



DELHI MUMBAI INDUSTRIAL CORRIDOR  
DEVELOPMENT CORPORATION LIMITED

# FINAL ENVIRONMENTAL IMPACT ASSESSMENT REPORT

(Including Public Hearing Proceedings held on 30.10.2014)

**SHENDRA MEGA INDUSTRIAL PARK,  
DISTRICT AURANGABAD, MAHARASHTRA**



*Prepared for:*

**Delhi Mumbai Industrial Corridor Development Corporation  
Chanakyapuri, New Delhi-110021**

*Prepared by:*

**AECOM, Gurgaon  
[www.aecom.com](http://www.aecom.com)**

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## EXECUTIVE SUMMARY

### 1.0 Introduction

The Government of India (GoI) has proposed the development of a Dedicated Freight Corridor (DFC) between Delhi and Mumbai covering a total length of 1483 km and passing through six states. The corridor is envisaged to influence the pattern of development and industrialization of the region. To tap the development potential of the proposed freight corridor, a band spanning 150 kilometers wide on both sides of the freight corridor has been identified as Influence Region and is proposed to be developed as Delhi-Mumbai Industrial Corridor (DMIC). Several industrial nodes comprising of Investment Regions (IR) and Industrial Areas (IA) have been identified along the length of this corridor. In line with this development strategy, the Delhi Mumbai Industrial Corridor Development Corporation Limited (DMICDC), an SPV formed under Ministry of Commerce (MoC), Government of India, is undertaking the planning and development of a **Mega Industrial Park at village Shendra; district Aurangabad** in the state of Maharashtra. The Maharashtra Industrial Development Corporation (MIDC) will be the nodal agency responsible for implementation of Shendra MIP in Maharashtra.

The proposed Shendra MIP is spread over an area of 845.26 hectares (ha), covering three villages- Ladgaon, Karmad and Kumbephal and primarily includes rural hinterland, comprising of agricultural lands, village settlements and scrub lands. The land for the project is under possession with MIDC and was acquired as per the Land Acquisition Act, 1894.

The draft development plan for the industrial park for Shendra MIP has obtained in-principle approval from Maharashtra Industrial Development Corporation (MIDC) has been prepared by Design Point Consult Private Limited. The planned development for Shendra MIP is consistent with the Metropolitan Area Development Plan for Aurangabad, Town Planning and Valuation Department which designates the proposed site location for Industrial landuse.

The proposed MIP is adjacent to the existing MIDC Shendra industrial area in the east. It will have industries, commercial spaces, public/ semi-public areas, a logistic hub, truck terminal, residential areas, utilities, parks and open spaces.

The proposed project falls under item 7(c) i.e Industrial Estate/ park and 8(b) i.e Township and area development as per the Environment Impact Assessment Notification 2006 and has been categorised as Category 'A' project. DMICDC has appointed AECOM India Pvt. Limited to conduct the EIA study as per the Term of Reference (ToR) approved by Ministry of Environment and Forest (MoEF) for the project and to obtain environmental clearance.

### 2.0 Site Selection

The primary objective behind selection of site for the Shendra MIP was to identify and potential areas for industrial development in the proximity of Aurangabad city. An area of interest (AOI), having total area of 5175 km<sup>2</sup> and including the existing MIDC land and additional adjacent areas of potential value for development, was selected. Firstly the basic suitability of the entire area of

interest (AOI) was assessed. Thematic maps for elevation, slope, land use and water resources were prepared for the identified AOI and an environmental sensitivity analysis was conducted. Based on it, the overall development suitability of the AOI was determined. The development suitability map indicated that the largest area of contiguous land with low environmental sensitivity (and therefore more suitable for development) is found in the centre of the AOI, along with smaller pockets to the east and west of Aurangabad City Centre.

Secondly the feasibility assessment of three alternative sites within the developable region of the AOI was undertaken.

- Alternative 1- Around Existing MIDC Shendra Industrial Park
- Alternative 2- Around Bidkin town
- Alternative 3- Combination of Alternative 1 and Alternative 2

The three alternatives were evaluated against criteria such as connectivity, water resources, topography, socio-economy and environmental sensitivity and final scores were assigned to each option based on the ranking system. Alternative-3 was selected as the final alternative for development of Shendra MIP. The site has a total developable area of 845.26 ha encompassing three villages. The series of National and State highways including NH 211, SH 178 and SH 148 and the rail line at Karmad enhances the overall connectivity of the site. The site also has good accessibility to the existing Aurangabad Airport. The site also has viable water resources in the form of Sukhna lake and Jayakwadi Dam Reservoir. As compared to other two options, the site comprises of gentler slope over majority of the area which is suitable for development. The population density and irrigation density of the site also favours development. Moreover, the site is just adjacent to the existing Shendra Industrial area of MIDC and has the presence of good number of industries and industrial infrastructure. Also, the site is the least sensitive in terms of environment as compared to the other two options.

### 3.0 Project Description

The proposed project will be developed in an area of 845.26 ha with 36% of industrial development. The population has been estimated to be about 39220 and will create employment opportunities for about 51026 persons. The project will include mixed land use development including residential, industrial and commercial development along with state-of-the-art supporting infrastructure.

**Site Location and Settings-** The proposed site for Shendra MIP is located towards the east of Aurangabad city. Planned adjacent to the existing Shendra Industrial Area, and north of Jalna road, the proposed Shendra MIP is strategically positioned for direct connection to major state and national highways and rail network. The area will also provide connections to the city of Aurangabad on new expressways leading to NH-211, SH-148, MH SH-30. The land use is dominated by agricultural land that is most likely irrigated with water from the Sukhna Dam Reservoir located in the south direction. Some parts of the hills located on the western and eastern side of the project site boundary are also zoned as reserved forest. No other protected forest area is reportedly present within the study area. Immediately to the east of the project boundary lies the existing MIDC Shendra Industrial area.

**Development Plan-** Industries have been planned integrated with the existing Shendra Industrial development. The siting of industries has been done considering the predominant wind direction with respect to the residential areas. Only green category industries have been proposed. During micro planning, similar industries will be clustered together to encourage the sharing of common facilities and linkages in production. Concept of industrial ecology will be encouraged. A 30 m wide high tension buffer has been planned between the residential and industrial land uses. About 50 ha of park and green areas have also been proposed.

Degraded hillsides towards the north and centre of the development area will be reforested and labelled as “Ecological Restoration Zone”. The forest lands and hillocks in the north and north-western part of the MIP will be preserved. The catchment of Sukhna Reservoir and the water bodies within the MIP boundary will also be conserved.

About 36% of the total area has been demarcated for industrial land use, 6% for residential land use, 28% for transportation, 9 % for commercial and 8 % for public/semi-public uses. About 6 % of the total area has been earmarked for parks and open spaces. The industrial mix proposed for the MIP shall include clusters comprising of engineering, food parks and textiles. The project is proposed to be developed over a 10 year period upto year 2025.

**Project Construction –** It is estimated that for the development of each phase, two labour camps with a capacity to accommodate 1000-1200 workers each during peak phase. The labour camps shall be provided with adequate water and power supply and sanitation facilities including toilets with septic tanks. The construction material shall be sourced from authorised quarries and power shall be met from the existing substations. MIDC shall allocate water supply for the labour camps and for the construction activities. The waste generated shall be disposed off in the existing waste management facilities in the region.

### **Project Utilities**

**Water and Wastewater -** The water demand for the region has been estimated to be about approximately 27-30 MLD including water losses (15%) and water for firefighting.

**Power –** The power demand for Shendra MIP has been estimated to be 350 MW and will be sourced from existing substations at Shendra and Chitegaon at a distance of 10 km from project site. It is proposed that renewable energy certificates shall be purchased and solar assisted heating shall be made mandatory for all institutional buildings. Also, MIDC will enforce the Energy Conservation Building Codes developed by Bureau of Energy Efficiency. Waste to energy options will also be explored.

**Solid Waste Management –** The municipal solid waste generation from the proposed region has been estimated as 41 TPD for the year 2025. Industrial waste generation from the proposed project has been estimated to be about 356 TPD. A waste collection and transportation system has been designed in compliance with the Municipal Solid Waste Management Rules, 2000. As part of waste

management, an Integrated Solid Waste Management facility has been proposed in the east of the development area spread over 3.62 ha land within the project site boundary.

**Transport Infrastructure** – A well designed network of urban roads (arterial, sub-arterial and collector roads) have been proposed. A 90 m wide spine road with dual and four line carriageways and service roads on either side will traverse through the Shendra MIP. Primary roads (sub-arterial roads) with ROWW of 60 m are proposed to be three-lane dual carriageways (six lanes) with little scope of expansion. Secondary roads (collector roads) with ROW of 45 m will directly connect to the major roads and primary roads for different land use purposes and will be two-lane dual carriageways. Finally, the Tertiary roads (local roads) with ROW of 30 m will have two-lane carriageway. These are the roads from where traffic actually originates.

#### 4.0 Baseline Environment

The baseline environmental status for Shendra MIP and the study area extending upto 10 kms from the project site boundary has been assessed using primary data collection and secondary data review. One season primary monitoring was carried out during December 2011- March, 2012. The data was supplemented by the latest environmental monitoring data (December 2013-April 2014) collected by Maharashtra State Pollution Control Board (MSPCB) in Aurangabad city. The baseline data generation included site visits, primary environmental monitoring, ecological surveys, social surveys and interviews, processing of satellite imagery and secondary data review from established sources such as Indian Meteorological Department, Census of India etc. The details have been presented in Table E-1.

**Table E-1: Baseline Environmental Status**

Parameter	Description
Topography	The project site falls largely within the Deccan Plains and is relatively flat, with two small areas of hilly land lying to the north and west of the project site that reach a height of over 750 meters. The area slopes south east wards from the Sahyadris and land between these two hill ranges forms a valley draining to the Sukhna Reservoir.
Land Use	The predominant land use within study area is fallow land, open forest, followed by agricultural land and scrub forest land. Built up area constitute around 3 % and water bodies just 1% of the study area.
Physiography and Drainage	The study area falls in the catchment of Godavari basin, with Sukhna Lake being the important reservoirs where the area drains into. The area is sloping towards the south-southeast as the drainage of the area is guided through various small streams and seasonal channels
Climate and Meteorology	The climate of the area is characterized by a hot summer with dry conditions throughout the year except during the south west monsoon season. The summers are hot and winters are warm. The summer months are the driest when the relative humidity is generally between 20% and 25% in the afternoons. As per the onsite meteorological data collected for winter season, the predominant wind direction was observed to be North east and the average wind speed was recorded at 0.69m/s. The southwestern monsoon constitutes about 80% of total rainfall in the region. The months of July and August receive maximum rainfall in the range of 150-160mm. The average annual rainfall observed in the project area range between 640mm and 748mm.
Ambient Air Quality	Ambient air quality was monitored at 3 locations for a period of twelve weeks for PM <sub>10</sub> , PM <sub>2.5</sub> , SO <sub>2</sub> , NO <sub>x</sub> , CO, HC and O <sub>3</sub> . The PM <sub>10</sub> and PM <sub>2.5</sub> values were in the range of 26.4- 67.8µg/m <sup>3</sup> and 11.3-34.1µg/m <sup>3</sup> and were within standards. SO <sub>2</sub> and NO <sub>x</sub> levels were observed to be in the range of 8.4-24.8µg/m <sup>3</sup> and 11.2-37.7µg/m <sup>3</sup> and were well within the standards. Maximum

	concentration of CO was observed to be 1135 $\mu\text{g}/\text{m}^3$ and was well within the standards. All other parameters were observed to be below detection limits.
Water Resources and Quality	As per studies by Central Ground Water Board, the scope of groundwater development in Aurangabad is about 55% and falls under Safe category. The groundwater is alkaline in nature and is not found suitable for drinking purpose due to high nitrate concentration. Ground water monitoring was undertaken at 2 locations and TDS and total hardness levels exceeded the respective desirable limits. Surface water samples collected from 3 locations. The samples from Sukhna Dam were found to be fit for Propagation of Wild life and Fisheries while the one collected from a pond was found to be fit for irrigation. None of the samples were found to be fit for drinking purposes.
Ambient Noise Levels	Noise level was monitored at 3 locations in the study area and was observed to be within prescribed CPCB standards at all locations.
Soil Quality	Soil samples were collected from 2 locations. The soil texture was found to be sandy. The porosity of the soil samples ranged from 25.8 – 31.3% and permeability is high which refers to well-drained soil. Heavy metals such as zinc, copper, iron, lead, chromium and manganese were found in the soil samples.
Traffic Density	Traffic density was monitored at 2 locations, SH 178 at Shendra (Jalna road) and NH-211 at Aadgaon (Beed road). Maximum traffic was observed during night time along both highways. This traffic can be attributed to the high movement of the goods vehicles during the night time. The observed had significant volume of two wheelers followed by Light commercial Vehicle (LCV) which indicate that the roads are mainly used by people going to workplaces.
Ecological Environment	The natural areas in the region comprise of forested patches and open scrub stretches with species such as <i>Acacia catechu</i> , <i>Albizzia procera</i> , <i>Acacia nilotica</i> , <i>Balanites aegyptica</i> , <i>exotic Lantana camara</i> , etc. The study area also comprises of habitations, farmlands, orchards and plantations with trees like Mango, papaya, Bitter Almond, crops like wheat, maize, millets etc. The avifaunal profile is dominated largely by birds associated with open scrublands and wetland birds. The survey-area does not coincide with any known major avian migratory flyway. The important ecological sites in the survey-area include the Sukhna Lake and network of streams which drain the area and a Reserved Forest in the north. An important eco-sensitive area is the Jayakwadi Bird Sanctuary about 40 km in the south direction of the proposed Shendra MIP site.
Social Environment	The project area is spread over 3 villages namely Karmad, Ladgaon and Kumbephal in Aurangabad Tehsil. As per Census 2001 data, the project area comprises of total population of 11451 with average household size being 6. The literacy rates in the project area is 63%. Much of the population is agriculture dependent. The project area lacks access to healthcare facilities. The education infrastructure in the region is poor and there are no colleges or Industrial training Institute in the project area.

## 5.0 Impact Assessment and Mitigation Measures

The project activities during construction and operation phase were identified and assessed based on various criteria such as spread, duration, intensity and nature of impacts. The impacts identified and the mitigation measures suggested are presented in Table E-2.

**Table E-1: Environmental/Social Impacts and Mitigation Measures**

S.N	Component	Impacts Identified	Suggested Mitigation Measures	Responsibility
<b>CONSTRUCTION PHASE</b>				
1.	<b>Ambient Air Quality</b>	<ul style="list-style-type: none"> <li>Emissions from construction equipments, vehicles;</li> <li>Improper handling and storage of construction material;</li> <li>Fugitive dust emissions</li> <li>Emissions from onsite operation of diesel generators;</li> <li>Burning of waste at camp sites;</li> </ul>	<ul style="list-style-type: none"> <li>Power supply for construction will be sourced from existing source of MIDC supply.</li> <li>Generators to be used only as backup source</li> <li>Appropriate stack height as per the CPCB guidelines to be provided for DG sets.</li> <li>LPG cylinders to be provided in labour canteens and use of fuel wood to be discouraged.</li> <li>Suppression of fugitive dust emissions by spraying water, wetting of the stockpile,</li> <li>Proper maintenance of machines and vehicles will be undertaken;</li> <li>Paved roads shall be cleaned regularly and un-paved roads to be stabilized and watered regularly.</li> <li>Vehicle speed to be restricted to 25 km/h on unpaved roads.</li> </ul>	SPV
2.	<b>Water Resources and Quality</b>	<ul style="list-style-type: none"> <li>Change in topography and alteration of drainage pattern</li> <li>Additional pressure on local water resources</li> <li>Sediment run off from construction area</li> <li>Disposal of sewage from construction camps</li> <li>Contamination of surface and groundwater resource</li> </ul>	<ul style="list-style-type: none"> <li>Water for construction phase to be sourced from existing sources allocated to MIDC supplemented with authorised tanker supply.</li> <li>Adequate number of toilets (at least 8-10 toilets per 100 labours) with septic tanks and soak pits arrangements to be provided onsite.</li> <li>Sludge from waste water treatment systems to be disposed off properly.</li> <li>Adequate slopes and drainage channels to be provided across the project site to manage storm water.</li> <li>Diversion dykes to channel runoff to be constructed around the excavated site.</li> <li>Oil and grease containing effluents to be pre-treated before discharge.</li> <li>Surface contours will be restored in relation to the surroundings of the project area.</li> </ul>	SPV
3.	<b>Landscape and Topography</b>	<ul style="list-style-type: none"> <li>Change in existing land use from agricultural to mixed use (including industrial and residential)</li> <li>Change in topography</li> <li>Change in drainage pattern</li> <li>Localized flooding and related health issues due to decreased infiltration</li> </ul>	<ul style="list-style-type: none"> <li>50-100m riparian buffer to be provided around existing water bodies.</li> <li>Excavated soil to be used in level raising;</li> <li>Greenbelt and green buffers will be developed to improve the landscape.</li> <li>Land surface contours to be restored in relation to the surroundings.</li> <li>Construction footprint will be well defined and construction work to be carried out within the Project footprints only</li> <li>Visual intrusion and aesthetics to be considered during the project construction.</li> </ul>	SPV
4.	<b>Soil Resources</b>	<ul style="list-style-type: none"> <li>Soil Erosion and compaction</li> </ul>	<ul style="list-style-type: none"> <li>Top soil to be preserved and relocated after construction activities.</li> </ul>	SPV

S.N	Component	Impacts Identified	Suggested Mitigation Measures	Responsibility
		<ul style="list-style-type: none"> <li>Soil contamination</li> </ul>	<ul style="list-style-type: none"> <li>Excavation works to be avoided during monsoon season;</li> <li>Dikes, berms, drainage swales or ditches to be provided to divert surface run-off.</li> <li>Movement and parking of heavy machinery and vehicles to be restricted to identified area;</li> <li>Trainings to be imparted to all workers and subcontractors regarding hazardous waste storage and disposal procedures;</li> <li>On completion of construction activities, septic tanks for camp sites to be abandoned and filled with earth.</li> <li>Hazardous waste to be handles and disposed of in accordance with the requirements of Hazardous Waste Management Rules 2008.</li> </ul>	
5.	<b>Traffic and transport</b>	<ul style="list-style-type: none"> <li>Increased traffic volume</li> <li>Damage to existing village roads</li> <li>Disruption of traffic and increased case of road related hazards</li> </ul>	<ul style="list-style-type: none"> <li>Temporary widening of roads to be undertaken based on project specific surveys;</li> <li>Traffic and heavy machinery movement schedule to be communicated to the local inhabitants. Prior consultation with local Police and local Panchayat to be undertaken. Roads damaged due to project vehicles will be continuously repaired.</li> <li>Provision of adequate training to drivers to be made.</li> </ul>	SPV
6.	<b>Ambient Noise Quality</b>	<ul style="list-style-type: none"> <li>Noise due to Construction activities (such as excavation, grading, erecting equipment, piling, etc)</li> <li>Noise due to operation of heavy equipment and machinery</li> <li>Movement of vehicles</li> </ul>	<ul style="list-style-type: none"> <li>Acoustic enclosures, noise barriers to be provided at construction site</li> <li>Construction workers to use ear muffs in high noise generation areas;</li> <li>Noise barriers will be provided between the activities and the receptors.</li> <li>Restriction on use of equipments generating high noise during night time will be put in place.</li> </ul>	SPV
7.	<b>Socio-Economic</b>	<ul style="list-style-type: none"> <li>Land Acquisition</li> <li>Loss of existing village assets</li> <li>Loss of landholdings</li> <li>Impact on livelihood of the villages</li> <li>Loss of livelihood</li> <li>Loss of Common Property Resources</li> </ul>	<ul style="list-style-type: none"> <li>Land has been procured through procedures under the Land Acquisition Act 1894.</li> <li>Value of the land to be decided by the district administration after due assessment</li> <li>Local community to be consulted about their concerns and expectations.</li> <li>Affected land losers to be considered for benefits like employment, contracts etc.</li> <li>Skilled and qualified entitled persons to be given preference in employment and other contractual benefits;</li> <li>Procurement of community land to be avoided to the extent possible and adequate buffer area to be retained around villages.</li> </ul>	SPV/ MIDC
8.	<b>Occupational Health and Safety</b>	<ul style="list-style-type: none"> <li>Injury due improper handling, operation and execution</li> </ul>	<ul style="list-style-type: none"> <li>Good housekeeping practices to be exercised.</li> <li>Proper signage to be provided around construction site.</li> </ul>	SPV

S.N	Component	Impacts Identified	Suggested Mitigation Measures	Responsibility
		<ul style="list-style-type: none"> <li>• Trip and fall, inadequate fall safe arrangements</li> <li>• Exposure to hazardous substances</li> </ul>	<ul style="list-style-type: none"> <li>• Use of Personal Protection Equipment (PPEs) to be mandatory at work site.</li> <li>• Workers to be provided with health and safety training on regular basis</li> <li>• Use of temporary fall protection measures in scaffolds and out edges of elevated work surfaces. Safety harness to be ensured for workers while working at heights.</li> <li>• First aid and essential medical services to be provided at site.</li> </ul>	
9.	<b>Employment and Local Economy</b>	<ul style="list-style-type: none"> <li>• Increased employment opportunities</li> <li>• Contracting opportunities for locals</li> <li>• Better avenues for Small scale service providers.</li> </ul>	<ul style="list-style-type: none"> <li>• Project to utilize the facilities available from the local market to support the local economy to the extent possible.</li> <li>• Wherever possible, labour from local community will be employed for project.</li> </ul>	SPV/MIDC with approval from State Apex Authority
10.	<b>Ecology</b>	<ul style="list-style-type: none"> <li>• Loss of trees and ground vegetation</li> <li>• Habitat destruction</li> <li>• Adverse impact on wildlife due to noise, vehicle movement, poaching, illumination</li> <li>• Increased turbidity and siltation</li> </ul>	<ul style="list-style-type: none"> <li>• All reserve forest patches have been excluded from the development of master plan.</li> <li>• A distance of 2km from the western and the northern boundary of project site to be designated as “Zero Development Zone”.</li> <li>• Area around Sukhna reservoir to be preserved in proposed MIP Development Plan;</li> <li>• Original soil profile shall be retained by storing each excavated layers separately</li> <li>• Tree felling to be minimized to the extent possible. Hunting activities will not be permitted within and around the delineated area.</li> <li>• A ‘Local Ecological Monitoring Group’ will be setup to monitor the environmental and ecological safeguard measures during construction phase.</li> <li>• Standard noise levels to be maintained during construction activities.</li> </ul>	SPV
<b>OPERATION PHASE</b>				
11.	<b>Air Quality</b>	<ul style="list-style-type: none"> <li>• Emission from power backup/ DG sets</li> <li>• Stack emission from industries</li> <li>• Fugitive emission from industrial processes</li> <li>• Emissions from increase in traffic volume</li> </ul>	<ul style="list-style-type: none"> <li>• SPV developed for overview of power supply shall ensure that the power failure is maintained at minimal to reduce use of Diesel generators</li> <li>• All emission sources to be provided with adequate stack height as per CPCB / MoEF norms. Air pollution control equipments to be employed by industries.</li> <li>• Red and Orange category industries shall be located away from the proposed residential areas and existing settlements</li> <li>• Individual industries will be required to obtain adequate approvals such as Consent to Establish/Consent to operate or environment clearance.</li> <li>• The SPV shall establish a Transport Authority for the region and the authority to ensure infrastructure for pollution checking.</li> </ul>	SPV/MIDC

S.N	Component	Impacts Identified	Suggested Mitigation Measures	Responsibility
			<ul style="list-style-type: none"> <li>Vegetative barrier of 20-40m to be provided around planned industrial area.</li> </ul>	
12.	<b>Ambient Noise Quality</b>	<ul style="list-style-type: none"> <li>Increase in noise levels in residential areas and adjoining villages</li> <li>Impact on avifaunal species due to increased noise</li> <li>Movement of vehicles</li> </ul>	<ul style="list-style-type: none"> <li>All habitations to have a suitable buffer area delineated around them.</li> <li>Vegetative barriers in form of green belt to be provided around all industrial areas.</li> <li>All industrial operations to have acoustic enclosures and employ noise attenuation measures.</li> <li>All roads and highways to be provided with vegetative barriers and barrier walls.</li> </ul>	SPV
13.	<b>Water Resources and Quality</b>	<ul style="list-style-type: none"> <li>Increase load on fresh water sources</li> <li>Unplanned disposal of industrial waste water generated and sewage</li> <li>Inadequate management of storm water</li> <li>Spills, leaks from industries, storage areas</li> <li>Contamination of natural water resources and ground water aquifers</li> </ul>	<ul style="list-style-type: none"> <li>Water requirements to be met through allocation from Jayakwadi reservoir</li> <li>Minimum extraction of groundwater;</li> <li>Individual projects shall have separate water meters;</li> <li>Building and plumbing code to propose dual plumbing layout;</li> <li>SCADA system to be implemented for monitoring leakages;</li> <li>A reliable technical department for maintenance and quality control shall be established;</li> <li>Domestic and industrial wastewater generated will be treated separately;</li> <li>Rain water harvesting to be carried out by each individual project;</li> <li>Proper storm water drainage network designed for 100 year flood period</li> </ul>	SPV/MIDC
14.	<b>Solid Waste Disposal</b>	<ul style="list-style-type: none"> <li>Generation of 1685 MTD for the year 2042.</li> <li>Inadequate collection and treatment of domestic waste</li> <li>Unhygienic conditions, odor problem</li> <li>Localized flooding</li> <li>Contamination of soil and groundwater</li> <li>Improper disposal of sludge and industrial waste</li> </ul>	<ul style="list-style-type: none"> <li>Integrated solid waste management will be developed for collection, transportation, treatment and disposal of waste.</li> <li>2 bin system for Shendra MIP for waste collection;</li> <li>Industries generating hazardous waste to comply with the requirements of Hazardous Waste (Management, Handling and Tran boundary Movement) Rules, 1989 and subsequent amendments.</li> <li>The recyclable waste like glass, metal, plastics, paper etc likely to be generated from different land uses, will be collected separately and sold to authorized recyclers/ vendors.</li> </ul>	SPV/MIDC
15.	<b>Traffic Volume</b>	<ul style="list-style-type: none"> <li>Increase in traffic flow</li> <li>Increase in private traffic volume</li> <li>Traffic congestion</li> </ul>	<ul style="list-style-type: none"> <li>The roads will be designed to carry the maximum traffic loads with anticipated future development and on a par with IRC Standards;</li> <li>A well planned public transport infrastructure has been envisaged for the project;</li> </ul>	SPV with approval from State Apex

S.N	Component	Impacts Identified	Suggested Mitigation Measures	Responsibility
		<ul style="list-style-type: none"> <li>Irregular Parking</li> </ul>	<ul style="list-style-type: none"> <li>Four categories of roads (Major roads (arterial roads) with right of way (ROW) of 90 meters; Primary roads (sub-arterial roads) with ROW of 60 meters; Secondary roads (collector roads) with ROW of 45 meters; Tertiary roads (local roads) with ROW of 30 meters) proposed;</li> <li>The proposed road circulation shall provide for safe and efficient movement of people;</li> <li>Pedestrian Guard Rails, Road safety Signage and overhead signs shall be placed wherever necessary;</li> <li>Road widths and lane configurations have been designed based on the modelling exercise;</li> <li>All roads in the Shendra MIP will include designated lanes to encourage cycling and improve the safety of cyclists;</li> <li>Comprehensive traffic and travel surveys shall be conducted every 5 years to monitor traffic characteristics and travel behaviour to develop strategies for effective transportation;</li> <li>Each residential project to provide parking facilities as per applicable norms and regulations.</li> </ul>	Authority
16.	<b>Land Use Pattern</b>	<ul style="list-style-type: none"> <li>Impact on irrigated agricultural fields</li> <li>Impacts on existing human settlements</li> <li>Impact on reserved forests lying to the north and western boundary of project, barren land/hills on western boundary of the site</li> <li>Potential for localized flooding due to alteration of topography</li> </ul>	<ul style="list-style-type: none"> <li>Delineation of the project site during planning stage to select the option based on socio-economic factors.</li> <li>High sensitivity forest area towards northern and eastern fringe have been avoided;</li> <li>It is planned to retain all key water channels in the project area as natural water bodies;</li> <li>All irrigation channels and check dams of significance will be retained to ensure no impact on the agricultural activities around the delineated project area;</li> <li>To limit the development in the existing settlements, the Urban Planning Department shall define the land use for these regions through the proposed Development Plan of Shendra MIP and limit the densities in these region through the application of the Building bye laws;</li> </ul>	SPV/MIDC with approval from State Apex Authority
17.	<b>Ecology</b>	<ul style="list-style-type: none"> <li>Vast areas designated as reserved forests in the north of delineated boundary and few patches on the western fringe of the project boundary.</li> </ul>	<ul style="list-style-type: none"> <li>Degraded hillsides towards the central and north of the development area recommended to be reforested and designated as 'Ecological Restoration Zone';</li> <li>The Sukhna reservoir and its catchment areas to be preserved and excluded from any heavy developmental activities;</li> <li>Each industry shall develop green belt in 33% of the total land area with native and</li> </ul>	SPV

S.N	Component	Impacts Identified	Suggested Mitigation Measures	Responsibility
		<ul style="list-style-type: none"> <li>Impact on flora and fauna of the adjoining green areas including reserve forest</li> <li>Illegal hunting and cutting of trees.</li> <li>Bird kill</li> <li>Habitat fragmentation and loss</li> </ul>	<p>local species as per the CPCB guidelines;</p> <ul style="list-style-type: none"> <li>Transmission lines and chimneys will be provided with optical markers to enhance visibility for birds.</li> </ul>	
18.	<b>Socio-Economic</b>	<ul style="list-style-type: none"> <li>Increased employment and business opportunities</li> <li>Improvement in infrastructure</li> <li>Increased income levels</li> <li>Stabilization of the rural economies</li> <li>Potential for cultural conflict</li> <li>Unplanned secondary development in the adjoining areas</li> </ul>	<ul style="list-style-type: none"> <li>DMICDC and individual project to undertake CSR program to ensure communal harmony and cooperation.</li> <li>Area of 10km around the project are will be regulated by DMICDC/MIDC to avoid any secondary development or unplanned development.</li> <li>DMICDC/MIIDC to extend the infrastructure facilities such as water supply, power, transportation etc. to the villages in the project area.</li> <li>Mechanism to train and improve the skill sets of the local community.</li> <li>The project to put in place SPV's responsible for efficient management and maintenance of infrastructure.</li> </ul>	SPV/ MIDC
19.	<b>Cultural Impact</b>	<ul style="list-style-type: none"> <li>Influx of migrant population</li> <li>change of culture and conflicts</li> <li>Impact on archeological monuments</li> </ul>	<ul style="list-style-type: none"> <li>All identified archaeological structures fall outside the delineated project area.</li> <li>DMICDC and individual project to undertake CSR program to ensure communal harmony and cooperation.</li> </ul>	SPV

## 6.0 Social Impact Assessment

The land required for Shendra MIP comprises of land parcels already in possession of MIDC and private land acquired under the Land Acquisition Act, 1894 falling in three villages namely Karmad, Ladgaon and Kumbephal in Aurangabad Tehsil.

The key impact of land acquisition has been identified as loss of landholdings directly affecting the livelihood of the villagers residing within the project area.

A project specific Resettlement and Rehabilitation entitlement matrix has been developed for the project in accordance with the provisions of the National Resettlement and Rehabilitation Policy.

## 7.0 Public Hearing

In line with the MoEF's EIA Notification dated 14th September, 2006 and as per newspaper Notice dated 9/9/2014, issued by the Office of Sub-Regional Officer, Aurangabad, Maharashtra Pollution Control Board, Public Hearing was scheduled to be conducted on 30.10.2014 at 10:30 am for development of proposed Mega Industrial Park. The notice for public hearing was published in two newspaper dailies. The public hearing was conducted under the chairmanship of Honb'le Additional Collector, Auragabad, Sh. Kisanrao Lawande and attended by representatives from Maharashtra Pollution Control Board, the Regional Officer Shri. P.M. Joshi and Sub-Regional Officer Shri. Anand N. Katole and EIA Consultants from AECOM, Sarpanches, Panches and general public of nearby villages.

The main issues raised by the public who attended the Hearing included the following:

- Existing pollution levels with respect to air, noise and water by existing industries and factories in the MIDC Shendra area.
- Open surface disposal of industrial waste water, which is leading to water logging, contamination of ground water
- Empty plots which were aquired by the government about 10 years back
- Community social development schemes to be brought-in, including engagement of locals in factories

All the queries were satisfactorily answered to, by the propject proponent and the environmental consultant representative.

## 8.0 Environment Management Plan

**Institutional Framework** - For the development of Shendra MIP, a city level SPV will be incorporated as a 50:50 Joint Venture Entity between the State Government and the Central Government.

**Environmental and Social Monitoring** – A comprehensive environmental and social monitoring plan has been developed for the construction and operation phases of Shendra MIP. It is proposed to establish the monitoring plan by two mechanism, viz., Internal and external monitoring mechanism. Internal monitoring team will be headed by SPV's representative and will also comprise of the

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Environment and Public Relations Department's representatives. This team shall ensure adherence of specific monitoring conditions included while granting statutory clearances.

The external monitoring will ensure that the monitoring activities are carried out as per the plan, norms and schedule, in a transparent manner. The external monitoring will be conducted by a group of experts and stake holders such as Representatives from the company/DMIC, Pollution Control Board, Industrial associations/ federations and/or local NGO group etc.,.

This committee will submit a bi-yearly report to the top management of the company with their review comments and suggestions.

**Corporate Social Responsibility** – The SPV shall undertake CSR activities as a part of the development of Shendra MIP project. Based on the need assessment in the project area, it is suggested to develop Industrial Training Institutes to impart training to the affected population to enhance their skill base so that they can find employment in the proposed development. It is also provided that schools with adequate teaching staffs to be set up within the vicinity of the villages so that local children can avail this facility. A 100 bedded hospital is also proposed along with extension of public amenities, setting up of vocational training institutes and encouraging self help groups in the region. Additionally, provision of public amenities such as drinking water facility at each of the project villages can be provided.

### Terms of Reference (ToR) Compliance

S.No.	Approved TOR	Reference in the report
i.	Project boundary does not pass through any eco-sensitive area and within 10 km from eco- sensitive area.	Refer Section 3.3.2 Site Surroundings  The Jayakwadi Reservoir -Wildlife Sanctuary lies about 40 km towards the south of the delineated project boundary. No other protected forest area is reportedly present within the study area.
ii.	The proponent informed that the proposal does not involve any forests land. Confirmation to this effect shall be submitted.	Refer Section 1.2 Project Background  It is confirmed that no protected or reserve forest land is involved in the project area.
iii.	Reasons for selecting the site with details of alternate sites examined/rejected/selected on merits with comparative statement and reason/basis for selection. The examination should justify site suitability interms of environmental damages, resources sustainability associated with selected site as compared to rejected sites. The analysis should include parameters considered along with weightage criteria for short-listing selected site.	Refer Chapter 2: Project Justification  Section 2.3 Alternative Site options Section 2.3.3 Site Selection Criteria Section 2.3.4 Weightage to Criterion  The primary objective behind selection of site for the Shendra MIP was to identify and potential areas for industrial development in the proximity of Aurangabad city.The basic suitability of the entire area of interest (AOI) was first assessed on the basis of environmental sensitivity analysis. A development suitability map was generated for the AOI and area of contiguous land with low environmental sensitivity was identified. Three alternative sites within this developable area was then identified and evaluated against criteria such as connectivity, water resources, topography, socio-economy and environmental sensitivity. Scores were assigned to each option based on a ranking system and final alternative for development of Shendra MIP was selected.
iv.	Submit the details of the trees to be felled for the project.	A tree survey was taken up as a part of the topographic survey. There are about 387 trees within the project site. Efforts will be taken to protect all trees. No tree will be felled unless deemed unavoidable, with prior approval from the concerned authorities.  Exact number of trees to felled can only be assessed on the detailing of the Development Plan.
v.	Submit the details of the infrastructure to be developed.	Refer Chapter 3 Project Description Table 3.1 Key Details of the Project Following infrastructure has been proposed: New internal and external roads

S.No.	Approved TOR	Reference in the report
		<p>Transmission line Waste Management facility One WTP of approx. 30 MLD One STP of approx. 9 MLD One CETP of 9 MLD</p>
vi.	Submit the details of the road/rail connectivity along with the likely impacts and mitigative measures	<p>Refer Chapter 3 Project Description Section 3.3.3 Accessibility to Site Figure 3.2 Existing Road and Rail Connectivity of Shendra MIP</p> <p>The Shendra MIP site is strategically positioned for direct connection to major state highways and the national rail network. The area will also provide connections to the city of Aurangabad on through National Highway (NH) 211, SH-178 (Jalna Road), and SH-148 (Paithan Road).</p>
vii	Submit the present land use and permission required for any conversion such as forest, agriculture etc.	<p>Section 5.3 Existing Land Use Pattern</p> <p>The existing land use of the Shendra MIP study area is dominated by agricultural land that is primarily irrigated from Sukhna Reservoir and other tanks in the region. This productive land is concentrated around drainage channels and reservoirs; agricultural land farther from these water features appears to be non-irrigated and dependent on rainfall.</p> <p>There are no protected/ reserved forest falling within the site.</p> <p>No diversion of forest land is envisaged.</p>
viii	Submit details regarding R&R involved in the project.	<p>The land for the project is under possession with MIDC and was acquired as per the Land Acquisition Act, 1894.</p> <p>No village settlements/ abadi areas will be acquired.</p>
ix.	Zoning of the area in terms of 'type of industries' coming-up in the industrial park based on the resource requirement.	<p>Section 3.4.6 Salient features of the proposed landuse plan</p> <p>The industrial clusters of the MIP will be organised in such a manner so as to allow compatible and mutually supporting industries and businesses to locate near one another, while providing adequate buffers to separate industries that should be located away from one another (eg. food industries) and from residential neighbourhoods.</p>

S.No.	Approved TOR	Reference in the report
		Industries clusters will also be sited based on their compatibility with the industries in the existing Shendra Industrial development.
x.	Submit the details of Water management studies	Refer Section 6.3.3 Impact on Water Resources and Quality Sub-section- Mitigation measures
xi.	The project boundary area and study area for which the base line data is generated – submit through a suitable map.  Justification of the parameters, frequency and locations shall be discussed in the EIA.	Refer Figure 1-1 Land Use Plan of Project and Study Area (10 kms around the project site)  Environmental Monitoring Section 5.9-Section 5.12
xii	Submit Legal frame work for the implementation of Environmental Clearance conditions - to be clearly spelt out in the EIA report.	Refer Chapter- 4 Environmental Legislation and Regulatory Framework
xii	Submit Roles and responsibility of the DMIC/developer etc for compliance of environmental regulations under the provisions of EP Act.	Refer Chapter- 8 Environmental and Social Management Plan  For the development of Shendra MIP, a city level SPV is being incorporated as a 50:50 Joint Venture Entity between the State Government and the Central Government. Within the SPV, the Government of India will be represented by DMIC Project Implementation Trust Fund. The State Government will provide the land as its Equity to the proposed SPV while DMIC Trust will provide the money for the development of trunk infrastructure (water, power, drainage etc.) which is essential for attracting industries. The planning and development functions will also be vested with the city SPV.
xiv	Site justification of the identified industry sectors from environmental angle and the details of the studies conducted if any.	Siting of Industrial Areas under Section 3.4.7 Salient Features of Land Use Plan  Heavily polluting industries have been excluded, and were not considered for the Shendra MIP. The industrial clusters of the MIP will be organised in such a manner so as to allow compatible and mutually supporting industries and businesses to locate near one another. Similarly, all the industries which will have an environmental conflict (in terms of pollution impacts on the processes or products of the neighbouring industry) will not be sited next to each other.
xv	Ground water classification as per the Central Ground Water Authority.	Chapter-5 Section 5.5.4 Ground Water Development
xv	Adequate buffers to separate industries to be located away from one another and from residential	Section 3.4.7 Salient Features of Land Use Plan Section 6.3 Impacts during Operation Phase

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S.No.	Approved TOR	Reference in the report
	neighbourhoods – Specific details like buffer distance and this will be enforced with role and responsibilities, the act provisions shall be submitted.	The industrial clusters of the MIP will be organised in such a manner so as to allow compatible and mutually supporting industries and businesses to locate near one another. Similarly, all the industries which will have an environmental conflict (in terms of pollution impacts on the processes or products of the neighbouring industry) will not be sited next to each other.

# 1 Introduction

The Government of India (GOI) is developing a 1483 kilometers long western corridor as a high-axle dedicated freight corridor between Delhi and Mumbai and passing through the states of Uttar Pradesh, Madhya Pradesh, Haryana, Rajasthan, Gujarat and Maharashtra with end terminals at Dadri in the National Capital Region of Delhi and Jawaharlal Nehru Port near Mumbai. The corridor is envisaged to influence the pattern of development and industrialization of the region. To tap the development potential of the proposed freight corridor, a band spanning 150 kilometers wide on both sides of the freight corridor has been identified as Influence Region and is proposed to be developed as Delhi-Mumbai Industrial Corridor (DMIC). **Figure 1-1** represents the dedicated freight corridor (red line) and DMIC Influence Region (yellow line).

The vision for DMIC is to strengthen the Indian economy by creating state-of-the-art infrastructure and a globally competitive environment that activates local commerce, increases foreign investment, and promotes sustainable development through the development of several large scale developments. To achieve this objective, several industrial nodes comprising of Investment Regions (IR) and Industrial Areas (IA) have been identified along the length of the corridor. In line with this development strategy, the Delhi Mumbai Industrial Corridor Development Corporation Limited (DMICDC) is undertaking the planning and development of a **Mega Industrial Park at village Shendra**, district Aurangabad in the state of Maharashtra.

**Figure 1-1 Alignment of Dedicated Freight Corridor and Delhi-Mumbai Industrial Corridor Industrial Corridor Influence Region**



Source: "Prospective Plan: Delhi Mumbai industrial Corridor"- October 2009

This EIA study covers the **Shendra Mega Industrial Park (MIP)** which will comprise of industrial clusters, commercial spaces, service/civic areas, a logistic hub, truck terminal, supporting residential areas, parks and open spaces. The industrial mix proposed for Shendra MIP will include industries focusing on sustainable, high-yield agricultural production (such as seeds), pharmaceuticals and biotech research, breweries and distilleries, automotive and engineering parts; and the software and high-tech sectors comprising of engineering technology.

The Draft Development Plan of Shendra MIP has been developed by Design Point Consult Pvt Ltd which has obtained an in-principle approval from MIDC in April 2014.

## 1.1 Project Proponent

A special purpose company, Delhi Mumbai Industrial Corridor Development Corporation Limited (DMICDC), has been created under Ministry of Commerce (MoC), Government of India to coordinate the project planning, development and implementation of Shendra MIP. The Maharashtra Industrial Development Corporation (MIDC) is the nodal agency responsible for implementation of Shendra MIP project in Maharashtra.

## 1.2 Project Background

The project was issued Terms of References for conducting an EIA study by Ministry of Environment, Forest and Climate Change (MoEFCC) during 121<sup>st</sup> EAC meeting held on 18<sup>th</sup> -19<sup>th</sup> February 2013, by Expert Appraisal Committee (EAC) for Building/Construction Projects/Township and Area Development Projects, Coastal Regulation Zone, Infrastructure Development and Miscellaneous projects. The approved TOR mentions an area of 1090ha to be developed as Shendra MIP. However, during the course of preparation of the Draft Development Plan, the project area has been optimised to 845.26ha, to be spread over three villages namely Karmad, Ladgaon and Kumbephal, in tehsil Aurangabad of District Aurangabad. The Draft Development Plan has obtained an in-principle approval from MIDC for development of Shendra MIP. The area has been selected after excluding any reserve forest areas, existing settlements and existing industries. The delineated region includes rural hinterland mainly comprising of agricultural lands, village settlements and scrub lands and open degraded forest land. The location of the proposed Shendra MIP has been shown in Figure 1.2. This planned development for Shendra MIP is consistent with the Metropolitan Area Development Plan for Aurangabad, Town Planning and Valuation Department, presented in Figure 1-3, which designates the proposed site location for Industrial landuse.

There is an existing industrial area at village Shendra, under Maharashtra Industrial Development Corporation (MIDC) located adjacent to the proposed Shendra MIP site in the West direction. This existing MIDC industrial area is located to the east of the city of Aurangabad with connectivity from SH-8, SH-178, and NH-211. As per the Metropolitan Area Development Plan, the area in the south of the planned MIP and the area in the east of existing MIDC industrial area have been designated for residential landuse. It is understood that the work force will travel to the industrial areas for from these residential areas. The existing infrastructure in the surrounding area of the proposed Shendra MIP is shown in Figure 1.4.

Figure 1-2 : Location of Shendra MIP

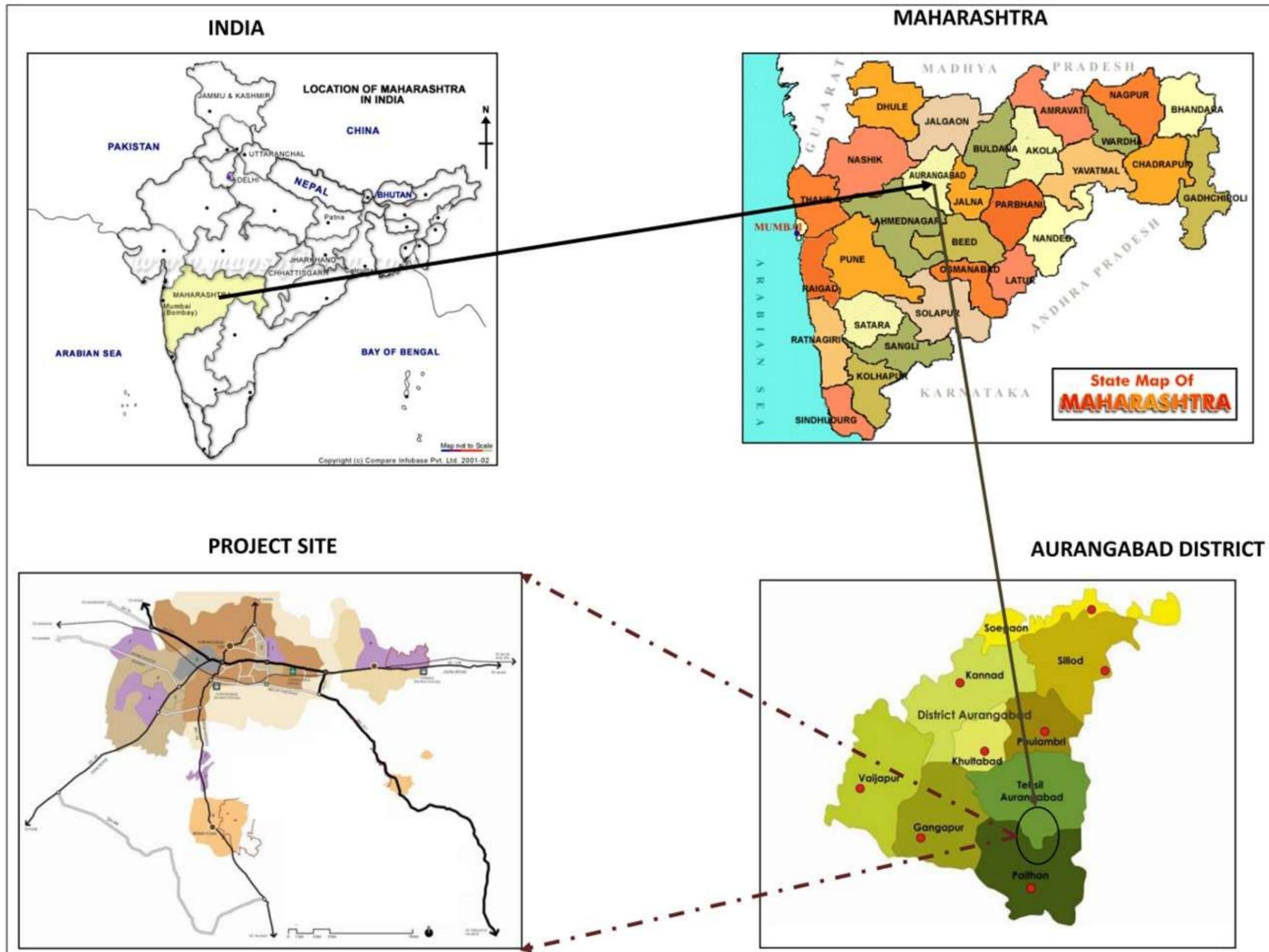
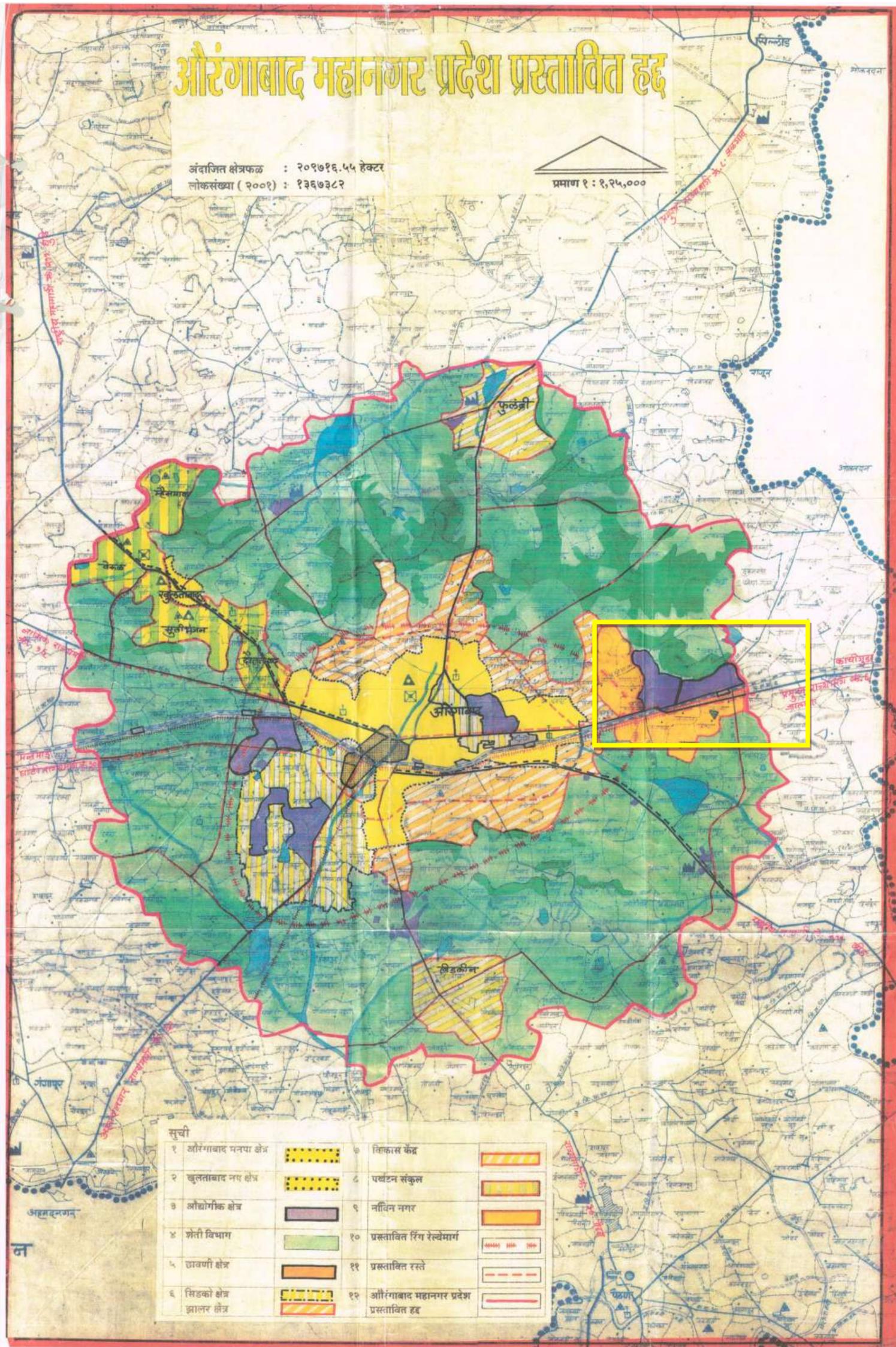


Figure 1-3 Metropolitan Area Development Plan for Aurangabad



(Source: Town Planning and Valuation Department, Maharashtra)

Figure 1-4: Plan Showing Proposed Location of Shendra MIP, also showing existing regional development, including the surrounding industrial areas



## 1.3 Objectives and Scope of work

### Need for the study

DMICDC has developed a draft Development Plan for the proposed MIP and intends to ensure environmental compliance and embed elements of environmental good practice in the planning stage itself. The need for conducting an Environment Impact Assessment arises because the development of such large manufacturing hubs is likely to alter and have impact on the environment and social aspect of the area. The environment impact assessment study has been conducted at the concept plan level and intends to seek environmental clearance under category 7(c) and 8(b) as per the EIA Notification, 2006 for the proposed development plan for Shendra MIP. All project components including industries, residential spaces and waste management facilities, if any, to be developed shall seek separate environmental clearance as per the requirements of the EIA notification.

### Scope of Work

- To undertake detailed Environmental Impact Assessment Study for the proposed Shendra MIP as per the Terms of Reference obtained from the Ministry of Environment, Forest and Climate Change (MoEFCC) during 121<sup>st</sup> EAC meeting held on 18<sup>th</sup> -19<sup>th</sup> February 2013, by Expert Appraisal Committee (EAC) for Building/Construction Projects/ Township and Area Development Projects, Coastal Regulation Zone, Infrastructure Development and Miscellaneous projects (**attached as Annexure I**);
- The EIA and public hearing will be undertaken according to the requirements of EIA Notification 2006; and
- Incorporation of comments received from the Client and during Public Hearing into the final EIA report and its submission to the Client.

## 1.4 Limitations

The Environmental Impact Assessment study is based on the primary baseline monitoring undertaken during study period (December 2011-March 2012), supplemented with the available secondary information, project details provided by the project proponent and public interactions undertaken with various stakeholders. The trend of various technologies and its repercussion on environmental components cannot be predicted at this stage. However, to the extent possible, the likely changes in technologies over the development period has been considered in the EIA report. Appropriate scientific factors and professional judgement has been used to arrive at an approximate quantity for all such components. The study is based on the understanding that all individual projects that will be developed in the Shendra MIP will seek separate Environmental Clearance as required by the EIA Notification, 2006 and subsequent amendments.

## 1.5 Structure of report

The Environmental Impact Assessment Report comprises of the following structure:

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Chapter-2: provides the **Project Justification**

Chapter-3: outlines the **Project Description**

Chapter-4: provides an overview on the **Environmental Legislation and Regulatory Framework**

Chapter-5: gives details of the existing **Environmental and Social Baseline** of the study area

Chapter-6: presents the project **Impact Assessment and Mitigation Measures**

Chapter-7: provides the baseline condition with respect to Socio-Economic Environment

Chapter-8: provides **Environmental and Social Management Plan**

Chapter -9: mentions the **Disclosure of EIA consultants**

## 2. Project Justification

This section of the report presents the analysis of alternatives considered for the proposed project. The following scenarios have been considered:

- Project versus No project Scenario;
- Alternatives considered for development of Industrial Corridors; and
- Alternatives considered for selection of site.

### 2.1 Project versus No Project Scenario

The industrial sector plays a vital role in the economy of the country and has emerged as a key contributor to the significant economic growth witnessed by the country in the recent past. As per CBRE Research, the manufacturing sector in India contributes to 34% of the Foreign Direct Investment (FDI), 15 % of the Gross Domestic Product (GDP) and provides employment to 30% of the non agricultural workforce<sup>1</sup> in the country. The Planning Commission of India has set a targeted annual GDP growth rate of 8.5 to 9% for the next 20 years and to sustain this growth rate, it is essential that both manufacturing and services grow at more than 11%.

According to the Economic Survey 2007-08, 64.8% of India's population would be in the working age of 15-64 years in 2026. By 2015, India will have 800 million people in the productive age group of 15 to 59, ahead of China which is expected to have only 600 million. This means that India needs to create employment and enterprise opportunities at that scale. For this to happen, jobs will have to be created both in the services and the manufacturing sector.

The growth of the industrial sector in the country has, however, been mostly unplanned and unorganized. The growth of industrial areas is primarily associated with availability of factors of production and connectivity to the region is one of the most important driving factors. The spread and distribution of the industries in India has been governed by the above mentioned factors and has been irregular in nature and lacks basic infrastructure facilities such as effluent treatment plant, hazardous waste management systems thereby leading to contamination. In a recent study carried out by Central Pollution Control Board in conjunction with Indian Institute of Technology, out of 88 industrial clusters studied, 43 were found to be 'critically polluted' and another 32 were found to be 'severely polluted'. The industrialization is also accompanied with significant influx of population from outside areas bringing with it unplanned urban growth.

The Government of India has, therefore, conceived the Delhi Mumbai Industrial Corridor which will address the issues discussed above. The DMIC has been conceived along the Dedicated Freight Corridor from Dadri to JNP Port and will provide efficient logistics chain with multi modal transshipment zones and logistic hubs to provide the much needed impetus to the industrial development. The Shendra Mega Industrial Park (MIP) has been conceived as a part of this development plan. The planned MIP will include industrial clusters, institutional and commercial land uses, public amenities and residential areas.

<sup>1</sup> Source: <http://www.cisco.com/web/IN/about/network/manufacturing.html>

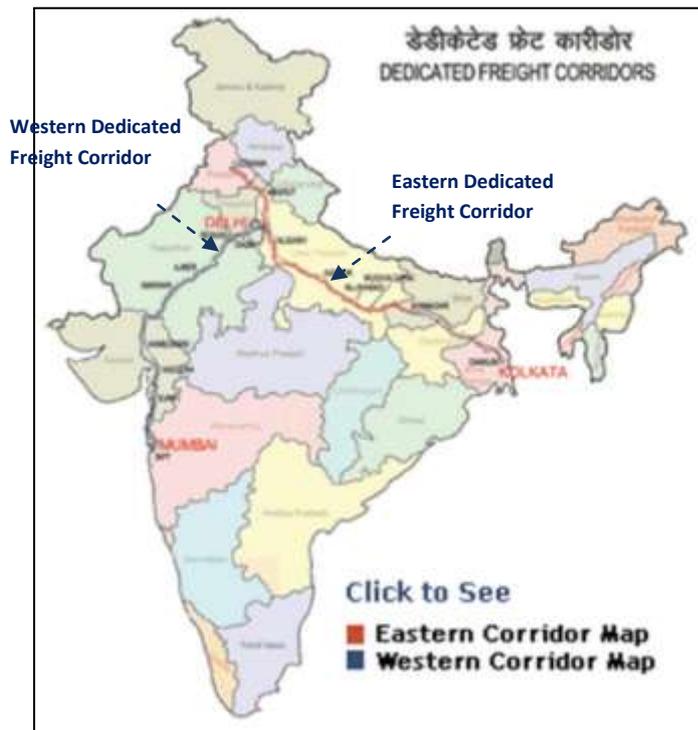
The proposed project presents an opportunity to promote planned development in the region. The “No Project Scenario” will not contribute to the growth of planned industrial developments. The alternative without the project is undesirable as the development will be unplanned and will lack the basic infrastructure facilities leading to pollution and contamination.

**2.2 Alternatives considered for development of industrial corridors**

The Government of India has proposed development of Dedicated Freight Corridors (DFCs) across the country in the form of railways. The creation of rail infrastructure on such a large scale is expected to drive the establishment of industrial corridors and logistic parks along its alignment. A Special Purpose Vehicle, Dedicated Freight Corridor Corporation of India (DFCCIL), therefore, has been set up under the administrative control of Ministry of Railways to undertake planning & development, mobilization of financial resources and construction, maintenance and operation of the Dedicated Freight Corridors.

In the first phase, DFCCIL will be constructing two corridors – the Western DFC and Eastern DFC- spanning a total length of about 3300 route km. The Eastern Corridor, starting from Ludhiana in Punjab will pass through the states of Haryana, Uttar Pradesh, Bihar and terminate at Dankuni in West Bengal. The Western Corridor will traverse the distance from Dadri to Mumbai, passing through the states of Delhi, Haryana, Rajasthan, Gujarat, and Maharashtra. Both the corridors have been illustrated in figure below Figure 2-1.

**Figure 2-1: Proposed Dedicated Freight Corridors in India**



## Comparative Evaluation of the Corridors

The Eastern DFC (EDFC) has a total length of 1839km and will connect Dankuni in West Bengal to Dadri in Uttar Pradesh. The 1483km long Western DFC (WDFC) connects Dadri in Uttar Pradesh to Mumbai in Maharashtra. The development of industrial corridor was considered along these two freight corridors and the final selection was governed by the following reasons:

### Population Density

The population density along the two freight corridors was considered as a primary factor for selecting the industrial corridor. The details of average population density for the states through which the eastern and western dedicated freight corridors pass are presented in **Table 2-1**.

**Table 2-1: Average Population Density for Eastern and Western DFC**

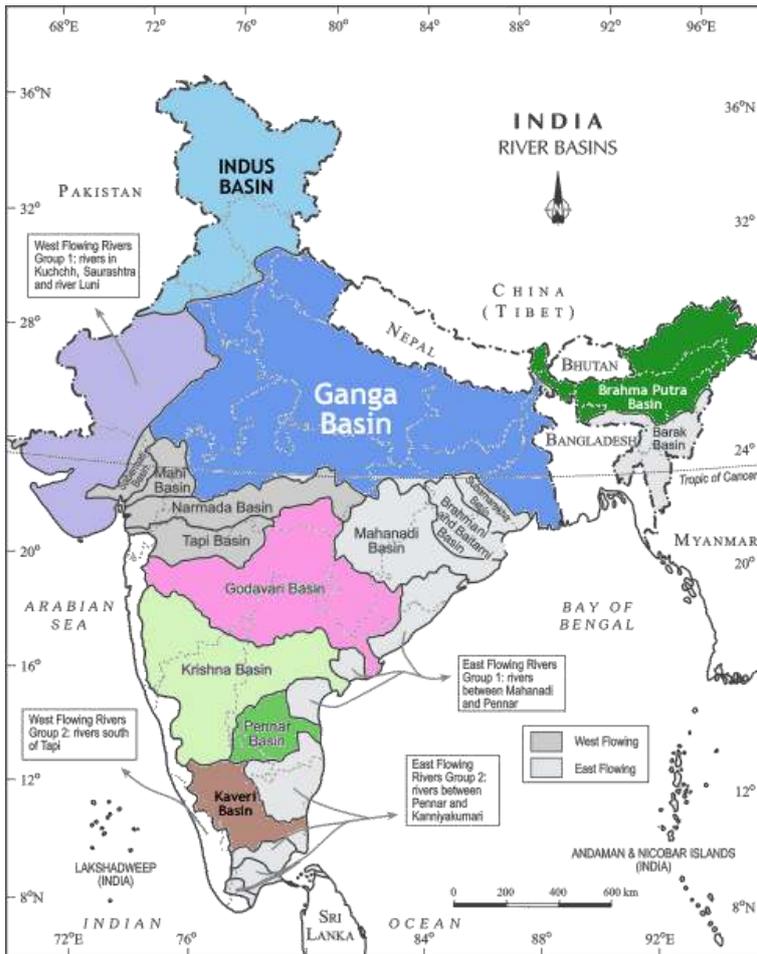
State	Average Population Density (Persons per sq.km)
<b>Eastern Dedicated Freight Corridor</b>	
Haryana	372
Uttar Pradesh	473
Bihar	685
West Bengal	767
<b>Western Dedicated Freight Corridor</b>	
Haryana	372
Rajasthan	129
Gujarat	211
Maharashtra	257

As seen from the Table 2-1 above, the population density along the eastern Dedicated Freight is significantly higher than along the western corridor. The development of the industrial corridor will, therefore, be more suitable along the western corridor as the aim of the project is to decongest cities and to develop well-established industrial areas.

### Land Fertility

The entire EDFC is positioned within the Indo-Gangetic Plain, which is a large and fertile plain encompassing most of northern and eastern India. The Indo-Gangetic belt is the world's most extensive expanse of uninterrupted alluvium formed by the deposition of silt by the numerous rivers which drain it. Whereas majority of the western DFC passes through Haryana and Rajasthan which do not have any significant surface water bodies. The map showing the important river basins is presented in Figure 2-2. The WDFC was observed to be more suitable for development as it is less suitable for agriculture. Delhi-Mumbai Industrial Corridor (DMIC) will be spread across the states of Rajasthan, Haryana, Gujarat, Maharashtra and Madhya Pradesh. The states of Maharashtra and Gujarat are drained by Godavari, Narmada and Tapi Rivers.

**Figure 2-2: River Basins of India**



**2.3 Alternative Site Options**

The Shendra Mega Industrial Park (MIP) has been planned as a new industrial area extending from the existing MIDC industrial park in Shendra. To undertake the initial identification and delineation of the Shendra MIP, two-step process has been undertaken –

- Step 1 – Site Suitability Analysis** – assessment of whole Aurangabad region for basic suitability
- Step 2 – Investment Region Alternatives** – feasibility of 3 sites for potential development

**Site Suitability Analysis**

As a part of planning exercise, a basic site suitability analysis was carried out for the whole Aurangabad Region to delineate a larger area suitable for development. Region of approximately 5175 km<sup>2</sup> area was considered as overall Area of Interest (AOI) and has been depicted in **Figure 2-3**. The AOI focused on areas to the south and east of Aurangabad city centre, including existing CIDCO land. Additional adjacent areas of potential value for development were also included in the assessment.

**Area of Interest (AOI)**

Current land use pattern in delineated AOI is predominantly irrigated and non-irrigated agricultural land. The Shendra MIP AOI falls largely within the fertile Deccan Plains and is relatively flat, with the only significant range of hills lying to the north of Aurangabad urban center, rising to approximately 920 meters. The upland and hilly region is dominated by forest and shrub habitats. The land falls away gradually to the south and southwest, towards the river Godavari, which flows northwest to southeast across the AOI. The most prominent water body within the Aurangabad region AOI is the Nathasagar/ Jayakwadi reservoir located on Godavari River south of Aurangabad city. It has a surface area of approximately 80 km<sup>2</sup> and receives water from Godavari River and its tributaries Shivna River and Kham River. Jayakwadi Reservoir is the only source of water in the entire region. All the rivers within the site belong to the Godavari basin and they flow in a general northwest to southeast direction following the topography. Jayakwadi Bird Sanctuary is also located in the Aurangabad AOI (refer **Figure 2-3** below). Developed and urbanized areas are largely limited to Aurangabad city and its immediate surroundings. The most recent industrial development in the AOI is the existing MIDC Shendra Industrial Park on Jalna road. Another important industrial development in the region is in Bidkin towards the south of AOI. The region is well by road network through NH 211, SH 148, SH 178 and SH 60. The main line of Central Railway connects Pune to Nagpur via Aurangabad. The nearest railway station to the site is at Karmad near the existing MIDC Shendra industrial area.

**Figure 2-3 Aurangabad Area of Interest (AOI)**



**Qualitative assessment of overall AOI**

The initial identification of suitable site for development of MIP has been done based on the qualitative assessment of overall AOI region on the following parameters-

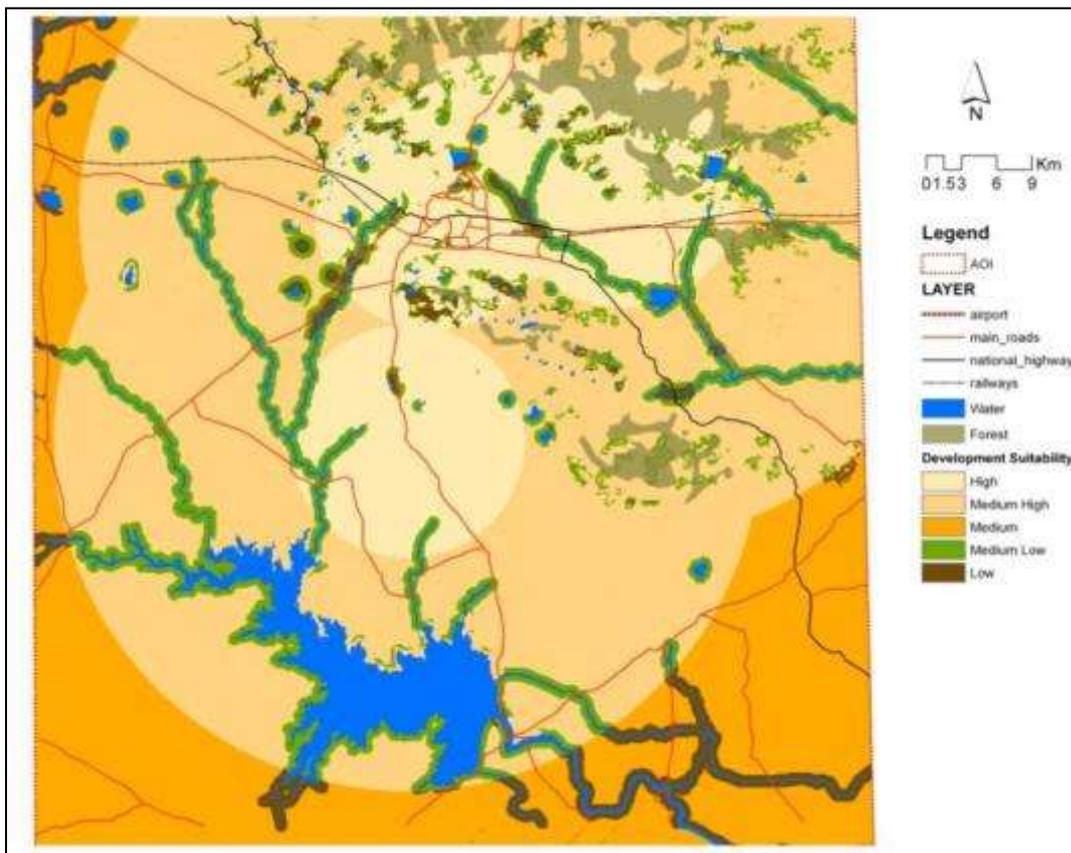
- Existing environmental sensitivity
- Existing and Planned land uses in the region

- Proximity to major transit systems, including National and State highways, Railways/Railway Stations and Airports
- Proximity to existing MIDC Industrial sites

The environmental sensitivity analysis clearly shows that development potential of the Aurangabad AOI is constrained to the north of the AOI and also to the south of the AOI, with unsuitable undulating topography found to the north, and the presence of large Jayakwadi Reservoir (which is also a Wildlife Sanctuary) to the south. The hills in the north and south east of AOI are zoned as Reserved Forest and thus unsuitable for proposed development. Additional constraints are posed by the low range of hills running northwest to southeast through the centre of the AOI. The largest area of contiguous land with low environmental sensitivity (and therefore more suitable for development) is found in the centre of the AOI, along with smaller pockets to the east and west of Aurangabad City Centre. The existence of MIDC Shendra, Bidkin industrial area in south and expansion areas in the Aurangabad hinterland also makes the center and north east of AOI suitable for proposed development of MIP.

Figure 2-4 shows the area suitable for development of MIP in the overall Aurangabad AOI. These areas are relatively flat, have low environmental sensitivity and have few existing or planned land use restrictions.

**Figure 2-4 Initial Site Suitability of Aurangabad AOI**



## Investment Region Alternatives

Based on qualitative analysis described above, it becomes evident that there are several options for the location of a Mega Industrial Park in the Aurangabad AOI. Three options which have been studied are as follows:

1. The first option is just south and north of existing MIDC Industrial Park at Shendra; and is presented in **Figure 2-5**.
2. The second alternative is the area around the town of Bidkin, south of Aurangabad on Paithan Road and is presented in **Figure 2-6**
3. A third alternative location is acobination area, comprising of an area around the MIDC Industrial Park at Shendra and an area in the southwest of Aurangabad-Beed Road, near Bidkin which is presented in **Figure 2-7**.

The map showing location of all the three alternatives is presented in **Figure 2-8**.

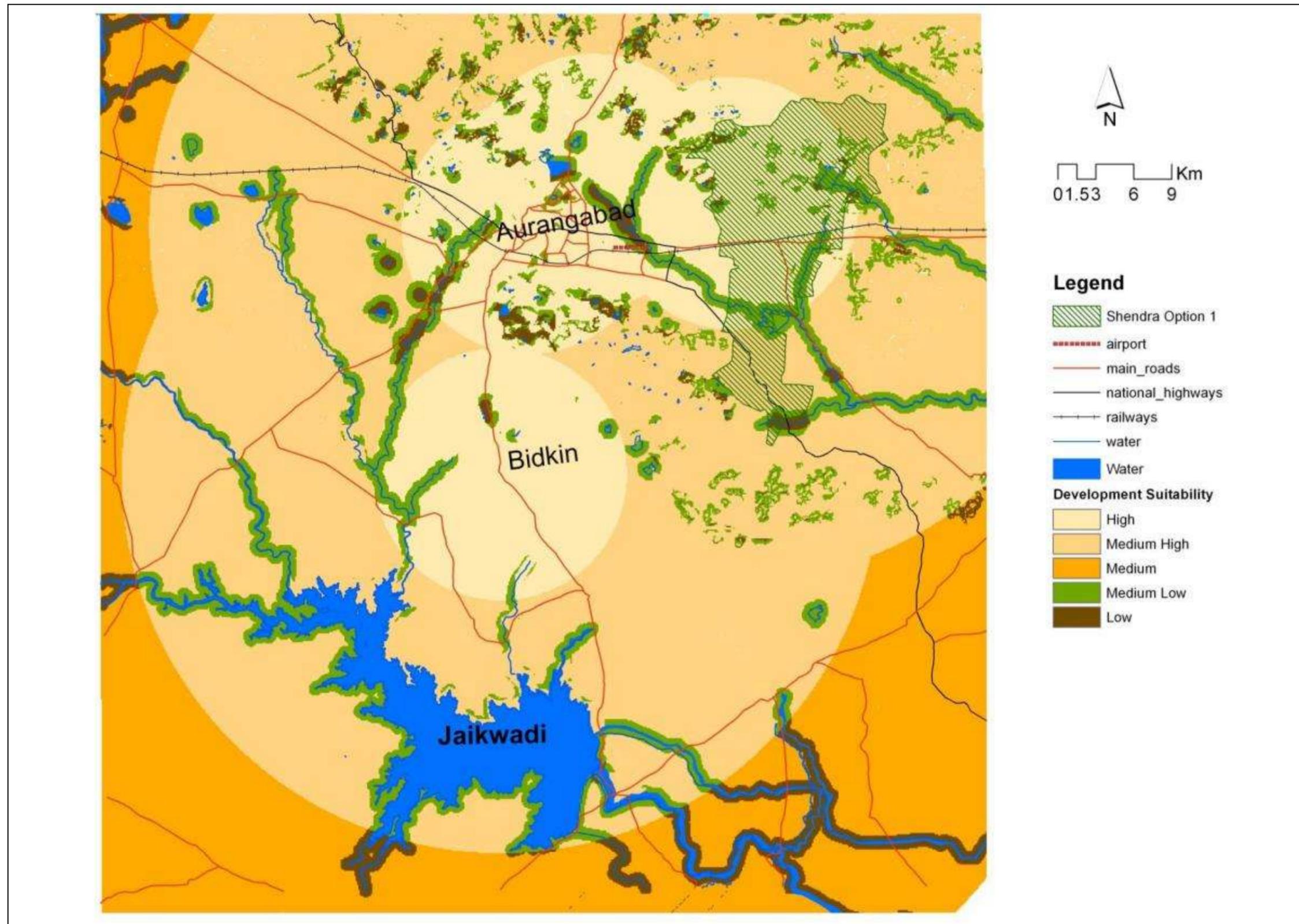
A detailed feasibility analysis was carried out to delineate final area for the development of MIP. The analysis was based on a ranking system taking into account topography and land use, water resources and their availability, socio-economic factors, environmental sensitivity and connectivity as detailed out in subsequent sections.

The details of the alternatives have been provided below:

### **Alternative 1: Around Existing MIDC Shendra Industrial Park**

The site considered as Alternative 1 comprises of 26 villages in tehsil Aurangabad of district Aurangabad. It is approximately 15 kilometers east of Aurangabad City Center. The area extends from about 10 km towards north of the existing MIDC Shendra Industrial development to 6km in the south and south west direction between SH-178 and NH-211. The site is relatively flat and unobstructed with majority being agricultural land. The areas can provide for the planning and development of one large compact integrated and connected Township. Sukhna Dam is the major water body that lies in the identified area for Alternative 1. The entire area surrounding Sukhna Dam is irrigated land with multiple crops. Apart from this, a number of drainage channels criss-cross the site. The site has excellent access and visibility for the major roadway (National Highway 211) and the existing national rail lines. The proposed site is 8-10 kilometers east of the Aurangabad airport. Expansion of the MIP would be constrained in the northern direction because of the hilly terrain. This alternative for MIP is presented in **Figure 2-5**.

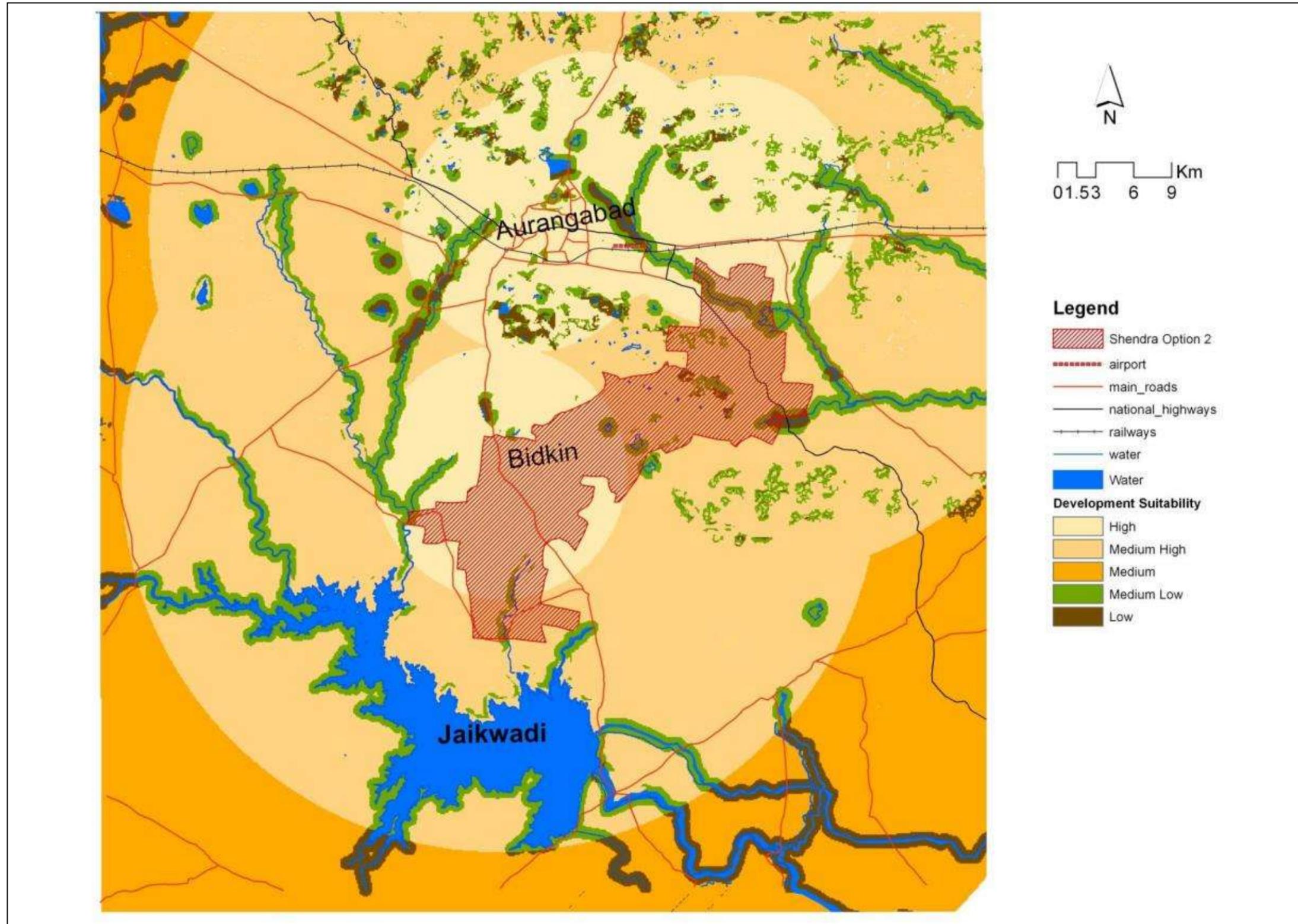
Figure 2-5 Site Alternative - 1 considered for MIP



***Alternative 2: MIP location around Bidkin town***

The site considered as second alternative site extends from south and south west of NH-211 towards the Jaikwadi Reservoir. The area includes 39 villages spread in Paithan tehsil and Aurangabad tehsil. The area between NH-211 and SH-148 is primarily fallow land with some parts under cultivation. There are some patches of barren and rocky land along the western boundary of site. A big patch of forest also lies towards the east of site boundary. The Jayakwadi dam is located 5 km south of the area. There are no major rivers running through or close to the site. However, the site does have numerous smaller river and channels that drain east to the Sukhna Reservoir or south/southwest to the Jaikwadi Reservoir. The extension of MIP under this alternative would be restrained in the south direction because of Jaikwadi Reservoir. The alternative 2 for MIP is presented in **Figure 2-6**.

Figure 2-6 Site Alternative - 2 considered for MIP



**Alternative 3: Combination of Alternative 1 and Alternative 2**

As Alternative 3, smaller areas have been carved out from the two areas delineated in Alternative 1 and 2 respectively and have been analysed for their suitability (**Figure 2-7**). If the two sites will be found suitable, two separate Mega Industrial Parks will be developed by DMICDC at these two locations.

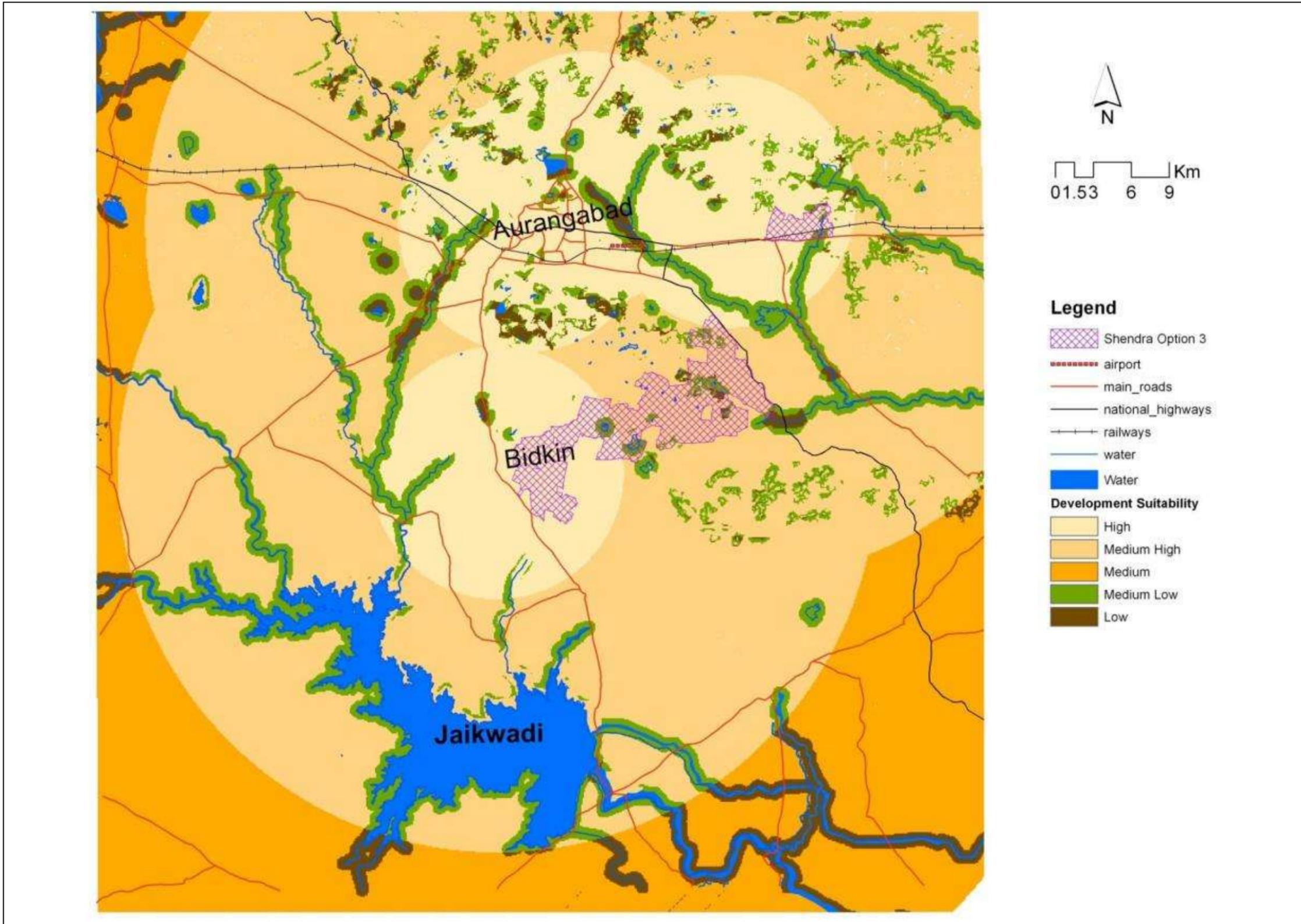
**Assessment**

The first parcel of land falls in the north direction of Jalna Road adjoining the existing MIDC Shendra Industrial Park. This area is spread over three villages namely Karmad, Ladgaon and Kumbephal.

The second land parcel falls in the southeast of the city of Aurangabad. This delineated area spreads over 22 villages in the Aurangabad and Paithan tehsils of Aurangabad district.

The land use of the first land parcel (close to existing Shendra MIDC) is productive agricultural land that is most likely irrigated with water from the Sukhna Reservoir. The hills at the western boundary of the site are largely barren land, denuded of vegetation cover by over-grazing and collection of timber/ firewood. About 15 kms farther down the southern tip of the delineated area is Jayakwadi Dam, one of the largest earthen dams in Asia and one of the biggest irrigation projects in the state of Maharashtra. Sukhna Dam and its catchment between NH-211 and SH-178 are excluded from site identified for Alternative 3. The site has good connectivity from SH-148 (Paithan Road), SH-178 (Jalna Road), and National Highway (NH) 211. NH-211 connects the site to the airport, railway station and city of Aurangabad. The alternative 3 for MIP is presented in **Figure 2-6**.

Figure 2-7 Site Alternative - 3 considered for MIP (selected option)



## Site Selection Criteria

The evaluation of site alternatives has been carried out based on a ranking system. A set of 15 parameters have been considered. Each parameter has been provided with score and weights based on their significance in selection of a site. The details of the parameters and the rationale for selection of these parameters have been provided in **Table 2-2**.

**Table 2-2: Rationale for Selected Parameters**

Subject Group	Parameter	Rationale
Connectivity	Proximity to NH and SH	This offers inter nodal/ modal connectivity and potential for regional and local bus based rapid transit system
	Proximity to DFC	It is important for industries to be located in proximity to DFC as NSIIR is expected to focus on export oriented industries. Shorter the lead distance lower is the logistics cost.
	Proximity to Aurangabad Airport	International connectivity is important for success of NSIIR.
	Rail Connectivity	This offers regional connectivity for freight movement and potential route for Mass rapid rail transit system.
Water Resources and Availability	Groundwater Depth	Higher the water table, more abundant is the groundwater resource
	Proximity to viable source of surface water	Availability of water resources in close proximity is essential for development of any industrial and residential township.
	Rainfall	Higher the rainfall, higher is the possibility of replenishing ground water in water starved areas
Topography and Land Use	Slope	Slopes have to be suitable for urban development
	Land Use/Land Cover	Lands which are not productive such as scrub land or wasteland are considered suitable for urbanization
Socio Economic	Population Density	Lower the population, lesser is the rehabilitation and resettlement issues
	Irrigation Density	Higher the irrigation density, higher is the agriculture development in the area
	Existence of industrial estate	Site near to any existing industrial development has been given preference.
Environmental Sensitivity	Distance from water body	The site should be located away from water bodies
	Proximity to ecologically sensitive features	The site should be as far from ecologically sensitive areas as possible
	Proximity to ASI sites	The site should be located away from ASI sites

The rationale for selecting of the above mentioned criteria and the sub-criteria are detailed in the following sub sections:

### Connectivity

The concept of industrial node is woven around its proximity to freight corridor and access to rail and road connectivity. The proximity to National Highways, State highways and Dedicated Freight Corridor was considered as a favorable factor due to its economic, social and environmental implications.

- The economic factors included cost implications in transport of raw material, finished goods and construction of new access road/rail connections

- The social factors included additional loss of land, crop and community assets arising out of development of new road and rail connections.
- The environmental factors considered with creation of long approach roads and rail lines include additional loss of trees/ vegetation along the corridor of Impact, habitat loss, habitat fragmentation, change in local drainage pattern and incremental change in ambient air noise and soil quality.

Proximity to Central Railway line and Aurangabad airport and NH-211, SH-178 and SH-148 has been considered as a favorable factor as it would also enhance connectivity of the site.

### ***Water Resources and Availability***

Availability of water both in terms of quality and quantity was also considered as important criteria. The sub factors considered for water resources were.

- Proximity to viable source of water
- Availability of Ground water
- Rainfall

#### **A. Proximity of viable source of water**

Availability of water resources in close proximity is essential for development of any industrial and residential township. The site options which were close to viable surface water bodies were considered as favorable, while those located at distance were considered as less favorable owing to following factors:

- Larger cost implications resulting from construction of new reservoirs, pipelines etc.
- Construction of new pipeline will involve land issues, loss of crop, need for right of way and other changes at micro-level
- It will also be prone to water losses, water theft and other community issue pertaining to water demand along the route.
- Loss of trees/vegetation along the route of water transport

The viability of water resource was preferred over proximity of the water resource. The viability of water resource was understood during the planning stage based on the development plan of the local administration, competitive use and resource capacity. In case of Shendra MIP, proximity of sites to Jayakwadi Reservoir in Paithan tehsil has been considered as it is the only viable source of water in the region.

#### **B. Availability of Ground water and Water Quality**

The availability of groundwater was also considered as an important criterion although dependence on ground water is very limited. The site options with high water levels and good water quality were preferred as it will reduce issues such as water theft, tampering with pipelines and competitive use of the identified surface water resource.

#### **C. Rainfall**

Areas with high rainfall were considered to be better options as it would enable natural recharge of water resources. It will also provide opportunity to install rain water harvesting structures and undertake artificial recharge of the ground water resources.

### ***Topography and Land use***

Topography and land use were considered as key parameters for site selection. Areas with steep slopes or notified as Reserved/Protected Forest were excluded from the site selection. The parameters that were considered for topography and land use are detailed below:

#### **A. Slope**

Areas with gentle slope were preferred over areas with steep slopes because of the following concerns:

- Steep slope areas will require more levelling operations thereby resulting in loss of top soil;
- Steep slope areas are highly prone to soil erosion during construction activities, loss of soil can also adversely affect the receiving water bodies;
- Alteration of slope can alter the micro level drainage of the area which may affect the catchments downstream;
- Movement of vehicles with load along the slope will result in increase in consumption of fuel and resulting emissions;
- Movement of water and waste water up along the slope will require additional fuel consumption and related emissions

Areas with hilly terrain or requiring extensive leveling were avoided to the extent possible to reduce potential for erosion and fuel consumption from additional use of machinery.

#### **B. Land use**

The land use and existing agricultural practices were considered as key criteria for selection of site. Areas with rich biodiversity or identified as forest land were excluded or delineated from the options considered to the extent possible. Areas with existing agricultural practices and other community benefits were considered as less favorable while areas that were fallow land or barren land were considered as more favorable.

Single Cropped Land: Single cropped land usually depends on rainfall for irrigation and remains vacant for the remaining part of the year. Single crop land was considered as less favourable for the site selection as it involves livelihood issues and economic displacement.

Double Cropped Land: Double cropped land pertains to land which remains cultivated for most part of the year. Such lands are important sources of livelihood for local community and were therefore considered as least favourable. Double cropped land was avoided to the extent possible and was considered only wherever they were unavoidable.

Current Fallow: Fallow land was preferred as it had minimal impact on the local socio-economics. Most of the fallow land considered was devoid of any agricultural practices for long time and not being used for any productive community use.

Wasteland: Wasteland was considered as the preferred location as the impact from such land was minimum.

Barren rocky/Stone waste: Barren rocky/stone wasteland was considered also considered as suitable owing to insignificant impact on social and ecological aspects, however removal of stones and excavation activities will have economic and environmental (blasting, drilling etc.) implications therefore it is less preferred to land with scrubs.

Forest Land: All notified forestland were avoided from site selection, wherever forest area fell in the site area it was delineated. Forest land was considered as least preferred and avoided to the extent possible to ensure limited loss of trees and impact on ecology.

### ***Socio Economic***

Socio-economic development and social up-liftment of the local community and minimal impact on the existing social fabric was one of the key criteria for site selection. The site selection ensured that land take leading to physical displacement of household or resettlement were not considered. The key parameters selected were:

- Population Density
- Irrigation Density
- Existence of Industrial Area

#### **A. Population Density**

Areas with high population density were less preferred as the purpose of the project is to decongest cities/towns and create parallel areas of development and income opportunities. Areas with low population density also limited the extent of any potential social impact.

High population densities would also result in hindrance to create new infrastructure and support facilities with disrupting the exiting once, there areas with low population density were rated higher.

#### **B. Irrigation Density**

As addressed under the subhead of land use, agricultural land was less preferred for site selection. This was further stressed upon in the areas where agricultural land was unavoidable preferences were given to irrigation density. The areas with high irrigation density (above 35%) were least preferred while those had low irrigation density (below 5%) were more preferred.

#### **C. Existence of Industrial Areas**

Existing industrial areas in the proximity were considered while site selection, as integration of such facilities and existing developments will prevent creation of parallel infrastructures. The site options in proximity to existing industrial estates or already a part of proposed plan were given high preference over those away from such developments. However, all the alternatives considered for proposed Shendra MIP lie within 1 km of existing industrial developments of MIDC Shendra, this factor was not considered as decisive for selection of site.

### **Environmental Sensitivity**

Besides the above factors, environmental sensitivity was also considered as a criterion for the site selection. The criteria were based on the proximity of site to important water bodies, ecologically sensitive areas and protected structures.

#### **A. Distance from water body**

Distance from water body was considered as a parameter for environmental sensitivity because the drainage pattern in the area will be impacted and the probability of contamination from construction and operation of integrated township will increase with proximity of water body. The water bodies considered were those which had local importance, or influence the drainage of the area, or had downstream stakeholders. For Shendra MIP, Jayakwadi Reservoir, Sukhna Reservoir and other small reservoirs within the site have been considered.

Sites with water bodies falling in the demarcated area was less preferred as compared to those located away from the water bodies. Proximity to water bodies with check dams, bunds etc. were also less preferred.

#### **B. Proximity to ecologically sensitive area**

Proximity to ecologically sensitive areas such as Reserved/Protected Forest, sanctuaries/National Park, wetland, migratory corridor and other notified areas were considered as important factor for site selection. Proximity to sanctuaries / National Park was considered within 5 km as the major project impacts are likely to be limited within this area. Further, during the planning stage, care will be taken to locate the industrial areas away from the ecologically sensitive features. Areas falling under any migratory corridor have not been considered for selection to the extent possible. Reserved/Protected forest within or in proximity were less preferred as they may get exposed to residual noise and air impacts, however impacts will be limited as the all notified forest land will be delineated and no diversion is proposed. For the options evaluated, Jayakwadi Bird Sanctuary and Reserved forest are the ecologically sensitive features considered.

#### **C. Proximity to protected Structures**

Site options in close proximity to monuments and structures protected by Archaeological Survey of India were not considered for the project. Activities such as demobilization, piling, drilling etc can cause vibrations leading to potential damage to such structure. Also during operation of industrial activities, residual pollution levels can hamper the structure of old monuments. The site options close to location of protected monuments were less preferred than those falling in areas away from any such structures. However there are no protected monuments or cultural heritage sites located in the immediate vicinity of any of the proposed alternatives.

The scores and weights provided to each parameter and subject group have been discussed in **Table 2-3.**

**Table 2-3: Assigned Scores and Weights**

Subject Group	Parameter	Score	Weight
Physical and Topography	<b>Slope</b>		25
	Below 10%	10	

Subject Group	Parameter	Score	Weight
	Between 10% and 20%	5	
	Above 20%	1	
	<b>Land Use/Land Cover</b>		
	Single Cropped	4	
	Double Cropped	1	
	Agricultural Plantations	3	
	Current Fallow	8	
	Wasteland	10	
	Barren rocky/Stone waste	9	
	Forest Land	1	
	Socio Economic	<b>Population Density</b>	
below 200 persons/sq.km		10	
200-400 persons/sq.km		7	
400-600 persons/sq.km		5	
600-800 persons/sq.km		3	
above 800 persons/sq.km		1	
<b>Irrigation Density</b>			
Below 5%		10	
5-15%		7	
15-25%		5	
25-35%		3	
Above 35%		1	
<b>Development Pattern</b>			
Existence of industrial Estate within 15 km	10		
Water Resources	<b>Ground Water Depth</b>		20
	2-5 m	10	
	5-10 m	6	
	10-20 m	3	
	20 m and above	1	
	<b>Rainfall</b>		
	Above 600 mm	10	
	600-500 mm	6	
500 and below	3		
Environmental Sensitivity	<b>Distance from Water Body</b>		25
	0-2 km	1	
	2-4 km	3	
	4-6 km	5	
	6-8 km	8	
	8 km and above	10	
	<b>Proximity to ecologically sensitive area (within 5km)</b>		
	Reserved/Protected Forest	5	
	Sanctuaries / National Park	1	
	Wetland / Mangrove	3	
	Migratory corridor	2	
	Other notified areas	3	
	None	10	
	<b>Proximity to ASI sites</b>		
0-500 m	1		
500-2000 m	5		
>2000 m	10		
Connectivity	<b>Road Connectivity - Distance from NH and SH</b>		10
	0-2 km	10	
	2-4 km	8	
	4-6 km	5	

Subject Group	Parameter	Score	Weight
	6-8 km	3	
	8 km and above	1	
	<b>Proximity to DFC</b>		
	Up to 100 km	10	
	100-200 km	8	
	200-300 km	5	
	300-400 km	2	
	400 km and above	1	
	<b>Rail Connectivity - Distance from Railway Line</b>		
	0-2 km	10	
	2-4 km	8	
	4-6 km	5	
	6-8 km	3	
	8 km and above	1	
	<b>Proximity to Aurangabad Airport</b>		
	Up to 10 km	10	
	10-15 km	8	
	15-20 km	5	
	20-30 km	2	
	30 km and above	1	

## Weightage to Criterion

The weightage given to all the five primary criteria are as provided in **Table 2-4**.

**Table 2-4: Criteria for Rationale**

Criteria	Weightage	Rationale
Connectivity	10%	Proximity to Highways, highways and rail links is considered as a favorable factor. The Shendra project area has good connectivity of road and rail network.
Water Resources	20%	Availability of water resources is of prime importance for such a large industrial development. The project area has good availability of water resources.
Physical and Topography	25%	It is envisaged that the large scale industrial development will result in alteration of the topography and land use of the region to a considerable extent. Hence this parameter has been given maximum (one fourth) weightage.
Socio-Economic	20%	The project involves acquisition of land in the Aurangabad district. Socio-economic development and social up-liftment of the local community is envisaged due to implementation of the project. Therefore the existing socio-economic condition of the area is an important indicator for finalizing the site.
Environmental Sensitivity	25%	The upcoming industrial development is likely to have major impacts on the surrounding environment of the region. Therefore it is important to understand and assess the environmental sensitivity of the proposed project area before finalizing the site.

## Comparative statement for site selection

Based on the above ranking system, the site alternatives were evaluated. The final scores for all the three options have been presented below in **Table 2-5**. Detailed scoring for all the three alternatives considered has been presented in Annexure II.

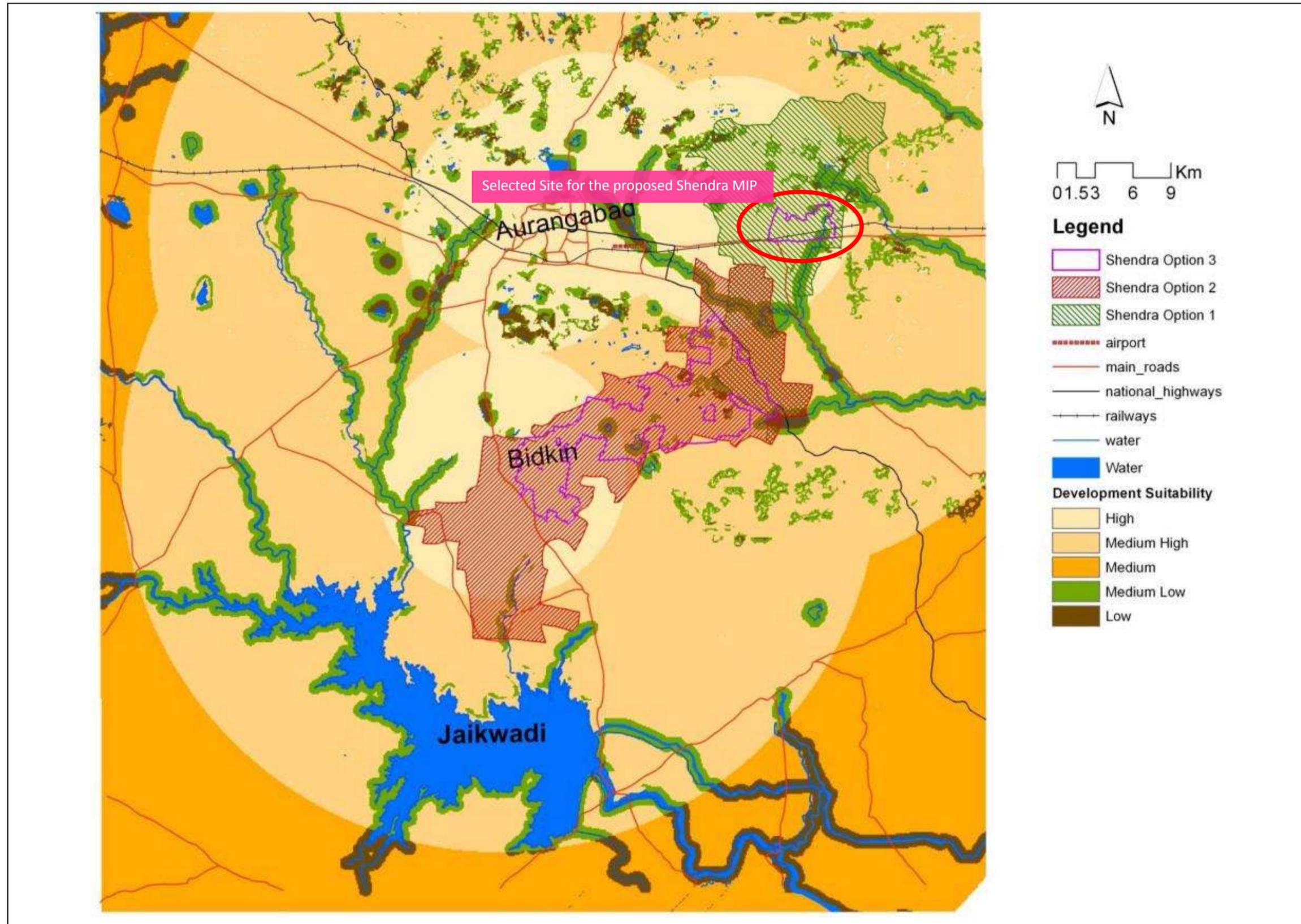
**Table 2-5: Evaluation of Alternate Options**

Alternatives	Connectivity	Water Resources and Availability	Physical and Topography	Socio-Economic	Environmental Sensitivity	Total Score
Alternative 1	60	70	51	79	47	60
Alternative 2	43	63	70	90	45	63
Alternative 3	54	70	81	85	58	71

An analysis of the sites on the above mentioned criteria indicated that the **Alternative 3** is most **suitable for the proposed development**. DMICDC has planned to develop the site near to Shendra town as **Shendra MIP** (adjacent to existing MIDC Shendra Industrial Park).

**Figure 2-8** presents the three alternative sites for the proposed MIP at Shendra.

Figure 2-8 Three Alternatives shown for the proposed MIP at Shendra



**Table 2-6 Evaluation of Delineated Alternatives**

Parameter	Alternative 1	Alternative 2	Alternative 3
<b>Connectivity</b>	The site has excellent access through the major roadway (National Highway 211 and State Highway 178) and the existing national rail line – Central Railway Line. The existing Karmad Junction Station is within the delineated area. The Aurangabad Airport is also with 10 km from the site. The proximity to major connectivity infrastructure would mean faster movement of industrial goods/ raw materials/ finished products at industrial areas of delineated area and reduced logistic costs for the industries.	The accessibility of site to highways and road network is poor. The site is connected only through NH 211 towards the north and SH 148 which passes through Bidkin. The central line station of Karmad is around 20 km from the delineated area. However, the existing airport of Aurangabad is close to the northern part of the site. The southern tip of delineated area is very far from airport and railway station which will increase the logistic cost and the time taken to transport goods from this region as compared to other two alternatives.	The two non-contiguous land parcels considered as Alternative 3, envisaged to be developed into two separate MIPs have good connectivity through a series of National and State highways including NH 211, SH 178 and SH 148. The south-central railway line connects Aurangabad to the Karmad which lies within the site. The site also has good accessibility to the existing Aurangabad Airport. All these factors will considerably reduce the logistic cost and time requirement for movement of industrial goods thus making site suitable for development. It has been planned by DMICDC to develop the site near to Shendra town as Shendra MIP.
<b>Water Resources and Availability</b>	The site lies entirely in Aurangabad tehsil of Aurangabad district which receives fairly high amount of rainfall and the depth of ground water is also good in the range of 5-10m. However, the only viable source of water in the region is Jayakwadi Reservoir which is more than 35 km from the site. The maximum distance to the northern portion of delineated area is approximately 50 km from Jayakwadi Dam which makes this option unsuitable for development with respect to water resource availability.	The rainfall and groundwater resources in this site are stressed. For major portion of the delineated area, the rainfall is lower than 500 mm and the ground water depth in pre monsoon season is in the range of 10-20m. Most of the area covered in this alternative is with 15 km distance of the Jayakwadi Reservoir, thus ensuring excellent availability of surface water. The cost implications for transporting water in this alternative will be lowest as compared to other alternatives.	Most of area receives rainfall above 600 mm and ground water depth during pre-monsoon season generally ranges between 5-10m. The land near the proposed Shendra MIP is approx. 6 kms from Sukhna Lake. This alternative along with Alternative-2 is most suitable for development with respect to water resource availability.
<b>Physical and Topography</b>	The site is generally flat and slopes gently towards the Sukhna Reservoir. However, the northern part of delineated area has high slope in	The delineated region is largely characterized by gentle slopes which slope towards the Jayakwadi Reservoir. Although the general slope of the area is	The site comprises of gentle slope which is mostly less than 10%. This is suitable for development as it involve less cutting/filling operations and will

Parameter	Alternative 1	Alternative 2	Alternative 3
	<p>the range of 10% to 20% with some parts having more than 20% slope. The land use in the area is dominated by productive agricultural land (with multiple crops) which is mostly irrigated with water from Sukhna Reservoir and other small dams in the region.</p> <p>The region is strongly dependent on agriculture and is therefore not appropriate for development.</p>	<p>conducive to proposed development, the land use is mixed with some portions of fallow land and rest as agricultural land. Mostly double agriculture is practiced in the region because of its proximity to Jayakwadi Dam. The land use thus makes the site unfavorable for development.</p>	<p>therefore entail reduced loss of top soil. There is only small area of hilly land lying to the west of area; however, it is excluded from the delineated boundary. The predominant land use in the region is agricultural which is mostly categorized by single crop. However, a major portion of delineated land comprises of fallow land which is suitable for the development of Mega Industrial Park.</p>
<b>Socio Economic</b>	<p>The population density and economic backwardness levels in the region are unfavorable for development. Although the population density in the area is low (&lt; 200 persons per sq km), the irrigation density is relatively high as compared to other two alternatives. It ranges from 5% to 25% of the area, emphasizing on the dependence on agriculture in the region. The entire area surrounding the Sukhna Reservoir is irrigated with multiple crops. The area is around the existing MIDC Shendra industrial area therefore provides for good alternative for development. Overall in terms of socio-economic factor the site scores low because of high irrigation density.</p>	<p>The socio economic factors in the region such as population density and economic backwardness levels are conducive to development. The population density and irrigation density in the area are low. The site is also located around Bidkin which has good presence of presence of good number of industries and industrial infrastructure and therefore the future development in the region will only require expansion of and strengthening of existing resources.</p>	<p>The delineated area has comparatively low population and irrigation density. The region has approximately 200-400 persons per sq km of area. The irrigation density ranges between 5% and 25%. The site will also benefit from the existence of an industrial area – MIDC Shendra Industrial area towards west. The areas to the east are currently notified for acquisition and expansion of the existing industrial park. The areas can provide for the planning and development of one large compact integrated and connected Township. Currently, the proposed City Comprehensive Plan for the area designates the areas to the west and south of the MIDC Shendra Industrial Park for mixed use urban development that would allow for the creation of comprehensive new Township. Limited potential social impact. Combined together, the socio-economic factors such as population and irrigation density and development plan makes the site suitable development of MIP.</p>

Parameter	Alternative 1	Alternative 2	Alternative 3
<b>Environmental Sensitivity</b>	<p>For environmental sensitivity, the distance from Jayakwadi Reservoir and other small water bodies in the region and ecologically sensitive features comprising of Reserved forest and Jayakwadi Bird Sanctuary have been considered. The Jayakwadi Reservoir lies just south of the delineated boundary and will be directly impacted by development under this alternative. Also the ecologically sensitive Jayakwadi Bird Sanctuary lies with 5km of most of the villages within the site.</p>	<p>Sukhna Reservoir and Bangaon Reservoir are the two most important water bodies within the site and most of the villages lie in close proximity (within 4 km distance) to them. Also most of the northern portion of delineated boundary is marked as reserved forest. Thus environmental sensitivity criteria including presence of water bodies and ecologically sensitive reserved forest makes the site highly unsuitable for development of proposed Mega Industrial Park.</p>	<p>The distance from three prominent water bodies viz a viz Jayakwadi Reservoir, Sukhna Reservoir and Bangaon Reservoir (north of Shendra MIP), and ecologically sensitive features including Jayakwadi Bird Sanctuary and Reserved Forest has been considered for evaluating the environmental sensitivity of this alternative. Jayakwadi Reservoir and Bird Sanctuary lie approx. 40 kms from the southern tip of the boundary and therefore will not have any significant environmental impact. However, Sukhna and Bangaon Reservoir are close to the some of the villages in the northern part. There is also a patch of reserved forest north of the site boundary. Only few of the villages in north are within 5 km distance of reserved forest. Taking into account all the environmental factors, this alternative is most favorable for the development.</p>

### 3. Project Description

This Chapter presents the information related to various attributes of the proposed development including details of industrial, residential and commercial facilities. Population projections and expected employment generation are also provided. Both construction and operation phases of the project have been detailed in this Section.

#### 3.1 Key Features

The Shendra Mega Industrial Park (MIP) project aims to bring about industrial development and seeks to double the employment potential, triple the industrial output and quadruple exports from the region over every five years. The proposed Shendra MIP is located in Aurangabad district of Maharashtra comprising of 845.26 ha of delineated land area to be developed as mixed land use, spread over 3 villages- Karmad, Ladgaon and Kumbhepal in the Aurangabad tehsil. For the EIA study, an area of 10 km extending from the boundary of the delineated Shendra MIP has been considered as study area.

The key features of the project are presented below:

**Table 3-1 Key Details of the Project**

Parameter	Details
District	Aurangabad
Proposed Project Area	845.26 Ha
Spread over villages	3 villages namely Karmad, Ladgaon and Kumbhepal
Project Resident Population size	39220
Direct Employment	51026 (12213; industrial and 38813; non-industrial employment)
Water Demand	approx 27-30 MLD (including approx. 11-15 MLD industrial water demand)
Source of Water	Existing MIDC's 72 MLD WTP at Waluj, which sources its water from Jayakwadi reservoir
Waste Water generated	Approx. 17-20 MLD (8-9MLD Domestic waste water + 9-10 MLD Industrial effluent)
Sewage Treatment Plant (STP)	One approx 10.0 MLD STP MBR technology
Effluent Treatment Plant (ETP)	Individual industries to treat effluent upto secondary treatment.
Common Effluent Treatment Plant (CETP)	One 9.0 MLD CETP To treat only the pre-treated effluent of a defined quality
Municipal Solid Waste generated	Approx. 41 TPD
Industrial Solid Waste generated	Approx. 356 TPD (Hazardous + non-hazardous)
Power requirement for MIP	Approx. 350 MW (Industrial demand 233MW (67%))

#### 3.2 Project Area and Study Area

**Project Area** – Based on the land demand assessment based on economic projections and presence of existing environmentally sensitive features, an area of 845.26 hectares has been identified. Areas

such as reserve / protected forests and undulating hilly terrain have been excluded from the selected site.

**Study Area for EIA study**– For the purpose of undertaking an environment and social impact assessment, an area of 10 km extending from the boundary of the Project Area is referred to as the Study Area in this report.

### 3.3 Site Description

#### Site Location

The proposed site for Shendra MIP is located towards the east of Aurangabad city, falling in Aurangabad district of Maharashtra. Planned adjacent to the existing MIDC’s Shendra Industrial Area, and north of Jalna road, the proposed Shendra MIP is strategically positioned for direct connection to major state and national highways and rail network. The area will also provide connections to the city of Aurangabad on new expressways leading to NH-211, SH-148, MH SH-30.

#### Geographical Coordinates

The geographical coordinates of the Shendra MIP project site are provided in **Table 3-2** and presented in .

**Figure 3-1 Geographical Coordinates of delineated Shendra MIP**



Source: Google Earth

**Table 3-2 Geographical Co-ordinates outlining the Site**

Points	Latitude	Longitude
A	19°53'23.89"N	75°30'39.89"E
B	19°53'37.83"N	75°33'0.63"E

Points	Latitude	Longitude
C	19°52'31.73"N	75°33'13.21"E
D	19°52'4.87"N	75°30'14.79"E

**Site Surroundings**

The delineated Shendra MIP comprises mostly of rural settings which includes both agricultural fields and village settlements. The project area of 845.26 ha is spread over 3 villages- Karmad, Ladgaon and Kumbhephal in the Aurangabad tehsil of Aurangabad district. The village map has been presented in Figure 3.2.

**Figure 3-2 Map showing village map of Shendra MIP**



The land use is dominated by productive agricultural land that is most likely irrigated with water from the Sukhna Dam Reservoir located in the south direction. Some parts of the hills located on the western and eastern side of the project site boundary are also zoned as reserved forest. However, these reserved forests are highly degraded due to excessive grazing and other anthropogenic activities. No other protected or reserve forest area is reportedly present within the study area. Immediately to the east of the project boundary lies the existing MIDC Shendra Industrial area.

The surrounding region comprises of relatively flat land with two small areas of hilly land lying to the north and west of the project area that reach a height of over 750 m. The land between these two hill ranges forms a valley draining to the Sukhna Reservoir. Another important water feature is

Jayakwadi Reservoir and Jayakwadi Wildlife Sanctuary which lies about 40 km towards the south of the delineated project boundary.

### Accessibility to Site

Adjacent to the existing Shendra Industrial Area, the Shendra MIP site is strategically positioned for direct connection to major state highways and the national rail network. The area will also provide connections to the city of Aurangabad on through National Highway (NH) 211, SH-178 (Jalna Road), and SH-148 (Paithan Road).

**Figure 3-3** shows the existing road and rail connectivity of the area.

National Highway 211: NH-211, commonly known as Beed Road, connects Aurangabad to Dhule in the northwest and Solapur in the southeast. The road connects the MIP site to the airport, railway station, and city of Aurangabad.

State Highway 178: SH-178, commonly known as Jalna Road, connects Aurangabad to Jalna and then to Nagpur. The road connects to the Shendra parcel of the MIP.

State Highway 148: SH-148, commonly known as Paithan Road, connects Aurangabad to Paithan in the south and provides an access to the proposed Shendra MIP.

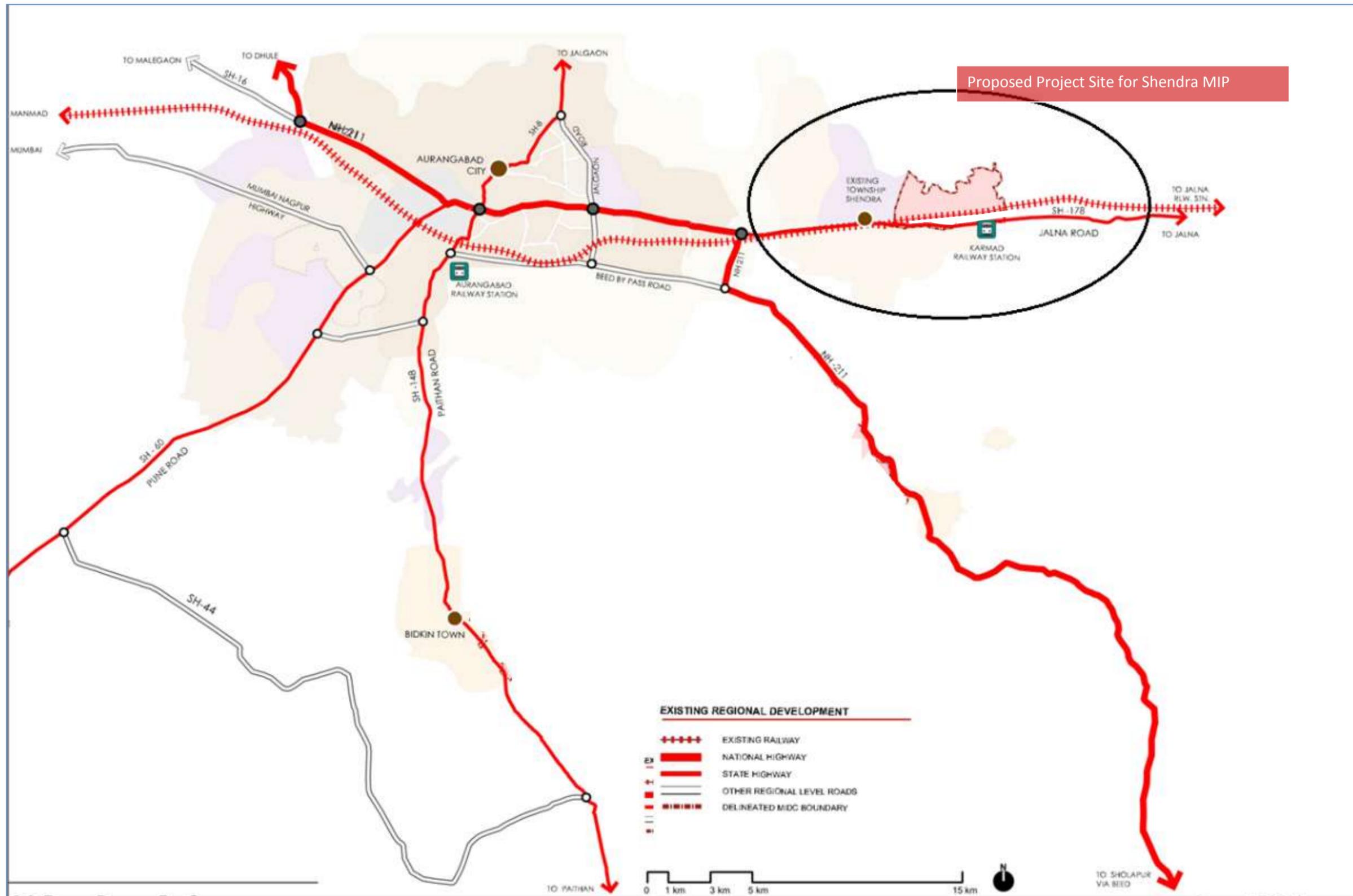
State Highway 60: SH-60, commonly known as Pune Road, does not directly connect to the MIP site but vehicles from Pune can reach the MIP site via SH-178, SH-148, or NH-211.

Railways: The main line of the Central Railway connects Aurangabad to Manmad, about 120 km away. The nearest railway station to the site is at Karmad, which adjoins the new Shendra area acquired for the MIP.

A rail siding is also proposed near Karmad station, adjacent to the main line on the station building side (the left side when going from Karmad to Mudkhed) ahead of Karmad station between the Manmad–Parbhani section of the Nanded Division, to facilitate efficient movement of goods.

Although Aurangabad is well connected by SH-148, SH-176, and NH-211, still requires the augmentation of existing linkages and development of new network connections to connect the Shendra MIP to the existing urban city centre and industrial areas. Better connections are also required to the nearby districts of Nashik, Pune, and Ahmednagar. The main airport is at Chikalthane, Aurangabad, which is about 10 km from the Shendra MIP site.

Figure 3-3 Existing Road and Rail Connectivity of Shendra MIP



### 3.4 Project Overview

The proposed project is an industrial area development project and has been planned as a mixed land use development comprising of residential, industrial and commercial land uses. The subsequent sub-sections provide the project description.

#### Project Objectives

The vision behind Shendra MIP is to identify and harness the potential of Maharashtra’s leading manufacturing industries in a sustainable manner. Shendra MIP, positioned on the outer ring of urban center of Aurangabad, will be developed as a state-of-art, mixed use community that is transit oriented and clean, low carbon city and provides a healthy, lifestyle for working and learning. To achieve these objectives, a series of key guiding principles have been adopted for Shendra MIP.

#### Development Concept

The key guiding principles adopted for formulating the Development Plan for Shendra MIP have been discussed briefly in **Table 3-3**.

**Table 3-3 Key Guiding Principles for formulating the Development Plan for Shendra MIP**

Guiding Principle	Strategy
Compact Development	<ul style="list-style-type: none"> <li>Develop a series of high-tech, transit-oriented centers integrated with the greater city of Aurangabad</li> <li>Conserve land and promote livability, transportation efficiency, and walkability</li> <li>Promote high density, compact development which would preserve green buffers between the urban regions.</li> </ul>
Livable Communities	<ul style="list-style-type: none"> <li>Create a high-quality environment in which people can work and live</li> <li>A gradation of densities for industrial and residential land use is proposed to ensure maximum compatibility of land uses. The high-intensity, most polluting industries are located farthest from the residential neighbourhood.</li> <li>Variety of open spaces will be provided within the development to encourage walking, physical activity, and time spent outdoors.</li> </ul>
Connectivity	<ul style="list-style-type: none"> <li>Establish a well-connected system of transportation services that integrates the existing MIDC industrial areas at Shendra with the proposed MIP. Also connectivity will be provided between the MIP and the residential areas, from the workers will commute for work.</li> <li>A 90 m central spine road has been planned which will connect various industrial clusters. This 90 m central spine road connects the MIP with the 30 m State Highway road at four locations.</li> <li>The 90 m wide road planned in the east, adjacent to the Logistic</li> </ul>

	<p>hub connects the MIP to Bidkin town. The four roads also provide a good access to the Karmad rail line.</p>
<p>Identity</p>	<ul style="list-style-type: none"> <li>● Establish an identity by defining distinct industrial clusters across the Shendra MIP with vibrant centers and a range of densities and built forms.</li> <li>● A Central Business District has been planned within the proposed Shendra MIP, near the existing MIDC Industrial Area in the east direction.</li> </ul>
<p>Sustainability</p>	<ul style="list-style-type: none"> <li>● Set a precedent for sustainable development by protecting the ecological landscape, promoting clean industries, promoting renewable energy, and endorsing sustainable social development</li> <li>● While siting of industries, the concept of ‘industrial symbiosis’ will be adopted, wherein the willing industrial facilities exchange materials, energy, or information in a mutually beneficial manner.</li> <li>● The concept of ‘industrial ecology’ will also be adopted, where the material flows and energy flows through industrial systems will be evaluated. Clustering of industry will be done in such a manner that the waste generated from one industry could be used as a rawfeed to the adjoining/ surrounding industry thereby reusing materials and have a largely closed loop cycling of materials to improve environmental performance of the industries.</li> <li>● Only low-intensity or clean industries have been planned in the MIP.</li> <li>● The area in the south of the proposed MIP has been designated for residential purpose in the Aurangabad Metropolitan Area Development Plan. It is understood that the work force will travel from these residential areas to Shendra MIP for work making the development self sufficient and self supporting.</li> <li>● A complete multi-modal transportation and transit system complementing the land use distribution will be provided to enable an efficient and sustainable living environment.</li> <li>● Improve community access to social services and limit car travel.</li> <li>● Reduce energy requirements by installing green roofs or high albedo surfaces to reduce heating loads</li> <li>● Encourage onsite, self-supplied, renewable energy to reduce environmental and economic impacts associated with fossil fuel energy use.</li> </ul>
<p>Natural Heritage and Pedestrian Oriented</p>	<ul style="list-style-type: none"> <li>● Design parking to increase pedestrian orientation and minimize the adverse environmental effects of parking facilities</li> </ul>

	<ul style="list-style-type: none"> <li>● Design continuous sidewalks on both sides of the street in public areas and provide buffers from any adjacent traffic</li> <li>● Utilize local or regional materials for landscape features.</li> <li>● Conservation of hillocks and forest lands.</li> </ul>
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### Phasing Plan

The Shendra MIP is envisaged to be developed in one phase over a period of ten years, starting in 2015.

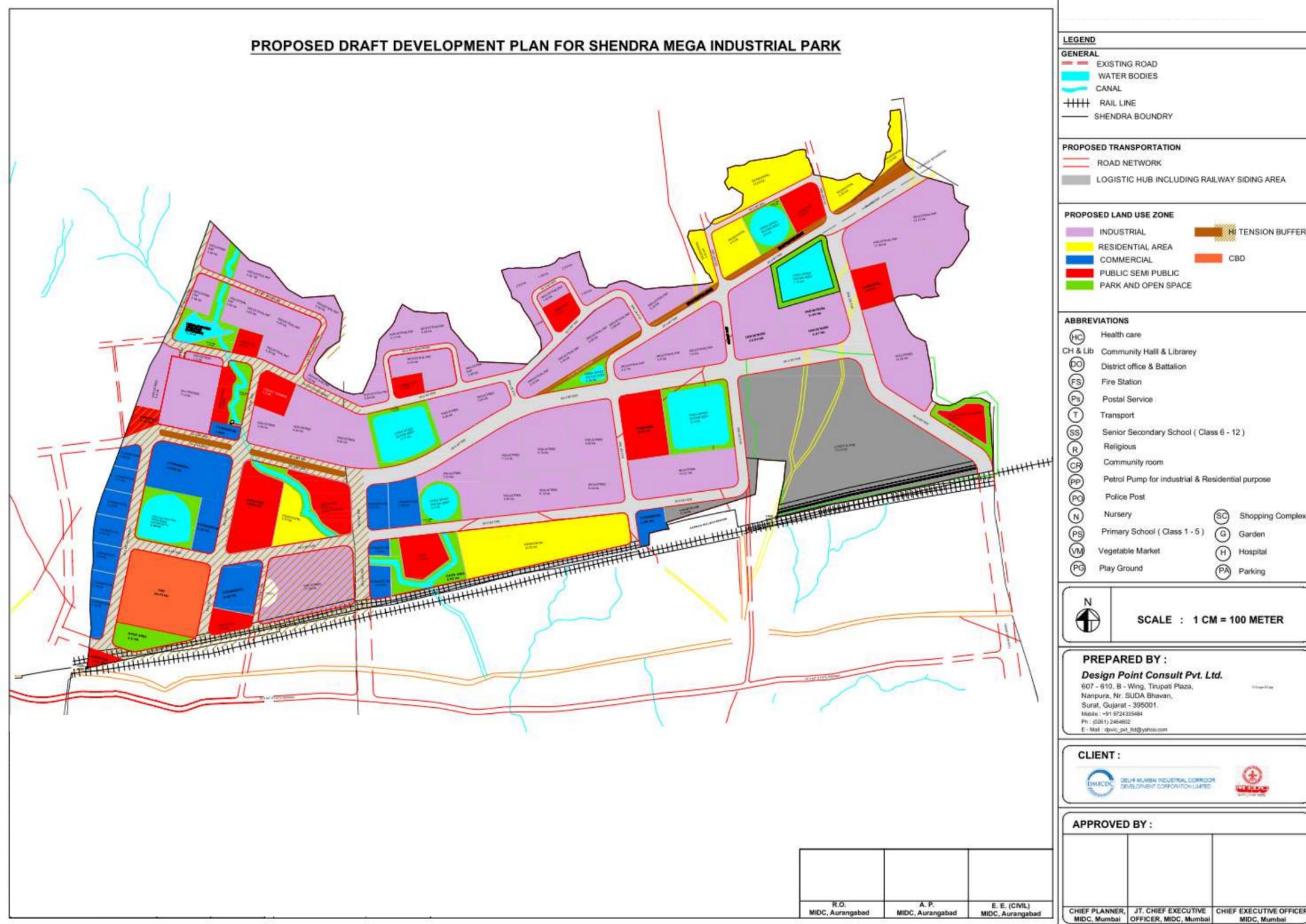
Initially, the development is proposed near already existing settlements areas that can be accessed by state and national highways to cut down on start-up costs. This will be supplemented by simultaneous development of key infrastructure facilities.

### Proposed Development Plan for Shendra MIP

The Development Plan for the Shendra MIP envisions an integrated new sustainable township in the Aurangabad region that will set precedents for smart urban developments and growth. The MIP will be developed according to a comprehensive land-use framework following international standards. The MIP will offer parks and open spaces, public transportation, pedestrian and bicycle trails, and other amenities. The industrial location is strategically positioned and directly connected to the major state highways and the national rail network. Because of the industrial area’s connectivity, visibility, and strategic location, the area will provide an ideal site for investment and employment growth for years to come. The industrial clusters within the MIP will be organized on the basis of ‘industrial ecology’ wherein the waste produced in one industry might be used as a raw feed to the nearby manufacturing facility. Compatible and mutually supporting industries and businesses will be encouraged to locate near one another, while providing adequate buffers to separate industries that should be located away from one another and from residential neighborhoods. The Development Plan for Shendra MIP has been developed considering the availability of land, ground features, location of environmentally sensitive receptors and social considerations. The Draft Development Plan for Shendra MIP, approved in-principle by MIDC has been presented in Figure 3.4.



Figure 3-4 Draft Development Plan for the proposed Shendra MIP



### Proposed Land Use of Shendra MIP

The proposed land use framework of the Shendra MIP aims to be a high-intensity, compact development which would preserve green buffers between the urban areas in the region.

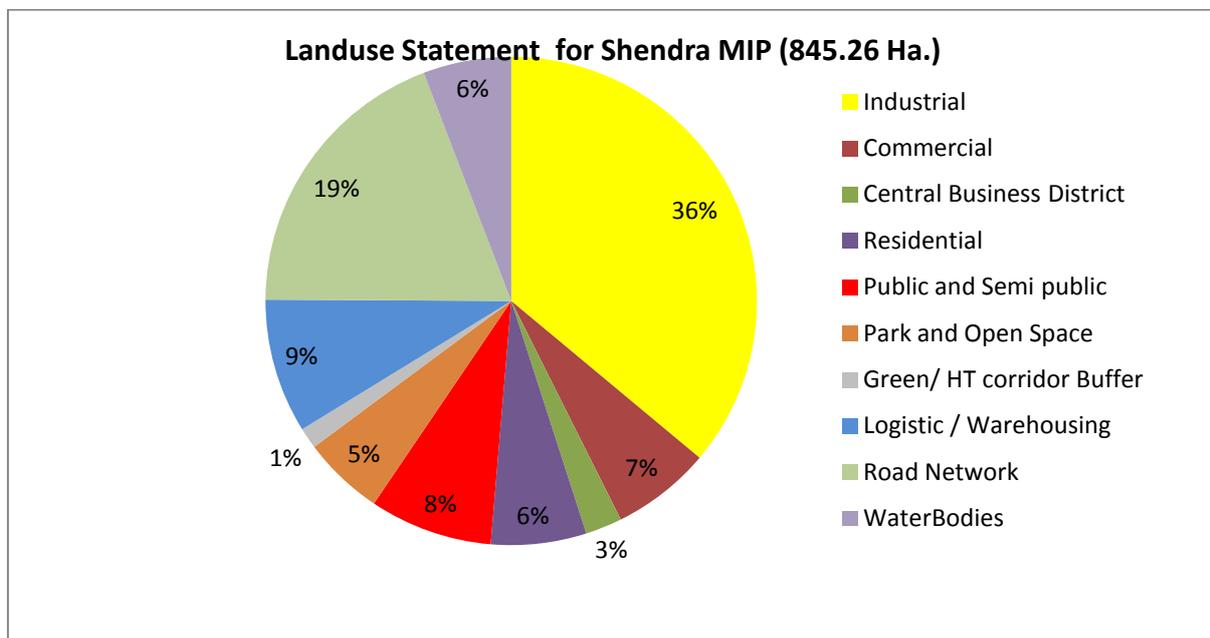
The landuse of Shendra MIP consists of industrial, residential, commercial, logistic hub, truck terminal, civil facilities, roads and open spaces. The project area spreads over 845.26 Ha and has been carved out after avoiding the existing settlements and protecting the area’s ecology. The summary of land use distribution is given below in **Table 3-4** and graphically presented in **Table 3-5**.

**Table 3-4 Proposed Land Use Summary of Shendra MIP**

S. No.	Proposed Area Statement	Area (Ha.)	% Share
1	Industrial	305	36.0
3	Commercial	55.3	6.5
4	Central Business District	20.39	2.4
5	Residential	53	6.3
6	Public and Semi public	68.4	8.1
7	Park and Open Space	45.36	5.4
8	Green/ HT corridor Buffer	11.72	1.4
9	Logistic / Warehousing	75.16	8.9
10	Road Network	161.56	19.1
11	WaterBodies	48.91	5.8
	<b>Total Area</b>	<b>845.26</b>	<b>100.0</b>

Source: DMICDC / IL&FS

**Figure 3-5 Proposed Land Use Classification of Shendra MIP**



## Salient Features of proposed Land Use Plan of Shendra MIP

The salient features of the proposed land use of Shendra MIP have been presented below:

### **Siting of Industrial Areas**

- The location of the MIP is strategically positioned and directly connected to the major state highways and the national rail network. The area will provide direct connections through the city of Aurangabad on new expressways leading to National Highway (NH) 211 and the north-south State Highway (SH) 60.
- The industrial clusters of the MIP will be organised in such a manner so as to allow compatible and mutually supporting industries and businesses to locate near one another. Similarly, all the industries which will have an environmental conflict (in terms of pollution impacts on the processes or products of the neighbouring industry) will not be sited next to each other.
- Adequate buffers will be provided to separate industries from residential neighbourhoods.
- Industries clusters will also be sited based on their compatibility with the industries in the existing Shendra Industrial development.
- Three 45 m wide roads have been planned in the west direction of the MIP connecting it to the existing MIDC industrial area.
- As per long term trends, the prevailing wind direction has been observed to be from west. Aurangabad falls in the upwind direction will, therefore, not be subject to any major impacts from the industrial development.
- Only green category industries have been planned for Shendra MIP.
- It has been suggested that during micro planning, similar industries will be clustered together to encourage the sharing of common facilities and linkages in production.
- A gradation of densities for industrial and residential land use is proposed to ensure maximum compatibility of land uses.

### **Social Considerations**

- All existing villages have been preserved and provided with a dedicated access to connect to the regional transportation network.
- Existing village settlements in surrounding areas have been provided a green buffer to enable comfortable social integration with the surrounding newly emerging community.
- New mixed use development is proposed independently with full economic and social support facilities and within a defined project area.

### **Provision of Green Buffers**

- A 30m wide green buffer zone has been provided all along the 45m m wide road which runs parallel along the residential area planned in the north east direction of the MIP.
- The residential areas planned in the south of the MIP have been separated from the industrial area by a 60m wide road. Similarly, residential pockets planned in the northeast of the MIP have a 45 m road separating them from the industrial areas.
- A green buffer line is also suggested all along the railway track, running parallel to the southern boundary of the proposed MIP site. This will act as a pollutant sink.
- About 60 ha of park and green areas will be developed as part of the Shendra MIP.

- About 48 ha of water bodies will be developed as part of the Shendra MIP.
- Apart from the planned master greens areas planned in the Development Plan or the MIP, individual industries will be required to maintain layered/ tier buffer or greenbelts within their premises.

### **Environment Protection**

- All the natural waterways and drainage channels will be preserved with riparian buffers as greenways.
- The forest lands and hillocks in the north and north-western part of the MIP have been identified to be preserved in the Draft Development Plan for Shendra MIP.
- Degraded hillsides towards the north and centre of the development area will be reforested as a part of development of the proposed MIP.
- The catchment of Sukhna Reservoir and the water bodies within the delineated MIP boundary will also be conserved.

### **Infrastructure Planning**

- The Shendra MIP is well positioned in terms of water availability. Partial water demand for the proposed MIP will be met from the Jayakwadi Dam Reservoir located approximately 40 km from the southern side of project boundary. Remaining demand will be met by groundwater with suitable rain water harvesting measures.
- The wastewater management system for the region has been planned taking into consideration the topography of the area.
- The location of the integrated waste management facility including waste processing facilities and landfill have been done on the basis of shortest haul route, wind direction and surrounding land uses.
- High density development is proposed along major transportation corridors.
- Commercial and public-semi public uses concentrated around transit nodes to facilitate efficient access.
- Existing irrigation and other infrastructure facilities in the project area have been preserved in the proposed MIP Development Plan.

## **Proposed Land Use Distribution**

Based on detailed land demand analysis, the total land required for Shendra MIP is 845.26 ha. The saleable area will be composed of residential, industrial, public/ semi public and commercial land areas. The non-saleable land will account for all the roads, utilities, and open space around the entire MIP as well as within each land-use parcel.

The land use distribution as per the proposed MIP Development Plan has been briefly described in following sub sections.

### ***Industrial Land Use***

The Shendra MIP will comprise of various clusters of industries spread over an area of approximately 305 Ha. Heavily polluting industries have been excluded, and were not considered for the Shendra MIP. On the basis of an economic analysis undertaken by AECOM, it was suggested that a resource-based industrial cluster will be best suited for the Aurangabad district, leveraging upon the existing

natural resources will come up. The industry types proposed to be part of the Shendra MIP have been presented below:

1. Food, beverage, tobacco
2. Fibers and textiles
3. Textile products and apparel
4. Paper and products
5. Basic chemicals and products
6. Rubber, plastics, petroleum, coal
7. Non-metallic mineral products
8. Basic alloys and metals
9. Metal products and parts
10. Machinery and equipment
11. Transport equipment and parts

A 90 m central spine road has been planned which will connect various industrial clusters. This 90 m central spine road connects the MIP with the 30 m State Highway road at four locations. The 90 m wide road planned in the east, adjacent to the Logistic hub connects the proposed Shendra MIP to Bidkin town. The four roads also provide a good access to the Karmad rail line.

To ensure a sustainable and environmentally conducive development of the region, zoning of areas has been done in the proposed MIP Development Plan. The industrial land requirements were worked out based on the following parameters:

- similarity of infrastructure requirements,
- correlation between supply chain for the similar industries—similarity in backward and forward linkages and similar technological requirements, concept of ‘industrial symbiosis’
- energy and space requirements of similar industries, and
- environmental safety and compatibility of uses

‘No development zones’, buffer zones, safe zones for development of industries, as the case may be, will be proposed for various types of industries and residential areas.

The planned Industrial Clusters for Shendra MIP are presented below in **Table 3-5**.

**Table 3-5 Proposed Industrial Clusters in Shendra MIP**

Clusters proposed	Proposed Industry-type
Engineering Cluster	Anchored by metal products, machinery/ equipment manufacturing, and automobile and parts, Basic alloys and metals
Food Park	Food processing, Food, beverage, tobacco
Textile and Printing Construction	Natural and synthetic textile material/ apparel, chemical (dyes), printing, Fibers and textiles

### Residential land Use

The total area planned for residential development will cover approx. 53 Ha. Residential pockets have been planned away from the industrial pockets. A variety of mid-rise and high-rise building types to provide housing options for community residents will be developed. About 70% of the residential area will be developed as medium density type (200-400 persons/ Ha) residential areas. About 20% of the residential areas will be developed as low density residential areas comprising of units for EWS and LIG.

### Commercial land Use

About 55.3 Ha of land is proposed to be developed under commercial development. The Shendra MIP will have commercial districts or zones which will primarily include office complexes, R&D centers, retail outlets such as shopping centers and hotels. A Central Business District (CBD) is also proposed to be developed on approx. 21 ha apart from the planned commercial areas.

### Public/ Semi-public Facilities

A comprehensive range of public/ semi public facilities have been planned for the Shendra MIP on an area of 68-70 ha. Public/ semi public facilities that will provide services to residents, and at the same time generate additional activity in the area, include schools, hospitals, police and fire stations, post office, religious areas, community halls, libraries, and transport stands.

**Table 3-6 Public/ semi public facilities Proposed for Shendra MIP**

S No.	Public/ semi public Facility Categories	Components
1.	Education	Primary and secondary education
2.	Shopping Complex, Vegetable Market	
3.	Healthcare	Dispensaries, nursing homes, specialty and general hospitals
4.	Socio-cultural facilities	Religious, community halls, library, recreational clubs
5.	Distribution services	Petrol pumps, LPG gas godowns, milk, fruit & vegetable booths
6.	Police, civil defense, and home guards	Police post, police station
7.	Fire stations	--
8.	Postal services	Post office counters, head post office
9.	Transport	Three-wheeler and taxi stand, Bus terminal, bus depot

### Park and Open Space

Open spaces have been incorporated into the development plan for Shendra MIP to provide a comprehensive system of 'green' infrastructure that offers direct access to green spaces throughout and surrounding the Shendra MIP. About 6% of the total area at proposed MIP Development Plan has been planned as park and open spaces. These open spaces will encourage healthy lifestyles and outdoor life, while acting as buffers between incompatible land-uses as well.

### 3.5 Construction phase of Shendra Mega Industrial Park (MIP)

#### Labour

As discussed in the earlier section, the project will be developed in one phase spanning over 10 years. It is estimated that two labour camps will be established with a capacity to accommodate a peak labour of 1000-1200 workers at each campsite. It is assumed that about 30% of the labour will be migrant labour.

The construction phase will include hiring of local labour but considering the magnitude of development, a temporary influx of population from outside areas is expected. The labour camps will be established and with provision of water, power supply and sanitation facilities including toilet facilities along with septic tanks.

#### Construction Material

The proposed project will involve large scale construction activities and will involve large quantities of construction materials. Construction aggregate, sand, gravel, stone etc needed for will be sourced only from authorized quarries in and around the region.

#### Power Requirement

Power will be primarily required for operation of heavy construction machinery and equipments. Some amount of power will be sourced from the substations proposed in the region and remaining will be generated through diesel generator sets. For the construction phase, the power requirement will be met entirely through diesel generators.

#### Water Requirement

The water requirement for the construction phase will include water for construction activities such as curing and formation of concrete mixtures and water for domestic consumption. For each construction camp housing maximum 1200 workers each, about 76 KLD water will be required @ 45 litres per person per day (lpcd) for local labour and 60 lpcd for migrant labour. Hence, a total of approx. 150-200 m<sup>3</sup>/day water will be required for two labour camps. MIDC will make adequate allocations for providing piped water supply to the labour colonies. For construction activities, tankers will be provided and adequate water allocations will be made by the nodal agency. It is estimated that about 2m<sup>3</sup> of water will be required per sq.m of built up area<sup>2</sup>.

#### Wastewater Generation

It is expected that during construction phase, approximately 60 KLD (for about 1200 labourers) of sewage will be generated per camp. A total of approximately 120 -150 KLD of waste water will be generated from two labour camps. The labor camps will be provided with adequate number of soak

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<sup>2</sup> CSE brochure on Green Buildings

pits and septic tanks for disposal of sewage. Alternatively, the sewage might be send to existing sewage treatment plants with adequate additional capacity in the nearby vicinity.

## Waste Generation

The waste generation during construction phase will include construction waste and residential waste from labor colonies. The construction waste will largely comprise of excavated earth and debris which can be used as a fill material for low lying areas and for construction of roads. The waste from construction activities has been estimated to be in the range of 40-60 kg/m<sup>2</sup>. Dumper placer bins will be provided for labor colonies. The municipal waste from each construction camp has been estimated to be 0.4-0.6 TPD. The domestic waste generated will be collected in bins to be provided at the labor colonies.

The construction activities will also entail generation of hazardous wastes such as waste oil. MIDC, through contractual obligations, will specify disposal of hazardous waste by the contractor to authorized recyclers/agencies.

## 3.6 Operation Phase of Shendra Mega Industrial Park (MIP)

### Employment Potential

The Shendra MIP will involve development of 305 ha of industrial area and will generate vast employment opportunities. It has been estimated that the proposed Shendra MIP will generate about 51,026 direct industrial and non-industrial jobs.

### Population Projections

The total resident population for the entire Shendra MIP has been estimated to be approx 39,220.

## Water Infrastructure

### Water Demand Assumptions

A preliminary assessment of the water requirement for the Shendra MIP was calculated based on the following assumptions:

#### **Water demand:**

- The per-capita water demand for residential and working population including firefighting demand was calculated in accordance with the *Manual on Water Supply and Treatment*, published by the Ministry of Urban Development, Central Public Health and Environmental Engineering Organization (CPHEEO) in May 1999. The factors used for calculating water demand are as follows:
  - for residential and working population were 135 Litre Per Capita per day (LPCD) and 45 LPCD respectively.
  - The fire demand is calculated at 100 VP in Kilo Litre per day (KLD) wherein P is population in thousands.

- The industrial water demand is assumed to be 35 kiloliters per hectare per day (Kl/ha/day), based on the present practice in the state of Maharashtra. The water demand for commercial, social/civic, open spaces and roads, and utilities were assumed as 32, 16, 45, and 5 Kl/ha/day, respectively, as per general practices in the field.
- The industrial water demand is normally calculated on the type, process, and production capacity (t/annum, m<sup>3</sup>/annum, etc) of the concerned industry. However, as the same could not be ascertained at this stage, the general principal of water demand calculation on area basis was adopted.

**Waste water generation:**

- Sewage generated by the residential and working population was calculated as 80% of the total water demand in accordance with the *Manual on Sewerage and Sewage Treatment*, published by CPHEEO in December 1993.
- The wastewater generation for industries was considered to be 65% of total water demand.
- The total water demand for open spaces, roads, and fire fighting will be met by treated wastewater (recycled water). About 75% water is wasted from open spaces, roads.
- For parks and
- The demand for residential and commercial was calculated by multiplying the population with the per-capita water demand factor. The industrial water demand was calculated by multiplying the proposed industrial area with the unit demand on area basis.

**Water Demand**

The estimated total water demand during operation phase of Shendra MIP is approx. 27-30 MLD, including water losses (15%) and water for fire fighting.

**Table 3-7 Estimated Water Demand for Shendra MIP**

Water Demand	Per capita water demand (CPHEEO)		Estimated Water Demand (MLD)	Waste Water generation		
				% generation	Domestic Waste water (MLD)	Industrial Waste water (MLD)
Industrial Area	35000	l/ha/day	10.70	65%	0.44	6.95
Commercial	32000	l/ha/day	1.77	80%	0.80	-
Central Business District	32000	l/ha/day	0.65	80%	0.52	-
Residential	135	lpcd	5.29	80%	4.24	-
Public and Semi public	16000	l/ha/day	1.09	80%	0.16	-
Park and Open Space	45000	l/ha/day	2.04	75%	1.53	-
Green/ HT corridor Buffer	45000	l/ha/day	0.53	75%	0.40	-
Logistic / Warehousing	5000	l/ha/day	0.38	75%	-	0.28
Road Network	5000	l/ha/day	0.81	75%	-	0.61
Fire demand	100√p	Pop. In thousands	0.0006	80%	-	-
Water Losses	15%		3.49	80%		
<b>Total water demand</b>			<b>26.74</b>	-	<b>8.08</b>	<b>7.8</b>

Approximately 8.08 MLD of domestic waste water and 7.8 MLD of industrial waste water will be generated. The treatment facilities have been discussed in later sections.

### *Water Sources*

The main source of water identified for Shendra MIP is Jayakwadi Dam Reservoir on Godavari River. The dam is located at Paithan, approximately 40 km from the site. The Maharashtra Industrial Development Corporation (MIDC) has been allocated 150.68 MLD of water from the Jayakwadi Dam Reservoir for its development in the region. At present, 60.27 MLD of water is used by the MIDC to meet the water requirements of the existing industries and residential areas. Thus, approximately 90 MLD is the un-utilized quantum available to meet the water demand for the future development. This available water will be used during operation phase of Shendra MIP.

An intake of required capacity is proposed at the identified intake point at the Jayakwadi Dam Reservoir. Water will be transmitted from the source to the area of use through a closed conduit, mainly ductile iron pipes with proper protection against corrosion. The pipeline carrying raw water to the Shendra MIP project site is proposed to extend along the existing Paithan Road up to the proposed development. As proposed, the transmission line is to extend around 40 kilometers from the source to the proposed raw-water storage reservoirs within the development.

### *Water Treatment Plant*

A conventional water treatment plant (WTP) with a unit process of coagulation followed by flocculation, settling, and filtration has been proposed. It has been estimated that **30 MLD WTP** will be installed which will cater to the needs of Shendra MIP in the operation phase.

## Sewage and Wastewater Infrastructure

Expected wastewater generation from Shendra MIP from the non-industrial areas such as residential areas, commercial spaces, parks, open spaces, civil structures will be about 8-10 MLD. Industrial areas will contribute about 8 MLD of effluent. The wastewater from industries and sewage from residential areas will be treated separately in a common effluent treatment plant (CETP) and sewage treatment plant (STP) respectively.

The STP will consist of an inlet chamber, screens, mechanical grit removal, and biological unit in the form of a membrane bioreactor (MBR), because the sewage will be reused for non-potable purposes after treatment.

The treated effluent from the CETP will have suspended solids of less than 5 mg/l and biochemical oxygen demand (BOD) of less than 2 mg/l for reuse for non-potable purposes. The treated wastewater from the ETP will be recycled to meet the demand for non-potable water. Because various industries will have a variety of types of industrial effluent, only industrial wastewater of a predefined quality will be permitted to enter the equalization tank of the ETP. For any kind of specific pre-treatment, industries will need to treat industrial wastewater in their own captive wastewater treatment facilities and discharge the wastewater of predefined quality into the collection system. The CETP plant will permit treatment of industrial wastewater that meets the following parameters:

- suspended solids,  $\leq 1,000$  mg/l;
- chemical oxygen demand (COD),  $\leq 1,200$  mg/l;
- BOD,  $\leq 700$  mg/l;
- oil and grease,  $\leq 100$  mg/l;
- pH,  $\sim 7.8$  to 8;
- total nitrogen (T-N),  $\leq 130$  as N mg/l; and
- total phosphorus (T-P),  $\leq 75$  mg/l.

The proposed locations of the common effluent treatment plant (CETP) for Shendra MIP are shown in **Figure 3-6**.

Figure 3-6 Proposed Locations for CETP for Shendra MIP



## Storm Water Drainage

A well developed network of storm water drainage will be provided for the region to accommodate a one-in-100 year flood event. For management of storm water, roof-top rain water harvesting will be made mandatory in all residential, commercial and industrial buildings. In addition, riparian buffer zones will be maintained alongside major drainage channels, to provide opportunities for biofiltration of storm water prior to discharge into receiving water bodies.

## Power Requirement

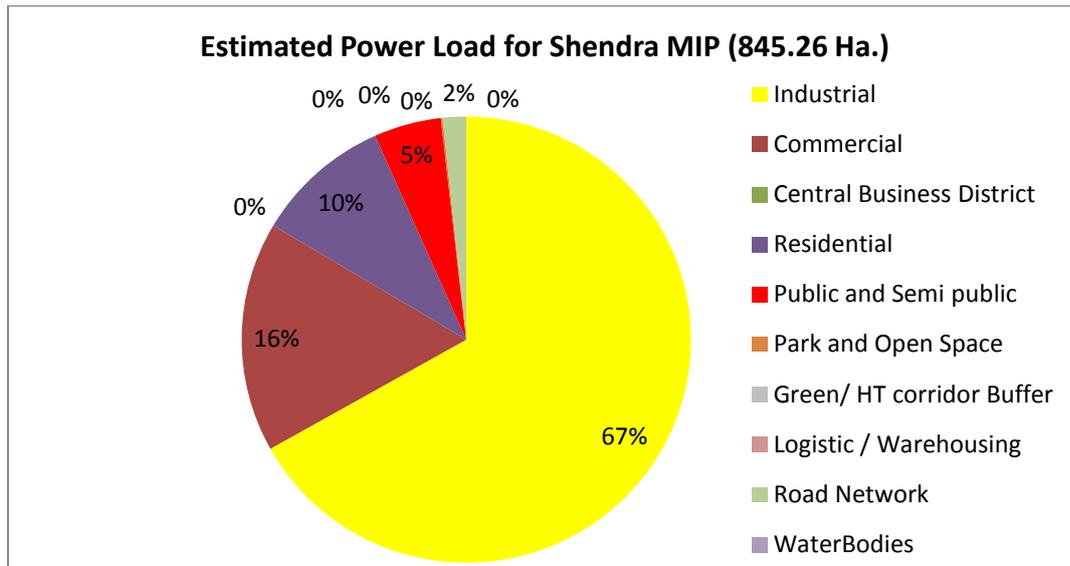
The total power requirement for Shendra MIP during operation phase has been estimated with a view to providing state-of-the-art facilities for the Indian conditions. Residential areas have been categorized into low, medium, and high standards of living, which require different types of heating, lighting, and cooling facilities. The commercial area, malls, hotels, offices, information technology, and related enhancement services industries' panel rooms and offices are expected to have a controlled environment. Many of the services in the industries will be unmanned and fully automated, requiring a large amount of electrical power. Street lighting, holdings, signal lights, pathway lighting, and other factors have also been considered. The approximate total power demand estimated for the Shendra MIP is shown in **Table 3-8**:

**Table 3-8 Power Demand Estimates for Shendra MIP**

S.No.	Proposed Statement	Estimated Load (MW)	% Share of Total Load
1	Industrial	233.31	66.86
2	Commercial	58.21	16.68
4	Residential	34.18	9.79
5	Public and Semi public	16.92	4.85
6	Park and Open Space	0.45	0.13
7	Road Network	5.87	1.68
	<b>Total</b>	<b>349 MW</b>	<b>100%</b>

Source: Area provided by DMICDC

**Figure 3-7: Distribution of Load for Shendra MIP**



**Sourcing for Power**

The power for Shendra MIP will be drawn from the National Grid. Two substations have been identified in the area from where power will be sourced, as given in the table below:

**Table 3-9 List of Proposed Substations**

Sl.No.	Substation capacity	Location	Distance from Project Site
1.	200kV	Shendra	10km
2.	200kV	Chitegaon	10km

**Renewable Energy Source**

There has been an increase in emphasis on the use of renewable energy and several obligations and incentives have been issued by the government. The Electricity Act, 2003 has specified state utilities to purchase a certain percentage of their energy from renewable sources known as Renewable Purchase Obligation. The Maharashtra State Electricity Regulatory Commission (MERC) has set up a Renewable Purchase Obligation (RPO) of 4%. It is recommended that the regional power company for the MIP shall also set the same RPO standards and will meet 4% of its power requirements from renewable energy sources. To meet the RPO commitments, following instruments may be assessed at later stage of detailed design:

- Integration of the waste to energy plant within MIP to the grid;
- Purchase of Renewable Energy Certificates (Certificates from renewable energy producers who do not have a Power Purchase Agreement (PPA) for renewable energy with state utilities) from other renewable projects

## Energy Efficiency

The nodal agency for the development of MIP shall enforce Energy Conservation Building Codes (ECBC) developed by the Bureau of Energy Efficiency. The code shall be mandatory for:

- Commercial Buildings or building complexes that have a connected load of 500 kW or greater;
- Contract demand of 600 kVA or greater, and
- All buildings with a conditions floor area of 1000 m<sup>2</sup> or greater

Also, MIDC will put efforts to maximize the use of solar energy especially for street lighting. Building byelaws shall specify building orientation guidelines for energy efficiency.

The Shendra MIP development has an opportunity to proactively minimize its energy footprint. This can be done by developing an energy budget that is self-reliant and incorporates renewable energy technologies. The following strategies will be considered during detailed designing of MIP:

- Large areas of hard-scaped surfaces, particularly parking lots, will be shaded to reduce heat island effects. Extensive use of native trees in streetscapes and other open spaces will help minimize heat island effects through shading and transpiration cooling.
- Feasibility of having either green roofs or high albedo surfaces, or a mix of both will be assessed for all new buildings to be constructed within the MIP. Roof gardens will be encouraged on industrial/commercial buildings to achieve energy savings and provide recreational space for workers in the buildings.
- Within the MIP, various renewable energy technologies (including solar street lighting, solar water heating, and micro turbines will be included in the development.
- The feasibility of introducing fuel-cell powered buses will be considered as the MIP planning and design progresses.
- Efforts will be made to obtain LEED certification for public buildings in the Shendra MIP.
- There are various building design strategies that can help reduce solar heat gain in hot, humid climates such those found in Aurangabad, thereby lowering energy requirements for air conditioning. These include building orientation, street design, and street orientation, as discussed below:
  - **Building Orientation**  
Typically, low-rise buildings should be aligned on an east-west axis, with relatively long north and south walls, and shorter east and west facing walls. This configuration helps reduce solar heat gain from the early morning and late afternoon sun. This effect is enhanced by placing buildings close together along the east-west axis: the shading provided by adjacent buildings further reduces solar gain. The front of the building, including larger windows, should be located on the north facade (which receives the least solar radiation). Smaller windows, as well as eaves, verandas, or other shading structures should be provided on the south facade to minimize solar gain through windows.
  - **Street Orientation**  
Prevailing wind direction should also be considered to make best use of cooling breezes during the hot summer months. In Aurangabad, wind direction is variable during the year,

but during the hottest months (March–July), winds are generally from the west. Aligning streets on an east-west axis will maximize penetration of these breezes. However, a simple east/west orientation would potentially create wind tunnels that would cause discomfort to pedestrians. Orienting buildings at an oblique angle to the prevailing winds (between 30° and 120°) is recommended to avoid this phenomenon. With this orientation, upwind walls are in pressure zones while downwind walls are in suction zones, and will allow for the penetration of prevailing winds into the heart of the development, and allow breezes to run through the buildings.

- **Street Design**

Street design can also be considered to reduce solar gain, with the ratio of building height to street width having a significant influence on solar radiation reaching the street and consequently the thermal comfort of pedestrians as well as people in vehicles. Narrow streets with high buildings perform better with regard to thermal comfort than wide streets with low buildings. Where the ratio is relatively low (i.e., low buildings with wide streets), the use of vegetation/other shading structures becomes increasingly important.

### Solid Waste Management

The quantities of waste likely to be generated from the construction and operation of Shendra MIP have been estimated on the basis of population and land use characteristics. Apart from Municipal waste and Industrial waste, solid waste in the form of dried sludge will also be generated from water treatment plant, STP and CETP.

It is estimated that during operation phase, the total municipal solid waste likely to be generated is approximately 40-45 metric ton per day (TPD). This includes municipal waste from industrial areas and all other landuses-residential, commercial, civic, open spaces, roads etc.

In addition to this, there will be sludge from 8-10 MLD STP which would be about 1.5-2.0 TPD.

The total industrial waste likely to be produced during the project operation has been estimated to be 356 TPD. Out of this, the industrial waste will comprise of about 3% hazardous waste (i.e 11 TPD). Also, on average approx. 150 kgs of sludge (dry weight) will be produced per MLD of sewage treatment. Waste generation factors specific to various land uses were used to estimate the quantities of solid waste likely to be generated from various landuses.

A summary of waste quantification (cumulative values) is presented in below:

**Table 3-10 Quantity of Solid Waste (metric ton per day)**

Sno	Proposed Statement	Area (Ha)	WEF for Municipal Waste	Waste Quantities	
				Municipal Waste (TPD)	Industrial Waste (TPD)
1	Industrial	305	0.2 kg/capita/day	2.4	356
2	Commercial	55.3	0.3 kg/capita/day	6.6	-
3	Central Business District	20.39	0.4 kg/capita/day	5.4	-

4	Residential	53	0.4 kg/capita/day	15.7	-
5	Public and Semi public	68.4	0.003 kg/sqm/day	2.1	-
6	Park and Open Space	45.36	0.2 kg/capita/day	0.1	-
7	Green/ HT corridor Buffer	11.72	0.2 kg/capita/day	0.0	
8	Logistic / Warehousing	75.16	0.2 kg/capita/day	0.3	
9	Road Network	161.56	0.005 kg/capita/day	8.1	
	<b>Total Area</b>	<b>845.26</b>		<b>41.0 TPD</b>	<b>356.0 TPD</b>

### Treatment of Solid Waste Management

A conceptual SWM program has been proposed in accordance with the Municipal Solid Waste (Management and Handling) Rules 2000 and the Hazardous Wastes (Management, Handling and Trans-boundary Movement) Rules 2008, and thereafter Second Amendment Rules, 2009.

Considering the type of waste likely to be generated from the construction and operation of the Shendra MIP, adoption of a two-bin system for storage at source has been recommended. For processing of municipal waste, it has been suggested to undertake a detailed techno-economic feasibility study for selecting the most appropriate technique, viz. compost plant, biomethanation and incineration along with heat/ electricity generation. The industrial waste will be handled and treated separately. Feasibility of incineration and pyrolysis will be undertaken.

The dried sludge produced from WTP will be disposed off at Municipal landfill. Sludge from STP will be blended with compost and sold as manure to augment revenue. Since the exact nature of industries is not known, it has been considered that the sludge from the CETP will be hazardous in nature and hence will be disposed off to the nearest CHWTSDF.

The bio-sludges from the treatment plants have Volatile Suspended Solids (VSS) content in the range of 60 % to 70% of the total sludge (dry basis). Normally, the sludge with this level of VSS is disposed-off after thickening and dewatering (or solar drying). If it is required to reduce the VSS content below 50%, Aerobic/Anaerobic Digestion process is used to process this sludge.

Different Sludge treatment scheme that may be studied in detail to dispose off sludge in environmental friendly manner are:

- Gravity Thickeners
- Centrifuge-Dewatering of sludge
- Aerobic Digester

Dried Sludge will be generated after mechanical dewatering in proposed waste water treatment plants. These treatment plants are Water treatment plant (WTP), Sewage treatment plant (STP) and Common Effluent treatment plant (CETP).

The consistency of sludge from WTP has been assumed to be 15% and from STP and CETP to be 22%. The dried sludge produced from WTP will be disposed off at Municipal landfill. Sludge from STP being rich in Nitrogen content will be blended with compost and sold as manure to augment

revenue. Also since the exact nature of industries is not known, it has been considered that significant quantity of sludge from Common Effluent treatment plant will be hazardous in nature and hence will be disposed off in a secured landfill.

An Integrated Solid Waste Management facility has been proposed in the east of the development area, spread over 3.62 ha land within the project site boundary. **Figure 3-8** shows the proposed location of the facility. This waste disposal site will have various facilities to treat different types of waste generated from the MIP such as In vessel composting, biomethantion, Waste-to-energy facility. It is recommended to undertake techno-economic feasibility study to understand the suitability of the treatment options.

**Figure 3-8 Proposed Location for Integrated Solid Waste Management Facility**



## Transport Infrastructure

This section presents the transportation system proposed for Shendra MIP.

### ***Existing Transportation Network***

Aurangabad is well connected by roadways, rail service, and an airport. Aurangabad is served by National Highway 211 (NH-211) and by State Highways 30, 60, and MSH 6 (SH-30, SH-60, and MSH-6). The roadway network for the Aurangabad region is shown in **Figure 3-10**.

SH-60 connects Aurangabad with Pune via Ahmednagar. NH-211 (Dhule–Solapur Highway), which runs completely within the state of Maharashtra, connects Dhule, Ellora, Aurangabad, Pachegaon, Osmanabad, and Solapur.

The Shendra MIP is located adjacent to the city of Aurangabad and is well connected by two state highways—SH-30 (Paithan Road) and MSH-6 (Aurangabad–Jalna Road)—and a national highway, NH-211. SH-30 (Paithan Road), which connects the cities of Aurangabad and Paithan via Bidkin, passes through the industrial area. Aurangabad and Jalna are connected by the existing MSH-6. The state highway extends towards north of the railway line until it reaches the Maharashtra Industrial Development Corporation (MIDC) area of Shendra.

Shendra MIP falls between Aurangabad city and Karmad village, which are connected by the Central Railway line, with Karmad being the nearest railway station. Presently, the movement of containers from the Shendra MIDC is from CONCOR ICD (Container Corporation of India Ltd. Inland Container Depot), which is about 15 kilometers from the proposed site. The main airport in Aurangabad is at Chikalthana. It is a public facility operated by the Airports Authority of India. The airport is about 10 kilometers from the center of the city towards the Shendra MIP site.

### ***Proposed Transportation System***

With the upcoming MIP, there will be movement of vehicles like goods-carriers; personal vehicles used by commuters, public transport to transfer workers, travel for business activities within the MIP and also between the existing MIDC industrial area and the proposed Shendra MIP. There will be an additional load on the existing transportation infrastructure. Hence, new transportation infrastructure will be developed within the MIP and in the surrounding areas, comprising of new roads, pedestrian and bicycle paths, public transit and rail access etc.

### ***Proposed Road Network***

The project will encourage use of public transport; all residential areas will be within 500 meters of planned public transportation. All roads in the Shendra MIP will include designated lanes to encourage cycling and improve the safety of cyclists.

The roads proposed are classified into four categories and are listed below hierarchically.

1. Major roads (Arterial Roads) with ROW of 90 m

A 90 m wide spine road traverses through the Shendra MIP. This road will be dual, four-lane carriageways with service roads on either side.

A major road has been proposed in the east direction for connecting the Shendra MIP to the town of Bidkin in the southern direction. This will prevent congestion on internal roads and increase the level of service of the proposed roads within the MIP. This bypass road will be an access controlled, dual four-lane carriageway.

2. Primary roads (Sub-arterial Roads) with ROW of 60 m

Primary roads (sub-arterial roads) are proposed to feed the traffic from-and-to the highways and major roads. These roads will be three-lane dual carriageways (six lanes) with little scope of expansion. These roads are proposed to have an ROW of 60 m.

3. Secondary roads (Collector Roads) with ROW of 45 m

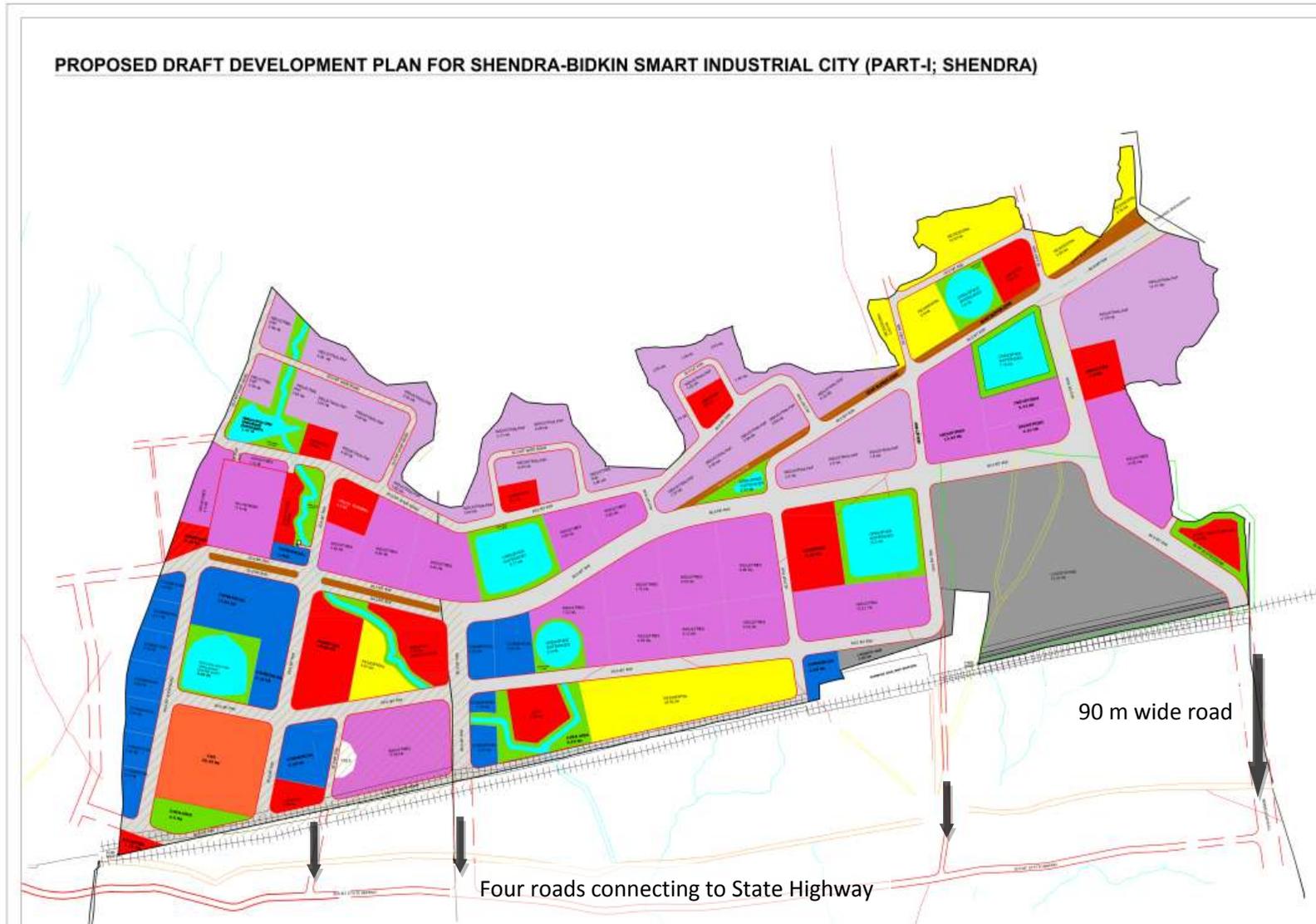
Secondary roads (collector roads) collect traffic from local roads and are proposed to feed major roads, and vice versa. In some sections, the secondary roads are directly connected to the major roads and primary roads for different land use purposes; their junctions will be designed to have a smooth transition of traffic between these two types of roads. These roads will be two-lane dual carriageways.

4. Tertiary roads (Local Roads) with ROW of 30 m

Tertiary roads (local roads) are the roads from which the traffic actually originates. These roads are the end roads feeding directly into the proposed land use. These roads will have two-lane carriageway. For purpose of the conceptual design, traffic assignments for these roads are not presently included.

Proposed Transportation Network for Shendra MIP is shown in **Figure 3-9**.

Figure 3-9 Road network planned within the Shendra MIP



### **Proposed Rail Network**

The south central railway line connects Aurangabad and Karmad with an intermediate station at Chilkathana. A rail siding is proposed at Shendra in the private land adjacent to the main line on the station building side (the left side when going from Karmad to Mudkhed) ahead of Karmad station between the Manmad–Parbhani section of the Nanded Division.

The lead line of the proposed siding will take off from the overshoot line of the loop line on the Parbhani end, then enter into MIDC land with a left-hand curve and traverse a proposed bridge. The lead line, with a right-hand curve, cuts across the proposed bridge and continues about 200 meters farther to enter the in-plant yard of the MIDC. Necessary shunt signals will be provided on each of the existing starter signal posts on the Parbhani end of the Karmad station, and on a lead line to enter into the station yard to control the movement of trains into and out of the siding. The CONCOR ICD Aurangabad station is located 15 kilometers from the northwest side of the city of Aurangabad. This container freight station can be used by the proposed Shendra MIP. The location of ICD Aurangabad and Shendra rail siding are shown in Figure 3-10.

Figure 3-10 Location of Rail Sidings around Aurangabad



## 4. Environmental Legislation and Regulatory Framework

### 4.1 Introduction

The environmental laws and regulations of India applicable to the proposed development of Shendra mega industrial park project at Aurangabad district are listed and commented upon below. It broadly focuses on the following:

- Enforcement Agencies;
- Applicable Environmental and Social Laws, Regulations and Policy; and
- Applicable Environmental Standards.

### 4.2 Enforcement Agencies

In India, the national level laws are formulated by Ministry of Environment, Forest and Climate Change (MoEFCC) and state governments are required to consider these regulations as base level for implementation. The State Pollution Control Boards (SPCBs) are responsible for securing compliance under the Environmental Protection Act, 1986, the umbrella legislation regulating environmental issues in the country. A brief description of the relevant enforcement agencies both at central level and state level with respect to the institutional framework is described in Table 4-1.

**Table 4-1: Relevant Enforcement Agencies**

S.No.	Agency	Functions
<b>Central Level</b>		
1.	Ministry of Environment, Forests and Climate change (MoEFCC)	<p>MoEFCC is responsible for the implementation and enforcement of the Environment Protection Act, 1986, and Rules issued under the Act, including the EIA notification. Under sections 3 and 5 of the EP Act, 1986, it retains enormous powers to issue directions in the interests of environment protection.</p> <p>The specific functions of MoEFCC include the following:</p> <ul style="list-style-type: none"> <li>• Environmental policy planning;</li> <li>• Effective implementation of legislation;</li> <li>• Monitoring and control of pollution;</li> <li>• Environmental Clearances for industrial and development projects covered under EIA notification;</li> <li>• Promotion of environmental education, training and awareness; and</li> <li>• Forest conservation, development, and wildlife protection.</li> </ul>
3.	The National Green Tribunal	<p>National Green tribunal has been constituted in 2010 for effective and expeditious disposal of cases relating to environmental protection and conservation of forests and other natural resources including enforcement of any legal rights relating to environment and giving relief and compensation for damages to persons and property.</p> <p>The tribunal has jurisdiction over all civil cases relating to implementation of the following regulations:</p> <ul style="list-style-type: none"> <li>• The Water Act, 1974;</li> <li>• The Water Cess Act, 1977;</li> <li>• The Forest Conservation Act, 1980;</li> </ul>

S.No.	Agency	Functions
		<ul style="list-style-type: none"> <li>• The Air Act, 1981;</li> <li>• The Environment Protection Act, 1986;</li> <li>• The Public Liability Insurance Act, 1991; and</li> <li>• The Biological Diversity Act, 2002</li> </ul>
4.	Central Ground Water Authority	<p>Central Ground Water Authority has been constituted under Section 3 (3) of the Environment (Protection) Act, 1986 to regulate and control development and management of ground water resources in the country.</p> <p>The Authority has been conferred with the following powers:</p> <ul style="list-style-type: none"> <li>• To regulate and control, management and development of ground water in the country and to issue necessary regulatory directions for the purpose.</li> </ul>
5.	Petroleum and Explosives Safety Organization (PESO)	<p>The PESO is under the Department of Industrial Policy &amp; Promotion, Ministry of Commerce and Industry, Government of India. The Chief Controller of explosives is responsible to deal with provisions of:</p> <ul style="list-style-type: none"> <li>• The Explosive Act 1884 and Rules, 1983,</li> <li>• The Petroleum Act 1934 and the Rules 2002,</li> <li>• The Static and Mobile pressure vessels {Unfired} Rules, 1981 and amendment 2000,2004,</li> <li>• Manufacture, Storage and Import of Hazardous Chemical Rules, 1989 and amendment, 2000.</li> </ul>
<b>State Level</b>		
8.	Maharashtra Pollution Control Board (MPCB)	<p>Maharashtra Pollution Control Board (MPCB) implements various environmental legislations in the state of Maharashtra, mainly including Water (Prevention and Control of Pollution) Act, 1974, Air (Prevention and Control of Pollution) Act, 1981, Water (Cess) Act, 1977 and some of the provisions under Environmental (Protection) Act, 1986 and the rules framed there under like, Biomedical Waste (M&amp;H) Rules, 1998, Hazardous Waste (M&amp;H) Rules, 2000, Municipal Solid Waste Rules, 2000 etc. MPCB is functioning under the administrative control of Environment Department of Government of Maharashtra. Some of the important functions of MPCB are:</p> <ul style="list-style-type: none"> <li>• To plan comprehensive program for the prevention, control or abatement of pollution and secure executions thereof,</li> <li>• To collect and disseminate information relating to pollution and the prevention, control or abatement thereof,</li> <li>• To inspect sewage or trade effluent treatment and disposal facilities, and air pollution control systems and to review plans, specification or any other data relating to the treatment plants, disposal systems and air pollution control systems in connection with the consent granted,</li> <li>• Supporting and encouraging the developments in the fields of pollution control, waste recycle reuse, eco-friendly practices etc.</li> <li>• To educate and guide the entrepreneurs in improving environment by suggesting appropriate pollution control technologies and techniques</li> <li>• Creation of public awareness about the clean and healthy</li> </ul>

S.No.	Agency	Functions
		environment and attending the public complaints regarding pollution.
10.	Maharashtra Forest Department	<p>Maharashtra Forest Department is entrusted with the role of conservation and development of the State's forests spread over about 20 percent of its geographical area. The key primary objectives of the Maharashtra Forests Department include the following:</p> <ul style="list-style-type: none"> <li>• To recommend to the State and Central government, policies which will provide an enabling environment for various non-governmental players to play and active role in this sector</li> <li>• To generate and disseminate knowledge and information relevant to the sector to various stakeholders and provide Research and Development support to the sector.</li> <li>• To regulate the activities of various players involved in forestry sector development.</li> <li>• To undertake co-ordinated planning along with the other government departments and agencies.</li> <li>• To develop a pro-active interface with political and executive arm of the government and public</li> <li>• To act as a nodal agency at the grass-root levels in the forest lands</li> </ul>
11.	Transport Department, Maharashtra	<p>The Motor Vehicles Department has been established under section 213 (1) of the Motor Vehicles Act, 1988. This is a Central Act applicable throughout the country. Motor Vehicles Department is mainly responsible for enforcing various provisions of this Act. Motor Vehicles Department is headed by the Transport Commissioner. The main functions of the Motor Vehicles Department are as follows:</p> <ul style="list-style-type: none"> <li>• Enforce the provisions of the Motor Vehicles Act, 1988, the Central Motor Vehicles Rules, 1989 and the Maharashtra Motor Vehicles Rules, 1989.</li> <li>• Ensure a co-ordinated development of Road Transport through the regime of permit.</li> <li>• Levy and collection of tax on Motor Vehicles under the Bombay Motor Vehicles Tax Act, 1959 and on Passengers under the Bombay Motor Vehicles (Transportation of Passengers) Act, 1958.</li> </ul>
12.	District Administration for Acquisition of Land	The land required for Shendra MIP comprises of partly of land parcels already in possession of MIDC. This will impact three villages – Karmad, Ladgaon and Kumbephal, falling within the project area.
13.	Director Industrial Safety and Health	The main objective of the Director, Industrial Safety and Health is to ensure safety, health, welfare and working conditions of workers working in factories and in construction works by effectively enforcing the provisions of the Factories Act, the Building & Other Construction Workers Act and others labour legislations. It is also to ensure the protection of rights of workers and to redress their grievances.

### 4.3 Applicable Environmental Laws, Regulations and Policies

The relevant acts and Rules pertaining to the project is summarised in section below.

#### **The Environment (Protection) Act; 1986 and Environment (Protection) Rules 1986 and amendments**

The Environment (Protection) Act, 1986 has been enacted to provide for the protection and improvement of environment by preparation of manuals, codes or guides relating to prevention, control and abatement of environment pollution. This Act is an umbrella legislation that provides a single focus for the protection of the environment and seeks to plug the loopholes of earlier legislation relating to the environment. The Act further makes it mandatory that discharges from any industry or operation are not in excess of the standards and hazardous substances handling comply with the procedural safeguards.

The salient provisions of the Act include but not limited to the following:

- Restrict or prohibit industries, operations or processes in specified areas;
- Undertake environmental impact assessment for certain categories of industries to inform the decision making in approval of new or expansion projects;
- Restrict or prohibit handling of hazardous substances in specified areas;
- Protect and improve the quality of the environment and prevention, control and abatement of environmental pollution;
- Lay down standards for the quality of the environment, emissions or discharges of environmental pollutants from various sources;
- Lay down procedures and safeguards for the prevention of accidents, which may cause environmental pollution;
- Bar on filling of any suit or legal proceedings against the Government or officials empowered by it for action taken in good faith, in pursuance of the Act; and
- Bar of jurisdiction to Civil Court to entertain any suit or proceedings in respect of anything done, action taken or directions issued by the Central Government or any other authority empowered by it, in pursuance of the Act.

#### **The Water (Prevention and Control of Pollution) Act 1974 and Air (Prevention and Control of Pollution) Act 1981**

The objectives of the Water (Prevention and Control of Pollution) Act are to provide for the Prevention and Control of Water Pollution and the maintenance or restoration of the wholesomeness of water for the establishment, with a view to carrying out the purposes aforesaid, of Boards for the prevention and control of water pollution, for conferring on and assigning to such Boards powers and functions relating thereto and for matters connected therewith.

The Air (Prevention and Control of Pollution) Act, 1981 has been enacted to implement measures devised for its effective prevention, control or abatement of air pollution. The Act assigns powers and functions to the CPCB and the SPCBs for prevention and control of air pollution and all other

related matters. The CPCB, as well as the SPCBs are eligible for contributions from the Central as well as the State Government, respectively, to perform their functions appropriately. The Act prohibits the construction and operation of any industrial plant without the consent of SPCBs.

#### **EIA Notification 2006 as amended till 2009**

The EIA Notification provides for conducting environmental impact assessment studies and obtaining environmental clearance from Ministry of Environment, Forest and Climate Change or State Environment Impact Assessment Authority. The Schedule of the notification provides criteria for categorising projects into A and B categories based on the magnitude and scale of the impacts associated with the project and provides for incorporating environmental safeguards in the project planning phase.

#### **Noise Pollution (Regulation and Control) Rules, 2000**

As per the Noise Pollution (Regulation and Control) Rules 2000, every operating facility is required to take all possible steps to meet the ambient noise level standards prescribed in the Rules. The rules prescribe maximum permissible values of day and night time noise levels for zones A, B, C and D representing industrial, commercial, and residential and silence zone respectively.

#### **Hazardous Waste Management, Handling and Trans Boundary Movement Rules 2008 as amended**

The rule states the requirement for handling and managing wastes categories as hazardous under the schedule. It lays down requirement for:

- Authorisation for collection, reception, storage, transportation and disposal of hazardous wastes
- Filing of annual return under the rules
- Other compliance under the rules
- Authorisation by Central Pollution Control Boards to vendors accepting waste/used oil
- Liability of the occupier, transporter and operator of a facility: The occupier, transporter and operator of a facility shall be liable for damages caused to the environment resulting due to improper handling and disposal of hazardous waste listed in schedules to the Rules;
- The occupier and operator of a facility shall also be liable to reinstate or restore damaged or destroyed elements of the environment;

The occupier and operator of a facility shall be liable to pay a fine as levied by the State Pollution Control Board with the approval of the Central Pollution Control Board for any violation of the provisions under these rules.

#### **Forests (Conservation) Act, 1980 and Rules 1981**

The Act restricts the powers of the State in respect of de-reservation of forests and the use of forestlands for non-forest purposes. An advisory committee has been created to oversee the

implementation of the statute. According to Section 2 of the Act " prior approval of the Central Government is required for:

- De-reservation of a reserved forest
- Use any forest land for any non -forest purpose
- Assign any forest land to any private person or entity not controlled by the Government
- Clear any forest land of naturally grown trees for the purpose of using it for reforestation

#### Ancient Monuments and Archaeological Sites and Remains Rule 1959

According to this Act, area within radii of 100m and 300m from the “protected property” are designated as “protected area” and “controlled area” respectively. No development activity (including mining operations and construction) is permitted in the “protected area” and development activities likely to damage the protected property are not permitted in the “controlled area” without prior permission of the Archaeological Survey of India (ASI) if the site/remains/monuments are protected by ASI or the State Department of Archaeology.

### 4.4 Applicable Social Laws, Regulations and Policies

#### Legal Framework

The total land area to be acquired is 845.26 ha spread over 3 villages namely Karmad, Ladgaon and Kumbephal of tehsil Aurangabad. However, no physical rehabilitation and resettlement of people is expected to take place as no house will be acquired. Adequate area will be retained around each existing settlement for the purpose of future expansion or development. Maximum individual loss will be limited to agricultural land surrounding the physical structure of the houses and common community assets outside the development zone of the villages which has been left to accommodate future expansion of the area.

The land that will be acquired based on the following legal framework.

#### Land Acquisition Act, 1894

The Land Acquisition Act (LAA) of 1894 was created with the expressed purpose of facilitating the government’s acquisition of privately held land for public purposes. The word "public purpose", as defined in the act, refers to the acquisition of land for putting up educational institutions or schemes such as housing, health or slum clearance, apart from the projects for rural planning or formation of sites. The land acquisition process as per the Land Acquisition Act is given in the Table 4.2 below:

**Table 4.2: Land Acquisition Process as per LAA**

Legal Provisions	Actions
Section 4	<ul style="list-style-type: none"> <li>– The requiring agency prepares draft, Ministry of Law verifies it, then it is printed and proofread. Published in official gazette and two local newspapers; notice is posted in the locality concerned.</li> <li>– No further land sales, transfers, or subdivisions after notice are allowed.</li> <li>– A land acquisition officer (LAO) is appointed to survey the land.</li> </ul>

Legal Provisions	Actions
	<ul style="list-style-type: none"> <li>– Notices under Section 4(1) are issued to individual owners and interested parties (1 month).</li> </ul>
Declaration of Public Purpose	<ul style="list-style-type: none"> <li>– Government certifies that land is required for a public purpose.</li> <li>– Declaration is published.</li> <li>– Collector/Deputy Commissioner receives order from Revenue Department, state government.</li> <li>– Land appraisal begins (2 weeks to 1 month).</li> </ul>
Section 5(a), Enquiry	<ul style="list-style-type: none"> <li>– Enquire objections to land acquisition.</li> <li>– Landowners and interested parties appear before LAO.</li> <li>– Revenue Commissioner calls for comments of acquiring agency if objections are raised (1–3 months).</li> </ul>
Section 6	<ul style="list-style-type: none"> <li>– State government issues notices.</li> <li>– LAO serves individual notice on all interested parties of government’s intention to take possession of land.</li> <li>– Time and place set for claims to LAO.</li> <li>– Public notice given.</li> <li>– Collector or LAO investigates claims (12 months).</li> </ul>
Section 9	<ul style="list-style-type: none"> <li>– LAO conducts on-site inquiry regarding area of land acquisition and compensation payable.</li> <li>– LAO determines compensation (12 months).</li> </ul>
Sections 11 and 12	<ul style="list-style-type: none"> <li>– Declaration of final award by collector/commissioner/state government after inquiry of total valuation.</li> <li>– Notice of awards given to interested parties for payment of compensation.</li> <li>– Government can take possession of land and hand over to implementing agency (14 months).</li> </ul>

### National Rehabilitation and Resettlement Policy, 2007

The National Rehabilitation and Resettlement Policy, 2007 recognises rehabilitation and resettlement issues as intrinsic to the development process formulated with the active participation of the affected persons, rather than as externally imposed requirements. The objectives of the policy are as follows:-

- a) To minimise displacement and to promote, as far as possible, non-displacing or least displacing alternatives;
- b) To ensure adequate rehabilitation package and expeditious implementation of the rehabilitation process with the active participation of the affected families;
- c) To ensure that special care is taken for protecting the rights of the weaker sections of society, especially members of the Scheduled Castes and Scheduled Tribes, and to create obligations on the State for their treatment with concern and sensitivity.
- d) To provide a better standard of living, making concerted efforts for providing sustainable income to the affected families;
- e) To integrate rehabilitation concerns into the development planning and implementation process.
- f) Where displacement is on account of land acquisition, to facilitate harmonious relationship between the requiring body and affected families through mutual cooperation.

The procedure mentioned in Chapter 6 of the policy shall be followed for declaration of the affected area, carrying out survey and census of affected persons, assessment of government land available and land to be arranged for rehabilitation and resettlement.

### **Maharashtra Industrial Development Corporation Act, 1961**

MIDC acquires land through Chapter VI of the MIDC Act of 1961. This act is very similar to the Land Acquisition Act, 1894 and is basically for involuntary land acquisition. The Section 6 of the act authorises the government to use force if the land is not vacated after due notification. Most of the provisions under this act largely resemble the Land Acquisition Act. However, the MIDC Act also provides for return of the land to the previous owner if MIDC desires.

### **MIDC Rehabilitation and Resettlement Policy, 2009**

MIDC has an R&R policy, which was upgraded in 2009. MIDC generally acquires land in the rural area. To encourage farmers' participation as partners in the development process in an industrial area, MIDC has offered benefits to farmers whose lands are acquired for conversion to an industrial area, under Consent Award per notification under Chapter VI of the MID Act of 1961. The benefits as mentioned in the R&R policy do not apply to the farmer who does not give consent for land acquisition because the farmer can approach relevant government organisation to request enhanced compensation for the acquired land.

### **Rehabilitation and Resettlement: Entitlement Framework**

This framework has been drawn on the spirit of the Rehabilitation and Resettlement Policy of Maharashtra Industrial Development Corporation, 2009 and the National Rehabilitation and Resettlement Policy (NRRP) 2007 as NRRP recognises the rights of landless labourers besides that of the landowners. Considering the fact that half of the workforce employed in agricultural and other allied activities are landless labourers, once these land get acquired they will lose their only mode of employment. As this is not taken into account under the Rehabilitation and Resettlement Policy of MIDC, 2009 where compensation is paid only to the legal titleholders and no compensation package are paid to the non-titleholders like landless labourers, encroachers and squatters etc., the National Rehabilitation and Resettlement Policy, 2007 also fits well as far as this project is concerned.

#### Definitions of Rehabilitation and Resettlement Framework

Various terms which are relevant to the proposed project are described in the following:

(a) "*Project Affected Family*" means:

- (i) a family whose primary place of residence or other property or source of livelihood is adversely affected by the acquisition of land for a project or involuntary displacement for any other reason; or

(ii) any tenure holder, tenant, lessee or owner of other property, who on account of acquisition of land (including plot in the abadi or other property) in the affected area or otherwise, has been involuntarily displaced from such land or other property; or

(iii) any agricultural or non-agricultural labourer, landless person (not having homestead land, agricultural land, or either homestead or agricultural land), rural artisan, small trader or self-employed person; who has been residing or engaged in any trade, business, occupation or vocation continuously for a period of not less than three years preceding the date of declaration of the affected area, and who has been deprived of earning his livelihood or alienated wholly or substantially from the main source of his trade, business, occupation or vocation because of the acquisition of land in the affected area or being involuntarily displaced for any other reason.

(b) "*Project Affected Area*" means area notified by the appropriate authority of the Government of Rajasthan, where land is acquired for construction of any component of the project, infrastructure, township, offices, construction facilities, welfare facilities, etc. for the project.

(c) "*Agricultural Labourer*" means a person primarily resident in the affected area for a period of not less than three years immediately before the declaration of the affected area who does not hold any land in the affected area but who earns his livelihood principally by manual labour on agricultural land therein immediately before such declaration and who has been deprived of his livelihood;

(d) "*Agricultural Land*" includes lands being used for the purpose of

(i) agriculture or horticulture;

(ii) dairy farming, poultry farming, pisciculture, breeding of livestock or nursery growing medicinal herbs;

(iii) raising of crops, grass or garden produce; and

(iv) land used by an agriculturist for the grazing of cattle, but does not include land used for cutting of wood only;

(e) "*Appropriate Government*" means,

(i) in relation to the acquisition of land for the purposes of the Union, the Central Government;

(ii) in relation to a project which is executed by the Central Government agency or undertaking or by any other agency on the orders or directions of the Central Government, the Central Government;

(iii) in relation to the acquisition of land for purposes other than (i) and (ii) above, the State Government; and

(iv) in relation to the rehabilitation and resettlement of persons involuntarily displaced due to any other reason, the State Government;

(f) '*BPL family*' means: The below poverty line (BPL) families shall be those as defined by the Planning Commission of India from time to time and included in a BPL list for the time being in force;

(g) "*Commissioner for Rehabilitation and Resettlement*" means the Commissioner for Rehabilitation and Resettlement appointed by the State Government not below the rank of Commissioner or of equivalent rank of that Government;

- (h) "*Family*" includes a person, his' or her spouse, minor sons, unmarried daughters, minor brothers, unmarried sisters, father, mother and other relatives residing with him or her and dependent on him or her for their livelihood; and includes "nuclear family" consisting of a person, his or her spouse and minor children;
- (i) " *Holding*" means the total land held by a person as an occupant or tenant or as both;
- (j) "*Khatedar*" means a person whose name is included in the revenue records of the parcel of land under reference;
- (k) "*Land Acquisition*" or "*Acquisition of Land*" means acquisition of land under the Land Acquisition Act, 1894 (1 of 1894), as amended from time to time, or any other law of the Union or a State for the time being in force;
- (l) "*Marginal Farmer*" means a cultivator with an un-irrigated land holding up to one hectare or irrigated land holding up to half hectare;
- (m) "*Non-Agricultural Labourer*" means a person who is not an agricultural labourer but is primarily residing in the affected area for a period of not less than three years immediately before the declaration of the affected area and who does not hold any land under the affected area but who earns his livelihood principally by manual labour or as a rural artisan immediately before such declaration and who has been deprived of earning his livelihood principally by manual labour or as such artisan in the affected area;
- (n) "*Notification*" means a notification published in the Gazette of India or, as the case may be the Gazette of a State;
- (o) "*Small Farmer*" means a cultivator with an un-irrigated land holding up to two hectares or with an irrigated land holding up to one hectare, but more than the holding of a marginal farmer;
- (p) "*Community*" mean residents of a Panchayat as a whole, where land has been acquired;
- (q) "*Vulnerable Person*" such as disabled, destitutes, orphans, widows, abandoned women, or persons above fifty years of age who are not provided or cannot immediately be provided with alternate livelihood and who are not otherwise covered as part of a family

### Entitlement Framework

The Government of Maharashtra has a separate policy on Rehabilitation and Resettlement, hence, all the compensation for land acquisition is based on the Rehabilitation and Resettlement (R&R) Policy of MIDC which was upgraded in 2009. To encourage farmers' participation as partners in the development process in an industrial area, MIDC has offered benefits to farmers whose lands are acquired for conversion to an industrial area, under Consent Award per notification under Chapter VI of the MIDC Act of 1961. The benefits as mentioned in the R&R policy do not apply to the farmer who does not give consent for land acquisition because the farmer can approach relevant government organisation to request enhanced compensation for the acquired land. In addition, the policy does not take into account the fact that there may be a number of persons affected by the project who do not own land or other property but whose livelihood or economic interests depend on the land acquired, the proposal is that the land which is acquired under this project will need to

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be based on both the clauses of the National Rehabilitation and Resettlement Policy, 2007 as well as the R & R Policy of MIDC as it caters to the concerns of the landowners as well as the landless labourers.

The SPV constituted for managing the entire Shendra MIP will be responsible for implementation of the Resettlement and Rehabilitation Framework, as applicable, for the project area. The entitlement matrix for the project has been developed in accordance with the National Resettlement & Rehabilitation Policy 2007 and is provided in the **Table 4.3** below:

Table 4-3: Entitlement Matrix as per NRRP, 2007

Type of Loss	Definition of Affected Party	Entitlement Provisions
Loss of House due to acquisition	Each Nuclear Family	<ul style="list-style-type: none"> <li>Allotment of free of cost house site to the extent of actual loss of area of the acquired house but not more than two hundred and fifty square meter of land in rural areas, or one hundred and fifty square meter of land in urban areas, as the case may be, for each nuclear family;</li> <li>Provided that, in urban areas, a house of up to one hundred square meter, carpet area may be provided in lieu thereof Such a house, if necessary may be offered in a multi-storied building complex.</li> </ul>
Loss of House for BPL families without homestead land for a period of not less than three years preceding the date of declaration of but residing in the affected area continuously the affected area	Affected Family	<ul style="list-style-type: none"> <li>The Family will be entitled to a house of minimum one hundred square meter carpet area in rural areas, or fifty square meter carpet area in urban areas (which may be offered, where applicable, in a multi-storied building complex), as the case may be, in the resettlement area;</li> <li>Provided that any such affected family which opts not to take the house offered, will get a suitable one-time financial assistance for house construction, and the amount will not be less than what is given under any program of house construction by the Government of India.</li> </ul>
Loss of Agricultural land	Affected Family	<ul style="list-style-type: none"> <li>For loss of entire agriculture land, the AP will be provided agricultural land or cultivable wasteland to the extent of actual land loss by the khatedar(s) in the affected family subject to a maximum of one hectare of irrigated land or two hectares of un-irrigated land or cultivable wasteland, if Government land is available in the resettlement area. This benefit will also be available to the affected families who have, as a consequence of the acquisition or loss of land, been reduced to the status of marginal farmers.</li> </ul>
Financial Assistance for Agriculture Land Losers	Each <i>Khatedar</i>	<ul style="list-style-type: none"> <li>In case of allotment of wasteland or degraded land in lieu of the acquired land, each khatedar in the affected family will get a one-time "financial assistance of such amount as the appropriate Government may decide but not less than fifteen thousand rupees per hectare for land development</li> <li>In case of allotment of agricultural land in lieu of the acquired land, each .khatedar in the affected family will get a one-time financial assistance of such amount as the appropriate Government may decide but not less than ten thousand rupees, for agricultural production.</li> </ul>
Financial Assistance for Cattle shed	Affected Family	<ul style="list-style-type: none"> <li>One-time financial assistance of such amount as the appropriate Government may decide but not less than fifteen thousand rupees, for construction of cattle shed</li> </ul>
Financial Assistance for Shifting	Affected Family	<ul style="list-style-type: none"> <li>One-time financial assistance of such amount as the appropriate Government may decide but not less than ten thousand rupees, for shifting of the family, building materials,belongings and cattle.</li> </ul>
Financial Assistance for rural artisan, small trader or self employed person	Affected Person	<ul style="list-style-type: none"> <li>One-time financial assistance of such amount as the appropriate Government may decide but not less than twenty-five thousand rupees, for construction of working shed or shop</li> </ul>
Other Project Benefits in case of land Acquisition	Affected Family	<ul style="list-style-type: none"> <li>Preference to the affected families – at least one person per nuclear family - in providing employment in the project, subject to the availability of vacancies and suitability of the AP for the employment;</li> <li>Arrange for training of the APs, so as to enable such persons to take on suitable jobs;</li> <li>Offer scholarships and other skill development opportunities to the eligible persons from the affected families as per the criteria as may be fixed by the appropriate Government;</li> <li>Preference to the APs or their groups or cooperatives in the allotment of outsourced contracts, shops or other economic opportunities coming up in or around the project site; and</li> <li>The requiring body will give preference to willing landless laborers and unemployed APs while engaging labor in the project during the construction phase.</li> </ul>
Training for Livelihood	Affected Person	<ul style="list-style-type: none"> <li>Training facilities for development of entrepreneurship, technical and professional skills for self employment</li> </ul>
Rehabilitation Grant	Affected Family	<ul style="list-style-type: none"> <li>Affected families who have not been provided agricultural land or employment will be entitled to a rehabilitation grant equivalent to seven hundred fifty days minimum agricultural wages or such other higher amount as may be prescribed by the appropriate Government;</li> <li>Provided that, if the requiring body is a company authorized to issue shares and debentures, such affected families will be given the option of taking up to twenty percent of their rehabilitation grant amount in the form of shares or debentures of the requiring body, in such manner as may be prescribed;</li> <li>Provided further that the appropriate Government may, at its discretion, raise this proportion up to fifty percent of the rehabilitation grant amount.</li> </ul>
Compensation for Land Development Projects	Affected Family	<ul style="list-style-type: none"> <li>In cases where the acquisition of agricultural land or involuntary displacement takes place on account of land development projects, in lieu of land-for-land or employment, such affected families would be given site(s) or apartment(s) within the development project, in proportion to the land lost, but subject to such limits as may be defined by the appropriate Government.</li> </ul>
Subsistence Allowance	Affected Family	<ul style="list-style-type: none"> <li>Monthly subsistence allowance equivalent to twenty-five days minimum agricultural wages per month for a period of one year from the date of displacement.</li> </ul>
Special Provision for vulnerable persons such as the disabled, destitute, orphans, widows, unmarried girls, abandoned women, or persons above fifty years of age; who are not provided or cannot immediately be provided with alternative livelihood, and who are not otherwise covered as part of a family	Vulnerable Affected Person	<ul style="list-style-type: none"> <li>Arrange for annuity policies that will pay a pension for life to the vulnerable APs, of such amount as may be prescribed by the appropriate Government subject to a minimum of five hundred rupees per month.</li> </ul>
Emergency Acquisition	Affected Family	<ul style="list-style-type: none"> <li>Each affected family which is displaced will be provided with transit and temporary accommodation, pending rehabilitation and resettlement scheme or plan, in addition to the monthly subsistence allowance and other rehabilitation and resettlement benefits due to them under this policy</li> </ul>

Type of Loss	Definition of Affected Party	Entitlement Provisions
Assistance for Linear Projects	Each Khatedar	<ul style="list-style-type: none"> <li>▪ An ex-gratis payment of such amount as the appropriate Government may decide but not less than twenty thousand rupees, in addition to the compensation or any other benefits due under the Act or program or scheme under which the land, house or other property is acquired Provided that, if as a result of such land acquisition, the land-holder becomes landless or is reduced to the status of a "small" or "marginal" farmer, other rehabilitation and resettlement benefits available under this policy will also be extended to such affected family.</li> </ul>
<b>Project affected families belonging to the Scheduled Tribes and Scheduled Caste as per NRRP,2007</b>		
Loss of Land	PAFs	<ul style="list-style-type: none"> <li>▪ In case of a project involving land acquisition on behalf of a requiring body which involves involuntary displacement of two hundred or more Scheduled Tribes families, a Tribal Development Plan Shall be prepared in such form as may be prescribed, laying down the detailed procedure for setting land rights due but not settled and restoring titles on alienated land by undertaking a special drive together with land acquisition. The plan shall also contain a programme for development of alternate fuel, fodder and non-timber forest produce (NTFP) resources on non-forest lands within a period of five year sufficient to meet requirement of tribal who are denied access to forest.</li> <li>▪ In case of involuntary displacement of two hundred or more Scheduled Tribes families from the Scheduled Areas, the concerned Tribes Advisory Councils (TCAs) may be consulted.</li> <li>▪ Each affected family of Scheduled Tribe followed by Scheduled Caste categories shall be given preference in allotment of land-for-land, if Government land is available in the resettlement area.</li> <li>▪ In case of land being acquired from members of the Scheduled Tribes, at least one-third of the compensation amount due shall be paid to the affected families at the outset as first installment and set the rest at the time of taking over the possession of the land.</li> <li>▪ In case of a project involving land acquisition on behalf of a requiring body, each Scheduled Tribe affected family shall get an additional one-time financial assistance equivalent to five hundred days minimum agriculture wages for loss of customary rights or usages of forest produce.</li> <li>▪ The Scheduled Tribes affected families will be re-settled as for possible in the same schedule Area in a compact block, so that they can retain their ethnic, linguistic and culture identity. Excepted would be allowed only in rare case where the requiring body in case of a project involving land acquisition, or the state Government in the other cases of involuntary displacement, is unable to offer such land due to reasons beyond its control.</li> <li>▪ The resettlement areas predominantly by the Scheduled Tribes shall get land free of cost for community and religious gathering to the extent decided by the appropriate Government.</li> <li>▪ In case of a project involving land acquisition on behalf of a requiring body, the Scheduled tribes affected families resettled out of the district will get twenty-five per cent higher rehabilitation and resettlement benefits in monetary terms</li> <li>▪ Any alienation of tribal lands in violation of the law and regulation for the time being in force shall be treated as null and void. In case of acquisition of such land, the rehabilitation and resettlement benefits would be available to the original tribal land-owners.</li> <li>▪ The Scheduled Tribes and Schedule castes affected families enjoying reservation benefits in the affected area shall be entitled to get the reservation benefits at the resettlement area.</li> <li>▪ The affected Scheduled Tribes families, who were in possession of forest lands in the affected area prior to the 13th day of December, 2005, shall also be eligible for the rehabilitation and resettlement benefits under this policy.</li> </ul>

## 4.5 Overview of Applicable Policies of Government of India

Various policies released by the Government of India from time to time needs to be addressed while undertaking the projects. These policies have been discussed briefly in the subsequent sections.

### *National Resettlement and Rehabilitation Policy, 2007*

The objectives of the National Rehabilitation and Resettlement Policy are: to minimise displacement and to promote, 'as far as possible, non-displacing or least-displacing alternatives; to ensure adequate rehabilitation package and expeditious' implementation of the rehabilitation process with the active participation of the affected families; to ensure that special care is taken for protecting the rights of the weaker sections of society, especially members of the Scheduled Castes and Scheduled Tribes, and to create obligations on the State for their treatment with concern and sensitivity; to provide a better standard of living, making concerted efforts for providing sustainable income to the affected families; to integrate rehabilitation concerns into the development planning and implementation process; and where displacement is on account of land acquisition, to facilitate harmonious relationship between the requiring body and affected families through mutual cooperation.

### *National Environmental Policy 2006*

Government of India released the National Environment Policy in 2006. The present national policies for environmental management are contained in the National Forest Policy, 1988, the National Conservation Strategy and Policy Statement on Environment and Development, 1992; and the Policy Statement on Abatement of Pollution, 1992. Some sector policies such as the National Agriculture Policy, 2000; National Population Policy, 2000; and National Water Policy, 2002; have also contributed towards environmental management. All of these policies have recognized the need for sustainable development in their specific contexts and formulated necessary strategies to give effect to such recognition.

The dominant theme of this policy is that while conservation of environmental resources is necessary to secure livelihoods and well-being of all, the most secure basis for conservation is to ensure that people dependent on particular resources obtain better livelihoods from the fact of conservation, than from degradation of the resource.

## 4.6 Applicable Environmental Standards

The applicable environmental standards for the proposed project have been discussed in the subsequent sections.

### *Ambient Air Quality*

National Ambient Air Quality Standards (NAAQS), as notified under Environment (Protection) Rules 1986 and revised through Environment (Protection) Seventh Amendment Rules, 2009 are given in Table 4-4

**Table 4-4: National Ambient Air Quality Standards**

Pollutant	Time Weighted Average	Concentration in Ambient Air	
		Industrial, Residential, Rural and other Areas	Ecologically Sensitive Area (notified by Central Government)
Sulphur Dioxide (SO <sub>2</sub> ), µg/m <sup>3</sup>	Annual*	50	20
	24 Hours**	80	80
Nitrogen Dioxide (NO <sub>2</sub> ), µg/m <sup>3</sup>	Annual*	40	30
	24 Hours**	80	80
Particulate Matter (size less than 10 µm) or PM <sub>10</sub> , µg/m <sup>3</sup>	Annual*	60	60
	24 Hours**	100	100
Particulate Matter (size less than 2.5 µm) or PM <sub>2.5</sub> , µg/m <sup>3</sup>	Annual*	40	40
	24 Hours**	60	60
Ozone (O <sub>3</sub> ), µg/m <sup>3</sup>	8 Hours**	100	100
	1 Hour**	180	180
Lead (Pb), µg/m <sup>3</sup>	Annual*	0.5	0.5
	24 Hours**	1	1
Carbon Monoxide (CO), mg/m <sup>3</sup>	8 Hours	2	2
	1 Hour**	4	4
Ammonia (NH <sub>3</sub> ), µg/m <sup>3</sup>	Annual*	100	100
	24 Hours**	400	400
Benzene (C <sub>6</sub> H <sub>6</sub> ), µg/m <sup>3</sup>	Annual*	5	5
Benzo (O) Pyrene (BaP), particulate phase only, ng/m <sup>3</sup>	Annual*	1	1
Arsenic (As), ng/m <sup>3</sup>	Annual*	6	6
Nickel (Ni), ng/m <sup>3</sup>	Annual*	20	20

\* Annual arithmetic mean of minimum 104 measurements in a year taken twice a week, 24 hourly at uniform interval

\*\* 24 hourly or 8 hourly or 01 hourly values as applicable shall be complied with 98% of the time in a year. 2% of the time they may exceed, but not on 2 consecutive days. Note: Whenever and wherever monitoring results on two consecutive days of monitoring exceed the limits specified above for the respective category, it shall be considered adequate reason to institute regular or continuous monitoring and further investigation.

### Water Quality Standards

The designated best use classification as prescribed by CPCB for surface water is as given in Table 4-5.

**Table 4-5: Primary Water Quality Criteria for Designated-Best-Use-Classes**

Designated-Best-Use	Class	Criteria
Drinking Water Source without conventional treatment but after disinfection	A	<ul style="list-style-type: none"> <li>Total Coliforms Organism in MPN/100ml shall be 50 or less</li> <li>pH between 6.5 and 8.5</li> <li>Dissolved Oxygen 6mg/l or more</li> <li>Biochemical Oxygen Demand 5 days 20°C 2mg/l or less</li> </ul>
Outdoor bathing (Organised)	B	<ul style="list-style-type: none"> <li>Total Coliforms Organism MPN/100ml shall be 500 or less</li> <li>pH between 6.5 and 8.5</li> <li>Dissolved Oxygen 5mg/l or more</li> <li>Biochemical Oxygen Demand 5 days 20°C</li> </ul>

Designated-Best-Use	Class	Criteria
		3mg/l or less
Drinking water source after conventional treatment and disinfection	C	<ul style="list-style-type: none"> <li>Total Coliforms Organism MPN/100ml shall be 5000 or less</li> <li>pH between 6 to 9</li> <li>Dissolved Oxygen 4mg/l or more</li> <li>Biochemical Oxygen Demand 5 days 20°C 3mg/l or less</li> </ul>
Propagation of Wild life and Fisheries	D	<ul style="list-style-type: none"> <li>pH between 6.5 to 8.5</li> <li>Dissolved Oxygen 4mg/l or more</li> <li>Free Ammonia (as N) 1.2 mg/l or less</li> </ul>
Irrigation, Industrial Cooling, Controlled Waste disposal	E	<ul style="list-style-type: none"> <li>pH between 6.0 to 8.5</li> <li>Electrical Conductivity at 25°C micro mhos/cm Max.2250</li> <li>Sodium absorption Ratio Max. 26</li> <li>Boron Max. 2mg/l</li> </ul>
	Below-E	Not Meeting A, B, C, D & E Criteria

Source: Central Pollution Control Board

### Ambient Noise Standards

Noise standards notified by the MoEFCC vide gazette notification dated 14 February 2000 based on the A- weighted equivalent noise level ( $L_{eq}$ ) are as presented in Table 4-6.

**Table 4-6: Ambient Noise Standards**

Area Code	Category of Area	Limits in dB(A) Leq	
		Day time*	Night Time
A	Industrial Area	75	70
B	Commercial Area	65	55
C	Residential Area	55	45
D	Silence Zone**	50	40

Note: \* Day time is from 6 am to 10 pm, Night time is 10 pm to 6.00 am;

\*\* Silence zone is defined as area up to 100 meters around premises of hospitals, educational institutions and courts. Use of vehicle horns, loud speakers and bursting of crackers are banned in these zones.

### Noise Standards for Occupational Exposure

Noise standards in the work environment are specified by Occupational Safety and Health Administration (OSHA-USA) which in turn are being enforced by Government of India through model rules framed under the Factories Act.

**Table 4-7: Standards for Occupational Noise Exposure**

Total Time of Exposure per Day in Hours (Continuous or Short term Exposure)	Sound Pressure Level in dB(A)
8	90
6	92
4	95
3	97
2	100
3/2	102
1	105
¾	107
½	110

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Total Time of Exposure per Day in Hours (Continuous or Short term Exposure)	Sound Pressure Level in dB(A)
¼	115
Never	>115

- No exposure in excess of 115 dB(A) is to be permitted.
- For any period of exposure falling in between any figure and the next higher or lower figure as indicated in column (1), the permissible level is to be determined by extrapolation on a proportionate scale.

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## 5. Baseline Environment

Baseline assessment is an integral part of environmental impact assessment. It helps in understanding the prevailing environmental and socio economic status of the study area. The baseline data is necessary to predict the future environmental scenario of the area due to the construction and operation of proposed projects.

The baseline environmental status in the proposed area marked under Shendra Mega Industrial Park site and the surrounding area was established through a comprehensive primary data collection program (during the study period between December 2011 and March 2012) and supplemented by the latest environmental monitoring data (December 2013-April 2014), collected by Maharashtra State Pollution Control Board (MSPCB) in Aurangabad city. The baseline data generation included site visits, primary environmental monitoring, ecological surveys, social surveys and interviews, processing of satellite imagery and secondary data review from established sources such as Indian Meteorological Department, Census of India etc.

The environmental monitoring for ambient air quality, water quality, soil quality, noise levels, meteorology and traffic survey of the study area extending upto 10km from the the site boundary was carried out by M/s Netel (India) Ltd, Thane as per the Terms of Reference approved by the Expert Appraisal Committee, Ministry of Environment, Forest and Climate Change (then called Ministry of Environment and Forest (MoEF). The baseline information generated for the project is presented in the following sections.

### 5.1 Methodology

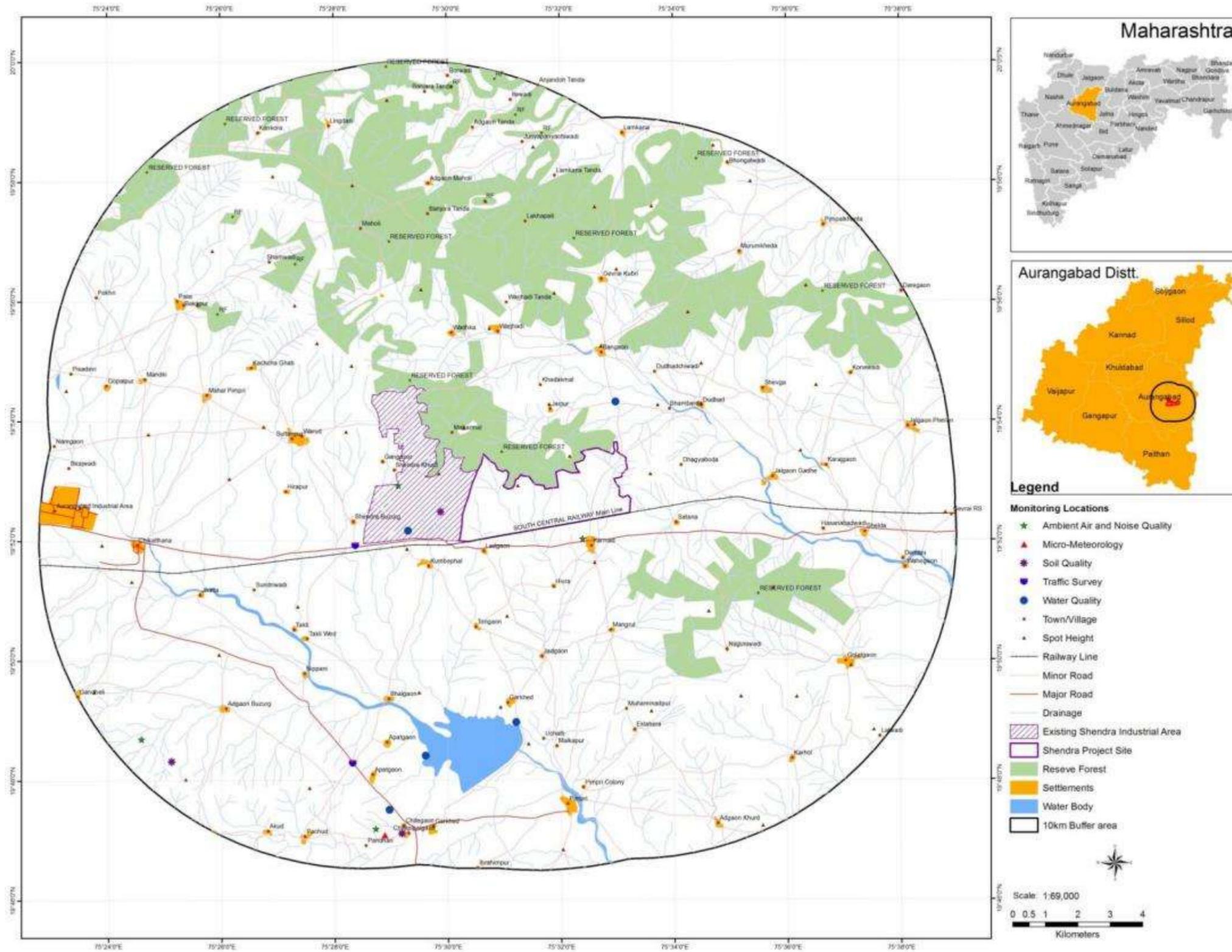
The baseline assessment is based on project site assessment and reconnaissance survey of the study area of 10 km radius around the boundary of the identified area. Baseline data is also supplemented by secondary information collected from various literatures, documents, report of previous surveys and also census data of the study area. Primary environmental baseline data was collected during December 2011- March 2012.

Secondary data and information on various environment aspects like hydrogeology, hydrology, drainage pattern, ecology meteorology and socio economic aspects were collected from different institutions, government offices and literatures etc. Socio economic baseline is based on information given in the District Census Handbook of Aurangabad.

The baseline ambient air quality, water quality, soil quality, noise level and traffic density in the study area is based on the monitoring conducted in the winter season. The baseline sampling and monitoring was done in compliance with applicable standards as prescribed by CPCB.

The baseline monitoring locations within study area of 10 km radius around the boundary of Shendra Mega Industrial Park site are presented in Figure 5-1. Details have been discussed in later sections.

Figure 5-1 Monitoring locations for Shendra MIP Site



## 5.2 Site Setting & Topography

The Shendra MIP site is located east to the city of Aurangabad with connectivity from SH-178 (Jalna Road), SH-148 (Paithan Road) and National Highway (NH) 211. The Shendra MIP is strategically positioned for direct connection to major state highways and the national rail network.

The planned MIP at Shendra will be spread over three village settlements – Ladgaon, Karmad and Kumbhephal. Settlements occurring within the delineated boundary are proposed to be integrated in new industrial township plan with minimal displacement. The important features around the identified project area are as provided below:

**East:** The area towards the east is mostly rural with Shendra and Kubhephal being important villages.

**South:** The project area has Sukhna Lake to the south, about 6km away, river Sukhna extending from the Sukhna Lake flows southeastwards, away from the project area.

**West:** The MIDC industrial area abuts the proposed site. The western boundary of the site is located about 10 km from the Aurangabad airport. The western side of the site is bound by hilly terrain extending towards Aurangabad city.

**North:** The important features in the North are hilly areas (with an average height of 650m amsl) categorized as Reserve Forest at about 1km from the site boundary.

The site settings are also presented in *Figure 5-2*.

The Shendra MIP project site falls largely within the Deccan Plains and is relatively flat, with two small areas of hilly land lying to the north and west of the project site that reach a height of over 750 meters. The area being a part of the Deccan plateau is sloping southeastwards from the Sahyadris. The land between these two hill ranges forms a valley draining to the Sukhna Reservoir. The topography map of study area is presented in *Figure 5-3* and *Figure 5-4*.

Figure 5-2 Shendra MIP - Site Settings

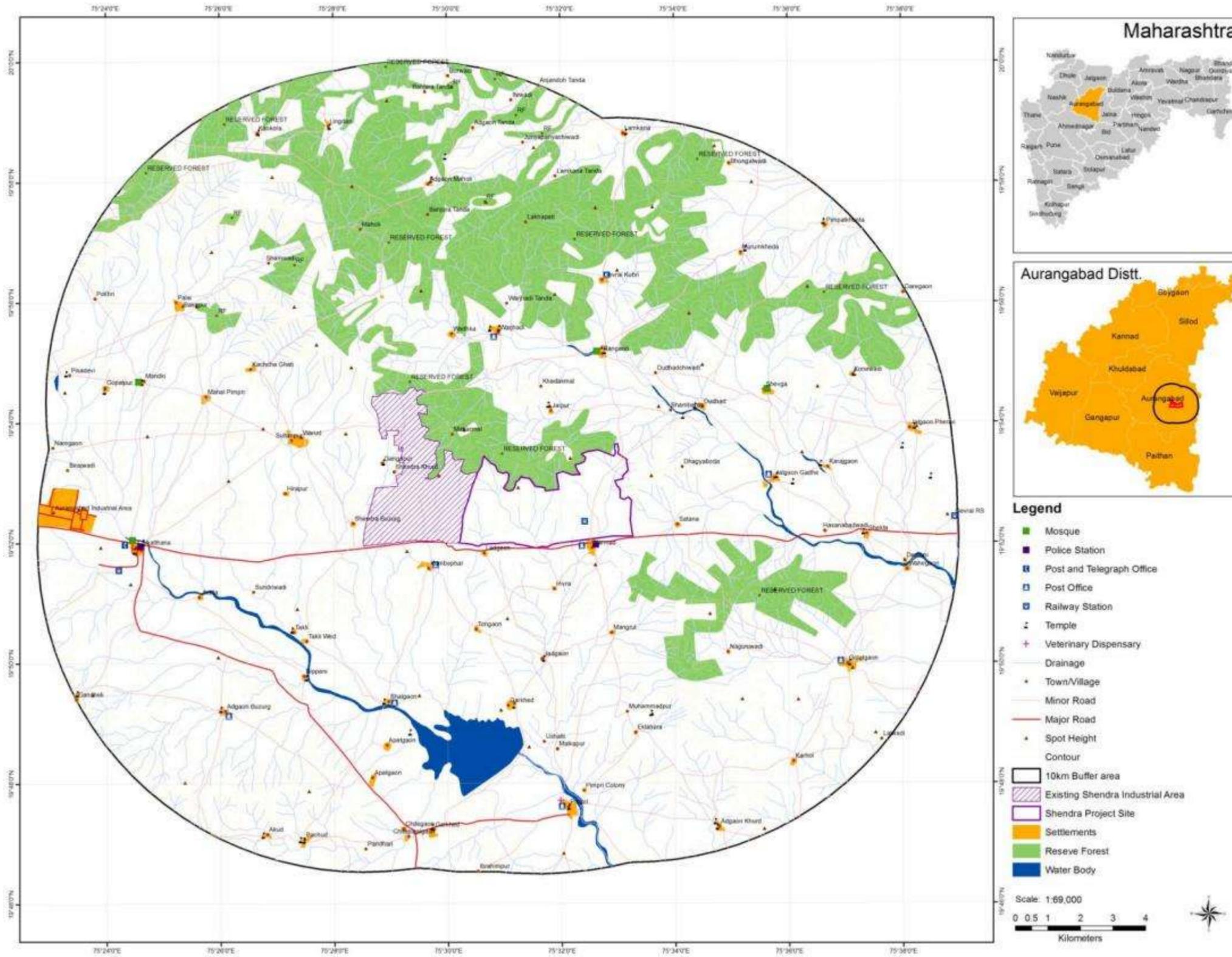


Figure 5-3 Detailed Topographical Map showing Shendra MIP

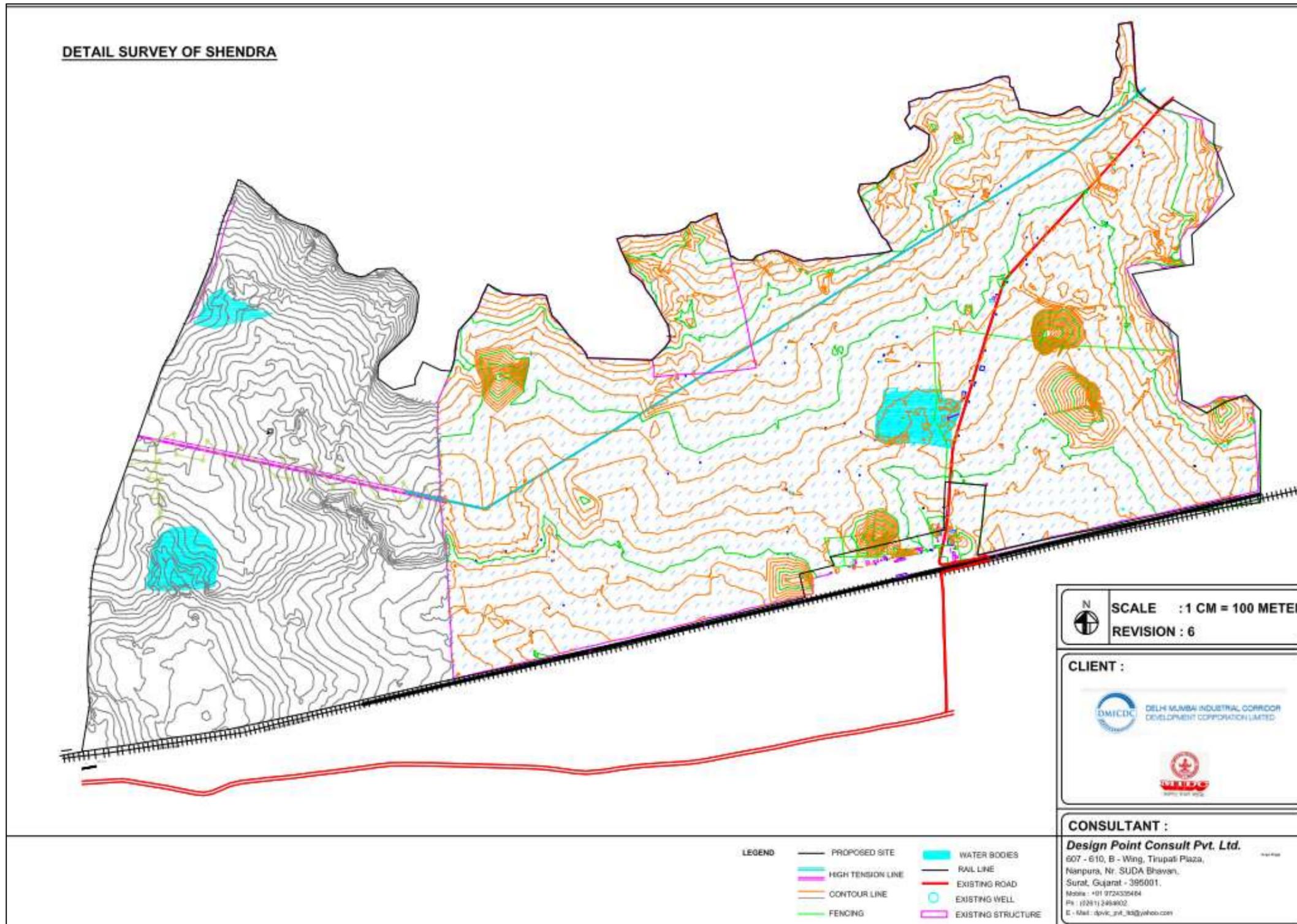
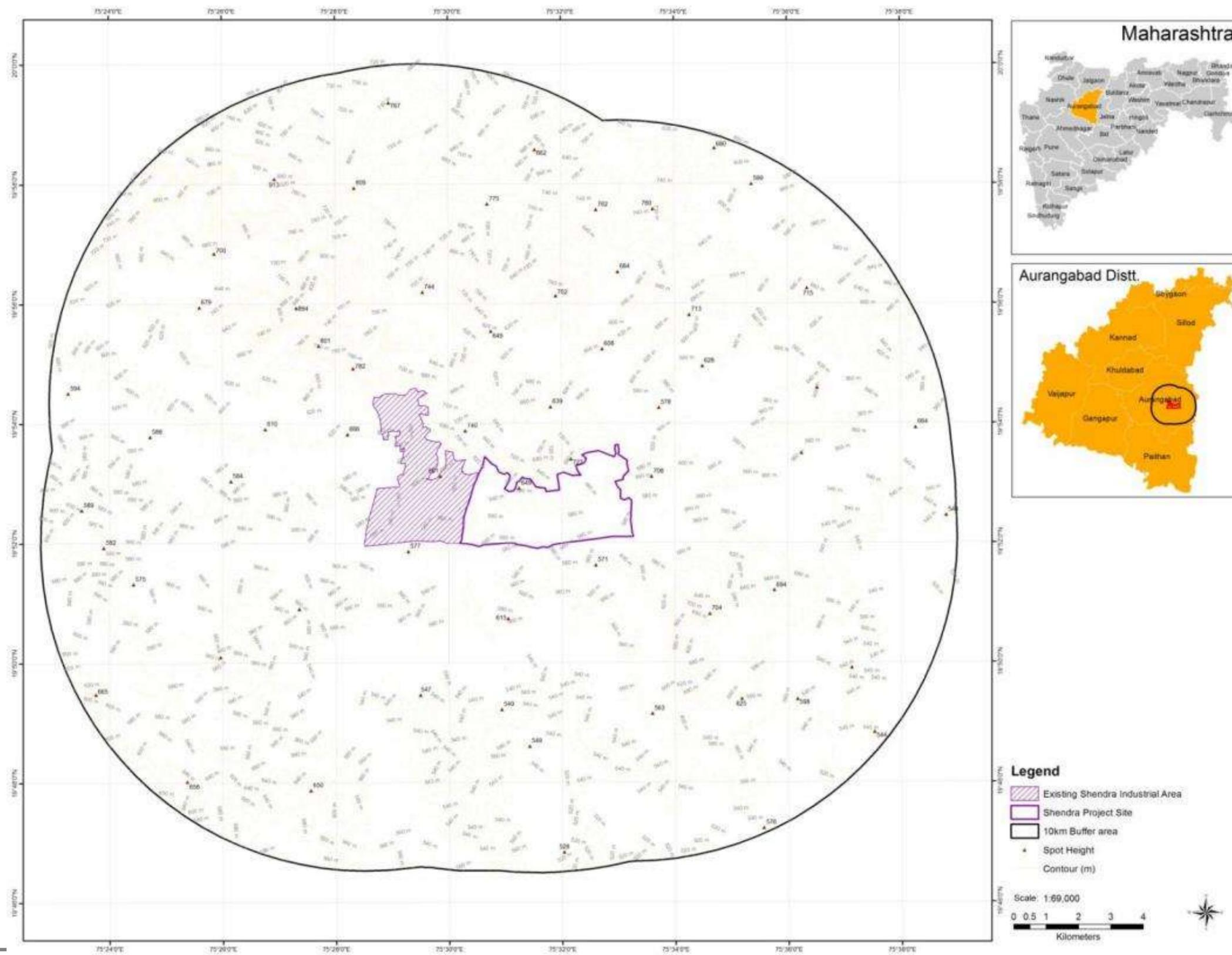


Figure 5-4: Topographical Map showing details within 10 km delineated boundary of Shendra MIP



### 5.3 Existing Land Use Pattern

In general, the existing land use of the Shendra MIP study area is dominated by agricultural land that is primarily irrigated from Sukhna Reservoir and other tanks in the region. This productive land is concentrated around drainage channels and reservoirs; agricultural land farther from these water features appears to be non-irrigated and dependent on rainfall. Other notable features of land use on the project site include:

- *Reserved Forest*—the hills immediately north of the project site are categorised as reserve forest. Like many areas of reserve forest in the Aurangabad region, the forests are highly degraded due to excessive grazing and population pressure. The forests are southern dry deciduous forests. Dominant species found in the forest include teak, Anjan, Dhaua, Salai, Char, Chandan, Mohi, Tembru, Kandol, Khair, Mhowa, Palas and Ain.
- *Barren Land*—the hills occurring at the western boundary of the site are largely barren lands, denuded of vegetation cover by overgrazing and collection of timber/firewood.
- *Industrial Land*—several areas to the north of Aurangabad—Jalna Highway have already been developed for light industrial, largely car manufacturing and assembly plants. Abutting the site on the west is existing MIDC’s Shendra Industrial area.
- *Rural Land*—there are three large villages – Ladgaon, Karmad and Kumbephal, occurring within the delineated boundary of Shendra MIP. The site boundary has been delineated to avoid impacts on these villages where possible, but some areas of rural village development will still occur within the site boundary.

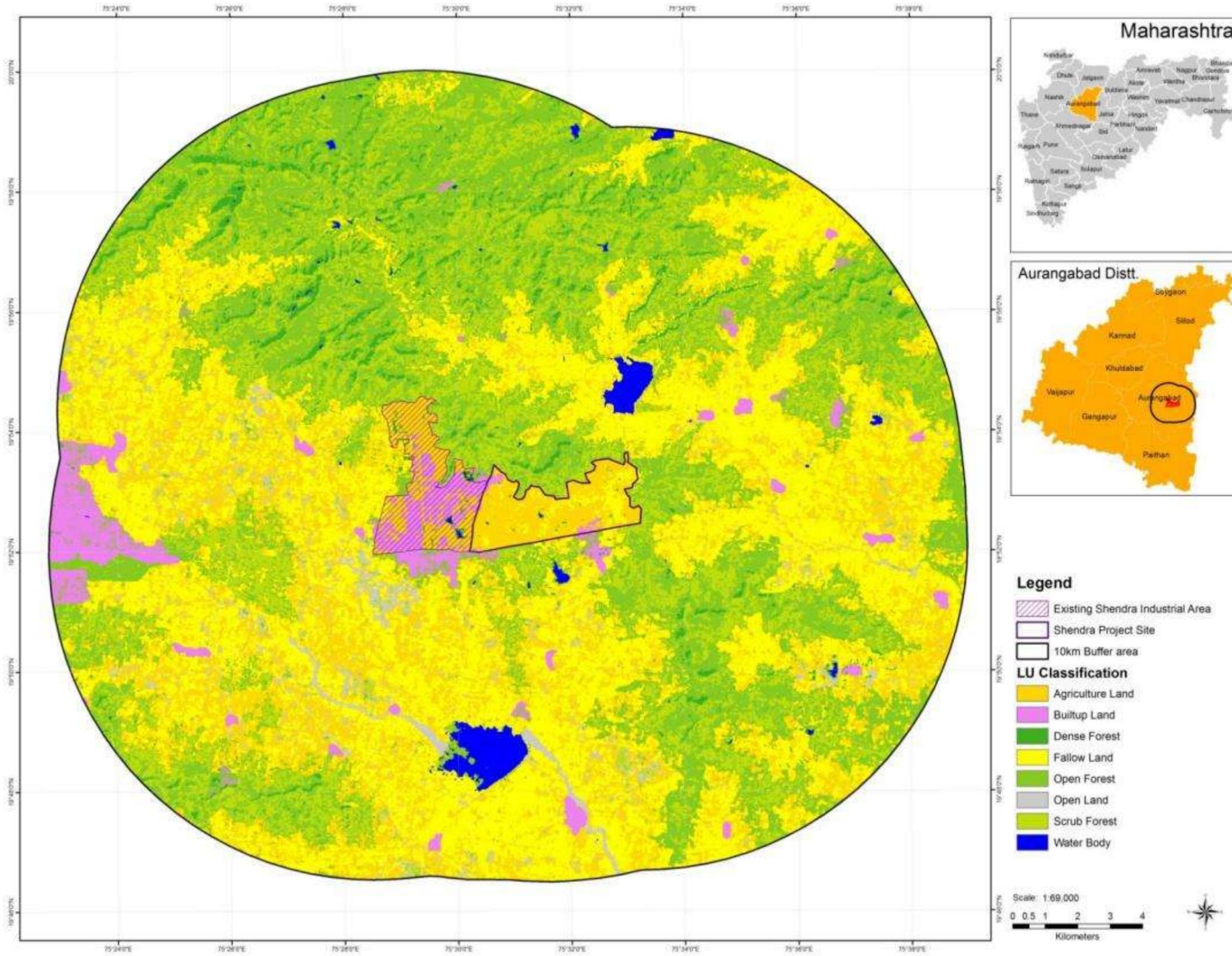
The existing land use break-up of the Study Area of 10km radius is provided in *Table 5-1* and presented in *Figure 5-5*.

**Table 5-1 Existing Land Use Pattern of Study Area (10 kms)**

S.No	Landuse	Area in km <sup>2</sup>	%
1	Agriculture	122.9	21.1
2	Builtup	18.0	3.1
3	Fallow	162.8	28.0
4	Open	12.7	2.2
5	Dense Forest	13.6	2.3
6	Scrub Forest	85.2	14.7
7	Open Forest	160.3	27.6
8	Water Body	5.8	1.0
<b>Total Area</b>		<b>581.4</b>	<b>100.0</b>

The predominant land use within study area is fallow land, open forest, followed by agricultural land and scrub forest land. Built up area constitute around 3 % and water bodies just 1% of the study area.

Figure 5-5 Land Use Plan of Project and Study Area



## 5.4 Morphology

The study area is a part of the Godavari basin with Sukhna River forming an important tributary. The proposed site falls within the catchment of Sukhna lake. The normal annual rainfall over the district varies from about 500 mm to about 840 mm.

## 5.5 Hydrogeology

The major part (95%) of the district constitutes a sequence of basaltic lava flows (Deccan Trap) while alluvium occupies a small portion mainly along the valleys. There are two distinct hydrogeological units in the district i.e. fissured formations (different units of basaltic lava flows) and porous formations (isolated patches of alluvial deposits). Deccan basalts are basically impervious and ground water occurs along the fractured/fissured and weathered zones. The occurrence and movement of ground water is controlled by variation in water bearing properties of these formations. The project area falls in Deccan trap, horizontally disposed and apparently more or less uniform in composition. The ground water occurs under water table and semi confined to confined conditions in Deccan Trap Basalt. The vesicular units in different trappean flows range in thickness from 2-8 meters and have primary porosity.

However, the nature and density of the vesicles, their distribution, interconnection between the vesicles, depth of weathering and topography of the area are the decisive factor for occurrence and movement of ground water in these units. Since the zeolitic units in vesicular traps are highly susceptible to weathering, the vesicular units comprising weathered zeolitic traps occurring in topographic lows are the main water bearing formation in hard rock terrain of the district.

In massive unit of Deccan Trap Basalt, ground water occurs in soil cum weathered mantle, joints, cracks and other weaker zones. The upper portion of the massive traps show persistent spheroidal weathering and exfoliation which helps in retaining more ground water in these rocks in comparison to compact massive unit. The storage of ground water in compact massive unit totally depends upon the presence of joints and their nature, distribution and interconnection. The average depth range of dugwells is 12.00 m to 15.00 m and that of borewells is 50.00 to 60.00 m in hard rock areas, whereas the yield ranges from 0.60 to 3.10 lps.

## Depth of Water Table

The data for depth of ground water table in Aurangabad district has been collected from Ground Water Information for Aurangabad District, Ministry of Water Resources (2010), Central Ground Water Board (CGWB).

### *Pre-monsoon Depth to Water level*

The depth to water levels in Aurangabad district recorded during May 2007 ranged between 4.82 m bgl (Ajanta) and 16.00 m bgl (Paithan). Shallow water levels within 2 to 5 m bgl were observed in northern parts of the district in parts of Soygaon and Sillod tehsils. Entire Khuldabad tehsil and major parts of Aurangabad, Gangapur, Kannad and Sillod tehsils experience water levels within 5 to 10 m bgl.

### Post-monsoon Depth to Water level

The depth to water level during post-monsoon (Nov. 2007) ranged between 1.85 (Chauka) and 16.00 (Paithan). Shallow water levels within 5 m bgl have been recorded in the past studies, in north-south extended patch along eastern side of the district occupying parts of Soygaon, Kannad, Silod and Gangapur tehsils and almost entire Aurangabad tehsil. Water levels within 5 to 10 m bgl have been recorded in major part of the district in western, southern and north eastern parts of the district, occupying almost entire Vaijapur, Paithan, Kannad and Sillod tehsils and parts of Khuldabad and Gangapur tehsils.

### Seasonal Fluctuation and Water Level Trend

The water level fluctuation in the district ranges from 0.00 (Adul) to 7.90 m (Limbe Jalgaon). The water level fluctuation in the range of 0 to 2 m is found in major part of the district in northern and southern parts occupying almost entire Soygaon, Sillod, Kannad, Paithan and parts of Gangapur tehsils. As per the past studies, water levels fluctuate in the range of 2 to 4 m in central part of the district covering parts of Khuldabad, Aurangabad and Gangapur tehsils. Fluctuations of more than 4 m is found in 2 scattered patches occupying eastern part of Aurangabad tehsil and parts of Vaijapur and Gangapur tehsil.

As per the ground water investigation undertaken during the period 1998-2007, during pre-monsoon season, only at a few locations, there is a rise in water table in the range of 0.01 to 0.68 m/ year. Most of the locations in district recorded a fall in water table which ranged between 0.03 to 0.79 m/ year. During post-monsoon period rise in water levels recorded at few locations has been ranging between negligible to 0.41 m/year whereas fall in water levels ranging between 0.01 and 0.97 m/year has been observed at most of the locations. In major part of the Aurangabad district, both during pre and post-monsoon periods declining trends in water levels have been observed. The depth to water table and seasonal fluctuations during pre-monsoon and post-monsoon season in Aurangabad district is presented in Table 5-2.

**Table 5-2 Depth to Water Table in Aurangabad District (2007)**

S. No	Season	Depth to Water Table	Seasonal Fluctuations (1998-2007)
1	Pre-monsoon (May)	4.82 to 16.70 m bgl	Rise - 0.01 to 0.68 m/year
			Fall - 0.03 to 0.79 m/year
2	Post-monsoon (Nov)	1.84 to 16.00 m bgl	Rise - Negligible to 0.41 m/year
			Fall - 0.01 to 0.97 m/year

Source: Ground Water Information for Aurangabad District, Ministry of Water Resources (2010)

### Ground Water Quality

Central Ground Water Board monitors the ground water quality of the Aurangabad district through National Hydrograph Network stations (NHNS), which mainly consist of the dugwells representing shallow aquifer. During the year 2007, CGWB carried out the ground water quality monitoring of 14 NHNS in Aurangabad. The chemical analysis results show that the ground water in the district is alkaline in nature, while the EC and TDS values show that the ground water in the area is mineralized

to medium extent. The concentrations of the major ions indicate that among the cations, the concentration of magnesium ion is highest followed by calcium and sodium while among anions, the concentration of chloride ion is highest followed by bicarbonate and sulphate ions. The ground water quality in most of the monitored wells is not suitable for drinking purpose due to high nitrate concentration. (Source: *Ground Water Information District Aurangabad, Maharashtra, 2004*). Overall, the ground water quality in the wells monitored is good for irrigation purpose.

### Ground Water Development

As per the data by Central Ground Water Board (CGWB) and Ground Water Survey and Development Agency (GSDA) for March 2004, the total annual ground water recharge is 1208.25 MCM with the natural discharge of 62.06 MCM, thus the net annual ground water availability in Aurangabad district is 1146.19 MCM. The annual gross draft for all uses is estimated at 632.72 MCM with irrigation sector being the major consumer having an annual draft of 605.84 MCM. The allocation for domestic and industrial water requirement is at 53.74 MCM/year for next 25 years. The net annual ground water availability for future irrigation is estimated at 459.72 MCM. The overall stage of ground water development for Aurangabad district is about 55% and it falls under “Safe” category. The status of ground water resources in Aurangabad tehsils is presented in Table 5-3. Figure 5-6 shows the Ground Water Resources for district Aurangabad.

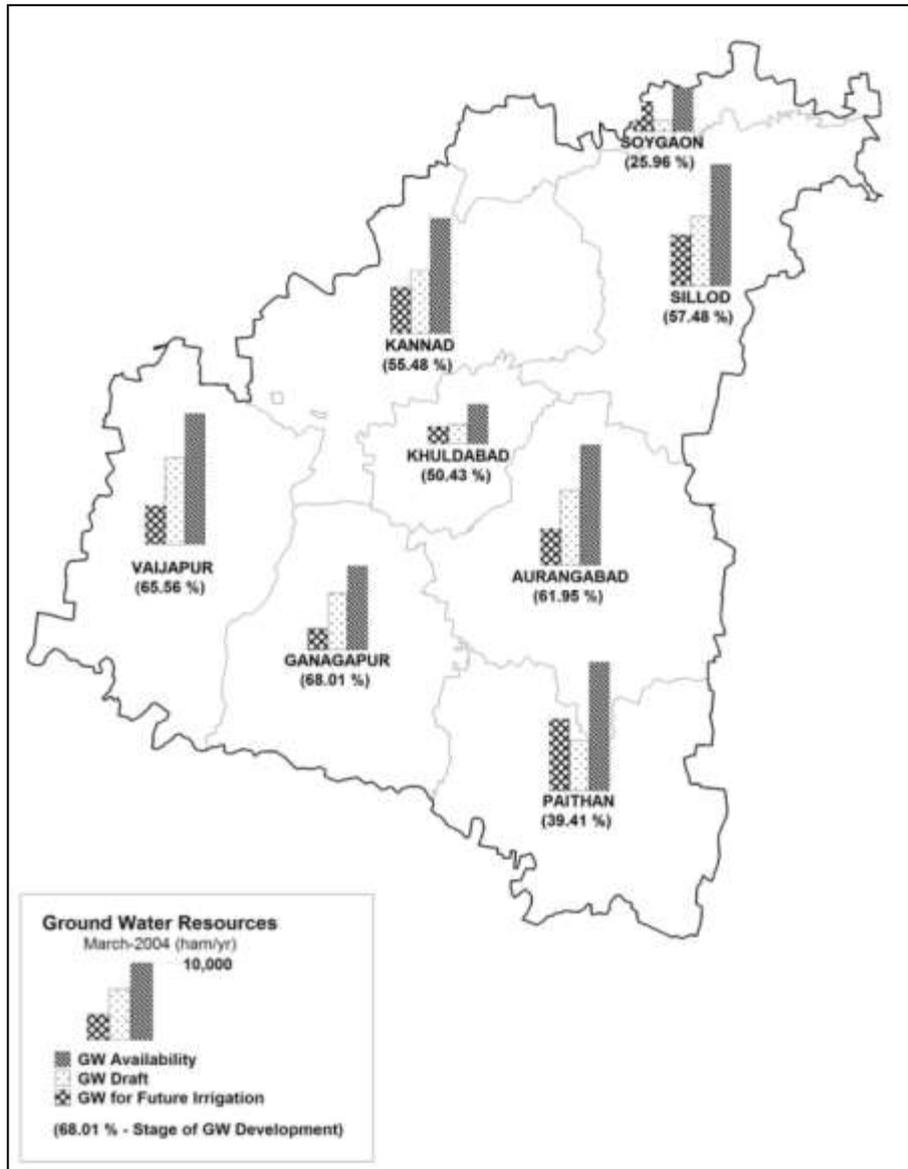
**Table 5-3 Ground Water Resources in Aurangabad District (March 2004)**

Tehsil	Net Annual Ground Water available (MCM)	Net Annual Draft (MCM)	Total Future Allocation for industrial and domestic req. (MCM)	Ground Water availability for future irrigation (MCM)	Percentage Development	Category
Aurangabad	175.17	108.51	8.90	53.24	61.95%	Safe

Note : MCM = Million Cubic Meter (Volume of Water)

Source: *Ground Water Information for Aurangabad District, Ministry of Water Resources (2010)*

Figure 5-6: Ground Water Resources (March 2004) for district Aurangabad

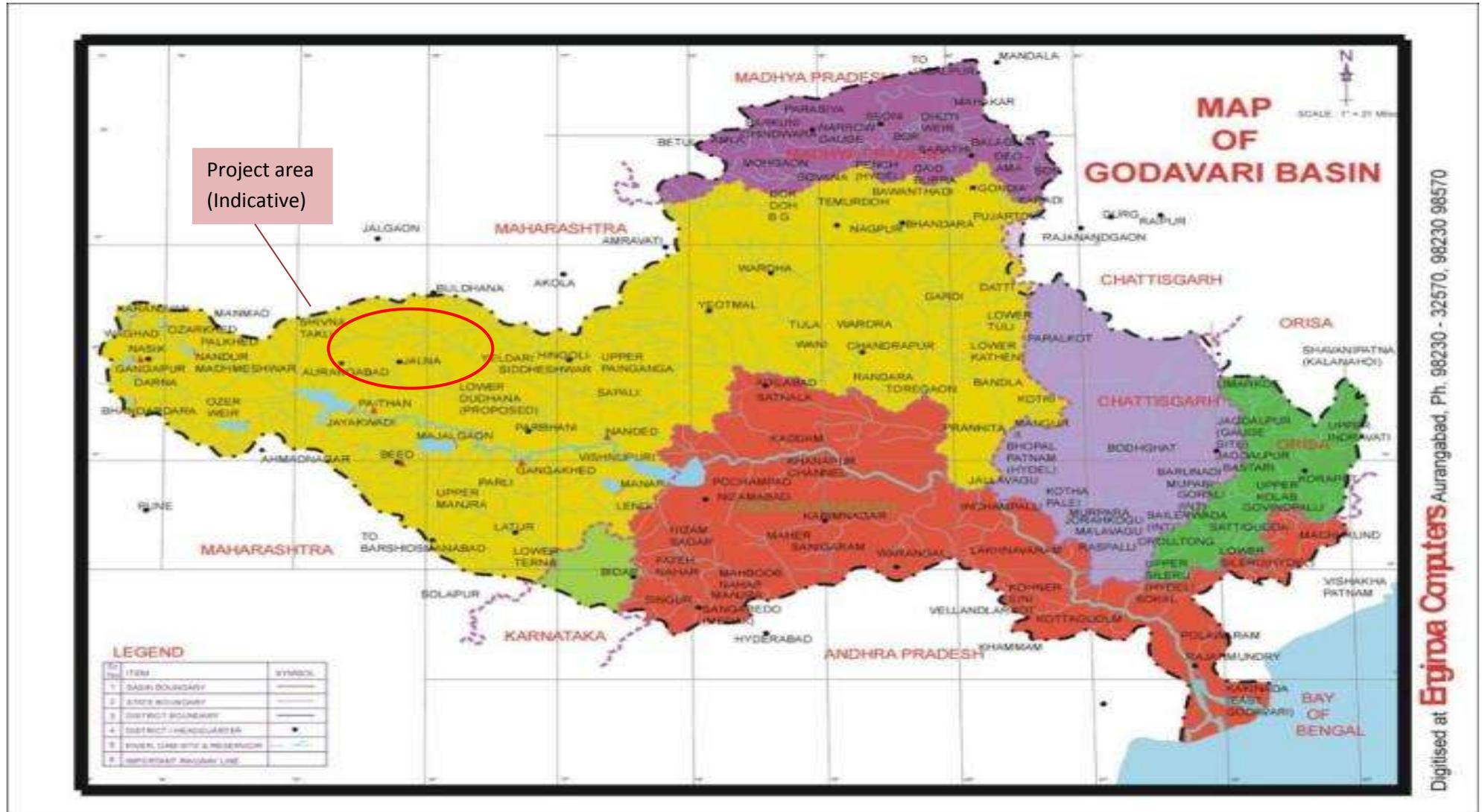


Source: Ground Water Information District Aurangabad, Maharashtra, 2004

### 5.6 Drainage pattern

Major part of the district falls in Godavari basin with a small area in north eastern parts falling Tapi Basin. The study area falls in the catchment of Godavari basin, with Sukhna Lake being the important reservoirs where the area drains into. The area is sloping towards the south-southeast as the drainage of the area is guided through various small streams and seasonal channels. Figure 5-7 presents river Godavari basin and indicative site area.

Figure 5-7 Plan depicting River Godavari basin with Indicative Project Area



## 5.7 Geology and Seismicity

The district is monotonously covered by the basaltic lava flows called Deccan Trap. The lava flows are called trap because of the step like or terraced appearance of their outcrops, the term being of Scandinavian origin. The lava flows are indicative of a great volcanic activity. The close of cretaceous period in the Indian Sub-continent was marked by an outburst of great volcanic activity through a series of gigantic fissures. The eruptions were not continuous but occurred at intervals separated by long or short periods of quiescence. These periods of diminished or no activity were marked by deposition of layers of volcanic ash or tuffaceous material or lacustrine or fluviatile sedimentary beds called Inter-trappeans, which in turn, were covered by subsequent outpourings of lava flows.

No notable economic mineral that could be exploited profitably has been discovered in the district, so far. As per the seismic zoning map of India (IS: 1893, Part-1, 2002), the project site is located in the Zone II, classified as MSK VII i.e., area having low damage risk zone. The design of the project buildings takes into account the required seismic resistance.

## 5.8 Climate & Micro-meteorology of the Study Area

Climatic conditions in the project area have been established from meteorological data provided in the Climatological tables published by the India Meteorological Department (IMD) for Aurangabad, which is 17 km west from the site.

### Climate of the Study Area

The climate of the area is characterized by a hot summer with dry conditions throughout the year except during the south west monsoon season, which is from June to September while October and November constitute the post-monsoon season. The winter season commences towards the end of November when temperatures fall rapidly and December is the coldest month. The daily temperature increases continuously from the beginning of March while May is the hottest month. The temperature falls appreciably with the onset of the south-west monsoon by about the second week of June.

### IMD Meteorological Data 1952-2000

The secondary data on surface meteorology based on 49 years data of Aurangabad IMD observatory for ambient temperature, and rainfall for the period 1952-2000 is summarized in Table 5-4.

**Table 5-4 Meteorological Data (1952-2000) at Aurangabad IMD Observatory**

Month	Temperature (Mean daily in °C)		Mean Rainfall in mm
	Maximum	Minimum	
January	29.0	11.0	11.3
February	31.7	13.0	2.7
March	35.6	17.6	5.6
April	38.5	21.9	3.9
May	39.5	23.9	26.2
June	34.7	22.9	132.2

Month	Temperature (Mean daily in °C)		Mean Rainfall
July	30.3	21.7	<b>157.9</b>
August	29.2	21.1	152.7
September	30.3	20.6	146.0
October	31.8	18.0	62.1
November	30.0	13.7	26.8
December	28.4	<b>10.7</b>	12.0

Source: IMD

### Temperature

Aurangabad has moderate type of climate and the temperature difference between summers and winters is not large. The summers are hot and winters are warm. According to the meteorological data published by IMD, the daily mean minimum temperature annually varies from 10.7°C in December to 23.9°C in May and the daily mean maximum temperature varies from 28.4° C in December to 39.5° C in May.

Cold weather commences by about the end of November when temperatures begin to fall rapidly. December is the coldest month of the year with the mean daily maximum temperature at 28.5° C) and the mean daily minimum at 10.7°C. In the cold season the district is sometimes affected by cold waves in association with the eastward passage of western disturbances across north India, when the minimum temperature may drop down to about 2° C to 4° C.

From the beginning of the month of March there is a rapid rise in both day and night temperatures. May is the hottest month of the year with the mean daily maximum temperature at 39.5° C and the mean daily minimum at 23.9°C. During the hot season the heat is often intense and the day temperatures on individual days may rise to about 45°C to 46° C. There is relief from the heat on some days when thundershowers occur during the afternoons. With the advance of the southwest monsoon into the district by about the second week of June there is an appreciable drop in both the day and night temperatures and the weather is pleasant. With the withdrawal of the monsoon by about the end of September the day temperatures increase a little and a secondary maximum in day temperature is recorded in October. But night temperatures decrease progressively after the withdrawal of the monsoon. After October both day and night temperatures steadily decrease.

### Relative Humidity

The air is generally dry over the study area except during the southwest monsoon season when the relative humidity is high. The summer months are the driest when the relative humidity is generally between 20% and 25% in the afternoons.

### Rainfall

In Aurangabad District, the rainy season starts from June to September when it experiences southwestern monsoon. The southwestern monsoon constitutes about 80% of total rainfall in the region. The months of July and August receive maximum rainfall in the range of 150-160mm.

The Aurangabad District has an average annual rainfall of 760 mm, even though the seasonal and inter annual variations in rainfall are also quite large. The rainfall is fairly well distributed throughout the wet season, with monthly rainfall of June, July, August, and September contributing to 19%, 23%, 23%, and 21% of the annual total respectively. Within the Aurangabad District, Khultabad and Sillod talukas have the highest rainfalls, while Vaijapur (western part of the site) has slightly lower rainfall. The average annual rainfall data for the period 1998-2007 obtained for the observations at Aurangabad are provided in **Table 5-5**.

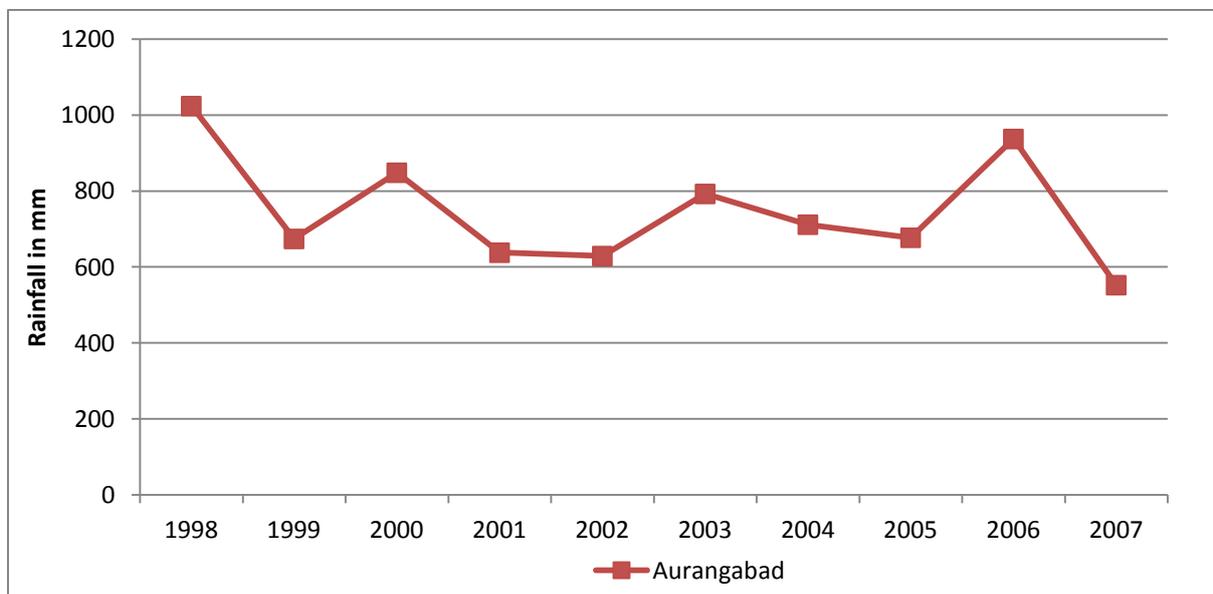
**Table 5-5 Average Annual Rainfall of Aurangabad District (1998-2007) in mm**

Year	Rainfall (mm)
1998	1024.0
1999	674.2
2000	848.5
2001	637.9
2002	629.0
2003	792.7
2004	711.6
2005	677.2
2006	937.4
2007	552.4
<b>Average Annual Rainfall</b>	<b>748.5</b>

Source: IMD data for Aurangabad

The average annual rainfall observed in the project area range between 640mm and 748mm which is not significant. The rainfall pattern over the years 1998-2007 at Aurangabad is as illustrated in Figure 5-8.

**Figure 5-8 Rainfall Pattern in Aurangabad District (1998-2007)**



**Project Area Specific Micro Meteorology**

An automatic weather station was installed at village Chitte Pimpalgaon, about 9km from the boundary of MIP Shendra (19°47'16.53"N; 75°29'7.50"E) for continuous recording of data for 24-hour period for during December 2011 – March 2012. Parameters that were recorded were wind speed, wind direction, temperature, relative humidity, cloud cover and rainfall. The meteorological data is tabulated below in Table 5-6.

**Table 5-6 Meteorological Monitoring Data (December 2011 to March 2012) for Study Area**

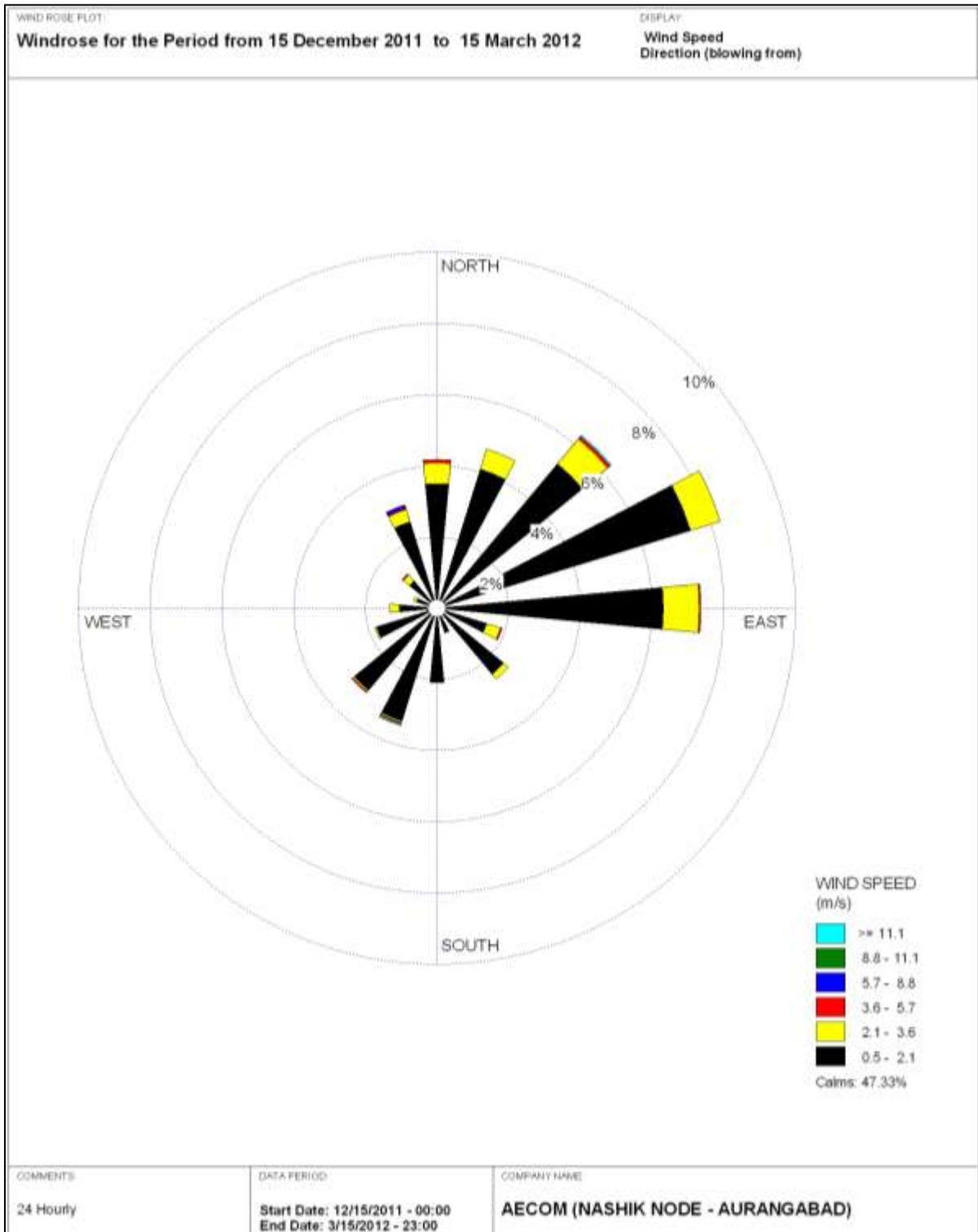
	Temperature (°C)	Relative Humidity (%)	Rainfall (mm)	Cloud Cover (oktas)
Maximum	39.4 °C	91%	0	3
Minimum	1.3 °C	4%	0	1
Average	21.3 °C	48%	0	2

The average temperature in the study area during monitoring period (Dec, 2011 – March, 2012) was 21.3 °C while the maximum temperature went up to 39.4 °C. The minimum temperature during monitoring period dipped to 1.3 °C. The relative humidity in the area ranged between 91% and 4%. The average humidity value in the area was recorded at 48%. There was no rainfall at the Chitte Pimpalgaon location throughout the monitoring period. The average wind speed in the area was recorded at 0.69 m/s and 47.3% of the time the wind was calm in the study area. The prominent wind direction during study period was **North-East**. The wind rose diagram for the study area is presented in Figure 5-9.

**Wind Speed/Direction**

Winds are generally light to moderate with increase in speed during the latter half of the summer season and in the monsoon season. The winds blow predominantly from directions between west and north during the hot season. These are mostly from directions between southwest and northwest during the southwest monsoon season. **Wind blow mostly from the directions northeast and southeast during the rest of the year.** The IMD wind data for Aurangabad (Chikalhana) for the period 1952-1980 reveals that the winds have maximum speed of about 19.8 km/hr during June and have an average speed of about 5.2 km/hr for December. The wind rose diagram for the study period of December, 2011 to March 2012 is presented below in Figure 5-9.

**Figure 5-9 Wind Rose diagram for study area (Dec, 2011 - Mar, 2012)**



## 5.9 Ambient Air Quality

The existing ambient air quality of the study area provides an assessment of pollution load and assimilative capacity of region and forms an important tool for planning further development in the area. Main air pollution sources in the study area are industrial areas (existing MIDC industrial areas of Shendra) vehicular traffic, and from domestic burning of fuel. Monitoring of ambient air in the Shendra MIP and its surrounding area was done to assess the ambient air quality in the study area and also to check the conformity with the ambient air quality standards specified by Central Pollution Control Board (CPCB).

### 5.9.1 Primary Monitoring

Ambient air quality monitoring was conducted at 3 locations; details are given in **Table 5-7**. The monitoring locations were selected primarily on the predominant wind direction in the area. The predominant wind direction during the monitored period at project site was observed to be **north-east**. However, the annual pattern shows that the predominant combined wind direction is from west and north-west.

The other factors locations were also considered while selection of the monitoring stations:

- Topography;
- Representative nature of the sample;
- Location of receptors;
- Accessibility; and
- Availability of power.

**Table 5-7 Details of Ambient Air Monitoring Stations**

S. No.	Sampling Locations	Location Code	Direction to the site	Geographical Location	Distance from the site (in km)	Rationale
1.	Shendra	AQ-1	NE	19°52'22.52"N 75°29'22.86"E	Within site boundary	This location was selected to establish the baseline air quality in existing Shendra industrial area
2.	Chitegaon	AQ-2	SW	19°47'16.53"N 75°29'7.50"E	Within site boundary	Location selected in the upwind direction
3.	Karmad	AQ-3	SE	19°52'1.85"N 75°32'18.96"E	Within site boundary	Location selected in upwind direction

The sampling and analysis of ambient air quality parameters was carried out as per the procedures detailed in relevant Parts of IS-5182 (Indian Standards for Ambient Air Quality Parameters). The applied testing procedures are given in brief in Table 5-8

**Table 5-8 Brief summary of the Methodology followed for Analysis of Ambient Air Quality**

S. No.	Parameter	Method/Protocol Followed	Analysis Procedure

S. No.	Parameter	Method/Protocol Followed	Analysis Procedure
1.	SPM	IS:5182 (Pt.-4)	-Sample collection with NPM-FDS 2.5A fine particulate sampler. -Analysis by gravimetric method.
2.	PM10	IS-5182 (Pt- 23)	-Sample collection for PM-10 with fine dust sampler NPM-FDS 2.5A without PM-2.5 inlet. -Analysis by gravimetric method.
3.	PM2.5	IS-5182 (Pt- 23)	- Sample collection for PM-2.5 with fine dust sampler NPM-FDS 2.5A with impactor. -Analysis by gravimetric method.
4.	SO <sub>2</sub>	IS:5182 ( Pt.-2)	-Sample collection in multi-gas sampler, absorption in Potassium tetrachloromercurate solution. - The absorbance of the intensely colored para-rosaniline methyl sulphonic acid was measured and the amount of SO <sub>2</sub> in the sample was computed.
5.	NO <sub>x</sub>	IS:5182 (Pt.-6)	-Sample collection carried out through orifice-tipped Impinger containing solutions of sodium hydroxide and sodium arsenite. - The ambient NO <sub>x</sub> concentrations were computed from the total nitrite ion present in the impingers, overall efficiency of the Impinger and the procedure, and the volume of air sampled.
6.	CO	IS:5182 (Pt.10)	-Collection of air in rubber bladder and aspirator. -Measurement by direct reading, Non Dispersive Infrared (NDIR) based CO analyzer.
7.	HC	IS:5182 (Pt.11)	-Collection of air in rubber bladder and aspirator. -Analysis by gas chromatography.
8.	O <sub>3</sub>	IS:5182 (Pt.9)	-Sample collected through absorption in potassium iodine solution. -Analysis by photometric method.
9.	H <sub>2</sub> S	IS:5182 (Pt.7)	

SPM PM10 PM2.5 SO<sub>2</sub> NO<sub>x</sub> CO HC O<sub>3</sub> H<sub>2</sub>S SPM PM10 PM2.5 SO<sub>2</sub> NO<sub>x</sub> CO

The ambient air quality monitoring was undertaken twice a day for two weeks. One set of 24 hour average samples were collected continuously. Analytical results of the air monitoring are presented in Table 5-9.

**Table 5-9 Ambient Air Quality in the Study Area (in µg/m<sup>3</sup>)**

Parameters	Observed	AQ-1	AQ-2	AQ-3
SPM : 24 Hourly	<b>NAAQS</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>
	Minimum	86.5	92.7	80.2
	Maximum	157.1	129.6	114.3
	Average	122.7	101	91.3
	98 <sup>th</sup> Percentile	156.8	123.2	113.3
PM10 : 24 Hourly	<b>NAAQS</b>	<b>100</b>	<b>100</b>	<b>100</b>
	Minimum	42.4	31.3	26.4
	Maximum	67.8	47.2	43.8
	Average	52.4	36.8	32.9
	98 <sup>th</sup> Percentile	67.4	46.5	43.7
PM 2.5 : 24 Hourly	<b>NAAQS</b>	<b>60</b>	<b>60</b>	<b>60</b>
	Minimum	16.9	12.4	11.3
	Maximum	34.1	19.3	17.5
	Average	25.4	16.6	15.5
	98 <sup>th</sup> Percentile	33.6	19.2	17.5
SO <sub>2</sub> : 24 Hourly	<b>NAAQS</b>	<b>80</b>	<b>80</b>	<b>80</b>
	Minimum	9.7	9.7	8.4
	Maximum	24.8	14.4	14.9
	Average	16.2	13.2	12.9
	98 <sup>th</sup> Percentile	24.5	14.4	14.9
NO <sub>x</sub> : 24 Hourly	<b>NAAQS</b>	<b>80</b>	<b>80</b>	<b>80</b>
	Minimum	18.1	13.6	11.2
	Maximum	37.7	19.6	17.4
	Average	28.6	17.8	15.5
	98 <sup>th</sup> Percentile	37.6	19.6	17.4
CO : 8 Hourly	<b>NAAQS</b>	<b>2000</b>	<b>2000</b>	<b>2000</b>
	Minimum	72	85	47
	Maximum	1135	770	721
	Average	525	430	380
	98 <sup>th</sup> Percentile	1105	753	704
HC (Methane): 24 Hourly	<b>NAAQS</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>
	Minimum	275	260	213
	Maximum	666	576	535
	Average	505	441	403
	98 <sup>th</sup> Percentile	663	575	530
HC (Non-Methane): 24 Hourly	<b>NAAQS</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>
	Minimum	<200	<200	<200
	Maximum	<200	<200	<200
	Average	<200	<200	<200
	98 <sup>th</sup> Percentile	<200	<200	<200
O <sub>3</sub> : 8 Hourly	<b>NAAQS</b>	<b>100</b>	<b>100</b>	<b>100</b>
	Minimum	<1.0	<1.0	<1.0
	Maximum	19.9	14.8	12.7
	Average	8.8	6.7	6.2
	98 <sup>th</sup> Percentile	19.6	14.0	12.0
H <sub>2</sub> S : 8 Hourly	<b>NAAQS</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>
	Minimum	<1.0	<1.0	<1.0
	Maximum	<1.0	<1.0	<1.0
	Average	<1.0	<1.0	<1.0
	98 <sup>th</sup> Percentile	<1.0	<1.0	<1.0

Detection Limits: SPM: 10µg/m<sup>3</sup>; RPM: 10µg/m<sup>3</sup>; SO<sub>2</sub>: 10µg/m<sup>3</sup>; NO<sub>x</sub>: 3µg/m<sup>3</sup>; CO: 0.1 mg/m<sup>3</sup>; HC (as CH<sub>4</sub> and non CH<sub>4</sub>): 0.5 ppm.

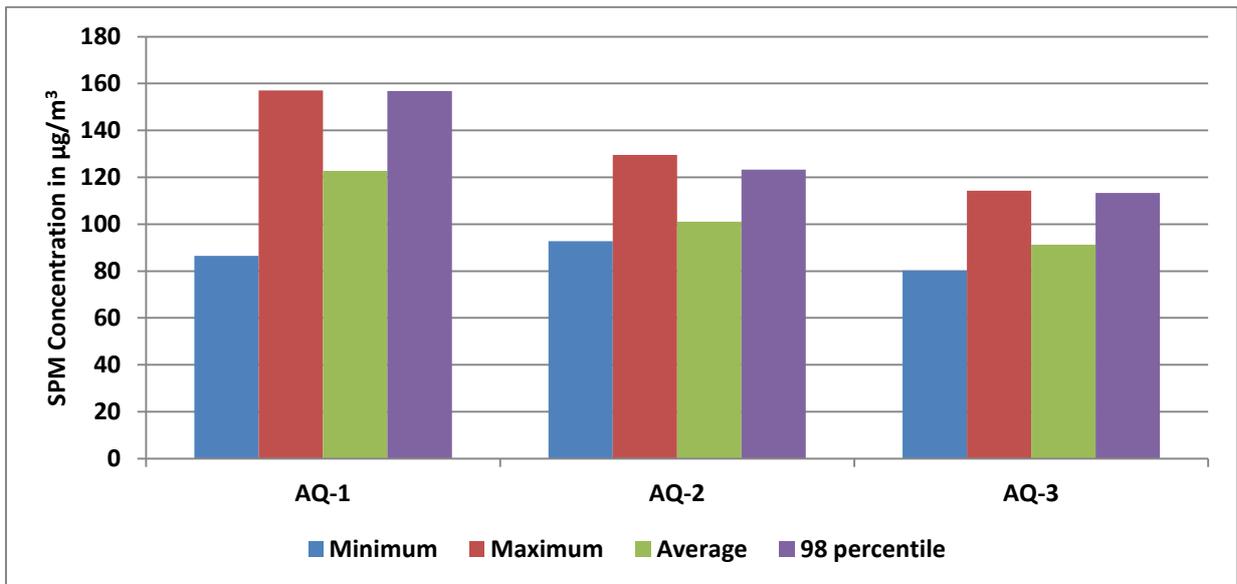
The analysis of the above results clearly show that all the monitored values are well within the limits prescribed by Central Pollution Control Board for residential, commercial, rural and industrial areas. The summary of results is presented in the following sub sections.

**5.9.2 Inferences**

**Suspended Particulate Matter (SPM)**

The observed SPM concentration varied from 80.2µg/m<sup>3</sup> to 157.1µg/m<sup>3</sup>. The minimum and maximum values were recorded at Karmad (AQ-3) and Shendra (AQ-1) respectively. The average SPM values varied from 91.3µg/m<sup>3</sup> to 122.7µg/m<sup>3</sup>. The 98 percentile values ranged from 113.3µg/m<sup>3</sup> to 156.8µg/m<sup>3</sup>. The graphical representation of observations is presented in **Figure 5-10**.

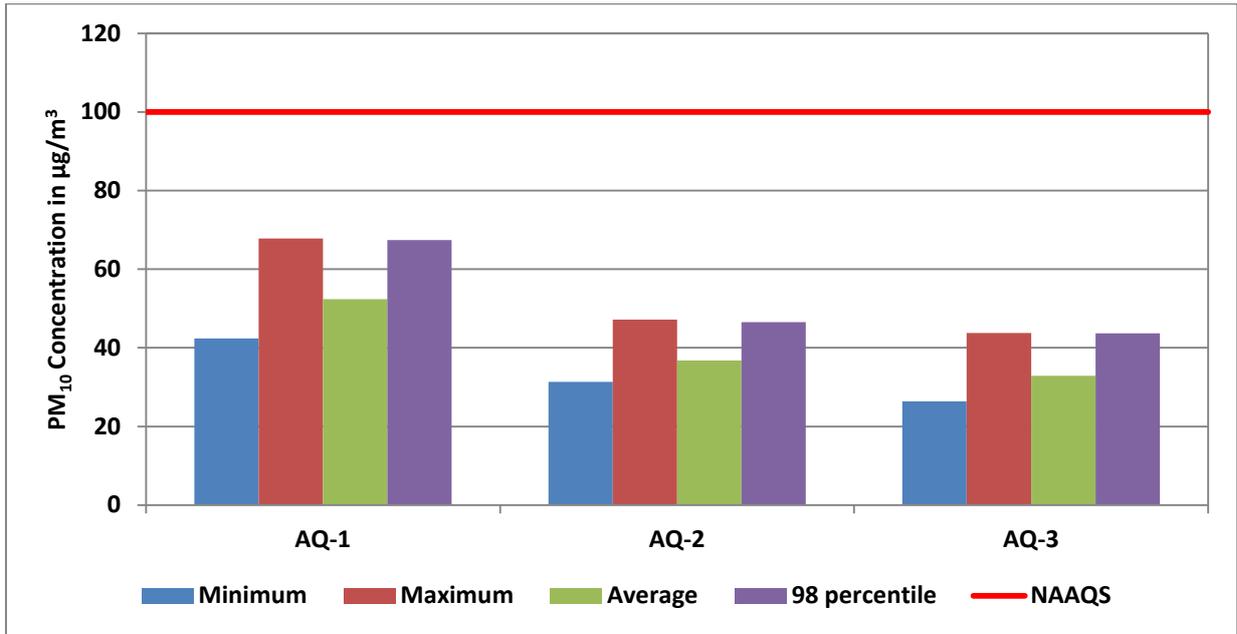
**Figure 5-10 Suspended Particulate Matter (SPM)**



**Particulate Matter – PM10**

The PM-10 concentration at all the sampling locations was within the prescribed CPCB limits of 100µg/m<sup>3</sup>. The minimum value recorded was 26.4µg/m<sup>3</sup> at Karmad (AQ-3). The maximum value recorded was 67.8µg/m<sup>3</sup> at Shendra (AQ-1). The 98 percentile values ranged from 43.7µg/m<sup>3</sup> to 67.4µg/m<sup>3</sup>. The average values varied from 32.9µg/m<sup>3</sup> to 52.4µg/m<sup>3</sup>. The graphical representation is provided in Figure 5-11.

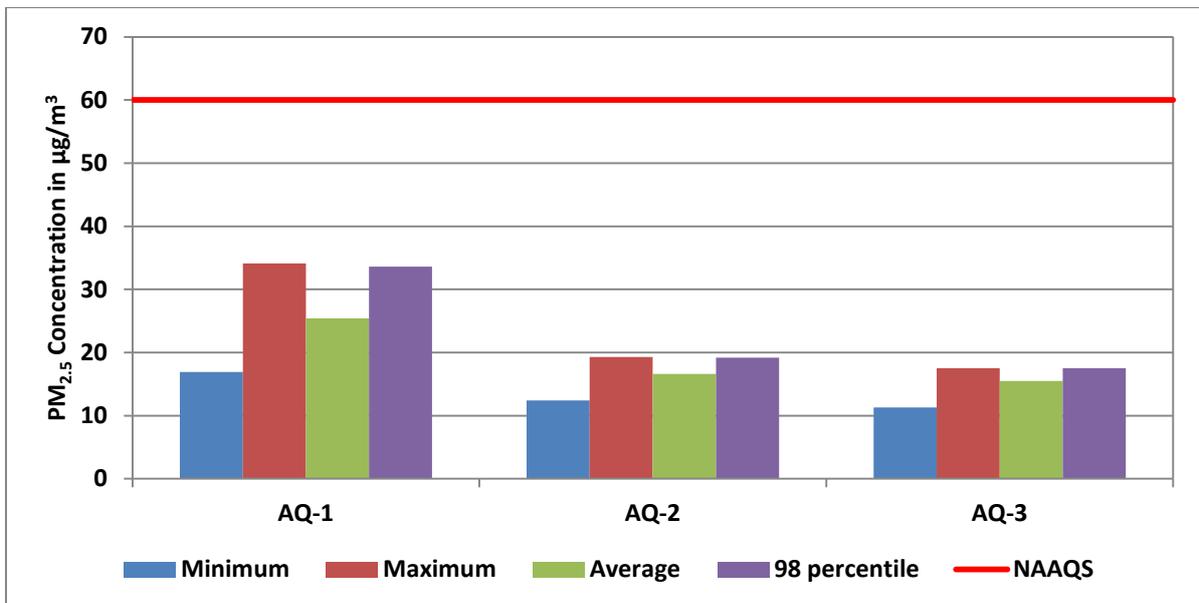
**Figure 5-11 Particulate Matter - PM10**



**Particulate Matter – PM2.5**

The observed PM-2.5 concentrations varied from a minimum of 11.3µg/m<sup>3</sup> recorded at Karmad (AQ-3) to maximum of 34.1µg/m<sup>3</sup> at Shendra (AQ-1). The average values ranged from 15.5µg/m<sup>3</sup> to 25.4µg/m<sup>3</sup>. The 98 percentile values of PM-2.5 ranged from 17.5µg/m<sup>3</sup> to 33.6µg/m<sup>3</sup>. All the values were observed to be within the prescribed CPCB standards of 60µg/m<sup>3</sup>. The observations of PM-2.5 are presented graphically in Figure 5-12.

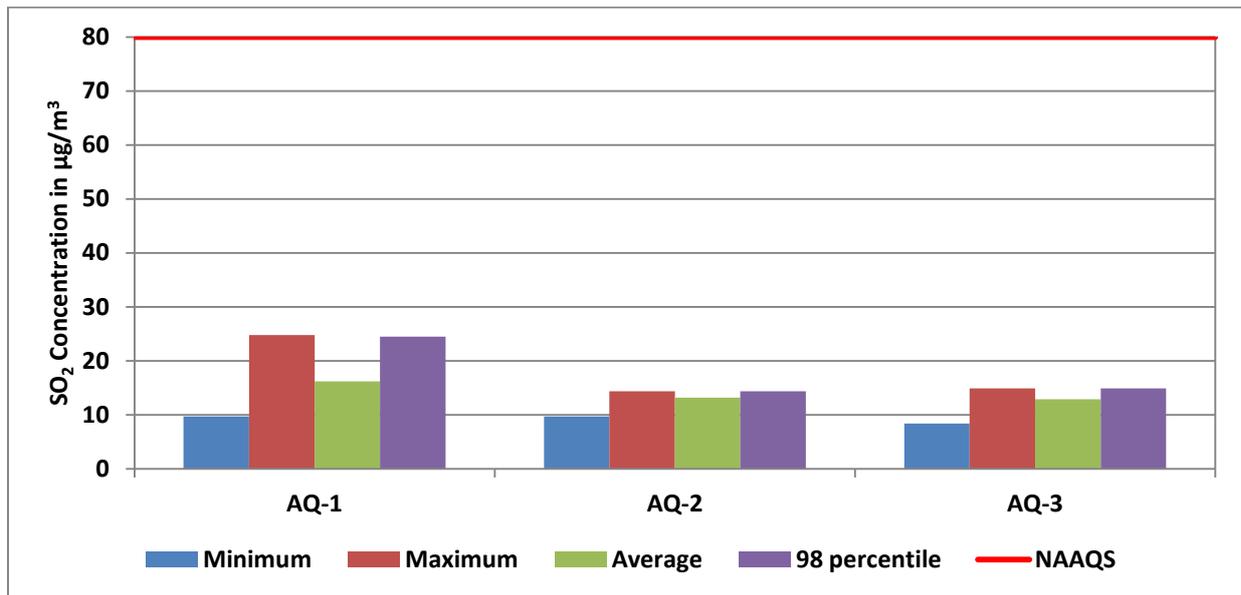
**Figure 5-12 Particulate Matter - PM2.5**



**Sulphur Dioxide (SO<sub>2</sub>)**

The concentrations of sulphur dioxide were observed to be in the range of 8.4µg/m<sup>3</sup> to 24.8µg/m<sup>3</sup>. The minimum value was recorded at Karmad (AQ-3). The maximum value of SO<sub>2</sub> was recorded at Shendra (AQ-1). The average values ranged from 12.9µg/m<sup>3</sup> to 16.2µg/m<sup>3</sup> and 98 percentile values varied from 14.4µg/m<sup>3</sup> to 24.5µg/m<sup>3</sup>. The graphical representation of observations is presented in Figure 5-13

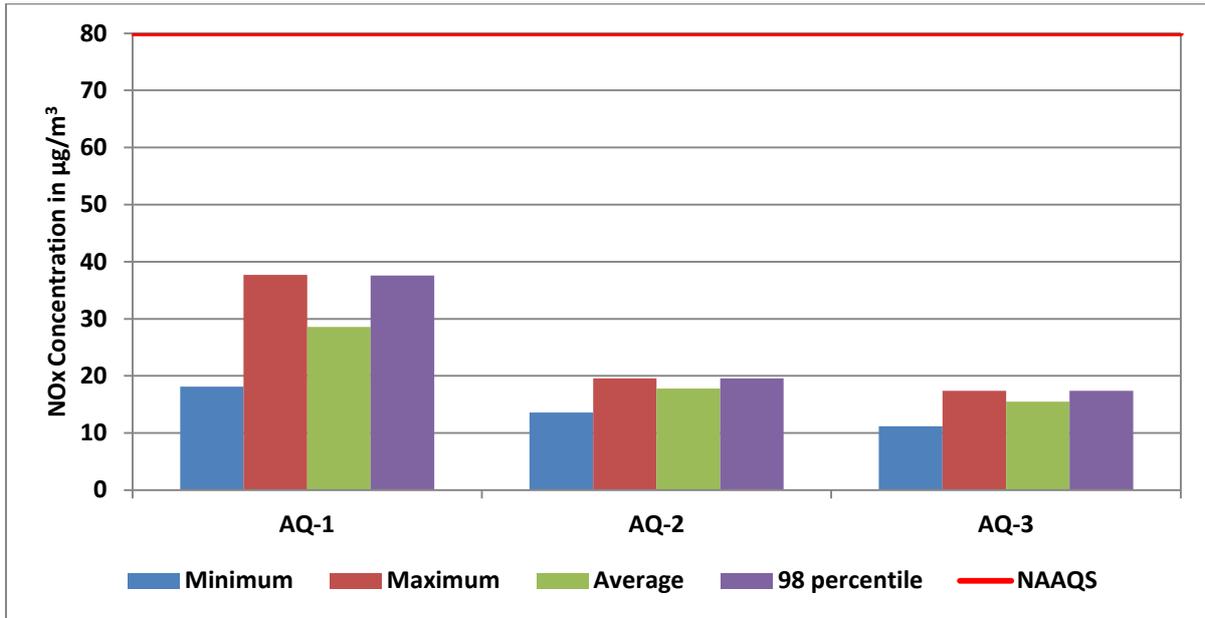
**Figure 5-13 Sulphur Dioxide (SO<sub>2</sub>)**



**Oxides of Nitrogen (NO<sub>x</sub>)**

The maximum NO<sub>x</sub> concentration observed was 37.7µg/m<sup>3</sup> at Shendra (AQ-1). The minimum value recorded was 11.2µg/m<sup>3</sup> at Karmad location (AQ-3). The 98 percentile values measured were in the range of 17.4µg/m<sup>3</sup> and 37.6µg/m<sup>3</sup>. The average values ranged from 15.5µg/m<sup>3</sup> to 28.6µg/m<sup>3</sup>. The NO<sub>x</sub> concentrations were within the prescribe norms of 80 µg/m<sup>3</sup> as per NAAQS guidelines. The observations of NO<sub>x</sub> are presented graphically in Figure 5-14.

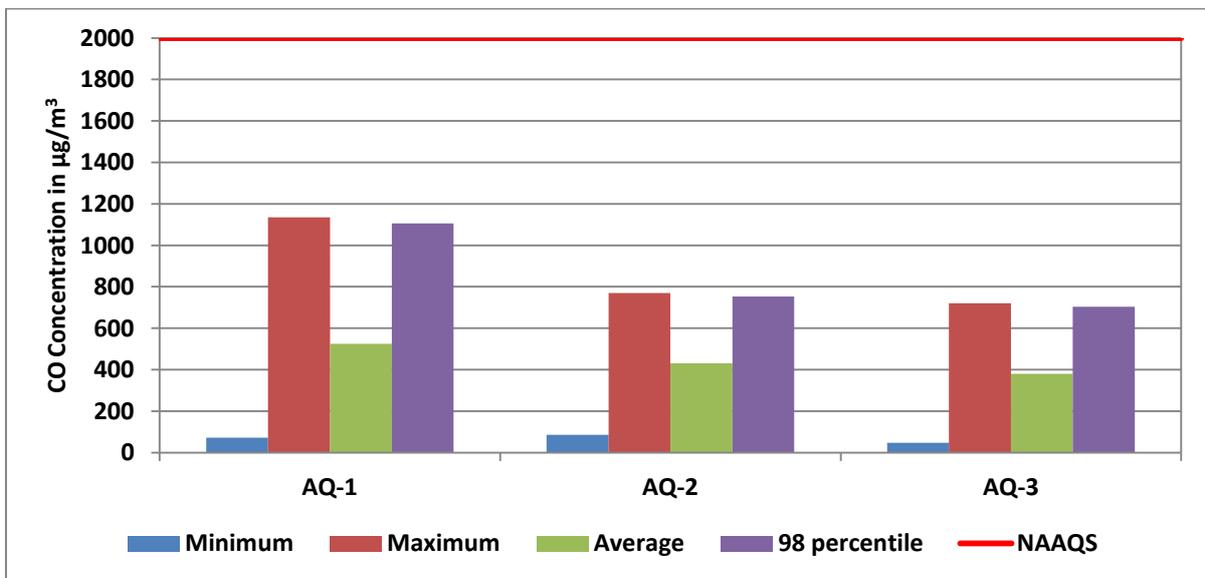
**Figure 5-14 Oxides of Nitrogen (NOx)**



**Carbon Monoxide (CO)**

The observed CO concentration varied from 47µg/m<sup>3</sup> to 1135µg/m<sup>3</sup>. The minimum value was recorded at Karmad (AQ-3) and the maximum was recorded at Shendra (AQ-1). The average CO values varied from 380µg/m<sup>3</sup> to 525µg/m<sup>3</sup>. The 98 percentile values ranged from 704µg/m<sup>3</sup> to 1105µg/m<sup>3</sup>. All the values observed for CO in the study area were below the NAAQS guidelines of 2000µg/m<sup>3</sup>. The graphical representation of observations is presented in Figure 5-15.

**Figure 5-15 Carbon Monoxide (CO)**

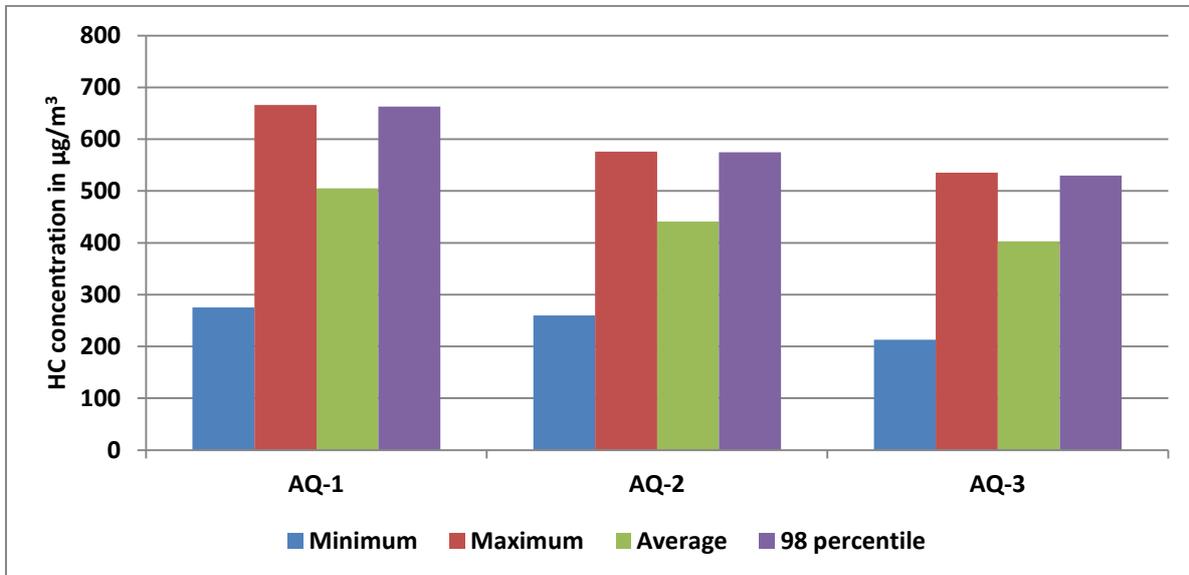


**Hydrocarbon (HC)-Methane**

The minimum Hydrocarbon (methane) concentration recorded in the study region was 213µg/m<sup>3</sup> at Karmad (AQ-3) while the maximum concentration recorded was 666µg/m<sup>3</sup> at Shendra (AQ-1). The

average HC (methane) concentration varied from 403 $\mu\text{g}/\text{m}^3$  to 505 $\mu\text{g}/\text{m}^3$ . The 98 percentile values measured were in the range of 530 $\mu\text{g}/\text{m}^3$  and 663 $\mu\text{g}/\text{m}^3$ . The monitoring values of Hydrocarbon (methane) are presented graphically in Figure 5-16

**Figure 5-16 Hydrocarbon (Methane)**



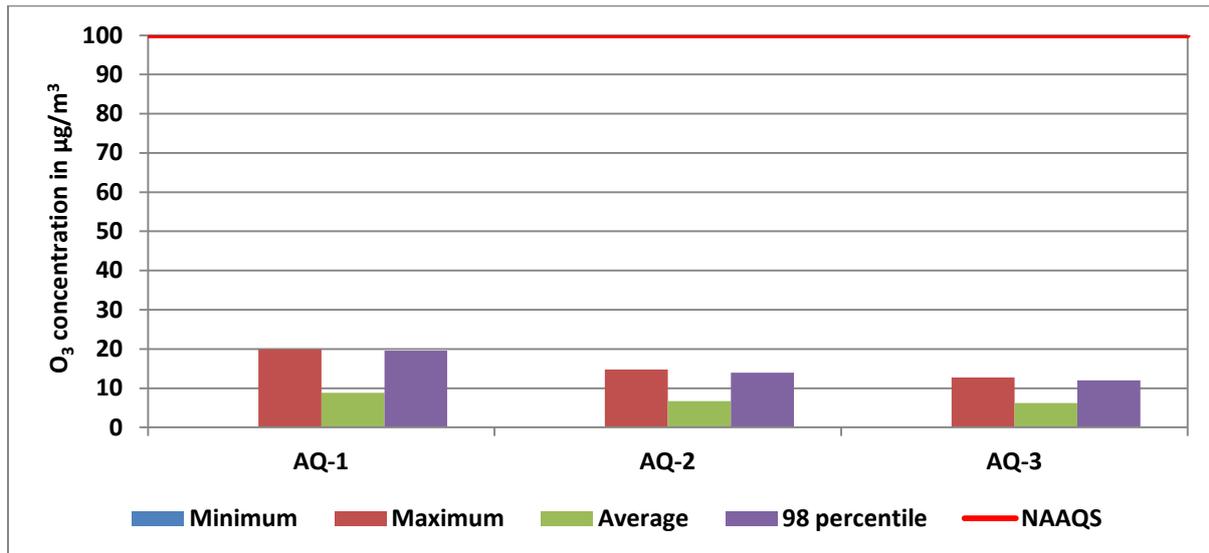
**Hydrocarbon (HC)-Non Methane**

The Non methane hydrocarbon concentrations monitored in the survey region were below the detection limit (BDL) of 200 $\mu\text{g}/\text{m}^3$ .

**Ozone (O<sub>3</sub>)**

The Ozone concentrations recorded at all monitoring locations were much below the CPCB prescribed limit of 100 $\mu\text{g}/\text{m}^3$ . The minimum value in study area was below detection limit (BDL) of 1.0 $\mu\text{g}/\text{m}^3$  for O<sub>3</sub>. The maximum value recorded was 19.9 $\mu\text{g}/\text{m}^3$  at Shendra (AQ-1). The 98 percentile values ranged from 12 $\mu\text{g}/\text{m}^3$  to 19.6 $\mu\text{g}/\text{m}^3$ . The average values varied from 6.2 $\mu\text{g}/\text{m}^3$  to 8.8 $\mu\text{g}/\text{m}^3$ . Figure 5-17 gives the graphical representation of Ozone (O<sub>3</sub>) monitoring values.

Figure 5-17 Ozone (O<sub>3</sub>)



**Hydrogen Sulphide (H<sub>2</sub>S)**

At all the eight monitoring locations within the study area, the hydrogen sulphide (H<sub>2</sub>S) values were below the detection limit (BDL) of 1.0 µg/m<sup>3</sup> for H<sub>2</sub>S.

The ambient baseline air quality can be considered as good, as all the monitored parameters were observed are considerably below the required standards. The site and surrounding is either rural or semi urban and the identified sources of pollution in the area are existing Shendra Industrial development. The location at Shendra recorded the maximum levels of SPM, PM-2.5, SO<sub>2</sub>, NO<sub>x</sub> and CO and O<sub>3</sub>, which can be attributed to the industrial activities in existing Shendra area. Additionally it may be because of high vehicular emissions near Shendra, located along SH-178.

**5.9.3 AAQ Monitoring by Maharashtra Pollution Control Board (MPCB)**

Maharashtra Pollution Control Board (MPCB) has established Ambient Air Quality (AAQ) stations at various locations in Aurangabad for monitoring the ambient air quality of the area at periodic intervals. The following table presents the ambient air quality data monitored by MPCB. The monitoring was undertaken at frequency of two days in a week for the period December 2013-April 2014.

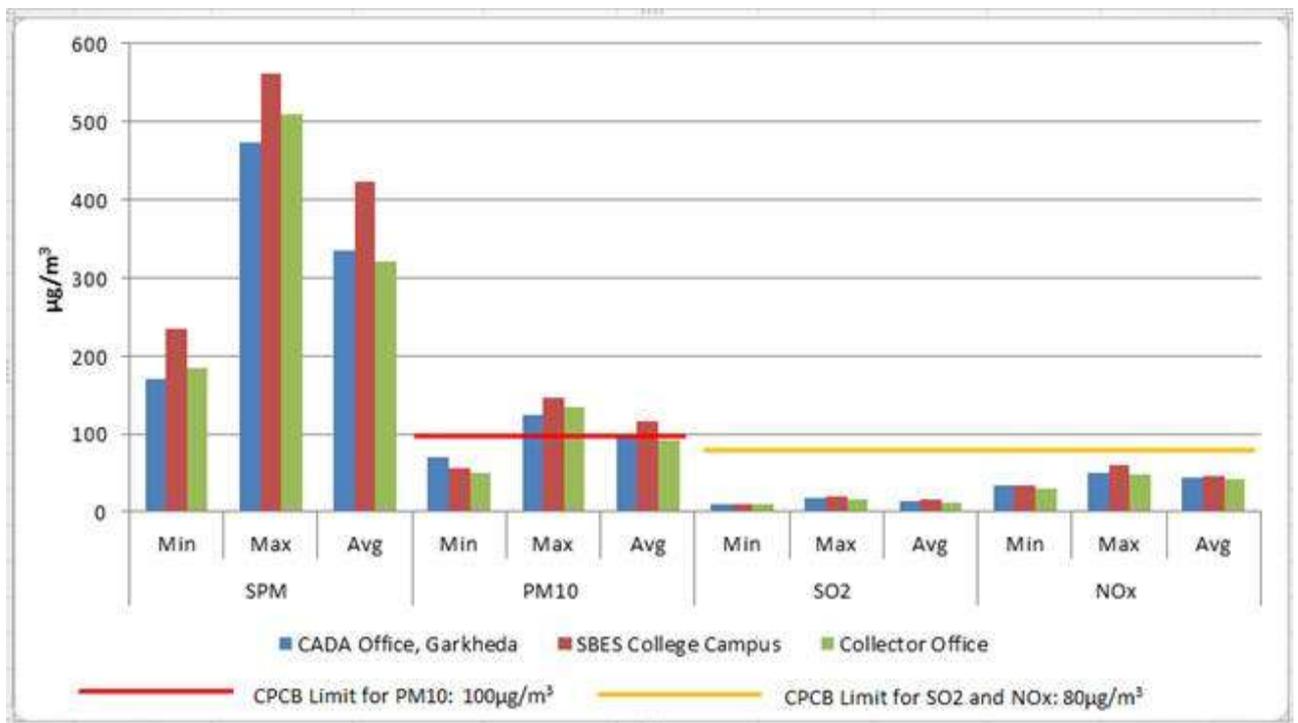
Table 5-10 Ambient Air Quality Monitored by MPCB at Aurangabad (Dec 2013-Apr 14)

Parameters	Monitored	CADA Office, Garkheda Road	SBES College Campus	Collector Office
SPM (µg/m <sup>3</sup> ): 24 Hourly	<b>NAAQS</b>	<b>NA</b>	<b>NA</b>	<b>NA</b>
	Minimum	170	235	184
	Maximum	473	561	510
	Average	334.79	422.54	321.63
PM10 (µg/m <sup>3</sup> ): 24 Hourly	<b>NAAQS</b>	<b>100</b>	<b>100</b>	<b>100</b>
	Minimum	70	57	50

Parameters	Monitored	CADA Office, Garkheda Road	SBES College Campus	Collector Office
	Maximum	125	147	135
	Average	96.95	115.79	91.26
SO <sub>2</sub> (µg/m <sup>3</sup> ): 24 Hourly	<b>NAAQS</b>	<b>80</b>	<b>80</b>	<b>80</b>
	Minimum	10	10	9
	Maximum	18	20	16
	Average	14.24	15.41	12.08
NO <sub>x</sub> (µg/m <sup>3</sup> ): 24 Hourly	<b>NAAQS</b>	<b>80</b>	<b>80</b>	<b>80</b>
	Minimum	34	34	31
	Maximum	51	61	49
	Average	44.5	45.97	41.47

Source: MPCB

Figure 5-18 Ambient Air Quality Monitored by MPCB at Aurangabad (Dec 2013-Apr 14)



As observed from the above table, the values for SO<sub>2</sub> and NO<sub>x</sub> are within the prescribed CPCB standard for ambient air quality (80 µg/m<sup>3</sup>). However, the PM10 values exceed the permissible limits prescribed by CPCB at the station located in SBES College Campus. This can be due to the fact that the monitoring station is located in an area with high commercial activities in the vicinity.

### 5.10 Water Quality

Water environment consists of water availability in the form of surface and ground water resources, its quality and use (both present and intended). Study of the water environment is essential in preparation of EIA for identification of critical issues including planning the mitigation measures with a view to have optimum use of the water resources. Ground water and surface water samples were

collected from five sampling locations in and around the study area. The samples were analyzed against prescribed standards for surface and ground water. The results have been presented in the following sections.

### Ground Water Quality

Two ground water samples were collected from hand pumps in identified villages. The location of the sources is provided in Table 5-10 below:

**Table 5-10 Ground Water Sampling Locations**

Sample code	Location
GWQ-1	Shendra
GWQ-2	Chitegaon

The ground water samples collected were analyzed for parameters as per IS: 10500 standards. The analysis was undertaken as per IS 3025 and relevant APHA standard methods. The results of water quality monitoring are presented in the Table 5-11 below:

**Table 5-11 Results of Water Quality Monitoring in the Study Area**

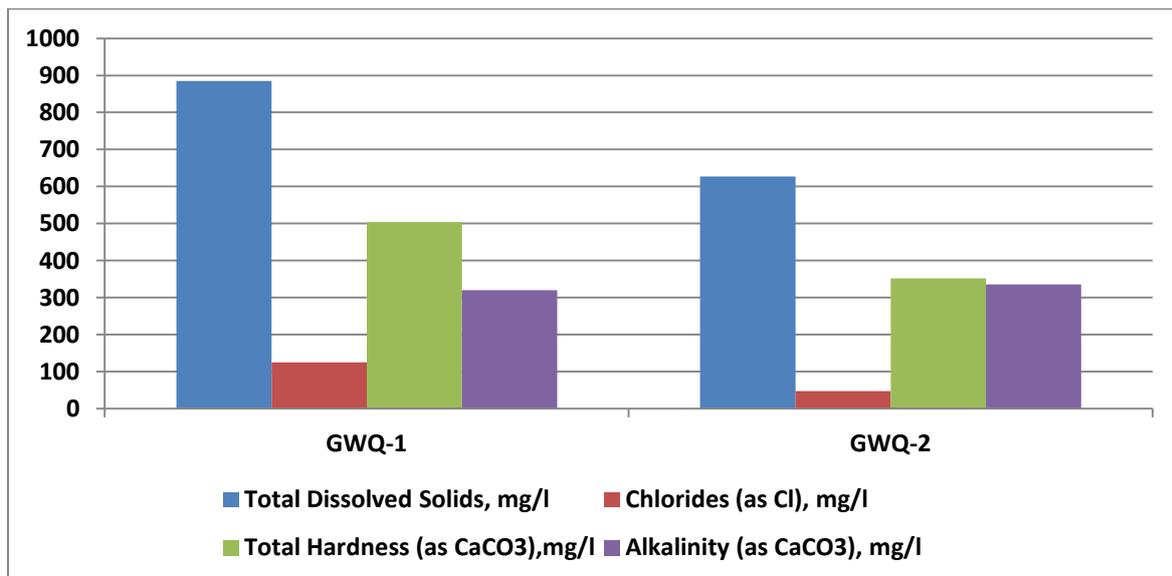
S. No	Parameters	IS 10500 Prescribed Standard*	Ground Water	
			Shendra	Chitegaon
			WQ-1	WQ-2
1.	pH Value	<b>6.5-8.5</b>	7.12	6.91
2.	Temperature, °C	-	26	26
3.	Turbidity, NTU	<b>5 (10)</b>	14	10
4.	Color, Hazan Unit	<b>5 (25)</b>	<5	<5
5.	Conductivity ms/sec	-	1.15	0.844
6.	Alkalinity (as CaCO <sub>3</sub> ), mg/l	<b>200 (600)</b>	<b>320</b>	<b>336</b>
7.	Total Dissolved Solids, mg/l	<b>500 (2000)</b>	885	627
8.	Total Suspended Solids, mg/l	-	5	6
9.	Oil & Grease, mg/l	-	<0.01	<0.01
10.	B.O.D. mg/l	-	<1	<1
11.	C.O.D. mg/l	-	<4	<4
12.	Nitrate mg/l	<b>45 (100)</b>	8.52	7.21
13.	Salinity, ppt	-	0.23	0.09
14.	Dissolved Oxygen, mg/l	-	3.8	2.8
15.	Chlorides (as Cl), mg/l	<b>250 (1000)</b>	124.96	47.98
16.	PCB, mg/l	-	<0.002	<0.002
17.	Anionic detergents, mg/l	<b>0.2 (1.0)</b>	<0.1	<0.1
18.	Sulphate (as SO <sub>4</sub> ), mg/l	<b>200 (400)</b>	45.78	12.28
19.	Fluorides (as F), mg/l	<b>1 (1.5)</b>	0.483	0.804
20.	Total Hardness (as CaCO <sub>3</sub> ), mg/l	<b>300 (600)</b>	504	352
21.	Calcium (as CaCO <sub>3</sub> ), mg/l	<b>75 (200)</b>	118.4	38.4
22.	Magnesium (as CaCO <sub>3</sub> ), mg/l	<b>30 (100)</b>	49.92	61.44
23.	Phosphate (as PO <sub>4</sub> ) mg/l	-	<0.2	<0.2
24.	Phenolic Compound (as C <sub>6</sub> H <sub>5</sub> OH), mg/l	<b>0.001 (0.002)</b>	<0.001	<0.001
25.	TPH	-	<0.002	<0.002
26.	Arsenic (as As), mg/l	<b>0.05</b>	<0.01	<0.01
27.	Iron (as Fe), mg/l	<b>0.3 (1.0)</b>	0.102	<0.03
28.	Copper (as Cu), mg/l	<b>0.05 (1.5)</b>	<0.01	<0.01
29.	Lead (as Pb), mg/l	<b>0.01</b>	<0.02	<0.02

S. No	Parameters	IS 10500 Prescribed Standard*	Ground Water	
			Shendra	Chitegaon
			WQ-1	WQ-2
30.	Manganese (as Mn), mg/l	<b>0.1 (0.3)</b>	<0.01	<0.01
31.	Zinc (as Zn), mg/l	<b>5 (15)</b>	0.087	0.115
32.	Aluminium (As Al),mg/l	<b>0.03 (0.2)</b>	<0.02	<0.02
33.	Cyanide, mg/l	<b>0.05</b>	<0.01	<0.01
34.	Total Chromium (as Cr), mg/l	<b>0.05</b>	<0.01	<0.01
35.	Barium (as Ba),mg/l	<b>0.7</b>	<0.01	<0.01
36.	Cadmium (as Cd), mg/l	<b>0.01</b>	0.003	0.004
37.	Total Coliforms, Nos./100ml	<b>Nil</b>	0	0
38.	Faecal Coliforms, Nos./100ml	<b>Nil</b>	Absent	Absent

\* IS: 10500 - 2004, values in bracket indicate the permissible limits

The groundwater quality monitoring results indicate that most of the parameters are within the permissible standards as per IS: 10500. The Alkalinity of ground water exceeded the desirable limit of 200 mg/l at both the locations. However, it was within the permissible limit of 600 mg/l. The total dissolved solids; total hardness levels exceeded the respective desirable limits at all the ground water sampling locations. The calcium level exceeded the desirable limits of 200 mg/l in the samples collected from Shendra and is within the limit in the sample collected from Chitegaon location. The Magnesium level exceeded the desirable limits at both the sampling locations but was within prescribed limit of 100 mg/l. All heavy metals were also found to be below the respective detection limit. None of the groundwater samples were found to have any bacteriological contamination. The ground water quality results are presented in Figure 5-18

**Figure 5-18 Ground Water Quality Results**



**Surface Water Quality**

Three surface water samples were collected from upstream and downstream locations of major rivers in the project area, as provided in *Table 5-12* below.

**Table 5-12 Surface Water Sampling Locations**

Sample code	Location
SW-1	Sukna Dam – Up Stream
SW-2	Sukna Dam – Stream
SW-3	Bangaon Talav

The surface water samples were analyzed against the designated best use classification of Central Pollution Control Board as given in Table 5-13 below:

**Table 5-13 Water Quality Standards by CPCB for Best Designated Usage**

Designated-Best-Use	Class of water	Criteria
Drinking Water Source without conventional treatment but after disinfection	A	Total Coliforms Organism MPN/100ml shall be 50 or less
		pH between 6.5 and 8.5
		Dissolved Oxygen 6mg/l or more
		Biochemical Oxygen Demand 5 days 20°C 2mg/l or less
Outdoor bathing (Organised)	B	Total Coliforms Organism MPN/100ml shall be 500 or less pH between 6.5 and 8.5 Dissolved Oxygen 5mg/l or more
		Biochemical Oxygen Demand 5 days 20°C 3mg/l or less
Drinking water source after conventional treatment and disinfection	C	Total Coliforms Organism MPN/100ml shall be 5000 or less pH between 6 to 9 Dissolved Oxygen 4mg/l or more
		Biochemical Oxygen Demand 5 days 20°C 3mg/l or less
Propagation of Wild life and Fisheries	D	pH between 6.5 to 8.5 Dissolved Oxygen 4mg/l or more
		Free Ammonia (as N) 1.2 mg/l or less
Irrigation, Industrial Cooling, Controlled Waste disposal	E	pH between 6.0 to 8.5
		Electrical Conductivity at 25°C micro mhos/cm Max.2250
		Sodium absorption Ratio Max. 26
		Boron Max. 2mg/l
-	Below-E	Not Meeting A, B, C, D & E Criteria

The results of surface water quality monitoring are presented in the Table 5-14 below.

**Table 5-14 Results of Surface Water Quality Monitoring in the Study Area**

S. No	Parameters	Surface Water		
		Sukhna Dam – Up Stream	Sukhna Dam – Down Stream	Bangaon Talav
		SWQ-1	SWQ-2	SWQ-3
1.	pH Value	6.92	6.96	7.26
2.	Temperature, °C	26	27	26
3.	Turbidity, NTU	64	71	22
4.	Color, Hazan Unit	<5	<5	<5
5.	Conductivity ms/sec	0.61	0.57	0.415

S. No	Parameters	Surface Water		
		Sukhna Dam – Up Stream	Sukhna Dam – Down Stream	Bangaon Talav
		SWQ-1	SWQ-2	SWQ-3
6.	Alkalinity (as CaCO <sub>3</sub> ), mg/l	140	160	156
7.	Total Dissolved Solids, mg/l	402	394	387
8.	Total Suspended Solids, mg/l	50	76	16
9.	Oil & Grease, mg/l	<0.01	<0.01	<0.01
10.	B.O.D. mg/l	7	5	<1
11.	C.O.D. mg/l	16	12	<4
12.	Nitrate mg/l	1.96	6.79	9.21
13.	Salinity,ppt	0.17	0.17	0.05
14.	Dissolved Oxygen, mg/l	4.4	4.2	3.2
15.	Chlorides (as Cl), mg/l	93.97	92.97	28.99
16.	PCB,mg/l	<0.002	<0.002	<0.002
17.	Anionic detregents,mg/l	<0.1	<0.1	<0.1
18.	Sulphate (as SO <sub>4</sub> ), mg/l	27.17	22.89	23
19.	Fluorides (as F), mg/l	0.417	0.397	0.2
20.	Total Hardness (as CaCO <sub>3</sub> ),mg/l	176	160	152
21.	Calcium (as CaCO <sub>3</sub> ),mg/l	51.2	35.2	28.8
22.	Magnesium (as CaCO <sub>3</sub> ), mg/l	11.52	17.28	19.2
23.	Phosphate (as PO <sub>4</sub> ) mg/l	<0.2	<0.2	<0.2
24.	Phenolic Compound (as C <sub>6</sub> H <sub>5</sub> OH), mg/l	<0.001	<0.001	<0.001
25.	TPH	<0.002	<0.002	<0.002
26.	Arsenic (as As), mg/l	<0.01	<0.01	<0.01
27.	Mercury (as Hg), mg/l	<0.001	<0.001	<0.001
28.	Iron (as Fe), mg/l	1.43	5.869	0.23
29.	Copper (as Cu), mg/l	<0.01	0.02	<0.01
30.	Lead (as Pb), mg/l	<0.02	<0.02	<0.02
31.	Mangnese (as Mn), mg/l	<0.01	<0.01	<0.01
32.	Zinc (as Zn), mg/l	0.114	0.118	0.095
33.	Aluminium (As Al),mg/l	<0.02	<0.02	<0.02
34.	Cyanide,mg/l	<0.01	<0.01	<0.01
35.	Total Chromium (as Cr), mg/l	<0.01	<0.01	<0.01
36.	Barium (as Ba),mg/l	<0.01	<0.01	<0.01
37.	Cadmium (as Cd), mg/l	0.003	0.006	0.003
38.	Total Coliforms, Nos./100ml	63	70	8
39.	Faecal Coliforms, Nos./100ml	Present	Present	Present

In the surface water samples collected from Sukhna upstream and downstream locations, the dissolved oxygen levels are more than 4mg/l but the BOD levels are more than 3 mg/l. Thus the quality of water samples from these locations can be classified as CPCB Class D (Propagation of Wild life and Fisheries) or above. The water quality at location Bangaon Talav (SWQ-3) can be classified as CPCB Class E (Irrigation, Industrial Cooling, Controlled Waste disposal) or above. None of the samples were found to be fit for drinking purposes.

### 5.11 Ambient Noise Level

Ambient noise levels were monitored at three locations within the project site, identified during preliminary baseline survey. The details of monitoring areas are provided in *Table 5-13*.

**Table 5-15: Noise Monitoring Locations in the study area**

Sample Code	Village
NQ-1	Shendra
NQ-2	Chitegaon
NQ-3	Karmad

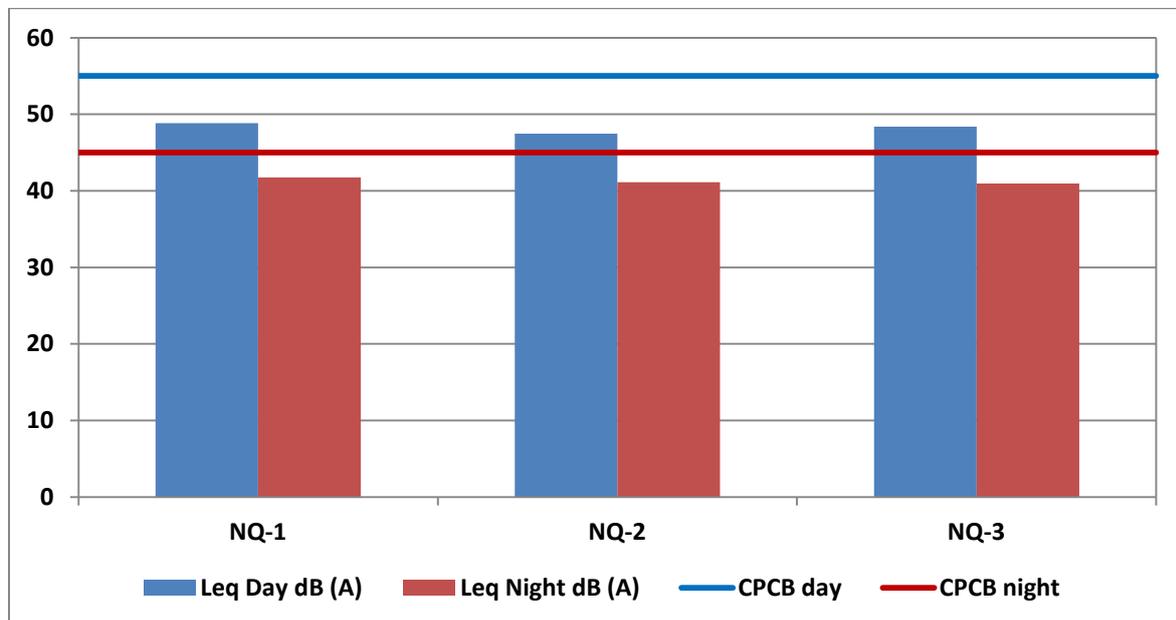
The observations of noise monitoring were calculated as  $Leq_{Day}$  and  $Leq_{Night}$ . The results are presented in the Table 5-16.

**Table 5-16: Results of Noise level monitoring**

Location Code	CPCB Norm	NQ-1	NQ-2	NQ-3
Leq Day dB (A)	55	48.86	47.48	48.38
Leq Night dB (A)	45	41.75	41.13	40.96

The noise levels at all the locations were found to be within the prescribed CPCB standards for residential area of 55 dB(A) and 45 dB(A) for day and night time respectively. The day and night time noise levels are depicted in Figure 5-19

**Figure 5-19 Noise Levels monitored in the study area**



## 5.12 Soil Quality

The study area is covered with mostly red sand and gravel with moderate amounts of red-loam and occasional black loam tracts. Soil Samples were collected from the following two locations in the study area –

- Chitegaon (SQ-1)
- Shendra (SQ-2)

The results are presented below in Table 5-21

**Table 5-17 Results of Soil Quality Analysis**

S. No.	Parameters	Chitegaon	Shendra
		SQ-1	SQ-2
1	Texture	Sandy	Sandy
	I) Sand, %	98.98	97.02
	II) Silt, %	0.63	1.84
	III)Clay, %	0.39	1.14
2	pH (1:10 suspension)	6.5	6.2
3	Permeability, cm/sec	0.025	0.05
4	Porosity, %	25.8	30.7
5	Bulk density, g/cm3	1.23	1.09
6	Conductivity, mS/cm	0.092	0.125
7	Cation exchange capacity, Meq/100 g	52.75	64.81
8	Nitrite, mg/kg	<0.01	0.8
9	Nitrate, mg/kg	1.22	1.25
10	Phosphate, mg/kg	<0.2	<0.2
11	TPH, ppm	<0.1	<0.1
12	Sodium (Na), ppm	351.7	947.7
13	Potassium (K), ppm	155.8	126.7
14	Iron as Fe, ppm	725.7	752.7
15	Lead as Pb, ppm	22.2	10.25
16	Manganese as Mn, ppm	547.4	411.2
17	Nickel as Ni, ppm	87.9	46.86
18	Barium as Ba, ppm	<0.01	<0.01
19	Zinc as Zn, ppm	51.52	48.92
20	Copper as Cu, ppm	75.24	103.7
21	Cadmium as Cd, ppm	2.757	2.048
22	Chromium as Cr ,ppm	71.24	44.92
23	Arsenic as As, ppm	<0.001	<0.001
24	Mercury as Hg, ppm	<0.001	<0.001
25	Total Hydrocarbons, ppm	<0.2	<0.2

The soil texture was found to be sandy in the study area. The porosity of the soil samples ranged from 25.8 – 31.3% and permeability is high which refers to well drained soil. Heavy metals such as zinc, copper, iron, lead, chromium and manganese were found in the soil samples.

### 5.13 Traffic Density

Traffic density in the study region was monitored at two major roads, the details of which have been provided in Table 5-18. These roads will be significant for the traffic movement to the project.

**Table 5-18 Traffic Monitoring Locations in the Study Area**

Location Code	Location	Description
T-1	SH 178 at Shendra	Commonly known as Jalna Road, connects Aurangabad to Jalna and then to Nagpur. The road connects to the Shendra parcel of the MIP.
T-2	NH-211 at Aadgaon	Commonly known as Beed Road, connects Aurangabad to Dhule in the northwest and Solapur in the southeast. The road connects the MIP site to the airport, railway station, and city of Aurangabad.

## Observations

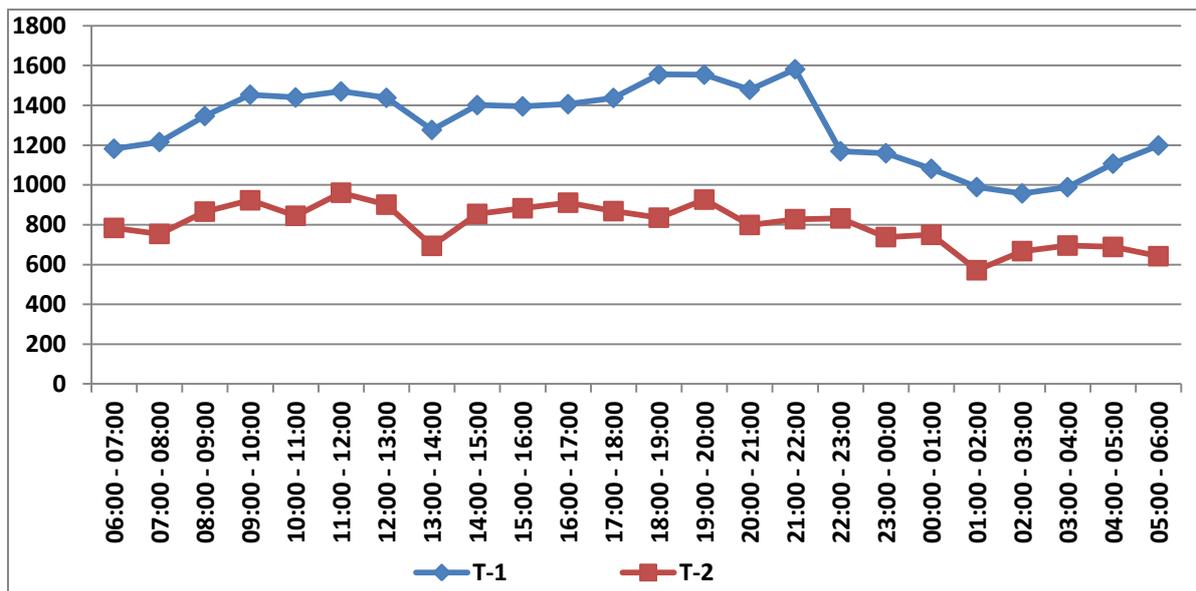
The traffic density along all the two (2) roads was observed to be high. The total Passenger Car Units (PCU) Equivalents for traffic movement (to & fro) and other details from traffic survey have been summarized in Table 5-19.

**Table 5-19: Existing Traffic Volumes in the Study Area**

Description	PCU Equivalents at T-1	PCU Equivalents at T-2
Total PCU/24 Hours	31284	19219
Average Traffic Flow/Hr	1303	801
Max Traffic Flow(Nos.)/Hr	1582	961
Min Traffic Flow(Nos.)/Hr	958	572

As per observations, the traffic count at SH-178 (T-1) and NH-211 (T-2) increased peaks during the morning hours between 9:00 and 10:00 hours and also during 11:00 hours and 12:00 hours. The traffic count at location T-1 reached peak during night hours between 21:00 hours and 22:00 hours and T-2 between 20:00 hours and 21:00 hours. This traffic can be attributed to the high movement of the goods vehicles during the night time. Traffic count at both the monitored roads did not have any particular peak during day. The traffic flow is graphically depicted in the Figure 5-20.

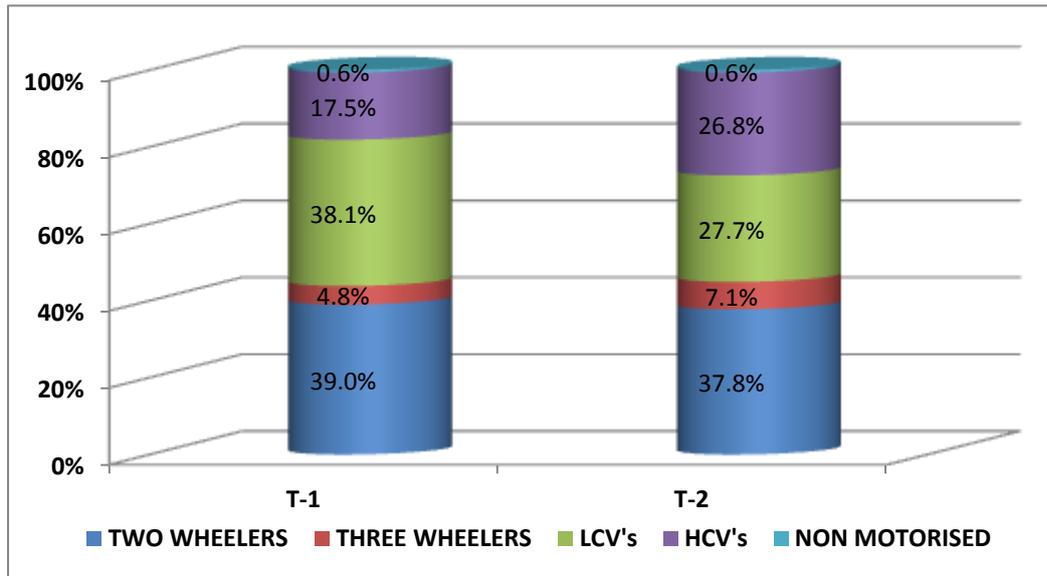
**Figure 5-20: Traffic Observations (in PCU)**



## Traffic Composition

Traffic at observed roads had significant volume of two wheelers (39% at T-1 and 37.8% at T-2) followed by Light commercial Vehicle (LCV). The vehicle composition observed is graphically depicted in Figure 5-21. The high volume of two wheelers and three wheelers at all two locations indicate that the roads are mainly used by people going to workplaces.

**Figure 5-21: Traffic Composition Observed**



**5.14 Ecological Environment**

The following section presents the details of the ecological assessment carried out for the project area. Primary survey was carried out for the project site and an area comprising of the proposed project-site and extending up to 10 km from the boundary of the project site was considered for the survey. The survey was carried out during winter season in the month of January, 2011. The details of the survey have been presented in the following sections.

**Methodology**

For the survey, a total of 10 sites were identified within the area representative of the ecosystem and land-use types in the region. These sites are divisible into four quartiles, North-east, North-west, South-west and South-east Quartiles respectively, depending on the direction in which they lie with reference to the approximate centre of the project area. The selected sites included four sites in the North-east Quartile, one in the North-west Quartile, one in the South-west Quartile and four in the South-east Quartile.

For floral diversity assessment, a quadrat of approximately 20 m x 20 m was marked. The species of trees, shrubs and large climbers, as well as the number of individuals of each species, falling within this area were noted. A quadrat of approximately 5 m x 5 m was marked within this larger quadrat. The species of herbs, both grasses and forbs, and the number of individuals of each species, falling within this area were noted.

Smaller quadrats of 1m x 1 m, for the more prolifically-growing larger herbs, and 10 cm x 10 cm, for prolifically-growing minute herbs, were employed when required. At each site, faunal diversity was studied through direct evidence, in the form of visual sightings, and indirect evidence, such as calls, nests, burrows, droppings, scats, moults, tracks, etc.

The biodiversity of the survey area was then evaluated in terms of:

- species richness of the woody and non-woody floras, and the avifauna,
- percentage frequency, abundance and density of each floral species, and
- percentage frequency of each bird species

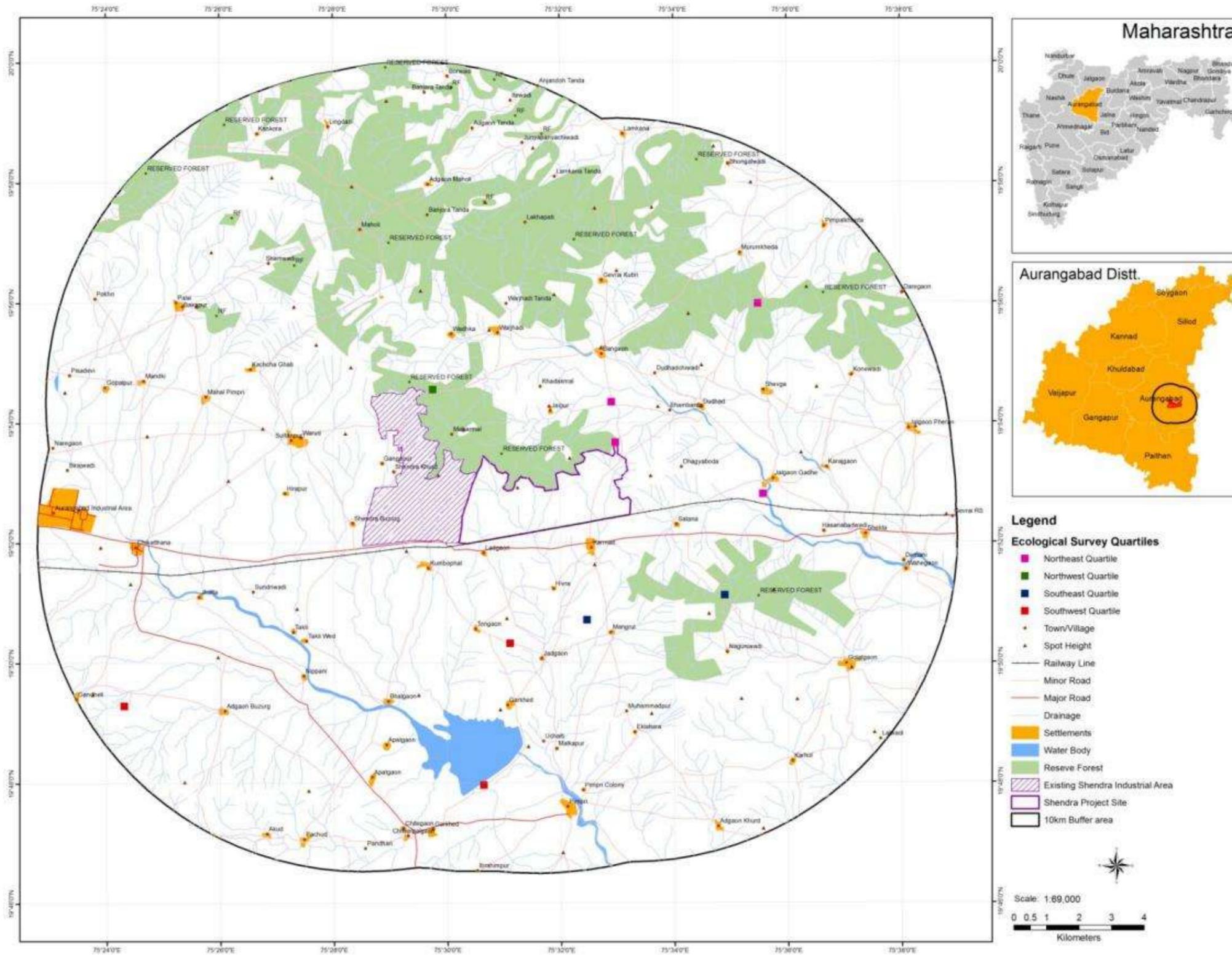
The Shannon Index has also been worked out, separately for the woody and non-woody plant species recorded in each quartile, as a comparative measure of the floral diversity.

The details of the survey sites have been presented in Table 5-20. The survey quartiles are also presented in Figure 5-22.

**Table 5-20 Overview of Survey Sites**

Quadrat No.	Location	Elevation (m)	Nearest village(s)
<b>Northeast Quartile</b>			
6	N19°54'19.1" E75°33'00.0"	605	Bangaon
7	N19°56'01.2" E75°35'24.0"	614	Pimpalkhunta
8	N19°53'31.8" E75°33'02.3"	602	Dudhad
9	N19°52'45.4" E75°35'32.7"	552	Jalgaon Gadhe
<b>Northwest Quartile</b>			
5	N19°54'34.9" E75°29'47.1"	620	Warjhadi
<b>Southwest Quartile</b>			
14	N19°48'38.2" E75°22'39.9"	680	Shindon Bhindon
<b>Southeast Quartile</b>			
1	N19°48'05.9" E75°30'35.7"	549	Sukhna Lake
2	N19°50'18.7" E75°31'12.6"	552	Jadgaon, Tongaon
3	N19°50'45.9" E75°32'28.1"	563	Mangrul
4	N19°51'03.6" E75°34'46.5"	620	Naguniwadi

Figure 5-22 Ecology Survey Quartiles in the study area



## Forest Type

According to the Champion and Seth Classification of Indian Forests, the natural vegetation of the survey area represents the following forest-types:

### Type 5A/C1a (Sub-group 5A – Southern Tropical Dry Deciduous Forest, Sub-division C1a - Very Dry Teak Forest)

These forests in areas which received less than 900 mm rainfall, dry and infertile soil, scanty ground-cover, annual fires and heavy grazing. The forests are open supported by shallow, stony soils. Species associated with such forests include:

- Trees like *Acacia leucophloea*, *Aegle marmelos*, *Anogeissus latifolia*, *Azadirachta indica*, *Bombax ceiba*, *Boswellia serrata*, *Butea monosperma*, *Cassia fistula*, *Cochlospermum religiosum*, *Cordia dichotoma*, *Dalbergia latifolia*, *Diospyros melanoxylon*, *Embllica officinalis*, *Flacourtia indica*, *Hardwickia binata*, *Holoptelea integrifolia*, *Lannea coromandelica*, *Madhuca indica*, *Phoenix sylvestris*, *Tamarindus indica*, *Tectona grandis*, *Terminalia tomentosa*, *Wrightia tinctoria* and *Zizyphus sp.*;
- Bamboos like *Dendrocalamus strictus*;
- Shrubs like *Carissa congesta*, *Euphorbia spp.*, *Helicteres isora*, *Holarrhena pubescens*, *Lantana camara*, *Maytenus spp.*, *Securinega leucopyrus*, *Woodfordia fruticosa* and *Zizyphus spp.*;
- Herbs like species of Acanthaceae family, *Atylosia spp.*, *Cassia spp.*, *Ocimum spp.*, *Sida spp.*, *Spermaceo spp.* and *Tridax procumbens*; and
- Grasses like *Apluda mutica*, *Aristida spp.*, *Chrysopogon fulvus*, *Dicanthium annulatum*, *Eragrostis spp.*, *Heteropogon contortus* and *Themeda quadrivalvis*.

### Type 5A/C3 (Sub-group 5A – Southern Tropical Dry Deciduous Forest, Sub-division C3 – Southern Dry Mixed Deciduous Forest)

These forests are characterized by the occurrence of thorny plants which increase in proportion to the extent of grazing to which the area is subjected. Bamboos are often absent, and of poor quality when present. Climbers are generally few. Grass is very conspicuous unless it is grazed down or burnt. Species associated with such forests include:

- Trees like *Acacia leucophloea*, *Acacia nilotica*, *Aegle marmelos*, *Albizzia spp.*, *Anogeissus latifolia*, *Azadirachta indica*, *Balanites aegyptica*, *Bauhinia spp.*, *Boswellia serrata*, *Butea monosperma*, *Cochlospermum religiosum*, *Dolichandrone falcata*, *Flacourtia indica*, *Heterophragma quadriloculare*, *Ixora arborea*, *Lannea coromandelica*, *Melia azedarach*, *Morinda tinctoria*, *Santalum album*, *Stereospermum personatum*, *Syzigium cumini*, *Tectona grandis*, *Terminalia bellerica*, *Terminalia tomentosa* and *Vitex negundo*;
- Bamboos like *Dendrocalamus strictus*;

- Shrubs like *Capparis decidua*, *Carissa congesta*, *Grewia* spp., *Helicteres isora*, *Holarrhena pubescens*, *Justicia adhatoda*, *Lantana camara*, *Maytenus* spp., *Randia dumetorum*, *Woodfordia fruticosa* and *izyphus* spp.;
- Herbs like *Achyranthes aspera*, *Abutilon* spp., *Cassia* spp., *Corchorus* spp. and *Indigofera* spp.; and
- Grasses like *Apluda* sp., *Aristida* sp., *Chloris* sp., *Chrysopogon fulvus*, *Dicanthium annulatum*, *Eragrostis* spp., *Heteropogon contortus*, *Iseilema* sp., *Panicum* sp. and *Themeda quadrivalvis*.

#### Type 5/DS4 (Group 5 – Tropical Dry Deciduous Forests, Degradation Stage DS4 – Dry Grassland)

The dominant grass-cover in dry deciduous forests is the *Sehima-Dicanthium* type. Characteristic species associated with this type include *Chrysopogon fulvus*, *Cymbopogon* spp., *Eremopogon foveolatus*, *Heteropogon contortus*, *Sehima nervosum* and *Themeda* sp. on hills and hill-slopes, while the deeper soils of plateaus and valleys support *Bothriochloa pertusa*, *Cynodon dactylon* and *Dicanthium annulatum*.

Deteriorated grasslands are characterized by the presence of far more annual species like *Aristida* spp., *Andropogon pumilus*, *Chloris* spp., *Eragrostis* spp., the annual form of *Heteropogon contortus* and *Melanocentris royleana*.

#### Type 6A/C1 (Sub-group 6A - Southern Tropical Thorn Forest, Sub-division C1 – Southern Thorn Forest)

These forests are met with on shallow dry soil, or deep but sandy soil. The ground is usually flat or in the form of low undulating hills and plateaux. Species associated with this type include:

- Trees like *Acacia leucophloea*, *Acacia latronum*, *Acacia nilotica*, *Aegle marmelos*, *Ailanthus excelsa*, *Albizia* spp., *Anogeissus latifolia*, *Azadirachta indica*, *Balanites aegyptica*, *Bauhinia racemosa*, *Capparis decidua*, *Capparis divaricata*, *Cassia fistula*, *Cordia dichotoma*, *Dichrostachys cinerea*, *Dolichandrone falcata*, *Ficus* spp., *Flacourtia indica*, *Gardinia gummifera*, *Grewia tiliaefolia*, *Ixora arborea*, *Phoenix sylvestris*, *Prosopis spicigera*, *Randia* spp., *Santalum album*, *Strychnos* spp. and *Zizyphus mauritiana*;
- Shrubs like *Calotropis* spp., *Canthium* spp., *Carissa congesta*, *Cassia auriculata*, *Dodonaea viscosa*, *Euphorbia* spp., *Lantana camara*, *Maytenus* spp., *Mimosa hamata* and *Zizyphus* spp.;
- Herbs like *Cardiospermum halicacabum*, *Opuntia elatior* and *Pergularia daemia*; and
- Grasses like *Aristida* spp., and *Heteropogon contortus*.
- (Ecologically, such thorny woodlands and grasslands are considered to be the effect of excessive cutting and browsing, and thus, not a true climatic formation. Protection of such an area is likely to lead to the regeneration of elements of a tropical dry deciduous forest.)

## Vegetation

### Vegetation of Natural Areas

The natural areas in the region comprise of forested patches and open scrub stretches. The forested patches comprises of a range of deciduous species such as *Acacia catechu*, *Albizia procera*, *Bombax ceiba*, *Butea monosperma*, *Bauhinia racemosa*, *Diospyros sp.*, *Grewia tiliaefolia* and *Gmelina arborea*. The semi-evergreen or evergreen species, such as *Cordia dichotoma*, *Flacourtia indica*, *Ixora arborea* and *Syzigium cumini* are confined to the moister, more sheltered areas. There is a discontinuous undergrowth of shrubs such as *Carissa congesta*, *Maytenus spp.*, *Woodfordia fruticosa* and *Ziziphus spp.* A few large, woody climbers are sometimes present, including *Abrus precatorius*, *Argyrea sp.*, *Combretum ovalifolium* and *Tylophora indica*.

In the open scrub stretches, the few trees are too isolated to form a canopy. Many of the trees, shrubs and herbs are thorny/spiny or show other xerophytic characters. Common examples of these include *Acacia leucophloea*, *Acacia nilotica*, *Balanites aegyptica*, *Capparis decidua*, *Euphorbia spp.* and *Ziziphus spp.* The ground-cover is diverse, varying from penetrating herbs and grasses, in areas of relatively deep and moist soil-conditions, to annuals and ephemerals, in areas of dry, shallow, gravelly soil. *Ficus glomerata*, *Kirganellia reticulata*, *Pongamia pinnata* and *Syzigium cumini* are also typically found in the beds or on the banks of streams, rivulets and canals.

Significant specimens of *Acacia nilotica*, *Albizia lebbek*, *Azadirachta indica*, *Dalbergia sissoo* and *Ficus spp.* Are present along the major roads, while *Limonia acidissima*, *Mangifera indica*, *Melia azedarach*, *Pithecolobium dulce* and *Tamarindus indica* are fairly common along the internal roads.

The invasive exotic *Lantana camara* is very common at the edges of all natural patches and farmlands. A number of smaller exotic plants, notably, *Amaranthus sessilis* and *Parthenium hysterophorus*, are seen to have become widely common - the former, along most paths and field edges, and the latter, in and around most of the farmland.

Water-logged soil-patches are invariably found infested with *Ipomoea carnea*, an exotic weed associated with artificial wetlands.

### Vegetation of Habitations, Farmlands, Orchards and Plantations

Plants found around habitations include fruit-trees like Mango (*Mangifera indica*), Papaya (*Carica papaya*) and Jujube (*Ziziphus mauritiana*), medicinal plants like Neem (*Azadirachta indica*) and *Justicia adhatoda*, ornamental or shade-trees like Bitter Almond (*Terminalia catappa*), flower-shrubs like *Calendula sp.*, *Canna indica*, *Mirabilis jalapa* and *Vinca rosea*. Creepers of gourds used as vegetables are frequently found trailing along the sloping, tiled roofs of village-houses.

Crops in the farmlands included cereals like Wheat (*Triticum aestivum*) and Maize (*Zea mays*), millets like Sorghum (*Sorghum vulgare*) and Pearl Millet (*Pennisetum typhoideum*), Amaranth (*Amarantus*

*frumentaceum*), oil-seeds like Mustard (*Brassica nigra*) and Castor (*Ricinus communis*), vegetables like Cauliflower (*Brassica oleracea botrytis*), Onion (*Allium cepa*) and Chilli (*Capsicum frutescens*) and fodder crops like Lucerne. There are orchards of Amla (*Emblia officinalis*), Fig (*Ficus cairica*), Mango (*Mangifera indica*) and Sweet Lime (*Citrus medicago*).

Bamboo (*Dendrocalamus strictus*) and Teak (*Tectona grandis*) are popularly planted along farm-bunds, while the exotic shrub *Jatropha curcas* is often found planted as a hedge along farm-boundaries.

Plantations are present mainly in areas designated as Reserve Forests and predominantly comprise the exotic tree *Gliricidia sepium*.

### Flora of the Survey Area

The following section describes the floristic diversity of the area and presents the classification of the vegetation.

#### Observed Floristic Diversity

The observations of the floral diversity based on the survey of the above mentioned quadrats are provided in *Table 5-21* and *Table 5-22*.

**Table 5-21 Woody Flora**

Species	Habit	% frequency	Abundance	Density per ha
<i>Abrus precatorius</i>	Climber	3.6	1.0	14.3
<i>Abutilon indicum</i>	Shrub	10.7	1.0	42.9
<i>Acacia catechu</i>	Tree	3.6	1.0	0.9
<i>Acacia leucophloea</i>	Tree	50.0	2.9	35.7
<i>Acacia nilotica</i>	Tree	85.7	5.7	122
<i>Ailanthus excelsa</i>	Tree	14.3	1.0	3.6
<i>Albizia lebbek</i>	Tree	7.1	1.0	1.8
<i>Albizia procera</i>	Tree	10.7	1.0	2.7
<i>Anona squamosa</i>	Tree	14.3	1.5	5.4
<i>Argyrea sp.</i>	Climber	7.1	1.0	28.6
<i>Azadirachta indica</i>	Tree	89.3	3.7	83.0
<i>Balanites aegyptica</i>	Tree	28.6	2.6	18.8
<i>Barleria prionitis</i>	Shrub	3.6	1.0	14.3
<i>Bauhinia racemosa</i>	Tree	3.6	1.0	0.9
<i>Bombax ceiba</i>	Tree	3.6	1.0	0.9
<i>Butea monosperma</i>	Tree	3.6	1.0	0.9
<i>Caesalpinia bonduc</i>	Climber	7.1	1.0	28.6
<i>Calotropis gigantea</i>	Shrub	57.1	1.1	242.9
<i>Capparis decidua</i>	Shrub	7.1	1.0	28.6
<i>Capparis sepiaria</i>	Climber	3.6	1.0	14.3
<i>Carissa congesta</i>	Shrub	7.1	1.5	42.9
<i>Cassia auriculata</i>	Shrub	71.4	1.2	328.6
<i>Clerodendron phlomidis</i>	Shrub	10.7	1.3	57.1
<i>Combretum ovalifolium</i>	Climber	17.9	1.0	71.4

Species	Habit	% frequency	Abundance	Density per ha
<i>Cordia dichotoma</i>	Tree	10.7	1.3	3.6
<i>Croton bonplandianus</i>	Shrub	3.6	1.0	14.3
<i>Cryptostegia grandiflora</i>	Climber	3.6	1.0	14.3
<i>Dalbergia sissoo</i>	Tree	7.1	1.0	1.8
<i>Dendrocalamus strictus</i>	Bamboo	14.3	1.3	4.5
<i>Diospyros sp</i>	Tree	3.6	3.0	2.7
<i>Eucalyptus sp.</i>	Tree	3.6	1.0	0.9
<i>Euphorbia sp.</i>	Shrub	3.6	1.0	14.3
<i>Ficus arnottiana</i>	Tree	10.7	1.0	2.7
<i>Ficus benghalensis</i>	Tree	3.6	1.0	0.9
<i>Ficus glomerata</i>	Tree	17.9	1.4	6.3
<i>Ficus religiosa</i>	Tree	3.6	1.0	0.9
<i>Flacourtia indica</i>	Tree	3.6	1.0	14.3
<i>Gliricidia sepium</i>	Tree	21.4	6.7	35.7
<i>Gmelina arborea</i>	Tree	3.6	1.0	0.9
<i>Grewia tiliaefolia</i>	Tree	3.6	1.0	0.9
<i>Ipomoea carnea</i>	Shrub	35.7	6.2	885.7
<i>Ixora arborea</i>	Tree	3.6	1.0	14.3
<i>Jatropha curcas</i>	Shrub	25.0	3.6	357.1
<i>Kirganellia reticulata</i>	Tree	14.3	1.0	57.1
<i>Lantana camara</i>	Shrub	82.1	1.3	428.6
<i>Leucaena latisiliqua</i>	Tree	3.6	1.0	0.9
<i>Limonia acidissima</i>	Tree	10.7	1.0	2.7
<i>Mangifera indica</i>	Tree	17.9	1.0	4.5
<i>Maytenus emarginata</i>	Shrub	28.6	1.4	157.1
<i>Maytenus rothiana</i>	Shrub	7.1	1.0	28.6
<i>Melia azedarach</i>	Tree	3.6	1.0	0.9
<i>Morinda tinctoria</i>	Tree	7.1	3.5	6.3
<i>Moringa oleifera</i>	Tree	7.1	1.5	2.7
<i>Parkinsonia aculeata</i>	Tree	3.6	3.0	2.7
<i>Phoenix sylvestris</i>	Tree	14.3	4.8	17.0
<i>Pithecolobium dulce</i>	Tree	3.6	2.0	1.8
<i>Pongamia pinnata</i>	Tree	10.7	2.7	7.1
<i>Prosopis chilensis</i>	Tree	35.7	7.0	62.5
<i>Ricinus communis</i>	Shrub	14.3	1.0	57.1
<i>Santalum album</i>	Tree	3.6	4.0	3.6
<i>Securinega leucopyrus</i>	Shrub	7.1	1.0	28.6
<i>Sida acuta</i>	Shrub	10.7	1.0	42.9
<i>Syzygium cumini</i>	Tree	3.6	1.0	0.9
<i>Tamarindus indica</i>	Tree	7.1	1.5	2.7
<i>Tephrosia purpurea</i>	Shrub	39.3	3.6	571.4
<i>Tylophora indica</i>	Climber	3.6	1.0	14.3
<i>Ventilago calyculata</i>	Climber	3.6	1.0	14.3
<i>Vitex negundo</i>	Tree	3.6	4.0	3.6
<i>Woodfordia fruticosa</i>	Shrub	3.6	1.0	14.3
<i>Ziziphus mauritiana</i>	Tree	42.9	2.1	22.3
<i>Ziziphus nummularia</i>	Shrub	50.0	1.0	200
<i>Ziziphus xylopyrus</i>	Shrub	17.9	1.4	100
Unidentified Specimen 1	Shrub	7.1	2.5	71.4
Unidentified Specimen 2	Shrub	3.6	1.0	14.3
Unidentified Specimen 3	Climber	3.6	1.0	14.3

Species	Habit	% frequency	Abundance	Density per ha
<i>Unidentified Specimen 4</i>	Climber	3.6	1.0	14.3
<i>Unidentified Specimen 5</i>	Tree	3.6	1.0	0.9

**Table 5-22: Non - Woody Flora**

Species	Habit	% frequency	Abundance	Density per ha
<i>Abelmoschus manihot</i>	Herb	3.6	1.0	357
<i>Achyranthes aspera</i>	Herb	35.7	1.5	5357
<i>Aerva sp.</i>	Herb	3.6	1.0	357
<i>Agave americana</i>	Herb	7.1	1.0	29
<i>Alternanthera sessilis</i>	Herb	42.9	1.5	6429
<i>Amaranthus sp.</i>	Herb	3.6	1.0	357
<i>Apluda sp.</i>	Grass	39.3	1.5	6071
<i>Argemone mexicana</i>	Herb	28.6	1.0	2857
<i>Aristida sp.</i>	Grass	32.1	1.6	5000
<i>Blumea sp.</i>	Herb	7.1	1.0	714
<i>Boerhaavia diffusa</i>	Herb	10.7	1.0	1071
<i>Caralluma adscendens</i>	Herb	7.1	1.0	714
<i>Cassia occidentalis</i>	Herb	7.1	1.0	714
<i>Cassia tora</i>	Herb	28.6	1.3	3571
<i>Celosia argentea</i>	Herb	28.6	1.0	2857
<i>Chloris sp.</i>	Grass	32.1	1.1	3571
<i>Cocculus villosus</i>	Climber	21.4	1.3	114
<i>Corchorus sp.</i>	Herb	3.6	1.0	357
<i>Cyanotis sp.</i>	Herb	3.6	1.0	357
<i>Cyathocline purpurea</i>	Herb	3.6	1.0	357
<i>Cymbopogon martini</i>	Grass	3.6	1.0	357
<i>Cynodon dactylon</i>	Grass	25.0	12.9	32143
<i>Cyperus sp.</i>	Herb	7.1	1.5	1071
<i>Datura sp.</i>	Herb	3.6	1.0	14
<i>Echinops echinatus</i>	Herb	32.1	1.0	3214
<i>Eragrostis sp.</i>	Grass	7.1	1.0	714
<i>Euphorbia heterophyllus</i>	Herb	3.6	1.0	357
<i>Euphorbia hirta</i>	Herb	10.7	1.0	1071
<i>Grangea maderaspatana</i>	Herb	3.6	1.0	357
<i>Heteropogon contortus</i>	Grass	3.6	1.0	357
<i>Hygrophila auriculata</i>	Herb	3.6	1.0	357
<i>Hyptis suaveolens</i>	Herb	28.6	1.4	3929
<i>Indigofera cordifolia</i>	Herb	14.3	3.8	5357
<i>Ipomoea obscura</i>	Climber	14.3	1.0	57
<i>Ipomoea sp.</i>	Climber	7.1	1.0	29
<i>Ipomoea turbinata</i>	Climber	7.1	1.0	29
<i>Launaea procumbens</i>	Herb	7.1	1.0	714
<i>Lavandula lawii</i>	Herb	3.6	1.0	357
<i>Leonotis nepetifolia</i>	Herb	3.6	1.0	357
<i>Lepidagathis cristata</i>	Herb	7.1	1.0	714
<i>Leucas aspera</i>	Herb	3.6	1.0	357
<i>Mucuna pruriens</i>	Climber	10.7	1.0	1071
<i>Mukia maderaspatana</i>	Climber	10.7	1.0	1071

Species	Habit	% frequency	Abundance	Density per ha
<i>Ocimum canum</i>	Herb	3.6	4.0	1429
<i>Parthenium hysterophorus</i>	Herb	64.3	1.4	8929
<i>Pergularia daemia</i>	Climber	7.1	1.0	714
<i>Peristrophe bicalyculata</i>	Herb	17.9	1.2	2143
<i>Pulicaria sp.</i>	Herb	14.3	1.0	1429
<i>Solanum surattense</i>	Herb	3.6	1.0	357
<i>Themeda sp.</i>	Grass	7.1	1.0	714
<i>Tribulus terrestris</i>	Herb	10.7	1.0	1071
<i>Tridax procumbens</i>	Herb	35.7	1.1	3929
<i>Vernonia cinerea</i>	Herb	21.4	1.0	2143
<i>Xanthium indicum</i>	Herb	53.6	1.0	214
Unidentified Specimen 1	Herb	7.1	1.0	714
Unidentified Specimen 2	Grass	3.6	1.0	357
Unidentified Specimen 3	Climber	3.6	1.0	14

## People and Local Plant Biodiversity

Some of the plants observed within the survey area are known to be of direct use to humans, in essentially three forms – as uncultivated foods, for traditional medicinal purposes and for a small range of secondary uses.

### Food Plants

The food plants in the study area include *Acacia leucophloea* (bark, tender pods), *Acacia nilotica* (tender pods), *Amaranthus sp.* (tender shoots, leaves), *Anona squamosa* (fruit), *Azadirachta indica* (ripe fruits), *Boerhaavia diffusa* (plant), *Capparis decidua* (fruit), *Caralluma adscendens* (plant), *Carissa congesta* (fruit), *Cassia tora* (tender shoots, leaves), *Celosia argentea* (leaves), *Cordia dichotoma* (unripe and ripe fruit), *Dendrocalamus strictus* (tender shoots), *Emblica officinalis* (fruit), *Euphorbia hirta* (tender shoots, leaves), *Ficus glomerata* (fruits), *Flacourtia indica* (fruits), *Lantana camara* (fruits), *Launaea procumbens* (leaves), *Limonia acidissima* (fruits), *Mangifera indica* (fruits), *Moringa oleifera* (leaves, flowers, fruit), *Phoenix sylvestris* (sap, pith, fruits), *Pithecolobium dulce* (fruits), *Syzgium cumini* (fruit), *Tamarindus indica* (leaves, fruits), *Zizyphus mauritiana* and *Zizyphus nummularia* (fruit).

### Medicinal Plants

Medicinal plants in the region comprise of *Abrus precatorius* (leaves), *Abutilon indicum* (leaves), *Acacia catechu* (bark), *Acacia nilotica* (gum), *Achyranthes aspera* (roots, seeds), *Ailanthus excelsa* (juice of bark and leaves), *Albizzia lebbek* (bark, leaves, seeds), *Argemone mexicana* (plant-juice, seed-oil), *Argyrea sp.* (leaves), *Azadirachta indica* (leaves, seed-oil), *Balanites aegyptica* (fruit-pulp), *Barleria prionitis* (roots), *Boerhaavia diffusa* (plant), *Calotropis gigantea* (root-bark and latex), *Celosia argentea* (leaves, seeds), *Dalbergia sissoo* (bark), *Datura metel* (leaves), *Echinops echinatus* (plant), *Emblica officinalis* (fruit), *Euphorbia hirta* (plant), *Grangea maderaspatana* (leaves), *Hygrophila auriculata* (seeds), *Justicia adhatoda* (leaves), *Leucas aspera* (leaves), *Melia azedarach* (seed-oil), *Mucuna pruriens* (roots, seeds), *Mukia maderaspatana* (plant), *Ocimum canum* (seeds), *Pongamia pinnata* (seeds), *Ricinus communis* (seed-oil), *Santalum album* (wood), *Sida acuta* (roots, leaves), *Solanum surattense* (roots), *Syzgium cumini* (seeds), *Tephrosia purpurea* (plant, seed-oil),

*Tribulus terrestris* (roots, fruit), *Tylophora indica* (plant), *Vernonia cinerea* (roots, leaves, seeds), *Vitex negundo* (leaves)

### Secondary-use Plants

Plants for secondary use include *Abutilon indicum* (stem-fibre for rope), *Acacia nilotica* (wood for implements & fuel, bark and pods for tanning, leaves as fodder), *Aegle marmelos* (leaves or rituals), *Anogeissus pendula* (wood for furniture, leaves for dye), *Azadirachta indica* (twigs for toothbrushes), *Balanites aegyptica* (dry fruit-shell in fireworks), *Bauhinia racemosa* (leaves for rolling 'beedis' and for religious rituals), *Bombax ceiba* (seed-floss for stuffing), *Butea monosperma* (leaves for plates and packaging), *Caesalpinia bonduc* (plant for live-fencing), *Calotropis gigantea* (plant-fibre for cordage, seed-floss for stuffing), *Cassia auriculata* (bark for tannin), *Corchorus sp.* (stem-fibre for rope, sacking), *Cryptostegia grandiflora* (bark-fibre for fishing-lines), *Cynodon dactylon* (plant for lawn), *Dalbergia sissoo* (wood for timber), *Dendrocalamus strictus* (bamboo for timber), *Diospyros sp.* (leaves for cigarettes), *Eragrostis sp.* (plant as fodder), *Ficus benghalensis* (leaves for packaging), *Ficus religiosa* (wood for rituals), *Gmelina arborea* (wood for timber), *Ipomoea carnea* (plant as hedge), *Moringa oleifera* (leaves as fodder, seed-oil in perfumes), *Phoenix sylvestris* (leaves for thatch, matting and brooms), *Pongamia pinnata* (seed-oil for lamps), *Prosopis chilensis* (wood for fuel & agricultural implements, ripe pods as fodder), *Santalum album* (wood for perfume), *Sida acuta* (stem-fibre for cordage), *Tectona grandis* (wood for timber), *Woodfordia fruticosa* (flowers for dye), *Ziziphus mauritiana* (wood for furniture & toys, leaves as fodder), *Ziziphus nummularia* (twigs for shades, leaves as fodder).

In addition to the species listed above, a number of tree and shrub species are tapped for firewood, while a number of grass species are used as fodder.

## Fauna of the Survey Area

At each site, faunal diversity was studied through direct evidence, in the form of visual sightings, and indirect evidence, such as calls, nests, burrows, droppings, scats, moults, tracks etc.

### Avifaunal Profile

The avifaunal profile is dominated largely by birds associated with open scrublands and wetland birds. The former group includes species such as Grey Francolin, Green Bee-eater, Laughing Dove, Yellow-wattled Lapwing, Bay-backed Shrike, Long-tailed Shrike, Southern Grey Shrike, Large-billed Crow, Black Drongo, Indian Robin, Common Stonechat, Pied Bushchat, Brahminy Starling, Wire-tailed Swallow, Red-rumped Swallow, Plain Prinia, Large Grey Babbler, Ashy-crowned Sparrow Lark, Rufous-tailed Lark, Greater Short-toed Lark, Chestnut-shouldered Petronia, Indian Silverbill and Baya Weaver.

The latter group includes a number of migratory species such as Ruddy Shelduck, Eurasian Wigeon, Common Teal, Northern Pintail, Northern Shoveler, Common Greenshank, Common Sandpiper, Brown-headed Gull, Whiskered Tern, Grey Heron, Glossy Ibis, Blyth's Reed Warbler, White Wagtail and Yellow Wagtail, besides resident species like White-throated Kingfisher, White-breasted Waterhen, Purple Swamphen, Common Coot, Black-winged Stilt, Red-wattled Lapwing, River Tern,

Little Grebe, Little Cormorant, Indian Cormorant, Little Egret, Intermediate Egret, Indian Pond Heron, Black-headed Ibis, Black Ibis, Painted Stork, Asian Openbill and Woolly-necked Stork.

Another significant component comprises birds associated with habitation, cultivation and gardens, including Common Barbet, Common Hoopoe, Indian Roller, Rock Pigeon, Common Myna, Red-vented Bulbul, Ashy Prinia, Common Tailorbird, Purple-rumped Sunbird, Purple Sunbird, House Sparrow and Scaly-breasted Munia.

There is also a distinct component comprising birds showing a preference for forests, plantations, groves or orchards, including Brown-headed Barbet, Indian Grey Hornbill, Asian Koel, Greater Coucal, Rose-ringed Parakeet, Spotted Dove, Rufous Treepie and Common Iora.

Raptors sighted include Black-shouldered Kite, Black Kite, Crested Serpent Eagle, Eurasian Marsh Harrier, White-eyed Buzzard, Bonelli’s Eagle and Common Kestrel. Nests of Baya Weaver were also observed.

**Table 5-23: Avifaunal Profile of the Region**

Common Name	Scientific Name	% frequency
Grey Francolin	<i>Francolinus pondicerianus</i>	3
Ruddy Shelduck	<i>Tadorna ferruginea</i>	1
Eurasian Wigeon	<i>Anas penelope</i>	1
Common Teal	<i>Anas crecca</i>	1
Northern Pintail	<i>Anas acuta</i>	2
Northern Shoveler	<i>Anas clypeata</i>	1
Brown-headed Barbet	<i>Megalaima zeylanica</i>	1
Coppersmith Barbet	<i>Megalaima haemacephala</i>	3
Indian Grey Hornbill	<i>Ocyrceros birostris</i>	1
Common Hoopoe	<i>Upupa epops</i>	2
Indian Roller	<i>Coracias benghalensis</i>	3
White-throated Kingfisher	<i>Halcyon smyrnensis</i>	9
Green Bee-eater	<i>Merops orientalis</i>	14
Asian Koel	<i>Eudynamys scolopacea</i>	3
Greater Coucal	<i>Centropus sinensis</i>	5
Rose-ringed Parakeet	<i>Psittacula krameri</i>	2
Rock Pigeon	<i>Columba livia</i>	4
Laughing Dove	<i>Streptopelia senegalensis</i>	9
Spotted Dove	<i>Streptopelia chinensis</i>	1
White-breasted Waterhen	<i>Amaurornis phoenicurus</i>	1
Purple Swampphen	<i>Porphyrio porphyrio</i>	2
Common Coot	<i>Fulica atra</i>	1
Common Greenshank	<i>Tringa nebularia</i>	2
Common Sandpiper	<i>Actitis hypoleucos</i>	2
Black-winged Stilt	<i>Himantopus himantopus</i>	2
Yellow-wattled Lapwing	<i>Vanellus malabaricus</i>	1
Red-wattled Lapwing	<i>Vanellus indicus</i>	4
Brown-headed Gull	<i>Larus brunnicephalus</i>	1
River Tern	<i>Sterna aurantia</i>	2
Whiskered Tern	<i>Chlidonias hybridus</i>	1
Black-shouldered Kite	<i>Elanus caeruleus</i>	4

Common Name	Scientific Name	% frequency
Black Kite	<i>Milvus migrans</i>	1
Crested Serpent Eagle	<i>Spilornis cheela</i>	1
Eurasian Marsh Harrier	<i>Circus aeruginosus</i>	1
White-eyed Buzzard	<i>Butastur teesa</i>	1
Bonelli's Eagle	<i>Hieraaetus fasciatus</i>	1
Common Kestrel	<i>Falco tinnunculus</i>	2
Little Grebe	<i>Tachybaptus ruficollis</i>	2
Little Cormorant	<i>Phalacrocorax niger</i>	4
Indian Cormorant	<i>Phalacrocorax fuscicollis</i>	1
Little Egret	<i>Egretta garzetta</i>	2
Intermediate Egret	<i>Mesophoyx intermedia</i>	3
Cattle Egret	<i>Bubulcus ibis</i>	5
Indian Pond Heron	<i>Ardeola grayii</i>	5
Grey Heron	<i>Ardea cinerea</i>	3
Glossy Ibis	<i>Plegadis falcinellus</i>	1
Black-headed Ibis	<i>Threskiornis melanocephalus</i>	1
Black Ibis	<i>Pseudibis papillosa</i>	1
Painted Stork	<i>Mycteria leucocephala</i>	2
Asian Openbill	<i>Anastomus oscitans</i>	2
Woolly-necked Stork	<i>Ciconia episcopus</i>	3
Bay-backed Shrike	<i>Lanius vittatus</i>	3
Long-tailed Shrike	<i>Lanius schach</i>	7
Southern Grey Shrike	<i>Lanius meridionalis</i>	3
Rufous Treepie	<i>Dendrocitta vagabunda</i>	1
Large-billed Crow	<i>Corvus macrorhynchos</i>	1
Black Drongo	<i>Dicrurus macrocercus</i>	10
Common Iora	<i>Aegithina tiphia</i>	3
Indian Robin	<i>Saxicoloides fulicata</i>	4
Common Stonechat	<i>Saxicola torquata</i>	2
Pied Bushchat	<i>Saxicola caprata</i>	2
Brahminy Starling	<i>Sturnus pagodarum</i>	5
Common Myna	<i>Acridotheres tristis</i>	10
Wire-tailed Swallow	<i>Hirundo smithii</i>	1
Red-rumped Swallow	<i>Hirundo daurica</i>	14
Red-vented Bulbul	<i>Pycnonotus cafer</i>	11
Plain Prinia	<i>Prinia inornata</i>	2
Ashy Prinia	<i>Prinia socialis</i>	3
Blyth's Reed Warbler	<i>Acrocephalus dumetorum</i>	7
Common Tailorbird	<i>Orthotomus sutorius</i>	1
Large Grey Babbler	<i>Turdoides malcolmi</i>	10
Ashy-crowned Sparrow Lark	<i>Eremopterix grisea</i>	2
Rufous-tailed Lark	<i>Ammomanes phoenicurus</i>	5
Greater Short-toed Lark	<i>Calandrella brachydactyla</i>	5
Purple-rumped Sunbird	<i>Nectarinia zeylonica</i>	1
Purple Sunbird	<i>Nectarinia asiatica</i>	15
House Sparrow	<i>Passer domesticus</i>	2
Chestnut-shouldered Petronia	<i>Petronia xanthocollis</i>	1
White Wagtail	<i>Motacilla alba</i>	3
Yellow Wagtail	<i>Motacilla flava</i>	1
Baya Weaver	<i>Ploceus philippinus</i>	5
Indian Silverbill	<i>Lonchura malabarica</i>	3

Common Name	Scientific Name	% frequency
Scaly-breasted Munia	<i>Lonchura punctulata</i>	2

### Migratory Avifauna

The survey-area does not coincide with any known major avian migratory flyway. However, the survey-area does lie in the path of various winter migrant birds entering the Indian subcontinent from the north and headed farther south. With its diversity of habitats, it is very likely to be providing wintering-areas or staging-points to many of these winter visitors. The large lakes in the survey-area are well-known to be the winter-habitats of a number of visiting water-birds. The survey-area is also known to be a destination for a few summer visitors, as also, part of the passage traversed by migratory birds headed elsewhere. Migratory species known to be associated with the region in which the survey-area lies are listed below in *Table 5-24*.

**Table 5-24 Migratory Avifauna**

Common Name	Scientific Name	Type
Common Quail	<i>Coturnix coturnix</i>	Winter Visitor
Bar-headed Goose	<i>Anser indicus</i>	Winter Visitor
Ruddy Shelduck	<i>Tadorna ferruginea</i>	Winter Visitor
Common Shelduck	<i>Tadorna tadorna</i>	Winter Visitor
Eurasian Wigeon	<i>Anas penelope</i>	Winter Visitor
Mallard	<i>Anas platyrhynchos</i>	Winter Visitor
Common Teal	<i>Anas crecca</i>	Winter Visitor
Garganey	<i>Anas querquedula</i>	Winter Visitor
Northern Pintail	<i>Anas acuta</i>	Winter Visitor
Northern Shoveler	<i>Anas clypeata</i>	Winter Visitor
Red-crested Pochard	<i>Rhodonessa rufina</i>	Winter Visitor
Ferruginous Pochard	<i>Aythya nyroca</i>	Winter Visitor
Tufted Duck	<i>Aythya fuligula</i>	Winter Visitor
Eurasian Wryneck	<i>Jynx torquilla</i>	Winter Visitor
Blue-tailed Bee-eater	<i>Merops philippinus</i>	Winter Visitor
Pied Cuckoo	<i>Clamator jacobinus</i>	Summer Visitor
Short-eared Owl	<i>Asio flammeus</i>	Winter Visitor
Oriental Turtle Dove	<i>Streptopelia orientalis</i>	Winter Visitor
Demoiselle Crane	<i>Grus virgo</i>	Winter Visitor
Pintail Snipe	<i>Gallinago stenura</i>	Winter Visitor
Common Snipe	<i>Gallinago gallinago</i>	Winter Visitor
Jack Snipe	<i>Lymnocyptes minimus</i>	Winter Visitor
Black-tailed Godwit	<i>Limosa limosa</i>	Winter Visitor
Eurasian Curlew	<i>Numenius arquata</i>	Passage Visitor
Spotted Redshank	<i>Tringa erythropus</i>	Winter Visitor
Common Redshank	<i>Tringa tetanus</i>	Winter Visitor
Marsh Sandpiper	<i>Tringa stagnatilis</i>	Winter Visitor
Common Greenshank	<i>Tringa nebularia</i>	Winter Visitor
Green Sandpiper	<i>Tringa ochropus</i>	Winter Visitor
Wood Sandpiper	<i>Tringa glareola</i>	Winter Visitor
Common Sandpiper	<i>Actitis hypoleucos</i>	Winter Visitor
Little Stint	<i>Calidris minuta</i>	Winter Visitor
Temminck's Stint	<i>Calidris temminckii</i>	Winter Visitor
Ruff	<i>Philomachus pugnax</i>	Winter Visitor
Kentish Plover	<i>Charadrius alexandrinus</i>	Winter Visitor

Common Name	Scientific Name	Type
Brown-headed Gull	<i>Larus brunnicephalus</i>	Winter Visitor
Black-headed Gull	<i>Larus ridibundus</i>	Winter Visitor
Gull-billed Tern	<i>Gelochelidon nilotica</i>	Winter Visitor
Whiskered Tern	<i>Chlidonias hybridus</i>	Winter Visitor
Osprey	<i>Pandion haliaetus</i>	Winter Visitor
Eurasian Marsh Harrier	<i>Circus aeruginosus</i>	Winter Visitor
Pallid Harrier	<i>Circus macrourus</i>	Winter Visitor
Montagu's Harrier	<i>Circus pygargus</i>	Winter Visitor
Steppe Eagle	<i>Aquila nipalensis</i>	Winter Visitor
Booted Eagle	<i>Hieraetus pennatus</i>	Winter Visitor
Common Kestrel	<i>Falco tinnunculus</i>	Winter Visitor
Great Crested Grebe	<i>Podiceps cristatus</i>	Winter Visitor
Grey Heron	<i>Ardea cinerea</i>	Winter Visitor
Greater Flamingo	<i>Phoenicopterus ruber</i>	Passage Visitor
Glossy Ibis	<i>Plegadis falcinellus</i>	Passage Visitor
Black-necked Stork	<i>Ephippiorhynchus asiaticus</i>	Winter Visitor
Indian Pitta	<i>Pitta brachyura</i>	Summer Visitor
Ashy Drongo	<i>Dicrurus leucophaeus</i>	Winter Visitor
Asian Paradise Flycatcher	<i>Terpsiphone paradisi</i>	Summer Visitor
Blue Rock-Thrush	<i>Monticola solitarius</i>	Winter Visitor
Asian Brown Flycatcher	<i>Muscicapa daurica</i>	Winter Visitor
Red-throated Flycatcher	<i>Ficedula parva</i>	Winter Visitor
Bluethroat	<i>Luscinia svecica</i>	Winter Visitor
Black Redstart	<i>Phoenicurus ochrurus</i>	Winter Visitor
Common Stonechat	<i>Saxicola torquata</i>	Winter visitor
Chestnut-tailed Starling	<i>Sturnus malabaricus</i>	Winter Visitor
Rosy Starling	<i>Sturnus roseus</i>	Passage Visitor
Barn Swallow	<i>Hirundo rustica</i>	Winter Visitor
Blyth's Reed Warbler	<i>Acrocephalus dumetorum</i>	Winter Visitor
Clamorous Reed Warbler	<i>Acrocephalus stentorius</i>	Winter Visitor
Booted Warbler	<i>Hippolais caligata</i>	Passage Visitor
Lesser Whitethroat	<i>Sylvia curruca</i>	Winter Visitor
Orphean Warbler	<i>Sylvia hortensis</i>	Winter Visitor
Common Chiffchaff	<i>Phylloscopus collybita</i>	Winter Visitor
Sulphur-bellied Warbler	<i>Phylloscopus griseolus</i>	Winter Visitor
Greenish Warbler	<i>Phylloscopus trochiloides</i>	Winter Visitor
Greater Short-toed Lark	<i>Calandrella brachydactyla</i>	Winter Visitor
White Wagtail	<i>Motacilla alba</i>	Winter Visitor
Citrine Wagtail	<i>Motacilla citreola</i>	Winter Visitor
Yellow Wagtail	<i>Motacilla flava</i>	Winter Visitor
Grey Wagtail	<i>Motacilla cinerea</i>	Winter Visitor
Tree Pipit	<i>Anthus trivialis</i>	Winter Visitor
Olive-backed Pipit	<i>Anthus hodgsoni</i>	Winter Visitor
Common Rosefinch	<i>Carpodacus erythrinus</i>	Winter Visitor
Grey-necked Bunting	<i>Emberiza buchanani</i>	Winter Visitor
Black-headed Bunting	<i>Emberiza melanocephala</i>	Winter Visitor
Red-headed Bunting	<i>Emberiza bruniceps</i>	Winter Visitor

### Other Vertebrate Fauna

Other vertebrate fauna observed in the area includes:

Mammals like Blackbuck (*Antilope cervicapra*), Grey Mongoose (*Herpestes edwardsii*), Indian Hare (*Lepus nigricollis*), Three-striped Palm Squirrel (*Funambulus palmarum*) and Pipistrelle (*Pipistrellus sp.*)

Local people interviewed reported fairly regular sightings of:

Mammals like Rhesus Macaque (*Macaca mulatta*)(locally called 'Maakad'), Hanuman Langur (*Semnopithecus entellus*)(locally called 'Langur'), Blackbuck (*Antilope cervicapra*)(locally called 'Kaalveet'), Indian Gazelle (*Gazella bennettii*)(locally called 'Hareen'), Wild Pig (*Sus scrofa*)(locally called 'Dukkar'), Jackal (*Canis aureus*) (locally called 'Kolha'), Striped Hyena (*Hyaena hyaena*)(locally called 'Todos'), Wolf (*Canis lupus*)(locally called 'Laandga'), Indian Fox (*Vulpes bengalensis*)(locally called 'Kolha'), Grey Mongoose (*Herpestes edwardsii*), Indian Hare (*Lepus nigricollis*) (locally called 'Sasa'), Indian Porcupine (*Hystrix indica*), Five-striped Palm Squirrel (*Funambulus pennantii*) and Indian Flying Fox (*Pteropus giganteus*); and

- Reptiles like Red Sand Boa (*Eryx johnii*)(locally called 'Dutondya') and Bengal Monitor (*Varanus bengalensis*) (locally called 'Ghorpad').

The local Forest Department records report the presence of the following rare mammalian species within the Aurangabad Forest Division:

Blackbuck (*Antilope cervicapra*), Four-horned Antelope (*Tetracerus quadricornis*), Indian Gazelle (*Gazella bennettii*), Wolf (*Canis lupus*) and Common Leopard (*Panthera pardus*).

### **Invertebrate Fauna**

A small range of invertebrate fauna was sighted in the survey area, including butterflies, moths, dragonflies, damselflies, bugs, beetles, ants, bees, wasps and spiders. Nests of Tunnel Spiders were commonly present in the moister grassy patches.

Ant-nests were come upon at a number of sites, while termite-hills were seen at a few. A bee-hive was noted in the branches of a large tree at one site.

Butterflies sighted during the survey include Common Grass Yellow (*Eurema hecabe*), White Orange Tip (*Ixias marianne*), Plain Tiger (*Danaus chrysippus*) and Glassy Tiger (*Parantica aglea*).

## **Species of Special Conservation Concern**

### **Protected Higher Fauna**

Table 5-23 presents the list of higher faunal species associated with the region that are protected under the Wildlife Protection Act – Schedules I & II.

**Table 5-25 Protection Status**

Name	Scientific Name	IUCN* / WPA** Status
Rhesus Macaque	<i>Macaca mulatta</i>	LR / II
Hanuman Langur	<i>Semnopithecus entellus</i>	LR / II
Blackbuck	<i>Antelope cervicapra</i>	V / I
Four-horned Antelope	<i>Tetracerus quadricornis</i>	V / I
Indian Gazelle	<i>Gazella bennettii</i>	LR / I
Jackal	<i>Canis aureus</i>	LR / II
Wolf	<i>Canis lupus</i>	DD / I
Indian Fox	<i>Vulpes benghalensis</i>	LR / II
Common Leopard	<i>Panthera pardus</i>	LR / I
Jungle Cat	<i>Felis chaus</i>	LR / II
Rusty Spotted Cat	<i>Prionailurus rubiginosus</i>	V / I
Honey Badger	<i>Mellivora capensis</i>	LR / I
Smooth-coated Otter	<i>Lutrogale perspicillata</i>	-- / II
Small Indian Civet	<i>Viverricula indica</i>	LR / II
Common Palm Civet	<i>Paradoxurus hermaphroditus</i>	LR / II
Grey Mongoose	<i>Herpestes edwardsii</i>	LC / II
Ruddy Mongoose	<i>Herpestes smithii</i>	LC / II
Indian Pangolin	<i>Manis crassicaudata</i>	LR / I
Indian Peafowl	<i>Pavo cristatus</i>	LC / I
Lesser Florican	<i>Sypheotides indica</i>	E / I
White-rumped Vulture	<i>Gyps bengalensis</i>	CE / I
Long-billed Vulture	<i>Gyps indicus</i>	CE / I
Red-headed Vulture	<i>Sarcogyps calvus</i>	CE / I
Shikra	<i>Accipiter badius</i>	LC / I
Red-necked Falcon	<i>Falco chicquera</i>	LC / I
Laggar Falcon	<i>Falco jugger</i>	NT / I
Peregrine Falcon	<i>Falco peregrinus</i>	LC / I
Eurasian Spoonbill	<i>Platalea leucorodia</i>	LC / I
Indian Rock Python	<i>Python molurus</i>	NT / II
Olive Keelback Water Snake	<i>Atretium schistosum</i>	- / II
Checkered Keelback Water Snake	<i>Xenochrophis piscator</i>	- / II
Indian Rat Snake	<i>Ptyas mucosa</i>	- / II
Spectacled Cobra	<i>Naja naja</i>	- / II
Russell's Viper	<i>Daboia russelii</i>	- / II
South Asian Chameleon	<i>Chamaeleo zeylanicus</i>	- / II
Bengal Monitor	<i>Varanus bengalensis</i>	LC / II
Mugger Crocodile	<i>Crocodylus paluster</i>	-- / I
Indian Softshell Turtle	<i>Aspideretes gangeticus</i>	- / I
Indian Flapshell Turtle	<i>Lissemys punctata</i>	- / I

Note: CE – Critically Endangered, DD – Data Deficient, LC – Least Concern, LR – Lower Risk, E – Endangered, NT – Near Threatened, V – Vulnerable

\*\* Schedule in which declared protected under the Indian Wildlife Protection Act

### Endemic Higher Fauna

Only a few endemic species has been observed in the Dry Deciduous Forests of the Deccan Plateau. The few endemic or near-endemic species associated with the region in which the survey area is located include the following:

- Kondana Rat (*Millardia kondana*) – endemic to the Pune region of Maharashtra,

- Schneider's Leaf-nosed Bat (*Hipposideros speoris*) and Fulvous Leaf-nosed Bat (*Hipposideros fulvus*) – both endemic to the Indian sub-continent,
- Indian Bustard (*Ardeotis nigriceps*) – endemic to India,
- Lesser Florican (*Sypheotides indica*) – endemic to the Indian sub-continent,
- Bristled grassbird (*Chaetornis striatus*) – endemic to the Indian sub-continent and
- Sykes's Lark (*Galerida deva*) – endemic to the central and north-western Deccan Plateau.

## Ecologically Important Sites

The important ecological sites in the survey-area include the Sukhna Lake and network of streams which drain the area. Towards north, there is a Reserved Forest. An important eco-sensitive area in the region is the Jayakwadi Bird Sanctuary about 40 km in the south direction of the proposed Shendra MIP site.

### Ridges and Hillocks

A number of low, gentle-sloped and flat-topped ridges and hillocks are located in the survey area. These structures form an important part area's natural landscape, providing relief and creating unique microhabitats in an otherwise flat terrain. Most of these are designated as Reserve Forests falling under the purview of the Maharashtra State Forest Department and have been provided with legal protection.

Some of these ridges and hillocks, their original forests lost, now lie barren and exposed, bereft of any vegetation save a few Euphorbia bushes, as at Kachner. Others at Nagonachi Wadi, Pimpalkhunta and Dudhad are covered by nearly monocultural plantations, mostly comprising of exotic tree-species *Gliricidia sepium*. However, a small patch, such as the one at Varzhadi, continue to harbour region's original natural dry and mixed deciduous vegetation, while others, such as the one at Gadiwat, hold on to vestiges of their original vegetation in the form of disjoint groves of remnant species. These repositories of the region's native species act as natural gene-banks and also provide refuges to the area's wildlife. The vegetation on the ridge and hillock-slopes also helps in checking soil-erosion and improving ground water recharge by increasing percolation of rain-water.

### Wetlands

The water-bodies like lakes located within survey-area provide habitats to a range of wetland-species, from hydrophytes and insects to turtles and birds. The larger lakes such as Sukhna Reservoir provide wintering-areas or staging-sites to large numbers of migratory birds visiting the sub-continent over the northern winter. On the other hand, seasonal water-bodies, both natural and anthropogenic, also provide habitats to several ephemeral species, in the process of passing through a series of stages as they expand and shrink with the changing of the seasons. These water-bodies function as important wetland-habitats for a wide range of wetland-associated species.

Wetlands also contribute to water-conservation, securing crucial moisture in their hyporrheic zones and recharging the region's wells and aquifers during the dry season. Healthy, well-established wetlands often acquire diverse features such as clumps of aquatic grasses, beds of reeds and sedges, rafts of floating vegetation, small islets amidst the water and trees and shrubs along their banks with

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boughs overhanging the water. All of these provide a range of safe roosting and nesting sites for the associated wildlife. Thus, protection, conservation and restoration of the area's wetlands would safeguard and enhance their ecological services to the region.

## 6. Impact Assessment

This Section describes various social and environmental impacts identified and assessed for the construction and operation phases of the proposed Mega Industrial Park at Shendra. These impacts have been identified through available project details and activities; discussions with the local community; the project proponents and AECOM’s previous project experience in handling assignments of a similar nature.

This section identifies and assesses the range of potential impacts and extent of their severity on environment, ecology, socio-economic resources, demographics, livelihoods, as well as access and infrastructure issues. Mitigation measures for the identified impacts are also suggested with a management plan for the proposed mitigation measures.

### 6.1 Impact Appraisal Criteria

The criterion employed to appraise impacts on various social and environmental components has been presented as Table 6-1 below.

**Table 6-1 Impact Appraisal Criteria**

Criteria	Sub-Classification	Defining Limit	Remarks
<b>Spread:</b> refers to area of direct influence under the impact of a particular project activity.	Insignificant/ Local spread	Impact is restricted within the foot prints of the Project boundary	except for ecology for which insignificant impact is defined as limited loss of vegetation only at site
	Medium Spread	Impact is spread up to 3 km from the boundary of the Project	except for ecology for which medium impact is defined as loss of vegetation at site including large trees with limited disturbance to adjoining flora & fauna
	High spread	Impact is spread up beyond 3 km from footprint boundary of the Project	except for ecology for which high impact is defined as loss of vegetation at site and/or damage to adjoining flora and fauna
<b>Duration:</b> based on duration of impact and the time taken by an environmental component to recover back to its best possible pre-project state	Insignificant/ Short Duration	Impact is likely to be restricted for duration of less than 2 years	the anticipated recovery of the effected environmental component within 2 years
	Medium Duration	Impact extends up to 5 years	With an anticipated recovery of the effected environmental component within 5 years
	Long Duration	Impact extends beyond 5 years;	With anticipated recovery of prevailing condition to happen within 5 years or beyond or upon completion

Criteria	Sub-Classification	Defining Limit	Remarks
			of the project life
<b>Intensity:</b> defines the magnitude of Impact	Insignificant intensity	when resulting in changes in the environmental baseline conditions is up to 10%	However, it shall be reconsidered where the baseline values are already high.
	Low intensity	when resulting in changes in the baseline conditions up to 20%	for ecology it refers to minimal changes in the existing ecology in terms of their reproductive capacity, survival or habitat change
	Moderate intensity	when resulting in changes in the baseline conditions for up to 30%	for ecology it refers to changes that are expected to be recoverable
	High intensity	when change resulting in the baseline conditions is beyond 30%	While for ecology, high intensity refers to changes that result in serious destruction to species, productivity or their habitat.
<b>Nature:</b> refers to whether the effect is considered beneficial or adverse	Beneficial	Useful to Environment and Community	-
	Adverse	Harmful to Environment and Community	-

A significance assessment matrix was developed to assess the impact based on the appraisal criteria developed above which is as given in *Table 6-2*.

**Table 6-2 Impact Significance Criteria**

Spread	Duration	Intensity	Overall Significance	
			Adverse	Beneficial
Local	Short	Low	Insignificant	Insignificant
Local	Short	Moderate	Minor	Minor
Local	Medium	Low		
Local	Medium	Moderate		
Medium	Short	Low		
Local	Long	Low		
Local	Short	High	Moderate	Moderate
Local	Medium	High		
Local	Long	Moderate		
Medium	Short	Moderate		
Medium	Medium	Low		
Medium	Medium	Moderate		
Medium	Long	Low		
Medium	Long	Moderate		
High	Short	Low		

High	Short	Moderate		
High	Medium	Low		
High	Medium	Moderate		
High	Long	Low		
Local	Long	High	Major	Major
Medium	Short	High		
Medium	Long	High		
High	Short	High		
High	Medium	High		
High	Long	Moderate		
High	Low	Low		
High	Low	High		

The reversible and irreversible nature of impacts will also be considered. Any minor or moderate impact of irreversible nature will be considered as a moderate and major impact. The impacts for the proposed project are covered under the following subsections:

- Impacts during Construction Phase
- Impacts during Operational Phase

## 6.2 Impacts during Construction Phase

*The construction phase will be spread over a period of 10 years. The construction of individual projects like industries, residential colonies, commercial complexes etc will be undertaken by their respective proponents after obtaining the applicable environmental clearance and consents from the regulatory authorities. MIDC will take up the construction of basic infrastructure facilities like trunk lines for sewerage, roads, water supply etc.* Based on the activities involved, an impact interaction matrix for construction phase was prepared for the project. The impact identification matrix is presented in Table 6-3.

**Table 6-3 Impact Identification Matrix for Construction Phase**

S.No	Main Activities	Potential Impacts								
		Ecology	Water Resources	Ambient Air Quality	Soil Resources	Ambient Noise Quality	Water Quality	Traffic & Transport	Livelihood	Occupational Health & Safety
<b>A</b>	<b>Site Preparation / Reclamation</b>									
1	Site Clearing				√		√		√	√
2	Excavation			√		√				
3	Access Road			√				√		
4	Tree and vegetation clearance	√			√					
5	Transportation of Machinery			√		√		√		√
<b>B</b>	<b>Labour Engagement</b>									
1	Construction of Labour Camp		√				√			
2	Waste handling & its disposal		√		√		√			√
3	Sewage disposal						√			
4	Power Supply			√						
5	Water Requirement		√							
<b>C</b>	<b>Material Handling &amp; Storage</b>									
1	Transportation & Unloading of construction material			√		√		√		
2	Storage & Handling of construction material			√						√
<b>D</b>	<b>Construction activities</b>									
1	Preparation/Mixing of construction material			√		√				
2	Supply of water, power, sanitation facilities		√				√			
3	Operation of construction machinery			√		√				
4	Handling and Disposal of construction wastes									√
<b>E</b>	<b>Demobilisation</b>									
1	Demobilisation of Construction Equipment								√	√
2	Dismantling of temporary support					√				√

S.No	Main Activities	Potential Impacts								
		Ecology	Water Resources	Ambient Air Quality	Soil Resources	Ambient Noise Quality	Water Quality	Traffic & Transport	Livelihood	Occupational Health & Safety
	construction structures /equipments									
3	Removal of construction machinery			√				√		
4	Transportation of Construction/Dismantled wastes			√				√		

Based on activity - an impact interaction matrix for construction phase of the project, have been identified:

- Ambient Air Quality;
- Water Resources and Quality;
- Ecological;
- Landscape and Topography;
- Ambient Noise Quality;
- Soil Resources;
- Traffic & Transport;
- Socio-Economic Environment;
- Employment and Local Economy;
- Occupational Health and Safety.

### Impact on Ambient Air Quality

The heavy construction operations will be major source of air emissions during construction phase of proposed Shendra MIP. The potential sources of air pollution include:

- Fugitive dust emissions from land clearing, soil excavation and vehicle movement on unpaved roads and construction activities;
- Fugitive dust from improper storage of raw material, excavated soil and debris;
- Emissions from operation of diesel generators at the construction campsites;
- Use of heavy construction equipment and vehicles at the construction site; and
- Dust from operation of batching plant

The dust emissions will vary substantially from day to day based on the level of activity, the specific operations and the prevalent meteorological conditions. The site grading operations will include grading, trenching, soil compaction, cut and fill activities and transport of material into and off site. These activities will result in particulate matter (PM<sub>10</sub> and PM<sub>2.5</sub>) emissions. The average PM<sub>10</sub> emission factors ranges for loading and unloading operations<sup>3</sup> will be in the range of 2.8 to 4.7 kg/1000 m<sup>3</sup> respectively. It is estimated that the transportation of construction material will involve movement of 50-400 trucks/day which will result in tail pipe emissions. The scraper transit emission factors will be in the range of 3.9 – 4.5 kg/vehicle-km for loaded vehicle and 1.4-3.1 kg/vehicle-km for empty vehicle.

The construction will require two campsites close to any area where MIDC can provide electricity, which will house approximately 1000-1200 labours each. However, one DG Set of 1000 KVA will be installed at each of the camp site as an emergency power back up. The generators will be in operation for maximum

<sup>3</sup> Source - "Particulate Emissions from construction activities" by Gregory E. Muleski, Chatten Cowherd and John S. Kinsey published in *Journal of the Air and Waste Management Association*, 2005

3 hours in a day. Emissions from DG sets are expected to cause localized impact on air quality for short duration. High Speed Diesel (HSD) will be used as fuel in the DG sets to reduce the quantity of SPM, SO<sub>2</sub>, NO<sub>x</sub> and CO emissions. The construction labourers may also use firewood as fuel for cooking purposes resulting in emissions and tree felling. Open burning of waste may also be done by the construction labourers leading to SO<sub>2</sub>, NO<sub>x</sub> and CO emissions.

### *Mitigation Measures*

The impacts on air quality will be minimized through mitigation measures to be included in the construction contract, requiring contractors to strictly implement them. The project authorities set up by DMIC shall supervise and monitor the performance of all project proponents during construction. The mitigation measures include the following:

- The project proponent shall ensure that the construction contractors implement measures for suppression of fugitive dust emissions such as spraying water, wetting of the stockpile, proper location of material stockpiles, from the habitations, screening of or providing wind breaks for stockpiles, covering of trucks with tarpaulin sheets during transportation of soil and material at the site and in delineated area;
- For minimising dust from material handling sources, conveyors and bins, covers and/or control equipment (water suppression, bag house, or cyclone) will be employed;
- Limited vehicular movement shall be permitted on disturbed soils;
- It is recommended to develop a 20m-40m wide green buffer lines separating the residential areas from the industrial zones which will help to abate air pollution and noise pollution.
- A green buffer line is also suggested all along the railway track, running parallel to the southern boundary of the proposed MIP site. This will act as a pollutant sink.
- Contractors shall be required to maintain valid PUC – Pollution under Control certificates and to maintain proper maintenance records for their fleet as part of the contract bid and at regular intervals throughout the life of the contract;
- The excess fill material to be transported shall be stockpiled prior to loading into the truck;
- The heights from which materials are dropped will be reduced to a practical minimum height to control fugitive dust emissions arising during material handling;
- Paved roads will be cleaned regularly and un-paved roads will be stabilized to reduce offsite transport of soil and avoid dust generation;
- Power supply for construction will be sourced from existing source of MIDC supply;
- Diesel generators for power back-up will be optimally operated and regularly maintained so as to ensure that emissions from fuel combustion remain at design levels. Appropriate stack height as per the CPCB/MPCB guidelines will be provided for the generators;
- The construction camps will be provided with canteen facilities equipped with LPG cylinders and construction labourers will be discouraged to use firewood as cooking fuel;

- Activities that generate high dust will be avoided during high wind conditions (particularly during summer season);
- All loose construction material at construction site will be covered to reduce generation of dust;
- Open burning of waste shall not be permitted and will be the responsibility of the contractor;
- Speed of vehicle plying on unpaved areas will be limited to 20 km/hour to minimize potential for dust generation in the surroundings;
- Idling of machinery will be avoided and all machine will be turned off when not in use;
- Housekeeping of the area will be maintained by deputing sweepers to remove dirt/debris from the floors/ sites on daily basis;
- Paint, polishes, building fittings and flooring material etc will be procured carefully to minimize emission of VOCs;
- Fleet owners /operators shall implement the manufacturer recommended engine maintenance programs irrespective of the size or type of vehicle;
- Drivers will be instructed on the benefits of driving practices that reduce both the risk of accidents and fuel consumption, including measured acceleration and driving within safe speed limits.

**Significance of Impact**

The overall impact on the air quality is assessed to be moderate, however, with the implementation of mitigation measures the impact can be contained with minor residual impacts.

**Table 6-4 Impact significance – Ambient Air Quality**

Aspect	Scenario	Spread	Duration	Intensity	Overall
Air Quality	Without Mitigation	Medium	Medium	Moderate	Moderate
	With Mitigation	Local	Medium	Low	Minor

**Impact on Water Resources and Quality**

The impact on water resources and quality from the construction phase of the project arises from the following:

- Change in topography and alteration of drainage pattern
- Requirement of water for construction and labour camps
- Sediment run off from construction area
- Disposal of sewage from construction camps

The project activities will involve minor alteration of topography due to localized leveling of terrain, small drainage channels may get diverted or lost due to change in topography, construction of access

roads, pipeline etc. The alteration of drainage pattern can lead to localized flooding and undesired health issues associated with water logging.

As mentioned above, the construction activities will require setting up of 2 labour camps will be established with a capacity to accommodate a peak labour of 1000-1200 workers at each campsite. The labour camps will require water for consumption of workers as well as for the construction activities (such as preparation of concrete mix, curing, housekeeping, dust suppression etc). It is estimated that about 2m<sup>3</sup> of water will be required during construction, per sq m<sup>4</sup> of built up total area. The requirement of water for construction will put additional pressure on the local resources.

It is expected that during construction phase there will be generation of sewage and minor quantity of rejected water from testing of utility tanks and pipelines during commissioning of the project. About 80 to 100 m<sup>3</sup>/day of sewage is expected to be generated due to working of 1000 to 1200 labour at each construction camp site. There is a potential for contamination of surface and groundwater resources resulting from improper management of sewage.

The construction activities will result in disturbance of topsoil rendering it vulnerable to erosion and runoff. The potential impact on water quality can be due to escape of excavated soil along the existing channels where the loose silt and sand could be washed along the surface drainage. Improper storage of excavated soil, raw material for construction and debris can lead to contamination/siltation of adjoining water bodies or streams that may lead to the main water bodies such as Sukhna Reservoir. There is potential for contamination of soil and groundwater due to spillage and migration of fuel, lubricants etc being used for heavy machinery and generators.

### *Mitigation*

The mitigation measures provided shall be implemented by each individual projects based on its applicability to the activities and processes. Construction activities close to water channels shall ensure greater degree of precautions and effectiveness of implementation.

- Water for the construction phase will be sourced through the existing sources allocated to MIDC supplemented with authorized tanker supply. The SPV proposed by MIDC to ensure that supply is from approved water sources;
- The construction campsites will put in place optimal water conservation measures along with adequate awareness measures for the labourers.
- To minimise adverse impacts due to escape/discharge of untreated sewage outside the project site, adequate number of toilets (at least 10 toilets per 100 labour) with septic tanks and soak pits arrangements shall be provided onsite for disposal of sewage as per the design aspects of Bureau of Indian Standards;

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<sup>4</sup> CSE brochure on Green Buildings

- Random disposal of wastewater by workers in the labour colony will be strictly restricted. Adequate drains and collection sumps for recharge of water from bathing are at the labour campsites.
- All the debris resulting from construction activities shall be removed from the site on regular basis to prevent their runoff. Secondary containment and bund shall be provided around excavated soil or loose construction material to prevent runoff to nearby water bodies;
- Storage area shall be kept away from the storm water drain to prevent any wash away into water bodies outside the facility;
- Segregation and pre-treatment of oil and grease containing effluents from workshop (e.g. use of a grease trap) shall be undertaken prior to discharge into sewer systems;
- Sludge from sanitary wastewater treatment systems will be disposed in compliance with local regulatory requirements;
- Surface contours will be restored in relation to the surroundings followed by developing drains and providing adequate slopes across the project site prior to start of excavation work thereby ensuring adequate cross drainage for quick evacuation of catchment water;
- Diversion dykes to channel runoff will be constructed around the excavated site to avoid surface runoff of excavated material;
- Storm water will be collected in garland drains around the construction area with silt trap and oil trap prior to disposal into existing sewerage system or stream;
- Implement rainwater harvesting system for all the campsites for effective recharge of groundwater during rainy season.

### Significance of Impact

The overall impact on the water resources is assessed to be moderate, however with the implementation of mitigation measures the impact can be contained with minor residual impacts.

**Table 6-5 Impact significance - Water Resources and Quality**

Aspect	Scenario	Spread	Duration	Intensity	Overall
Water Resources and Quality	Without Mitigation	Medium	Medium	Moderate	Moderate
	With Mitigation	Local	Medium	Low	Minor

### Impact on Ecology

During construction phase, the key potential impacts on ecology will be associated with activities like site clearance, ground excavations, dredging, barging of spoil, filling of habitats with spoil, construction of embankment along rivers etc.

The ecological sensitivity of the area as highlighted in Section 4 includes the following:

- Jayakwadi Bird Sanctuary located about 40 km from the lower project boundary in the south-west direction.
- The patches of reserve forests lying along the northern boundary of proposed project.
- The water bodies like Sukhna Reservoir which provide wintering-areas or staging-sites to large numbers of migratory birds visiting the sub-continent over the northern winter.

### *Impacts*

The construction activities will entail site clearance and development activities which will lead to loss of vegetation and tree felling within the delineated area for the development of the various projects. Loss of trees will result in destruction of habitats for small mammals and birds. The project related construction activities involving noise and vibrations, construction vehicle movement, illumination at the project site will have adverse impact on wildlife. Use of wood as fuel by cutting trees in the nearby area by construction labour would result as a threat to the ecology of the area.

Unplanned storage of construction raw material and indiscrete disposal of construction debris can result in contamination of soil and water bodies in the proximity, which may also lead to increase in turbidity of water and increase siltation towards mouth of water streams. High turbidity and presence of construction debris can result in damage to aquatic habitats.

Villagers in the area have reported presence of Mammals like Indian Blackbuck, Grey Mongoose, Indian Hare, Wild Pig, Striped Hyena, Wolf and Palm Squirrel. Construction activities can lead to loss of habitats for these mammals resulting in undesired poaching of these animals by construction labourers/migrant workers or the local community.

### *Mitigation*

The mitigation measures provided shall be implemented by each individual projects based on its applicability to the activities and processes. The project authorities set up by DMIC/ MIDC to supervise and monitor the performance of all project proponents during construction phase.

- All patches of reserve forest located within and on the hills in the vicinity of a distance of at least 2 km from the western and the northern boundary of the proposed project-site shall be designated as a 'No Development Zone';
- It is recommended to develop a 20m-40m wide green buffer line all along the railway track, running parallel to the southern boundary of the proposed MIP site.
- The area in and around of catchment of Sukhna Reservoir will be preserved;
- Excavation and subsequent dumping of soil shall be undertaken after ensuring that each soil-layer is extracted, marked and stored separately, so that the original soil-profile can be restored while relocating it. Special efforts must be taken to conserve the uppermost thin, humus-rich, fertile soil-layer;
- All individual projects envisaged within the proposed Shendra MIP (Industrial and/or Residential) shall ensure that no felling of trees is taken up unless necessary or without approval

of the concerned agencies. The construction contractors shall be instructed to avoid tree cutting and avoid disturbance to ecology to the extent possible. In case any tree is to be cut, ensure that prior approval is obtained from the designated Tree officer as required under the Maharashtra Felling of Tree (Regulation) Act 1964;

- No hunting activity to be permitted within and around the delineated area and strict guidelines will be given to contractors to ensure that such activities are not allowed;
- In case of any wildlife being spotted, trained personnel from Department of Forest and Wildlife Warden’s office and approved experts should be intimated for rescue of the wildlife;
- All project proponents to ensure implementation of measures to control silt/sediments during construction phase and special attention should be given to containment systems in project-related dumping-sites to prevent leaching of foreign materials into the surrounding environment.
- The project activities to ensure that storage of raw material and debris are kept away from water bodies, streams and run off areas to avoid any increase in turbidity or sedimentation in the key rivers of the area.
- Ensure measures as suggested for ambient air quality and traffic and transport of material to minimize impacts on existing ecology at the site and its surroundings;
- Minimum levels of noise during construction activities shall be maintained, illumination and night operations will be restricted in areas close to reserve forests.

**Significance of Impact**

The overall impact on the ecology is assessed to be moderate. It is assessed that with implementation of suggested mitigation measures the overall impact on ecology can be maintained as minor.

**Table 6-6 Impact significance – Ecology**

Aspect	Scenario	Spread	Duration	Intensity	Overall
Ecology	Without Mitigation	Medium	Medium	Moderate	Moderate
	With Mitigation	Local	Medium	Moderate	Minor

**Impact on Landscape and Topography**

The landscape of the area will gradually change over a period of 10 years with various urban developments constituting of industries, highways, planned green belts, etc. The change in topography will mainly be due to leveling of area or modification of terrain. The construction activities such as excavation works for foundations of various project-components, development of drains, providing proper slopes across the area etc and ultimately for erection of the associated structures and buildings will change the topography of the area.

The runoff from urban areas will be comparatively higher because the replacement of vegetation by impervious built and paved surfaces leads to less infiltration. This can lead to more localized flooding and undesired health issues associated with it.

**Mitigation**

All projects undertaken as part of Industrial park shall ensure following mitigation measures to minimise impact on landuse, topography, landscape and drainage of each project site and surrounding region:

- A riparian buffer zone of 20-40m will be provided around the existing water bodies and streams;
- Greenbelt shall be developed around each industrial zone within the proposed Industrial Area.
- Adequate area around all significant habitation will be retained for the development of villages;
- The project proposes to provide large open spaces and landscaping to ensure adequate recharge and control of runoff;
- No extra soil shall be brought into the site from outside the project boundary for the construction activity. All excavated soil is used in level raising;
- The construction contractors shall be instructed not to cut any tree. Wherever possible avoid disturbance to existing ecology to improve the landscape of the project site;
- Restore land surface contours in relation to the surroundings followed by developing drains and providing adequate slopes across the project site prior to start of excavation work thereby ensuring adequate cross drainage for quick evacuation of catchment water;
- Ensure construction footprint is well defined and construction work to be carried out within the Project footprints only;
- Visual intrusion or aesthetics will be considered during the project and the project will ensure good housekeeping at campsites, construction area and area under its control. All debris and excavation material will be store securely and removed within a stipulated period.

**Significance of Impact**

The overall impact on the landscape and topography is assessed to be moderate, however, with the implementation of mitigation measures the impact can be contained with minor residual impacts.

**Table 6-7 Impact significance – Landscape and Topography**

Aspect	Scenario	Spread	Duration	Intensity	Overall
Landscape and Topography	Without Mitigation	Medium	Medium	Moderate	Moderate
	With Mitigation	Local	Medium	Low	Minor

**Impact on Ambient Noise Quality**

Construction source noise is associated with a variety of mobile and stationery sources, each having unique noise characteristics and operating for different time periods. The stationery sources will include operation of heavy equipment and machinery engaged for construction activities (such as excavation,

grading, erecting equipment, piling, etc.) and mobile sources will movement of vehicles. The major noise generating sources and noise levels generated by them, envisaged during construction phase are given in Table 6-8.

**Table 6-8: Noise levels generated by Typical Construction Equipment**

S.No	Equipment	Typical Noise Level dBA – 50 ft. from source
<b>A</b>	<b>Earth Movers</b>	
1	Dozers	85
2	Loaders	85
3	Backhoes	80
4	Pavers	89
5	Tippers/Trucks	88
6	Scrapers	89
7	Graders	85
<b>B</b>	<b>Material Handlers</b>	
1	Concrete mixers	85
2	Concrete pumps	82
3	Cranes (movable)	83
4	Vehicular Traffic - Construction material & plant machinery	88
<b>C</b>	<b>Stationary Equipment</b>	
1	DG Sets	81
2	Pumps	76
3	Compressors	81
<b>D</b>	<b>Impact Based Equipment</b>	
1	Pneumatic Wrenches	85
2	Jack hammer	88
3	Pile drivers (peak)	101

Source: U.S. Environmental Protection Agency, "Noise from Construction Equipment and Operations, Building Equipment and Home Appliances"

Construction associated with proposed project lead to excessive ground-borne vibration or ground-borne noise levels. The noise generation during such large-scale construction activities would be considerable and can have significant impact on the health of construction workers. The disturbance to existing habitations is expected to be limited as adequate area around the villages will be de-notified and no project construction activity will be undertaken close to any settlements. During construction, it can be expected that most wildlife and bird species occupying the immediate vicinity of the construction site will be initially affected. However, construction activities will be of short duration (in the context of the Project life cycle) and, therefore, it is not likely that significant effects will occur.

**Mitigation**

The following mitigation measures shall be implemented by each individual project based on the applicability to the individual project’s activities and processes.

- The working time and construction schedule will be arranged rationally, and all engineering contractors will make reasonable arrangements for working time, and construction activities from 22:00 hours to 6:00 hours will be strictly prohibited;
- Prior to construction of project facilities, the contractor shall develop and implement a construction noise attenuation plan as needed on a project-by-project basis to reduce noise-related impacts at nearby sensitive receptors to the degree feasible;
- Prior consultation and notification shall be undertaken with nearby residents that may be affected by noise or vibration generating activities;
- Construction equipment shall be properly outfitted and maintained with noise reduction devices to minimize construction-generated noise. Wherever possible, noise-generating construction equipment shall be shielded from nearby residences by noise-attenuating buffers, such as structures or trucks. Stationary construction equipment shall be centrally located onsite at the greatest distance possible from nearby noise-sensitive receptors;
- Rubber padding will be provided for construction machinery for vibration control;
- Acoustic enclosures will be provided for DG sets so that the maximum permissible sound pressure level does not exceed 75 dB(A) at 1 m distance;
- Noise barriers shall be constructed such as temporary walls or piles of excavated material, between noisy activities and noise sensitive receptors;
- Traffic shall be rerouted to avoid or minimise the project transportation through community areas;
- Regular maintenance of construction equipments and machinery shall be carried out;
- Loading/unloading and transportation will be done during daytime if possible, and equipment of high noise will not be operated at night.
- Construction workers working near high noise generation will be required to use ear muffs.

### Significance of Impact

The overall impact on ambient noise is assessed to be moderate, however with the implementation of mitigation measures the impact can be contained with minor residual impacts.

**Table 6-9 Impact Significance - Ambient Noise Quality**

Aspect	Scenario	Spread	Duration	Intensity	Overall
Noise Quality	Without Mitigation	Medium	Medium	Low	Moderate
	With Mitigation	Local	Medium	Low	Minor

### Impact on Soil Resources

Three major impacts on soil resources are associated with construction activities of proposed Shendra MIP. These include- soil erosion, soil compaction and soil contamination. The construction activities will include site clearing and earthwork which will result in top soil removal and will disturb the soil surfaces.

The impact on soil resources is proportional to the disturbances caused. Soil erosion may be caused by exposure of soil surfaces to rain and wind during site clearing, earth moving, and excavation activities. This will also result in loss of good quality top soil. The mobilization and transport of soil particles may, in turn, result in sedimentation of surface drainage networks, which may result in impacts to the quality of natural water systems and ultimately the biological systems that use these waters.

Compaction of soil will occur particularly during site clearance stage due to movement of heavy machinery and vehicles and during setting up of construction camps and stockyards. The compaction of soil can result in reduction in ground recharge potential and can render the soil less suitable for agricultural purposes.

The construction activities will also include storage, handling and disposal of petroleum based products such as lubricants, hydraulic fluids, or fuels during their storage, transfer, or use in equipment. The improper storage, handling and disposal of these products may pose a risk of potential leakage and contamination of the land. The maintenance of heavy machinery and equipments involves replacement of machine oil, greasing and other such activities that may contribute to soil contamination, if not handled properly. The construction activities will also result in generation of waste such as construction debris, waste from site clearance, excavated materials and municipal waste from labour colonies. The waste from construction activities has been estimated to be in the range of 40-60 kg/ m<sup>2</sup> and the municipal waste from each construction camp has been estimated to be 0.2-0.8 MT/day. The dumping of municipal waste can lead to contamination of soil and the leaching of the waste material can cause contamination of the surface and groundwater resources in and around the dumping site. The unwarranted disposal of construction spoil and debris will add to soil contamination. This contamination is likely to be carried over to any nearby water bodies like Sukhna reservoir if dumping is done near water body locations.

### *Mitigation*

Following erosion and sediment control measures shall be implemented to minimise impacts on soil resources and quality due to site preparation include the following:

- The construction activities will be planned in stages of development such that only the areas which are actively being developed are exposed so that amount of land disturbed is limited;
- Surface runoff from the construction site and exposed areas will be diverted using dikes, drainage swales or ditches. The method of choice will depend on the size of the drainage area and the steepness of the slope;
- Major activities pertaining to site grading and excavation for foundation and backfilling will be planned for dry season;
- Minimum clearance of vegetation shall be carried out and the vegetative cover shall be redeveloped wherever possible;

- Excavated soil will be used/transported at the earliest for filling low lying areas at the site for raising of level as planned;
- Completed earthworks will be sealed and/or re-vegetated as soon as reasonably practicable with the help of landscape expert;
- The movement and parking of heavy machinery and other vehicles will be restricted to identified area to limit the possibility of compaction;
- On-site collection and settling of storm water, prohibition of equipment wash downs, and prevention of soil loss and toxic releases from the construction site shall be done;
- All stacking and loading areas should be provided with proper garland drains equipped with baffles to prevent run off from the site from entering into any water body;
- Storage facilities will be designed within paved surface, provided with covered shed and adequate containment facility at the construction site to prevent contamination of soil due to accidental spills of lubricating oil, fuel oil, paints, thinner, varnishes, chemicals etc.;
- Adequate hazardous waste collection and storage facilities shall be provided in a designated place away from storm drains or watercourses with proper access control and proper labelling;
- All the hazardous waste containers will be properly labelled with the waste being stored and the date of generation;
- The hazardous waste shall not be stored for more than 90 days at the site and will be sold to authorized recyclers;
- An inventory of the hazardous waste generated and sold to recyclers shall be maintained by the contractors;
- Paintbrushes and equipment for water and oil based paints shall be cleaned within a contained area and shall not be allowed to contaminate site soils, watercourses, or drainage systems.
- Segregation of potentially hazardous waste from non-hazardous construction site debris.
- The contractor shall educate the workers and subcontractors about hazardous waste storage and disposal procedures;
- Hazardous wastes including used oil, waste oil and residue containing oil or other hazardous substances will be stored at a designated place at all construction sites for disposal through authorized vendors approved by the State Pollution Control Board.
- The contractor shall provide adequate number of toilets (at least 10 toilets per 100 labour) with septic tanks and soak pits arrangements for disposal of sewage as per the design aspects of Bureau of Indian Standards;
- The septic tanks shall be abandoned and filled with earth after the labour camps are evacuated on completion of works;
- Construction wastes from site such as metal cuttings debris, plastic packing material, wooden logs etc will be segregated and kept in specially identified waste bins. All metal scrap will be sold while concrete waste/debris and other inert materials that cannot be recycled to be crushed and reused for level raising onsite or in road/pavement development within the site;

- Covered garbage bins shall be provided for the construction camps and will be collected and transferred to the existing/proposed waste management facilities;
- Waste generated will be segregated into biodegradable and non-biodegradable contents. All biodegradable wastes from kitchen to be collected for secondary use such as animal feed or for vermi-compost. Other biodegradable wastes to be collected and disposed of in humus pits generated onsite for subsequent use as manure;
- The construction waste shall be used as a fill material for the low lying areas and for construction of roads;
- Empty containers, which may contain some toxic substances such as paints, solvents, adhesives and sealants shall be returned to the manufacturers or disposed appropriately as the case may be.

### Significance of Impact

The overall impact on the soil resources is assessed to be moderate. It is assessed that with implementation of suggested mitigation measures the overall impact can be maintained as minor.

**Table 6-10 Impact significance –Soil Resources**

Aspect	Scenario	Spread	Duration	Intensity	Overall
Soil Resources	Without Mitigation	Moderate	Medium	Moderate	Moderate
	With Mitigation	Local	Medium	Low	Minor

### Impact on Traffic and Transport

The construction phase will entail transportation of construction materials, cut and fill material to and from site and transportation of labour. The delineated region is connected by the National Highway NH-211, State Highways (SH- 148, Sh-178 and SH-60), and other village access roads. It is estimated that each construction phase will involve a movement of 100 to 150 trucks per day for transportation of materials. The additional traffic during construction phase will add on to the traffic along highways and may lead to traffic congestions and may cause reduction in speeds. Also, the turning movement of vehicles to construction camps may lead to further increase in travel time. However, increase in transportation due to movement of workers will be limited as significant section workers will be accommodated at the campsite.

The construction activities will not be limited to areas around the major roads and will have to be accessed through internal village roads. The major portion of the internal roads comprises of unpaved roads which are not being currently used by heavy traffic hence increase in traffic on these roads may lead to increased risk of traffic hazards which may result in injury, fatalities or environmental damage. These roads may incur some damage during the construction phase due to movement of heavy vehicles and equipment. Some of the existing village roads and cart tracks may need to be upgraded prior to commencement of construction to bear the load of heavy earth moving and construction vehicles/

equipment. Disruption of traffic is also anticipated on connecting roads due unplanned entry to the site, parking of trucks, breakdowns, etc. Since the rural roads do not have appreciable traffic volume, disruption to regular traffic is not anticipated.

### *Mitigation*

The following mitigation measures are suggested for minimising the impacts on the traffic and transportation. These measures will be implemented by MIDC and the SPV responsible for the development of Mega Industrial Park.

- SPV for logistics will assess the need for strengthening of access roads, village roads, bridges, culverts etc prior to setting up of campsite;
- Where road widths are insufficient, either temporary widening of the road with gravel or full depth widening of the pavement structure will be undertaken;
- MIDC shall ensure that the access roads to the construction sites are developed well in advance to facilitate smooth movement of traffic;
- Wherever possible, rerouting of construction traffic to wider, less-restrictive road shall be preferred;
- An up to date database of all vehicles and construction equipments deployed across various project component locations will be maintained. The database will contain details about the periodical maintenance, schedule of maintenance, vehicular emission and noise emission testing done as per Indian regulatory requirements, PUC certificates etc;
- A detailed plan for signage around the construction areas to facilitate traffic movement, parking facilities, provide directions to various components of the works, provide safety advice and warnings will be prepared. All signs to be posted in both English and Marathi;
- The parking of construction vehicles along footpaths, single lane roads shall be prohibited on community roads and public highways in the vicinity of the project site. Provision for dedicated parking area will be made near the project office, intake site and other suitable location for the private vehicles of construction personnel.
- Liaison with the police and other authorities prior to the movement of any abnormal loads or any over dimensioned consignment;
- Create traffic awareness among the local people and inform parents to keep children from exposing themselves to the traffic in the construction area. Vehicle traffic will be minimized during the periods when children are travelling to and from schools falling on traffic routes;
- Construction site will be provided with exclusive entry and exit of the construction vehicles;
- The contractor shall provide training to the drivers regarding the traffic rules and management provisions. Training records shall be maintained by the contractor;

### *Significance of Impact*

The overall impact on the traffic and transportation is assessed to be moderate to high. It is assessed that with implementation of suggested mitigation measures the overall impact can be maintained as minor.

**Table 6-11 Impact significance –Traffic and Transportation**

Aspect	Scenario	Spread	Duration	Intensity	Overall
Traffic and Transportation	Without Mitigation	Medium	Medium	Moderate	Moderate
	With Mitigation	Local	Medium	Low	Minor

## Impact on Socio-Economic Environment

### Status of Land Acquisition

The land required for Shendra MIP comprises of land parcels already in possession of MIDC and private land acquired under the Land Acquisition Act, 1894 falling in three villages – Karmad, Ladgaon and Kumbephal. The abadi areas / village settlements of two villages Karmad and Ladgaon fall within the delineated site boundary, will not be acquired for project development. The village settlements/ abadi areas of village Kumbephal do not fall within the delineated Shendra MIP site.

The extent of land loss after provision of adequate buffer around each village will only be established after the process of acquisition is firmed up.

The key impact of the acquisition on this scale is identified as loss of landholdings directly affecting the livelihood of the villages which will be delineated within the project area. The project will result in the following types of Affected Families:

- Families who lose some fractions of their landholding;
- Families who lose significant fraction of their land holding;
- Families who lose their entire landholding; and
- People who lose access to their land or community resources (wells, pond, roads etc.)

The households losing smaller fraction will not have significant loss of income and will be relatively easier to be compensated.

The families which lose significant portion of their land will find it difficult to continue with farming as a source of livelihood as the compensation money may not be sufficient to buy land in immediate vicinity of the village, as the rate will be significantly high for private procurement. They may also change to other livelihood options also.

The families, who have lost that entire land to the project, will have the option to relocate or buy land elsewhere and continue with agriculture, if so intended. However, they will have to opt for smaller parcels of land as the land prices will be significantly higher.

Installation of various infrastructure facilities such as pipelines, transmission lines, telecom cable etc, will require right of way (ROW) along their routes this will render the land restricted for use as per the regulatory requirements. Such land adjacent area will also be regularly accessed for maintenance work in future also, and therefore are likely to experience a loss in land value.

### **Loss of Assets**

Although all the villages and settlement will be retained as it, there will be, however, isolated houses, storage structures, cattlesheds and assets like tube wells, pipelines, open wells, pumps, etc falling in areas outside the village boundary (and delineated area of adequate buffer) which will be required to be physically removed for the project. Also, valuable trees and standing crop will also be lost from acquisition of the land.

### **Loss of Livelihood**

The proposed to be acquired for the project is agricultural land with a large portion being rainfed and the remaining is unirrigated. The area is under cultivation for cereals (rice, ragi, vari and kodra), pulses (val, mug, and urad) and fruit and vegetables. Agriculture is an important source of income for the local community and the affected population. Depending on the land loss the livelihood impact can be minor to severe.

The loss of land will indirectly affect agricultural laborers, who are hired by local community to work in their fields. They will be severely affected and will either have to migrate or look for other income generating opportunity.

### **Loss of Common Property Resources**

The common resources such as Panchayat land, provide for agriculture by Scheduled Tribe community (Dali land) will be either lost entirely or reduced to a smaller areas. This would affect the livelihood of the ST community. The will either have to migrate or switch to different occupation. The acquisition of land will also result in loss of grazing areas, areas for common functions and rituals etc.

The market rate of the land in the area will increase. The compensation offered through Land Acquisition Act may not be in tune with the rise in property rates anticipated due to advent of such large scale development in the vicinity. This can result in resent and unwillingness among the landholders in future.

## ***Mitigation***

### **Land losers**

- Land has been procured and in due course, will be procured through the procedures established under the Land Acquisition Act, and the affected families will have the opportunity express their concerns. Compensation for assets will also be decided by the district administration through a valuation process.
- The value of the land will be decided by the district administration after due assessment and consultation with the community about their concerns and expectations. It will be the highest

value which similar land in the locality has fetched in a bona fide transaction between a willing purchaser and a willing seller near about the time of the acquisition;

- Compensation in cash for the loss of land at replacement cost will be paid to the legal titleholders and land owners whose land will be acquired for the Project;
- Land loser who will become landless or significantly affected due will be considered as a for benefits like employment, contracts etc;
- Land which will be rendered unviable for use ( due to size, access to water source, access etc) will be also be acquired as per the valuation process;
- In the event of disputes regarding land records (not updated/ mutated) or where the desired documents are not available, the compensation amount will be deposited with the competent authority till the settlement of a dispute;
- Compensation for crop damage will be paid to the entitled persons by the competent authority as per the guidelines of the relevant Acts and Legislations;
- Skilled and qualified entitled persons who meet the needs of the project will be given preference in employment and other contractual benefits;
- The project will try and avoid community land to the extent possible and retain adequate buffer around the villages for development purposes;
- A significant section of agricultural labor find employment with the construction contractors;

### Significance of Impact

The overall impact on socio-economics is assessed to be moderate to high, however with the implementation of proper public hearing, communication and compensation the impact can be contained with minor.

**Table 6-12 Impact significance – Socio- Economic Environment**

Aspect	Scenario	Spread	Duration	Intensity	Overall
Socio-economics	Without Mitigation	Moderate	Medium	High	Moderate
	With Mitigation	Local	Medium	Low	Minor

The social impact assessment has been discussed in detail in *Section-7*.

### Impact on Employment and Local Economy

The construction of proposed Shendra MIP will likely to have positive impact on livelihood and local economy of the area.

#### Employment

The project will create the following avenues for direct and indirect employment opportunities during the construction phase:

- Approximately 1000-1200 workers will be housed in each of the two planned camp sites. A significant number of these workers will be hired locally which will stimulate local labour contracting activities as well as generate employment opportunities for unskilled labour available in the area;
- Local small scale service providers such as electricians, welders, fitters, transporters, caterers etc will find avenues with various contractors and stakeholder;
- Contracting opportunities will be available for locals possessing tractors, dumper trucks or other vehicles which would be needed to carry away excavated soil and other material;
- There will be generation of significant indirect employment through the local community establishing small shops like tea stalls, eateries, repair outlets, hardware stores, supply of intermediate raw materials etc.

### **Local Economy**

- Rented accommodation for migrant workers and staff will also provide opportunities for local community for income generation;
- Wherever possible local companies will be contacted to supply the construction materials, therefore stimulating the job market and local economic activities;
- Some of the small shops as mentioned above may become sustainable enterprises in the long run depending on the need at various stages of construction and even during operation phase. This increase in income would influence the local economy of the project area.
- There will be an increase in disposable incomes due to increased wages and employment opportunities;
- There will be an influx of more liquidity into the system due to new sources of income like rent, increased expenditure on essential commodities and inflation due to supply side shortages;
- The local businesses will have the opportunity to provide construction materials and equipments on hire and will benefit economically; and
- There will be increased demand for goods and services of all kinds.

### ***Mitigation***

- DMICDC and its subcontractors will try and utilize the facilities available from the local market and shops to support the local economy to the extent possible. However, there will be no binding on the contractors to utilize the local facilities;
- Employment of labourers on the project will depend on the skill sets of individual with respect to the requirements of the contractors or the project proponent. However efforts will be made to employ people from the local community wherever possible. At least one individual from

each of the project affected family shall be offered with employment during the construction work;

- Employment opportunities shall consider vulnerable section of the society such as economically weaker class, families with small land holdings.

### Significance of Impact

The overall impact on employment and local economy is assessed to be positive, and can be enhanced by the support from the Project proponent.

**Table 6-13 Impact Significance - Employment and Local Economy**

Aspect	Scenario	Spread	Duration	Intensity	Overall
Employment and local economy	Without Mitigation	Local	Medium	Low	Moderate
	With Mitigation	Medium	Medium	Low	Minor

### Occupational Health and Safety

The key health and safety concerns associated with construction activities include the physical injury due to inadequate handling of materials, exposure to hazardous substances, occupational hazards like electric shocks, high noise and diseases from unhygienic surrounding.

Potential impacts on health and safety include the following:

- Trip and Fall hazards due to improper storage and placing of construction equipments and machinery;
- Working without the use of adequate Personal Protection Equipment (PPE) may result in accident/ hazards.
- Accidents and injury due to vehicle collision/ slip along terrain, road accidents etc;
- Use of welding and electrical operation may have potential fire and electrical hazards;
- Improper, storage, handling and use of fuel for operation of emergency power back up system can lead to fire hazards;
- At times blasting would be required at rocky terrain, inadequate storage of explosives, use of explosives etc. can lead to accidents.

### Mitigation

- All machines to be used will conform to the relevant Indian Standards (IS) codes, will be kept in good working order, will be regularly inspected and properly maintained as per IS provisions and to the satisfaction of the site Engineer.

- No employee will be exposed to a noise level greater than 90 dB(A) for a duration of more than 8 hours per day as per the Factories Act, 1948, as amended. Provision of ear plugs, ear muffs etc and undertake rotation of workers operating near high noise generating areas.
- The construction staff and contractors involved in the construction activities to be trained about the mandatory precaution and safety practices prior to commencement of construction activity;
- Construction contractors are required to ensure necessary safety measures to be taken up before and during the construction activities for all electrical driven machinery;
- Usage of high speed diesel needs to be provided with proper storage in covered area, away from welding or other construction activities;
- The public will be prevented from accessing the area under construction by providing fencing and therefore will not be at risk;
- Training programs will be organized for the operational workforce regarding proper usage of PPEs, handling and storage of fuels and chemicals etc. Hard hat areas will be marked and informed to all workers;
- All workers will be required to practice mandatory use of PPEs at all times while working on site;
- Work permit system shall be implemented for working at height (typically when working over 2m above). Prior to undertaking work, integrity of structures shall be inspected. Only workers trained in climbing techniques and use of fall protection measures; inspection, maintenance, and replacement of fall protection equipment shall be engaged for work at height;
- Appropriate fall-protection system will be provided as per the requirement. Safety belts will be mandatory and shall be monitored for wear and tear on regular basis. While operating power tools at height, workers will be provided with a second (backup) safety strap;
- Vehicle movements to follow the traffic norms and maintain a safe speed while moving through the hilly tracts;
- All excavation activities to be conducted in supervision of the site contractor;
- Proper signage to be provided in places of excavated areas;
- Storage of explosives and blasting activities with undertaken as per the requirements of PESO and established good practices.

**Significance of Impact**

The overall impact from Occupational Health and Safety is assessed to be moderate, and can be reduced significantly with implementation of mentioned practices and procedures.

**Table 6-14 Impact Significance - Occupational Health and Safety**

Aspect	Scenario	Spread	Duration	Intensity	Overall
Occupational Health and Safety	Without Mitigation	Local	Medium	High	Moderate
	With Mitigation	Local	Medium	Low	Minor

### 6.3 Impacts during Operation Phase

The environmental and social impacts associated with operation phase of the construction project will depend on the activities and land use of the completed project. Therefore before assessing the impacts and identifying the mitigation measures for operation phase, a summary of activities within Shendra MIP has been presented below.

#### Summary of Activities

Shendra MIP will be spread over 845.26 ha and will include mixed land use development comprising of residential, industrial and commercial land uses. Out of total area, 305 ha will comprise of industrial development and the industrial mix will include the following clusters.

- *Engineering Cluster* – Anchored by metal products, machinery/equipment manufacturing, and automobile and parts
- *Food Park* – Food Processing
- *Textile and Printing* – Natural and synthetic textile material/apparel, chemical (dyes), printing

The residential development will comprise of a total area of 53 ha and will have a population of 16480. by the end of the year 2022. Details of activities have been provided in Section3.

*Each individual project to be developed within the Shendra MIP will obtain environmental clearance and consents from regulatory authorities as per the relevant Acts and Notifications. Each individual project shall comply with the clearance/consent conditions. The mitigation measures provided shall be implemented by each individual project based on its applicability to the activities and processes.*

Based on the activities involved, an impact interaction matrix for operation phase was prepared for the project. The impact identification matrix is presented in Table 6-15:

**Table 6-15 Activity - Impact Identification Matrix for Operation Phase of Shendra MIP**

S.N	Aspect /Activities	Potential Impacts									
		Ecology	Water Resources	Ambient Air Quality	Soil Resources	Ambient Noise Quality	Water Quality	Traffic &Transport	Socio Economic	Cultural Impact	Onsite Risks
<b>A</b>	<b>Residential Townships</b>										
1	Influx of population	√							√	√	
2	Water Consumption		√				√				
3	Wastewater generation				√		√				
4	Power back up			√		√					
5	Waste generation				√		√				
6	Transportation			√				√			
<b>B</b>	<b>Industrial Operations</b>										
1	Engineering Cluster		√	√		√	√	√			√
2	Food Processing		√	√		√	√	√			√
3	Pharma R&D/Biotech			√	√	√	√	√			√
4	Services Sector		√					√	√		
<b>C</b>	<b>Utilities</b>										
1	Operation				√	√	√	√	√		√
2	Maintenance				√		√				
3	Structural Failure										√
4	Aesthetics								√		
<b>D</b>	<b>Waste Management Facilities</b>										
1	Power Backup systems			√							√
2	Handling and Disposal of wastes	√					√	√			
<b>E</b>	<b>Effluent Treatment Plants</b>										
1	Operation		√	√	√		√		√		
2	Disposal of treated effluent		√				√				
<b>F</b>	<b>Employment and Secondary Development</b>										

1	Plant Operations								√		
2	Maintenance								√		
3	Security personnel								√		
4	Transportation								√		
5	Shops and ancillary units								√		
6	Unplanned Habitations								√	√	

The likely activities that could lead to environmental impacts are broadly covered under the following aspects:

- Air Quality;
- Water Resources (surface water and ground water) and Quality
- Ecology
- Ambient Noise
- Traffic Volume
- Soil & Land Quality
- Land use pattern
- Socio economic Environment
- Cultural Impact

### **Impact on Air quality**

During operation phase of the project, industrial and residential activities will have impact on air quality of the area. The air emissions estimated to be generated from operation phase and major impacts from project activities have been discussed in below sub sections.

#### ***Impact: Industrial Activities***

The industry mix proposed for the project comprises of engineering cluster, foodpark, textile and printing. The likely emission sources from industrial operations are presented below:

- Stack emission from industries;
- Fugitive emissions from storage, handling and transfer of raw material and loose material and other industrial processes;
- Emission of VOCs and other organic vapours from processes involving use of organic solvents and chemicals;
- Emissions from increase in traffic volume;
- Emissions from DG sets used for power back up supply.

The exact capacity and location of each industrial unit proposed under various industrial clusters has not been detailed at this stage of planning, however the possible pollutant types associated with the various industries are discussed below:

#### **Engineering Cluster**

The engineering and technology industrial sectors will comprise of metal fabrication processes, machinery and equipment manufacturing and automobile parts etc. These industries will involve activities like forming (including thermal treatments), welding, pre-surface treatments and finishing (including surface treatments, metal cleaning, electroplating and coating).

Air emissions from forming processes will include solvents and cooling/lubricant solutions, or vapours generated from quenching (e.g. from oils and greases present on the surface of metals during plunge cooling) and quenching bath emissions such as vapours/mists comprising water mixed

with chemical additives or synthetic oils. Emissions from welding processes will be related directly to the material and the welding method employed. Air emissions from surface cleaning relate to the evaporation of chemicals from degreasing, cleaning, and rinsing. Particulate emissions may be generated by sand blasting and dry surface grinding and these can include metallic particulates and oxides. Electrochemical surface treatments will produce air emissions, mists, and gas bubbles arising from heated fluids which may contain metals and other substances present in the bath. During painting, atmospheric emissions will consist primarily of the organic solvents used as carriers for the paint. Emissions can also result from paint storage, mixing, application and drying.

### **Food Parks**

Air emissions from Food parks/ food processing industries are generally not a major concern. Most of the processes such as solids handling, solid reduction and drying, microbial action and thermal processing will emit low process air emissions like particulate matter and odour.

### **Textile and Printing**

Textile and Printing operations that may generate significant sources of air pollutants include finishing processes like coating and dyeing operations. Other significant sources of air emissions in textile operations include drying, printing, fabric preparation, and wastewater treatment residues. Hydrocarbons are emitted from drying ovens and from mineral oils in high-temperature drying/curing. These processes can emit formaldehyde, acids, softeners, and other volatile compounds. Common air emissions from textile and clothing processes include VOCs, NO<sub>x</sub>, SO<sub>2</sub>, CO, PM<sub>10</sub>.

Dust emissions also associated with textile manufacturing occur during natural fiber and synthetic staple processing and yarn manufacturing. Fiber (especially cotton) handling and storage are other sources of dust, particularly within work areas.

### ***Estimated Air Emissions***

The maximum air pollution load estimated based on possible type of industries proposed and prevailing processes will be as follows:

- Particulate Matter (PM) – 0.5- 1.0 TPD
- Sulphur Dioxide (SO<sub>2</sub>) - 1.0-2.0 TPD; and
- Oxides of Nitrogen (NO<sub>x</sub>) – 1.0-1.5 TPD.

Only such industries will be allotted the plots which will have a self-monitoring on line systems to keep a check on the emissions. All industries will be required to meet the applicable standards for air emissions as per their operation. Thick green buffers will be provided along all key roads and around industrial area.

### *Mitigation: Industrial Activities*

Air quality mitigation measures as discussed below have already been incorporated in the proposed Development Plan of Shendra MIP:

- Green buffer will be provided between residential areas and industries to minimise the environmental impacts such as air and noise pollution.
- Adequate buffer will be delineated around each village, where no industrial development will be undertaken. It is anticipated that the impact of air emissions will be minimal after provision of buffer area.
- Vegetative barrier of 20-40m is proposed around industrial area to minimise impact of fugitive dust and particulates on residential area.

The prevailing wind direction as per long term trends has been observed to be **west**. The MIP has been located in such a way that the major cities/towns such as Aurangabad, Bidkin are located in the crosswind or upwind directions and will therefore not be subject to any major impacts from the proposed industrial development.

The potential mitigation measures for the industrial activities proposed based on the existing best industry practices are provided in the following subsections. The measures provided shall be adequately implemented and upgraded with improvement of technology as available during the operations, which may happen in the later phases.

- Air emission control technologies such as electrostatic precipitators, fabric filters or baghouses and wet scrubbers as mentioned in conditions of Environmental clearance/ Consent to Establish/ Operate will be installed by individual industrial units to reduce the concentration of particulates in process off-gases before stack emission;
- All the emissions sources, i.e. process (heat exchanger and fryer), boilers and diesel generators will have adequate stack height in conformance to the set norms of CPCB/MoEFCC;
- The project will ensure that use of either low sulphur fuel (i.e. HSD) or renewable energy sources like RDF in all the combustion systems (Boilers, Heat Exchanger, Fryer);
- All manufacturing operations to be run as a closed system, allowing little or no emissions to escape to the atmosphere;
- Chemical recover system to be installed at all plants to prevent any loss of chemical to atmosphere;
- All the fugitive emissions from various sources will be collected through ducts or hoods and treated along with channelized emissions.
- Continuous monitoring equipment in the stack and suitable height of the stacks for appropriate dispersion will be ensured by MIDC.
- Nitrogen oxide (NO<sub>x</sub>) emissions will be reduced by using low-NO<sub>x</sub> burners and optimization of fuel usage.
- DG sets to be located in the downwind direction with respect to residential areas.
- Preventive maintenance and equipment and materials management so as to minimize opportunities for evaporative losses, and other releases of potentially toxic chemicals will be adhered to.
- MIDC and MPCB will organize seminars for industries about best practices in controlling air emissions from various sectors.

### ***Impact: Residential Townships***

Air pollution associated with residential areas is limited to use of Diesel Generators for power backup facilities. The residential townships being proposed will be provided power from the following sub stations identified in the vicinity of the project site, as per the plans of the State Transmission Utility (STU), Central Electricity Authority (CEA), and Central Transmission Authority (CTU). The following substations have been identified to provide the required power to the proposed MIP at Shendra:

- Shendra - 200kV
- Chitegaon - 200kV

However, the power backup requirement for residence will be limited to less than 2 hours a day and this will not be regular occurrence.

### ***Mitigation: Residential Township***

- The location of DG sets will be identified such that it remain downwind of the residential area for most part of the year.
- The stack height for DG sets will be provided as per the requirements of consent to establish and CPCB norms
- The SPV developed for overview of power supply shall ensure that the power failure is maintained at minimal.

### ***Impact: Vehicular Emissions***

Apart from specific air emissions from industrial and residential activities, impact on air is also anticipated from vehicular emissions. The proposed Shendra MIP will involve vehicular emissions due to travelling and transportation of goods.

### ***Mitigation: Vehicular Emissions***

- All the public transport infrastructure for MIP including the city bus/ transport fleet plying in the city shall be CNG/LPG based;
- The SPV for Shendra MIP shall establish a Transport Authority for the region;
- The Transport Authority will make necessary linkages with Maharashtra State Pollution Control Board, Motor Vehicles Department and the Traffic Police to ensure infrastructure for pollution checking is maintained and emission norms are implemented;
- Necessary modifications as per the provisions of the Air (prevention and Control) of Pollution Act 1973 may be initiated to make all the vehicles in the MIP EURO III/EURO IV compliant at later stages of the project implementation.

### ***Significance of Impact***

The overall impact on the air quality is assessed to be high with the commissioning of the Industrial operations; however with the implementation of suggested buffer areas, delineation and emission control measures the overall impact on air quality can be maintained as minor.

**Table 6-16 Impact significance - Air Quality**

Aspect	Scenario	Spread	Duration	Intensity	Overall
Air Quality	Without Mitigation	Local	Long	High	Major
	With Mitigation	Local	Medium	Low	Minor

## Impact on Water Resources and Quality

### Impacts on Water Resource

The estimated total water demand for the industrial areas and other areas such as residential, commercial, civic/ utilities, roads, open spaces etc during operation phase of Shendra MIP is approx. 34 MLD (million liters per day) which can be met from the existing allocation.

The main source of water identified for Shendra MIP will be Jayakwadi Dam Reservoir on Godavari River. The dam is located at Paithan, about 40 km from the site. The Maharashtra Industrial Development Corporation (MIDC) has been allocated 150.68 MLD of water from the Jayakwadi Dam Reservoir for its development in the region. At present, 60.27 MLD of water is used by the MIDC to meet the water requirements of industries and residential areas. Thus, approximately 90 MLD is the unutilized quantum available to meet the water demand for the future development. This available water will be used during operation phase of Shendra MIP.

MIDC has installed a 72-MLD-capacity water treatment plant (WTP) at Waluj to meet the water demand for its industrial areas at Waluj, Chikalthana, Shendra, and Jalna. The raw water drawn from Jayakwadi Dam Reservoir is pumped up to Waluj, where it is treated in the WTP and later distributed to the industrial areas.

### Waste Water Treatment

About 8 MLD of industrial wastewater will be generated from the proposed industries. Domestic sewage of 13 MLD will also be generated from other areas. The wastewater from industries and sewage from residential areas will be treated separately in a common effluent treatment plant (CETP) and sewage treatment plant (STP), respectively. The wastewater generated from the MIP will be collected through a well developed sewage network.

Every industry will be advised to install an STP for primary level treatment of the effluent generated. From there, a pre-defined quality and quantity of effluent will be transported to the CETP for further rigorous treatment. An SPV constituted to handle the project shall ensure that the STPs and CETPs are installed and commissioned well in advance of the activities generating effluent. The treated wastewater from the treatment plants will be recycled to meet the demand for non-potable water.

The proposed developments will result in increase in paved areas, thereby resulting in increased runoff. During planning stage, it has been suggested that the increased runoff shall be tapped for groundwater recharge.

### *Mitigation measures: Water Resources*

- All allocations for future phases will be made in advance and incorporated in the plans of the relevant agencies/SPV to ensure minimal impact on competitive users;
- In order to reduce stress on available water resources, recycling of waste water after treatment will be employed for residential as well as industrial facilities;
- After considering the use of treated wastewater by treating the wastewater generated within the project area to meet the non-potable water demand for the proposed development the amount of freshwater required after the wastewater is recycled is 35% of the total water demand;
- Within individual plants, designers should specify high-efficiency building and process equipment to reduce consumption. Process water from one plant may be reused by another, passing through a pretreatment plant as needed;
- The building and plumbing code shall provide for restrictions on the use of fresh water for non potable water requirements such as flushing, horticulture, industrial process water requirements etc.
- Online monitoring system will be implemented for checking leakages in water transportation system;
- The total water demand for open spaces, roads, and fire fighting will be met by treated wastewater (recycled water);
- Effort will be made to have provisions for dual plumbing system in maximum possible residential units and industrial units to utilize treated waste water
- Water metering for individual projects will be undertaken;
- Existing man-made irrigational channels will be retained and resource allocated for agriculture shall not be diverted for any other activity;
- The entire area is considered as safe and the ground water levels are considered to be good for exploration;
- Rainwater harvesting or rainwater collection measures will be put in place to ensure a positive recharge of the ground water resources in maximum possible residential and industrial facilities.
- Use of ground water will be kept to minimum and surface water resources will be preferred.

### *Impact on Water Quality*

- The potential impact on water quality will be mainly due to unplanned disposal of industrial waste water generated from the industrial areas and sewage generated from residential area;
- Inadequate management of storm water from industrial area can lead to contamination of natural water resources during the rainy season;
- Incidents of spills from industries, storage areas can lead to contamination of ground water aquifers.
- Possible leaks from various storage areas, solid waste and STP sludge spills etc.

### *Mitigation: water Quality*

- A comprehensive water management plan will be put into place for Shendra MIP that will enable collection, treatment, and reuse of wastewater from residential, commercial, and industrial sectors;
- Domestic and industrial wastewater generated will be treated separately. The wastewater from industries and sewage from residential areas will be treated in a common effluent treatment plant and sewage treatment plant, respectively.
- The final treated effluent from the plant will have suspended solids of less than 5 mg/l and biochemical oxygen demand (BOD) of less than 2 mg/l for reuse in non-potable purposes.
- As various industries will have a variety of types of industrial effluent, only industrial wastewater of a predefined quality will be permitted to enter the equalization tank of the effluent treatment plant. For any kind of specific treatment, industries will need to treat industrial wastewater in their own captive wastewater treatment facilities and discharge the wastewater of predefined quality into the collection system. The common effluent treatment plant will permit treatment of industrial wastewater that meets the following parameters:
  - suspended solids,  $\leq 1,000$  mg/l;
  - chemical oxygen demand (COD),  $\leq 1,200$  mg/l;
  - BOD,  $\leq 700$  mg/l;
  - oil and grease,  $\leq 100$  mg/l;
  - pH,  $\sim 7.8$  to 8;
  - total nitrogen (T-N),  $\leq 130$  as N mg/l; and
  - total phosphorus (T-P),  $\leq 75$  mg/l.
- The storm water drainage will be designed to accommodate a one-in-100-year flood event. Various water sensitive urban design (WSUD) features will be embedded throughout the industrial areas of the MIP to capture and clean this water before it is discharged to the major drainage channels.
- In addition, riparian buffer zones would be maintained alongside major drainage channels, providing further opportunities for bio-filtration of storm water prior to discharge into receiving bodies of water.
- Secondary containment to be provided for all storage area and waste water treatment facilities to prevent any accidental discharge into water bodies.
- Monitoring of ground water resources will be undertaken by MIDC / Shendra MIP SPV at periodic intervals to identify any contaminations from leak or spills.

### *Significance of Impact*

The overall impact on the water resources is assessed to be moderate considering the existing allocation and future proposals. The delineation of existing resources and provision of riparian buffer will also act towards minimizing any potential impact. Impact on water quality is assessed as moderate as the waste water generated from industrial area and residential sewage will be treated at planned CETPs and STPs respectively, prior to disposal. Stringent implementation of the proposed measures and evaluation of competitive user for future expansions will ensure that the impacts are minor.

**Table 6-17 Impact significance - Water resource and Quality**

Aspect	Scenario	Spread	Duration	Intensity	Overall
Water Resource and Quality	Without Mitigation	Local	Long	Moderate	Moderate
	With Mitigation	Local	Medium	Low	Minor

### Impact on Ecology

The ecologically sensitive features present in close proximity to the proposed project site of Shendra MIP include the following:

- Vast area designated as Reserve Forests in the North and East of delineated boundary and few patches of hilly areas on the north and northeast direction of the project boundary. These forests and hilly areas are an important part of the area’s natural landscape, creating unique microhabitats and providing relief in an otherwise flat terrain;
- Large reservoirs in particular, Sukhna reservoir which provides wintering-areas or staging-sites to large numbers of migratory birds;
- Jayakwadi Reservoir and Bird Sanctuary, is located 40 kms away from the southern delineated boundary, is an important stopover in the migratory flyway of cranes and other birds;

The potential ecological impacts of the proposed project have been discussed below:

- Operation of industrial process and associated activities will generate air emissions and noise which will adversely affect the fauna and flora of the adjoining green areas including reserve forest and other degraded hillocks;
- The secondary development around the industrial area may lead to influx of migrant population which may encroach upon forest land or exploit the forest resources for fire wood and other uses. The possibility of hunting of listed species and damage to critical habitat cannot be ruled out.
- Release of industrial waste water without treatment will affect the surface water features such as Sukhna and Jayakwadi reservoir;
- Degradation of the scrublands in the area due to development activities in the area is likely to result in edging out of these unique avifaunal species by more generalist ones, as has already occurred in the cultivated tracts of the area.
- The area attract birds during winters, movement of these birds will be hindered and may lead to fatalities from advent of tall chimneys and transmission lines.
- Loss of existing patches of greenery or introduction of roads through forest areas will lead to habitat fragmentation and habitat loss for smaller mammals and birds.

### Mitigation

- An area of 845.26 hectares has been identified as the project area based on environmental sensitivity to avoid any existing settlements and the forest areas;
- Degraded hillsides towards the centre and north of the development area recommended to be reforested as part of the Development plan. These areas, may be labeled as ‘Ecological Restoration Zone’;

- The Sukhna reservoir and its catchment areas will be preserved and excluded from any heavy developmental activities;
- Natural open spaces near rivers and lakes; agricultural areas; and sites with habitat value will be preserved whenever possible and will be incorporated into the greenway system.
- Green buffers of 20-40 meters have been recommended to protect the existence the existing villages while retaining access to them. Wherever this is not possible, a compatible adjacent land use, preferably workers housing or clean industries have been proposed;
- As a planning strategy a buffer of 20-40meters has been recommended around the existing water bodies and streams as riparian buffer zones. While acting as a green connector between varied land use, they protect and enhance the existing natural resources;
- A total area of 50 hectares (6%) has been designated as green and open space in the proposed Development Plan of Shendra MIP. This space has been planned as a ‘productive landscape’ which will act as flood buffer during heavy rainfall events;
- Natural water-flows in and around the project-area should not be altered or obstructed;
- All forestland falling in the delineated area will the preserved and retained as it is within the proposed Development Plan;
- No roads are planned through forest land, natural open spaces with habitat value will be preserved whenever possible and will be incorporated into the greenway system that includes pedestrian and bicycle trails and linear parks as recreation amenities;
- Transmission lines and chimneys will be provided with optical markers to enhance visibility for birds;
- Development around the project area will be regulated and no unauthorised development will be allowed. All migrant workers and local contractors will be provided with fuel arrangements at construction campsite to avoid any discrete collection of fuel wood;
- Only native and local species will be chosen for green belt;
- Building by laws shall provide for achieving shading through plantations of all hard scaped parking and pedestrian surfaces;
- The effluent from individual industries will be treated as per the standards prescribed by MPCB/ CPCB before discharging on land or water bodies.
- Individual industrial units will develop a green belt of 33% of total land area as per CPCB guidelines.

### Significance of Impact

The overall impact on the ecology is assessed to be moderate to high with the commissioning of the Industrial operations, residential communities; however with the implementation of suggested buffer areas, delineation and emission/discharge control measures the overall impact can be maintained as minor.

**Table 6-18 Impact significance - Ecology**

Aspect	Scenario	Spread	Duration	Intensity	Overall
Ecology	Without Mitigation	Regional	Long	High	Moderate
	With Mitigation	Local	Medium	Low	Minor

## Impact on Ambient Noise Quality

The baseline data obtained from monitoring in the study area suggest that the noise quality in the study area is within the CPCB norms for day time and night time. However, the industrial and residential and other commercial activities proposed in the area will generate additional noise due to their operation. The anticipated impacts on ambient noise levels area is as provided below:

- The degree of noise generated by industrial uses is dependent upon various factors, including type of industrial activity, hours of operation, and the location relative to other land uses. Operation of machinery, associated operations, air compressors, outdoor truck activity, transportation, loading –unloading, generators etc are the potential noise sources associated with industrial use. These activities will result in increase of noise at all the adjoining villages and residential uses. The impact is anticipated to be higher during the night time.
- Commercial activities such as bars, restaurants, entertainment centres, events and other facilities can affect the noise levels in the area. These operations which are active after 7 pm may contribute to an urban noise environment that can affect residential or other sensitive land uses;
- High noise generation in areas close to forest patches will hamper the avifaunal activities.
- Increase in traffic volume along the road would yield a proportionate increase in noise in areas adjacent to intersections, state highways, and major roads in the MIP and thus could create a significant impact on sensitive noise land uses.
- Development of mixed-use land uses or multi-family residential land uses on transit corridors and rail and bus rapid transit stations could also expose more people to the higher levels of noise generated by higher traffic volume transit corridors.

### *Mitigation Measures*

- All habitations will have adequate buffer including green area delineated around them where no industrial development within that, the noise levels will be significantly attenuated with presence of such buffer spaces;
- Vegetative barriers in form of green belt and green buffer will be developed around all industrial areas which may vary from 50-100m in width.
- All industrial operations will ensure acoustic enclosure and provide noise attenuation measures for their operations.
- Vegetative barriers and barrier walls will be provided along the roads and highways to reduce the noise at receptive residential areas.
- Nodal agency for Shendra MIP will undertake regular noise monitoring within the industrial zone to ensure that ambient noise levels are within the prescribed CPCB standards for respective land use.
- Individual industries will also undertake noise monitoring within their respective premises as per CPCB/ MPCB guidelines.
- All roads in the Shendra MIP will include designated lanes to encourage cycling and improve the safety of cyclists. The promotion and increased use of bicycles as an alternative mode of transportation in the MIP will help in reduced vehicular movement and associated noise generation.

### Significance of Impact

The overall impact on the noise levels in the area will be moderate with the commissioning of the Industrial operations and increase in traffic ; however with the implementation of suggested buffer areas, green barriers and attenuation measures the overall impact can be maintained as minor.

**Table 6-19 Impact Significance - Ambient Noise Quality**

Aspect	Scenario	Spread	Duration	Intensity	Overall
Noise Quality	Without Mitigation	Local	Long	Moderate	Moderate
	With Mitigation	Local	Medium	Low	Minor

### Impact on Traffic and Transportation

The proposed Shendra MIP is well connected connected by two state highways—SH-158 (Paithan Road) and SH-178 (Aurangabad–Jalna Road)—and a national highway, NH-211. These links can be conveniently used for providing regional connectivity to the proposed MIP. The traffic survey conducted for EIA study suggests that the current load on existing roads is quite low. However, the operation of various activities under Shendra MIP will result in increase in vehicular movement on roads. This is likely to have following impacts on the traffic and transportation in the area.

- Increase in traffic volume due to proposed developments and likelihood of congestion on proposed and existing road network;
- Radom parking of vehicles and unplanned loading / unloading areas can lead to chaos
- The current traffic load in the area is low and the road facilities are according to the load, the existing infrastructure will not be sufficient for the proposed project.
- The development of Industrial Township will increase the traffic volume in the existing industrial area and townships in the region along with that of delineated area.
- Influx of labour and workforce will increase the traffic load during peak hours and change of shifts.

The state government has already initiated various programs for expanding many important roads including NH-211 and SH-158 to six/ four lanes to provide basic infrastructure for the growth and development of industrial and residential areas.

### Mitigation

The following measures have been incorporated at the planning stage:

- The proposed roads have been derived from the requirement of the overall development area to carry the anticipated traffic load as per the Indian Roads Congress (IRC) standards. The sizes have been derived according to the traffic in the respective zones.
- The roads will be designed to carry the maximum traffic loads with anticipated future development;
- Four categories of roads (Major roads (arterial roads) with right or way (ROW) of 90 meters; Primary roads (sub-arterial roads) with ROW of 60 meters; Secondary roads (collector roads)

with ROW of 45 meters; Tertiary roads (local roads) with ROW of 30 meters) have been proposed for Shendra MIP to provide safe, convenient, and efficient motorized and non-motorized transportation systems.

- A bypass road has been proposed along the south side of the Shendra MIP to segregate the external traffic from internal traffic movements. This will prevent congestion on internal roads and increase the level of service of the proposed roads within the MIP.
- The road proposed are based on traffic forecast obtained, the traffic infrastructure is integrated with rail network.
- The proposed road circulation shall provide for safe, convenient, and efficient movement of people and goods integrated into a motorized and non-motorized transport system following a hierarchy of road networks.
- The project will encourage use of public transport; all residential areas will be within 500 meters of planned public transportation.
- All roads in the Shendra MIP will include designated lanes to encourage cycling and improve the safety of cyclists;
- Maintenance of systematic spatial and technical database for the roads which would enable regular monitoring and feedback on road conditions thereby managing effective periodic maintenance
- Pedestrian Guard Rails, Road safety Signage and overhead signs shall be placed on a structurally sound gantry or cantilever structure made of circular pipes or steel sections;
- Comprehensive traffic and travel surveys shall be conducted every 5 years to monitor traffic characteristics and travel behavior to develop strategies for effective transportation;
- Each individual project shall develop parking facilities as per the Development Control Regulations;
- Intelligent transport system shall be adopted for traffic management , fleet operation, user information and all other relevant parameters;

### **Congestion Management and Intelligent Transportation System**

It is suggested to adopt an Intelligent Transportation System (ITS) program for Shendra MIP. The Intelligent Transportation System (ITS) program is a worldwide initiative to add information and communications technology to transport infrastructure and vehicles. ITS is an umbrella term for advanced automation in moving vehicles. It includes internal and vehicle-to-vehicle communication systems as well as collision avoidance and crash detection systems. The ITS also covers systems that monitor traffic to control signal lights, electronic speed limit signs, and other road safety components. One of the useful functions of the ITS is automatic vehicular guidance, which steers a car by sensors in the road. Implementing the ITS has several benefits including the following:

- safety improvements;
- fewer delays and reduced travel times;
- improvement in the effective capacity of the system;
- greater commuter satisfaction;
- energy and environmental benefits, such as a reduction in emissions;
- shift from private transportation to patronage of the public transport system;

- reduction of travel uncertainty and accidents;
- increase in reliability and punctuality; and
- reduction in traffic congestion.

The ITS applications that can be adopted as the traffic increases in the Shendra MIP area include the following. Components for the ITS will include a vehicle tracking system, real-time passenger information system, and central control station. Core technologies include a global positioning system (GPS), electronic display systems, and information and communication technologies.

- *Driver information*— the information regarding routes, road conditions, congestion, and delays will be communicated to the driver in terms of pre-route trip information, en-route trip information, and route guidance via variable message signs (VMS).
- *Traffic control*—the traffic can be controlled at any location by adjusting signal phase sequencing and providing priority to public transportation.
- *Travel demand management in the form of parking management*—Advance parking information can be provided to drivers.
- *Incident management*—Accident areas and road construction/repair areas can be identified. The sensors will determine the incident based on the speed and congestion and the information will be communicated to the user through VMS. Emergency services can be adopted quickly.
- *Travel service information*—Public transport schedules, traffic conditions, and route planning can be communicated to the transport system user through computer, kiosk, mobile, and other modes.
- *Emergency management*—Updates are provided regarding services, road closures, emergency shelters, and other special circumstances.
- *Traffic safety*—Speeding vehicles will be determined by sensors and a warning message will be communicated to the driver after a speed limit violation.

The ITS will encourage the use of public transport and reduce the use of personal vehicles. This will significantly contribute in attenuating the impact of increased vehicular movement on transportation networks and reducing congestion on roads.

### Significance of Impact

The overall impact on the Traffic in the area will be moderate as the future traffic projections are considered in planning roads; timely implementation of suggested roads infrastructure and management measures can be maintained the impact as minor.

**Table 6-20 Impact significance – Traffic and Transportation**

Aspect	Scenario	Spread	Duration	Intensity	Overall
Traffic	Without Mitigation	Local	Long	Moderate	Moderate

Aspect	Scenario	Spread	Duration	Intensity	Overall
	With Mitigation	Local	Medium	Low	Minor

### Impact due to Management of Solid Waste

The proposed Shendra MIP will generate solid waste from industrial, residential and commercial land uses. Based on population estimates and land use characteristics, it has been calculated that during operation phase, the total municipal solid waste likely to be generated is approximately 62 metric ton per day (TPD). This includes municipal waste from industrial areas and all other land uses- residential, commercial, civic, open spaces, roads etc. Breakup of solid waste quantities and other assumptions has been included in *Chapter 3*. The environmental impacts associated with improper handling or disposal of solid waste are discussed below:

- Approximately 365 TPD of industrial waste is likely to be generated from MIP comprising of 3% of hazardous waste from the planned green industries. Such waste may be potentially toxic because of presence of chemicals, metals etc. Improper handling and storage of such waste can lead contamination of soil and groundwater;
- Accidental exposure to toxic industrial solid waste can result in specific health problems;
- Sacks, cardboard cartons and paper envelopes contaminated with chemicals packed in them, when burnt can cause respiratory problems due to emission of irritating fumes;
- Inadequate collection and treatment of solid waste can lead to unhygienic conditions leading to spread of diseases and other vectors;
- Improper storage and collection facility can lead to contaminated run offs which can lead to pollution of rivers and other water bodies;
- Unceremonious dumping of solid waste into rivers and surface water bodies can alter the aquatic habitat and harm native plants and animals;
- The accumulation of waste along streets can clog drains and cause localized flooding;
- Improper disposal of sludge generated from industrial process can lead to contamination of ground water and soil;
- Improper disposal of industrial waster over a period of time can lead to bioaccumulation of contaminants which can lead severe ecological issues;
- Inadequate management of solid waste will result in bad odour, windblown litter in and around the waste storage areas;
- Potential for odour emissions and vector borne diseases near waste processing facilities.

### Mitigation

- Individual projects within Shendra MIP shall manage their waste in compliance with Municipal Solid Waste (Management and Handling) Rules 2000 and the Hazardous Wastes (Management, Handling and Transboundary Movement) Rules 2008.
- A solid waste management facility for Shendra MIP will be developed storage, treatment and disposal of solid waste generated from the residential and industrial activities;
- Waste estimates have been calculated based of best international practises and existing data of operational Industrial estates in Maharashtra and other parts of India;

- For Shendra MIP, a two (2) bin system will be adopted to facilitate an organized and hierarchical system of waste collection and disposal, which will then be upgraded to a three-bin system progressively.
- Multi-storeyed residences, commercial complexes, and storage facilities in individual residences and shops will keep containers within their premises, matching the MIP’s collection system.
- For municipal and industrial solid waste, a highly modernized, robust, and sophisticated vehicular collection and transportation system is recommended for Shendra MIP project. The final transportation of waste to the Integrated Solid Waste Management Facility would be through trucks and other transportation vehicles.
- It is suggested that a detailed techno-commercial feasibility analysis is carried out for selecting the best option for treatment of waste, based on the quantity and quality of waste. A Plasma Gasification will be installed along with incinerator for Industrial waste.
- Only inert waste will be sent to to landfill sites for its ultimate disposal.
- The recyclable waste like glass, metal, plastics, paper etc likely to be generated from different land uses, will be collected separately and sold to authorized recyclers/ vendors.

### Significance of Impact

The overall impact of the solid waste generated from the commissioning of the Industrial operations and residential activities will be moderate to high if unaddressed; however with the implementation of suggested collection, treatment and disposal measures the overall impact can be maintained as minor.

**Table 6-21 Impact significance - Solid Waste Management**

Aspect	Scenario	Spread	Duration	Intensity	Overall
Solid Waste	Without Mitigation	Local	Long	Moderate	Moderate
	With Mitigation	Local	Long	Low	Minor

### Impact on Land use pattern

The development of the proposed Shendra MIP will result in change in existing land use of the delineated area to industrial, residential and other commercial developments. Presently the project site is dominated by productive agricultural land that is irrigated from Sukhna Reservoir and other small tanks in the region. This productive land is concentrated around drainage channels and reservoirs. The agricultural land farther from these water features is generally non-irrigated and dependent on rainfall. Other notable features of land use on the project site include reserved forests lying to the north and western boundary of project, barren land/ hills on western boundary of the site. Most of these hills are highly degraded due to over-grazing and the pressure of population. There are three villages namely Karmad, Ladgaon and Kumbephal, occurring in the Shendra MIP delineated boundary. The site boundary has been revised to avoid impacts on these villages where possible, but some areas of rural village development will still occur within the site boundary.

For large area development projects such as construction of Shendra MIP, it has been observed that the peripheral areas also experience unplanned growth. This phenomenon is mostly driven by the price of property. It is expected that the area south of the planned MIP might experience haphazard and unorganized growth.

Other key issues identified with respect to change in land use pattern of the delineated area:

- The areas along the northern boundary of the delineated area consist of gently sloping ridges and hillocks. These are hillocks are designated as reserved forests. Activities in these fringe areas can lead to negative ecological impacts.
- The delineated area is drained by a network of seasonal rain water channels and streams generally converging towards either Sukhna Reservoir, the abundant rainfall pose a potential risk from flooding during monsoons. The potential for such localized flooding will be enhanced by modification of topography.
- The flat terrain is predominantly agricultural and most of the agricultural land is rain-fed which is supported by a number of check dams and irrigation channels. The change in land use or damage to existing infrastructure facilities will have adverse impact on local people.

### *Mitigation*

The initial delineation of the project area is based on a suitability analysis which was undertaken to develop a comprehensible and defensible approach for the planning of Shendra MIP. The basic premise of suitability analysis was that each aspect of the landscape has intrinsic characteristics that are to some degree, either suitable or unsuitable for the activities being planned. The intent of the sensitivity analysis process was to determine the optimum site location for activities while minimizing negative impacts the environment.

The details of site suitability analysis carried out for MIP have been provided in Section 2. The following factors have been considered in suitability assessment to ensure that obvious land use conflicts and incompatibilities are avoided:

- Human factors include community needs, economics, community organization, demographics, land use, and history.
- Biotic factors include wildlife and vegetation (mammals, birds, reptiles, fish and habitats and plant types).
- Geomorphological factors include soils, hydrology, topography, geology, and climate.

Thematic maps were prepared for an identified Area of Interest (AOI). The AOI focused on areas to the south and east of Aurangabad city centre, including existing SIDCO land. The total area of the AOI is approximately 5,175 Km<sup>2</sup>. The maps were prepared for themes viz-a-viz geomorphology (elevation and slope), land use and water resources which were considered of key importance for the overall sensitivity analysis.

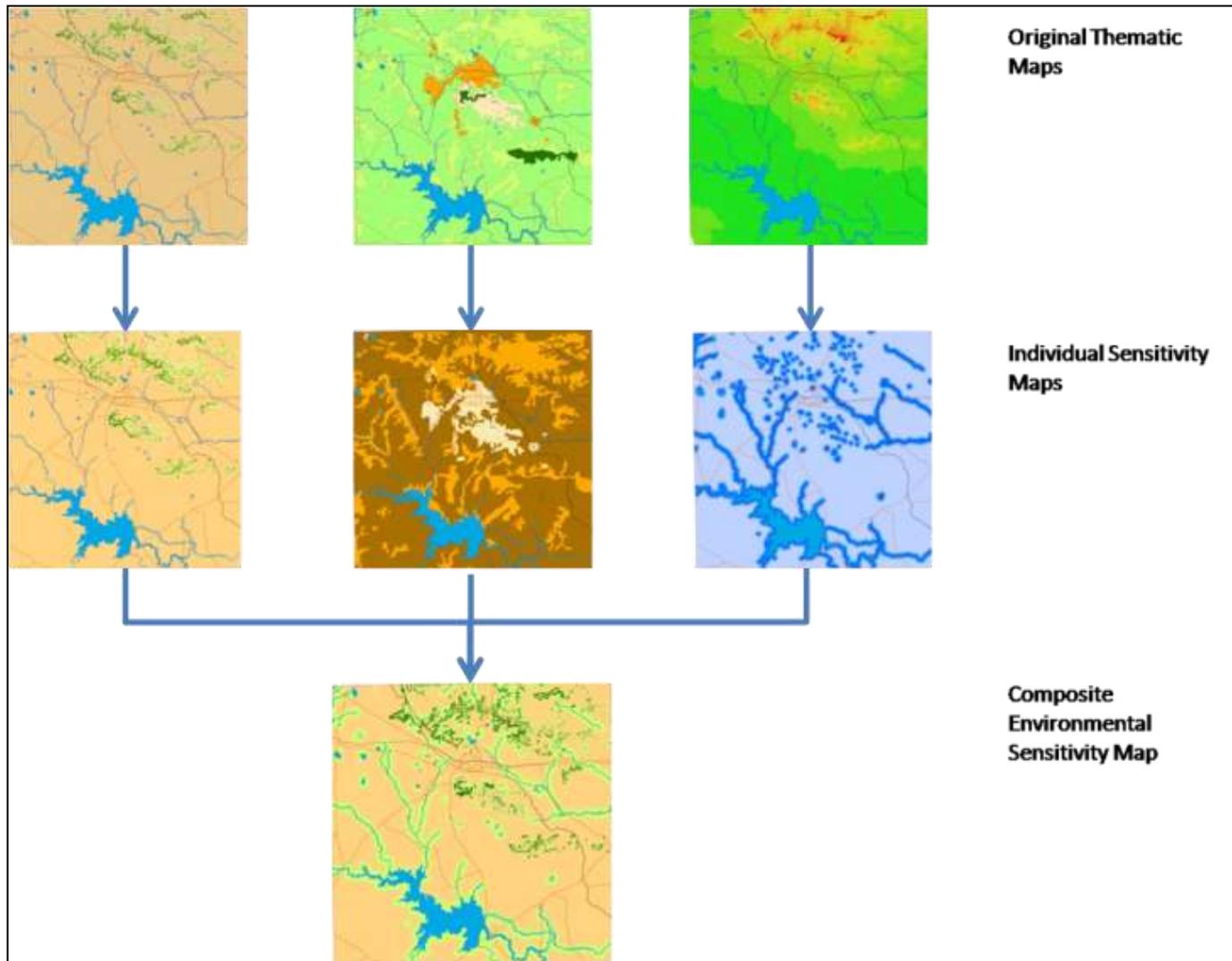
Based on the thematic maps, an environmental sensitivity analysis was conducted. Criteria for the analysis are described in Table 6-22 below.

**Table 6-22 Environmental Sensitivity Mapping Criteria**

Factor	Sensitivity Rating				
	<i>Low</i>	<i>Medium-Low</i>	<i>Medium</i>	<i>Medium-High</i>	<i>High</i>
Slope	0-10%	11-15%	16-20%	21-25%	25%+
Land-use	Developed Land Barren Land	Mono Agricultural Land	Double Agriculture Land	Scrub	Forest, Mangrove/ Mudflats
Water Features	1000m+		500m – 1000m		Water Features +0m-500m Buffer

The three sensitivity layers used in the analysis were then overlain to develop an overall composite environmental sensitivity map.

Figure 6-1 Composite Environmental Sensitivity Map



- The evaluation concluded that the development potential of the project area is constrained to the north and south of the AOI, with unsuitable topography and reserve forests found to the north, and the large Jayakwadi Reservoir (which is also a Wildlife Sanctuary) to the south. Additional constraints are posed by the low range of hills running northwest to southeast through the centre of the AOI. Therefore, the final project area has excluded the high sensitivity forest area towards northern and eastern fringe from the proposed Development Plan;
- The land finally delineated avoids existing settlements and proposes to leave an adequate buffer area around them as no development zone.
- It is planned to retain all key water channels in the project area as natural water bodies. The areas where existing drainage is altered, sufficient arrangements will be made to retain the natural flow and for prevention of flooding;
- All irrigation channels and check dams of significance will be retained to ensure no impact on the agricultural activities around the delineated project area;
- Existing water features, lakes, creeks and river channels will be integrated into the proposed Development Plan of MIP;
- To restrict unplanned development along the peripheral areas, fiscal measures shall be incorporated;
- The unplanned development in the area between the upper delineated boundary around Shendra and Lower boundary along NH-211 shall be regulated by MIDC/ DMIC.

### Significance of Impact

The overall impact on land use in-terms of forestland, agricultural land and water bodies will be moderate to high; however with the implementation of suggested buffers, retention of water bodies and delineation of habitations and forest patches along with ecological protection zones the overall impact can be maintained as minor.

**Table 6-23 Impact significance - Land use**

Aspect	Scenario	Spread	Duration	Intensity	Overall
Land use	Without Mitigation	Local	Long	Moderate	Moderate
	With Mitigation	Local	Long	Low	Minor

### Impact on Socio economic Environment

The socio-economic impact from the industrialization of the area will include the villages falling in the project area and the entire region due to economic change. The proposed project will provide direct employment to about 1,10,028 persons during operation phase. The residential areas will also get fully populated by 2025 with a total population of about 50,733. The combination of industrial growth with residential township will tremendously reduce the influx load on the major towns of Pune and Mumbai.

### *Impacts*

- The local community will benefit with industrial growth which will provide direct employment through engagement with operations and indirect opportunities through facilities such as transportation, security services, housekeeping agencies, recyclers, catering etc. The influx of large populations in the residential area will also provide opportunities for commercial activities proposed MIP Development Plan, wholesalers and retailers of domestic consumable items and consumer goods in the region will also benefit from the project.
- The acquisition of private land for the projects will impact the total land available in villages falling within the project area where only limited land will be available for agricultural cultivation. This will result in change of land holdings per household in the impacted villages, and can result in landholdings rendered economically unviable for cultivation. This can lead to a change in the traditional occupational patterns with a shift from agriculture towards other activities, including business and services. There is a potential for emergence of diverse occupational patterns in the project area and adjoining villages due to the associated needs of industrial development and domestic demands of residential township.
- The economy of the villages at present is largely driven by agriculture and related activities, which would be gradually modified with implementation of each phase of the project. The changes would be significant in the project area and the delineated villages, while for the adjoining villages the impact will be moderate to low depending on their proximity to project area.

The positive impact of the Shendra MIP development can be delineated as:

- Improvement of infrastructure in the area, in terms of road, power supply, water supply, waste management, transportation etc.
- Increase in the minimum daily wage rates for men and women;
- Increase in income levels due to new employment opportunities, and further improvement in standard of living of the local community;
- Stabilization of the rural economies due to sustained demand from the industrial sector and parallel developments will benefit the community;
- Opening of a plethora of business avenues, such as travel agency, property dealers, hotels, cafeteria, retail shops, consumer items, etc for the local community to invest in or be a part of;
- The advent of industrial operations and parallel developments would create aspirations of increasing technical knowledge and educational progress among the local community.
- There would be an increase in the number of men and women opting for higher education and skill trainings in the face of demand from the industrial sector.

The negative aspect of the project implementation would include:

- There is potential for cultural conflict with migrant workers / residents who move in from other parts of the country. Maharashtra has got a history of such cultural conflicts in the past.
- There is a strong potential for secondary development in the adjoining areas falling outside the project area. This would result in unplanned developments and unwanted load on the existing infrastructures of the adjoining areas such as sanitation, sewerage, power supply, road,

housing, etc. This unwanted secondary development can lead to unhygienic surroundings, social conflicts and reputational risk for the project.

### Mitigation

- The project will ensure measures for Corporate Social Responsibility to continuously engage with community and address their grievances on a regular basis.
- It is recommended that an area of 10km around the project are will be regulated by DMICDC/MIDC to avoid any secondary development or unplanned development. This would be notified as per the Maharashtra Regional and Town Planning Act 1966.
- It is recommended that DMIDC/ MIDC extend the infrastructure facilities such as water supply, power, transportation etc. to the villages within the project area to avoid any conflict with the community.
- It is recommended to include a mechanism in place to train and improve the skill sets of the local community and improve their prospect of job with the project.
- The project will put into place SPV’s responsible for efficient management and maintenance of infrastructure to ensure the committed quality.

### Significance of Impact

The overall impact on socio-economic scenario will be positive which when coupled adequate management measures can improve the economic scenario of the region with a moderate to high intensity of change.

**Table 6-24 Impact significance - Socio-economic Environment**

Aspect	Scenario	Spread	Duration	Intensity	Overall
Socio-economic	Without Mitigation	Local	Long	Moderate	Moderate
	With Mitigation	Regional	Long	High	High

### Impact on Cultural Impact

There is no identified place of archaeological importance located within close proximity of the delineated boundary. Therefore no cultural impact is anticipated due to proposed project activities.

However the project will involve deployment of population not belonging to the area. The influx of migrant population and urbanization will have influence over the existing customs and practices followed by the local community. This may result in conflicts in customs and rituals which may lead to disharmony in the area. The output will ultimately result in change of culture with shift towards more urbane practices. This impact will not be significant and can be managed by measures such as organizing CSR program in coordination with individual projects to ensure communal harmony and cooperation between the communities.

## 7. Socio-Economic Environment

The social baseline is based on the review of secondary data and information obtained through qualitative and quantitative methods.

### Administrative Profile

The project area is positioned in Aurangabad district of Maharashtra. The delineated land spreads over 3 villages, Karmad, Ladgaon and Kumbhepal in the Aurangabad tehsil. The delineated area is adjacent to the existing Maharashtra Industrial Development Corporation (MIDC) Shendra Industrial Area (east of Aurangabad on Jalna Road).

The Aurangabad District is mainly located within the south and east portions of the Godavari River Basin, which is northwest of the Tapi River Basin. The northwestern portion of the district falls within the Purna–Godavari River Basin. The northern boundary separating Aurangabad District from Jalgaon District lies mostly in the northern zone of the Ajanta Range. The eastern boundary of the district zigzags through the landscape. The boundary follows no natural features except for a small stretch along the Dhamna River, another stretch along the southwestern edge of the Buldhana plateau, and a few smaller stretches along some smaller streams, such as the Madhna River and the Dol River. Unlike the other boundaries, the southern boundary is well defined because it coincides with the bed of the Godavari River, except for some half dozen small deviations. The western boundary separating the district from Nashik District is one of administrative convenience and has no natural significance.

Aurangabad District is subdivided into nine tehsils, with Aurangabad tehsil as headquarters of the District. The total area of the district is 10,100 square kilometres, of which 141.1 square kilometres is urban and the remainder rural. A total of 1,344 revenue villages are spread over the nine tehsils. In Aurangabad District, the total forest area is 135.75 square kilometres, which is 9.03% of the total forest area in Maharashtra.

### Villages falling in the project area

There are total of 3 villages in the delineated area for Shendra MIP namely Karmad, Ladgaon and Kumbhepal. The details of villages along with total area, demograpohic profile is presented in Table 7-1.

**Table 7-1 Social details of 3 villages falling within the proposed site for Shendra MIP**

DEMOGRAPHIC DETAIL (2011)				
SR. NO.	PARAMETERS	Karmad	Ladgoan	Kumbhepal
1	Area	553 ha	274 ha	18.8 ha
2	% area	65.4 %	32.4 %	2.2 %
3	Population	5934	1254	4263
4	Male Population	3069	689	2177
5	Female Population	2865	565	2086
6	In the age group 0-6 years	925	151	691
7	In the age group 0-6 years(Boys)	482	98	396
8	In the age group 0-6 years(Girls)	443	53	295

9	Sex Ratio	919	540	745
10	Literates	3860	803	2579
11	Male Literates	2228	498	1481
12	Female Literates	1632	305	1098

Source: Census 2011

The total population in three villages is approx 11451 villagers as per Census 2011. The average household size in the project area works out to be 5.49 which is marginally higher than Aurangabad (5).

## Social Stratification

### Aurangabad Tehsil

The data for underprivileged group i.e. Schedule Caste/ Schedule Tribe has been collected for Aurangabad Tehsil and the Project villages from Census 2001. The data reveals that Aurangabad and has significant SC population of around 16.10%. The SC population in the tehsil is higher than the district average of 13%. The ST population in the tehsil is quite low as compared to SC population. Aurangabad tehsil has 1.3% of its total population under ST category.

### Project Area

In the project villages, the total tribal population is 1884, i.e approx 22 % of the total population. The concentration of SC and ST population in Aurangabad tehsil, and project area is presented in Table 7.2.

**Table 7-2 Social Stratification in Tehsil and Project area**

S No.	Name	% of SC	% of ST
1	Aurangabad tehsil	16.10%	1.30%
2	Project Villages (3)	22.58%	1.75%

Source: Census 2001

## Literacy Rate

Literacy rate is a development indicator of a particular area and based on its new developments can be proposed for utilization of existing human resources for new opportunities.

### Aurangabad Tehsil and Project Area

Literacy rate may be defined as the percentage of literates to the total population age 7 years and above. The literacy rate of Aurangabad tehsil is 67.46%. There is a huge difference in the male and female literacy rates with the female literacy rate being a mere 59.65% as compared to 74.53% of males for Aurangabad district.

As per Census 2011, the overall literacy rate in the project area is 63% which is lower than the literacy rates for Aurangabad district. The literacy rates for males and females in the project area are lower than the corresponding rate for Aurangabad tehsils.

The details of literacy rate of Aurangabad tehsils and of the project impacted villages re presented below in mentioned below in Table.

**Table 7-3 Literacy rate of Aurangabad tehsil and 3 villages impacted by the proposed Shendra MIP**

PLACE	INDICATORS	Census 2011
Karmad	Literacy rate ( % )	65
	Sex Ratio	934
Ladgoan	Literacy rate ( % )	64
	Sex Ratio	820
Kumbhepal	Literacy rate ( % )	60
	Sex Ratio	958
Aurangabad	Literacy rate ( % )	78
	Sex Ratio	919

Source: Census 2011

According to Census 2011, total number of literates in Karmad, Ladgoan and Kumbhepal is 7242, which is approximately of 63.19 %. Out of this there are 4207 males and 3035 females.

**Table 7-4 Literacy rate of 3 villages impacted by the proposed Shendra MIP**

SR. NO	PARAMETERS	Karmad Ladgoan & Kumbhepal	RATE (%)	AURANGABAD	RATE (%)
1	Literates	7242	63.19	908,725	77.58
2	Male Literates	4207	59.07	497,404	54.74
3	Female Literates	3035	40.95	411,321	45.26

## Employment Profile

### Aurangabad Tehsil

The employment pattern of any area is another development indicator of the area. According to the data of Census 2001, Aurangabad Tehsil has 32.40% population as workers. Approximately 90% of the total working population in both the tehsils constitute main workers.

### Project Area

As per the Census 2001, out of the total population of the existing villages impacted by the proposed Shendra MIP project area, about 45% are workers. Out of these, 85% are main workers while the rest are marginal workers.

Though the percentage of main workers is very high in the project area, the value is lower than that in Aurangabad tehsils. The employment profile of Aurangabad tehsil and project area is presented in **Table 7-5**.

**Table 7-5 Employment profile**

S. No	Name	Main workers	Marginal workers	Total workers	Non workers
1	Aurangabad	350,919	26,725	37,7644	787,923
2	Project villages	3498	373	3871	4473

Source: Census 2001

In the present scenario, most of the areas under project area are rural and much of the population is agriculture dependent. As per census 2001, it is found that of the total working population in the project villages around 38% are cultivators and 4.5% are agricultural labourers. The pattern is in complete contrast with that in Aurangabad tehsil where majority (74.74%) of the total working population is engaged in other trades and only 15.20% and 8.59% of total working population are cultivators and agricultural labourers respectively.

The distribution of workforce (main workers) in Aurangabad tehsil and MIP Project villages (3 in no.) is presented in **Table 7-6**.

**Table 7-6: Workforce Participation**

S. No	Particulars	Name			
		Aurangabad Tehsil	%	Project Area	%
1	Cultivators	57,417	15.20%	93	24.9
2	Agricultural Labourers	32,452	8.59%	176	47.2
3	Household industries	5,508	1.46%	8	2.1
4	Other workers	282,267	74.74%	96	25.7
		377644	100%	373	100%

## Existing Social Infrastructure

The social infrastructure of the area indicates the nature of development of the area and facilitates mapping the areas where further development is needed and new development programmes are made to address the gaps in order to enhance the eminence of lives of the local residents. An assessment of the social infrastructure of the MIP is described in the subsequent sections.

### ***Educational Facilities***

The Shendra MIP project area has an overall literacy rate of about 58%. As per data recorded in Census 2001, the project area has 3 Primary Schools, 3 Middle Schools, 3 Secondary Schools and one Senior Secondary Schools. However there is no college, training school, industrial school or adult literacy centre in this area. The poor education infrastructure especially higher education is a disadvantage to the original residents of project area. The Number of educational facilities within the MIP project area is presented in Table 7.7:

**Table 7-7 Educational facilities in the three Project Villages**

S. No	Educational Facilities	Number
1	Primary School	3
2	Middle School	3
3	Secondary School	2
4	Senior Secondary School	1
5	Other Educational facilities	0
	<b>Total</b>	<b>9</b>

Source: Census 2001

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**Health Care Facilities**

The project lacks proper health care facilities. There are 3 small medical facilities in these 3 villages and one operational hospital in the area. There is one TB clinic and one primary health centre. There are 4 qualified health care workers in these 3 project villages

**Other Facilities**

The other facilities in the project area include banking facilities. There are total of 3 banking facilities present which includes one commercial bank and two cooperative bank.

**Anticipated Project Impacts**

As the proposed project site is spread over 3 villages – Ladgaon, Karmad and Kumbephal in Aurangabad District. The impact of the project will be most effective in the direction of the socio-economic condition of the communities residing in these villages. A variety of implications will surface for the population in the delineated area. Below is a list of potential negative impacts which are likely to emerge during the course of the project.

**Inflow of Migrants**

With the large scale construction activities that are going to take place during the different phases of the project, a huge inflow of migrant labourers is expected which may change the demographic set up of the population to a considerable extent. As the population in the delineated area is mainly agriculturalist, this inflow might cause an economic imbalance as the workers will be employed over the population which will be rendered unfit for this work. This in turn, might lead to migration of affected population to other areas to look for work in order to sustain themselves. In addition, once the project gets completed, the expected inflow of people to both come and reside in this industrial region will be much higher which will result in the affected population becoming a minority and thus, altering the entire democratic profile of the area.

**Loss of Traditional Knowledge**

With the inflow of migrants to the projected area, there is a chance that there will be a loss of traditional knowledge of the population that has been residing in this area since years. This loss of traditional knowledge is likely to threaten the very survival of the local community to a significant extent. Traditional knowledge here means a cumulative body of knowledge, know-how, practices and representations maintained and developed by people with extended histories of interaction with the natural environment and passed from generation to generation in the form of folk tales, folk songs, stories, legends, rituals etc.

**Inadequate Food Security**

As the agricultural land of the affected population will be acquired for the project, this is likely to affect the food security of the population. With no land to grow fresh vegetables and pulses for their consumption, the population will have to look at alternate modes of procuring their food which will

cause hardships in terms of higher economic expenses thus bringing about a burden to their meagre economic resources.

#### *Loss of Livelihood*

The acquisition of agricultural land is likely to result in loss of livelihood of the affected population. With skills related to the agricultural sector, this population will find it difficult to implement their skills in the new scenario. They will need to find another source of income and being unskilled, it will be difficult for them to find a job within the vicinity of the area.

#### *Loss of Household*

The projected activities of the project will be possible only when the delineated area will be acquired. This to a large extent will affect the squatters, encroachers and landless labourers who have been living on the agricultural lands. This section of the population will be rendered homeless and they will need to leave the land in search of a new place to live and adapt themselves.

#### *Loss to access of Common Property*

With the acquisition of land, there is potential loss of access to common property. Common property here refers to grazing lands, water bodies like ponds, wells, valuable trees, medicinal plants, firewood etc. which might hinder the daily existence of the population.

#### *Marginalisation*

Marginalisation is often caused when families who were relatively well off lose their economic power. The individuals will not be able to use their earlier acquired skills in the new circumstances and hence there will be a loss of human capital as their skills will become redundant. This vulnerability of economic marginalisation will have its repercussive effect on the psychic of the individuals thus creating psychological stress in the long run.

#### *Increase of Income Inequality*

With the inflow of people to the projected industrial area, the skilled population who will base themselves here will be provided with all modern amenities that will render their lives securely and this will increase their economic resource significantly. However, the affected population will be drastically burdened with the only source of livelihood. Searching for new livelihood activities might become their top most priority in lives. This will increase the gap between the rich and the poor to an enormous extent.

## **Beneficial Impacts**

Although with the execution of this project, a few of the above mentioned negative implication are likely to come up, there are certain positive impacts as well which will be beneficial for the population in the long run. Below is a list of the anticipated positive project impacts on the affected population:

#### *Alternate Employment Opportunities*

The new project has enormous potential to create alternate employment opportunities in terms of development of industries, corporate institutions, educational institutions, tertiary service sector and independent small scale enterprises. The land outsees will be able to engage themselves by upgrading their skills and becoming a part of the new workforce that will form in the area. In

addition, this also will be creation of employment opportunities for women in the service sector. The educated women will have opportunities in workplaces thus impacting the changing gender role in the community to a substantial extent.

### *Increase of Literacy Level*

Due to the projected activities of this project, there is potential for the construction of new educational institutions like pre-primary, primary, secondary schools and colleges which will give better prospects to the population residing in the area and in turn increase the literacy level of the district. Availability of higher educational institutions within the vicinity will give the students ample scope to pursue their studies in that area instead of migrating to bigger cities to avail the opportunities present there. A point to note here is the construction of toilets for girls within the vicinity of the schools and proper water facilities in these toilets which should be given significance so that girl students can continue their education without dropping out from schools as this has been a major factor in the huge dropout rate once they reach puberty. In addition, with the development of amenities being available in the long run, the prospect of teachers joining these schools and colleges will also increase thus, giving impetus to the educational facilities available in the area.

### *Retention of Local Population*

With the implementation of the project and the increase of employment opportunities for the affected population, retention of local population in the area will be possible. This will reduce the migration flow of the local people to bigger cities in search of work. This will not only be beneficial to the individual person but will also help the social life of the family significantly, thus reducing the psychological stress of the local community.

### *Skill Development*

With the setting up of new industries, skill development will be a major factor in making the population employable. The development of training and coaching centres will be necessary to tap the raw skills of the local population. Various training service institutes which offer training on customer handling, communication, interpersonal skills, and sales management will need to be set up to placate the high demand which will arise once the industries and commercial offices operate in the area. In addition, setting up of vocational centres like auto repairing, mobile repairing, and computer training centres, spoken English language centres etc. will also assist in both developing the skill of the people as well as creating jobs in the small skilled trade sector. Setting up of adult literacy centres which will help in providing the necessary knowledge to the adult learners so that they can also be a part of the employable population.

### *Public Amenities*

- With the execution of the project, there is a possibility that the villages in the vicinity will be able to receive electricity due to the proximity of the industries and commercial activities in the area
- Construction of public toilets in main areas near the market place, community gathering area etc. for both men and women
- Proper garbage disposal system which will help the population to combat health issues which might arise due to littering of the streets and clogging of drains
- Improvement of roads and inner lanes which connect the households to the main highway

- 
- Creation of recreational and community centres for the benefit of all
  - Better public transport facilities for the people
  - Establishment of more banks and cash dispenser machines around the area
  - Establishment of post offices
  - Establishment of communication network in terms of facilities like telecom connectivity and internet connectivity
  - Water supply to the households and community within the area

### ***Health Facilities***

With the development of the area and the inflow of people, it is likely that better health facilities will be initiated to counter the health issues that might emerge with increase in population. This, in turn, will also help the local population living in the area to avail these services. Construction of hospitals, clinics, primary health centre providing outreach services such as immunization, basic curative care services, maternal and child health services and pharmacies will be a major attribute in making the health facilities available to the common people. In addition, provisions in creating opportunities for a paramedical service to cater to the people in emergency situations would also be a huge benefit. With the development of the industries and commercial activities, doctors and para-medical staff who might not be keen to be based in a rural area will flock here for a better employment opportunity, thus, in turn benefitting the local population.

### ***Women Employment***

The project will help the women population living in the area by providing opportunities relating to employment, education and health facilities so that they can bring themselves in equal parity with that of their male counterpart. Insecurity among the women will also reduce to a significant extent with the retention of population in the area because of the setting up of industries and commercial activities. This will also reduce the cases of migration of male members of the families to migrate to cities for better employment opportunities, thus reducing the burden on women members of the families, of looking after the children and elderly, all alone. In addition, there is a possibility that with the setting up of crèches, a support system can be generated both for the women who are working mothers and for the elder (girl) siblings who often tend to be burdened with the responsibility of looking after their younger siblings and missing out on school. The prospects of women being decision makers and financially independent will change the gender role in the community and secure their place in the workplace and family alike.

### ***Assistance to the Farmers***

The farmers in the vicinity of the area will be benefitted with the knowledge and cooperation from the high tech institutes in relation to increase of local food production and newer techniques of farming. There will be a fair amount of exchange of ideas between traditional and newer knowledge which will revitalise the agricultural scenario in the area. In addition, the market areas which will be created within the complexes will also be a ready market for selling of the farm produces. With the increase of demand of food products by the inflow of population in the area, the prices of the food products will go up and hence, this in turn, will help raise the income of the farmers to a considerable extent.

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### **Community Development**

With the availability of employment opportunities, the per capita income of the affected population will increase. This will alleviate the population from poverty and will raise their living standard. In addition, with the capacity development programmes which will be initiated for the affected population, the community will receive the required prospects which they have been deprived of when they were dependent solely on agricultural activities.

### **Corporate Social Responsibilities Activities**

Certain recommendations have been put forward as part of the Corporate Social Responsibilities Activities (CSR) in these tehsils to enhance the lives of the affected population in the project area. The CSR activities will relate to the following areas:

#### **Health Service**

As the region has poor health facilities, a 100 bedded hospital is proposed to be set up so that the population can receive amenities related to health services. The hospital will host all the facilities like operation theatre, intensive care units, pathology labs, wards, pharmacies, morgue within its premise. An ambulance service will also be linked to the hospital so that the people in the area can avail the services whenever necessary.

#### **Industrial Training Institute**

An Industrial Training Institute is proposed to be established so that technical training can be imparted to the affected population, especially those people who have been identified to fall below the poverty level. This training will form part of the skill development programme so that the population can be given an opportunity to become employable in the industries which will be set up in the area.

#### **Training to Farmers**

There will be a transfer of knowledge from the experts on modern agricultural techniques and processes to the farmers who can enhance their skills by adopting these alternate farming techniques and increase the agricultural productivity in the long run.

#### **Public Amenities**

Additional, water supply schemes will be planned for the affected population so that drinking water supply facilities can be provided to each village once the land has been acquired for the project implementation.

#### **Vocational Education**

Setting up of a vocational training institute will be proposed so that adolescent girls and boys including school drop outs will be given preference in developing their skills in specific trade and craft. Trainings in computer operation, computer hardware, tailoring, auto part repairing, mobile repairing, bangle making, pickle making, personality development, folder making, doll making, bag making, tribal handicraft etc. will be provided. An NGO specialising in these activities will be short listed and will be given the responsibility to impart these training on a regular basis.

**Self Help Groups**

In order to empower the women in the area, women self help groups (SHGs) will be created with the aid of a local NGO which is based in the area. Adoption of micro-enterprise development projects for the SHGs will be implemented which will create alternative employment activities and resource formation for the community. Here emphasis will be given on promoting savings and credit activities so that this may lead to a strong and permanent improvement of the socio economic condition of the population.

**Schools**

Schools will be set up within the vicinity of the villages so that children can avail the services without any hindrance. Proper toilet facilities within the school premises will also need to be developed. There is a necessity that adequate number of teachers will need to be appointed so that there is a proper ratio of learners and teachers.

**Sanitation Facilities**

Training camps on health issues relating to proper sanitation facilities within the households should be imparted to the community. Provisions need to be made regarding supply of low pricing toilet seats to each household so that proper initiative of building toilets within the houses can be undertaken by each family.

Besides the activities mentioned above, efforts will be made by the project sponsors to make the affected communities a part of the project activities so that mutual cooperation and co existence can prevail in the area. The project sponsors will need to be transparent and accountable in their dealings with the affected community in order to gain their trust throughout the project execution. A separate mechanism for grievance redressal will need to be provided periodically by way of directives to be issued by the Project Sponsor for better participation of the affected people in the long run.

***Estimated Cost for CSR***

The budget to be allocated for the CSR activities will be 0.4% of the total project cost for each phase. The SPV for Shendra MIP shall allocate the budget for the CSR activities. Individual projects shall also allocate a budget of 0.4% of their project cost to conduct their own CSR activities.

## 9. Environmental and Social Management Plan

This section of the report presents the Environment Management Plan (EMP) for the proposed project and discusses the institutional and legal framework to be adopted for the development, operation and governance of the delineated area. This section also provides for environmental monitoring to be implemented during different stages of the project.

The objective of the Environment Management Plan is to delineate mitigation measures to minimize such impacts by allocating management responsibility and suggesting skill requirements for implementation of these measures during construction and operation phases.

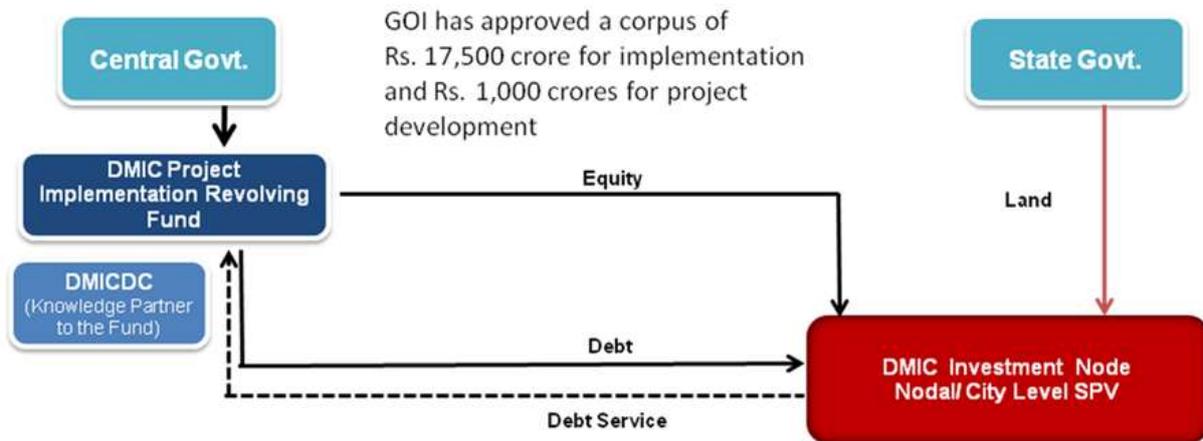
### 9.1 Institutional and Legal Framework

For the development of Shendra MIP, a city level SPV is being incorporated as a 50:50 Joint Venture Entity between the State Government and the Central Government. Within the SPV, the Government of India will be represented by DMIC Project Implementation Trust Fund. The State Government will provide the land as its Equity to the proposed SPV while DMIC Trust will provide the money for the development of trunk infrastructure (water, power, drainage etc.) which is essential for attracting industries. The planning and development functions will also be vested with the city SPV.

The city SPV will also also responsible for implementation, operation and management of trunk infrastructure either directly or through some developer/operator and will be allotting the developed plots to the industries. Each industry will follow the existing procedure of Central/State Government obtains separate environmental clearance, as applicable. The SPV shall ensure that the individual units shall have a self monitoring online system to keep a check on the emissions and waste discharged. These industries will have to strictly adhere to the prescribed environmental guidelines applicable and will remain under the purview of concerned State pollution Control Board regarding adherence to the compliances related to monitoring of pollution levels, violations of environmental norms etc.

The proposed institutional framework for the Shendra MIP is presented in Figure 9-1.

**Figure 9-1 Proposed Institutional and Legal Framework**



**Nodal Agency (Maharashtra Industrial Development Corporation (MIDC))**

MIDC has been designated as the nodal agency for the Shendra MIP as the industrial development is the main driver for the development of the region. The agency shall be responsible for inviting Private Sector Participation for the development of Infrastructure projects. The functions of the nodal agency have been provided below:

- Conceiving and detailing of projects
- Techno-commercial and feasibility studies.
- Project and financial structuring.
- Marketing of Shendra MIP;
- Raising finance from the market.
- Promote PPP
- Execute contracts/agreements with developer

The key tasks related to development, operation and governance of the project along with the agency responsible for its implementation have been provided in Table 9-1.

**Table 9-1 Responsibility Matrix**

S.N	Activities	Responsible Agency
1	Preparation, Implementation and Monitoring Development Plan, Town Planning Schemes, Development Control Regulations and Building Byelaws	SPV
2	Demarcate and develop sites for industrial, commercial, residential and other social infrastructure purposes according to the plans	SPV
3	Levy development charges & fees;	SPV
4	Impose penalty and mode of recovery	SPV
5	Enter into any land or building with or without assistance	SPV
6	Land Procurement/ Acquisition;	SPV /MIDC
7	Holding, Sale, Lease & Auction of land, buildings structures of industrial, residential, commercial and with other uses	SPV
8	Negotiate and enter into contracts/ agreements of any form with for development of land, building, project, infrastructure, for MIP	SPV /MIDC with approval from State

		Apex Authority
9	Enter into contracts, agreements or concession agreements with any person, entity, developer or organization for performing its functions	SPV
10	Construct, support, monitor and facilitate development of Infrastructure, amenities and utilities (water, waste water, power, solid waste, telecommunication, roads, drains, street lighting, logistic parks, fire stations, flood protections, bridges, etc; within IR as well as outside MIP but required for MIP	SPV /MIDC
11	Promote, establish and execute industries, projects or enterprises for material or any substance which are likely to promote industrial development of the state	SPV
12	Promote and establish companies or associations for implementation of industries / projects leading to development of Investment Region.	SPV
13	Develop, maintain, monitor and operate public transport systems (both rail & road based)and infrastructure solely or through concession agreement	SPV with approval from State Apex Authority
14	Capable to identify, conceptualize, prioritize infrastructure projects and approve Concessions upto certain limit without State/ Apex Authority approval and rest with approval from State/ Apex Authority	SPV /MIDC
15	Co-ordinate with government department, agencies, local authorities, etc” for development of infrastructure in the IR	SPV
16	Inspect, monitor, visit and review the progress of infrastructure project	SPV
17	Ensure, provide and maintain civic amenities and services	SPV
18	Protection, preservation, conservation and upkeep of Environment	SPV
19	Protection, preservation, conservation and rehabilitation of Historical Monuments & Buildings of Importance	SPV
20	Promote and encourage economic activities through marketing initiatives	MIDC

The following departments under the SPV formed will be responsible for the implementation of the Environment Management Plan:

- **Project Management:** The project management will have the responsibility to arrange the resources, manpower and budget for the management of environment.
- **Environment and Conservation:** This department will be responsible for Implementation of all conditions as stipulated in the Environmental Clearance and Consents obtained by the project. It will also be responsible to ensure compliance to all commitments made under the EMP.
- **Public Relations:** This department will be responsible for undertaking public consultation for dissemination of information pertaining to the project, land acquisition and address the grievance of the people.
- **Land Acquisition:** This department will undertake all activities pertaining to land acquisition to be undertaken for all new land to be acquired beyond which is already with MIDC.
- **Resettlement and Rehabilitation:** This department will be responsible for addressing all resettlement and rehabilitation issues arising out of land acquisition. All commitment made under the R&R plan will be implemented and monitored by this department.

The SPV will constitute of an Environmental Management committee which will include all the above mentioned departments to implement and monitor various aspects of environment management, including social issues.

The **Environment Management committee** for MIP will comprise of:

- **Environment Cell:** Comprising of all environment and public relations departments of the SPV and headed by the SPV's Environmental Officer. The environment cell will be responsible for:
  - Periodic review of environmental status
  - implementation and maintenance of green buffer areas,
  - management of water bodies,
  - review of CETP/STP operations
  - monitoring of collection and treatment of waste
  - compliance to conditions stipulated in Environmental clearances and consents
  - Implementation of EMP
  - Undertake awareness activities for industries and residential areas
  
- **Social Cell:**
  - Undertake continuous engagement with local community
  - Address grievances of the industries, local community and residents
  - Overview the land acquisition, Resettlement and Rehabilitation process

The Environment Management Committee (EMC) shall undertake:

### Inspection, Monitoring & Audit

The Environment cell under the Environment Management Committee team will undertake inspection and monitoring of the environmental management measures during construction and operation phase activities in order to ensure the effectiveness of suggested mitigations.

- The Project Management department of SPV will ensure that all the contractors comply with the requirements of conditions for all applicable permits and guidelines. The inspections and audits will be undertaken by Environment cell directly or through external agencies/experts.
- The inspection and audit findings will be implemented by the contractors in their respective areas. The entire process of inspections and audits will be documented.
- Monitoring of green buffer areas, eco protection zone and other delineated area will also be undertaken by the Environment cell.

### Reporting and Review

Reporting of environmental, health, safety and social performance reports or check list, incident record register etc will be developed and implemented through a program of reporting by the Environment Cell throughout the project.

- Reports from inspection, audits and other improvement program will be regularly communicated with the Project management of the SPV. The communication process will involve regular team briefings, group meetings and meeting with stakeholders.
- All contractors engaged will be required to adhere to the reporting requirements in terms of timely report submission with required details. All complaints and enquiries will be addressed with records maintained in an assigned register by the safety officer of each contractor.

- Internal and external reporting mechanism will be developed, internal reporting will comprise of the Environment Cell, the representatives of the contractors and the top management of DMIC Trust while external reporting will comprise of the top management, other government agencies and civil society.
- The internal reporting will be undertaken on quarterly basis while the external reporting will be undertaken of six monthly basis.

## Record Keeping

The SPV will be required to keep records of all EHS and social aspects, which will be documented and updated. Personnel will be identified to ensure documentation with detail of responsibilities and training on documentation system. Documents of key importance to developed and controlled include:

- Standard Operation Procedures (SOP);
- Register on Legal Commitment;
- Incident Communication Report;
- Complaints register and Grievances
- Emergency Response Procedures;
- Training Records;
- Monitoring Reports and;
- Inspection and Auditing Reports

## Social Aspects

The project will constitute a social team comprising of Public relation, Land Acquisition and R & R department of the SPV formed under the DMIC trust to undertake various activities. Land for the project will be acquired as per the Land Acquisition Act/ MIDC Act. The compensation shall be provided as per the guidelines of NRRP, 2007. All queries and grievance of the land losers pertaining to land acquisition will be addressed by the district administration. The Land acquisition department will enable Redressal Mechanism managed by the Community Liaison Officer (CLO) to address all grievances through an established redressal system. In case of disputes that cannot be internally resolved, the project will set up an independent mechanism with representation from community, locally authority, other stakeholders etc. to sort these conflicts. If there are issues beyond the authority of project proponent or with legal implications then the administration will be approached. The project will share information about these mechanisms to the local community. This grievance mechanism will respond to the concerns and grievances of local families, NGOs, local bodies and any other aggrieved party.

The Grievance Redressal procedure will provide an outline of the process and steps to be taken along with the time limit within which the issue would need to be resolved to the satisfaction of the complainant. The project will endeavor to get all complaints recorded and addressed in a uniform and consistent manner.

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## Review and Amendments of EMP

This EMP shall to be reviewed annually or as considered essential to incorporate any change in the organization, process, or regulatory requirements. Following a review, amended EMP will be communicated to all the staff.

## Suggested Management and Monitoring Plans

Based on the findings of the Environmental Assessment management plans for mitigation, monitoring and performance improvement measures for identified social and environmental impacts has been prepared. The following plans are detailed in the following subsections:

- Environment Management Plan (EMP)
- Monitoring Action Plan (Environment)

## Environment Management Plan

The Environment management plan lists out the mitigation measures and management strategies for construction and operation phases of the proposed project. The proposed mitigation measures have been prepared considering all possible strategies oriented towards effective environmental management including pollution prevention and control, waste minimization and management, and residual attenuation for the proposed project. The environmental impacts and mitigation measures suggested for various environmental components for the construction and operation phase of the project are provided in *Table 9-2* and *Table 9-3*.

**Table 9-2 Environmental Impacts and Mitigation Measures - Construction Phase**

S.No.	Component	Impacts Identified	Suggested Mitigation Measures	Responsibility
1.	<b>Ambient Air Quality</b>	<ul style="list-style-type: none"> <li>Emissions from construction equipments, vehicles</li> <li>Improper handling and storage of construction material</li> <li>Fugitive dust emissions</li> <li>Emissions from onsite operation of diesel generators</li> <li>Burning of waste at camp sites</li> </ul>	<ul style="list-style-type: none"> <li>Suppression of fugitive dust emissions by spraying water, wetting of the stockpile,</li> <li>Dust control equipments such as bag house, or cyclone to be employed.</li> <li>Vehicles with valid Pollution under Control (PUC) certificate to be engaged for project.</li> <li>Contractors to maintain proper records for fleet engaged.</li> <li>Stockpiling of excess fill material.</li> <li>Minimum possible drop height to be maintained while unloading/screening of material.</li> <li>Paved roads to be cleaned regularly and un-paved roads to be stabilized and watered regularly.</li> <li>Power supply for construction will be sourced from existing source of MIDC supply.</li> <li>Generators to be used only as backup source.</li> <li>Diesel generators to be optimally operated and regularly maintained.</li> <li>Appropriate stack height as per the CPCB guidelines to be provided for DG sets.</li> <li>LPG cylinders to be provided in labour canteens and use of fuel wood to be discouraged.</li> <li>High dust generating activities to be avoided in conditions of very high wind.</li> <li>Covers and enclosures to be provided for loose construction material at construction site.</li> <li>Open burning of waste shall not be permitted.</li> <li>Vehicle speed to be restricted to 25 kmph on unpaved roads.</li> <li>Limited vehicular movement to be permitted on disturbed soil.</li> <li>Trucks /dumpers engaged to be covered during off site transportation.</li> <li>Ensure machinery is turned off when not in use.</li> <li>Housekeeping of the area to be maintained by deputing sweepers to remove dirt/debris from the floors/ sites on daily basis.</li> <li>Paint, polishes, building fittings and flooring material etc to be procured carefully to minimize emission of VOCs.</li> <li>Regular driver training programmes to be organized.</li> </ul>	SPV

S.No.	Component	Impacts Identified	Suggested Mitigation Measures	Responsibility
2.	<b>Water Resources and Quality</b>	<ul style="list-style-type: none"> <li>• Change in topography and alteration of drainage pattern</li> <li>• Additional pressure on local water resources due to water requirement for construction work and labor camps</li> <li>• Sediment run off from construction area</li> <li>• Disposal of sewage from construction camps</li> <li>• Contamination of surface and groundwater resources</li> </ul>	<ul style="list-style-type: none"> <li>• Water for construction phase to be sourced from existing sources allocated to MIDC supplemented with authorised tanker supply.</li> <li>• Optimal water conservation measures at camp sites along with adequate awareness programmes to be organized for the workers.</li> <li>• Adequate number of toilets (at least 8-10 toilets per 100 labour) with septic tanks and soak pits arrangements to be provided onsite.</li> <li>• Random disposal of wastewater from labour colonies to be restricted.</li> <li>• Adequate drains and collection sumps to be provided around campsites.</li> <li>• Regular removal of debris from construction site to be practiced.</li> <li>• Secondary containment and bund shall be provided around excavated soil or loose construction material.</li> <li>• Storage area to be kept away from the storm water drain.</li> <li>• Sludge from wastewater treatment systems to be disposed off properly.</li> <li>• Oil and grease containing effluents to be pre-treated before discharge.</li> <li>• Surface contours will be restored in relation to the surroundings of the project area.</li> <li>• Adequate slopes and drainage channels to be provided across project site.</li> <li>• Diversion dykes to channel runoff to be constructed around excavated site.</li> <li>• Storm water to be collected in garland drains around the construction area with silt trap and oil trap prior to disposal into existing sewerage system or stream.</li> <li>• Rainwater harvesting opportunities to be explored and implemented.</li> </ul>	SPV
3.	<b>Ecology</b>	<ul style="list-style-type: none"> <li>• Loss of trees and ground vegetation</li> <li>• Habitat destruction</li> <li>• Adverse impact on wildlife due to noise, vehicle movement, poaching, illumination</li> <li>• Increased turbidity and siltation</li> </ul>	<ul style="list-style-type: none"> <li>• All reserve forest patches have been excluded from the development of proposed Development Plan.</li> <li>• A distance of 2km from the western and the northern boundary of project site to be designated as "Zero Development Zone".</li> <li>• Area around Sukhna reservoir to be preserved in proposed MIP Development Plan;</li> <li>• Original soil profile shall be retained by storing each excavated layers separately and restoring it later.</li> <li>• Tree felling to be minimized to the extent possible. Contractors shall be instructed to practice the same.</li> <li>• Hunting activities will not be permitted within and around the delineated area.</li> </ul>	SPV

S.No.	Component	Impacts Identified	Suggested Mitigation Measures	Responsibility
			<ul style="list-style-type: none"> <li>Only trained personnel from Department of Forest and Wildlife Warden's office to be intimidated in case of any wildlife rescue emergency.</li> <li>Raw materials and debris to be stored away from water bodies, streams and run off areas.</li> <li>A 'Local Ecological Monitoring Group' will be setup to monitor the environmental and ecological safeguard measures during construction phase.</li> <li>Standard noise levels to be maintained during construction activities.</li> </ul>	
4.	<b>Landscape and Topography</b>	<ul style="list-style-type: none"> <li>Change in existing land use from agricultural to mixed use (including industrial and residential)</li> <li>Change in topography</li> <li>Change in drainage pattern</li> <li>Localized flooding and related health issues due to decreased infiltration</li> </ul>	<ul style="list-style-type: none"> <li>50-100m riparian buffer to be provided around existing water bodies.</li> <li>Greenbelt and green buffers will be developed to improve the landscape.</li> <li>Large open spaces to be provided to ensure adequate recharge and control of runoff.</li> <li>No extra soil to be brought into the site from outside the project boundary for the construction activity.</li> <li>Excavated soil to be used in level raising;</li> <li>The construction contractors shall be instructed not to cut any tree.</li> <li>Land surface contours to be restored in relation to the surroundings.</li> <li>Construction footprint will be well defined and construction work to be carried out within the Project footprints only.</li> <li>Visual intrusion and aesthetics to be considered during the project construction.</li> </ul>	SPV
5.	<b>Ambient Noise Quality</b>	<ul style="list-style-type: none"> <li>Noise due to Construction activities (such as excavation, grading, erecting equipment, piling, etc)</li> <li>Noise due to operation of heavy equipment and machinery</li> <li>Movement of vehicles</li> </ul>	<ul style="list-style-type: none"> <li>Working hours and construction activities to be aligned and works to be prohibited during night hours (22:00 hours through 6:00 hours next day).</li> <li>Contractor to develop and implement noise attenuation plan around construction site.</li> <li>Existing villages and local community to be informed about high noise activities.</li> <li>Adequate planning to avoid high noise activities to be undertaken.</li> <li>Acoustic enclosures, noise barriers to be provided in areas of high noise generating sources.</li> <li>Rubber padding to be provided for vibration control</li> <li>Movement of vehicles during night time to be limited.</li> <li>Regular maintenance of vehicles and repair of equipments.</li> <li>Noise barriers will be provided between the activities and the receptors.</li> <li>Restriction on use of equipments generating high noise during night time.</li> </ul>	SPV

S.No.	Component	Impacts Identified	Suggested Mitigation Measures	Responsibility
			<ul style="list-style-type: none"> <li>Construction workers to use ear muffs in areas with potential for high noise generation.</li> </ul>	
6.	<b>Soil Resources</b>	<ul style="list-style-type: none"> <li>Soil Erosion and compaction</li> <li>Soil contamination</li> </ul>	<ul style="list-style-type: none"> <li>Adequate planning to undertaken so that amount of land disturbed is limited.</li> <li>Dikes, berms, drainage swales or ditches to be provided to divert surface run-off.</li> <li>Site grading and excavation to be undertaken during dry season.</li> <li>Top soil to be preserved and relocated after construction activities.</li> <li>Clearance of vegetative cover to be minimized to the extent possible and redeveloped latter on.</li> <li>Excavated soil to be used/ transported at the earliest for filling low lying areas.</li> <li>Completed earthworks to be sealed and/or re-vegetated at the earliest with the help of landscape expert.</li> <li>Movement and parking of heavy machinery and vehicles to be restricted to identified area.</li> <li>Proper routing and adequate capacity of the storm water run-offs drains to be provided.</li> <li>Adequate measures for collection of storm water shall be undertaken;</li> <li>All stacking and loading areas to be provided with proper garland drains equipped with baffles;</li> <li>All storage facilities to be designed with paved surface, provided with covered shed and adequate containment facility at the construction.</li> <li>Paintbrushes and equipment for water and oil based paints shall be cleaned within a contained area and shall not be allowed to contaminate site soils, watercourses, or drainage systems.</li> <li>All waste to be handled as per applicable regulations.</li> <li>Hazardous waste to be handles and disposed of in accordance with the requirements of hazardous waste management rules 2008.</li> <li>Portable spill containment and cleanup equipment to be made available at construction site and training for use of such equipment to be imparted.</li> <li>Provision of covered bins at camp sites.</li> <li>Waste to be segregated in biodegradable and non-biodegradable fraction.</li> <li>Biodegradable waste to be used for animal feed/ vermi-compost/ manure.</li> <li>Construction waste such as debris, inert material to be crushed and reused for</li> </ul>	SPV

S.No.	Component	Impacts Identified	Suggested Mitigation Measures	Responsibility
			<ul style="list-style-type: none"> <li>onsite level raising and filling.</li> <li>Metal scrap and other recyclables to be sold to authorized vendors.</li> <li>Trainings to be imparted to all workers and subcontractors regarding hazardous waste storage and disposal procedures.</li> <li>On completion of construction activities, septic tanks for camp sites to be abandoned and filled with earth.</li> </ul>	
7.	<b>Traffic and transport</b>	<ul style="list-style-type: none"> <li>Increased traffic volume</li> <li>Damage to existing village roads</li> <li>Disruption of traffic and increased case of road related hazards</li> </ul>	<ul style="list-style-type: none"> <li>SPV to assess the need for strengthening of existing transportation infrastructure.</li> <li>Wherever required temporary widening of roads to be undertaken.</li> <li>Access roads to be completed prior to start of construction activities.</li> <li>Wider and less restrictive roads to be used.</li> <li>Database of project vehicles, and construction equipments to be maintained.</li> <li>Detailed plan for signage around the construction areas to be prepared to facilitate traffic movement.</li> <li>Parking along footpaths, single lane roads shall be prohibited.</li> <li>Dedicated parking area to be provided for project vehicles.</li> <li>Traffic and heavy machinery movement schedule to be communicated clearly to the local inhabitants. Prior consultation with local Police and local Panchayat to be undertaken.</li> <li>Exclusive entry and exit points to be provided at construction site.</li> <li>Roads damaged due to project vehicles will be continuously repaired.</li> <li>Provision of adequate training to drivers.</li> </ul>	SPV
8.	<b>Socio-Economic</b>	<ul style="list-style-type: none"> <li>Land Acquisition</li> <li>Loss of existing village assets</li> <li>Loss of landholdings</li> <li>Impact on livelihood of the villages</li> <li>Loss of livelihood</li> <li>Loss of Common Property Resources</li> </ul>	<ul style="list-style-type: none"> <li>Land to be procured through procedures under the land acquisition act.</li> <li>Compensation for assets to be decided by the district administration.</li> <li>Value of the land to be decided by the district administration after due assessment,</li> <li>Local community to be consulted about their concerns and expectations.</li> <li>Legal title holders to be identified and paid compensation.</li> <li>In case of legal dispute, competent authority to take in-charge of compensation.</li> <li>Affected land losers to be considered for benefits like employment, contracts etc.</li> <li>Compensation for crop damage to be paid to the entitled persons by the competent authority as per the guidelines of the relevant Acts and Legislations.</li> <li>Skilled and qualified entitled persons to be given preference in employment and</li> </ul>	SPV/ MIDC

S.No.	Component	Impacts Identified	Suggested Mitigation Measures	Responsibility
			other contractual benefits; • Procurement of community land to be avoided to the extent possible and adequate buffer area to be retained around villages.	
9.	<b>Employment and Local Economy</b>	<ul style="list-style-type: none"> <li>• Increased employment opportunities</li> <li>• Contracting opportunities for locals</li> <li>• Better avenues for Small scale service providers.</li> </ul>	<ul style="list-style-type: none"> <li>• Project to utilize the facilities available from the local market to support the local economy to the extent possible.</li> <li>• Wherever possible, labour from local community will be employed for project.</li> <li>• Employment opportunities shall consider vulnerable section of the society.</li> </ul>	SPV/MIDC with approval from State Apex Authority
10.	<b>Occupational Health and Safety</b>	<ul style="list-style-type: none"> <li>• Injury due to improper handling, operation and execution</li> <li>• Trip and fall, inadequate fall safe arrangements</li> <li>• Exposure to hazardous substances</li> </ul>	<ul style="list-style-type: none"> <li>• Machines to be kept in good working condition as per IS codes.</li> <li>• Workers exposed to high noise levels to be provided with ear plugs, ear muffs etc.</li> <li>• The construction staff and contractors involved in the construction activities to be trained about the mandatory precaution and safety practices prior to commencement of construction activity.</li> <li>• Construction contractors are required to ensure necessary safety measures to be taken up before and during the construction activities for all electrical driven machinery.</li> <li>• Usage of high speed diesel needs to be provided with proper storage in covered area, away from welding or other construction activities.</li> <li>• Fencing to be provided around construction area to restrict public access.</li> <li>• Use of Personal Protection Equipment (PPEs) to be mandated at work site.</li> <li>• Workers to be provided with health and safety training.</li> <li>• Measures such as job rotations and stretch breaks to be adopted.</li> <li>• Use of temporary fall protection measures in scaffolds and out edges of elevated work surfaces, such as hand rails and toe boards to prevent materials from being dislodged shall be done.</li> <li>• Safety harness to be ensured for workers while working at heights.</li> <li>• Good housekeeping practices to be exercised.</li> <li>• Proper signage to be provided around construction site.</li> <li>• All excavation activities to be conducted in supervision of the site contractor.</li> <li>• First aid and essential medical services to be provided at site.</li> <li>• Storage of explosives and blasting activities to be undertaken as per the</li> </ul>	SPV

S.No.	Component	Impacts Identified	Suggested Mitigation Measures	Responsibility
			requirements of PESO and established good practices.	

**Table 9-3 Environmental Impacts and Mitigation Measures - Operation Phase**

Sl.No.	Component	Impacts Identified	Suggested Mitigation Measures	Responsibility
1.	<b>Air Quality</b>	<ul style="list-style-type: none"> <li>Emission from power backup/ DG sets</li> <li>Stack emission from industries</li> <li>Fugitive emission from industrial processes</li> <li>Emissions from increase in traffic volume</li> </ul>	<ul style="list-style-type: none"> <li>Residential areas have been separated from industries by the provision of suitable buffers.</li> <li>The green category industries have been located along the periphery of industrial area near industrial workers housing to act as an additional buffer for the polluting industries.</li> <li>Adequate buffer area to be delineated around existing villages.</li> <li>Vegetative barrier of 50-100m to be provided around planned industrial area.</li> <li>All red category industries have been located downwind of the residential area to minimize any impact of air emission.</li> <li>Individual industries will be required to obtain adequate approvals such as Consent to Establish/Consent to Operate or environment clearance from MPCB/SEIAA/MoEFCC.</li> <li>All emission sources to be provided with adequate stack height as per CPCB / MoEFCC norms.</li> <li>Low emission fuels to be used in all combustion systems.</li> <li>Manufacturing operations to be run as a closed system.</li> <li>Chemical recovery system to be installed at all plants.</li> <li>MIDC to ensure adequate stack heights and undertake continuous monitoring of stacks.</li> <li>Nitrogen oxide (NOx) emissions to be reduced by using low-NOx burners and optimization of fuel usage.</li> <li>All vehicles and equipments to be regularly maintained.</li> <li>DG sets to be located in the downwind direction with respect to residential areas.</li> <li>MIDC and MPCB to organize seminars for industries about best practices for controlling air pollution.</li> <li>SPV developed for overview of power supply shall ensure that the power failure is maintained at minimal.</li> <li>Public transport in the MIP to be CNG/LPG based.</li> </ul>	SPV/ MIDC

Sl.No.	Component	Impacts Identified	Suggested Mitigation Measures	Responsibility
			<ul style="list-style-type: none"> <li>The SPV shall establish a Transport Authority for the region and the authority to ensure infrastructure for pollution checking.</li> </ul>	
2.	<b>Water Resources and Quality</b>	<ul style="list-style-type: none"> <li>Increase load on fresh water sources</li> <li>Unplanned disposal of industrial waste water generated and sewage</li> <li>Inadequate management of storm water</li> <li>Spills, leaks from industries, storage areas</li> <li>Contamination of natural water resources and ground water aquifers</li> </ul>	<ul style="list-style-type: none"> <li>Water requirements to be met through allocation from Jayakwadi reservoir</li> <li>Treated wastewater to be reused for meeting non potable water requirements;</li> <li>Minimum extraction of groundwater;</li> <li>Individual projects will have separate water meters and two inlet sources for use of treated wastewater;</li> <li>Building and plumbing code to provide for restrictions on the use of fresh water for non potable purposes;</li> <li>Online monitoring system to be implemented for monitoring leakages in the water conveyance system;</li> <li>Rain water harvesting to be carried out by each individual project;</li> <li>The existing canal infrastructure shall be retained and the irrigation water shall not be diverted for any other activity;</li> <li>Domestic and industrial wastewater generated will be treated separately;</li> <li>Industries to provide treatment to trade effluents to treat it to the specified quality permitted for the common effluent treatment plants</li> <li>Proper storm water drainage network designed for 100 year flood period</li> </ul>	SPV/ MIDC
3.	<b>Ecology</b>	<ul style="list-style-type: none"> <li>Vast areas designated as reserved forests in the north of delineated boundary and few patches on the western fringe of the project boundary.</li> <li>Impact on flora and fauna of the adjoining green areas including reserve forest</li> <li>Illegal hunting and cutting of trees.</li> <li>Bird kill</li> <li>Habitat fragmentation and loss</li> </ul>	<ul style="list-style-type: none"> <li>Degraded hillsides towards the centre and north of the development area recommended to be reforested as part of the proposed MIP Development Plan. These areas, may be labeled as 'Ecological Restoration Zone';</li> <li>The Sukhna reservoir and its catchment areas to be preserved and excluded from any heavy developmental activities;</li> <li>A buffer of 50-100 meters planned around the existing water bodies and streams as riparian buffer zones.</li> <li>A total area of 930 hectares has been designated as open space in the proposed Development Plan.</li> <li>Only native and local species will be chosen for green belt.</li> <li>Each industry shall develop green belt in 33% of the total land area as per the CPCB guidelines;</li> <li>Development around the project area will be regulated and no unauthorised development will be allowed. All migrant workers and local contractors will be</li> </ul>	SPV

Sl.No.	Component	Impacts Identified	Suggested Mitigation Measures	Responsibility
			<p>provided with fuel arrangements at construction campsite to avoid any discrete collection of fuel wood.</p> <ul style="list-style-type: none"> <li>Transmission lines and chimneys will be provided with optical markers to enhance visibility for birds.</li> </ul>	
4.	<b>Ambient Noise Quality</b>	<ul style="list-style-type: none"> <li>Increase in noise levels in residential areas and adjoining villages</li> <li>Impact on avifaunal species due to increased noise</li> <li>Generation of noise due to vehicular movement</li> </ul>	<ul style="list-style-type: none"> <li>All habitations to have a suitable buffer area delineated around them.</li> <li>Vegetative barriers in form of green belt to be provided around all industrial areas.</li> <li>All industrial operations to have acoustic enclosure and employ noise attenuation measures.</li> <li>All roads and highways to be provided with vegetative barriers and barrier walls.</li> </ul>	SPV
5.	<b>Traffic and Transportation</b>	<ul style="list-style-type: none"> <li>Increase in traffic flow</li> <li>Increase in private traffic volume</li> <li>Traffic congestion</li> <li>Irregular Parking</li> </ul>	<ul style="list-style-type: none"> <li>The roads in general to be designed to carry the maximum traffic loads with anticipated future development and on a par with IRC Standards;</li> <li>A well planned public transport infrastructure has been envisaged for the project;</li> <li>Four categories of roads (Major roads (arterial roads) with right of way (ROW) of 90 meters; Primary roads (sub-arterial roads) with ROW of 60 meters; Secondary roads (collector roads) with ROW of 45 meters; Tertiary roads (local roads) with ROW of 30 meters) proposed</li> <li>A bypass road proposed along the south side of the MIP to segregate the external traffic from internal traffic movement.</li> <li>The project will encourage use of public transport; all residential areas will be within 500 meters of planned public transportation;</li> <li>All roads in the Shendra MIP will include designated lanes to encourage cycling and improve the safety of cyclists;</li> <li>The proposed road circulation shall provide for safe and efficient movement of people;</li> <li>Maintenance of systematic spatial and technical database for the roads which would enable regular monitoring and feedback on road conditions thereby managing effective periodic maintenance;</li> <li>Pedestrian Guard Rails, Road safety Signage and overhead signs shall be placed wherever necessary;</li> <li>Road widths and lane configurations to be designed based on the modelling exercise;</li> </ul>	SPV with approval from State Apex Authority

Sl.No.	Component	Impacts Identified	Suggested Mitigation Measures	Responsibility
			<ul style="list-style-type: none"> <li>Comprehensive traffic and travel surveys shall be conducted every 5 years to monitor traffic characteristics and travel behaviour to develop strategies for effective transportation;</li> <li>Each individual project shall develop parking facilities as per the Development Control Regulations.</li> <li>Each residential project to provide parking facilities as per applicable norms and regulations.</li> <li>Intelligent transportation system to be adopted for MIP;</li> <li></li> </ul>	
6.	<b>Solid Waste Disposal</b>	<ul style="list-style-type: none"> <li>Generation of 1685 MTD for the year 2042.</li> <li>Inadequate collection and treatment of domestic waste</li> <li>Unhygienic conditions, odour problem</li> <li>Localized flooding</li> <li>Contamination of soil and groundwater</li> <li>Improper disposal of sludge and industrial waste</li> </ul>	<ul style="list-style-type: none"> <li>An integrated solid waste management facility will be put in place for collection, transport, treatment and disposal of solid waste generated from the residential and industrial activities;</li> <li>Integrated solid waste management will be developed for collection, transportation, treatment and disposal of waste.</li> <li>2 bin system for Phase I for waste collection;</li> <li>The municipal waste will be sent for composting (with landfill) during the Phase I and e industrial waste will be sent for incineration (along with landfill). During phase II part of municipal waste will be sent for Bio-methanation while Plasma Gasification will be installed along with incinerator for Industrial waste. For processing of the total solid waste (both municipal and industrial waste) likely to be generated after Phase II, two units of plasma gasification plants of 350-TPD proposed</li> <li>The waste management process also intends to generate power from bio-methanation, incineration and plasma gasification plants;</li> <li>Industries generating hazardous waste to comply with the requirements of Hazardous Waste (Management, Handling and Tran boundary Movement) Rules, 1989 and subsequent amendments.</li> <li>The recyclable waste like glass, metal, plastics, paper etc likely to be generated from different land uses, will be collected separately and sold to authorized recyclers/ vendors.</li> </ul>	SPV/ MIDC
7.	<b>Land Use Pattern</b>	<ul style="list-style-type: none"> <li>Impact on irrigated agricultural fields</li> <li>Impacts on existing human</li> </ul>	<ul style="list-style-type: none"> <li>During the planning stage, detailed analysis has been undertaken to delineate site for the project and various site alternatives were examined and ranked to select the option based on socio-economic factors.</li> </ul>	SPV/MIDC with approval from State Apex

Sl.No.	Component	Impacts Identified	Suggested Mitigation Measures	Responsibility
		<ul style="list-style-type: none"> <li>settlements</li> <li>Impact on reserved forests lying to the north and western boundary of project, barren land/ hills on western boundary of the site</li> <li>Potential for localized flooding due to alteration of topography</li> </ul>	<ul style="list-style-type: none"> <li>The final project area has excluded the high sensitivity forest area towards northern and eastern fringe from the proposed MIP Development Plan;</li> <li>The land finally delineated avoids existing settlements and proposes to leave and adequate buffer area around them as no development zone.</li> <li>It is planned to retain all key water channels in the project area as natural water bodies;</li> <li>All irrigation channels and check dams of significance will be retained to ensure no impact on the agricultural activities around the delineated project area;</li> <li>To limit the development in the existing settlements, the Urban Planning Department shall define the land use for these regions through the proposed Development Plan of Shendra MIP and limit the densities in these region through the application of the Building bye laws;</li> </ul>	Authority
8.	<b>Socio-Economic</b>	<ul style="list-style-type: none"> <li>Increased employment and business opportunities</li> <li>Improvement in infrastructure</li> <li>Increased income levels</li> <li>Stabilization of the rural economies</li> <li>Potential for cultural conflict</li> <li>Unplanned secondary development in the adjoining areas</li> </ul>	<ul style="list-style-type: none"> <li>DMICDC and individual project to undertake CSR program to ensure communal harmony and cooperation.</li> <li>Area of 10km around the project are will be regulated by DMICDC/MIDC to avoid any secondary development or unplanned development.</li> <li>DMICDC/MIIDC to extend the infrastructure facilities such as water supply, power, transportation etc. to the villages in the project area.</li> <li>Mechanism to train and improve the skill sets of the local community.</li> <li>The project to put in place SPV's responsible for efficient management and maintenance of infrastructure.</li> </ul>	SPV/ MIDC
9.	<b>Cultural Impact</b>	<ul style="list-style-type: none"> <li>Influx of migrant population</li> <li>change of culture and conflicts</li> <li>Impact on archeological monuments</li> </ul>	<ul style="list-style-type: none"> <li>All identified archaeological structures fall outside the delineated project area.</li> <li>DMICDC and individual project to undertake CSR program to ensure communal harmony and cooperation.</li> </ul>	SPV

## 9.2 Environmental Monitoring Plan

This section of the report presents the environmental and social monitoring framework for the Shendra MIP. It is proposed that monitoring of the environmental, social and other aspects related to the project should be undertaken by two mechanisms:

- Internal monitoring mechanism and
- External monitoring mechanism

### **Internal Monitoring:**

The internal monitoring will be conducted by designated project officials and the Environment Management Cell members as per the given monitoring plan. If any specific monitoring conditions are included while granting statutory clearances, the same will have to be carried out through internal monitoring systems. Where ever necessary, consultants could be hired for the monitoring. This monitoring team will be headed by the SPV's representative and will also comprise of the Environment and Public Relations Department's representatives.

### **External Monitoring:**

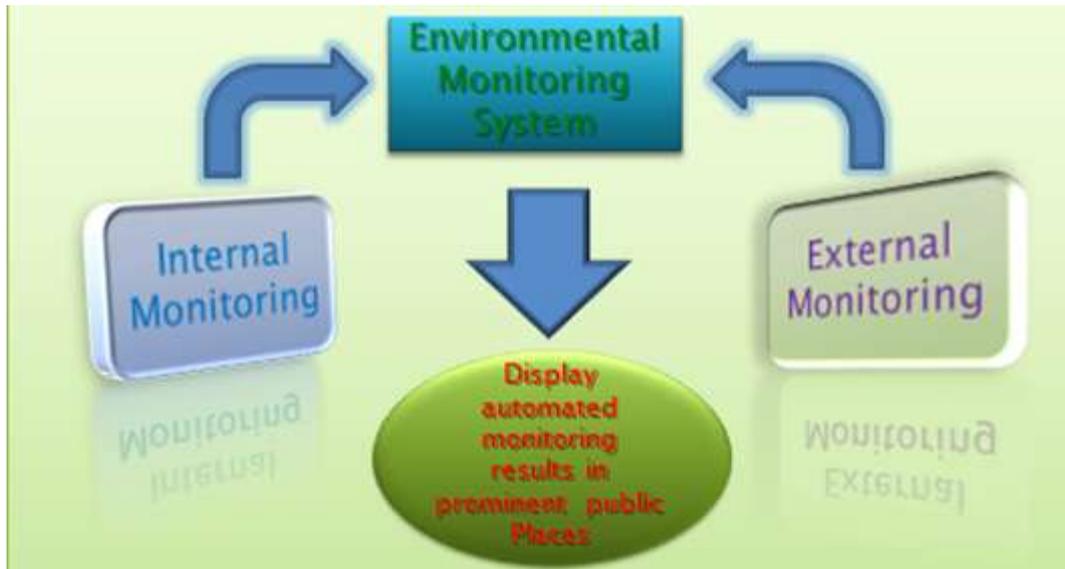
The external monitoring is carried to ensure that the monitoring activities are carried out as per the plan, norms and schedule, in a transparent manner. The external monitoring will be conducted by a group of experts and stake holders consisting of the following:

1. Representatives from the company/DMIC
2. Representative from the Pollution Control Board
3. Industrial associations/ federations
4. Representative from the regional MOEFCC offices
5. Representative from the state forest department
6. Representative of the local stake holder (like Village Pradhan, respected elderly person/college or a school teacher
7. Representative from a local NGO groups

This committee will submit a bi-yearly report to the top management of the company with their review comments and suggestions. Their scope of services will be as below, (though not limited to):

- Study the monitoring (conducted in-house) results and suggests remedial measures if required.
- Ensure the compliance of the conditions imposed by State Pollution Control Board and Ministry of Environment, Forest and Climate Change
- Ensure the adherence to DMIC's Environmental and Social Policy
- Ensure the inclusion of environmental obligations in the contracts awarded to various parties as suggested in the EIA
- Report the progress on the green belt development and compensatory afforestation

- Report the progress on the R&R issues and peripheral development as suggested in the EIA
- Any other environmental and social issues that might be considered necessary to address



The environmental and social monitoring plan is presented in Table 9-4.

**Table 9-4 Environmental and Social Monitoring Plan**

Component	Monitoring Parameters	Frequency	Agency responsible	Public sphere of influence
Land use	<ul style="list-style-type: none"> <li>• Check for unplanned growth in protected areas such as</li> <li>• Forest Areas</li> <li>• Green Buffers</li> <li>• Riparian Buffers</li> <li>• Existing Settlements</li> <li>• Eco Development Zones</li> <li>• Change in land use from approved</li> <li>• Development Plan</li> <li>• Monitor Secondary Development in peripheral areas</li> </ul>	Monthly Review Meetings	SPV	Bi-annual reports to be sent for review to a Public Committee comprising of members from panchayats, industrial associations, Welfare associations, other interested stakeholder groups.
Water Resources	<ul style="list-style-type: none"> <li>• Monitoring of GW levels along with seasonal Fluctuations</li> <li>• Check for unregistered groundwater boring in the area</li> <li>• Monitor the Rain Water Harvesting activities</li> <li>• Conduct water demand assessment study and evaluate water resources availability for the region</li> <li>• Monitoring of water transmission losses</li> <li>• Repair of leakage points in transmission lines</li> </ul>	Once in 10 years  Annually  Once in 10 years  Weekly through online monitoring system	} SPV / CGWB/Mo WR   } SPV	-do-

Component	Monitoring Parameters	Frequency	Agency responsible	Public sphere of influence
Water Quality	Monitor <ul style="list-style-type: none"> <li>• Surface water quality for Sukhna Reservoir – As per CPCB Water Quality Standards</li> <li>• Ground water quality – As per IS:10500 Standards</li> <li>• Water effluent quality for individual projects</li> <li>• Treated water quality from Sewage Treatment Plant/Common Effluent Treatment Plants</li> </ul>	Half Yearly  Half Yearly Pre-monsoon and Post Monsoon Annually  Daily	SPV/ MoWR  SPV / CGWB/MoWR  SPV/MPCB  MPCB/SPV	-do-
Ambient Air	<ul style="list-style-type: none"> <li>• Monitoring of ambient air quality - PM, SO<sub>2</sub>, NO<sub>x</sub>, CO</li> <li>• Stack emission monitoring for individual projects</li> </ul>	Quarterly	SPV/MPCB  MPCB/Individual Projects	Automated daily monitoring to be conducted at representative locations within the industrial area and residential areas and displayed at strategic locations.  Online results to be displayed on automated digital boards .
Traffic	<ul style="list-style-type: none"> <li>• Traffic Count surveys for major road networks to check for adequacy of roads</li> <li>• Adequacy of public parking spaces</li> <li>• Performance monitoring for public transport infrastructure</li> </ul>	Once in 5 years  Once in 2 years  Once in 2 years	SPV	
Forest Resources	<ul style="list-style-type: none"> <li>• Check for illegal felling of trees for fuel wood etc, poaching of animals</li> </ul>	Quarterly	SPV/Forest Department	
Noise	<ul style="list-style-type: none"> <li>• Monitor noise levels</li> </ul>	Monthly	SPV/MPCB	
Social	Monitor <ul style="list-style-type: none"> <li>• Quality of housing provided to PAFs to be relocated;</li> <li>• Entitlement of land/cash</li> <li>• utilization of compensation</li> <li>• Restoration Schemes</li> <li>• cases of LA referred to court, pending and settled</li> <li>• number of grievance cell meetings</li> <li>• number of village level meetings</li> <li>• number of field visits by LAO</li> </ul>	Monthly	SPV with Land Acquisition Officers	

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Component	Monitoring Parameters	Frequency	Agency responsible	Public sphere of influence
	<ul style="list-style-type: none"><li>• number of cases disposed by SDS/PIU</li></ul>			

## 10. Disclosure of EIA Consultants

The following consultants were engaged for preparation of Environment Impact Assessment study of Shendra MIP at district Aurangabad, Maharashtra.

**Table 10-1 List of Approved EC/FAEs**

EC/FAE	Sector/ FA	Expert approved by NABET
EIA Coordinator	Industrial estate (31)	Ajay Pillai
	Township and Area Development (39)	Rashmi Datta
Functional Area Experts	Land Use (LU)	JayaKrishna
	Meteorology, Air Quality Modeling and Prediction (AQ)	Ajay Pillai
	Air Pollution, Monitoring, Prevention and Control (AP)	Navin Handa
	Water Pollution Monitoring, Prevention and Control (WP)	Ritu Paliwal
	Ecology and Biodiversity (EB)	Deepti Parth Bapat
	Socio-economic aspects (SE)	Selva Kumar
	Noise (NV)	Ishita Shah
	Geology (GEO)	C.S. Khokhar
	Soil Conservation (SC)	C.S. Khokhar
	Hydrology, Ground water and Water conservation (HG)	Anup Singh
	Solid and Hazardous waste management (SHW)	Dr. Somnath Mukherjee Nidhi Sharma

## ANNEXURE I

### *Approved Terms of Reference From MoEF*

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- I. *In the 121<sup>st</sup> EAC meeting held on 18<sup>th</sup> -19<sup>th</sup> February 2013, the Expert Appraisal Committee (EAC) for Building/Construction Projects/ Township and Area Development Projects, Coastal Regulation Zone, Infrastructure Development and Miscellaneous projects approved the following TOR:*
- II. **Approved TOR**

As presented by the project proponent, the proposal is for development of Mega Industrial Park in Shendra, Maharashtra. The total area is 1090 ha spread over 3 villages in Aurangabad Tehsils, Aurangabad District. No forest Land is involved. The proposed MIP has Connectivity from SH-178 and NH-211.

The project falls within Category 'A' under 7(c) and 8(b) of EIA Notification, 2006 since it is proposed to accommodate Category "A' & "B" type of industries and residential colony.

**Construction Phase:** The entire MIP at Shendra is proposed to be developed by year 2022. Construction materials will be sourced from authorized quarries in and around the region. Domestic water consumption will be about. 80-320 m<sup>3</sup> /day for each construction camp and source will be MIDC approved private water tankers. Waste water generated about 70-300 m<sup>3</sup> /day for each construction camp will be treated through adequate soak pits and septic tanks will be provided. Power requirement - 1500-2500 KW will be met from DG sets. Construction waste will be used as a filling material for low lying areas and for construction of roads in all three phases. Hazardous waste -waste oil from machines handed over to the authorized recyclers/ agencies.

**Operation Phase:** Total population for the Shendra MIP is estimated to be 45,483 persons by year 2022. Total water consumption is 42 MLD. Source of water will be partially met from the Jayakwadi Dam Reservoir and remaining demand will be met by groundwater with suitable rain water harvesting measures. Waste water generated will be ~22.6 MLD. One STP is proposed for treating domestic waste water and Two WWTPs are proposed in fortreating industrial effluent.

An integrated solid waste management facility will be set up to accommodate these treatment plants (Compost plant, bio-methanation and plasma arc gasification plants are proposed). Hazardous waste: waste oil from machines handed over to the authorized recyclers/agencies. Transport Infrastructure: well-connected transportation system consisting of roads, pedestrian and bicycle paths, public transit, and rail access is proposed.

**During the discussions, the Committee finalized the following TOR for further study:**

- i. *Project boundary does not pass through any eco- sensitive area and within 10 km from eco-sensitive area.*
- ii. *The proponent informed that the proposal does not involve any forests land. Confirmation to this effect shall be submitted.*

- iii. Reasons for selecting the site with details of alternate sites examined/rejected/selected on merits with comparative statement and reason/basis for selection. The examination should justify site suitability in terms of environmental damages, resources sustainability associated with selected site as compared to rejected sites. The analysis should include parameters considered along with weightage criteria for short-listing selected site.*
- iv. Submit the details of the trees to be felled for the project.*
- v. Submit the details of the infrastructure to be developed.*
- vi. Submit the details of the road/rail connectivity along with the likely impacts and mitigative measures*
- vii. Submit the present land use and permission required for any conversion such as forest, agriculture etc.*
- viii. Submit details regarding R&R involved in the project*
- ix. Zoning of the area in terms of 'type of industries' coming-up in the industrial park based on the resource requirement.*
- x. Submit the details of Water management studies*
- xi. The project boundary area and study area for which the base line data is generated – submit through a suitable map. Justification of the parameters, frequency and locations shall be discussed in the EIA.*
- xii. Submit Legal frame work for the implementation of Environmental Clearance conditions - to be clearly spelt out in the EIA report.*
- xiii. Submit Roles and responsibility of the DMIC/developer etc for compliance of environmental regulations under the provisions of EP Act.*
- xiv. Site justification of the identified industry sectors from environmental angle and the details of the studies conducted if any.*
- xv. Ground water classification as per the Central Ground Water Authority.*
- xvi. Adequate buffers to separate industries to be located away from one another and from residential neighbourhoods – Specific details like buffer distance and this will be enforced with role and responsibilities, the act provisions shall be submitted.*

Public hearing to be conducted for the project as per provisions of Environmental Impact Assessment Notification, 2006 and the issues raised by the public should be addressed in the Environmental Management Plan.

A detailed draft EIA/EMP report should be prepared as per the above additional TOR and should be submitted to the Ministry as per the Notification.

## ANNEXURE II

### Scoring for Alternatives for Shendra MIP

Table 10-2 Scores for Alternative 1

Village Name	Connectivity					Water Resources				Physical and Topography			Socio Economic			Environmental Sensitivity			Total
	Road Connectivity	Proximity to DFC	Rail Connectivity	Proximity to Airport	TOTAL	Ground Water Depth	Rainfall	Proximity to surface water	TOTAL	Slope	Land Use/Land Cover	TOTAL	Population Density	Irrigation Density	TOTAL	Distance from Water Body	Eco sensitive area (within 5 km)	TOTAL	
Apatgaon	10	5	3	10	70	6	10	7	77	10	1	55	10	7	85	1	10	55	67
Bhalgaon	3	5	3	10	53	6	10	7	77	10	1	55	10	7	85	1	10	55	65
Chitegaon	10	5	3	8	65	6	10	7	77	10	8	90	7	7	70	3	10	65	75
Garkheda	8	5	5	5	58	6	10	7	77	10	1	55	7	10	85	3	10	65	68
Hivra	10	5	8	8	78	6	10	7	77	10	1	55	10	5	75	3	5	40	62
Jadgaon	8	5	8	8	73	6	10	7	77	10	1	55	7	5	60	1	5	30	56
Kadarbad	10	5	1	5	53	6	10	7	77	10	8	90	7	7	70	5	10	75	76
Karmad	10	5	10	8	83	6	10	7	77	10	8	90	7	5	60	1	5	30	66
Kumbhepal	10	5	5	10	75	6	10	7	77	10	1	55	7	10	85	3	5	40	64
Ladgaon	10	5	8	8	78	6	10	7	77	10	8	90	10	5	75	1	5	30	68
Pimpalgaon Chite	10	5	1	8	60	6	10	7	77	10	1	55	10	7	85	1	10	55	66
Pimpalgaon Pandhari	10	5	1	10	65	6	10	7	77	10	8	90	10	7	85	1	10	55	75
Shendra Kamangar	5	5	5	10	63	6	10	3	63	10	1	55	7	5	60	5	5	50	57
Shendraban	5	5	5	8	58	6	10	3	63	10	1	55	10	7	85	5	5	50	62
Tongaon	10	5	8	8	78	6	10	7	77	10	1	55	7	5	60	1	5	30	56

Village Name	Connectivity					Water Resources				Physical and Topography			Socio Economic			Environmental Sensitivity			Total
	Road Connectivity	Proximity to DFC	Rail Connectivity	Proximity to Airport	TOTAL	Ground Water Depth	Rainfall	Proximity to surface water	TOTAL	Slope	Land Use/Land Cover	TOTAL	Population Density	Irrigation Density	TOTAL	Distance from Water Body	Eco sensitive area (within 5 km)	TOTAL	
Warud	8	5	8	10	78	6	10	3	63	10	1	55	7	7	70	10	5	75	67
Kachhighati	5	5	5	10	63	6	10	3	63	1	1	10	10	10	100	10	5	75	60
Pirwadi	3	5	3	8	48	6	10	3	63	1	1	10	10	10	100	10	5	75	59
Warzadi	3	5	3	8	48	6	10	3	63	1	1	10	10	5	75	3	5	40	45
Wadkha	3	5	3	8	48	6	10	3	63	1	1	10	10	10	100	3	5	40	50
Georai	1	5	1	5	30	6	10	3	63	1	1	10	7	5	60	1	5	30	38
Georai Kubali	3	5	3	5	40	6	10	3	63	10	1	55	10	10	100	1	5	30	58
Bangaon	5	5	5	5	50	6	10	3	63	10	1	55	10	7	85	1	5	30	56
Dudhad	8	5	8	5	65	6	10	3	63	10	1	55	10	7	85	1	5	30	57
Lakhatpati	1	5	1	5	30	6	10	3	63	1	1	10	10	10	100	1	5	30	46
Bhambarda	8	5	8	5	65	6	10	3	63	10	1	55	7	5	60	1	5	30	52
<b>Total Score</b>					<b>60</b>				<b>70</b>			<b>51</b>			<b>79</b>			<b>47</b>	<b>60</b>

Table 10-3 Scores for Alternative 2

Village Name	Connectivity					Water Resources				Physical and Topography			Socio Economic			Environmental Sensitivity			Total
	Road Connectivity	Proximity to DFC	Rail Connectivity	Proximity to Airport	TOTAL	Ground Water Depth	Rainfall	Proximity to surface water	TOTAL	Slope	Land Use/Land Cover	TOTAL	Population Density	Irrigation Density	TOTAL	Distance from Water Body	Eco sensitive area (within 5 km)	TOTAL	
Apatgaon	10	5	3	10	70	6	10	7	77	10	1	55	10	7	85	1	10	55	67
Bangla Tanda	10	5	1	5	53	3	3	10	53	10	8	90	10	10	100	8	10	90	81
Banni Tanda	8	5	1	5	48	3	3	10	53	10	8	90	7	7	70	5	10	75	71
Bembalwadi	8	5	1	8	55	6	10	10	87	10	8	90	7	10	85	5	10	75	81
Bhalgaon	3	5	3	10	53	6	10	7	77	10	1	55	10	7	85	1	10	55	65
Bidkin	10	5	1	5	53	3	3	10	53	10	8	90	7	10	85	10	10	100	80
Chincholi	5	5	1	8	48	3	3	10	53	10	1	55	10	10	100	3	10	65	65
Chitegaon	10	5	3	8	65	6	10	7	77	10	8	90	7	7	70	3	10	65	75
Gadiwat	1	5	1	8	38	6	10	10	87	1	9	50	10	10	100	1	5	30	61
Gadiwat Tanda	1	5	1	8	38	6	10	10	87	1	8	45	10	10	100	1	5	30	60
Ghardon	1	5	1	8	38	6	10	10	87	10	8	90	10	1	55	1	5	30	62
Ghardon Tanda	1	5	1	8	38	6	10	10	87	10	9	95	10	1	55	3	5	40	66
Jambhili	3	5	1	8	43	3	3	10	53	10	8	90	10	10	100	3	5	40	67
Kadarbad	10	5	1	5	53	6	10	7	77	10	8	90	7	7	70	5	10	75	76
Khodegaon	5	5	1	8	48	6	10	10	87	10	9	95	10	10	100	5	10	75	85
Laygaon	8	5	1	8	55	6	10	7	77	10	10	100	10	10	100	5	10	75	85
Maharban Naiktanda	5	5	1	8	48	3	3	10	53	5	9	70	10	10	100	3	5	40	63
Nandalgaon	10	5	1	2	45	3	3	10	53	10	4	70	10	10	100	8	10	90	75
Niljagaon	3	5	1	5	35	3	3	10	53	10	1	55	10	10	100	1	5	30	55
Pachod	10	5	3	10	70	6	10	7	77	10	8	90	7	7	70	5	10	75	78

Village Name	Connectivity					Water Resources				Physical and Topography			Socio Economic			Environmental Sensitivity			Total
	Road Connectivity	Proximity to DFC	Rail Connectivity	Proximity to Airport	TOTAL	Ground Water Depth	Rainfall	Proximity to surface water	TOTAL	Slope	Land Use/Land Cover	TOTAL	Population Density	Irrigation Density	TOTAL	Distance from Water Body	Eco sensitive area (within 5 km)	TOTAL	
Padali	3	5	1	5	35	3	3	10	53	10	8	90	10	10	100	1	10	55	70
Pimpalgaon Chite	10	5	1	8	60	6	10	7	77	10	1	55	10	7	85	1	10	55	66
Pimpalgaon Pandhari	10	5	1	10	65	6	10	7	77	10	8	90	10	7	85	1	10	55	75
Dhorkingaon	10	5	1	1	43	3	3	10	53	10	1	55	7	10	85	1	1	10	48
Shekta	5	5	1	2	33	3	3	10	53	10	1	55	7	7	70	1	1	10	44
Chauryahattar Jalgaon	3	5	1	1	25	3	3	10	53	10	4	70	10	10	100	1	1	10	53
Khamjalgaon	3	5	1	1	25	3	3	10	53	10	1	55	10	10	100	1	1	10	49
Kaudgaon	10	5	1	2	45	3	3	10	53	10	1	55	10	10	100	5	10	75	68
Aliyabad	5	5	1	2	33	3	3	10	53	10	4	70	10	10	100	3	1	20	56
Dinnapur	5	5	1	2	33	3	3	10	53	10	1	55	10	10	100	5	1	30	55
Dhupkheda	8	5	1	2	40	3	3	10	53	10	1	55	7	10	85	1	10	55	59
Tondoli	5	5	1	2	33	3	3	10	53	10	4	70	10	10	100	1	1	10	54
Sompuri	8	5	1	2	40	3	3	10	53	10	1	55	7	10	85	5	10	75	64
Jainpur	5	5	1	2	33	3	3	10	53	10	1	55	10	10	100	1	1	10	50
Mohalkheda	5	5	1	2	33	3	3	10	53	10	1	55	10	10	100	1	1	10	50
Shahapur Manegaon	3	5	1	1	25	3	3	10	53	10	1	55	10	7	85	1	1	10	46
Gidhada	5	5	1	1	30	3	3	10	53	10	1	55	10	10	100	1	1	10	50
Takli Paithan	10	5	1	1	43	3	3	10	53	10	1	55	10	10	100	1	1	10	51
Lohgaon Khurd	1	5	1	1	20	3	3	10	53	10	1	55	10	7	85	1	1	10	46
<b>Total Score</b>					<b>43</b>				<b>63</b>			<b>70</b>			<b>90</b>			<b>45</b>	<b>63</b>

Table 10-4 Scores for Alternative 3

Village Name	Connectivity					Water Resources				Physical and Topography			Socio Economic			Environmental Sensitivity			Total
	Road Connectivity	Proximity to DFC	Rail Connectivity	Proximity to Airport	TOTAL	Ground Water Depth	Rainfall	Proximity to surface water	TOTAL	Slope	Land Use/Land Cover	TOTAL	Population Density	Irrigation Density	TOTAL	Distance from Water Body	Eco sensitive area (within 5 km)	TOTAL	
Apatgaon	10	5	3	10	70	6	10	7	77	10	1	55	10	7	85	1	10	55	67
Bangla Tanda	10	5	1	5	53	3	3	10	53	10	8	90	10	10	100	8	10	90	81
Banni Tanda	8	5	1	5	48	3	3	10	53	10	8	90	7	7	70	5	10	75	71
Bembalwadi	8	5	1	8	55	6	10	10	87	10	8	90	7	10	85	5	10	75	81
Bhalgaon	3	5	3	10	53	6	10	7	77	10	1	55	10	7	85	1	10	55	65
Bidkin	10	5	1	5	53	3	3	10	53	10	8	90	7	10	85	10	10	100	80
Chincholi	5	5	1	8	48	3	3	10	53	10	1	55	10	10	100	3	10	65	65
Chitegaon	10	5	3	8	65	6	10	7	77	10	8	90	7	7	70	3	10	65	75
Gadiwat	1	5	1	8	38	6	10	10	87	1	9	50	10	10	100	1	5	30	61
Ghardon	1	5	1	8	38	6	10	10	87	10	8	90	10	1	55	1	5	30	62
Ghardon Tanda	1	5	1	8	38	6	10	10	87	10	9	95	10	1	55	3	5	40	66
Jambhili	3	5	1	8	43	3	3	10	53	10	8	90	10	10	100	3	5	40	67
Kadarbad	10	5	1	5	53	6	10	7	77	10	8	90	7	7	70	5	10	75	76
Karmad	10	5	10	8	83	6	10	7	77	10	8	90	7	5	60	1	5	30	66
Khodegaon	5	5	1	8	48	6	10	10	87	10	9	95	10	10	100	5	10	75	85
Kumbhepal	10	5	5	10	75	6	10	7	77	10	8	90	7	10	85	3	5	40	72
Ladgaon	10	5	8	8	78	6	10	7	77	10	8	90	10	5	75	1	5	30	68
Laygaon	8	5	1	8	55	6	10	7	77	10	10	100	10	10	100	5	10	75	85
Maharban Naiktanda	5	5	1	8	48	3	3	10	53	5	9	70	10	10	100	3	5	40	63
Nandalgaon	10	5	1	2	45	3	3	10	53	10	4	70	10	10	100	8	10	90	75

Village Name	Connectivity					Water Resources				Physical and Topography			Socio Economic			Environmental Sensitivity			Total
	Road Connectivity	Proximity to DFC	Rail Connectivity	Proximity to Airport	TOTAL	Ground Water Depth	Rainfall	Proximity to surface water	TOTAL	Slope	Land Use/Land Cover	TOTAL	Population Density	Irrigation Density	TOTAL	Distance from Water Body	Eco sensitive area (within 5 km)	TOTAL	
Niljagaon	3	5	1	5	35	3	3	10	53	10	1	55	10	10	100	1	5	30	55
Pachod	10	5	3	10	70	6	10	7	77	10	8	90	7	7	70	5	10	75	78
Padali	3	5	1	5	35	3	3	10	53	10	8	90	10	10	100	1	10	55	70
Pimpalgaon Chite	10	5	1	8	60	6	10	7	77	10	1	55	10	7	85	1	10	55	66
Pimpalgaon Pandhari	10	5	1	10	65	6	10	7	77	10	8	90	10	7	85	1	10	55	75
<b>Total Score</b>					<b>54</b>				<b>70</b>			<b>81</b>			<b>85</b>			<b>58</b>	<b>71</b>

## ANNEXURE III

### *Planning Standards and Norms*

S. No.	Facility/ Infrastructure	Population Threshold per Facility
1	Nursery	2,500
2	Primary School	5,000
3	Senior Secondary School	7,500
4	Integrated School with or without hostel facility	100,000
5	College	125,000
6	Dispensary	15,000
7	Nursing home/child welfare/maternity Clinic	45,000
8	Polyclinic with observation beds	50,000
9	Intermediate hospital Category B	100,000
10	Specialty hospital	100,000
11	Religious area	5,000
12	Community room	5,000
13	Community hall and library	15,000
14	Recreational club	100,000
15	Music, dance, drama, and meditation and spiritual center	100,000
16	Petrol Pump	150 hectares in residential area; 40 hectares in industrial area
17	Liquefied petroleum gas godown	50,000
18	Milk distribution (milk, fruit, and vegetable booth)	5,000
19	Police Post	50,000
20	Police Station	90,000
21	District office and battalion	250,000
22	Fire stations	200,000
23	Fire Substation	150,000
24	Post office counter without delivery	15,000
25	Head post office and telegraph office with delivery	250,000
26	Convenience shopping	5,000
27	Local shopping including service center	15,000
28	Community center with service center	100,000
29	Informal markets	100,000
30	Three-wheeler and taxi stand	15,000
31	Bus terminal	100,000
32	Tot lot	250
33	Housing area park/playground	5,000
34	Neighborhood park/play area	10,000
35	Community Park	100,000