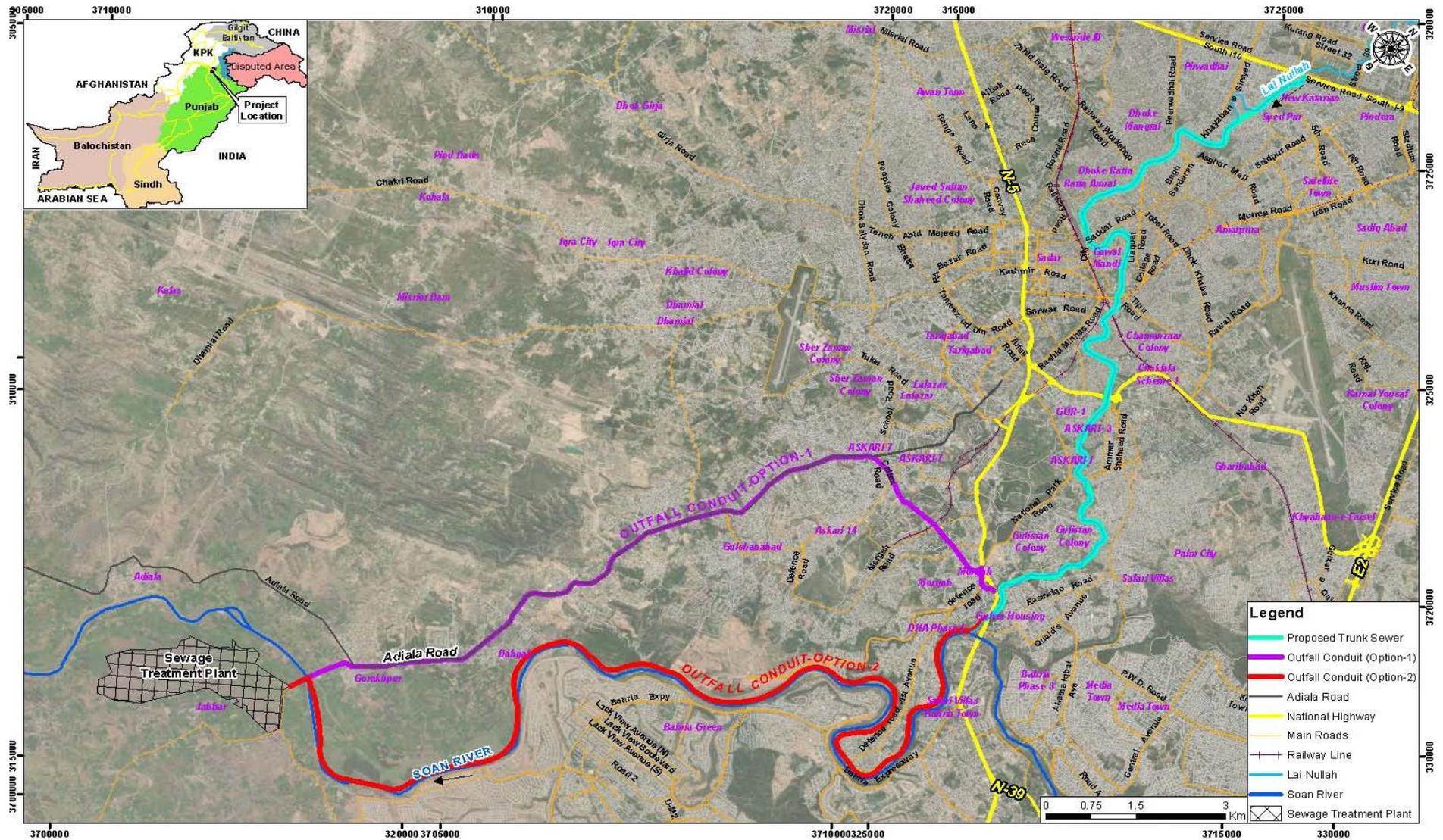


Figure 3.1: Project Area Accessibility Map for Component I & II



3.4 TYPE & COMPONENTS OF THE PROJECT

The proposed Project is divided into two (02) major components:

- Component-I: Lai Expressway; and
- Component-II: Trunk Sewer System along with STP.

3.4.1 Component-I (Lai Expressway)

The proposed Lai Expressway involves the construction of three (03) interchanges including the first at start point on G.T Road, second at Ammar Chowk and third at Katarian Bridge (IJP Road), eight (08) flyovers and two (02) underpasses on the expressway, detailed in **Table 3-1**. The project would ease the traffic congestion on GT Road, Murree Road and Airport Road. **Figure 3.2** depicts the locations of interchanges, flyover and underpasses along the proposed Expressway route.

Table 3.1: List of Proposed Structures

Sr. No.	Type of Structure	Chainage	Location
1	Interchange	0+000	At N-5 (Near Swan River)
2	Flyover	4+220	At Askari-I bridge
3	Interchange	5+800	At Ammar Chowk/ Chaklala
4	Flyover	7+620	At Dhok Charaghdin
5	Underpass	7+900	At Railway Line
6	Underpass	8+200	At Murree Road
7	Flyover	9+190	At Gawal Mandi
8	Flyover	10+110	At Saddar City
9	Flyover	11+090	At Ratta Amral
10	Flyover	11+940	At Gunj Mandi
11	Flyover	12+740	At Pir Wadhai
12	Flyover	13+400	At Dhok Dalal
13	Interchange	15+780	At IJP (Katarian Bridge)

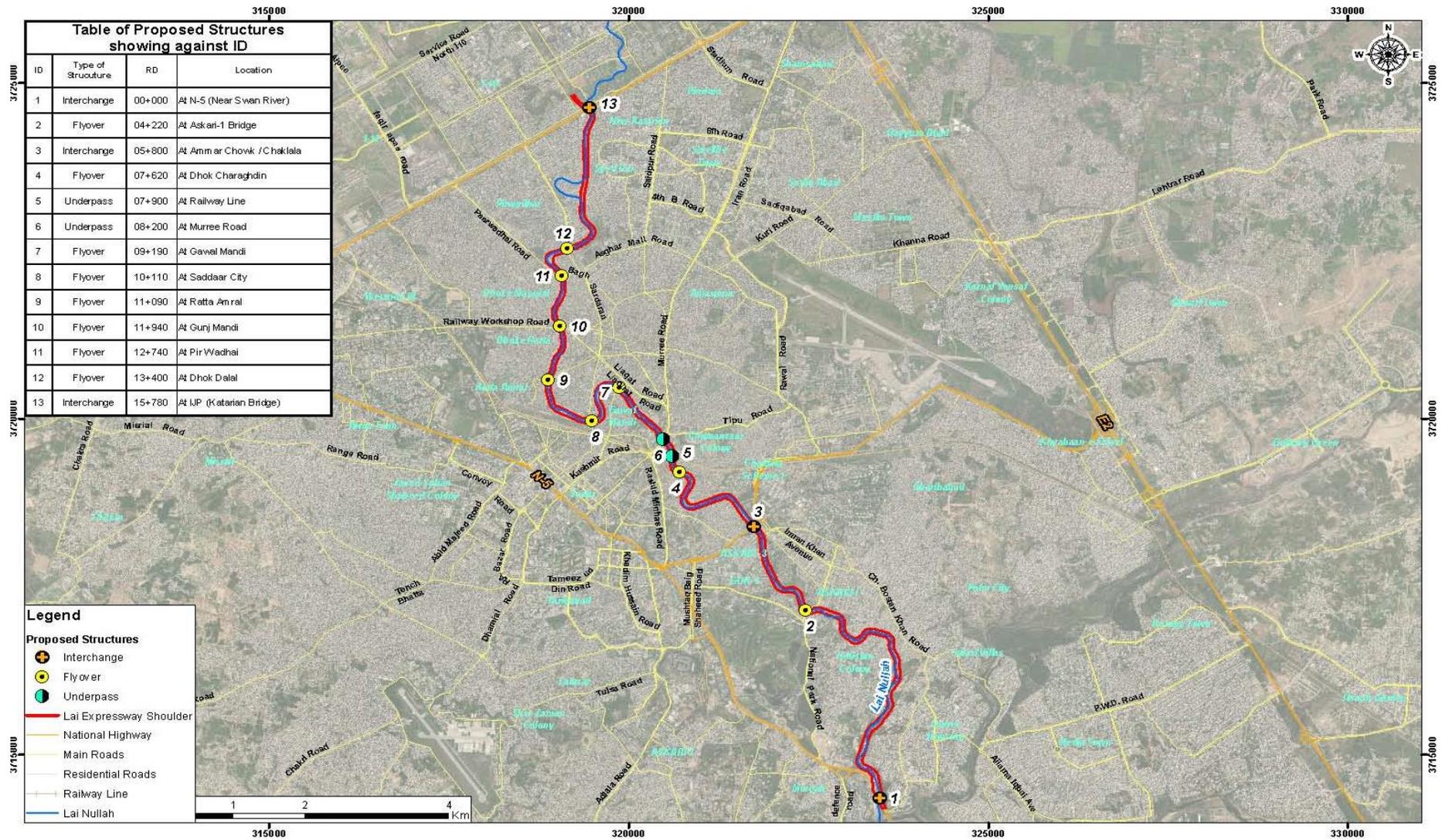


Figure 3.2: Locations of Interchanges, Flyovers and Underpasses along Expressway Route

3.4.2 Component-II (Trunk Sewer System along with STP)

Component-II of the proposed project includes the installation of Trunk Sewer and Treatment Plant to develop a better sewerage system along Nullah Lai to meet the present and future requirements of efficient and effective service delivery.

a) Trunk Sewer System

The area along Nullah Lai of Rawalpindi is completely lacking the facility of trunk sewer line. The proposal of new integrated trunk sewers will develop a better sewerage system along Nullah Lai to meet the present and future requirements. With the implementation of this proposal, Nullah Lai will only be used for storm water. The purpose of this proposal is also to improve the environmental conditions of the surrounding areas. Presently most of the raw sewage generated from the adjoining areas of Nullah is being discharged directly into the Nullah Lai. For this purpose, trunk sewers will be laid along both banks of Nullah Lai to cater the sewage flow from adjoining areas. Proposed Trunk Sewer System comprised of following components:

- Trunk Sewer along Right Side of Nullah Lai (Line-A)
- Trunk Sewer along Left Side of Nullah Lai (Line-B)
- Outfall Conduit

b) Improvement of the Nullah Lai

Flood management in the Nullah Lai involves deepening, straightening of sharp bends and lining of the Nullah bed by increasing capacity of the Nullah Lai to minimize flood risks.

c) Sewage Treatment Plant

An area of 5400 kanals has been acquired by RDA for the construction of STP. Different treatment technologies are available for the treatment of wastewater and these technologies range from relatively simple low-cost options like Waste Stabilization Ponds (WSP) to highly mechanized and costly systems such as Activated Sludge Process (ASP).

The choice between the various options depends upon the following factors:

- The effluent standards to be achieved;
- The capital and maintenance cost of each option; and
- Institutional capacity available to run an option.

Activated Sludge Process (ASP) will be utilized for proposed STP on the basis of aforementioned criteria which is discussed in detail in Analysis of Alternatives.

3.5 DESIGN ASPECT

Salient features of the proposed Expressway are provided below:

Project Length	16 Kms
Design Speed	50 Kph
R.O.W Nullah Roadway	31 m ~ 53 m (Varies) 14.0 m each side
Proposed Cross Section Roadway Shoulders Utility Corridor	2 + 2 Lanes 7.2 m each 0.6 m (inner) & 2.4 m (outer) 3.0 m each side

3.5.1 Construction of Carriageway

The proposed Expressway will be constructed along both banks of the Nullah Lai. The construction work involves construction of two lanes carriageways (3.6-meter standard width for each lane) with the total length of about 16 km. The total RoW varies from 31-53 meters. The variation in the RoW is mainly due to the variation in the width of the Nullah Lai (27.40 to 49 m).

Other construction work involves construction of 0.6 meter wide inner shoulder, 2.4 meters wide outer shoulder, 3.0 meters wide utility corridor on each side, 1.75 meters wide side drain, and lighting poles. The slope of the road is 2%. **Figure 3.3** shows typical cross-section of the proposed Expressway.

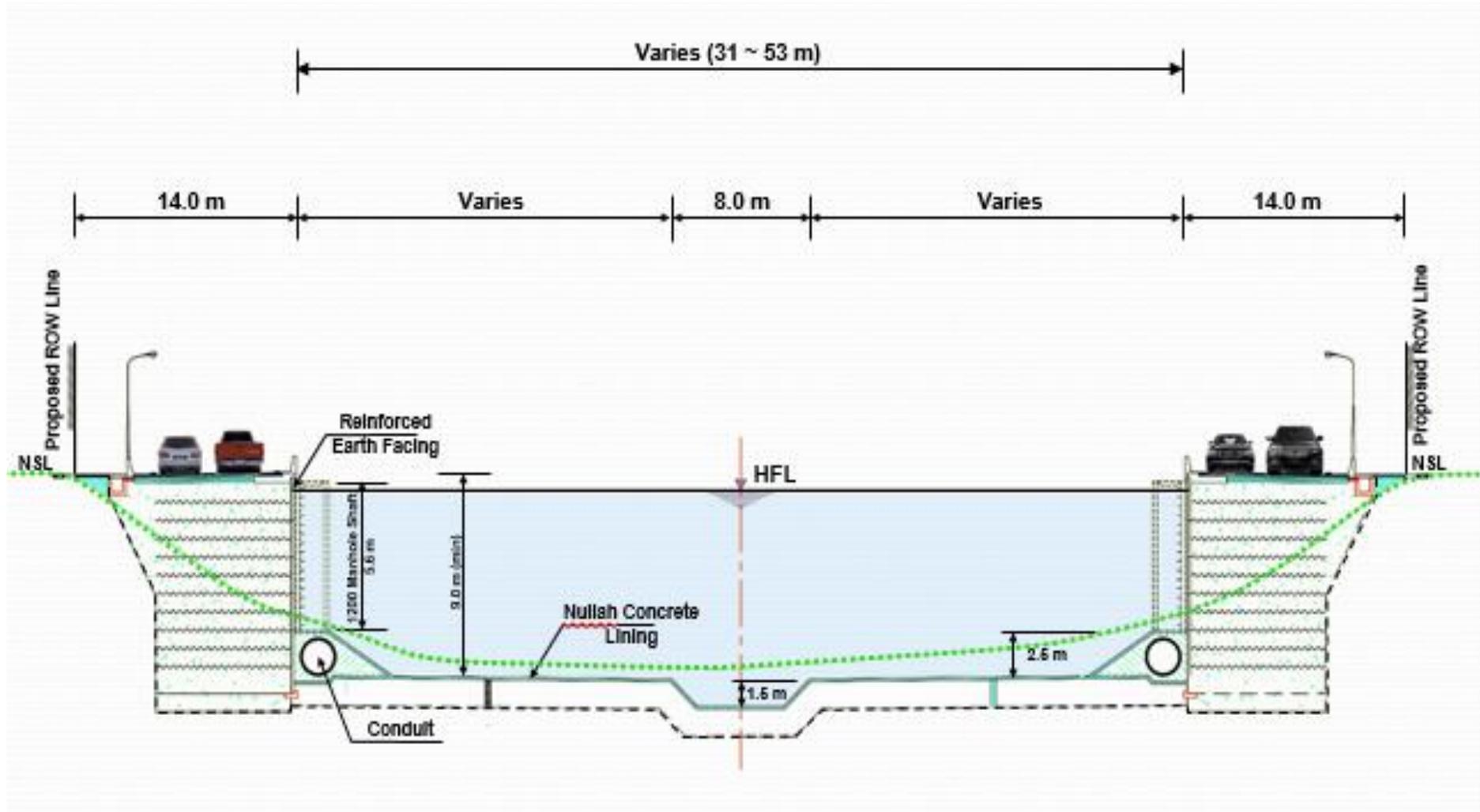


Figure 3.3: Typical Cross-section of the Proposed Expressway



3.5.2 Interchanges

Total three (03) No. of interchanges have been proposed in order to provide access for traffic to and from the local road network, thus facilitating existing and future commercial traffic from this region. The interchanges are also necessary in order to provide breaks in the Expressway for access of vehicles at regular intervals for purposes of maintenance, services and security. **Table 3.1** shows details of these interchanges.

The combined effect of the long deceleration lanes and the even longer acceleration lanes required at the entrance and exit of the interchanges and also the large area required for the ramps dictated the choice of suitable locations for the interchanges and its configuration.

3.5.3 Flyovers and Underpasses

Total eight (08) No. of flyovers and two (02) underpasses will be constructed to ensure a signal free, continuous and smooth flow of traffic with limited access. **Table 3.1** lists down the details of flyovers and underpasses.

3.6 TRUNK SEWER SYSTEM ALONG WITH STP

3.6.1 Trunk Sewer System

Trunk sewers will be laid along both banks of Nullah Lai to cater the sewage flow from adjoining areas. Following is the detail of main trunk lines:

a) Line-A (Right Side of Nullah Lai)

Right side of the Project Area will be served by a RCC trunk sewer line ranging from 42" to 72" diameter and conduit of 2.5m x 2.5m having length of 10500m & 8200m respectively.

b) Line-B (Left Side of Nullah Lai)

Left side of the Project Area will also be served by a RCC trunk sewer line ranging from 36" to 66" diameter and conduit of 2.0m x 1.5m having length of 7700m & 11000m respectively.

c) Outfall Conduit

An RRC Conduit of 3.0m x 3.0m is proposed to be constructed from Soan Adda to STP, which will cater the flow from preceding conduits along both sides of Nullah Lai.

3.6.2 Improvement of the Nullah Lai

Channelization of Nullah Lai involves deepening, straightening of sharp bends and lining of the Nullah bed. The retaining walls (reinforced earthfill walls) will be constructed along both sides of the Nullah Lai. The height of the retaining wall varies from 9 meters to 13 meters. The proposed minimum depth of the Nullah is 9 meters while the width varies from 27.4

meters 49 meters. A CUNET, 8.0 meters wide and 1.5 meters deep, will be provided in the bed of the Nullah to carry storm water during the dry season. The sharp bend along the Nullah Lai will be straightened to maintain the designed speed of 50 kilometers per hour. **Figure 3.3** shows cross-section of the Nullah Lai.

3.7 CONSTRUCTION ASPECTS (COMPONENT I & II)

3.7.1 Construction Schedule and Implementation

The construction time for Lai Express shall be two (02) Years.

3.7.2 Construction Camps

Camp sites will be located keeping in view the availability of an adequate area for establishing camps, including parking areas for machinery, stores and workshops, access to communication and local markets, and an appropriate distance from the sensitive receptors in the vicinity. Keeping in view the following criteria guidelines, the Contractor has to identify the construction camp sites before start of the construction.

- There should be no resettlement issue for the location of the camps;
- Camp site should be away from the residential areas and sensitive receptors;
- Selection of sites for construction camps shall be near the Project Area having proper access to the nearby main/link road;
- The camps must be located in a place where the drainage from and through the camps will not threaten any domestic or public water supply;
- Camp site must be adequate in size to prevent overcrowding of necessary structures;
- The camp site should consider avoiding any damage of property, vegetation, irrigation, and drinking water supply systems;
- The camp site must not be subject to periodic flooding; and
- There should not be any ecological sensitive areas e.g. wildlife sanctuaries, game reserves, national parks, forest areas, etc. near to the construction camp site.

3.7.3 Construction Materials

The estimated quantity of construction materials for the proposed Project is 1.6 million cubic meters. Following are the proposed sources of construction materials:

- **Soan River:** Approximately 22 kilometers from Katarian. The materials available here are mostly flaky and sub angular silty gravels. Reserves need to be investigated.
- **Korang River:** Approximately 20 kilometers from Katarian. The material available here is silty sandy gravel. Reserves are sufficient to meet the Project requirement.
- **Bara Kahu:** Approximately 24 kilometers from Katarian. The material is silty sandy gravel. Reserves need to be investigated.
- **Haro River:** Approximately 55 kilometers from Katarian. Material is sub rounded to sub angular silty sandy gravel. Reserves are sufficient to meet the Project requirement.



- **Local Nullah / Pits:** within a radius of 40 km with limited reserves.

3.7.4 Work Force

Man power demand estimation is an essential component to facilitate deployment of manpower. Total man power required for the proposed project will be estimated by the contractor at construction stage, whereas as per consultant's previous experience the workforce for proposed project has been estimated as 150 workers 50 skilled and 100 unskilled labourers.

3.7.5 Water Requirement

The source of water during the construction phase will be from water bowser tanks and groundwater (if available) from local sources will be used. The water consumption is estimated to be 6,000 liters /day⁵ for 150 construction workers comprising 50 skilled and 100 unskilled labourers (approx.) for the proposed Project.

3.7.6 Wastewater Generation

The wastewater generation is estimated to be 4,800 liters/day for 150 construction workers comprising 50 skilled and 100 unskilled labourers (approx.) for the proposed Project.

3.7.7 Solid Waste Estimation

Due to construction activities waste will be generated at construction site and contractors camp. The contractor will provide the estimated quantity of excavation material during the construction phase. These wastes will be generated due to the construction activities and the up to the extent possible the excavated materials will be reused, where applicable, for construction purposed. Solid waste generated during construction and camp sites shall be safely disposed in demarcated waste disposal sites.

The solid waste generation is estimated to be 75 kg/day (as per 0.5 kg/capita/day waste generation)⁶ for 150 construction workers comprising 70 skilled and 80 unskilled labors for the proposed Project.

3.7.8 Power Requirement/ Power Source

The main source of electricity/electric power during construction phase will be diesel generators for construction camps and construction machinery and during the operational phase it would be taken from main electric power grid, supplying power to the main city. The Contractor(s) will provide the details about capacity, type and number of generators to be utilized during construction phase.

5. Tentative Work Force Requirements Including Client and Contractor Staff"
= (150) x (40) = 6,000 liters/day
= (150) x (80% of wastewater) =4,800 liters/day

6. Source: The World Bank Report 2012 – What a Waste: A global review of solid waste management. Based on UNEP estimates for waste generation in the Asia Pacific. Average is 0.45 kg/capita/day

3.7.9 Construction Equipment

The list of the machinery and the equipment required for the proposed Project is provided in **Table 3.2**.

Table 3.2: Machinery and Equipment Requirement

Sr. No.	Type of Machinery/ Equipment	Sr. No.	Type of Machinery/ Equipment
1	Bulldozer	13	Rollers
2	Excavator	14	Tandem
3	Dump Trucks	15	Vibratory Combination Rubber Mounted Tandem Roller
4	Grader	16	Crane
5	Grader with Scarifier	17	Beam Launching Truss
6	BackHoe	18	Piling Equipment
7	Water Tanker	19	Vibrator for Concrete
8	Front End Loader	20	Road Marking Machine
9	Paver	21	Concrete Batching Plant
10	Power Broom	22	Asphalt Premix Plant
11	Bitumen Pressure Distributor	23	Laboratory with Equipment (1 permanent & 1 mobile)
12	Pug Mill		

3.7.10 Clearance of RoW

The total quantity of excavated material from LAI nullah is 3,598,920 m³ for the purpose of Clearance of RoW.

3.8 OPERATION AND MAINTENANCE

3.8.1 Lai Expressway (Traffic Projection)

The Lai Expressway, when completed, would provide shorter as well as a better and faster facility to most of the residents of Rawalpindi and Islamabad as compared to the existing roads/routes especially Murree Road.

In order to make assessment for such traffic, Origin and Destination (O&D) Surveys, were conducted by NESPAK at the following locations:

- Lai Expressway to I.J. P. Road
- Lai Expressway Traffic

The basic purpose of the O&D surveys was to assess the volume of traffic likely to divert to Lai Expressway and the volume of traffic likely to continue to use the existing roads/routes.

The traffic categories noted during count survey included Animal-drawn Vehicles, Cycles, Motorcycles, Rickshaws, Cars/Jeeps/Taxis/Pajeros, Loader Pickups, Suzuki Passenger

Pickups, Buses, Mini Buses/Coasters, Tractors/Tractor Trolleys, Trucks 2–Axles, Trucks 3–Axles, Large Trucks/Trailers/4-Axles, etc. (Table 3.3).

Table 3.3: Total Lai Expressway Traffic (Year 2020)

Sr. No	Traffic Split	Entering Traffic
1	Rickshaw	9,554
2	Motorcycle / Scooter	35,986
3	Car/Taxi	23,607
4	Pajero/Jeep/Suzuki	1,752
5	Hiace Wagon / Datsun	1,053
6	Medium Bus / Flying Coach	703
7	Bus	308
8	Loader / Pickup	2,657
9	Tractor / Trolley	37
10	Truck 2 axle	369
11	Truck 3 axle	539
12	Truck 4 axle	40
13	Truck 5 axle & above	63
Total		76,667

Based on the traffic report, Daily Entry-Exit Traffic for the Lai expressway from different areas is shown in Tables 3.4.

Table 3.4: Traffic Projections on Lai Expressway

Lai Expressway upto IJP- Traffic (Year 2020)				
Sr. No.	Interchange	Entry-Exit Traffic /Day		Segment Traffic
		Entry	Exit	
1	9 th Avenue	-		
2	IJP	4,576	4,593	
3	Pir Wadhai	10,563	10,040	9,169
4	Gunj Mandi	6,012	9,390	25,298
5	Ratta Bridge	6,951	6,339	17,156
6	Gawal Mandi	5,260	7,360	4,058
7	Muree Road	11,015	22,583	15,518
8	Ammar Chowk	19,582	2,662	32,932
9	Ayube Park Road	750	439	24,418
10	GT Road	11,958	13,261	25,219
Total		76,667	76,667	

3.8.2 Trunk Sewer System along with STP

ASP will be used for treatment during operation of the STP. It is the biological treatment method, in which aerobic microorganisms present in wastewater, use the colloidal and

dissolved organic matter of the wastewater, for their multiplication and growth, with the help of oxygen thus converting them into readily settleable biomass. Generally, the required oxygen supplies are maintained by forced supply of air to the wastewater in the aeration tank. The aerated effluent is then allowed to pass through a secondary settling tank to separate the biomass or the “activated sludge”. A part of the "activated sludge" is recycled to the aeration tank to maintain optimum microorganism concentrations. The remaining secondary sludge is removed from the system periodically; dewatered and dried; and disposed of.

3.9 COST OF THE PROJECT

The estimated total cost of the proposed Project is Rs. 85 Billion while the cost of the construction works is Rs. 62.5 Billion.

3.10 ANALYSIS OF ALTERNATIVES

Different alternatives were considered for both project components respectively based on technical, technological, economical, financial, environmental and social parameters. The best suitable option selected for the construction of Lai Expressway and Sewerage System along with STP in the light of the same. The alternatives for both project components are discussed below.

3.11 COMPONENT-I (CONSTRUCTION OF LAI EXPRESSWAY)

The alternatives that have been considered for component-I are:

- No Project Option; and
- Construction of Lai Expressway.

3.11.1 No Project Option

No project option means no project will be implemented to resolve the issues arising due to increase in growth of traffic in Rawalpindi and Islamabad Cities which has put tremendous pressure on infrastructure of the city, particularly the road network. The traffic volumes on roads and intersections have reached saturation point mainly due to rapidly growing population of the cities as shown in **Table 3.5**.

Table 3.5: Population of Islamabad and Rawalpindi Cities⁷

Sr. No.	Name of City	Population (as per Census)		Average Annual Growth Rate
		2017	1998	1998-2017
1.	Islamabad	2,006,572	805,235	4.91%
2.	Rawalpindi City	2,098,231	1,409,768	2.22%

⁷ Pakistan Bureau of Statistics, Census 2017

The table 3.5 reveals that during the period between the last two census (i.e. 1998 and 2017) the rate of population growth in Islamabad City is 4.91 % where as in Rawalpindi City it is 2.22 %, which is considerably high. The high population growth results in tremendous traffic load especially on Murree road, which is the hub of commercial, educational and government sector activities in the city, and as a result long traffic queues and traffic jams are a common sight on Murree Road. Existing Murree Road of length 9.963 km (from G.P.O Chowk to Faizabad Interchange) is carrying heavy loads of local (Rawalpindi City) traffic as well as through traffic between Rawalpindi and Islamabad. The Average Daily Traffic (ADT) is 65,119⁸ and which is bound to increase in future due to rapid rise in population. This will further worsen the traffic situation on Murree Road. Therefore the “No Project Option” is deemed unfeasible due to prevailing conditions.

3.11.2 Construction of Lai Expressway

Keeping in view rising problems of traffic growth in twin cities that has put tremendous pressure on infrastructure of the cities, particularly on road network and Murree Road, RDA has proposed to establish a signal free Lai Expressway from Sawan Adda to Katarian supported by interchanges, flyovers and fences on either bank of Lai Nullah to provide an alternative route to the residents of twin cities for the mobilization purposes to alleviate traffic problems.

Options for Route Alignment

The two route options considered for the construction of Lai Expressway are as follows:

- **Option A:** Construction of Lai Expressway from Sawan Adda to Katarian Bridge and further connected to 9th Avenue (Agha Shahi Road); and
- **Option B:** Construction of Lai Expressway from Sawan Adda to Katarian Bridge and further connected to 10th Avenue.

Figure 3.4 shows route alignment options for the construction of Lai Expressway.

⁸ Traffic Survey Report of Murree Road, 2007

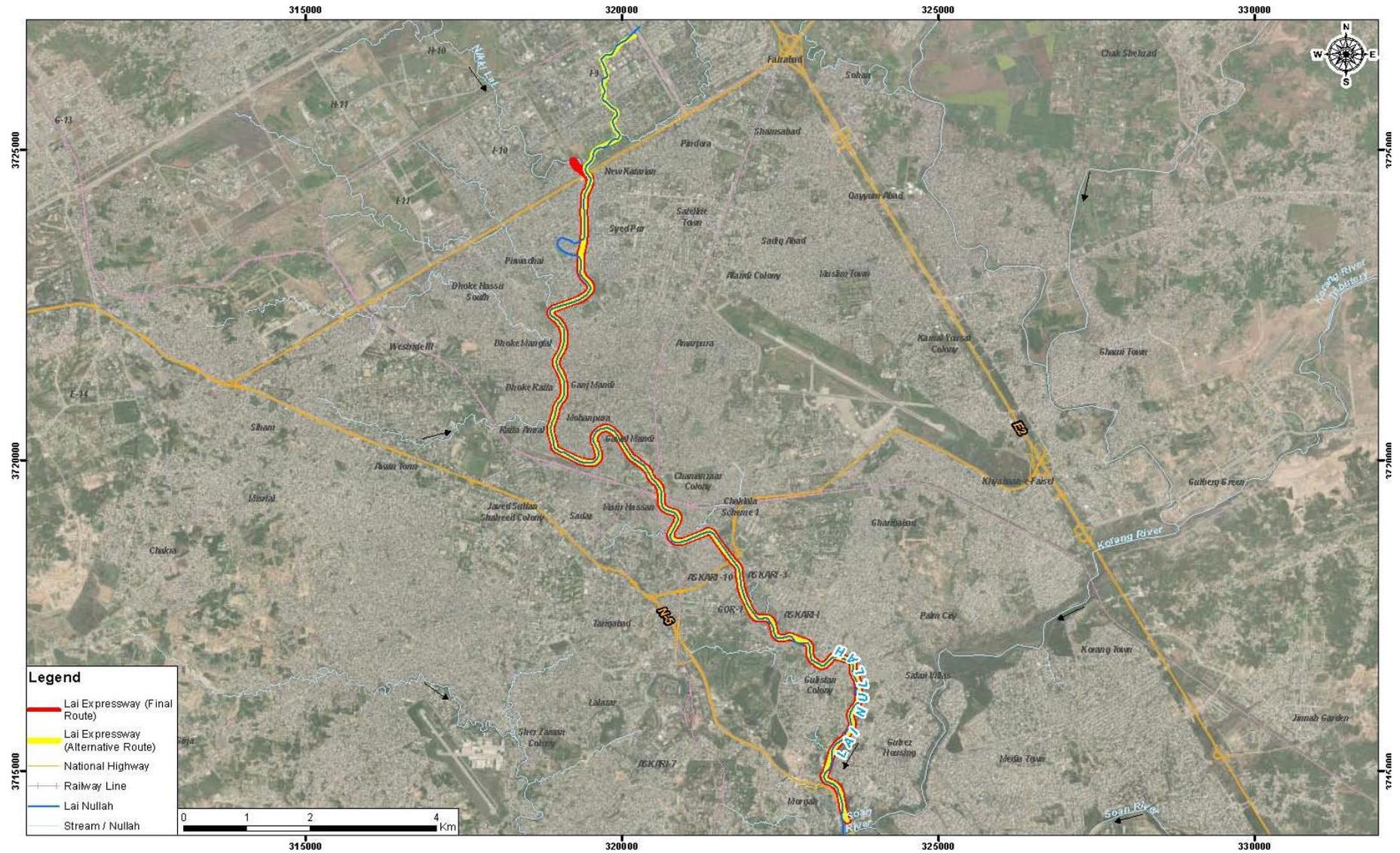


Figure 3.4: Options for Lai Expressway Route Alignment

The following criteria were developed for the selection of the route considering physical, ecological and socio-economic environment:

- Avoid densely populated areas/towns;
- Avoid land acquisition and displacement of local people to the minimum;
- Avoid cultural, religious and historical buildings;
- Minimize disturbance to the natural habitats of flora and fauna;
- Avoid wildlife sanctuaries, national parks and game reserves;
- Avoid potentially security vulnerable areas;
- Appropriate distance from the sensitive receptors (for instance, minimum 500m);
- Avoid crossing large water bodies like lakes, rivers or streams; and
- Avoid crossing airports, railway tracks and other similar structures and facilities (where possible).

Both route options were surveyed and studied for the construction of Lai Expressway in the light of above mentioned criteria. It was observed that Option B is most feasible option for the construction of Lai Expressway as it involves less land acquisition and resettlement issues, disturbance to local population, health institutes and educational facilities, fewer tree cutting, and no damage to graveyards and shrines in comparison to Option A, which involves damage to different structures including residential, commercial, mosques, schools, parks, playgrounds and graveyards need to be demolished (fully/partially), enormous number of tree cutting along the alignment and increased land acquisition issues for the construction of proposed Lai Nullah Expressway resulting significant environmental and socioeconomic impacts/upheavals in the Project Area.

Environmental, Social and Economic Sustainability

The Construction of Lai Expressway from Sawan Adda to Katarian Bridge and further connected to 10th Avenue will increase the environmental, social and economic sustainability in various ways:

- Climate change issues will be reduced due to vehicular emissions (NO_x, SO_x, CO, CO₂ and Particulate Matters) by constructing signal free expressway which will eliminate traffic jams;
- Less noise pollution and vibration issues due lack of traffic jams;
- Less / negligible damage to the natural habitats of local flora and fauna during construction and operational phase;
- Improved mental health of the road users due to smooth flow of traffic and lack of traffic jams;
- Smooth flow of traffic and saving of vehicle travel time and vehicle operating costs of commuters;
- Reduction in traffic accidents and casualties by traffic congestions;
- Efficient movement of trade, goods and traffic in relatively shorter time;
- Quicker transports of agricultural products including perishable goods to final destination;

- Reduction in the fuel consumption and transportation cost caused by traffic congestion and bumpy roads;
- Construction of Lai Expressway will reduce the burden of traffic flow on Murree Road;
- Improved environmental aesthetics of the areas due to plantation of trees and ornamental plants along the route alignment; and
- Increase in economic growth by providing employment opportunities to the local residents and vendors during construction phase.

3.12 COMPONENT-II (CONSTRUCTION OF TRUNK SEWER ON BOTH SIDES OF NULLAH LAI ALONG WITH STP)

To study different alternatives for the selection of most feasible option, three (03) different alternatives considered for the component-II of the proposed project as follows:

- No Project Option;
- Rehabilitation of Existing Sewer System; and
- Construction of New Trunk Sewer on both Sides of Nullah Lai along with STP.

3.12.1 No Project Option

No project option means no project will be implemented to resolve the issues arising due to the absence of adequate sewerage system in the study area to meet the present needs of overflowing sewers that ultimately discharge into the Lai Nullah, the main drain passing through the city due to the lack of a proper sewerage network that has worsened conditions, especially for poor people living in low-lying areas. Therefore; this option is not feasible in terms of environmental and social economic aspects.

3.12.2 Rehabilitation of Existing Sewer System

Under the option, sewer lines of the existing sewerage system will be replaced with new one's that only covers about 30%⁹ of the city area that includes Satellite Town and Khayabn-e-Sir Syed comprising 10 main sewer lines carrying sewage flow of 145 cusecs on right side and 76 cusecs flow on left side from adjoining areas along Lai Naullah with no sewage treatment facilities. Whereas, remaining 70% of the city raw sewage will be discharged into Lai Nullah due to the absence of sewerage network, sewage disposal, and treatment.

Moreover, it was analyzed from the field study and previous studies that due to the absence of proper sewerage network, sewage disposal, and treatment the conditions in the study area has worsened, especially for poor people living in low-lying areas. Heavy rains also cause extensive local flooding and storm water mixes with raw sewage, spreading contamination throughout the neighborhood while low-lying areas remain flooded for a long time. Most of the existing drains in the city have been encroached upon, which has further deteriorated the situation. The storm water channels carrying the untreated sewage of

⁹ ADB, 2005. Technical Assistance to the Islamic Republic of Pakistan for Rawalpindi Environmental Improvement Project. Manila

Islamabad and Rawalpindi are virtually sludge carriers that ultimately discharge into nearby Soan River, affecting aquatic life and agriculture. All these factors have seriously affected (i) drinking water quality; (ii) open water storage reservoirs are being contaminated with the discharge of uncontrolled and untreated sewage; (iii) defective, old, leaking water pipelines that run alongside the sewerage system receive sewage at leaking points; (iv) groundwater sources become contaminated by percolation of sewage because of the inadequate sewerage system; and (v) discharge of untreated sewage from Islamabad in Lai Nullah has contaminated all the tube wells located along this drain.

Therefore; this option is also not feasible in terms of environmental and social economic aspects.

3.12.3 Construction of Trunk Sewer on Both Sides of Nullah Lai along with STP

A) Construction of Trunk Sewer

The proposed project option lies within Rawalpindi city. The Trunk sewer will be laid on both sides of the Nullah Lai to carry storm water and wastewater disposed of directly and indirectly from the residential areas, industries and drains into the Nullah Lai without any treatment. The approximate length of trunk sewer is about 16 Km with carrying capacity of about 250 cusecs. The right side of the Project Area will be served by a RCC trunk sewer line ranging from 42" to 72" diameter and will cater the sewage flow from new Katarian, Mohalla Raja Sultan, Mehmood Abad, Gulshan Abad, Millat Colony, Naya Mohalla, Moti Mahal, Soan Adda, Agha Sahi, Satellite Town and other small towns located nearby, and left side of the area will also be served by a RCC trunk sewer line with diameter ranging from 36" to 66" and will cater the sewage flow from Khayaban-e-Sir Syed, Western Side of Niki Lai, Cantonment Area, Soan Adda and other small towns located nearby this reach. Moreover, Lai Nullah will only be used for storm water due to the implementation of the proposed option.

B) Outfall Conduit

An RRC Outfall Conduit of 3.0 m x 3.0 m is proposed to be constructed from Soan Adda to STP which will cater the flow from preceding conduits along both sides of Lai Nullah.

Route Optimization for Outfall Conduit

The two options have been proposed for the route of outfall conduit i.e.:

- Option-A: Conduit will be constructed along the Adiala Road up to STP (Length= 14km approx.).
- Option-B: Conduit will be Constructed along the Soan River up to STP (Length= 18km approx.).

The route option A and B for the construction of STP is shown in **Figure 3.5**.

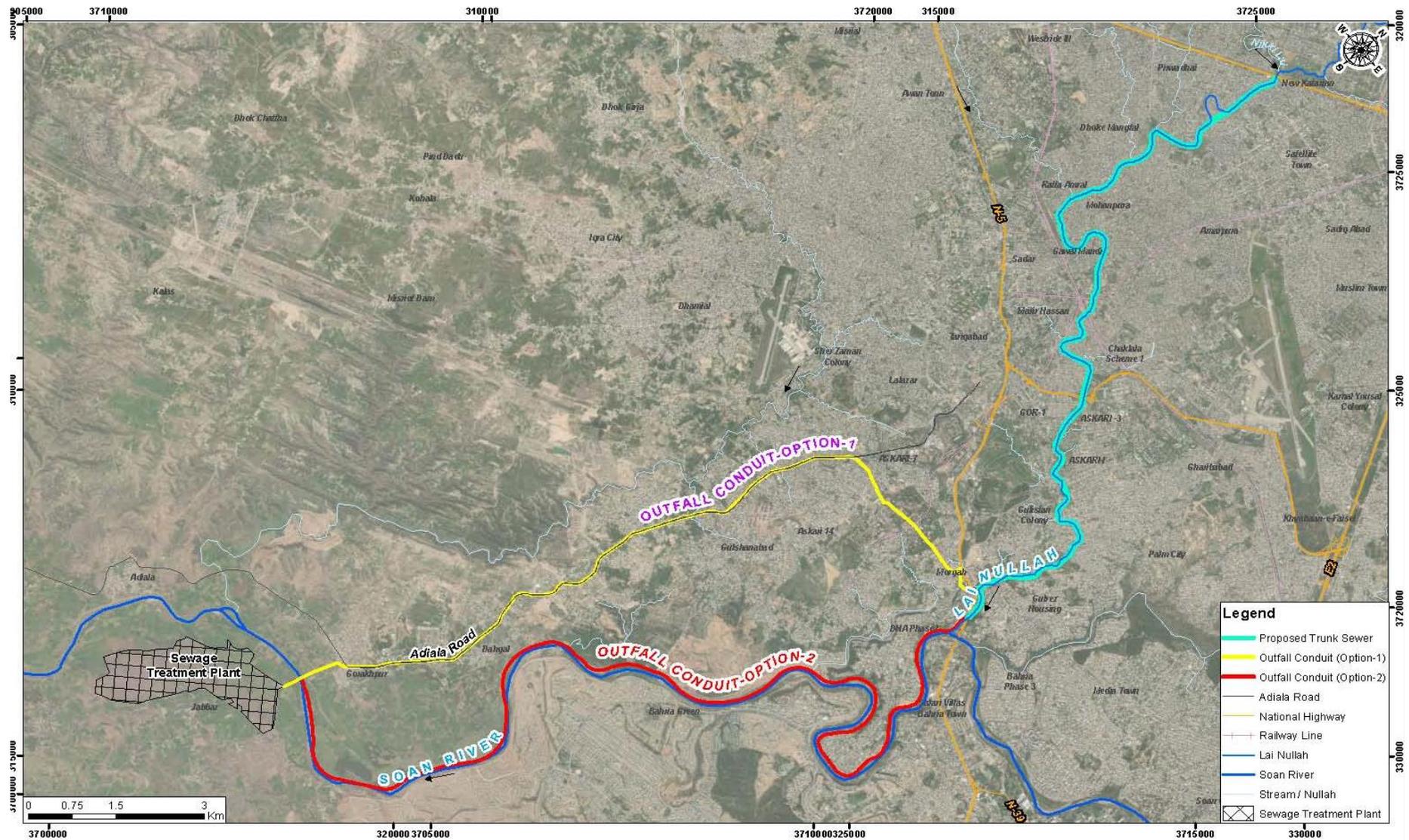


Figure 3.5: Route Optimization for Outfall Conduit



The criterion used for the selection of the route considering physical, ecological and socio-economic environment is same as mentioned in Section 3.11.2.

Both route options were surveyed and studied for the construction of outfall conduct in the light of above mentioned criteria. It was observed that Option B is most feasible option for the construction of outfall conduct as it involves less land acquisition and resettlement issues, disturbance to local population, health institutes and educational facilities, fewer tree cutting, and no damage to graveyards and shrines in comparison to Option A, which involves damage to different structures including residential, commercial, mosques, schools, parks, playgrounds and graveyards need to be demolished (fully/partially), enormous number of tree cutting along the alignment and increased land acquisition issues for the construction of proposed outfall conduct resulting significant environmental and socioeconomic impacts/upheavals in the Project Area.

C) Construction of STP

The STP will be constructed over an area of 675 acres near Jabbar village on Adiala-Rawat Link Road on the left bank of Soan River. The trunk sewer will be connected to the STP through an RCC Conduit of 3.0 m x 3.0 m as discussed above which will cater the sewerage flow from preceding conduits along both sides of Nullah Lai.

Technology for the Treatment of Wastewater

Different treatment technologies are studied for the treatment of wastewater and these technologies range from relatively simple low-cost options like Waste Stabilization Ponds (WSP) to highly mechanized and costly systems, for instance the Activated Sludge Process (ASP). The choice between the various options depends upon the following factors: (i) the effluent standards to be achieved; (ii) the capital and maintenance cost of each option and (iii) institutional capacity available to run an option.

A brief discussion and comparison of each option is given as follows:

i) Waste Stabilization Pond System

Waste Stabilization ponds are large shallow basins, in which raw wastewater is treated entirely by natural processes, involving both algae and bacteria. They are the most important method of wastewater treatment in hot climates. However, since the rate of oxidation is slow so large areas are required for their construction. Their specific advantages are simple operation and no sludge management problem.

ii) Activated Sludge Process

Activated sludge process is the biological treatment, in which aerobic microorganisms present in wastewater, use the colloidal and dissolved organic matter of the wastewater, for their multiplication and growth, with the help of oxygen thus converting them into readily settle able biomass. Generally, the required oxygen supplies are maintained by forced

supply of air to the wastewater in the aeration tank. The aerated effluent is then allowed to pass through a secondary settling tank to separate the biomass or the “activated sludge”. A part of the "activated sludge" is recycled to the aeration tank to maintain optimum microorganism concentrations. The remaining secondary sludge is removed from the system periodically; dewatered and dried; and disposed of.

iii) Aerated Lagoons

Aerated lagoons are completely mixed basins, with detention periods, ranging from 2 to 6 days, in which wastewater is generally treated on flow through basis (without solids recycling), with forced aeration. The aerobic suspended biological flocs, responsible for the waste conversion, closely resemble to that of activated sludge process. Area requirements are in between those of the oxidation ponds and activated sludge process.

iv) Tricking Filter Process

In this process, the settled wastewater is allowed to trickle down over a circular deep bed of coarse aggregates filter. The microbial film, developed on the surface of aggregates over time, treats the wastewater. A part of this film, washed away by the hydraulic action of trickling wastewater, is separated in secondary clarifier, in form of humus sludge, disposed of after sludge treatment.

v) Oxidation Ditch

Oxidation ditches are modified form of activated sludge process with longer SRT and Low FM ratio. The comparison of different Technologies in terms of Area and Cost is discussed in **Table 3.6**.

Table 3.6: Comparison of Different Technologies in Terms of Cost¹⁰

Technologies	Land Requirement	Capital Cost (Excluding Land Cost)	Annual Operational Cost
	(Acres)	(Million PKR)	(Million PKR)
Waste Stabilization Ponds	850	4,100	50
Activated Sludge Process	82	11,100	1,375
Trickling Filter	99	16,100	1,175
Aerated Lagoon	205	8,900	1,425
Oxidation Ditch	107	12,700	1,800

Based on the average sewage flow, the above table presents tentative cost assessment and land requirement for various wastewater treatment technologies for budgetary estimates. However, the treatment technology to be used for the treatment of sewage will be ASP.

¹⁰ Feasibility Report of Lai Expressway Project for STP, 2020



Therefore; the Construction of Trunk Sewer on both Sides of Nullah Lai along with STP is most feasible option in terms of environmental and social economic aspects.

Table 3.7 depicts the reasons for the selection of Construction of Trunk Sewer on both Sides of Nullah Lai along with STP in comparison with other options in terms of Economic, Environmental, and Social Aspects.



Table 3.7: Analysis of Alternatives in Terms of Economic, Environmental, and Social Aspects

Impacts of Project Options on Parameters	Types of Alternatives		
	1. No Project Option	2. Rehabilitation of Existing Sewer System	3. Construction of Trunk Sewer on both Sides of Nullah Lai along with STP
Environmental and Engineering Considerations	<ul style="list-style-type: none"> ▪ Climate change issues will arise due to the emissions of greenhouse gases (GHS) and hydrogen sulphide (H₂S) from the nearby drains and Nullah Lai due to the absence of sewer system, as observed during site visit. ▪ Urban flooding will increase in the study area during intense rainfall events due to the overflow of Nullah Lai in absence of adequate sewer system. ▪ Eutrophic¹¹ issues will arise in nearby Nullah Lai. 	<ul style="list-style-type: none"> ▪ The existing sewer is reportedly blocked - under capacitated or failed due to 'Microbiologically Induced Corrosion' which will result in seepage of wastewater to the groundwater table, hence deteriorating the groundwater quality. ▪ Climate change issues will arise due to the emissions of greenhouse gases (GHS) and hydrogen sulphide (H₂S), as existing sewerage system covers only 30% of the city area. ▪ Urban flooding will increase in the study area during intense rainfall events due to the overflow of Nullah Lai in absence of adequate sewer system. ▪ Tree cutting will be involved along excavation sites. ▪ Due to deep excavation, it disturbs ground which may be home to small animals and insects, resulting in the disturbance of local ecosystem, and habitat of the species in the immediate vicinity. 	<ul style="list-style-type: none"> ▪ Capacity of sewer system will be enhanced that will eradicate microbial corrosion and seepage in groundwater. ▪ Climate change issues will be reduced due to the adequate sewerage system. ▪ Enhancement in storm water carrying capacity of Nullah Lai during intense rain events. ▪ Tree cutting will be less. ▪ Eutrophic issues will be reduced in Nullah Lai due adequate sewerage system. ▪ Due to deep excavation, it disturbs ground which may be home to small animals and insects, resulting in the disturbance of local ecosystem, and habitat of the species in the immediate vicinity Therefore, it is suggested that Trenchless technology shall be used for lying sewer network on both sides of Nullah Lai, which significantly

¹¹ Eutrophication is an enrichment of water by nutrient salts that causes structural changes to the ecosystem such as: increased production of algae and aquatic plants, depletion of fish species, general deterioration of water quality and other effects that reduce and preclude use



Impacts of Project Options on Parameters	Types of Alternatives		
	1. No Project Option	2. Rehabilitation of Existing Sewer System	3. Construction of Trunk Sewer on both Sides of Nullah Lai along with STP
			<p>reduced the volume of excavation, disturbs less ground which may be home to small animals and insects. This reduces the impact of the new pipe and tunnel on the local ecosystem, and maintains the habitat of the species in the immediate vicinity.</p> <ul style="list-style-type: none"> ▪ Improved topography by adequate conveyance of sewage in the study area. ▪ Improved quality of Soan River due to disposal of the treated water from STP.
Social	<ul style="list-style-type: none"> ▪ Local population of the proposed Project Area will suffer from dengue, malaria, asthma, hepatitis and gastrointestinal diseases. 	<ul style="list-style-type: none"> ▪ Local population of the proposed Project Area will suffer from dengue, malaria, asthma, hepatitis and gastrointestinal diseases due to improper sewer system. ▪ Utilities present near the Project Area will require temporary shifting during construction phase. 	<ul style="list-style-type: none"> ▪ Local population of the proposed Project Area will not suffer from health and safety issues due to prescience of adequate sewer system. ▪ Utilities present near the Project Area will require temporary shifting during construction phase.
Economic	<ul style="list-style-type: none"> ▪ Cost will be required to mitigate the climate change issues, urban flooding and health problems. ▪ No job opportunities for skilled and unskilled labours. 	<ul style="list-style-type: none"> ▪ Job opportunities for skilled and unskilled labors. ▪ Cost will be required to mitigate the climate change issues and health problems. ▪ Compensation cost will be incurred for 	<ul style="list-style-type: none"> ▪ Job opportunities for skilled and unskilled labours. ▪ Less cost will be required to mitigate climate change issues. ▪ Compensation cost will be incurred for purchasing land from local



Impacts of Project Options on Parameters	Types of Alternatives		
	1. No Project Option	2. Rehabilitation of Existing Sewer System	3. Construction of Trunk Sewer on both Sides of Nullah Lai along with STP
		<p>purchasing land from local masses for the construction of temporary construction camps.</p> <ul style="list-style-type: none">▪ Cost will be required for shifting utilities.▪ Cost required for the construction will be less in comparison to option one and three.	<p>masses for the construction of temporary construction camps.</p> <ul style="list-style-type: none">▪ Decline in loss of income from the dumping of electrical appliances due to emissions of methane and hydrogen sulphide from nearby Nullah Lai.▪ Cost required for the construction will be more in comparison to option one and two but issues related to handling sewerage system will be alleviate and will benefit local population in elongated run.



4 DESCRIPTION OF THE ENVIRONMENT

4.1 GENERAL

For any development project, the prevailing environmental conditions need to be assessed prior to the preliminary stages of planning, designing and execution of the project. Identification of physical, ecological and social aspects of environment and collection of relevant data is essentially important for the evaluation of impacts as well as for the suggestion of adequate mitigation measures, which forms the basis for the implementation of the proposed project in terms of prevailing environmental and social conditions in the study area.

The existing environmental conditions of the proposed project have been considered within a COI of 25 m from the shoulder on either side along the proposed route for the Lai Expressway Project with respect to physical, biological and socio-economic aspects (COI Maps already referred in **Chapter-1**). Information has been collected from variety of sources, including published literature, District Census Reports (DCRs), field observations and surveys, conducted specifically for this project have been analyzed for this study. Consultations were also held with the general public and stakeholders of the Project Area in order to seek the public opinion on the implementation of the proposed project.

The data presented in the forthcoming sections has been collected from the primary and secondary sources. For primary data acquisition, the Environment and Social team conducted the field visit from 11th to 17th of March, 2020. Filed visit report is attached as **Annex-III**. Various questionnaires and checklists were utilized as a tool for baseline data collection during field visit which are attached as **Annex-IV**.

4.2 PHYSICAL ENVIRONMENT

The following section provides an overview of the information on physical environment of the COI collected from primary as well as secondary sources. The major parameters covered include Physiographic and Topography, Geology, Soil, Seismicity, Climate and Meteorology, Water Resources, Solid Waste, and Land Use, etc.

4.2.1 Physiographic and Topography

The metropolitan area of Islamabad-Rawalpindi lies between longitude 72°45' and 73°30' E and latitude 33°30' and 33°50' N in the Islamabad and Rawalpindi District of the Punjab with general height varies from 457 to 1,604 m above the mean sea level (msl). The terrain in the metropolitan area of Islamabad-Rawalpindi consists of plains and mountains whose total relief exceeds 1,175 m.

The metropolitan area divided into four physiographic¹² zones i.e.:

- Margalla Hills;
- Higher Plain;
- Lower Plain; and
- Valley Area.

Margalla hills are located in the north of the area. The dominant formations are composed of sandstone, shale, and lenses of conglomerates and are covered with permanent mixed scrub and coniferous forest. The ground elevation is up to 1,240 m at the upstream end. There are three major tributaries of Lai Nullah namely Saidpur Kas, Tenawali Kas and Bedarawali Kas, which originate from the Margalla Hills forming a very steep channel bed slope of about 1/10.

The **higher plain** expands over the built-up area of Islamabad City with a gradual slope from North to South. Saidpur Kas, Tenawali Kas and Bedarawali Kas run southward in the plain and finally flow into Lai Nullah just upstream of Kattarian Bridge.

The **lower plain** extends over the upper part of the Rawalpindi area above Chaklala Bridge. This area is flatter than the upper Higher Plain and the lower Valley Area forming a bowl-shaped topography. Rawalpindi city area is covered with alluvium and eolian deposits and is part of dissected basin plain formed by Lai Nullah and its tributaries.

The **valley area** is located below Chaklala Bridge. The valley area, falling down to the Soan River, a tributary of the River Indus is composed of gravel/boulder and sand/silt.

The study area of the proposed project falls in both upland (North) and lowland (South) areas surrounded by roads, bridges, flyovers, graveyards, residential areas, medical and health institutions and commercial area. **Figures 4.1 & 4.2** represent the topography of the Component-I and Component-II respectively.

¹² JICA (2003) The Study on Comprehensive Flood Mitigation and Environmental Improvement Plan of Lai Nullah Basin in The Islamic Republic of Pakistan, Final Report, CTI Engineering International Co., Ltd., Pacific Consultants International

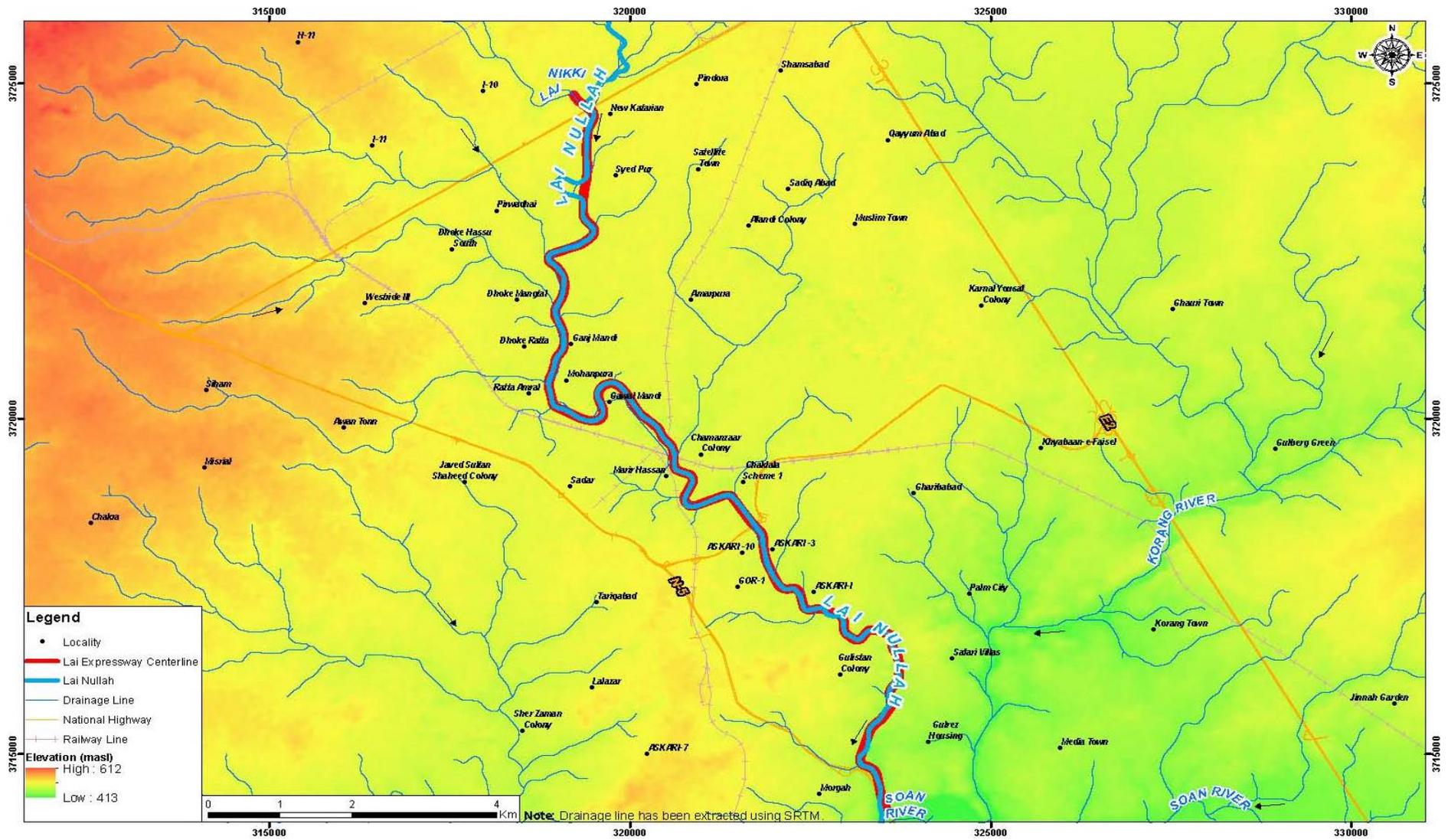


Figure 4.1: Topography of the Study Area (Component-I)

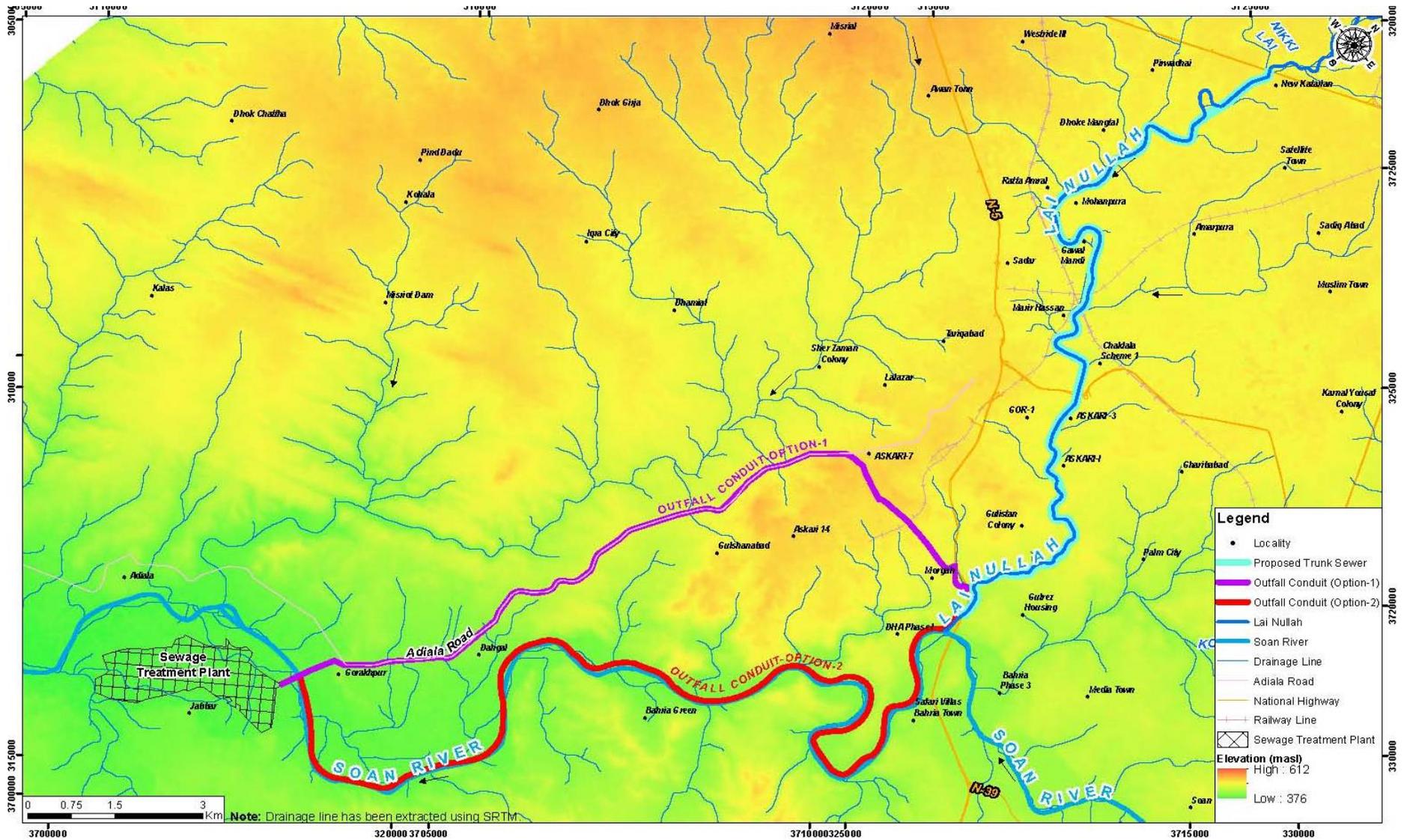


Figure 4.2: Topography of the Study Area (Component-II)

4.2.2 Geology

The geological structure and stratigraphy of the Islamabad-Rawalpindi area is very complex due to the convergence of the Indo-Pak and Eurasian Tectonic Plates and their collision that began about 20 million years ago. The geological history records a long period of gentle geological fluctuations and slow deposition in the study area while the Indo-Pak Plate drifted northward. This period is followed by more vigorous tectonic processes and rapid deposition since the convergence of the Indo-Pak and Eurasian Plates. Therefore, the period from the Middle Jurassic to the Lower Miocene (150 million years) is represented by only 675 m of primarily marine sedimentary rocks, whereas the last 20 million years are represented by more than 7,570 m of continental sedimentary rock¹³.

The sedimentary rocks exposed in the Islamabad area date from the Middle Jurassic to the Quaternary. Three structural zones can be pointed out in the study area:

- **Mountainous Margalla Hills in the North:** Jurassic through Eocene limestone and shale complexly folded and thrust along the Hazara Fault Zone;
- **South of the Margalla Hills:** The southward-sloping piedmont bench (piedmont fold belt) is underlain mainly by truncated folds in the sandstone and shale of the Rawalpindi Group; and
- **Southernmost Area:** Fluvial sandstone, clay stone and conglomerate deposits along the axis of the Soan syncline west-southwestward.

The **Hazara Fault Zone** is located in the north of the Islamabad-Rawalpindi area and affects a scope of about 25 km of width and 150 km of length. The area is convex to the south and extends west-southwestward away from the Himalayan Syntaxis. Hence, the thrust and fold structure of the Margalla Hills immediately north of Islamabad is complex: there are at least five principal thrust sheets repeating the pre-Miocene marine section.

In the **Piedmont Fold Belt Area**, Pleistocene conglomerate, overlying sandstone of the lower Miocene, is folded in the broad anticline at Shakar Parian Park in Islamabad.

The **Soan Syncline** is an asymmetric, faulted fold of regional extent, plunging west-southwestward where fluvial sandstone, clay stone and conglomerate were deposited. The maximum width of the synclinal in the study area is about 11 km, but the fold extends 100 km to the southwest.

The **Quaternary Deposits** are generally heterogeneous. The subsurface mainly presents silt and clay deposits. The gravel beds are present in discontinuous layers with silty clay. Their thickness decreases in the south and west. The average thickness of the alluvium is more than 200 m, and can even be 300 m in some areas.

¹³ Iqbal M. Sheikh, Mustafa K. Pasha, Van S. Williams, S. Qamer Raza, and Kanwar S.A. Khan (2007), Environmental Geology of the Islamabad-Rawalpindi Area, Northern Pakistan, Study by Geological Survey of Pakistan, under the auspices of the U.S. Agency for International Development, U.S. Department of State, and the Government of Pakistan

Four different main lithological units are present in the Islamabad-Rawalpindi area: (i) Sandstone and limestone of Cretaceous age, (ii) Margalla Hill limestone of Eocene age, (iii) Nimadrics of Miocene to Lower Pleistocene, and (iv) Deposits of Pleistocene and Quaternary age. The stratigraphic section of consolidated rocks in the Islamabad-Rawalpindi area is shown in **Figure 4.3**. **Figures 4.4 & 4.5** show the geology of the study area Component-I & II respectively. **Table 4.1** showing the different formations of the Pleistocene and Holocene in the study area and their main lithology characteristics.

Table 4.1: Lithology Characteristics of Geological Units

Sr. No.	Unit Name	Lithology	Thickness (m)
1.	Stream-Channel Alluvium	Unconsolidated, channel-cross bedded, moderately sorted channel and bar deposits of sand and gravel	3
2.	Flood Plain and Fan Alluvium	Flood plain: Unconsolidated, channel cross bedded, moderately sorted channel and bar deposits of sand and gravel, overlain by relatively thin veneer of silt, clay and organic material Fan alluvium: Primarily unconsolidated sand and gravel of a mixture of the lithologies found in the tributary watersheds. The surface may be covered with thin soil of silt and clay. Poorly sorted and bedded. Debris-flow deposits are common	Flood-plain alluvium: 6 Fan alluvium: 20
3.	Alluvium and Windblown Silt	Eolian silt and stream-channel, flood plain, terrace and slope-wash alluvium	10
4.	Terrace Alluvium	Unconsolidated, channel-cross bedded, moderately sorted channel and bar deposits of sand and gravel, overlain by relatively thin veneer of silt, clay and organic material	6
5.	Potwar Clay	Windblown clay and silt and subordinate amounts of alluvial gravel. Fine grained, hard, compact and calcareous	1-35
6.	Lei Conglomerate	Subangular cobbles of Eocene limestone as large as 30 cm. Matrix of reworked eolian silt. Conglomerate is thickly interbedded with sandy silt beds and gravel beds.	106

Source: Geological Survey of Pakistan, under the auspices of the U.S. Agency for International Development, U.S. Department of State, and the Government of Pakistan (2007)

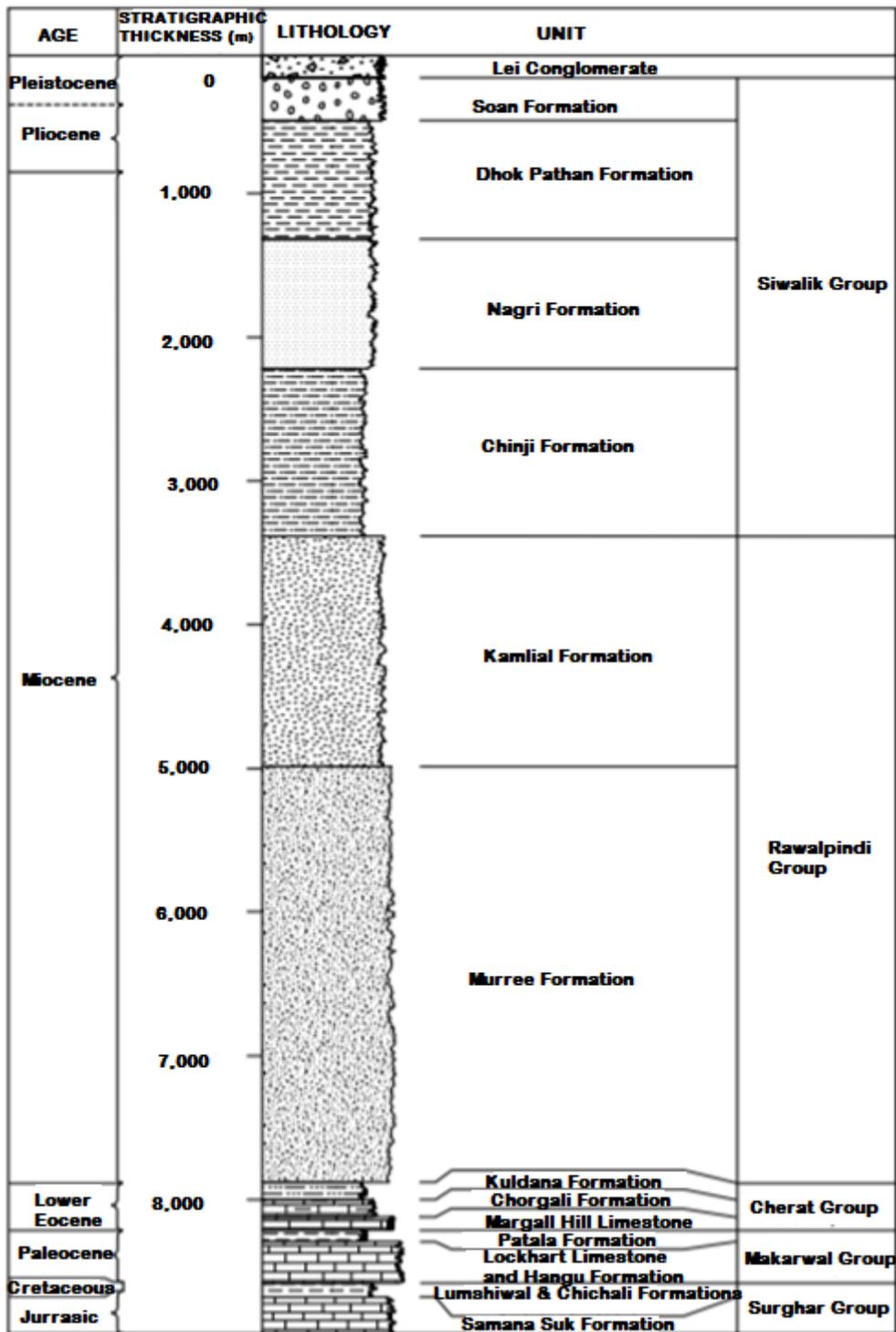


Figure 4.3: Composite Stratigraphic Section of Consolidated Rocks in Study Area

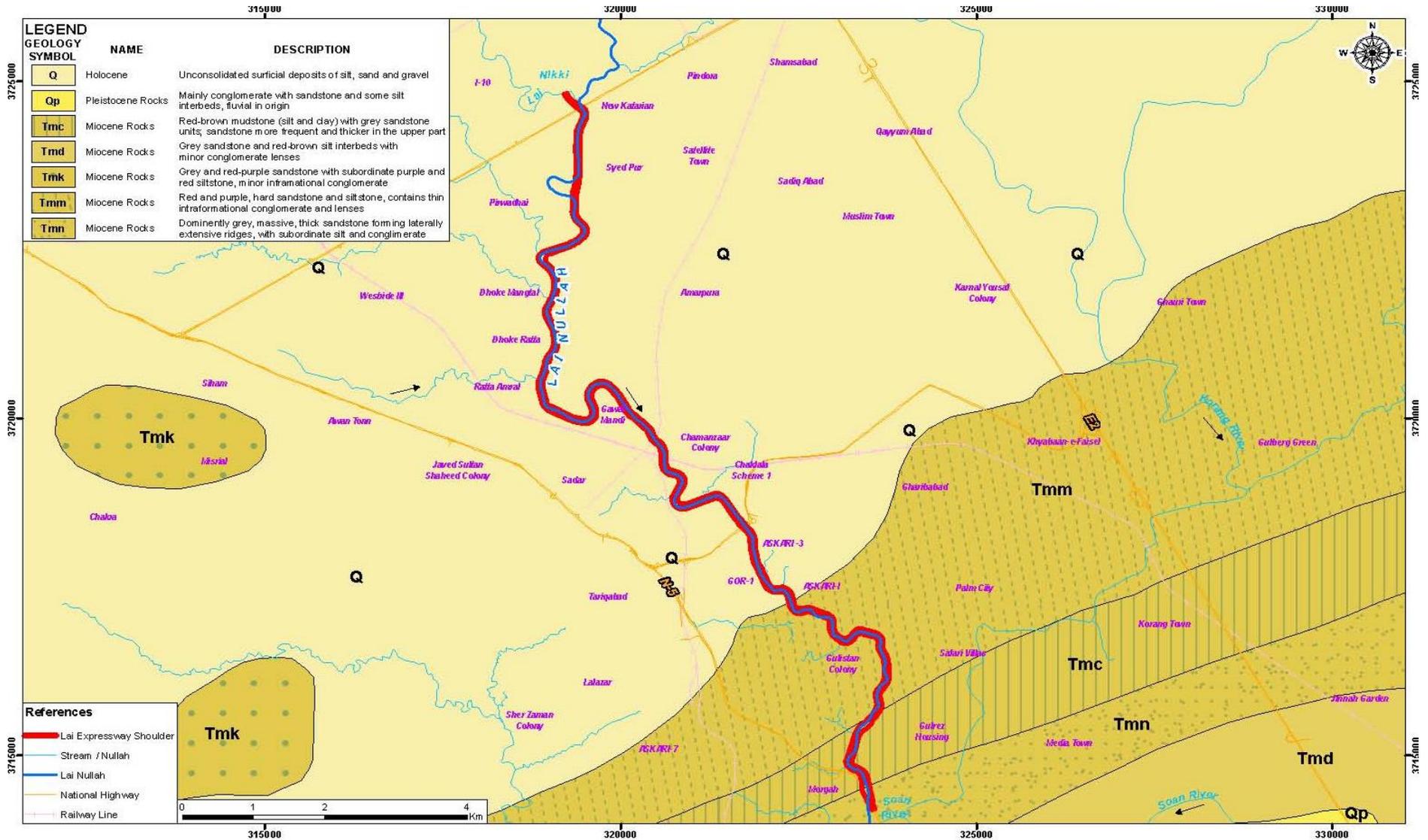


Figure 4.4: Geology of Study Area (Component-I)

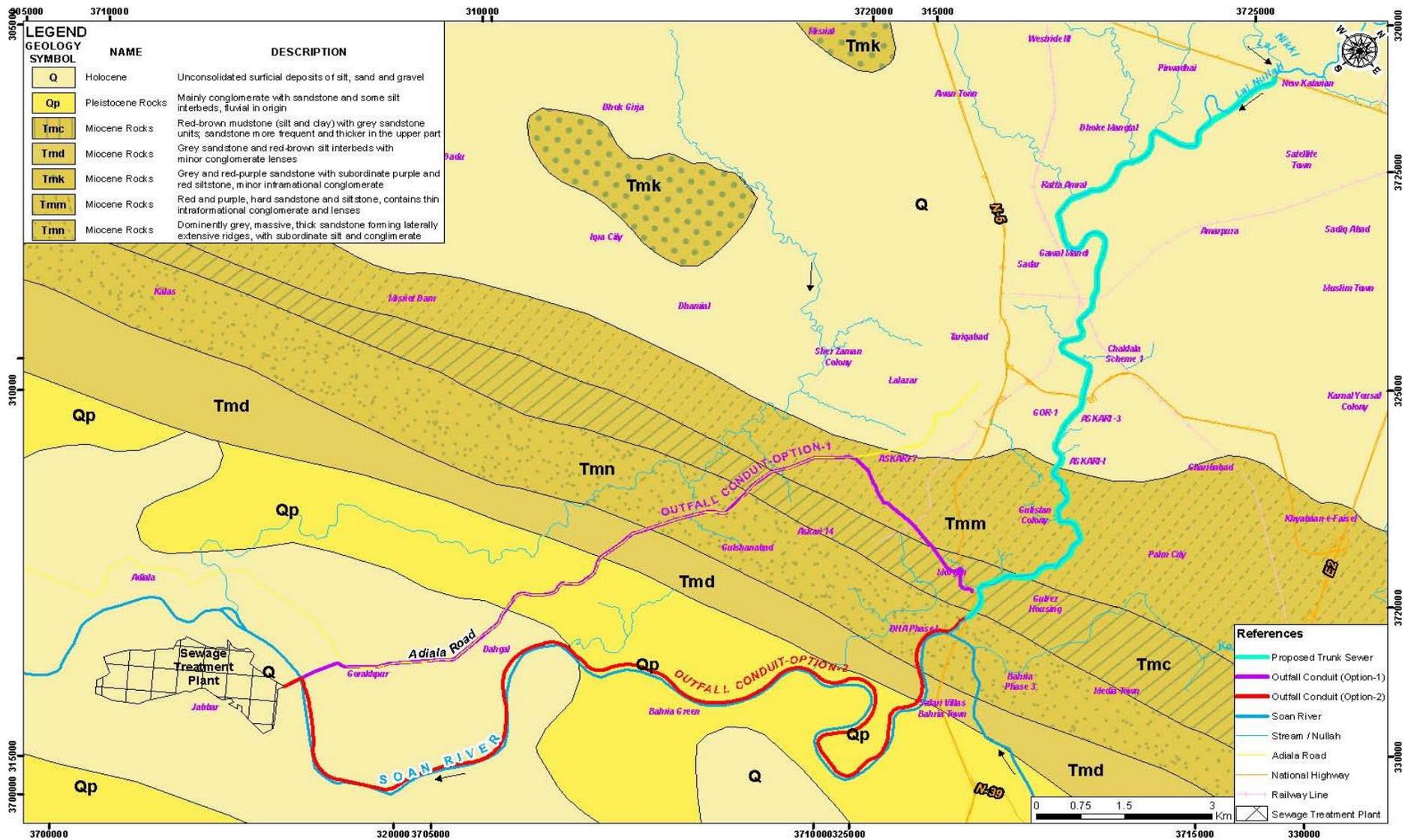


Figure 4.5: Geology of Study Area (Component-II)

4.2.3 Soil

Soil in the area derived from rocks in the province, as well as originates from fluvial deposits. In zones where depositional landforms are present, the surface can be: (i) without any soil development (stream beds, low islands and bars), (ii) covered with fine sand, silt and clay with a relatively high organic content and fertile soil (stream flood plains), (iii) covered with a thin layer of fine-textured soil overlying channel deposits of sand and gravel (stream and fan terraces), and (iv) covered with fertile and easy tilled soil overlying fine silt and clay deposits (loess plains).

In areas where erosional landforms are present, the surface can be covered with thin sandy soil derived from weathering of the underlying rock (conglomerates of the Soan formation or Lei conglomerate, Kamlial formation). The soil in the study area varies from sandy loam to sandy clay loam, silty and loamy.

4.2.4 Seismology

The project site falls in the Punjab Plain, which has low to moderate level of seismicity. The project region has been subjected to severe shaking in the past due to earthquakes in the Himalayas. The known main active fault of the Himalayas is the Main Boundary Thrust (MBT). The epicenters of low to moderate magnitude earthquakes, recorded in the Punjab Plain are associated with the subsurface fractures in the basement rocks, which are concealed by thick alluvial deposits.

According to Building Code of Pakistan, 2007 prepared by NESPAK, the Project Area falls in Seismic Zone 2B of Pakistan (low to moderate damage), and peak ground acceleration (PGA) from 0.16 to 0.24g. The proposed Project Area falling under Seismic Zone-2B. **Figures 4.6 & 4.7** show the seismic zoning map of both components.

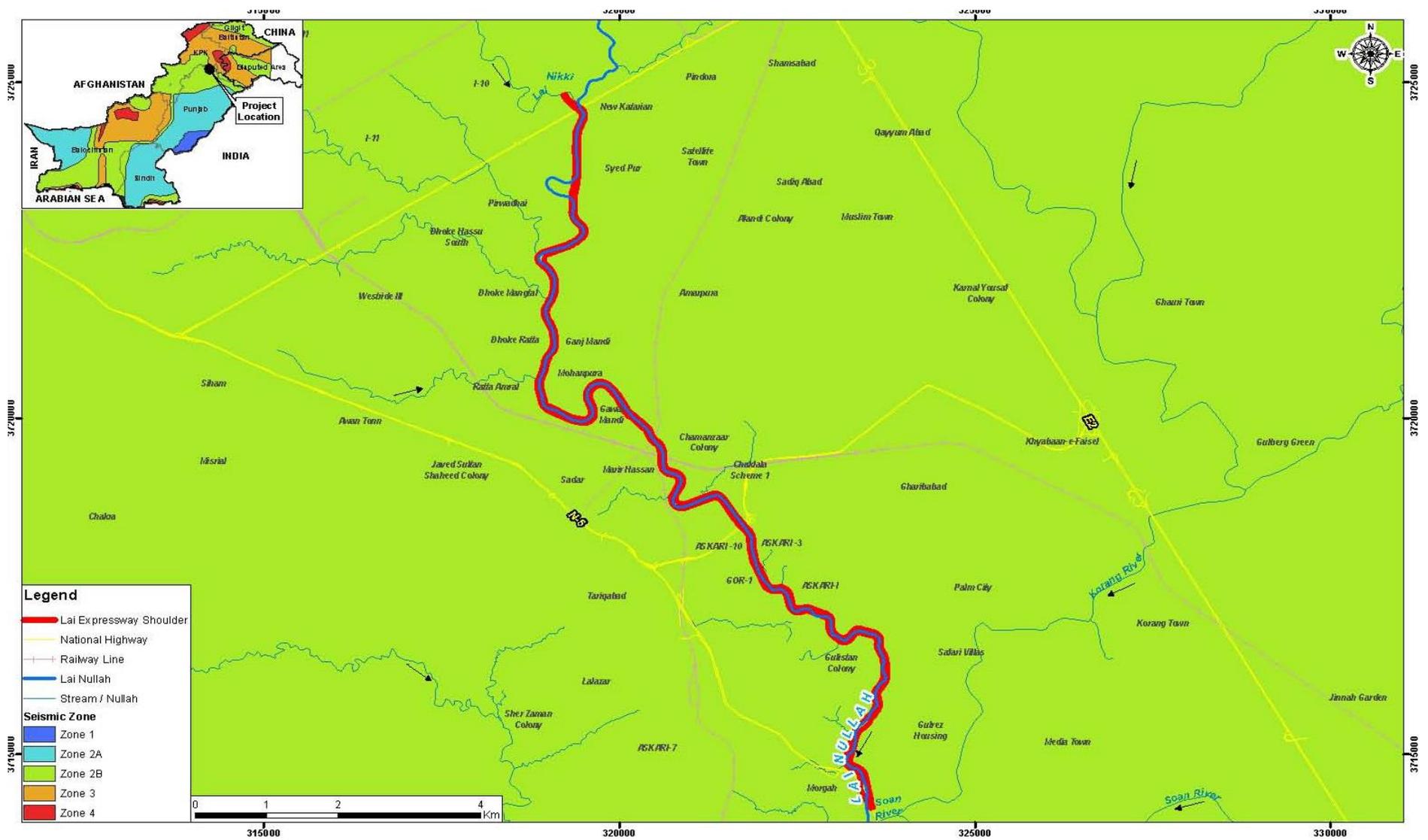


Figure 4.6: Seismic Zone Map of Component-I

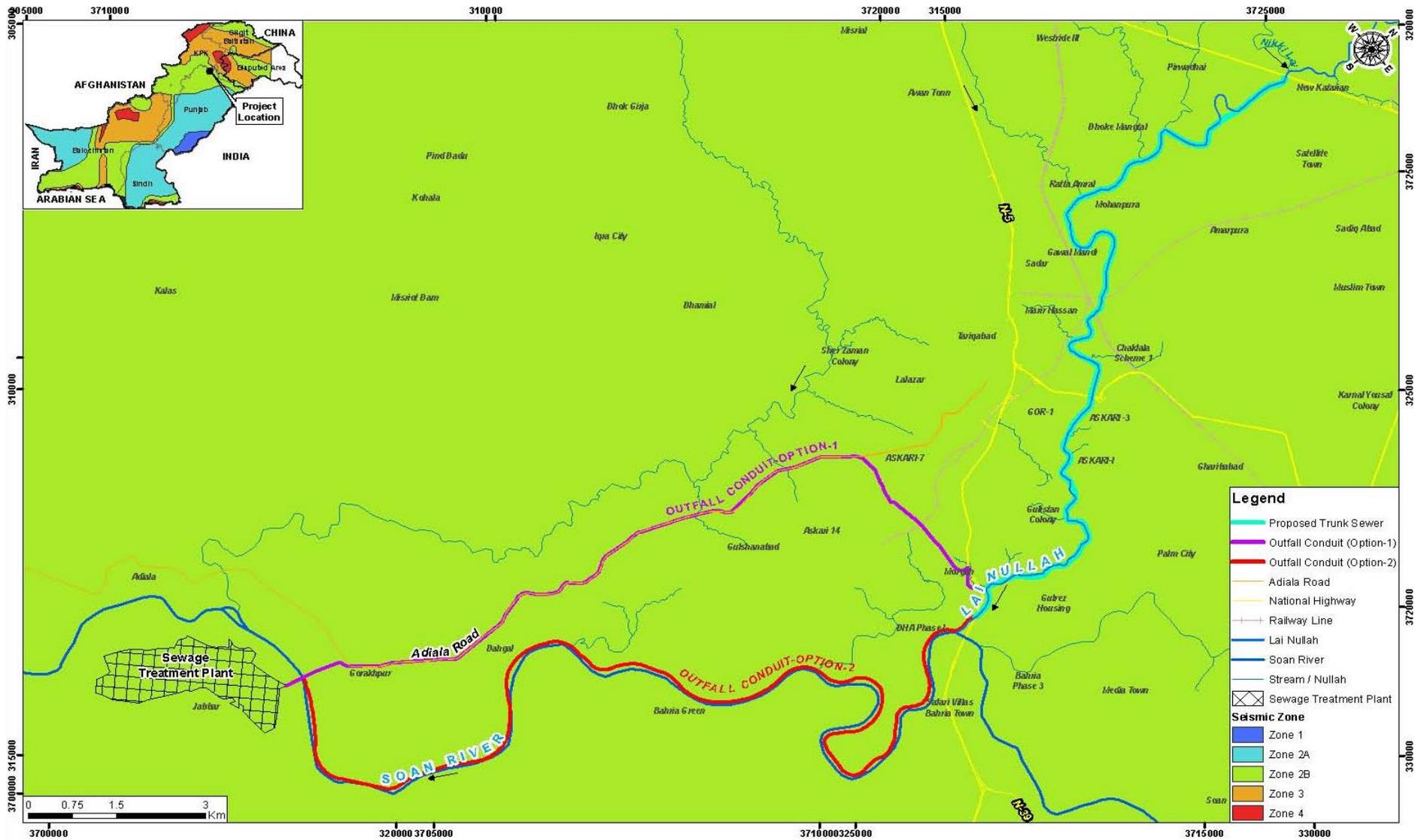


Figure 4.7: Seismic Zone Map of Component-II



4.2.5 Climate and Meteorology

The seasonal climatic conditions must be considered for the design and execution of the developmental projects. The climate including air, temperature, precipitation, humidity and evaporation are an influencing factor, affecting the construction of engineering structures. However, to determine the overall effect of the climatic stresses, daily and seasonal temperature changes, site altitude, direct solar radiation, and precipitation must be considered.

The Project Area has moderate to extreme climate conditions, with hot summers and cold winters. The summer starts from April and lasts till September, with mean minimum and maximum temperature ranges from 28°C to 42°C. The winter seasons lasts from November to March, with mean minimum and mean maximum temperature ranges from 3°C to 18 °C.¹⁴

The Project Area receives rains in all the seasons but monsoon rain is pronounced and constitutes a definite rainy season between the month of July and September. The average rainfall is about 1,172 mm per year.

Based on climatic elements, five seasons are recognized in the Project Area i.e.:

i. Pre-monsoon Season

Pre-monsoon refers to the period from April to June prior to the setting in of the monsoon. This is the hottest and the driest season, with persistent dry and hot winds. Day time temperature rises to 42°C. The flows in the rivers begin to rise simultaneously due to snow-melt water in the high mountains. The water table falls to the maximum depth.

ii. Monsoon Season

Monsoon is the main rainy period, which starts at the beginning of July, reaches its climax in August and gradually, subsides in September. The intense rainfall events cause soil erosion, which is a function of erosivity and erodibility. The cool monsoon winds followed by heavy showers lower the temperature to great extent. The part of rain percolates into the soil and is conserved in the subsoil, and adds to the groundwater. The conserved moisture in the soils is generally sufficient to rejuvenate the vegetation. All plants grow rapidly and mature towards the end of the season. With the start of monsoon season, the rivers flow at their peak level. The groundwater level is improved toward the end of the season in September and October.

iii. Post-Monsoon Season

Post monsoon season refers to autumn (October-November). The temperature starts falling but the extreme aridity prevents plants to flower early and set seed toward mid-seasons. Groundwater level rises as a result of infiltration from rainfall.

¹⁴Meteorological Data for Islamabad (1981-2010)

iv. Winter Season

Winter refers to the period from December to January. The lowest temperature is less than 2°C, and cold winds characterize this season. The plants become dormant and most of them dry out. Most of the trees shed their leaves and few remain green or partly green. Sometimes this season becomes severe due to cold Siberian winds. Groundwater level declines in this season due to low flows in the rivers, and no or little rains which usually fall in light showers causing little soil erosion.

v. Spring Season

Spring refers to the period from February to March. Temperatures become pleasant. The mean maximum temperature is 24.50C with the highest precipitation of 92.4 millimeter. Some light showers of rain may also fall without generating run off. The vegetation sprouts again because of conserved moisture from winter and spring rains (if any), and the water table starts falling.

Temperature, precipitation, relative humidity, evaporation, wind speed and wind direction of the study area (Islamabad and Rawalpindi) is discussed below.

Temperature

Table 4.2 and **4.3** shows mean maximal and minimal temperatures observed for each month between 2006 and 2015 in the study area. The highest temperature measured between 2006 and 2015 is 42°C in May, 2011, and the lowest temperature was measured in December, 2011 i.e. 0.5°C.

Table 4.2: Mean Maximum Temperatures (2006 & 2015)¹⁵

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
2006	18.3	25.0	26.2	32.7	39.1	37.7	34.6	32.9	33.7	31.3	24.1	18.3
2007	19.7	19.3	23.1	33.9	37.3	37.6	35.2	34.2	32.8	31.5	26.1	20.1
2008	15.2	19.3	29.8	29.7	36.9	34.7	35.1	33.3	33.1	31.0	25.2	20.1
2009	18.9	20.4	25.0	29.4	36.6	38.9	38.2	35.0	34.0	32.1	24.3	20.7
2010	20.9	19.5	29.4	34.2	36.8	38.4	36.4	32.5	31.9	30.8	26.2	20.3
2011	16.8	17.9	26.5	29.6	42.0	38.8	34.0	34.0	33.4	30.5	25.3	20.9
2012	17.0	18.0	25.6	29.8	36.3	39.7	38.9	34.5	32.4	30.1	25.1	18.9
2013	17.8	18.8	25.7	30.5	37.4	37.7	35.3	31.4	31.4	30.5	24.1	19.9
2014	19.0	19.3	22.0	29.6	33.5	40.0	36.2	35.9	31.4	29.0	25.0	19.1
2015	18.7	20.9	23.0	29.1	35.6	35.3	34.0	34.2	34.2	29.9	23.0	19.5

¹⁵ Pakistan Meteorological Data for Islamabad (2006-2015)

Table 4.3: Mean Minimal Temperatures (2006 & 2015)¹⁶

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
2006	3.8	9.7	11.4	15.3	23.0	23.0	24.0	23.3	20.5	15.9	9.4	4.1
2007	1.0	6.6	9.0	15.9	19.8	23.0	21.5	21.8	19.5	12.6	8.2	5.1
2008	3.0	4.9	11.5	15.8	20.7	22.2	22.8	23.0	19.7	15.4	8.1	5.5
2009	3.9	6.4	9.9	14.2	18.7	21.6	24.7	28.3	21.1	14.0	7.5	3.8
2010	3.4	7.9	14.3	17.8	22.0	23.6	24.5	27.2	22.3	17.5	9.9	3.3
2011	2.8	6.8	11.9	15.5	23.0	25.8	24.4	24.3	22.7	16.1	11.2	0.5
2012	2.0	4.5	9.8	16.1	19.6	21.5	26.2	24.0	20.6	15.3	8.4	5.1
2013	2.4	6.9	11.7	16.1	20.8	24.9	24.0	23.2	21.0	17.7	7.1	3.9
2014	2.2	5.5	9.0	14.4	19.2	23.2	23.9	25.1	19.0	15.3	6.5	4.3
2015	4.4	8.4	11.3	17.2	21.1	23.9	24.0	24.6	21.8	12.1	10.3	5.4

Figure 4.8 shows the graphical presentation of mean wise temperature in the study area for the year 2006-2015.

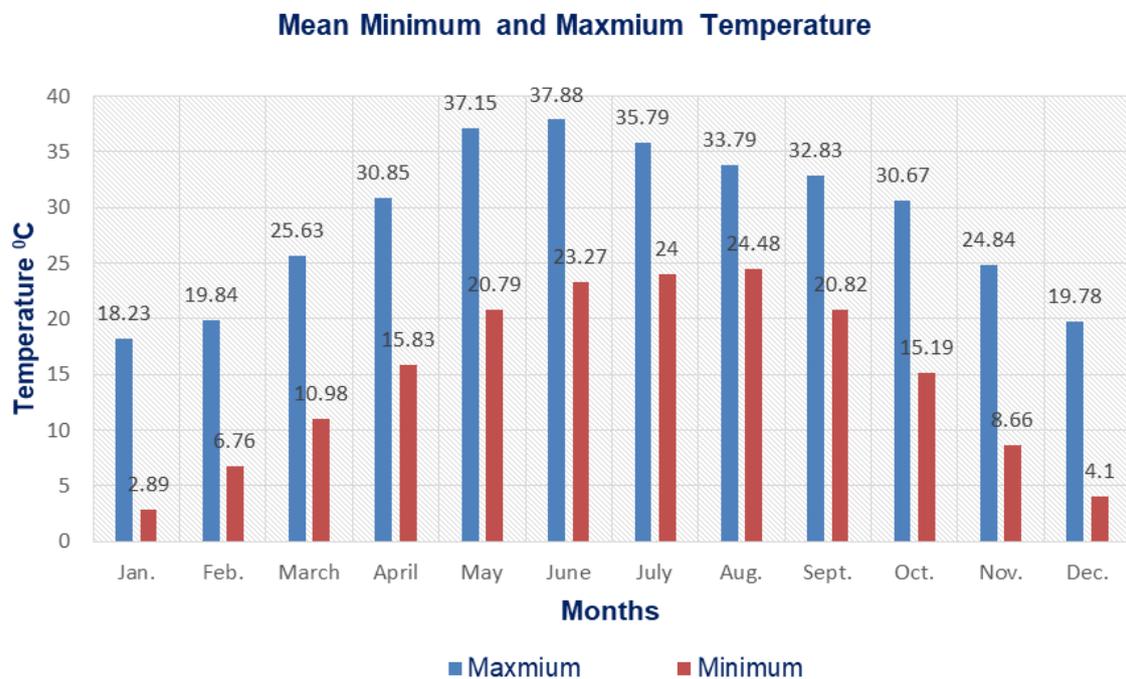


Figure 4.8: Mean Minimum and Maximum Temperature in the Study Area (2006-2015)

¹⁶ Pakistan Meteorological Data for Islamabad (2006-2015)

Precipitation (Rainfall)

Table 4.4 shows mean monthly precipitation observed in the study area from 1981 to 2010 with an annual average rainfall of 1,248.2 mm.

Table 4.4: Mean Monthly Precipitation (1981-2010)¹⁷

Month	Precipitation (millimeters)
January	56.2
February	84.1
March	92.4
April	63.2
May	35.8
June	75.3
July	307.8
August	340.3
September	110.7
October	31.7
November	14.4
December	36.3
Annual	1248.2

Figure 4.9 shows the graphical presentation of mean monthly precipitation in the study area for the year 1981-2010.

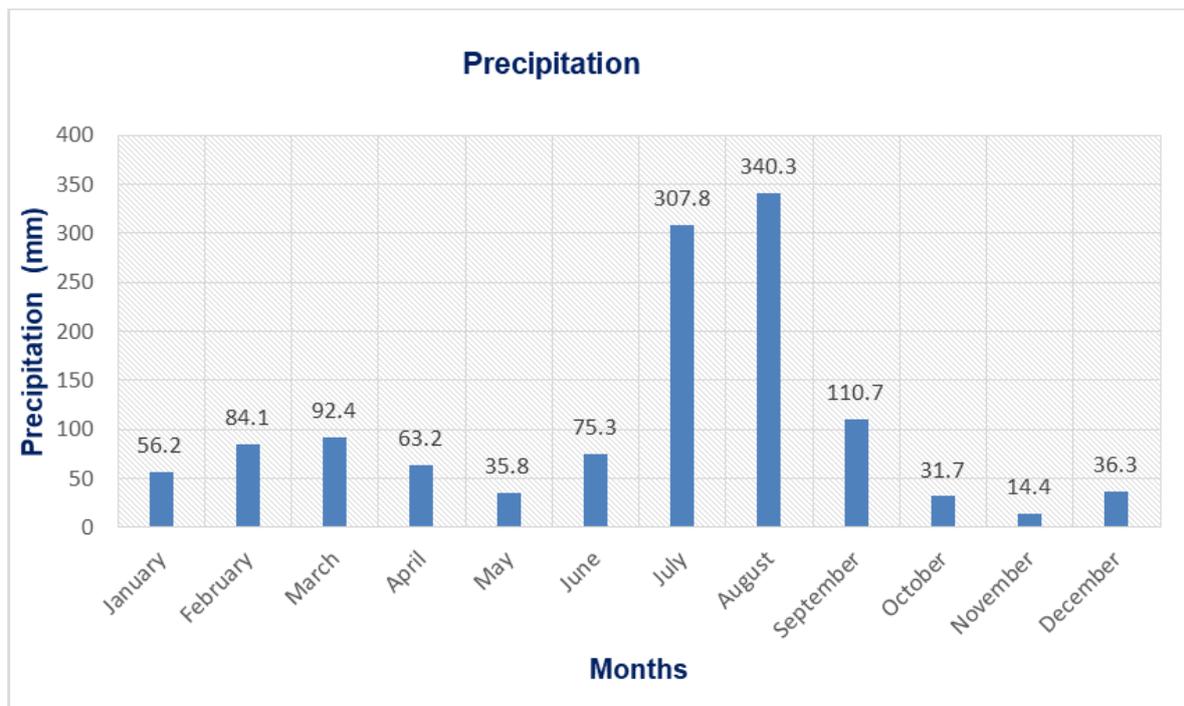


Figure 4.9: Average Precipitation in the Study Area (1981-2010)

¹⁷ Meteorological Data for Islamabad (1981-2010)

Evapotranspiration

A mean daily data of evapotranspiration on a monthly basis from 2006 to 2015 is shown in **Table 4.5**. Daily evapotranspiration varies between 0.9 mm and 6.8 mm corresponding to a mean annual evapotranspiration of 1,283 mm.

Table 4.5: Mean Evapotranspiration (2006 & 2015)¹⁸

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
2006	1.3	2	3.4	5.7	6.6	5.2	2.7	2.6	4.3	4.8	3.4	2.1
2007	2	1.3	2.8	5.5	6.8	5.8	3.5	2.3	3.2	4.6	3.7	2.9
2008	2.2	1.6	2.4	5.1	6.2	5.3	4.1	2.6	3.7	3.9	3.9	3.1
2009	2.7	2.3	0.9	3.3	6	6.4	5.9	3.8	2.5	3.2	3.5	3.1
2010	3.2	2.3	2.4	3.2	6.7	6.1	5.5	3.4	2.3	2	3.4	3.2
2011	2.9	2.3	2.4	1.8	3.9	5.9	4.9	4.1	2.7	1.7	2.2	2.9
2012	2.7	2.7	2.7	1.9	2.7	4.6	5.7	4.7	3.2	1.6	1.7	2.3
2013	2.8	2.7	3.5	3.1	2.2	3.9	4.6	4	3.9	2.6	1.4	2.3
2014	2.4	3	3.3	3.2	2.5	2.1	4	5.4	4.2	2.9	1.2	1.3
2015	1.9	3.2	3.7	4.6	4.1	3.4	3.1	4.8	5.4	4	1.8	1.1

Figure 4.10 shows the graphical presentation of mean monthly evapotranspiration in the study area for the year 2006-2015.

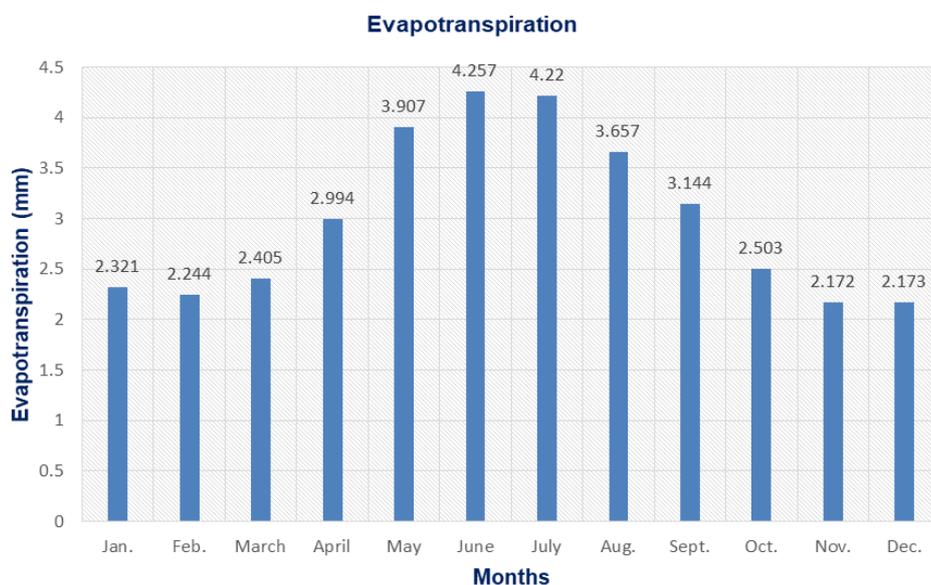


Figure 4.10: Mean Monthly Evapotranspiration in the Study Area (2006-2015)

¹⁸ Pakistan Meteorological Data for Islamabad (2006-2015)

Relative Humidity

A mean daily data of humidity taken at 3 time intervals on a monthly basis from 1981 to 2010 is shown in **Table 4.6** and **Figure 4.11**.

Table 4.6: Mean Relative Humidity (1981-2010)¹⁹

Month	Relative Humidity at 00:00 Hrs. (%)	Relative Humidity at 03:00 Hrs. (%)	Relative Humidity at 12:00 Hrs. (%)
January	87.4	86.8	46.6
February	84.1	82.5	43.4
March	80.2	74.0	39.3
April	72.7	60.1	32.3
May	62.0	47.6	26.5
June	63.5	49.3	30.3
July	81.7	73.5	52.8
August	88.8	81.6	60.9
September	85.3	76.0	50.5
October	83.9	76.1	41.4
November	86.2	82.7	44.0
December	87.6	86.8	48.7
Annual	81.5	74.3	44.0

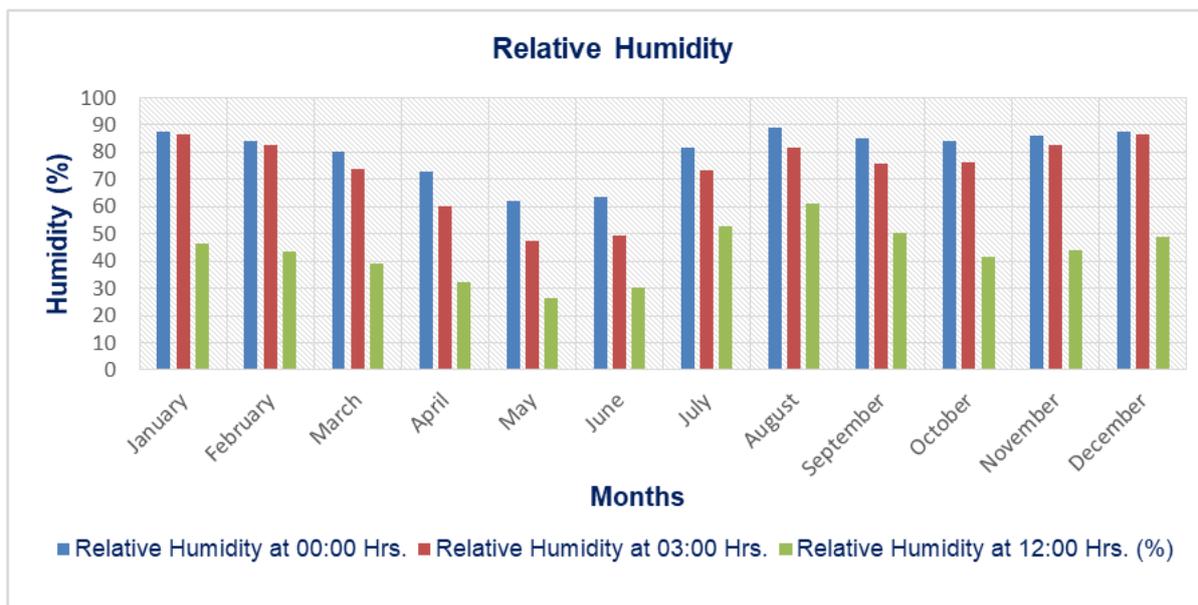


Figure 4.11: Relative Humidity in the Study Area (1981-2010)

Wind Speed and Wind Direction

A mean daily data of wind speed and wind direction taken at 3 time intervals on a monthly basis from 1981 to 2010 is shown in **Table 4.7**.

¹⁹ Meteorological Data for Islamabad (1981-2010)

Table 4.7: Mean Wind Speed and Wind Direction (1981-2010)²⁰

Month	Wind Speed at 00:00 Hrs. (Knots)	Wind Speed at 03:00 Hrs. (Knots)	Wind Speed at 12:00 Hrs. (Knots)	Wind Direction at 00:00 Hrs.	Wind Direction at 03:00 Hrs.	Wind Direction at 12:00 Hrs.
January	0.7	0.6	6.4	N37E	S	W
February	1.2	1.1	8.8	N	N	N82W
March	1.6	1.4	9.5	N20E	N30E	N72W
April	2.4	2.2	10.0	N20E	N13E	N67W
May	2.9	2.6	9.9	N29E	N36E	N72W
June	2.8	3.5	9.4	N63E	N85E	S48W
July	3.6	3.5	8.3	N85E	S84E	S16E
August	3.1	2.4	6.7	N77E	N79E	S5E
September	1.5	1.5	5.9	N63E	N66E	S51W
October	0.8	0.7	4.9	N32E	N40E	N85W
November	0.6	0.4	4.5	N	N	N86W
December	0.4	0.4	5.0	E	E	W
Annual	1.3	1.2	5.1	N53E	N67E	S83W

4.2.6 Ground Water

The municipal water supply is the main source of water supply in the study area. Depth of groundwater table ranges from 15 to 20 meters.

Groundwater resources in the Islamabad-Rawalpindi area are mainly contained in and discharged from the recent Quaternary alluvium deposits. Several aquifers, lying upon another, are located in the sector: a superficial aquifer and a deeper aquifer. The presence of these aquifers is conducted by the intercalation of large clayey lenses causing dissection and therefore an insignificant connectivity in some sectors. Recharge is principally due to precipitation and supplied by nearby streams.

The amount of the available groundwater isn't exactly known. Former reports supposed an availability of 86 MGD (HESC, 2014). Capital Development Authority (CDA) is supplying the ground water of 180 tube wells to Islamabad while Rawalpindi Development Authority (RDA) is supplying by 260 tube wells to Rawalpindi²¹. Private and municipal wells are also used to fulfill the water requirements. However, the number of private wells is difficult to estimate, but NESPAK study (2007) identified 129 tube wells in Islamabad and their total daily discharge of about 63 MGD. The extraction of groundwater is also comprehended by a public bore well network which consists of about 200 bore wells.

Groundwater in Islamabad and Rawalpindi is being depleted on a gradual pace due to the unsustainable use of water, increased ground water extraction and reduced water percolation in soil due to urban expansion and increasing population. On average,

²⁰ Meteorological Data for Islamabad (1981-2010)

²¹ Water resource vulnerability assessment in Rawalpindi and Islamabad, Pakistan using Analytic Hierarchy Process (AHP), October 2016. Journal of King Saud University – Science, Volume 28, Issue 4, , Pages 293-299

groundwater is depleting at the rate of 1.7 meters per year. A maximum 20 meters drop in groundwater level was noticed in Gulshanabad Mohallah²². **Figure 4.12** shows decline of groundwater levels in Islamabad from 1986 to 2015.

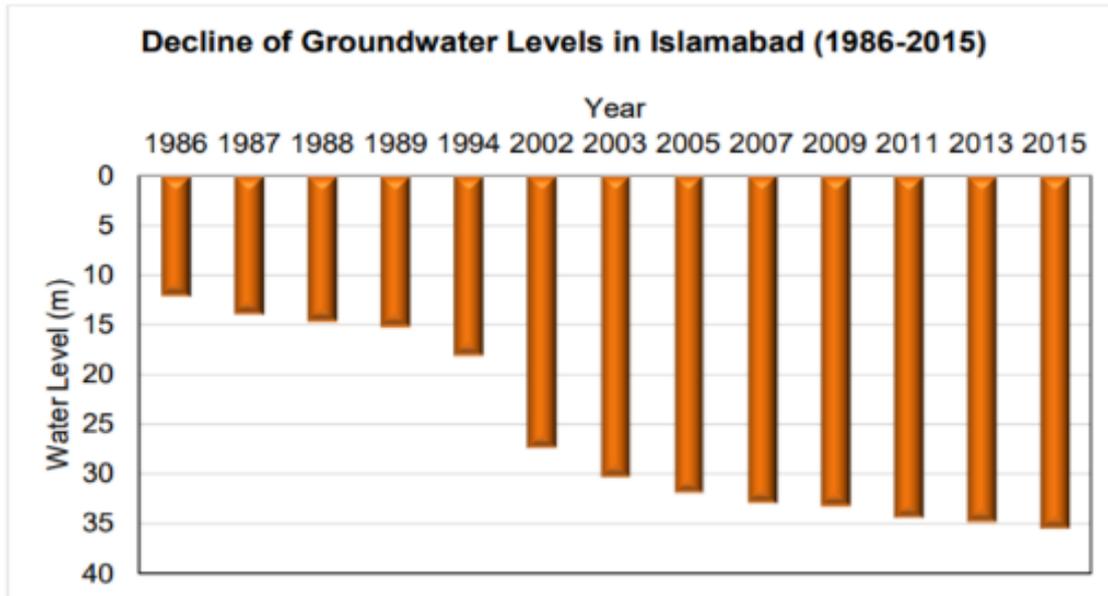


Figure 4.12: Decline of Groundwater Levels in Islamabad from 1986 to 2015

4.2.7 Surface Water Hydrology and Drainage

Due to the location of Islamabad at the foot of the Margalla Hills on the north and the Murree and Kotli Sattian Hills on the east, the area benefits from the natural slope in terms of surface water resources. The various streams flow in and around the city of Islamabad as shown in **Figure 4.13**.

²² Nestle Water Factory Islamabad Study (2016), Constructive Critical Review of Hydrogeological Reports.

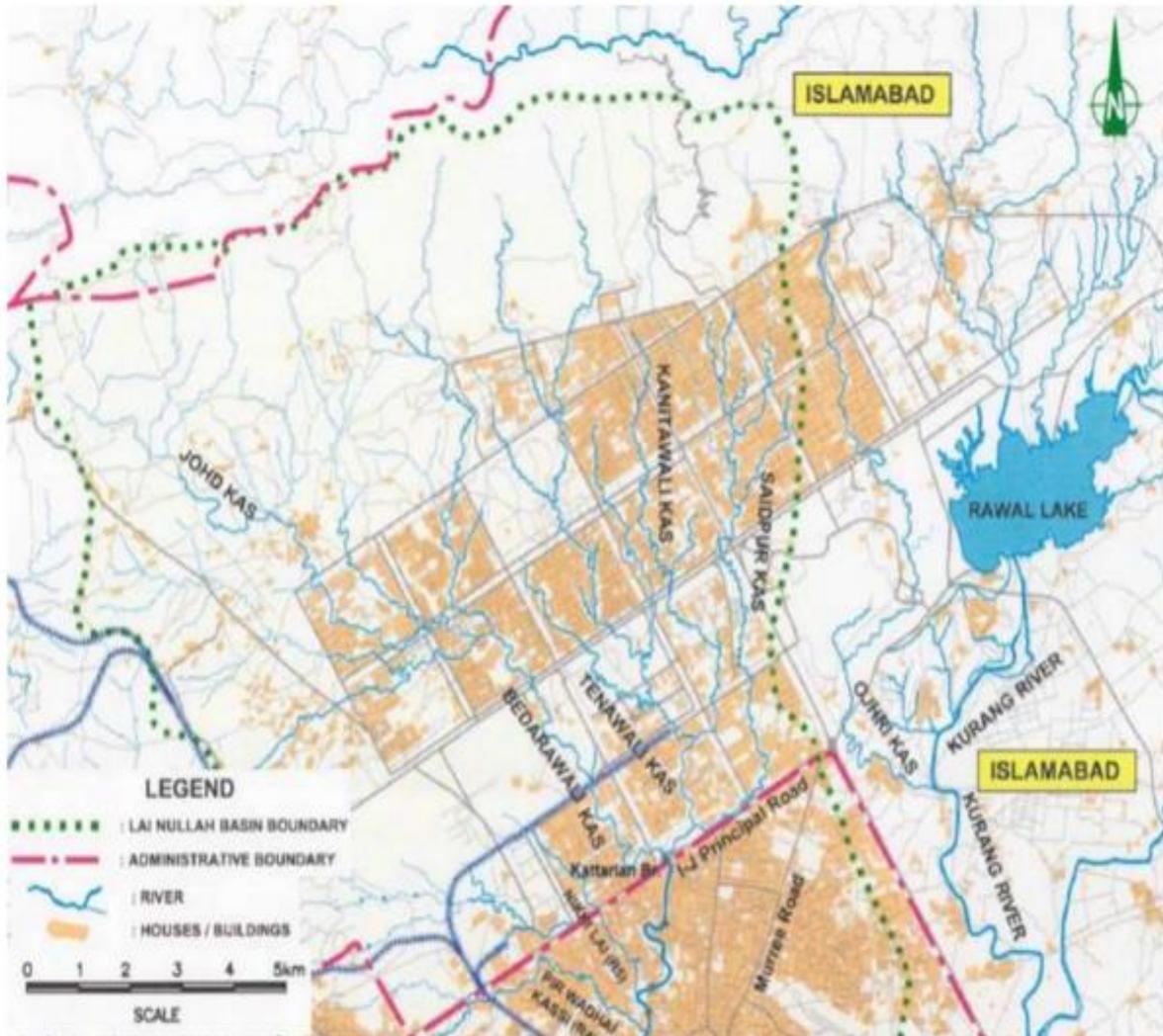


Figure 4.13: Streams Network in and around the City of Islamabad (Source JICA, 2003)

In the jurisdiction of Islamabad the river system is composed of three major tributaries, namely (i) Saidpur Kas, (ii) Tenawali Kas, and (iii) Bedarawali Kas. They originate from the Margalla Hills and flows into the mainstream of Nullah Lai just upstream from Kattarian Bridge, at I.J. Principal Road forming the administrative boundary between Islamabad and Rawalpindi.

Below Kattarian Bridge, in the jurisdiction of Rawalpindi, the mainstream meets other major tributaries; namely (i) Nikki Lai, (ii) Pir Wadhai Kas, and (iii) Dhok Ratta Nullah one after another, then flows down through the center of Rawalpindi City and finally pours into Soan River.

In addition to these major tributaries, there are other six (06) tributaries or drainage channels / sewerage channels, which joint the mainstream between the confluences of Dhok Ratta

Nullah and Soan River²³. The name and the catchment area of the whole tributaries is given in **Table 4.8**.

Table 4.8: Name and the Catchment Area of the Whole Tributaries

Location of Confluence with Main Stream	No. and Name of Tributary		
	No.	Name	Catchment Area (km ²)
Islamabad	-	Saidpur Kas	24.7
	-	Tenawali Kas (Including Kanitawali Kas as the secondary tributary)	39.7
	-	Bedarawali Kas (Including Johd Kas as the secondary tributary)	79.9
	Sub-total =		144.3
Rawalpindi	R5	Nikki Lai Kas	20.9
	R4	Pir Wadhai Kassi	11.2
	R3	Dhok Ratta Nullah	10.8
	R2	Unknown	22.8
	R1	Saddar Tributary	
	L2	Arya Nullah	
	L1	Dhok Chiraghdin Tributary	
	L4	Workshop Tributary	6.8
	L3	Unknown	
	-	Residual Area	18.0
	Sub-total =		90.5
Grand Total =		234.8	

The different surface water resources²⁴ present in and around the Islamabad and Rawalpindi jurisdictions are discussed below and shown in **Figure 4.14**.

A) Soan River

Soan River rises near the small village Bun in the foothills of Patriata and Murree and drains much of the water of the Potohar region. Its water is stored in the Simly Dam. After treading a long path of 250 km, this relatively small stream falls into the Indus River near by the Kalabagh Dam close to Pirpiyahi.

B) Kurang River

Kurang River is the main stream draining the area of Islamabad. It's mainly tributary is Gumrah Kas which drains westward into the Kurang River from the area between Kurang and Soan River.

²³ Terms of Reference of Lai Expressway Project.

²⁴ Nestle Water Factory Islamabad Study (2016), Constructive Critical Review of Hydrogeological Reports.

C) Rawal Lake or Rawal Dam

Rawal Lake is an artificial reservoir located in an isolated section of the Margalla Hills National Park. It's fed by water from Kurang River and other small streams coming from the Margalla Hills like the Jinnah Stream. Its storage capacity is about 58,600,000 m³, the discharge capacity of its spillway is about 2,300 m³/s. It provides drinking water for the population of Islamabad and Rawalpindi. Mean annual water available is 72 MGD (million gallons per day).

D) Simly Dam

Simly dam is located on the Soan River at some 30 km east of Islamabad and fed by melting snow and natural springs of Murree Hills. It's the largest reservoir of drinking water for the population of Islamabad. The storage capacity of the dam is about 35,463,000 m³ with a spillway of discharge capacity of 1,275 m³ /s. Mean annual water available is 68 MGD.

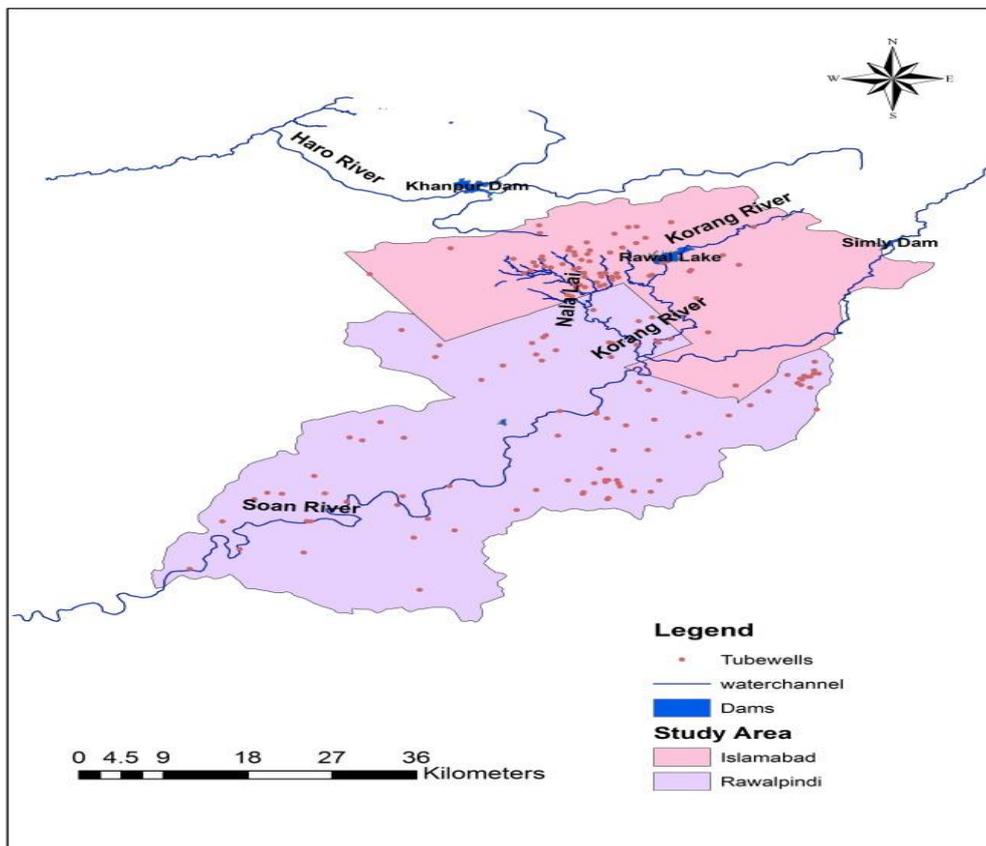


Figure 4.14: Map of the Study Area with Water Resources

E) Khanpur Dam

Khanpur Dam is located on the Haro River in the north of the Margalla Hills at about 40 km of Islamabad. Its stored water provides domestic water to Rawalpindi and Islamabad as well as irrigation water for agriculture and industries in the surroundings of these cities. The storage capacity of the dam is about 140,000,000 m³. Mean annual water available is 198 MGD.



F) Headworks

Headwork water is diverted from springs located at Saidpur, Nurpur and Shahdara. The capacity of the four headwork's sources is as follows: (i) Kurang River: 4 MGD, (ii) Saidpur: 0.8 MGD, (iii) Nurpur: 0.7 MGD, and (iv) Shahdara: 1.6 MGD.

G) Nullah Lai

Lai Nullah, commonly called Nullah Lai, is rain water fed natural stream flowing through the city of Rawalpindi. Lai Nullah stream flows from the Margalla Hills down through the city of Rawalpindi discharging into Soan River. The stream carries most of the liquid waste from Rawalpindi and contributes greatly to the pollution of the Soan River below their confluence. In the upper reaches, Nullah Lai cuts through the surficial deposits, generally consists of Potwar loessic silt. In deposits, forming a thick mantle over. In lower reaches of Nullah Lai, the surficial deposits are found to be present directly over loder formation, where the Lai Conglomerate has been removed by degradation.

The Lai Nullah Basin is located between 33° 33' and 33° 46' North and 72° 55' and 73° 07' East. It has a catchment area of 239.8 Km² (161.2 Km² in Islamabad and 73.6 Km² in Rawalpindi) and a length of about 30 Km, stretching from the Margalla hills in Federal Capital City Islamabad at the Northwestern edge until Soan River at the South-eastern edge in District Rawalpindi of Province of the Punjab The principal surface water sources in Lai Nullah basin come from Simly Dam on Soan River, Khanpur Dam on Haro River and Rawal Dam on Kurang River and the current land use in the Lai Nullah basin is 38.6 % of residential and 14.2 % of agricultural areas, 14.8 % of forest and the rest are grass and bare land surfaces. The Catchment Area of Nullah Lai is shown as **Figure 4.15**.

The present water supply capacity in the Lai Nullah Basin area is about 785 million liters per day in total. Out of the total water supply, the service area of Capital Development Authority in federal Capital, Islamabad shares 507.33 million liters per day, while the service area of Water & Sanitation Agency (WASA) of Rawalpindi city and its Cantonment share 122.74²⁵ Million.

Floods in Nullah Lai

Floods in the Lai Nullah Basin occur during the monsoon season (July to September) when Pakistan receives rainfall from three types of weather systems, namely: (i) monsoon depressions from the Bay of Bengal, India (the most important system); (ii) westerly waves from the Mediterranean Sea; and (iii) seasonal lows from the Arabian Sea. This is superimposed by snowmelt for the Indus River.

In Rawalpindi City, being on the lower elevation, low-lying areas along Lai Nullah and tributaries suffer from even small floods. Serious flood events to occur along in particular: the

²⁵ Pakistan: Lai Nullah Basin Flood Problem Islamabad – Rawalpindi Cities, The Associated Programme On Flood Management by World Meteorological Organization (2004)

main stream between Gunj Mandi Bridge and Railway Bridge, and the tributaries of Arya Nullha, Dhok Rata and Nullah Dhok Charaghdin. Flood inundation starts in these areas once the water level of Lai Nullah reaches 18 feet (491.5 m) at Gawal Mandi Bridge.

In the Lai Nullah area a total of 19 floods occurred during the 59-year period from 1944 to 2002; thus, on average there were flood damages almost once every three years in the twin cities of Islamabad and Rawalpindi.

Extreme flood years were 1981, 1988, 1997 and 2001, the latter having been the largest among the recorded events. On July 23, 2001, an unprecedented rainfall occurred over

Islamabad-Rawalpindi resulting in 620 mm of rain in a span of about 10 hours²⁶. The intensity and amount of rainfall caused the water level of Nullah Lai and its tributaries to rise. The flood had caused the worst damage in Rawalpindi. A total of 74 human lives were lost, about 400,000 people were affected, 742 cattle head perished, 1,087 houses were completely and 2,448 partially damaged.

The following measures were suggested to manage flood in the aftermath of the above incident in studies conducted by Mott Macdonald Pakistan (MMP)-2001, Japan International Corporation Agency (JICA)-2003 and NESPAK, 2007.

- Straightening and widening of the Nullah Lai cross-section to accommodate the peak flood discharges;
- Removal of garbage disposal;
- Raising the height of some of the existing bridges and construction of three new bridges at Dhoke Chiragh Din, Gowalmandi and Pir Wadhaj; and
- Stone pitching of some of the existing Nullah Lai portion to prevent erosion and danger of collapse of building standing close to the Nullah catchment.

Table 4.9 shows flood discharges at various locations along the Nullah Lai estimated by NESPAK in the present study to handle the 100 Years derived flood discharge with concrete lining in Nullah bed.

²⁶ Strengthening of Flood Risk Management in Lai Nullah Basin, <http://www.jica.go.jp/project/english/pakistan/0700597/01/01.html>

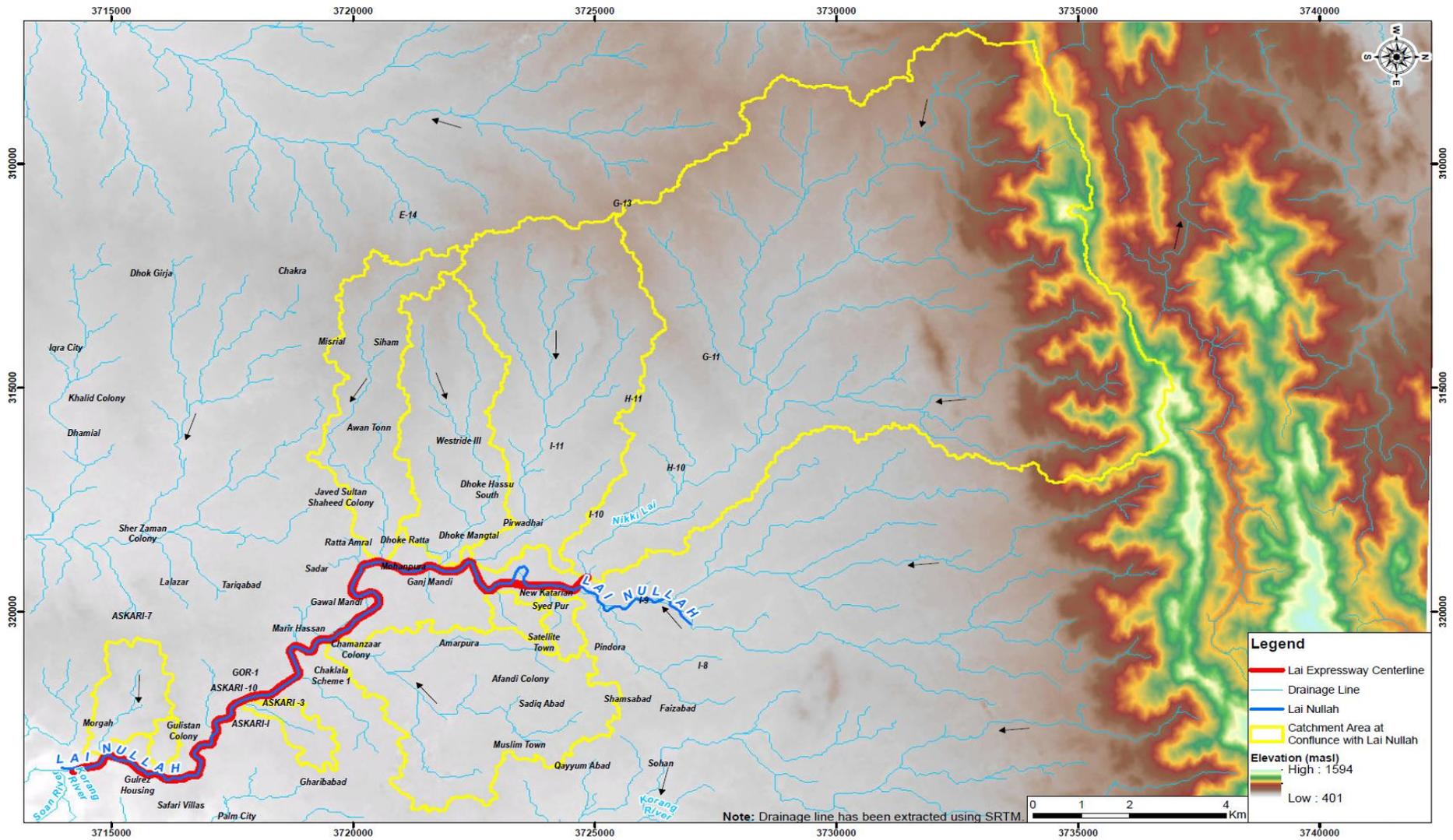


Figure 4.15: Catchment Area of Nullah Lai

Table 4.9: Peak Flood Discharges at Various Locations (NESPAK 2020)

Sr. No.	Location	Chainage	Reach	Peak Flood Discharge (cfs)
				100-Yr
1.	Katarian Bridge	9+900		47,339
2.	Katarian Bridge To 8+500	9+900 to 8+500	1400	48,511
3.	8+500 To Dhok Dalal Bridge	8+500 to 7+600	900	49,265
4.	Dhok Dalal Bridge to Pir Wada Bridge	7+600 to 6+900	700	58,253
5.	Pir Wadai To Gunj mandi Bridge	6+900 to 6+100	800	61,000
6.	Gunj mandi bridge To Ratta Amral	6+100 to 5+300	800	65,510
7.	Ratta Amral To City Sadar Road Bridge	5+300 to 4+300	1000	66,491
8.	City Sadar Road Bridge to Gawal Mandi	4+300 to 3+400	900	67,335
9.	Gawal Mandi To Foot bridge	3+400 to 2+800	600	68,516
10.	Foot bridge To Muree road Underpass	2+800 to 2+400	400	69,304
11.	Muree road Underpass to Railway underpass	2+400 to 2+100	300	69,894
12.	Railway underpass To Dhok Charaghdin Bridge	2+100 to 1+800	300	70,485
13.	Dhok Charaghdin Bridge to Chaklala	1+800 to 0+000	1800	73,693
14.	Chaklala To Confluence	0+00 to D/S	0	77,286

4.2.8 Solid Waste

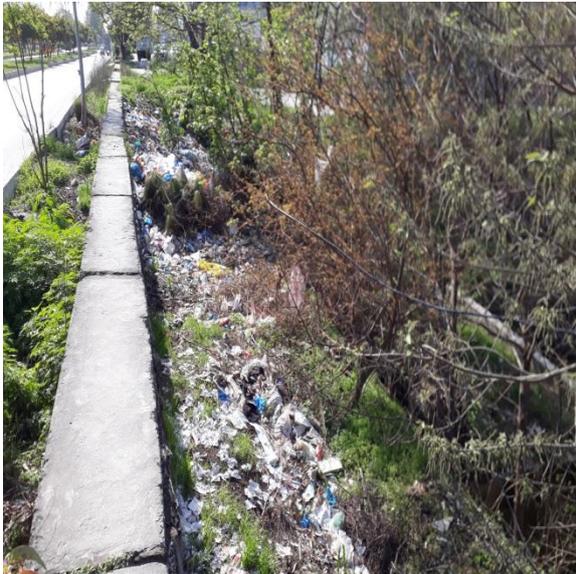
Rawalpindi Waste Management Company (RWMC) and Capital Development Authority (CDA) are responsible authorities to ensure efficient collection, transportation, recovery, treatment and disposal of waste generation in Rawalpindi and Islamabad respectively.

The total waste generation of Islamabad is approximately 500–600 tons²⁷ per day (200,750 tons per year). Sixty percent of the waste is collected by Capital Development Authority (CDA) and the rest is contracted out to private contractors. The waste disposal practice that is being carried out in Islamabad is open dumping without any gas collection or leachate control system to protect surface and ground water resources. The current dumping site, i.e., I-12, is situated in a residential area and is adjacent to a big government hospital, which is not suitability as a waste disposal site due to the presence of sensitive receptors.

²⁷ Ali, S.M.; Pervaiz, A.; Afzal, B.; Hamid, N.; Yasmin, A. Open dumping of municipal solid waste and its hazardous impacts on soil and vegetation diversity at waste dumping sites of Islamabad city. J. King Saud Univ. Sci. **2014**, *26*, 59–65.

The average solid waste generation rate in Rawalpindi is 1.87²⁸ kg/households/day and per capita waste generation rate is 0.32kg daily. The solid waste management department carries only 50 per cent of waste from various parts of the city. However, a major chunk of waste material is thrown by the residents into Nullah Lai and other small channels.

From the field survey, it was observed that the workers of CDA and RWMC collect and transport waste daily from the waste bins present near the proposed route i.e. Agha Shahi (9th Avenue), Sector I-9/1 and I-9/4, Pothwar Road, IJP Road (Katarian Bridge), Murree Road, Askari Road, National Park Road, Ayub Park Road and adjoining localities. However, in Ammar Chowk, Rashid Minhas Road, Dohk Chiragh Din, Gawal Mandi, Gordon College Road, Fawara Chowk, Ratta Amral, Railway Colony, Dhok Ratta, Hamilton Road, Pir Wadhai Road, Syed Khayaban-e-Sir Syed Road, Mohallah Raja Sultan and Khayaban-e-Sir Syed Road, there is no facility of waste management, as waste was seen dumped as open heaps at road sides, and in nearby Nullah Lai by residents as shown in **Plate 4.1**.



A View of Waste Dumping near Road Side



A View of Waste Dumping in Nullah Lai

Plate 4.1: A view of Waste Dumping in the Study Area

4.2.9 Environmental Parameters for Monitoring

The environmental monitoring of parameters like ambient air quality, noise level, surface water, and ground water help us to analyze the prevailing environment conditions in and around the study area, and to protect it from any adverse activities due to the proposed project implementation.

²⁸ Municipal Solid Waste Management-Analysis of Waste Generation: A Case Study of Rawalpindi City, Pakistan, September 2011.



The environmental monitoring has not been carried at this stage. However, it is suggested that environmental monitoring of parameters like ambient air quality, noise level, surface water, and ground water shall be carried out during detailed EIA stage of the proposed project. However, tentative environmental monitoring and sampling locations have been provided in **Figure 4.16**.

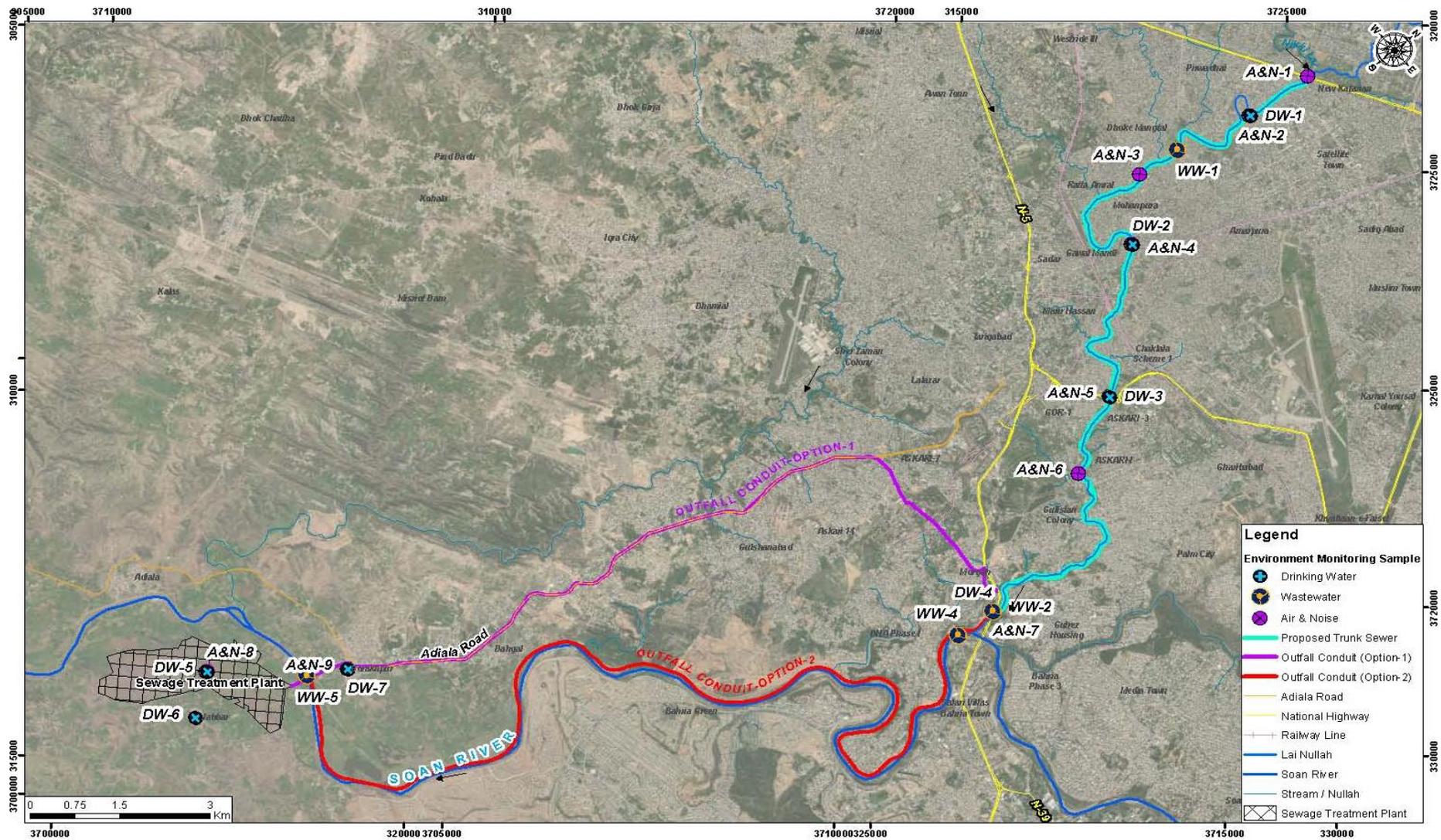


Figure 4.16: Environmental Monitoring and Sampling Points



4.2.10 Land Use Pattern

The land use of the study area is mainly residential and commercial covered by educational institutions, health facilities, religious sites (mosques, graveyards and shrines), recreational amenities, surface water bodies, tubewells, wells, industrial area, and road side green belt. **Figures 4.17 & 4.18** show the index maps of both project components. Detailed land use maps are provided as **Annex V**, whereas **Plate 4.2** shows pictorial view of land use.

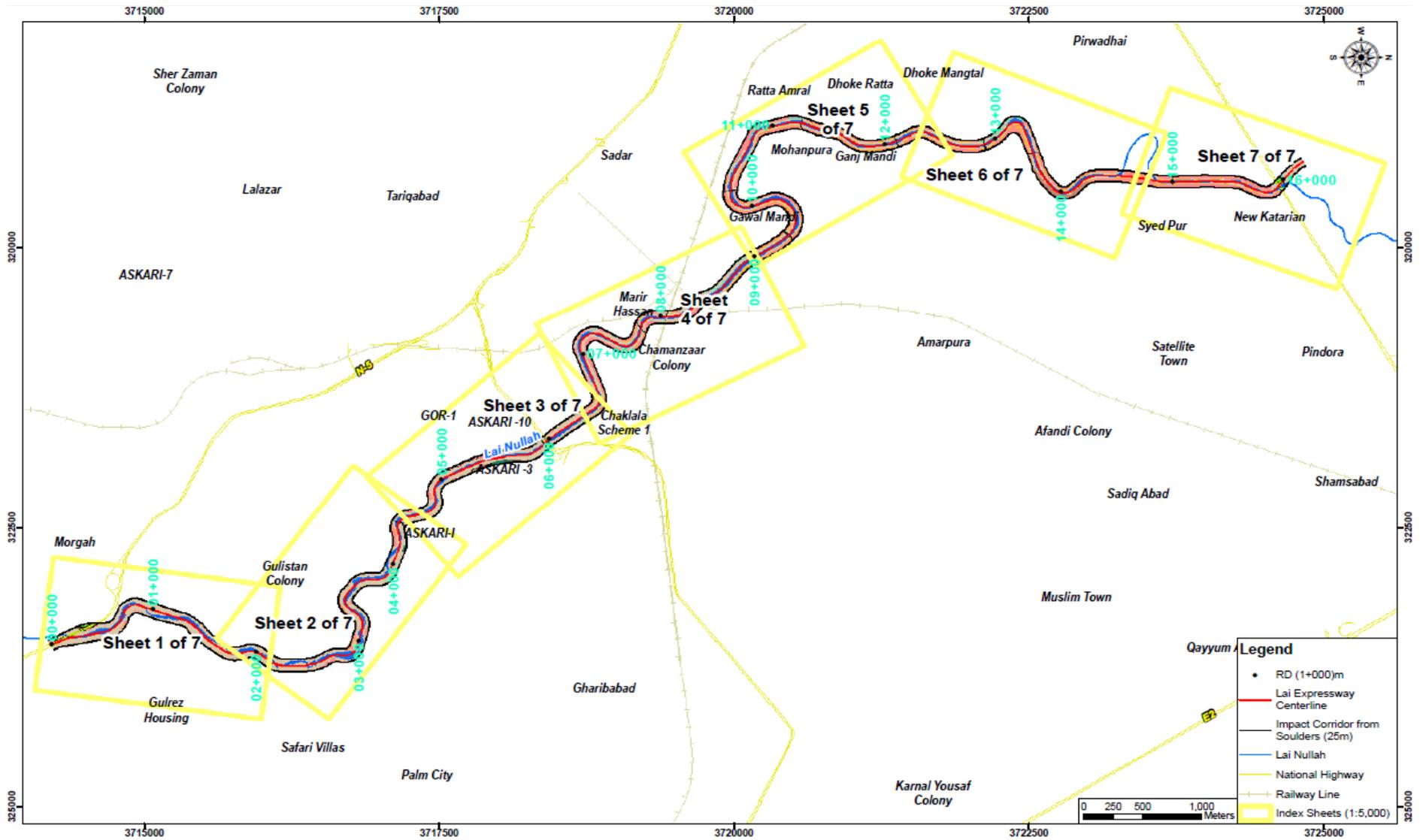


Figure 4.17: Index Land Use Map of Component-I

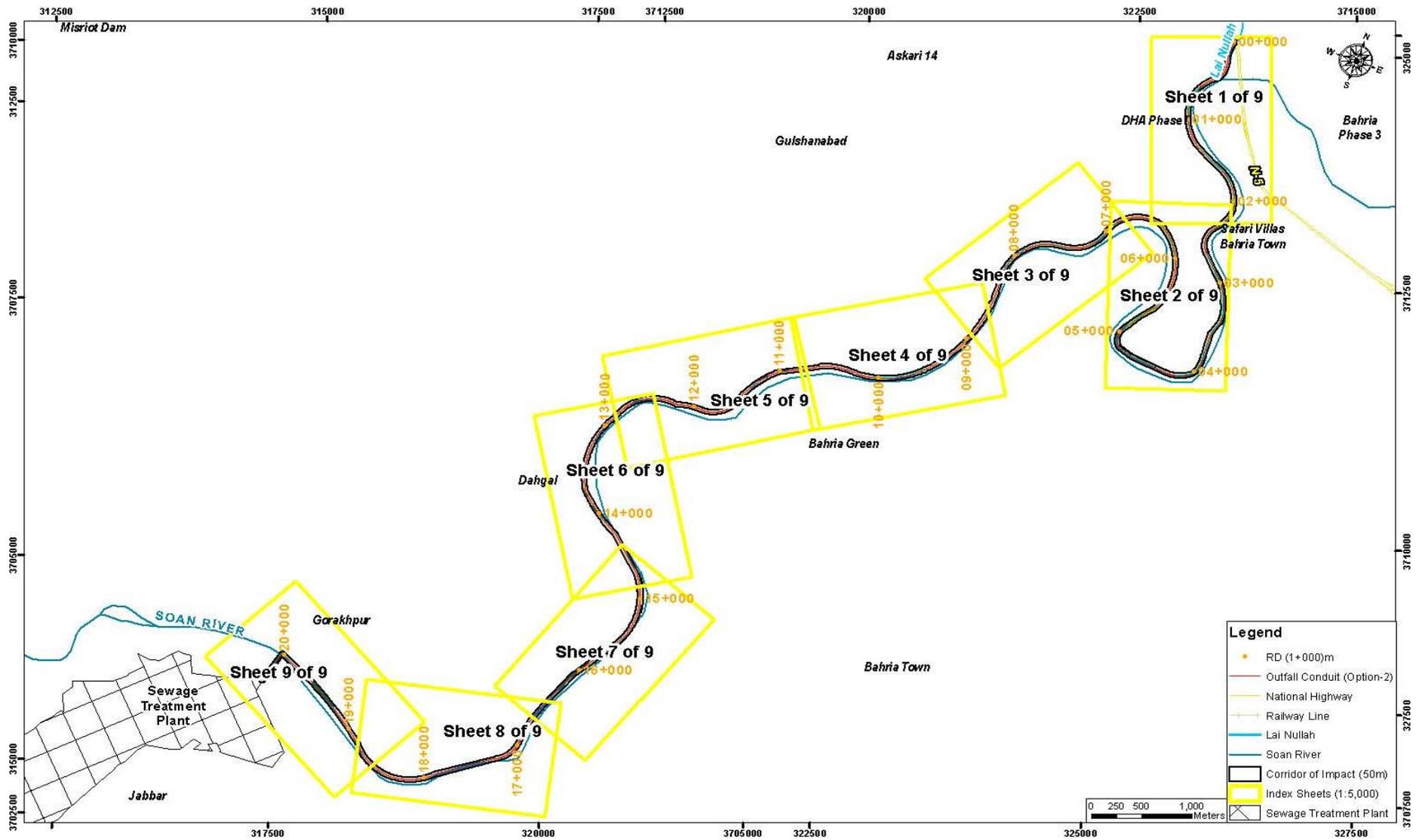


Figure 4.18: Index Land Use Map of Component-II



A View of Nullah Lai



A View of Tube Well near STP



A View of Park in the Study Area



A View of Graveyard in the Study Area



A View of Shrine in the Study Area



A view of Residential Area

Plate 4.2: A view of Land Use of the Study Area

4.2.11 Environmental Sensitive Receptors

Sensitive receptors are mainly people or other organisms that may have a significantly increased sensitivity and exposure to the pollutants and social disturbance, due to the developmental projects. Thus, sensitive receptors are necessary to be identified, to evaluate the potential impacts of the proposed project on public health and the environment.

The sensitive receptors identified for the proposed project within COI (i.e. 25 meter) are: residential areas; educational institutions; health facilities; and religious places (graveyards and mosques). They are prone to sensitivity during construction phase, due to emission of air pollutants, noise and vibration, traffic jams, temporary edifice of construction camps, and mobilization issues. The detail maps of sensitive receptors for both project components are attached as **Figures 4.19 & 4.20**

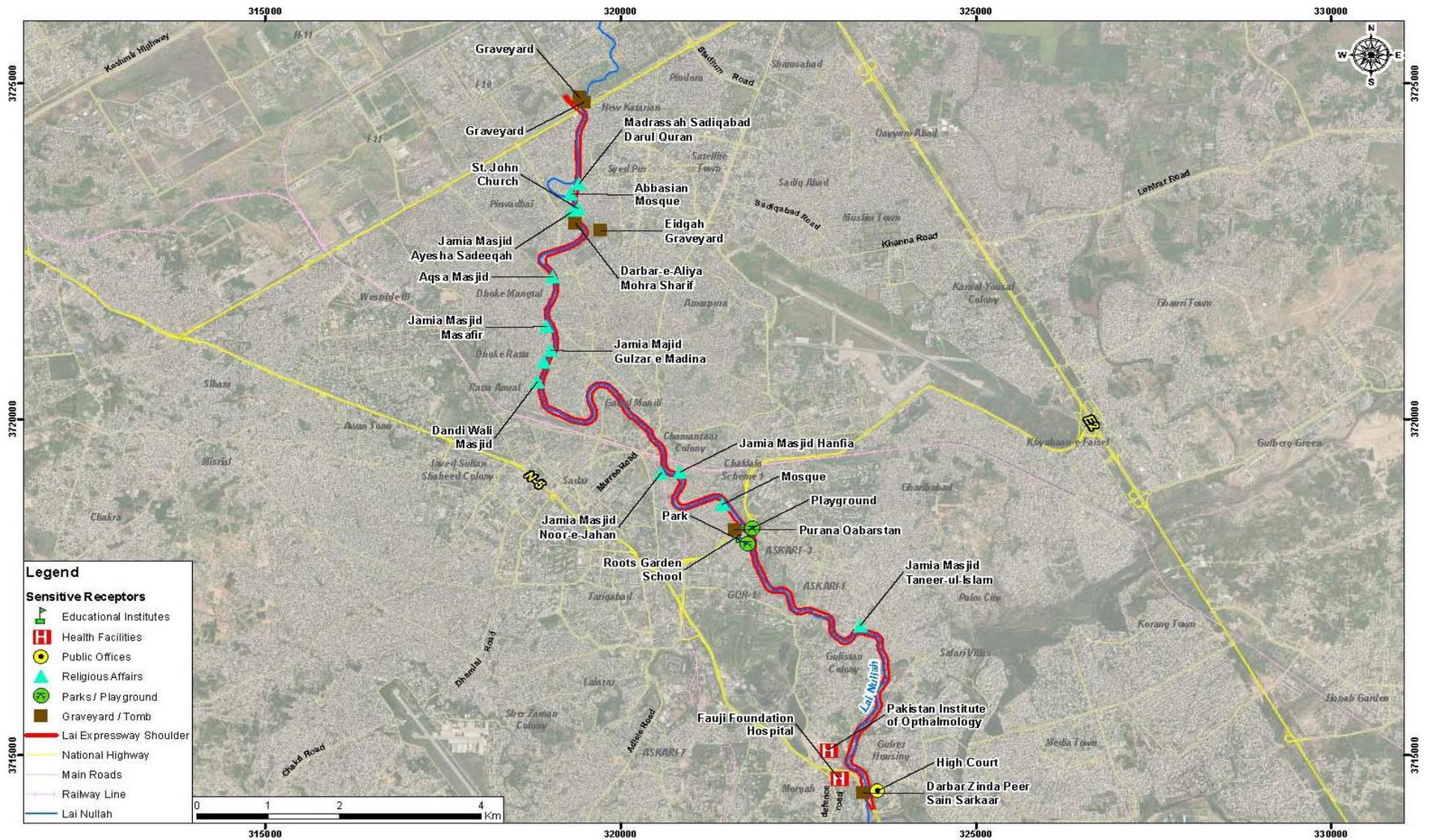


Figure 4.19: Sensitive Receptor Map of Lai Expressway (Component-I)

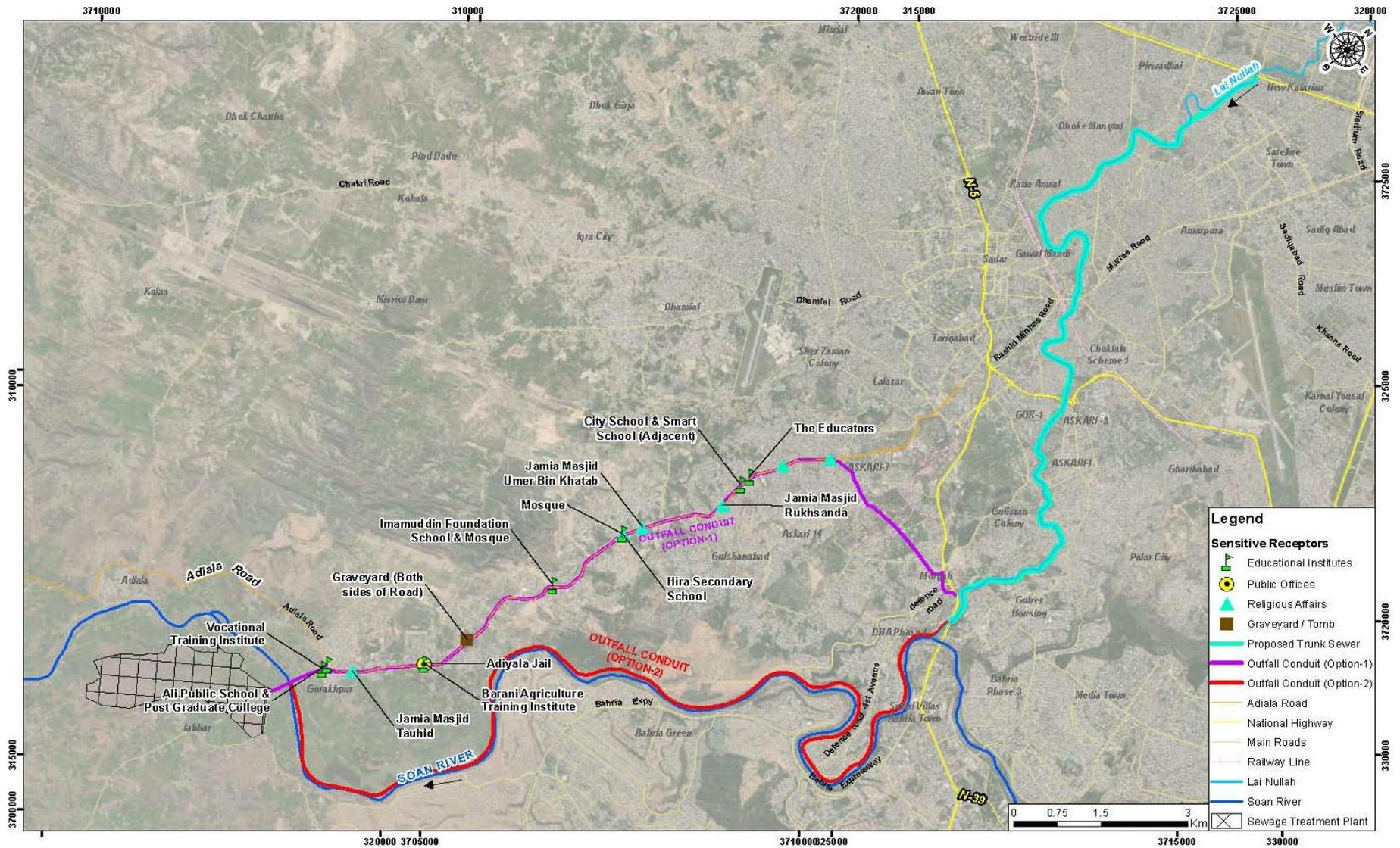


Figure 4.20: Sensitive Receptor Map of Trunk Sewer and STP (Component-II)



4.3 BIOLOGICAL ENVIRONMENT

4.3.1 Ecosystem and Floristic Composition

Rawalpindi is the fourth-largest city in Pakistan by population. The larger Islamabad-Rawalpindi metropolitan area is the country's third largest with a population exceeding four million. Influx of people to Rawalpindi is high and its population increased from 180,000 at the time of independence (1947) to over 4.5 million in 2007 because of its location adjacent to the national capital of Islamabad.

Flora in Rawalpindi district varies with elevation. In the upper reaches of the Murree Hills, the main tree species include deodar (*Cedrus deodara*), kail (*Pinus wallichiana*) while Chir pine (*Pinus roxburghii*) covers the lower hills, along with kao, or wild olive, phulai (*Acacia modesta*), dharek (*Melia azedarach*); and sanatha (*Dodona viscosa*). Vegetation grows for the most part in scattered clumps. At lower elevations and in the plains, the most common trees are shisham (*Dalbergia sissoo*), mulberry (*Morus alba*), dharek (*Melia azedarach*), phulai, (*Acacia modesta*), ber (*Zizyphus mauritiana*), pipal (*Ficus religiosa*), kikar (*Acacia nilotica*). Non-timber forest products include floral buds of the kachenar, pomegranate, blackberries, raspberries, cranberries, and wild pears. Trees are rare along the field boundaries and in cultivated areas, but stunted trees are common in the ravines.

Besides coniferous and sub-tropical dry forests of the region, the Project Area fall in sub-tropical broad leaved evergreen scrub forest. Dominant tree species include Phulai (*Acacia modesta*), Wild olive (*Olea ferruginea*), Hobbush (*Dodonaea viscosa*), Black berries (*Monothea buxifolia*), *Reptonia buxifolia*, Beri (*Zizyphus mauritiana*), Royle's Spike Thorn (*Gymnosporia royleana*), Baikarh (*Adhatoda vasica*), Zebrawood (*Pistacia integerrima*), *Tecoma undulate*, and *Capparis decidua* on drier slopes. However, in the project and the study area, Paper Mulberry (*Broussonetia papyrifera*) dominate. Phulahi (*Acacia modesta*), sufaida (*Eucalyptus camaldulensis*), Dharek (*Melia azedarach*), Shisham (*Dalbergia sissoo*) and mulberry (*Morus alba*) have also been observed wildly. The detail of vegetative species in different components of the Project Area are given in **Table 4.10 & 4.11** and **Plate 4.3** below. For all the ecological base studies in the linear project, systematic sampling technique for counting of herbs/ shrubs/tree species falling in the project alignment should be adopted while in case of non-linear project, random sampling of the area should be carried out to quantify and identify all the possible trees species which will be affected. The current project falls in both the cases, i.e. linear in case of expressway and non-linear regarding STP. Therefore, all the possible parameters of both the sampling technique was adopted for quantification of the trees in different components of the project.

Floristic composition of these forests consists of low branching small evergreen trees with varying densities. Some of these tree species are thorny. Most of these tree and shrub species produce substantial feed and fodder for wildlife and livestock.

These forests types have been subjected to heavy felling and lopping as well as excessive grazing in the past and are now found in degraded condition. These forests occur at height of 1500-5000 feet. These forests found in Gujrat, Margalla Hills, Attock, Rawalpindi and

Malakand. Actually, broadly speaking, these forests occur throughout the country at suitable elevation merging downwards with the sub-tropical pine forest.

Table 4.10: Trees/ Plants of the Project Area

Sr. No.	Common Name	Scientific Name	Present Status/Condition	Components
1	Sufaida	<i>Eucalyptus camaldulensis</i>	Sub-mature	Lai Expressway
	Paper mulberry	<i>Broussonetia papyrifera</i>	Mature, sub-mature and pole crop	
	Poplar	<i>Populus nigra</i>	Mature	
	Injeer	<i>Ficus carica</i>	Sub-mature	
	Phulai	<i>Acacia modesta</i>	Mature and sub-mature	
	Jaman	<i>Syzygium cumini</i>	Sub-mature	
	Dharek	<i>Melia azedarach</i>	Mature and sub-mature	
	Mulberry	<i>Morus alba</i>	Pole	
2	Sufaida	<i>Eucalyptus camaldulensis</i>	Mature and sub-mature	STP
	Mulberry	<i>Morus alba</i>	Mature and sub-mature	
	Dharek	<i>Melia azedarach</i>	Mature and sub-mature	
	Phulai	<i>Acacia modesta</i>	Mature and sub-mature	
	Shisham	<i>Dalbergia sisso</i>	Sub-mature	
	Orange	<i>Citrus sinensis</i>	Saplings	
	Jaman	<i>Syzygium cumini</i>	Saplings	

Table 4.11: Herbs, Shrubs and Grasses in the Project Area

Sr. No.	Common Name	Scientific Name	Present Status/Condition	Components
1	Ber	<i>Ziziphus mauritiana</i>	Mature	Lai Expressway
	Ricinus	<i>Ricinus communis</i>	Sub-mature and saplings	
2	Sarkanda	<i>Saccharum bengalense</i>	Mature	STP
3	Sarkanda	<i>Saccharum bengalense</i>	Mature and Sub-mature	Outfall Conduit-B

<p>Sufaida (<i>Eucalyptus camaldulensis</i>) trees in STP site</p>	<p>Sarkanda (<i>Saccharum bengalense</i>) occupy most of the STP Site</p>
<p>Phulai in the STP site</p>	<p>Poles of Paper mulberry (<i>Broussonetia papyrifera</i>) along the edges of Nullah Lai- Expressway component</p>
<p>Mature trees of Paper mulberry (<i>Broussonetia papyrifera</i>) along Nullah Lai- Expressway component</p>	<p>Ricinus spp. With poles of paper mulberry (<i>Broussonetia papyrifera</i>) along Nullah Lai</p>

Plate 4.3: Shows Floral Species Along the Project Alignment



4.3.2 Present Status of the Project Site

The project site comprises of three components i.e. expressway, sewerage line and waste water treatment plant. The present condition shows that a large amount of paper mulberry (*Broussonetia papyrifera*) is present along expressway component while Phulahi (*Acacia modesta*), sufaida (*Eucalyptus camaldulensis*), Dharek (*Melia azedarach*), Shisham (*Dalbergia sissoo*) and mulberry (*Morus alba*) were also present there. Almost 500 species in Pakistan are reported to be alien/ invasive species. Among those, only 5 are found to have caused very serious damage to already existing species in the local ecosystem. These are paper mulberry (*Broussonetia papyrifera*), mesquite (*Prosopis juliflora*), a low height spiny shrub, common water hyacinth (*Eichhornia crassipes*), Giant Salvinia (*Salvinia molesta*), carrot grass (*Parthenium hysterophorus*), and West Indian Lantana (*Lantana camara*). The most invasive of these is paper mulberry (*Broussonetia papyrifera*). *Broussonetia papyrifera* having East Asian origin is an invasive species in the Himalayas foothills which threatens natural vegetation of Islamabad and South Azad Jammu and Kashmir (Muhammad Asif *et al.*, 2018).

Its effects on the local ecosystem are given as following:

- It causes pollen allergy to almost 50% population of Islamabad.
- It competes with locally adapted species of plants for natural resources.
- It regenerates very vigorously dominating other plant species.
- Causes breathing disorder and asthma in population

Following steps should be taken to mitigate the negative effect of paper mulberry;

- Its physical removal
- Chemicals are sprayed on its plants to remove waste the pollen
- Its plants are either destroyed or covered with plastic sheets to avoid dispersal of its pollen
- Quarantine measures are taken to stop shipments of other such plants from entering to the ecosystems where they are not adapted

Moreover, it was observed that a huge number of trees species falling in all the project alignment except sewerage line option-2 which passes through structures and populated areas. All these vegetation is in good condition supporting the compactness of soil along the Nullah Lai. Most of this vegetation will be disturbed during the construction activities of the project.

4.3.3 Fauna

The Project Area, on account of nature of vegetation and topography, once rich in vegetation and wildlife has now reduced its potential due to over hunting, loss of proper habitat, conversion of forest land. No tigers or leopards are found in the forests of Rawalpindi district. Jackals are still common, however, and there are few wolves, foxes and bears. Deer and wild goats are occasionally reported in the lower Murree Hills. Hare are found on all the low



hills and in most of the ravines. Birds called chakors are found hills and low spurs. Grey partridges are common, but black partridges are rare. Ducks are found along the rivers and marshes. Geese are found in the Soan Valley and quail are common in spring and autumn. Specific fauna found in the project site include jackals, foxes, pigs, and common birds. Several kinds of fish such as rahu, mari, thaila, gulfam and daula fish can be found in the upper reaches of the Soan River. Only daula fish are reported downstream of Rawalpindi and at the confluence with the Lai Nullah. No endangered or rare species of flora or fauna are present in the Project Areas.

Fauna of the tract consists of mammals, reptiles, amphibians and birds. The details are given as under

4.3.4 Mammals

Long time ago, the current Project Area once supported a large number of wild animals but the number of wild animals on Earth has halved in the past 40 years, according to a new analysis. Creatures across land, rivers and the seas are being decimated as humans kill them for food in unsustainable numbers, while polluting or destroying their habitats as the time passes and population increases and the current areas has been occupied by humans. Some of the mammalian species of the twin cities including the Project Area are Jackals, foxes whose piercing bark is usually heard in the hills and Wild boars and are listed in the **Table 4.12** below;

Table 4.12: List of Indigenous Mammals of the Twin Cities

Sr. No.	Mammals	Scientific Name
1	Rhesus macaque	<i>Macaca mulatta</i>
2	Jackal	<i>Canis aureus</i>
3	Fox	<i>Vulpes Vulpes</i>
4	Jungle Cat	<i>Felis chaus</i>
5	Palm Squirrel	<i>Funambulus palmarum</i>
6	Mongoose	<i>Herpestes auro punctatus</i>
7	Indian mole rat	<i>Rattus rattus</i>
8	Field mouse	<i>Funambulus pennant</i>
9	Porcupine	<i>Hystrix indica</i>
10	Rabbit	<i>Oryctolagus cuniculus</i>
11	Cape hare	<i>Lepus capensis</i>
12	Masked palm civet	<i>Paguma larvata</i>
13	Wild Boar	<i>Sus scrofa</i>

4.3.5 Amphibians

Worldwide declines in amphibian populations have caused great concern in the scientific community in recent years, and regional accounts are invaluable tools for informing ecological knowledge and conservation. Many scientists consider loss of suitable habitat to be the largest single factor contributing to declines of amphibians (Alford *et al.*, 1999). The most common causes of their population decline include climate change, increased exposure to ultraviolet radiation, pathogens, introduced species, habitat destruction and



modification, acid rain, and chemical stressors such as pesticides and fertilizers (Blaustein *et al.*, 1994) (Blaustein *et al.*, 2003) (Boone *et al.*, 2003) (Bridges *et al.*, 1997) (Gibbons *et al.*, 2000).

In the Project Area, the most common cause of population decline of amphibians is habitat destruction due to rapid growth of urbanization. It means that due to urbanization, suitable habitat has been lost due to which the current situation of homeland amphibians has been declined.

Following amphibians are found near or around the Project Area are given in the **Table 4.13** below;

Table 4.13: Amphibians of the Study Area

Sr. No.	Local/ English Name	Scientific Name
1	Common frog	<i>Rana tigrine</i>
2	Common toad	<i>Bufo bufo</i>
3	Marble frog	<i>Uperodon systoma</i>

4.3.6 Reptiles

Worldwide declines in reptile's populations is due to habitat loss and degradation, environmental pollution, disease and parasitism, unsustainable use, and global climate change. The disappearance of reptiles from the natural world is genuine and should be a matter of concern not simply because of reptiles' perceived associations with amphibians, but because reptile declines, like those of amphibians, are growing and serious in their own right. Current evidence suggests that amphibian and reptile declines, which are exacerbated by burgeoning human populations, constitute a worldwide crisis.

Moreover, on the other hand, Rawalpindi and Islamabad support a good variety of reptiles so far. In Islamabad and Rawalpindi, the most common reptile that is worth mentioning here and is occasionally witnessed by the hikers is Monitor Lizard. These are generally large reptiles, although some can be as small as 12 centimeters in length. They have long necks, powerful tails and claws, and well-developed limbs.

Following Reptiles are found near or around the Project Area are given in the **Table 4.14** below;

Table 4.14: Reptiles of the Study Area

Sr. No.	Local/ English Name	Scientific Name
1	Fringed toed Lizard	<i>Acanthodactylus cantoris</i>
2	Spiny tailed Lizard	<i>Uromastyx hardwickii</i>
3	Common Krait	<i>Bungarus caeruleus</i>
4	King Cobra	<i>Ophiophagus Hannah</i>
5	Viper	<i>Vipera xanthina</i>



4.3.7 Birds- Avifauna

Avifauna of the Project Area consists of different partridges, seasonal ducks and migratory Quail. Grey partridge is common and Duck are found along the rivers and marshes. Grey Geese (*Anser anser*) are found in the Soan Valley. Quail come in enormous numbers in the spring and autumn. Most common birds are House Sparrow, House Crow and Mynah. In addition to these birds Red-vented Bulbul (*Pycnonotus cafer*), Asian Koel (*Eudynamys scolopacea*), Rose ringed parakeet (*Psittacula krameri*) and Rock Dove (*Columba livia*) are also part of the Project Area.

The common birds observed and reported in the Study Area are given in **Table 4.15** below:

Table 4.15: Birds Found in Study Area

Sr. No.	Common Name	Scientific Name
1	Rock Dove	<i>Columba livia</i>
2	Spotted doves	<i>Spilopelia chinensis</i>
3	Grey Geese	<i>Anser anser</i>
4	Myna	<i>Acrida thestritis</i>
5	Grey Partridge	<i>Perdix perdix</i>
6	Quail	<i>Coturnix coturnix</i>
7	House Sparrow	<i>Passer domesticus</i>
8	House Crow	<i>Corvus splendens</i>
9	Red-billed chough	<i>Pyrrhocorax pyrrhocorax</i>
10	Red-vented Bulbul	<i>Pycnonotus cafer</i>
11	Asian Koel	<i>Eudynamys scolopacea</i>
12	Rose ringed parakeet	<i>Psittacula krameria</i>
13	Ram Chakor	<i>Alectoris chukar</i>
14	Peregrine falcon	<i>Falco peregrinus</i>
15	Kalij pheasants	<i>Lophura leucomelanos</i>
16	Golden orioles	<i>Oriolus oriolus</i>

4.3.8 Endangered Fauna

There are no endangered species of fauna in the tract.

4.3.9 Wetlands

There are no wetlands in the Project Area.

4.3.10 Game Reserves/ Wildlife Sanctuaries/ National Parks

There is no game reserve, wild sanctuaries and National Park present in the Project Area.



4.4 SOCIAL ENVIRONMENT

This section deals with the social conditions of the Project Area. During the desk/ office study, available reports/ documents were comprehensively studied. During the field survey interviews and meetings with the shopkeepers, students, pedestrians, Govt employees and retire official of different departments, drivers (taxi, rickshaw, wagon etc.), were held and observations were also recorded after giving due consideration during survey.

4.4.1 Political and Administrative Setup

The proposed Project Area falls in the administrative jurisdiction of Tehsil Rawalpindi of the Rawalpindi District. The Tehsil administration is under the Tehsil Municipal Administration (TMA). The Cantonment Board is looked after administratively by Cantonment Executive Officer (CEO). The total area of the District Rawalpindi is 5,285 square kilometers out of which Tehsil Rawalpindi covers a total area of 1682 square kilometers.

4.4.2 Demographic Characteristics of the Project Area

According to the results of 2017 census report, the total population of Pakistan is estimated as 207,774,520 persons with annual growth rate of 2.40% and the total population of Rawalpindi District is 5,405,633, with urban population of 1,014,825 which is around 50.58% of the total population. The average annual growth rate of population in the district during this period was 4.91 percent. The total area of district is 1682 kilometers which gives population density of 1,322 persons per square kilometers. The total population of Tehsil Rawalpindi is 1,927,612 as enumerated in the March 1998 Census. The annual average growth rate of population in the Tehsil is 3.5%. As mentioned earlier, Rawalpindi Tehsil has 1682 square kilometers of area, which means population density of 1146 persons per square kilometers.

A. Rural and Urban Distributions

The urban population is 1,788,273 or 53.2 percent of the total population of the district which grew at an average rate of 3.5 percent during 1981-98. There are one Municipal Corporation, Three municipal committee, four cantonments and two town committees. There are 1164 Mouzas (a smallest revenue unit) in 1998 of which 34 had population over five thousand, 161 had 2 to 5 thousand, 300 had 1 to 2 thousand, 568 had under 1 thousand persons while 101 were un-inhabited. Project Area entirely falls in rural area of tehsil Gujjar khan & Rawalpindi of Rawalpindi district.

B. Religion

The population of the Rawalpindi District of which the Project Area is an integral part is predominantly Muslim i.e. 97.72 percent. The next higher proportion is that of Christians with 2.11 percent. While other minorities like Ahmadis, Hindus, etc. also live in very small numbers. The population of the Project Area is also predominantly Muslims.



C. Ethnic Structure

One of the important races and tribes living in the Rawalpindi District are the Rajputs, amongst whom the important sub-divisions are Bhatti, Rawal, Janjua, and Chohans. People of the District Rawalpindi are well built and of medium height and are considered to be among best soldiers in the Pakistan Army. The main castes of population in the settlements of the Project Area are Arrain, Syed, Pathan, Jat, Sheikh, Gujjar, Awan, Rajput, Jatun, Butt, Komboh, Raja, Mughal, Khokhar, and Qureshi etc.

D. Mother Tongue

The mother tongue refers to the language used for communication between parents and their children in any household. Punjabi is the predominant language being spoken by majority of the population of the district i.e. Rawalpindi followed by Urdu, Pashto, Hindko and Pothohari etc.

E. Sex Ratio

Sex ratio, i.e. number of males for every 100 females, according to census 2017 the sex ratio is 102.96, which was 105 per cent recorded in 1998 Census which had decreased from 107 in 1981. The ratio was 96 per cent in rural areas and 113 in urban areas. The higher sex ratio observed in the latter areas as compared to the former areas could be sex selective migration to the latter areas.

F. Migration

The total number of life time in migrants in Rawalpindi district were 710,804 or 21.1 percent of population of the district of the total life time in migrants 635,542 persons are settled in the towns. Of total district migrants 52.6 per cent came from Punjab, 28.7 per cent were from Sindh, NWFP and Baluchistan. 12.2 per cent from Azad Kashmir and Northern Areas while remaining 6.0 per cent were Pakistanis who repatriated from other countries. There are only 0.5 per cent cases of migrants whose birth place is not reported.

4.5 ECONOMIC CONDITIONS

4.5.1 Economical Active Population

The economically active population is defined here as the persons working, most of the time during the year preceding the census date March 1998 looking for work, laid off and unpaid families helper assisting their family. The economically active population as enumerated in the last census was 21.9 per cent of the total population or 29.4 per cent of the population 10 years and over i.e. the population exposed to the risk of entering the economically active life at any time. Of the total male population 41.4 per cent were economically active, while 58.6 per cent not economically active 25.5 per cent children under ten years, 22.1 per cent students, 2.1 per cent domestic workers while 8.9 per cent were land lords.



4.5.2 Unemployment

Unemployment rate is measured as ratio of looking for work and laid off in total economically active population comprising employed, looking for work, laid off and un paid family helpers, generally representing in percentage. The unemployment rate in the district was 21.1 per cent which was mainly due to unemployment amongst male representing 21.8 per cent. While unemployment rate among women was just 0.9 per cent. This is because of their small proportion in their total economically active population. The unemployment rate was almost three times higher in rural as compared to urban areas representing 36.0 and 11.9 per cent respectively.

4.5.3 Occupations

Majority of the population of the Project Area is running their own small level businesses like shops of furniture, carpet, ceramics, lights, auto shops, mechanic workshops, spare parts shops, cold drink shops and PCO's, hotels & restaurants, CNG stations, petrol pump, medical stores, health clinics, departmental stores, fishing shops etc. Beside this, the people of the Project Area also resort to labor jobs, while others go for government and private jobs in the Project Area.

4.5.4 Industry

This district is not famous for industrial goods like other districts. The progress has been mostly in the private sector. Apparently, there is no shortage of skilled manpower. There are at present about 939 industrial units including Kohinoor Textile Mill, Wattan Woolen Hosiery Mill, Banday and Yousaf Textile mills etc. operating in the district.

4.5.5 Roads

Murree, a fine hill resort about 46 km from Rawalpindi is connected by an excellent metalled road. The system of communication in Rawalpindi Murree, Gujar Khan, Texila, KotaliSattian, and Kahuta is very satisfactory. The district has total metal led road length of 1,146 km.

4.5.6 Railways

The main line of Pakistan Railways and the Grand Trunk Road parallel to the railway runs through the district from North and South from Rawalpindi to various sides such as Peshawar, Kohat, Mianwali, Faisalabad, Lahore and Karachi etc.

4.5.7 Educational Facilities

There are three (3) Universities (Fatima Jinnah Women University, Barany University and National University of Sciences and Technology), for males and females, 17 Degree Colleges, 27 Intermediate Colleges, 424 Secondary High Schools, 15 Higher Secondary Schools, 514 Middle Schools, 1888 Primary Schools, 3 Technical Training Institutions, and 391 Mosque Madras's working in the Rawalpindi District. In addition, there are also



Rawalpindi Medical College, Army Medical College and Islamic International Medical College imparting education in the medical field.

Whereas, AnjmanFaiz-ul-Islam Model High School, AnjmanFaiz-ul-Islam Technical Institute, Government Islamai Higher Secondary School, and Cane Public Primary School, St. Marry Cambridge School, Al-Sadique Public School, Beacon House School, Asif Public School, Degree College for women, Superior College Rawalpindi, Punjab Post Graduate Institute of Poultry sciences, Rawalpindi Institute of Technology, and Arid Agriculture University are available. For higher education, students have to move to colleges and other higher level educational institutions in the city.

4.5.8 Health Facilities

The major health facilities available in the District are Central Government Hospital, District Headquarter Hospital, Police Hospital, General Hospital Rawalpindi, Holy Family Hospital, T.B. Hospital, WAPDA Hospital, Central Jail Hospital, Pakistan Railway Hospital, Infectious Diseases Hospital. About 200 dispensaries are working in urban and rural areas of the District.

Likewise, Benazir Bhutto General Hospital and other Basic level private health facilities are also available in the communities. However, in case of serious ailments, people seek medical assistance from other hospitals in the city.

4.5.9 Archeological and Cultural Property/ Places of Interest

The most common physical and cultural heritage of District Rawalpindi is discussed as following:

i) Shrine

There is a shrine of Sufi saint Hazrat Syed Hassan Shah Bukhari in the city Saddar area. An annual "Urs" is also held at the shrine each year. A shrine of Shah di Talian is also observed. The number of participants in the "Urs" varies ranging from two hundred (200) to three hundred (300) people. In the Project Area, a little number of shrines was also reported by people like darbar Sain Ghulam Hussain, Baba Clyan Shraif, Baba Fazal Shah and mander in Takhatparri village.

ii) Mosques

There are also small roadside mosques including Gulshan-e-Madina, Abu-Bakar, Bilal, Ghousia, Baba Fazal shah, Jamia Banth, Jamia Bosalli, Jamia bhattian Noor Din & Doke Gujjrian, Jamia Maira Mohra, Masjid Qutab Ferozwal, Jamia Sain G. Hussain jamia umer and jamia usmania etc, along the entire stretch of the Project route. Those mosques have been constructed with mutual contributions of Government and the local residents of concerned communities.



iii) Graveyards

There are many local graveyards consisting of number of graves. The presence of shrines, mosques and graveyards has a very sensitive religious and cultural significance in our society.

iv) Recreational Sites

The famous recreational sites in the city are Ayub National Park and Liaquat Memorial Park (Company Bagh).

4.6 IMPACT ASSESSMENT SURVEY OF THE PROJECT AREA

The information regarding impact assessment is derived from primary data collection. A social survey was carried out in the Project Area to identify the impacts and their magnitudes on the affected population. A sample of 60 respondents was taken on the basis of random sampling technique, which included shop keepers, pedestrians, drivers, hospital management, students etc. The purpose of this survey was to get response about the perceived impacts and preferences towards the project implementation. The survey was conducted in the surrounding area of nullah LAI these areas are Doughal, Dokh Dalaal, Ghorakhpuar, Jabbar, Dokh Charag din, Gulshan Colony, New Pagwari, Kachi Abaddi and Soan Adda, etc.

4.6.1 Survey Findings

Detailed findings of the survey comprising of different parameters are discussed in the following section.

A) Demographic Characteristics.

I. Gender Ratio of the Respondent

Total 60 respondents were contacted, comprising of 100% males. **Table 4.16** shows Gender ratio of the respondents interviewed.

Table 4.16: Gender Ratio of the Respondents

Sr. No.	Gender Ratio	Number	Percentage
1	Male	60	100
2	Female	0	0
Total		60	100

II. Age

The demographic characteristics of the sample survey show **Table 4.17** that 15% of the respondents were 15 to 25 years of age. 28% of the respondents were aged 26 to 35 years, 17% were 36 to 45 years and 40% were 46 years & above of age. These figures show that

large no of respondents was mature enough to give their opinion about the construction of ring road and foresee its impacts.

Table 4.17: Age Composition of the Respondents

Age Composition of the Respondents			
Sr. No.	Age Limit	Number	Percentage
1	15-25	9	15
2	26-35	17	28
3	36-45	10	17
4	Above 45	24	40
Total		60	100

The pie chart given below, (Figure 4.21) reflects the age composition of the respondents.

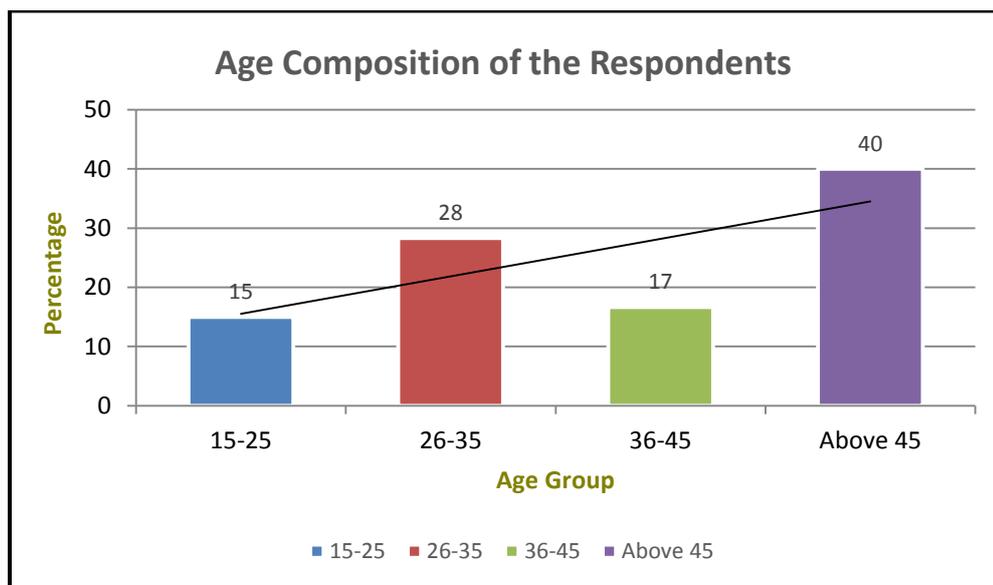


Figure 4.21: Age Composition of the Respondents

III. Education

Education distribution of the respondents is shown in Table 4.18. From the data presented in the table it is clear that 23% respondents were educated up to metric level. 20% of the respondents were primary, 17% were with middle schooling, 13% were educated intermediate and above. The respondents 27% were illiterate.

Table 4.18: Educational Level of the Respondents

Education of Respondents			
Sr. No.	Education level	Number	Percentage
1	Illiterate	16	27
2	Primary	12	20
3	Middle	10	17
4	Metric	14	23
5	Inter & above	8	13
Total		60	100



The pie chart given below shows the educational level of the respondents.

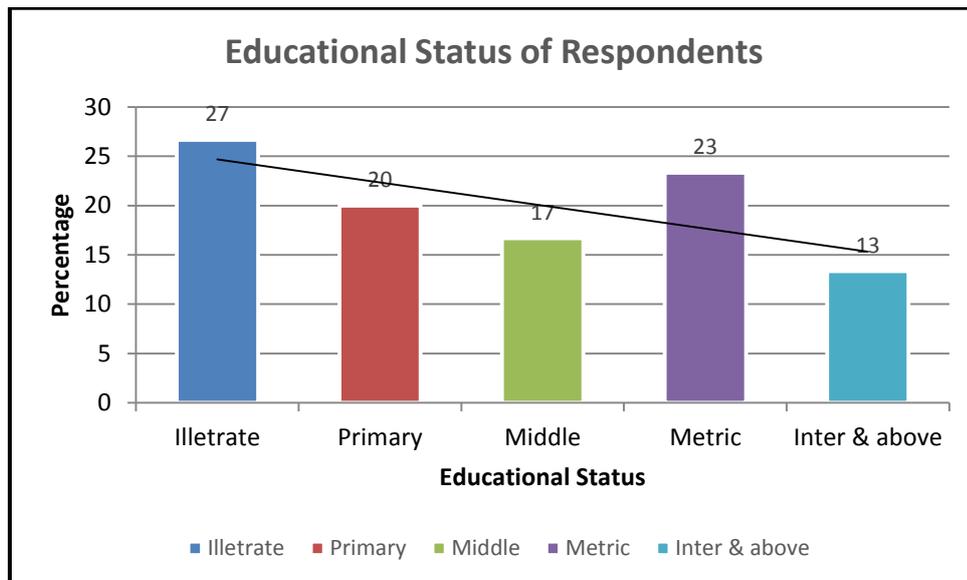


Figure 4.22: Educational Level of the Respondents

IV. Marital Status

The marital status of the sampled respondents was also inquired during the survey. About 80% of the respondents were married and only 20% were unmarried. Details are given in **Table 4.19**.

Table 4.19: Marital Status of the Respondents

Marital Status			
Sr. No.	Marital Status	Number	Percentage
1	Married	48	80
2	Unmarried	12	20
Total		60	100

The pie chart given below shows the marital status of the respondents.

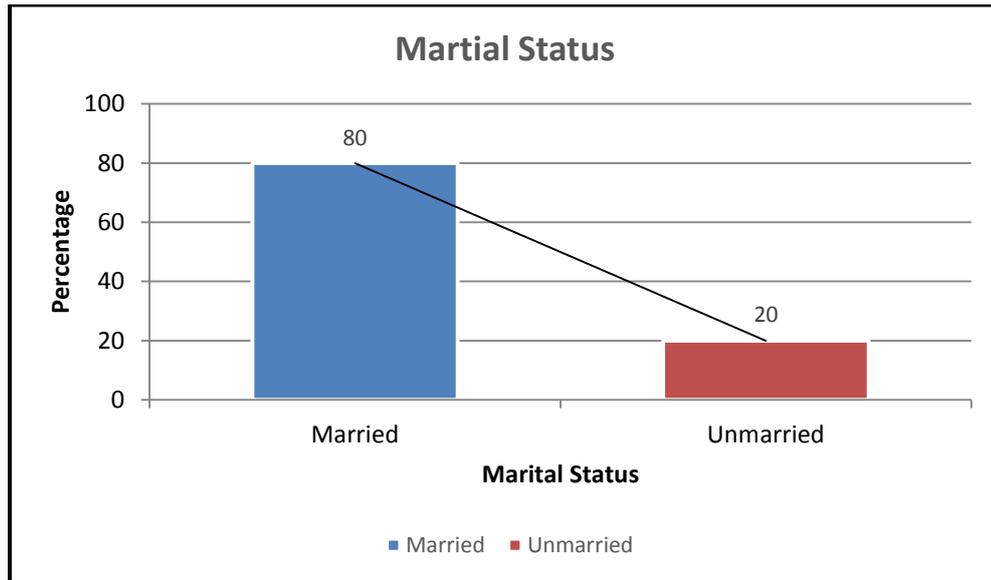


Figure 4.23: Marital Status of the Respondents

V. Occupation

Regarding occupational status of the respondents about 03% related to Agriculture, 08% were drivers, 13% were office workers/ employee and retired from different department, 37% Labor/workers, 25% of the respondents were businessmen/ shop owners and 13% were in other jobs i.e student, private job etc. Detail is given in **Table 4.20** below.

Table 4.20: Occupations of the Respondents

Professional status of Respondents			
Sr. No.	profession Type	Number	Percentage
1	Agriculture/ Farming	2	3
2	Driver	5	8
3	Govt Job/Retire	8	13
4	Labor	22	37
5	Shopkeeper	15	25
6	Any Other	8	13
Total		60	100

The occupational distribution of the respondents is given below in the form of pie chart.

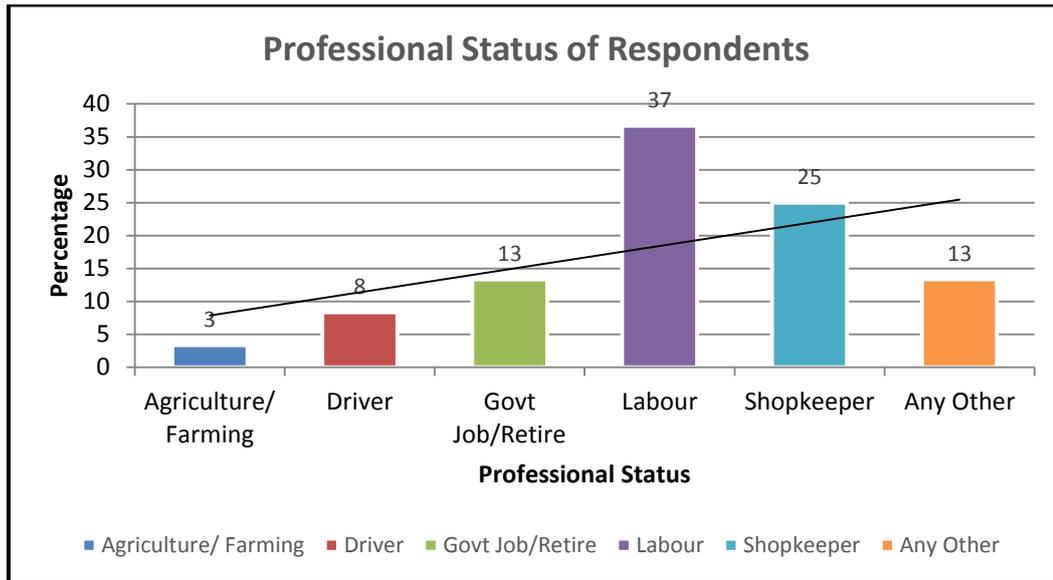


Figure 4.24: Occupational Distribution of the Respondents

VI. Religion

Respondents were asked about their religion status during the survey. Significant number of the respondents i.e. 97% were reported their religion Islam and 3% were Christian.

VII. Ethnic Structure

The most important ethnic groups were found in Project Area as given below in **Table 4.21**. The data presented in table shows that Syed were 13%, followed by Rajput/Raja 04%, Pathan 53%, Malik were 17%, Mughal were 07% & Christian were 02%, respectively Of the total sampled respondents as reflected in given **Figure 4.25** below;

Table 4.21: Ethnic Structure

Caste/Ethnic Group of the Respondents			
Sr. No.	Caste	Number	Percentage
1	Syed	8	13
2	Rajput/Rana	4	7
3	Pathan	32	53
4	Malik	10	17
5	Mughal	4	7
6	Mashi	2	3
Total		60	100

The ethnic group of the respondents is given below in the form of pie chart.

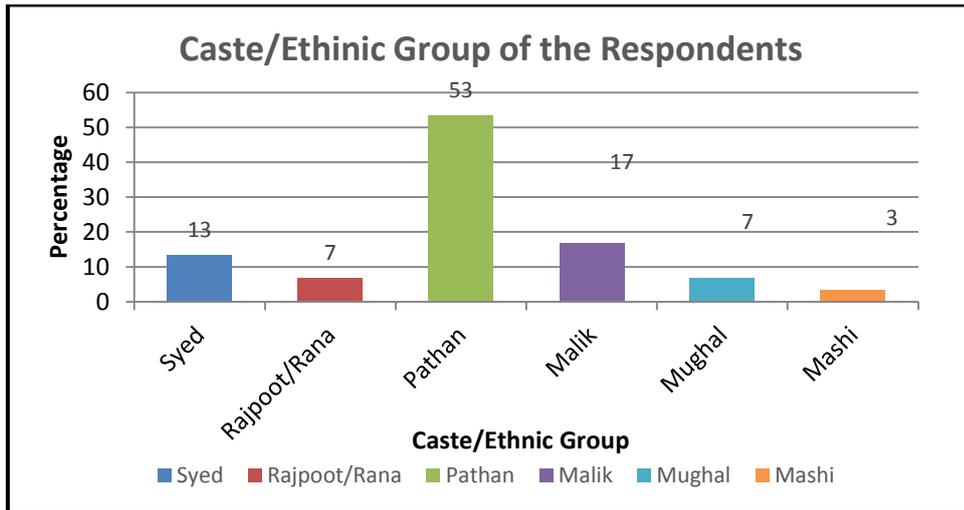


Figure 4.25: Ethnic Structure of the Respondents

VIII. Languages

Punjabi/Pothwari is the language being spoken by majority of the population 50% of the Project Area. It was reported that 17% of the respondents speak Punjabi/urdu. The respondents who speak Pushto/Urdu were 33% of the total sampled respondents, as shown in **Table 4.22**. & the graphical representation of language spoken in the Project Area is depicted in **Figure 4.26** below;

Table 4.22: Languages Spoken in Project Area

Mother Tongue			
Sr. No.	Mother Tongue	Number	Percentage
1	Punjabi, Urdu	10	17
2	Punjabi, Pothwari	30	50
3	Pushto, Urdu	20	33
Total		60	100

The pie chart given below shows the language spoken by the respondents in Project Area.

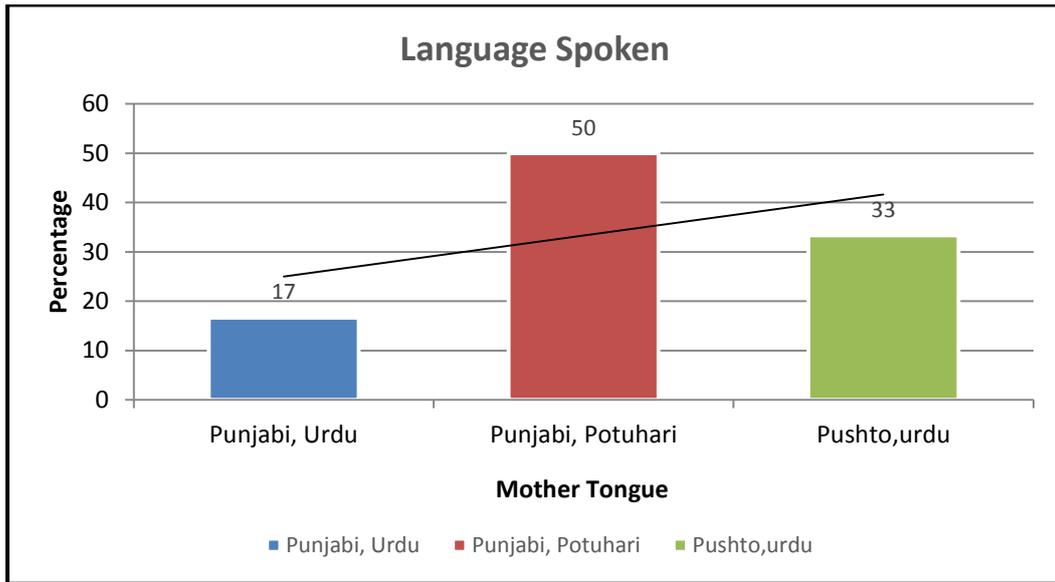


Figure 4.26: Language Spoken by the Respondents

IX. Family Structure

Of the total sampled population 20 percent were living in joint family system where grandparents are also living under same roof and 80 percent respondents reported as nuclear family system. The figures are shown in **Table 4.23** blow;

Table 4.23: Family Structure

Family System of Respondents			
Sr. No.	Type	Number	Percentage
1	Joint	12	20
2	Nuclear	48	80
Total		60	100

The pie chart given below shows the family structure of the respondents.

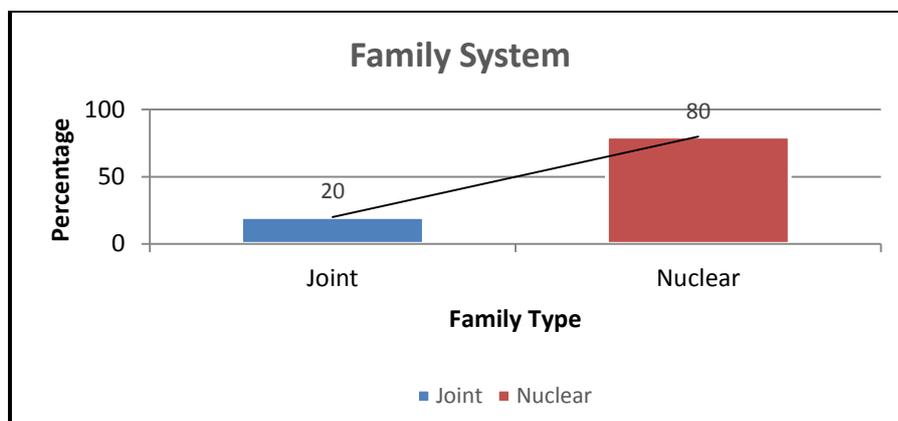


Figure 4.27: Family Structure of the Respondents



B) Socio- Economic Characteristics

i) Income Level of the Respondents

From the **Table 4.24**, it is clear that majority of the respondents 39% fall in the income group of Rs. 11,000 to 20,000, 18% belong to income group of less than 10,000 and 26% of the respondents were earning their monthly income 21,001 to 30,000. Whereas 8% earning their income 31,001 to 40,000 and 9 % respondents earning their monthly income above 40,000.

Table 4.24: Average Monthly Income of the Respondents

Average Monthly Income			
Sr. No.	Distribution	Number	Percentage
1	Less than 10,000	11	18
2	10,000 to 20,000	22	39
3	20,001 to 30,000	16	26
4	30,001 to 40,000	5	8
5	Above 40,000	6	9
Total		60	100

In the pie chart the income groups of various respondents are shown below.

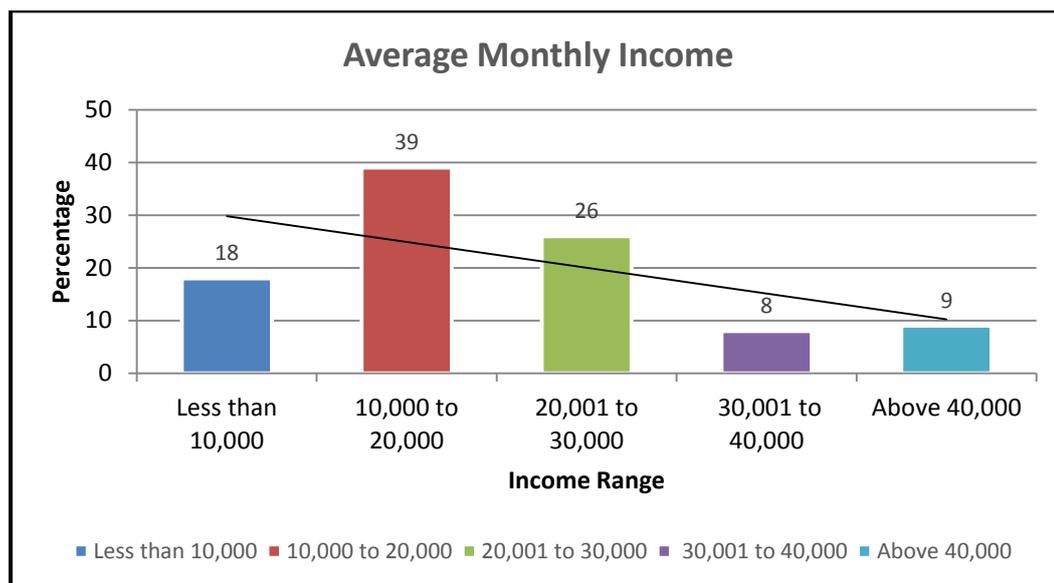


Figure 4.28 : Average Month Income Level of the Respondents

ii) Housing Ownership Status

Sampled respondents were asked about their housing ownership status in order to know their level of living standard as reflected in **Table 4.25**. Majority of respondents 63% were living in their own houses while 20% was living in rented houses. About 17% were

encroacher build their houses on govt land. **Figure 4.29** is about graphical presentation of housing ownership status of respondents.

Table 4.25: Housing Ownership Status of Respondents

Ownership of House			
Sr. No.	Response	Number	Percentage
1	Self-Owned	38	63
2	Rented	12	20
3	Encroacher	10	17
Total		60	100

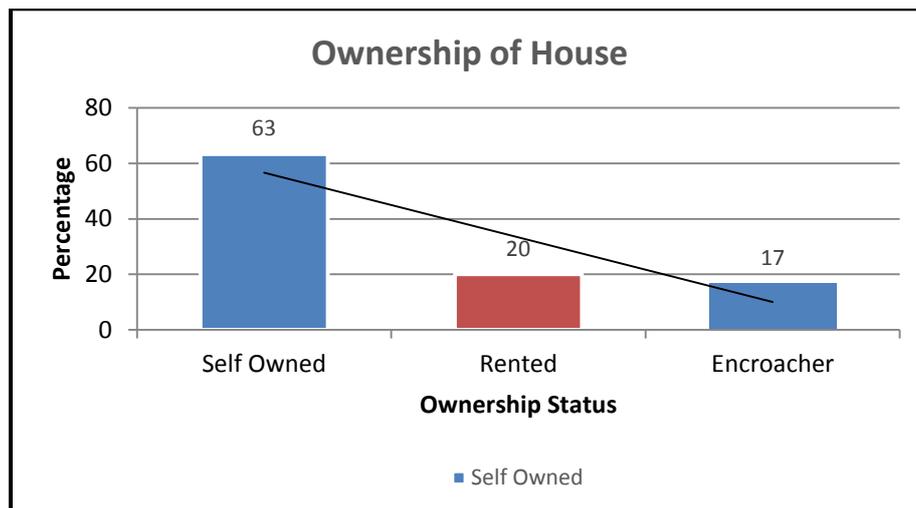


Figure 4.29: Graphical View about Ownership Status of Respondents

iii) Housing Construction Pattern

A large number of the respondents 63 % live in Pacca houses that are constructed with superior materials and workmanship while 23% respondents have Semi pacca houses that are houses made of bricks masonry with mud mortar. The remaining 14% of the respondents lives in katcha houses. **Table 4.26** shows Construction pattern of houses in Project Area.

Table 4.26: Type of the Construction of Houses

Nature of the Construction of House			
Sr. No.	Type	Number	Percentage
1	Pacca	38	63
2	Semi-Pacca	14	23
3	Kaccha	8	14
Total		60	100

Construction pattern of houses in Project Area is shown in **Figure 4.30** below;

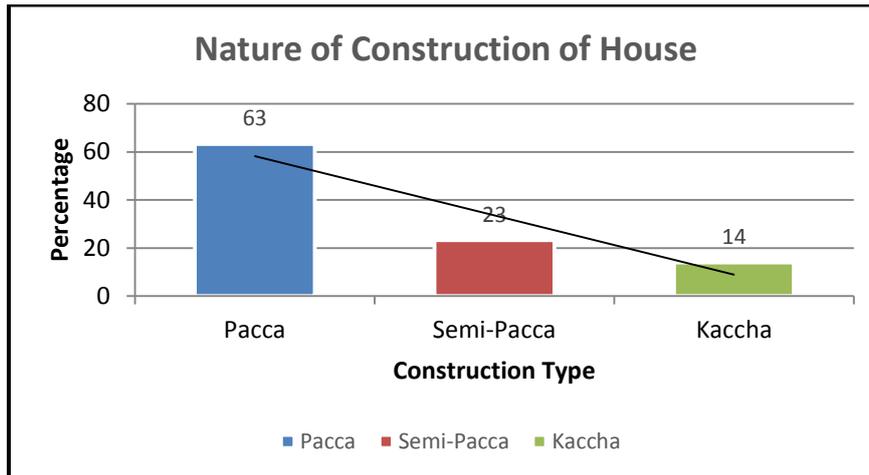


Figure 4.30: Graphical Presentation of Housing Construction Pattern.

C) Civic Amenities

i) Basic Amenities in the Project Area

The situation of available basic amenities in the Project Area including Electricity, Natural Gas, Water Supply, Telephone, and Sewerage is depicted in **Table 4.27**. It shows that 100% of respondents have only the facility of electricity and who have combination of electricity & gas was 54% of the sampled population. While, facilities like electricity/gas/water supply was being enjoyed by 08 percent respondents. Whereas, 20% have the facility of Sewerage system and 26% respondents also enjoying the facility of telephone.

Table 4.27: Availability of Basic Amenities

Sr. No.	Facility Available in the Project Area	Yes	Percentage
1	Electricity	60	100
2	Gas	32	54
3	water supply	5	8
4	Sewerage System	12	20
5	Telephone	16	26

ii) Sources of Drinking Water

Table 4.28 shows the source of drinking water. The respondents 08% were enjoying public water supply scheme and 44% respondents were depending on bore water/motor pump, 09% were depending on hand pump and 39% were using water of filtration plant as source of water for their domestic usage.

Table 4.28: Sources of Domestic Water

Source of Drinking Water in Project Area			
Sr. No.	Source of water	Number	Percentage
1	Public water supply	5	8
2	Hand Pump	6	9
3	Motor/Pump	26	44
4	Filtration Plant	23	39
Total		60	100

In the pie chart (**Figure 4.31**), the status of domestic water of respondents acquired are shown below.

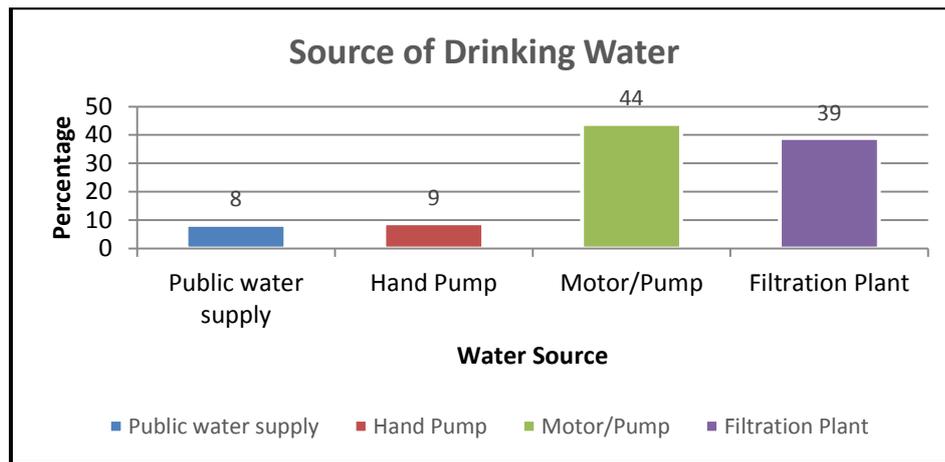


Figure 4.31: Different Sources of Water Supply in the Project Area

iii) Satisfaction about Quality of Water

Table 4.23 shows the current situation of the water quality in the Project Area. Majority of the respondents 88% were satisfied with the quality of water available in the Project Area. While 12% respondents were not happy with the quality of water due to hard and brackish water.

Table 4.29: Quality of Water

Satisfaction Level with Water Quality			
Sr. No.	Response	Number	Percentage
1	Yes	53	88
2	No	7	12
Total		60	100

In the pie chart (**Figure 4.32**), the satisfaction about quality of water are shown below.

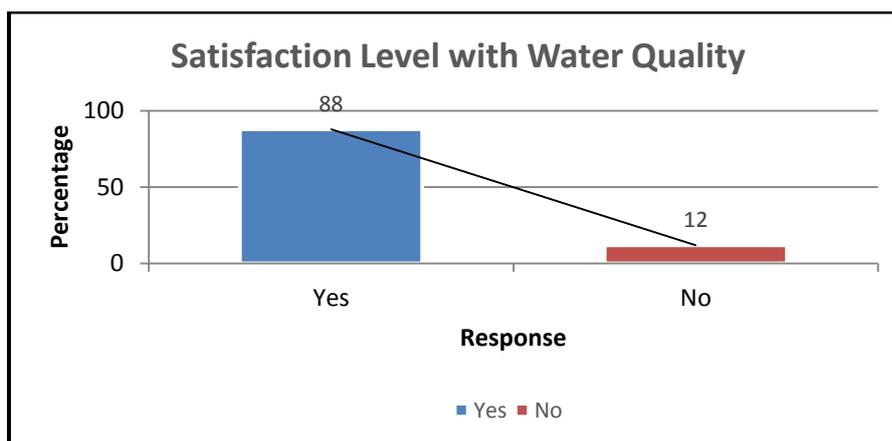


Figure 4.32: Level of Satisfaction of Domestic Water Supply

iv) Social Institutions (Education & Health)

i. Availability of Education Facility

Table 4.30 indicates that the education facility is available from primary to higher secondary levels in entire Project Area. These education facilities include Govt. High /Elementary/ Primary Schools (Boys / Girls) and a number of private schools found in Project Area.

Table 4.30: Availability of Educational Institutes

Sr. No.	Educational Institute	Number	Percentage
1	Yes	58	97
2	No	2	3
Total		60	100

ii. Health Facility

Table 4.31 indicates the availability of health facilities in the Project Area. The survey findings showed that 30% sampled respondents in study area have been provided basic health facilities by the Government. These health institutes include Thesil Hospital and many other Private hospitals & health care centers. Rest of the project population 70% is not provided any health care facility nearby their settlements by Government. For this purpose, they have to consult Private Practitioners / Hakims practicing at their door steps in case of illness.

Table 4.31: Availability of Health Institutes

Availability of Health Institutes			
Sr. No.	Response	Number	Percentage
1	Yes	18	30
2	No	42	70
Total		60	100

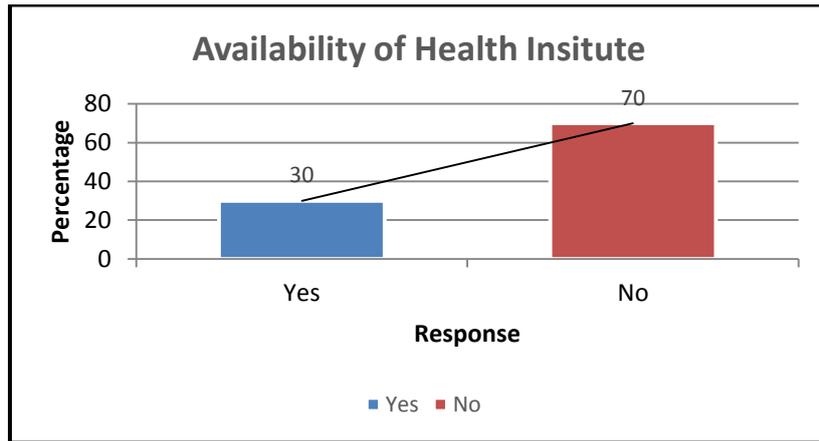


Figure 4.33 : Availability of Health Institutes

D) Cultural Characteristics.

i) Shrines / Mosques

Survey finding shows the availability of religious property (Mosques / Shrines) in the Project Area. The survey results are highly significant (100%) regarding availability of Mosque like Abu-Bakar, Bilal, Ghousia, Baba Fazalshah, Jamia, gusia, jamia gulzar e madina, jamia Noor Din & Jamia Namria, Masjid Qutab Ferozwal, Jamia Faridea and jamia usmania etc. in the Project Area a little number of shrines was also reported by project people like darbar Sain Ghulam Hussain, Baba Clyan Shraif and Baba Fazal Shah.

E) Awareness Regarding the Proposed Project

A large number of respondents 88% were aware of the proposed Project while only 12% were those, who had no prior knowledge of the Project (**Table 4.32**).

Table 4.32: Awareness about the Project

Knowledge about the Proposed Project			
Sr. No.	Response	Number	Percentage
1	Yes	53	88
2	No	7	12
Total		60	100

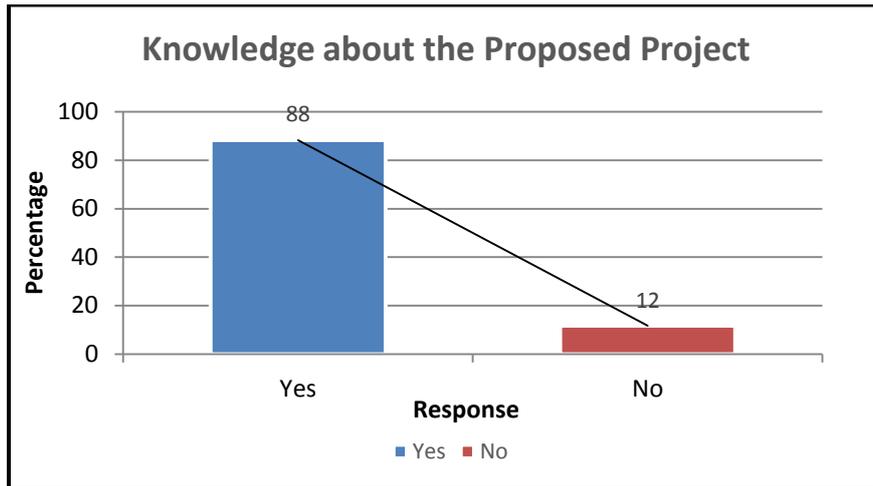


Figure 4.34: Graphical View of Awareness of Project

F) Acceptability of the Proposed Project

During the survey 67% respondents favored the construction of this project keeping in view its importance and 33% respondent's response were against the construction of the proposed project due to loss of their property and business structures. (Table 4.33).

Table 4.33: Acceptability of the Proposed Project

Acceptability of the Proposed Project			
Sr. No.	Response	Number	Percentage
1	Yes	40	67
2	No	20	33
Total		60	100

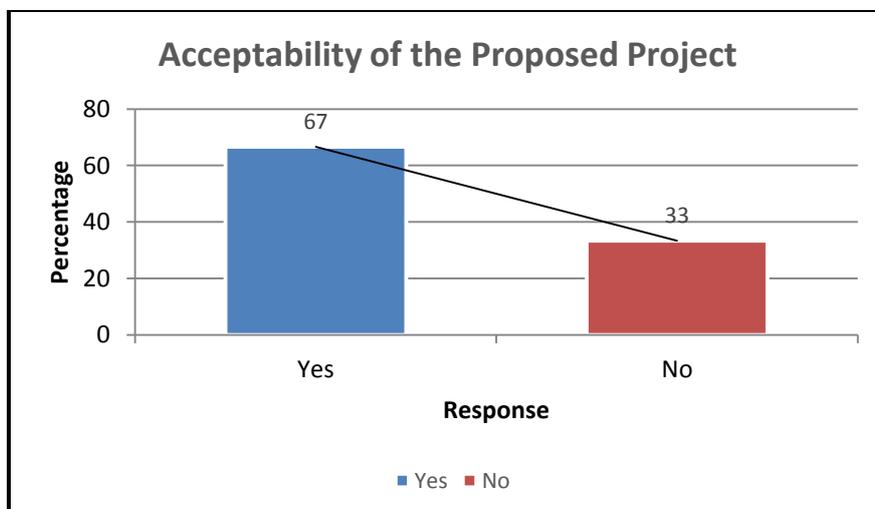


Figure 4.35 : Graphical View of Project Acceptability



i. Pressing Needs

Survey outcomes showed that the project population needs a number of facilities such as Clean Drinking Water, Sui gas, Infrastructure, Schools and Hospitals as depicted in **Table 4.34**. It shows that the Educational and health facility was the most desired need by 31% of the total sampled respondents. Whereas, 12% demanded for gas facility. 24% demanded for up gradation of existent roads, 19% were deprived of clean water and upgradation of sewerage system and 14% respondents needed for graveyard in the area. **Figure 4.36** given below is about graphical presentation of pressing needs of the Project Area of influence.

Table 4.34 : Pressing Need of the Area

Pressing Needs of the Area			
Sr. No.	Pressing Needs	Number	Percentage
1	Gas	7	12
2	Road & water	14	24
3	Schools and Hospitals	19	31
4	Water & Sewerage	12	19
5	Graveyard	8	14
Total		60	100

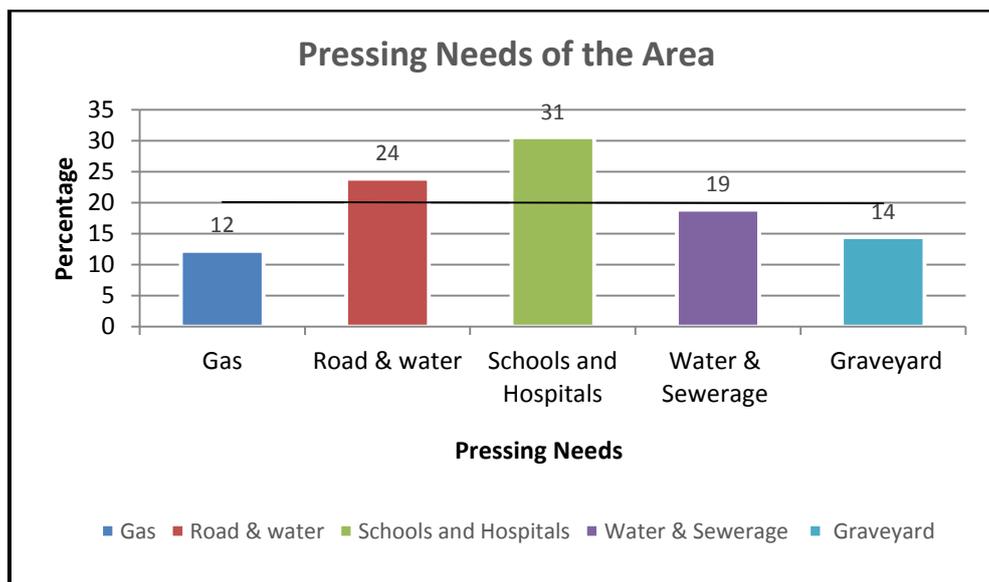


Figure 4.36: Depicts the Graphical Representation of Pressing Need of Project Area



5 STAKEHOLDER CONSULTATIONS

5.1 GENERAL

This section describes the outcome of the Public Consultation sessions held with different stakeholders that may be directly or indirectly affected by the proposed project. Public Consultation is mandatory for development projects. The adequacy of the Public Consultation and information disclosure is one of the basic criteria used to determine the project compliance with the national / international safeguard policies.

The consultation process was carried out in accordance with the requirements of Pakistan Environmental Guideline for Public Consultation.

5.2 OBJECTIVES OF PUBLIC CONSULTATION

The objectives of this process were to:

- Inform the public about is proposed project.
- Identify and involve all stakeholders, especially local residents, in the consultative and participation process;
- Share information with stakeholders on the design and construction of the proposed project and anticipated impacts on the physical, biological and socio-economic environment of the Project Area;
- Understand stakeholders' concerns regarding various aspects of the project, including the existing available facilities and problems, construction of the project and the likely impacts (positive & negative) of construction and operation related activities;
- Understand the perceptions, assessment of social impacts and concerns of the communities in the vicinity of the proposed project;
- Provide an opportunity to the public in the Public Consultation session to provide valuable suggestions for the project design in a positive manner; and
- Reduce the chances of conflict through the early identification of controversial issues, and consult them to find acceptable solutions.

5.3 CONSULTATION AND PARTICIPATION PROCESS

For ascertaining the perceptions of different stakeholders about the project (during construction/operation) consultation meetings were held with them. These meetings were carried out in the vicinity areas of proposed project. The meetings with stakeholders were carried out during 11 to 15 March, 2020.

Public Consultation was carried out in order to establish stakeholder's opinion regarding project implementation. The following tools were used for public consultation with project stakeholders

- Scoping Sessions
- Formal Meetings



- Informal Meetings
- Individual Interview

5.4 IDENTIFICATION OF STAKEHOLDERS

Stakeholders are those who have a direct or indirect interest in project development, and who will be involved in the consultation process. During the field survey, significant efforts were made to identify the possible categories of stakeholders and their stakes. The stakeholders identified during field survey were given in **Table 5.1**. All the stakeholders had different type of stakes according to their professions which are listed down along with their apprehensions. Informal group discussions were also held as an additional tool for the assessment of the perceptions of the stakeholders.

Table 5.1: Stakeholders Category in the Project Area

Sr. No.	Stakeholder Category
1	Local Residents
2	Shop Keepers
3	Property Dealer
4	Students
5	Teachers
6	Laborers
7	Imam Masjid
8	Govt Employees
9	Private Job
10	Retire Official

5.5 STAKEHOLDERS AND THEIR APPREHENSIONS

Among all stakeholders some major stakeholders were identified in the proposed Project Area. **Plate 5.1** shows the pictorial view of Interviews and consultation meetings held with the stakeholders. **Table 5.2** contains the list of major stakeholders and their apprehensions.

Table 5.2: Major Stakeholders and Their Apprehensions in the Project Area

Sr. No.	Stakeholders	Apprehensions
1	Local Residents/ Retire Officials	PAPs (legal land holders and encroachers) will have to lose their land and housing structures due to the land acquisition for the proposed project and will ultimately result in permanent physical and economic displacement. During construction period, local resident will face difficulties while walking to nearby places existing in the vicinity of proposed Project Area. Movement problem for local residents, dust and noise problem, privacy / safety issues, disturbance of public utilities, traffic jam and destroy the environment.
2	Shopkeepers	Loss of business & reduction in number of customers during construction phase, noise, air pollution, dust and noise, movement problem.



Sr. No.	Stakeholders	Apprehensions
3	Property Dealers	Loss of business & reduction in number of customers during construction phase, noise, air pollution, dust and noise, movement problem.
4	Customers	Movement problem for customer, dust, noise and vibration problems, safety issues.
5	Students	Movement problem for students, dust, noise and vibration problems, safety issues.
6	Govt Official	Traffic congestion, dust, noise and vibration, disruption to travelers, increase travelling time during construction. Need more plantation in the area
7	Private Employee	During construction period, we will face difficulties while moving to offices and increase in travelling time. Also, face difficulties walking to nearby places existing in the vicinity of proposed Project Area.
8	Imam Masjid	During the construction phase, we may face the issue of dust and movement, disturbance for people coming for namaz, need relocation of masque.
9	Teachers	Movement problem, dust, noise and vibration problems, safety issues, traffic congestion, increase in travelling time.
10	Laborers	Loss of labor, dust, noise and vibration problems, safety issues, traffic congestion, increase in travelling time.

5.6 CONSULTATION MEETINGS AND FORMAL & INFORMAL GROUP DISCUSSIONS

Scoping sessions were conducted with these stakeholders, these sessions were carried out at various locations of the proposed Project Area. Consultation meetings regarding project impacts, their magnitude and mitigation measures were held with the, local residents, Shopkeepers, property dealer, students, teachers, laborers, imam Masjid, Govt department employees, private employees, retire official, advocate and general public to know their concerns regarding proposed project.

Generally, it was found that people were already aware of the proposed project. After the meetings, respondents including local residents and other stakeholders showed mixed support for the proposed project without any delay. This project will be beneficial in terms of control over traffic congestion as well as good infrastructure development, not only for the local residents but also good for the economic development of the area. According to some stakeholders this project is not possible for this area because this will ultimately result in permanent physical and economic displacement which destroy their living environment.

5.7 CONCERNS / SUGGESTIONS OF THE STAKEHOLDERS

The most commonly raised concerns during the meetings are listed below:

- Construction of proposed Development of Lai Expressway should be completed in time without any delay because we are listening about this project from last 20 years.
- Exposure of noise and dust pollution will cause disturbance and health & safety issues to the local residents and other stakeholders throughout the construction



stage due to the movement of construction machinery and transportation of construction materials. The effects of noise and dust pollution on the local residents should be minimized by making necessary arrangements. Dust pollution should be controlled by water sprinkling on regular basis;

- Due to the movement of loaded trucks during the construction period of proposed project, congestion on the access Road will increase. Proper diversion route rather than access Road should be clearly defined to avoid traffic blockage during the entire construction period;
- During construction period, local residents, road users and students will face difficulties while moving to places in the vicinity of proposed Project Area. Appropriate diversion plan should be developed to avoid the disruption of all the people due to use of heavy machinery in day timings and should avoid disturbance for the local residents living in the project vicinity;
- Local residents should be given priority for jobs during the construction phase;
- Due to the construction of the proposed project, public utilities will be disturbed. Arrangements should be made to minimize the disruption of public utilities or they may be rehabilitated on priority basis to reduce the impacts;
- Increase in traffic and safety hazards will create problems to local population and surrounding communities. Accordingly, a detailed health and safety plan must be developed to mitigate the construction and operation risks of the proposed project on the local residents and surrounding communities.
- Solid waste produced during construction should be disposed of timely and properly.
- Construction material and site camp of labor should be located outside the residential area.
- The labor camps and batching plant should be away from the populated area.
- Good quality construction machinery may be used to reduce noise and pollution issue.

5.8 MITIGATION MEASURES PROPOSED FOR ADDRESSING THE STAKEHOLDER'S CONCERNS

The contractors and design consultants may include the following environmental and safety provisions in the project design in order to protect the surrounding communities from the anticipated impacts of pre and post construction activities:

- Significant efforts including change in design should be adopted to minimize the physical and economical disturbance of the local residents.
- Local residents should be given priority while hiring during construction phase of the proposed project;
- Construction machinery should be placed at adequate locations away from the sensitive areas to minimize the impacts related to the noise;
- Project facilities should be located outside the existing residential areas. In order to avoid restricting the daily movement of the local residents, construction vehicles should remain confined within their designated areas of movement;
- The utilities to be shifted due to the implementation of the proposed project should be rehabilitated on priority basis to minimize the impacts on the stakeholders;
- Solid waste generated during construction at site should be disposed-off safely at the waste disposal sites approved by the client; and
- All necessary measures should be taken to ensure the safety of traffic during construction, including barricades, signs boards, pavement markings, flags, and lights). All such barricades will be set up to facilitate the local traffic.



5.9 DETAILS OF MEETINGS WITH DEPARTMENTAL STAKEHOLDERS

The detailed schedule of meetings at site with the departmental stakeholders and the issues raised by them are given below in **Table 5.3**.

5.10 DETAILS OF MEETINGS WITH PRIMARY STAKEHOLDERS

The detailed schedule of meetings at site with the primary stakeholders and the issues raised by the respondents are given below in **Table 5.4**.



Table 5.3: Details of Departmental Consultations

Sr. No.	Department	Participants	Views / Concerns	Addressed
1.	Rawalpindi Development Authority (RDA)	Mr. Azizullah Khan (Deputy Director) 0333-5289384 051-5774444 Mr. Noor Rabbani (Assistant Director) 0305-7895427	<ul style="list-style-type: none">• The Deputy Director briefed that the proposed Lai Expressway route falls under the jurisdiction of Municipal Committee, RDA, Rawalpindi Cantonment Board, and Chaklala Cantonment Board.• He also elaborates that WASA is agency of RDA.• If the Lai Expressway route extends to Islamabad Capital Territory, then CDA will execute that segment of the road.	Noted down.
2.	Environment Protection Department (EPD), Rawalpindi	Mr. Amin Baig (DO, Environment) 0322-5177346 Ms Romaisa Babar (Assistant Director) Abdus Salam (Environmental Inspector)	<ul style="list-style-type: none">• Environmental monitoring needs to be done by considering sensitive receptors from EPA certified laboratory.• Community should be engaged to record their views and concerns.• Tree plantation plan should be developed and roadside plantation also needs to be done.	Noted down and suggested in the report.
3.	Pakistan Environmental Protection Agency (Pak-EPA)	Mr. Arshad Rafi Kiani (Deputy Director, EIA / Monitoring) 051-9250716	<ul style="list-style-type: none">• Environmental monitoring of ambient air quality, noise, ground water and wastewater should be conducted by considering sensitive receptors from EPA certified laboratory.• Issues regarding land acquisition and compensation should be resolved prior to start of construction activities.• Primary data should be collected for baseline environment of the Project Area and a comprehensive social survey needs to be conducted for this purpose.	Noted down.



Sr. No.	Department	Participants	Views / Concerns	Addressed
			<ul style="list-style-type: none">• Maximum flood levels of Lai Nullah should be considered during design phase of the Project.• A comprehensive waste management plan should also be part of the report.• Report should be precise and comprehensive.	
4.	Capital Development Authority (CDA)	Mr. M. Arshad Chouhan (Director, Regional Planning) 0334-5223488	<ul style="list-style-type: none">• Team briefed the official about the proposed Lai Expressway route.• Mr. Chouhan responded that proposed Lai Nullah Expressway should be connected with the proposed 10th Avenue instead of 9th Avenue.• He also informed that some projects of CDA are already proposed along the proposed route of Lai Expressway in Islamabad. Therefore, it is recommended to revisit the design in the light of above discussion.	Noted down and suggested in the report. Route related concerns are also conveyed to Design Team for further necessary action.
5.	Forest Department Soan Complex, Rawalpindi	Mr. Ashfaq Bashir Bhutta (Divisional Forest Officer) 0331-5419629	<ul style="list-style-type: none">• He recommended more vegetation enhancement for reduction of erosion and sedimentations.• He recommended that plantation of spacing 10*10 should be carried out if RoW is 20m.• He also suggested certain indigenous plant species to be planted including Terminalia, Alstonia, such chain and chir pine.• The concerned official recommended minimum damage of trees during implementation of the project and to avoid unnecessary damages to the soil and other natural resources.	Noted down.



Sr. No.	Department	Participants	Views / Concerns	Addressed
			<ul style="list-style-type: none">• He recommended proper sprinkling of sites to avoid dusts which leads to slowing the process of photosynthesis.	
6.	Wildlife Department, Rawalpindi	Mr. Muhammad Nadeem Qureshi (Deputy Director Wildlife) 0300-5426350	<ul style="list-style-type: none">• The consultant Ecologist shed light on the overall project and discussed the proposed route and project details.• The concerned official shed light on Indus flyway and guided us about some of the local birds nesting in the Project Area including quail and seasonal ducks.• He recommended Kikar and Ber to be planted there after construction because these plant species are suitable refugee's species for the local birds of the area.• He further shared that no game reserve or protected area is falling near the project vicinity.	Noted down.
7.	Parks and Horticulture Authority (PHA), Rawalpindi	Mr. Taimor Bashir (Assistant Director) 0303-6263781	<ul style="list-style-type: none">• Assistant director guided us in detail about the current situation of the area and told us that huge amount of plantation has been observed along the route which was then physically confirmed by consultant ecologist on the ground.• He informed us about the area designated to Horticulture authority for taking care of plantation.• He also told us about the previous plantations carried out and about bare rooted and evergreen plants of the concerned area.• He further told us that transportation of plants has been carried out from their	Noted down.



Sr. No.	Department	Participants	Views / Concerns	Addressed
			own nurseries raised by themselves to keep in touch the varieties and good health of the seedlings.	
8.	Fisheries Department ICT, Islamabad	Mr. Mazhar Ali (Deputy Director) 0300-5503745 Mr. Malik Nazir (Office Assistant) 0344-5503745	<ul style="list-style-type: none">The consultant Team shed light on the overall project and discussed the proposed route and project details.Deputy Director told us that no effect shall be made on fishes as far as the current project is concerned.He also shared some details about kinds of fish found in rivers and streams of the current region.	Noted down.
9.	Social Welfare Department	Javaid Iqbal (Social Welfare Officer) 051-44744015	<ul style="list-style-type: none">According to the social Welfare officer take necessary measure to save the community from dust and pollution and ensure the safety of traffic during construction. Local residents should be given priority while hiring during construction phase.Underground water pipe line should be avoided to damage. Shift pipelines step by step to minimize the effect of water supply. save the underground cable of PTCL, save the electric poles and supply lines,	Dust pollution should be controlled by water sprinkling on regular basis.



Table 5.4: Schedule of Meetings with Primary Stakeholders and their Concerns/ Apprehensions

Sr. No.	Agency/Department/ Stakeholder	Date	Time	Apprehensions Raised	Suggestions
1	Local Resident Jabbar	12-03-020	10:30 am	<ul style="list-style-type: none">• Vibration issues will take place due to the movement of heavy machinery during the construction period of the project which may damage the structures and may create health issues for the local residents.• According to stakeholders, no proper solid waste management system exists in the proposed Project Area. When solid waste will not be properly disposed of, odor will produce. Open dumping of the waste will cause larva breeding. Mosquitoes and other vectors will also grow up which finally results in outbreak of diseases like malaria, fever, typhoid etc. The affectees demanded that the odor produced by this proposed project should be minimized as much as possible in order to avoid a number of diseases in their living places.	<ul style="list-style-type: none">• Mitigation measures should be adopted to minimize the vibration effect of heavy machinery.• Efforts should be made that the odor produced by this proposed WWTP should be minimized as much as possible in order to avoid a number of diseases in their living places.
2	Wider Community Ghorakpur	12/03/2020	2:00 pm	<ul style="list-style-type: none">• The market value of the area will be decreased in construction and operational phase.• Being in front of this point, we will face direct impacts of the construction of this project.• Also, face the mobility problems due to the labor movement.	<ul style="list-style-type: none">• To avoid the mobility problem, an appropriate diversion plan should be developed and implemented.• Significant efforts including change in design should be adopted to minimize the physical and economical disturbance of the local residents.
3	Shopkeepers	09-02-2020	11:00	<ul style="list-style-type: none">• Customers will face movement problem during construction phase.	<ul style="list-style-type: none">• To avoid the mobility problem, an appropriate diversion plan should be



Sr. No.	Agency/Department/Stakeholder	Date	Time	Apprehensions Raised	Suggestions
				<ul style="list-style-type: none">• Delay in construction will create problems for locals.• Exposure of noise and dust particles for the locals would cause impacts on their health.	<p>developed and implemented.</p> <ul style="list-style-type: none">• The efforts should be made to complete the construction work within the given implementation period.• Dust pollution should be controlled by water sprinkling on daily basis.
4	Wider Community (Dhok Dalal, Pagwari etc)	13-03-2020	1400 pm	<ul style="list-style-type: none">• PAPs will have to lose their land and housing structures due to the land acquisition for the proposed project and will ultimately result in permanent physical and economic displacement.• Exposure of noise and dust particles for the local resident would cause impacts on their health.• Delay in construction will create problems.• Solid waste produced during construction period is a major concern.• The project should be complete well in time as per given project deadline.	<ul style="list-style-type: none">• PAPs (legal title holder and non-legal title holder) who suffered from physical displacement must be compensated on the basis of current market rate.• The effects of noise and dust pollution on the local residents should be minimized by making necessary arrangements. Dust pollution should be controlled by water smattering on daily basis.• Solid waste produced should be properly managed and disposed in designated area.• The project will be completed as per design time



Consultation Meeting with Locals



Consultation Meeting with Locals



Consultation Meeting with Locals



Consultation Meeting with Locals



Consultation Meeting with Locals



Consultation Meeting with Locals

Plate 5.1: Pictorial Presentation of Consultation Meetings



Consultation with Director, Town Planning at CDA, Islamabad



Consultation with Deputy Director at RDA



Meeting with Officials of Environment Department, Rawalpindi



Consultation with Assistant Director, PHA, Rawalpindi



Consultation with Divisional Forest Officer, Soan complex, Rawalpindi



Meeting with Deputy Director, Wildlife, Rawalpindi

Plate 5.2: Pictorial Presentation of Consultation Meetings with Department Representative

6 SCREENING OF POTENTIAL ENVIRONMENTAL IMPACTS & MITIGATION MEASURES

6.1 GENERAL

This section screen out the potential environmental and social impacts due to the implementation of the proposed Project on the physical, ecological and socio-economic environment. This Chapter also suggest/propose the mitigation measures that will help to avoid, reduce and mitigate the Project’s adverse environmental and social impacts due to the proposed Project.

The impacts of the proposed Project are divided into two (02) major components which are given below:

- Lai Expressway; and
- Trunk Sewer System along with STP.

6.2 TOOLS USED FOR IMPACT ASSESSMENT

As the methodology, has been described in Chapter-1. Following tools were used for the identification of the Project potential environmental and social impacts:

6.2.1 Project Impact Matrix

A Project impact matrix helps in identifying the potential temporal impact and screens the Project for environmental and social soundness. Each Project activity is screened separately with regard to its construction and operation phases and according to the various physical, ecological and social parameters. Matrices are used to identify temporal impacts. These impacts are categorized on the basis of nature, magnitude /severity, extent, timing, duration, uncertainty and reversibility. The classification criteria used in the Project Impact Matrix for the environmental impacts of the proposed Project activities is given below in **Table 6.1**.

Table 6.1: Impacts Classification Criteria for Project Impact Matrix

Level	Positive	Adverse
Insignificant / No Impact	○	○
Low	●	X
Medium	●	X
High	●	X

6.2.2 Overlays

In order to identify the spatial based (location based) impacts, overlays are used. An overlay is based on a set of transparent maps each of which represents the spatial distribution of environmental characteristics (for example susceptibility to erosion). Information for an array of variables is collected for the standard geographical units within the COI and recorded in a series of maps typically one for each parameter. These maps are overlaid to produce a composite map. The resulting composite maps characterize the area's physical, ecological, socio-economic and other relevant characteristics relative to the location of the proposed Project. Software used for the overlays are Arc View and AUTOCAD. For the subject Project digitized available Google Earth Imageries and ARC GIS was used to prepared overlay maps. Land-use maps prepared for overlays of the COI are attached as **Figure 4.17 & 4.18**.

6.3 DELINEATION OF PROJECT COI

Before proceeding to the environmental analysis of the Project, it is imperative to delineate the COI. COI is a limit which identifies the area where direct and indirect impacts of the Project activities are envisaged. This limit includes ROW and 25 m wide strip at either side of both banks of nullah Lai for collection of baseline information, impacts assessment and mitigation measures of physical, ecological as well as social resources.

Study Area for the STP is the area to be acquired for the construction as well as the adjoining area where the Project activities may have impact on the environment.

As the location of Construction/Contractor camps, vehicle, equipment yard, material quarry areas and access tracks have not been defined yet, so impacts evaluated due to these facilities in this section will be of generic nature.

6.4 POSITIVE IMPACTS

Due to the implementation of the proposed project components following benefits will be attained in terms of environmental, social, public health and economic sustainability:

- Smooth flow of traffic;
- Saving of vehicle travel time and vehicle operating costs of commuters;
- Reduction in traffic accidents and casualties by traffic congestions;
- Efficient movement of trade, goods and traffic in relatively shorter time;
- Reduction in the fuel consumption and transportation cost caused by traffic congestion and bumpy roads;
- Reduced in air emissions from vehicular exhaust especially in case of traffic congestion;
- Improved drainage and sewerage system;
- Enhancement in storm water carrying capacity of Nullah Lai due to elimination of sewage and wastewater flows during intense rain events;
- Attenuations in the pollution risks to the groundwater due to leakage in timeworn sewer pipes;
- Improved public health, hygiene and sanitation;

- Improved environmental aesthetics of the areas;
- Decline in loss of income due to dumping of electrical appliances due to emissions of methane and hydrogen sulphide from Nullah Lai; and
- Increase in economic growth by providing employment opportunities to the local residents and vendors.

6.5 POTENTIAL ADVERSE IMPACTS

Apart from positive impacts of the Lai Expressway and trunk sewer system & STP on the environment, there are number of potential significant adverse environmental and social impacts on the local environment. The proposed Project has been divided into three (03) phases i.e. Pre-construction/ Planning phase, Construction phase and Operational phase.

6.5.1 Adverse Impacts During Pre-Construction/ Planning Phase

Following is the brief description of impacts envisaged and the recommended mitigation measures during Pre-construction/Design Phase of the proposed project.

6.5.1.1 Physical Environment

i. Design & Layout Planning

Component I & II

Incompatible layout plan and engineering design of the project's structures can undermine the overall aesthetic beauty and ambience of the Project Area. Also low utilization of the available spaces and not designing the structures taking into account, the prospective and futuristic needs can result in structures with low social acceptability and functionality. This impact will be permanent and moderate negative in nature.

Mitigation:

All structural, layout and engineering designing of Lai Expressway and Trunk Sewer & STP should be in strict accordance with the applicable by-laws and engineering parameters.

i. Sensitive Receptors and Existing Infrastructure

Component-I

The proposed expressway will cross major roads at twelve (12) locations and railway track at one (01) location. The RoW of Expressway has the potential to negatively impact sensitive receptors (graveyards, schools, hospitals, environmentally sensitive areas) and existing infrastructure (roads, railways, etc.). This impact will be permanent and major negative in nature.

Component-II

Proposed trunk sewer line will pass within the vicinity of several settlements and it is impossible to completely avoid all infrastructure and sensitive areas. Moreover, improper route selection for the Conduit from Soan Adda to STP can lead to social issues of resettlement/relocation of assets and displacement of people. This impact can be major negative in nature.

Mitigation

To mitigate these impacts:

- During the selection of the alignment and route of proposed expressway and sewer line, significant efforts will be directed to avoid or minimize impacts on sensitive receptors and existing infrastructure by incorporating environment- friendly construction methods in the engineering design.
- Works around public utilities will be carried out in consultation with relevant authorities. Public consultation will be undertaken prior to the construction phase to ensure that the public is aware of planned construction activities.

ii. Land Acquisition and Resettlement

Component-I

One of the major project related impact will be the land acquisition for the Project ROW that will result in causing disturbance to the affected residents of the Project Area. About 1,711 kanals of land would be acquired for the construction of 16 km proposed Expressway whereas 675 acres of land has already been acquired by RDA for the construction of STP. Moreover, the land required for the proposed project is mostly residential with mainly dense population. This impact will be permanent and major negative in nature.

Component-II

No land acquisition is involved for laying trunk sewer line. However, about 675 acres land has already been acquired for construction of proposed STP.

Mitigation

Mitigation measures will involve careful alignment and route selection by the design team to minimize the impacts by avoiding the residences of affected families. Proper access should be provided to the nearby communities at a minimum travel distance. For the land coming in the ROW, the affected people will be compensated in a fare manner and rate should be given at current market value.

iii. **Site Selection of Construction Camps and Storage of Construction Material / Stockpiles**

Component-I & II

The site may require for establishment of workers camps, workshops and stockpiles for the proposed expressway and trunk sewer. Selection of site for construction camps and stockpiles shall be near the construction site. However, if it is deemed necessary to locate elsewhere, sites should consider avoiding any damage of property, vegetation, irrigation, drinking water supply systems and away from residential areas.

The priority should be given to protect the human environment (i.e. to curb accident risks, health risks due to air and water pollution and dust, and noise, and to prevent social conflicts and crime). Otherwise it may affect the progress of the project. This impact is local, medium intensity, short term, reversible and high probability.

Mitigation

- The Contractor shall identify the site for construction camp in consultation with the individual owners and community representatives;
- There should be no resettlement issue for the location of the camps;
- Selection of a site for construction camps and stockpiles shall be near the Project Area;
- Campsite should be away from the residential areas and sensitive receptors;
- The Campsite must not be subject to periodic flooding, nor located in the near vicinity of swamps, pools, sink holes or other surface water bodies;
- All sites must be graded, ditched and rendered free from depressions in which water may become a nuisance;
- The camp site should consider avoiding any damage of property, vegetation, irrigation, and drinking water supply systems; and
- Existing infrastructure, in particular the water and sanitation, electricity and transport systems of the host community will not be compromised by external workforce.

iv. **Seismicity**

Component-I & II

The proposed Project falls under Zone-2B (zone of moderate damage) as per seismic zoning map included in Building Code of Pakistan prepared by NESPAK. In case of an earthquake, the proposed Expressway, outfall trunk sewer and STP are expected to suffer damages if they are designed without consideration of seismic activities. This would be permanent and major negative in nature.

Mitigation

At the detailed design stage, the safety of the proposed Expressway, outfall trunk sewer and STP against the damages due to the seismic activity will be ensured. The design will be checked against expected seismic factors in view of the seismic and geological record of the area. However, Zone-2B parameters will be adopted for the design of all the project structures.

v. Flooding

Component-I & II

The water regime of the Nullah Lai is characterized by monsoon floods and large devastation has been reported in the previous incidents of floods. In every monsoon season, the nullah overflows after being fed by its catchment basin (234.8 km²) in the Margalla Hills. The most recent floods that occurred in the nullah are of 27 August 1997 and 23 July 2001. The flood peaks generated in the Lai Nullah was 43,000 cusecs and 94,000 cusecs for the two major floods, respectively. Which claimed number of lives in addition to huge monetary losses which included severe damage of 3,000 houses.

The basic aim of the project is to construct a flood channel that will be helpful in saving the citizens of Rawalpindi from the situation of floods. Failure to address this issue at the design level will most certainly impact the operations of the road, trunk sewer and STP. It will also reduce the project life through erosion and destruction of infrastructure.

Mitigation

- The design of the Nullah Lai will be based on detailed hydrological investigation, which will include past peak flood records. The cross-section of the Nullah Lai will be sufficient to accommodate peak flood flows.
- All the structures of the proposed Project will be designed to withstand the highest flood level in the Nullah Lai. A detailed hydrological study will be required out to precisely forecast the impact of flooding on the proposed structures and vice versa. The designer will ensure that the trunk sewer and its appurtenances like manholes are protected against damages by placing the manholes above the highest flood level and if the manholes at some places are laid below the highest flood level, they will be properly sealed.

Component-II

In addition to the above mentioned impacts, there are some other issues that are closely related to the design of Trunk Sewer and STP which are as follows:



vi. Infiltration

Infiltration rate will be much higher due to installation of the sewers under / above the bed (depending upon the final design) of flowing Nullah as compared to dry conditions. This may significantly increase the design flow affecting the working efficiency of the trunk sewer.

Mitigation

The designer will pay due consideration to this factor and adopt infiltration rates as per field conditions.

vii. Scouring

The part of outfall trunk sewer that will be laid under / above the bed (depending upon the final design) of the Lai Nullah and that will rest over pile structure is subjected to the scour action especially during high floods. The bed levels may be lowered by scour action at that point. This may expose the trunk sewer and result in damaging the trunk sewer line and its appurtenances.

Mitigation

The designer will study and establish scour depth along the route and protect the sewer and the appurtenances against scouring action.

6.5.1.2 Ecological Environment

Component-I & II

To ensure sustainable development, various mitigation and enhancement measures have to be integrated at the early stages of project planning. Furthermore, appropriate mitigation measures that is newly planned and implemented in future, which are currently in operation, need to be devised.

i. Vegetation Cover

During the pre-construction phase, activities such as installation of construction camps, construction of temporary roads and mobility of construction staff may damage the local vegetation/trees. As the heavy machinery and camps will be moved and installed, which require significant space due to which available vegetation is expected to be removed. This impact is Site-specific, Permanent, Irreversible, Medium Significant and needs to be encountered prior to the start of construction stage.

Mitigations

- The camps, mobility of machinery and construction of temporary road should be proper planned and well designed to avoid any loss to local green cover.

- It is recommended to establish the construction camps where minimum or no vegetation exists.
- Similarly, the alternate routes for roads and points for camps are recommended where no loss of vegetation is expected.
- The location of construction camp will be selected so as to have limited environmental effect during construction phase and to reduce the cost and land requirement.

ii. Fauna

As movement and installations of machinery and vehicles will take place so noise and habitat loss is expected. The routes of the available wildlife and other habitats may be affected due to camps set-up and machinery movements & installations. Temporary road may also affect the habitat of locally available fauna. This impact is Site-specific, Temporary, Irreversible and Low Significant.

Mitigations

- The standard measures must be adopted to minimize noise due to machinery movements and installations;
- Wildlife movements and routes must be considered during activities and should be avoided to their maximum level;
- The alternate routes and points are recommended to avoid any damage to locally available fauna;
- The camps shall be properly fenced and gated to check the entry of animals in search of eatable goods; and
- Similarly, wastes of the camps shall be properly disposed of to prevent it being eaten by animals, as it may be hazardous to them.

6.5.1.3 Socio-Economic Environment

Component-I & II

During the planning and design phase of the Project it is anticipated that there will not be any potentially significant adverse impact on the socio-economic environment. Locals may be temporarily disturbed due to the field investigations and site clearance activities. It is anticipated that key range of socio-economic issues will be raised by host community due to development activities:

- Uncertainty and security of future;
- Fear of displacement and resettlement;
- Imminent loss of physical assets;
- State of disturbance and stress prevalent among communities; and
- Fair compensation and delaying factor in making payment if any involved.



This impact can be categorized low negative, site-specific and reversible.

Mitigations

The design consultant shall carefully select the alignment and route to minimize the impact by avoiding the residences. Provision of local population will be given preference in construction related jobs. Most unskilled workers will be hired from local communities, while for skilled manpower also, first choice will be given to local area residents.

6.5.2 Adverse Impacts During Construction Stage

6.5.2.1 Physical Environment

i. Topography

Component-I

The proposed project lies in the plains and mountainous area and the topography of the area will be changed due to excavation and filling of the area in order to stabilize and strengthen the slope of the area. Excavation and filling will have significant change in the topography during construction. This impact can be categorized as site-specific, medium negative and irreversible.

Component-II

The proposed Trunk Sewer will be laying along the both sides of Nullah Lai and finally moves along the Soan River and ends at STP. There is no impact on topography of the Project Area due to Component-II of the proposed project.

Mitigation

Mitigation measures will include:

- Excavation shall be controlled and shall be strictly limited to the Project Area;
- Incorporate technical design measures to minimize removal of trees and disturbance to natural habitats; and
- The aesthetics of the area shall be restored to original or better condition.

ii. Land Use

Component-I & II

The land use of the study area is mainly residential and commercial covered by educational institutions, health facilities, religious sites (mosques, graveyards and shrines), recreational amenities, surface water bodies, tubewells, wells, industrial area, and road side green belt. Construction of the proposed road and Trunk Sewer would involve several key land use issues and impacts, including:



- Acquisition of land for ROW and ancillary facilities (e.g., access roads, Interchanges, flyovers, underpasses and construction camps);
- Possible damage to public utilities such as drains, Telephone lines, Electricity polls and cables, etc.;
- Potential visual impacts attributable to the removal of existing vegetation and visibility of exposed soil; and
- Increased dust and noise to neighbouring residential and commercial areas

The duration of the construction phase would also affect the degree of land use impact for which proper remedial measures will be needed. This will be local, medium negative and irreversible in nature. Permanent impacts would also include the presence of new ancillary facilities as well as visual disturbances in the landscape (i.e., tree removal, demolition of residences, etc.).

Mitigation

- General best management practice measures, including worksite appearance, maintenance, and noise and dust control;
- Measures to avoid or minimize potential damage to public infrastructure.
- Efforts shall be made to avoid or minimize the removal of vegetation, however, if removal of trees is unavoidable; compensatory plantation shall be done;
- Camp sites will be established on waste/barren land rather than social and commercial land. However, if such type of land is not available, it will be ensured that minimum clearing of the vegetation is carried out and minimum damage is caused to trees and undergrowth;
- Construction vehicles, machinery and equipment will remain confined within their designated areas of movement;
- Contractor will provide gas cylinders at the camps for cooking purposes and cutting of trees/bushes for fuel will not be allowed;
- Installing temporary fences with gates around construction areas to prevent injury to people, livestock or workers; and
- Returning damaged improvements to at least their condition prior to construction.

iii. Soil Erosion

Component-I

Impact of soil erosion is expected during construction activities *viz.*, clearing and grubbing, excavation, filling, concrete works and setting up construction camps and operation of vehicles as these will affect the existing soil condition within the COI. Moreover, tree removal will loosen the soil thus making it more prone to erosion.

The likely impacts of soil erosion are:

- Excavation of earth/cutting operations, clearing of vegetation and land levelling activities can destabilize the surrounding land surface, particularly if the excavated area is left unfilled for long time, which may lead to rainfall induced soil erosion;
- During rainfall, the eroded soil if mixed with stagnant water can form slush thus impacting movement of vehicles and machinery as well as of the local people, ultimately hampering construction work.
- Onsite storage of the construction materials such as sand, aggregate, crushed stone, cement, bricks, lubricants, fuels and iron bars on the land without an intervening barrier, can degrade soil quality and may smear them with fine particulates of the dumped materials;
- Improper onsite storage of equipment and machinery such as wheel barrows, mixers and compactors and disorderly parking of machinery and equipment may cause soil contamination from trickling or accidental leakages of oils and lubricants.

Component-II

The construction of trunk sewer and STP will involve laying of new pipelines, clearing of the area (cutting of tress, bushes, etc.), Removal of spoil material i.e. solid waste, sludge from Nullah Lai, excavation, bedding, joining/welding, backfilling, ground works for the STP, etc. These activities may result in soil erosion which may become significant in rainy seasons. In addition to soil erosion, localized contamination of soil in the construction phase may result from the storage, handling and transfer of lubricants and fuels, liquids and solid waste. This impact will be short term and moderate negative in nature, but cumulative impact of construction of both components will be high negative and require stringent mitigation and management measures. Which will be discussed in detail at EIA stage.

Mitigation

- Good engineering practices will help in minimizing the soil erosion both at the construction sites and in peripheral areas, particularly along the haul tracks;
- All machineries and materials should be stored at the designated areas and compounds;
- Special slope protection measures should be adopted in the sensitive areas;
- Site restoration plan for the Project should be strictly followed; and
- Controlled and well managed vehicular movement, excavation, vegetation and regular water sprinkling will reduce the chances of soil erosion.

iv. Air Quality

Component-I

Ambient air quality will be affected by the fugitive dust and emissions from the construction machinery and vehicular traffic during the construction phase of the Lai Expressway. Emissions may be carried over long distances depending on the wind speed, wind direction, temperature of the surrounding atmosphere, atmospheric stability, topography, occurrence



of any significant obstruction such as buildings and type of terrain. The critical sources of air pollution during the construction phase are:

- Excavation activities at the project site would cause a minimum dust impact as the material excavated would be mainly from the Nullah having moisture content: however, the tasks involving channelization of Nullah, demolishing of the structures and the excavation of borrow and quarry areas would be the potential sources of construction dust emission.
- Transportation of construction materials such as earthen materials, aggregate and sand in uncovered form;
- Open storage of construction materials;
- Earthwork operations such as land clearing, excavation, hauling, dumping, spreading, grading and compaction;
- Movement of construction machinery, equipment, construction materials transport vehicles on unpaved roads or areas;
- Construction activities like preparation of concrete at batching plants;
- Exhausts of construction machinery, equipment, vehicles mostly using diesel as fuel; and
- Emissions from asphalt and batching plants.

The emissions from the above sources would cause a lot of public health hazard and nuisance to the communities resided in the immediate surroundings of the proposed Project Site. The major pollutants in the atmosphere would be Carbon Monoxide (CO), Oxides of Sulphur (SO_x), Oxides of Nitrogen (NO_x), Particulate Matter (PM₁₀), Volatile Organic Compounds (VOC) etc. Generators would be another source of air pollution. This impact will be direct and medium negative.

Component-II

In addition to the above-mentioned activities and their associated impacts, there are several construction activities related to component-II that will also impact air quality of the Project Area. These activities may also affect the agricultural crops surrounding the STP. The impact of construction of trunk sewer and STP will be low to medium negative and temporary in nature. However, cumulative impact of both project components will be enhanced and may cause health issues in neighboring communities and to the workers and staff of the contractor via some diseases such as asthma and bronchitis, dryness and roughness of the throat, eyes, nose, etc.

Mitigation

The following effective measures need to be adopted for controlling the potential adverse impacts on ambient air quality:

- Sprinkling of water shall be carried out at all the surfaces likely to generate fugitive dust emissions;

- Storage of construction materials shall be made either in sheltered areas or within hoardings. The storage areas shall be located away from sensitive receptors. Stockpiles shall be covered with tarpaulin with application of sprayed water during dry and windy weather. During high wind, no dust generating operations shall be permitted near residential areas having regard to the prevailing wind direction. Stockpiles of debris shall be dampened prior to their movement;
- Concrete batching plants should be equipped with dust control equipment such as fabric filters or wet scrubbers to reduce the level of dust emissions;
- Ensure the proper and periodic tuning of the vehicles;
- Haul-trucks carrying sand aggregate and other materials will be kept covered with tarpaulin to reduce the dust pollution;
- NEQS provisions for ambient air quality, stack emission, noise levels and vehicular exhaust should be used for reference during the construction works.

v. Noise

Component-I

Noise generated by the construction machinery during the construction stage is likely to affect the COI particularly the sensitive receptors like nearby schools, hospital etc. Sources of noise during construction of Lai Expressway are heavy machinery such as bulldozers, excavators, stabilizers, concrete mixing plant, pneumatic drills, stone crushers and other equipment. This impact will be temporary and moderate negative in nature.

Component-II

Construction noise impacts related to Trunk Sewer & STP are from construction machinery, generators, construction activities and vehicular movement carrying construction materials and spoil. The noise impact of component-II is not anticipated to be significant.

These combined activities of both components will have significant noise impacts on pedestrians and residents of properties adjacent to the Nullah Lai/sewer routes and STP. According to the PEQS, the noise level of vehicles is 85 dB(A). The noise levels higher than the given standard may cause psycho-physiological disorders such as impaired alertness, disturbed sleep, hypertension, headaches, neuroses, gastric troubles and reduction in mental and physical efficiency, hearing impairment and in acute cases, permanent hearing loss, rupture of ear drum etc.

The phasing of Lai expressway and sewer construction will ensure that noise impacts in each location are only for a short period of time and will be limited to normal daytime working hours. Noise impacts, although temporary, will have be mitigated using standard silencing equipment. Internationally recognized regulations limiting noise will be included in the specifications of all contract documents for construction works and supply of mechanical and electrical equipment.

Mitigation

- Selection of up-to-date and well maintained plant or equipment with reduced noise levels ensured by suitable in-built damping techniques or appropriate muffling devices;
- Confining excessively noisy work to normal working hours in the day, as far as possible;
- Providing the construction workers with suitable hearing protection like ear cap, or earmuffs and training them in their use;
- Preferably, restricting construction vehicles movement during night time;
- Heavy machinery like percussion hammers and pneumatic drills should not be used during the night without prior approval of the Client;
- Vehicles and equipment used should be fitted, as applicable, with silencers and properly maintained;
- Use of low noise machinery, or machinery with noise shielding and absorption;
- Contractors should comply with submitted work schedule, keeping noisy operations away from sensitive points; implement regular maintenance and repairs; and employ strict implementation of operation procedures; and
- Noise barriers in sensitive areas in the form of high boundary walls (concrete or wood), earth berms, etc. in front of schools, hospitals and mosques.

vi. Waste Disposal (Construction Waste and Hazardous Waste)

Due to construction activities waste will be generated at construction and contractors camp site, which is discussed below in detail. The data is not available about construction camp site and workforce; hence identified impacts are of general in nature.

a) Liquid and Solid Waste from Construction Camps

Component-I

Approximate labor in all camps involved for road works will be depended on the Contractor's activity schedule at the time when the contract is awarded. Total amount of water required for the camps domestic and drinking water requirements is not much. However, a proper planning should be done for the source of water to be used to provide water for the camp area. Disposal of wastewater without treatment will pollute the soil and groundwater.

Workers Camp will generate solid waste of domestic nature comprising kitchen waste, garbage, putrescible waste, rubbish and small portion of ashes and residues. Improper waste management activities will result in unhygienic conditions, health risk to work force and public at the camp site.

The likely impacts of solid waste are:

- Inadequate waste management practices can increase disease transmission, contaminate ground and surface water and ultimate damage to the ecosystem.



- Insecure and unhygienic disposal of the solid wastes generated at the worksite, particularly garbage and trash may cause degradation of soil and land;
- Insecurely disposed off heaps of wastes containing kitchen garbage and food waste can serve as breeding grounds for the disease spreading vectors and rodents;
- Throwing away of solid wastes into water channels and the wastewater network can result into choking of the water system.

This impact will be moderate negative and reversible.

Component-II

During the construction phase of Trunk Sewer, wastewater will be produced from construction camp and other construction activities. Construction camps for Component-I and II may be developed at same location. Hence wastewater and solid waste related impacts due to construction camps will be the same as described above.

Cleaning of Nullah Lai and disposal of solid waste from the both banks of nullah would be the main area of concern. About 3,598,920 m³ of solid waste will be generated. This issue is short term but can be severe in nature.

Mitigation

To dispose the liquid and solid waste generated from the construction activities, the following steps should be taken by the Contractor:

- During construction phase, temporary drains and septic tanks would be necessarily made to dispose sewage waste appropriately. Proper monitoring to check the compliance of PEQS will be carried out;
- Sewage from construction camps will be disposed of after proper pre-treatment and processes such as soakage pit;
- All the solid waste from the camps should be properly collected at source by placing containers and disposed of through proper solid waste management system. The Contractor will coordinate with local representatives and administration concerned department for the disposal of solid waste; The concerned department must develop a plan of action for transporting the waste to the disposal site for final disposal. It is the responsibility of the concerned department to ensure that the disposal site is properly lined to prevent the leachate from contaminating the groundwater;
- Secondly, the disposal site must be located away as far as practical from populated areas and regions that have a high density of Wildlife;
- Toxic waste will be handled, stored, transported and disposed-off separately;
- The waste will be properly sealed in containers with proper labels indicating the nature of the waste;
- Solid waste will be segregated at source so that it can be re-used or recycled;
- Insecticides that are less toxic to human health should be used;

- Construction workers and supervisory staff should be encouraged and educated to practice waste minimization, reuse and recycling to reduce quantity of the waste for disposal;
- Prohibit open burning of solid waste;
- Solid/hazardous waste removed from cleaning of Nullah Lai should be disposed off at designated landfill site;
- Transport routes should be coordinated with the relevant government department and communities for safe haulage; and
- Trucks carrying waste/sludge should be covered with protective sheets.
- A sanitation plan & construction waste management plan has been proposed which is attached as **Annex-VI & VII**.

b) Construction Waste (Component-I & II)

The construction waste will include wastewater, oil spillage from machinery and solid waste (damaged or spoiled materials, temporary and expendable construction materials etc.). The handling and storage of oil, asphalt/bitumen may be a source of environmental pollution as a hazardous waste. Improper disposal of construction waste can lead to nuisance and hazards towards environment and local population.

The likely impacts of construction waste are:

- The unspent materials and debris produced from consumed up materials, if left as such and allowed to mix with soil underneath, can degrade the quality of receiving soils and may render them unfit for plantation later on;
- Leakages of oils, lubricants, chemicals, and other similar substances from their storage sites and from engines of the generators, machines, equipment and vehicles can spoil the receiving soils and may undermine ability of the spoiled soils to support growth of vegetation and plants;
- Also, washing of the gadgets, machinery and equipment without proper drainage of the washout water can adversely affect the soil quality.

This impact will be short term, moderate to high negative and reversible.

Mitigation

Mitigation measures will include:

- Wastewater effluent from equipment washing yards would be passed through gravel/sand beds to remove oil/ grease contaminants before discharging it into natural streams;
- An efficient and responsive solid waste management system should be devised for the entire duration of the construction phase. Such a system should provide for separate collection of different categories of constructional wastes. The wastes which will be reusable/recycleable (iron bars, aluminum) should be sold to waste vendors

and those which cannot be sold out (brick pieces) may be used as a filling material for leveling the depressions, subject to technical feasibility;

- Training of working force in the storage and handling of materials and chemicals that can potentially cause soil contamination;
- Solid waste generated during construction will be safely disposed in demarcated waste disposal sites and the contractor will prepare a site-specific waste management plan;
- Proper labelling of containers, including the identification and quantity of the contents, hazard contact information etc. and Material Safety Data Sheets (MSDS) should be strictly followed during handling and storage of chemicals;
- The site will be restored back to its original conditions after construction phase;
- As applicable and needed, plantation of grasses and shrubs will be done at appropriate place where required;
- Training of employees involved in the transportation of hazardous material regarding emergency procedures; and
- Providing the necessary means for emergency response on call 24 hours/day.

vii. Water Resources

Component-I

a) Contamination of Surface Water

The proposed expressway and Trunk Sewer will be constructed along the banks of the Nullah Lai, which is a storm-water drain and is already polluted by sewage and solid waste disposal. It may get further polluted due to the following activities:

- Contaminated discharge from workshops, machinery and equipment washing areas, asphalt plants, batching plants, fuel and chemical storages and refuelling areas; and
- Indiscriminate disposal of construction waste and solid waste & wastewater from construction camps.

The impacts would be temporary and moderate negative in nature.

Mitigation

As a mandatory step, all the effluents should be disposed in surface water body as per the requirements of PEQS. To reduce the risk of surface water contamination, good management practices will be adopted to ensure that fuels, chemicals, raw sewage and wastewater effluent are disposed of in a controlled manner. These measures are described below:

- Protection of surface water reserves i.e. Nullah Lai, Soan River from any source of contamination such as the construction and oily waste;
- The wastewater from the construction camp(s) shall be collected and properly disposed of into the existing municipal drain. According to the PEQS, Biological



Oxygen Demand (BOD) of all surface discharges from domestic and industrial wastes should not exceed 80 mg/l.

- The municipal solid waste from these camp(s) shall be disposed off in officially designated dumping sites. The Contractor(s) shall submit details of site-specific waste management plan;
- Regular water quality monitoring shall be carried out according to the schedule specified in the Environmental Monitoring Plan (section 7).

b) Contamination of Groundwater

Waste from the construction camp or washing yard, if allowed to stagnate, may percolate through the soil and have potential impact on ground water quality that is likely to be moderate to severe negative

Mitigation

- Store waste on impermeable surfaces in secure, covered areas with clear labelling of containers protected from rain and wind;
- Proper sanitation facilities and drainage arrangements for wastewater shall be provided to restrict impoundments and percolation of wastewater generated at camp and construction sites (storage reservoirs and Intake Point) and will be properly disposed off.;
- Maintenance of vehicle and machineries will be practiced on an impermeable surface such as a concrete floor. A storage room should also be provided with an impermeable floor;
- Storage of the lubricant and fuel on the bunded area; and
- Washing yards shall be developed away from the surface water bodies and agricultural land and paved to avoid seepage from the yard

c) Siltation of Natural Streams and Channels

The surface water channels i.e. Nullah Lai and Soan River may also be prone to increase in sedimentation and silt if the runoff from excavated material (loose aggregate) from the construction area, workshops and equipment washing-yards is not avoided.

Mitigation

- Proper storage areas far away from the water bodies will be defined to manage excavated material.
- All the areas disturbed due to erosion need to be protected against soil erosion by stripping and stockpiling all the available topsoil for later re-vegetation.

Component-II



Potential sources of pollution from the laying of proposed Trunk Sewer and construction of STP includes runoff and erosion from exposed soil surfaces, earth work areas and stockpiles e.g. grouting and cement material mixed with rain, wash water from dust suppression sprays, fuel and lubricants from maintenance of construction vehicles and mechanical equipment, and spillage of liquids stored on-site such as oil, diesel, and solvents etc. are likely to result in water pollution.

The Issues associated with Surface and groundwater contamination and siltation of natural channels are already discussed in detail in Component-I. The overall impact of construction activities of both components may be enhanced many folds and needs special attention and management. The detailed study of both components needs to be prepared at later stages that will be able to highlight each area of concern with complete details.

viii. Flooding

Component-I & II

The Nullah Lai is experiences the flash flooding in every monsoon period due to heavy rains in its upper catchment areas. Construction activities may be hampered in case of any flash flood during the rainy season in the Nullah Lai which may damage under construction structures of the proposed expressway, trunk sewer, STP and resulting in loss of human lives. This would be permanent and major negative impact.

Mitigation

- Construction activities shall be carried out during dry part of the year and the Contractor shall plan the work accordingly.

ix. Traffic Management

Component-I

Traffic management will be an issue due to increased traffic volume in the Area caused by movement of vehicles carrying construction materials, construction machinery and equipment and commutation of workforce. These issues are envisaged as temporary and major negative in nature due to already overcrowded roads leading to the Project Site, such as Kutchery Road to Ammar Chowk, Murree Road from Marrir Hassan to Liaqat Bagh Chowk, Liaqat Bagh Road, Gawalmandi Road, City Sadr Road, Ratta Amaral Road and Road leading to Pir Wadhai Bridge.

Component-II

Construction activities related to Trunk sewer and STP involve transportation of building materials, debris and solid/construction waste. Construction traffic, especially cleaning of Nullah Lai may create a heavy load of trucks on local roads (many of which are already in



poor condition) and result in further deterioration of some roads. It will also affect the traffic movements, road users and pedestrians.

Mitigation

To minimize traffic problems in the Project Area:

- Public will be made aware of changes to traffic flows in advance of construction and during construction at the site.
- Site specific traffic management plan will be prepared by the Contractor to avoid traffic jams/public inconvenience;
- Movement of vehicles carrying construction materials should be restricted during the daytime to reduce traffic load and inconvenience to the local population;
- Construction vehicles, machinery and equipment will move or be stationed in the designated ROW to avoid traffic congestion;
- Damages should be instantly repaired and/or compensated;
- Availability of continuous services of the police in the diversion and control of traffic;
- The executing agency is required to maintain liaison between the traffic police, local residents/ travelers and the contractor to facilitate traffic movement during construction stage;
- Planning of haulage routes in the vicinity of the Project Area;
 - The traffic on the existing roads shall be managed by the local traffic police department in order to avoid traffic accidents and congestions causing unnecessary delays;
 - Special attention shall be given to the routes to be used for transportation of construction materials to the construction site(s); and
- Provision of proper sign boards for smooth flow of traffic.

x. Occupational Health and Safety

Component-I & II

Health risks and work safety problems may result at the workplace if the working conditions provide an unsafe and/or unfavorable working environment. The workers' Health and Safety issues are mostly associated with the operation of construction machinery and equipment, and transportation. The underlying causes of these issues generally involve human errors, operational faults of machinery and Slips and falls are associated with poor housekeeping including excessive debris, oil spills, and loose construction materials. Increased air and noise pollution levels may also cause health-related impacts on the workers. The local communities and workers will be vulnerable to increased incidences of diseases due to indiscriminate disposal of solid waste and wastewater in the Project Area. However, these impacts are envisaged as temporary and moderate negative in nature.

Mitigations



- The issues related to operation of the construction machinery and equipment and transportation shall be overcome by efficient management, staff training, maintenance of machinery and equipment, and other preventive measures. Preventing accident is an engineering and administrative problem, which strictly relies on adherence to establish safety rules and regulations;
- The construction contractor will be required to provide on-site workers with Personal Protective Equipment (PPEs) including gloves, noise attenuators, dust masks, steel-tipped shoes and hard hats. In addition, sanitary facilities and clean water should be provided. All workers employed on mixing of concrete shall be provided with protective foot wear and protective goggles. Adequate precautions shall be taken to prevent danger from electrical equipment of the existing buildings. No material will be so stacked or placed as to cause danger or inconvenience to any person or the public. Workers who are engaged in welding works shall be provided with welder's protective eye shields. All necessary precautions should be observed while constructing at height.
- Training of the workers in the construction safety, storage and handling of materials and chemicals;
- Safety of the workers working under high risk situations like flooding;
- Provision of emergency medical support like first aid kit;
- The Contractor(s) shall also ensure that borrow pits are left in a tidy state with stable side slopes and proper drainage in order to avoid creation of stagnant water bodies, which are favorable places for breeding disease vectors (flies, mosquitoes);
- Preparation of layout plan for camp site indicating safety measures taken by the Contractor, e.g. fire fighting equipment, safe storage of hazardous materials, first aid, security, fencing, and contingency measures in case of accidents;
- Adequate signage, lightning devices, barriers during construction to manage traffic at construction sites and access roads;
- Road safety education shall be imparted to drivers operating construction vehicles; and
- Timely public notification on planned construction works.

xi. Community Health and Safety

Component-I & II

The construction activities and vehicular movement at construction sites and access service roads may also result in road side accidents particularly inflicting local communities who are not familiar with the presence of heavy equipment and machinery. This is a temporary and moderate negative impact.

Quality of ground water and surface water resources available in the nearby local communities may get contaminated due to the construction activities, oil spillage and leakage, roadside accidents etc. The laborers work with different transmittable diseases may cause spread out of those diseases in the local residents.

Mitigations

It is recommended that the following mitigation measures should be implemented:

- Close consultation with local communities to identify optimal solutions for diversions to maintain community integrity & social links;
- Seeking cooperation from local educational facilities (school teachers) for road safety campaigns;
- If identified, consider additional guardrails at accident-prone stretches and sensitive locations (schools etc.);
- Provision of proper safety signage, particularly at sensitive/accident-prone spots;
- Sprays shall be regularly done to control vector borne diseases;
- Reducing the impacts of vector borne diseases on the long-term health of workers should be accomplished through implementation of diverse interventions aimed at eliminating the factors that lead to disease, which includes prevention of larval and adult propagation of vectors through sanitary improvements and elimination of breeding habitats close to human settlements and by eliminating any unusable impounding of water;
- During construction work pedestrian and vehicular passages should be provided for crossing near settlement;
- Use of water should not disturb public water availability and source of water should be selected carefully; and
- Restricting access to the site through a combination of institutional and administrative control.

xii. COVID-19 Scenario

The COVID-19 belongs to a family of viruses known as the Coronaviruses, which can cause illnesses ranging from the common cold to more severe diseases, such as the Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS). Infected people can spread COVID-19 through their respiratory secretions via droplets produced when an infected person coughs or sneezes, etc.

To avoid the risk of exposure to COVID-19 Contractor must consider the physical well-being and safety of all the persons entitled to be on the Site and follow reasonable guidelines and recommendations of Government authorities and healthcare professionals.

Mitigations

Since, there is no vaccine available to protect against human Coronavirus infections. Therefore, transmission can be prevented through following measures:

- Cover your mouth while cough or sneeze;
- Avoid close contact with people who are sick;
- Avoid the use of hard soap;
- Wash your hands often with liquid soap and water for at least 20 seconds;
- All the employees should ensure sanitization of hands at appropriate time;



- Avoid touching your eyes, nose, and mouth with unwashed hands;
- Use of Personal Protective Equipment (PPE) according to risk (a surgical or N95 mask);
- Do not spit, wrap your oral and nasal secretion with tissue and throw it in a covered dustbin;
- Balance your nutrition and exercise moderately; and
- Sterilization / disinfection of medical devices at Site dispensaries.

Guidelines to combat with COVID-19 are attached as **Annex-VIII**.

xiii. Resource Conservation

Component-I & II

The materials used in construction of proposed project would include coarse aggregates (crush), fine aggregates (sand), steel, water, asphalt, reinforcement and cement etc. Almost all the materials to be used in the construction of proposed project are non-renewable and therefore their sustainable use is necessary for the future use.

Fuel will be used to operate construction machinery, asphalt plant and batching plants. Sustainable use of energy resources is very important not only to continue future use but it will also help to reduce air emissions. For conservation of energy, efficiency of the engines and burning processes shall be considered during planning stage.

Mitigations

- Wastage of water should be reduced by training the workers involved in water use;
- Source of water should be carefully selected as water use for proposed project should not disturb the existing community water supplies;
- Ensure adequate insulation to reduce heat loss through batching plants; and
- Regularly monitor CO and CO₂ content of the flue gases to verify that combustion systems are using practical excess air volumes.
- Resource Conservation Plan is attached as **Annex-IX**.

xiv. Possibility of Finding the Artifacts

Component-I & II

During excavation, there is a chance of finding of artifacts. In that case, proper mitigation should be needed for the safety of any antiques. This impact can be categorized as local, short term, moderate to high intensity medium probability and reversible.

Mitigation

- The contractor shall immediately report through Supervision Consultant to Directorate General (DG) of Archaeological Department, Government of the Punjab to take further suitable action to preserve those antiques or sensitive remains; and Chance finds procedure (attached as **Annex-X**) should be developed and adopted in case of any accidental discover of cultural heritage.

xv. Emergency Response

Component-I & II

Disasters such as earthquakes, flooding and other hazards may occur and that must be given priority for minimizing their impacts. This impact can be categorized as local, short term, moderate to high intensity medium probability and reversible.

Mitigation

Mitigation measures will include:

- An Emergency Preparedness and Response Plan for flooding, earthquakes and manmade hazards shall be implemented in close consultation with the Rescue Services Department, Fire Fighting Department, bomb disposal squad and paramedics.
- In addition, training of the staff/employees regarding the emergency procedures/plans will be regularly conducted. A site-specific Emergency Preparedness and Response Plan is proposed to be prepared by Contractor during construction phase.
- An ERP is attached as **Annex-XI**.

6.5.2.2 Ecological Environment

Component-I & II

i. Impacts on Flora

The project will involve destruction of vegetation cover on construction areas particularly along expressway road construction and due to construction of the wastewater treatment plant. Option 2 component of the project will have minimum impact on the vegetation cover as negligible vegetation exists there. About 883 mature, sub-mature, pole crop and saplings of different tree/plants species will be disturbed during the construction phase of the project in different components of the project. The detail of which is provided in **Tables 6.2 & 6.3**. Moreover, trees of small and medium sizes will be removed due the layout of the project for which compensation will be made to concerned parties (local community/forest department.) The direct & indirect assessment, in cutting of total 883 trees/ plants approximately 309 trees/plants will be affected due to construction of wastewater treatment plant and 574 trees/plants due to expressway road construction. However, no significant trees/Plants were found at option 2 of sewerage line of the Project Area and immediate sites

Exhaust of noxious gases from movement of heavy machinery and dust will pollute air which will adversely affect health and vigor of plants. During construction activities, the Contractor's workers may damage the vegetation and trees (for use as fire-wood to fulfill the camps requirements).

Overall, it can be stated that given the relatively small areas affected and the present status of the vegetation in these areas no forest of other valuable habitat types, no rare or vulnerable species present in and near the vicinity of the Project Area.

This impact is Direct, Site-specific, Short-term, Irreversible and High Significant.

Table 6.2: Tree Species Potentially Affected

Sr. No.	Common Name	Scientific Name	Number of Affected Trees	Present Status/Condition	Components
1	Sufaida	<i>Eucalyptus camaldulensis</i>	214	Mature and sub-mature	STP Plant
	Mulberry	<i>Morus alba</i>	35	Mature and sub-mature	
	Dharek	<i>Melia azedarach</i>	27	Mature and sub-mature	
	Phulai	<i>Acacia modesta</i>	22	Mature and sub-mature	
	Shisham	<i>Dalbergia sisso</i>	2	Sub-mature	
	Orange	<i>Citrus sinensis</i>	2	Saplings	
	Jaman	<i>Syzygium cumini</i>	7	Saplings	
2	Total		309		Expressway
	Sufaida	<i>Eucalyptus camaldulensis</i>	18	Sub-mature	
	shahtooth	<i>Paper mulberry</i>	471	Mature, sub-mature and pole crop	
	Poplar	<i>Populous nigra</i>	17	Mature	
	Injeer	<i>Ficus carica</i>	7	Sub-mature	
	Shisham	<i>Dalbergia sisso</i>	2	Mature	
	Phulai	<i>Acacia modesta</i>	27	Mature and sub-mature	
	Jaman	<i>Syzygium cumini</i>	1	Sub-mature	
	Dharek	<i>Melia azedarach</i>	30	Mature and sub-mature	
	Mulberry	<i>Morus alba</i>	1	Pole	
	Total		574		
	Grand Total		883		

Table 6.3: Herbs, Shrubs and Grasses Potentially Affected

Sr. No.	Common Name	Scientific Name	Number of Affected Trees	Present Status/Condition	Components
1	Sarkanda	<i>Saccharum bengalense</i>	Bunches	Mature	STP



Sr. No.	Common Name	Scientific Name	Number of Affected Trees	Present Status/Condition	Components
2	Sarkanda	Saccharum bengalense	Bunches	Mature and Sub-mature	Outfall Conduit-B
3	Ber	<i>Ziziphus mauritiana</i>	12	Mature	Expressway
	Bamboos	<i>Bambusa vulgaris</i>	132 (in Bunches)	Mature	
	Ricinus	<i>Ricinus communis</i>	223	Sub-mature and saplings	

Mitigations

- Cutting of trees shall be avoided, as far as possible so, that negative effects on the process of natural regeneration of species are minimized.
- A tree plantation program shall be formulated with the recommendations and technical support of concerned Forest Department.
- As a principal, ten trees shall be planted in place of felling of one tree in consideration of mortality.
- Water and Power Department shall implement the program with the help of Forest Department and with the consultation of DFO.
- The Forest Department shall involve the communities for carrying out plantation.
- Open fires should be banned in the area to avoid hazards of fire in the area.
- Clearing of vegetation cannot be avoided at the areas specified for project structures, but damage to the natural vegetation may be minimized by establishing campsites, workshops and batching plants on waste/barren land rather than on forested or agriculturally productive land.
- However, if such type of land is not available, it shall be ensured that minimum clearing of the vegetation is carried out and minimum damage is caused to trees and undergrowth.
- Construction vehicles, machinery and equipment will remain confined within their designated areas of movement.
- The Contractor's staff and labour shall be strictly directed not to damage any vegetation such as trees or bushes. They shall use the paths and roads for movement and shall not be allowed to trespass through farmlands or forested areas.
- Contractor shall provide gas cylinders at the camps for cooking purposes and cutting of trees/bushes for fuel shall not be allowed.

ii. Impacts on Fauna

During construction phase the existing population of mammals and reptiles of the construction areas will be affected due to disturbance arising from construction activities involving excavation, blasting, movement of machinery and vehicular traffic, movement of labour, camping, etc. The existing animals will leave the directly affected areas due to



construction activities and human intervention. Some animals particularly reptiles may get killed during the earthworks operations. Moreover, the movements of the mammals and reptiles will be restricted during the construction phase.

Birds as well will tend to move away from the construction areas and find shelter and food elsewhere due to the activities mentioned above for fear of being hunted / trapped.

Noise generated from blasting and machinery particularly during the night hours will even scare the wildlife residing in habitats located at some distance from the construction areas. Uncontrolled blasting may even disturb the wildlife of the Project Areas. Food and refuse at the Contractor's camps may attract animals that might in turn be hunted by the workers. This impact is Indirect, Site-specific, Temporary, Reversible, Possible and Medium Significant.

Mitigation

- Care shall be taken during construction activities for avoiding purposely or chance killing of animals.
- Hunting, poaching and harassing of wild animals shall be strictly prohibited, and Contractor shall be required to instruct and supervise its labour force accordingly and clear orders should be given in this regard.
- The Contractor must be held responsible for instructing his work force accordingly and for enforcing this restriction. In addition, this shall have to be controlled by the Wildlife Department.
- Special measures shall be adopted to minimize impacts on the wild birds, such as avoiding noise generating activities during the critical periods of breeding.
- Blasting and other noise generating activities shall not be carried out during the night by the work force, clear orders should be given.
- Similarly, wastes of the camps shall be properly disposed of to prevent it being eaten by animals, as it may be hazardous to them.
- Noise produced by blasting and other construction activities may be kept to acceptable level.

6.5.2.3 Socio-Economic Environment

Component-I

Main impacts that may arise from construction of Lai expressway would be construction related impacts. Further construction of Lai expressway requires skilled and trained workforce to avoid untoward situation. Limited interruption in public trespassing from bridges is anticipated at the time of their construction and rehabilitation. This project has both positive and negative socioeconomic impacts that includes:

- Skilled and unskilled labor opportunities
- Employment of locals and immigrants
- Local economic development
- Loss of privacy and security



- Differences of cultural values
- Disruption of utilities and load on physical infrastructure
- Development of solid waste on site
- Gentrification

i. Social Impacts of Labour Influx

This can be particularly acute in smaller communities hosting a largely male workforce and/or a workforce from other regions which may result in conflicts between locals and non-locals concerning employment opportunities, wages and natural resources. Mobile workers can also contribute significantly to gender-based social impacts and risks.

Mitigation

Local population will be given preference in construction related jobs. Most unskilled workers will be hired from local communities, while for skilled manpower also, first choice will be given to local area residents. The Contractor will prepare the construction camp management plan which, in addition to other components, will include the labor influx management plan.

Good relations with the local communities should be developed. Contractor should provide job opportunities to skilled and unskilled locals and on-the-job training in construction for young people.

Contractor will restrict his permanent staff to mix with the locals to avoid any social problems by developing code of conduct.

ii. Impact on Graveyard

Graveyards and burial sites are very sensitive for the local communities. During field survey, some graveyards were identified with more than 100 graves near the Lai expressway Project Area. These graves are ancient (kadeem) and belonging to the local communities.

The shifting of graves falling in the ROW may cause social disruption leading to possible conflicts, ultimately affecting the project works. However, in the proposed project, no graves or burial site would be affected.

Mitigations

Proposed project poses a destruction and disturbance to local graveyard. Detailed consultation will be conducted with the local communities and after the consensus and approval of the community the affected graves would be relocated to some other site. For this, a proper shifting allowance would be provided.



iii. Religious Cultural Resources

Considerable religious cultural resources fall along the ROW which will be affected by the project. People will face problem in access. Noise and dust will also be a concern for public and will cause nuisance. This is moderate negative impact.

Mitigations

Avoid as far as possible interference with religious cultural resources; and prior notification to public before commencement of project.

iv. Disruption of Existing Public Utilities/ Infrastructure

There may be some disruption to the already existing public utilities such as electricity poles; telephone lines drains, cables lines etc.

Mitigations

Mitigation measures will include rehabilitation of existing utilities before construction to avoid any inconvenience to the residents of the Project Area or provide them with alternate arrangement during the construction period.

v. Indigenous People

No indigenous group fall in the area of the proposed Project. Hence there will be no impact on indigenous people.

Component- II

The STP will be constructed at the site which is Govt. owned land which is approximately 675 acres and has been transferred to WASA Rawalpindi and no land acquisition is required.

6.5.3 Potential Impacts and Mitigation Measures During the Operational Phase

6.5.3.1 Physical Environment

Component-I (Lai Expressway)

i. Landscape

At present, the landscape of the proposed Project Area is dominated by residential and commercial area. However, after the construction of Lai Expressway at both sides of Nullah Lai, the landscape of the Project Area will change in terms of road infrastructure, construction of bridges & flyovers, interchanges, and planned plantation of trees along the

road. This will permanently change the landscape of the Project Area by removal of solid waste along the both sides of the Nullah, shifting of encroachers, demolition of nearby residences, etc. but at the same time will have a positive impact in terms of better landscape by removal of major source of nuisance and socio-economic development of the Project Area.

ii. Ambient Air Quality

Air quality will improve in the short term due to improved road condition and reduced travel time thereby causing less fuel consumption. With the elapse of time, the traffic volume will increase with consequent increase in air pollution, which will induce impacts on environment and human health. The impacts on air quality would be permanent and moderate positive in the short-term and moderate negative in the long run.

Mitigations

The impacts on air quality will be alleviated by the following measures:

- Setting up a system to monitor air quality along expressway in accordance with the applicable standards/limits;
- Roadside tree plantations as applicable and feasible under harsh climatic conditions; plants should be selected in accordance to their ability to absorb emissions;
- Regular road maintenance to ensure good surface condition;
- Speed limits at sensitive locations;
- Regular vehicle check up to control/ensure compliance with NEQS; and
- Enforcement and penalties against traffic rules violators.

iii. Noise

Noise will be generated due to movement of traffic and use of pressure horns which may cause psychological and physiological impacts on the surrounding population. These noise levels should not exceed to NEQS values. This would have permanent and major negative impacts on the neighboring population.

Mitigations

The mitigation measures proposed for these impacts will include:

- Concrete or wood acoustic insulation barrier will act as noise barriers;
- Tree plantation (proposed along both sides of the Expressway) will also help to curtail noise;
- The pressure horns will be banned on the Expressway;
- Enforcement and penalties against traffic rules violators; and
- Noise measurements will be carried out at locations and as per schedule specified in the Environmental Monitoring Plan (Section-7 of this Report) to ensure the



effectiveness of the mitigation measures, e.g. speed limits, noise control, plantations at sensitive spots.

iv. Surface & Groundwater Contamination

No major adverse impact on groundwater and surface water is anticipated during the operational phase, with the exception of some occasional oil spills from the vehicles, accidental spills from oil tankers, and occasional spills in the service areas. Though such spills are accidental, infrequent, and restricted upto the road surface, but sometimes the oil maybe washed into surface and groundwater during rains etc.

Mitigations

- The service areas will work under a system that have proper SOPs, provisions for oil spill prevention, staff training etc.
- Random vehicle check to ensure compliance requirement
- Enforcement and penalties against vehicle fitness violators.

v. Waste Generation

During operation phase, non-hazardous waste may generate from road sweepings and small quantities of municipal waste from expressway management offices. No hazardous waste is expected to generate in operation phase except during road maintenance works. Transportation of hazardous waste is also expected and must be regulated.

Solid waste generation during operation and maintenance activities may include road resurfacing waste (e.g. removal of the old road surface material); road litter, illegally dumped waste, or general solid waste; vegetation waste from right-of-way maintenance; and sediment and sludge from storm water drainage system maintenance. Paint waste may also be generated from road and bridge maintenance (e.g. due to removal of old paint from road stripping and bridges prior to re-painting).

Mitigations

- A waste disposal site will be selected with the approval of provincial EPA for disposing off the regular waste on a daily basis.
- The operations contractor/entity will hire sufficient number of sweepers for collection and disposal of solid waste.
- Suitable number of waste bins will be placed along the road sides, bus stops and other such places.
- For maintenance and re-carpeting, contractor will be required to submit a solid waste management plan.

vi. Traffic Safety

Enhanced vehicular movement and speed in the long run may result in road safety issues like traffic accidents. This impact is permanent but moderately adverse in nature, since the frequency of accidents may be lowered, but their intensity may be quite severe due to enhanced speeds at which vehicles will move.

The high-speed vehicles may result in road safety issues like traffic accidents. This impact is permanent but moderately adverse in nature, since the frequency of accidents may be lowered, but their intensity may be quite severe due to enhanced speeds.

Mitigations

Mitigation measure will include strict enforcement of speed limits, installation of speed guns and channelization of traffic with respect to categories (heavy vehicle traffic and light vehicle traffic) and enforcement of penalties for the violators.

vii. Emergency Preparedness

Emergency situations most commonly associated with road operations include accidents involving single or multiple vehicles, pedestrians, and / or the release of oil or hazardous materials.

Mitigations

RDA will prepare an emergency preparedness and response plan in coordination with the local community, local emergency responders and the traffic police to provide timely first aid response in the event of accidents and hazardous materials response in the event of spills.

viii. Operational and Management Manual

At operational phase, the Project Manager will develop a comprehensive operational and Management Manual of the expressway and an effective monitoring plan. Mistakes at operational level or handling of operations by untrained staff can prove very risky and costly. Important points to be attended at operational stage are as follows:

- Strict application of prescribed M&E plan;
- Continuous evaluation of design efficiencies;
- Understanding and training of Operational and Maintenance Manual;
- Regular maintenance of engineering works (mechanical as well as civil);
- Continued Public consultation and feedback; and
- Refresher Training Courses for operational and maintenance staff.

ix. Flooding

The structures of the proposed Expressway may be damaged due to high velocity flood water. An emergency response plan will be prepared to handle unforeseen emergencies.

Component-II (Trunk Sewer & STP)

i. Odor

The operation of STP will result in generation of odour from biological tanks, sludge holding areas and dewatering units. Moreover, scum is also another source of odour. Overloading of the ponds will also result in odour problems because the treatment capacity will have exceeded. Wind is an effective source of aeration through surface mixing, but too much wind action can disturb bottom sediments and also create an odour problem. In most instances, the odours are generated as a result of an anaerobic or "septic" condition, which causes nuisance to the residential community in the surroundings of the STP and the people passing by this area for schools, mosque and shops. The magnitude of this impact will be moderate adverse.

Mitigations

- Strictly follow standard operating procedures and operational manual for operation and maintenance of lifting and pump stations;
- Ensure that operating staff is properly trained, and have clear understanding of odor issues related with operational practices;
- Ensure proper maintenance of the machinery;
- Regular cleaning of aeration tank walls and floors, washing weirs, and removing scum regularly, also helps in odour reduction;
- Ensure adequate water flow in ponds and aeration to reduce the potential of odour formation;
- Regularly monitor spread of unpleasant odors around STP, and apply additional measures of odor control based on the monitoring outcomes;
- The proposed STP may install synthetic windbreakers (e.g. walls) around the existing facility may serve to minimize potential odour dispersions and will reduce the significance of the odour impact; and
- A landscape should be properly designed with provision of new trees and ornamental plants around the boundary, roadside and stretches of open land.

ii. Air Quality

The operation of sewerage scheme and STP will result in generation of fugitive emissions including H₂S and CH₄ (due to anaerobic conditions) and minor concentrations of N₂ and NH₃ from biological tanks and from sludge, if not handled properly or remain unattended. H₂S is a foul smelling poisonous gas which might be harmful for the workers of sewer maintenance and could be fatal sometimes. CH₄ is a natural gas also referred to as a main greenhouse gas contributes to global warming and having global warming potential of much higher than the carbon dioxide (CO₂).

During operation phase, operation of stand-by generator and un-necessary idling of diesel run will also result in the emission of pollutants (CO, Smoke, NO₂, SO₂, CO₂ and PM₁₀) into the air, thus deteriorating air quality. These emissions may adversely affect the health of the



nearby residents and working staff. This impact can be categorized as negative, local, medium negative and long-term.

Mitigations

- To mitigate the pollutants emissions use of low sulfur fuel should be ensured;
- Location of generators should be carefully selected;
- Plantation of trees along the STP to create a buffer zone that will help in absorbing the emissions;
- Use of gas generators (if possible) should be preferred for low emissions;
- The height of the generator stacks should be high enough to disperse the emissions in the air;
- Provision of budget for regular monitoring of ambient air quality in accordance with PEQS, 2016;
- Improved monitoring, planning, and maintenance of the STP by WASA;
- Workers for cleaning or maintenance of Sewer and STP should cover their faces with mask;
- Use gas detector before inspection;
- If possible, use different mechanisms to capture CH₄ and H₂S that can be used commercially; and
- Plan and execute appropriate tree plantation along the Trunk Sewer and STP.

iii. Noise

Due to the operation of proposed STP, noise and vibration may produce from the running of pumping machinery and standby generators which will be a constant source of nuisance to the local population. Therefore, the magnitude of this impact is considered to be moderate adverse.

Mitigations

Following mitigation measures shall be adopted:

- Regular maintenance of vibrating parts through a well-coordinated operation and maintenance procedure which consists of checking periodically all parts of the pumping machinery, its oiling to remove friction, replacement in case of malfunctioning and periodic noting of noise levels;
- All noisy equipment and machinery such as generators and blowers should be housed in closed rooms or buildings;
- Provision of budget for regular monitoring of noise in accordance with PEQS, 2016; and
- Tree Plantation Plan should be devised to reduce noise issues.

iv. Surface & Groundwater Contamination



The proposed project will involve the installation of Trunk Sewer, there are certain environmental risks from the operation of the sewer system, most notably from leakage of sewer pipes, as untreated fecal material can mix with ruptured water supply lines and contaminate drinking water supply as well as groundwater. Temporary flooding of adjacent areas may occur due to accidental leakages, bursts and blockage of trunk sewer and impairment of receiving water quality in surface and sub-surface source.

During operation of STP, there is a possibility for ground water contamination due to leakages from evaporation pond or lagoons containing wastewater or short term storage of sludge in ponds, which may lead to the accumulation of heavy metals in water resources.

Aforementioned impacts on water resources will be reduced as it will be ensured during the design phase that the ponds, lagoons and the storage pits are lined with geo-permeable membrane or other lining material. However, there may be a slight possibility of contamination risk due to damage of lining material beneath the lagoons and storage pits.

During the operation phase, treated wastewater from STP is planned to be discharged into Soan River. Maximum permissible discharges of pollutants into surface water body will be as per PEQS/NEQS or worked with close coordination with EPA.

Mitigations

- Establish regular maintenance program including regular cleaning of sewer lines to remove grease, grit, and other debris that may lead to sewer backups;
- The retention times should be kept to its lowest possible, so that there is no stagnation of sewage for long time which could create anaerobic conditions;
- Cleaning should be conducted more frequently in problematic areas;
- Inspection of the condition of sanitary sewer structures and identifying areas that need repair and maintenance comprising cracked and deteriorating pipes; leaking joints or seals at manhole; frequent line blockages; lines that generally flow at or near capacity; and suspected infiltration or exfiltration;
- Monitoring of sewer flow to identify potential inflows and outflows;
- Maintain records; review previous sewer maintenance records to help and identify “hot spots” or areas with frequent maintenance problems and locations of potential system failure, and conduct preventative maintenance, rehabilitation, or replacement of lines as needed;
- Develop an Emergency Response System for the sewerage system leaks, burst and overflows;
- Provide necessary health and safety training to the staff in sewer cleaning and maintenance;
- Develop standard operating procedures and operational manual for operation and maintenance of trunk sewer and STP, and provision of sufficient O&M staff in annual budget;
- Provision of sewer cleaning equipment should be included in the project cost; and
- Development of a system to register public complaints and urgent clearance of blockages in the system.



v. Solid Waste

Domestic and hazardous wastes would be generated during cleaning and maintenance facilities of Trunk Sewer. The solid waste during operational phase will consist of plastics, metal and organic wastes present in sewer lines. Hazardous waste will be present in form of sludge. Such wastes can cause blockage to drainage systems. Some of these waste materials especially plastics and polythene which are not biodegradable may cause long term injurious effects on the environment. This will be a temporary and minor negative impact.

Sludge will be produced during the operational phase of STP as a solid waste. The concentrate produced will be evaporated on-site in evaporation ponds and sludge will be moved for disposal. The temporary accumulation of sludge in the ponds after evaporation and in the storage pits may be the potential cause of soil or water resources contamination. Sludge accumulation can create two problems:

- It produces odour because it accumulates and becomes anoxic.
- It serves as a vector for diseases and propagation of flies and mosquitoes.

However, it has been ensured during the design phase that the ponds and the storage pits are lined with geo-permeable membrane or other lining material which reduces the significance of impact. In addition, sludge shall be collected and disposed off in time and proper manner which reduces the impact of sludge accumulation.

Mitigations

Mitigation measures include:

- The sludge removed from the sewers should not be left openly on the roads. It may be recycled as fertilizer;
- Ensure temporary storage of sludge from STP on lined material to avoid soil contamination.
- Regular inspection and maintenance should be schedule and implemented to ensure removal of solid waste and sludge when accumulated;
- Proper disposal of sludge to the designated solid waste dumping site;
- Implementation of sludge handling and storage procedures should be ensured;
- Provide adequate ventilation where volatile wastes are stored;
- Waste minimization should be encouraged and regular training should be provided to WASA staff in correct identification and disposal of waste;
- Storage areas should be cleaned regularly to minimize odor, pests and nuisances and preserve visual amenity;
- All empty containers not suitable for reuse should be rinsed and punctured prior to disposal;
- An organized collection system and its implementation through a licensed contractor; and



- Schedule inspection of the sewer lines to keep it clean, and to identify any hazardous material.

vi. Health Risks Associated with Burst Sewers

Improper maintenance of trunk sewer can lead to dispersal of raw sewage particularly at manholes and burst areas into the environment. These can cause outbreaks of water borne diseases like malaria, cholera and typhoid from contamination of water sources by raw sewage.

Mitigations

Mitigation measures include:

- Ensure proper and periodic maintenance of sewer lines;
- Awareness rising among community members not to dump solid waste in manholes;
- Development of an inventory of system components, with information including age, construction materials, and drainage areas served elevations required for proper maintenance;
- Design manhole covers to withstand anticipated loads, and ensure that the covers can be readily replaced if broken, to minimize entry of garbage and silt into the system; and
- Ensure sufficient hydraulic capacity to accommodate peak flows and adequate slope in gravity mains to prevent build-up of solids and hydrogen sulphide generation.

vii. Health and Safety of Workers

The operation of the proposed trunk sewer and STP may cause some negative impacts on health and safety of workmen. The sewer cleaning staff may be exposed to waterborne communicable diseases if precautionary measures are not adopted. Since the proposed trunk sewer, upon its completion, will be handed over to WASA, the concerned officials of the WASA will ensure that the operation and maintenance personnel are fully aware of the hazards involved in running the system.

Mitigations

The following mitigation measures are proposed to ensure health and safety of workers:

- All operation and maintenance staff will be trained in hygienic procedures designed to avoid infection from wastewater, and health and safety procedures against any exposure to hazardous gases;
- Gas detector will be used to indicate the presence of any hazardous gas before the entry of workers into the sewer for cleaning purposes;
- Ventilation of sewers will be done before entry to avoid accumulation of noxious gases;

- Workers will also be inoculated against infectious diseases and kept under medical surveillance;
- Formal emergency procedures will be developed by the concerned officials of WASA for dealing with the accidents; and
- The sewer & STP cleaning workers will be provided protective clothing.

viii. Operational Sustainability

The most pressing need is the sustainability of Sewage collection system and its disposal, and it can be assessed on many factors including capacity issues of government departments dealing with municipal services, efficiency of the system and its performance, life cycle analysis (aging and deterioration), natural hazards (earthquakes, floods and fire outbreaks), escalation in population growth and energy requirements.

The three major drivers considered worldwide for ensuring sustainability are: (i) economic considerations, (ii) social considerations and (iii) environmental protection. Therefore, the municipal services provider i.e. WASA, must consider these aspects in achieving appropriate and optimize use of sewer and drainage system.

Mitigations

The operational sustainability can be achieved by adopting following measures:

- Establishment of Monitoring and Maintenance System for wastewater treatment before its final disposal into surface water bodies;
- Regular operation and maintenance of the scheme;
- Capacity building and training of workers;
- Periodic environmental monitoring;
- Trunk sewer & STP should be designed in a such ways that withstand existing climate change issues e.g.: intense rainfall events and increase and decrease in temperature;
- Cost for the operation and maintenance in the annual budget of WASA; and
- Recover heat that is present in sewage for energy use i.e. heating swimming pools and office buildings²⁹.

ix. Emergency Preparedness and Response

The operation of the Trunk Sewer & STP may encounter emergencies like operation failure in addition to disasters such as earthquakes and floods. This impact is negative, temporary and moderate in nature.

Mitigations

²⁹ Schmid, F. Sewage water: Interesting heat source for heat pumps and chillers. In Proceedings of the 9th International IEA Heat Pump Conference, Zürich, Switzerland, 20–22 May 2008; pp. 1–12.

Mitigation measures include:

- An Emergency Response Plans for floods, earthquakes, and manmade disasters must be developed by the WASA, in close consultation with Fire Fighting Department (FFD) and National Disaster Management Authority (NDMA);
- Training of staff and employees regarding the emergency procedures and plans should be regularly conducted;
- Responsible person to implement the Emergency Response Plan should be clearly designated;
- Emergency numbers should be clearly posted, so that a quick action is taken when an emergency arises;
- Fire Fighting Systems should be calibrated and maintained regularly; and
- Regular drills for fire emergencies should be carried out.

6.5.3.2 Ecological Environment

Component- I & II

a) Impacts on Flora

During Operational stage the Project will not affect Flora (Trees and agricultural crops) or release any significant pressure detrimental to flora. Low level impact is expected at operational phase on Flora due to the Operational and Maintenance activities. This impact is Site-specific, Temporary, Short-term, Irreversible, Unlikely and Low Significant.

Mitigations

- The implementation of plantation plan recommends in compensation for cutting of trees should start working during operational stage, to ensure the ecological balance and to avoid any impact on local Environment.
- Large scale planting with suitable indigenous trees, shrubs and ornamental plants in the form of Tree Groves, and Linear plantation will be carried out in accordance with the Tree Plantation Plan to improve aesthetic value and offset the effect of removal of vegetation.
- Proper check and balance for above activities is highly recommended. Plantations so, raised must be maintained according to the Silvicultural practices which include proper Irrigation, Cleaning, Pruning, Thinning at prescribed intensity, Silt clearance and Trench-opening, etc.
- Maintenance and security of the plantation should be done for at-least five years (in consultation with the forest department). Measures such as fencing, watch guards and fire protection should be considered.
- All activities must be done under the technical supervision of Forest department.

b) Impacts on Fauna



There is no protected area, Game reserve, Game sanctuary or national park in the Project Area so no major impact on Wildlife & Livestock in the area is expected through, noise, vibration and any type of normal activity in the Project Area, thus will have no effect on productivity.

This impact is Site-specific, Irreversible and Medium Significant.

Mitigations

- The pathways of locally available wildlife for food, Shelter and other normal activities must be compensated with proper alternative routes/pathways & water points must be provided to minimize the impact & movement of available wild animals.
- In proper consultations with Forest and Wildlife department permanent water points for available fauna must be provided to conserve local ecosystems & biodiversity.
- Strict control must be exercised for stoppage of killing/poaching of available wildlife species by enhancing protection practices and deploying effective watch and ward system.
- The precautionary measures described for future shall also be applicable during operation phase as relevant for the conservation of wildlife species in the Study Area.

6.5.3.3 Socio-Economic Environment

Component- I & II

During the operational phase of the Project it is anticipated that it involves key range of socio-economic & land acquisition related impacts of propose project, which are as follows:

- Development of economic activities that boost the living standards of locals
- Increased value of area and price of land
- Secured water rights
- Loss of religious and cultural sites
- Flood control and pollution
- Promotion of recreational activity
- Control over Water borne diseases.

Gender Issues

At operational stage the induction of outside labor for O&M works may create social and gender issues due to the unawareness of local customs and norms. It will also cause hindrance to the mobility of the local women. Disturbance may occur to the privacy of the local women residing in the nearby area.

This impact is Site-specific, Long-term, Irreversible, Possible and Low Significant.

Mitigation



Project staff should respect the local community's sensitivity towards their customs and traditions. The staff must not involve any un-ethical activities and should obey the local norms and cultural restrictions particularly with reference to women.

7 ENVIRONMENTAL MANAGEMENT PLAN

7.1 GENERAL

Environmental Management Plan (EMP) is a tool for the implementation of the all the suggested measures to make the project environmentally sustainable. It provides an overall approach for managing and monitoring the environmental, ecological and socio-economic issues of the proposed Project, and describes the institutional framework and reporting mechanism to implement EMP for the Project.

7.2 EMP COMPONENTS

The EMP comprises following main components:

- EMP Objectives;
- Scope of the EMP;
- Institutional Requirements;
- Environmental Mitigation and Management Matrix;
- Environmental Monitoring Plan;
- Training and Capacity Building;
- Communication & Documentation;
- Management Plans; and
- EMP Cost.

7.3 EMP OBJECTIVES

The main objectives of the EMP are:

- Provide project impacts along with the proposed mitigation measures, and a corresponding implementation phase;
- To ensure that all necessary corrective actions are carried out in time to counter any adverse environmental impact;
- To ensure the regular monitoring of those factors which may affect the safety of the environment under a systematic monitoring approach;
- Define the roles and responsibilities of the Project Proponent, Supervision Consultant (SC) and Contractor in the existing setup of proponent in order to effectively communicate environmental issues among them;
- Provide a procedure for timely action in the face of unanticipated environmental situation;
- Identify training requirements at various levels including Project Proponent, Contractor and SC;
- Provide a monitoring mechanism in the form of an environmental monitoring program, which includes monitoring parameters, monitoring frequency to ensure that all the mitigation measures are completely and effectively implemented;
- Provides estimation of environmental cost for the implementation of EMP;

- Define the requirements necessary for documenting compliance with EMP and communicating it to all the concerned regulatory agencies; and
- Provide the needs for other plans considering the project specific requirements.

7.4 SCOPE OF THE EMP

The scope of the EMP includes the following phases of the proposed Project:

- Pre-construction Phase;
- Construction Phase; and
- Operation and Maintenance (O&M) Phase.

All the activities performed during these phases will be controlled and monitored according to this EMP.

7.5 INSTITUTIONAL REQUIREMENTS

The institutional requirements for the construction and O&M phases of the proposed Project are provided in below sections.

7.5.1 Institutional Arrangements for Implementation of EMP During Construction Phase

The key players involved during construction phase of the proposed Project are the Rawalpindi Development Authority (RDA) as employer/proponent, Punjab-EPA, the SC and the Contractor. The roles and responsibilities of these organizations are outlined below.

The following staff will be involved in the implementation of EMP:

- RDA/Proponent/Employer;
- SC's; and
- Contractor's Environmental Manager.

The employer RDA will make Contractor bond through contract documents to implement the EIA including EMP and other terms and conditions of the Environmental Permit. The whole EMP will be included as a clause of the contract documents. Construction camps will be established after necessary approvals and submission of Site-Specific EMPs to be developed in the light of the relevant agencies requirements, before commencement of new works. The organizational setup for implementation of EMP during construction phase is provided in **Figure 7.1**.

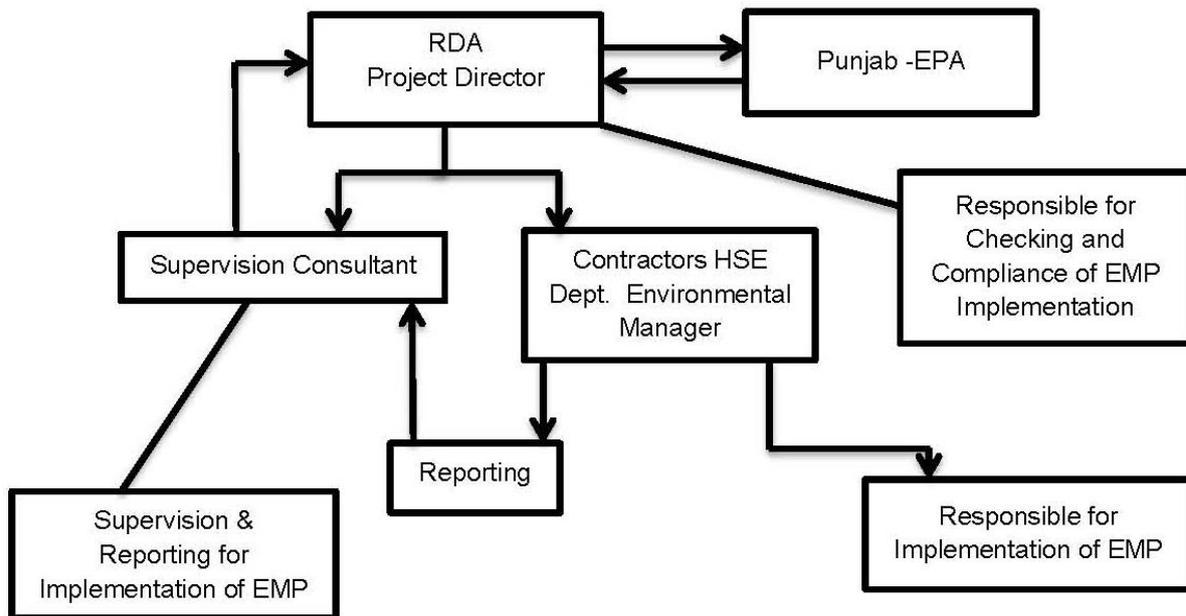


Figure 7.1: Organizational Setup for Implementation of EMP at Construction Phase

7.5.1.1 Roles and Responsibilities

a) EPAs

As per PEPA, 1997 and approval of 18th Amendment each provincial government has its own EPA responsible for environmental protection and pollution control. The provincial EPAs are responsible for the approval of the EIA and IEE of all the developmental projects under their jurisdictions. The concerned agency for the Proposed Project is Punjab-EPA. Therefore, this agency will undertake audits (as and when required) of the proposed Project activities with respect to the protocols as defined in EMP.

b) Employer Concerned Staff (RDA)

RDA is directly in-charge for the financial and technical matters through the Project Director (PD). The general monitoring responsibilities of the PD will consist of:

- Ensuring that the required environmental training is provided to the concerned staff;
- To carrying out random site visits to the construction sites to review the environmental performance of the Contractor;
- Review monitoring reports for the progress of environment related activities;
- Make sure that the Contractor is implementing the additional measures suggested by the SC in environmental monitoring reports;
- Valuation of property (if any) and negotiation with the affectees for fixation of compensation to be paid for land acquisition;
- Assist in checking genuine ownerships of the claimants, in consultation with the Revenue staff for prompt payment to the affectees;
- To ensure that the tenants get their rightful compensation as per prevailing law;

- Assist the Contractor for the timely payments of negotiated prices;
- To assist Contractor for obtaining necessary approvals from the concerned departments;
- Maintaining interface with the other lined departments/stakeholders; and
- Reporting to the Punjab-EPA on status of EMP implementation.

c) Supervisory Consultant

Roles and responsibilities of SC will be:

- To oversee the performance of the Contractor to make sure that the Contractor is complying with EMP;
- Ensuring that the day-to-day construction activities are carried out in an environmentally and socially sound and sustainable manner;
- Strong coordination with the Contractor and RDA;
- Preparing training materials and implementing programs;
- Ensure the implementation of the mitigation measures suggested in EMP;
- To supervise and monitor environmental activities being performed at site;
- To organize periodic environmental training programs and workshops for the consultant's and contractor's staff;
- Periodic reporting as mentioned in EMP; and
- Suggest any additional mitigation measures (if required).

d) Construction Contractor

Contractors will be bond to appoint site based Environmental Manager with relevant educational background and experience for each construction camp. Contractors' Environmental Manager will carry out following activities:

- Implementation of the mitigation measures at construction site;
- Contractor will be bond through contract to take actions against all the special and general provisions of the contract document;
- Contractor will make sure the compliance of EMP recommendations and will also be responsible for effective liaison with local heads of villages;
- Provision of proper Personal Protective Equipment (PPEs) to the workers and train them for their proper use;
- To conduct the environmental and health & safety trainings to the workers/labour; and
- Coordinate with Environmental Specialist of SC.

7.5.2 Institutional Arrangement for Implementation of EMP During O&M Phase

The proposed Project will be administrated by RDA during the O&M phase as described in detail below and the existing institutional setup of RDA for implementation of the project is

illustrated in **Figure 7.2**. The existing organizational setup of RDA for O&M phase of the project is fully integrated with handling of environment and socioeconomic issues.

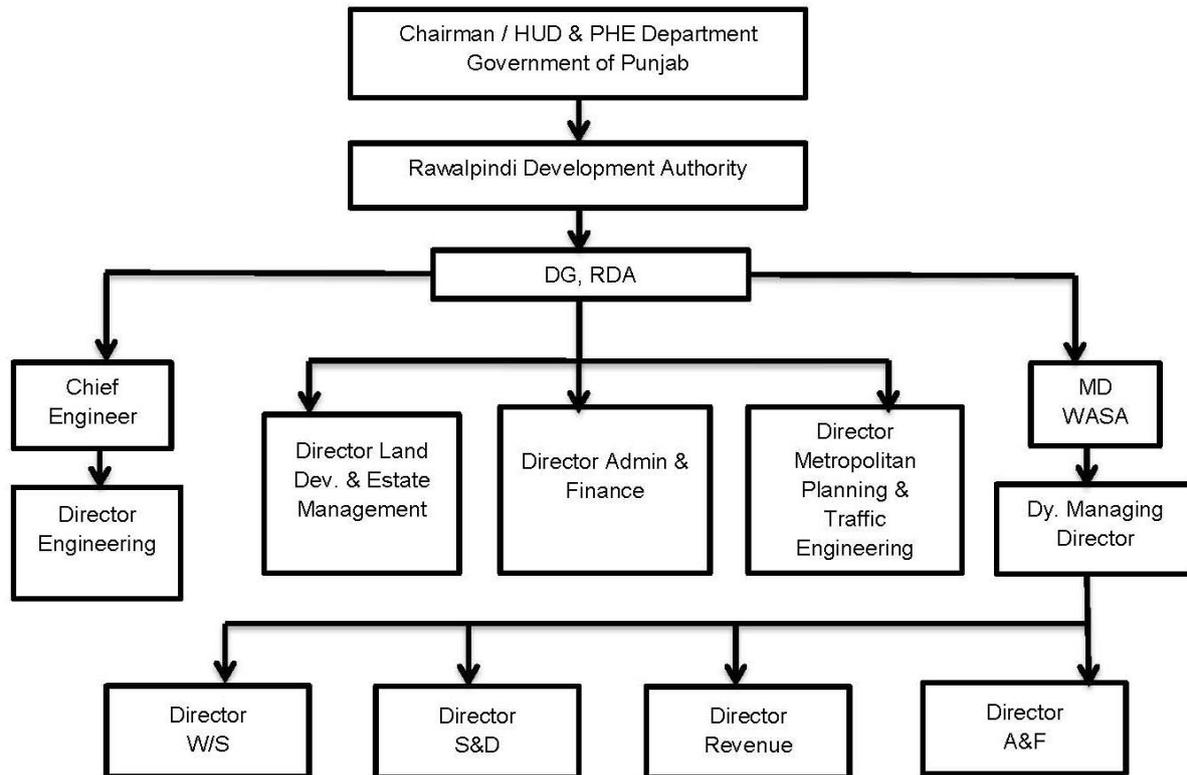


Figure 7.2: Organizational Setup for Implementation of EMP at O&M Phase

7.6 ENVIRONMENTAL MITIGATION AND MANAGEMENT MATRIX

Environmental Mitigation and Management Matrix (EMMM) is considered as one of the main elements of EMP. It will be used as the management tool for the implementation of mitigation measures. The plan includes following:

- The envisaged impacts as identified during environmental assessment and their recommended mitigation measures; and
- The person/organization directly responsible for adhering to or executing the required mitigation measures.

It is highlighted that although the responsibilities for executing and monitoring the mitigation measures have been delegated to different organizations, RDA will hold the primary responsibility for ensuring the full implementation of EMP. **Table 7.1** provides information about all impacts to be raised due to project activities during different phases of the Project i.e. pre-construction, construction and O&M.



Table 7.1: Environmental Mitigation and Management Matrix

Sr. No	Aspect	Impacts	Mitigation Measure	Responsibility	
				Implementation	Monitoring
Pre-Construction/Design Phase					
Physical Environment					
1.	Design & Layout Planning	<ul style="list-style-type: none"> Incompatible layout plan and engineering design of the project's structures can undermine the overall aesthetic beauty and ambience of the project area. Also low utilization of the available spaces and not designing the structures taking into account, the prospective and futuristic needs can result in structures with low social acceptability and functionality. This impact will be permanent and moderate negative in nature. 	<ul style="list-style-type: none"> All structural, layout and engineering designing of Lai Expressway and Trunk Sewer & STP should be in strict accordance with the applicable by-laws and engineering parameters. 	Design Consultant	Proponent
2.	Sensitive Receptors and Existing Infrastructure	<ul style="list-style-type: none"> The proposed expressway will cross major roads at twelve (12) locations and railway track at one (01) location has the potential to negatively impact sensitive receptors (graveyards, schools, hospitals, environmentally sensitive areas) and existing infrastructure (roads, railways, etc.) Proposed trunk sewer line will pass within the vicinity of several settlements, improper route selection for the Conduit from Soan Adda to STP can lead to social issues of resettlement/relocation of assets and displacement of people. 	<ul style="list-style-type: none"> During the selection of the alignment and route of proposed expressway and sewer line, significant efforts will be directed to avoid or minimize impacts on sensitive receptors and existing infrastructure by incorporating environment- friendly construction methods in the engineering design. Works around public utilities will be carried out in consultation with relevant authorities. Public consultation will be undertaken prior to the construction phase to ensure that the public is aware of planned construction activities. 	Design Consultant	Proponent
3.	Land Acquisition and	<ul style="list-style-type: none"> About 1,711 kanals of land would be acquired 	<ul style="list-style-type: none"> Mitigation measures will involve 	District	Proponent



Sr. No	Aspect	Impacts	Mitigation Measure	Responsibility	
				Implementation	Monitoring
	Resettlement	<p>for the construction of proposed Expressway whereas 675 acres of land has already been acquired by RDA for the construction of STP.</p> <ul style="list-style-type: none"> No land acquisition is involved for laying trunk sewer line. 	<p>careful alignment and route selection by the design team to minimize the impacts by avoiding the residences of affected families. Proper access should be provided to the nearby communities at a minimum travel distance. For the land coming in the ROW, the affected people will be compensated in a fair manner and rate should be given at current market value.</p>	Government	
4.	Site Selection of Construction Camps and Storage of Construction Material / Stockpiles	<ul style="list-style-type: none"> The site may require for establishment of workers' camps, workshops and stockpiles for the proposed expressway and trunk sewer. Selection of site for construction camps should consider avoiding any damage of property, vegetation, irrigation, drinking water supply systems and away from residential areas. The priority should be given to protect the human environment (i.e. to curb accident risks, health risks due to air and water pollution and dust, and noise, and to prevent social conflicts and crime). 	<ul style="list-style-type: none"> The Contractor shall identify the site for construction camp in consultation with the individual owners and community representatives; There should be no resettlement issue for the location of the camps; Selection of a site for construction camps and stockpiles shall be near the project area; Campsite should be away from the residential areas and sensitive receptors; The Campsite must not be subject to periodic flooding, nor located in the near vicinity of swamps, pools, sink holes or other surface water bodies; All sites must be graded, ditched and rendered free from depressions in which water may become a nuisance; 	Contractor	Proponent



Sr. No	Aspect	Impacts	Mitigation Measure	Responsibility	
				Implementation	Monitoring
			<ul style="list-style-type: none"> The camp site should consider avoiding any damage of property, vegetation, irrigation, and drinking water supply systems; and Existing infrastructure, in particular the water and sanitation, electricity and transport systems of the host community will not be compromised by external workforce. 		
	Seismicity	<ul style="list-style-type: none"> The proposed Project falls under Zone-2B (zone of moderate damage) as per seismic zoning map included in Building Code of Pakistan prepared by NESPAK. In case of an earthquake, the proposed Expressway, outfall trunk sewer and STP are expected to suffer damages if they are designed without consideration of seismic activities. 	<ul style="list-style-type: none"> At the detailed design stage, the safety of the proposed Expressway, outfall trunk sewer and STP against the damages due to the seismic activity will be ensured. The design will be checked against expected seismic factors in view of the seismic and geological record of the area. However, Zone-2B parameters will be adopted for the design of all the project structures. 	Design Consultant	Proponent
6.	Flooding	The basic aim of the project is to construct a flood channel that will be helpful in saving the citizens of Rawalpindi from the situation of floods. Failure to address this issue at the design level will most certainly impact the operations of the road, trunk sewer and STP. It will also reduce the project life through erosion and destruction of infrastructure.	<ul style="list-style-type: none"> The design of the Nullah Lai will be based on detailed hydrological investigation, which will include past peak flood records. The cross-section of the Nullah Lai will be sufficient to accommodate peak flood flows. All the structures of the proposed Project will be designed to withstand the highest flood level in the Nullah Lai. A detailed hydrological study will 	Design Consultant	Proponent



Sr. No	Aspect	Impacts	Mitigation Measure	Responsibility	
				Implementation	Monitoring
			be required out to precisely forecast the impact of flooding on the proposed structures and vice versa. The designer will ensure that the trunk sewer and its appurtenances like manholes are protected against damages by placing the manholes above the highest flood level and if the manholes at some places are laid below the highest flood level, they will be properly sealed.		
7.	Infiltration	Infiltration rate will be much higher due to installation of the sewers under / above the bed (depending upon the final design) of flowing Nullah as compared to dry conditions. This may significantly increase the design flow affecting the working efficiency of the trunk sewer	The designer will pay due consideration to this factor and adopt infiltration rates as per field conditions.	Design Consultant	Proponent
8.	Scouring	The part of outfall trunk sewer that will be laid under / above the bed (depending upon the final design) of the Lai Nullah and that will rest over pile structure is subjected to the scour action especially during high floods. The bed levels may be lowered by scour action at that point. This may expose the trunk sewer and result in damaging the trunk sewer line and its appurtenances.	The designer will study and establish scour depth along the route and protect the sewer and the appurtenances against scouring action.	Design Consultant	Proponent
Ecological Environment					
9.	Vegetation Cover	During the pre-construction phase, activities such as installation of construction camps, construction of temporary roads & mobility of	<ul style="list-style-type: none"> The camps, mobility of machinery and construction of temporary road should be proper planned and well designed 	Contractor	Proponent



Sr. No	Aspect	Impacts	Mitigation Measure	Responsibility	
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		construction staff may damage the local vegetation/trees. As the heavy machinery and camps will be moved and installed, which require significant space due to which available vegetation is expected to be removed.	<p>to avoid any loss to local green cover.</p> <ul style="list-style-type: none"> • It is recommended to establish the construction camps where minimum or no vegetation exists. • Similarly, the alternate routes for roads and points for camps are recommended where no loss of vegetation is expected. • The location of construction camp will be selected so as to have limited environmental effect during construction phase and to reduce the cost and land requirement. • 		
10.	Fauna	As movement and installations of machinery and vehicles will take place so noise and habitat loss is expected. The routes of the available wildlife and other habitats may be affected due to camps set-up and machinery movements & installations. Temporary road may also affect the habitat of locally available fauna.	<ul style="list-style-type: none"> • The standard measures must be adopted to minimize noise due to machinery movements and installations; • Wildlife movements and routes must be considered during activities and should be avoided to their maximum level; • The alternate routes and points are recommended to avoid any damage to locally available fauna; • The camps shall be properly fenced and gated to check the entry of animals in search of eatable goods; and 	Contractor	Proponent



Sr. No	Aspect	Impacts	Mitigation Measure	Responsibility	
				Implementation	Monitoring
			<ul style="list-style-type: none"> Similarly, wastes of the camps shall be properly disposed of to prevent it being eaten by animals, as it may be hazardous to them. 		
Socio-Economic Environment					
11.		<p>It is anticipated that key range of socio-economic issues will be raised by host community due to development activities:</p> <ul style="list-style-type: none"> Uncertainty and security of future; Fear of displacement and resettlement; Imminent loss of physical assets; State of disturbance and stress prevalent among communities; and Fair compensation and delaying factor in making payment if any involved. 	<ul style="list-style-type: none"> The design consultant shall carefully select the alignment and route to minimize the impact by avoiding the residences. Provision of local population will be given preference in construction related jobs. Most unskilled workers will be hired from local communities, while for skilled manpower also, first choice will be given to local area residents. 	Design Consultant / Contractor	Proponent
Construction Phase					
12.	Topography	<p><u>Component-I</u> The proposed project lies in the plains and mountainous area and the topography of the area will be changed due to excavation and filling of the area in order to stabilize and strengthen the slope of the area. Excavation and filling will have significant change in the topography during construction.</p> <p><u>Component-II</u> The proposed Trunk Sewer will be laying along the both sides of Nullah Lai and finally moves</p>	<ul style="list-style-type: none"> Excavation shall be controlled and shall be strictly limited to the project area; Incorporate technical design measures to minimize removal of trees and disturbance to natural habitats; and The aesthetics of the area shall be restored to original or better condition. 	Contractor	Proponent



Sr. No	Aspect	Impacts	Mitigation Measure	Responsibility	
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		along the Soan River and ends at STP. There is no impact on topography of the project area due to Component-II of the proposed project.			
13.	Land Use	<p>Construction of the proposed road and Trunk Sewer would involve several key land use issues and impacts, including:</p> <ul style="list-style-type: none"> • Acquisition of land for ROW and ancillary facilities (e.g., access roads, Interchanges, flyovers, underpasses and construction camps); • Possible damage to public utilities such as drains, Telephone lines, Electricity polls and cables, etc.; • Potential visual impacts attributable to the removal of existing vegetation and visibility of exposed soil; and • Increased dust and noise to neighbouring residential and commercial areas. 	<ul style="list-style-type: none"> • General best management practice measures, including worksite appearance, maintenance, and noise and dust control; • Measures to avoid or minimize potential damage to public infrastructure. • Efforts shall be made to avoid or minimize the removal of vegetation, however, if removal of trees is unavoidable; compensatory plantation shall be done; • Camp sites will be established on waste/barren land rather than social and commercial land. However, if such type of land is not available, it will be ensured that minimum clearing of the vegetation is carried out and minimum damage is caused to trees and undergrowth; • Construction vehicles, machinery and equipment will remain confined within their designated areas of movement; • Contractor will provide gas cylinders at the camps for cooking purposes and cutting of trees/bushes for fuel will not be allowed; 	Contractor	Proponent



Sr. No	Aspect	Impacts	Mitigation Measure	Responsibility	
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			<ul style="list-style-type: none"> Installing temporary fences with gates around construction areas to prevent injury to people, livestock or workers; and Returning damaged improvements to at least their condition prior to construction. 		
14.	Soil Erosion	<p><u>Component-I</u> The likely impacts of soil erosion are:</p> <ul style="list-style-type: none"> Excavation of earth/cutting operations, clearing of vegetation and land levelling activities can destabilize the surrounding land surface, particularly if the excavated area is left unfilled for long time, which may lead to rainfall induced soil erosion; During rainfall, the eroded soil if mixed with stagnant water can form slush thus impacting movement of vehicles and machinery as well as of the local people, ultimately hampering construction work. Onsite storage of the construction materials such as sand, aggregate, crushed stone, cement, bricks, lubricants, fuels and iron bars on the land without an intervening barrier, can degrade soil quality and may smear them with fine particulates of the dumped materials; Improper onsite storage of equipment and machinery such as wheel barrows, mixers and 	<ul style="list-style-type: none"> Good engineering practices will help in minimizing the soil erosion both at the construction sites and in peripheral areas, particularly along the haul tracks; All machineries and materials should be stored at the designated areas and compounds; Special slope protection measures should be adopted in the sensitive areas; Site restoration plan for the Project should be strictly followed; and Controlled and well managed vehicular movement, excavation, vegetation and regular water sprinkling will reduce the chances of soil erosion. 	Contractor	Proponent



Sr. No	Aspect	Impacts	Mitigation Measure	Responsibility	
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		<p>compactors and disorderly parking of machinery and equipment may cause soil contamination from trickling or accidental leakages of oils and lubricants.</p> <p>Component-II</p> <p>The construction of trunk sewer and STP will involve laying of new pipelines, clearing of the area (cutting of tress, bushes, etc.), Removal of spoil material i.e. solid waste, sludge from Nullah Lai, excavation, bedding, joining/welding, backfilling, ground works for the STP, etc. These activities may result in soil erosion which may become significant in rainy seasons. In addition to soil erosion, localized contamination of soil in the construction phase may result from the storage, handling and transfer of lubricants and fuels, liquids and solid waste. This impact will be short term and moderate negative in nature, but cumulative impact of construction of both components will be high negative and require stringent mitigation and management measures.</p>			
15.	Air Quality	<p>Component-I</p> <p>The critical sources of air pollution during the construction phase are:</p> <ul style="list-style-type: none"> Excavation activities at the project site would cause a minimum dust impact as the material excavated would be mainly from the Nullah having moisture content: however, the tasks 	<ul style="list-style-type: none"> Sprinkling of water shall be carried out at all the surfaces likely to generate fugitive dust emissions; Storage of construction materials shall be made either in sheltered areas or within hoardings. The storage areas shall be located away from sensitive 	Contractor	Proponent



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		<p>involving channelization of Nullah, demolishing of the structures and the excavation of borrow and quarry areas would be the potential sources of construction dust emission.</p> <ul style="list-style-type: none"> • Transportation of construction materials such as earthen materials, aggregate and sand in uncovered form; • Open storage of construction materials; • Earthwork operations such as land clearing, excavation, hauling, dumping, spreading, grading and compaction; • Movement of construction machinery, equipment, construction materials transport vehicles on unpaved roads or areas; • Construction activities like preparation of concrete at batching plants; • Exhausts of construction machinery, equipment, vehicles mostly using diesel as fuel; and • Emissions from asphalt and batching plants. <p>The emissions from the above sources would cause a lot of public health hazard and nuisance to the communities resided in the immediate surroundings of the proposed Project Site.</p> <p><u>Component-II</u> In addition to the above-mentioned activities and their associated impacts, there are several</p>	<p>receptors. Stockpiles shall be covered with tarpaulin with application of sprayed water during dry and windy weather. During high wind, no dust generating operations shall be permitted near residential areas having regard to the prevailing wind direction. Stockpiles of debris shall be dampened prior to their movement;</p> <ul style="list-style-type: none"> • Concrete batching plants should be equipped with dust control equipment such as fabric filters or wet scrubbers to reduce the level of dust emissions; • Ensure the proper and periodic tuning of the vehicles; • Haul-trucks carrying sand aggregate and other materials will be kept covered with tarpaulin to reduce the dust pollution; • NEQS provisions for ambient air quality, stack emission, noise levels and vehicular exhaust should be used for reference during the construction works. 		



Sr. No	Aspect	Impacts	Mitigation Measure	Responsibility	
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		<p>construction activities related to component-II that will also impact air quality of the project area. These activities may also affect the agricultural crops surrounding the STP. The impact of construction of trunk sewer and STP will be low to medium negative and temporary in nature. However, cumulative impact of both project components will be enhanced and may cause health issues in neighboring communities and to the workers and staff of the contractor via some diseases such as asthma and bronchitis, dryness and roughness of the throat, eyes, nose, etc.</p>			
16.	Noise	<p><u>Component-I</u> Noise generated by the construction machinery during the construction stage is likely to affect the COI particularly the sensitive receptors like nearby schools, hospital etc. Sources of noise during construction of Lai Expressway are heavy machinery such as bulldozers, excavators, stabilizers, concrete mixing plant, pneumatic drills, stone crushers and other equipment.</p> <p><u>Component-II</u> Construction noise impacts related to Trunk Sewer & STP are from construction machinery, generators, construction activities and vehicular movement carrying construction materials and spoil. The noise impact of component-II is not anticipated to be significant. These combined</p>	<ul style="list-style-type: none"> • Selection of up-to-date and well maintained plant or equipment with reduced noise levels ensured by suitable in-built damping techniques or appropriate muffling devices; • Confining excessively noisy work to normal working hours in the day, as far as possible; • Providing the construction workers with suitable hearing protection like ear cap, or earmuffs and training them in their use; • Preferably, restricting construction vehicles movement during night time; • Heavy machinery like percussion hammers and pneumatic drills should not be used during the night without 	Contractor	Proponent



Sr. No	Aspect	Impacts	Mitigation Measure	Responsibility	
				Implementation	Monitoring
		activities of both components will have significant noise impacts on pedestrians and residents of properties adjacent to the Nullah Lai/sewer routes and STP.	<p>prior approval of the Client;</p> <ul style="list-style-type: none"> Vehicles and equipment used should be fitted, as applicable, with silencers and properly maintained; Use of low noise machinery, or machinery with noise shielding and absorption; Contractors should comply with submitted work schedule, keeping noisy operations away from sensitive points; implement regular maintenance and repairs; and employ strict implementation of operation procedures; and Noise barriers in sensitive areas in the form of high boundary walls (concrete or wood), earth berms, etc. in front of schools, hospitals and mosques. 		
Waste Disposal (Construction Waste and Hazardous Waste)					
17.	Liquid and Solid Waste from Construction Camps	<p>Component-I</p> <p>Workers Camp will generate solid waste of domestic nature comprising kitchen waste, garbage, putrescible waste, rubbish and small portion of ashes and residues. Improper waste management activities will result in unhygienic conditions, health risk to work force and public at the camp site.</p> <p>The likely impacts of solid waste are:</p> <ul style="list-style-type: none"> Inadequate waste management practices can increase disease transmission, contaminate 	<ul style="list-style-type: none"> During construction phase, temporary drains and septic tanks would be necessarily made to dispose sewage waste appropriately. Proper monitoring to check the compliance of PEQS will be carried out; Sewage from construction camps will be disposed of after proper pre-treatment and processes such as soakage pit; 	Contractor	Proponent



Sr. No	Aspect	Impacts	Mitigation Measure	Responsibility	
				Implementation	Monitoring
		<p>ground and surface water and ultimate damage to the ecosystem.</p> <ul style="list-style-type: none"> • Insecure and unhygienic disposal of the solid wastes generated at the worksite, particularly garbage and trash may cause degradation of soil and land; • Insecurely disposed off heaps of wastes containing kitchen garbage and food waste can serve as breeding grounds for the disease spreading vectors and rodents; • Throwing away of solid wastes into water channels and the wastewater network can result into choking of the water system. <p><u>Component-II</u> Construction camps for Component-I and II may be developed at same location. Hence wastewater and solid waste related impacts due to construction camps will be the same as described above. Cleaning of Nullah Lai and disposal of solid waste from the both banks of nullah would be the main area of concern. About 3,598,920 m³ of solid waste will be generated.</p>	<ul style="list-style-type: none"> • All the solid waste from the camps should be properly collected at source by placing containers and disposed of through proper solid waste management system. The Contractor will coordinate with local representatives and administration concerned department for the disposal of solid waste; The concerned department must develop a plan of action for transporting the waste to the disposal site for final disposal. It is the responsibility of the concerned department to ensure that the disposal site is properly lined to prevent the leachate from contaminating the groundwater; • Secondly, the disposal site must be located away as far as practical from populated areas and regions that have a high density of Wildlife; • Toxic waste will be handled, stored, transported and disposed-off separately; • The waste will be properly sealed in containers with proper labels indicating the nature of the waste; • Solid waste will be segregated at source so that it can be re-used or recycled; 		



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			<ul style="list-style-type: none"> • Insecticides that are less toxic to human health should be used; • Construction workers and supervisory staff should be encouraged and educated to practice waste minimization, reuse and recycling to reduce quantity of the waste for disposal; • Prohibit open burning of solid waste; • Solid/hazardous waste removed from cleaning of Nullah Lai should be disposed off at designated landfill site; • Transport routes should be coordinated with the relevant government department and communities for safe haulage; and • Trucks carrying waste/sludge should be covered with protective sheets. 		
	Construction Waste (Component-I & II)	<p><u>Component-I & II</u> The construction waste will include wastewater, oil spillage from machinery and solid waste (damaged or spoiled materials, temporary and expendable construction materials etc.). The handling and storage of oil, asphalt/bitumen may be a source of environmental pollution as a hazardous waste. Improper disposal of construction waste can lead to nuisance and hazards towards environment and local population. The likely impacts of construction waste are:</p>	<ul style="list-style-type: none"> • Wastewater effluent from equipment washing yards would be passed through gravel/ sand beds to remove oil/ grease contaminants before discharging it into natural streams; • An efficient and responsive solid waste management system should be devised for the entire duration of the construction phase. Such a system should provide for separate collection of different categories of 	Contractor	Proponent



Sr. No	Aspect	Impacts	Mitigation Measure	Responsibility	
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		<ul style="list-style-type: none"> • The unspent materials and debris produced from consumed up materials, if left as such and allowed to mix with soil underneath, can degrade the quality of receiving soils and may render them unfit for plantation later on; • Leakages of oils, lubricants, chemicals, and other similar substances from their storage sites and from engines of the generators, machines, equipment and vehicles can spoil the receiving soils and may undermine ability of the spoiled soils to support growth of vegetation and plants; • Also, washing of the gadgets, machinery and equipment without proper drainage of the washout water can adversely affect the soil quality. 	<p>constructional wastes. The wastes which will be reusable/recycleable (iron bars, aluminum) should be sold to waste vendors and those which cannot be sold out (brick pieces) may be used as a filling material for leveling the depressions, subject to technical feasibility;</p> <ul style="list-style-type: none"> • Training of working force in the storage and handling of materials and chemicals that can potentially cause soil contamination; • Solid waste generated during construction will be safely disposed in demarcated waste disposal sites and the contractor will prepare a site-specific waste management plan; • Proper labelling of containers, including the identification and quantity of the contents, hazard contact information etc. and Material Safety Data Sheets (MSDS) should be strictly followed during handling and storage of chemicals; • The site will be restored back to its original conditions after construction phase; • As applicable and needed, plantation of grasses and shrubs will be done at appropriate place where required; 		



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			<ul style="list-style-type: none"> • Training of employees involved in the transportation of hazardous material regarding emergency procedures; and • Providing the necessary means for emergency response on call 24 hours/day. 		
18.	Water Resources	<p><u>Component-I & II</u> a) Contamination of Surface Water The proposed expressway and Trunk Sewer will be constructed along the banks of the Nullah Lai, which is a storm-water drain and is already polluted by sewage and solid waste disposal. It may get further polluted due to the following activities:</p> <ul style="list-style-type: none"> • Contaminated discharge from workshops, machinery and equipment washing areas, asphalt plants, batching plants, fuel and chemical storages and refuelling areas; and • Indiscriminate disposal of construction waste and solid waste & wastewater from construction camps. 	<ul style="list-style-type: none"> • Protection of surface water reserves i.e. Nullah Lai, Soan River from any source of contamination such as the construction and oily waste; • The wastewater from the construction camp(s) shall be collected and properly disposed of into the existing municipal drain. According to the PEQS, Biological Oxygen Demand (BOD) of all surface discharges from domestic and industrial wastes should not exceed 80 mg/l. • The municipal solid waste from these camp(s) shall be disposed off in officially designated dumping sites. The Contractor(s) shall submit details of site-specific waste management plan; • Regular water quality monitoring shall be carried out according to the schedule specified in the Environmental Monitoring Plan 	Contractor	Proponent



Sr. No	Aspect	Impacts	Mitigation Measure	Responsibility	
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		<p>b) Contamination of Groundwater Waste from the construction camp or washing yard, if allowed to stagnate, may percolate through the soil and have potential impact on ground water quality that is likely to be moderate to severe negative</p>	<ul style="list-style-type: none"> • Store waste on impermeable surfaces in secure, covered areas with clear labelling of containers protected from rain and wind; • Proper sanitation facilities and drainage arrangements for wastewater shall be provided to restrict impoundments and percolation of wastewater generated at camp and construction sites (storage reservoirs and Intake Point) and will be properly disposed off.; • Maintenance of vehicle and machineries will be practiced on an impermeable surface such as a concrete floor. A storage room should also be provided with an impermeable floor; • Storage of the lubricant and fuel on the bunded area; and • Washing yards shall be developed away from the surface water bodies and agricultural land and paved to avoid seepage from the yard 		
		<p>c) Siltation of Natural Streams and Channels The surface water channels i.e. Nullah Lai and Soan River may also be prone to increase in sedimentation and silt if the runoff from excavated material (loose aggregate) from the</p>	<ul style="list-style-type: none"> • Proper storage areas far away from the water bodies will be defined to manage excavated material. • All the areas disturbed due to erosion need to be protected against soil 		



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		construction area, workshops and equipment washing-yards is not avoided.	erosion by stripping and stockpiling all the available topsoil for later re-vegetation.		
19.	Flooding	<p><u>Component-I & II</u> The Nullah Lai is experiences the flash flooding in every monsoon period due to heavy rains in its upper catchment areas. Construction activities may be hampered in case of any flash flood during the rainy season in the Nullah Lai which may damage under construction structures of the proposed expressway, trunk sewer, STP and resulting in loss of human lives.</p>	<ul style="list-style-type: none"> Construction activities shall be carried out during dry part of the year and the Contractor shall plan the work accordingly. 	Contractor	Proponent
20.	Traffic Management	<p><u>Component-I</u> Traffic management will be an issue due to increased traffic volume in the Area caused by movement of vehicles carrying construction materials, construction machinery and equipment and commutation of workforce. These issues are envisaged as temporary and major negative in nature due to already overcrowded roads leading to the Project Site.</p> <p><u>Component-II</u> Construction activities related to Trunk sewer and STP involve transportation of building materials, debris and solid/construction waste. Construction traffic, especially cleaning of Nllah Lai may create a heavy load of trucks on local roads (many of which are already in poor condition) and result in further deterioration of</p>	<p>To minimize traffic problems in the Project Area:</p> <ul style="list-style-type: none"> Public will be made aware of changes to traffic flows in advance of construction and during construction at the site. Site specific traffic management plan will be prepared by the Contractor to avoid traffic jams/public inconvenience; Movement of vehicles carrying construction materials should be restricted during the daytime to reduce traffic load and inconvenience to the local population; Construction vehicles, machinery and equipment will move or be stationed in the designated ROW to avoid traffic 	Contractor	Proponent



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				Implementation	Monitoring
		some roads. It will also affect the traffic movements, road users and pedestrians.	<p>congestion;</p> <ul style="list-style-type: none">• Damages should be instantly repaired and/or compensated;• Availability of continuous services of the police in the diversion and control of traffic;• The executing agency is required to maintain liaison between the traffic police, local residents/ travelers and the contractor to facilitate traffic movement during construction stage;• Planning of haulage routes in the vicinity of the Project Area;• The traffic on the existing roads shall be managed by the local traffic police department in order to avoid traffic accidents and congestions causing unnecessary delays;• Special attention shall be given to the routes to be used for transportation of construction materials to the construction site(s); and• Provision of proper sign boards for smooth flow of traffic.		
21.	Occupational Health and Safety	<u>Component-I & II</u> Health risks and work safety problems may result at the workplace if the working conditions provide an unsafe and/or unfavorable working environment. The workers' Health and Safety	<ul style="list-style-type: none">• The issues related to operation of the construction machinery and equipment and transportation shall be overcome by efficient management, staff training, maintenance of	Contractor	Proponent



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				Implementation	Monitoring
		<p>issues are mostly associated with the operation of construction machinery and equipment, and transportation. The underlying causes of these issues generally involve human errors, operational faults of machinery and Slips and falls are associated with poor housekeeping including excessive debris, oil spills, and loose construction materials. Increased air and noise pollution levels may also cause health-related impacts on the workers. The local communities and workers will be vulnerable to increased incidences of diseases due to indiscriminate disposal of solid waste and wastewater in the Project Area.</p>	<p>machinery and equipment, and other preventive measures. Preventing accident is an engineering and administrative problem, which strictly relies on adherence to establish safety rules and regulations;</p> <ul style="list-style-type: none"> The construction contractor will be required to provide on-site workers with Personal Protective Equipment (PPEs) including gloves, noise attenuators, dust masks, steel-tipped shoes and hard hats. In addition, sanitary facilities and clean water should be provided. All workers employed on mixing of concrete shall be provided with protective foot wear and protective goggles. Adequate precautions shall be taken to prevent danger from electrical equipment of the existing buildings. No material will be so stacked or placed as to cause danger or inconvenience to any person or the public. Workers who are engaged in welding works shall be provided with welder's protective eye shields. All necessary precautions should be observed while constructing at height. Training of the workers in the construction safety, storage and 		



Sr. No	Aspect	Impacts	Mitigation Measure	Responsibility	
				Implementation	Monitoring
			<p>handling of materials and chemicals;</p> <ul style="list-style-type: none">• Safety of the workers working under high risk situations like flooding;• Provision of emergency medical support like first aid kit;• The Contractor(s) shall also ensure that borrow pits are left in a tidy state with stable side slopes and proper drainage in order to avoid creation of stagnant water bodies, which are favorable places for breeding disease vectors (flies, mosquitoes);• Preparation of layout plan for camp site indicating safety measures taken by the Contractor, e.g. fire fighting equipment, safe storage of hazardous materials, first aid, security, fencing, and contingency measures in case of accidents;• Adequate signage, lightning devices, barriers during construction to manage traffic at construction sites and access roads;• Road safety education shall be imparted to drivers operating construction vehicles; and <p>Timely public notification on planned construction works.</p>		



Sr. No	Aspect	Impacts	Mitigation Measure	Responsibility	
				Implementation	Monitoring
22.	Community and Safety Health	<p>Component-I & II</p> <p>The construction activities and vehicular movement at construction sites and access service roads may also result in road side accidents particularly inflicting local communities who are not familiar with the presence of heavy equipment and machinery. This is a temporary and moderate negative impact.</p> <p>Quality of ground water and surface water resources available in the nearby local communities may get contaminated due to the construction activities, oil spillage and leakage, roadside accidents etc. The laborers work with different transmittable diseases may cause spread out of those diseases in the local residents.</p>	<ul style="list-style-type: none"> • Close consultation with local communities to identify optimal solutions for diversions to maintain community integrity & social links; • Seeking cooperation from local educational facilities (school teachers) for road safety campaigns; • If identified, consider additional guardrails at accident-prone stretches and sensitive locations (schools etc.); • Provision of proper safety signage, particularly at sensitive/accident-prone spots; • Sprays shall be regularly done to control vector borne diseases; • Reducing the impacts of vector borne diseases on the long-term health of workers should be accomplished through implementation of diverse interventions aimed at eliminating the factors that lead to disease, which includes prevention of larval and adult propagation of vectors through sanitary improvements and elimination of breeding habitats close to human settlements and by eliminating any unusable impounding of water; • During construction work pedestrian and vehicular passages should be provided for crossing near settlement; 	Contractor	Proponent



Sr. No	Aspect	Impacts	Mitigation Measure	Responsibility	
				Implementation	Monitoring
			<ul style="list-style-type: none"> • Use of water should not disturb public water availability and source of water should be selected carefully; and • Restricting access to the site through a combination of institutional and administrative control. 		
23.	COVID-19 Scenario	<p>The COVID-19 belongs to a family of viruses known as the Coronaviruses, which can cause illnesses ranging from the common cold to more severe diseases, such as the Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS). Infected people can spread COVID-19 through their respiratory secretions via droplets produced when an infected person coughs or sneezes, etc.</p> <p>To avoid the risk of exposure to COVID-19 Contractor must consider the physical well-being and safety of all the persons entitled to be on the Site and follow reasonable guidelines and recommendations of Government authorities and healthcare professionals.</p>	<ul style="list-style-type: none"> • Cover your mouth while cough or sneeze; • Avoid close contact with people who are sick; • Avoid the use of hard soap; • Wash your hands often with liquid soap and water for at least 20 seconds; • All the employees should ensure sanitization of hands at appropriate time; • Avoid touching your eyes, nose, and mouth with unwashed hands; • Use of Personal Protective Equipment (PPE) according to risk (a surgical or N95 mask); • Do not spit, wrap your oral and nasal secretion with tissue and throw it in a covered dustbin; • Balance your nutrition and exercise moderately; and • Sterilization / disinfection of medical 	Contractor	Proponent



Sr. No	Aspect	Impacts	Mitigation Measure	Responsibility	
				Implementation	Monitoring
			devices at Site dispensaries.		
24.	Resource Conservation	<p><u>Component-I & II</u> The materials used in construction of proposed project would include coarse aggregates (crush), fine aggregates (sand), steel, water, asphalt, reinforcement and cement etc. Almost all the materials to be used in the construction of proposed project are non-renewable and therefore their sustainable use is necessary for the future use.</p> <p>Fuel will be used to operate construction machinery, asphalt plant and batching plants. Sustainable use of energy resources is very important not only to continue future use but it will also help to reduce air emissions. For conservation of energy, efficiency of the engines and burning processes shall be considered during planning stage.</p>	<ul style="list-style-type: none"> Wastage of water should be reduced by training the workers involved in water use; Source of water should be carefully selected as water use for proposed project should not disturb the existing community water supplies; Ensure adequate insulation to reduce heat loss through batching plants; and Regularly monitor CO and CO₂ content of the flue gases to verify that combustion systems are using practical excess air volumes. 	Contractor	Proponent
25.	Possibility of Finding the Artifacts	<p><u>Component-I & II</u> During excavation, there is a chance of finding of artifacts. In that case, proper mitigation should be needed for the safety of any antiques. This impact can be categorized as local, short term, moderate to high intensity medium probability and reversible.</p>	<ul style="list-style-type: none"> The contractor shall immediately report through Supervision Consultant to Directorate General (DG) of Archaeological Department, Government of the Punjab to take further suitable action to preserve those antiques or sensitive remains; and Chance finds procedure should be developed and adopted in case of any accidental discover of cultural 		



Sr. No	Aspect	Impacts	Mitigation Measure	Responsibility	
				Implementation	Monitoring
			heritage.		
26.	Emergency Response	<p>Component-I & II</p> <p>Disasters such as earthquakes, flooding and other hazards may occur and that must be given priority for minimizing their impacts. This impact can be categorized as local, short term, moderate to high intensity medium probability and reversible.</p>	<ul style="list-style-type: none"> An Emergency Preparedness and Response Plan for flooding, earthquakes and manmade hazards shall be implemented in close consultation with the Rescue Services Department, Fire Fighting Department, bomb disposal squad and paramedics. In addition, training of the staff/employees regarding the emergency procedures/plans will be regularly conducted. A site-specific Emergency Preparedness and Response Plan is proposed to be prepared by Contractor during construction phase. 	Contractor	Proponent
Ecological Environment					
27.	Impacts on Flora	<p>The project will involve destruction of vegetation cover on construction areas particularly along expressway road construction and due to construction of the wastewater treatment plant. Option 2 component of the project will have minimum impact on the vegetation cover as negligible vegetation exists there. About 883 mature, sub-mature, pole crop and saplings of different tree/plants species will be disturbed during the construction phase of the project in different components of the project.</p> <p>Exhaust of noxious gases from movement of</p>	<ul style="list-style-type: none"> Cutting of trees shall be avoided, as far as possible so, that negative effects on the process of natural regeneration of species are minimized. A tree plantation program shall be formulated with the recommendations and technical support of concerned Forest Department. As a principal, ten trees shall be planted in place of felling of one tree in consideration of mortality. 		



Sr. No	Aspect	Impacts	Mitigation Measure	Responsibility	
				Implementation	Monitoring
		heavy machinery and dust will pollute air which will adversely affect health and vigor of plants. During construction activities, the Contractor's workers may damage the vegetation and trees (for use as fire-wood to fulfill the camps requirements).	<ul style="list-style-type: none">• Water and Power Department shall implement the program with the help of Forest Department and with the consultation of DFO.• The Forest Department shall involve the communities for carrying out plantation.• Open fires should be banned in the area to avoid hazards of fire in the area.• Clearing of vegetation cannot be avoided at the areas specified for project structures, but damage to the natural vegetation may be minimized by establishing campsites, workshops and batching plants on waste/barren land rather than on forested or agriculturally productive land.• However, if such type of land is not available, it shall be ensured that minimum clearing of the vegetation is carried out and minimum damage is caused to trees and undergrowth.• Construction vehicles, machinery and equipment will remain confined within their designated areas of movement.• The Contractor's staff and labour shall be strictly directed not to damage any vegetation such as trees or bushes. They shall use the paths and roads for		



Sr. No	Aspect	Impacts	Mitigation Measure	Responsibility	
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			<p>movement and shall not be allowed to trespass through farmlands or forested areas.</p> <ul style="list-style-type: none"> Contractor shall provide gas cylinders at the camps for cooking purposes and cutting of trees/bushes for fuel shall not be allowed. 		
	Impacts on Fauna	<p>During construction phase the existing population of mammals and reptiles of the construction areas will be affected due to disturbance arising from construction activities involving excavation, blasting, movement of machinery and vehicular traffic, movement of labour, camping, etc. The existing animals will leave the directly affected areas due to construction activities and human intervention. Some animals particularly reptiles may get killed during the earthworks operations. Moreover, the movements of the mammals and reptiles will be restricted during the construction phase.</p> <p>Birds as well will tend to move away from the construction areas and find shelter and food elsewhere due to the activities mentioned above for fear of being hunted / trapped.</p> <p>Noise generated from blasting and machinery particularly during the night hours will even scare the wildlife residing in habitats located at some distance from the construction areas.</p>	<ul style="list-style-type: none"> Care shall be taken during construction activities for avoiding purposely or chance killing of animals. Hunting, poaching and harassing of wild animals shall be strictly prohibited, and Contractor shall be required to instruct and supervise its labour force accordingly and clear orders should be given in this regard. The Contractor must be held responsible for instructing his work force accordingly and for enforcing this restriction. In addition, this shall have to be controlled by the Wildlife Department. Special measures shall be adopted to minimize impacts on the wild birds, such as avoiding noise generating activities during the critical periods of breeding. Blasting and other noise generating activities shall not be carried out during the night by the work force, 	Contractor	Proponent



Sr. No	Aspect	Impacts	Mitigation Measure	Responsibility	
				Implementation	Monitoring
		Uncontrolled blasting may even disturb the wildlife of the Project Areas. Food and refuse at the Contractor's camps may attract animals that might in turn be hunted by the workers.	<p>clear orders should be given.</p> <ul style="list-style-type: none"> • Similarly, wastes of the camps shall be properly disposed of to prevent it being eaten by animals, as it may be hazardous to them. • Noise produced by blasting and other construction activities may be kept to acceptable level. 		
28.	Socio-Economic Environment				
	Social Impacts of Labour Influx	This can be particularly acute in smaller communities hosting a largely male workforce and/or a workforce from other regions which may result in conflicts between locals and non-locals concerning employment opportunities, wages and natural resources. Mobile workers can also contribute significantly to gender-based social impacts and risks.	<ul style="list-style-type: none"> • Local population will be given preference in construction related jobs. Most unskilled workers will be hired from local communities, while for skilled manpower also, first choice will be given to local area residents. The Contractor will prepare the construction camp management plan which, in addition to other components, will include the labor influx management plan. • Good relations with the local communities should be developed. Contractor should provide job opportunities to skilled and unskilled locals and on-the-job training in construction for young people. • Contractor will restrict his permanent staff to mix with the locals to avoid any social problems by developing code of 	Contractor	Proponent



Sr. No	Aspect	Impacts	Mitigation Measure	Responsibility	
				Implementation	Monitoring
			conduct.		
	Impact on Graveyard	<p>Graveyards and burial sites are very sensitive for the local communities. During field survey, some graveyards were identified with more than 100 graves near the Lai expressway project area. These graves are ancient (kadeem) and belonging to the local communities.</p> <p>The shifting of graves falling in the ROW may cause social disruption leading to possible conflicts, ultimately affecting the project works. However, in the proposed project, no graves or burial site would be affected.</p>	<ul style="list-style-type: none"> Proposed project poses a destruction and disturbance to local graveyard. Detailed consultation will be conducted with the local communities and after the consensus and approval of the community the affected graves would be relocated to some other site. For this, a proper shifting allowance would be provided. 	Contractor	Proponent
	Religious Cultural Resources	Considerable religious cultural resources fall along the ROW which will be affected by the project. People will face problem in access. Noise and dust will also be a concern for public and will cause nuisance. This is moderate negative impact.	Avoid as far as possible interference with religious cultural resources; and prior notification to public before commencement of project.	Contractor	Proponent
	Disruption of Existing Public Utilities/ Infrastructure	There may be some disruption to the already existing public utilities such as electricity poles; telephone lines drain, cables lines etc.	Mitigation measures will include rehabilitation of existing utilities before construction to avoid any inconvenience to the residents of the project area or provide them with alternate arrangement during the construction period.	Contractor	Proponent
O&M Phase					
Component-I (Lai Expressway)					
29.	Landscape	At present, the landscape of the proposed project area is dominated by residential and commercial area. However, after the	No Mitigation	Proponent	Proponent



Sr. No	Aspect	Impacts	Mitigation Measure	Responsibility	
				Implementation	Monitoring
		<p>construction of Lai Expressway at both sides of Nullah Lai, the landscape of the project area will change in terms of road infrastructure, construction of bridges & flyovers, interchanges, and planned plantation of trees along the road.</p> <p>This will permanently change the landscape of the project area by removal of solid waste along the both sides of the Nullah, shifting of encroachers, demolition of nearby residences, etc. but at the same time will have a positive impact in terms of better landscape by removal of major source of nuisance and socio-economic development of the Project Area.</p>			
30.	Ambient Air Quality	<p>Air quality will improve in the short term due to improved road condition and reduced travel time thereby causing less fuel consumption. With the elapse of time, the traffic volume will increase with consequent increase in air pollution, which will induce impacts on environment and human health. The impacts on air quality would be permanent and moderate positive in the short-term and moderate negative in the long run.</p>	<ul style="list-style-type: none"> • Setting up a system to monitor air quality along expressway in accordance with the applicable standards/limits; • Roadside tree plantations as applicable and feasible under harsh climatic conditions; plants should be selected in accordance to their ability to absorb emissions; • Regular road maintenance to ensure good surface condition; • Speed limits at sensitive locations; • Regular vehicle check up to control/ensure compliance with NEQS; and • Enforcement and penalties against 	Proponent	Proponent



Sr. No	Aspect	Impacts	Mitigation Measure	Responsibility	
				Implementation	Monitoring
			traffic rules violators.		
31.	Noise	Noise will be generated due to movement of traffic and use of pressure horns which may cause psychological and physiological impacts on the surrounding population. These noise levels should not exceed to NEQS values. This would have permanent and major negative impacts on the neighboring population.	<ul style="list-style-type: none"> • Concrete or wood acoustic insulation barrier will act as noise barriers; • Tree plantation (proposed along both sides of the Expressway) will also help to curtail noise; • The pressure horns will be banned on the Expressway; • Enforcement and penalties against traffic rules violators; and • Noise measurements will be carried out at locations and as per schedule specified in the Environmental Monitoring Plan (Section 7 of this report) to ensure the effectiveness of the mitigation measures, e.g. speed limits, noise control, plantations at sensitive spots. 	Proponent	Proponent
32.	Surface Groundwater Contamination &	No major adverse impact on groundwater and surface water is anticipated during the operational phase, with the exception of some occasional oil spills from the vehicles, accidental spills from oil tankers, and occasional spills in the service areas. Though such spills are accidental, infrequent, and restricted upto the road surface, but sometimes the oil maybe washed into surface and groundwater during rains etc.	<ul style="list-style-type: none"> • The service areas will work under a system that have proper SOPs, provisions for oil spill prevention, staff training etc. • Random vehicle check to ensure compliance requirement • Enforcement and penalties against vehicle fitness violators. 	Proponent	Proponent



Sr. No	Aspect	Impacts	Mitigation Measure	Responsibility	
				Implementation	Monitoring
33.	Waste Generation	<p>During operation phase, non-hazardous waste may generate from road sweepings and small quantities of municipal waste from expressway management offices. No hazardous waste is expected to generate in operation phase except during road maintenance works. Transportation of hazardous waste is also expected and must be regulated.</p> <p>Solid waste generation during operation and maintenance activities may include road resurfacing waste (e.g. removal of the old road surface material); road litter, illegally dumped waste, or general solid waste; vegetation waste from right-of-way maintenance; and sediment and sludge from storm water drainage system maintenance. Paint waste may also be generated from road and bridge maintenance (e.g. due to removal of old paint from road stripping and bridges prior to re-painting).</p>	<ul style="list-style-type: none"> • A waste disposal site will be selected with the approval of provincial EPA for disposing off the regular waste on a daily basis. • The operations contractor/entity will hire sufficient number of sweepers for collection and disposal of solid waste. • Suitable number of waste bins will be placed along the road sides, bus stops and other such places. • For maintenance and re-carpeting, contractor will be required to submit a solid waste management plan. 	Proponent	Proponent
34.	Traffic Safety	<p>Enhanced vehicular movement and speed in the long run may result in road safety issues like traffic accidents. This impact is permanent but moderately adverse in nature, since the frequency of accidents may be lowered, but their intensity may be quite severe due to enhanced speeds at which vehicles will move.</p> <p>The high-speed vehicles may result in road safety issues like traffic accidents. This impact is</p>	<ul style="list-style-type: none"> • Mitigation measure will include strict enforcement of speed limits, installation of speed guns and channelization of traffic with respect to categories (heavy vehicle traffic and light vehicle traffic) and enforcement of penalties for the violators. 	Proponent	Proponent



Sr. No	Aspect	Impacts	Mitigation Measure	Responsibility	
				Implementation	Monitoring
		permanent but moderately adverse in nature, since the frequency of accidents may be lowered, but their intensity may be quite severe due to enhanced speeds.			
35.	Emergency Preparedness	Emergency situations most commonly associated with road operations include accidents involving single or multiple vehicles, pedestrians, and / or the release of oil or hazardous materials.	<ul style="list-style-type: none"> RDA will prepare an emergency preparedness and response plan in coordination with the local community, local emergency responders and the traffic police to provide timely first aid response in the event of accidents and hazardous materials response in the event of spills. 	Proponent	Proponent
36.	Flooding	The structures of the proposed Expressway may be damaged due to high velocity flood water.	An emergency response plan will be prepared to handle unforeseen emergencies.	Proponent	Proponent
Component-II (Trunk Sewer & STP)					
37.	Odor	The operation of STP will result in generation of odour from biological tanks, sludge holding areas and dewatering units. Moreover, scum is also another source of odour. Overloading of the ponds will also result in odour problems because the treatment capacity will have exceeded. Wind is an effective source of aeration through surface mixing, but too much wind action can disturb bottom sediments and also create an odour problem. In most instances, the odours are generated as a result of an anaerobic or "septic" condition, which causes nuisance to the residential community in the surroundings of the STP and the people passing by this area for	<ul style="list-style-type: none"> Strictly follow standard operating procedures and operational manual for operation and maintenance of lifting and pump stations; Ensure that operating staff is properly trained, and have clear understanding of odor issues related with operational practices; Ensure proper maintenance of the machinery; Regular cleaning of aeration tank walls and floors, washing weirs, and removing scum regularly, also helps in 	Proponent	Proponent



Sr. No	Aspect	Impacts	Mitigation Measure	Responsibility	
				Implementation	Monitoring
		schools, mosque and shops. The magnitude of this impact will be moderate adverse.	odour reduction; <ul style="list-style-type: none"> • Ensure adequate water flow in ponds and aeration to reduce the potential of odour formation; • Regularly monitor spread of unpleasant odors around STP, and apply additional measures of odor control based on the monitoring outcomes; • The proposed STP may install synthetic windbreakers (e.g. walls) around the existing facility may serve to minimize potential odour dispersions and will reduce the significance of the odour impact; and • A landscape should be properly designed with provision of new trees and ornamental plants around the boundary, roadside and stretches of open land. 		
38.	Air Quality	The operation of sewerage scheme and STP will result in generation of fugitive emissions including H ₂ S and CH ₄ (due to anaerobic conditions) and minor concentrations of N ₂ and NH ₃ from biological tanks and from sludge, if not handled properly or remain unattended. H ₂ S is a foul smelling poisonous gas which might be harmful for the workers of sewer maintenance and could be fatal sometimes. CH ₄ is a natural gas also referred to as a main greenhouse gas	<ul style="list-style-type: none"> • To mitigate the pollutants emissions use of low sulfur fuel should be ensured; • Location of generators should be carefully selected; • Plantation of trees along the STP to create a buffer zone that will help in absorbing the emissions; • Use of gas generators (if possible) 	Proponent	Proponent



Sr. No	Aspect	Impacts	Mitigation Measure	Responsibility	
				Implementation	Monitoring
		<p>contributes to global warming and having global warming potential of much higher than the carbon dioxide (CO₂).</p> <p>During operation phase, operation of stand-by generator and un-necessary idling of diesel run will also result in the emission of pollutants (CO, Smoke, NO₂, SO₂ CO₂ and PM₁₀) into the air, thus deteriorating air quality. These emissions may adversely affect the health of the nearby residents and working staff. This impact can be categorized as negative, local, medium negative and long-term.</p>	<p>should be preferred for low emissions;</p> <ul style="list-style-type: none"> • The height of the generator stacks should be high enough to disperse the emissions in the air; • Provision of budget for regular monitoring of ambient air quality in accordance with PEQS, 2016; • Improved monitoring, planning, and maintenance of the STP by WASA; • Workers for cleaning or maintenance of Sewer and STP should cover their faces with mask; • Use gas detector before inspection; • If possible, use different mechanisms to capture CH₄ and H₂S that can be used commercially; and • Plan and execute appropriate tree plantation along the Trunk Sewer and STP. 		
39.	Noise	<p>Due to the operation of proposed STP, noise and vibration may produce from the running of pumping machinery and standby generators which will be a constant source of nuisance to the local population. Therefore, the magnitude of this impact is considered to be moderate adverse.</p>	<ul style="list-style-type: none"> • Regular maintenance of vibrating parts through a well-coordinated operation and maintenance procedure which consists of checking periodically all parts of the pumping machinery, its oiling to remove friction, replacement in case of malfunctioning and periodic noting of noise levels; • All noisy equipment and machinery such as generators and blowers 	Proponent	Proponent



Sr. No	Aspect	Impacts	Mitigation Measure	Responsibility	
				Implementation	Monitoring
			<p>should be housed in closed rooms or buildings;</p> <ul style="list-style-type: none"> • Provision of budget for regular monitoring of noise in accordance with PEQS, 2016; and • Tree Plantation Plan should be devised to reduce noise issues. 		
40.	Surface & Groundwater Contamination	<p>The proposed project will involve the installation of Trunk Sewer, there are certain environmental risks from the operation of the sewer system, most notably from leakage of sewer pipes, as untreated fecal material can mix with ruptured water supply lines and contaminate drinking water supply as well as groundwater. Temporary flooding of adjacent areas may occur due to accidental leakages, bursts and blockage of trunk sewer and impairment of receiving water quality in surface and sub-surface source.</p> <p>During operation of STP, there is a possibility for ground water contamination due to leakages from evaporation pond or lagoons containing wastewater or short term storage of sludge in ponds, which may lead to the accumulation of heavy metals in water resources.</p> <p>Aforementioned impacts on water resources will be reduced as it will be ensured during the design phase that the ponds, lagoons and the</p>	<ul style="list-style-type: none"> • Establish regular maintenance program including regular cleaning of sewer lines to remove grease, grit, and other debris that may lead to sewer backups; • The retention times should be kept to its lowest possible, so that there is no stagnation of sewage for long time which could create anaerobic conditions; • Cleaning should be conducted more frequently in problematic areas; • Inspection of the condition of sanitary sewer structures and identifying areas that need repair and maintenance comprising cracked and deteriorating pipes; leaking joints or seals at manhole; frequent line blockages; lines that generally flow at or near capacity; and suspected infiltration or exfiltration; 	Proponent	Proponent



Sr. No	Aspect	Impacts	Mitigation Measure	Responsibility	
				Implementation	Monitoring
		storage pits are lined with geo-permeable membrane or other lining material. However, there may be a slight possibility of contamination risk due to damage of lining material beneath the ponds and storage pits.	<ul style="list-style-type: none">• Monitoring of sewer flow to identify potential inflows and outflows;• Maintain records; review previous sewer maintenance records to help and identify “hot spots” or areas with frequent maintenance problems and locations of potential system failure, and conduct preventative maintenance, rehabilitation, or replacement of lines as needed;• Develop an Emergency Response System for the sewerage system leaks, burst and overflows;• Provide necessary health and safety training to the staff in sewer cleaning and maintenance;• Develop standard operating procedures and operational manual for operation and maintenance of trunk sewer and STP, and provision of sufficient O&M staff in annual budget;• Provision of sewer cleaning equipment should be included in the project cost; and• Development of a system to register public complaints and urgent clearance of blockages in the system.		



Sr. No	Aspect	Impacts	Mitigation Measure	Responsibility	
				Implementation	Monitoring
41.	Solid Waste	<p>Domestic and hazardous wastes would be generated during cleaning and maintenance facilities of Trunk Sewer. The solid waste during operational phase will consist of plastics, metal and organic wastes present in sewer lines. Hazardous waste will be present in form of sludge. Such wastes can cause blockage to drainage systems. Some of these waste materials especially plastics and polythene which are not biodegradable may cause long term injurious effects on the environment. This will be a temporary and minor negative impact.</p> <p>Sludge will be produced during the operational phase of STP as a solid waste. The concentrate produced will be evaporated on-site in evaporation ponds and sludge will be moved for disposal. The temporary accumulation of sludge in the ponds after evaporation and in the storage pits may be the potential cause of soil or water resources contamination. Sludge accumulation can create two problems:</p> <ul style="list-style-type: none"> • It produces odour because it accumulates and becomes anoxic. • It serves as a vector for diseases and propagation of flies and mosquitoes. <p>However, it has been ensured during the design phase that the ponds and the storage pits are lined with geo-permeable membrane or other</p>	<ul style="list-style-type: none"> • The sludge removed from the sewers should not be left openly on the roads. It may be recycled as fertilizer; • Ensure temporary storage of sludge from STP on lined material to avoid soil contamination. • Regular inspection and maintenance should be schedule and implemented to ensure removal of solid waste and sludge when accumulated; • Proper disposal of sludge to the designated solid waste dumping site; • Implementation of sludge handling and storage procedures should be ensured; • Provide adequate ventilation where volatile wastes are stored; • Waste minimization should be encouraged and regular training should be provided to WASA staff in correct identification and disposal of waste; • Storage areas should be cleaned regularly to minimize odor, pests and nuisances and preserve visual amenity; • All empty containers not suitable for reuse should be rinsed and punctured prior to disposal; 	Proponent	Proponent



Sr. No	Aspect	Impacts	Mitigation Measure	Responsibility	
				Implementation	Monitoring
		lining material which reduces the significance of impact. In addition, sludge shall be collected and disposed off in time and proper manner which reduces the impact of sludge accumulation.	<ul style="list-style-type: none"> An organized collection system and its implementation through a licensed contractor; and Schedule inspection of the sewer lines to keep it clean, and to identify any hazardous material. 		
42.	Health Risks associated with Burst Sewers	Improper maintenance of trunk sewer can lead to dispersal of raw sewage particularly at manholes and burst areas into the environment. These can cause outbreaks of water borne diseases like malaria, cholera and typhoid from contamination of water sources by raw sewage.	<ul style="list-style-type: none"> Ensure proper and periodic maintenance of sewer lines; Awareness rising among community members not to dump solid waste in manholes; Development of an inventory of system components, with information including age, construction materials, and drainage areas served elevations required for proper maintenance; Design manhole covers to withstand anticipated loads, and ensure that the covers can be readily replaced if broken, to minimize entry of garbage and silt into the system; and Ensure sufficient hydraulic capacity to accommodate peak flows and adequate slope in gravity mains to prevent build-up of solids and hydrogen sulphide generation. 	Proponent	Proponent
43.	Health and Safety of Workers	The operation of the proposed trunk sewer and STP may cause some negative impacts on health and safety of workmen. The sewer	<ul style="list-style-type: none"> All operation and maintenance staff will be trained in hygienic procedures designed to avoid infection from 	Proponent	Proponent



Sr. No	Aspect	Impacts	Mitigation Measure	Responsibility	
				Implementation	Monitoring
		cleaning staff may be exposed to waterborne communicable diseases if precautionary measures are not adopted. Since the proposed trunk sewer, upon its completion, will be handed over to WASA, the concerned officials of the WASA will ensure that the operation and maintenance personnel are fully aware of the hazards involved in running the system.	<p>wastewater, and health and safety procedures against any exposure to hazardous gases;</p> <ul style="list-style-type: none"> • Gas detector will be used to indicate the presence of any hazardous gas before the entry of workers into the sewer for cleaning purposes; • Ventilation of sewers will be done before entry to avoid accumulation of noxious gases; • Workers will also be inoculated against infectious diseases and kept under medical surveillance; • Formal emergency procedures will be developed by the concerned officials of WASA for dealing with the accidents; and • The sewer & STP cleaning workers will be provided protective clothing. 		
44.	Operational Sustainability	The most pressing need is the sustainability of Sewage collection system and its disposal, and it can be assessed on many factors including capacity issues of government departments dealing with municipal services, efficiency of the system and its performance, life cycle analysis (aging and deterioration), natural hazards (earthquakes, floods and fire outbreaks), escalation in population growth and energy requirements.	<ul style="list-style-type: none"> • Establishment of Monitoring and Maintenance System for wastewater treatment before its final disposal into surface water bodies; • Regular operation and maintenance of the scheme; • Capacity building and training of workers; • Periodic environmental monitoring; • Trunk sewer & STP should be 		



Sr. No	Aspect	Impacts	Mitigation Measure	Responsibility	
				Implementation	Monitoring
		The three major drivers considered worldwide for ensuring sustainability are: (i) economic considerations, (ii) social considerations and (iii) environmental protection. Therefore, the municipal services provider i.e. WASA, must consider these aspects in achieving appropriate and optimize use of sewer and drainage system.	<p>designed in a such ways that withstand existing climate change issues e.g.: intense rainfall events and increase and decrease in temperature;</p> <ul style="list-style-type: none"> • Cost for the operation and maintenance in the annual budget of WASA; and • Recover heat that is present in sewage for energy use i.e. heating swimming pools and office buildings. 		
45.	Emergency Preparedness and Response	The operation of the Trunk Sewer & STP may encounter emergencies like operation failure in addition to disasters such as earthquakes and floods. This impact is negative, temporary and moderate in nature.	<ul style="list-style-type: none"> • An Emergency Response Plans for floods, earthquakes, and manmade disasters must be developed by the WASA, in close consultation with Fire Fighting Department (FFD) and National Disaster Management Authority (NDMA); • Training of staff and employees regarding the emergency procedures and plans should be regularly conducted; • Responsible person to implement the Emergency Response Plan should be clearly designated; • Emergency numbers should be clearly posted, so that a quick action is taken when an emergency arises; • Fire Fighting Systems should be calibrated and maintained regularly; 	Proponent	Proponent



Sr. No	Aspect	Impacts	Mitigation Measure	Responsibility	
				Implementation	Monitoring
			and <ul style="list-style-type: none"> Regular drills for fire emergencies should be carried out. 		
Ecological Environment					
46.	Impacts on Flora	During Operational stage the Project will not affect Flora (Trees and agricultural crops) or release any significant pressure detrimental to flora. Low level impact is expected at operational phase on Flora due to the Operational and Maintenance activities. This impact is Site-specific, Temporary, Short-term, Irreversible, Unlikely and Low Significant.	<ul style="list-style-type: none"> The implementation of plantation plan recommends in compensation for cutting of trees should start working during operational stage, to ensure the ecological balance and to avoid any impact on local Environment. Large scale planting with suitable indigenous trees, shrubs and ornamental plants in the form of Tree Groves, and Linear Plantation will be carried out in accordance with the Tree Plantation Plan to improve aesthetic value and offset the effect of removal of vegetation. Proper check and balance for above activities is highly recommended. Plantations so, raised must be maintained according to the Silvicultural practices which include proper Irrigation, Cleaning, Pruning, Thinning at prescribed intensity, Silt clearance and Trench-opening, etc. Maintenance and security of the plantation should be done for at-least five years (in consultation with the 	Proponent	Proponent



Sr. No	Aspect	Impacts	Mitigation Measure	Responsibility	
				Implementation	Monitoring
			forest department). Measures such as fencing, watch guards and fire protection should be considered. <ul style="list-style-type: none"> All activities must be done under the technical supervision of Forest department. 		
47.	Impacts on Fauna	There is no protected area, Game reserve, Game sanctuary or national park in the project area so no major impact on Wildlife & Livestock in the area is expected through, noise, vibration and any type of normal activity in the project area, thus will have no effect on productivity.	<ul style="list-style-type: none"> The pathways of locally available wildlife for food, Shelter and other normal activities must be compensated with proper alternative routes/pathways & water points must be provided to minimize the impact & movement of available wild animals. In proper consultations with Forest and Wildlife department permanent water points for available fauna must be provided to conserve local ecosystems & biodiversity. Strict control must be exercised for stoppage of killing/poaching of available wildlife species by enhancing protection practices and deploying effective watch and ward system. The precautionary measures described for future shall also be applicable during operation phase as relevant for the conservation of wildlife species in the Study Area. 	Proponent	Proponent
48.	Gender Issues	At operational stage the induction of outside labor for O&M works may create social and	Project staff should respect the local community's sensitivity towards their	Proponent	Proponent



Sr. No	Aspect	Impacts	Mitigation Measure	Responsibility	
				Implementation	Monitoring
		gender issues due to the unawareness of local customs and norms. It will also cause hindrance to the mobility of the local women. Disturbance may occur to the privacy of the local women residing in the nearby area.	customs and traditions. The staff must not involve any un-ethical activities and should obey the local norms and cultural restrictions particularly with reference to women.		

7.7 ENVIRONMENTAL MONITORING PLAN

Environmental monitoring provides timely and useful information to the project management and implementation agencies. Conceptually, “monitoring” means to check and balance, on a regular basis, the status of the project activities and realization of various developmental targets during construction, operation and maintenance. It helps in timely identification/analysis and removal of the bottlenecks and expedites actions. Certain environmental parameters (physical, ecological and social) are selected and quantitative analysis is carried out. The results of analysis are compared with the guidelines; standards and pre-project condition to investigate whether the EMP and its implementation are effective for the mitigation of impacts or not. The objectives of environmental monitoring plan during the construction and O&M phases will be as follows:

- Monitor the actual project impacts on physical, ecological and socio-economic receptors;
- Recommend mitigation measures for any unforeseen impact or where the impact level exceeds the anticipated level in the report;
- Ensure compliance with legal and community obligations including safety during construction and O&M phases;
- Ensure the safe disposal of excess construction materials, solid waste, water and wastewater and gaseous emissions;
- Appraise the adequacy of the EIA with respect to the project’s predicted long-term impacts on the area’s physical, ecological and socio-economic environment;
- Evaluate the effectiveness of the mitigation measures proposed in the EMP and recommend improvements in EMP, if required; and
- Compile periodic incidents/accidents data to support analyses that will help to minimize future risks.

7.7.1 Monitoring Strategy

Under the proposed monitoring strategy, it is recommended that RDA should be responsible for all the monitoring activities. All the findings and results in the form of monitoring report will be finally shared with Punjab-EPA. The monitoring program has been designed carefully considering the identified impacts mentioned in **Chapter-6** and some additions or deletions probably in frequency may be taken up in this program after learning lessons from one year operation of the Project through Change Record Register. **Table 7.2** provides environmental monitoring schedule for construction and operational phases of the proposed Project.



Table 7.2: Environmental Monitoring Plan

Sr. No.	Receptor	Monitoring Parameters / Performance Indicator	Location	Monitoring Mechanism	Monitoring and Reporting Frequency
1	Water Resources/ Water Quality	Compliance with all parameters as per NEQS 2000 and PEQS 2016 for wastewater and drinking water.	Major receptor i.e. Swan River and Lai Nullah, residential areas etc. within the RoW of the proposed Expressway, Trunk Sewer and STP site. However, estimated sampling points for drinking water and wastewater are five (05) each which will be verified at construction stage. Other proposed effluent discharge points are: <ul style="list-style-type: none">– Contractors camps– Concrete preparation plants– Fuel (Petrol. Oil and Grease) products storages.– Vehicle and machines repairing and servicing yards.	Visual checks of Environmental Monitoring activities by laboratory Discrete grab sampling and laboratory testing of water samples by EPA approved Laboratory for monitoring.	Once before the start of construction by activity monitors and reported on quarterly basis during the construction Bi-annually for at least one year during O&M.
2	Soil Contamination	Soil contamination, uncontrolled solid waste disposal activities at sites.	Expressway Route, Trunk Sewer and STP site. Other proposed sampling sites are: <ul style="list-style-type: none">– Construction Camp.– Equipment washing yards.– Spillage points of fuel, chemicals and lubricants.	Visual observations and checks of laboratory activities Sampling and laboratory testing for soil samples.	Once before the start of construction by activity monitors and reported on quarterly basis during the construction Bi-annually for at least one year during O&M.
3	Land Resources	Landuse change from residential to commercial.	Expressway route and STP site.	Random visits and visual observations of landuse change.	Once before the start of construction by activity monitors and reported on Monthly



Sr. No.	Receptor	Monitoring Parameters / Performance Indicator	Location	Monitoring Mechanism	Monitoring and Reporting Frequency
					basis during the construction Bi-annually for at least one year during O&M.
4	Dust Emissions	Compliance with PM ₁₀ , PM _{2.5} as per NEQS 2010 and PEQS 2016	Sensitive receptors within the RoW of the proposed Expressway, Trunk Sewer and STP site. Estimated sampling points are ten (10) which will be verified during construction stage.	Visual checks of Environmental Monitoring activities by laboratory Onsite Ambient Air Monitoring equipments	Once before the start of construction by activity monitors and reported on quarterly basis during the construction Bi-annually for at least one year during O&M.
5	Noise Pollution	Compliance with dBA Leq. as per NEQS 2010 and PEQS 2016	Sensitive receptors within the RoW of the proposed Expressway, Trunk Sewer and STP site. Estimated sampling points are ten (10) which will be verified during construction stage.	Visual checks of Environmental Monitoring activities by laboratory Monitoring of noise level at site.	Once before the start of construction by activity monitors and reported on quarterly basis during the construction Bi-annually for at least one year during O&M.
6	Fumes and gases	Monitoring of CO, CO ₂ , SO _x , NO _x , HC and PM _{2.5} PM ₁₀ and compliance with NEQS 2010 and PEQS 2016. Vehicular emissions as per NEQS 2009 and	Major receptors within the RoW of the proposed Expressway, Trunk Sewer and STP site. Estimated sampling points are ten (10) which will be verified during construction stage. Emissions from the silencers of heavy machinery, trucks and other vehicles.	Visual checks of Environmental Monitoring activities by laboratory Onsite monitoring of ambient air quality will be preferred.	Once before the start of construction by activity monitors and reported on quarterly basis during the construction Bi-annually for at least one year during O&M.



Sr. No.	Receptor	Monitoring Parameters / Performance Indicator	Location	Monitoring Mechanism	Monitoring and Reporting Frequency
		PEQS 2016			
7	Ecological Resources	Disturbance to natural habitat, uncontrolled floral cutting which can be avoidable.	Natural habitats along the RoW of the proposed Expressway, Trunk Sewer and STP site.	Visual checks to ensure that only marked trees are cut within the Project corridor. Monitoring of Wildlife / birds hunting.	Once prior to the start of construction. Monitoring and reporting on monthly basis during the construction stage. Bi-annual monitoring and reporting during the operation stage.
8	Structure e.g. houses, schools, mosques, etc.	Disturbance and removal of avoidable structures which are within the Project corridor.	Structures within the RoW of the proposed Expressway. These structures will be verified prior to the start of construction.	Random visits and consultations with AP's.	Prior to the start of construction.
9	Public Infrastructure	Disturbance or damage to public infrastructure	Public infrastructures within the RoW of the proposed Expressway, Trunk Sewer and STP site. These structures will be verified prior to the start of construction.	Random visits and consultations with AP's.	Prior to the start of construction.
10	Community around the Project Area	Use of common resources. Hindrance to mobility. Community health and safety	Communities within the RoW of the proposed Expressway, Trunk Sewer and STP site.	Community consultations.	Prior to the start of construction and during the construction stage.



7.8 TRAINING AND CAPACITY BUILDING

To enhance the capacity of the Proponent as well as the Contractor, training will be imparted related to the environmental and social issues of the proposed Project, implementation of mitigation measures and the monitoring protocols and reporting mechanism will also be carried out.

In-house training for the project staff including contractor, consultant and the supervisory staff of the Proponent will be ensured through the provision of one day basic training and one day advanced training, covering environmental and social aspects of the development projects in general, and implementation requirements with emphasis on the roles and responsibilities of the proponent and the contractor staff while executing the environmental management and monitoring plan in particular. The training protocols will include the following aspects:

- Procedures for monitoring the air quality parameters and measures to be adopted for avoiding or minimizing air pollution, particularly from the concrete batching plant, haul-trucks, etc.;
- Procedures for monitoring water quality parameters and measures to be adopted for avoiding or minimizing water pollution, particularly from the wastewater effluent generated from the workshops, machinery washing yards, and other obnoxious chemicals;
- Safe waste management and disposal practices;
- Safe noise levels from the construction machinery etc.;
- General housekeeping and cleanliness;
- Communicable diseases;
- Safety measures against hazards for workforce and the local communities arising from the construction activities; and
- Use of safety gadgets by the workforce.

A comprehensive training manual will be developed and implemented by the Contractor with prior consent of SC environmental staff.

7.9 COMMUNICATION & DOCUMENTATION

Communication and documentation is an essential feature of EMP. The key features of such mechanism are:

7.9.1 Data Recording and Maintenance

All forms to be used for recording information during the environmental monitoring will follow a standard format which will correspond to the data base in to which all the gathered information will be placed. Check boxes will be used as much as possible to facilitate data entry. Tracking system will be developed for each form.

7.9.2 Database

The database may include the following information:

- Training programs;
- Staff deployment;
- Non-compliances;
- Corrective actions
- List of environmental data; and
- List of environmental data to be maintained:
 - Soil and land pollution;
 - Disposal of waste;
 - Water resources;
 - Fuel oil and chemical spills;
 - Vegetation record;
 - Noise pollution;
 - Air and dust pollution;
 - Socio-economic data; and
 - Ecological sensitivities.

7.9.3 Meetings and Reporting

Monthly meetings will be held at site during the construction phase. The purpose of these meetings will be to discuss the routine activities, non-compliances and their remedial measures. Various reports will also be produced at periodic time intervals, as provided in **Table 7.3** along with information regarding persons responsible for report preparation and review process. Additionally, minutes of meeting will also be submitted as part of routine environmental reports.

Table 7.3: Periodic Reporting Mechanism

Sr. No.	Report Category	Prepared by	Reviewed by
1	Monthly	Contractors' environmental staff	RDA/SC
2	Quarterly	Contractors' environmental staff	RDA/SC
3	Bi-Annual	Construction Supervision staff	RDA/SC
4	Annual Report	Contractors' environmental staff	RDA/SC
5	Completion Report	Contractors' environmental staff	RDA/SC

7.9.4 Social Complaint Register

The Contractor will maintain a register of complaints record from local communities and measures taken to mitigate these concerns.

7.9.5 Photographic Records

Contractors will maintain photographic records during the implementation of the proposed Project. As a minimum, the photographic records will include the site photographs, all the roads, camp sites and monitoring activities, etc.

7.9.6 Non-Compliance of the EMP

The implementation of the proposed EMP involves inputs from various functionaries. The Contractor will be primarily responsible for ensuring implementation of the mitigation measures proposed in the EMP, which will be part of the contract documents. The provision of the environmental mitigation cost will be made in the total cost of Project, for which the Contractor will be paid on the basis of monthly compliance reports. However, if the Contractor fails to comply with the implementation of EMP and submission of the monthly compliance reports, deductions will be made from the payments to the Contractor claimed under the heads of environmental components.

7.9.7 Review of Recorded Data

All the data and communication recorded and maintained by the Contractor will be periodically review and checked by SC and RDA and necessary action will be recommended to Contractor to improve the recording and documentation.

7.10 MANAGEMENT PLANS

Various site-specific management plans will be prepared by Contractor as a part of EMP for the better management and implementation of EMP during all phases of the proposed Project. However, approval of these site-specific plans from RDA should be sought before start of construction activities. These site-specific plans are listed below:

- Tree Plantation Plan;
- Health, Safety and Environment (HSE) Management Plan;
- Emergency Preparedness and Response Plan;
- Restoration and Rehabilitation Plan;
- Waste Management Plan;
- Traffic Management Plan;
- COVID-19 Safety Plan;
- Resource Conservation Plan; and
- Change Management Plan.

7.11 EMP COST

The cost for EMP will be part of the contract document with the Contractor. It must be noted that environmental cost will not be a separate entity because all of its components will be addressed in the bidding document under various heads of account. The annual estimated cost for the implementation of environmental monitoring for both components of the proposed Project is given in **Table 7.4** along with sampling parameters and frequency during construction and operational phases.

The total estimated cost for the environmental management, monitoring and auditing during pre-construction, construction and O&M (annual cost and will be updated for next upcoming years accordingly) comes to about PKRs. 53.36 million.



Table 7.4: Environmental Management and Monitoring Cost Estimate

Sr. No.	Parameter	Mechanism	Frequency	Unit Rate (PKR)	Quantity (No.)	Annual Cost* (PKRs)	Remarks	
A	PRE- CONSTRUCTION PHASE							
A-1	Environmental Monitoring Cost							
1	Drinking Water	Discrete grab sampling and laboratory testing of water samples by EPA approved Laboratory for monitoring.	Once	15,000	5	75,000	One time monitoring shall be carried out before the mobilization of Contractor.	
2	Wastewater	Discrete grab sampling and laboratory testing of water samples by EPA approved Laboratory for monitoring.	Once	15,000	5	75,000		
3	Noise Levels	dBA Leq. as per NEQS 2010 and PEQS 2016	Once	1,500	10	15,000		
4	Ambient Air Monitoring	Monitoring of CO, CO ₂ , SO _x , NO _x , HC and PM _{2.5} PM ₁₀ by EPA approved Laboratory	Once	25,000	10	250,000		
	Sub-Total (A-1)						4,15,000	



Sr. No.	Parameter	Mechanism	Frequency	Unit Rate (PKR)	Quantity (No.)	Annual Cost* (PKRs)	Remarks
B	CONSTRUCTION PHASE						
B-1	Environmental Monitoring Cost						
1	Drinking Water	Discrete grab sampling and laboratory testing of water samples by EPA approved Laboratory for monitoring.	Quarterly	15,000	5x4	300,000	Quarterly monitoring cost for the one year construction period and will be updated each year based on latest rates during construction timeline of the proposed Project.
2	Wastewater	Discrete grab sampling and laboratory testing of water samples by EPA approved Laboratory for monitoring.	Quarterly	15,000	5x4	300,000	
3	Noise Levels	dBA Leq. as per NEQS 2010 and PEQS 2016	Quarterly	1,500	10x4	60,000	
4	Ambient Air Monitoring	Monitoring of CO, CO ₂ , SO _x , NO _x , HC and PM _{2.5} PM ₁₀ by EPA approved Laboratory	Quarterly	25,000	10x4	1,000,000	
Sub-Total (B-1)						1,660,000	
B-2	Environmental and Social Management Cost						
1	HSE	Environment Personnel will monitor / conduct	Monthly	300,000 for each component of the Project (300,000*12*2)		7,200,000	This is the tentative monthly cost for one year period for one senior and two junior HSE



Sr. No.	Parameter	Mechanism	Frequency	Unit Rate (PKR)	Quantity (No.)	Annual Cost* (PKRs)	Remarks
		all HSE related activities e.g. TBTs, PPEs, housekeeping, safety signage, emergency preparedness, etc.			Lump sum 6,000,000 for each component of the Project	12,000,000	experts along with their monthly logistics. Cost for PPEs, extinguishers, emergency lights, housekeeping equipment, safety signage and barricade, emergency preparedness kit, first aid kit, etc.
2	Solid Waste Management	Collection, segregation, transportation, disposal and management of domestic, commercial, construction wastes	Monthly	200,000 for each component of the Project (200,000*12*2)		4,800,000	This is the tentative monthly cost for one year period.
					Lump sum 3,000,000 for each component of the Project	6,000,000	Cost for Collection, segregation, transportation, disposal and management of domestic, commercial, construction wastes
3	Training Cost	Literature preparation, printed material such as posters & pamphlets trainer(s), and venue, etc.	Monthly	100,000 for each component of the Project (100,000*12*2)		2,400,000	This is the tentative monthly cost for one year period for one trainer along with logistics at site.
4	Environmental Audit	Auditor's checklists & proformas	Bi-annual	500,000 for each component of the Project (500,000*2*2)		2,000,000	This is the tentative biannual cost for one year period for at least two auditors along with logistics, travels and accommodation charges.



Sr. No.	Parameter	Mechanism	Frequency	Unit Rate (PKR)	Quantity (No.)	Annual Cost* (PKRs)	Remarks
5	Communicable Diseases	Tests should be performed by approved laboratory	Quarterly	500,000 for each component of the Project (500,000*4*2)		4,000,000	This is the tentative quarterly cost for one year period for medical tests of kitchen staff at each camp site.
Sub-Total (B-2)						38,400,000	
Sub-Total B ((B-1)+(B-2))						40,060,000	Tentative for One (01) year project construction period. The cost shall be updated based on the current market prices during construction phase.
C	OPERATION & MAINTENANCE PHASE (One Year Cost)						
C-1	Environmental Monitoring Cost						
1	Drinking Water	Discrete grab sampling and laboratory testing of water samples by EPA approved Laboratory for monitoring.	Bi-annually	15,000	5x2	150,000	Bi-annually monitoring cost for the one year O&M Phase and will be reproduced for next years of O&M based on updated rates.
	Wastewater	Discrete grab sampling and laboratory testing of water samples by EPA approved Laboratory for monitoring.	Bi-annually	15,000	5x2	150,000	
2	Noise Levels	dBA Leq. as per NEQS 2010 and PEQS 2016	Bi-annually	1,500	10x2	30,000	



Sr. No.	Parameter	Mechanism	Frequency	Unit Rate (PKR)	Quantity (No.)	Annual Cost* (PKRs)	Remarks
3	Ambient Air Monitoring	Monitoring of CO, CO ₂ , SO _x , NO _x , HC and PM _{2.5} PM ₁₀ by EPA approved Laboratory	Bi-annually	25,000	10x2	500,000	
Sub-Total (C-1)						830,000	
C-2	Environmental and Social Management Cost						
1	HSE Activities	RDA	Monthly	300,000 for each component of the Project (300,000*12*2)		7,200,000	This is the tentative monthly cost for one year period for one senior HSE staff along with his site visit cost and logistics arrangements.
Sub-Total (C-2)						7,200,000	
Sub-Total C ((C-1)+(C-2))						8,030,000	Tentative for (01) year project O&M phase. The cost shall be reproduced for next years of O&M Phase and updated based on the current market prices during O&M phase.
Grand Total (A+B+C)						48,505,000	
Contingency Charges			10% of Grand Total			4,850,500	
Grand Total with Contingencies						53,355,500 (53.36 million)	

* Compensation and resettlement cost is not included in this EMP cost



8 CONCLUSION AND RECOMMENDATIONS

This Chapter summarizes the conclusion drawn and provides recommendations based on these conclusions.

8.1 CONCLUSIONS

The report provides conclusions based on the impacts assessed and the mitigation measures suggested. The implementation of the proposed project will have many positive impacts for the twin cities. Apart from the positive impacts of the project, the proposed Project will also have potential adverse environmental and social impacts during the construction and operational phases. Most of these adverse impacts during construction are of a temporary nature. These potential impacts can be avoided or mitigated by adopting suitable mitigation or remedial measures as mentioned in this report.

In order to minimize, avoid or reduce the potential adverse impact appropriate mitigation and remedial measures have been suggested against each identified impact. Efforts are made to propose economical and sustainable mitigation and remedial measures which can be easily implemented. An EMP has also been developed to provide proper framework for the implementation of the suggested mitigation measures. This includes the identification of the major stakeholders, roles and responsibilities along with the resource requirements.

As a conclusion of the study, the proposed Project has potential adverse environmental impacts therefore, an EIA Study of each component needs to be conducted during detailed design phase of the Project. Furthermore, a comprehensive Land Acquisition and Resettlement Plan (LARP) Study also needs to be conducted especially for Component-I (Lai Expressway) of the proposed Project.

8.2 RECOMMENDATIONS

Following recommendations should be implemented during respective phases of the proposed Project

- Environmental monitoring has not been conducted as part of this EIA Study. However, it is recommended to complete this task during detailed design phase of the proposed Project;
- The proposed Project will have both positive and negative impacts during the construction and operational phases, for which proper mitigation measures are necessary and proposed in the report. Proposed Project may contaminate surface or drinking water to make them unfit for irrigation or drinking; or pollute the ambient air in dust and fugitive emissions;
- Construction activities may also contaminate soil due to the discarded construction materials and obstruction in natural drainage due to un-attended excavated material. Generation of solid waste will be an important soil contaminating source and may yield temporary adverse impact but its mitigation will be possible through implementation of waste management plan recommended in EMP. Furthermore, oil

spills and other lubrication materials may also contaminate soil which requires to be mitigated as per recommendations provided in report;

- No major adverse impact on groundwater and surface water is anticipated during the operational phase, with the exception of some occasional oil spills from the vehicles, accidental spills from oil tankers, and occasional spills in the service areas. Untreated fecal material from leakage of sewer pipes can mix with ruptured water supply lines and contaminate drinking water supply as well as groundwater. Temporary flooding of adjacent areas may occur due to accidental leakages, bursts and blockage of trunk sewer and impairment of receiving water quality in surface and sub-surface source. Random vehicle check to ensure compliance requirement, enforcement and penalties against vehicle fitness violators, the service areas will work under a system that have proper SOPs, provisions for oil spill prevention, staff training, etc.
- Machinery in operation and other equipments may yield temporary adverse impacts on the air resources. Most of these use diesel engines that generate noise and exhaust emissions. Generally, they will generate PM_{2.5}, PM₁₀, smoke, dust, CO and NO_x in the ambient air, which will deteriorate the air quality and resulting in temporary adverse impacts on the human health, fauna and flora. Similarly, fugitive dust due to the construction activities may also affect the local air quality. Good engineering practices along with implementation of EMP will help to solve number of problems as mentioned here. During O&M phase of the Project, air quality will improve in the short term due to improved road condition and reduced travel time thereby causing less fuel consumption. However, operation of sewerage scheme and STP will result in generation of gases including H₂S and CH₄ (due to anaerobic conditions);
- Noise will be generated due to movement of traffic and use of pressure horns which may cause psychological and physiological impacts on the surrounding population. Due to the operation of proposed STP, noise and vibration may produce from the running of pumping machinery and standby generators which will be a constant source of nuisance to the local population. Concrete or wood acoustic insulation barrier will act as noise barriers, tree plantation (proposed along both sides of the Expressway) will also help to curtail noise, the pressure horns will be banned on the Expressway, Enforcement and penalties against traffic rules violators, etc. Regular maintenance of vibrating parts of STP through a well-coordinated operation and maintenance procedure which consists of checking periodically all parts of the pumping machinery, its oiling to remove friction, replacement in case of malfunctioning and periodic noting of noise levels, etc.
- The proposed construction activities and movement of heavy project vehicles for construction material supply may arise traffic problems for the commuters and transporters travelling to the proposed areas. The problems will include traffic jams and inconvenience to the public passing through the Project Area. The movement of vehicles along the haulage routes will cause soil erosion, debris flow, dust emissions, etc. A site-specific Traffic Management Plan will be implemented to avoid traffic accidents, jams/public inconvenience;
- Enhanced vehicular movement and speed in the long run may result in road safety issues like traffic accidents. The high-speed vehicles may result in road safety issues

like traffic accidents. Mitigation measures will include strict enforcement of speed limits, installation of speed guns and channelization of traffic with respect to categories (heavy vehicle traffic and light vehicle traffic) and enforcement of penalties for the violators;

- The structures of the proposed Expressway may be damaged due to high velocity flood water. Therefore, an emergency response plan will be prepared to handle unforeseen emergencies;
- The operation of STP might results in generation of odor which causes nuisance to the residential community in the surroundings of the STP and the people passing by this area for schools, mosque and shops. Mitigation measures are provided as part of EMP should be implemented with its true spirit;
- Domestic and hazardous wastes would be generated during cleaning and maintenance facilities of Trunk Sewer and during operation of STP. Hazardous waste will be present in the form of sludge. The sludge removed from the sewers should not be left openly on the roads. It may be recycled as fertilizer, Regular inspection and maintenance should be schedule and implemented to ensure removal of solid waste and sludge when accumulated, etc. Further mitigation measures are provided in EMP of this report;
- The operation of the proposed trunk sewer and STP may cause some negative impacts on health and safety of workmen. The sewer cleaning staff may be exposed to waterborne communicable diseases if precautionary measures are not adopted. All operation and maintenance staff will be trained in hygienic procedures designed to avoid infection from wastewater, and health and safety procedures against any exposure to hazardous gases, gas detector will be used to indicate the presence of any hazardous gas before the entry of workers into the sewer for cleaning purposes, etc.
- About 687 mature, sub-mature, pole crop and saplings of different tree/plants species will be disturbed during the construction phase of the project in different components of the project. Approximately 309 trees/plants will be affected due to construction of STP and 378 trees/plants due to expressway road construction. However, no significant trees/Plants were found at Option-A of Outfall Conduit of the Project Area and immediate sites. Thus, the number of plants to be raised is 10 times of plants to be removed. These all activates must be assigned, planned and implemented by Forest Department for successful plantation results and implementations on time. During the operation phase, there will be positive impact on the flora due to the extensive plantation;
- Impact on the fauna will be of minor and of temporary nature, and the Project is not expected to have any significant adverse impact on them. With the improved flora of the track, due to extensive plantation, general fauna and especially the avifauna will be attracted to the area;
- EMP should be part of the contract documents so that the contractor will be legally bound to implement it;
- Due to the proposed project in construction phase, private infrastructure, public utilities affected may create disruption of public services and economics. About 540 number of different structures including, residential, commercial, mosques, etc. need to be demolished (fully/partially) for the construction of proposed Lai Nullah



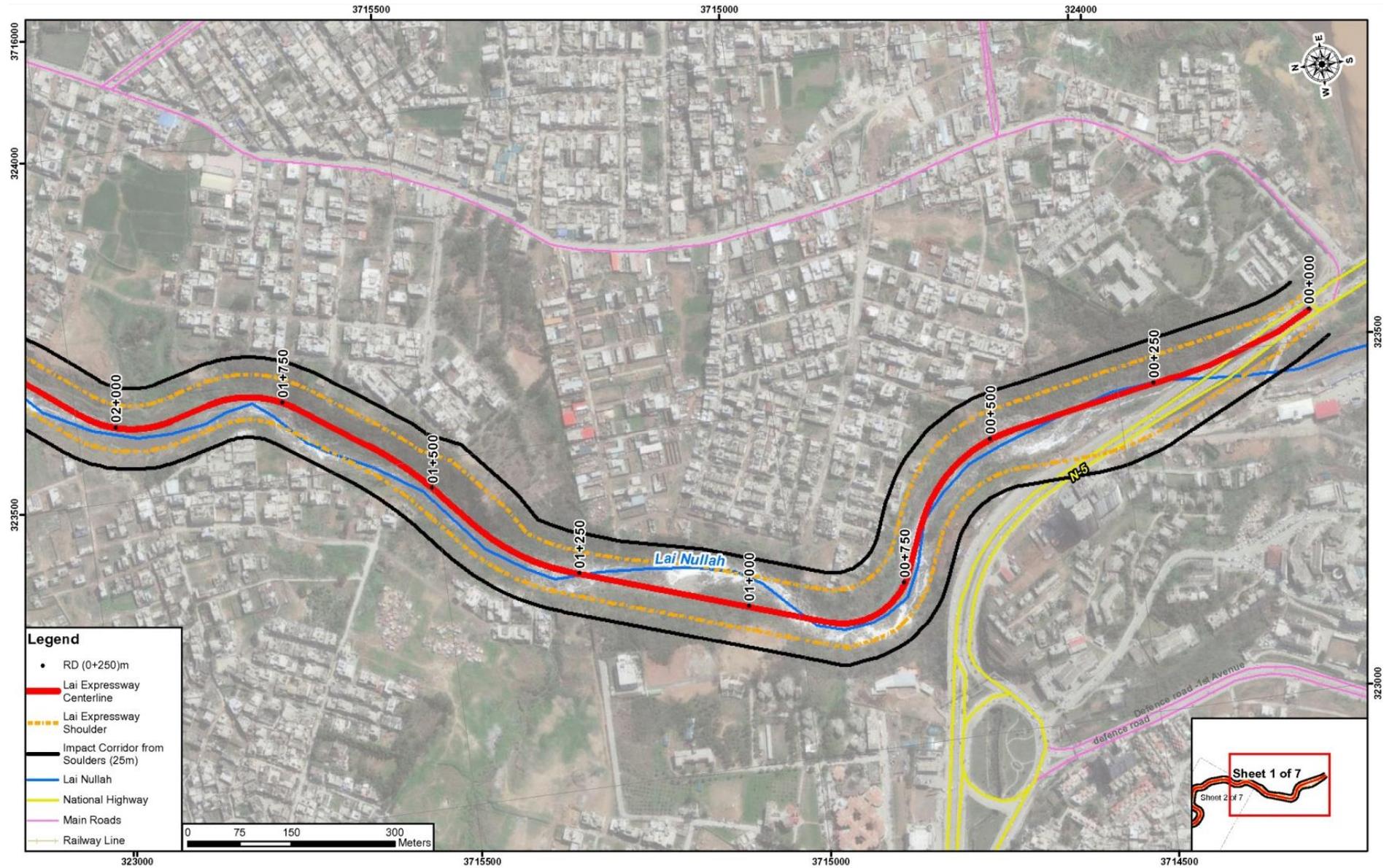
Expressway resulting huge socioeconomic disturbance in the Project Area. Incorporate technical design features to minimize effects on private infrastructure and all public utilities likely to be affected by the proposed Project. Contractor should obtain NOCs from concerned Departments well ahead of the commencement of construction;

- The proposed Project will involve about 1,711 kanals of land for the construction of Lai Expressway whereas about 675 acres of land has already been acquired by RDA for the construction of STP;
- Need to consult with the locals and religious scholars to protect the graves situated near the proposed Lai Expressway route alignment. Conducting the meaningful consultation with all the stakeholders including the local population on regular basis;
- A GRM for the Project shall be established as part of the overall project management system in order to address community concerns and complaints. Through this mechanism, queries, problems, and complaints about the social and environmental will be answered, resolved effectively, and addressed expeditiously. Jobs will be provided to local people on priority basis and clause must be added in the contract, so that the contractor will be legally bound to provide the jobs to local people;
- There may be some temporary adverse impacts of the presence of labor camp or project colony near the settlements in terms of the chances of fatal accidents and undesirable social mixing. Both of these impacts can be mitigated through safe traffic management plan and strict application of rules and regulations by the contractor.

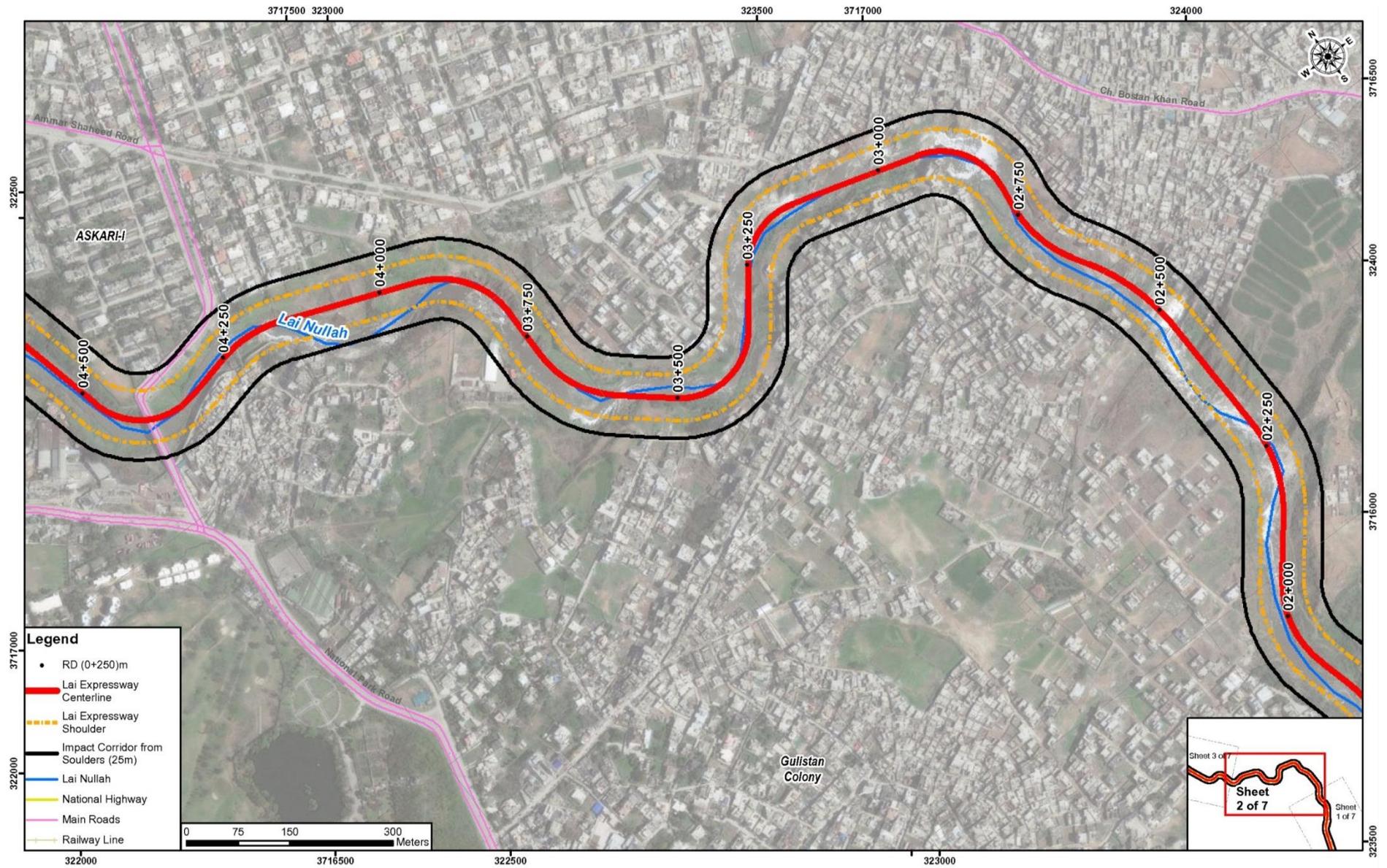
ANNEXES

**ANNEX I: CORRIDOR OF IMPACT
(COMPONENT-I)**

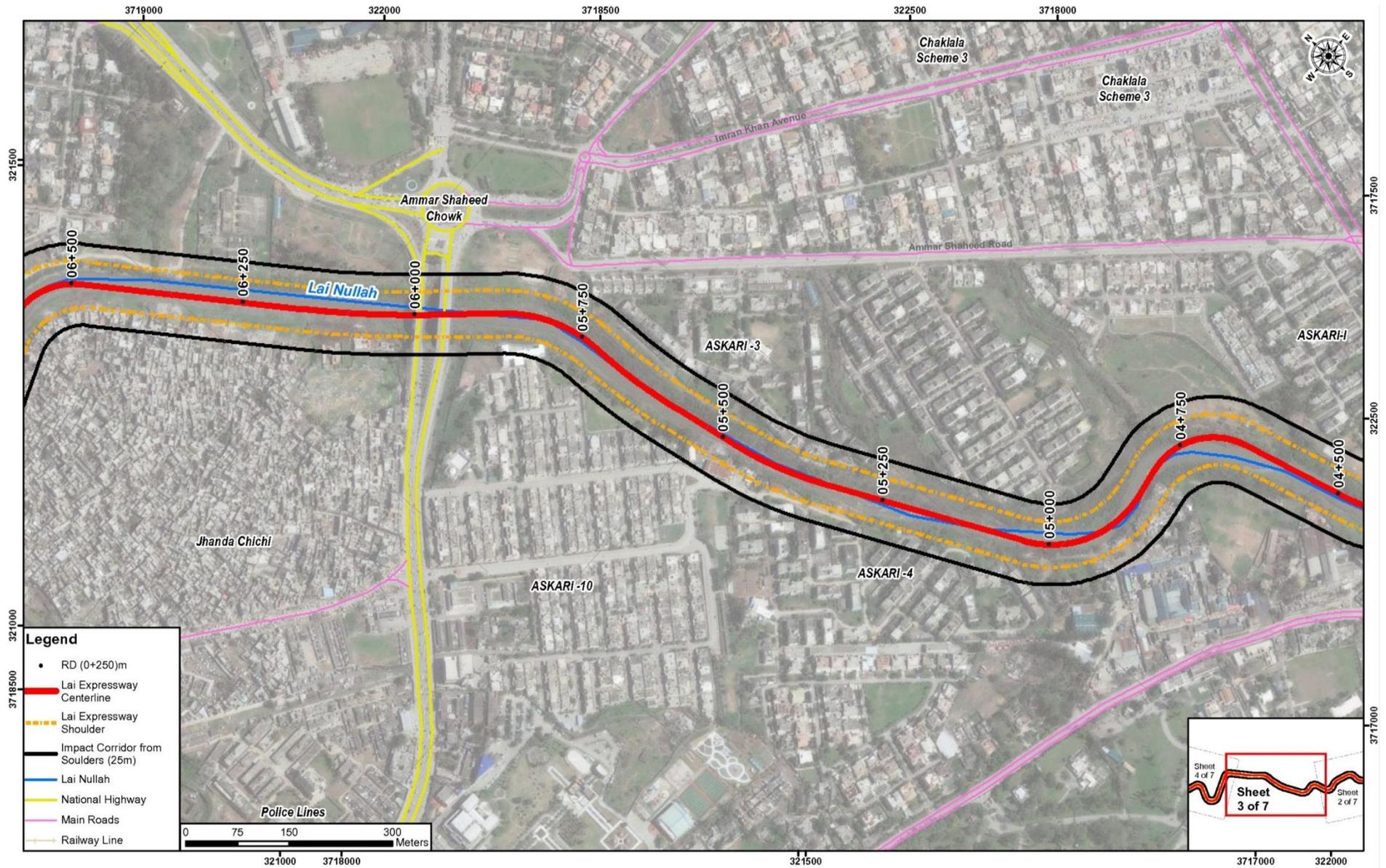
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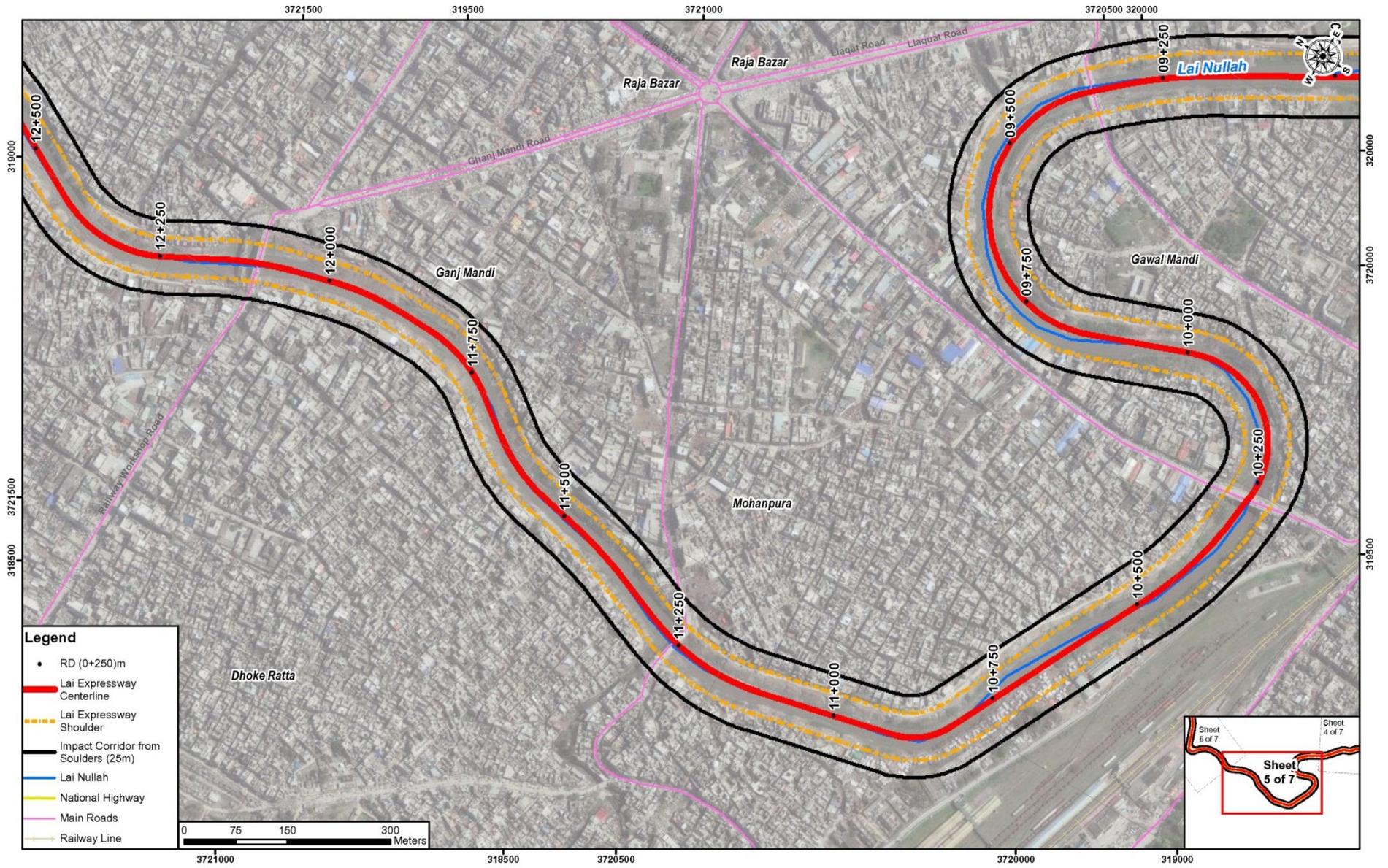
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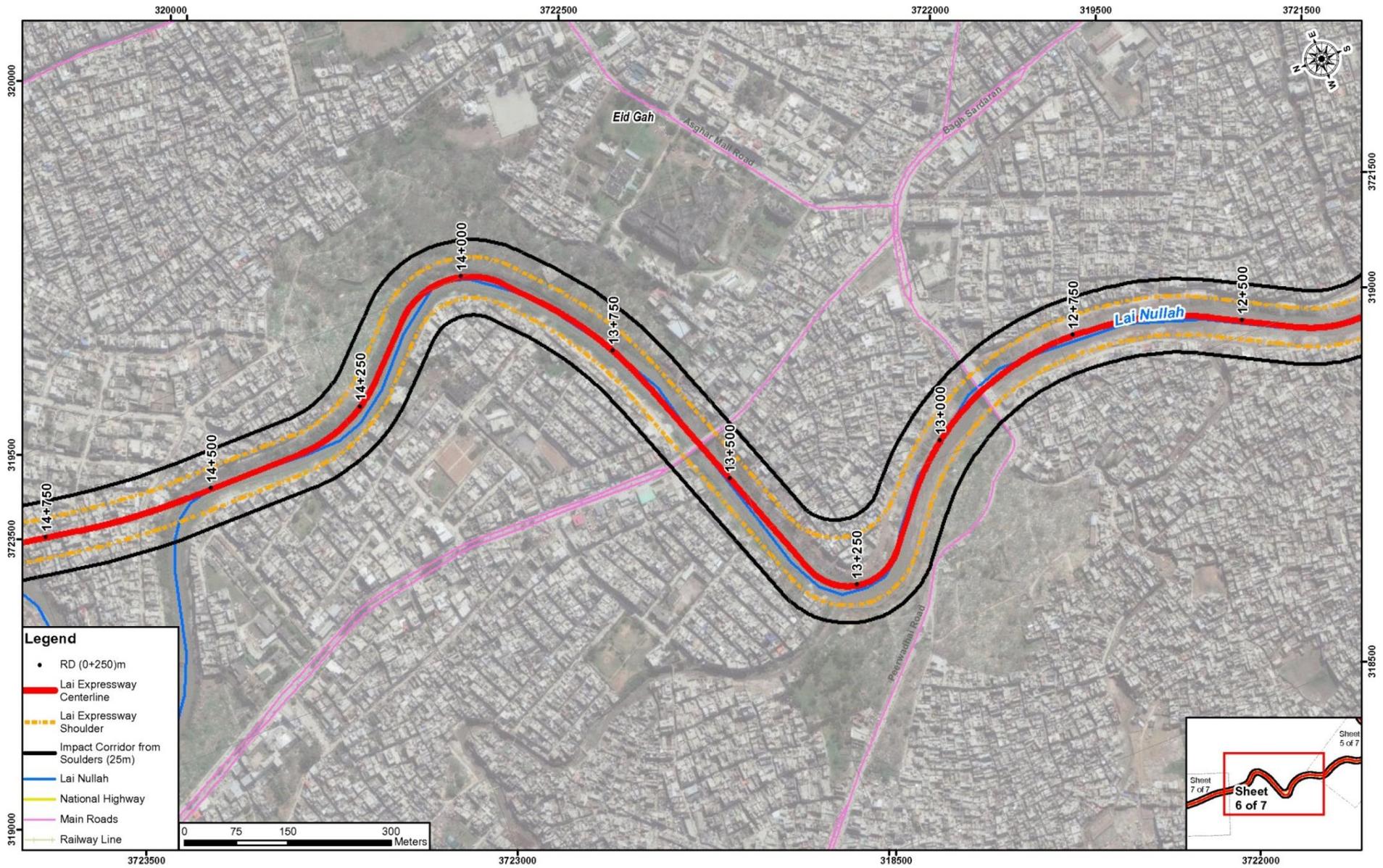
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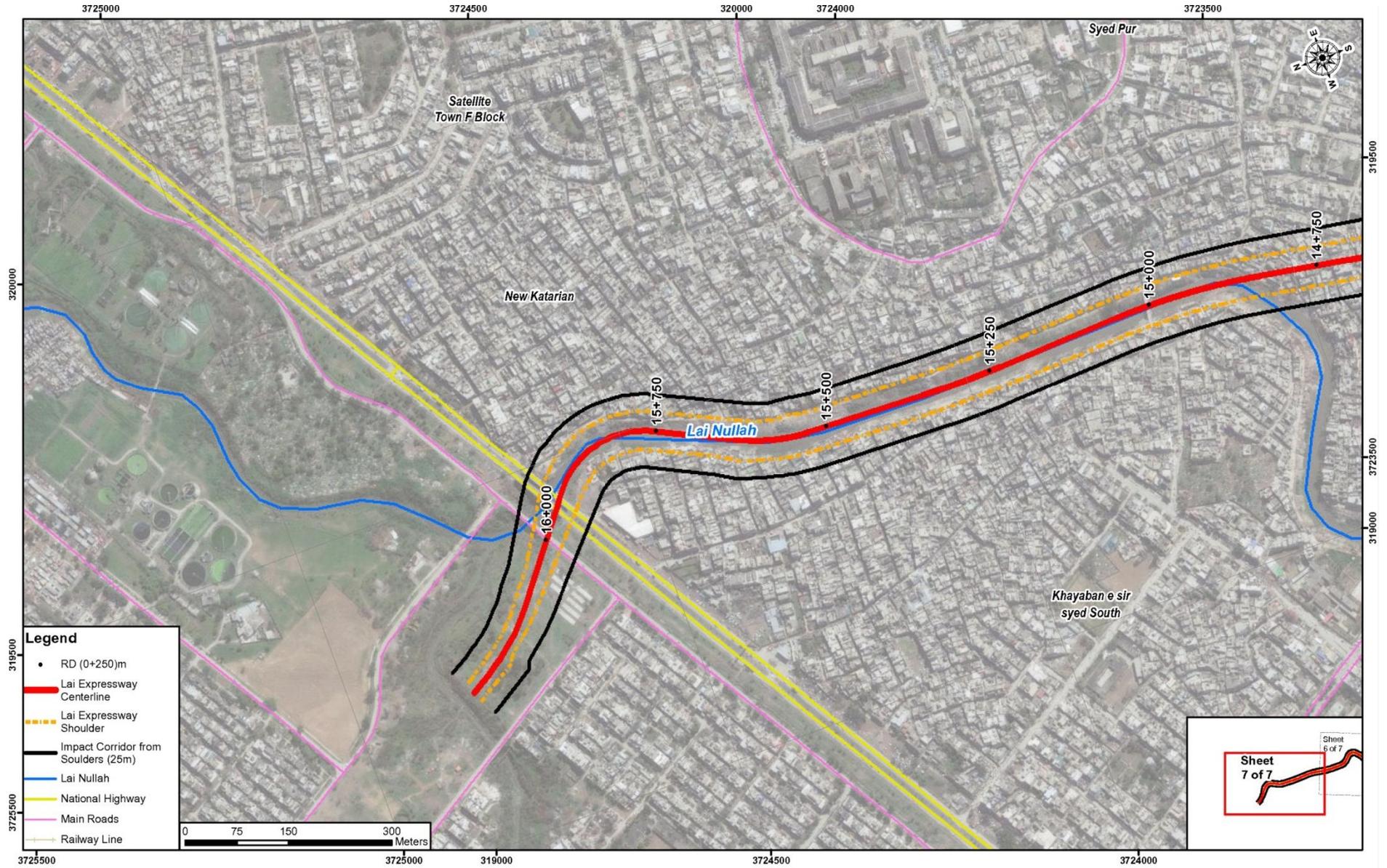
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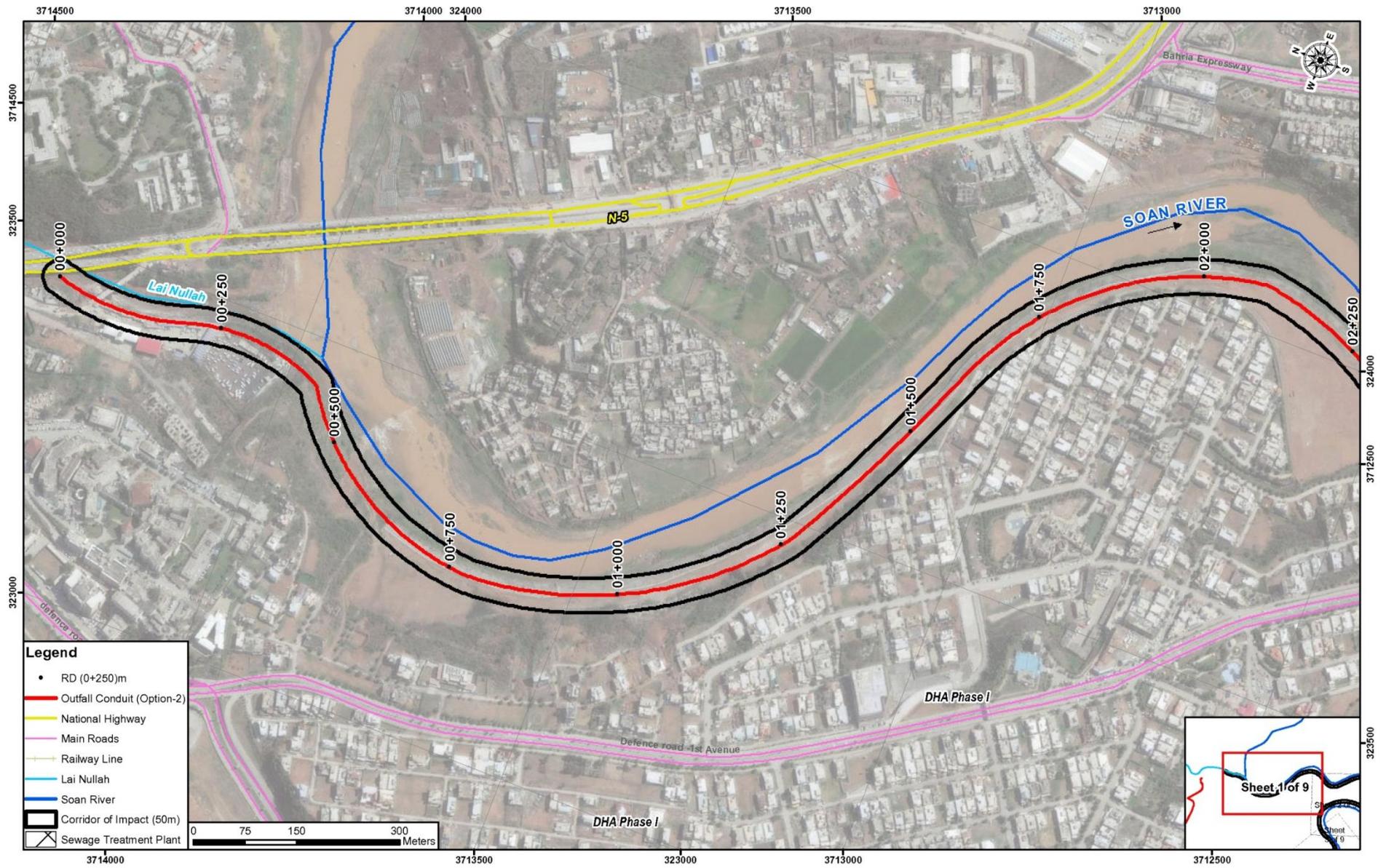


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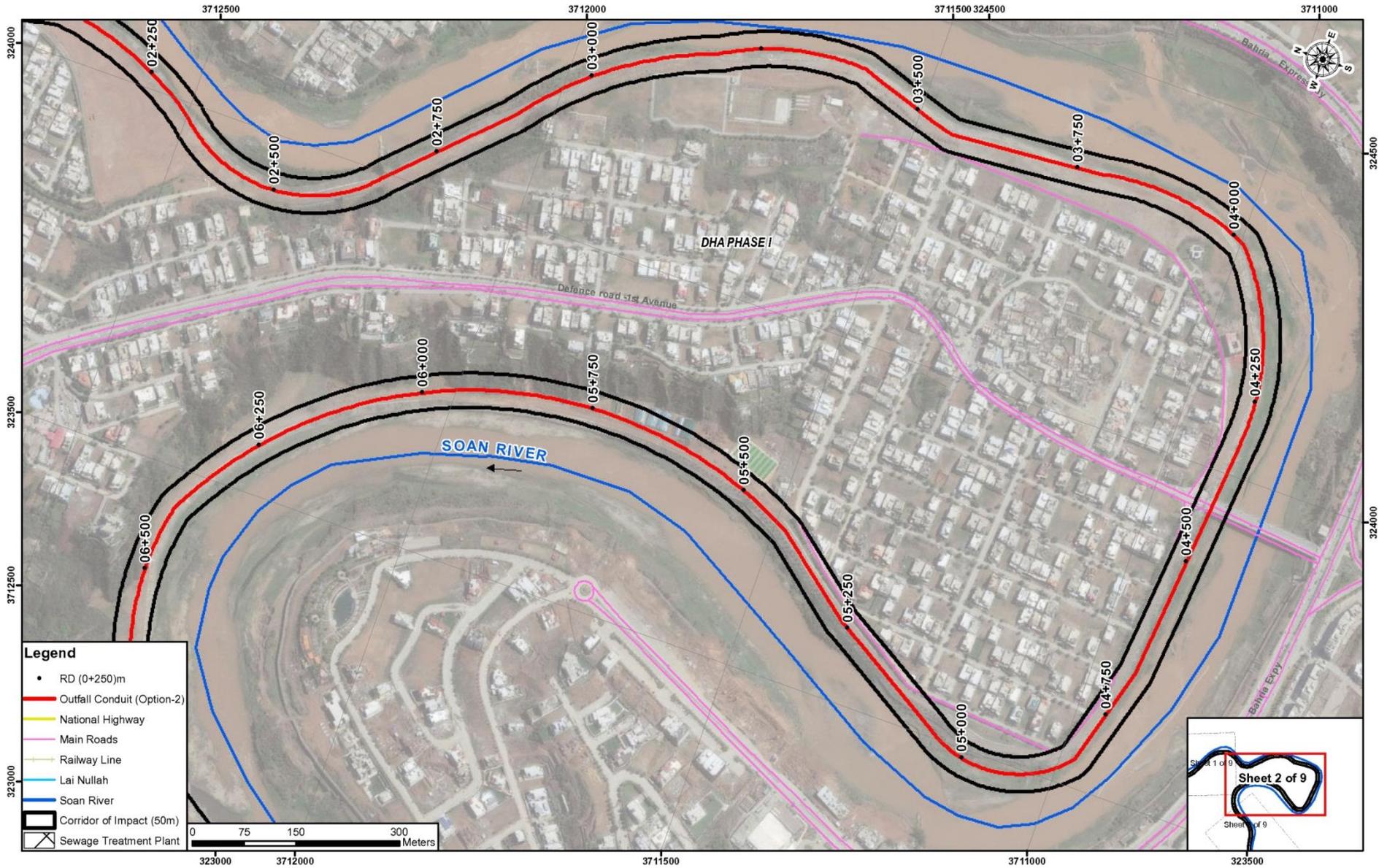


**ANNEX II: CORRIDOR OF IMPACT
(COMPONENT-II)**

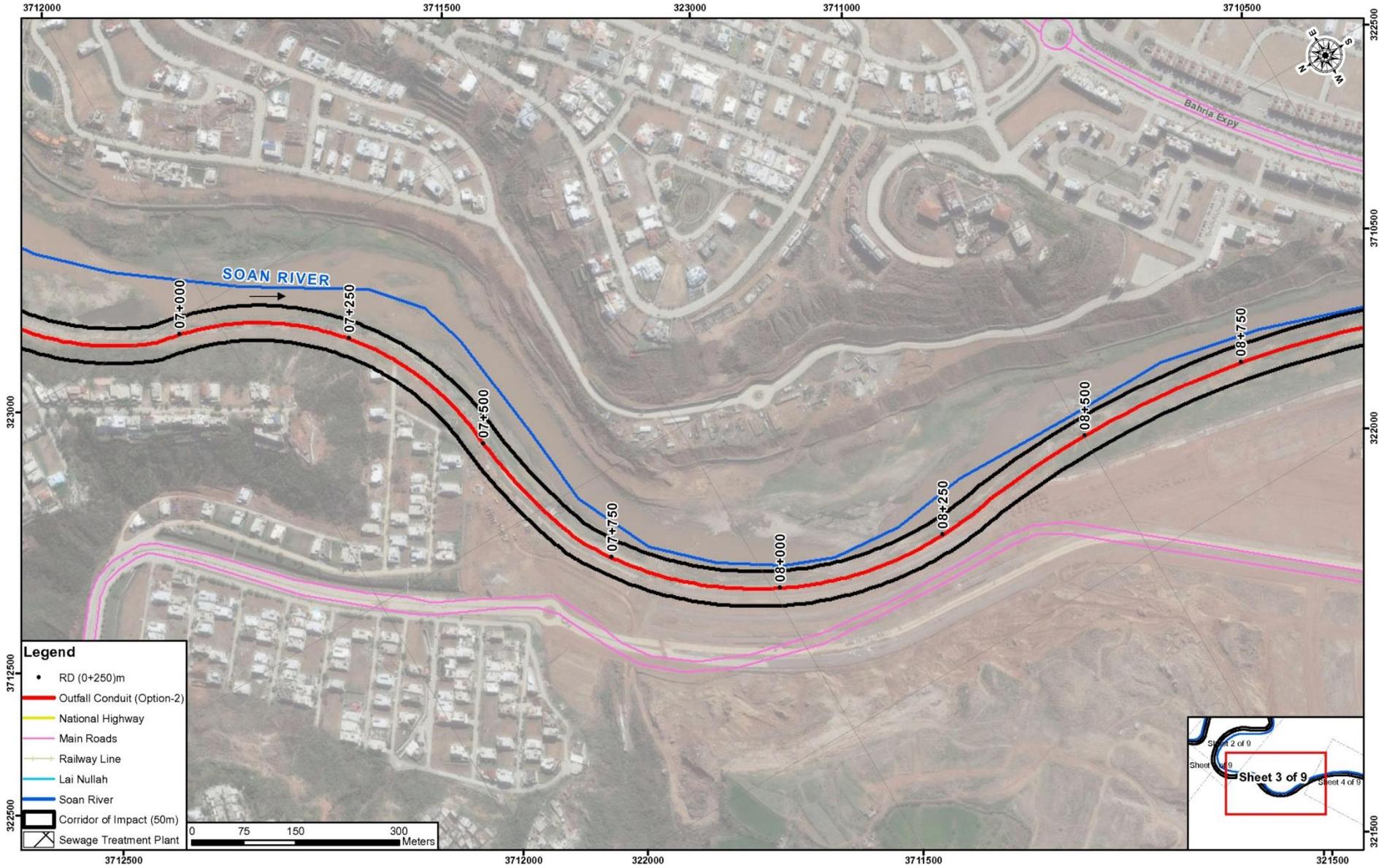
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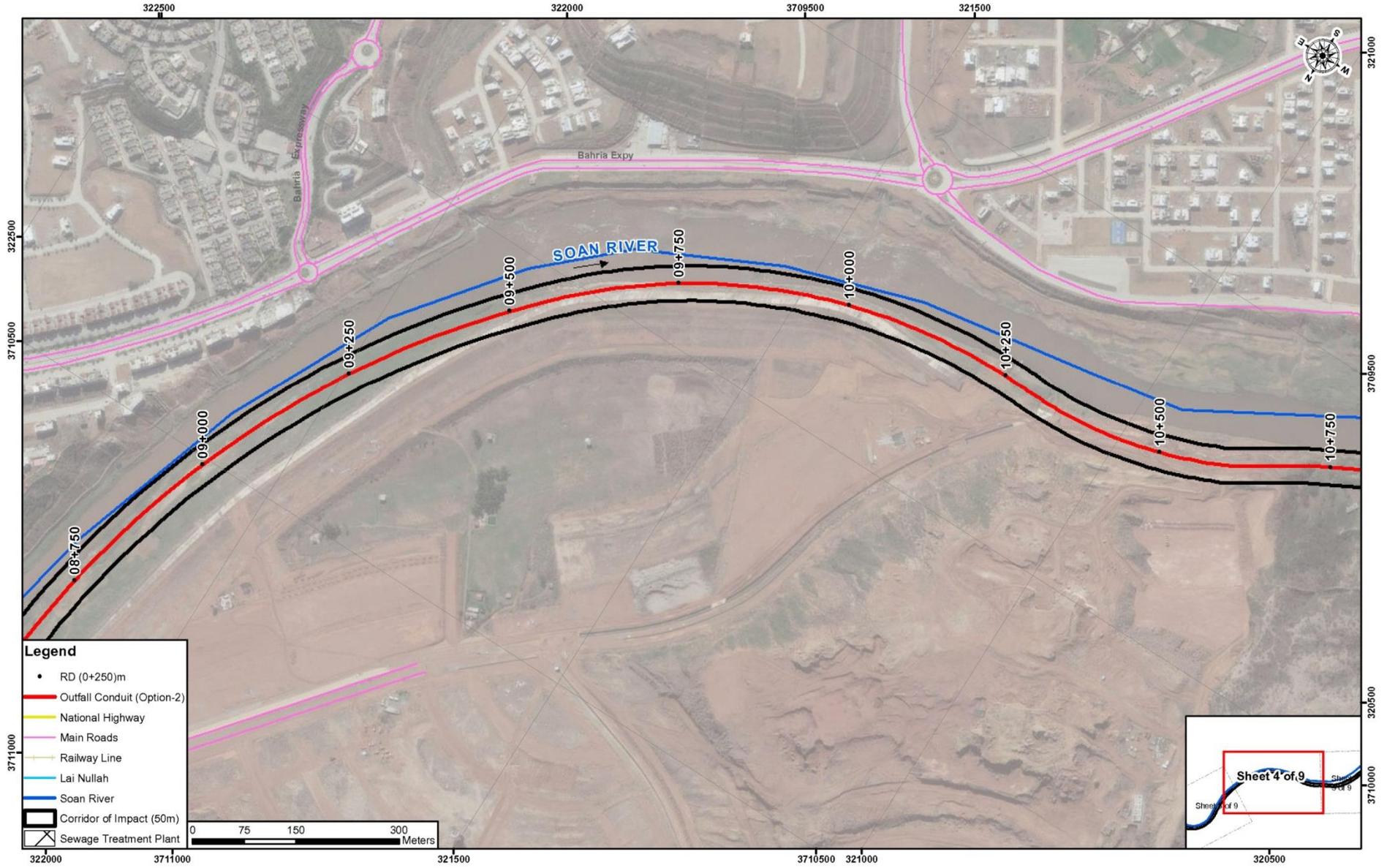
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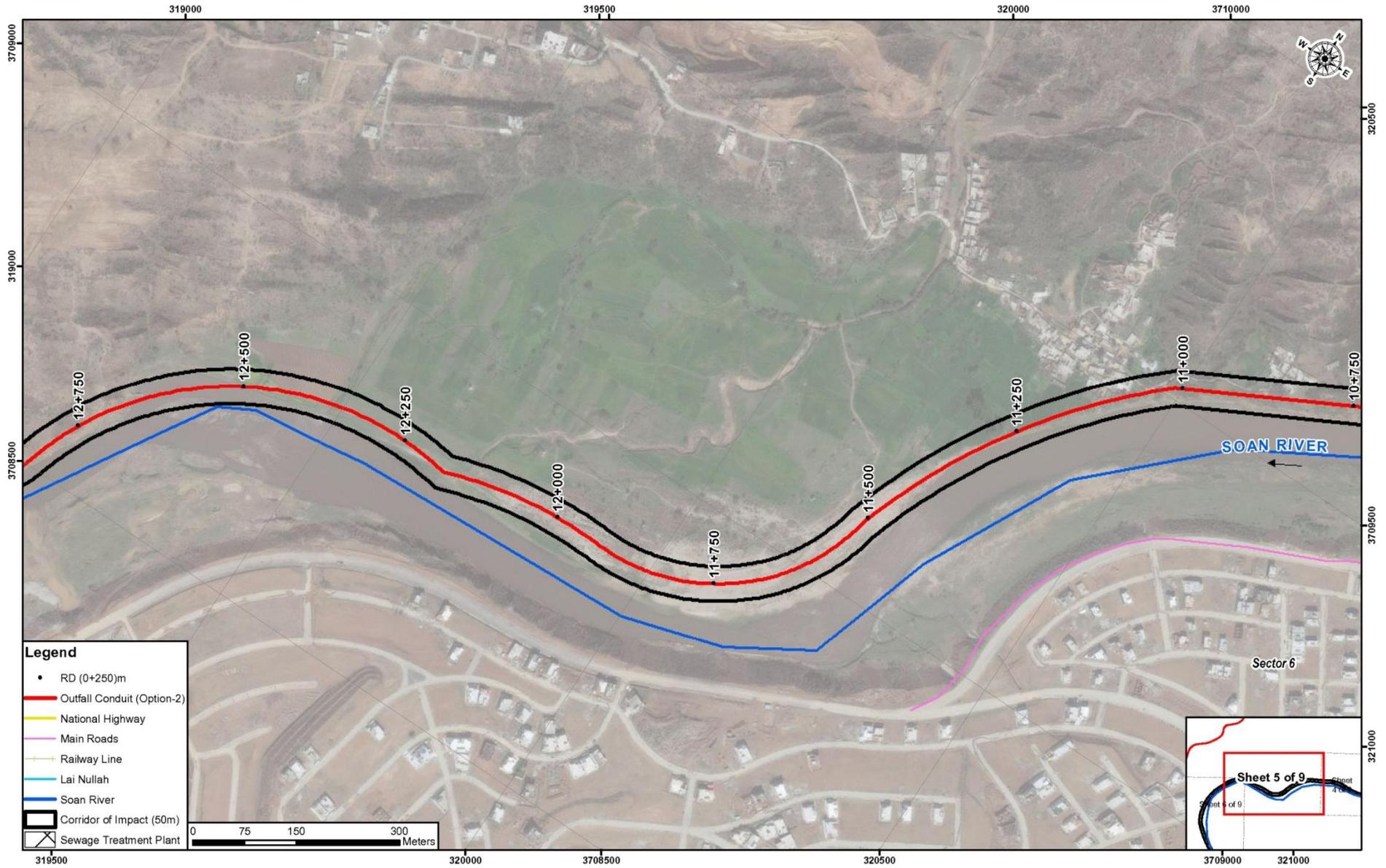
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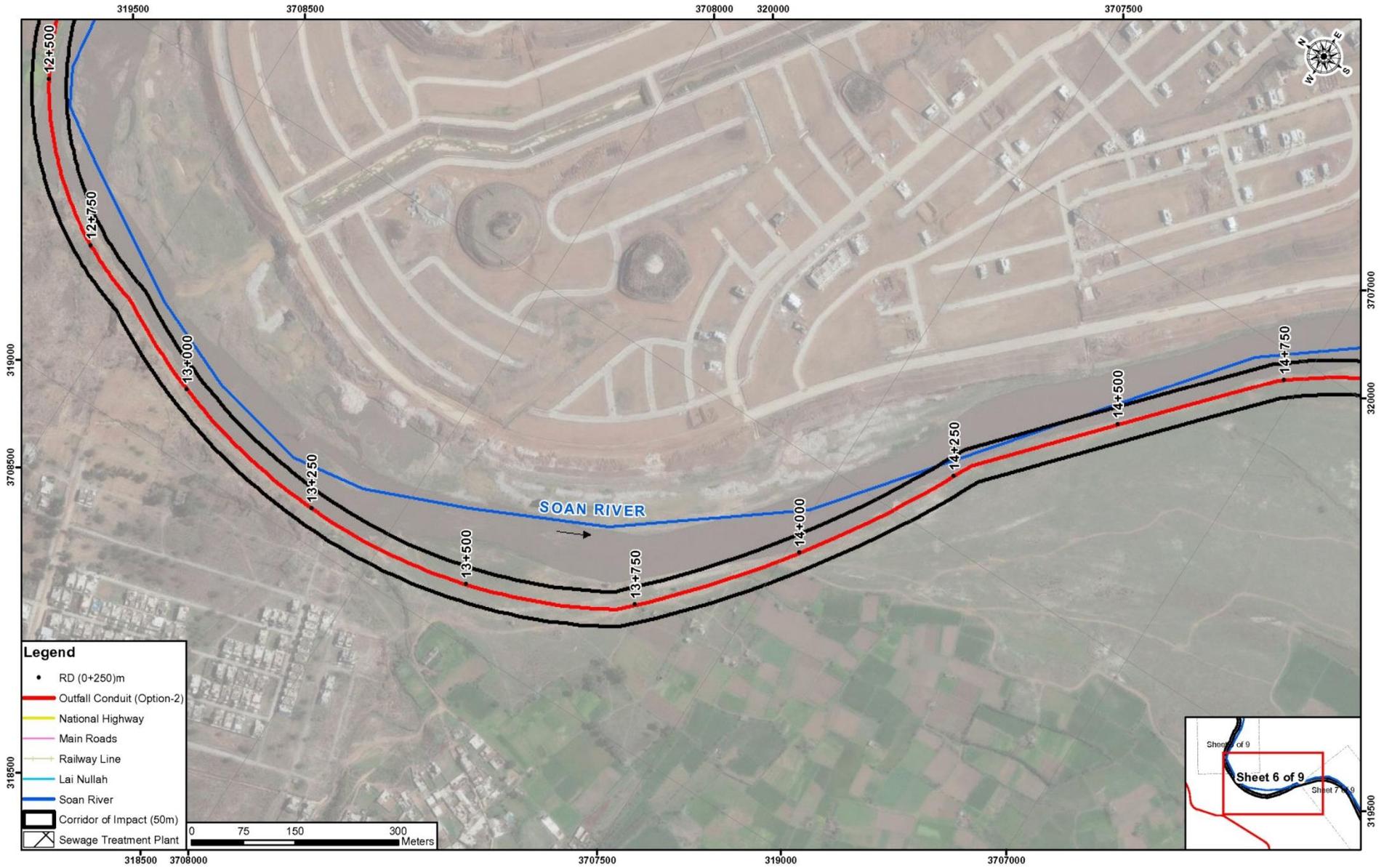
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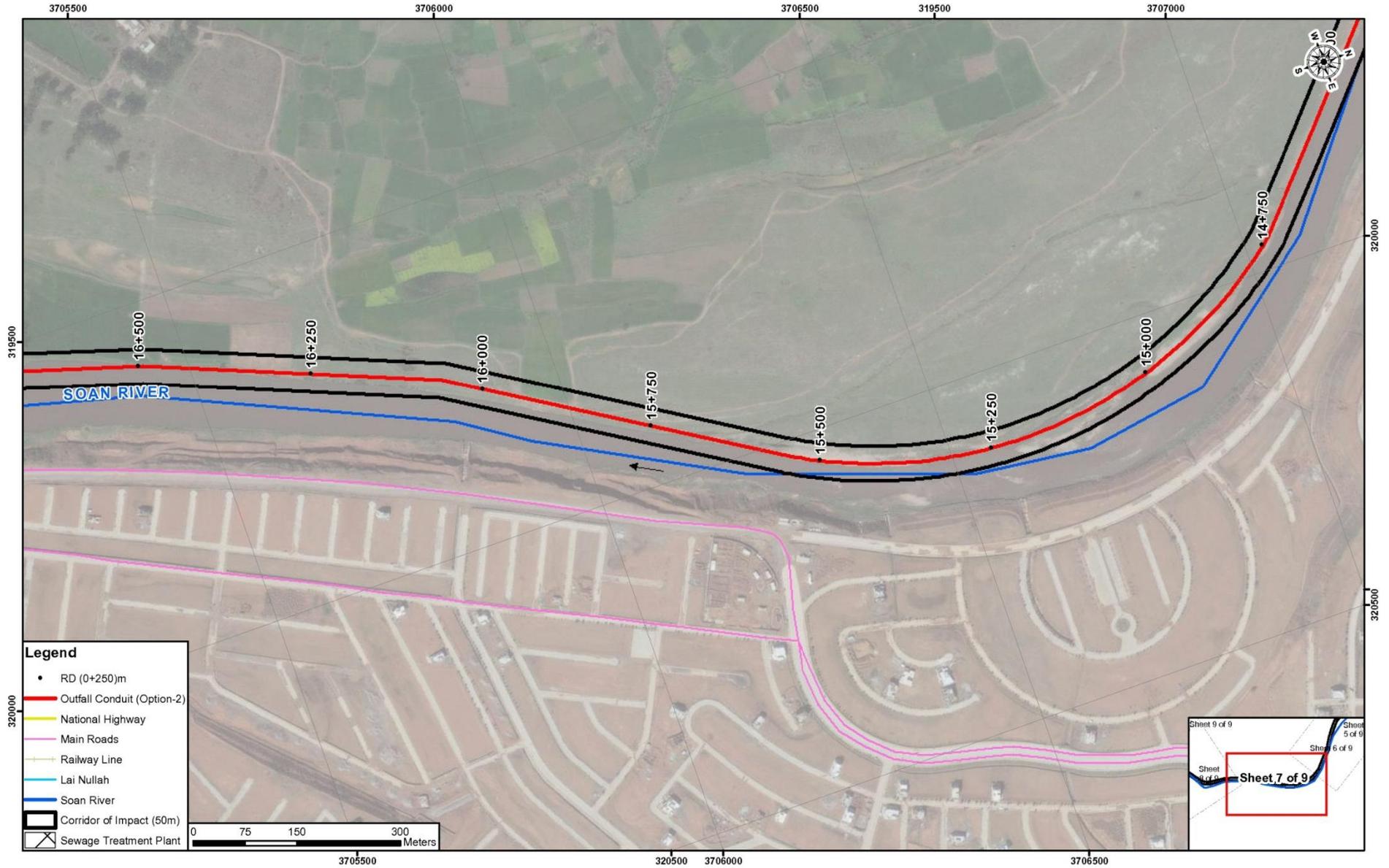
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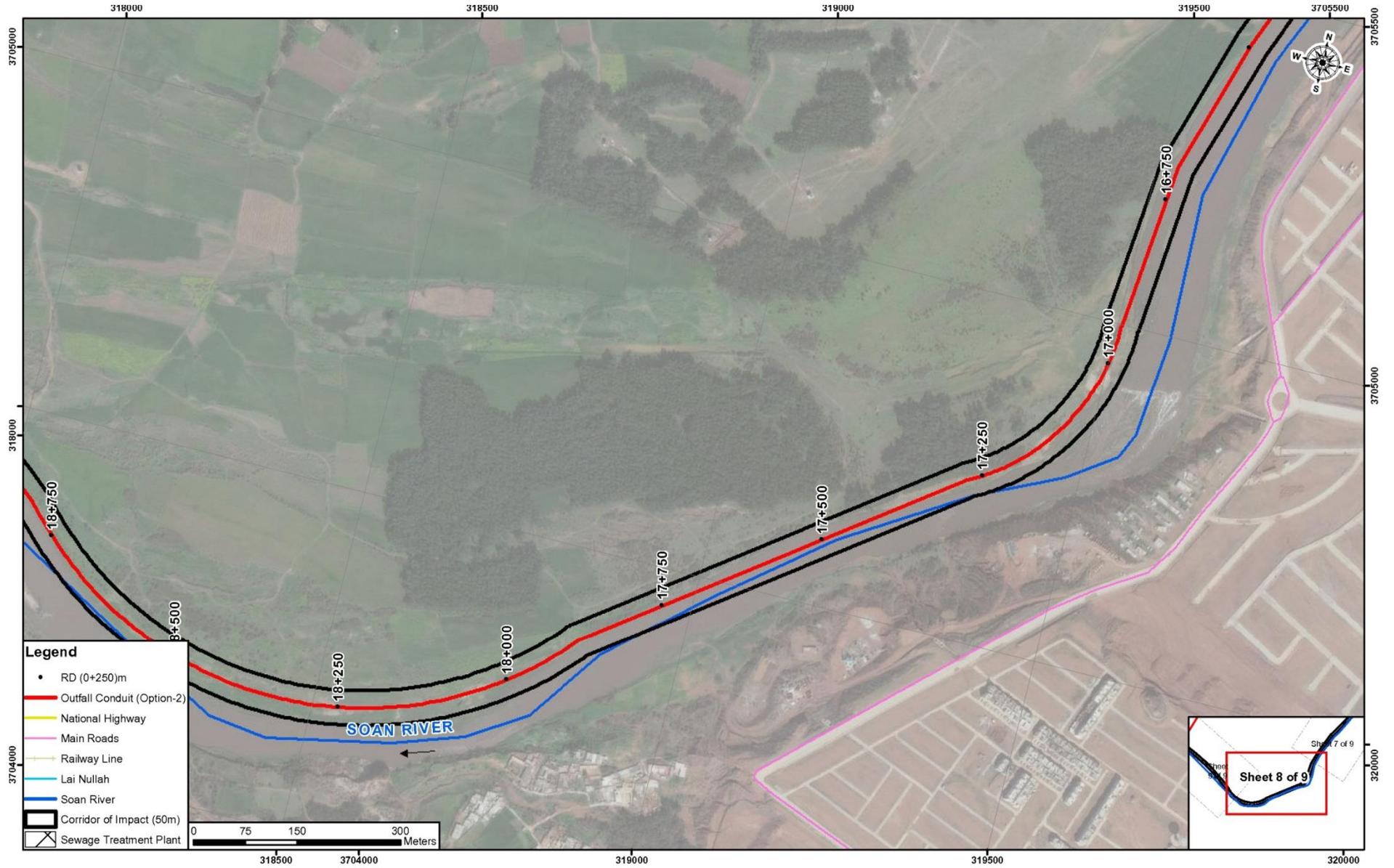
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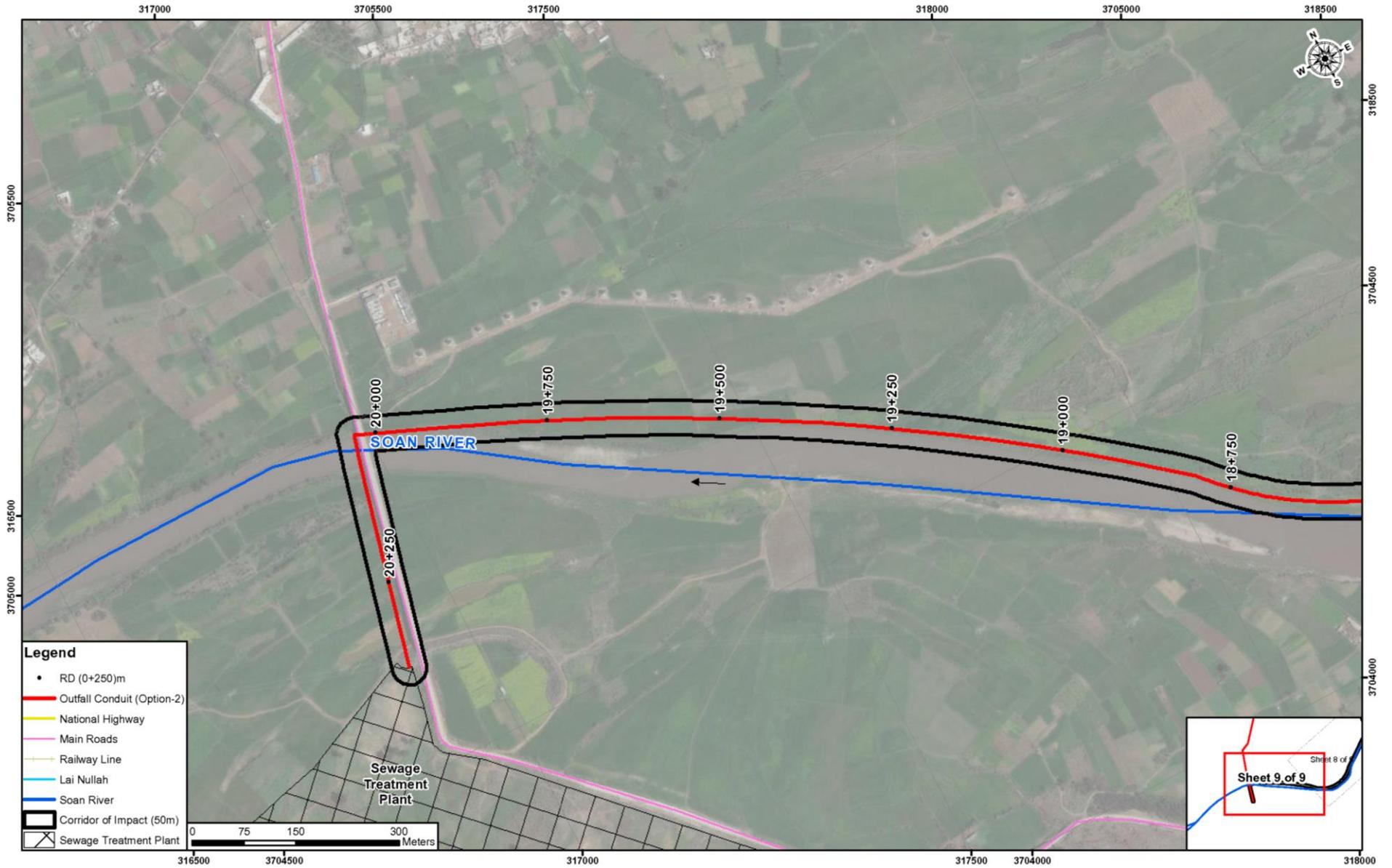
ANNEX II



ANNEX II



ANNEX II



ANNEX III: FIELD VISIT REPORT

ANNEX-III

PRELIMINARY ENVIRONMENTAL ASSESSMENT OF LAI EXPRESSWAY PROJECT

Field Visit Report

1. Introduction

Rawalpindi /Islamabad receives heavy rains in monsoon season that discharge flashy flow into Lai Nullah with eroded sediments causing colossal damages to lives and properties of the people. Nullah is heavily polluted due to uncontrolled waste dumping in Nullah and untreated wastewater of both cities. Rawalpindi Development Authority (RDA) proposed the project of Nullah Lai for environmental Improvement of the city which includes provision of alternate traffic route on either bank of Lai Nullah and Sewage collection and its disposal including treatment. As per scope of work, the proposed project mainly consists of following two components:

Component-I: Lai Expressway

Component-II: Sewage collection and disposal including its treatment

Component-I: Lai Expressway

The proposed alignment for Lai Expressway, is of approximately 19 km length. It starts from National Highway (N-5) near Sawan Lorry Adda, traverses along the Nullah with its end point on 9th avenue (Agha Shahi Avenue). The alignment crosses various existing roads/bridges including:

1. Bridge connecting Ayub Park road with Scheme-III;
2. Bridge at Ammar Chowk;
3. Bridge connecting Rashid Minhas Road with Dohk Chiragh Din;
4. Railway Line (Rawalpindi – Lahore Main Line);
5. Bridge on Murree Road;
6. Bridge connecting Gawal Mandi with Gordon College Road;
7. Bridge connecting Fawara Chowk with Railway Station;
8. Bridge connecting Fawara Chowk with Ratta Amral & Railway Colony;
9. Bridge connecting Westridge and Dhok Ratta with Hamilton Road;
10. Bridge connecting Chungi # 4 with Pir Wadhai Road;
11. Bridge connecting Chungi # 4 with Syed Khayaban-e-Sir Syed road;
12. Bridge connecting Mohallah Raja sultan with Khayaban-e-Sir Syed Road;
13. Bridge on I.J.P Road;
14. Bridge connecting Service road along I.J.P Road;

ANNEX-III

15. Bridge connecting I-9/1 with Service Road on I.J.P Road;
16. Bridge connecting I-9/1 with I-9/4;
17. Connecting Service Road of Agha Sahi Ave with Service Road West I-9;
18. Bridge on Pothowar Road; and
19. Connecting Service Road – N with I-9/3.

Component-II: Sewage Collection, Disposal and its Treatment

Nullah Lai, is a rain water fed natural stream flowing through the city of Rawalpindi. In every monsoon season, the stream floods after being fed by its catchment basin in the Margalla Hills. The Lai Nullah Basin has a catchment area of 234.8 km². The Lai Nullah has six major tributaries, three originating in the foothills of Islamabad in the higher plain area; it then flows down through the lower lying city of Rawalpindi, where another three tributaries join the river. There are 12 more nullahs which are disposed of into nullah Lai. A both side trunk sewer is to be proposed on both sides of nullah Lai. The main focus is to dovetail these sewers without pumping while keeping the integrated approach. A Sewage Treatment Plant (STP) site is also proposed near Jabbar village.

2. Objectives

Following are major objectives of the site visit:

- Baseline data collection including physical, ecological and socioeconomic environment for Preliminary Environmental Assessment of the Project; and
- To conduct departmental consultations in Rawalpindi and Islamabad.

3. Participants

Names of the team members are mentioned below:

1. Mr. Aashar Habib, Senior Environmental Scientist
2. Mr. Pervaiz Mailk, Senior Sociologist
3. Mr. Nasir Ali, Ecologist

4. Field Visit Duration

Field visit was conducted from 11th to 17th of March, 2020

5. Day Wise field Visit Activities

Following is the brief of the visit:

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DAY-1

Journey started on Wednesday afternoon from NESPAK House, Lahore on 11th of March, 2020. Team travelled by Daewoo at about 1530 hrs. and reached Regency Hotel, Islamabad at about 2130 hrs.

DAY-2

Despite of rainy day, following departments were visited and consulted by team on 12th of March, 2020:

1. Rawalpindi Development Authority;
2. Water and Sanitation Agency, Rawalpindi;
3. Parks & Horticulture Authority, Rawalpindi;
4. Social Welfare Department, Rawalpindi;
5. Forest Department, Rawalpindi;
6. Wildlife Department, Rawalpindi; and
7. Fisheries Department, Islamabad.

DAY-3

Team visited following project component (Component-2) and collected baseline data regarding physical, ecological and socioeconomic environment of the project area on 13th of March, 2020

1. STP Site located near Jabbar Village;
2. Trunk Sewer Line (Option-1); and
3. Trunk Sewer Line (Option-2).

DAY-4

Baseline data collection of proposed Lai Expressway was done by the team on 14th of March, 2020 starting from 9th Avenue, Islamabad to Gawal Mandi Bridge, Rawalpindi.

DAY-5

Baseline data collection of proposed Lai Expressway was done by the team on 15th of March, 2020 starting from Gawal Mandi Bridge to Sawan Adda, Rawalpindi.

Sr. Sociologist and Ecologist moved back to Lahore on completion of their assignment whereas Sr. Environmental Scientist stayed at Islamabad to check status of environmental compliance regarding Metro Bus Service from Peshawar Morr to New Islamabad Airport.

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DAY-6

Sr. Environmental Scientist had a meeting with Mr. Khuram (RE-Islamabad Metro) and Mr. Imranullah (from NHA) and conducted a site visit along the route to check the environmental compliance status of the previously mentioned Metro Bus Service on 16th of March, 2020.

DAY-7

Sr. Environmental Scientist conducted stakeholder consultations with below mentioned departments in Islamabad Capital Territory regarding Lai Expressway Project and travelled back to Lahore via Daewoo Express after completion of assigned tasks on 17th of March, 2020.

1. Pakistan Environmental Protection Agency; and
2. Capital Development Authority (CDA).

6. Findings

Key findings of the field visit are mentioned below:

- About 630 number of different structures including, residential, commercial, mosques, schools, parks, playgrounds, etc. need to be demolished (fully/partially) for the construction of proposed Lai Nullah Expressway resulting significant socioeconomic impacts in the Project Area;
- Proposed Lai Nullah Expressway route and its interchanges also passes through some major Graveyards of Rawalpindi/Islamabad which increases the social sensitivity of the Project Area;
- Total 883 number of various tree species need to be cut down for both Project Components. About 309 and 574 trees will be removed for Component-1 and Component-2 respectively;
- As the proposed Lai Expressway route passes through densely populated areas of Rawalpindi which demands for comprehensive environmental monitoring to assess the existing air & noise quality and water quality of the Project Area. As mentioned earlier, stakeholder consultations were also conducted with officials of Environment Protection Department, Rawalpindi and Pakistan Environmental Protection Agency. The officials also emphasized on the need to conduct environmental monitoring by considering sensitive receptors from EPA certified laboratory.

Refer to meeting with Mr. Muhammad Arshad Chouhan (Director, Regional Planning) of CDA, the proposed Lai Nullah Expressway should be connected with the proposed 10th Avenue instead of 9th Avenue. He also informed that some projects of CDA are already proposed along the proposed route of Lai Expressway in Islamabad. Therefore, it is recommended to revisit the design in the light of above discussion.

Based on the above findings and discussion, it is concluded that a comprehensive Environmental Impact Assessment (EIA) Study of each Project component needs to be

ANNEX-III

considered and a detailed Land Acquisition and Resettlement Plan (LARP) needs to be prepared. Your approval regarding detailed EIA Study shall be required as current study will be a Preliminary Environmental Assessment Study.

ANNEX-III

Photographs



Consultation with Director, Town Planning at CDA, Islamabad



Consultation with Deputy Director at RDA



Meeting with Officials of Environment Department, Rawalpindi



Consultation with Deputy Director Wildlife, Rawalpindi Region



Proposed STP Site near Jabbar Village



A Bunch of Euclyptus Trees need to be Removed at Proposed STP Site

ANNEX-III



A View of Lai Nullah



A View of Houses need to be Demolished at New Phagwari



A View of Graveyard Adjacent to the Proposed Lai Expressway Route at I-9



A View of Graveyard Adjacent to the Proposed Lai Expressway Route near New Phagwari

ANNEX IV: QUESTIONNAIRES

Annex-IV

A. PHYSICAL CHECKLIST

ENVIRONMENTAL IMPACT ASSESSMENT (EIA)
CHECKLIST FOR PHYSICAL BASELINE CONDITIONS

Date: _____

Project Component: _____

Location: _____

Coordinates: N _____

E _____

1. PHYSICAL ENVIRONMENT

a. Type of Area

- Mountainous
- Arid
- Semi-arid
- Forest
- Dense forest
- Populated
- Densely populated
- Any other _____ (specify)

b. Geological Conditions

- Is the geology of the area rocky? _____
- Is the origin of rocks sedimentary/igneous/metamorphic? _____
- Any other _____ (specify)

c. Seismology

- Is there any record of earthquakes in the past 50 years? _____
- Presence of faults/fractures _____
- Any other details _____ (specify)

d. Topography & Soils

- Are the soils mixtures of sand /silt/clay/gravel/clayey silt _____
- Any other _____ (specify)

Other Features

- Drains
- Hills
- Plain Areas
- Any other _____ (specify)

e. Surface and Ground Water

Sources of Surface Water

- Rivers
- Hill Torrents
- Surface Ponds
- Any other _____ (specify)
- Surface water quality visual? _____

Sources of Ground Water

- Wells
- Hand Pumps
- Tube wells
- Quality and Approx. depth _____

g. Air Quality

- Is the area visually pollution free? _____
- Identification of point sources (Industries Refineries, power plants) or any other _____ (specify)
- Identification of non- point sources (cars, trucks, tractors) or any other _____ (specify)

h. Liquid Effluents

- Liquid effluents sources (industries/household/commercial)
- If any other _____ (specify)
- Identification of any disposal source for wastewater from plant _____

i. Solid Waste

- Types of waste (municipal, commercial, institutional, agriculture industrial, biomedical) any other _____ (specify)
- Waste Disposal facility (landfill, dumping stations)
- Approx. waste generated (tons/day) _____
- Responsible solid waste management authority? _____
- Waste management (Good or Poor) _____ if poor, specify the reasons (lack of awareness among people, authority is not responsible enough)

j. Noise

- Sources of noise (traffic/industry or other _____) (specify)
- Areas under high noise pollution? _____

k. Natural Hazards

- Does the project area has any previous records of flooding? _____
- Are there any records of drought? _____
- Any other _____ (specify)

l. Accessibility

- Site is accessible through (metaled/unmetaled) road _____

m. Nearby Structures

- Is there any nearby structure? _____
If yes (provide details) _____

n. Sensitive Receptors

- Is there any nearby sensitive receptor? _____
If yes (provide details) _____

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B. ECOLOGICAL CHECKLIST



ECOLOGICAL CHECKLIST FOR TRANSACTION ADVISORY SERVICES FOR LAI EXPRESSWAY PROJECT

Data Sheet Number		Date / / 2020	Expert Name	
Location		Coordinates N	E	Project component
Present Status		Potential for Plantation	Yes / No	Near to

BIODIVERSITY FEATURES

Vegetation Type	<ul style="list-style-type: none"> ➤ Trees (Conifers/ Broadleaved/ Fruit Trees) ➤ Herbs ➤ Shrubs ➤ Grasses 	<ul style="list-style-type: none"> ➤ Mature ➤ Sub-mature ➤ Pole Crop 	Ecological Zone	Legal Status	
			Species Composition	1.	6.
2.	7.	Diameter Class (cm)		Agriculture Land	Yes/No
3.	8.			➤ 0-15	Crop Type
4.	9.			➤ 16-30	
5.	10.			➤ 31-45	
			➤ 46-60 or Above		

WILDLIFE/ FAUNA DESCRIPTION

Wildlife Protected Areas (Notified or Sensitive)		Avifauna/ Birds (Y/N)	
Mammals (Y/N)		Natural Wetlands (Y/N)	
Reptiles (Y/N)		Endangered Species (Y/N)	
Amphibians (Y/N)		Other Biodiversity features	
Aquatic Habitat (Y/N)			



Remarks/ Comments	

Annex-IV

C. SOCIOECONOMIC QUESTIONNAIRE



NATIONAL ENGINEERING SERVICES PAKISTAN (PVT) LIMITED (NESPAK)

Socioeconomic Baseline Survey for Transition Advisory Services for Lai Expressway Project

A. Name of Interviewer: _____ Date: _____

B. Site Location:

Mahalla _____ Village/Town _____
Union Council _____ Tehsil & District _____
_____ Cell no _____

1. Name of Respondent _____ Father's name _____

2. Gender: I. Male _____ II. Female _____

3. What is your age?

Age (year) 15 – 25 _____
25 – 35 _____
35 – 45 _____
Above 45 _____

4. Which is your marital status?

I. Married _____ II. Unmarried _____

5. What is your family size?

Number I Male _____ II Female _____

6. What is your caste /ethnic group? _____

7. What is your language? _____

8. What is your qualification?

I. Illiterate _____ II. Primary _____ III. Middle _____
IV. Metric _____ V. Intermediate _____ VI. Above Inter _____

9. What is your profession? _____

10. What is your family system?

I. Joint _____ II. Nuclear _____

11. What is employment status of your family members?

I. Government Employee II. Private Employee III. Self Employed
IV. Unemployed V. Household

12. What are your major sources of income?

- | | | | |
|----------------------|-------|------------------------|-------|
| I. Agriculture | _____ | II. Cattle (meat) | _____ |
| III. Trade /Business | _____ | IV. Driver | _____ |
| V. General Labour | _____ | VI. Milk /Ghee Selling | _____ |
| VII. Service | _____ | VIII. Any other | _____ |

13. What is your average monthly income?

- Rs. Less than 10,000 _____
- 10,000 – 15,000 _____
- 15000 – 20,000 _____
- 20,000 – 25,000 _____
- Above 25,000 _____

14. How much is your average monthly expenditure?

- Rs. Less than 10,000 _____
- 10,000 – 15,000 _____
- 15000 – 20,000 _____
- 20,000 – 25,000 _____
- Above 25,000 _____

15. What type of ownership you have for your house?

- | | | | |
|-----------------|-------|---------------------------|-------|
| I. Self Owned | _____ | II. Rented | _____ |
| III. Encroacher | _____ | VI. Relative House (Free) | _____ |

16. What is nature of construction of your house?

- | | | | | | |
|----------|-------|----------------|-------|-------------|-------|
| I. Pacca | _____ | II. Semi-Pacca | _____ | III. Kaccha | _____ |
|----------|-------|----------------|-------|-------------|-------|

17. Which of the following facilities are available in your house?

- | | | | | | |
|----------------|-------|------------------|-------|----------|-------|
| I. Electricity | _____ | II. Water Supply | _____ | III. Gas | _____ |
| IV. Telephone | _____ | V. Sewerage | _____ | | |

18. What is the source of energy for cooking and lightening in this area?

1. _____ 2. _____ 3. _____

19. Is there any educational institution in this area?

1. Yes 2. No

If yes, then

Name _____ Place _____

20. Is any health facility available in this area?

1. Yes 2. No

If yes, then

Name _____ Place _____

21. What are the common diseases in the project area?

1. Hepatitis _____ 2. Cholera _____ 3. Diarrhoea _____

4. Jaundice _____ 5. Skin Infection _____ 6. Abdominal Pain _____
 7. Diabetes _____ 8. High Blood pressure _____
22. Reason of diseases.
 Water borne _____
 Poor hygienic conditions _____
 Hereditary _____
 Any other (please specify) _____
23. What is the principle mode of transport being used by you (respondent) in this area?
 Mode of transport _____
24. What are the sources of water for your domestic use?
 I. Public Water Supply _____ II. Hand Pumps _____
 III. Motor/pump _____ IV. Any other _____
25. Are you satisfied with the quality of the water?
 I Yes. _____ II No. _____
 If No, then reason _____
26. What is status of your property?
 I. Owner _____ II. Encroacher _____
27. Type of Property likely to be affected: Land Structure Land/Structure
28. Kind of compensation you want? Cash _____ Land by land _____
29. In case of resettlement your preference? Self-resettle _____ Govt resettle _____
30. Since how long you are living here? _____
31. Is there any archaeological/historical or religious site in the town?
 I Mosque _____ II Church _____
 III Shrine _____ IV Any Other Place _____
32. Specify the existing Non -Government Organizations (NGOs) in your area and state their area of work?
 Name of Organization _____ Area of interest _____

33. Are you satisfied with current sewerage drain in this area?
 1. Yes 2. No
 If no, then reasons _____

34. Do you know that Lai Expressway is being constructed in the area?
 1. Yes 2. No

(If not, then tell him about the proposed Project)

35. In your opinion, should this Project be implemented here?

I. Yes _____

II. No _____

If yes, then reasons

if no, then reasons

36. In your opinion, what will be possible impacts of this Project?

During Construction

After Construction

37. What protective measures do you suggest to safeguard your interests?

38. In your opinion, what are the pressing needs of this area?

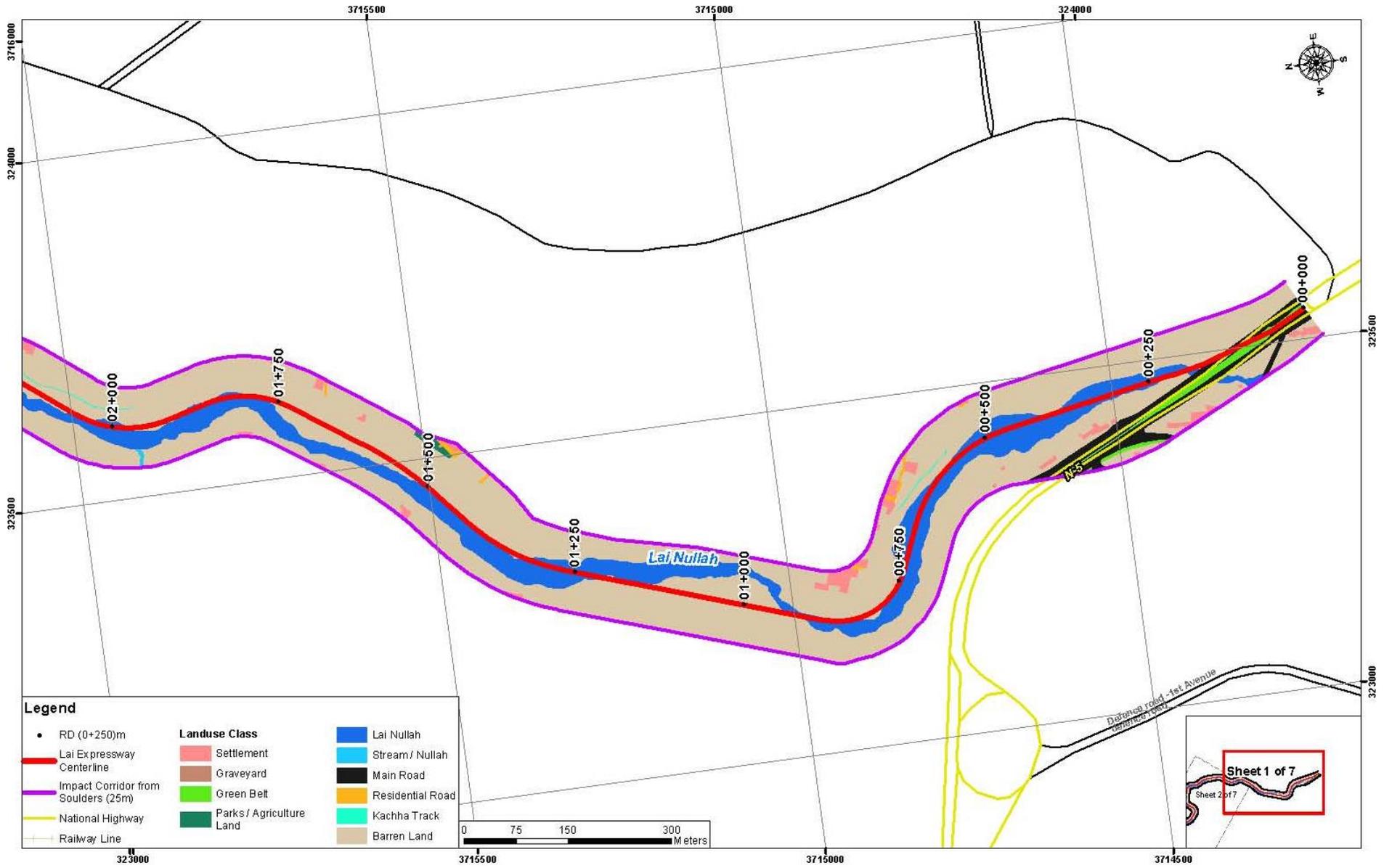
Signature of the Interviewer

**ANNEX V: DETAILED LAND USE
MAPS (COMPONENT-I&II)**

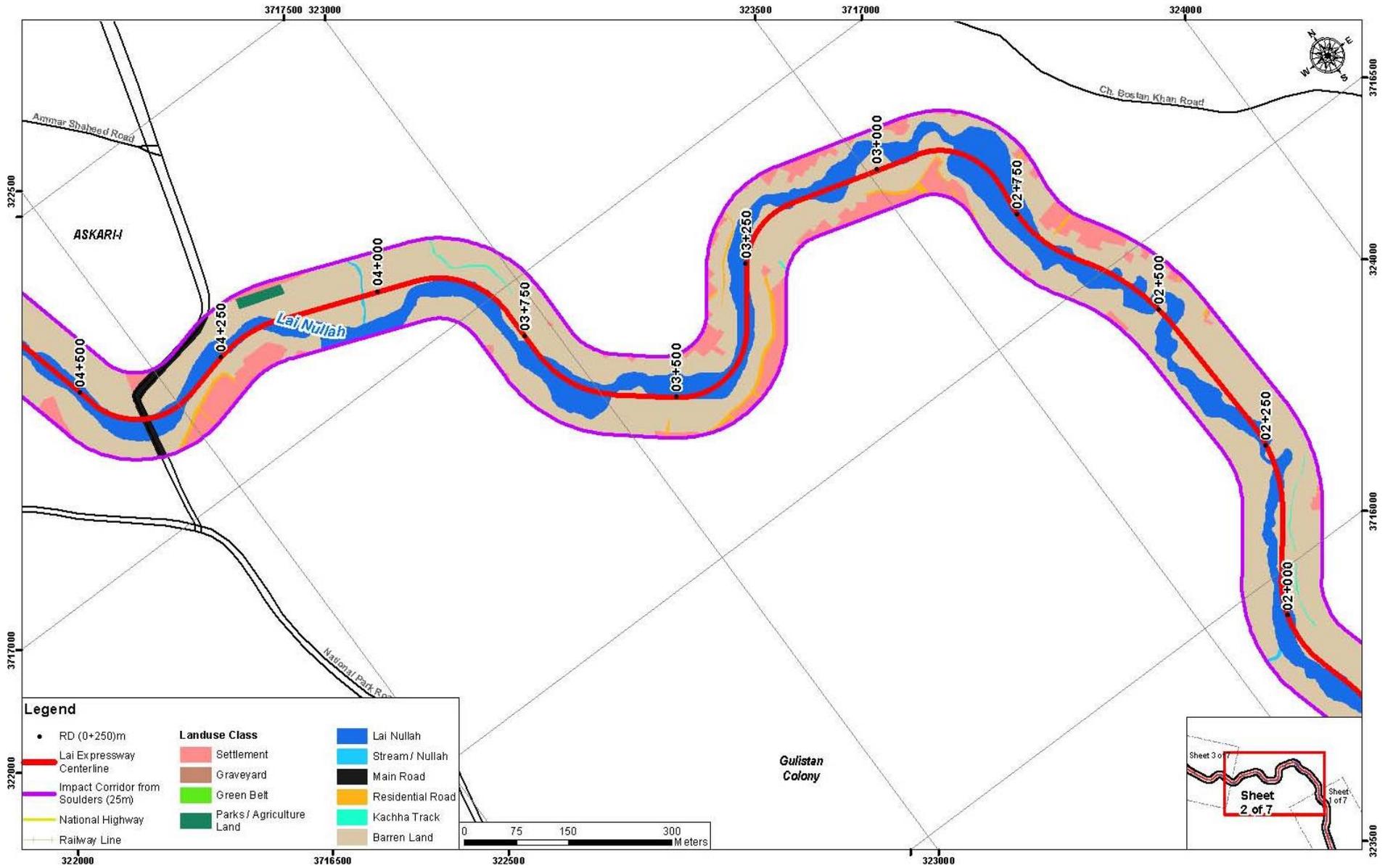
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LAI EXPRESSWAY

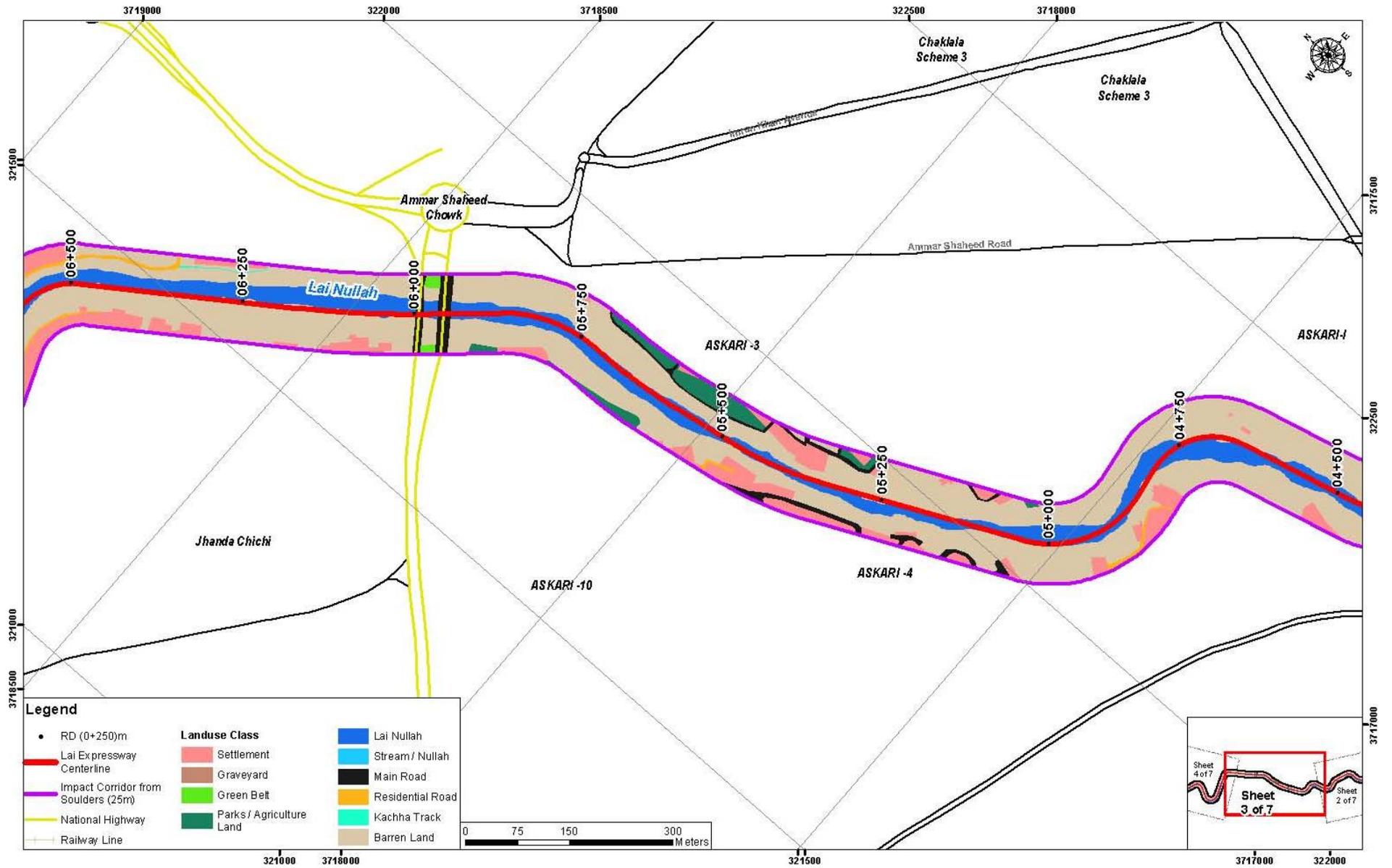
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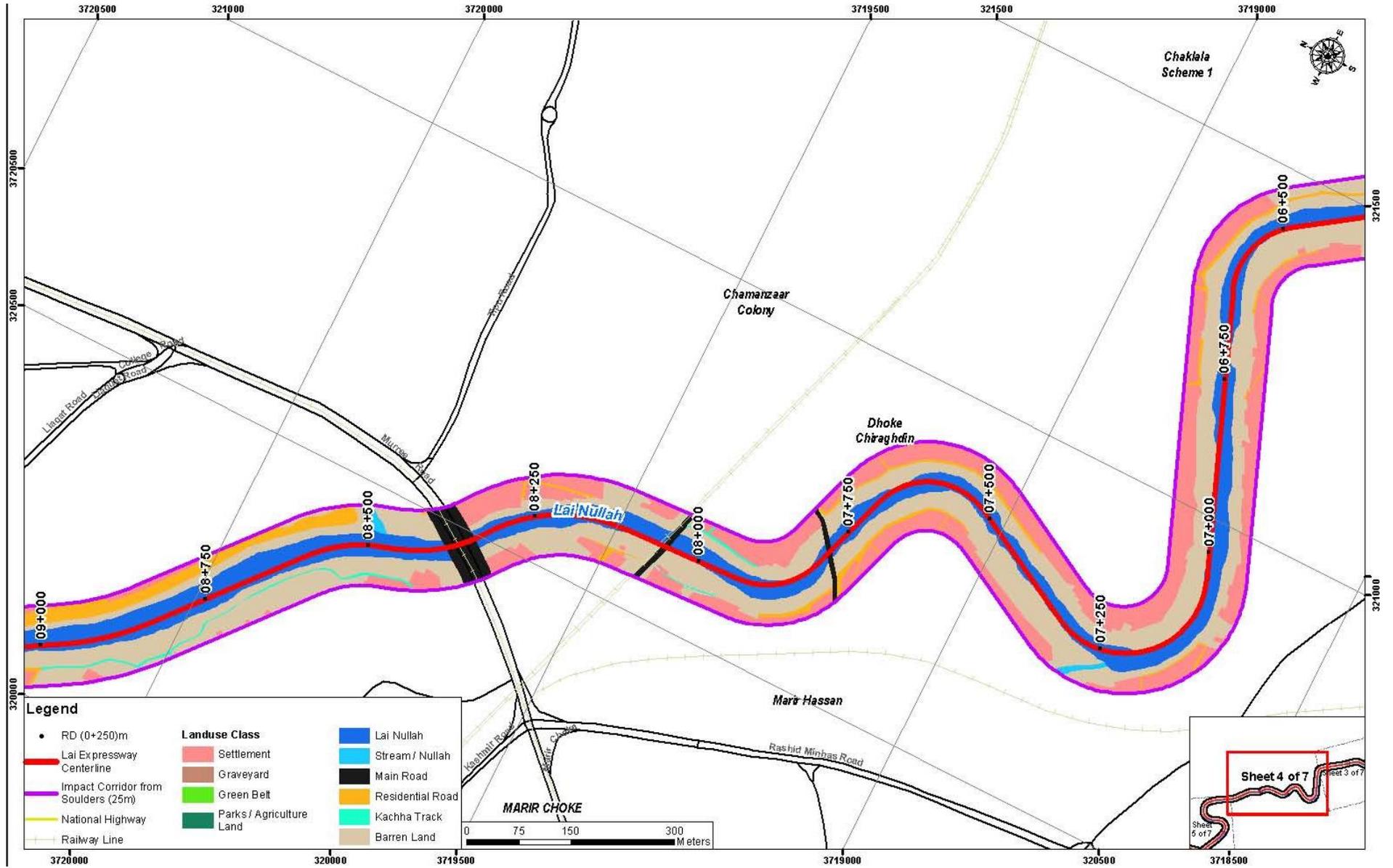
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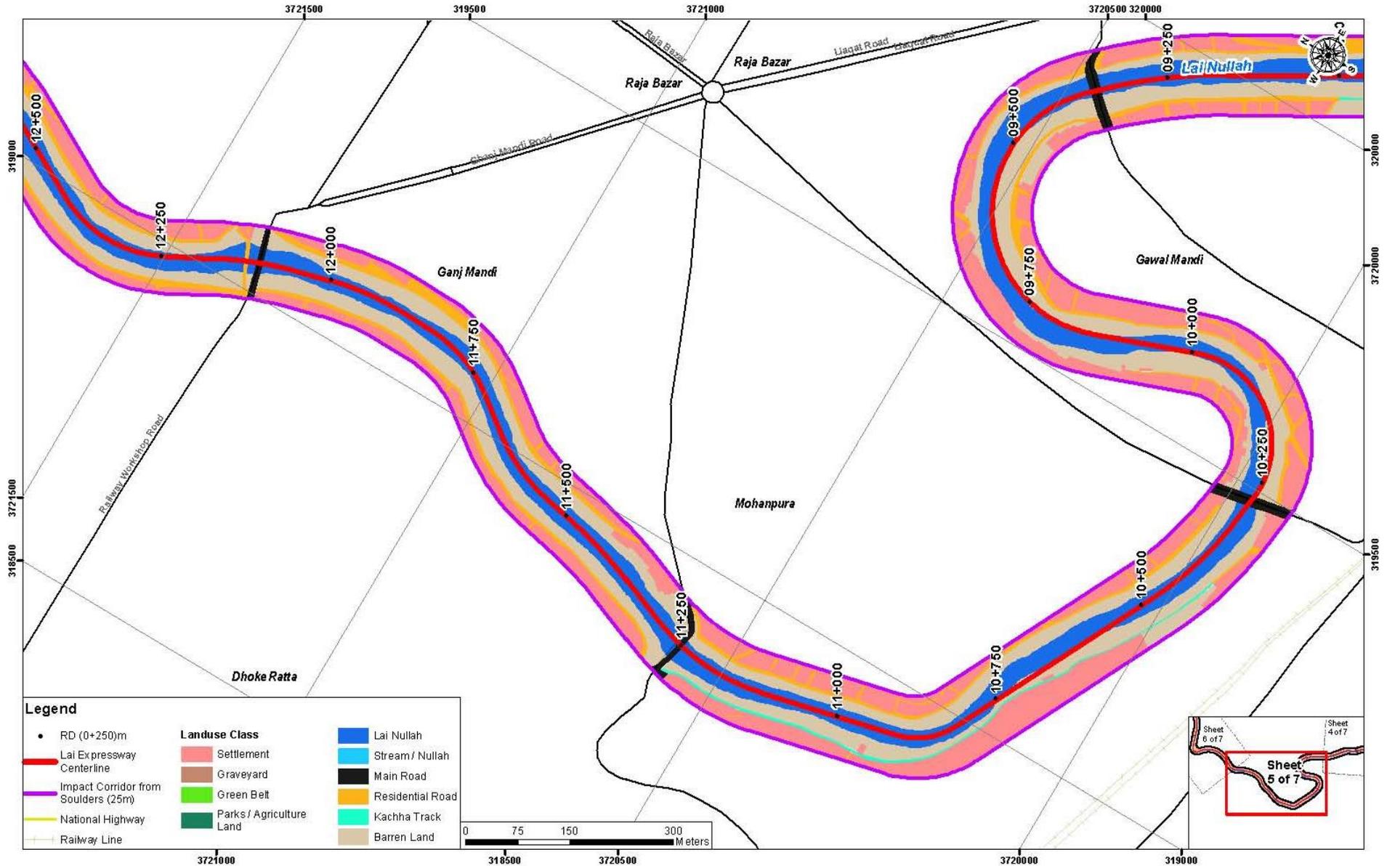
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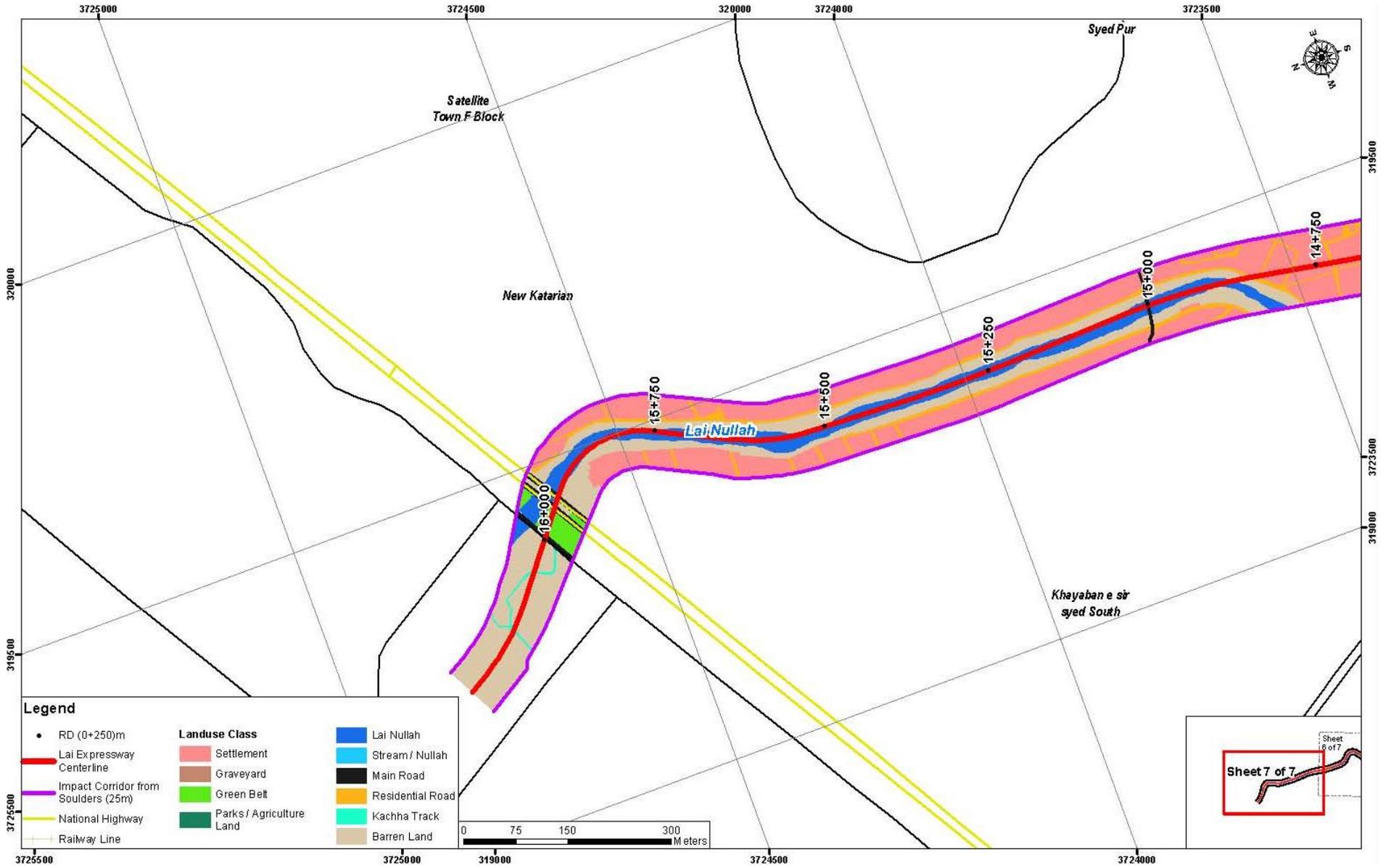
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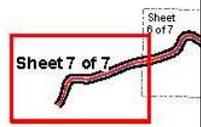
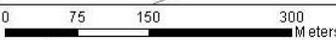


Annex-V



Legend

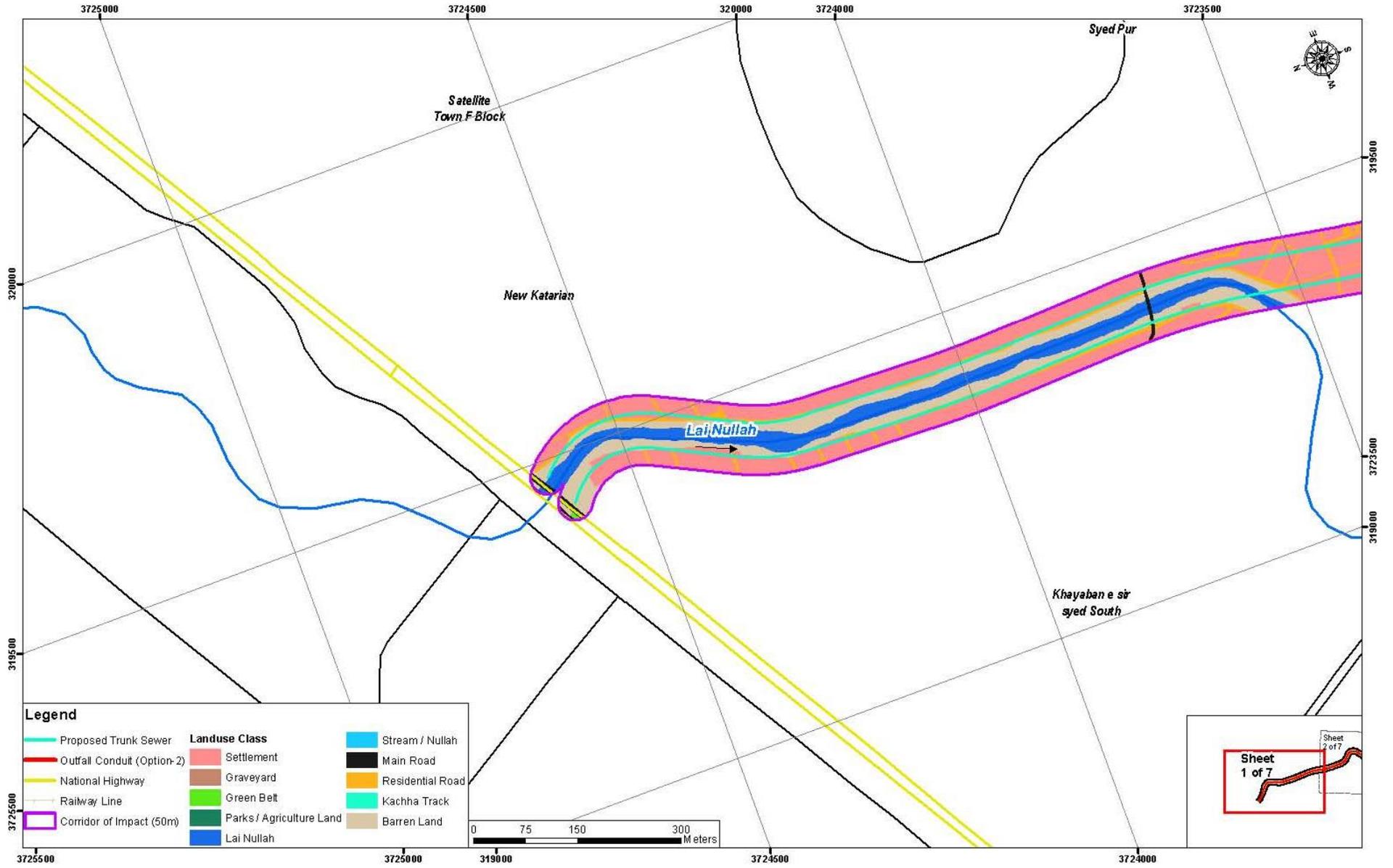
- | | | |
|---------------------------------------|----------------------------|--------------------|
| • RD (0+250)m | Landuse Class | ■ Lai Nullah |
| — Lai Expressway Centerline | ■ Settlement | ■ Stream / Nullah |
| — Impact Corridor from Soulders (25m) | ■ Graveyard | ■ Main Road |
| — National Highway | ■ Green Belt | ■ Residential Road |
| — Railway Line | ■ Parks / Agriculture Land | ■ Kachha Track |
| | ■ Barren Land | |



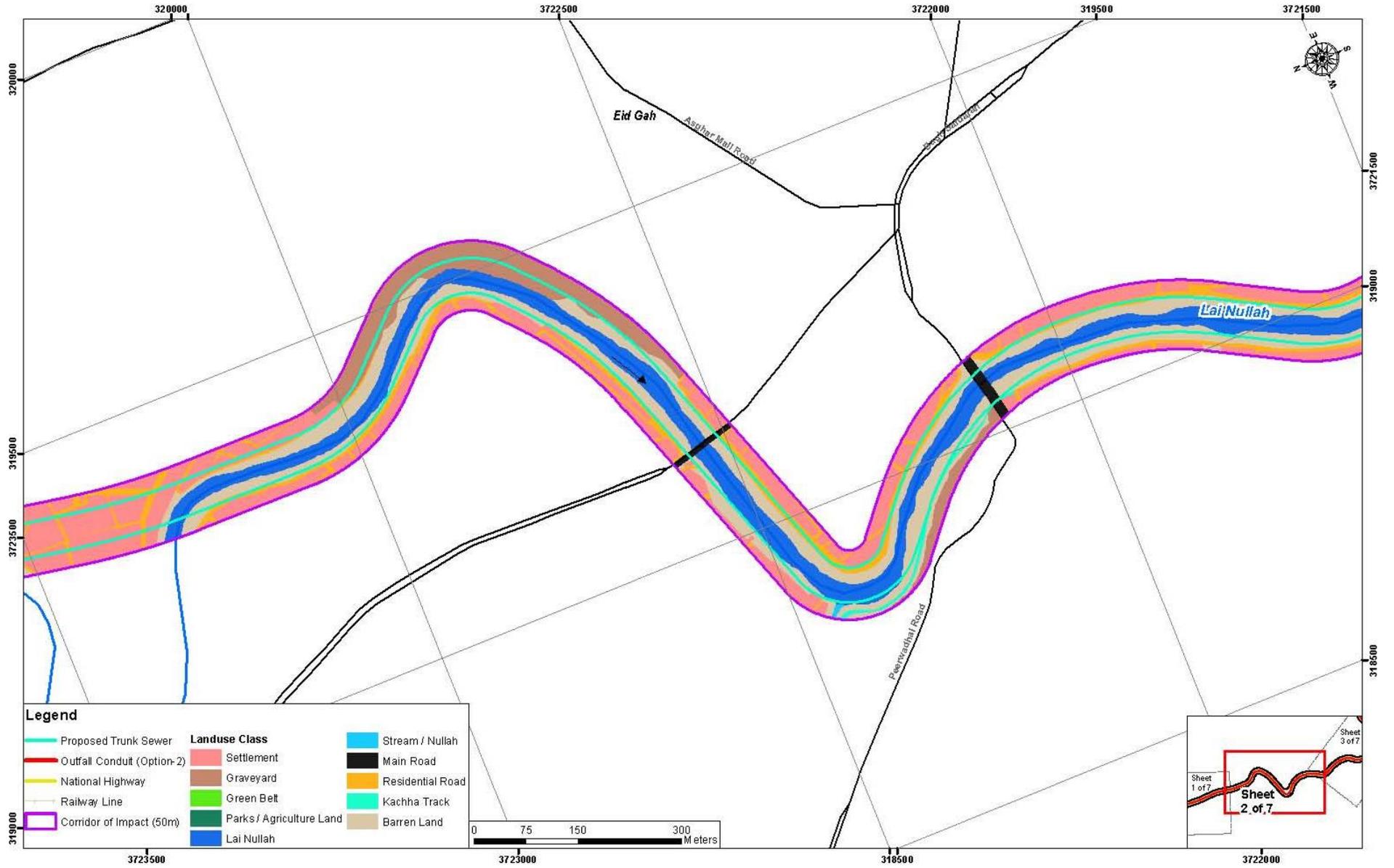
Annex-V

TRUNK SEWER

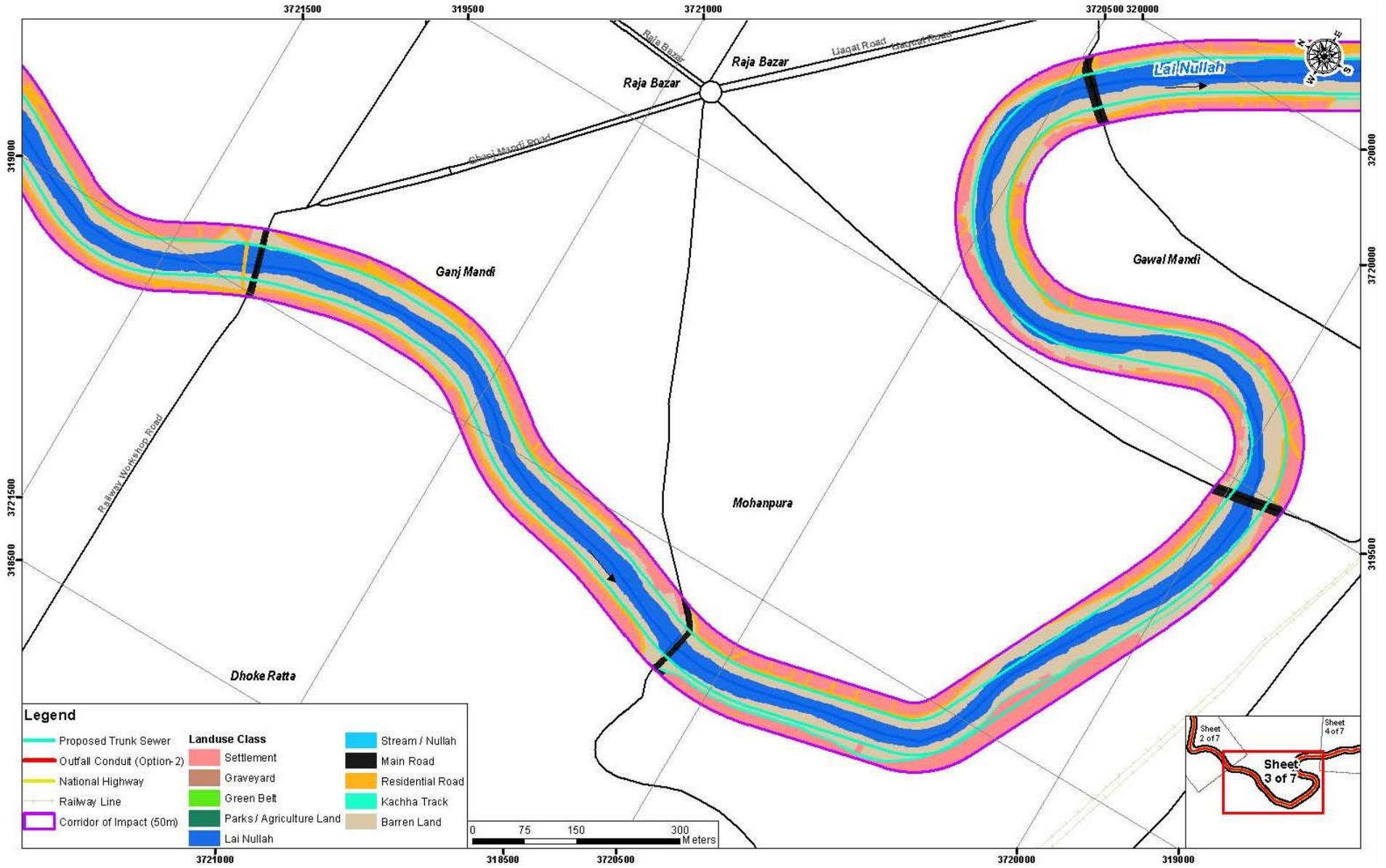
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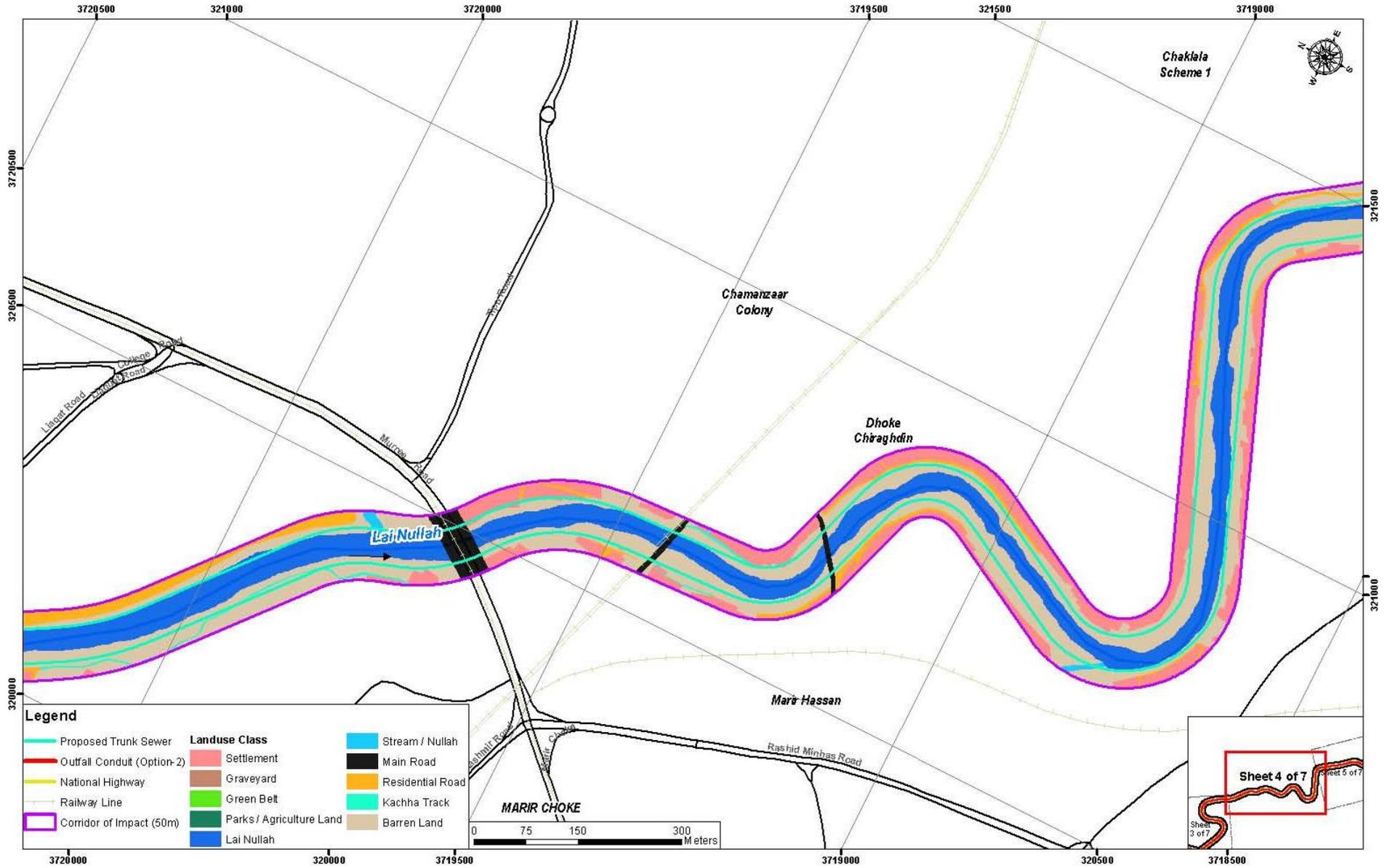
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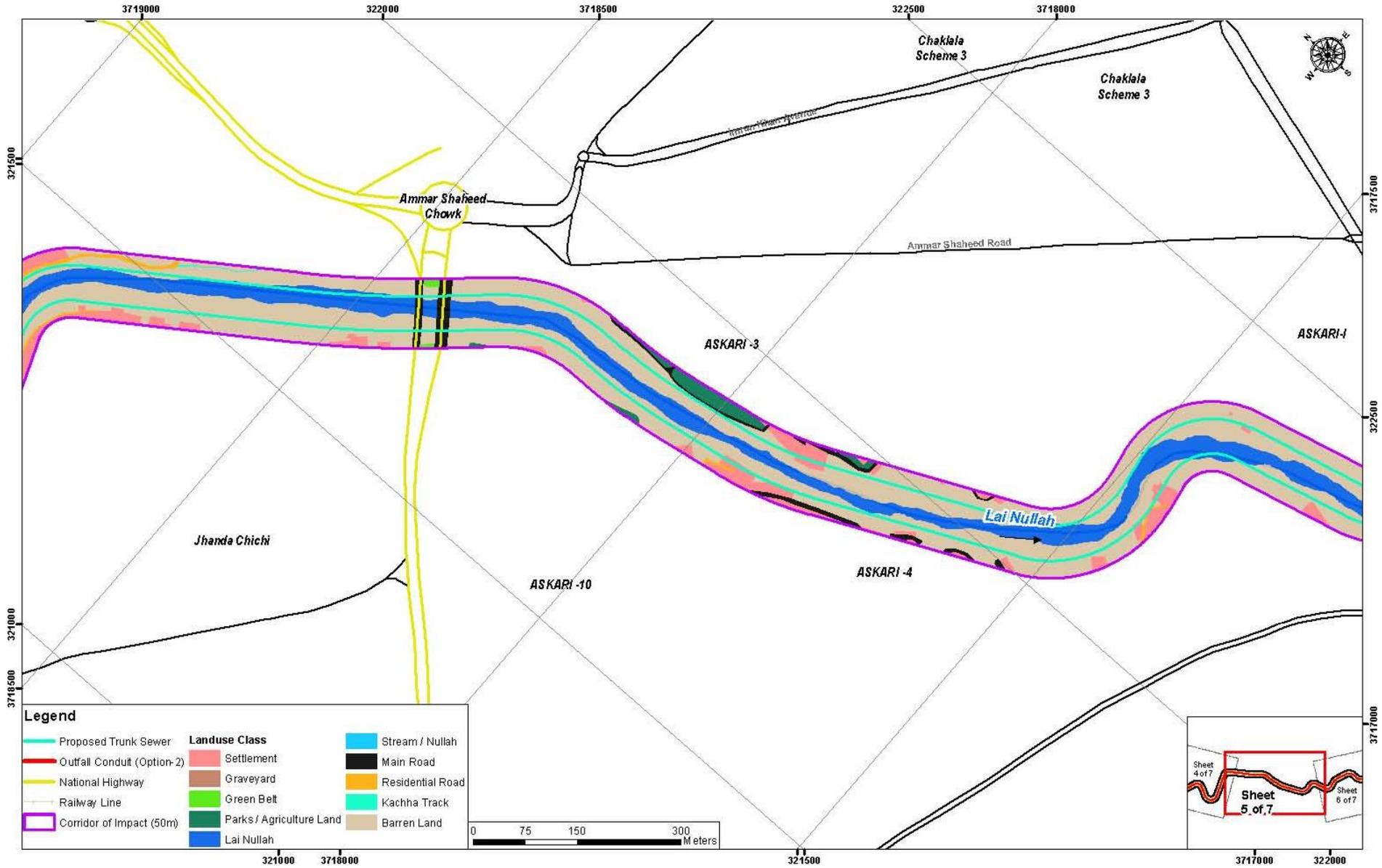
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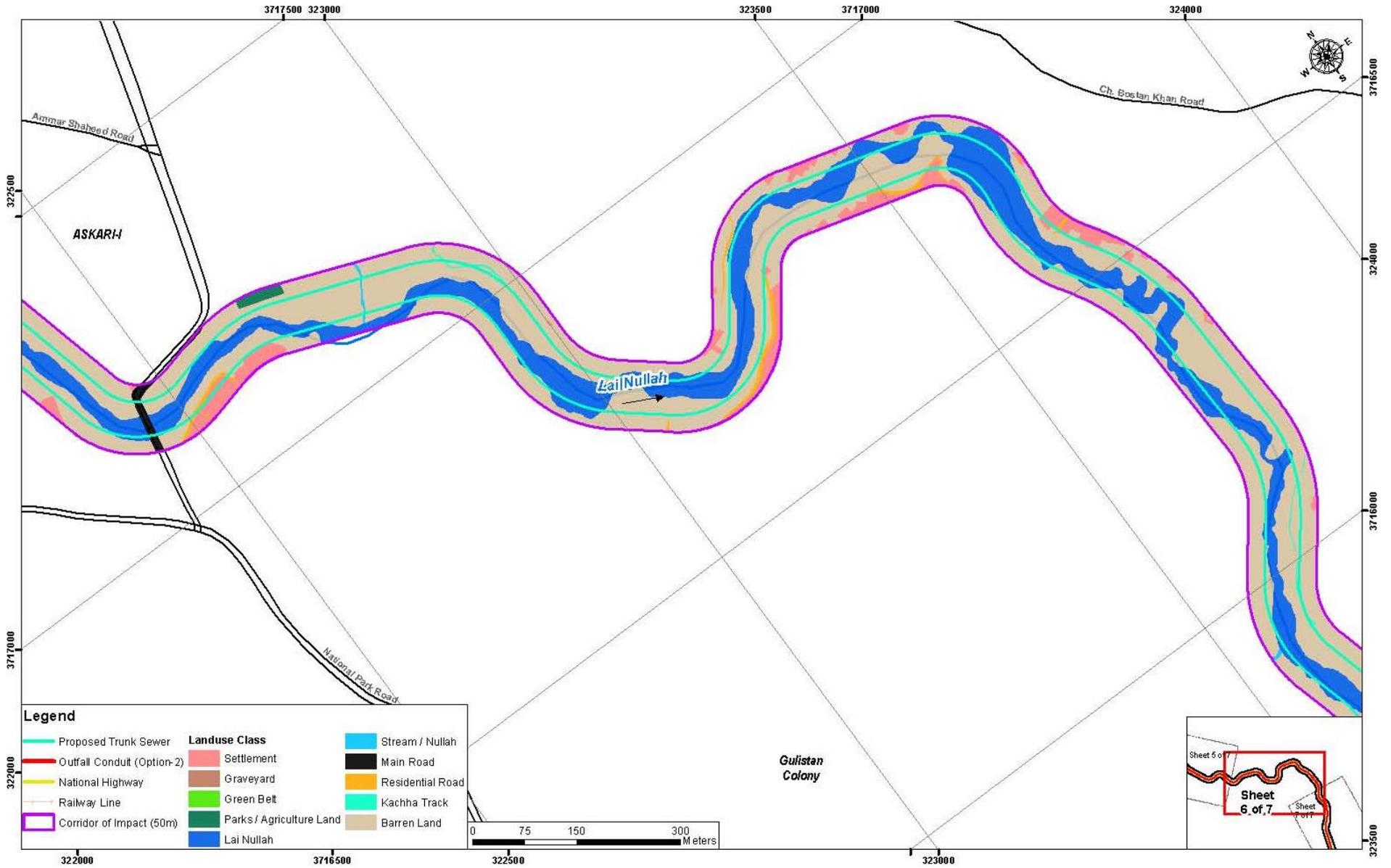
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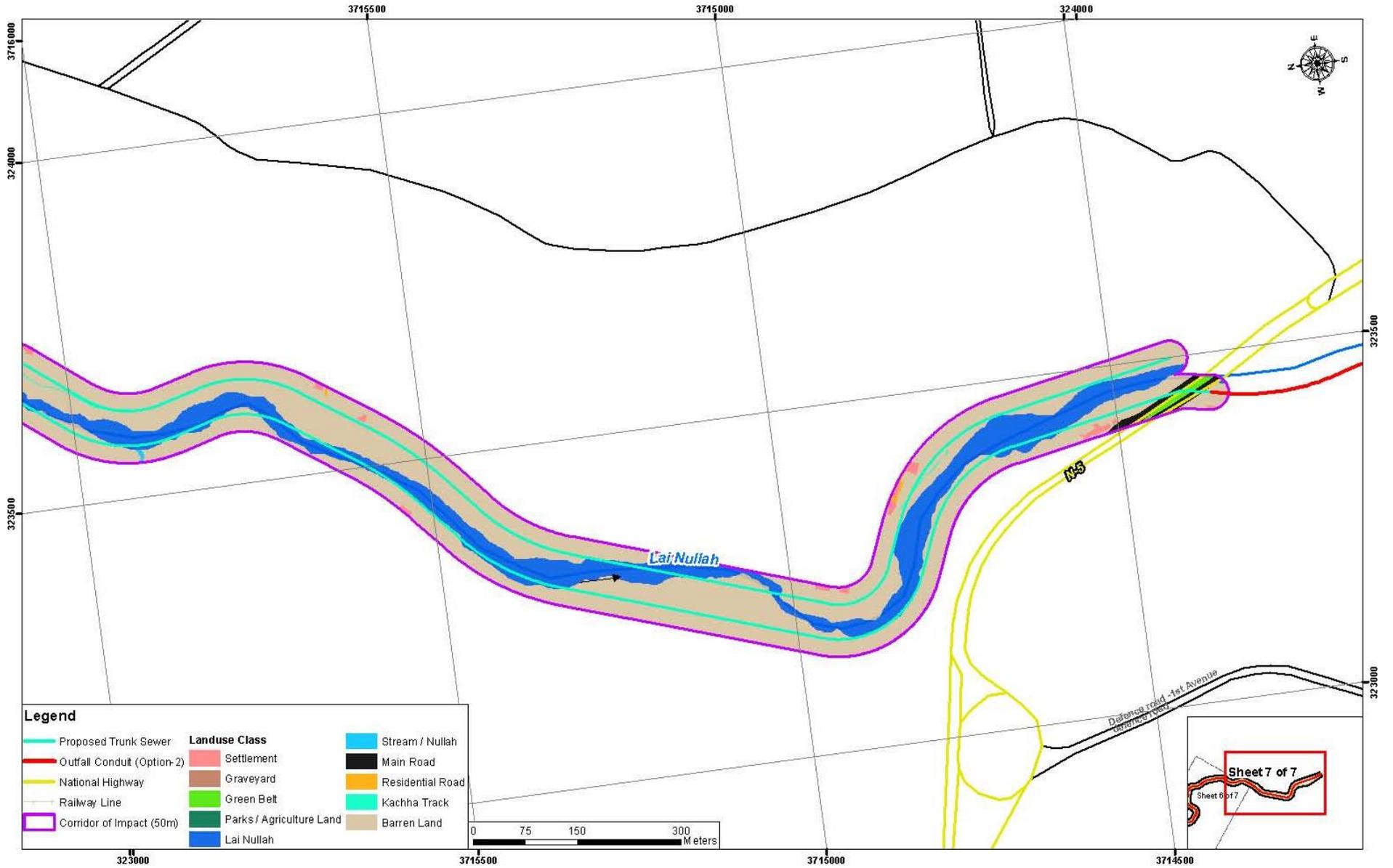
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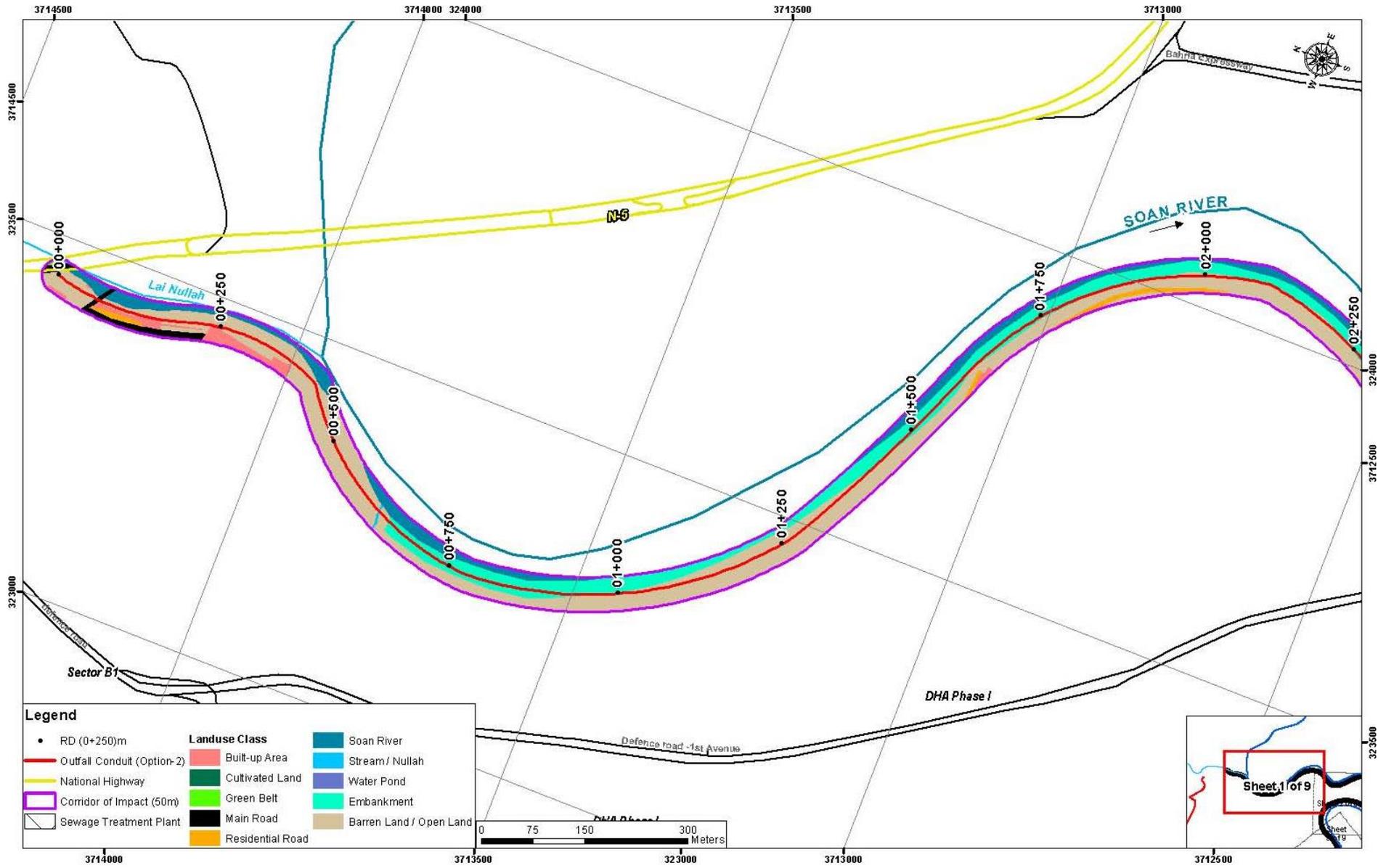
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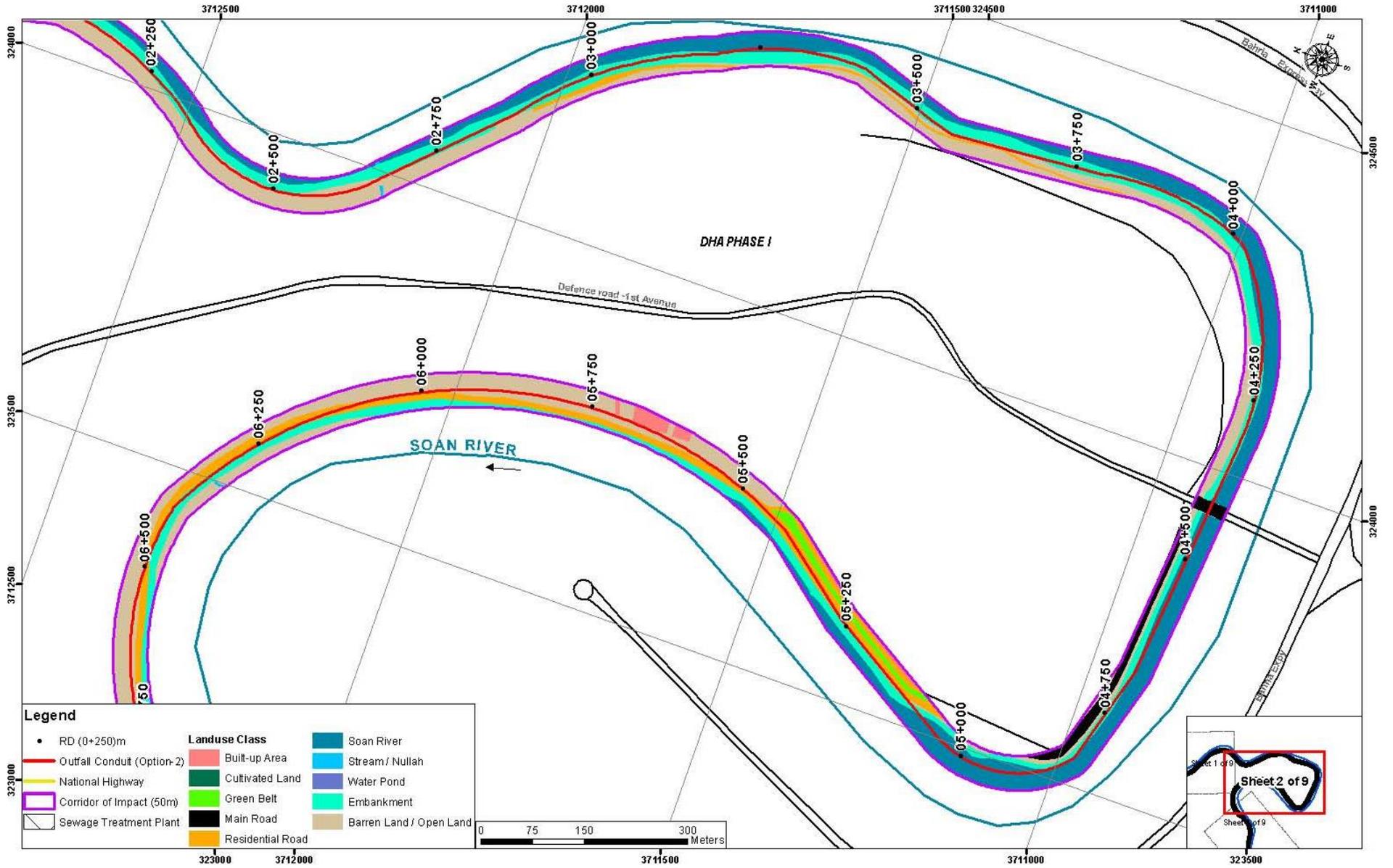
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OUT FALL CONDUIT (OPTION-2)

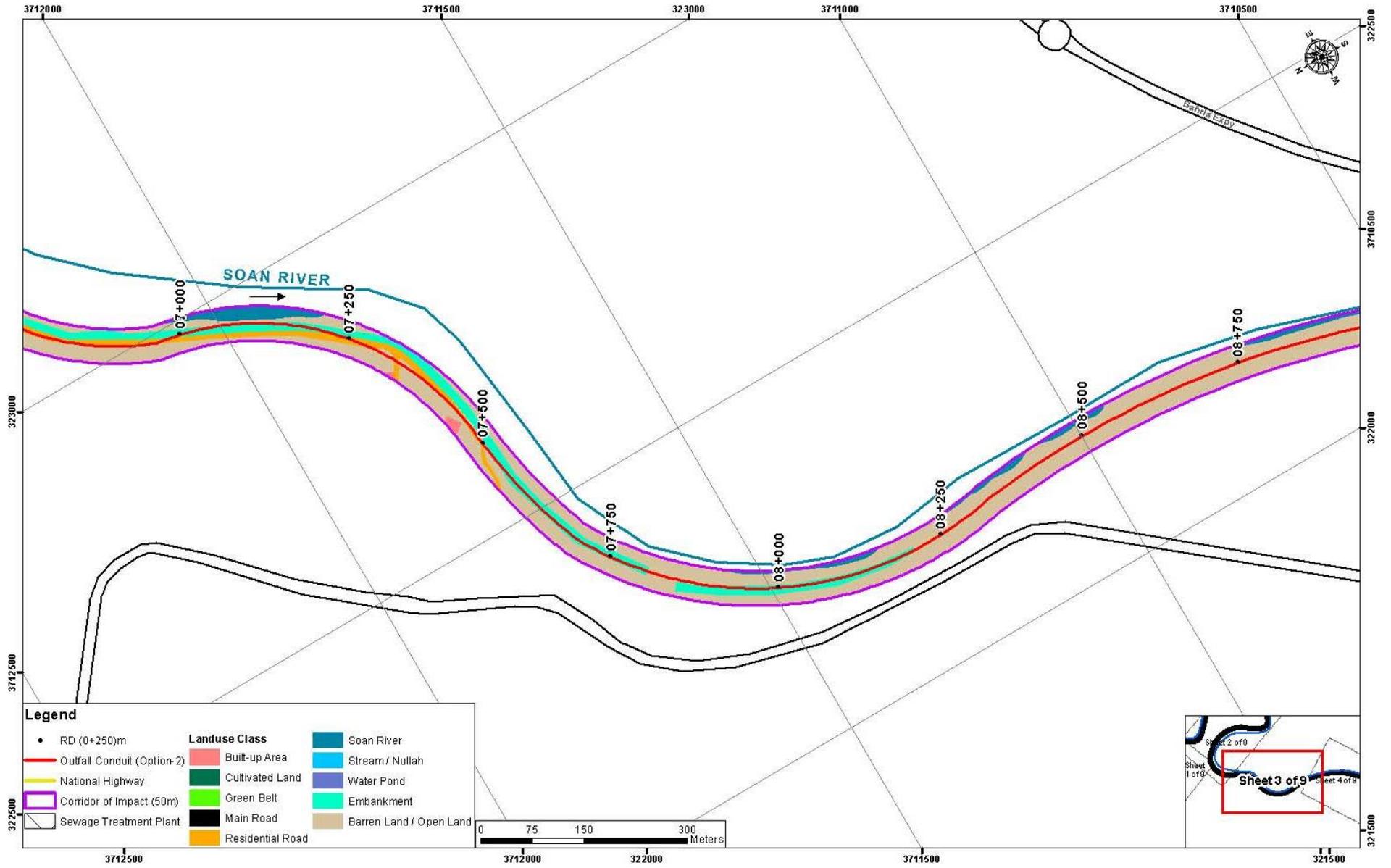
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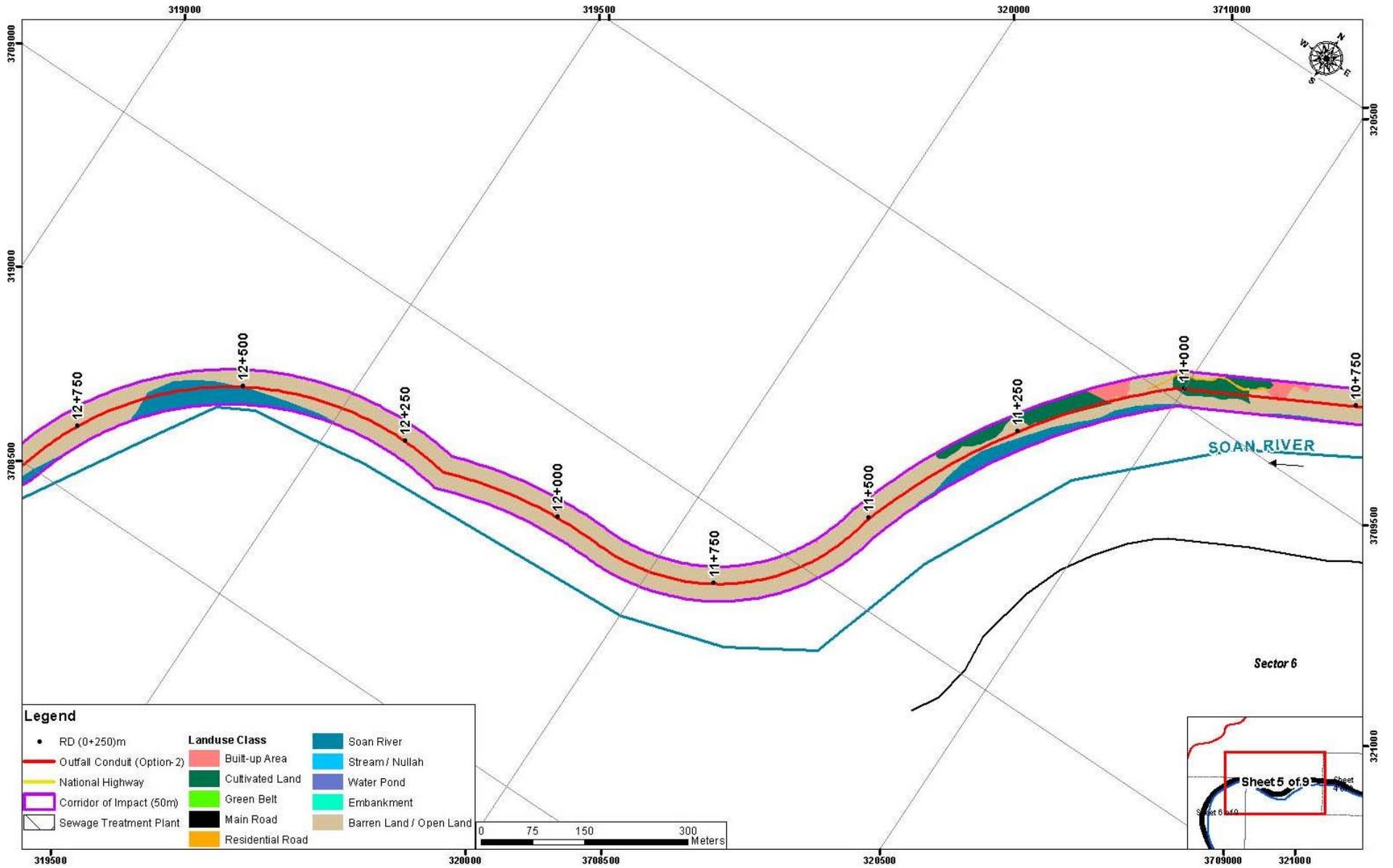
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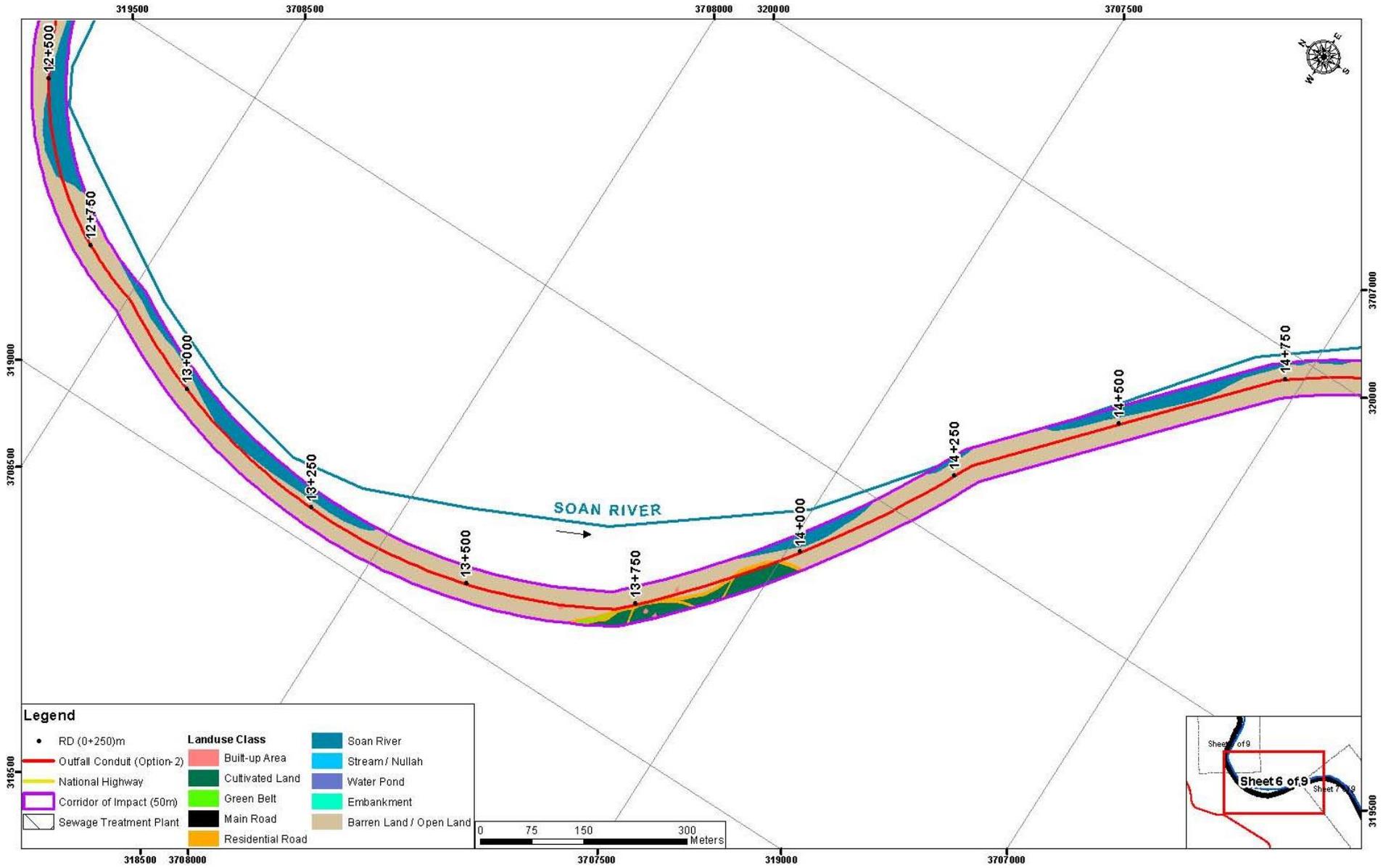
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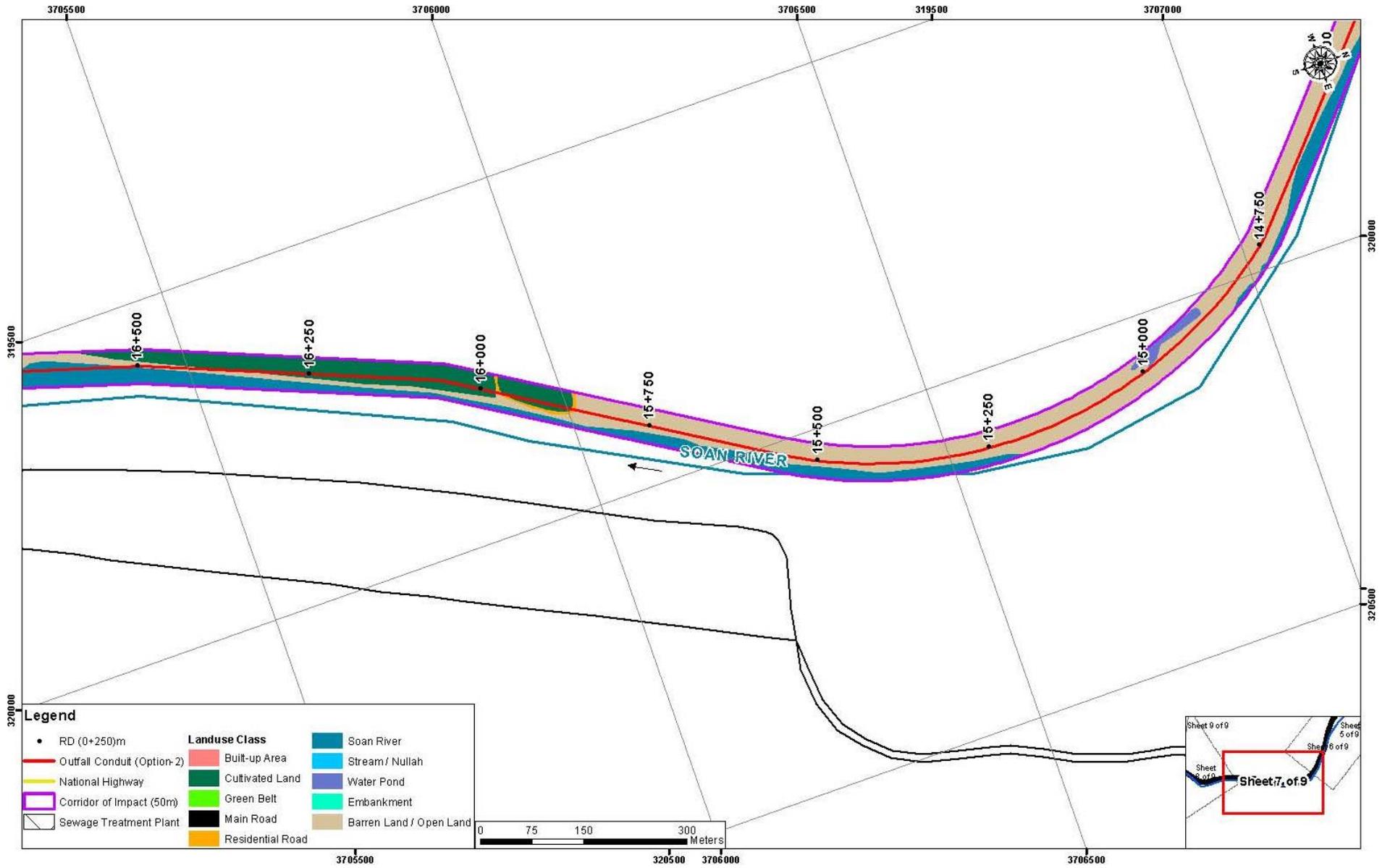
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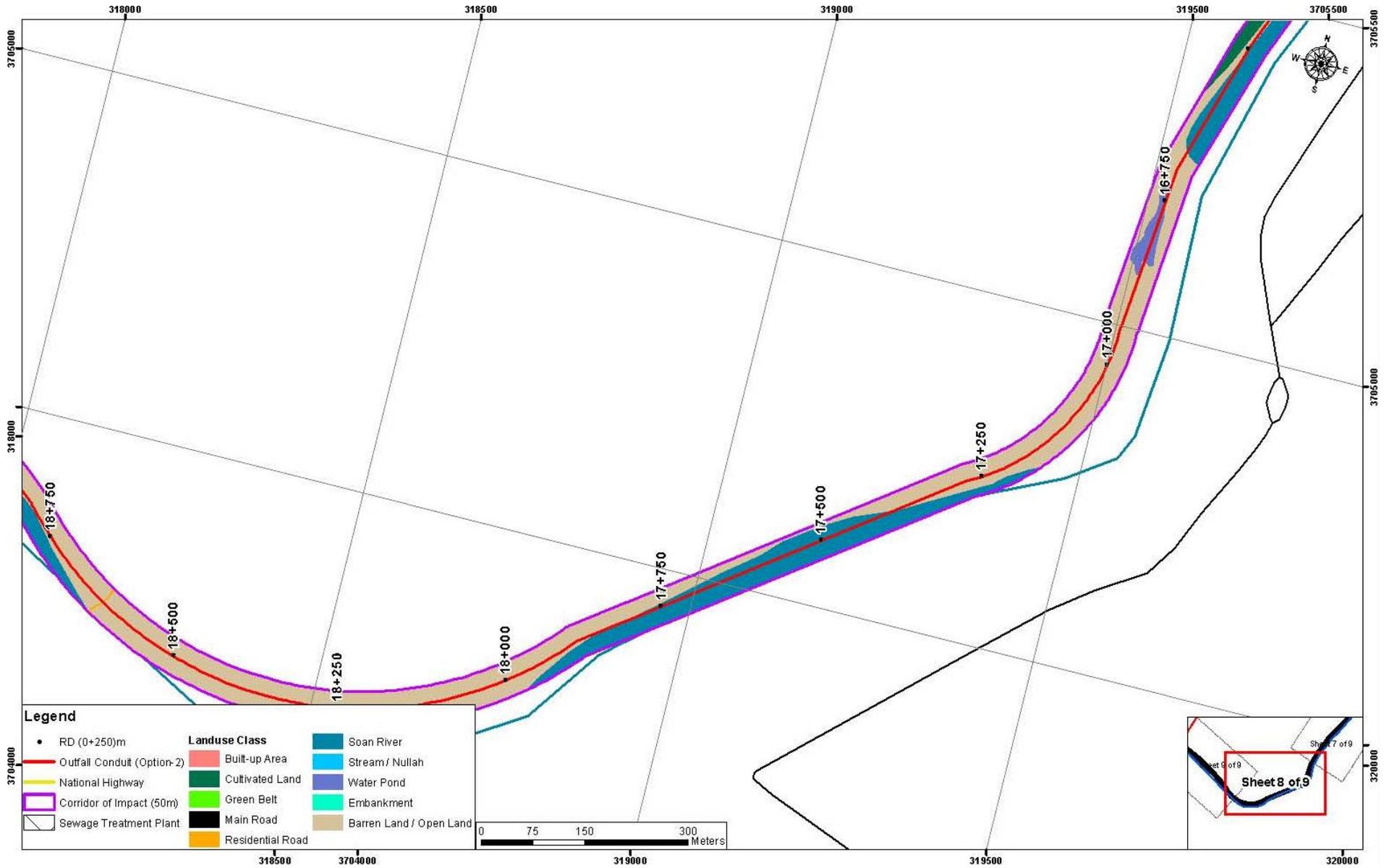
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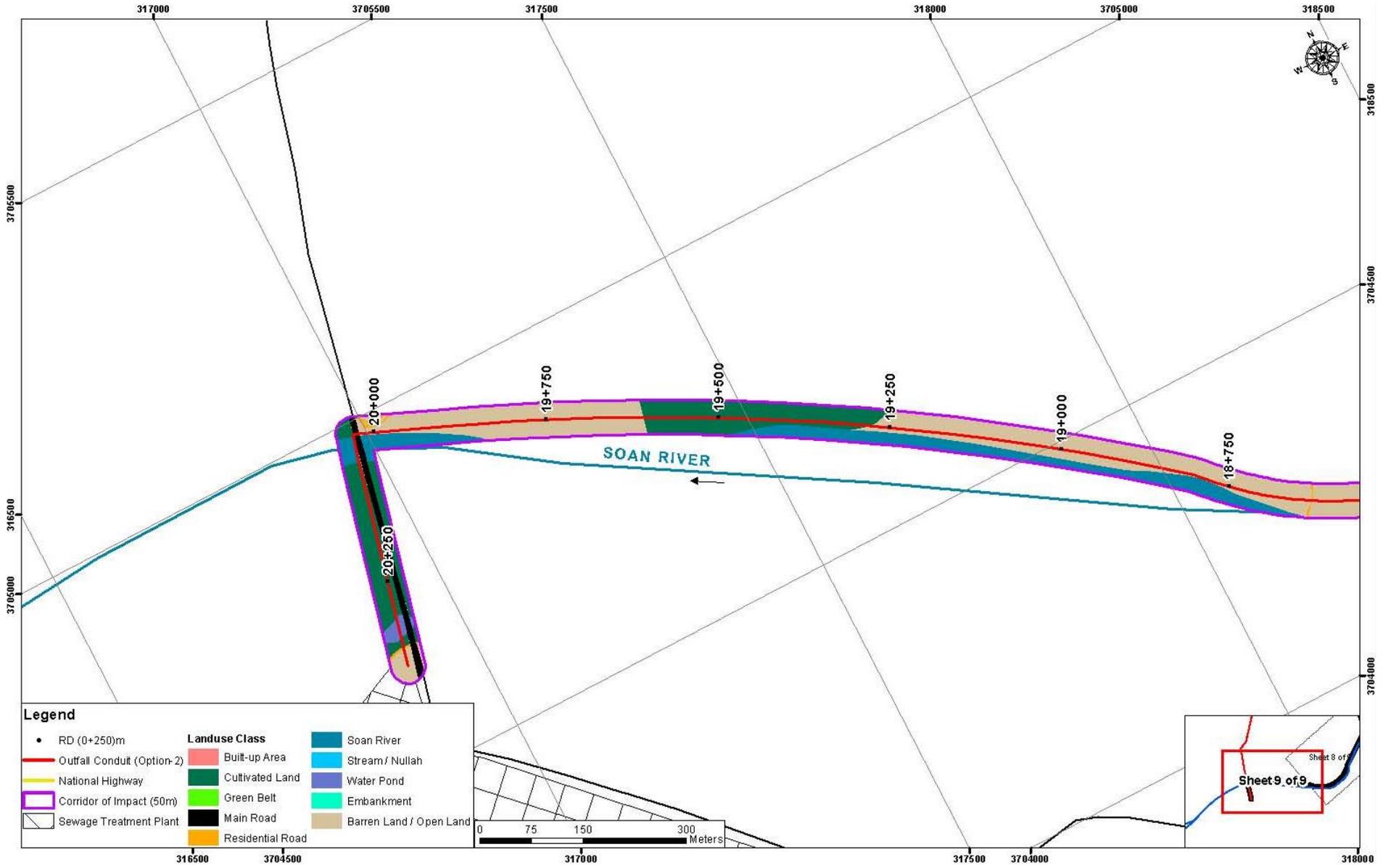
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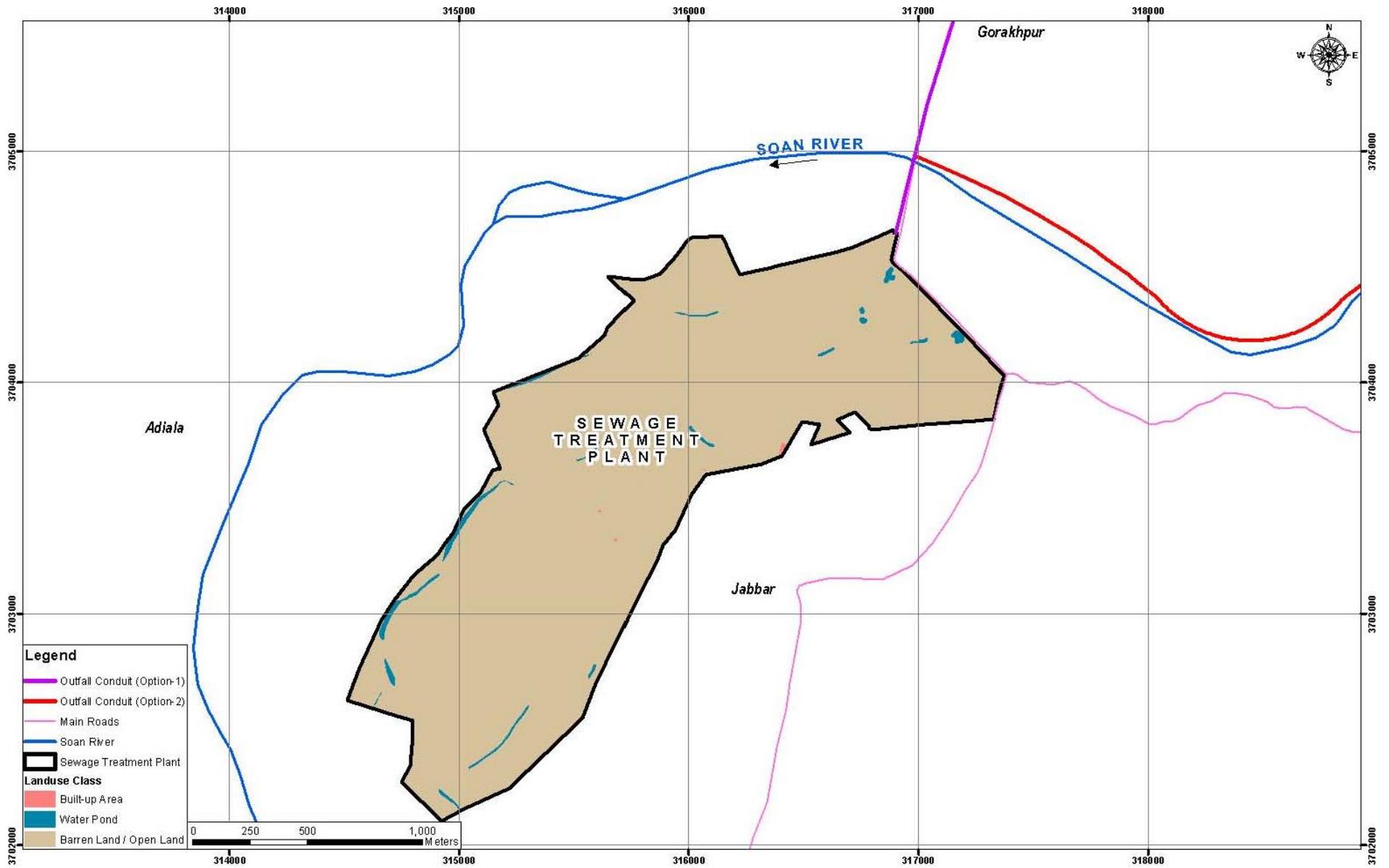
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SEWAGE TREATMENT PLANT

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**ANNEX VI:
SANITATION PLAN**

SANITATION PLAN

INTRODUCTION

This plan outlines the measures that can improve conditions of sanitation at construction sites during construction and operation phase.

1. PURPOSE OF THE PLAN

The plan intends to ensure sanitation including the control of water supplies, excrete and wastewater disposal, refuse disposal, vectors of diseases, housing conditions, food supplies and handling, atmospheric conditions, and the safety of the working environment.

2. MANAGEMENT OF SANITATION DURING CONSTRUCTION PHASE

i) Responsibility

The Health and Safety Inspector designated by construction contractor shall also inspect sanitation conditions and ensure safe working environment for workers.

ii) Location of Camp Sites

The accommodation and ancillary facilities for labor shall be constructed and maintained to standards and scales approved by the Resident Engineer.

The camps must be located such that the drainage from and through the camps shall not endanger any domestic or public water supply.

All sites must be managed to avoid ditches and depressions to minimize nuisance due to stagnant water.

iii) Water Supply

An adequate and convenient water supply, approved by the appropriate health authority, must be provided in each camp for drinking, cooking, bathing and laundry purposes.

Potable water supply systems for labor camps occupants shall meet the drinking water quality standards of PEQS, 2016. In addition, the design of water system facilities shall be based on the suppliers Engineer's estimates of water demands. The drinking water must be monitored regularly for drinking water quality parameters.

At all construction camps and other workplaces, good and sufficient water supply shall be provided and maintained to eliminate chances of waterborne diseases to ensure the health and hygiene of the workers.

iv) Toilet Facilities and Hygiene

According to health and safety guidelines OR-OSHA number of toilets required at construction site is as one toilet for 20 workers. **Table 1** shows the number of toilets required in accordance with the number of employees at construction site. The total numbers of employees at construction site are estimated to be 220 persons.

Table 1: Number of Toilets Required for Employees at Construction Site

No. of Employees	No. of Toilets and Urinals by OSHA	Total No. Toilets and Urinals Required at Construction Site
Up to 20 Employees	1 Toilet	5 Toilets
Up to 40 Employees	1 Urinal	2 Urinals

Within the premises of every workplace, toilets and urinals shall be provided in an accessible place, and the accommodation, separately for each of these, as per standards prevailing in the province and country.

Toilet facilities adequate for the capacity of the camp must be provided. Each toilet room must be located, so as to be accessible.

A toilet room must be located within 200 feet of the camp. No toilet may be closer than 100 feet to kitchen and sleeping area.

These toilets must be distinctly marked by signs printed in native language of the persons occupying the camp, or marked with easily understood pictures or symbols.

Urinals troughs in privies must drain freely into the pit or vault, and the construction of this drain must be such as to exclude flies and rodents from the pit.

Proper facility for hand washing and other cleaning activities to be provided as follows:

- Provide individual hand towels from a sanitary dispenser and receptacles for disposing of waste towels;
- Providing hand soap and industrial hand cleaner for removing paints and other contaminants;
- Prohibited use of gasoline or solvent for hand washing; and
- Keep the floor of facilities dry to prevent spills and falls.

v) Waste Disposal

The sewage system for the camp must be designed, built and operated in compliance with the relevant legislation so that no health hazard occurs and no pollution to the air, ground or adjacent watercourse takes place.

Garbage bins must be provided in the camps and regularly emptied and the garbage disposed of in a hygienic manner.

Unless otherwise arranged for by the local sanitary authority, arrangement for disposal of excreta should be done in the already existing sewerage system in the area.

On completion of the works, all such temporary structures shall be cleared away, all rubbish burnt, excreta tank and other disposal pits or trenches filled in and effectively sealed off and the outline site left clean and tidy, at the Contractor's expense, to the entire satisfaction of the engineer.

vi) Maintenance of Sanitary Facility

Proper maintenance of toilets and other sanitary facilities should assure by health and safety inspector. Toilets and other sanitary facilities shall be cleaned at least four times daily and at least twice during working hours and kept in a strict sanitary condition. Receptacles shall be tarred inside and outside at least once a year.

All buildings, rooms and equipment and the grounds surrounding them shall be maintained in a clean and operable condition, and be protected from rubbish accumulation.

All necessary means shall be employed to eliminate and control any infestations of insects and rodents within all parts of any labor camp.

3. Management of Sanitation During Operational Phase:

A proper sanitation plan is to be adopted for maintaining the hygienic conditions during the operational phase of the project. These includes

- Site Clearance;
- Sewage Pipe Clearing, and
- Solid Waste Management.

i) Site Clearance

The construction contractor shall assure the clearance of construction machinery, vehicle and other equipment used during the construction period after the completion of the project.

ii) Solid Waste Management

Municipal solid waste and medical waste produced along the road should be collected and managed properly by the concerned department. Waste bins should be placed along the road side; regular cleaning of the road should be carried out using mechanical sweepers and at least two to four sweepers should be deputed for the whole proposed road to assure regular cleaning.

iii) Awareness and Training

A training and awareness sessions shall be conducted for workers before commencement of the Project. The implementation of sanitation plan would be more effective if the importance of hygiene; sanitation and safety are known to the workers.

**ANNEX VII:
CONSTRUCTION WASTE
MANAGEMENT PLAN**

CONSTRUCTION WASTE MANAGEMENT PLAN

1. GENERAL INTRODUCTION

Construction work refers to a wide range of materials depending on their origin; they are categorized as excavation material, demolition materials and worksite waste material. Construction waste material of the proposed project consists mainly of concrete, bentonite, masonry, limestone, sandstone, metal, and wood. In addition to this, significant amount of municipal waste will also generate from the construction camps. The solid waste generation estimated to be 650 kilogram per day for 1,000 construction workers during construction phase of the proposed project.

2. ORIGINS AND CAUSES OF CONSTRUCTION WASTE

Origins of Waste	Causes of Waste
Contractual	<ul style="list-style-type: none"> ▪ Errors in contract documents; and ▪ Contract documents incomplete at commencement of construction.
Design	<ul style="list-style-type: none"> ▪ Design changes; ▪ Design and detailing complexity; ▪ Design and construction detail errors; ▪ Unclear and unsuitable specifications; and ▪ Poor coordination and communication (late information, last minute client requirements, slow drawing revision and distribution).
Procurement	<ul style="list-style-type: none"> ▪ Ordering errors (i.e. ordering items not in compliance with specification); ▪ Over allowances (i.e. difficulties to order small quantities); and ▪ Supplier errors.
Transportation	<ul style="list-style-type: none"> ▪ Damage during transportation; ▪ Difficulties for delivery vehicles accessing construction sites; ▪ Insufficient protection during unloading; and ▪ Inefficient methods of unloading
On-Site Management and Planning	<ul style="list-style-type: none"> ▪ Lack of on-site waste management plans; ▪ Improper planning for required quantities; ▪ Delays in passing information on types and sizes of materials and components to be used; ▪ Lack of on-site material control; and ▪ Lack of supervision.
Material Storage	<ul style="list-style-type: none"> ▪ Inappropriate site storage space leading to damage or deterioration; ▪ Improper storing methods; and ▪ Materials stored far away from point of application.
Material Handling	<ul style="list-style-type: none"> ▪ Materials supplied in loose form; ▪ On-site transportation methods from storage to the point of application; and ▪ Inadequate material handling.
Site Operation	<ul style="list-style-type: none"> ▪ Accidents due to negligence; ▪ Unused materials and products; ▪ Equipment malfunction; ▪ Poor craftsmanship;

Origins of Waste	Causes of Waste
	<ul style="list-style-type: none"> ▪ Use of wrong materials resulting in their disposal; ▪ Time pressure; and ▪ Poor work ethics.
Residual	<ul style="list-style-type: none"> ▪ Waste from application processes (i.e. over preparation of mortar); ▪ Off-cuts from cutting materials to length; ▪ Waste from cutting uneconomical shapes; and ▪ Packaging.
Other	<ul style="list-style-type: none"> ▪ Weather ▪ Vandalism ▪ Theft

3. CONSTRUCTION WASTE MANAGEMENT PLAN

a) Waste Management Goals

The contractor established goal that this project will generate at least 50 percent less waste into landfills and the processes shall be employed to ensure that this goal is met. These shall include prevention of damage to materials to be incorporated into the work due to mishandling, improper storage, contamination, inadequate protection, minimizing poor quantity estimation, and through design.

b) Responsibility

- a) The Contractor shall be responsible for the implementation of the administrative portions of this program, including the notification of subcontractor management, the training of the site supervisor and the onsite posting of this plan.
- b) The site supervisor shall be responsible for the implementation of the onsite portions of this program including the training of subcontractor personnel.

c) Waste Prevention Planning

- a) In addition to other requirements specified herein it is a requirement for the work of this project that the contractor comply with the applicable city waste disposal requirements.
- b) Of the inevitable waste that is generated, the waste materials designated in this specification shall be salvaged for reuse and or recycling where practical and possible. Waste disposal in landfills shall be minimized as much as possible.
- c) Project Construction Documents: The Contractor will contractually require all subcontractors to comply with the Construction Waste Management Plan (WMP)". A copy of the WMP will accompany all subcontractor agreements and require subcontractor participation.
- d) The "Construction Waste Management Plan" shall be implemented and executed as follows and as on the chart:
 - i) Salvageable materials will be diverted from disposal where feasible;
 - ii) There will be a designated area on the construction site reserved for materials that can be recycled;
 - iii) Areas shall be marked to designate what recycle materials are to be stored there; and

iv) Hazardous waste shall be managed by a licensed hazardous waste vendor.

d) Communication and Education Plan

- a) This Waste Management Plan will be posted onsite;
- b) Each subcontractor will be made aware of the intent of this project with respect to reduction of waste and recycling. Onsite recycling containers and/or areas will be plainly marked;
- c) The subcontractor will be expected to make sure all their crews comply with the Waste Management Plan;
- d) All recycling containers and areas will be clearly marked;
- e) Lists of acceptable and unacceptable materials will be posted at the site; and
- f) All subcontractors will be informed in writing of the importance of non-contamination with other materials or trash.

e) Motivation Plan

The Contractor will conduct a pre-award meeting for subcontractors. Subcontractors under consideration will be required to attend the meeting to review project goals and requirements with the project team. Attendance will be a prerequisite for award of subcontracts. This document will be an attachment to every subcontract. Copies of the attachment will be posted prominently at the job site.

f) Expected Project Waste, Disposal, and Handling

The following chart identifies waste materials expected on the proposed project, their expected disposal methods and handling procedures. New items may be added as needed

Material	Disposal Method	Handling Procedure
Land Clearing Debris	Keep separate for reuse and or wood sale. Suitable materials may be delivered to a composting site. Separate topsoil and rock for future landscaping use.	Keep separated in designated areas onsite.
Clean Dimensional Wood and Palette Wood	Keep separate for reuse by on-site construction or by site employees for either heating stoves or reuse in home projects. May be offered to public.	Keep separated in designated areas onsite.
Painted or Treated Wood	Reuse, off site recycle, and landfill.	Keep separated in designated areas onsite. Place in "Trash" container.
Concrete	Recycle when possible.	Keep separated in designated areas onsite.
Concrete Masonry Units	Keep separate for re-use by on-site construction or by site employees	Keep separated in designated areas onsite
Metals	Recycle off site when possible. Separate copper wire when possible.	Keep separated in designated areas onsite. Place in "Metals" container.
Gypsum drywall (unpainted)	Recycle with supplier when possible.	Keep scraps separate for recycling – stack on pallets in provided onsite. All scrap drywall should be taken back by contractor to drywall supplier
Paint	Reuse onsite; donate to Habitat for Humanity Restore.	Keep separated in designated areas onsite
Insulation	Reuse and landfill.	Keep separated in designated areas onsite.

Material	Disposal Method	Handling Procedure
Glass	Recycle locally.	Keep separated in designated areas onsite.
Plastics	Plastic Bottles: recycle locally; be aware of plastics that are acceptable to recycle facility.	Keep separated in designated areas onsite.

g) Waste Disposal Company:

- a) Lahore Waste Management Company (LWMC)
- b) OZPAK

h) Recycle Hauler

- a) To be determined;
- b) Contact Address; and
- c) Some or all recycle may be hauled by the authorized representative.

i) Possible Recycle Locations and Acceptable Materials

- a) Coordinate with companies in Lahore or which are registered with LWMC that accept materials for recycle; and
- b) Using the above as a resource, a list will be kept indicating local opportunities for recycle of expected materials. New locations should be added as needed.

**ANNEX VIII:
COVID-19 Guidelines**

PRECAUTIONARY ACTION AGAINST THE POTENTIAL RISK OF NOVEL CORONAVIRUS

INTRODUCTION

On February 11, 2020 the World Health Organization announced an official name for the disease that is causing the 2019 novel coronavirus outbreak, first identified in Wuhan China. The new name of this is coronavirus disease 2019, abbreviated as COVID-19. In COVID-19, 'CO' stands for 'corona,' 'VI' for 'virus,' and 'D' for disease. Formerly, this disease was referred to as "2019 novel coronavirus" or "2019-nCoV".

Coronaviruses are a large family of viruses. Some cause illness in people, and others, such as canine and feline coronaviruses, only infect animals. Rarely, animal coronaviruses that infect animals have emerged to infect people and can spread between people. This is suspected to have occurred for the virus that causes Coronavirus Disease 2019 (COVID-19). Middle East Respiratory Syndrome (MERS) and Severe Acute Respiratory Syndrome (SARS) are two other examples of coronaviruses that originated from animals and then spread to people.

The risk of exposure to COVID-19 is no different for employees of Employer, Engineer, Contractor, and suppliers than for the general population. Contractor, therefore, must consider the physical well-being and safety of all the persons entitled to be on the Site and follow reasonable guidelines and recommendations of Government authorities and healthcare professionals. As experience, has shown in other countries, confirmed cases of COVID-19 expand exponentially if health and safety controls are left unheeded.

Contractor should enforce all health and safety procedures at Site including sanitary protocols, proper hygiene, social distancing, use of personal protective equipment (PPE), toolbox talks on special COVID-19 requirements, and prompt reporting of health issues related to COVID-19. Contractors must put safeguards in place to keep workers exposed to COVID-19 away from Site for at least 14 days after the last potential exposure.

WHO declared the COVID-19 as a Public Health Emergency of International Concern (PHEIC) in January 2020 and afterwards announced the COVID-19 outbreak as pandemic on 11th March 2020 due to the widespread of the disease in 114 countries at that time. WHO Director General urged the countries to take action now to stop the disease.

The rapid spread of COVID-19 hits all the provinces of Pakistan Sindh, Balochistan, Punjab & Khyber Pakhtunkhwa including the Gilgit Baltistan and Azad Jammu & Kashmir. The prevailing virus creates the menacing and distressing situation when it arrived around the closed proximities of the Project Area.

Government of Pakistan has launched the National Action Plan for COVID-19 Pakistan to combat the challenge of prevailing virus, also available at <https://www.nih.org.pk/wp-content/uploads/2020/03/COVID-19-NAP-V2-13-March-2020.pdf>. The Government of Pakistan has launched the real-time data portal for COVID-19 <http://covid.gov.pk/>. These measures are mostly relating to the containment and awareness and capacity building. Besides this COVID-19 daily situation report is also available at <https://www.nih.org.pk/wp-content/uploads/2020/04/COVID-19-Daily-Updated-SitRep-03-April-2020.pdf>.

All the stakeholders are on board to jointly prevent/ limit/ control the spread of COVID-19. All of the staff is required to take precautionary measures as well as maintain social distances. The use of thermal

guns for checking every single person body temperature, placement of relevant flyers and disinfection spray inside of all the containers are few of the measures to combat COVID-19.

OBJECTIVE

Following are the objectives of this report to jointly prevent / limit/ control the spread of COVID-19 at Site that can hamper the progress of proposed Project:

1. To enhance understanding of the evolving COVID-19;
2. To share knowledge on COVID-19 and preparedness measures being implemented at Site;
3. To generate recommendations for adjusting COVID-19 containment and response measures; and
4. Outline the measures taken at Site. The advised measures will help all the stakeholders to plan their work continuity in response to the COVID-19.

Due to the evolving situation of the COVID-19, this document should be read in conjunction with the latest relevant advisories issued by WHO (especially "[Getting your workplace ready for COVID-19, 3 March 2020](#)") and Government of Pakistan.

WHAT IS CORONA VIRUS (COVID-19)

The COVID-19 belongs to a family of viruses known as the Coronaviruses, which can cause illnesses ranging from the common cold to more severe diseases, such as the Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS)¹. There have been four Covid-19 variants, i.e. Alpha, Beta, Gamma and Delta. The Delta variants possibly twice as transmissible as the original strain and the current vaccines were designed to target the original strain, the shots may not be as effective against Delta (as for original strain), which has a number of mutations on the virus's spike protein.

SYMPTOMS

The symptoms of the COVID-19 are similar to that of regular pneumonia. Typical symptoms include;

- Fever;
- Cough;
- Difficulty in breathing;
- Pneumonia;
- Runny nose;
- Sore throat; and
- Feeling of being unwell.

MODE OF SPREAD

Infected person – person transmission; Infected people can spread COVID-19 through their respiratory secretions via droplets produced when an infected person coughs or sneezes, similar to how influenza and other respiratory pathogens spread. The spread from person-to person is most likely among close contacts (about 6 feet);

- Infected animals' dead or Alive;
- Air by coughing and sneezing;
- Close personal contact, such as touching or shaking hands;

¹ Source: World Health Organization

- Touching an object or surface with a virus on it; and
- Touching your mouth nose or eyes before washing your hands.

GENERAL STANDARDIZED PRECAUTIONARY MEASURES

Following measures/recommendations are suggested as a general guidance to be followed for the protection of potential impacts of COVID-19:

Since, there is no vaccine available to protect against human Coronavirus infections. Therefore, transmission can be prevented through following measures:

- Cover your mouth while cough or sneeze;
- Avoid close contact with people who are sick;
- Avoid the use of hard soap;
- Wash your hands often with liquid soap and water for at least 20 seconds;
- All the employees should ensure sanitization of hands at appropriate time;
- Avoid touching your eyes, nose, and mouth with unwashed hands;
- If you are concerned about your symptoms you should see your health care provider at site or in office;
- Use of Personal Protective Equipment (PPE) according to risk (a surgical or N95 mask);
- Do not spit, wrap your oral and nasal secretion with tissue and throw it in a covered dustbin;
- Balance your nutrition and exercise moderately;
- Sterilization / disinfection of medical devices at Site dispensaries; and
- Do not touch, buy or eat wild animals (gamey). Try to avoid visiting markets that sell such animals.

PROJECT SITE SPECIFIC PRECAUTIONARY MEASURES

Measures for protecting staff and labour from exposure to, and infection with, the COVID-19 depend on the type of work being performed and exposure risk, including potential for interaction with infectious people and contamination of the work environment. Regardless of specific exposure risks, following are the main actions that have been jointly taken at Site to combat the COVID-19:

Employer's Side

Employer should issue the notification containing the precautionary measures in the light of GoPb guidelines to be implemented at Site. Upon receiving the Employer notification all the mentioned precautionary measures will be communicated to Engineer staff for compliance. Employer technical staff is also complying with the GoPb guidelines and Contractor suggestion to control the spread of COVID-19 at Site in the best interest of the Project and country.

Consultant's Side

Consultant's top management will issue the orders in the light of GoPb guidelines containing the precautionary measures to control the spread of COVID-19 for the staff working at Site.

Consultant staff at Site will fully complying with the orders including photographic evidence. Considering the severity of the prevailing virus Engineer devised the Standard Operating Procedure (SOP) containing precautionary action against the potential risk of novel corona virus.

Besides, above Consultant will ensure the following precautionary measures at Site.

- Adequate signage and information at all entrances and exits showing what is Corona Virus, how it spreads, what are the symptoms, standard precautions;
- The awareness session for the Contractor staff is equally important as of Consultant staff to combat the COVID-19 at Site. The Consultant will ensuring that Contractor is arranging such session at Site from time to time to reduce the potential risk of COVID-19. Further, all the newly inducted and existing staff have been given HSE training by the Consultant & Contractor.

Contractor's Side

Contractor will communicate various precautionary measures to Employer and Engineer through letters to control the spread of COVID-19 at Site. Following are the major steps to be taken by the Contractor:

- Contractor will convey the instructions and requirements of its superior unit for the prevention and control of COVID-19 epidemic at Site.
- Contractor will establish a special organization for epidemic prevention and control on the Project Site that is responsible for arranging, implementing, publicizing and supervising the epidemic prevention and control measures.
- Launch the plan for epidemic prevention and control on the project Site that includes:
 - All personnel in temporary camp are required to wear masks;
 - Contractor personnel incharge of Site to wear masks;
 - Arranged special personnel to measure and record the temperature of all personnel when entering or leaving the temporary camp;
 - If any person with fever, cold and other symptoms are found, they will be admonished to go home for isolation and asked about the development of the disease every day; and
 - Propagate and implement the epidemic prevention measures for the staffs and labours and warn them not to go outside and home as much as possible.
- All these meetings should carried out through video conference.

Contractor is not limited to the above precautionary measures but practicing and implementing the following;

- Contractor will prepare a pamphlet for the awareness of Site staff to combat the COVID-19. It will also place/posted at strategic points at Site.
- Launch awareness campaign to inform all the staff and labour about the coronavirus, to use facemask, hand hygiene, cough etiquette, and avoidance of close contact with animals and consumption of their raw products.
- Everyday awareness speech in English and Urdu in the temporary camp.
- All the employees are not allowed to go outside of the Project Area or on vacation to their homes and on daily basis visit to sites;
- Contractor will provide medical masks and antibacterial liquid hand wash to all personnel.
- Contractor will prepare the isolation facility at Site and provided three isolated rooms for such patients inside the temporary camp. Each room have three beds, oxygen cylinder, sanitizers, isolation kit, hand wash.
- Thermal scanning will be carried out continuously in the morning for everybody at the main gate of temporary camp.
- Record will be maintained for everyone that includes the temperature value of each person with their names, every morning and afternoon go to each department for scanning separately and noted down their name with temperature values.
- Contractor carry out disinfectant spray on daily basis morning and afternoon in each office and rooms and all the area of the camp.

- SSWMB and Consultant staff will also requested by Contractor to do not interact physically rather through electronically by emails or video conferencing.

RECOMMENDATIONS FOR THE CONTROL OF COVID-19 AT SITE

To Avoid Transmission

For all personnel at Site, it is always a good to practice the following precautionary measures:

- Workers to remain at least two meters apart from each other at all times (social distancing) – i.e. spread out and reduce the number of people working together in one area of the site;
- Avoid eating lunch in the form of group in available mess/canteens at Site;
- Close site canteens/ food preparation and eating areas (avoid gatherings) – workers to bring their own prepared lunch to site and eat alone e.g. in their van, car, or in an open space;
- Avoid in-person meetings if possible. In the case that an in-person meeting is unavoidable, make sure to have it in a well-ventilated area with sufficient space for attendees to distance themselves from one another. For meetings such as toolbox talks, consider breaking them up into smaller group meetings versus one large meeting;
- Introduce enhanced cleaning procedures across the Site and touch points e.g. office equipment, plant and machinery controls, taps/toilet/washing facilities, handrails;
- Stagger start times on site to avoid congestion in entrance areas;
- Reduce the number of people on site inductions at any one time and hold them outdoors if possible;
- Stop workers moving across various sites (potential for cross contamination);
- No outsiders should be at the Project Site;
- Contractor, Consultant and Employer personnel are advised to avoid travelling and in case traveling is unavoidable, prior approval from the management should be essential. In case of travelling, the above mentioned measures need to be strictly followed by the traveller;
- Prompt identification and isolation of potentially infectious individuals is a critical first step in protecting workers and other Site staff. An isolated area should be available at Site to immediately isolate suspected person, as it is most important to stop its spread at Site.
- Rapid Response Team should be formed and be informed immediately in case of suspect and confirmed case of COVID-19.
- Medical team at Site should separate the suspected person displaying fever, cough or difficulty breathing from other personnel; and
- If a person has had close contact with an individual that has confirmed COVID-19, that person will not be allowed to return to the Site until he/she has been symptom free for 14 days.
- Clean and fumigate all the workplaces at Site on daily basis;
- Ask people to stay at home if they have fever, cough, difficulty in breathing, runny nose, sore throat as per organizational rules;
- An immediate replacement of solid soap with liquid anti-bacterial soap bottles may be appropriate.
- Provision of alcohol-based hand sanitizer need to available for all staff;
- Clean the religious places carpets and rugs. Have them washed in place over the weekend and then do regular cleaning;
- Have the cleaners/ maintenance crews regularly clean surfaces that are touched frequently by personnel with disinfectants such as in and out doors;
- Fresh medical tests of staff working should be carried out at Site;
- Dispose of all contaminated waste (gloves, paper, swab handles, etc.) into biohazard waste bags for disposal;

- Ensure that panic is not created. In fact the posters should start with statements such as do not panic and fear the virus but know and prevent; and
- Ensure proper ventilation system for all the personnel at Site.

Use of Personal Protective Equipment (PPEs)

- Necessary PPE should be available at Site all the times and are being issued to each personnel at Site;
- Practice of using masks is also being ensured by all parties at Site (a surgical or N95 masks);
- Re-usable PPE should be thoroughly cleaned after use and not shared between workers. Single use PPE should be disposed of so that it cannot be reused;

Outside Visitors

- Visitors should enter with strictly wearing visitors card;
- Ensure sanitization of hands;
- All parties should ensure that the sick persons should be wearing a surgical or N95 masks;
- Note down the complete information of outsiders before entrance;
- Proper screening should be carried out before entering the Site;
- Refrain from handshakes. Rather than shaking hands, visitors may explain why handshakes can contribute to the risk of spread;
- Attempt to maintain a general six (6) feet distance between themselves. This will be challenging to follow at all times but it is Engineer recommendation to follow;
- Refrain from and/or limit touching of workplace surfaces; and
- In addition to these on-site procedures, it is advised to follow their respective organizational instructions related to Site visits.

**ANNEX IX:
RESOURCE CONSERVATION PLAN**

RESOURCE CONSERVATION PLAN

1. INTRODUCTION

The most of the resources in this world are finite and non-renewable in nature. We are completely dependent on these resources to fulfill all our daily requirements. Therefore, sustainable development calls for the need to conserve resources in a way that meet our needs of present generation as well as future generation, especially the non-renewable resources.

2. OBJECTIVE OF THE PLAN

The Resource Conservation Plan is intended to make an effort towards achieving sustainable development. The objective of the resource conservation plan is to:

- Minimize the use of natural resources; and
- Mitigate and prevent pollution contaminating the natural resources.

3. PLANNING

Careful estimations of quantities of material, fuel, water and energy required directly or indirectly shall be done to avoid excessive or unnecessary wastage of these materials. In addition to this, pollution prevention strategies shall also be devised to prevent contamination of resources. The estimations include the following:

- Estimation of construction material required for the project;
- Estimation of fuel consumption for construction machinery, construction vehicles and generators;
- Estimations of the energy requirements during all the stages of the project; and
- Estimations of water consumption for construction activities and construction camp sites.
- Strategies shall be planned to reduce loads on the identified resources to be consumed;
- Best management practices shall be devised to control or reduce pollution resulting from the activities during different stages of the project; and
- An inspector shall be assigned responsibility to oversee the ongoing activities to check the compliance of the planned strategies.

4. EXECUTION OF THE PLAN

The planned strategies shall be implemented to conserve the natural resources including but not limited to the following:

Material

- Material supplied shall be in conformance with the estimated quantities and excess material shall be returned to the supplier;
- Material wastage shall be avoided by using best management practices;
- Waste produced during the project execution shall be disposed off safely to the designated disposal sites through approved contractors; and
- Reuse of the materials shall be appreciated.

Energy

- Reduce trips and optimize routes to and from the construction site for all kinds of activities;
- Regular maintenance of equipment and vehicles to avoid leaks and sustain efficient fuel consumption;
- Switch off idle equipment and vehicles to avoid wastage of fuel;
- Minimize warm up time, unnecessary acceleration and deceleration of the construction equipment and vehicles;
- Avoid unnecessary burning of fuel for cooking in construction camps;
- Avoid unnecessary use of heating and cooling systems during extreme weathers events;
- Construction shall start in early hours of the day to avoid heat in summers and utilization of day light; and
- Alternate energy sources shall be considered for electricity generations during construction and operation to conserve fossil fuel as it is non-renewable resource.

Water

- Avoid using potable water for sprinkling, curing and washing of equipment and vehicles. Surface water or treated effluent can be used instead;
- Wastage of water should be controlled through providing proper valves and through controlling pressure of the water;
- Unnecessary equipment washings should be avoided;
- Awareness amongst workers shall be raised to conserve water and immediately report for any leaks detected; and
- Ensure protection of canal water from contamination resulting from construction activities.

Pollution

- Emissions shall be reduced and controlled as far as possible and direct discharges to air shall be avoided by strictly adhering to the mitigation measures outlined in IEE report;
- Waste water shall not be discharged directly into the canal and must be managed as per the recommendations presented in IEE; and
- Construction and demolition waste, and municipal solid waste shall not be dumped and burnt openly, and shall be handled according to the preventative measure given in IEE report.

5. CHECKING AND CORRECTIVE ACTIONS

The KPITB shall bind the construction contractor through contract agreement to comply with the strategies outlined in the Resource Conservation Plan. The Environmental Committee shall also appoint an Inspector who shall monitor the daily onsite activities and shall report any issues and concerns raised in relation to Resource Conservation Plan. The inspector shall recommend adequate corrective actions to mitigate the issues raised.

**ANNEX X:
CHANCE FIND PROCEDURE**

ARCHAEOLOGICAL 'CHANCE FIND' PROCEDURE

1. BACKGROUND

The purpose of this document is to address the possibility of archaeological deposits becoming exposed during ground altering activities within the project area and to provide protocols to follow in the case of a chance archaeological find to ensure that archaeological sites are documented and protected as required.

The Antiquities Act, 1975, protects archaeological sites, whether on Provincial Government owned or private land. They are non-renewable, very susceptible to disturbance and are finite in number. Archaeological sites are an important resource that is protected for their historical, cultural, scientific and educational value to the general public and local communities. Impacts to archaeological sites must be avoided or managed by development proponents. The objectives of this 'Archaeological Chance Find Procedure' are to promote preservation of archaeological data while minimizing disruption of construction scheduling. It is recommended that due to the moderate to high archaeological potential of some areas within the project area, all on site personnel and contractors be informed of the Archaeological Chance Find Procedure and have access to a copy while on site.

2. POTENTIAL IMPACTS TO ARCHAEOLOGICAL SITES

Developments that involve excavation, movement, or disturbance of soils have the potential to impact archaeological materials, if present. Activities such as road construction, land clearing, and excavation are all examples of activities that may adversely affect archaeological deposits.

3. RELEVANT LEGISLATION

It ensures the protection, preservation, development and maintenance of antiquities in the provinces of Pakistan. The Act defines "antiquities" as ancient products of human activity, historical sites, or sites of anthropological or cultural interest, national monuments, etc. The Act is designed to protect these antiquities from destruction, theft, negligence, unlawful excavation, trade, and export. The law prohibits new construction in the proximity of a protected antiquity and empowers the relevant provincial governments to prohibit excavation in any area that may contain articles of archaeological significance. Under the Act, the subproject proponents are obligated to ensure that no activity is undertaken in the proximity of a protected antiquity, report to the Department of Archaeology, any archaeological discovery made during the course of the project.

4. REMEDIES AND PENALTIES

The Antiquities Act, 1975 provides for heritage inspection or investigation orders, temporary protection orders, civil remedies and penalties to limit contraventions. These powers provide:

“A contravention of any provision of this Act or the rules shall, where no punishment has been specifically provided be punishable with rigorous imprisonment for a term which may extend to two years, or with fine up to rupees ten hundred thousand, or with both. ”

5. ARCHAEOLOGICAL ‘CHANCE FIND’ PROCEDURE

If you believe that you may have encountered any archaeological materials, stop work in the area and follow the procedure below:

The following ‘chance-find’ principles will be implemented by the contractor throughout the construction works to account for any undiscovered items identified during construction works:

- i. Workers will be trained in the location of heritage zones within the construction area and in the identification of potential items of heritage significance.
- ii. Should any potential items be located, the site supervisor will be immediately contacted and work will be temporarily stopped in that area.
- iii. If the site supervisor determines that the item is of potential significance, an officer from the Department of Archaeology (DoA) will be invited to inspect the site and work will be stopped until DoA has responded to this invitation.
- iv. Work will not re-commence in this location until agreement has been reached
- v. between DoA and NTDC as to any required mitigation measures, which may include excavation and recovery of the item.
- vi. A precautionary approach will be adopted in the application of these procedures.

6. DETAILED PROCEDURAL STEPS

- If the Director, department of Archaeology receives any information or otherwise has the knowledge of the discovery or existence of an antiquity of which there is no owner, he shall, after satisfying himself as to the correctness of the information or knowledge, take such steps with the approval of the Government, as he may consider necessary for the custody, preservation and protection of the antiquity.
- Whoever discovers, or finds accidentally, any movable antiquity shall inform forth with the Directorate within seven days of its being discovered or found.
- If, within seven days of his being informed, the Director decides to take over the antiquity for purposes of custody, preservation and protection, the person discovering or finding it shall hand it over to the Director or a person authorized by him in writing.
- Where the Director decides to take over an antiquity, he may pay to the person by whom it is handed over to him such cash reward as may be decided in consultation with the Advisory Committee.
- If any person, who discovers or finds any movable antiquity contravenes the provisions of the Act, he shall be punishable with imprisonment for a term which may extend to five (05) years, or with fine not less than fifteen hundred thousand rupees or with both and the Court convicting such person shall direct that the antiquity in respect of which such contravention has taken place shall stand forfeited to Government.
- The Director or any officer authorized by him with police assistance may, after giving reasonable notice, enter into, inspect and examine any premises, place or area which or the sub-soil of which he may have reason to believe to be, or to contain an antiquity and may cause any site, building, object or any antiquity or the remains of any antiquity in such premises, place or area to be photographed, copied or reproduced by any process suitable for the purpose.

- The owner or occupier of the premises, place or area shall afford all reasonable opportunity and assistance to the Director.
- No photograph, copy of reproduction taken or made shall be sold or offered for sale except by or with the consent of the owner of the object of which the photograph, copy or the reproduction has been taken or made.

**ANNEX XI:
EMERGENCY RESPONSE PLAN**

GUIDELINE EMERGENCY PREPAREDNESS AND RESPONSE PLAN

PURPOSE

The purpose of this Emergency Response Procedure is to provide measures and guidance for the establishment and implementation of emergency preparedness plans for the project. The aim of the Emergency Response Procedure is to:

- i. Ensure all personnel and visitors to the office/job sites are given the maximum protection from unforeseen events.
- ii. Ensure all personnel are aware of the importance of this procedure to protection of life and property.

EMERGENCY PREPARATION AND RESPONSE MEASURE SCOPE

The emergency management program is applied to all Project elements and intended for use throughout the Project life cycle. The following are some emergencies that may require coordinated response.

- i. Construction Accident
- ii. Road & Traffic Accident
- iii. Hazardous material spills
- iv. Structure collapse or failure
- v. Trauma or serious illness
- vi. Sabotage
- vii. Fire
- viii. Environmental Pollution
- ix. Loss of person
- x. Community Accident

RESPONSIBILITIES

The detailed roles and responsibilities of certain key members of the Emergency Response team available to assist in emergency are provided in **Table 1** below.

Table 1: Emergency Response Team

Action Group	Responsibility
Emergency Coordinator	<ul style="list-style-type: none">▪ Overall control of personnel and resources.▪ The Emergency Coordinator will support and advise the Site Safety Supervision as necessary.

Action Group	Responsibility
	<ul style="list-style-type: none"> ▪ Serves as public relations spokes persons, or delegates to some staff member the responsibility for working with news media regarding any disaster or emergency. Also assure proper coordination of news release with appropriate corporate staff or other designated people.
<p>Site Safety Supervision (Emergency Commander)</p>	<ul style="list-style-type: none"> ▪ Overall responsibility for activating emergency plan and for terminating emergency actions. ▪ Be alternative of emergency response chairpersons. ▪ Disseminates warnings and information as required to ensure all people in the immediate area have been warned and evacuated either by alarms or by word of mouth. ▪ Supervise the actions of the Emergency Response Team to ensure all persons are safe from the danger. ▪ Notify outside authorities if assistance is required. ▪ Carries the responsibility for coordinating actions including other organizations in accordance with the needs of the situation. ▪ Ensure maximum co-operation and assistance is provided to any outside groups called to respond to an emergency. ▪ Establish and appoint all emergency organization structure and team. ▪ Assures adequate delegation of responsibilities for all key positions of assistants on the Project to assist with any foreseeable emergency. ▪ Ensure resources available to purchase needed emergency response equipment and supplies. ▪ Assures that all persons on the Emergency Response Team aware and fully understand their individual responsibilities for implementing and supporting the emergency plan. ▪ Establish the emergency drill schedule of all identified emergency scenarios, track the status and evaluate the emergency. ▪ The Emergency Commander shall ensure that senior management personnel have been reported of the emergency as soon as practical after the event.
<p>Security Team</p>	<ul style="list-style-type: none"> ▪ Ensure that the exit route is regularly tested and maintained in good working order. ▪ Maintain station at the security gate or most suitable location to secure the area during any emergency such that only authorized personnel and equipment may enter, prevent access to the site of unauthorized personnel. ▪ Assist with strong/activation of services during an emergency. ▪ Ensure vehicles and obstructions are moved to give incoming emergency vehicles access to the scene, if ambulance or emergency services are attending the site, ensure clear access and personnel are located to direct any incoming emergency service to the site of emergency.
<p>Rescue & Medical Team</p>	<ul style="list-style-type: none"> ▪ Protect the injured from further danger and weather. ▪ Provide treatment to the victim(s) to the best of their ability by first aid and then transfer to hospital. ▪ Remain familiar with the rescue activities and rescue apparatus.

Action Group	Responsibility
General Administration Team	<ul style="list-style-type: none"> ▪ Assist outside medical services personnel when they arrive Response to support any requested general facilities for assisting Emergency Response Team in their work.
Government Relation Team	<ul style="list-style-type: none"> ▪ Coordinate with local government on a matter of concerned in the emergency response plan to liaise with local officers in their affair for support Emergency Response Team. ▪ Coordinate emergency plan with the government authorities, local community.
Environment Team	In case of emergency related to the environmental pollution such as the chemical spill, oil spill into the ambient, the environment team will support the technical advice to control and mitigate the pollution until return to the normal situation.
Department Heads	<ul style="list-style-type: none"> ▪ Call up of personnel into the safe location for protective life and property. ▪ Take immediate and appropriate action while Emergency Response Team is being mobilized. ▪ Keep in touch with the Emergency Commander ▪ Control and supervise operators and contractors on the implementation of this procedure, with consultation with Safety Team as necessary. ▪ Provide and maintain emergency equipment of their responsible areas.
Other Staff and Employees	<ul style="list-style-type: none"> ▪ All other staff and employees will remain at their workstations or assembly point unless directed otherwise from Emergency Response Team. ▪ Each supervisor will ensure that all members of his work group are accounted for and keep in touch with each of their Department Head.

PROCEDURE

Emergency situation and injuries to person can occur at any time or place either on Project site or elsewhere. The most two common types of emergencies on site are fire and serious accident.

Figure 3.1 Emergency Procedures for Fire

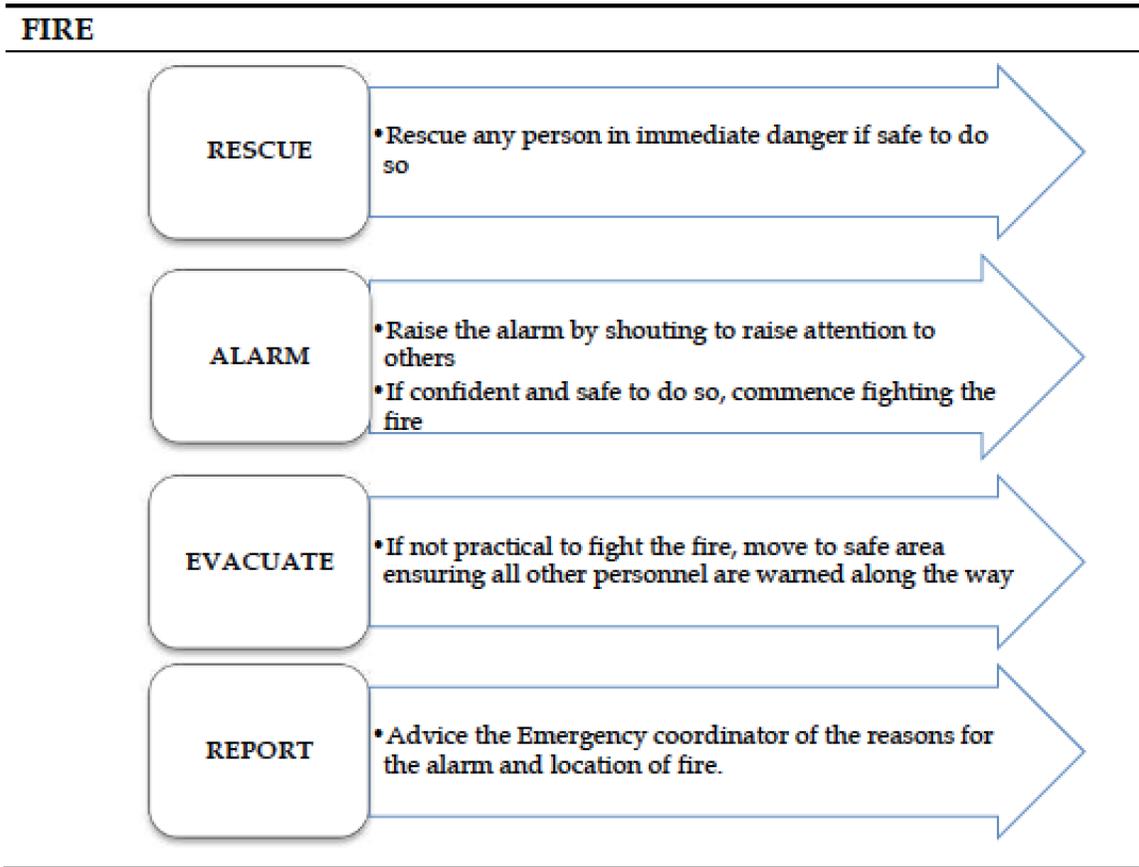


Figure 3.2 Emergency Procedures for Serious Accident

ACCIDENT

In the event of injuries of persons, the first person on the scene should take the following action:

If a hazard exists consider your own safety then if possible remove the hazard or the injured person.

Assess the patient by checking for Airway, Breathing, Pulse and obvious

Report directly to First Aid or Security Centers, when raising the alarm you must clearly give the following information;

- Your name and the detail of accident
- The location of the injured person(s)
- The number of persons injured
- The extent of the injuries, if known
- What known hazards are in the area

Make the injured person as comfortable as possible

Treat the obvious injuries

Reassure the injured person

COMMUNICATION WITH AUTHORITIES / PRESS AT SITE

In the event of an accident or incident, only senior staff is permitted to give factual information to the authorities for resource of liability exposure. The press must be avoided politely, at all costs, with the terse comment that “the matter is under investigation and relevant information when available will be provided by our Head Office” Do not ever give your opinion or story.

FIRST AID PERSONS

Upon advice of medical emergency, make immediate assessment to response required and if necessary, advise security to summon ambulance or medical assistance, the qualified first aid attendant should also,

- Provide treatment to the victim(s) to the best of his/her ability.
- Ensure the safety of victims by ceasing any work activity in the area.
- Protect the injured from further danger and weather.

- Assist medical services personnel when they arrive.

GENERAL ADMINISTRATION TEAM

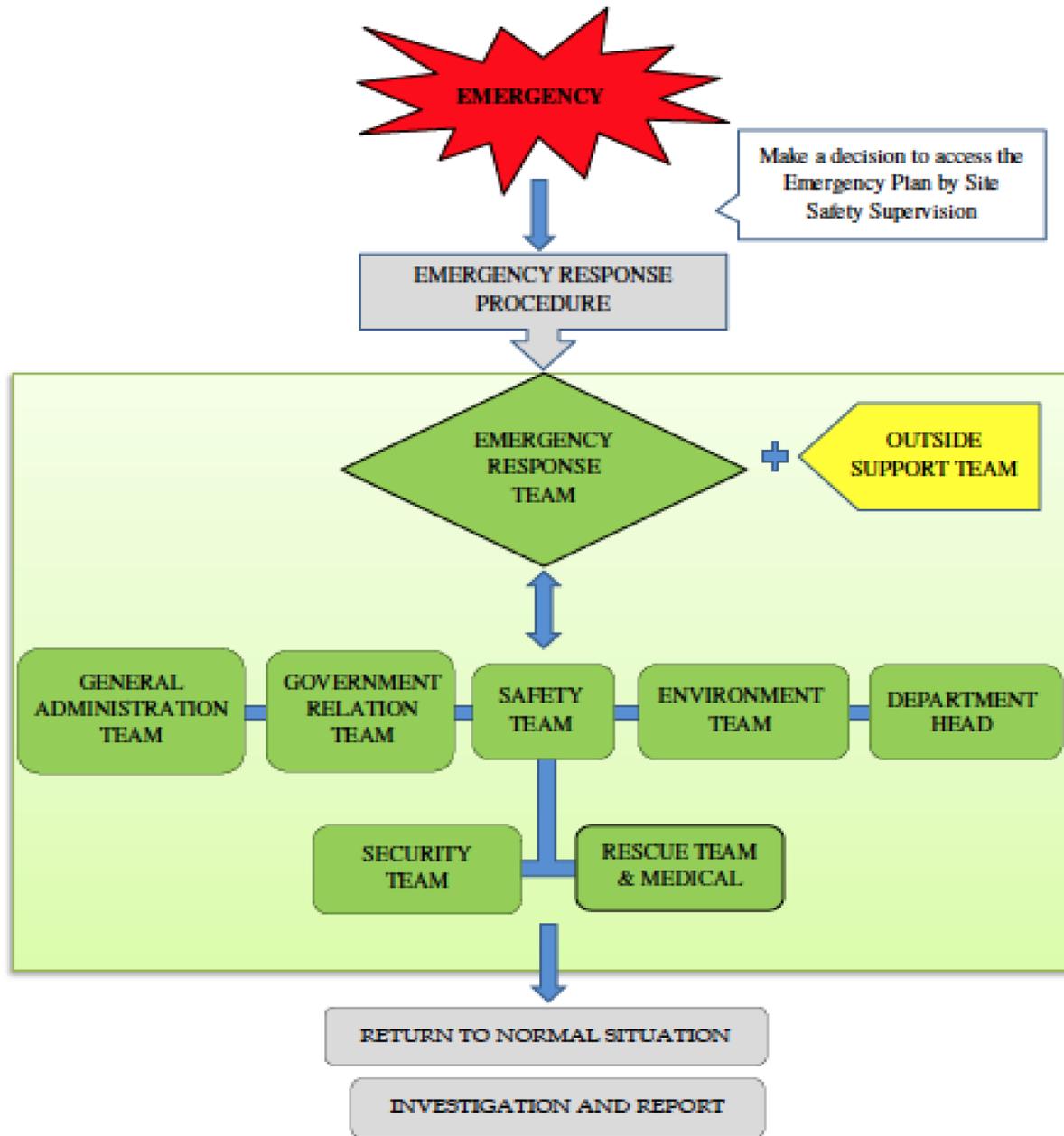
Upon advice of medical emergency, maintain contact with first aid personnel and summon ambulance if required.

SECURITY TEAM

- If ambulance or emergency services are attending the site, ensure clear access and personnel are located to direct vehicle closest to the scene.
- Prevent access to the site of unauthorized personnel (press, etc.).

EMERGENCY COORDINATOR

- The Emergency Coordinator shall assist emergency personnel at the scene as required through allocation of company resources.
- The Emergency Coordinator shall ensure next-of-kin are properly notified as soon as possible and give whatever company support and assistance is necessary to assist them bundle the situation
- The Emergency Coordinator shall ensure that senior management personnel are advised of the emergency as soon as practical after the event.



Note: Name of contact person and call number from Owner/ Contractor to be determined.

INCIDENT AND ACCIDENT REPORT

Section A: Identification Data										
Report No:	Date of Reported:				Reporter:	Sign:				
Job Title:					Company Name:					
Section B: Violence Rate										
Accident Violence: <input type="checkbox"/> 01-Death <input type="checkbox"/> 02-Serious Injury <input type="checkbox"/> 03-Lost Time Injury <input type="checkbox"/> 04-First Aid <input type="checkbox"/> 05- Not Injury <input type="checkbox"/> 06-Near Miss Property Damage Cost: <input type="checkbox"/> 1-2,000 USD <input type="checkbox"/> 2,001-10,000 USD <input type="checkbox"/> 10,001-50,000 <input type="checkbox"/> > 50,001										
Section C: Environmental Impact										
Affected area		<input type="checkbox"/> Construction area			<input type="checkbox"/> Public area					
Receptor		<input type="checkbox"/> None			<input type="checkbox"/> Workers		<input type="checkbox"/> Community			
Type of pollution		<input type="checkbox"/> Physical			<input type="checkbox"/> Chemical		<input type="checkbox"/> Biological			
Toxicity		<input type="checkbox"/> Non-toxic			<input type="checkbox"/> Low - toxic		<input type="checkbox"/> High - toxic			
Return to Normal		<input type="checkbox"/> 1 day			<input type="checkbox"/> 1 day to 1 week		<input type="checkbox"/> ≥ 1 week			
Cumulative impact		<input type="checkbox"/> Non-cumulative			<input type="checkbox"/> Cumulative					
Section D: Injured/Illness Employee										
1.Name:		Sex:	Date of Birth:			Age:	Regular Job Title:		Experience:	
		<input type="checkbox"/> Male <input type="checkbox"/> Female	Month	Day	Year				in this job title	in this Project
									Years	Weeks
Site:	Company:		Reference:			Phone No:		Social Security Number:		
Part of Body Injured or Affected:					Nature of Injury or Illness:					
<input type="checkbox"/> Head	<input type="checkbox"/> Hands	<input type="checkbox"/> Face	<input type="checkbox"/> Nose		<input type="checkbox"/> Laceration	<input type="checkbox"/> Amputation	<input type="checkbox"/> Puncture	<input type="checkbox"/> Fracture		
<input type="checkbox"/> Eyes	<input type="checkbox"/> Legs	<input type="checkbox"/> Teeth	<input type="checkbox"/> Neck		<input type="checkbox"/> Strain & Sprain	<input type="checkbox"/> Burns	<input type="checkbox"/> Contusion	<input type="checkbox"/> Dry Heat Friction		
<input type="checkbox"/> Trunk	<input type="checkbox"/> Toes	<input type="checkbox"/> Elbow	<input type="checkbox"/> Shoulder		<input type="checkbox"/> Hernia	<input type="checkbox"/> Foreign Body	<input type="checkbox"/> Chemical	<input type="checkbox"/> Contamination		
<input type="checkbox"/> Back	<input type="checkbox"/> Ankle	<input type="checkbox"/> Wrist	<input type="checkbox"/> Foot		<input type="checkbox"/> Skin (Occupationnel)	<input type="checkbox"/> Rash	<input type="checkbox"/> Irritation			
<input type="checkbox"/> Arms	<input type="checkbox"/> Thump	<input type="checkbox"/> Fingers	<input type="checkbox"/> Internal							
Remark:					Remark:					
2.Name:		Sex:	Date of Birth:			Age:	Regular Job Title:		Experience:	
		<input type="checkbox"/> Male <input type="checkbox"/> Female	Month	Day	Year				in this job title	in this Project
									Years	Weeks
Site:	Company:		Reference:			Phone No:		Social Security Number:		
Part of Body Injured or Affected:					Nature of Injury or Illness:					
<input type="checkbox"/> Head	<input type="checkbox"/> Hands	<input type="checkbox"/> Face	<input type="checkbox"/> Nose		<input type="checkbox"/> Laceration	<input type="checkbox"/> Amputation	<input type="checkbox"/> Puncture	<input type="checkbox"/> Fracture		
<input type="checkbox"/> Eyes	<input type="checkbox"/> Legs	<input type="checkbox"/> Teeth	<input type="checkbox"/> Neck		<input type="checkbox"/> Strain & Sprain	<input type="checkbox"/> Burns	<input type="checkbox"/> Contusion	<input type="checkbox"/> Dry Heat Friction		
<input type="checkbox"/> Trunk	<input type="checkbox"/> Toes	<input type="checkbox"/> Elbow	<input type="checkbox"/> Shoulder		<input type="checkbox"/> Hernia	<input type="checkbox"/> Foreign Body	<input type="checkbox"/> Contamination	<input type="checkbox"/> Chemical		
<input type="checkbox"/> Back	<input type="checkbox"/> Ankle	<input type="checkbox"/> Wrist	<input type="checkbox"/> Foot		<input type="checkbox"/> Skin (Occupationnel)	<input type="checkbox"/> Rash	<input type="checkbox"/> Irritation			
<input type="checkbox"/> Arms	<input type="checkbox"/> Thump	<input type="checkbox"/> Fingers	<input type="checkbox"/> Internal							
Remark:					Remark:					
Section E: Accidents/incident Details										
Date Accident/Incident Occurred:			Time Accident/Incident Occurred:				Exact Location of the Accident / Incident:			

Details of the actual Job Being done at the time:

Details of Accident/Incident/What actually happened?

Section F: Accident Cause (Basic cause mark X/Contributing cause, if any mark C)

UNSAFE CONDITIONS		UNSAFE ACTS	
1	<input type="checkbox"/> Inadequately Guarded	1	<input type="checkbox"/> Operating Without Authority / Training
2	<input type="checkbox"/> Unguarded	2	<input type="checkbox"/> Operating at Unsafe Speed
3	<input type="checkbox"/> Defective Tools, Equipment, or Substance	3	<input type="checkbox"/> Marking SHE Device Inoperative
4	<input type="checkbox"/> Unsafe Design or Construction	4	<input type="checkbox"/> Using Unsafe Equipment or Equipment Unsafely
5	<input type="checkbox"/> Hazardous Arrangement	5	<input type="checkbox"/> Unsafe Loading, Placing, Mixing
6	<input type="checkbox"/> Unsafe Illumination	6	<input type="checkbox"/> Taking Unsafe Position
7	<input type="checkbox"/> Unsafe Ventilation	7	<input type="checkbox"/> Working on Moving or Dangerous Equipment
8	<input type="checkbox"/> Unsafe Clothing	8	<input type="checkbox"/> Distraction, Teasing, Horse Play
9	<input type="checkbox"/> Insufficient Instruction	9	<input type="checkbox"/> Failure to use Personal Protective Devices
10	<input type="checkbox"/> Lack of system of work	10	<input type="checkbox"/> Lack of effective instruction or supervision
Why was the unsafe act committed? _____		Why did the unsafe condition exist? _____	

Section G: Guide to Corrective Action (Base on the cause checked above, I am taking the following corrective action)

UNSAFE ACT	UNSAFE CONDITION	If Supervisor can't handle, then recommend to
<input type="checkbox"/> Stop the Behaviour	<input type="checkbox"/> Remove	<input type="checkbox"/> Site Engineer, or
<input type="checkbox"/> Study the job	<input type="checkbox"/> Guard	<input type="checkbox"/> Site Manager, or
<input type="checkbox"/> Instruct (tell-show-try-check)	<input type="checkbox"/> Warn	<input type="checkbox"/> Project Manager, or
<input type="checkbox"/> Follow Up	<input type="checkbox"/> Supervisory Training	<input type="checkbox"/> Safety Committee
<input type="checkbox"/> Enforce		

Detail below any immediate remedial actions that have been taken:

Detail below any corrective and preventative actions that could be taken to prevent future re-occurrence:	Responsible	Completion Date

Section H: Witness Statement			
Witness Name		Interviewer Name	
Section I: Reviewed & Recommend by			
Recommendation:			
Reviewed By:	Position:	Signature:	Date:
Remarks : If Accident or Incident happened with lost time injury and affected to the publicity must further report to Safety Department; : First Aid Cases will not applicable to this form; : The accident report shall submit to Safety Department within 3 days : Attached the photograph or sketch the location of accident / incident;			

SUGGESTED CONTENTS OF EPRP

The Contractor should prepare the EPRP based on the guidelines provided in the above sections. The suggested structure of the EPRP is listed below:

1. Purpose
2. Applicable Scope
3. Preparation Basis
4. Emergency Response System
 - 4.1 Generals
 - 4.2 Emergency Response System
 - 4.3 Responsibilities
5. Major Safety Risks
6. Precautionary Measures
 - 6.1 Training and Exercise

- 6.2 Hazard Source Monitor
- 6.3 Alert Action
- 6.4 Management Measures
- 7. Control Measures
 - 7.1 Response
 - 7.2 Response Procedures
 - 7.3 Emergency Response
 - 7.4 Emergency Completion and Restoration
- 8 Emergency Response Report and Settlement
- 9 Supporting Measures
 - 9.1 Communication
 - 9.2 Emergency Team
 - 9.3 Funding for Emergency
 - 9.4 Provisions and Resources
- 10. Records