



**Telangana State Industrial Infrastructure
Corporation Limited**
(A Govt. of Telangana Undertaking)

Development of NIMZ Near Zaheerabad, Telangana



Draft EIA/EMP Report

December, 2020



QCI, NABET Accredited: L&T Infrastructure Engineering Limited



Undertaking by the Project Proponent

- 1 Telangana State Industrial Infrastructure Corporation Limited (TSIIC) has carried out an Environmental Impact Assessment (EIA/EMP) study for the proposed Development of Zaheerabad National Investment and Manufacturing Zone (NIMZ) in Sangareddy District of Telangana.
- 2 As per MoEF&CC Office Memorandum No.J-11013/41/2006-IA.II (I) dated October 05, 2011, TSIIC herewith declares the ownership of contents (information and data) of this EIA/EMP Report.

For and on behalf of

A handwritten signature in blue ink, appearing to read "VJL".

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Client: **Telangana State Industrial Infrastructure Corporation Limited**
Hyderabad

Project: **Development of NIMZ Near Zaheerabad, Telangana** **Project No.:** **C1171308**

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					Prepared	Checked	Init.	Sign.
						Approved		

Declaration by Experts contributing to the EIA/EMP for Development of NIMZ near Zaheerabad, Telangana

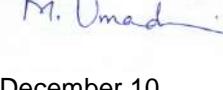
I, hereby, certify that I was a part of the EIA team in the following capacity that developed the above EIA.

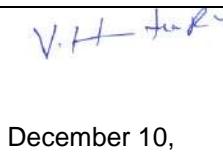
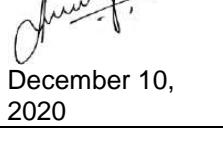
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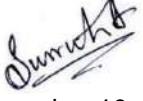
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Functional Area Experts

S. No	Functional Areas	Name of the Expert/s	Involvement (Period & Task)	Signature & Date	
1	AP	B. Ratheesh	Period: 2017-2020 Task: Selected monitoring locations, reviewed baseline ambient air and meteorological data. Identified Red category of industrial sectors. Identified probable emissions and suggested suitable control systems.	 December 10, 2020	
2	WP	B. Ratheesh	Period: 2017-2020 Task: Selected sampling locations. Calculated water requirement and WW generation and water balance. Identified probable impacts of effluent discharge. Suggested appropriate treatment schemes. Framed EMP and calculated the budget.	 December 10, 2020	
		M. Uma Devi	Period: 2019-2020 Task: Identified probable impacts of effluent discharge. Suggested appropriate treatment schemes.	 December 10, 2020	
<u>With Support From:</u>					
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3	SHW	Anshul Sanduja	Period: 2017- September 2019 Task: Identified hazardous and non-hazardous wastes from proposed project. Provided solid waste management.	 September 2019	
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S. No	Functional Areas	Name of the Expert/s	Involvement (Period & Task)	Signature & Date	
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4	SE	Dr. Latha Bhaskar	Period: 2017-2020 Task: Conducted baseline socio economic survey. Identified socio Economic impacts by the proposed project on nearby settlements.	 December 10, 2020	
		Ramu L. Banakar	Period: 2017-2020 Task: SIA and identified the need of economic and social infrastructure in PIA. Estimated the Corporate Environment Responsibility	 December 10, 2020	
		<u>With Support From:</u> Dr. Subramanyam N. V. R. M.(TM)			
5	EB	I.Sivarama Krishna	Period: 2017-November 2019 Task: Conducted primary survey, and prepared status report for rare, endangered and threatened species	 November 2019	
		Hanumantha Rao V Varapu	Period: 2017-2020 Task: Collected secondary data. Analysed the primary surveyed data and suggested species for Green Belt development, Conservation Plan was prepared	 December 10, 2020	
		<u>With Support From:</u> Dr. Subramanyam N. V. R. M.(TM)			
6	HG	C.V. Sundara Rajan	Period: 2017-2020 Task: Reviewed the surface hydrological data. Reviewed storm water drainage plan including management of storm water. Identified ground water potential and also identified watershed areas for surface waters	 October 20, 2020	
		<u>With Support From:</u> • Gorji Navya Tej (TM)			
7	GEO	C.V. Sundara Rajan	Period: 2017-2020 Task: Analysis of geology and geomorphology. Review of maps.	 October 20, 2020	
		<u>With Support From:</u> T.K.S. Sridhar Rajagopalachari (TM)			
8	SC	Hanumantha Rao V Varapu	Period: 2017-2020 Task: Identified sampling locations. Assessment of soil fertility by nutrient availability. Analysis of baseline soil quality data.	 December 10, 2020	
		Reji Baby Varghese	Period: 2017-2020 Task: Reviewed secondary data for soil quality in PIA. Suggested soil management plan.	 December 10, 2020	

S. No	Functional Areas	Name of the Expert/s	Involvement (Period & Task)	Signature & Date	
		<u>With Support From:</u> • M. Uma Devi (TM)			
9	AQ	Susruta Mamidanna	Period: 2017-2020 Task: Review of secondary data on meteorology. Air Quality modelling using AERMOD. Representation of GLCS using isopleths for different scenarios.	 December 10, 2020	
		<u>With Support From:</u> • M. Uma Devi (TM) • Gorji Navya Tej (FAA)			
10	NV*	Rajasekhar Elangovan	Period: 2017-2020 Task: Reviewed the baseline noise monitoring data. Identified probable noise and vibration impacts of the proposed sectors. Representation of same using relevant models. Suggested mitigation measures	 December 10, 2020	
		Reji Baby Varghese	Period: 2017-2020 Task: Selected noise monitoring locations. Identified impacts of noise from proposed industries and suggested control measures.	 December 10, 2020	
		<u>With Support From:</u> • M. Uma Devi (TM)			
11	LU	C.V. Sundara Rajan	Period: 2017-2020 Task: Reviewed the analysis of generated data for land use and review of maps. Identified probable impacts on Land Use by the proposed project.	 October 20, 2020	
		Gorji Navya Tej	Period: 2017-2020 Task: Generated data related to land use pattern. Prepared GIS based maps like land use map. Contribution to EIA documentation.	 December 10, 2020	
12	RH	Susruta Mamidanna	Period: 2017-2020 Task: Identified hazardous processes and risks in proposed sectors. Prepared on-site Emergency preparedness plan & off-site DMP.	 December 10, 2020	

Declaration by the Head of the Accredited Consultant Organization

I, T. K. S. Sridhar Rajagopalachari, hereby, confirm that the above mentioned experts prepared the **EIA/EMP for Development of NIMZ near Zaheerabad, Telangana**. I also confirm that the Consultant Organization shall be fully accountable for any misleading information mentioned in this statement.



Signature:

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Name of the EIA Consultant Organization: L&T Infrastructure Engineering Limited
NABET Certificate Number & Issue Date: NABET/EIA/2023/RA 0175 Dated July 01, 2020.

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LIST OF ACRONYMS

3D	Three Dimensional
AADT	Annual Average Daily Traffic
AAQ	Ambient Air Quality
ACF	Activated Carbon Filter
ACGIH	American Conference of Governmental Industrial Hygienists
ADT	Average Daily Traffic
AFFF	Aqueous Film Forming Foam
AFRF	Alternative Fuel and Resource Facilities
AL	Agricultural Laborers
AMSL	Above Mean Sea Level
AP	Andhra Pradesh
APC	Air Pollution Control
As	Arsenic
ASI	Archaeological Survey of India
ATM	Automated Teller Machine
BaP	Benzo Alpha Pyrene
BAU	Business As Usual
BDL	Bharat Dynamics Limited
BF	Blast Furnace
BHEL	Bharat Heavy Electricals Limited
BHK	Bedroom, Hall & Kitchen
BIS	Bureau of Indian Standards
BOD	Biological Oxygen Demand
BOF	Basic Oxygen Furnace
BPO	Business Process Outsourcing
C&D	Construction and Demolition
CETP	Common Effluent Treatment Plant
CFE	Consent For Establishment
CFO	Consent For Operation
CFU	Colony Forming Unit
CGWB	Central Ground Water Board
Cm	Centimeter
CMP	Conceptual Master Plan
CMSWMF	Common Municipal Solid Waste Management Facility
CN	Cyanide
CO	Carbon Monoxide
CO ₂	Carbon Dioxide
COD	Chemical Oxygen Demand
CPCB	Central Pollution control Board
CPHEEO	Central Public Health and Environmental Engineering Organisation
CSR	Corporate Social Responsibility
Cu	Copper
CVC	Classified Traffic volume counts
dB(A)	Decibels-A weighting
DCP	Dry Chemical Powder
DDMA	District Disaster Management Authority
DG	Diesel Generator
DGM	Deputy General Manager
DGMS	Director General of Mines Safety
DIPP	Department of Industry and Policy Promotion
DLLPC	District Level Land Procurement Committee
DMP	Disaster Management Plan
DO	Dissolved Oxygen
DOP	Diethyl phthalate
DPR	Detailed Project Report
DRDA	District Rural Development Agency

E	East
EAC	Expert Appraisal Committee
EAF	Electric Arc Furnace
EC	Environmental Clearance/Electrical Conductivity
EDTA	Ethylenediaminetetraacetic acid
EHS	Environmental Health and Safety
EIA	Environmental Impact Assessment
EMC	Environmental Management Cell
EMP	Environmental Management Plan
EMS	Environmental Management System
EP	Environmental Protection
EPZ	Export processing zones
ESIA	Environmental and Social Impact Assessment
ETP	Effluent Treatment Plant
F&E	Fire and Explosion
F&EI	Fire and Explosion Index
FDI	Foreign Direct Investment
Fe	Iron
FY	Financial Year
GDP	Gross Domestic Product
GFI	Ground fault interrupter
GIS	Geographical Information System
GM	General Manager
GoI	Government of India
GoTS	Government of Telangana State
GPH	General Process Hazard
GPS	Global Positioning System
GSDP	Gross State Domestic Product
GST	Goods and Service Tax
GVA	Gross Value Addition
GW	Groundwater
Ha	Hectares
HAP	Hazardous Air Pollutant
HAZOP	Hazard and Operability
HDPE	High-Density Poly-Ethylene
HEPA	High Efficiency Particulate Air
HH	House Hold
HVAC	Heating, ventilation and air conditioning
HW	Hazardous Waste
HWMP	Hyderabad Waste Management Plant
ICSC	International Chemical Safety Cards
IDLH	Immediately dangerous to life and health
IE	Industrial Estate
IIDC	IL&FS Infrastructure Development Corporation
IMD	Indian Meteorological Department
INR	Indian Rupee
IP	Industrial Park
IRC	Indian Road Congress
IS	Indian Standard
ISBT	Inter State Bus Terminal
ISO	International Organization for Standardization
IST	Indian Standard Time
IUCN	International Union for Conservation of Nature
IVI	Important Value Index
IWPA	Indian Wildlife Protection Act
KA	Karnataka
KL	Kilo Litres
KLD	Kilo Litres per Day

KMPH	Kilo Meter Per Hour
KSRTC	Karnataka State Road Transport Corporation
KV	Kilo Volts
KVA	Kilo Volt Ampere
kWp	Kilo Watt Peak
L	Litre
LAAR	Land Acquisition, Rehabilitation and Resettlement Act
LCV	Light Commercial Vehicle
LD ₅₀	Median lethal dose
LD _{LO}	Lethal dose low
LDPE	Low-density polyethylene
LEL	Lower Explosive limit
LNTIEL	L&T Infrastructure Engineering Limited
LPCD	Litre per Capita Per Day
LULC	Land Use Land Cover
m	meters
MAV	Multi Axle Vehicles
MD	Managing Director
MF	Material Factor
mg	Milligram
MLD	Million Litres per Day
mm	millimeter
MM5	NCAR Mesoscale Model
MoEF&CC	Ministry of Environment, Forest & Climate Change
MRSS	Main Receiving Substation
MSDS	Material Safety Data Sheet
MSIHC	Manufacture, Storage And Import Of Hazardous Chemical
MSL	Mean Sea Level
MSME	Micro, Small and Medium Enterprises
MSW	Municipal Solid Waste
MT	Metric Ton
MVA	Mega Volt Amp
MW	Megawatt
N	North
NAAQS	National Ambient Air Quality Standards
NABET	National Accreditation Board for Education & Training
NABL	National Accreditation Board for Testing and Calibration Laboratories
NFPA	National Fire Protection Association
NH	National Highway
NH ₃	Ammonia
Ni	Nickel
NIMZ	National Investment Manufacturing Zones
NIOSH	National Institute for Occupational Safety and Health
NMP	National Manufacturing Policy
NO ₂	Nitrogen Dioxide
NO _x	Nitrogen Oxide
NPE	Nonylphenol Ethoxylates
NRSC	National Remote Sensing Centre
NTU	Nephelometric Turbidity Unit
O&G	Oil and Grease
O&M	Operation and Maintenance
O ₃	Ozone
O-D	Origin- Destination
OFM	Ordnance Factory Medak
OHS	Occupational Health & Safety
OHSAS	Occupational Health and Safety Assessment System
OHT	Over Head Tank
ORR	Outer Ring Road

OSHA	Occupational Safety and Health Administration
OT	Others
PA	Protected Areas
Pb	Plumbum (Lead)
PCB	Pollution Control Board
PCU	Passenger Car Unit
PE	Poly-Ethelyne
PFOS	perfluorooctanesulfonate
pH	Hydrogen Ion Concentration
PHC	Primary Health Centre
PIA	Project Influence Area
PM ₁₀	Particulate matter <10 micron size
PM _{2.5}	Particulate matter <2.5 micron size
PPE	Personal Protective Equipment
ppm	Parts Per Million
PSV	Pressure Safety Valve
PUC	Pollution Under Control
PV	Photo Voltaic
PVC	Polyvinyl Chloride
QCI	Quality Council of India
R&D	Research and Development
R&R	Resettlement and Rehabilitation
RAS	Return Activated Sludge
REET	Rare or Endangered or Endemic or Threatened
RF	Reserved Forest
RGIA	Rajiv Gandhi International Airport
ROV	Remotely Operated Vehicle
ROW	Right Of Way
Rs.	Rupees
RTO	Regenerative Thermal Oxidiser
RWH	Rainwater Harvesting
S	South
SA	Social Accountability
SBR	Sequencing batch reactor
SC	Scheduled Caste
SCBA	Self Contained Breathing Apparatus
SCF	Seasonal correction factor
SCR	Southern Central Railway
SDMA	State Disaster Management Authority
SEZ	Special Economic Zones
SH	State Highway
SHG	Self Help Group
SIC	Site Incident Controller
SMC	Site Main Controller
SO ₂	Sulphur Dioxide
SO ₄	Sulphates
SOI	Survey of India
SOP	Standard Operating Procedure
SPCB	State Pollution Control Board
SPM	Suspended Particulate Matter
SPV	Special Purpose Vehicle
SS	Suspended Solids
SSC	Suspended sediment concentration
ST	Scheduled Tribe
STP	Sewage Treatment Plant
SW	Surface Water
TAC	Tariff Advisory Committee
TADF	Technology Acquisition and Development Fund

TDiS	Total Dissolved Inorganic Salts
TDS	Total Dissolved Solids
TI	Toxicity Index
TKN	Total Kjeldahl Nitrogen
TLV	Threshold Limit Value
TMC	Thousand Million Cubic feet
TN	Total Nitrogen
TOC	Total Organic Content
ToR	Terms of Reference
TP	Total Phosphorous
TPD	Tonnes Per Day
TS	Telangana State
TSDF	Treatment Storage & Disposal Facility
TSIIC	Telangana State Industrial Infrastructure Corporation Limited
TSPCB	Telangana Pollution Control Board
TSS	Total Suspended Solids
UF	Ultrafiltration
UNIDO	United Nations Industrial Development Organization
VCA	Vegetable Cleaning Agent
VOC	Volatile Organic Compounds
VRO	Village Revenue Officer
W	West
WLS	Wild Life Sanctuary
WPA	Wildlife Protection Act
WTP	Water Treatment Plant
WW	Wastewater
ZLD	Zero Liquid Discharge
Zn	Zinc

CHAPTER 1

INTRODUCTION

Chapter 1 Introduction

1.1 Preamble

The Indian government's "**Make in India**" initiative is a growth strategy based upon development of economic corridors whereby policy initiatives to spur manufacturing and overall growth are coordinated with transport corridors linking both developed and backward regions. The vision is to create a globally competitive manufacturing sector supported by world class infrastructure, logistics facilities, and a liberal policy regime.

In order to promote manufacturing in India, Government of India (GoI) has announced a National Manufacturing Policy (NMP), 2011, with the objective of enhancing the share of manufacturing in Gross Domestic Product (GDP) to 25% within a decade and creating 100 million jobs by 2022 in the manufacturing sector. The policy is the first of its kind for the manufacturing sector as it addresses areas of regulation, infrastructure, skill development, technology, availability of finance, exit mechanism and other pertinent factors related to the growth of the sector. It also seeks to empower rural youth by imparting necessary skill sets to make them employable as part of its objective to create one (01) million jobs in the same period. Sustainable development is integral to the spirit of the policy and technological value addition in manufacturing has received special focus.

The implementation of the NMP has been taken up in right earnest. The Government of India has made progress in the following areas for implementing the policy in consultation with concerned Government of India agencies and the State Governments:

- Initiating the process of simplification and rationalization of state level business regulations
- Advisory to States on simplification & rationalization of business regulations and skill development;
- Constitution of the approval/monitoring mechanism under the policy;
- Developing Technology Acquisition and Development Fund (TADF) under NMP
- Approval of Planning Commission accorded to the scheme under NMP on Master Planning of NIMZ (National Investment Manufacturing Zones);
- Guidelines for establishment of NIMZ and proforma for final approval of NIMZ circulated to State Governments;
- Definition of Cluster for dispensations under NMP circulated to State Governments;
- Guidelines and dispensations for clusters outside NIMZ under the NMP circulated to State Governments

NIMZs have been conceptualized as important instruments under the Policy to realize the objectives of the Policy. As per the Policy, "NIMZs will be developed as integrated industrial townships with state-of-the art infrastructure and land use on the basis of zoning; clean and energy efficient technology; necessary social infrastructure; skill development facilities etc. to provide a productive environment for persons transitioning from the primary to the secondary and tertiary sectors."

The policy also outlines the creation of National Investment and Manufacturing Zones (NIMZ) with minimum size of 5,000 Hectares as giant industrial Greenfield townships to promote world-class manufacturing activities. The focus sectors would be

- Capital goods industries like machine tools, heavy electrical equipment, heavy transport, earthmoving & mining equipment.

- Employment-intensive industries like textiles and garments, leather and footwear, gems and jewellery and food processing industries.
- Industries with strategic significance like aerospace, shipping, IT hardware & electronics, telecommunication equipment, defence equipment and solar energy.
- Industries where India enjoys a competitive advantage such as automobiles, pharmaceuticals & medical equipment.
- Small & medium enterprises.
- Public sector enterprise

Fourteen NIMZs outside the Delhi Mumbai Industrial Corridor (DMIC) region have been given in-principle approval viz. Nagpur (Maharashtra), Prakasam & Chittoor (Andhra Pradesh), Medak & Hyderabad Pharma NIMZ (Telangana), Tumkur, Kolar, Gulbarga & Bidar (Karnataka), Kalinganagar (Odisha), Thiruvallur & Ramanathapuram (Tamil Nadu), Auraiya & Jhansi (Uttar Pradesh). The NIMZs at Prakasam (Andhra Pradesh) and Medak (Telangana) have been granted final approval by Government of India.

Indian economy has witnessed tremendous growth in the last decade primarily due to the contributions made by the exports. In order to augment the growth of the exports the Government has to setup IPs, SEZs, Industrial Estates (IEs), etc., which would provide a hassle free and internationally competitive environment for companies. The exports have been facilitated by the growth in a number of industries such as chemical industries, pharmaceutical, textiles, engineering industries, etc. The proposed NIMZ would provide infrastructure support and other incentives for the growth of most lucrative businesses in Telangana State.

1.2 NIMZ near Zaheerabad

Telangana State Industrial Infrastructure Corporation Limited (TSIIC) proposed to establish NIMZ at Nyalkal and Jharasangam mandals near Zaheerabad in Sangareddy District of Telangana in an area of ~12,635 acres (Acres 12,635.14 guntas, 5,113 ha) in pursuit of NMP of Department of Industry and Policy Promotion (DIPP) of Government of India. DIPP has in principle approved the establishment of NIMZ near Zaheerabad in January, 2013 and subsequently issued the Final Approval in December, 2015.

TSIIC intends to provide world class eco system for manufacturing industries and proposes to establish infrastructure facilities for the proposed NIMZ. The processing area includes manufacturing zone for different manufacturing industries and service industry selected based on the market and demand assessment study undertaken.

The infrastructure development being proposed includes water supply, water distribution, internal roads, storm water drains, electrical distribution network, internal street lighting, wastewater and waste management facilities, other utilities such as technical and support buildings, housing along with allied facilities. Apart from industrial area there will be technical infrastructure facilities, amenities & utilities, township and logistics facilities.

1.3 Applicable Legal and Policy Framework

The proposed NIMZ and its facilities attract the Environment Impact Assessment (EIA) Notification, 2006 (as amended). The project categorisation as per EIA Notification is provided in **Table 1-1**.

Table 1-1: Project Components and its EIA Study

S. No.	Project	Activity as per schedule of EIA Notification	Category
	Industrial Park/NIMZ	7 (c) Industrial estates/ parks/ complexes/ areas,	Category A

S. No.	Project	Activity as per schedule of EIA Notification	Category
		export processing Zones (EPZs), Special Economic Zones (SEZs), Biotech Parks, Leather Complexes of EIA notification, 2006 (as amended)	

In due respect to the EIA (Environmental Impact Assessment) Notification 2006 (As amended) Industrial Parks (IPs) requires an Environmental Clearance (EC). Considering the area of development about **~12,635 acres** (Acres 12,635.14 guntas, 5,113 ha) and will house both Category A and Category B Industries listed in the EIA Notification, the proposed NIMZ shall be appraised by MoEF&CC. List of rules/regulations as applicable to this proposed development is given below

Applicable Policies & Regulations	Year	Objective	Reason for Applicability
Environmental (Protection) Act	1986	To protect and improve overall environment	Environment in general
Environmental Impact Assessment Notification (as amended)	2006	Re-engineered EIA notification for a more effective Environmental clearance process	Direct
Air (prevention and control of pollution) Act	1981	To control air pollution by controlling emissions according to prescribed standards	Control of Air pollution
Noise Pollution (Regulation and Control) (Amendment) rules	2000 & 2010	Noise pollution regulation and controls	Control of Noise pollution
Hazardous and other Wastes (Management and Transboundary Movement) Rules and Amendment Rules	2016 & 2019	To store/handle hazardous waste and materials as per the provisions of the manufacturer, storage and import of Hazardous Chemical Rules, Hazardous Wastes (Management and Handling) Rules and Amendments	Appropriate handling of Hazardous and other Waste
Water (Prevention and Control of Pollution) Act, amended	1974 & 1988	To control water pollution by controlling emission & Water pollutants as per the prescribed standards	Control of Water pollution
Solid Waste Management Rules	2016	For effective management of Solid waste	Appropriate handling of Solid Waste.
E-Waste (Management) Rules, amended	2016 & 2018	Management as a Consumer	Involvement of information technology and telecommunication equipment, electrical and electronics.
Batteries (Management and Handling) Rules	2001 (amended in 2010)	Consumer to ensure that used batteries are not disposed off in any manner other than depositing with the dealer, manufacturer, importer, assembler, registered recycler, reconditioner or at the designated collection centres.	Appropriate handling of used batteries.
Construction and Demolition Waste Management Rules	2016	Generator shall prima-facie be responsible for collection, segregation of concrete, soil and others and storage of construction and demolition waste generated, as directed or notified by the concerned local authority in consonance with these rules. The generator shall ensure that other waste (such as solid waste) does not get mixed with this waste and is stored and disposed separately.	Appropriate handling of Construction and Demolition waste.

Applicable Policies & Regulations	GoI & Year	Objective	Reason for Applicability
Bio-medical Waste Rules	2016	Management of dispensary/ health centre	Control of pollution due to Bio-medical waste
The Manufacture, Storage and Import of Hazardous Chemical Rules (as amended)	1989 & 2000	To prevent major chemical accidents arising from industrial activities; and to Limit the effects of chemical (industrial) accidents	Handling of Hazardous Chemicals by the member Industries.

1.4 Project Developer

Telangana State Industrial Infrastructure Corporation Limited (TSIIC), a wholly owned subsidiary of Government of Telangana State (GoTS), has a mandate to develop industrial areas across the state. As per the NIMZ guidelines, TSIIC formed a SPV 'Zaheerabad NIMZ Limited' to develop and operate the Zaheerabad NIMZ.

The contact details of authorised person are as follows:

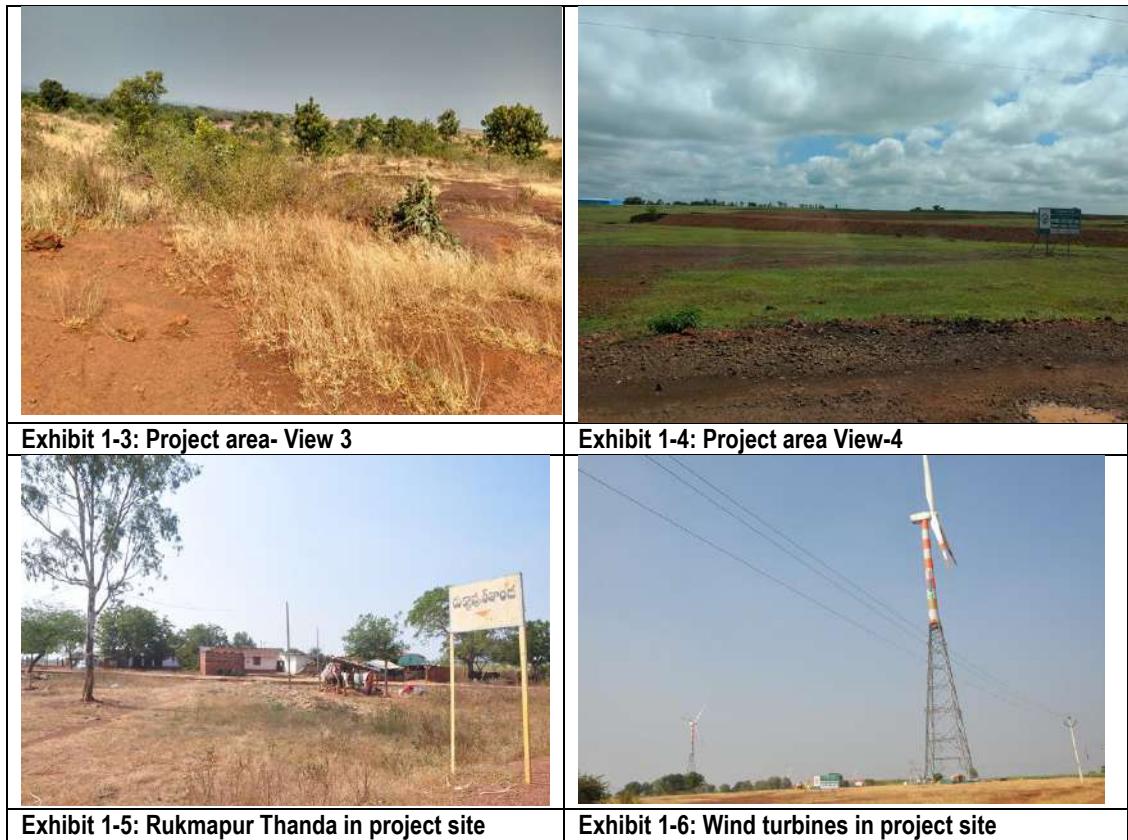
Sri. Shyam Sundar
Chief Engineer
ZAHEERABAD NIMZ LIMITED
(100% subsidiary of TSIIC),
Telangana State Industrial Infrastructure Corporation Limited (TSIIC)
6th Floor, 5958/B, Parishrama Bhavan,
Fateh Maidan Road, Basheerbagh,
Hyderabad – 500004
E-mail: ceo_projects@tsiic.telangana.gov.in/ tsiiicemp@gmail.com

1.5 Project Site

The project site is located in Nyalkal and Jharasangam Mandals of Sangareddy District, Telangana. This Project site falls between Latitude 17°47'24.00"N and Longitude 77°39'1.00"E with almost flat terrain with levels varying from 605m to 660m. The project location map is given as **Figure FD0101**.

The site is located at a distance of about 80 km north west of the state capital, Hyderabad; 65 km to the Hyderabad Outer Ring Road (ORR); 50 km to Sangareddy; and 9 km north of Zaheerabad, a major commercial centre of the district. Bidar City is located 8km northwest of the site. Photos of the project site are shown in **Exhibit 1-1 to Exhibit 1-6**.





1.5.1 Salient Features of Project Site

The project site is having a flat terrain with varying levels. The salient features of project site are given in **Table 1-2**.

Table 1-2: Salient Features of Project Site¹

S. No	Details	Description
1.	Location	Nyalkal & Jharasangam mandals near Zaheerabad
2.	District	Sanga Reddy
3.	State	Telangana
4.	Karnataka State border	Adjacent to project site
5.	Topography	Almost Flat terrain with levels varying from 605m to 660m
6.	Temperature ²	<ul style="list-style-type: none"> Mean Daily Maximum: 32.0⁰ C Mean Daily Minimum: 20.6⁰ C
7.	Wind Speed	<ul style="list-style-type: none"> The predominant wind direction is south-west
8.	Rainfall	<ul style="list-style-type: none"> Annual rainfall: 911.6 mm
9.	Relative Humidity	<ul style="list-style-type: none"> Annual Mean-Morning: 67% Annual Mean-Evening: 52%
10.	Present Land use	The site is mostly comprised of barren and vacant lands. Few pockets of farmlands are also located within the site
11.	Seismicity	Seismic Zone II (Least Active zone) ³
12.	Nearest Road Connectivity	<ul style="list-style-type: none"> SH-14 and SH-16 -passes through site. NH-65 (Pune – Machilipatnam Road) - 10km south

¹ Distances mentioned are from project boundary

² Source for Temperature, Wind Speed, Rainfall and Relative Humidity Data: IMD station, Bidar

³ Project site falls in seismic zone II (Least Active Zone). During the design stage, the effects from natural disasters will be considered as per IS:1893 (Part-1):2002 and necessary precautionary measures would be built-in/ implemented.

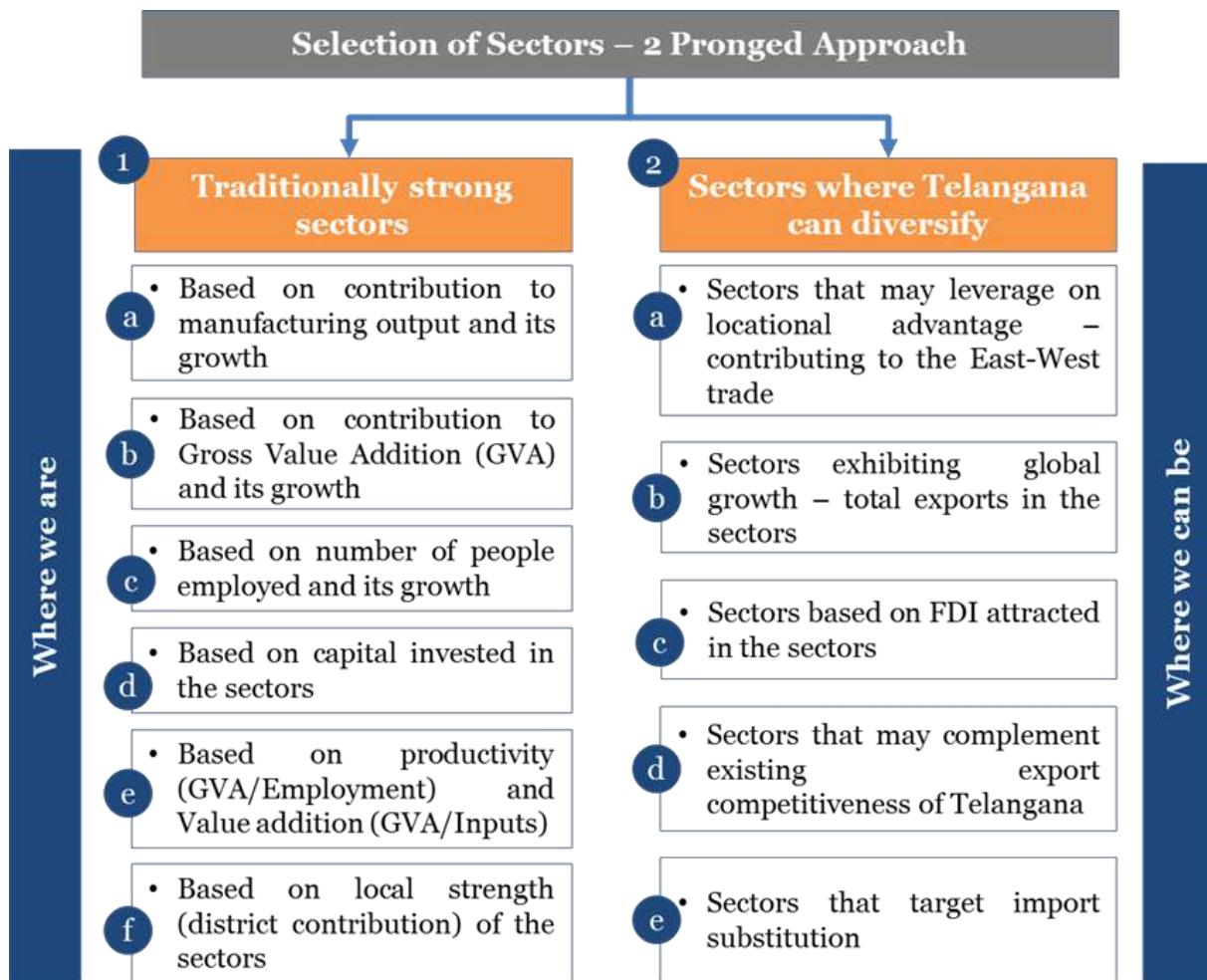
S. No	Details	Description																					
13.	Nearest Rail Connectivity	<ul style="list-style-type: none"> Metalkunta (1.4 km)- railway station Zaheerabad (10 km) railway station 																					
14.	Nearest Seaport	<ul style="list-style-type: none"> JNPT (600 km) on west coast Krishnapatnam Port (465 km) on east coast 																					
15.	Nearest Airport	<ul style="list-style-type: none"> The nearest airport is Rajiv Gandhi International Airport (RGIA) at Shamshabad, Hyderabad. It is located to the southeast of the site at a distance of 125 km by road (105 km aerial distance). Bidar Airport is located at 17 km by road from the NIMZ site and is currently under Indian Air Force Station. 																					
16.	Nearest Town/ Village	<table border="1"> <thead> <tr> <th colspan="3">Nearest villages</th> </tr> </thead> <tbody> <tr> <td>Ganeshpur</td> <td>Hadnoor</td> <td>Gangwar</td> </tr> <tr> <td>Husselli</td> <td>Namtabad</td> <td>Rejinthal</td> </tr> <tr> <td>Ganjoti</td> <td>Mamidgi</td> <td>Malkanpahad</td> </tr> <tr> <td>Mungi</td> <td>Kalbemal</td> <td>Chilepalle</td> </tr> <tr> <td>Rukmapur</td> <td>Basanthpur</td> <td>Yelgoi</td> </tr> <tr> <td>Metalkunta</td> <td>Bardipur</td> <td></td> </tr> </tbody> </table> <ul style="list-style-type: none"> Zaheerabad (TS) - 9 km, S Bidar (KA)- 8 km, NE 	Nearest villages			Ganeshpur	Hadnoor	Gangwar	Husselli	Namtabad	Rejinthal	Ganjoti	Mamidgi	Malkanpahad	Mungi	Kalbemal	Chilepalle	Rukmapur	Basanthpur	Yelgoi	Metalkunta	Bardipur	
Nearest villages																							
Ganeshpur	Hadnoor	Gangwar																					
Husselli	Namtabad	Rejinthal																					
Ganjoti	Mamidgi	Malkanpahad																					
Mungi	Kalbemal	Chilepalle																					
Rukmapur	Basanthpur	Yelgoi																					
Metalkunta	Bardipur																						

1.6 Need/Justification of Project Development

1.6.1 Market and Demand Assessment

1.6.1.1 Methodology for selection of focus sectors & industries

A two-pronged approach has been adopted to shortlist the focus sectors, and subsequently the industries, for NIMZ. The framework for selection of the sectors is shown in **Figure 1-1**.



(Source: Study team analysis)

Figure 1-1: Approach for Selection of Sectors & Industries for NIMZ Zaheerabad

1.6.1.2 Selection of Traditional Sectors & Industries

The traditionally strong sectors of Telangana have been identified based on different parameters relating to the manufacturing ecosystem in the state while also considering the strength of the sectors in Sangareddy district. Local strength, industrial output and value addition have been given more weightage in the analysis to ensure that the sectors with high manufacturing output, with high value addition and in proximity to NIMZ Zaheerabad are reflected in the analysis. Five (05) sectors have been identified as traditionally strong sectors i.e., Electrical Machinery, Metals, Food Processing, Non Metallic Minerals and Pharmaceuticals.

1.6.1.3 Selection of Sun-Rise Sectors

Selection of sunrise sectors has been done based on both global level and national level parameters. For identification of sectors performing well on the global level, global trade (exports) in the sectors is analyzed, along with the identification of top sectors contributing to the East-West trade and ranking the sectors based on FDI attracted at the global level. Additionally, sectors complimenting the existing export competitiveness of India have been listed and ranked. Among all these parameters, it has been ensured that all the sectors contributing to 70% of overall amount are shortlisted. Sectors identified based on this locational advantage along with their contribution to this regional trade and imports include

Electrical Machinery, Machinery, Motor Vehicles, Metals, Electronics and Transport Equipment.

1.6.2 Focus Sectors for NIMZ

Combining the traditionally strong sectors and the sunrise sectors, we get an exhaustive list of 9 focus sectors for Telangana. But considering the fact that TSIIC has already planned for future supply of ~16000 acre in Hyderabad Pharma city for Pharmaceutical sector and similarly 2-3 Electronics manufacturing clusters have been proposed near Hyderabad, which may be sufficient for 15 – 20 years of future demand for the state, the consultant has excluded these two (02) sectors from the list of focus sectors for NIMZ Zaheerabad. The resultant seven (07) final shortlisted sectors are mentioned in **Table 1-3**.

Table 1-3: Final short-listed focus sectors for NIMZ Zaheerabad

Sector	Traditional	Sunrise	Shortlisted
Electrical Machinery	✓	✓	✓
Metals	✓	✓	✓
Food Processing	✓		✓
Non-metallic minerals	✓		✓
Motor Vehicles		✓	✓
Machinery		✓	✓
Transport Equipment (other than automobiles, trailers and semi-trailers)		✓	✓

(Source: PWC Study Team Analysis)

Amongst the sectors shortlisted, sub-sectors (or industries) have been further shortlisted based on the relevance of global scale trade and growth and contribution of the industries to Telangana's manufacturing output. Only those industries have been shortlisted which contribute majorly to the global trade, having shown substantial growth in the last five (05) years and the industries which contribute majorly to Telangana's output in each sector, while also taking into account the location of Telangana, its sources for raw materials required for these industries and destination of the finished good. The industries from the shortlisted sectors are given in **Table 1-4**.

Table 1-4: Final Short-listed Sectors and Industries for NIMZ Zaheerabad

Sector	Industry
Electrical Machinery	Manufacture of electric motors, generators, transformers
	Manufacture of batteries and accumulators
	Manufacture of wiring and wiring devices
Metals	Manufacture of basic iron and steel (ferro alloys, wire of steel by cold drawing, tube and tube fittings etc.)
	Manufacture of basic precious and other non-ferrous metals (includes manufacture of copper from ore, lead etc.)
	Casting of metals (includes manufacture of tubes, pipes and hollow profiles, casting of non-ferrous metals)
Food Processing	Processing and preserving of meat (includes production, processing and preserving of meat and meat products)
	Manufacture of dairy products (includes manufacturing of milk, milk powder, ice cream etc.)
	Manufacture of grain mill products, starches and starch products (includes flour milling, rice milling, milling of other grains)
	Manufacture of other food products (includes manufacture of bakery products, noodles, Processing of edible nuts etc.)
	Manufacture of prepared animal feeds (manufacture of cattle feed, poultry feed, feed for pets etc.)
Non-metallic minerals	Manufacture of non-metallic mineral products (includes manufacture of refractory

Sector	Industry
	products, clay building materials, ceramic products etc.)
Automobiles	Manufacture of motor vehicles (such as manufacturing of Tractors, Buses etc.)
Machinery	Manufacture of general purpose machinery (includes manufacture of hydraulic and pneumatic components, pumps, compressors, taps, valves, lifts, etc.)
	Manufacture of special-purpose machinery (includes manufacture of agriculture implants, machine tools for drilling, milling, industrial machinery etc.)
Transport equipment	Manufacture of Railway locomotives and rolling stock
	Manufacture of Military fighting vehicles

(Source: Master Plan for NIMZ Zaheerabad)

1.6.3 Location Advantage/Justification

The site is located at a distance of about 80 km west of the state capital, Hyderabad; 65 km to the Hyderabad Outer Ring Road (ORR); 50 km to Sangareddy; and 9 km north of Zaheerabad, a major commercial centre of the district. Bidar is located 8 km northwest of the site.

Telangana is rich in labour pool, with large base of skilled labour, making it an ideal destination for knowledge-intensive sectors. The state also has well developed physical infrastructure in the form of Airports and Railway network. The state is now aggressively promoting industrial development.

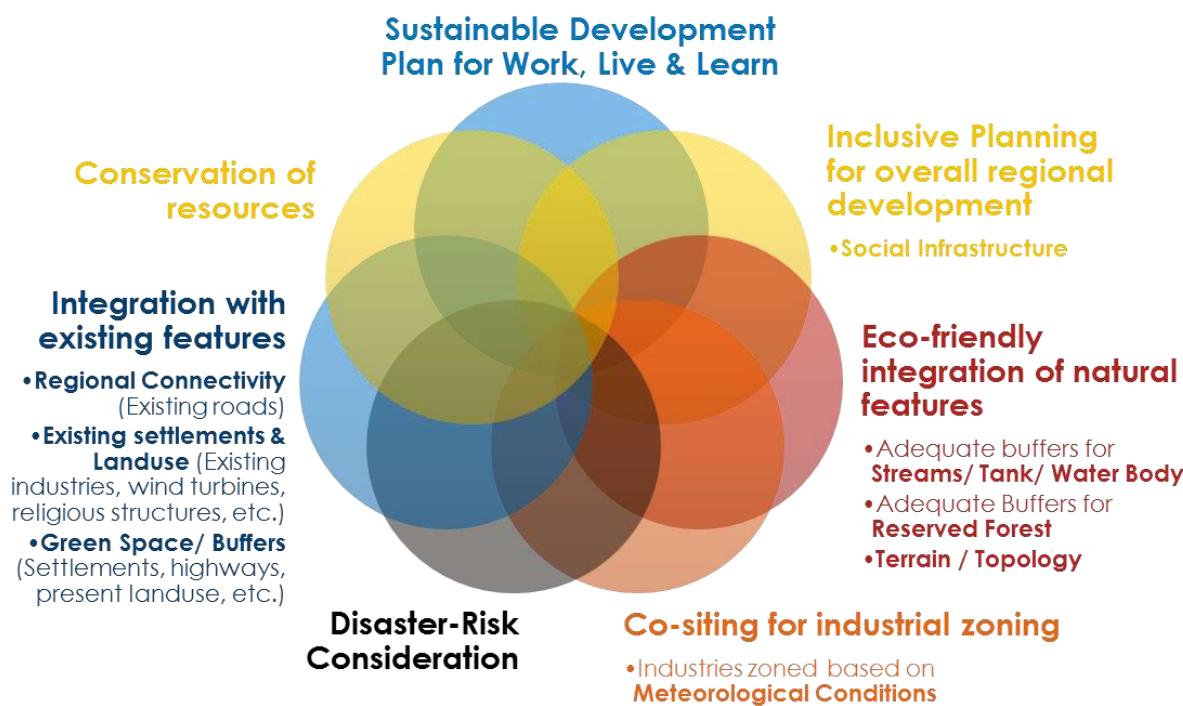
The influence zone also has strong talent pool availability across education segments which will help in catalysing industrialization. There are 25 Special Economic Zones in the state. The influence area is to house few of the major industrial establishments like Mahindra and Mahindra Ltd., MRF Tyres Ltd., Aurobindo Pharma Ltd., Sparsh Pharma Ltd., Cauvery Iron and steel Ltd., BHEL, Ordnance Factory Medak (OFM), Bharath Dynamics Ltd. (BDL), Trident Sugars Ltd., etc. This shows the potential for investment in industrial sector of the region.

A study of the critical and high parameters indicate that Telangana has a very high ranking among various states for attracting investments in the field of manufacturing due to following advantages:

- Relatively lower land cost.
- Power Availability.
- Availability of Engineering and Technical Manpower.
- Proximity to Hyderabad – major end user market.
- Linkage to Supply chains.
- Visionary government with Regulatory Scenario and Policies for manufacturing Industry.

1.7 Project Development Concept

The core principles for evolving the project is based on the overall vision laid out for NIMZs in the NMP, 2011 and on the broad objective of establishing a world class business environment targeted essentially at high growth industrial & infrastructure sectors.



- **Sustainable Development Plan for Work, Live and Learn:** The development of the entire NIMZ is envisaged around the basic principles for having synergy between industries, environment and community. The site master plan is prepared to integrate these aspects – work (industrial zone), live (residential, education, health, recreation, cultural) and learn (training institute, vocational institute, etc.)
- **Inclusive Planning:** The proposed NIMZ is envisaged to be developed not only keeping in mind the population living and working in NIMZ but also the surrounding population. This will be achieved by providing/improving the road links between the surroundings, improvement and provision of social infrastructure, technical infrastructure benefitting the local population, etc. These parameters in a longer run would help in achieving inclusive regional development which would limit migration for better employment from the region.
- **Cluster approach to industrial zoning:** The master plan is prepared based on the eco-industrial concept wherein the industries with similar infrastructure needs or industries with mutual requirements in terms of raw material, effluent generation, product distribution, etc are zoned together. This will result in segment/cluster specific requirements addressed collectively to leverage benefits.
- **Eco-friendly integration of national features and cultural spaces:** Existing site features that are identified to be protected shall be effectively integrated in to the master plan in an environmental-friendly manner.
- **Disaster-Risk Consideration:** The probable risk related to industrial disasters, and the large land spread of the project, multiple evacuation points are planned. The zoning of the non-processing area is planned in upwind direction of processing zone with adequate green buffers and lung space.
- **Conservation of resources/facilities:** Sustainable infrastructure planning, incorporation of eco-friendly concepts and environment sustainability, water conservation schemes, environmental infrastructure, recycling and reuse options etc. are incorporated in the NIMZ development program. NIMZ is planned with water recycling, waste management, rain water harvesting, use of non-renewable energy like solar powered street lights, etc. for efficient use of resources.

NIMZ development plan identifies the constraints and appropriate road network including the approach roads, road congestion removal by augmentation / widening of existing roads is considered.

- **Green Space/Lung Space:** NIMZ is planned with green spaces based on the need of the particular zone. They are planned to be meaningful spaces serving the very purpose and avoiding being unattended spaces.
- **Settlements:** There are few existing settlements within and around the project boundary. Some of them are having access passing through project area. Those existing access have been integrated in master plan. Some portion of existing village road will be retained and some portion will be connected to the nearest arterial road. In one of the option it was provided 200m wide land around perimeter of revenue boundary of settlement whereas in other option we it has been planned as green zone. Access to the settlements is connected to planned road of CMP.

1.8 Environmental and Social Impact Assessment (ESIA)

TSIIC submitted the proposal (Form-1, Draft ToR and Prefeasibility Report) for consideration by Expert Appraisal Committee (EAC), Ministry of Environment, Forest & Climate Change (MoEF&CC). The project was accorded Terms of Reference vide **letter no. F.No.21-237/2017-IA.III dated March 01, 2018** and same is attached as **Appendix A**. Compliance to Standard and Additional ToR is provided as **Appendix B**.

1.9 Approach and Methodology

1.9.1 Project Influence Area (PIA)/Study Area

An area covering 10 km radius from NIMZ boundary has been earmarked as study area for baseline environmental surveys and Impact Assessment respectively. The project study area is falling in states of Telangana (sangareddy district) and Karnataka (Bidar district). The study area map is given as **Figure FD0102**.

1.9.2 Study Period

The baseline environmental survey was carried out during winter season (December, 2017 – February 2018).

1.9.3 Methodology

The EIA study has been carried out considering construction as well as operational phases. In each phase, anticipated impacts due to proposed development on environment and social components have been addressed. The methodology adopted for the study is discussed in the following sections.

1.9.3.1 Project Description

The project development plan covering proposed industrial and infrastructure facilities, development schedule and project cost is discussed in **Chapter 2**.

1.9.3.2 Baseline Environmental Surveys

The baseline environmental status of the study area was established by carrying out the field surveys. In addition, authenticated secondary data was also collected, reviewed and presented. The baseline environmental data was collected within the study area for following attributes.

- Meteorology
- Ambient Air Quality
- Noise Levels
- Water Quality
- Soil
- Ecology (Flora and Fauna)
- Land use and Land Cover Mapping

Site specific hourly meteorological data was generated during the study period. In addition hourly meteorological data (pre-processed from MM5) of the year of 2017 was obtained from Lakes Environment. Ambient air quality monitoring at the identified monitoring locations in the study area was carried out with two samples a week frequency. Hourly noise levels were recorded at identified monitoring locations once during the study period. Inland water quality (surface and groundwater) and soil quality sampling was carried once during the study period at the identified sampling locations in the study area. The baseline environmental surveys were carried out by NABL and MoEF&CC accredited laboratory, M/s. Kiwis Labs, Hyderabad.

Socio-Economic Aspects: Comprehensive socio-economic baseline and social impact assessment was carried out by primary surveys and secondary data collected from Census of India, 2011.

The baseline environmental conditions are described in **Chapter 3**.

1.9.3.3 Anticipated Environmental Impacts and Mitigation Measures

The environmental impacts which are likely to arise due to the proposed development during the construction as well as operational phases have been studied in detail with respect to the facilities/activities being proposed. Further, the impacts have been assessed taking into consideration the existing baseline status of the terrestrial environment. The mitigation measures proposed to minimise/avoid each of the likely impacts are presented in **Chapter 4**.

1.9.3.4 Analysis of Alternatives

To ensure sustainable development under the given conditions, the analysis of alternatives considered for site selection and master plan layout have been discussed in detail and presented in **Chapter 5**.

1.9.3.5 Environmental Monitoring Programme

Environmental Monitoring Programme for construction and operation phases of project has been addressed and presented in **Chapter 6** of this report. The Environmental Monitoring Programme covers the technical and network design of monitoring including measurement methodologies, frequency, location, etc.

1.9.3.6 Additional Studies

Risk Analysis and Broad Disaster Management Plan: Risk analysis covering hazard identification and mitigation measures during handling of hazardous materials were described. Broad Disaster Management Plan was prepared outlining various measures to combat accidents and natural disasters. Also measures to guard against fire hazards have been addressed in **Chapter 7**.

Traffic Studies: Traffic surveys were undertaken to assess the existing traffic on external roads and forecast the traffic from the proposed development on these external roads as well

as internal roads of NIMZ. The traffic survey and forecast carried out at on NH-65 (old NH-9) near Ranjol, on Jharasangam Road near Zaheerabad Rural Police Station, Metalkunta Junction, NH-65 and SH-14 Junction and on SH-14 before Metalkunta Junction of project area is taken to understand the current traffic pattern and forecast projected in future. The traffic thus estimated is assigned on to the road/ rail network and adequacy of the same is evaluated and appropriate transport infrastructure to cater to NIMZ is suggested and presented in **Chapter 7**.

Social Impact Assessment: The likely social impacts associated with the project development during construction and operational phases are detailed out in **Chapter 7**.

1.9.3.7 Project Benefits

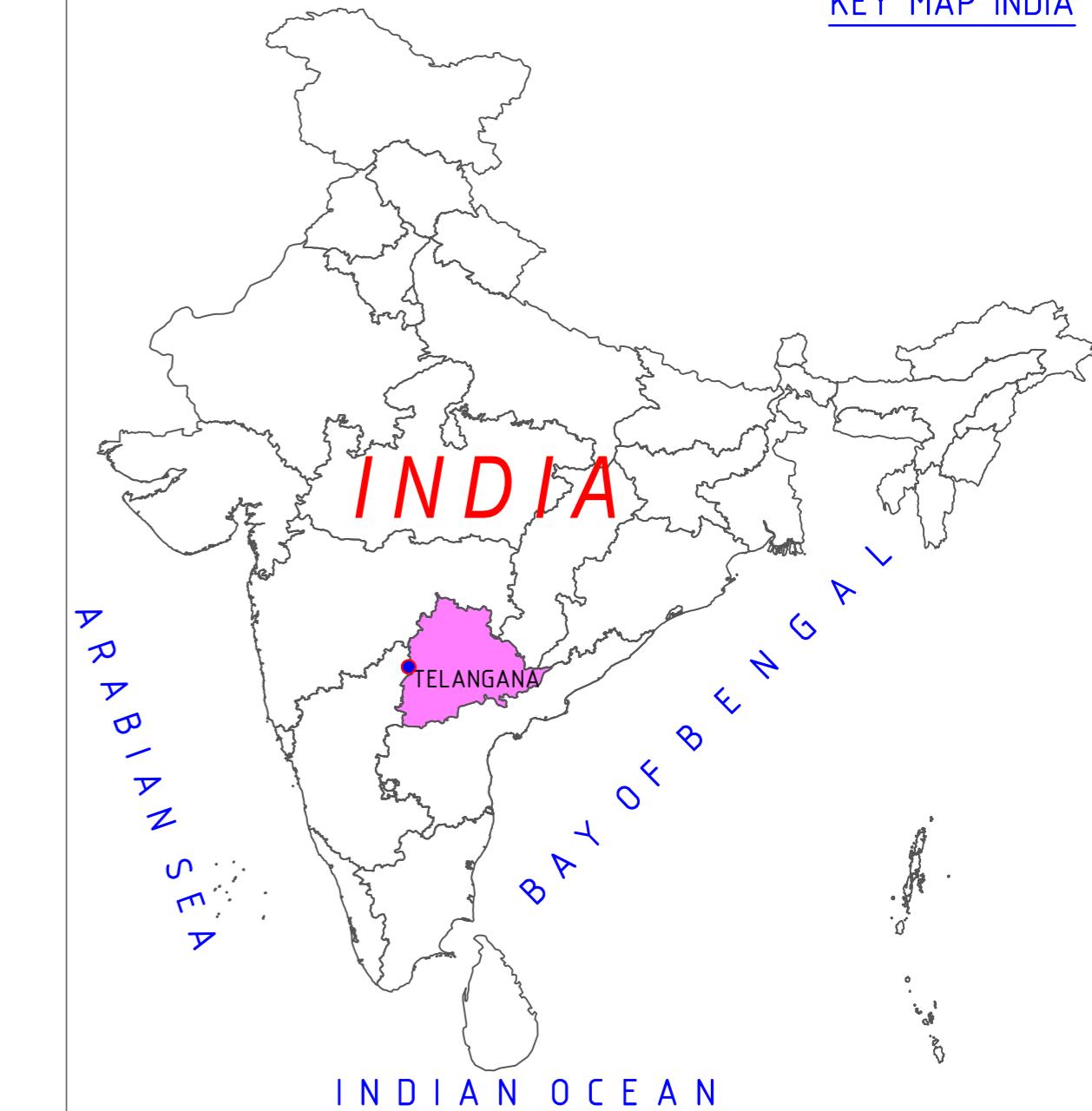
The project benefits in terms of improvements in the physical and social infrastructure, employment potential and other tangible benefits including Corporate Social Responsibility (CSR) are presented in **Chapter 8**.

1.9.3.8 Environmental Management Plan (EMP)

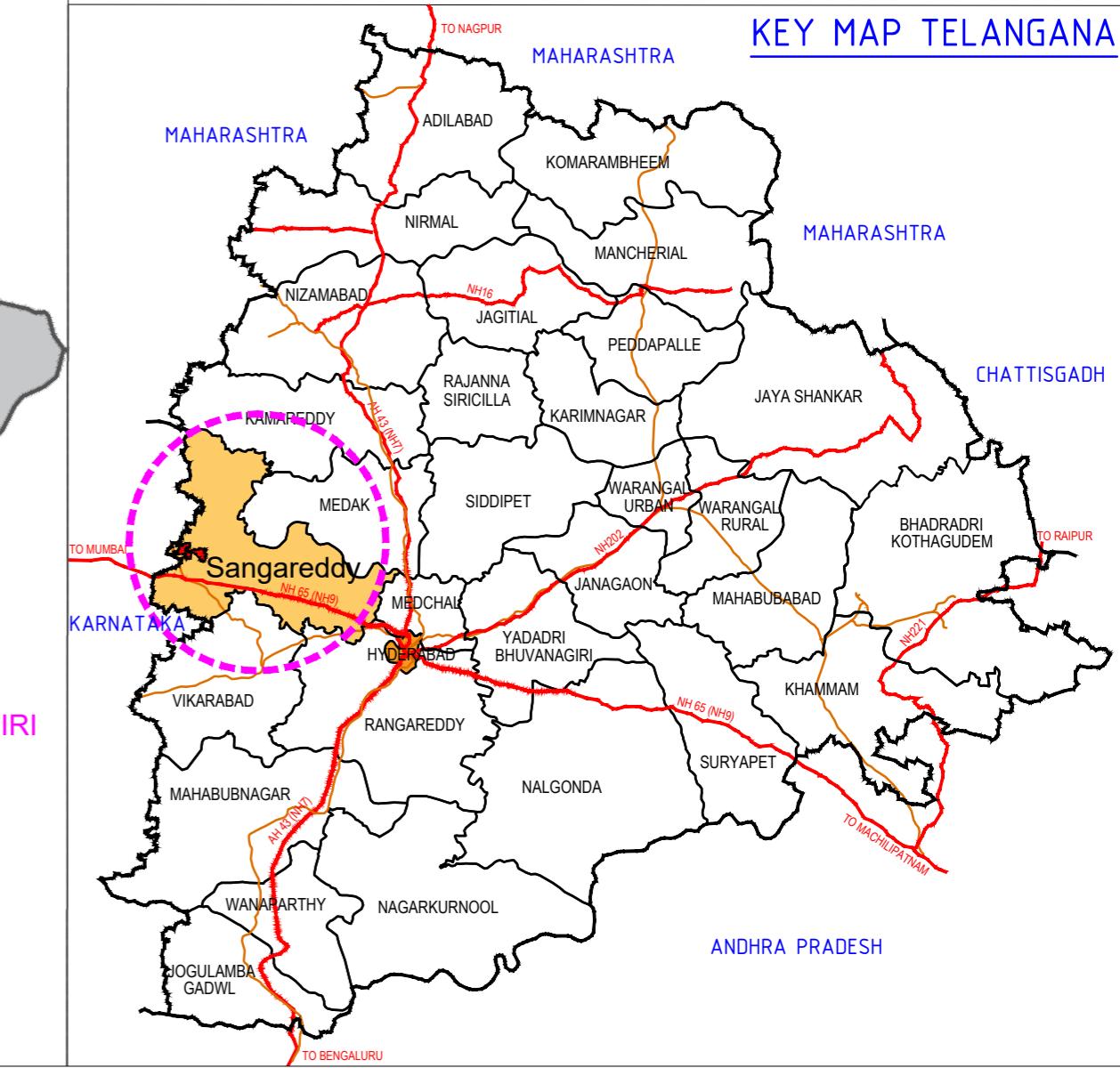
An Environmental Management Plan (EMP) was prepared based on the mitigation measures for the impacts during construction and operation phases and an environmental monitoring programme is proposed. The mitigation measures have been discussed in **Chapter 4** under the respective sections. The Environmental Monitoring Programme has been discussed in **Chapter 6**. The institutional mechanism responsible for the implementation of the mitigation measures, Greenbelt development and budgetary estimates are presented in **Chapter 9**.

FIGURES

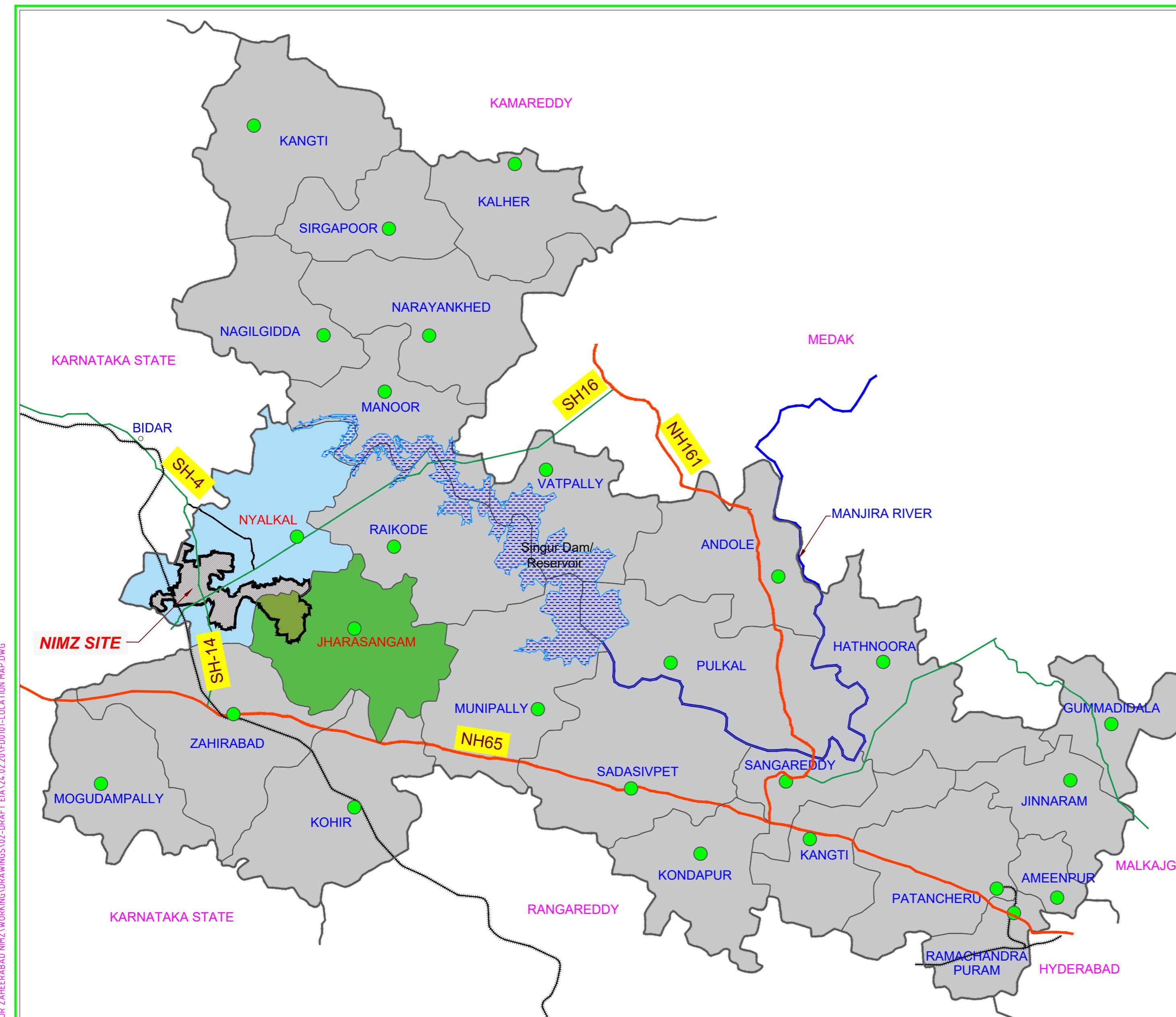
KEY MAP INDIA



KEY MAP TELANGANA



AUTO PATH: L:\PORTS\2017\CH171308 - ESI FOR ZAHEERABAD NIMZ\WORKING DRAWINGS\02-DRAFT EIA\24_02\20\FD0101-LOCATION MAPPING



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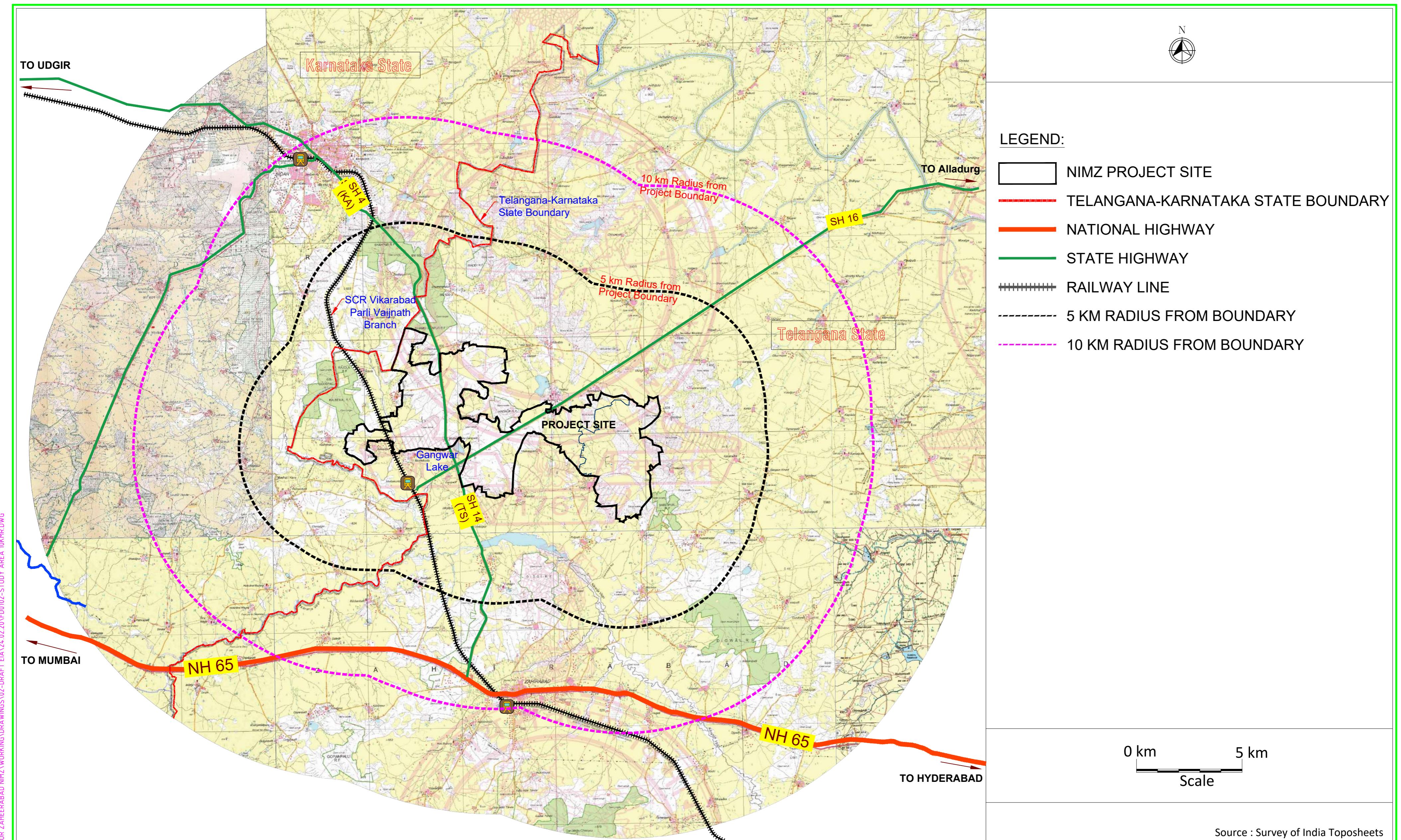
PROJECT: DEVELOPMENT OF NIMZ NEAR ZAHEERABAD,
SANGAREDDY DIST., TELANGANA STATE
PROJECT LOCATION MAP

L&T Infra Engineering

**L&T Infrastructure
Engineering Ltd.**

PROJECT NO:
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DATE: 26/02/2020
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PROJECT: DEVELOPMENT OF NIMZ NEAR ZAHEERABAD,
SANGAREDDY DIST., TELANGANA STATE

PROJECT STUDY AREA MAP

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PROJECT NO:
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CHAPTER 2

PROJECT DESCRIPTION

Chapter 2 Project Description

2.1 General

This chapter describes the salient features of NIMZ-Zaheerabad, its land requirement, details of Master Plan, infrastructure services and facilities planned as per Detailed Master Plan, prepared by L&T Infrastructure Engineering Limited.

2.2 Project Location

The project site is located in Nyalkal and Jharasangam Mandals of Sangareddy District, Telangana. The site is located at a distance of about 80 km North West of the state capital, Hyderabad; 65 km to the Hyderabad Outer Ring Road (ORR); 50 km West of Sangareddy town & 10 km North of Zaheerabad, a major commercial centre of the district. Bidar City is located 10 km North West to the proposed NIMZ site.

Primarily the Project site area comprises of barren and vacant lands with pockets of farmland and settlements. Few existing developments like wind turbines, solar power plant and other factories are part of the project site.

The Project is in the vicinity of large established industrial developments like Mahindra & Mahindra Manufacturing Plant near Zaheerabad, MRF Tyres near Sadasivpet, Automobile ancillary units in and around Zaheerabad. Detailed regional setting map is shown as **Figure FD0201**.

2.3 Project Land

The total extent of NIMZ is ~12,635 acres (Acres 12,635.14 guntas) and category wise land details are presented in table **Table 2-1**.

Table 2-1: Abstract –Distribution of land for NIMZ in Jharasangam & Nyalkal Mandals

S. No.	Name of Mandal	Patta land	Govt. land			Grand Total
			Un-assigned	Assigned	Total	
(In Acres and guntas ⁴)						
1	Nyalkal (14 Villages)	6855.32	710.23	2023.14	2733.37	9589.29
2	Jharasangam (3 villages)	1917.12	106.27	1021.26	1128.13	3045.25
Total		8773.04	817.10	3045.00	3862.10	12635.14
Roundoff						~12635

(Source: TSIIC, Zonal Office)

Around An area of Ac 2,924.38 gts. is under possession of TSIIC, out of which patta/private land is Ac.1311.38 gts of and government land is Ac. 1613. The details of the land under possession are presented in the table **Table 2-2**.

Table 2-2: Details of Land under Possession of TSIIC

S. No.	Name of Mandal	Name of Village	Extent of Patta Land	Extent of Govt. Land (both assigned and unassigned)	Total
				(In Acres and guntas)	
1	Jharasangham	Bardipur	138.38	202.24	341.22
		Chilepally	250.15	161.11	411.26
		Yelgoi	709.06	823.15	1532.21
2	Nyalkal	Rukmapur	109.08	161.36	271.04
		Mungi	104.11	263.34	368.05

⁴ 40 gunta=1 acre (for Eg. 8773.04 is 8773 acres and 04 Guntas)

S. No.	Name of Mandal	Name of Village	Extent of Patta Land	Extent of Govt. Land (both assigned and unassigned)	Total
			(In Acres and guntas)		
	Total		1311.38	1613.00	2924.38

(Source: TSIC)

2.4 Details of Zaheerabad NIMZ Master Plan

2.4.1 Planning Considerations

The aim to develop NIMZ is for developing the industrial scenario in Telangana with an excellent state-of-the art infrastructure facilities and professional management to attract and support investments in industrial and allied sectors. Hence, NIMZ in the form of prepared land is proposed with general and specialized infrastructure facilities. It focuses on development of large, medium and small-scale industries, as also trading and services. All facilities required for target industries are planned.

Thus, the proposed NIMZ will function as an integrated package having the required facilities and service activities with sufficient provision for future growth and expansion.

A careful planning exercise has been done to position the project considering the geographic, demographic, raw material resources, industrial, economic and social characteristics of the region.

Significant considerations are:

Road connectivity: SH16 is aligned parallel to the Project site.

Wind direction: The predominant wind direction is from South-West followed by North-East direction as observed from IMD Climatological tables of nearest station – Bidar.

Existing Land Use: Majority of the Project site falls under barren-scrub land followed by Agriculture land – Crop and Fallow Land Use classification.

Zoning: Industrial zoning planned for mid to small sized plots with few large plots and flexible enough to accommodate large scale industries. Residential zoning planned in Centre of the layout based on the predominant wind direction.

Existing streams: Zoned as green buffers and continues as green corridor with walkways

Existing roads within the Project site: Partly will be retained with strengthening and partly (cart roads) will be terminated after due diversion to closest road.

Existing settlements: Settlements will be retained with green buffers and are aligned with the residential area development within the NIMZ.

2.4.2 Site Master Plan

The layout for NIMZ is prepared based on the planning considerations with primary parameters in siting the various industries being Compatibility, Safety and Environmental safeguards. The detailed Master Plan Layout is given as **Figure FD0202**.

Existing streams/drains within the project site are retained as per the ToR requirement from MoEF&CC. Existing settlements are retained. Conceptual Master Plan is flexible to accommodate any settlement rehabilitation requirement within the NIMZ boundary. Presently the settlements are retained with adequate green buffers around it.

The land use pattern of the NIMZ is determined considering the land requirement for various industrial units, logistics requirements, industrial infrastructures, technical infrastructure

residential zone, various social amenities and commercial spaces etc. Based on the zoning concept, the proposed land use is given in **Table 2-3**.

Table 2-3: Proposed land use for Project Site

S. No.	Land Use	Area (Ac.)	%
1	Industrial Zone	6434.3	50.9
A	Automobile	2718.4	21.5
B	Electrical Equipment	311.8	2.5
C	Transport Equipment	160.5	1.3
D	Food Processing	1410.6	11.2
E	Machinery	501.4	4.0
F	Metals	855.0	6.8
G	Non-metallic mineral	476.6	3.8
2	Logistics Zone	658.4	5.2
A	Rail/Helipad	510.8	4.0
B	Warehousing	66.0	0.5
C	Parking	81.6	0.6
3	Green Zone	1974.4	15.6
A	Green Belt/ Traffic Rotaries	308.4	2.4
B	Green Buffer	1184.1	9.4
C	Green Space/ Open Space	481.9	3.8
4	Residential Zone	771.6	6.1
5	Technical Infrastructure	383.7	3.0
6	Utilities & Amenities	578.9	4.6
7	Commercial Zone	460.7	3.6
A	Retail shopping	210.2	1.7
B	Hospitality	22.5	0.2
C	Service Sector	228.0	1.8
8	Social Zone	92.4	0.7
A	Cultural	14.6	0.1
B	Educational	44.1	0.3
C	Health	33.7	0.3
9	Roads	1280.6	10.1
	Total (Sum of 1 to 9)	12635.0	100

2.4.3 Overall Project Zoning

Zoning for conceptual master plan is carried out based on the spread and shape of the project site, regional linkages, proposed entry exit points, wind directions, terrain and existing features in and around the project site. Zoning has also been done based on the industrial categorization as per CPCB. Non-manufacturing activities are zoned around the existing settlements, water bodies and reserve forest areas. Wherever not possible, only light (Green and White) category of industries are zoned. Orange category of industries is zone next to these industries, while red category of industries is zone away from existing settlements and water bodies. Factors considered for Zoning Plan and representative Zoning plan based on CPCB Categorization are shown in **Figure 2-1** and **Figure 2-2**.

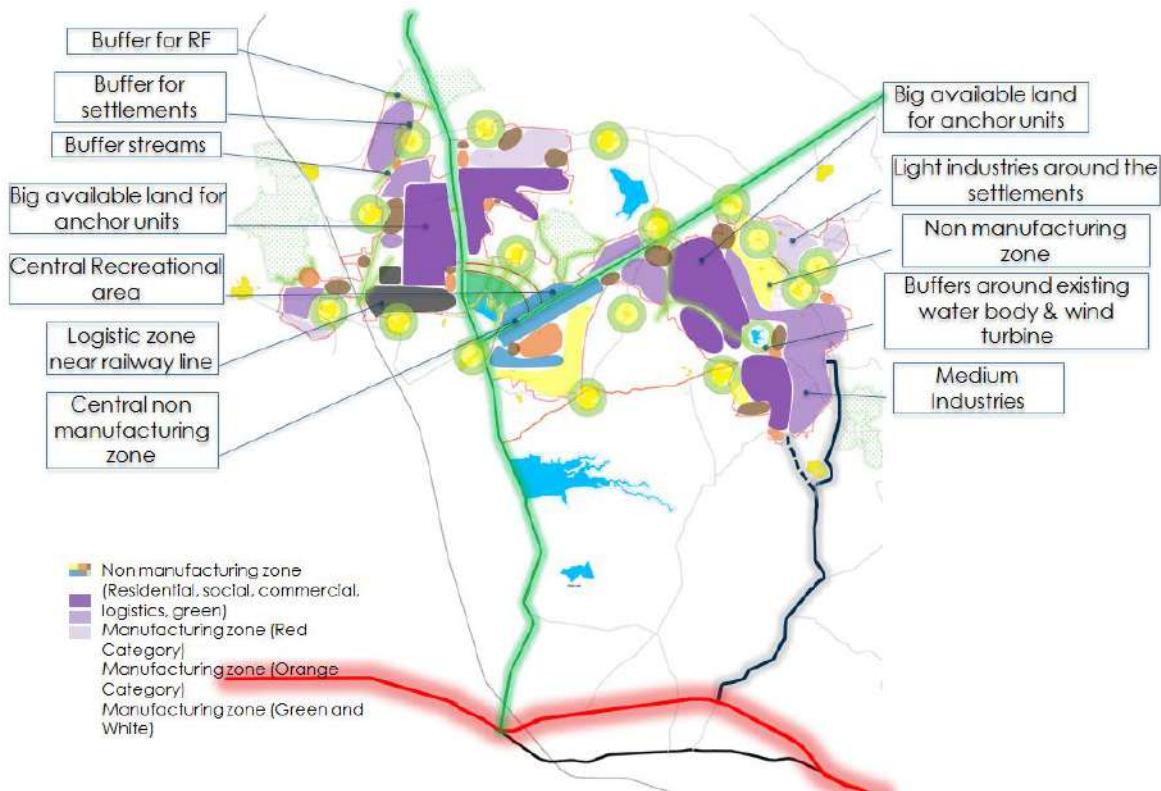


Figure 2-1: Factors considered for Zoning Plan

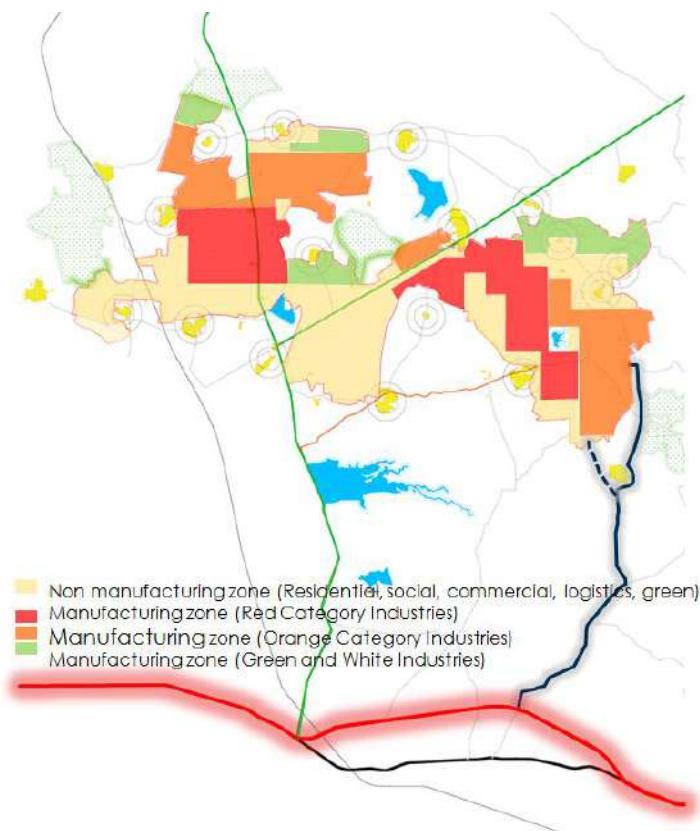


Figure 2-2: Representative Zoning plan based on CPCB Categorization

Based on the spread and shape of the Project site, regional linkages, proposed Entry-Exit points, wind directions, terrain and existing features the NIMZ site is categorized into various zones.

Industrial Zone to include - Industries in Automobile, Food Processing, Metals, Machinery, Non Metallic Mineral, Transport Equipments and Electrical Equipments and zoning plan is given **Figure FD0203**.

Logistics zone to include - Rail siding, railway yard, loading/ unloading area, cold storage, weigh bridge, control cabin, open stack yard, warehousing, security, truck parking, fuel station, driver facilities, repair & maintenance shops, transporter office, bus terminal, etc.

Green & Open Space to include - Peripheral buffer, recreational area, landscaped area, play ground, etc.

Residential Zone to include - Housing for hostels, housing for LIG, MIG and HIG, club house, guest house, etc.

Technical Infrastructure Zone to include - Incubation centre, R&D facilities, QA & QC, laboratory, raw material bank, certification lab, training centre, technical institutions, etc.

Utilities to include - Water supply facilities, wastewater facilities, waste management facility, treatment plants, power sub-stations, etc., & Amenities to include admin centre, fire station, police post, post office, security centre, marketing office, etc.

Commercial Zone to include - Shopping complex, mall, kiosk & plazas, shops, fuel station, repair centres, Hotels, restaurant, centralised kitchen, guest house, Banks, ATMs, service apartment, convention centre, commercial space, etc.

Social Zone to include - Community centre, burial area, crematorium, art gallery, day care centres, nursery, primary school, secondary school, including play ground, Dispensary, health centres, hospital, etc.

Non-polluting/low polluting industries are planned around existing features and polluting industries away from them Zoning and circulation plan is planned keeping the above aspects in view.

2.4.4 Industrial Sector and Sub-sectors

The proposed industrial sectors, sub-sectors, anticipated raw materials and categorisation as per EIA notification and Central Pollution Control Board (CPCB) are provided in **Table 2-4**.

Table 2-4: Proposed Industries in NIMZ

#	Possible Sector	Anticipated Types of industries/activities	Categorisation of Industry as per EIA notification, 2006	Anticipated Raw Materials	Categorization as per CPCB
1	Electrical equipment	Manufacture of electric motors, generators, transformers and electricity distribution and control apparatus (includes electric motors, generators and motor generator sets, switchgear and switchboard apparatus etc.)	Not Applicable	Wirings, shafts, castings, rotors, filters, exciter, capacitors, bearings, laminations.	Orange
		Manufacture of batteries and accumulators (includes batteries, rechargeable batteries, etc.)		Chemicals depending on the type of battery, casing, electrolytes, resistor, sensors, fuse, connector, gauges.	Red and Orange
		Manufacture of wiring and wiring devices (includes wires for live transmission, optical cables)		Material (copper, zinc, PVC, PE, Nylon), straight blade, joints, switches, wiring boards.	Orange
2	Metals	Manufacture of basic iron and steel (Ferro alloys, wire of steel by cold drawing, tube and tube fittings etc.)	Category A and B	Iron ore, coke, sinter, limestone, and other metals, recycled steel, coal.	Orange and White
		Manufacture of basic precious and other non-ferrous metals (includes manufacture of copper from ore, lead etc.)		Sulfide ores, acids, carbonates, pine oil, alum, lime, xanthate, coke.	Red and Orange
		Casting of metals (includes manufacture of tubes, pipes and hollow profiles, casting of non-ferrous metals)		Steel billet, PVC resin, DOP, Stabilizers, Processing acids, Lubricants, Colors, Fillers, Fittings.	
3	Food and Agro Processing	Processing and preserving of meat (includes production, processing and preserving of meat and meat) products, aqua food related processing (fish and prawns etc.)	Not Applicable	Different types of animal meats, freezers, spices, emulsifiers, animal proteins, fibres	Red
		Manufacture of dairy products (includes manufacturing of milk, milk powder, ice cream etc.)		Feed, cream powder, sweet whey powder, dry cottage cheese whey	Red
		Manufacture of grain mill products, starches and starch products (includes flour milling, rice milling, milling of other grains)		Wheat, barley, corn, rice, maize, and few other crops	Orange and Green
		Manufacture of other food products (includes manufacture of bakery products, noodles, Processing of edible nuts etc.)		Flour, rice, yeast, salt, flavors, stabilizers, dairy concentrates, margarine and other oils, custard powder	Orange
		Manufacture of prepared animal feeds (manufacture of cattle feed, poultry feed, feed for pets etc.)		Soyabean, millet, oil cakes, grass, maize strew, wheat strew, grain	Orange
4	Non-metallic minerals (except Glass)	Manufacture of non-metallic mineral products etc. (Includes manufacture of refractory products, clay building materials-bricks, tiles, ceramic products, AAC blocks, kerb stones, etc.)	Not Applicable	Potassium Feldspar, Kaolin Powder, Activated Alumina, Bone China Frit, chemical additives	Orange and Green
5	Automobile	Manufacture of motor vehicles (such as manufacturing of	Not Applicable	Iron, steel aluminum, glass, petroleum products,	Red

#	Possible Sector	Anticipated Types of industries/activities	Categorisation of Industry as per EIA notification, 2006	Anticipated Raw Materials	Categorization as per CPCB
		Tractors, Buses etc.)		plastics, rubber, copper, cobalt	
		Manufacture of parts and accessories for motor vehicles (includes parts such as brakes, gearboxes, axles, seats, tyres, rubber products etc.)			Orange and Green
6	Machinery	Manufacture of general purpose machinery (includes manufacture of hydraulic and pneumatic components, pumps, compressors, taps, valves, lifts, etc.), construction machinery, power machinery.	Not Applicable	Motor, Impeller shaft (made of heat treated Stainless Steel), cast iron, wear rings (bronze casing), ceramics; condenser, evaporator, insulator, fan, thermostat (made from different materials: Plastic, copper, steel, cast iron, rubber, Styrofoam, fiber glass, aluminum, Formica)	Red, Orange and White
		Manufacture of special-purpose machinery (includes manufacture of agriculture implants, machine tools for drilling, milling, industrial machinery etc.)		Stainless steel, cast iron, copper, rubber, plastics, pig iron, carbon and alloys	
7	Transport equipment	Manufacture of Railway locomotives and rolling stock	Category A and B	Stainless steel, cast iron, aluminium, copper, brakes, lighting, seats, propulsion, traction motors	Red
		Manufacture of Military fighting vehicles		Metals, stainless steel, iron ore, aluminium, titanium, ceramics, magnesium, alloys	

2.4.5 Entry/Exit

The proposed Entry/Exit points of NIMZ are shown in **Figure 2-3**.

Primary Entry/Exit of the NIMZ area marked towards East connects the length and breadth of complete layout. For the Entry/Exit of Initial Development area the connectivity from NH-65 will be via Bardipur road from Zaheerbad by-pass junction. In case of Entry/Exit points for the rest of the NIMZ layout will be through SH-14 and SH-16 passing through the mid of the layout with South wards access from NH-65 leading towards Bidar city.

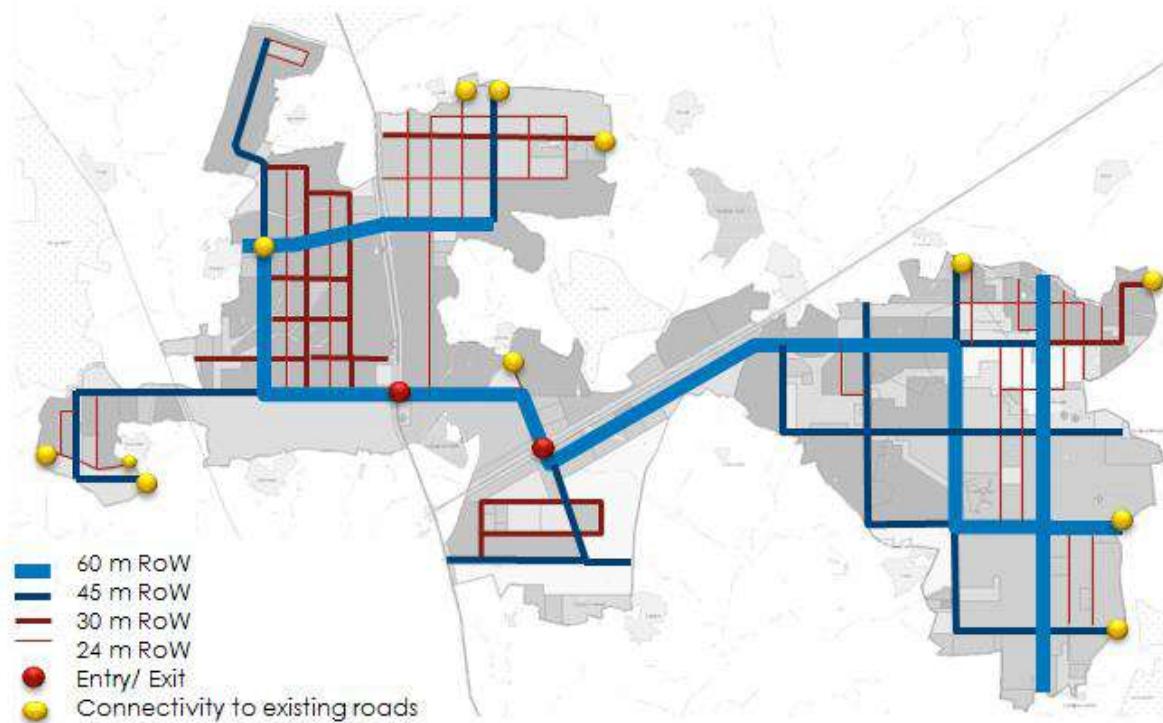


Figure 2-3: Entry/Exit points to Project Area

2.4.6 Circulation and Road Hierarchy

The proposed NIMZ is strategically placed in terms of road connectivity. SH14 and SH16 pass through the project site. NH65 (Pune – Machilipatnam Road) is located 10km south of the site. In addition there is another major district road connecting Zaheerabad with Jharasangam via Bardipur.

Greenfield connectivity with shortest distance of 1.5km to SH16 provided. Alignment avoids any settlement, water body, etc. and passes through open fields. Alignment joins the junction which further connects to Bidar.

Road connectivity in vicinity of the project site is shown in **Figure 2-4** and Project site connectivity with surrounding is shown in **Figure 2-5**.

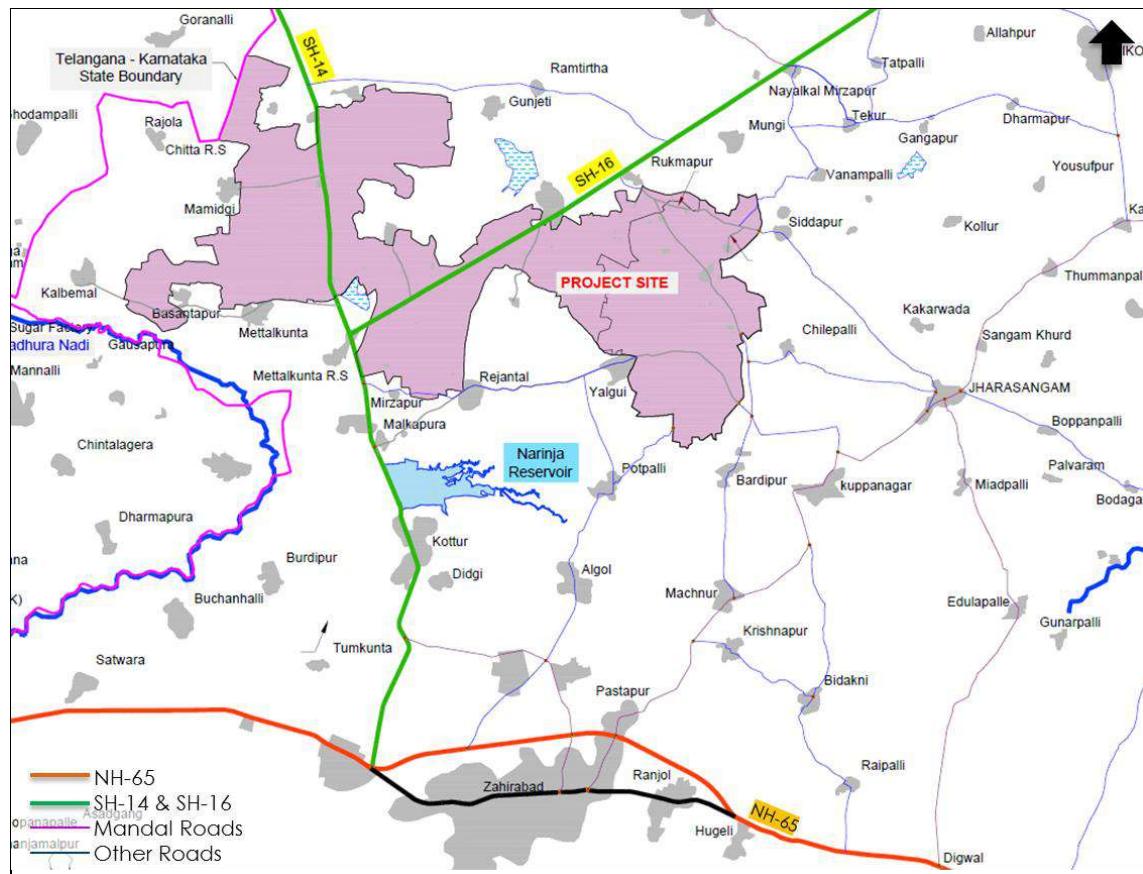


Figure 2-4: Road connectivity in vicinity of the Project Site

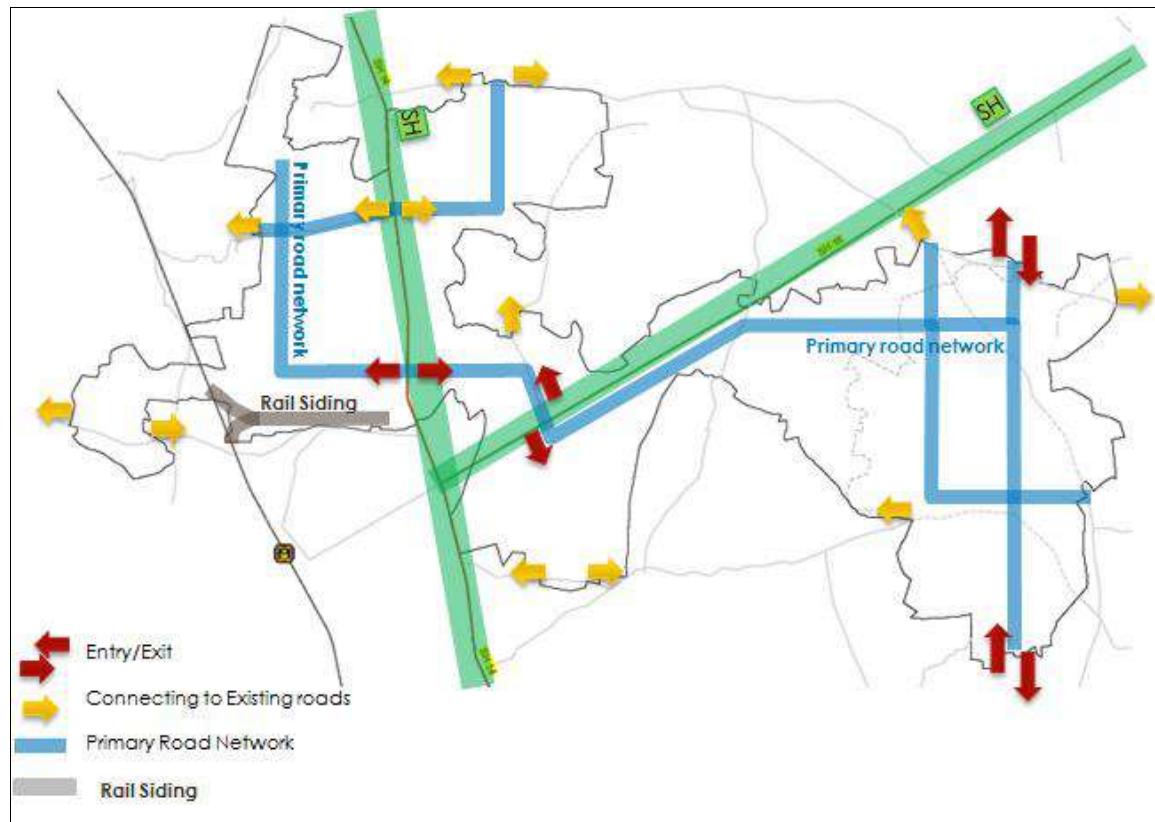


Figure 2-5: Project Site Connectivity with Surroundings

Mumbai Highway (NH-65): The Project site is strategically placed in terms of connectivity to National Highway (NH). NH65 (Pune – Machilipatnam) is located 10km South to the site. NH65 is the main access from the project site to the State Capital (Hyderabad). Currently NH65 is being upgraded to 4 lane standard till Sangareddy and is almost completed. The travel time to Hyderabad and the Hyderabad Airport will be reduced once the four lane road is completely operational.

	
NH-65 bypass to Zaheerabad	NH-65 inside Zaheerabad – Present view

Zaheerabad - Bidar Road (SH-14): SH-14 is the main access road to the site from NH-65. SH14 takes off West of Zaheerabad and travels North towards Bidar. It is a 2 lane road with a fair riding quality with required signages. The length of SH14 within the NIMZ area is 0.5km. SH-14 crosses the Vikarabad – Bidar Rail line and Narinja Reservoir. The minor bridge on Narinja dam is of intermediate lane configuration. There is a need for upgrading the SH within the Project influence area up to NH65, including construction of a RoB over the Bidar – Vikarabad Rail Line and a new bridge on Narinja reservoir to take care of the additional traffic that is likely to emanate from the proposed NIMZ.

	
Start Point of SH-14 Junction near NH-65 (old NH-9)	View of Zaheerabad - Bidar Road (SH-14)

Nizampet - Bidar Road (SH16): SH16 takes off from Metalkunta, travels Eastwards and connects NH161 (Sangareddy – Nanded Road). The section of SH16 passing through the NIMZ area is around 5km. SH16 is a two lane configuration road with good riding quality.

	
Metalkunta Junction- SH14 and SH16	Nizampet – Bidar Road (SH-16)

Jharasangam Road: Jharasangam road starts from Zaheerabad town. It is intermediate lane road with fair riding quality.

Metalkunta Road: Metalkunta road starts from Metalkunta Junction and connects through Metalkunta railway station, Metalkunta village and Basantpur South West of project site. It is a single lane bituminous road with fair riding quality.

	
Jharasangam Road	Metalkunta Road

Rejinthal Road: Rejinthal road takes off from SH-14 after Narinja reservoir and passes through the project site (Phase I area) and connects to Jharasangam road (on the Eastern side of NIMZ). It is a single lane bituminous road with a fair riding quality

Potpalle Road: Potpalle road is another access road to the Project site from Jharasangam road. It is a single lane bituminous road with fair riding quality.

	
Rejinthal Road	Potpalle Road

Bidar Cross Border Road: Bidar cross border road travelling along North-East of the project site connecting SH-14 and SH-16. It is a single lane bituminous road with fair riding quality.

	
Bidar Cross Border Road	Bidar Cross Border Road

These roads along with the existing State highways can be integrated in the overall planning of the cluster.

2.4.7 Rail Connectivity

The Vikarabad – Parli Vaijnath Rail line (South Central Railway) passing through the NIMZ area on the west near Basantpur village. The nearest railway stations are Metalkunta (2 km) & Zaheerabad (14 km) and Bidar (16 km). Rail siding can be taken from this line into the project site which will increase the goods mobility (raw material as well as finished goods).

	
Metalkunta Railway station located on west	Level Crossing (Railway chainage 73/23) north of Metalkunta station

There are also proposals by Government of Telangana to have direct rail link to Zaheerabad from Hyderabad. As per the information available on public domain, it has been given to understand that the Indian Railways have agreed in-principle to develop the above rail link. Once the railway line comes up, the travel time is expected to reduce significantly. Consultations are being planned with the officials of South Central Railway to ascertain the status on the above proposals and also to understand the development plans for Vikarabad – Parli rail link.

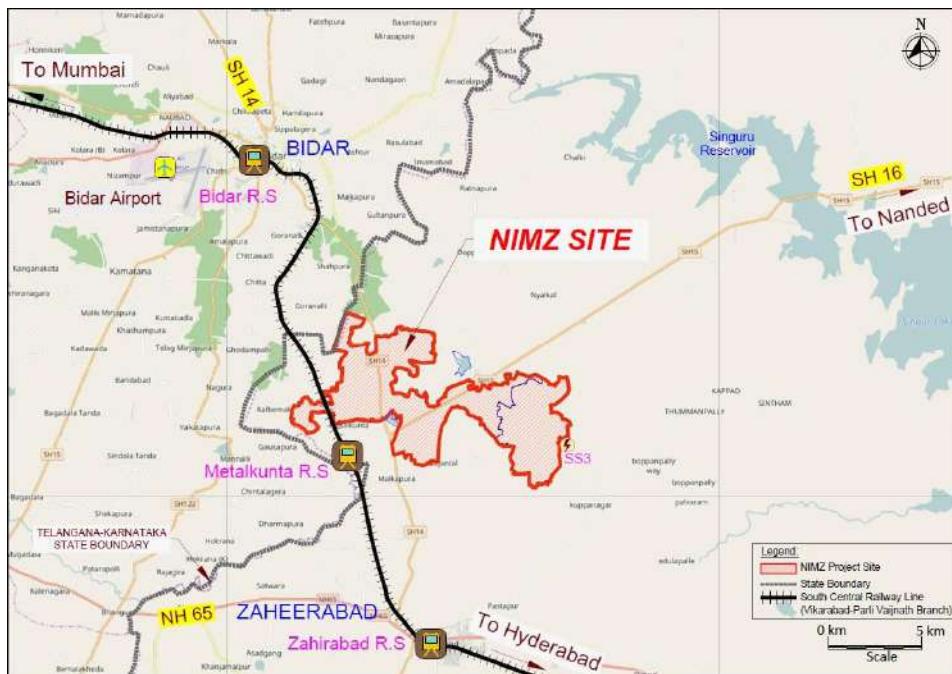


Figure 2-6: Railway Connectivity

2.4.8 Air Connectivity

The nearest airport to the NIMZ is Rajiv Gandhi International Airport (RGIA) at Shamshabad, Hyderabad. It is located to the South-East of the site at a distance of 125 km by road (105 km aerial distance). Bidar Airport is located at 17 km by road from the NIMZ site and is currently under Indian Air Force Station.

2.4.9 Port Connectivity

The nearest ports to the proposed NIMZ are: Krishnapatnam Port, Nellore on the East coast at a distance of 465km and Jawaharlal Nehru Port, (JNPT) Mumbai, which is around 600 km.

2.4.10 Green Areas

Based on the zoning considerations for planning as per the need for a specific zone, Green space/Lung Spaces were identified such a way as to serve the unattended spaces in the NIMZ layout.

The total Green area planned in the layout is 1974.4 acres (15.6%) under layout periphery green belt, traffic rotaries, green buffer areas and open green spaces. In addition each industrial plot will maintain 33% area of its area under Green areas. The green areas/belt layout is provided in **Figure FD0204**.

2.4.11 Common Amenities/Industry Related Facilities

The Common amenities, social infrastructure and support facilities planned for the complete NIMZ development are

For Industrial Zone:

- Administrative building, information centre, facilitation centre, marketing office, disaster management centre
- Training & incubation centre, hostel, certification lab and QA &QC lab
- Restaurant cum hotel, Banks, ATMs

- Customs, security, police outposts, temporary truck holding, weigh bridge, driver facilities
- OHT / UGS / WTP
- MRSS
- Solid waste management plant
- Common effluent treatment plant
- Distribution sub-station
- Zone specific utility
- Fuel station, repair sheds
- Warehouse & trans-shipment yard
- Railway logistics

For Social and Residential Zone:

- Residential blocks – 1BHK, 2 BHK, 3BHK & 4 BHK apartments
- Clubhouse
- Sports field, stadium, golf course & gymnasium
- Market and retail space
- Fire station & ambulance centre
- School, day care centre & technical institution
- Community hall, exhibition hall / convention centre
- Police station, post office, utility office & telephone exchange
- Hospitals and a Multi-specialty hospital
- Playground
- Library
- Bus stand and ISBT
- Restaurant and ATMs
- Commercial space

2.4.12 Social & Residential Zone

Demand for ~30,000 household, ~14,200 seater primary school infrastructure, ~9,000 seater secondary school infrastructure and ~240 bed hospital may be generated in NIMZ Zaheerabad. It is projected that once fully functional, NIMZ Zaheerabad may generate direct and indirect employment for around 2.66 lakh people. It is projected that demand for around 30,000 household units would be generated to accommodate ~30% of the overall directly employed people who may migrate to NIMZ Zaheerabad from other cities. Similarly for their welfare the state government may have to provide schooling infrastructure with a capacity of ~14,200 primary school seats, ~9000 secondary school seats, ~240 bed hospital facility and Commercial & retail space. The details of the same are provided in the table below.

Table 2-5: Projected social and commercial infrastructure demand

Parameters	Unit	Till 2025	Till 2030	Till 2035	Till 2040
BIS 2 scenario					
Employment (Direct + Indirect)	In No. of people	113,925	175,925	227,892	266,466
Household	In No. of units	12,817	19,792	25,638	29,977
Primary schools	In No. of seats	6,067	9,369	12,137	14,191
Secondary schools	In No. of seats	3,832	5,918	7,666	8,963
Hospital	In No. of beds	103	158	205	240

2.5 Infrastructure Services and Facilities

2.5.1 Water Supply System

2.5.1.1 Water Demand

The proposed NIMZ will comprise of various categories of consumers namely Industrial, residential, commercial, Institutional and others. The water requirement for each of these categories of consumers is different as there is no “one fit for all” demand estimation model, the water demand for various categories of consumers is derived based on the following methods.

- Potable water - For Industrial, Residential, Logistics hub, commercial, Technical Infrastructure, Amenities & Utilities –on per capita basis at 66% of the recommended LPCD as per National Building Code norms.
- Non Potable water - For Industrial, Residential, Logistics hub, commercial, Technical Infrastructure, Amenities & Utilities – on per capita basis at 33% of the recommended LPCD as per NBC norms.
- Process water – For Industries – On acreage basis
- Process support water (Non potable) – For cooling, heating and other similar usage in Industries – On acreage basis
- Fire protection demand

The norms considered for estimated the water demand is depicted in **Table 2-6**.

Table 2-6: Water demand estimation norms

Description	Demand	Source
Industries - process water (Manufacturing zone)	14 cum / ha / day	Consultant's in house data
Industries - process support water (Manufacturing zone)	14 cum / ha / day	Consultant's in house data
Manufacturing zone & Logistics hub	45 litres per capita – domestic water demand	CPHEEO ⁵
Technical Infrastructure	45 litres per capita	CPHEEO
Township	135litres per capita	CPHEEO
Amenities and utilities	45 litres per capita	CPHEEO
Roads	1.8 cum / ha / day	Consultant's in house data
Greenery	1.8 cum / ha / day	Consultant's in house data
Fire Protection demand	100 $\sqrt{\text{Population}}$ ~ 775.10KLD	CPHEEO

Based on the demand estimation the total water demand for development area is given in **Table 2-7**.

Table 2-7: Water Demand Estimation

Description of Land Use	Net Water Demand		Total Water Demand
	Potable Water	Non Potable	
	Cum/day		
Industrial Zone	35554.75	30186.26	65741.01
Automobile	10586.53	8318.49	18905.01
Electrical equipment's	1040.93	780.74	1821.67
Food Processing	13656.69	12479.76	26136.45
Machinery	2175.95	1757.60	3933.55
Metals	5613.19	4899.85	10513.04
Non-metallic minerals	1856.11	1458.46	3314.57

⁵ CPHEEO - Central Public Health and Environmental Engineering Organisation

Description of Land Use	Net Water Demand		Total Water Demand
	Potable Water	Non Potable	
	Cum/day		
Transport equipment	625.35	491.37	1116.72
Logistics Zone	394.05	210.64	604.69
Technical Infrastructure	2315.41	1157.71	3473.12
Residential Zone	12750	6375	19124.42
Roads		1030.40	1030.40
Amenities and utilities	218.30	109.15	327.44
Commercial retail shopping	1975.88	790.35	2766.23
Commercial hospitality	211.64	84.66	296.30
Commercial service sector	2144.18	857.67	3001.85
Social cultural	137.34	54.93	192.27
Social education	414.76	165.90	580.66
Social health	316.97	126.79	443.76
Green Zone		19849.78	19849.78
10% Visitors (From Residential)	1274.96	637.48	1912.44
Over all total	57708	61637	119344.35
MLD (rounded)	57.71	61.64	119.34 ⁶

2.5.2 Water Treatment Plant

Water treatment plant is envisaged to treat the water in order to meet the acceptable limits of water quality as per IS 10500:2012. Depending on actual quality of raw water, the system shall be optimized. The water treatment plant shall be established in proximity to the source wells (intake). This treatment plant will also consist of a receiving tank to hold 4 hours detention period prior to treatment and another storage tank to hold one day volume of NIMZ requirement

2.5.3 Fire Protection Water Demand

There is no separate fire hydrant system envisaged in NIMZ as a common facility, as it is not a continuous requirement on daily basis. However sufficient storage need to be provided. The fire water requirement in Kiloliters per day has been calculated as per the guidelines of CPHEEO manual. Fire water demand is estimated as 2,553 Kilolitres.

In terms of the manual it is proposed to consider the service storage capacity of one third of the volume of fire water requirement. Hence the capacity of the service storage reservoir works out 851 KL. The balance requirement will be distributed in several static tanks at strategic points. These static tanks have to be filled from the nearby ponds, streams, or canals by water tankers wherever feasible.

Non-potable water is considered for meeting the above calculated fire water requirements. The scope of developer / park authority is to ensure the provision for filling up of fire tenders, it is proposed to provide stand post with valves in the non-potable water network at every 500 m interval along the road network wherever feasible. Fire tenders will be able to refill the fire water tanks as necessary from the above provided stand post points. **Total water (one time) requirement for the proposed development is estimated as 119.34 MLD and 2.5 ML of fire water demand.**

⁶ During PFR and ToR stage, one time water requirement is estimated as 110 MLD, after working out detailed water requirements, one time water requirement is increased to 119.34 MLD from 110 MLD due to increase in non-potable water requirement. Net fresh water requirement was not changed much and it is 57.71 MLD compared to 57 MLD during PFR/ToR stage.

2.5.3.1 Reuse of Treated Wastewater

The total sewage generation of 43.64 MLD and total effluent generation of ~27.3 MLD are estimated from proposed NIMZ. After treatment of sewage in proposed STP of 43.64 MLD and effluent in CETPs of 27.3 MLD capacities, it is proposed to reuse the treated wastewater into the system which will be in the order of 61.64 MLD. **Thus the net water demand for the proposed NIMZ is 57.71 MLD.** The water balance diagram is given as **Figure 2-7**.

2.5.3.2 Water Source

Considering recycling of about 61.64 MLD into the system, net fresh water requirement is 57.71 MLD. The fresh water will be sourced from the Singur reservoir located at about 25 km. The Salient Features of Singur Reservoir are provided in **Table 2-8** and shown in **Exhibit 2-1**.

Table 2-8: Salient Features of Singur Dam

Singur Reservoir Salient Features	Details
River	Manjira
Village	Singur
Location	Latitude: $17^{\circ}45'$; Longitude: $77^{\circ}56'$
Gross Capacity	29.910 TMC
Water spread area	163.38 Sq.km
Present Water Users	(i) Mission Bhagiratha (ii) Water supply to canals of Singur project (iii) Irrigation Under Ghanpur Anicut (iv) Nizam Sagar for Irrigation etc.,
Water availability including Evaporation, Silting and Carryover capacity to Next Season	7.25 TMC



Exhibit 2-1: Singur Reservoir

Government of Telangana has proposals to allocate 10% of water from Singur Reservoir i.e around 3 TMC for meeting the industrial needs in the project region. The estimated NIMZ's ultimate water requirement is worked out to be around 1.54 TMC/Year (119.34 MLD⁷) for which Singur Reservoir is found to be adequate. The application is submitted by TSIIC to Irrigation and CAD Department and the consent letter obtained is given as **Appendix C**.

⁷ 1 MLD=0.0129 TMC

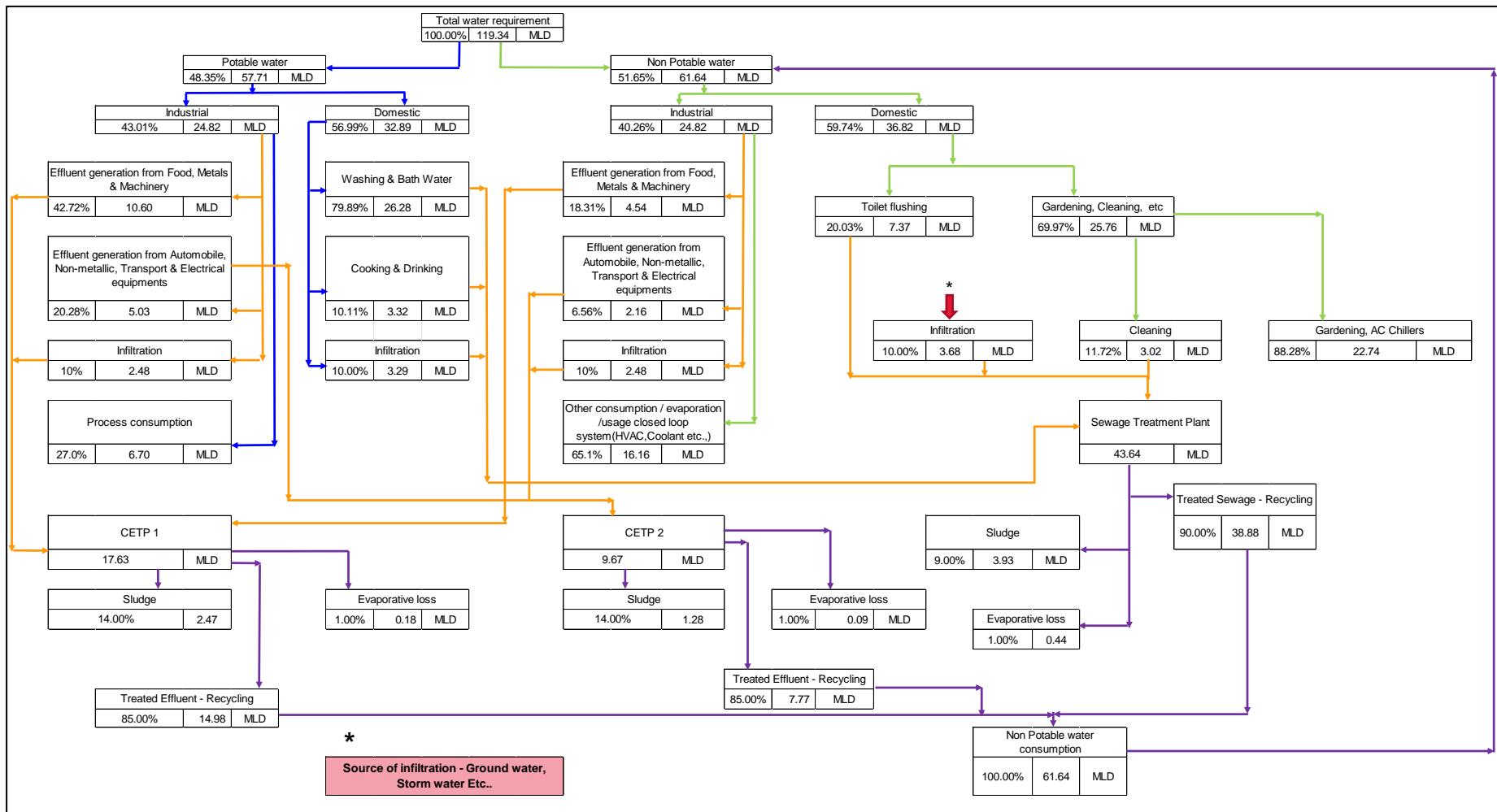


Figure 2-7: Water Balance Diagram

2.5.4 Fire Protection Services

Industries proposed in NIMZ which may be prone to hazards including Fire. In order to contain Fire hazard situations the following services with automated response system are conceived:

- Dedicated firefighting water/network
- Fire stations strategically located in the layout

In addition, the statutory requirements as per Development Control Rules for firefighting provisions within individual industrial plots to be enforce as a part of the development guidelines.

2.5.5 Wastewater Management

2.5.5.1 Wastewater Generation

Wastewater generation in NIMZ will be from the various zones as detailed in the Master Plan. The wastewater generated can be categorized broadly into two types namely:

- Industrial wastewater/Effluent
- Domestic wastewater/Sewage

The estimated wastewater to be generated from the project is given in **Table 2-9**.

Table 2-9: Wastewater Generation

Description of Land Use	Effluent generation			Total	Total Sewage Quantity
	From Process Water	From Process support water	Infiltration		
cum/ day					
Industrial Zone	15635.20	6700.80	4963.55	27299.55	14076.18
Automobile	3811.78	1633.62	1210.09	6655.49	5946.80
Electrical equipment's	327.95	140.55	104.11	572.61	682.21
Food Processing	7120.79	3051.77	2260.57	12433.12	3085.91
Machinery	843.72	361.59	267.85	1473.16	1096.93
Metals	2637.50	1130.36	837.30	4605.15	1870.39
Non-metallic minerals	668.31	286.42	212.16	1166.89	1042.64
Transport equipment	225.15	96.49	71.48	393.13	351.30
Logistics Zone					527.82
Technical Infrastructure					2741.26
Residential Zone					15094.53
Roads					1030.40
Amenities and utilities					286.18
Commercial retail shopping					2427.53
Commercial hospitality					260.02
Commercial service sector					2634.30
Social cultural					168.73
Social education					509.56
Social health					389.42
Green Zone					1984.98
10% Visitors (From Township)					1509.45
Total	15635.20	6700.80	4963.55	27299.55	43640.37

2.5.5.2 Effluent Treatment

The type of pollutant generation for each type of industry and its sub category is given in **Table 2-10**.

Table 2-10: Pollutant Generation for each Type of Industry

Type of industry	Industry category	Sub	Pollutant	Suitable system	Treatment
Electrical Machinery	Manufacture of electric motors, generators, transformers		<p>The industries under electrical and electronics manufacturing includes</p> <ul style="list-style-type: none"> • Semiconductors • Electronic Crystals • Electron Tubes • Phosphorescent Coatings • Capacitors. Fixed • Capacitors. Fluid Filled • Carbon and Graphite Products • Mica Paper • Incandescent Lamps • Fluorescent Lamps • Fuel Cells • Magnetic Coatings • Resistors • Transformers. Dry • Transformers. Fluid Filled • Insulated Devices. Plastic and Plastic Laminated • Insulated Wire and Cable. Nonferrous • Ferrite Electronic Parts • Motors. Generators. and Alternators • Resistance Heaters • Switchgear <p>The pollutants fall into three groups: Conventional, Non-conventional and toxics.</p> <p>Conventional pollutants are those generally treatable by secondary municipal wastewater treatment such as:</p> <ul style="list-style-type: none"> • pH • Biochemical Oxygen Demand (BOD) • Oil and Grease (O&G) • Total Suspended Solids (TSS) <p>Non-conventional pollutants are simply those which are neither conventional nor on the list of toxic pollutants. These includes Bismuth, Europium, Fluoride, Gadolinium, Gallium, Indium, Lithium, Niobium, Tellurium, Total Organic Carbon, Total Phenols, Yttrium, Calcium, Magnesium, Aluminum, Manganese, Vanadium, Boron, Barium, Molybdenum, Tin, Cobalt, Iron, Titanium, Xylenes, Alkyl Epoxides, Platinum, Palladium & Gold</p> <p>The wastewater pollutants concern in the manufacture of semiconductors and electronic crystals are arsenic, total toxic organics, fluoride. Suspended solids & pH.</p> <p>In these industries, wastewater primarily generated from processes associated with metal finishing, plastics moulding and forming</p>		Treatment for toxic wastewater to be provided in addition to the biological treatment
	Manufacture batteries and accumulators		<p>Pollutants found in significant amounts in lead battery manufacturing wastewaters include</p> <ul style="list-style-type: none"> • Toxic metals -- copper and lead • Nonconventional pollutants aluminum, iron, manganese and • Conventional pollutants – oil and grease, 		Treatment for toxic wastewater to be provided in addition to the biological treatment

Type of industry	Industry category	Sub Pollutant	Suitable Treatment system
		TSS, and pH. Toxic organic pollutants generally were not found in large quantities. Because of the amount of toxic metals present, the sludges generated during wastewater treatment generally contain substantial amounts of toxic metals. Current wastewater treatment systems in the battery manufacturing category range from no treatment to sophisticated physical chemical treatment combined with water conservation practices	
	Manufacture of wiring and wiring devices	Same as electric motors, generators, transformers	
Metals	Manufacture of basic iron and steel (Ferro alloys, wire of steel by cold drawing, tube and tube fittings etc.)	The metal-working industries discharge chromium, nickel, zinc, cadmium, lead, iron and titanium compounds, among them the electroplating industry is an important pollution distributor. In general, the pollutants include BOD, COD, oil, metals, acids, phenols, and Cyanide	Treatment for toxic wastewater to be provided in addition to the biological treatment
	Manufacture of basic precious and other non-ferrous metals (includes manufacture of copper from ore, lead etc.)	The nonferrous metals manufacturing category is comprised of plants that process ore concentrates and scrap metals contained in spent electroplating solutions, spent catalysts, old jewelry and various other sources. Depending on the metal and the desired purity, hydrometallurgical or pyro metallurgical exchange operations may be used to purify and upgrade metal values Nonferrous metals manufacturing includes Primary aluminum, copper smelting, copper electrolytic refining, lead, zinc, columbium-tantalum, and tungsten, secondary aluminum, silver, copper, lead, and metallurgical acid plants with subcategories such as Primary antimony, Bauxite refining, Primary beryllium, Primary boron, Primary cesium and rubidium, Primary and secondary germanium and gallium, Secondary indium, Primary lithium, Primary magnesium, Secondary mercury, Primary molybdenum and rhenium, Secondary molybdenum and vanadium, Primary nickel and cobalt, Secondary nickel, Primary precious metals and mercury, Secondary precious metals, Primary rare earth metals, Secondary tantalum, Primary and secondary tin, Primary and secondary titanium, Secondary tungsten and cobalt, Secondary uranium, Secondary zinc, and Primary zirconium and hafnium The pollutants from these manufacturing plants includes cadmium, copper, lead, nickel, zinc, TSS, Oil and greases, chlorides, fluorides, NH3, CN, PAHs, PFCs& Hg	Treatment for toxic wastewater to be provided in addition to the biological treatment
	Casting of metals (includes manufacture of tubes, pipes and hollow profiles, casting of non-ferrous metals)	Process water becomes contaminated either through its use in air pollution control devices associated with the various manufacturing processes or through direct contact of the water with some part of the process or casting. The pollutant characteristics of the resulting wastewaters may vary depending on the type of metal cast, the manufacturing process employed, and the type of air pollution control device associated with the manufacturing process.	Treatment for toxic wastewater to be provided in addition to the biological treatment

Type of industry	Industry category	Sub	Pollutant	Suitable Treatment system
			The pollutants present in metal molding and casting industry wastewaters are suspended solids, oil and grease, copper, lead, zinc, nickel, iron, aluminum, nonconventional phenols, pentachlorophenol, parachlorometa cresol, chrysene, benzo (a) pyrene, benzo (a) anthracene, benzo-(b) fluoranthene, benzo (k) fluoranthene, pyrene, dichloromethane, trichloromethane, bis (2-ethyl hexyl) phthalate, and pH.	
Food Processing	Processing and preserving of meat (includes production, processing and preserving of meat and meat products)		Meat processing includes cutting and deboning, cooking, seasoning, smoking, canning, grinding, chopping, dicing, forming, breading, breaking, trimming, skinning, tenderizing, marinating, curing, pickling, extruding, and linking. The pollutants include BOD, Total suspended solids, Hexane Extractable, Total Kjeldahl nitrogen, Total phosphorus (mg/L), Fecal coliform bacteria	Biological treatment will suffice to treat
	Manufacture of dairy products (includes manufacturing of milk, milk powder, ice cream etc.)		The process includes Whole milk, Skim milk, Pasteurized Milk, Buttermilk, Cream, Evaporated milk, Whey, Ice cream, Cheese, Butter, evaporated milk, etc. Industrial wastewater emanates from spillage of milk and products thereof, and from cleaning of equipment that has been in contact with milk products. The concentration and composition of the waste depends on the production programme, operating methods and the design of the processing plant. In general, wastes from the dairy processing industry contain high concentrations of organic material such as proteins, carbohydrates, and lipids, high concentrations of suspended solids, high biological oxygen demand (BOD) and chemical oxygen demand (COD), high nitrogen concentrations, high suspended oil and/or grease contents, and large variations in pH. BOD level varies from 40000 to 400000 mg/l. The pH of dairy effluent varies between 2 and 12, as a result of the use of acid and alkaline detergents for plant cleaning.	Biological treatment will suffice to treat. However, the high BOD level necessitates for exclusive treatment.
	Manufacture of grain mill products, starches and starch products (includes flour milling, rice milling, milling of other grains)			
	Manufacture of other food products (includes manufacture of bakery products, noodles, Processing of edible nuts etc.)		The starches that are obtained from various kinds of grains such as Maize (corn), Rice and Wheat, and from roots like tapioca, potato, arrowroot, etc. The pure starch slurry thus produced is converted to glucose either by acid hydrolysis or enzymatic conversion process. The above wet milling process and subsequent glucose making require a good volume of water and it generates a substantial quantity of effluent. The pollutants include pH, COD, BOD, TS, TDS, SO4& Cl	Biological treatment will suffice to treat. However, the high BOD level necessitates for exclusive treatment.
Non-metallic	Manufacture of non-		It includes the stone, clay, glass, and concrete	No separate ETP is

Type of industry	Industry Sub category	Pollutant	Suitable Treatment system
minerals	metallic mineral products n.e.c. (includes manufacture of refractory products, clay building materials, ceramic products etc.)	products sectors. The sector includes establishments engaged in the manufacturing of flat glass and other glass products, cement, structural clay products, pottery, concrete and gypsum products, cut stone, abrasive and asbestos products, and other products. Processes used include grinding, mixing, cutting, shaping, and honing. Heat often is used in the process and chemicals are frequently mixed to change the composition, purity, and chemical properties for the intended product. There is no major effluent generation is envisaged in this sector.	required
Automobiles	Manufacture of motor vehicles (such as manufacturing of Tractors, Buses etc.)	Production stages where vehicles are treated, washed, rinsed and painted and hence generating mass volume of wastewater. pollutants generated includes total suspended solids such as metals, oils, grease, dyestuff, detergents, chromium and phosphates, paint residuals, hydrofluoric acid and ammonium bi-fluoride products etc., Organic and inorganic pollutants, BOD (Biological Oxygen Demand) and COD (Chemical Oxygen Demand)	Biological treatment will suffice to treat
Machinery	Manufacture of general purpose machinery (includes manufacture of hydraulic and pneumatic components, pumps, compressors, taps, valves, lifts, etc.)	Similar to electrical machinery	Treatment for toxic wastewater to be provided in addition to the biological treatment
	Manufacture of special-purpose machinery (includes manufacture of agriculture implants, machine tools for drilling, milling, industrial machinery etc.)	Similar to electrical machinery	Treatment for toxic wastewater to be provided in addition to the biological treatment
Transport equipment	Manufacture of Railway locomotives and rolling stock	Similar to electrical machinery	Treatment for toxic wastewater to be provided in addition to the biological treatment
	Manufacture of Military fighting vehicles	Similar to Automobiles	Biological treatment will suffice to treat

2.5.5.3 CETP Capacity

Member industry shall carry out primary treatment and shall discharge to CETP after meeting the inlet characteristics of CETP. Multiple CETPs will be developed and overall capacity of CETP will be in the order of 27.3 MLD. The treated wastewater will be reused within the system for non-potable water requirement.

2.5.5.4 Conveyance of Wastewater to the CETPs

The industries are likely to be spread out in various areas within NIMZ. In the initial stages, the wastewater will be conveyed to the CETP by tankers only. As and when the occupancy in the IP exceeds 70%, and then conveyance system can be developed. The flows anticipated are low and even self-cleansing velocity will not be attained, hence the conveyance system can be planned once the occupancy level increases.

2.5.5.5 Wastewater Collection at Individual Units

Each industry shall have a minimum of 2 tanks for wastewater generated and the holding capacity of each tank shall be for a flow of 1 day. Depending on the wastewater characteristics, the unit shall have to provide screens, grit trap and oil and grease traps at the unit level.

Once a tank is filled, the CETP operator shall be informed, who shall then send his representative to check the effluent quality (finger print test) and assign the path way for onward conveyance and treatment at the CETP.

2.5.5.6 CETPs Location

CETPs are zoned based on the contours and the physical constraints. The location of CETP is shown in **Figure FD0202**.

2.5.5.7 Treatment Scheme

Based on the above wastewater generation from industries, the conceptual treatment system for treating organic and toxic industrial wastewater is given below. A Suitable treatment system for CETPs will be selected and implemented upon finalizing the type of industries, clustering, processing methods etc.

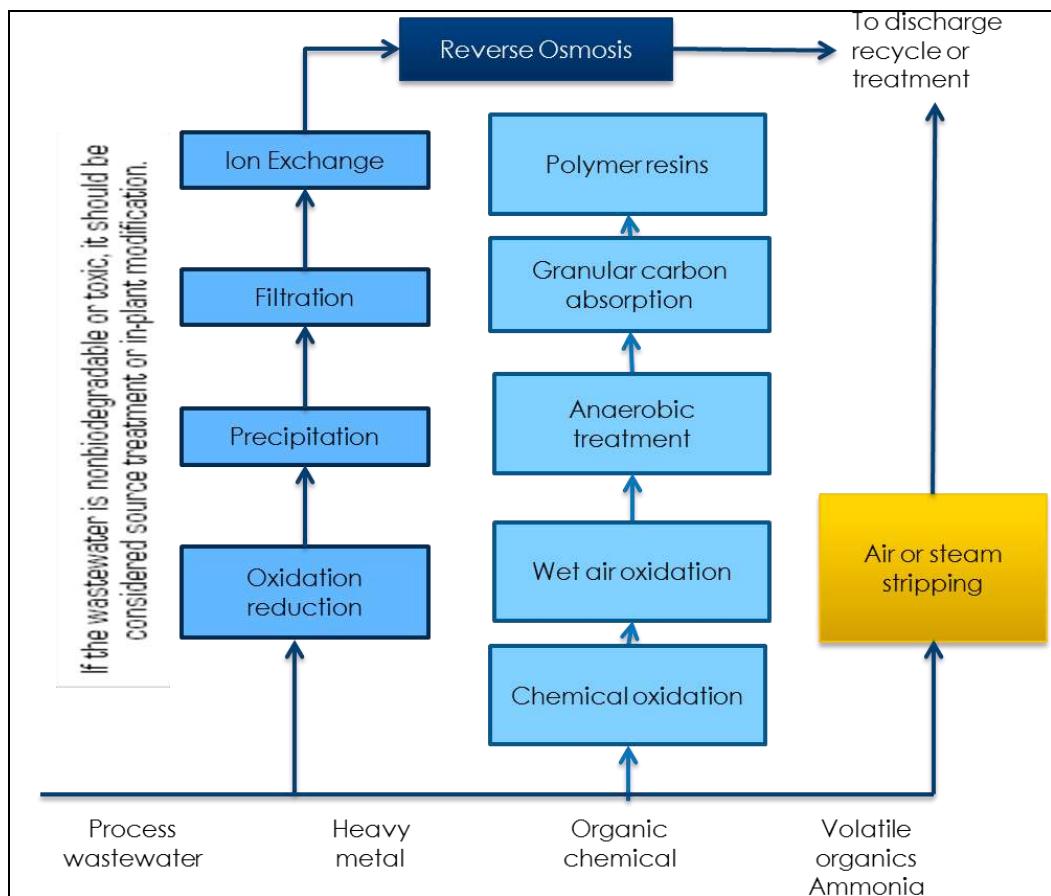


Figure 2-8: Conceptual Treatment System for Organic and Toxic Industrial Wastewater

The conceptual treatment for only toxic industrial wastewater is given in **Figure 2-9**.

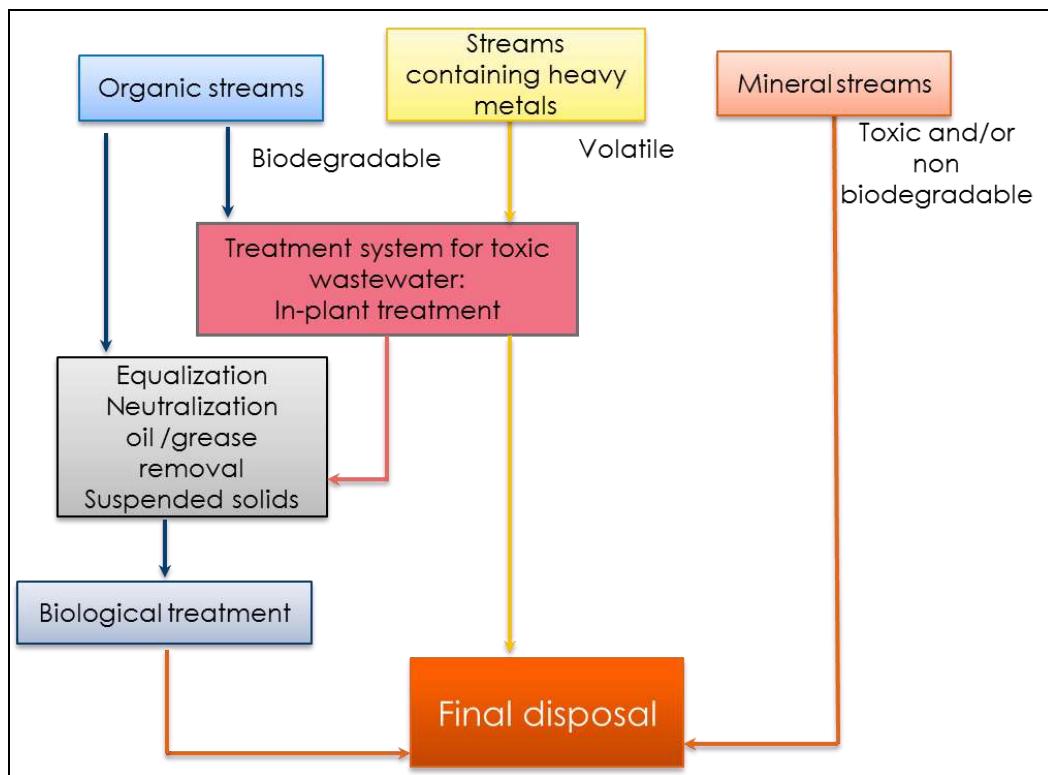


Figure 2-9: Conceptual Treatment System for Toxic industrial Wastewater

The option of biological treatment will be selected depending upon the site conditions, quality and quantity of wastewater etc. and its conceptual schema is given in **Figure 2-10**.

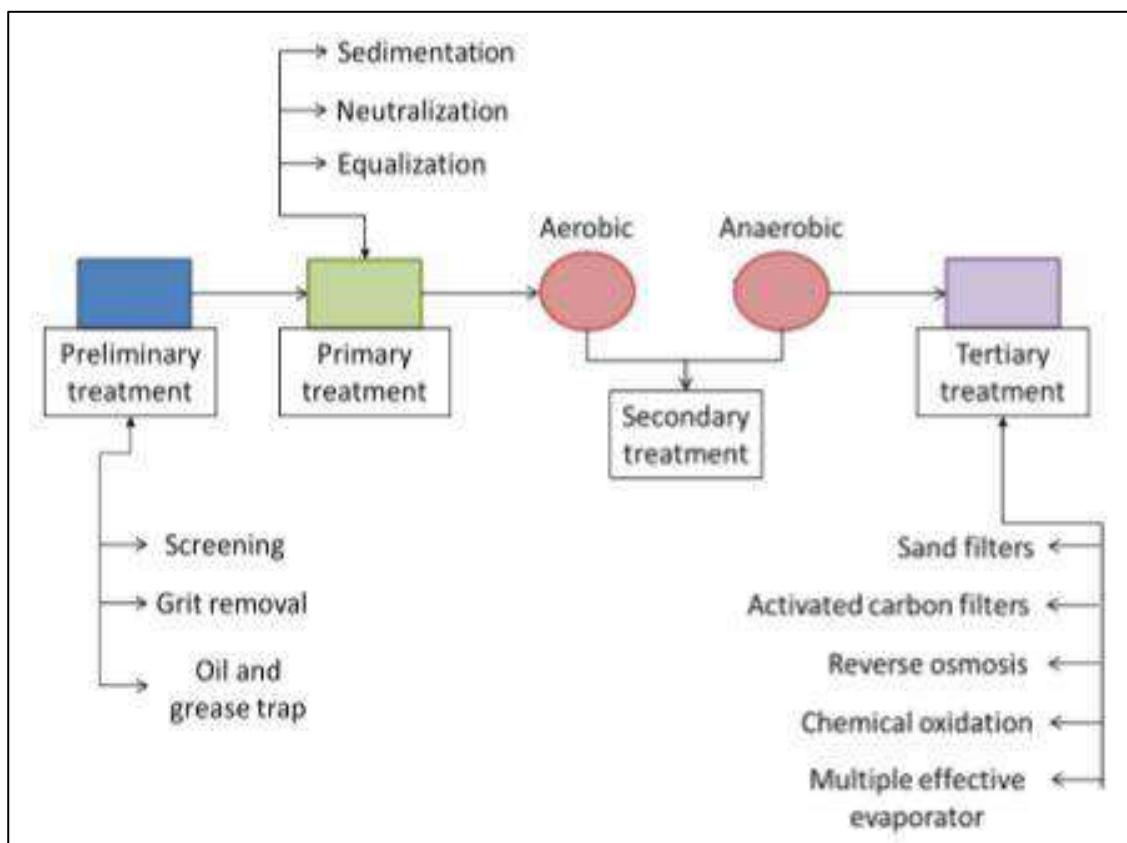


Figure 2-10: Conceptual schematic for biological treatment system

2.5.5.8 CETP Inlet Characteristics

After primary treatment by member industry, it shall send to the CETP after meeting the inlet characteristics as mentioned below:

Table 2-11: CETP Inlet Characteristics

S. No	Parameter	Unit	Quality at the inlet of CETPs*
1.	pH	-	5.5-9.0
2.	Temperature	°C	45.0
3.	Oil & grease	mg/l	20.0
4.	Phenolic compounds (as C ₆ H ₅ OH)	mg/l	5.0
5.	Ammonical Nitrogen (N)	mg/l	50
6.	Cyanide (CN)	mg/l	2.0
7.	Chromium Hexavalent (Cr ⁺⁶)	mg/l	2.0
8.	Chromium (Total) (as Cr)	mg/l	2.0
9.	Copper (Cu)	mg/l	3.0
10.	Lead (Pb)	mg/l	1.0
11.	Nickel (Ni)	mg/l	3.0
12.	Zinc (Zn)	mg/l	15.0
13.	Arsenic (As)	mg/l	0.2
14.	Mercury (Hg)	mg/l	0.01
15.	Cadmium (Cd)	mg/l	1.0
16.	Selenium (Se)	mg/l	0.05
17.	Fluoride (F)	mg/l	15.0
18.	Boron	mg/l	2.0
19.	Radioactive materials		

S. No	Parameter	Unit	Quality at the inlet of CETPs*
a	Alpha emitter	Hc/mL	10^{-7}
b	Beta emitter	He/mL	10^{-8}

Note: 1. The above characteristics is applicable to small-scale industries up to 25 KLD

- For each CETP and its constituent units, the state board will prescribe standards as per the local needs and conditions; these can be more stringent than above. However, in case of clusters of units, the state board with the concurrence of CPCB in writing may prescribe suitable limits.

2.5.5.9 CETP outlet Characteristics

The CETP tertiary treated water partly will be used for greenbelt application after meeting discharge standards of CETP and partly will be further treated in a membrane system to recover water and send it to industries for non-potable water usage.

Table 2-12: Characteristics of Tertiary treated wastewater

S. No.	Parameter	Concentration*
1	pH	5.5 - 9
2	TSS (mg/l)	< 20
3	TDiS (mg/l)	<1000
4	Temperature °C	Ambient
5	BOD (5 day @ 20°C) (mg/l)	< 30
6	COD (mg/l)	< 250
7	Cyanides as CN- (mg/l)	< 0.2
8	Chromium (Total) as Cr (mg/l)	< 1
9	NH ₃ -N	<50

The scheme would involve passing the tertiary treated wastewater through a UF system followed by a 2-Stage RO, RO-1 shall be fed with UF produced water and the recovery expected is about 80%. The reject from RO-1 shall be fed to RO-2 for further recovery. The recovery is the 2nd stage RO is expected to be about 65%.

Table 2-13: Characteristics of UF/RO treated wastewater

S. No	Parameter	After UF	RO-1 Prod	RO-2 Prod	RO-1 Rej	RO-2 Rej	Combined Product
1	Flow(Cum/d)	360	290	47	70	28	335
2	TDS	970	50	230	4700	11700	75
3	BOD	10	0.5	2.4	48	120	0.8
4	COD	30	1.5	7.2	144	360	2.3

2.5.5.10 Sludge Disposal

As per the guidelines of Ministry of Environment and Forests & Climate Change (MoEF&CC), the sludge from Effluent Treatment Plants is classified as Hazardous waste. In view of the MoEF&CC directives, the sludge and salts generated from the proposed CETP have to be disposed at Hazardous Waste Disposal Facility. The nearest facility is located at Hazardous waste management facility is located at Dundigal.

2.5.5.11 Sewage Treatment

Wastewater from non-industrial consumers as well as domestic wastewater from industrial consumers shall be conveyed through a buried network of trunk sewer provided with a series of inspection chambers & manholes. It will be finally discharged / connected in to sewage treatment plant (STP). The treatment water is proposed to be re-cycled for flushing & landscaping purpose.

2.5.5.11.1 Sewage Characteristics

The characteristics of domestic sewage will be as given in **Table 2-14.**

Table 2-14: Quality parameters of domestic sewage

S. No.	Parameters	Unit	Raw sewage / Primary treated effluent	Tertiary treated sewage
1	PH	-	6.0 – 8.5	6.5 – 8.0
2	Suspended solids	Mg/l	250 – 300	Less than 10
3	Biochemical oxygen demand	Mg/l	250 - 350	Less than 10
4	Chemical oxygen demand	Mg/l	400 - 600	Less than 100
5	Oil & grease	Mg/l	<50	Less than 5
6	Total residual chlorine	Mg/l		Less than 1
7	Ammonical nitrogen (as N)	Mg/l		Less than 1
8	Total kjeldahl nitrogen (as N)	Mg/l	45	Nil
9	Sulphate (as S)	Mg/l		Less than 2
10	Nitrate nitrogen	Mg/l		Less than 6
11	Total phosphorus	Mg/l	7	Less than 1
12	Fecal coliform	MPN/100 ml	1×10^6	Nil
13	Total coliform	MPN/100 ml	1×10^7	Nil

2.5.5.11.2 Sewage Treatment Plant

Sequencing Batch Reactor (SBR) system is proposed for sewage treatment. SBR system is a fill and draw activated sludge system. SBR process uses high-efficiency oxygen transfer aeration equipment to satisfy the high-rate oxygen consumption requirement at the beginning of the “fill” and “aeration” cycles. SBR is efficient in carbonaceous pollutant removal, and is easily modified to satisfy nutrient removal of nitrogen (N) and phosphorous (P). Because the fill, aeration, settlement and draw take place in the same reaction tank, SBR tank itself would serve as the clarifier. Refer **Figure 2-11** for process flow diagram.

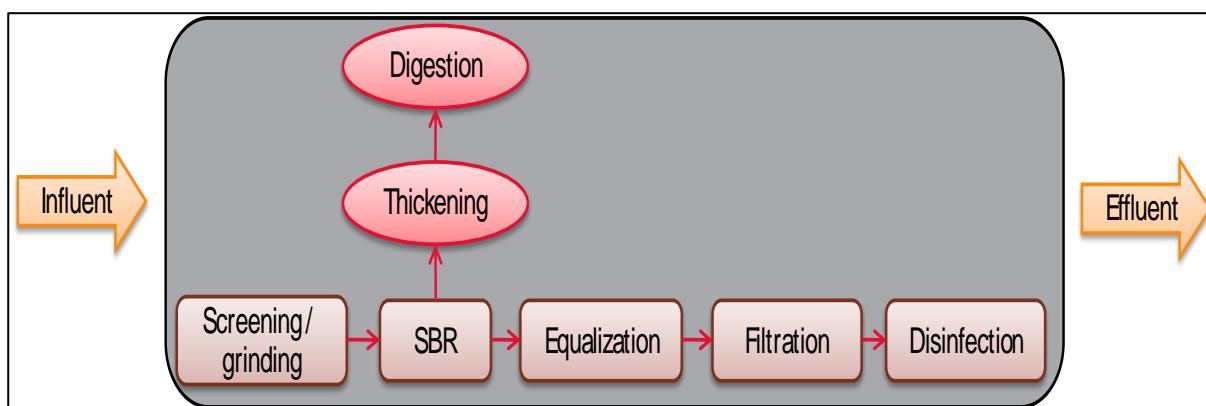
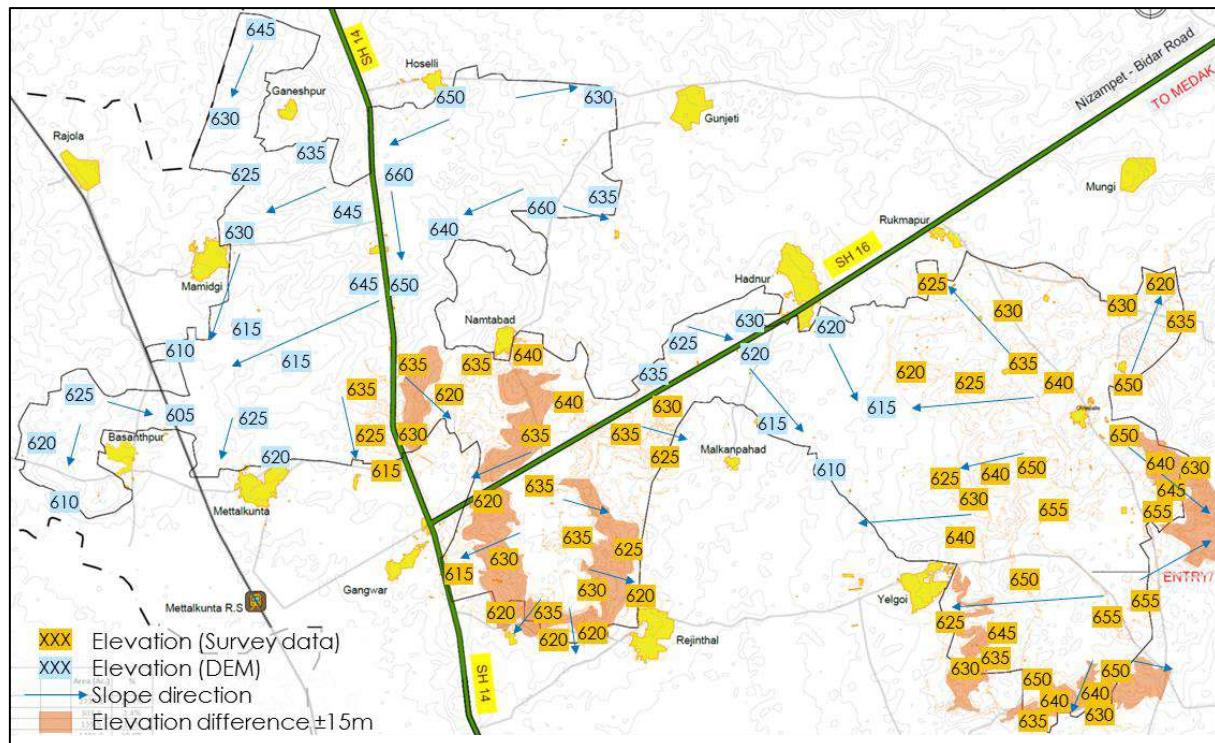


Figure 2-11: STP Process Flow Diagram (SBR Technology)

The total estimated STP capacity for overall development area is ~44 MLD. As the development is expected to happen over a period of years, the STP is planned in modular manner. The treated sewage shall be stored as non-potable water having detention time of minimum 24 hours. It is proposed to provide separate water distribution network for non-potable supply.

2.5.6 Site grading

The elevation of the project site varies from 605m to 660m.



(Source: Surveys and Satellite generated DEM data)

Figure 2-12: Terrain Condition/ Contour Map of Project Site

It is observed that the area near Malkanpahad and near Metlakunta is having the lowest level of 610m and 605m respectively where the Eastern part of the Project site is having highest elevation - 655m. The elevation on North Western part around SH-14 is about 660m while the South Western part is having elevations in the range of 620m. Few pockets of the Project site are having steep slopes which are marked in the **Figure 2-12**. Such areas are appropriately planned in master plan to avoid excessive cut/fill.

2.5.7 Solid Waste Management

The solid waste likely to be generated from NIMZ site can be broadly categorized into two groups namely:

- Municipal solid waste from non-Industrial occupants
- Industrial waste
- E-waste
- Biomedical waste

Types of Municipal Solid Waste (MSW) are shown in Figure 2-13 and Types of Industrial Waste is shown in Figure 2-14.



Figure 2-13: Types of Municipal Solid Waste (MSW)



Figure 2-14: Types of Industrial Waste

Municipal Solid Waste:

Municipal Solid waste generation of 154.37 TPD at 100% occupancy is estimated to be generated. Out of this, biodegradable waste constitutes to 123.5 TPD and the non-biodegradable waste constitutes to 30.87 TPD. The generated waste will comprise of wet kitchen waste, recyclables and non-recoverable inerts. The wet waste, with high moisture content (>40%), essentially comprises of food waste from kitchen and green waste. Dry waste generally comprises of recyclables and inerts have low moisture content (<20%) having lesser or no tendency to decompose biologically. The percentage composition of the MSW expected to be generated is Bio-degradable+ green waste from open spaces is 55%, Recyclables are 30% and Inert Waste of 15%. Integrated solid waste management facility is proposed for handling of MSW generated.

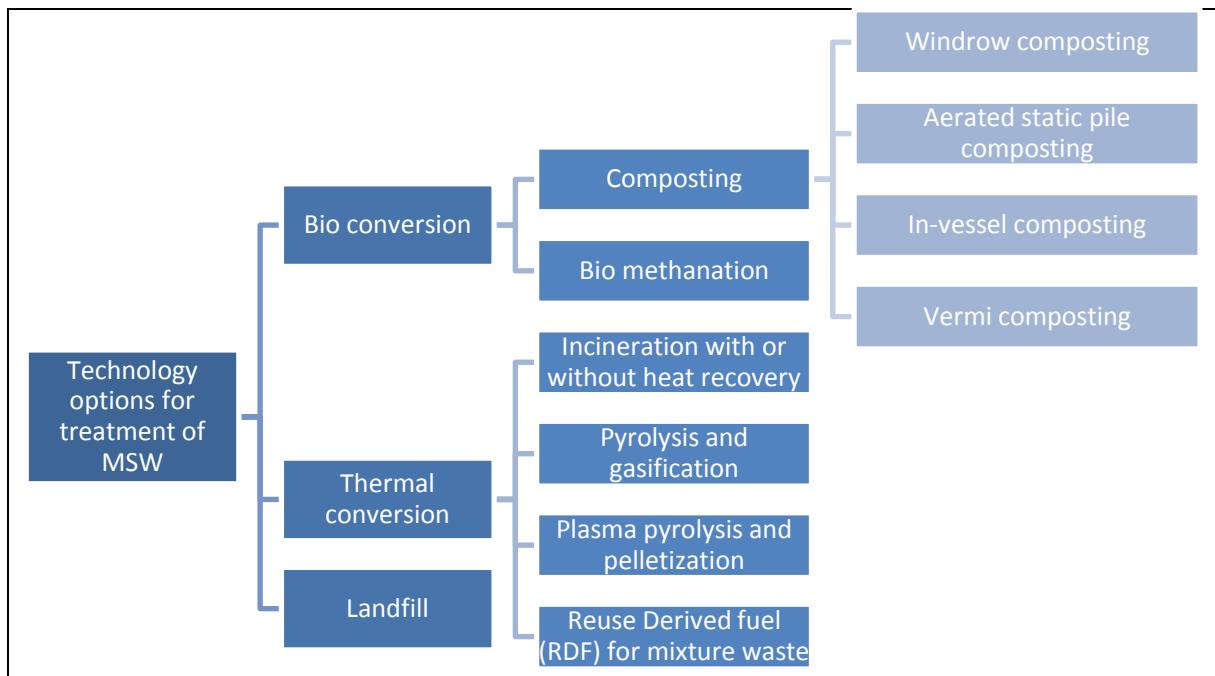


Figure 2-15: Technology options for treatment of wet MSW

For biodegradable waste, suitable composting methodology/Bio methanation can be envisaged and for non-bio degradable waste, suitable storage area can be provided and sent for recycling. The inert material and rejects remaining after segregation shall be disposed off by the respective occupant Industries directly to the authorized vendors as per the pollution control board norms from time to time.

Industrial Waste:

Industrial solid waste is estimated as 423 TPD which includes 85 TPD of hazardous waste and 338 TPD of non-hazardous waste. It has been estimated that about 13.2 tonnes of sludge will be generated daily (@300kg/ MLD) from the proposed STPs and about 8.2 tonnes/ day of sludge from the CETPs. Hazardous waste will be sent to Treatment, Storage, Disposal Facility (TSDF) located at Dundigal near Hyderabad ORR (78 km from project site). Non-hazardous waste will be given to TSPCB approved recyclers/vendors for further treatment and disposal.

E-Waste:

E-waste from both domestic and Industrial segments is also expected to be generated in NIMZ area. E-waste must be sorted out and disposed off by the respective occupant Industries directly to the authorized vendors as per the pollution control board norms from time to time.

Bio-medical waste:

Besides this, generation of bio medical waste is also expected from health care segments inside NIMZ area. The owners of health care segments have to either had their own disposal mechanism for bio medical waste or shall have tie up with authorized vendors as per the authorisations from respective State Pollution Control Boards (SPCBs) under relevant rules. All such waste will be handled and managed as per the requirements of the said Bio-medical Waste Management Rules, 2016.

Waste Management:

Presently there are no scientific solid waste management sites in the vicinity of the project site. Nearest municipal solid waste compost yard and dumping site is at Zaheerabad town under Zaheerabad Municipality (presently 5.04 acres of land) whereas the nearest Hazardous waste management facility is located at Dundigal near Hyderabad ORR (78 km from project site). The facility is managed by Hyderabad Waste Management Plant (HWMP) and has around 1,200 registered members/industries out of which around 450 are active members/industries. Presently secured landfill with stabilisation, incineration and Alternative Fuel and Resource Facilities (AFRF) are available at HWMP.

Industries shall have a temporary storage facility for 90 days detention for hazardous waste which will be designed as per the requirement. Wastes shall be periodically disposed to nearby TSDF by the member industry. Industries shall follow all the latest waste management rules.

In order to have dedicated solid waste management facility, provision of site is made in the master plan layout and shown in **Figure 2-16**.

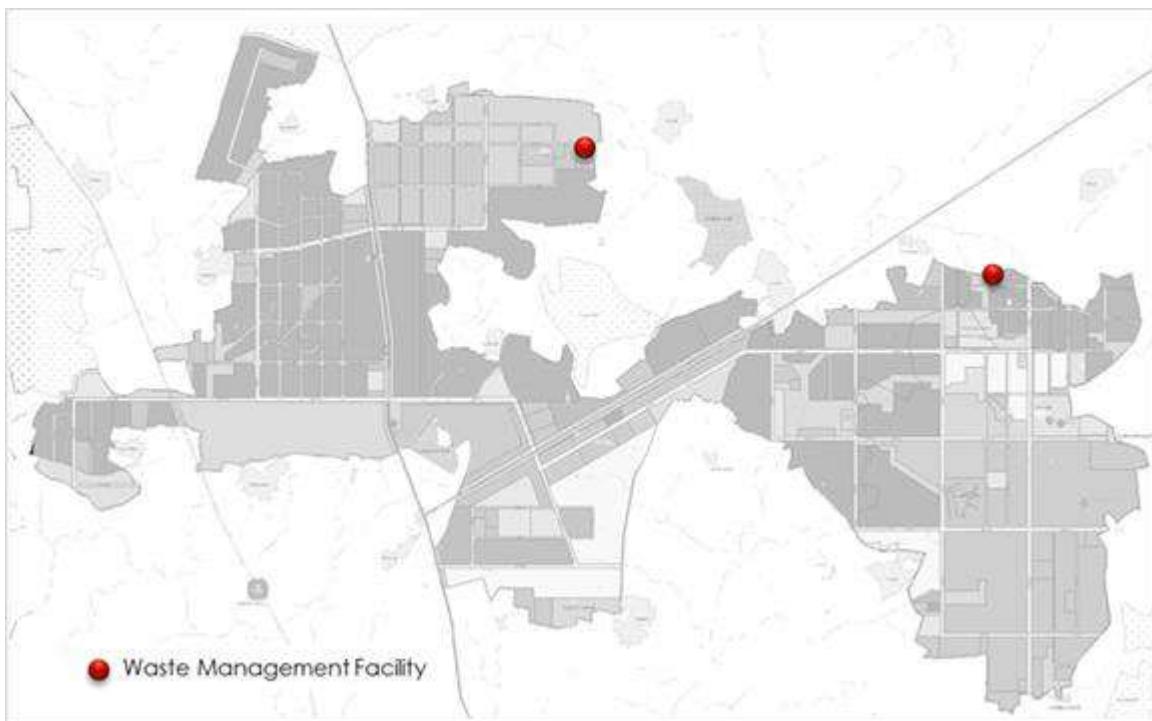


Figure 2-16: Waste Management Facility

2.5.8 Power Supply

The overall power requirement for the proposed NIMZ is 678.63 mVA. Considering the estimated bulk demand from large scale industrial units, the 400/220/ 132/33/11 kV Main

receiving sub-station and other two 132/33/11 kV main substations are strategically located in proximity to these bulk consumers to minimize distribution losses. An ROW of 28m is provided along the arterial roads within NIMZ site for these 132 kV alignments.

To cater to the rest of the consumer load demand, seven Nos. of 33/11 kV AIS distribution sub-stations are planned. The location of these secondary substations are also so planned so as to offer minimal distribution loss and ease of reticulation.

Initially, it is required to establish a 220/132/33/11 kV S/S to cater to the Power demand. This 220 kV sub-station needs to be enhanced to 400 kV S/S in future based on the actual demand scenario after full occupancy of NIMZ area.

The nearest 220 kV supply tapping point is Sadashivpet 220/132 kV S/S (also known as MRF S/S) which is fed from Shankarpalli 400 kV S/S by a double circuit feeder. From the discussions with the department officials, it is understood that this double circuit 400 KV feeder line from Shankarpalli 400 kV S/S to Sadashivpet 220/132 kV can carry a load of about 380 to 400 MVA.

TSIIC shall allocate a land space of about 50 acres for setting up this 400/22/132/33 kV S/S and 33/11 kV industrial feeder sub-stations within NIMZ site.

2.6 Project Cost

The total cost estimated for the development of various internal infrastructures by TSIIC is **Rs. 3,095 crores**. The summary of project cost is shown in **Table 2-15**.

Table 2-15: Summary of Project Cost

S. No	Project Component	Cost (in Crores)
1.	Site Development Works	414.6
2.	Roads	997.8
3.	Storm Water Management	236.9
4.	Water Supply System	157.6
5.	Sewerage System	151.2
6.	Industrial Effluent System	277.1
7.	Recycled Water System	86.3
8.	Solid Waste Management	124.2
9.	Electrical and ICT	267.3
10.	Logistics	322.0
11.	Buildings	59.9
	Total	3094.9
	Rounded off	3095

Note: Applicable taxes (1%cess, 12%GST and 2% unforeseen items) will be extra

2.7 Implementation Plan

2.7.1 Implementation Schedule

Parameters	Unit	Short-term	Medium Term	Long term	
		Till 2025	Till 2030	Till 2035	Till 2038
Investment	Rs. Crore	25,787	32,045	39,465	44,238
Industrial Land absorption	Acres	4,350	5,163	5,805	6,125

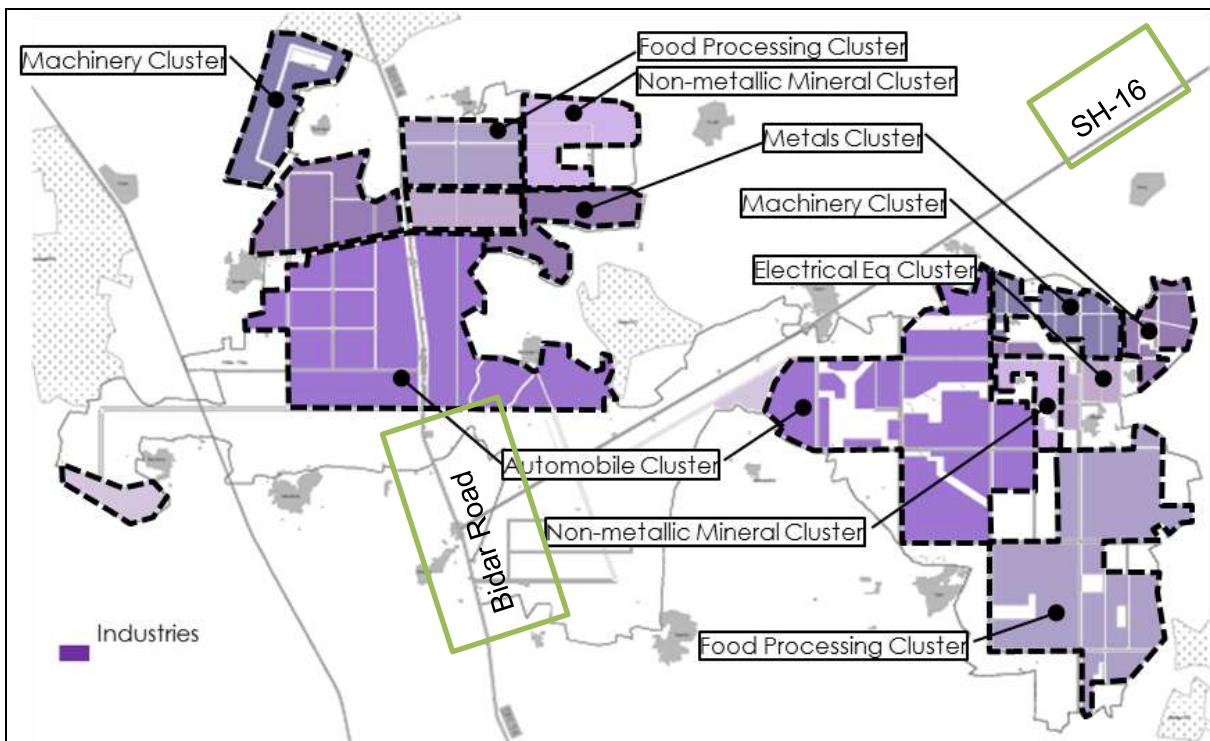
(Cluster wise Implementation)

The project is conceptualised into various clusters such as Automobile cluster, food processing cluster, engineering cluster, etc. with support infrastructure for the respective cluster and TSIIC can develop each cluster either by them or through public private partnership mode.

Initial Development - the area south of the SH16

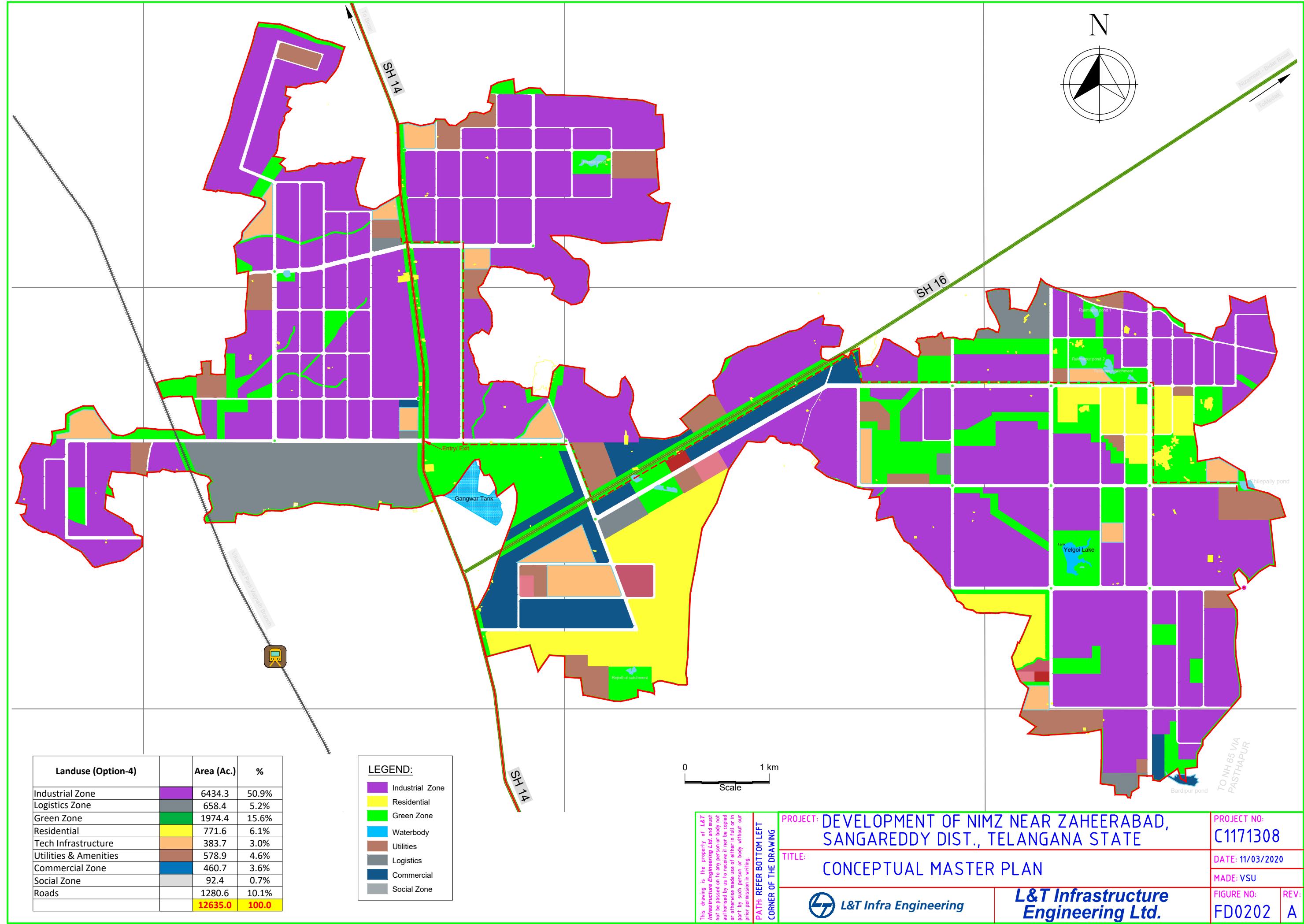
Overall Development- The area location on either side of the Bidar Roads

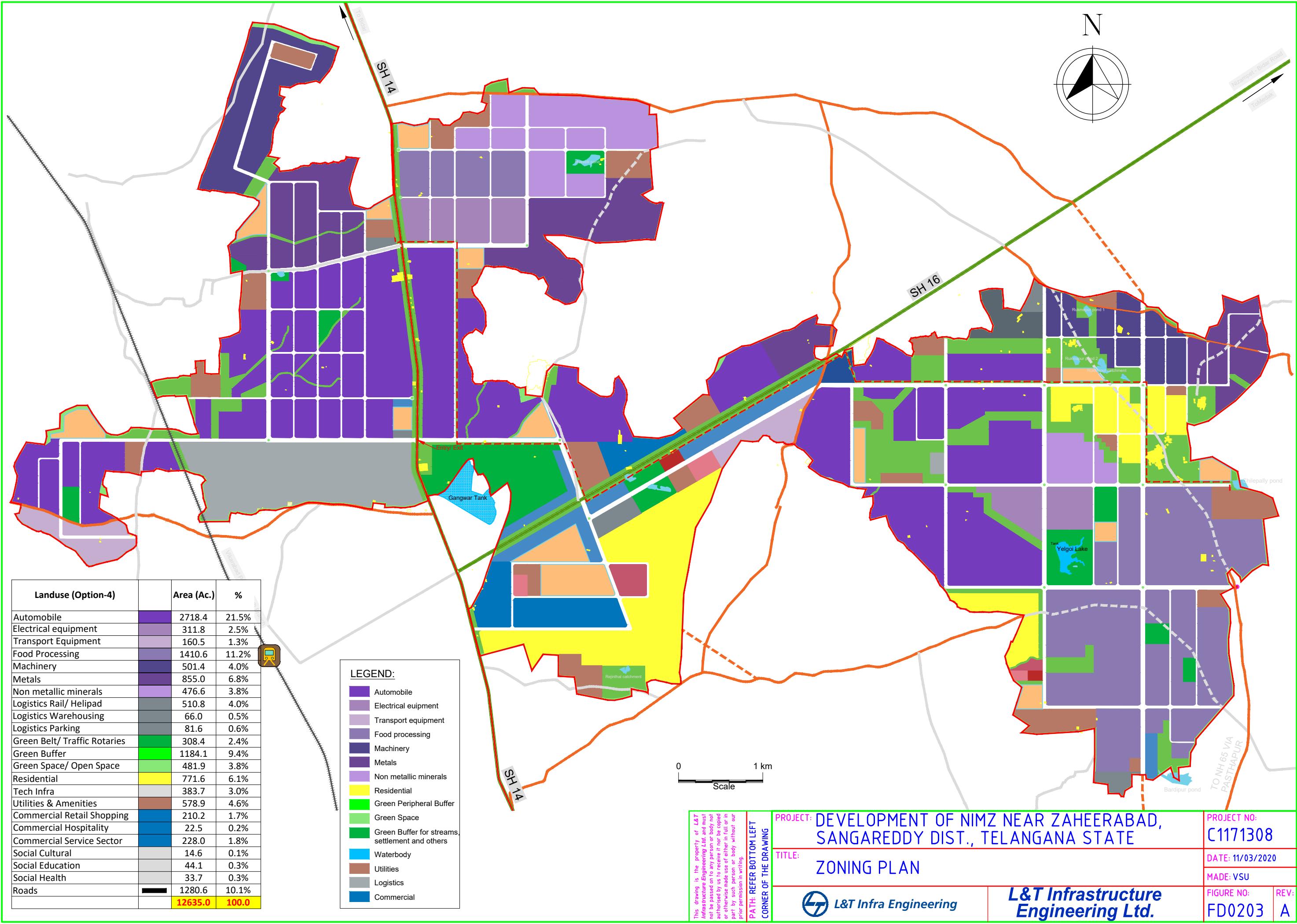
Both the zones are connected with a 45 M wide arterial with facility of entry / exit into the External road network. Each zone is planned to be self-supported with the required residential, social and recreational infrastructure.

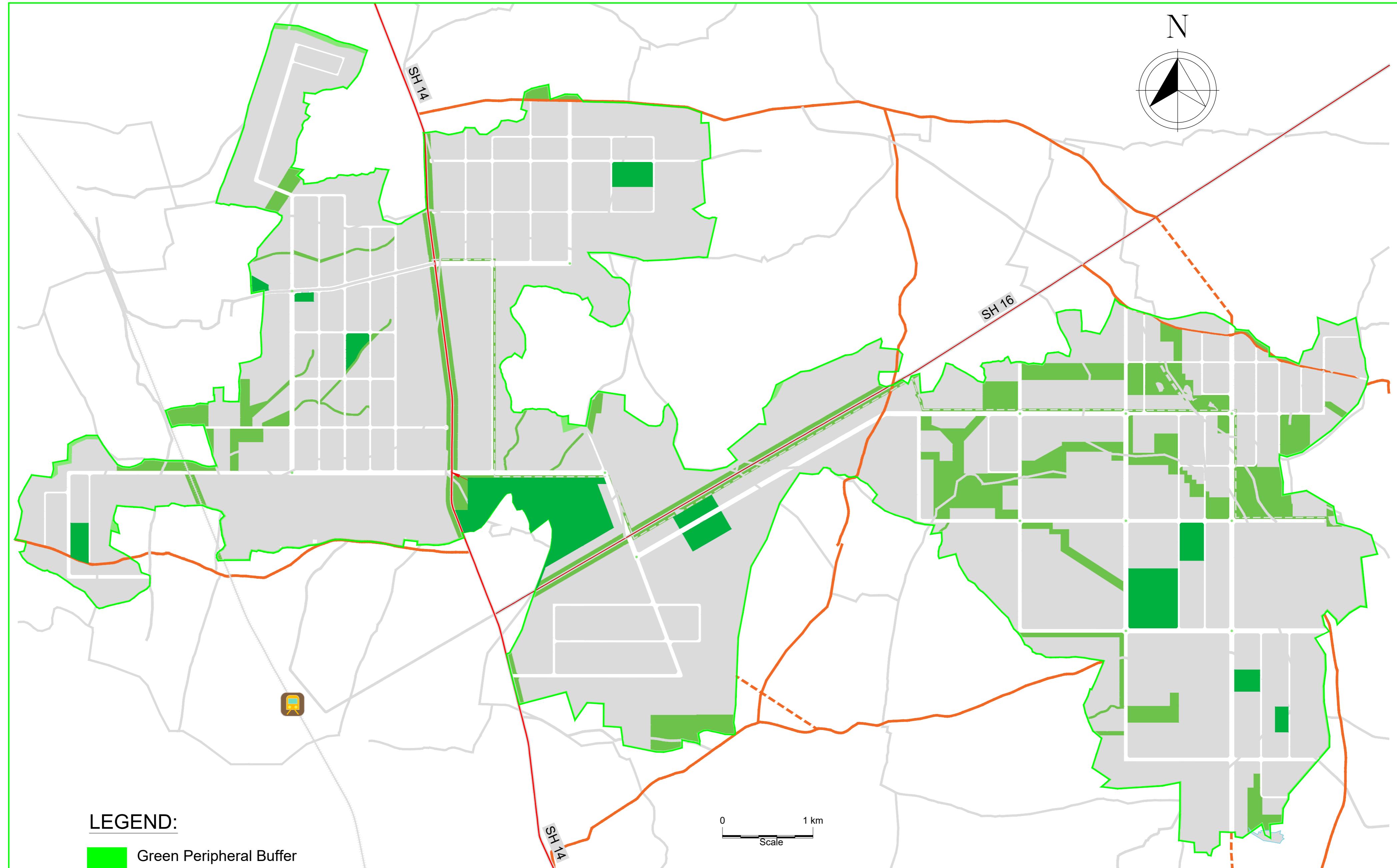


The project development activities are proposed to commence at the site after procuring all the necessary statutory approvals.

FIGURES







This drawing is the property of L&T Infrastructure Engineering Ltd. and must not be passed on to any person or body not authorized by us to receive it nor be copied or otherwise made use of either in full or in part by such person or body without our prior permission in writing.		PROJECT: DEVELOPMENT OF NIMZ NEAR ZAHEERABAD, SANGAREDDY DIST., TELANGANA STATE	PROJECT NO: C1171308
PATH: REFER BOTTOM LEFT CORNER OF THE DRAWING		TITLE: GREENBELT DEVELOPMENT PLAN	DATE: 26/02/20
REV: 0		MADE: VSU	FIGURE NO: FD0204
 L&T Infra Engineering		L&T Infrastructure Engineering Ltd.	

CHAPTER 3

DESCRIPTION OF ENVIRONMENT

Chapter 3 Description of Environment

3.1 Preamble

This chapter depicts the existing environmental conditions in and around the proposed National Investment & Manufacturing Zone (NIMZ) with an area of 5113 Ha (Acres 12635.14 guntas) located near Zaheerabad, Nyalkal and Jharasangam Mandals of Sangareddy District, Telangana. The primary baseline data was monitored and secondary data was collected from Government and Semi-Government Organisations. Terrestrial environmental components are as follows.

Terrestrial Environmental Components	
<ul style="list-style-type: none">• Meteorology<ul style="list-style-type: none">○ Temperature○ Relative Humidity○ Rainfall○ Wind Speed & Direction• Ambient Noise Levels<ul style="list-style-type: none">○ Day equivalent noise levels○ Night equivalent noise levels• Inland Water Quality<ul style="list-style-type: none">○ Groundwater Quality○ Surface Water Quality• Soil Quality• Flora & Fauna (Ecology)	<ul style="list-style-type: none">• Ambient Air Quality<ul style="list-style-type: none">○ Sulphur Dioxide (SO₂)○ Nitrogen Dioxide (NO₂)○ Particulate matter <10 micron size (PM₁₀)○ Particulate matter <2.5 micron size (PM_{2.5})○ Ozone (O₃)○ Lead (Pb)○ Carbon Monoxide (CO)○ Ammonia (NH₃)○ Benzene (C₆H₆)○ Benzo(a)Pyrene(BaP)○ Arsenic(As)○ Nickel (Ni)

3.2 Study Area/Study Period

Project Study Area: An area covering 10 km radius from NIMZ boundary has been earmarked as study area for baseline terrestrial environmental surveys.

Description of Project Influenced Area: The Project Site is located near Zaheerabad, Nyalkal and Jharasangam Mandals, Sangareddy District (formally under Medak District), Telangana. The project study area is covered in the Survey of India Toposheet nos. 56 G/5, 56 G/6, 56 G/9, 56 G/10, 56 G/13, 56 G/14 [1:50000 scale].

Zaheerabad is the major habitation in the project vicinity. There are 17 villages within the project region, spread over in Nyalkal and Jharasangam mandals of Sangareddy District. The site-specific location map showing the project boundary with coordinates and surrounding features is shown in Study area map of the project site in **Figure FD0102**.

Study Period: The baseline terrestrial environmental survey was carried out during winter season (December 2017 to February 2018).

3.3 Environmentally/Ecologically Sensitive areas

The environmental sensitive areas covering an aerial distance of 10 km from project boundary is given in **Table 3-1**.

Table 3-1: Environmentally Sensitive Areas within 10 km from Project Boundary

S. No.	Areas	Name/ Identity	Aerial distance (within 10 km.) ⁸
1.	Areas protected under international conventions, national or local legislation for their ecological, landscape, cultural or other related value	No protected monuments under international conventions. However, the following important structures are within 10 km radius: Shia Saint Khalil Allah Tomb, Ashtur Bidar Fort	- 8.7 km, N 9.6 km, NW
2.	Areas which are important or sensitive for ecological reasons - Wetlands, watercourses or other water bodies, coastal zone, biospheres, mountains, forests	Shamshalapur R.F(TS) Rajola R.F(TS) Kalbewal RF(TS) Sahapur R.F(TS) Godepalli R.F(KA) Didgi R.F(TS) Digwal R.F(TS) Zahirabad R.F(TS) Chitta R.F(KA) Tadapalli R.F(KA) Honnadi R.F(KA) Hadnuri RF(TS) Badripur RF(TS)	Adjacent, N 1.1km, W Adjacent, W 1.5km, N 2.8km, W 2.8km, S 4.7km, SE 4.9km, S 6.1km, W 7km, SW 9.5km, SW Adjacent, S 0.1km, SE
3.	Areas used by protected, important or sensitive species of flora or fauna for breeding, nesting, foraging, resting, over wintering, migration	-	-
4.	Inland, coastal, marine or underground waters	Madhura Nadi Narinja Reservoir	0.2 km, S 1.5 km, S
5.	State, National and International boundaries	Telangana – Karnataka State Boundary	adjacent to project site
6.	Routes or facilities used by the public for access to recreation or other tourist, pilgrim areas	SH14 SH16 NH9 (NH65) South Central Railway	Crossing across project site Crossing across project site 10 km, S Passing across project site
7.	Defence installations	Air force Station at Bidar, Karnataka	15 km
8.	Densely populated or built-up area	Zaheerabad (Telangana State) Bidar (Karnataka)	9km, S 8 km, NW
9.	Areas occupied by sensitive man-made land uses (hospitals, schools, places of worship, community facilities)	Major habitations within 10 km radius of project site include Zaheerabad and Bidar. In addition, the 10 km radius from project site has several smaller settlements/villages. Several settlements/villages have health care facilities, schools, places of worships, community facilities, etc.	
10.	Areas containing important, high quality or scarce resources, (ground water resources, surface resources, forestry, agriculture, fisheries, tourism, minerals)	Reserve forests as given s.no.2	
11.	Areas already subjected to pollution or environmental damage. (those where existing legal environmental standards are exceeded)	Nil	
12.	Areas susceptible to natural hazard which could cause the project to present environmental problems, (earthquakes, subsidence, landslides, erosion or extreme or adverse climatic conditions)	Proposed development area falls under Seismic Zone II (Low Damage Risk Zone) as per IS 1893 (Part I). During the design stage, the effects from natural disasters will be considered as per IS: 1893 (Part1): 2002 and necessary precautionary measures would be built-in/ implemented.	

⁸ Distances are aerial distances measured from the boundary of project site.

3.4 Physical Conditions

Two districts namely Sangareddy (formerly under Medak) in Telangana and Bidar in Karnataka are falling under PIA districts.

3.4.1 Natural Resources of PIA District

3.4.1.1 Forest Resources

Sangareddy: The forests of the district fall under Tropical Dry Deciduous and Tropical Thorn Forest. The hilly areas are covered under reserved forests comprising of Maddi, Chinangi, Satinwood, Mahua, Neem and Abnus. The leaves of Abnus are used for making beedis and are important forest products of the district.

Bidar: Forest areas of Bidar division are classified as Reserve forests, protected forests and unclassified forests. Bidar Forest division is having 43,592 ha. of Forest area and this area is about 8.5% of total geographical extent of the district.

Study Area:

In the study area of 10 km radius Forest Type (RF /PF/ unclassified) belongs to Tropical dry deciduous mixed scrub classification is observed. In the buffer area following RFs are observed Shamshalaipur R.F(TS), Rajola R.F(TS), Kalbewal RF(TS), Sahapur R.F(TS), GodepalliR.F(KA), Didgi R.F(TS), Digwal R.F(TS), Zahirabad R.F(TS), Chitta R.F(KA), Tadapalli R.F(KA), Honnadi R.F(KA), Hadnuri RF(TS), and Badripur RF(TS). In forest area mass plantations such as Eucalyptus globulus area observed grown as forest conservation programme. The other common native tree species in the RFs are *Vitex negundo*, *Prosopis juliflora*, *Azadirachta indica*, *Borassus flabellifer*, *Tamarindus indica* and *Acacia nilotica* are observed as predominant species .Forest map of PIA is shown in **Figure 3-1**.

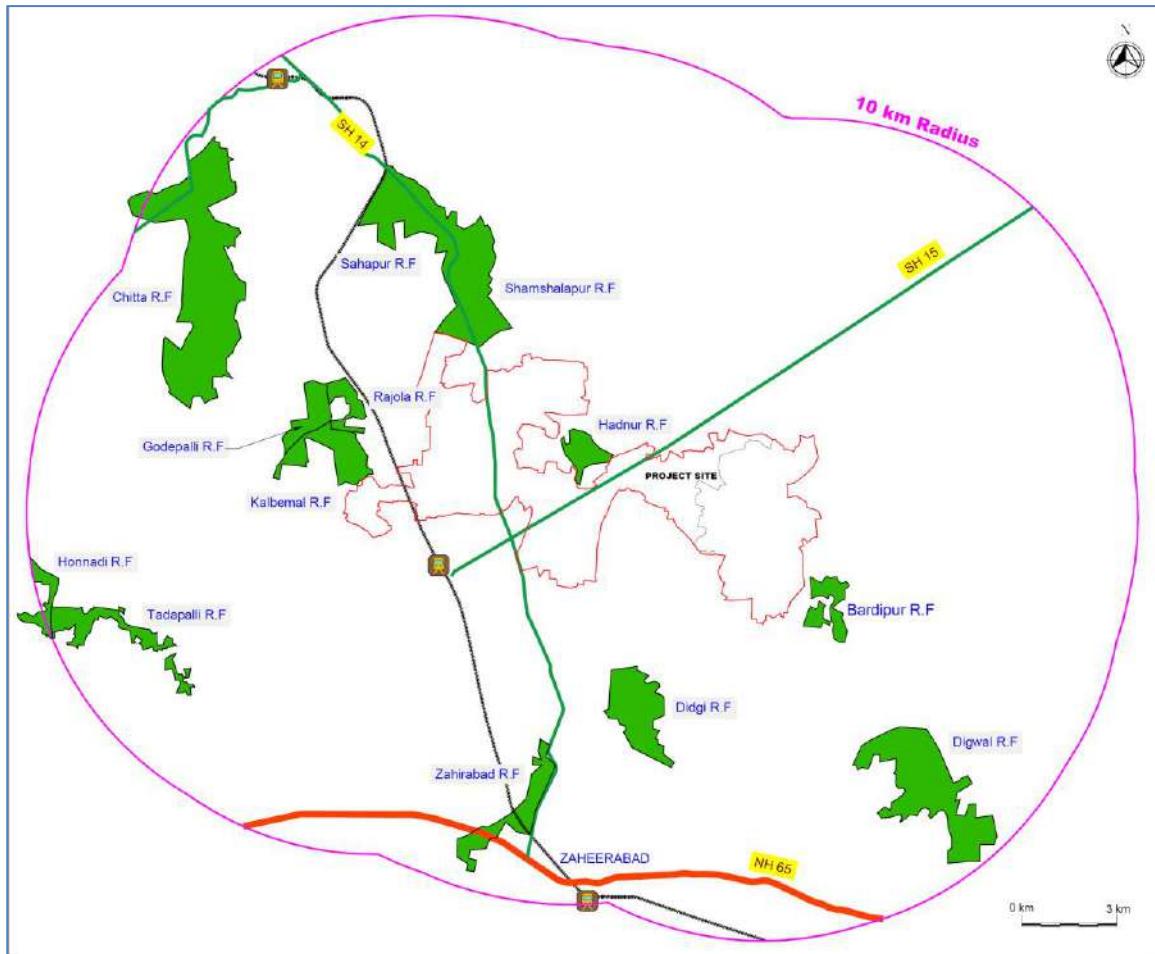


Figure 3-1: Forest Map of PIA

3.4.1.2 Agricultural resources

All the project villages are agrarian based; the major crops grown are sugarcane, jowar, maize, paddy, green gram and red gram.

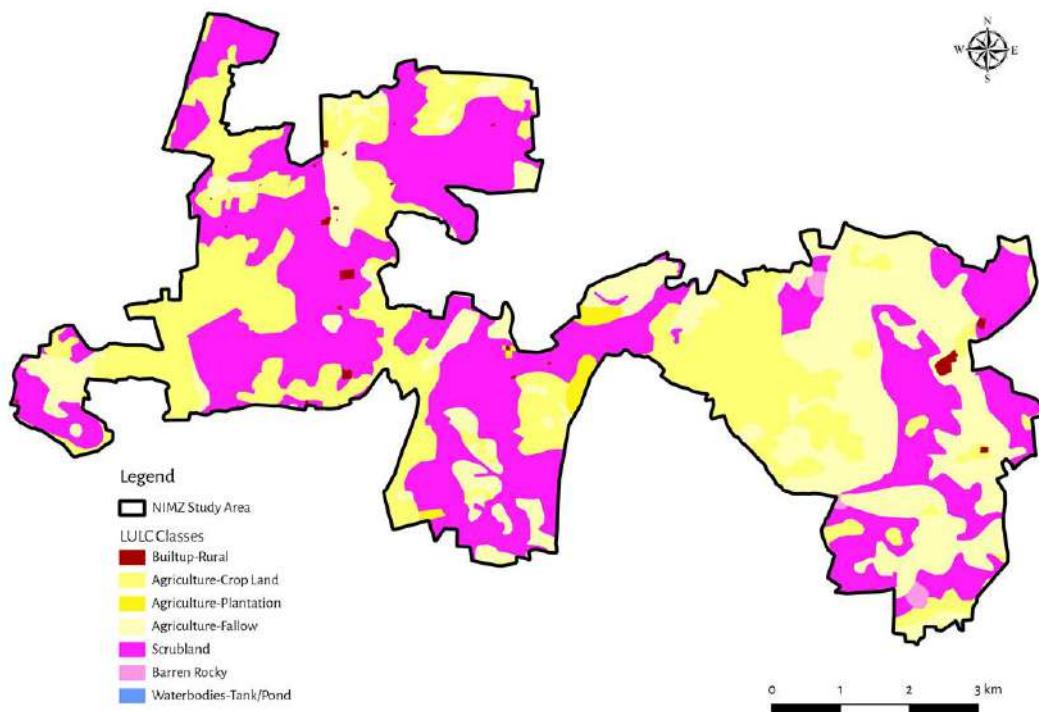
3.4.1.3 Mineral Resources

The major minerals found in the sangareddy district are quartz and laterite. Minor minerals include Silica sand, pink granite etc.

3.4.2 Land Use and Land Cover

3.4.2.1 Land Use Pattern in Project Area

The Land Use Land Cover (LULC) is prepared using the available Sentinel-2 satellite imagery data of 2019-2020 for Kharif and Rabi seasons. The land use/land cover map of the project site is given in **Figure 3-2**.



(Source: NRSC-Bhuvan, 2019-20)

Figure 3-2: land use/land cover map of the project site

Land use / land cover details are given in the Table 3-2.

Table 3-2: Land use Pattern in and around the Project Site

S. No	Land Use Type	Area (Ha)	% of Total Area
1	Scrub Land	2280.21	44.60
2	Agriculture: Crop Land	1413.70	27.65
3	Agriculture: Fallow	1339.92	26.21
4	Agriculture: Plantation	40.89	0.80
5	Rocky Area	21.77	0.43
6	Builtup-Rural	15.63	0.31
7	Waterbodies: Tanks/pond/lakes	0.89	0.02
	Total	5113	100

3.4.2.2 Land Use Pattern in and around Project Site (10 km radius)

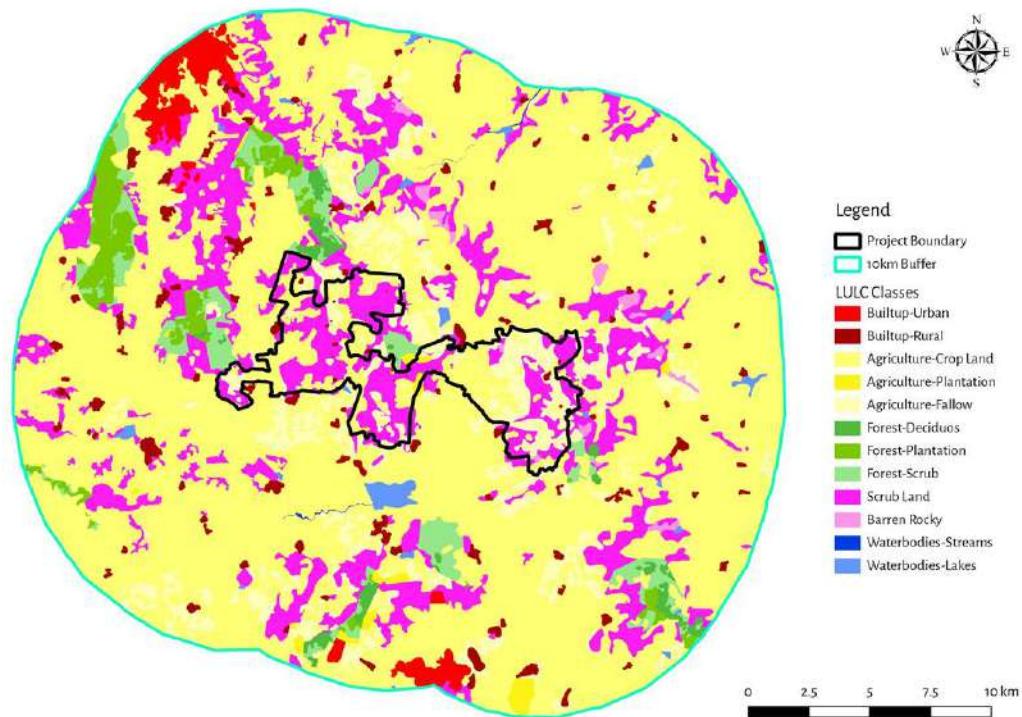
A 10 km buffer area from the project site was considered for understand the general land use of the area around the project site. **Figure 3-3** shows the Land use Pattern and LULC map prepared for the entire 10km buffer area and land use pattern of PIA is presented in **Exhibit 3-1**.

The land use pattern in and around 10 km radius is given in **Table 3-3**.

Table 3-3: Land use Pattern in and around 10 km radius

S. No	Land Use Type	Area (Ha)	% of Total Area
1.	Water bodies: Streams	53.99	0.08
2.	Agriculture: Plantation	374.74	0.53
3.	Barren: Rocky	418.66	0.59
4.	Forest: Deciduous	503.22	0.71
5.	Water bodies: Lakes	527.71	0.74
6.	Built-up: Rural	1133.03	1.59
7.	Built-up: Urban	1210.77	1.70

S. No	Land Use Type	Area (Ha)	% of Total Area
8.	Forest: Plantation	1348.41	1.89
9.	Forest: Scrub	2147.23	3.01
10.	Agriculture: Fallow	6985.46	9.80
11.	Barren: Scrub Land	11946.24	16.75
12.	Agriculture: Crop Land	44650.24	62.62
	Total	71299.70	100



(Source: NRSC-Bhuvan Imagery of 2019-20)

Figure 3-3: Land Use/Land Cover Map for PIA





Exhibit 3-1: Land use pattern in the Buffer Area

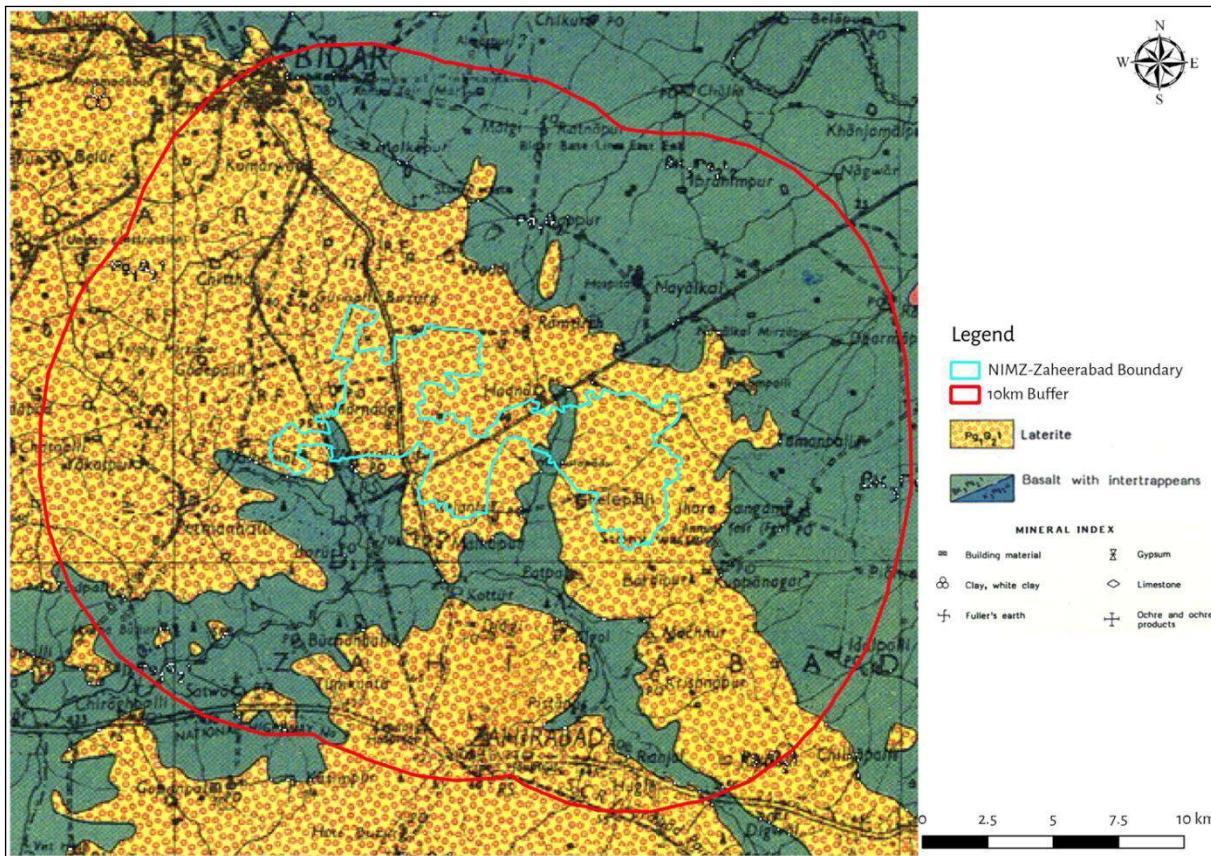
3.4.3 Topography

The majority of the project area falls on ridge line and elevations are varying from 605m to 660m. The contour map of project site is shown in **Figure 2-12**.

3.4.4 Geology

The Sangareddy district is composed of oldest rock formations, i.e., Archaean gneisses and those consisting principally of peninsular granite. The Western part has large deposits of Mesozoic – lower tertiary rocks. Besides, in the South-western part, Pliostocene - Laterites is found between Manjira and Kagna rivers. The soils developed in the Eastern half on Archaean gneisses are Ustalfs in the Northern part and Ustalfs-Tropepts in the Southern part. Usterts soil sub-order association is generally found in Western half with large extension of Orthents- Tropepts in extreme Western part of the district.

Geology and minerals Map of PIA district is shown in **Figure 3-4**. The project site is dominated by laterite formations.



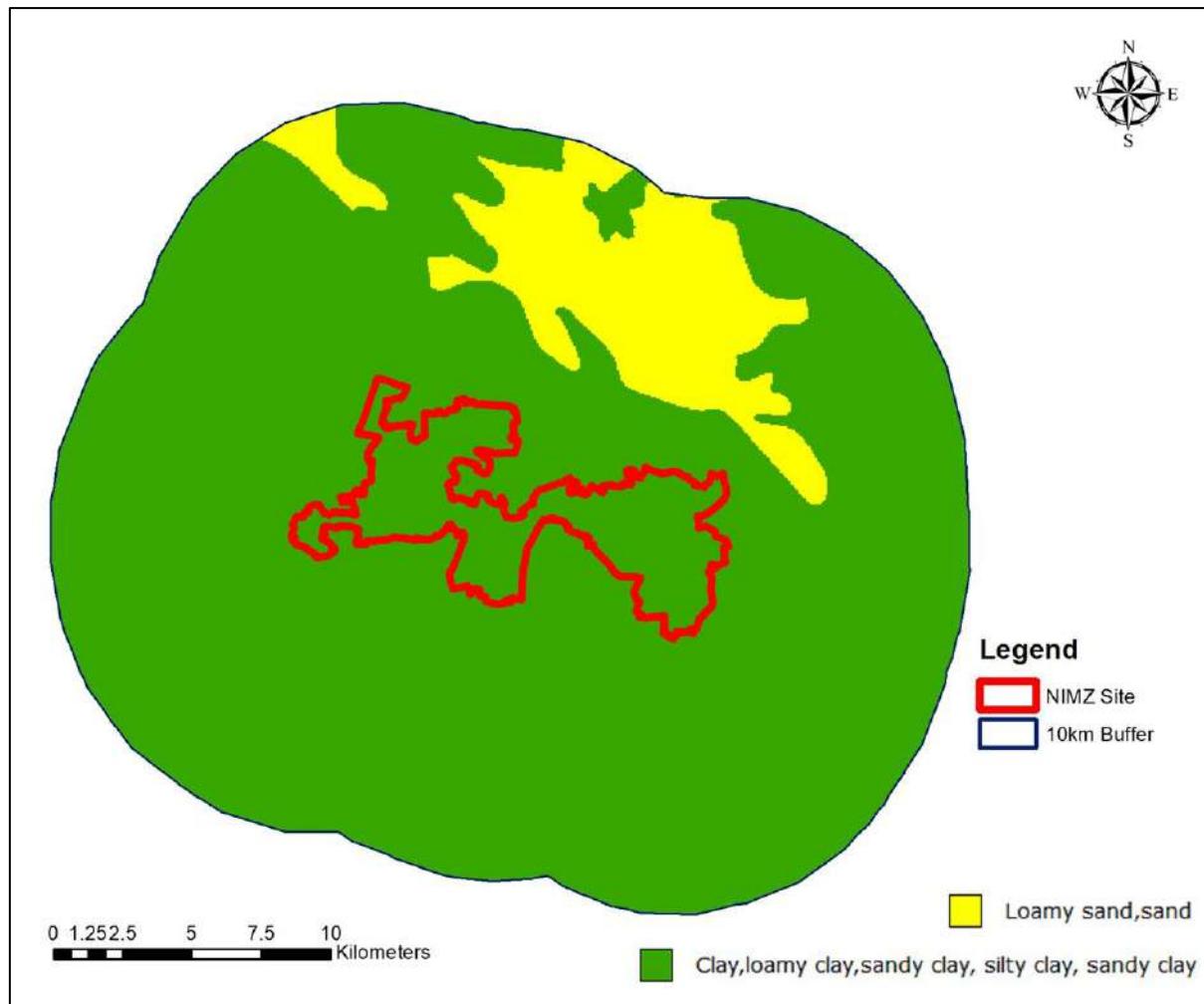
(Source: Geological Survey of India)

Figure 3-4: Geology and Minerals Map of study area

3.4.5 Soils

The soil of the sangareddy district is mainly red earth comprising loamy sands, sandy loams and sandy clay loams. The soil of the Zaheerabad area is predominantly red laterite. Regode and black cotton soil consisting of clay loams, clay and silty clay are found in the district.

Soil Map of the study area is shown in **Figure 3-5**. The project site is dominated by clay, clay loamy, sandy & silty clay.



(Source: NRSC-Bhuvan)

Figure 3-5: Soil map of the study area

3.4.6 Hydrogeology

The entire Sangareddy district is covered by hard rock except for 0.2% of the alluvium area. Ground water occurs under unconfined to confined conditions in hard rock (Archaean and Deccan traps ages) and recent alluvial formations. Yield potential of the aquifers in the consolidated rocks varies widely from 3 to 7 lps. As per the Ground Water Estimation Committee (GEC-97) norms, Nyalkal and Jharasangam mandals of Sangareddy district falls under critical level⁹. Ground Water Levels Observed near to Project site is given in **Table 3-4**.

Table 3-4: Ground Water Levels Observed near to Project site

Block_Name	Village Name	Well Type	Year of Observation	Monsoon	Rabi Season	Kharif Season	Premonsoon
Jerasangam	Jharasangam	Bore Well	2018	NA	6.76	6.98	NA
			2017	6.7	4.84	3.9	6.83
			2016	5.84	NA	2.08	24.18
			2015	5.83	7.03	6.38	9.3
			2014	6.23	3.86	6.66	6.68
			2013	1.65	6.58	0.67	14.68
			2012	NA	5.74	5.03	11.4

⁹ Central Ground Water Board Brochure-September 2013

Block_Name	Village Name	Well Type	Year of Observation_	Monsoon	Rabi Season	Kharif Season	Premonsoon
	Tatipally		2011	0.22	4.65	3.94	7.05
			2010	0.95	5.28	3.46	6.58
			2006	NA	12.12	NA	13.22
			2005	9.12	10.27	5.52	12.02
			2018	NA	15.5	10.9	NA
			2017	8.62	7.94	12.95	11.37
			2016	NA	NA	NA	11.55
			2016	10.7	NA	6.35	NA
			2015	9.3	8.15	8.93	9.7
			2014	7.68	6.05	8.88	NA
	Hadnur		2013	5	7.67	3.92	9.62
			2012	NA	7.22	7.3	9.87
			2006	NA	20.5	NA	23.06
			2006	NA	20.65	NA	23.35
			2005	17.7	19.12	16.23	22.24
			2005	17.76	18.15	16.33	22.34
			2018	NA	3.11	5.97	NA
			2017	2.72	2.95	2.15	6.45
			2016	3.57	NA	1.52	6.67
			2015	4.34	3.72	5.87	5.27
	Nyalkal	Dug Well	2014	2.85	1.65	2.87	3.67
			2013	1.07	3.94	'0.77	6.75
			2012	NA	3.39	2.67	5.42
			2011	1.09	1.39	2.35	3.47
			2010	'0.47	2.57	'0.86	5.45
			2009	2.06	2.33	1.72	4.82
			2008	'0.49	3.02	1.55	4.37
			2007	1.83	2.76	1.7	6.15
			2006	9.08	2.76	1.7	6.5
			2005	2.3	4.33	1.44	6.6
			2004	2.7	3.27	3.02	5.62
			2003	2.7	2.9	1.69	6.6
			2002	6.6	1.32	1.7	5.08
			2001	2.46	2.88	'0.54	5.8
			2000	1.7	2.5	1.83	4.22
			1999	1.06	2.38	2.04	4.28
			1998	'0.37	1.25	1.4	5.63
			1997	2.34	1.01	1.5	3.42
			1996	'0.6	1.53	'0.2	6.52
	Zaheerabad	Bore Well	2018	NA	'0.4	14.6	NA
			2017	9.86	1.72	'0.17	14.1
			2016	NA	NA	NA	NA
			2015	NA	8.95	14.6	14.6
			2014	8.85	2.84	9.42	6.57
			2013	2.15	7.09	3.23	NA
			2012	NA	11.09	NA	NA
			2011	5.63	2.65	6.99	11.3
			2010	1.4	5.1	NA	10.52
			2009	2.77	5.24	10.5	NA
			2008	1.97	NA	3.35	10.93
			2007	10.53	7.22	9.88	10.44
			2006	10.53	7.9	5.24	10.53
			2005	10.53	10.3	NA	10.93
			2004	9.1	12.4	7.22	10.93
			2003	9.4	10.53	5.19	NA
			2002	6.2	4.18	7.7	9.42

Block_Name	Village Name	Well Type	Year of Observation	Monsoon	Rabi Season	Kharif Season	Premonsoon	
			2001	3.43	5.6	NA	NA	
			2000	2.8	5.2	3.5	9.25	
			1999	2.9	3.82	3.55	6.5	
			1998	3.14	5.85	2.5	9.98	
			1997	7.97	3.52	6.28	8.02	
			1996	1.4	2.98	NA	8.6	
			2016	NA	NA	NA	14.6	
	Pastapur	Dug Well	2018	NA	7.18	13.65	NA	
			2017	5.2	7.66	4.79	19.45	
			2016	15.06	19.45	4.15	NA	
			2016	NA	NA	NA	19.45	
			2015	15.6	9.12	16.5	NA	
			2014	8.06	4.05	8.06	NA	
	Ranjole	Bore Well	2006	NA	53.5	NA	60.15	
			2005	39.05	44.9	30.7	52.08	
	Satwar		2018	NA	'0.7	4.4	NA	
			2017	4.5	3.38	'0.24	5.2	
			2016	1.19	6	'0.5	7.9	
			2015	3.32	4.73	5.85	5	
			2014	4.49	2.83	5.93	3.87	
			2013	'0.03	3.69	'0.06	4.64	
			2012	NA	NA	1.91	NA	
			2007	21.64	16.5	NA	21.64	
	Zaheerabad	Dug Well	2006	6.02	10.29	5.4	15.68	
			2005	5.63	16.71	6.15	21.58	
			2004	NA	14.9	15.18	21.64	
			2003	15.4	NA	10.52	NA	

(Source: CGWB through India-WRIS web portal)

3.4.7 Drainage & Irrigation

3.4.7.1 Drainage Network

Manjira, a tributary of River Godavari is an important drainage flowing in the district. The important Nizam Sagar dam is constructed on this river. The other important streams are Haldi and Kudalair flow in the Eastern half of the district. Streams and water bodies in study area are shown in **Figure 3-6**.

It is observed that general slope in the project region is SW. There are streams noted within the site which are flowing towards the Narinja dam. As per WRIS (Water Resource Information System) the proposed project of NIMZ-Zaheerabad falls in Manjira Sub-basin of Godavari basin. The buffer area falls under four watersheds namely; C03MAJ16, 17, 23 and 24.

The catchment and drainage pattern in the study area is shown in **Figure 3-7**. From figure, it can be observed that C03MAJ16 has Madhura River, C03MAJ17 has Karanja River and C03MAJ23 & 24 have Manjira River. The flow directions marked in black are to represent the drainage contributing to Madhura & Karanja Rivers whereas white direction heads are to represent drainage contributing to Manjira River.

The proposed project area is majorly falling in C03MAJ16 watershed and can be considered as project influenced watershed. Smaller eastern part of project area is having drainage originating into C03MAJ24 watershed contributing to Manjira catchment. This being a small area it will have least impact on the natural discharge in to Manjira reservoir.

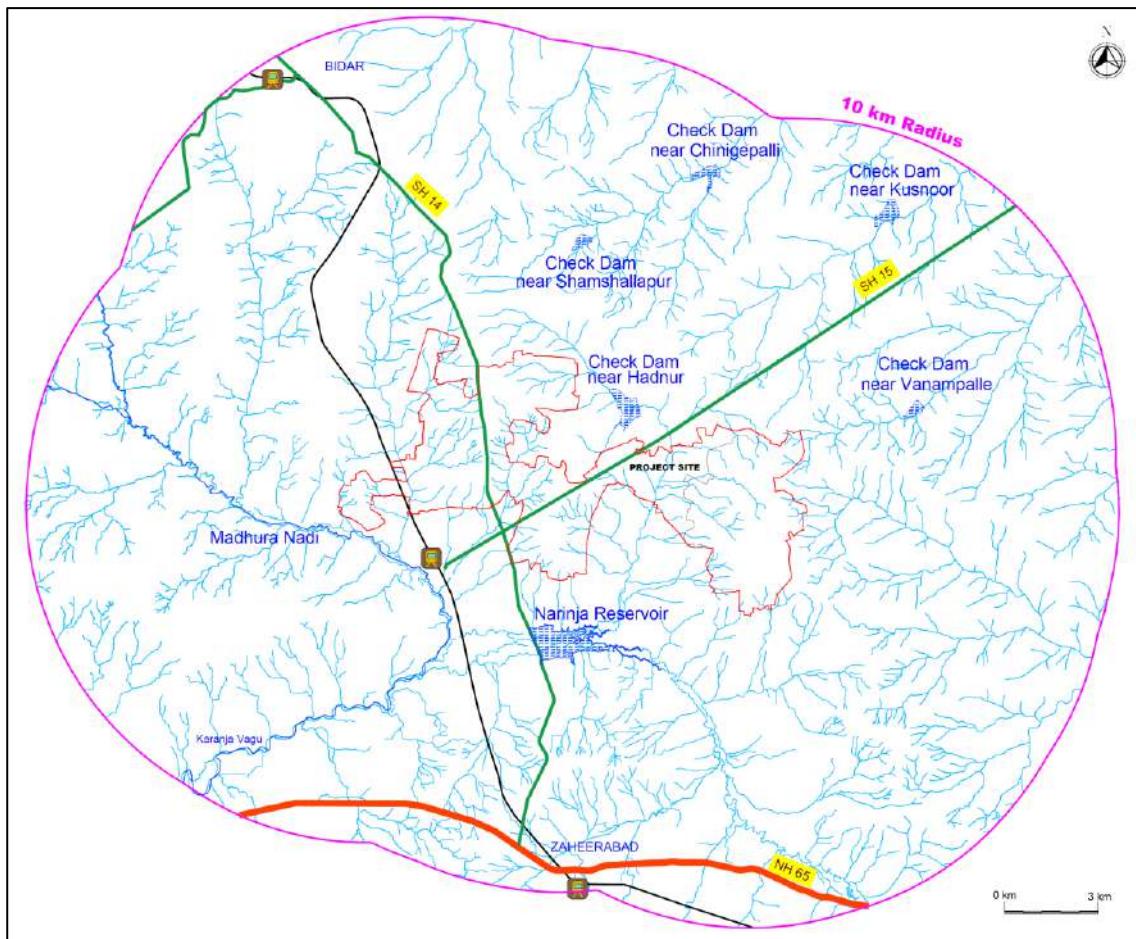


Figure 3-6: Streams and Water bodies in Study area

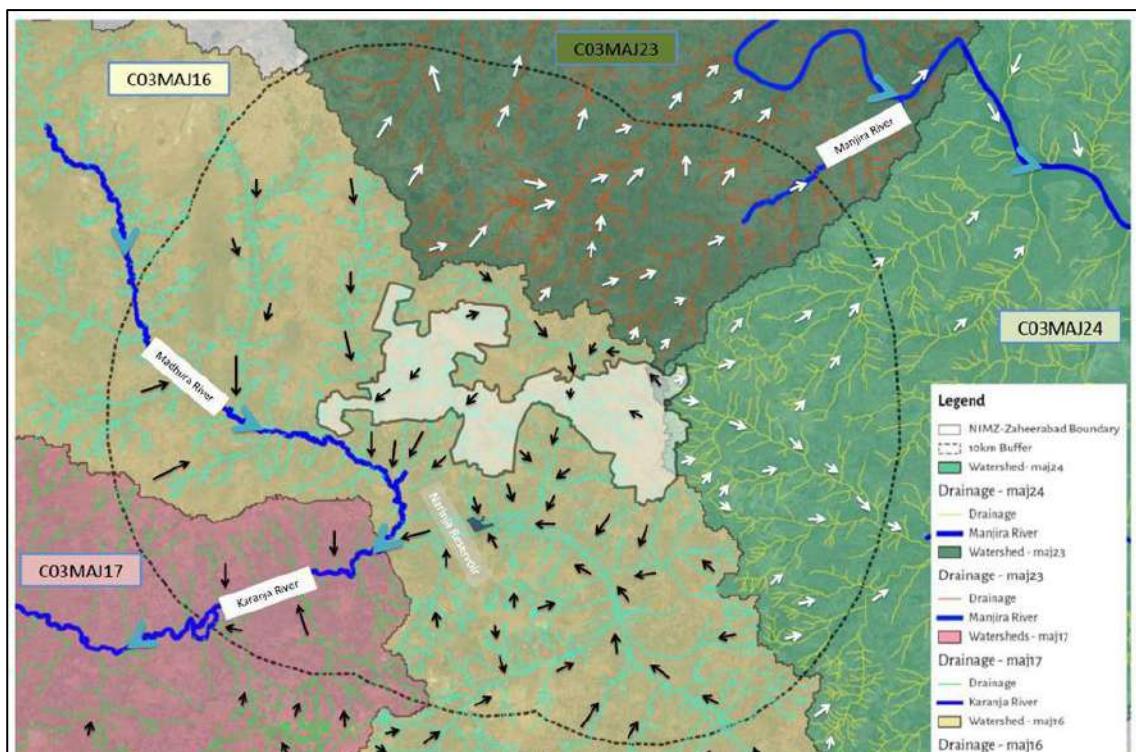
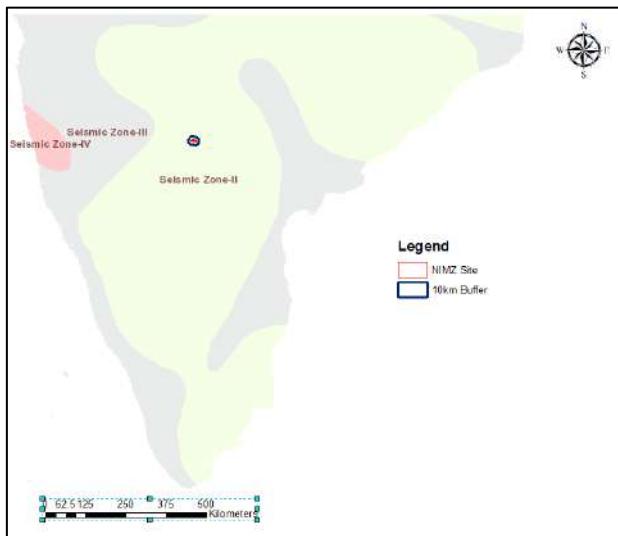


Figure 3-7: Drainage pattern in Study area

3.4.8 Natural Hazards

As per the Seismic Zoning Map of India (IS:1893-2002, BIS), the NIMZ site falls under Zone II. This region is liable to MSK VI or less and is classified as a 'Low Damage Risk Zone'. The IS code assigns zone factor of 0.10 (maximum horizontal acceleration that can be experienced by a structure in this zone is 10% of gravitational acceleration) for Zone II. This implies that the NIMZ site falls under a least active seismic zone. Seismic Zoning Map is given as **Figure 3-8**. Also NIMZ project area does not fall under flood prone area.



(Source: India-WRIS)

Figure 3-8: Seismic zoning Map of Southern India

3.5 Surface and Ground Water Quality

The baseline status of water quality has been assessed through the identification of water resources and appropriate sampling locations for surface and groundwater in the study area. The sampling locations for both surface and groundwater are shown in **Figure FD0301**. The water samples were collected once during the study period and were analysed for physical, chemical and bacteriological parameters. Standard methods prescribed for sampling and analysis were adopted. Sampling protocol was based on the hydrogeological conditions of the region and also based on the competitive usage of the respective water source from which the sample has been collected.

3.5.1 Groundwater Quality

Total Ten (10) ground water monitoring locations were identified for assessment in different villages around the project site based on the usage of ground water by the settlements/villages in the study area. Groundwater quality monitoring locations are given in **Table 3-5**. Ground water analysis results are given as **Appendix D**.

Table 3-5: Details of Ground water Quality Monitoring Locations

Station Code	Location	Distance (km) from Project boundary	Azimuth Directions	Sampling Source
GW1	Project Site	-	-	Bore Well
GW2	Yalgul (Yalgoi)	Adjacent	W	Bore Well
GW3	Rejantal	0.4	E	Bore Well
GW4	Tekur	2.8	NNE	Bore Well
GW5	Gunalli	1.7	W	Bore Well
GW6	Gunjetti	0.9	E	Bore Well

Station Code	Location	Distance (km) from Project boundary	Azimuth Directions	Sampling Source
GW7	Waddi	2.6	N	Bore Well
GW8	Hadnur	0.3	N	Bore Well
GW9	Metalkunta	Adjacent	S	Bore Well
GW10	Kalbemal	0.8	W	Bore Well

3.5.1.1 Results and Discussion on Groundwater Quality

A summary of analytical results are presented below:

- pH ranged between 7.01 and 7.87
- Electrical Conductivity (EC) varied between 657 $\mu\text{S}/\text{cm}$ and 965 $\mu\text{S}/\text{cm}$
- Total dissolved solids ranged between 407 mg/l and 598 mg/l
- Total alkalinity (as CaCO_3) varied between 166.32 mg/l and 289.08 mg/l
- Total hardness (as CaCO_3) ranged between 165.64 mg/l and 298.96 mg/l
- Calcium (as Ca) ranged between 34 mg/l and 90.67 mg/l
- Magnesium (as Mg) ranged between 12.76 mg/l and 27.48 mg/l
- Chlorides (as Cl^-) ranged between 48.32 mg/l and 197.32 mg/l
- Fluorides as (F^-) ranged between 0.37 mg/l to 0.78 mg/l
- Sulphates (as SO_4^{2-}) ranged between 55.56 mg/l and 120.59 mg/l
- Nitrates (as NO_3^-) ranged between 3.05 mg/l and 4.3 mg/l
- Zinc (Zn) ranged between 0.27 mg/l to 0.97 mg/l
- Iron (Fe) ranged between 0.28 mg/l to 0.6 mg/l
- Residual free chlorine ranged below 0.2 mg/l
- Total Nitrogen varied between 3.05 mg/l to 4.3 mg/l
- COD ranged between 4 mg/l and 14 mg/l
- DO ranged between 4.7 mg/l and 5.5 mg/l
- Total phosphorous, Phenolic compounds, BOD, Cadmium (Cd), Chromium (Cr^{+6}), Arsenic (As), Copper (Cu), Cyanides (CN), Mercury (Hg) are observed to be well below the desirable limit and Coli forms not detected at all locations

It is inferred that groundwater samples are within the limits specified for drinking water quality standards as per IS: 10500 (2012), except Hardness, Alkalinity, TDS, Calcium at some villages. But these exceeded values are within the permissible limits in the locations. Iron values at all the locations are exceeded the desirable limits this is probably due to laterite soils in the PIA.

3.5.2 Surface Water Quality

Five (05) Surface water bodies were found during the survey period. Surface water monitoring locations were identified for assessment based on the usage of surface water in the study area.

Water sample analysis with respect to physico-chemical, nutrient, demand and bacteriological parameters having relevance to public health and aesthetic significance are selected to assess the water quality status with special attention. Standard methods prescribed for surface sampling and analysis were adopted.

Surface water quality monitoring locations are given in **Table 3-6**. Surface water analysis results are given as **Appendix D**.

Table 3-6: Details of Surface water Quality Monitoring Location

Station Code	Location	Distance (km) from Project boundary	Azimuth Directions
SW1	Singur Reservoir	13.0	NE

Station Code	Location	Distance (km) from Project boundary	Azimuth Directions
SW2	Manjeera River	12.5	NE
SW3	Madhura Nadi near Metalkunta R.S.	0.6	S
SW4	Check dam near Hadnur	1.0	N
SW5	Narinja Reservoir	1.9	S

3.5.2.1 Results and Discussion on Surface Water Quality

A summary of analytical results are presented below:

- pH ranged between 7.26 and 7.48
- Electrical Conductivity (EC) varied between 485 $\mu\text{S}/\text{cm}$ and 764 $\mu\text{S}/\text{cm}$
- Total dissolved solids ranged between 301 mg/l and 474 mg/l
- Total alkalinity (as CaCO_3) varied between 126.72 mg/l and 190.08 mg/l
- Total hardness (as CaCO_3) ranged between 214.12 mg/l and 323.2 mg/l
- Calcium (as Ca) ranged between 58.9 mg/l and 74.48 mg/l
- Magnesium (as Mg) ranged between 14.72 mg/l and 33.37 mg/l
- Chlorides (as Cl⁻) ranged between 36.24 mg/l and 64.43 mg/l
- Fluorides as (F⁻) ranged between 0.64 mg/l to 0.68 mg/l
- Sulphates (as SO_4^{2-}) ranged between 22.22 mg/l and 87.25 mg/l
- Nitrates (as NO_3^-) ranged between 1.09 mg/l and 1.52 mg/l
- Iron (Fe) ranged between 0.26 mg/l to 0.33 mg/l
- Total Nitrogen varied between 1.09 mg/l to 1.52 mg/l
- COD ranged between 8 mg/l and 14 mg/l
- DO ranged between 4.5 mg/l and 4.9 mg/l
- Total phosphorous, Phenolic compounds, BOD, Residual free chlorine, Cadmium (Cd), Chromium (Cr^{+6}), Arsenic (As), Zinc (Zn), Copper (Cu), Cyanides (CN), Mercury (Hg) are observed to be well below the desirable limit and Coli forms not detected at all locations

It is inferred that almost of the parameters for surface water sample are within the permissible limits as per ISI-IS2296-1982 (Tolerance Limits for Inland Surface Waters - Outdoor bathing) Class – B, except Hardness. But these exceeded values are within the permissible limits in the locations. Iron at Singur Reservoir and Manjeera River exceeded the desirable limits.

3.6 Air Environment

3.6.1 Meteorological Data from Nearest Meteorological Station

The nearest Indian Meteorological Department (IMD) station located to project site is Bidar (Karnataka). The Climatological data for Bidar (17°55' N and 77°32' E), published by the IMD, based on daily observations at 08:30 and 17:30 hour IST for a 30 year period, is presented in the following sections on the meteorological conditions of the region. The monthly variations of the relevant meteorological parameters are reproduced in **Table 3-7**.

Table 3-7: Climatological Summary – Bidar Region (1981-2010)

Month	Temp (°C)		Rainfall (mm)		Relative Humidity (%)		Station Level Pressure hPa		Mean Wind Speed (km/h)	Predominant Directions (From)*		Wind
	Daily Max.	Daily Min.	Total	No. of days	08:30	17:30	08:30	17:30		08:30	17:30	
Jan	29.1	16.3	12.2	0.5	66	45	15.6	15.3	8.4	SE,SW	NE,E	
Feb	32.2	18.4	2.5	0.3	57	36	15.4	15.5	8.8	SW,SE	NE, SW	
Mar	35.8	21.9	11.4	0.8	50	36	17	18.5	8.8	SW, NW	NE, SW	

Month	Temp (°C)		Rainfall (mm)		Relative Humidity (%)		Station Level Pressure hPa		Mean Wind Speed (km/h)	Predominant Directions (From)*	
	Daily Max.	Daily Min.	Total	No. of days	08:30	17:30	08:30	17:30		08:30	17:30
Apr	38.1	24.4	22.8	2	49	36	20.3	20.5	9.4	SW, NW	NE, NW
May	38.9	25.3	21.1	2.7	56	41	23.5	23.1	11.5	NW,SW	NW, NE
Jun	33.7	22.9	132.8	7.9	77	59	25.9	25.2	16.2	SW,W	SW,W
Jul	29.9	21.7	193.1	10.9	84	68	25	24.6	16.6	SW,W	SW,W
Aug	28.9	21.3	211.9	12	85	71	24.6	24.8	14.7	SW,W	W,SW
Sep	30	21.4	152.5	8.8	81	67	24.5	24.2	9.7	NW,W	NW,W
Oct	30.2	20.4	116.5	5.5	72	58	22.2	20.7	7.6	NE,NW	NE,E
Nov	29	17.9	29.9	1.5	64	52	17.9	17.4	7.8	NE,SE	NE,E
Dec	28	15.8	5	0.4	64	49	15.4	15.5	7.9	SE,NE	NE,E

*Predominant wind in decreasing order (Source: IMD Climatological Data for Bidar Region)

As per the above Climatological table the observations drawn for the study area are given below

- Annual mean maximum temperature is 32.0°C and the Annual mean minimum temperature is 20.6°C.
- Total annual mean rainfall recorded is 911.6 mm.
- Maximum and minimum Mean wind speed is 16.6 kmph (4.61 m/s) and 7.6 kmph (2.11 m/s).

3.6.2 Meteorological Scenario during Study Period and for the Year 2017

Meteorological scenario in and around the project site is an essential requirement during study period for proper interpretation of baseline air quality status. Site-specific meteorological data was collected during the study period winter season (December 2017–February 2018). Automatic weather station was installed at project site to record the meteorological parameters during the study period. Meteorological parameters recorded include temperature, wind speed, wind direction, relative humidity and rainfall. For the purpose of carrying out the air quality modelling study, region specific meteorological data (pre-processed from MM5) for the entire year of 2017 obtained from Lakes Environmental Software, Canada. The overall wind pattern observed during the summer season, 2018 is shown in **Figure 3-9** and annual wind pattern is shown in **Figure 3-10**.

The wind roses were drawn for the met files obtained on a sixteen-point compass (N, NNE, NE, ENE; E, ESE, SE, SSE; S, SSW, SW, WSW; W, WNW, NW, and NNW). Wind pattern representing 24 hours for the entire year of 2017 is discussed. The frequency occurrence of wind at various speeds was calculated on the basis of total number of observations recorded in the respective wind speed category. The predominant wind directions observed were from West South West followed by South West and West; calm conditions prevailed for 3.61% of the total time. The average wind speed was observed to be 3.30 m/s.

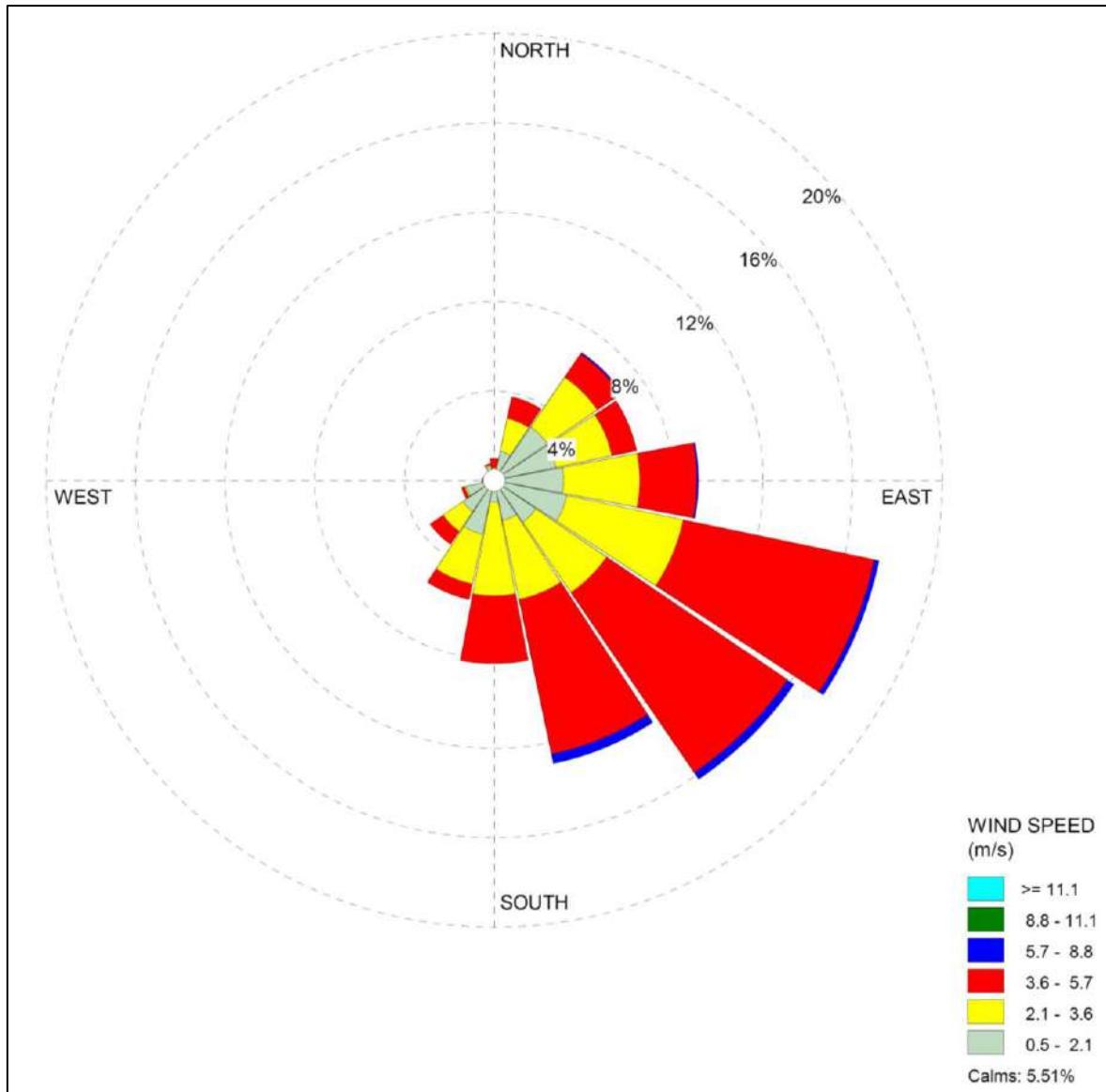


Figure 3-9: Wind Rose Diagram for winter season

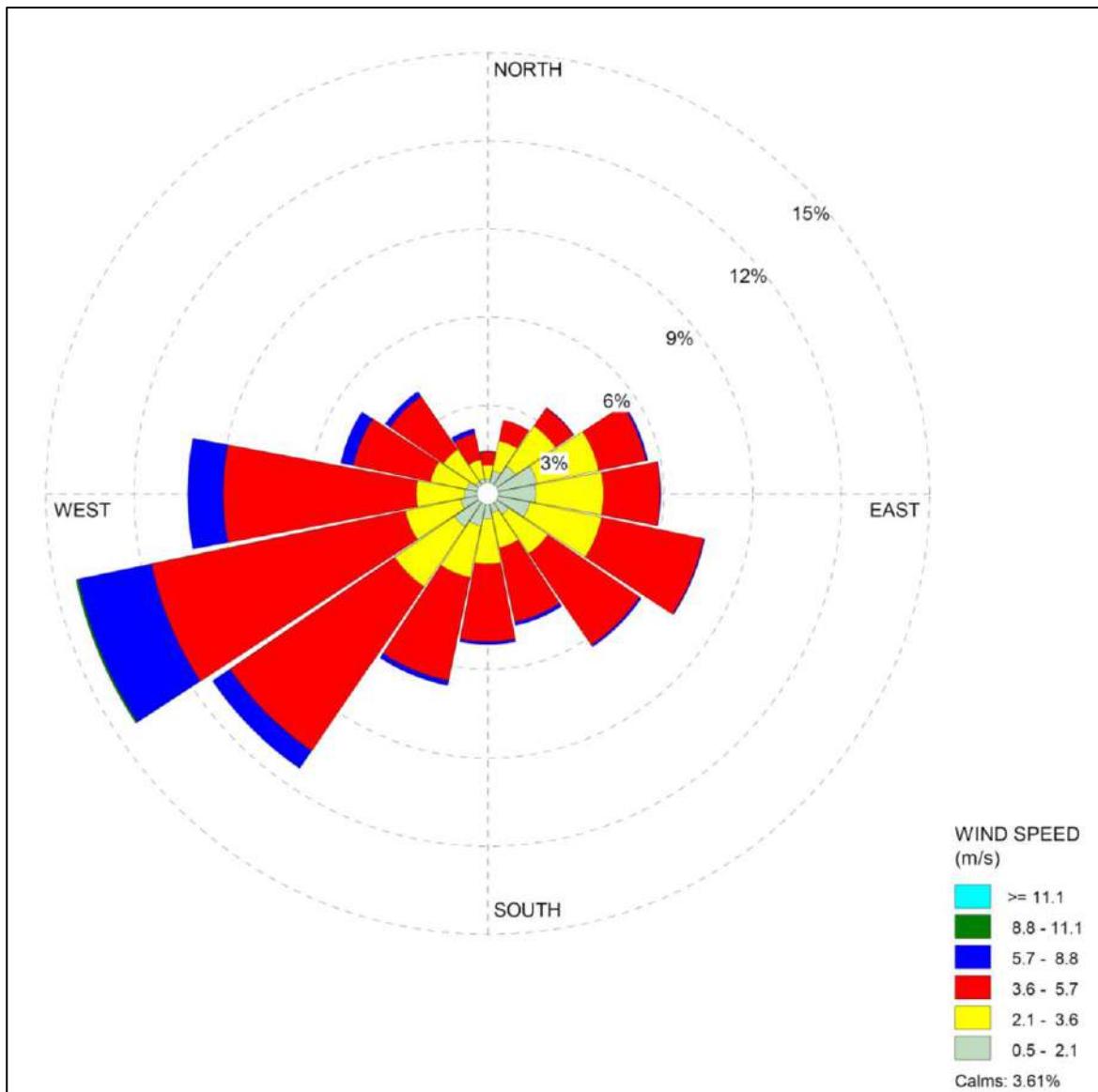


Figure 3-10: Annual wind rose (January – December 2017)

3.6.3 Ambient Air Quality

The selection criteria for monitoring locations are based on the following:

- Topography/Terrain
- Meteorological conditions
- Residential and sensitive areas within the study area
- Representatives of regional background air quality/pollution levels and
- Representation of likely impacted areas.

3.6.3.1 Ambient Air Quality Monitoring Stations

To evaluate the baseline air quality of the study area, Fifteen (15) monitoring locations have been identified. A map showing the monitoring locations is given as **Figure FD0301** and the details of the locations are given in

Table 3-8.

Table 3-8: Details of Ambient Air Quality Monitoring Locations

Station Code	Location	Distance (km) from Project boundary	Azimuth Directions
A1	Project Site	-	-
A2	Mettalkunta	Adjacent	S
A3	Yalgul (Yalgoi)	Adjacent	W
A4	Hadnur	0.3	N
A5	Rejantal	0.4	E
A6	Kalbemal	0.8	W
A7	Gunjetti	0.9	E
A8	Gunalli	1.7	W
A9	Waddi	2.6	N
A10	Tekur	2.8	NNE
A11	Manhalli	3.3	SSW
A12	Jharasangam	4.3	E
A13	Nyalkal	4.4	N
A14	Burdipar	4.9	S
A15	Zaheerabad	9.3	S

3.6.3.2 Ambient Air Quality Monitoring Techniques and Frequency

Ambient air quality was monitored weekly thrice during study period. All the 12 parameters (Sulphur Dioxide (SO₂), Nitrogen Dioxide (NO₂), Particulate Matter (PM_{2.5}), Particulate Matter (PM₁₀), Carbon Monoxide (CO), Ozone (O₃), Lead (Pb), Ammonia (NH₃), Benzene (C₆H₆), Benzo (a) Pyrene (BaP) – Particulate phase only, Arsenic (As) and Nickel (Ni)) are monitored as per NAAQS. The monitoring and analysis were carried out as per CPCB standard methods of measurements.

3.6.3.3 Results and Discussions

The variations of PM₁₀, PM_{2.5}, SO₂, NO_x, CO, and O₃ are compared with National Ambient Air Quality Standards (NAAQS), MoEF&CC Notification, November, 2009. Ambient Air Quality Monitoring Data for the study area is given in **Appendix D** and graphically presented in **Figure 3-11 to Figure 3-15**.

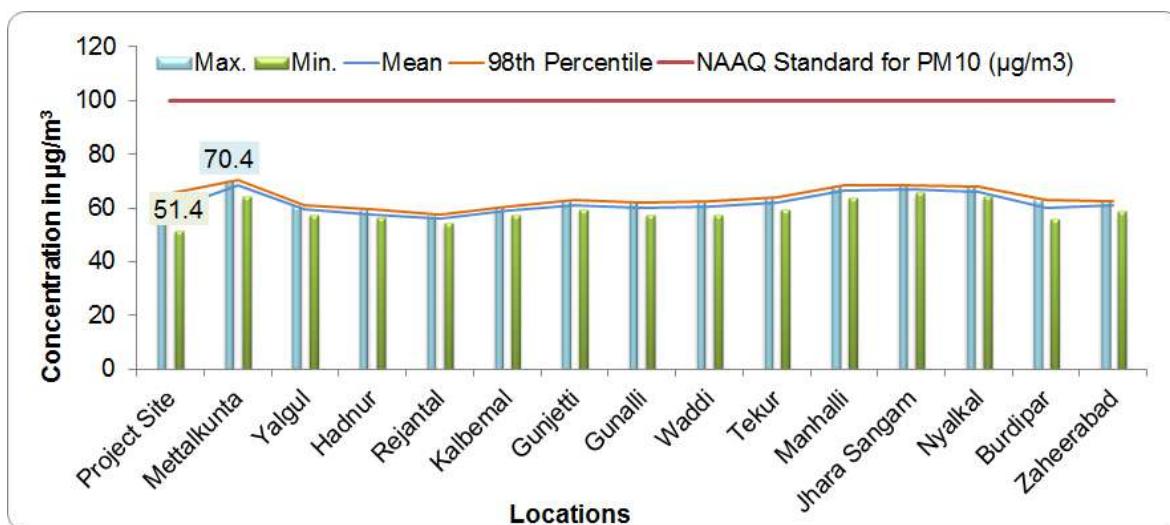


Figure 3-11: Ambient PM₁₀ Levels

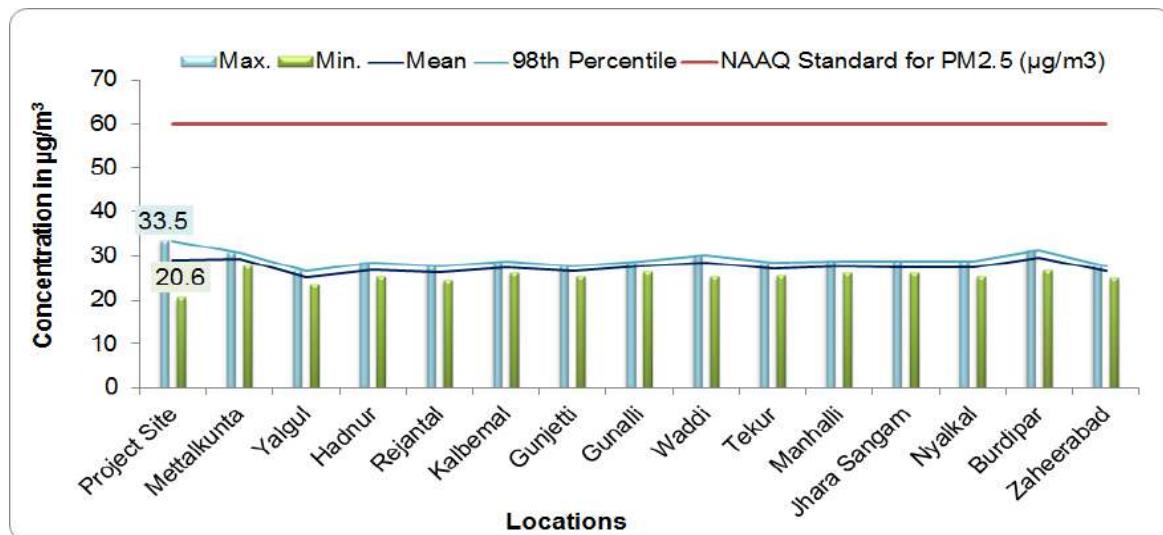


Figure 3-12: Ambient PM_{2.5} Levels

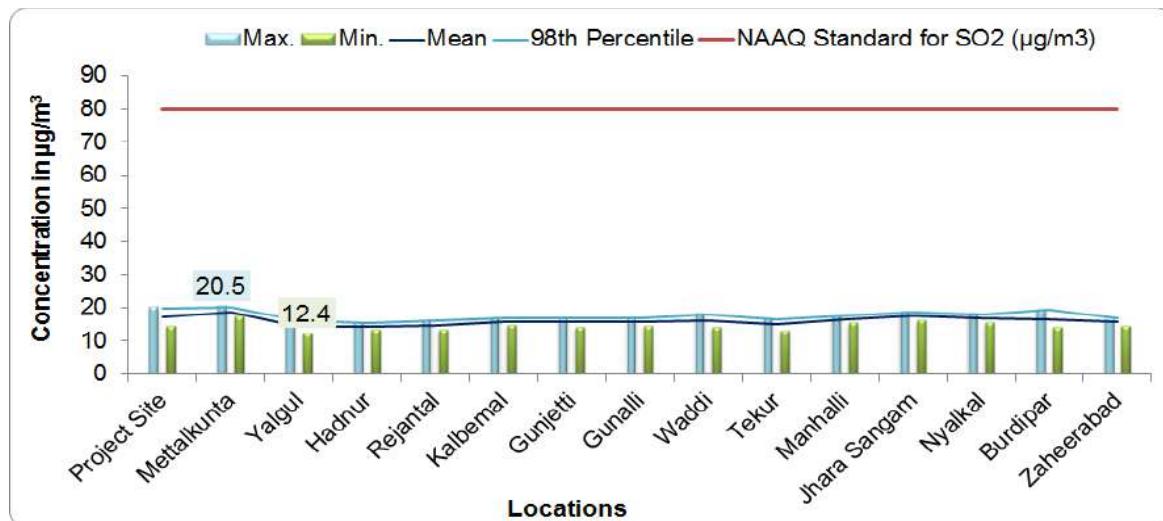


Figure 3-13: Ambient SO₂ Levels

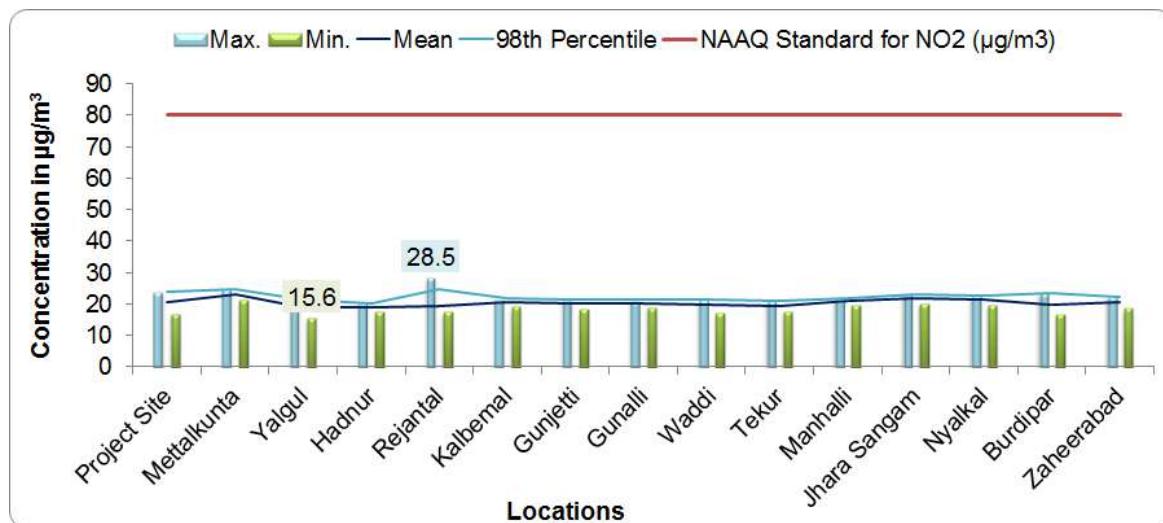


Figure 3-14: Ambient NO₂ Levels

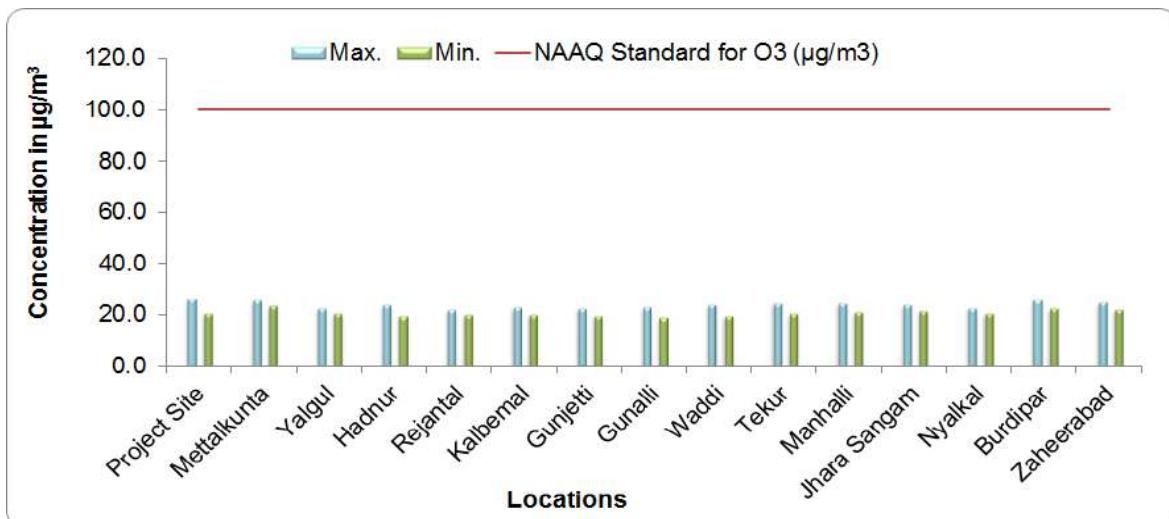


Figure 3-15: Ambient O₃ Levels

3.6.3.4 Observations

Maximum concentrations of Sulphur Dioxide (SO₂), Nitrogen Dioxide (NO₂), Particulate Matter (PM_{2.5}), Particulate Matter (PM₁₀), Carbon Monoxide (CO), Ozone (O₃), Ammonia (NH₃), Lead (Pb), Benzene (C₆H₆), Benzo (a) Pyrene (BaP) – Particulate phase only, Arsenic (As), Nickel (Ni), are well within the National Ambient Air Quality Standards for Residential areas at all monitoring locations during the study period.

- PM₁₀ ranged between 51.4 µg/m³ to 70.4 µg/m³. NAAQ stipulated standard for PM₁₀ for 24 hr. average is 100 µg/m³.
- PM_{2.5} values varied from 20.6 µg/m³ to 33.5 µg/m³. NAAQ stipulated standard for PM_{2.5} for 24 hr. average is 60 µg/m³.
- SO₂ ranged between 12.4 µg/m³ and 20.5 µg/m³. NAAQ stipulated standard for SO₂ for 24 hr. average is 80 µg/m³.
- NO₂ ranged between 15.6 µg/m³ to 28.5 µg/m³. NAAQ stipulated standard for NO₂ for 24 hr. average is 80 µg/m³.
- O₃ ranged between 19.2 µg/m³ to 26.2 µg/m³. NAAQ stipulated standard for O₃ for 8 hr. average is 100 µg/m³.
- CO, NH₃, Pb, C₆H₆, BaP, As, and Ni were observed below detectable limits.

3.7 Ambient Noise Levels

Ambient noise levels have been established by monitoring noise levels at Fifteen (15) locations in the study area during study period using precision noise level meter. The noise monitoring locations in the study area were selected after giving due consideration to the various land use categories. Noise levels were recorded on an hourly basis for one complete day at each location using pre- calibrated noise levels. A map showing the monitoring locations is given as **Figure FD0301**.

3.7.1 Results and Discussions

Based on the recorded hourly noise levels at each monitoring location, the day equivalent (Ld) and night equivalent (Ln) were calculated;

- Ld: Average noise levels between 6:00 hours to 22.00 hours.
- Ln: Average noise levels between 22:00 hours to 6.00 hours.

The Day-Night (Ldn) equivalent noise levels were calculated using the formula:

$$Ldn = 10 \log [0.0416 \{16 (10Ld/10) + 8 (10Ln+10/10)\}]$$

The Day and Night Noise levels monitored in the study area for the present land use are given in **Table 3-9**. The comparison of day equivalent noise levels (Ld) and night equivalent noise levels (Ln) with the respective CPCB stipulated noise standards are presented in **Figure 3-16 to Figure 3-17**.

Table 3-9: Day and Night Equivalent Noise Levels

S. No	Location	Noise level in dB(A) Leq		CPCB Standard		Environmental Setting
		Day	Night	Lday (Ld)	LNight (Ln)	
1	Project Site	52.94	43.55			
2	Mettalkunta	52.46	43.18			
3	Yalgul	50.38	41.58			
4	Hadnur	51.00	41.69			
5	Rejantal	51.16	42.09			
6	Kalbemal	50.90	41.19			
7	Gunjetti	51.16	41.39			
8	Gunalli	51.11	41.77			
9	Waddi	51.46	42.10			
10	Tekur	51.28	42.06			
11	Manhalli	53.05	42.04			
12	Jharasangam	51.52	42.24			
13	Nyalkal	52.62	42.83			
14	Burdipar	51.51	41.54			
15	Zaheerabad	54.12	42.81	65	55	Commercial

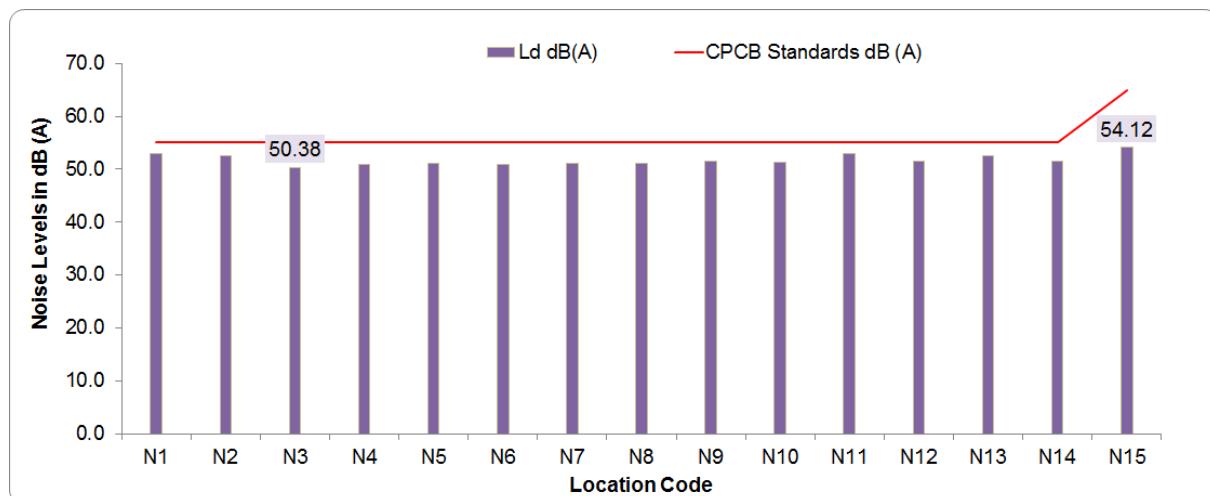


Figure 3-16: Ambient Day time Noise levels

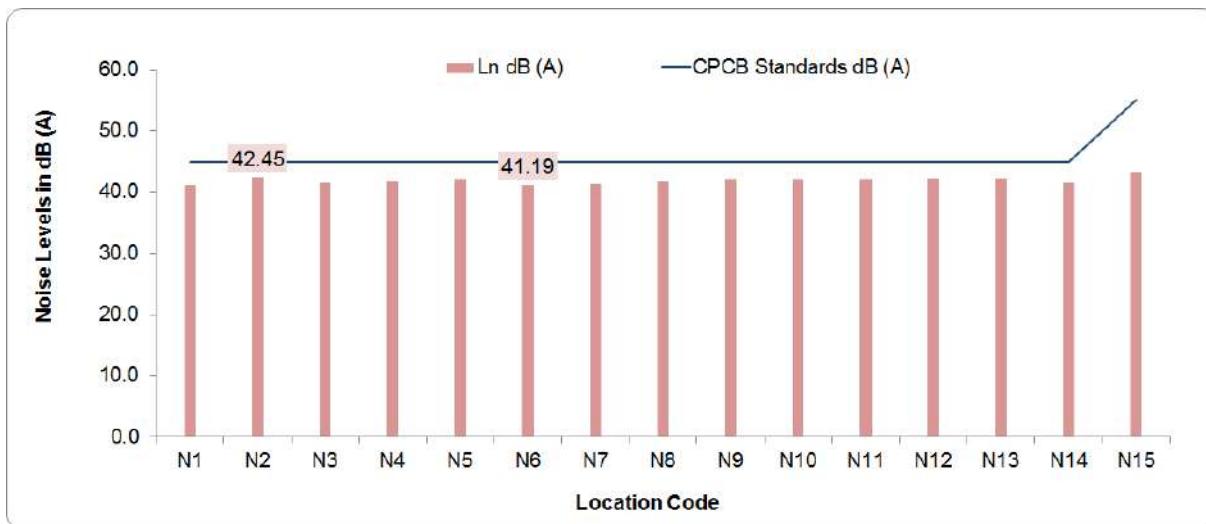


Figure 3-17: Ambient Night equivalent Noise levels

3.7.1.1 Observations

It is observed that the day equivalent and night equivalent noise levels at all locations are well within prescribed CPCB standards

- Day equivalent noise levels (Ld) ranged between 50.38 dB(A) to 53.05 dB (A) for Residential areas
- Day equivalent noise levels (Ld) recorded as 54.12 dB (A) for commercial areas
- Night equivalent noise levels (Ln) ranged between 41.19 dB(A) to 42.45 dB (A) for Residential areas
- Night equivalent noise levels (Ln) recorded as 43.18 dB (A) for commercial areas

The field observations during the study period indicate that the ambient noise levels in the study area are within the prescribed standards at residential noise zone prescribed by CPCB.

3.8 Soil Quality

In order to assess the quality of soil at different locations in the study area, various land use categories were taken into account. Soil sampling was carried out at Fifteen (15) locations in the study area. Soil analysis was carried as per IS: 2720 methods. Soil quality monitoring locations are given in **Table 3-10** and a map showing the monitoring locations is given as Figure FD0301. Soil quality analysis results are given as **Appendix D**.

Table 3-10: Details of Soil Quality Monitoring Locations

Station Code	Location	Distance (km) from Project boundary	Azimuth Directions
S1	Project Site	-	-
S2	Yalgul	Adjacent	S
S3	Rejantal	Adjacent	W
S4	Jharasangam	0.3	N
S5	Tekur	0.4	E
S6	Gunalli	0.8	W
S7	Gunjetti	0.9	E
S8	Waddi	1.7	W
S9	Nyalkal	2.6	N
S10	Hadnur	2.8	NNE
S11	Zaheerabad	3.3	SSW
S12	Burdipar	4.3	E

Station Code	Location	Distance (km) from Project boundary	Azimuth Directions
S13	Manhalli	4.4	N
S14	Mettalkunta	4.9	S
S15	Kalbemal	9.3	S

3.8.1.1 Results and Discussions

Summary of analytical results

- pH of soils ranged between 6.91 and 7.86 showing neutral to slightly alkaline nature
- Electrical Conductivity varied between 186 $\mu\text{mhos}/\text{cm}$ and 409 $\mu\text{mhos}/\text{cm}$ mostly harmful for germination and crops.
- Nitrates (NO_3^-) varied between 4.383 mg/100 gm and 11.734 mg/100 gm which shows very less availability in soil quantity
- Potassium (K) varied between 6.35 mg/100 gm and 10.2 mg/100 gm which shows very less availability in soil quantity
- Phosphates as PO_4^{2-} varied between 2.199 mg/100 gm and 6.197 mg/100 gm which shows very less availability in soil quantity
- Infiltration Rate ranged between 1.6 cm/h and 2.4 cm/h
- Water Holding Capacity varied between 18.34 % and 45.98%
- Bulk density varied between 1.08 gm/cc and 1.98 gm/cc
- Zinc (Zn) varied between 20.46 mg/kg and 31.24 mg/kg
- Iron (Fe) varied between 10974.76 mg/kg and 104727.71 mg/kg
- Manganese (Mn) varied between 21.8 mg/kg and 86.1 mg/kg
- Chromium (Cr) varied between 2.26 mg/kg and 8.52 mg/kg
- Nickel (Ni) varied between 3.26 mg/kg and 8.91 mg/kg

3.9 Biological Environment

3.9.1 Flora and Fauna

For better understanding of the habitat setup and identification of influences/impacts, the study was carried in both Core Zone and Buffer Zone.

Quantification has been done for the trees, shrubs, herbs, grasses and terrestrial & arboreal fauna in the core area. Status of natural vegetation, Green belt plantation type, soil type, and associated services were also recorded. Maximum effort has been taken to assess the impact caused by the activity (if any) in the study area and suggest appropriate implementable conservation measures if any.

PIA study: The following habitats are investigated in the study area.

- Vegetation type (Agriculture, Plantation types, Avenue plantations, Mangroves and Reserve Forests)
- Terrain type (Plain & Undulating)
- Aquatic Habitat (lentic and lotic)

3.9.1.1 Methodology

Methodology for study of fauna consisted of detailing taxonomic accounts based on visual observation, circumstantial evidence based on foot prints, feathers, skin, hair, hooves etc. and the habitat features, reports from locals and published literature including the reports, records and working plans of the forest department.

A comparative list of all floral & faunal species of the study area was prepared based on the plant species collected during the study period by the survey teams and supplemented by data provided by the local forest departments.

Vegetation/Flora: The primary data was collected by visual observations (documented in the field forms) as well as by discussion with villagers. For floral study quadrat method has been used for adopted to study woody and non woody species. 20 m X 20 m for tree species, 5 m X 5 m quadrates for shrubs and 1 m X 1 m quadrates for herbs. In locations where the quadrants are not possible such as hilly areas and agricultural, plantation areas a belt transect of 100m X 10m was adopted. List of floral species observed at each quadrant is documented and photographed. Species are compared with standard floras and identifying the plants need for conservation.

Total abundance, density and frequency in respect to individual species were calculated in order to understand the vegetation structure and relative importance of the sampled areas. We used Shannon Weaver Index (Shannon & Weiner, 1949) for Species diversity and Simpson dominance index (Simpson, 1949) for species dominance. Species enumeration (inventory), richness, total abundance, density, and evenness provide systematic baseline information of the vegetation community

Fauna: Methodology for study of fauna consisted of detailing taxonomic accounts based on visual observation, circumstantial evidence based on foot prints, feathers, skin, hair, hooves etc. and the habitat features, reports from locals especially the locals, and published literature including the reports, records and working plans of the forest department.

With regard to creating baseline data on birds transect method was used. A total of 6 transects of 2.0 Km length were walked in the early morning and evening hours for recording systematic sightings of birds in the project area and buffer area.

3.9.1.2 Study Area

The core area comprises of the site area is area of 12,635 acres (5,113 ha). The core area is a 5km radius designated from the center of the proposed project area. With four Reserve forests adjacent to this. They are Hadnuri RF Adjacent at South, Kalbewal RF Adjacent at West, Shamshalapur R.F (TS) Adjacent at North, Badripur RF at 0.1 km in South-East direction to the site. The site is habituated with all types of ecosystems predominantly terrestrial. Most of the region is open forest and under agricultural practice. There are certain thorny scrub patches and grassland. The common native species such as *Vitex negundo*, *Prosopis juliflora*, *Azadirachta indica*, *Borassus flabellifer*, *Tamarindus indica* and *Acacia nilotica* are observed as predominant species.

The buffer zone represents the habitat from an area from 5 km radius of the project site (after core zone) to 10 km radius. The buffer zone comprises mainly of agriculture fields, wastelands, forest plantation, and three reserve forests. The reserve forest near Chitta R.F is having rich diversity and density compared to other two Reserve forest of this zone. Thus buffer zone is much ecologically vulnerable than core zone. The dominant tree species observed here are *Azadirachta indica*, *Cassia fistula*, *Phoenix sylvestris*, *Borassus flabellifer*, *Leucaena leucocephala*, *Pongamia pinnata* and *Tectona grandis*. Some scattered bushes of *Euphorbia caducifolia*, *Balanites aegyptiaca*, *Opuntia dillenii*, *Prosopis juliflora*, *Datura stramonium*, *Jatropha gossipifolium* and *Zizyphus numularia* are also predominant here.

Major part of the buffer area is agriculture fields particularly on the North-East side of the project area. Thus, dry land farming is practiced in entire region. There are no economically important plant species in this region. The economic importance of these lies in the fact that

the local human population uses this biological wealth for medicinal, timber / fuel wood, fodder and other socio-economic purposes. Apart from the above several avenue trees such as *Tamarindus indica*, *Azadirachta indica*, *Pongamia pinnata* were very common.

Project Site	<i>Vitex sp.</i> Near the project area
<i>Ficus racemosa</i> , fruit bearing tree in the study area	<i>Prosopis Juliflora</i> , an invasive plant in the Study area
Agricultural lands in the Buffer Zone	Reserve Forest Vegetation in the study area
Spotbilled duck in buffer area	Great Egret in buffer Area

	
Great grey heron in Buffer area	Black winged stilt
	
Red wattled lapwing In buffer area	A flock of cormorants in the buffer area

Exhibit 3-2: Flora & Fauna observed in the Project area during the study

3.9.1.3 Status of Flora and Vegetation

A detailed study in both project area and study area has been carried out to assess the present floristic composition in the region. We have recorded a total of 282 plant species in the study area up to 10km radius area. Study revealed that higher number of trees compare to other life forms in the region.

The survey reveals that there are specific patches for certain species and mass plantations such as Eucalyptus, mango etc. There are good number of plantations on the road side such as *Ficus*, *Polyalthia longifolia*, *Alstonia scholaris*, *Peltophorum pterocarpum*, *Samania saman*, *Delonix regia*, *Tectona grandis* and *Acacia auriculiformis*.

Core Area: The core area is representation of flora and fauna within 5 km from the outer boundary of the proposed project site. This zone represents basically terrestrial ecosystem with six Reserve Forests. The agri ecosystem and aquatic ecosystem are sporadically seen. The RFs present in the core area are Rajola R.F 1.1 km at West, Sahapur R.F, 1.5 km at North, Godepalli R.F, 2.8 km at west, Didgi R.F, 2.8 km at South, Digwal R.F, 4.7 km at South East and Zaheerabad R.F, 4.9 km at South direction.

The wastelands are commonly enriched with natural as well as exotic biota. The reserve forests in the core zone sampling points represent *Vitex negundo*, *Tectona grandis*, *Prosopis juliflora*, *Pongamia pinnata*, *Azadirachta indica*, *Phoenix sylvestris*, *Borassus flabellifer*, *Dalbergia sissoo*.and *Cassia fistula*. Shrubs such as *Calotropis procera*, *Ziziphus nummularia*, *Lantana camera*, *Parthenium hysterophorus* are sporadically scattered. Trees such as *Tecoma stans*, *Alstonia scholaris*, *Dalbergia sissoo*, *Thespesia populnea*, *Polyalthia longifolia*, and *Pongamia pinnata* under commonly seen near village wood land.

Buffer area: The buffer zone represents the habitat from an area of 5 km radius of the project site (after core zone) to 10 km radius. The buffer zone comprises mainly of agriculture fields, wastelands, forest plantation, and three reserve forests i.e. Chitta R.F, 6.1 km at West, Tadapalli R.F 7 km at SW and Honnadi R.F, 9.5 km at SW directions. The reserve forest near Chitta R.F is having rich diversity and density compared to other two Reserve forest of this zone. Thus buffer zone is much ecologically vulnerable than core zone. The dominant tree species observed here are *Azadirachta indica*, *Cassia fistula*, *Phoenix sylvestris*, *Borassus flabellifer*, *Leucaena leucocephala*, *Pongamia pinnata* and *Tectona grandis*. Some scattered bushes of *Euphorbia caducifolia*, *Balanites aegyptiaca*, *Opuntia dillenii*, *Prosopis juliflora*, *Datura stramonium*, *Jatropha gossipifolium* and *Zizyphus numularia* are also predominant here.

Major part of the buffer area is agriculture fields particularly on the North-East side of the project area. Thus, dry land farming is practiced in entire region. There are no economically important plant species in this region. The economic importance of these lies in the fact that the local human population uses this biological wealth for medicinal, timber / fuel wood, fodder and other socio-economic purposes. Apart from the above several avenue trees such as *Tamarindus indica*, *Azadiracta indica*, *Pongamia pinnata* were very common.

The study area comprises of many small and medium sized tanks. These ponds provide the suitable habitat for fresh water aquatic and semi aquatic plants. *Pistia*, *Typha*, *Ipomoea aquatica* *Ipomoea carnea*, *Argeratum conyzoides*, *Azolla pinnata*, *Eichhornia crassipes*, *Lemna perpusilla*, *Spirodela polyrhiza* are common hydrophytes present in this area. There were no REET category species of aquatic and semi aquatic plants in the study area. The floristic survey of the existing farming site witnesses scattered growth of grasses (mainly weeds), rooted hydrophytes, emerging hydrophytes, shrubs in undisturbed area where human movement is absent. Among herbaceous species, weeds are commonly reported such as Congress grass (*Parthenium hysterophorus*), Lantana (*Lantana Camara*), *Eupatorium triplinerve*, *Solanum xanthocarpum* and *Datura stramonium*.

3.9.1.4 Floral abundance

Based on the study observations, 111 tree species, 49 shrub species, 79 herb species, 21 species of climbers, 11 grass species and 11 species of hydrophytes are present in the project study area.

Overall Terrestrial Vegetation structure of the study area as per the primary data. The survey reveals that there are specific patches for certain species and mass plantations such as Eucalyptus, mango etc. There are good number of plantations on the road side such as *Ficus*, *Polyalthia longifolia*, *Alstonia scholaris*, *Peltophorum pterocarpum*, *Samania saman*, *Delonix regia*, *Tectona grandis* and *Acacia auriculiformis*.

Trees: The most common tree species in the RFs are *Anogeissus latifolia*, *Terminalia tomentosa*, *Terminalia chebula*, *Lannea coromandelica*, *Pongamia pinnata*, *Polyalthia longifolia*, *Albizia lebbeck*, *Dalbergia latifolia*, *Eucalyptus globulus*, *Bauhinia purpurea*, *Ficus benghalensis*, *Azadirachta indica*, *Phoenix sylvestris*, *Alstonia scholaris*, *Acacia auriculiformis*, *Pithecellobium dulce*, *Caesalpinia pulcherrima*, *Ficus microcape*, *Grewia hirsuta*, *Peltophorum pterocarpum*, *Hardwickia binata*, *Chloroxylon swietenia*, *Hardwickia binata*, *Boswellia serrata*, *Soymida febrifuga*, *Buchnania lanza*, *Madhuca indica*, *Acacia catechu*, *Butea monosperma*, *Albizzia amara*, *Albizzia lebbek*, *Lagerstroemia parvifolia*, *Diospyros tomentosa*, *Emblica officinalis*, *Acacia catechu*, *Terminalia bellerica*, *Ficus glomerata*, *Semicarpus anacardium*, *Cassia fistula*, *Tectona grandis*.

Shrubs: The most common shrubs are *Wrightia tinctoria*, *Lantana camara*, *Dodonia viscosa*, *Bariospermum montana*, *Diospyras melonoxyon*, *Acacia latronum*, *Hyptis suaveolens*, *Cassia auriculata*, *Calotropis procera*, *Prosopis juliflora*, *Acacia leucocephala*, *Caesalpinia bonducella*, *Canthium parviflorum*, *Carissa carandas*, *Capparis sepiaria*, *Celastrus paniculata*. Many of the shrubs are unpalatable to cattle (*Holarrhena*, *Dodonaea*) or thorny (*Randia*, */Carrissa*).

Herbs: The most common herbs are *Tribulus terrestries*, *Tridax procumbens*, *Cassia occidentalis*, *Crotan bonplantianum*, *Datura metel*, *Eclipta alba*, *Boerhavia diffusa*, *Tephrocia purpuria*, *Achyranthes aspera*, *Cassia tora*, *Abutilon indicum* *Ipomoea macrantha*

Climbers: The commonly seen climbers are *Capparis horrida* *Abrus precatorius*, *Hemidesmus indicus*, *Clitoria ternatea*, *Cuscuta reflexa*, *Desmodium triflorum*, *Pergularia daemia*, *Desrris scandans*, *Hemidesmus indicus*, *Ipomoea pes-caprae*, *Ipomoea nil*, *Ipomoea macrantha*, *Mucuna pruriens*, *Evolvulus alsinoides*, *Gloriosa superba*.

Grasses: The common grass species are *Chloris barbata*, *Cyperus castaneus*, and *Cynodon dactylon* *Dactyloctenium aegyptium*, *Digitaria ciliaris*, *Eragrostis tenella*, *Fimbristylis cymosa*, *Ilaloipsis binata* and *Imperata cylindrica*.

Useful Plants in the Study Area: The direct dependence of the local populace upon the plants observed within the study area takes essentially three forms – utilization as food, for traditional medicinal purposes and a range of secondary uses

Uncultivated Food Plant: Uncultivated food-plants in the area include: *Acacia nilotica* (tender pods), *Amarantus spinosus* (tender shoots, leaves), *Azadirachta indica* (ripe fruits), *Capparis decidua* (raw fruits), *Euphorbia hirta* (tender shoots, leaves), *Leucas aspera* (tender shoots, leaves), *Mangifera indica* (fruits), *Moringa oleifera* (leaves, flowers, pods), *Opuntia elatior* (fruits), *Phoenix sylvestris* (sap, pith, fruits), *Pithecolobium dulce* (fruits), *Prosopis spicigera* (pods), *Solanum surratense* (tender leaves), *Syzygium cumini* (fruits), *Tamarindus indica* (tender leaves, fruits), *Zizyphus mauritiana* & *Z. oenoplia* (fruits).

Medicinal Plants: Medicinal Plants in the area comprises of *Decalepis hemiltonii* (roots), *Achyranthes aspera* (roots, seeds), *Alternanthera sessilis* (plant), *Azadirachta indica* (leaves, seeds), *Calotropis gigantea* (latex), *Euphorbia hirta* (plant), *Leucas aspera* (leaves), *Melia azedarach* (leaves, seeds), *Pongamia pinnata* (seeds), *Santalum album* (wood), *Sida acuta* (roots, leaves), *Solanum surratense* (roots), *Typha angustata* (seed-fibre), *Vernonia cinerea* (roots, leaves, seeds), *Vitex negundo* (leaves).

Secondary-use Plants: Secondary use plants in the area consists of *Agave americana* (plant-fibre for rope), *Cryptostegia grandiflora* (plant for rubber, bark-fibre for fishing-lines), *Gliricidia sepium* (leaves for manure), *Ipomoea carnea* (twigs for fishing-net floats), *Pongamia pinnata* oil for lamps), *Sesbania bispinosa* (leaves for manure), *Sida acuta* (stem-fibre for rope), *Vitex negundo* (leaves as pest-repellant).

General vegetation visible in the core and buffer areas are shown as **Exhibit 3-3** and **Exhibit 3-4**.

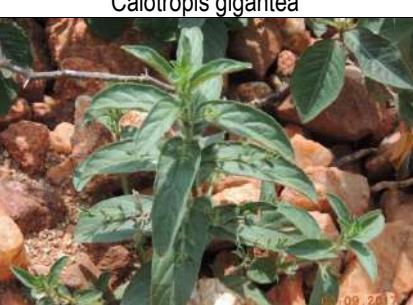
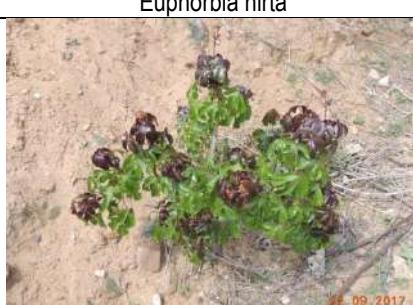
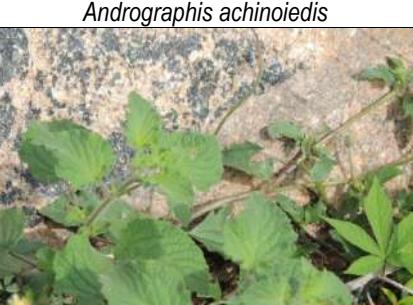
	
Tribulus terrestris	Tridax procumbens
	
Calotropis gigantea	Euphorbia hirta
	
Andrographis achinoediis	Jatropha glandulifera
	
Hyptis suaveolens	Croton bonplantianum
	
Tephrosia purpurea	Acalypha indica

Exhibit 3-3: Natural vegetation visible in the core area

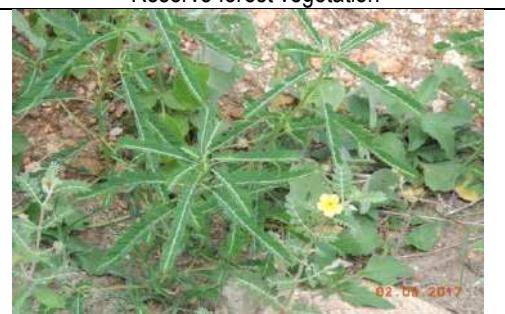
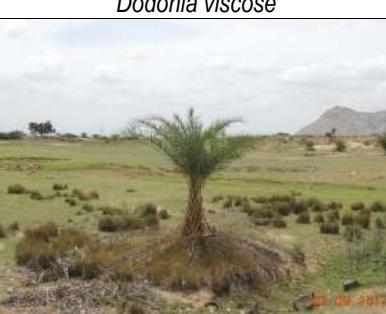
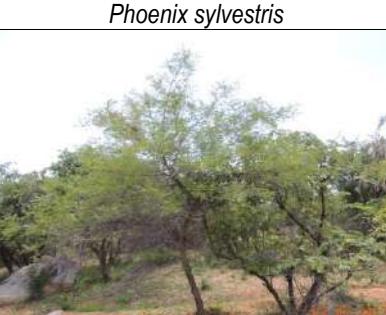
	
<i>Anogeissus latifolia</i>	Reserve forest vegetation
	
<i>Dodonia viscose</i>	<i>Phyllanthus amarus</i>
	
<i>Phoenix sylvestris</i>	<i>Lantana camara</i>
	
<i>Acacia nilotica</i>	<i>Agave americana</i>

Exhibit 3-4: Natural vegetation visible in the buffer area

Habit wise, Zone wise, Status wise, and Ecosystem wise number of species recorded in the study area are shown in **Figure 3-18** to **Figure 3-21**.

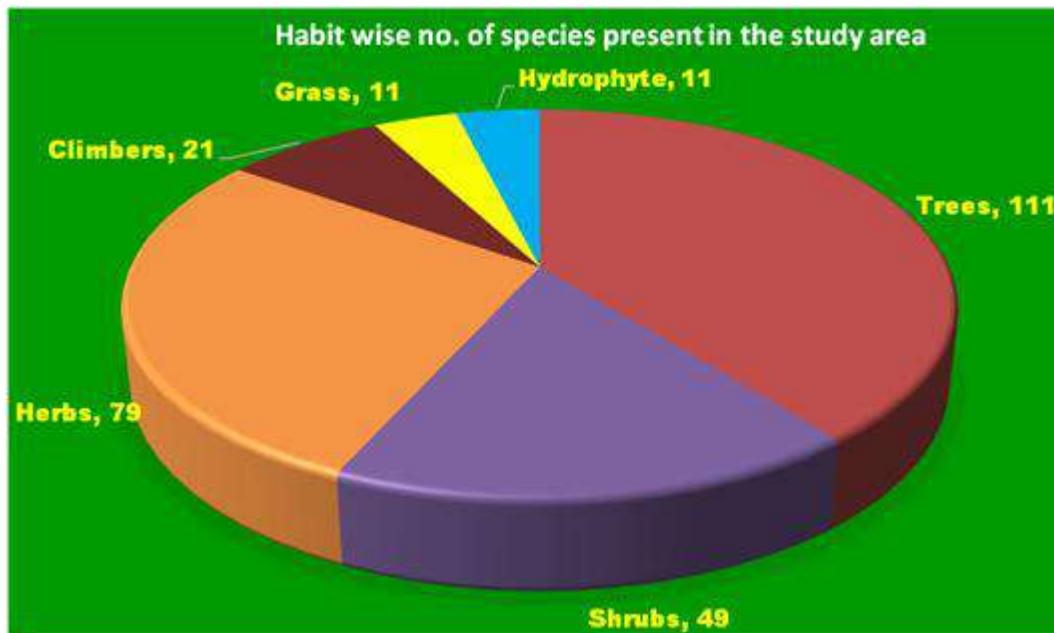


Figure 3-18: Habit wise number of species recorded in the study area

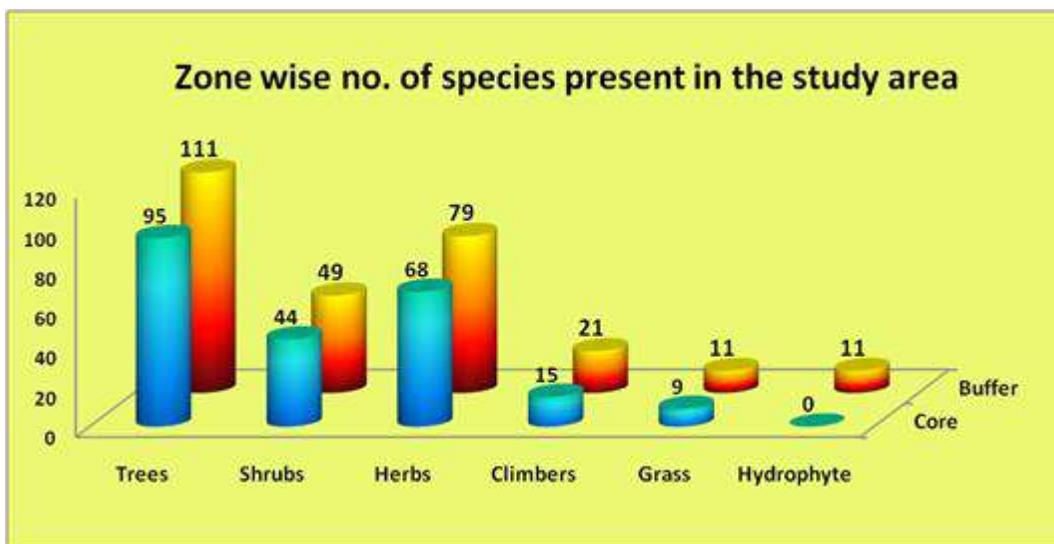


Figure 3-19: Zone wise number of species recorded in the study area

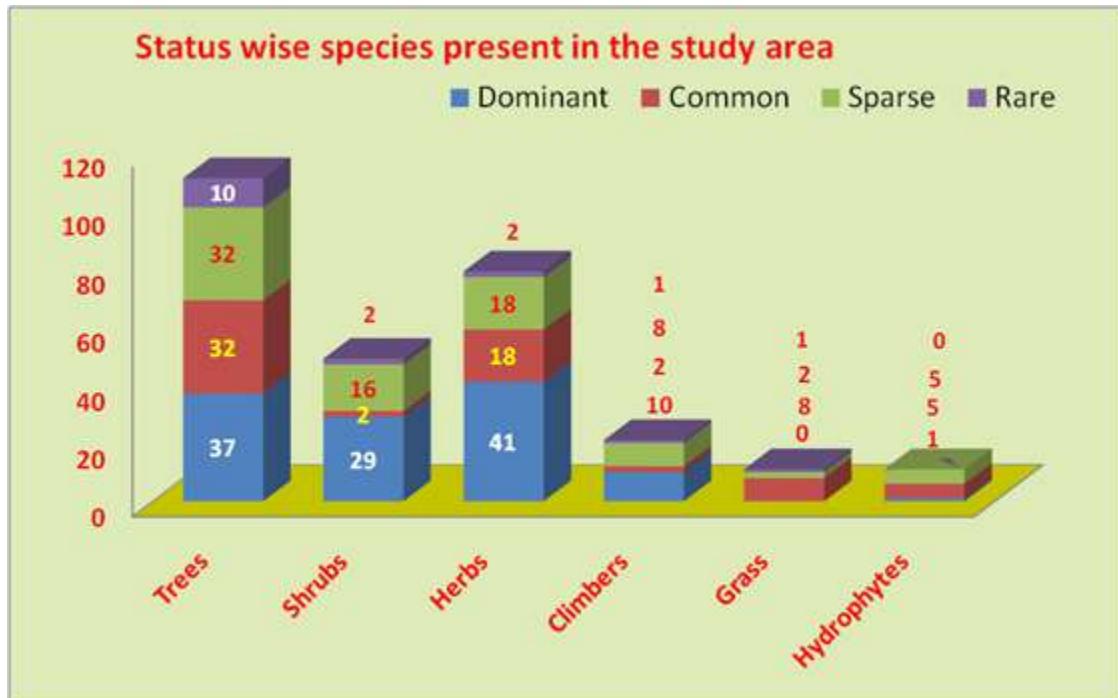


Figure 3-20: Status wise number of species recorded in the study area

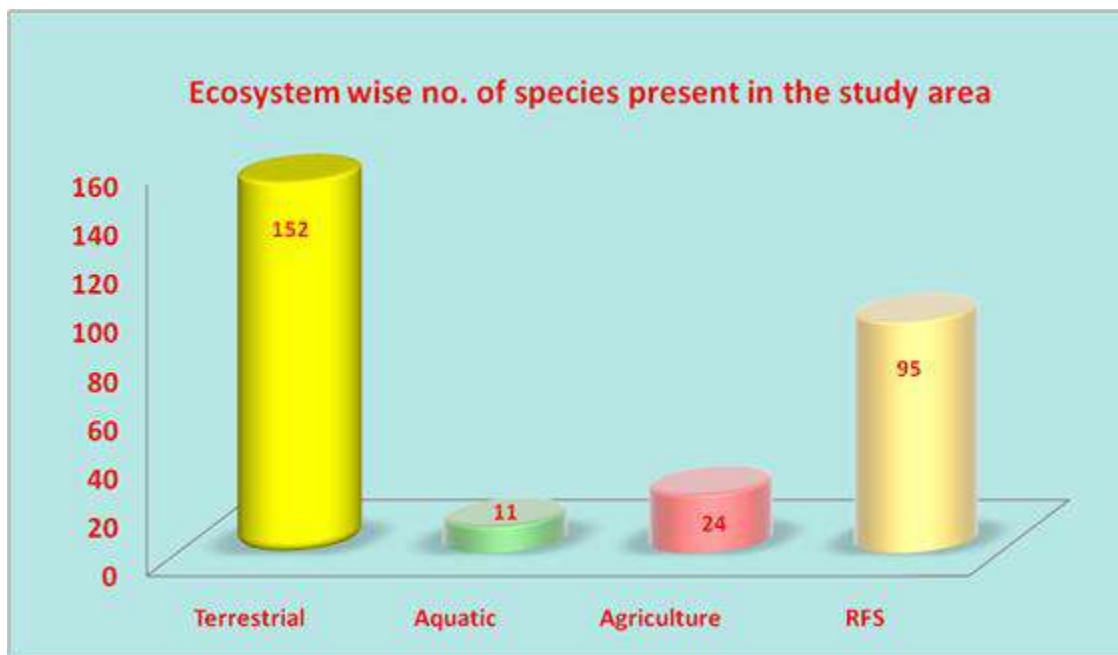


Figure 3-21: Ecosystem wise number of species recorded in the study area

3.9.1.5 Dominant plant species

3.9.1.5.1 Project Site

The project site is habituated with all types of ecosystems predominantly terrestrial. Most of the region is open forest and under agricultural practice. There are certain thorny scrub patches and grassland. The common native species such as *Vitex negundo*, *Prosopis juliflora*, *Azadirachta indica*, *Borassus flabellifer*, *Tamarindus indica* and *Acacia nilotica* are observed as predominant species. Invasive or exotic species

Prosopis juliflora is an evergreen tree native to South America, Central America and the Caribbean. In the United States, it is well known as mesquite. It is fast growing, nitrogen-fixing and tolerant to arid conditions and saline soils. *Prosopis juliflora* is an exotic and invasive widespread, multi-branched shrub/tree species in India. It has been invading grasslands, native scrubland and forests all over India. It was observed that the *Prosopis juliflora* is one of the most dominant and wide spread in the core and buffer areas of the project site

3.9.1.6 Endangered/Threatened/protected species

Our field survey in the project area suggest that there are no endangered, endemic, rare plant species present within the project boundary i.e. core area. However a few specimens of *Decalepis hamiltonii* an endangered plant as per IUCN is present in small numbers in the buffer area; especially in the reserve forest regions. It has wide spread uses that include its common usage as a health drink. Apart from this, it has got antimicrobial, anti-diabetic, antioxidant, anti-inflammatory, neuro-protective and hepatoprotective properties.

3.9.1.7 Species with ethno-botanical values

Medicinal Plants: Medicinal Plants in the area comprises of *Decalepis hamiltonii* (roots), *Achyranthes aspera* (roots, seeds), *Alternanthera sessilis* (plant), *Azadirachta indica* (leaves, seeds), *Calotropis gigantea* (latex), *Euphorbia hirta* (plant), *Leucas aspera* (leaves), *Melia azedarach* (leaves, seeds), *Pongamia pinnata* (seeds), *Santalum album* (wood), *Sida acuta* (roots, leaves), *Solanum surratense* (roots), *Typha angustata* (seed-fibre), *Vernonia cinerea* (roots, leaves, seeds), *Vitex negundo* (leaves). **Secondary-use Plants:** Secondary use plants in the area consists of *Agave americana* (plant-fibre for rope), *Cryptostegia grandiflora* (plant for rubber, bark-fibre for fishing-lines), *Gliricidia sepium* (leaves for manure), *Ipomoea carnea* (twigs for fishing-net floats), *Pongamia pinnata* oil for lamps), *Sesbania bispinosa* (leaves for manure), *Sida acuta* (stem-fibre for rope), *Vitex negundo* (leaves as pest-repellant).

3.9.1.8 Floral biodiversity in the project area

In order to understand the status of vegetation communities in terms of stability, diversity indices such as species dominance, species diversity, similarity index and abundance are derived.

Important Value Index

Important Value Index is a parameter for calculating the dominance and diversity indices for vegetation as it is combination of frequency, density and dominance. Based on the survey results it had been noted that *Vitex negundo*, *Azardichata Indica* & *Borassus flabellifer* are the most dominant among tree species for both core and buffer areas. IVI for *Vitex negundo* was 31.19 in the core area and 52.76 in the buffer area. *Prosopis juliflora* was 15.4 in buffer and 34.53 in core area where as *Sporolobus maderaspatenus* & *Cymbopogon martinii* were the having 9.34/08.3 and 10.54/09.2 in the core and buffer areas respectively. Phytosociological data of proposed project site, core area and buffer area are given from **Table 3-11** to

Table 3-13. Important Value Index of dominant tree species within Project site, core area and buffer area are shown from **Figure 3-22** to **Figure 3-24**.

Table 3-11: Phytosociological data of Proposed Project Site

S. No	Scientific Name	Density	Rel Density	Frequency	Rel Frequency	Abundance	Rel Abundance	IVI	Schannon Index
1	<i>Acacia auriculiformis</i>	0.50	2.13	25.00	2.47	2.00	5.70	10.29	0.08
2	<i>Vitex negundo</i>	5.88	25.00	87.50	8.64	6.71	19.12	52.76	0.35
3	<i>Azadirachta indica</i>	2.13	9.04	75.00	7.41	2.83	8.07	24.52	0.22
4	<i>Borassus flabellifer</i>	1.38	5.85	62.50	6.17	2.20	6.27	18.29	0.17
5	<i>Dalbergia sissoo</i>	0.63	2.66	37.50	3.70	1.67	4.75	11.11	0.10
6	<i>Pongamia pinnata</i>	0.63	2.66	62.50	6.17	1.00	2.85	11.68	0.10
7	<i>Eucalyptus globulus</i>	0.75	3.19	50.00	4.94	1.50	4.27	12.40	0.11
8	<i>Ficus benghalensis</i>	0.38	1.60	37.50	3.70	1.00	2.85	8.15	0.07
9	<i>Peltophorum pterocarpum</i>	0.75	3.19	62.50	6.17	1.20	3.42	12.78	0.11
10	<i>Grewia hirsuta</i>	0.75	3.19	62.50	6.17	1.20	3.42	12.78	0.11
11	<i>Salvadora persica</i>	1.13	4.79	62.50	6.17	1.80	5.13	16.09	0.15
12	<i>Acacia nilotica</i>	1.13	4.79	75.00	7.41	1.50	4.27	16.47	0.15
13	<i>Butea monosperma</i>	0.50	2.13	50.00	4.94	1.00	2.85	9.91	0.08
14	<i>Phoenix sylvestris</i>	0.63	2.66	50.00	4.94	1.25	3.56	11.16	0.10
15	<i>Prosopis juliflora</i>	4.25	18.09	100.0	9.88	4.25	12.10	40.06	0.31
16	<i>Randia uliginosa</i>	0.88	3.72	37.50	3.70	2.33	6.64	14.07	0.12
17	<i>Tamarindus indica</i>	1.25	5.32	75.00	7.41	1.67	4.75	17.47	0.16
		100		100		100	100	300	2.46

Table 3-12: Phytosociological data of Core zone

S. No	Scientific Name	Density	Rel Density	Frequency	Rel Frequency	Abundance	Rel Abundance	IVI
1	<i>Anacardium occidentale</i>	0.75	5.13	50.00	5.26	1.50	5.89	16.29
2	<i>Azadirachta indica</i>	0.88	5.98	62.50	6.58	1.40	5.50	18.06
3	<i>Borassus flabellifer</i>	0.75	5.13	62.50	6.58	1.20	4.72	16.42
4	<i>Butea monosperma</i>	0.63	4.27	50.00	5.26	1.25	4.91	14.45
5	<i>Cassia fistula</i>	0.75	5.13	62.50	6.58	1.20	4.72	16.42
6	<i>Chloroxylon swietenia</i>	0.50	3.42	37.50	3.95	1.33	5.24	12.61
7	<i>Chukrasia tabularis</i>	0.50	3.42	37.50	3.95	1.33	5.24	12.61
8	<i>Dalbergia sissoo</i>	0.75	5.13	62.50	6.58	1.20	4.72	16.42
9	<i>Hardwickia binata</i>	0.63	4.27	50.00	5.26	1.25	4.91	14.45
10	<i>Vitex negundo</i>	1.88	12.82	62.50	6.58	3.00	11.79	31.19
11	<i>Madhuca indica</i>	0.38	2.56	37.50	3.95	1.00	3.93	10.44
12	<i>Peltophorum pterocarpum</i>	0.75	5.13	50.00	5.26	1.50	5.89	16.29
13	<i>Phoenix sylvestris</i>	0.88	5.98	62.50	6.58	1.40	5.50	18.06
14	<i>Pongamia pinnata</i>	1.13	7.69	62.50	6.58	1.80	7.07	21.34
15	<i>Tectona grandis</i>	1.50	10.26	75.00	7.89	2.00	7.86	26.01
16	<i>Prosopis juliflora</i>	1.38	9.40	75.00	7.89	1.83	7.20	24.50
17	<i>Terminalia tomentosa</i>	0.63	4.27	50.00	5.26	1.25	4.91	14.45
		100		100		100	100	300.

Table 3-13: Phytosociological data of Buffer zone

S. No	Botanical Name	Rel Density	Rel Frequency	Rel Abundance	IVI	Schannon Index
1	<i>Ailanthus excelsa</i>	1.47	2.25	2.31	6.04	0.062
2	<i>Alstonia scholaris</i>	1.18	1.80	2.31	5.29	0.052
3	<i>Anacardium occidentale</i>	3.54	2.70	4.63	10.87	0.118
4	<i>Azadirachta indica</i>	6.49	4.05	5.65	16.20	0.177
5	<i>Borassus flabellifer</i>	5.31	4.05	4.63	13.99	0.156
6	<i>Boswellia serrata</i>	2.06	3.15	2.31	7.53	0.080
7	<i>Butea monosperma</i>	2.36	3.15	2.64	8.16	0.088
8	<i>Cassia fistula</i>	5.90	5.41	3.85	15.16	0.167
9	<i>Chloroxylon swietenia</i>	3.24	3.15	3.63	10.03	0.111
10	<i>Chukrasia tabularis</i>	2.65	3.15	2.97	8.78	0.096
11	<i>Dalbergia sissoo</i>	3.54	3.15	3.96	10.66	0.118
12	<i>Erythroxylon monogynum</i>	2.65	3.15	2.97	8.78	0.096
13	<i>Gmelina arborea</i>	2.65	3.15	2.97	8.78	0.096
14	<i>Gyrocarpus americanus</i>	2.65	3.15	2.97	8.78	0.096
15	<i>Hardwickia binata</i>	2.65	3.15	2.97	8.78	0.096
16	<i>Holarrhena antidysenterica</i>	2.65	3.15	2.97	8.78	0.096
17	<i>Leucaena leucocephala</i>	5.01	4.05	4.37	13.44	0.150
18	<i>Madhuca indica</i>	2.65	3.60	2.60	8.86	0.096
19	<i>Morinda tinctoria</i>	2.95	2.70	3.85	9.51	0.104
20	<i>Peltophorum pterocarpum</i>	3.83	4.05	3.34	11.23	0.125
21	<i>Phoenix sylvestris</i>	5.90	4.95	4.20	15.06	0.167
22	<i>Pongamia pinnata</i>	4.72	4.50	3.70	12.92	0.144
23	<i>Soymida febrifuga</i>	2.06	2.25	3.24	7.55	0.080
24	<i>Strychnos nux-vomica</i>	4.42	4.05	3.85	12.33	0.138
25	<i>Tectona grandis</i>	4.42	4.95	3.15	12.53	0.138
26	<i>Terminalia catappa</i>	3.24	3.60	3.18	10.03	0.111
27	<i>Terminalia chebula</i>	2.95	3.15	3.30	9.41	0.104
28	<i>Terminalia tomentosa</i>	2.36	2.70	3.08	8.15	0.088
29	<i>Thespesia populnea</i>	4.42	3.60	4.34	12.36	0.138
		100.	100.	100.	300.	3.293

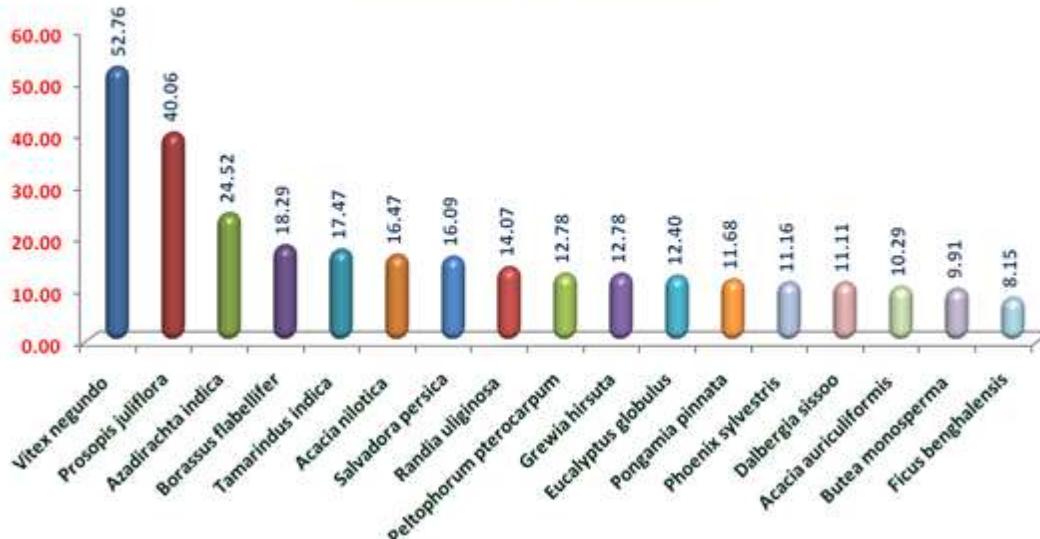
Graph showing IVI values of the dominant floral species within the proposed site

Figure 3-22: Important Value Index of dominant tree species within Project site

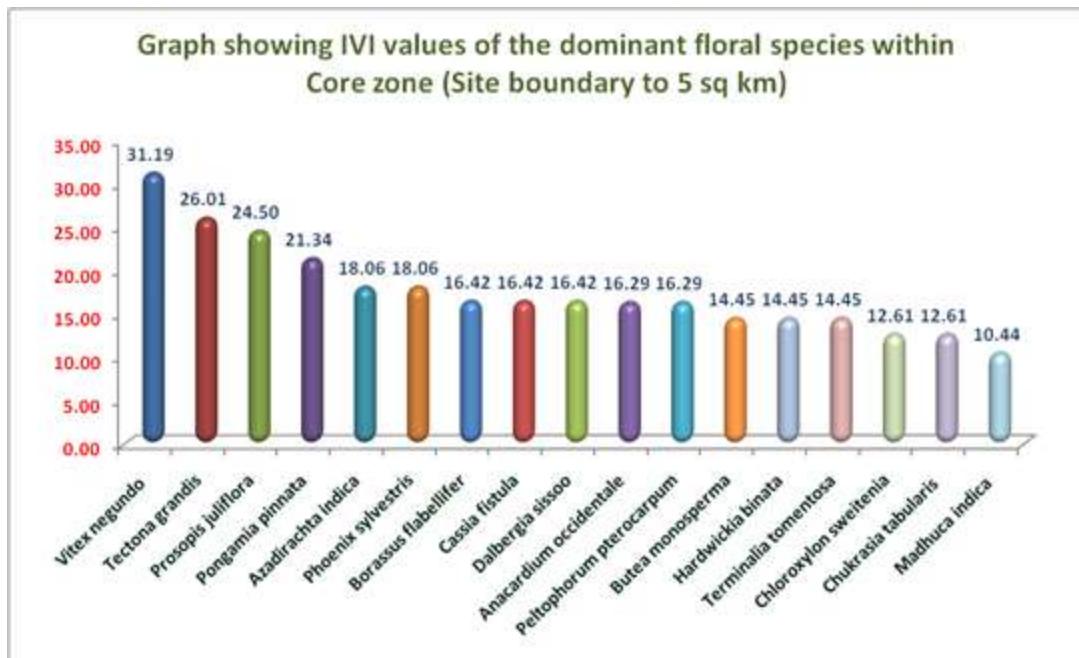


Figure 3-23: Important Value Index of dominant tree species within Core zone

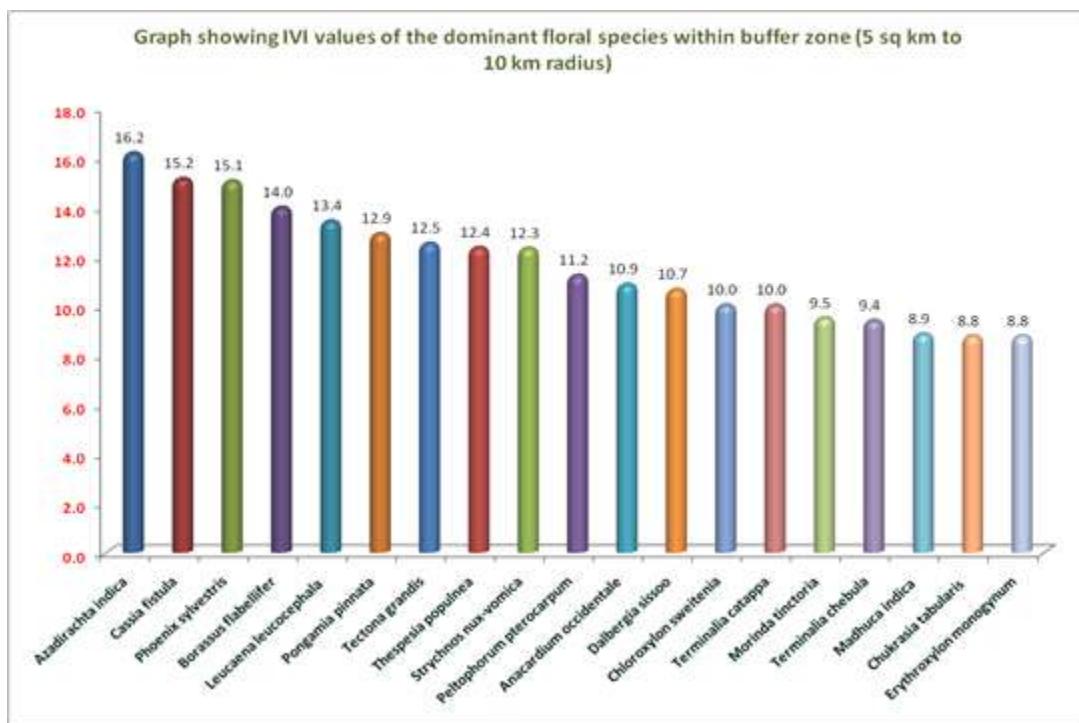


Figure 3-24: Important Value Index of dominant tree species within buffer zone

Shannon-Wiener Diversity Index: Average biodiversity values for core and buffer areas were derived from the quadrate samples laid in the field. The value of the Shannon-Wiener Index usually lies between 1.5 and 3.5 for ecological data and rarely exceeds 4.0. Lower value of H' suggests degraded or arid conditions with low biodiversity values (

Table 3-14). The results suggest the H' value to be normal for the dry arid conditions. There was marginal difference between the core and buffer area in terms of the diversity index.

This was because core area mostly consists of fallow agriculture land and open wasteland where as in buffer area there are variety of habitats and agriculture areas.

Table 3-14: Biodiversity indices (Averages) for the core and buffer areas

Parameter	Project site	Core Area	Buffer area
A/F value	0.035	0.027	0.031
Shannon H	2.678	2.817	3.326
Simpson 1-D	0.916	0.934	0.963
Dominance D	0.084	0.066	0.037
Evenness e^H/S	0.857	0.984	0.959

Distribution pattern (A/F ratio): The ratio between abundance and frequency was used to interpret the distribution pattern of species (Whitford, 1949). Distribution pattern of species in the study area is identified as **regular distribution** as the value of A/F ratio for project area is 0.036. This distribution of species is mainly due to similar ecosystem patterns and habitats within the proposed site. The value of A/F ratio for core area is **0.027**. This distribution of species is mainly due to more RFs and similar ecosystem patterns and habitats within the core zone.

Shannon indices value of project site is 2.678 indicates moderate diversity (Normal diversity in ecological studies is 1.5 to 3.5 range (Kerkhoff, 2010). As there are no RFs within the proposed site, diversity is less compared to core and buffer regions. For Core area is **2.817** indicates **moderate diversity** (Normal diversity in ecological studies is 1.5 to 3.5 range (Kerkhoff, 2010). As there are six RFs within the core zone, diversity is more compared to proposed site.

Population size and of the species for project area is 8% and Evenness is around 95% (Indicates the species are evenly distributed in the proposed site). This might be due to contiguous patches of natural species such as Vitex, *Azadirachta indica*, Eucalyptus, Phoenix, *Prosopis juliflora* (near the villages), *Peltophorum pterocarpum*, *Delonix regia* and Subabul (near road side). For core area is **7%** and **Evenness** is around **98%** (Indicates the species are evenly distributed in the core zone). This might be due to more RFs equally distributed though out this zone.

Frequency classification indicates for project site is AC<D>E as per the Raunkiaer's law of frequency classification indicates that species diversity is distributed maximum for 60 to 80%. This result indicates that some of the tree species are frequently found throughout the region. For core area is A<B<C<D>E as per the Raunkiaer's law of frequency classification indicates that species diversity is distributed maximum for 60 to 80%. This result indicates that some of the tree species are frequently found throughout the region.

3.9.1.8.1 Analysis of Results Buffer Zone

Distribution pattern (A/F ratio): The ratio between abundance and frequency was used to interpret the distribution pattern of species (Whitford, 1949). Distribution pattern of species in the study area is identified as **regular distribution** as the value of A/F ratio is **0.031**. This distribution of species is mainly due to RFs and similar ecosystem patterns and habitats within the buffer zone.

Shannon indices value of study area is **3.326** indicates **high diversity** (Normal diversity in ecological studies is 1.5 to 3.5 range (Kerkhoff, 2010). As there are three RFs within the buffer zone, diversity is more compared to proposed site and core zone.

Population size and of the species is **4%** and **Evenness** is around **96%** (Indicates the species are evenly distributed in the buffer zone). This might be due to more RFs other ecological habitats equally distributed throughout this zone.

Frequency classification indicates A<B<C>D>E as per the Raunkiaer's law of frequency classification indicates that species diversity is distributed maximum for 40 to 60%. This result indicates that some of the tree species are frequently found throughout the region.

3.9.1.9 Status of flora as per Raunkiaer's Frequency Classes

Raunkiaer classified the occurrence of species in an area into five classes of frequency Class – A (1 to 20%), Class – B (21 to 40%) Class – C (41 to 60%) Class – D (61 to 80%) and Class – E (81 to 100). The normal distribution of the frequency percentages derived from such classification is expressed as A>B>C=D<E, and has been named Raunkiaer's "Law of Frequency". The ecological status of vegetation was calculated using the Raunkiaer's normal frequency diagrams and the results are given in **Table 3-15**.

Table 3-15: Raunkiaer's Frequency Class values

Raunkiaer's Frequency Classes	Proposed project Site	Core zone	Buffer zone
	1 to 8	9 to 16	17 to 32
A	0	0	0
B	4	3	6
C	3	5	19
D	8	9	4
E	2	0	0
Total (n)	17	17	29

As per the above table, Raunkiaer's law of frequency classification in three zones, the present study indicates species diversity is distributed maximum for 40 to 80%. It is very clear that only few species are less and more frequent distribution throughout the three zones. In conservation aspect, the protection of dominant as well as rare species is to be considered while managing the green belt. The overall result is most of the plant species are very common throughout the region.

Cropland Ecosystem

The villages were surveyed for enlisting agricultural crops in study area, the project and study area which include 19 species. In study region cultivation *Oryzha sativa*, *Triticum vulgare*, *Triticum diococcum*, *Pennisetum glaucam*, *Sorghum bicolor*, *Zea mays*, which are mainly dependent on rainwater during monsoon season and also through ground water source, tube wells and open wells during non-monsoon season. In this crop land ecosystem in addition to the crop raised, a number of weeds like *Cynodon dactylon*, *Euphorbia hirta*, *Cyperus rotundus*, *Digetaria* sp and *Alyscicarpus* sp also contributing to the primary production. Apart from the commercial crops like ground nut, and several vegetable red chillies, Brinjal, Bhendi and leafy vegetable crops could also grow in this region. The detail of staple crops and commercial crops in study area is given in **Table 3-16**.

Table 3-16: List of agricultural crops & commercial crops in PIA

Sl. No	Scientific Name	Family	Common name
Crops			
1	<i>Arachis hypogea</i>	Fabaceae	Ground Nut
2	<i>Dolichosbiflorus</i>	Fabaceae	Horse Gram
3	<i>Oriza sativa</i>	Poaceae	Paddy
4	<i>Sesamumindicum</i>	Pedaliaceae	Sesame
5	<i>Sorghum bicolor</i>	Poaceae	Sorghum

Sl. No	Scientific Name	Family	Common name
6	<i>Vigna mungo</i>	Fabaceae	Black Gram
7	<i>Vigna radiate</i>	Fabaceae	Green Gram
8	<i>Zea mays</i>	Poaceae	Maize
Horticulture Crop			
9	<i>Citrus medica</i> .	Rutaceae	Citrus
10	<i>Mangifera indica</i>	Anacardiaceae	Mango
11	<i>Musa paradisiaca</i>	Musaceae	Banana
12	<i>Psidium guajava</i>	Myrtaceae	Guava
Vegetable/Commercial Crops			
13	<i>Abelmoschus esculentus</i>	Malvaceae	Bhendi
14	<i>Allium cepa</i> .	Liliaceae	Onion
15	<i>Capsicum annuum</i>	Solanaceae	Chilli
16	<i>Carica papaya</i>	Caricaceae	Papaya
17	<i>Lycopersicon esculentum</i>	Solanaceae	Tomato
18	<i>Moringa oleifera</i>	Moringaceae	Drumstick
19	<i>Solanum melongena</i>	Solanaceae	Brinjal

Aquatic Ecosystem

The study area comprises of many small and medium sized tanks. These ponds provide the suitable habitat for fresh water aquatic and semi aquatic plants. *Pistia*, *Typha*, *Ipomoea aquatica* were most abundant here. There were no REET category species of aquatic and semi aquatic plants in the study area. The floristic survey of the existing farming site witnesses scattered growth of grasses (mainly weeds), rooted hydrophytes, emerging hydrophytes, shrubs in undisturbed area where human movement is absent. Among herbaceous species, weeds are commonly reported such as Congress grass (*Parthenium hysterophorus*), Lantana (*Lantana camara*), *Eupatorium triplinerve*, *Solanum xanthocarpum* and Datura (*Datura stramonium*). Rooted hydrophytes are reported along the banks, where water level is less than a foot or water has recedes after flooding. The commonly reported hydrophytes are *Ipomoea carnea*, *Argeratum conyzoides*, *Azolla pinnata*, *Eichhornia crassipes*, *Lemna perpusilla*, *Spirodela polyrhiza*, *Ipomoea aquatica* etc.

3.9.1.10 Faunal Diversity

The present study has made assessment of 4 major higher vertebrate classes such as Reptiles, Amphibians, Birds and Mammals. The assessment of fauna representing higher trophic levels in the ecosystem was carried out since their diversity acts as indicators of the health of the ecosystem in which they live. The details of the results/observations are as follows:

Reptiles & Amphibians: In the present study we identified a total of 16 species of reptiles and 5 species of amphibians were reported in the project area. Of the reported reptiles species in the buffer area. The Water monitor (*Varanus bengalensis*) was also reported from the buffer area.

Birds: During the study a total of 105 bird species were observed in the study area. Majority of the species are resident species. Of the recorded species, all of them belong to 'Least Concerned' category rated by IUCN.

The birds reported from the core and buffer area belong to the Schedule-IV of Wildlife Protection Act 1972. The birds were recorded mainly The bird species groups observed in the study area were represented by species of open scrubland such as Passerines, Bee-eaters, warblers, shrikes etc. and water bodies birds such as Egrets, Herons, lapwings stilts and ducks. Majority of the birds observed in the study area represent birds of semi-arid non-forested landscapes with several small ponds and seasonal water bodies.

Mammals: A total of 15 mammal species in the study area were observed. The common mammalian species that were directly observed in the study area include Indian Jackal, Indian Mongoose, Indian Hare and three Striped Squirrel. No endangered or Schedule-I species reported from the core area of the project site. However, Indian jackal belongs to Schedule-II of WPA 1972.

3.9.1.11 Endangered/Threatened/protected species

Flora: Among the 282 plant species recorded in the study area. Three species were listed in the IUCN threatened category list, reported near the Reserve forest of the 10 km radius of the study area.

Table 3-17: IUCN listed Flora species at Reserve Forest of the Study area

Scientific Name	Common Name	IUCN
Saraca asoca	Asoka chettu	Vulnerable
Swietenia mahagoni	Magagani	Endangered
Decalepis hamiltonii	Maredu gaddalu	Endangered

Fauna: Among the 152 fauna species reported in the study area. Four species were listed in IUCN/IWPA threatened category list.

Table 3-18: IWPA listed Fauna species at Reserve Forest of the Study area

Scientific Name	Common Name	IUCN	IWPA Schedule
Pavo cristatus	Indian peafowl	Least concern	I
Mycteria leucocephala	Painted stork	Near Threatened	IV
Ciconia episcopus	Asian Woollyneck stork	Vulnerable	IV
Psittacula eupatria	Alexandrine Parakeet	Near Threatened	IV
Varanus bengalensis	Common Indian monitor	Least concern	I

Apart from this IWPA Schedule II species such as Indian Jackal, Deccan Hanuman Langur, Common Indian Mongoose, Indian Cobra & Russel Viper were also reported in the reserve forest blocks of the study area. The details of flora and fauna are provided in **Appendix D**.

There are no wildlife sanctuaries or biosphere reserves or nesting or breeding grounds for any of the rare species or other protected areas within the project area. There are no national parks or wildlife sanctuaries or biosphere reserves or nesting sites for threatened species either in the study area or around it in a radius of over 10 km. The project site is not situated within or adjacent to any cultural heritage sites, protected areas, buffer zones of protected areas, or special areas for protecting biodiversity. As such the area identified for the project is not ecologically sensitive.

3.10 Socio-Economic Profile (Geography and Demography) of the Project Influence Area

NIMZ project site falls in the Sangareddy district of Telangana state which is very strategically located. The proximity to highways of major states, rail connectivity and airport connectivity is close by. The study area for the proposed project is 10.0 km from the project site in that two states are falling Telangana and Karnataka.

3.10.1 Profile of Telangana State

Telangana state in the south of India is situated on the centre-south stretch of the Indian peninsula on the high Deccan Plateau. Telangana is bordered by the states of Maharashtra

to the north and northwest, Chhattisgarh, Odisha to the northeast, Karnataka to the west and Andhra Pradesh to the east and south. The terrain of Telangana region comprises mostly of hills, mountain ranges and a thick dense forests distribution of 27,292 sq. km spread over surroundings of wainganga of Adilabad, Rakhi hill area in Karimnagar district with Rachakondaghats in east Ranga Reddy district to Ananthagiri Hills near Vikarabad.

The state is well connected with other states by means of road; rail and airways. The state has a total of 16 national highways and accounts for a total length of 2,690.23 km (1,671.63 mi).

3.10.2 Districts Profile

3.10.2.1 Sangareddy District Profile

The district is spread over an area of 4,464.87 square kilometres (1,723.90 sq. m). Sangareddy (formerly Sangareddypeta) is a town and the district headquarters of Sangareddy district in the Indian state of Telangana. The Sangareddy Municipality, classified as a first grade municipality with 31 election wards, was created in 1954. The jurisdiction of the civic body is spread over an area of 13.69 km² (5.29 sq. m).

The city has three large-scale public sector industries in its constituency. These are BHEL (Bharat Heavy Electricals Limited-One of the MAHARATNA companies of Govt. of India), BDL (Bharat Dynamics Limited, where one of India's most powerful missile PRITHVI was produced), Ordnance Factory Medak (which manufactures the Saratha tanks for the Indian Army).

The district is well connected through road network NH-9 road passes through the Sangareddy district. About 15 km Away from Sangareddy there is an outer ring road which connects to Shamshabad airport - Rajiv Gandhi International Airport, Hyderabad. The nearest railway stations are Shankarpalli railway station which is about 22 km away, Lingampally, which is about 30 km away, Secunderabad (about 50 km away) and Nampally Station, which is around 55 km away. Sangareddy District Statistics

The district statistics is given in **Table 3-19** which shows the population statistics of the district as whole and further categorized in rural and urban areas. Other than the unemployed, non-working population, it also includes the population of children, old age persons.

Table 3-19: Sangareddy District Statistics

Population	Persons	Males	Females
Rural	23,05,417	11,52,806	11,52,611
Urban	7,27,871	3,70,224	3,57,647
Total	30,33,288	15,23,030	15,10,258
Literates	61.42	71.43	51.37
Scheduled Tribes	5.57	5.68	5.46
Scheduled Castes	17.73	17.49	17.98
Total Workers (Main and Marginal)	47.55	55.01	40.01
Non-Workers	52.45	44.99	59.99
Decadal Population Growth			13.60
Density of Population (Persons per km2.)			313

(Census of India 2011)

3.10.2.2 Bidar District Profile

Bidar district is the northernmost part of the Karnataka state in India. Geographically, it resembles the "Crown of the State", occupying its northeastern tip. It is bounded by

Kamareddy and Sangareddy districts of Telangana state on the eastern side, Latur and Osmanabad districts of Maharashtra state on the western side, Nanded district of Maharashtra state on the northern side and Gulbarga district on the southern side.

3.10.2.2.1 Bidar Statistics

The district statistics is given in which **Table 3-20** shows the population statistics of the district as whole and further categorized in rural and urban areas. Other than the unemployed, non-working population, it also includes the population of children, old age persons.

Table 3-20: Bidar District statistics

Population	Persons	Males	Females
Rural	1,277,348	651,250	626,098
Urban	425,952	219,415	206,537
Total	1,703,300	870,665	832,635
Literates	70.51	79.09	61.55
Scheduled Tribes	13.85	13.76	13.94
Scheduled Castes	23.47	23.46	23.48
Total Workers (Main and Marginal)	41.25	52.72	29.25
Non-Workers	58.75	47.28	70.75
Decadal Population Growth			13.37
Density of Population (Persons per sq. Km.)			313

3.10.1 Demographic Profile of Study Area

The socio economic profile (10.0 km radius) is studied and analysed based on the Census of India, 2011. In 10.0 km radius, total **110 villages** including hamlets/settlements are falling in **five mandals**. The brief profile is discussed in the following sections.

3.10.2 Settlements falling in the Study Area

The details of the settlement of respective project village falling within the project site are provided in following **Table 3-21**.

Table 3-21: Settlements falling in the Project Site

S .No	Project Revenue Village	Settlements within the site
1	Ganeshpur	-
2	Husselli	-
3	Ganjoti	-
4	Mungi	Mungi Tanda
5	Rukmapur	Chandranai Tanda & Suryanaik Tanda (Rukumpur tanda)
6	Hadnur	-
7	Namtabad	-
8	Mamidgi	-
9	Kalbemal	-
10	Basanthpur	-
11	Metalkunta	-
12	Gangwar	-
13	Rejinthal	-
14	Malkanpahad	-
15	Chilepalle	Chilepalle Tanda
16	Yelgoi	-
17	Bardipur	-

3.10.3 Project Villages and Villages falling in the Study area

The project land falls in 17 revenue villages which are given in following villages i.e. Ganeshpur, Husselli, Ganjoti, Mungi, Rukmapur, Hadnur, Namtabad, Mamidgi, Kalbemal, Basanthpur, Metalkunta, Gangwar, Rejinthal and Malkanpahad villages of Nyalkal Mandal and Chilipalle, Yelgoi and Bardipur villages of Jharasangam mandal, Sangareddy District. The revenue or census villages include all other hamlets or settlements within it. The following **Table 3-22** provides list of census villages falls in the project site and in the study area.

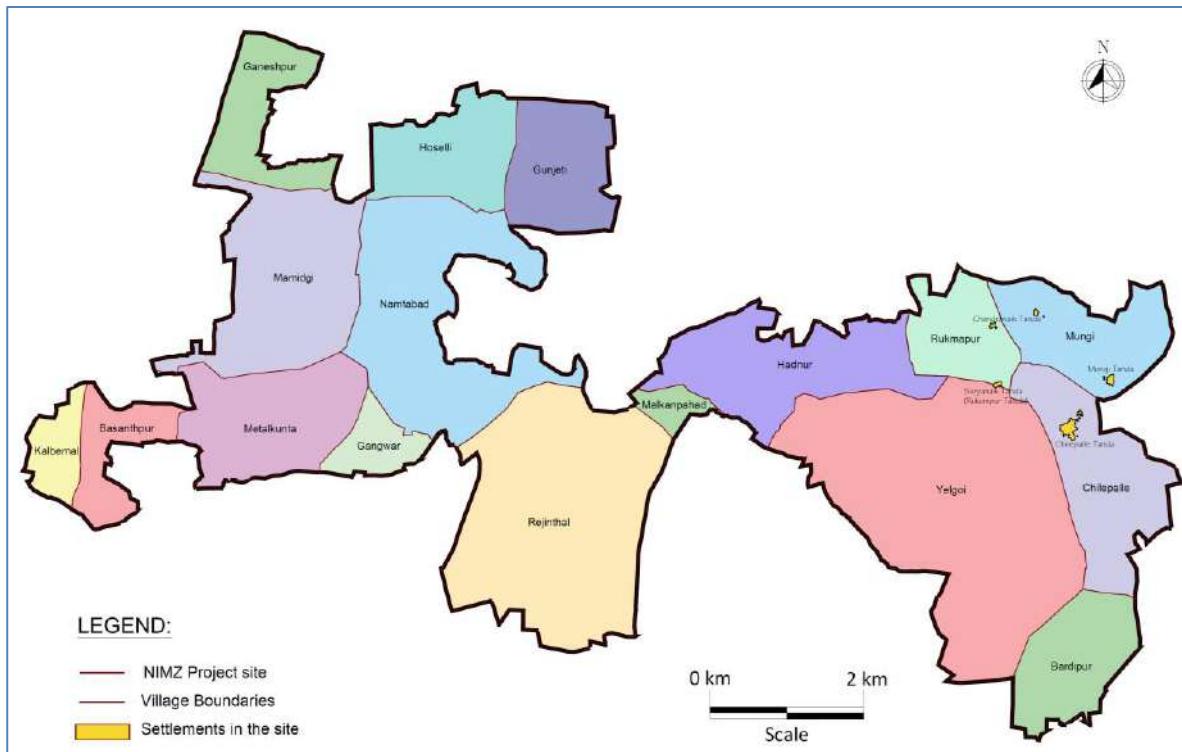


Figure 3-25: Project Villages

Table 3-22: Village Falling in the Study Area

Project Villages		0 to 1 KmR		1 to 5 KmR		5 to 10 KmR	
Nyalkal Mandal		Nyalkal Mandal		Nyalkal Mandal		Nyalkal Mandal	
1	Ganeshpur	18	Rajola	21	Dappur	52	Ibrahimpur
2	Husselli	19	Mirzapur[B]	22	Waddi	53	Chingepalle
3	Ganjoti	Jharasangam Mandal		23	Shamshallapur	54	Mariampur
4	Mungi	20	Siddapur	24	Ramtheerth	55	Ratnapur
5	Rukmapur			25	Nyalkal	56	Malgi
6	Hadnur			26	Mirjapur[N]	57	Atnur
7	Namtabad			27	Tatpalle	Zaheerabad Mandal	
8	Mamidgi			28	Tekur	58	Satwar
9	Kalbemal			29	Khaleelpur[M]	59	Buchnelli (Part)
10	Basanthpur			Zaheerabad Mandal		60	Tumkunta
11	Metalkunta			30	Burdipahad	61	Ranjole
12	Gangwar			31	Kothur [B]	62	Raiapalle
13	Rejinthal			32	Didgi	63	Huggelli
14	Malkanpahad			33	Algole	64	Zahirabad (M)
Jharasangam Mandal		Jharasangam Mandal		Jharasangam Mandal		65	Buchnelli
15	Chilepalle			34	Vanampalle	66	Pastapur
16	Yelgoi			35	Gangapur	67	Tamadpalle
17	Bardipur			36	Kollur	68	Hyderabad
				37	Kakkerwada	69	Hothi(K)
				38	Potpalle	Jharasangam Mandal	
				39	Kuppanagar	70	Tummanpalle
				40	Jharasangam	71	Kappad
				41	Machnoor	72	Kamalpalle
				42	Krishnapur	73	Narsapur
				Bidar Taluk		74	Sangam [Khurd]
				43	Shahpur	75	Bopanpalle
				44	Goonalli	76	Boregaon
				45	Ghodepalli	77	Pyarawaram
				46	Nagora	78	Medpalle
				47	Yakatpur	79	Bidekanna
				48	Manhalli	80	Edulapalle
				49	Gouspur	81	Giniyarpalle
				50	Barur	Raikode Mandal	
				51	Chintalgera	82	Kushnoor

Project Villages	0 to 1 KmR	1 to 5 KmR	5 to 10 KmR
			83 Hulgera
			84 Shamshuddinpur
			85 Allapur
			86 Raikode
			87 Dharmapur
			88 Yousufpur
			Bidar Taluk
			89 Tajlapur
			90 Immamabad
			91 Mirzapur Taj
			92 Ashtoor
			93 Malkapur
			94 Sultanpur (J)
			95 Amlapur
			96 Chitta
			97 Gornalli(B)
			98 Yadlapur
			99 Kasimpur (Pan)
			100 Baridabad
			101 Chatnalli
			102 Budhera
			103 Telang - Mirzapur
			104 Satoli
			105 Dharmapur
			106 Hokrana(B)
			107 Hokrana(K)
			108 Tadpalli
			109 Sindhol
			110 Bidar (CMC + OG)

(Source: Census 2011 Data and Government Websites and Sol, topo-sheet)

3.10.4 Primary Census Survey Data of the Project Study Area

The following (**Table 3-23**) settlements were visited by social team. The socio-economic survey was conducted during March, April, 2018 among the people from Rukmapur tanda and others were not cooperated during the survey.

Table 3-23: List of Sample study Conducted in the Project Settlements

S. No	Name of the Mandal	Name of the Project Villages	Settlements
1	Nyalkal	Mungi	Mungi Tanda
2	Nyalkal	Rukmapur	Chandranaiik Tanda & Suryanaik Tanda (Rukmapur Tanda)
3	Jharasangam	Chilepalle	Chilepalle Tanda

(Source: List of villages/Settlements for conduct of primary survey)

3.10.4.1 Sample Survey – Households & Population

The number of households could be surveyed are 56 of which total males are 127 and females are 119. An average family size expected is approximately 4-5 members. **Table 3-24** explicit the survey family details.

Table 3-24: Details of Respondents

Total Families Surveyed	Males	Females	Total
56	127	119	246

(*Rukmapur Tanda Primary Survey, 2018)

3.10.4.2 Type of Land Affected of Stakeholders

The type of land affected of the surveyed families are 17 households of Patta Land, 15 households of Assigned land and 19 household of government land. These lands have been acquired by the affected families. There are 5 families who did not reply due to hesitation. At present the surveyed families are currently farming as the land has not been physically acquired.

Table 3-25: Type of Land as per household

Patta Land	Assigned Land	Govt Land	Not replied	Total
17	15	19	5	56

(*Rukmapur Tanda Primary Survey, 2018)

3.10.4.3 Land with & without structures of Stakeholders

During the survey the families informed that some of the lands have structures of which some are paid. They also have bore wells on the land which are not paid during land acquisition. There are fruit and non-fruit bearing trees on the agriculture land which are not paid, and this will be done with coordination of horticulture department for valuation and compensation of trees will be paid.

Table 3-26: Land with & without structures

Land with Structure	Land without Structure	Total
8	46	56

(*Rukmapur Tanda Primary Survey, 2018)

3.10.4.4 Marital Status of Stakeholders

In the Rukmapur thandas, married persons are 137 and the unmarried persons are 100 and widows persons are 9. In the region the females' eligible age to get married is above 18 and males are 21. Widow Remarriage is not common in this region.

Table 3-27: Marital Status

Married	Unmarried	Widow	Total
137	100	9	246

(*Rukmapur Tanda Primary Survey, 2018)

3.10.4.5 Educational Status of Stakeholders

In the Rukmapur thanda, illiterate population is 122 which are almost 50% of the total population. Post graduates are very less which forms merely 2% of the total population. Senior Secondary educated are 37%, there are many persons who are drop out from schools. The ITI students form 6% of the total population.

Table 3-28: Educational Status

Uneducated	Till Senior Secondary Class	Degree, Graduate, degree holders	Post Graduate	ITI/Degree	Total
122	91	14	5	14	246

(*Rukmapur Tanda Primary Survey, 2018)

3.10.4.6 Occupational Status of Stakeholders

The work classification clearly reveals that the people are mostly engaged as labourers which are agricultural as well as industrial labourers. Agriculturists are those who cultivate on their own lands. Unemployment in the region is also a major concern which is approximately 23%. The total employed persons are 59%. Some of them did not reply due to hesitation. **Table 3-29** gives the work classification details

Table 3-29: Occupational Status

Agriculture	Labour	Driving	Job	Unemployed	Not replied	Total
58	79	2	7	57	43	246

(*Rukmapur Tanda Primary Survey, 2018)

3.10.4.7 Socio-Economic Condition of Stakeholders

With the observation and socio-economic study of the project area, the economical conditions of the villages are more dependable on agriculture activities and more are dependent on agricultural labour and other works. It was studied that the project study area is only dependent on agriculture and farming which is poor in economical conditions. The project components have to give technical and skill development training to the eligible and skilled unemployed to enhance the socio-economic conditions.

3.10.4.8 Project Perception of the Stakeholders

The project perception embraces opinions of the respondents about the proposed project. The perception on the project and its impacts will ultimately help sustainable livelihoods of the local people. 20% of the respondents including coolies, land owners, tenants and other people in favour of the project opined that more job opportunities will be created for the local population which would result in sustainable livelihoods and also helps in improving economic condition during construction and operation period which would ultimately result in skill up gradation, ancillary and auxiliary business opportunities, better infrastructure and transportation facilities and overall wellbeing of the area. And 70% are negative of the project and 10% of households unanswered the questions.

3.10.5 Secondary Census Data of Project Study Area

Socio-economic assessment of the study area villages was carried out by interpreting Census of India from Medak/Sangareddy District of Telangana i.e. PCA2804_2011_MDSS and 2804_PART_B_DCHB_MEDAK.pdf and from Bidar District of Karnataka i.e. PCA2904_2011_MDSS and 2904_PART_B_DCHB_BIDAR.pdf data along with various other statistical sources of Telangana and Karnataka governments. The study covers around **110 villages of 10km radius** from the proposed project site. The details of the assessment are provided below.

3.10.5.1 Census Population of the study area

In the study area, there are **93,024** households and population is **4,79,268** of which males are 51.13% and females are 48.87%. The sex ratio of the study area is 956 females over 1000 males. The detailed population, households, gender wise data and sex ratio is presented in **Table 3-30** and **Figure 3-26**.

Table 3-30: Households and Population of Study Area

Boundary (in Km)	No. of Households	Total Populations	Male	Male%	Female	Female %	Sex Ratio
Project Villages	5846	30536	15353	50.28	15183	49.72	989
0 to 1 KmR	743	3987	2042	51.22	1945	48.78	952
1 to 5 KmR	12828	64352	32566	50.61	31786	49.39	976
5 to 10 KmR	73607	380393	195080	51.28	185313	48.72	950
Total	93,024	4,79,268	2,45,041	51.13	2,34,227	48.87	956

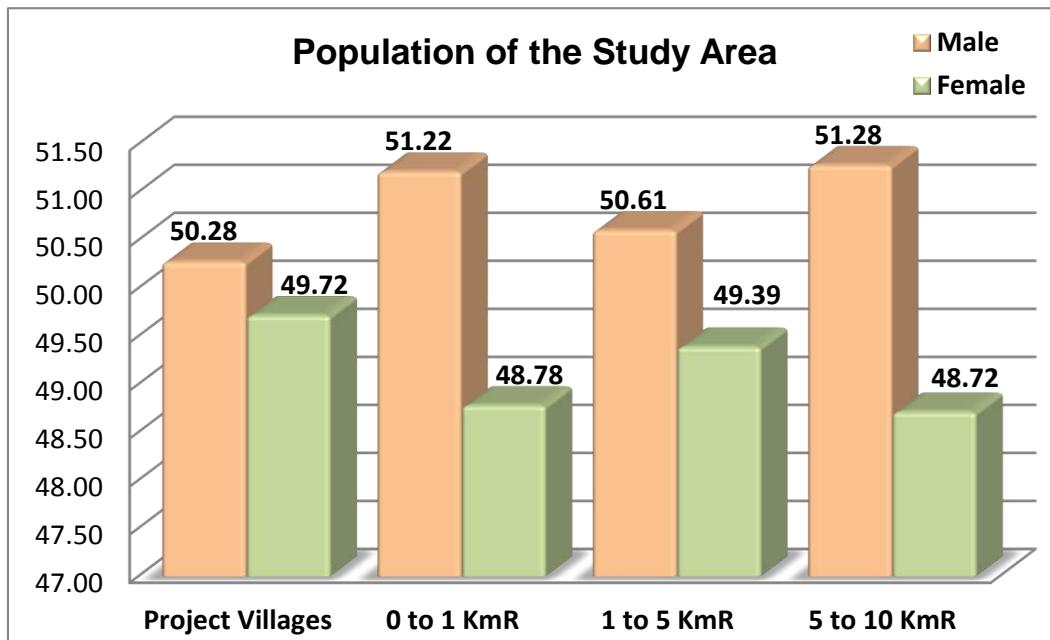


Figure 3-26: Total Population graph of study area

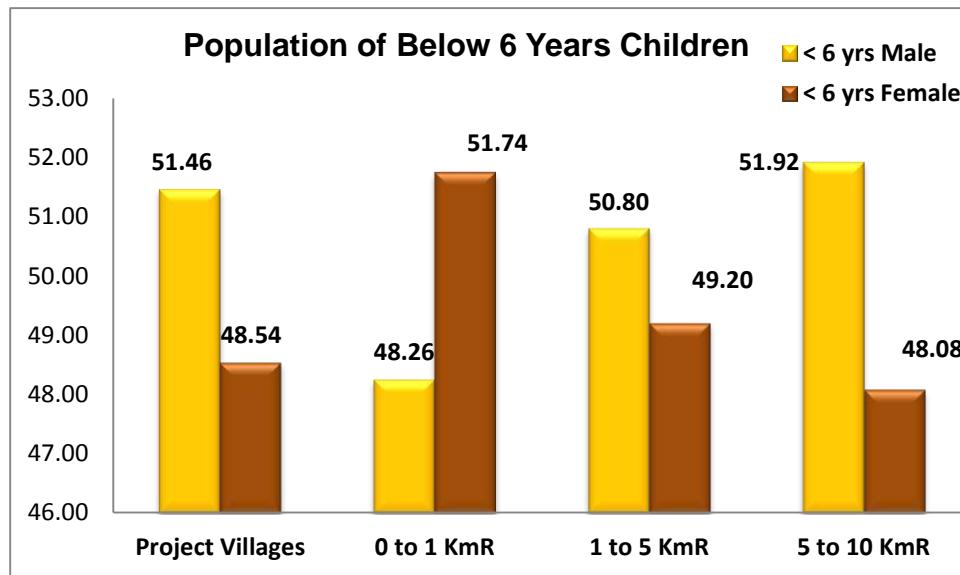
3.10.5.2 Population of Below 6 years Children

The category wise assessment of population–Child (aged 0-6), Schedule Caste and Schedule Tribe was carried out. Gender wise population and sex ratios is shown in

Table 3-31 and Figure 3-27.

Table 3-31: Population of <6 Years Children

Boundary (in Km)	No HH	TOT P	< 6 yrs Pop	%	< 6 yrs Male	%	< 6 yrs Female	%	Ratio
Project Villages	5846	30536	3937	12.89	2026	51.46	1911	48.54	943
0 to 1 KmR	743	3987	545	13.67	263	48.26	282	51.74	1072
1 to 5 KmR	12828	64352	8254	12.83	4193	50.80	4061	49.20	969
5 to 10 KmR	73607	380393	49155	12.92	25520	51.92	23635	48.08	926
Total	93024	479268	61891	12.91	32002	51.71	29889	48.29	934

**Figure 3-27: Population of <6 Years Children**

3.10.5.3 Population of Schedule Caste

The Schedule Caste population of the study area is **86,057** which constitute to be 17.96% of total population in study area. The schedule caste details are shown in **Table 3-32** and **Figure 3-28**.

Table 3-32: Population of Schedule Caste

Boundary (in Km)	No. of Households	Total Populations	SC Population	Total SC%	SC Male	%	SC Female	%	Ratio
Project Villages	5846	30536	9307	30.48	4640	49.85	4667	50.15	1006
0 to 1 KmR	743	3987	939	23.55	464	49.41	475	50.59	1024
1 to 5 KmR	12828	64352	16394	25.48	8245	50.29	8149	49.71	988
5 to 10 KmR	73607	380393	59417	15.62	30139	50.72	29278	49.28	971
Total	93024	479268	86,057	17.96	43488	50.53	42569	49.47	979

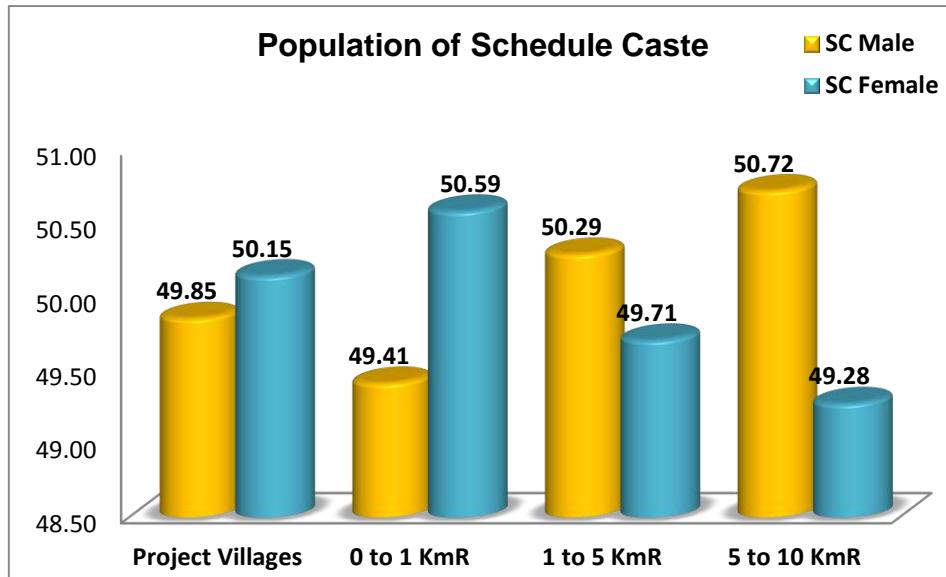


Figure 3-28: Population of Schedule Caste

3.10.5.4 Population of Schedule Tribe

The Schedule Tribe population is **27,818** which aggregate to 5.80% of total population in study area. The ST Population, gender wise data and ratio is shown in **Table 3-33** and **Figure 3-29**.

Table 3-33: Population of Schedule Tribe

Boundary (in Km)	No. of Households	Total Populations	ST Population	Total ST%	ST Male	%	ST Female	%	Ratio
Project Villages	5846	30536	954	3.12	532	55.77	422	44.23	793
0 to 1 KmR	743	3987	73	1.83	37	50.68	36	49.32	973
1 to 5 KmR	12828	64352	5403	8.40	2703	50.03	2700	49.97	999
5 to 10 KmR	73607	380393	21388	5.62	10799	50.49	10589	49.51	981
Total	93024	479268	27,818	5.80	14071	50.58	13747	49.42	977

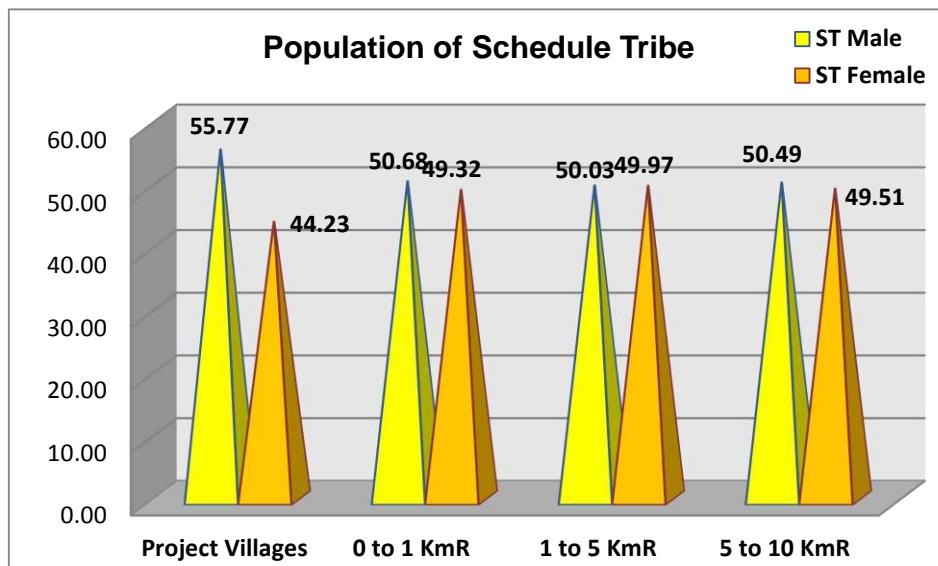


Figure 3-29: Population of Schedule Tribe

3.10.5.5 Literacy & Illiteracy Population of Study Area

Detailed literacy population and percentages are shown in **Table 3-34** and **Figure 3-30**. Educations of the people of study area are to be improved and given preferences under CSR activities.

Table 3-34: Population of Literate in the Study Area

Boundary (in Km)	No. of Households	Total Populations	Total Literacy	%	Male Lit.	%	Female Lit.	%	Ratio
Project Villages	5846	30536	15683	51.36	8957	57.11	6726	42.89	751
0 to 1 KmR	743	3987	2122	53.22	1230	57.96	892	42.04	725
1 to 5 KmR	12828	64352	33489	52.04	19448	58.07	14041	41.93	722
5 to 10 KmR	73607	380393	256512	67.43	141697	55.24	114815	44.76	810
Total	93024	479268	3,07,806	64.22	171332	55.66	136474	44.34	797

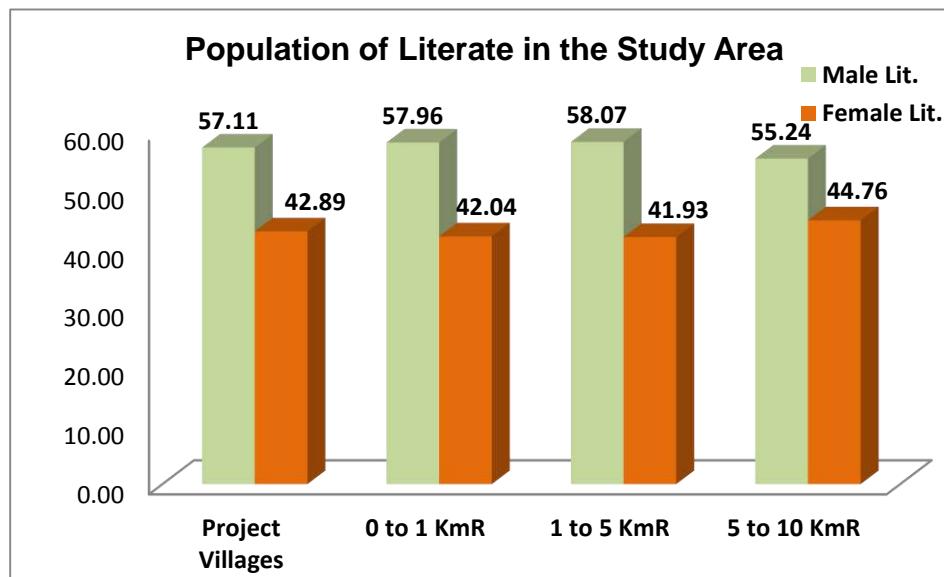


Figure 3-30: Population of Literate in the Study Area

The illiteracy is included of children below 6 years and old age people. Women educations are to be improved and considered by appropriate government and concern authorities. The detailed illiteracy data is shown in **Table 3-35** and **Figure 3-31**.

Table 3-35: Population of Illiterate in the Study Area

Boundary (in Km)	No. of Households	Total Populations	Total III	%	Male Illiterate	%	Female III	%	Ratio
Project Villages	5846	30536	14853	48.64	6396	43.06	8457	56.94	1322
0 to 1 KmR	743	3987	1865	46.78	812	43.54	1053	56.46	1297
1 to 5 KmR	12828	64352	30863	47.96	13118	42.50	17745	57.50	1353
5 to 10 KmR	73607	380393	123881	32.57	53383	43.09	70498	56.91	1321
Total	93024	479268	171462	35.78	73709	42.99	97753	57.01	1326

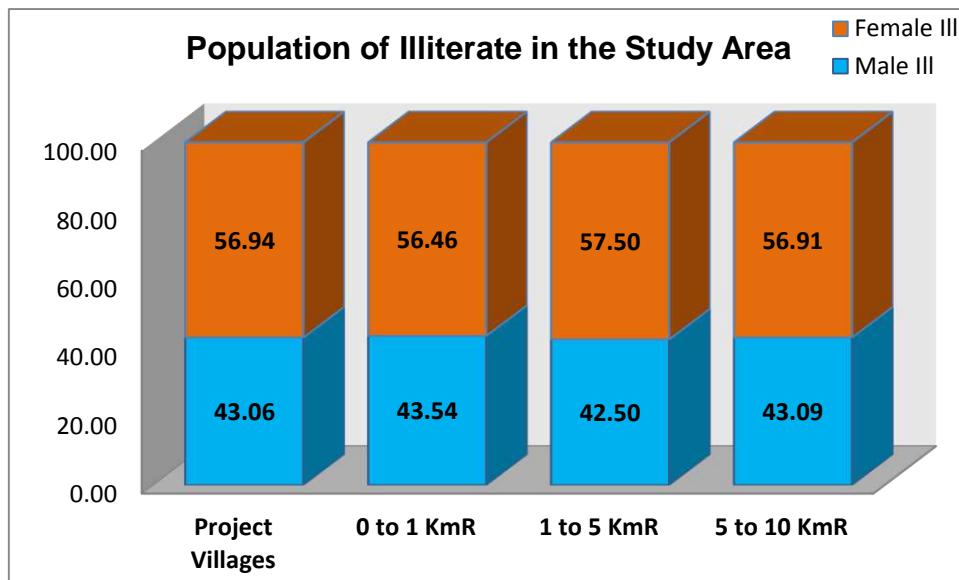


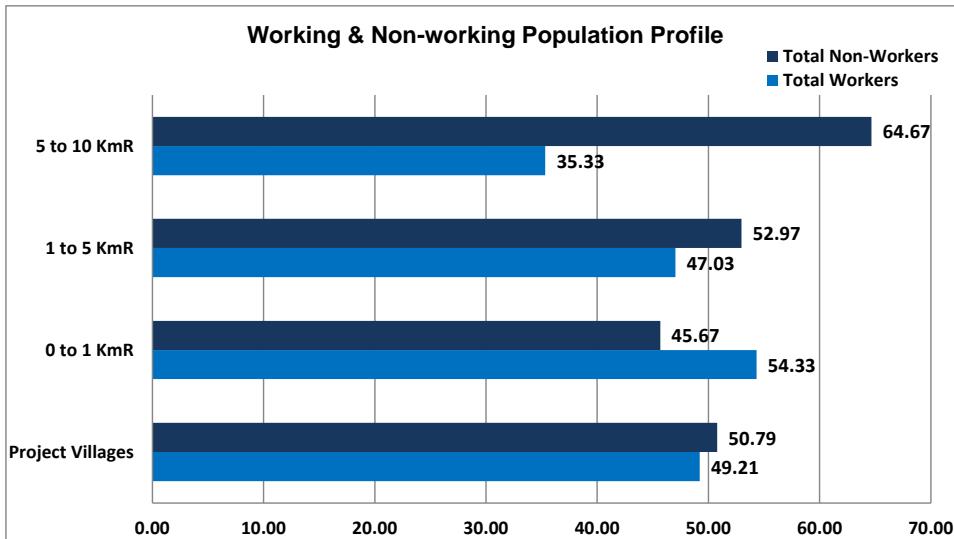
Figure 3-31: Population of Illiterate in the Study Area

3.10.5.6 Working & Non-Working Population

Working ratio of study area is very minimal and this should be raised by providing opportunities and skill development programs to the educated and non-educated of locales. The highest working population is in 5 to 10KmR area and least in 0-1kmR villages. Detailed working, non-working population details are provided in **Table 3-36** and **Figure 3-32**. The non-working population includes, children, old age people, dependents, and other disabled persons/ physical and mentally challenged and unemployed.

Table 3-36: Working & Non-Working Population Profile

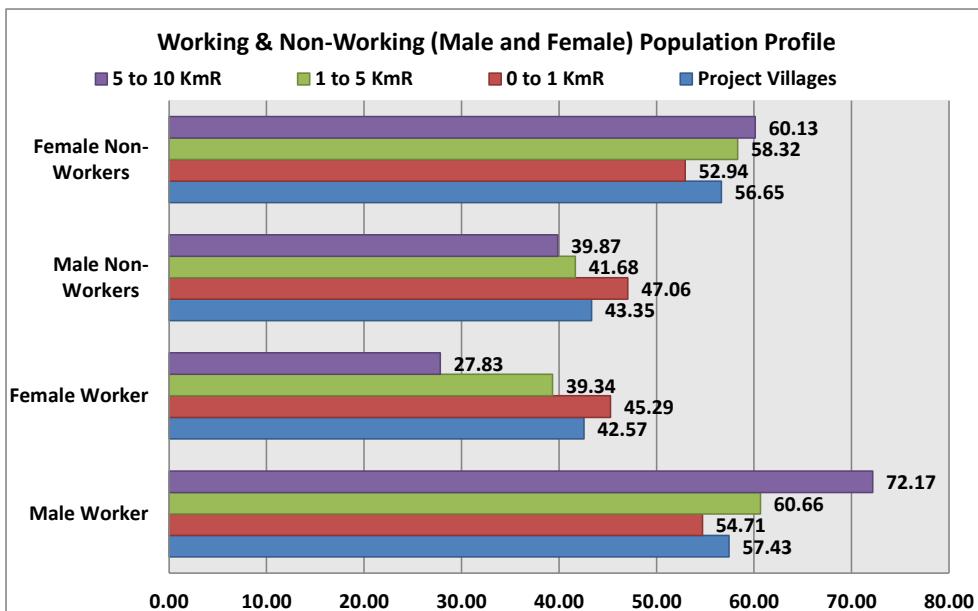
Boundary (in Km)	No. of Households	Total Populations	Total Worker	%	Total Non-Workers	%	Ratio
Project Villages	5846	30536	15027	49.21	15509	50.79	1032
0 to 1 KmR	743	3987	2166	54.33	1821	45.67	841
1 to 5 KmR	12828	64352	30262	47.03	34090	52.97	1126
5 to 10 KmR	73607	380393	134408	35.33	245985	64.67	1830
Total	93024	479268	1,81,863	37.95	2,97,405	62.05	1635

**Figure 3-32 : Working & Non-Working Population Profile**

The working population has been further categorized into gender wise (male and female) which is represented under **Table 3-37** and **Figure 3-33**. This shows that the female working population is very low in the technical studies which are drawing back from good job and employments in the study area. The working population is provided below in detailed way by gender wise and ratio. Working ratio is high in project villages and low in 1-5KmR.

Table 3-37: Working & Non-Working (Male and Female) Population Profile

Boundary (in Km)	Male Worker	%	Female Worker	%	Ratio	Male Non-Workers	%	Female Non-Workers	%	Ratio
Project Villages	8630	57.43	6397	42.57	741	6723	43.35	8786	56.65	1307
0 to 1 KmR	1185	54.71	981	45.29	828	857	47.06	964	52.94	1125
1 to 5 KmR	18356	60.66	11906	39.34	649	14210	41.68	19880	58.32	1399
5 to 10 KmR	97008	72.17	37400	27.83	386	98072	39.87	147913	60.13	1508
Total	125179	68.83	56684	31.17	453	119862	40.30	177543	59.70	1481

**Figure 3-33: Working & Non-Working (Male and Female) Population Profile**

3.10.5.7 Main & Marginal Workforce

The total working population has been categorised into two types as 1) Main Working Population - in which a person works for more than 6 months 2) Marginal Working Population - in which a person works for less than 6 months.

The details relative to distance are presented in **Table 3-38 & Table 3-39** and **Figure 3-34**.

Table 3-38 Main & Marginal Working Population Profile

Boundary (in Km)	Total Main work	%	Total Mar. Workers	%
Project Villages	11911	79.26	3116	20.74
0 to 1 KmR	1831	84.53	335	15.47
1 to 5 KmR	26288	86.87	3974	13.13
5 to 10 KmR	110658	82.33	23750	17.67
Total	150688	82.86	31175	17.14

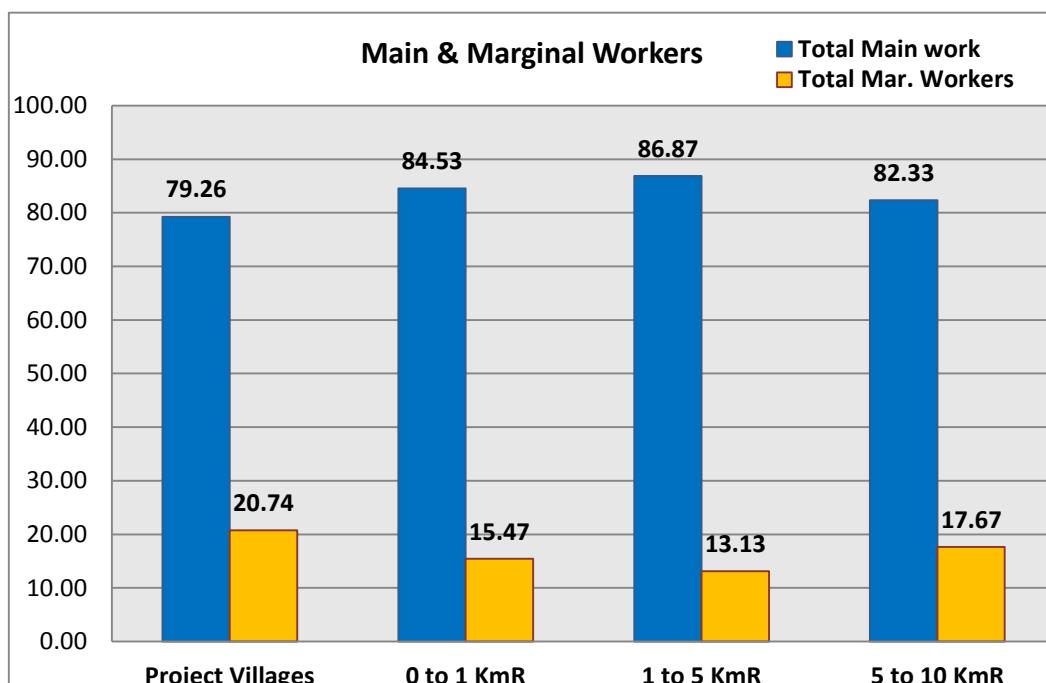


Figure 3-34: Main & Marginal Working Population Profile

Table 3-39: Main & Marginal (Male & Female) Working Population Profile

Boundary (in Km)	Main Work					Marginal Work				
	Male	%	Female	%	Ratio	Male	%	Female	%	Ratio
Project Villages	7252	60.88	4659	39.12	642	1378	44.22	1738	55.78	1261
0 to 1 KmR	1048	57.24	783	42.76	747	137	40.90	198	59.10	2000
1 to 5 KmR	16396	62.37	9892	37.63	603	1960	49.32	2014	50.68	1028
5 to 10 KmR	82868	74.89	27790	25.11	335	14140	59.54	9610	40.46	680
Total	107564	71.38	43124	28.62	401	17615	56.50	13560	43.50	770

The male work force is segregated into main work population and marginal work population with respect to total work force male. As represented it is represented in **Figure 3-35** and **Figure 3-36**.

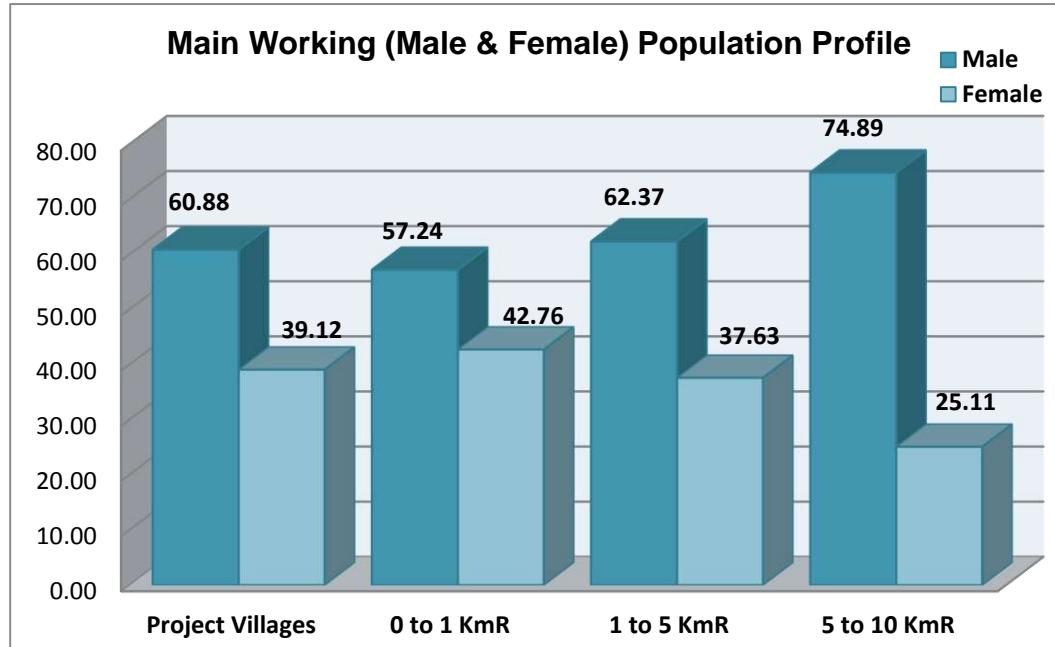


Figure 3-35 : Main Working (Male & Female) Population Profile

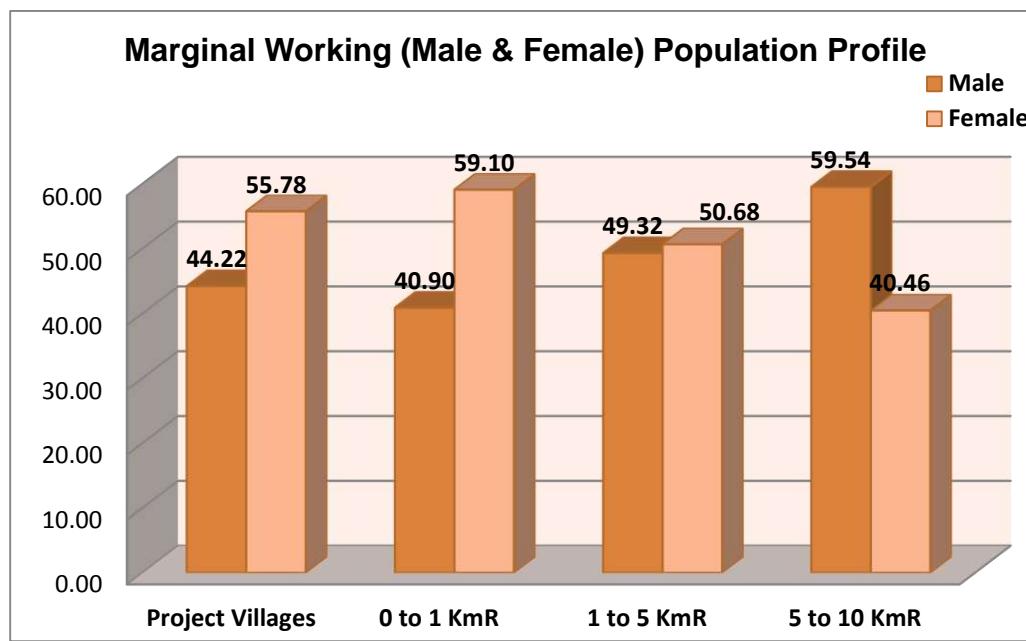


Figure 3-36: Marginal Working (Male & Female) Population Profile

3.10.6 Archaeological Sites in the study area

It was studied that no archeological sites were found within or around the project affected and influenced area. But there are historical places like Bahmani Tombs; Chaukhandi of Hazrat Khalil Ullah is located at Ashtur. Chaukhandi of Hazrat Khalil Ullah is a tomb built in honour of the renowned Hazrat Khalil Ullah. He was the spiritual adviser of Sultan Ahmed Shah. This is an ancient place identified by the local officials.

Bidar Fort is a fort situated in the Bidar, Karnataka, India. The fort, the city and the district are all affixed with the name Bidar. Sultan Alla-Ud Din Bahman of the Bahmanid Dynasty shifted his capital from Gulbarga to Bidar in 1427 and built his fort along with a number of Islamic

monuments. There are over 30 monuments inside Bidar fort. These historical places exist near the 9.7kms from project site.

	
Exhibit 3-5: Bidar Fort © Pic by Jayadeep Rajan	Exhibit 3-6: Bahamani tombs © Pic by Prasanna Sindol
	
Exhibit 3-7: Barid Shahi Tombs © Pic by Kiran Sasidharan	Exhibit 3-8: Madarsa Mahmud Gawan © Pic by Prasanna Sindol

These historical places identified and marked by the State Government of Karnataka

3.10.7 General amenities of the Study Area

3.10.7.1 Infrastructure Facilities

Infrastructure facilities status in the study area can be interpreted as developed to well-developed stage. The education system, hospitals for health care and general amenities are available and in good condition.

3.10.7.2 Public Health Institution

A Health facility is, in general, any location where health care is provided. Health facilities range from small clinics and doctor's offices to urgent care centres and large hospitals with elaborate emergency rooms and trauma centres. The number and quality of health facilities in a country, region, State, Mandal, village, is one common measure of that area's prosperity and quality of life. Medical facilities may be owned and operated by various organizations for-profit businesses, non-profit organizations, governments, and in some cases by individuals, with proportions varying. The government medical facilities are given in

Table 3-40.**Table 3-40: List of Medical Facilities**

S. No	Particulars	No of Hospitals	No. of Doctors	No of Beds
1	Primary Healthcare Centre	8	16	
2	Allopathic Hospitals	0	0	0
3	Dispensary Health Centre	3	3	0
4	Family Welfare Centre	14	14	0
5	Veterinary Hospital	31	31	0
6	Mobile Health Clinic	3	3	0
7	Non-Govt. Hospitals	118	136	195
8	Medical Shops	32	0	0

(Source: Census 2011 Handbook)

3.10.7.3 Educational Institution

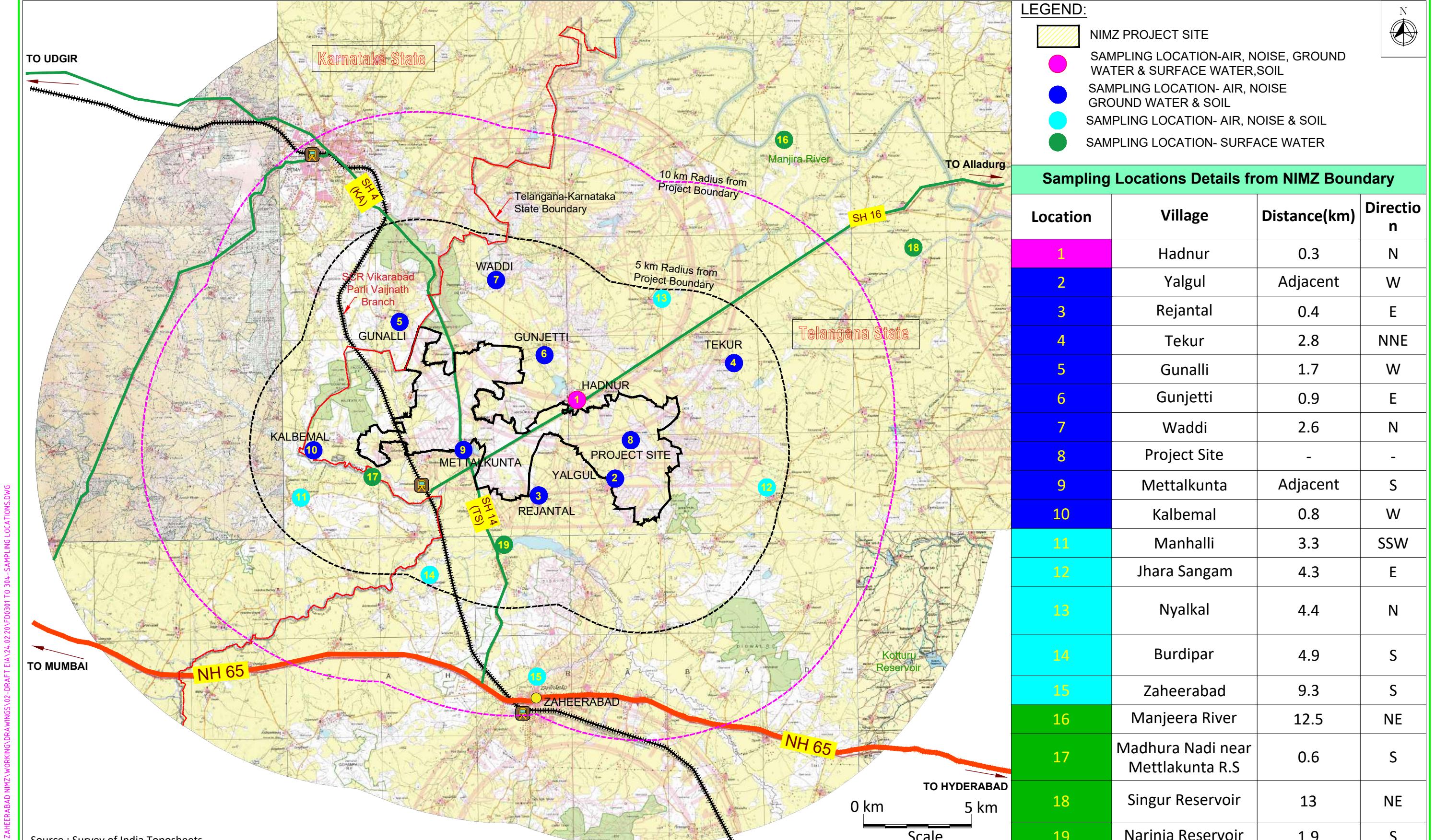
Educational Amenities: The type of different educational facilities available in the village is given in numbers. Government and private educational facilities / institutions are considered for this-purpose. If there are composite schools like Middle schools with Primary classes, or Secondary schools with middle classes, these are included in the number of Primary and Middle schools respectively. The lists of educational institutes are given in **Table 3-41**.

Table 3-41: List of Educational Institutes

S. No	Particulars	No of Schools/Colleges in TS Project area	No of Schools/Colleges in Bidar Taluk
1	Government Primary Schools	173	68
2	Government Middle Schools	76	42
3	Government Secondary Schools	28	10
4	Government Senior Secondary Schools	0	1
5	Private Primary Schools	18	27
6	Private Middle Schools	13	10
7	Private Secondary Schools	7	1
8	Private Senior Secondary Schools	0	1
9	Government Colleges	0	3
10	Private Colleges	0	10

(Source: Census 2011 Handbook)

FIGURES



AUTO PATH: L\PORTS\TS2017\CT171388 - ESI FOR ZAHEERABAD NIMZ\WORKING DRAWINGS\02-DRAFT EIA\24_0220\FD0301 TO 304-SAMPLING LOCATIONS.DWG

This drawing is the property of L&T Infrastructure Engineering Ltd. and must not be passed on to any person or body not authorised by us to receive it nor be copied or otherwise made use of either in full or in part by such person or body without our prior permission in writing.
PATH: REFER BOTTOM LEFT CORNER OF THE DRAWING

PROJECT: DEVELOPMENT OF NIMZ NEAR ZAHEERABAD,
SANGAREDDY DIST., TELANGANA STATE
TITLE: BASELINE SAMPLING LOCATIONS MAP

L&T Infra Engineering

L&T Infrastructure
Engineering Ltd.

PROJECT NO:
C1171308
DATE: 25/02/2020
MADE: VSU
FIGURE NO:
FD0301
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CHAPTER 4

ANTICIPATED ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Chapter 4 Anticipated Environmental Impacts and Mitigation Measures

4.1 General

The potential impacts on the environment from the proposed Zaheerabad NIMZ are identified considering the nature and extent of the activities associated with the Project implementation and operation. The list of industries and its sub-categories are listed in **Table 2-4**. The impacts are assessed and defined with relevant characteristics – type, extent and duration. The definition of each characteristic is given in **Table 4-1**.

Table 4-1: Impact characteristics

S.No	Characteristics	Definition	Classification	Definition
Type	It indicates the relationship of the impact to the project	Direct	Impacts that are from a direct interaction between the Project and receptor	
			Indirect	Impacts that follow on from the direct interactions between the Project and its environment as a result of subsequent interactions within the environment
			Induced	Impacts that result from other activities (which are not part of the Project) that happen as a consequence of the Project.
Extent	It indicates the reach of the impact in terms of spatial attribution	Local	Within the Project site/layout	
			5km buffer	Between site and 5km buffer from its boundary
			10km buffer	Area from Project boundary to 10km buffer of it
Duration	The time period over which a receptor is impacted	Temporary	Only during the source of impact is active	
			Short-term	Residual of the impact prevails for a short time period after temporary stage
		Long-term	Impact prevails for a longer time period but will subside in due course	
		Permanent	Impact is will be forever and in most cases irreversible	

In case of unplanned event/activities, the impact will be classified only based on likelihood/probability of occurrence as given in **Table 4-2**.

Table 4-2: Likelihood designations

Likelihood	Definition
Unlikely	The event is unlikely but may occur at some time during normal operating conditions (Probability less than 20%)
Possible	The event is likely to occur at some time during normal operating conditions (Probability greater than 20% and less than 50%)
Likely	The event will occur during normal operating conditions (Probability greater than 50%)

The intensity of the change that was predicted to occur in the receptor as result of the impact can be described by Magnitude. Based on the combination of the above described characteristics magnitude of an impact is ascertained and in case of unplanned events/activities likelihood is considered as magnitude. The universal magnitude designations are:

- ❖ Positive¹⁰
- ❖ Negligible
- ❖ Small
- ❖ Medium
- ❖ Large

Apart from magnitude, another tangible assessment indicator of impact is sensitivity of the receptor. The three universal designations of sensitivity are:

- ❖ Low
- ❖ Medium
- ❖ High

Significance of an impact can be established by relating the magnitude and sensitivity in form of an Impact Significance Matrix which is given in **Table 4-3**.

Table 4-3: Impact Significance Matrix

		Sensitivity of receptor		
		Low	Medium	High
Magnitude of Impact	Negligible	Negligible	Negligible	Negligible
	Small	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Major
	Large	Moderate	Major	Major

Where

Negligible significance	Receptor will essentially not be affected in any way or the impact is indistinguishable from natural background variations
Minor significance	Receptor will experience a noticeable effect but the magnitude should be well within applicable standards/guidelines
Moderate significance	The impact magnitude will be within applicable standards/guidelines, but falls somewhere in the range from a threshold below which the impact is minor, up to a level that might be just short of breaching a legal limit. Emphasis be given that the classification is for demonstration purpose and not a best practice design criteria
Major significance	It is where an accepted limit or standard may be exceeded. The assessment procedure aims to anticipate such impacts and ascertain whether they are long-term or extend over a larger area. In case of pertinence of major residual of the impact after applying possible mitigations, the positive impacts of the project will have to be weighed to decide upon such as employment, economy etc. as deciding factorials.

Using the above characteristics, likelihood and Significance the likely impacts have been identified, assessed and presented. To mitigate likely environmental impacts during Construction and Operation phases due to the proposed development of NIMZ site, suitable mitigation measures are incorporated as a part of planning process.

¹⁰ In current study degree of magnitude is not characterised for positive magnitude but just limited to notion that it is not adding any negative influence on the receptor

4.2 Land Environment

4.2.1 Potential impact due to Location

4.2.1.1 Impacts due to Land acquisition

The NIMZ in Zaheerabad is proposed to be developed in an area of about ~12,635 acres (Ac. 12635.14 guntas). The status of land acquisition is provided in **Table 2-2 of Chapter-2**. An area of Ac 2,924.38 gts is under possession of TSIIC, out of which patta/private land is Ac.1311.38 gts and government land is Ac. 1613.

The private land acquired has been purchased directly from the land owner through direct consent and negotiation. Government land is under process of transfer for the project. Compensation for land and structure are paid as per G.O. 123 issued by GoTS and **Telangana State RFCCT LAR&R Act 2016** in line with RFCT LAR&R Central Act, 2013. As such no R&R is proposed for the settlements existing in the project boundary.

The balance land will be acquired in compliance with the prevailing laws/acts of GoTS. The land identified for development consists of dwellings and relocation of dwellings is not proposed and moreover they are integrated within the social zone of NIMZ.

4.2.1.2 Impacts due to changes in Land Use Pattern

Project site is comprised predominantly with 44.6% of scrub land, 27.65% of crop land and 26.21% of fallow land and remaining land is under agro-plantation and water bodies. The primary survey reveals that there are specific patches for certain species and mass plantations such as Eucalyptus, mango etc. There are plantations on the road side such as *Ficus*, *Polyalthia longifolia*, *Alstonia scholaris*, *Peltophorum pterocarpum*, *Samania saman*, *Delonix regia*, *Tectona grandis* and *Acacia auriculiformis*. The land use of the existing area will be changed to industrial, commercial and residential areas which results in loss of existing vegetation. Also it will have impact on the existing drainage pattern if the development is not properly planned.

4.2.1.3 Mitigation Measures

- The change in land use pattern shall be as per requirement of the proposed project development/zoning plan
- The development shall be carried out in a such a way to not disturb the natural drainage to the best possible and ensure proper drainage by providing surface drainage system from the development parcels and connecting to storm water network
- Plantations where falling in green/open spaces will be retained.

4.2.2 Potential Impact due to Construction

4.2.2.1 Impact due to Site grading/levelling

The project site is relatively flat with minimum undulations and sloping from East to West with the ground levels varying from 605 m to 660 m above MSL. The soil composition of the site is covered with clay to sandy clay. During the construction phase minimal site levelling would be required which involves site preparation work, the soil and rock debris etc., achieved as cut material from the higher gradient shall be utilized to elevate the low level areas within project premises.

The land disposal of solid wastes such as construction rubble, camp site garbage and discarded topsoil may impact soil quality. There may be a temporary phase of dumping the

construction materials and wastes marring the aesthetics of the site. The landscape changes are expected with the changed land use. Apart from the localized construction impacts confined to the site, however, the impact is likely to be insignificant and no long term adverse impacts on topography are envisaged.

4.2.2.2 Mitigation Measures

The earth material will be balanced by cut and fill quantities within the project site. Hence the reduction in transportation/conveyance of earth material to and from the site is not envisaged. Proper disposal of construction waste has to be planned with temporary dump storage near to the site.

4.2.2.3 Impact on Local Infrastructure

During the construction phase of the project there will be large-scale employment generation in the form of skilled and semi-skilled labours. Also, majority of the works will be subcontracted, temporary worker camps will be set up for some workers and others will be transported from nearby town/villages.

Transportation of huge quantities of construction material and worker camps during construction phase results in use of public infrastructure like roads, railways, drainage, water and power supply which in turn results in extra burden on the existing infrastructure.

4.2.2.4 Mitigation Measures

- To mitigate impacts from transportation of construction material, existing roads will be strengthened where necessary
- Construction material shall be sourced from government approved quarries
- Temporary approach roads may be developed/strengthened with prior permission from competent authority
- Trucks with construction material susceptible for fugitive suspension will be covered with tarpaulin covers during transport of construction materials
- Transportation management will be adopted for movement of dumpers transporting quarry stones and construction materials and traffic will be regulated
- Vehicles deployed will conform to emission norms (air/noise) of CPCB and have valid Pollution Under Control (PUC) certificates
- Dumpers and trucks will comply with standards for exhaust emissions and noise levels
- To avoid/minimise impact/strain on the existing infrastructure, the worker camps will be self-sufficient and would not rely on any local resource. This would help to avoid any conflict with the local population. To mitigate impacts from health hazards, sanitation facilities will be provided.
- The worker camps will be adequately equipped with all the necessary facilities such as water supply, power supply, wastewater collection, solid waste collection and sanitation.
- The domestic wastes generated from the camps will be disposed at approved disposal sites.
- Periodic health check-ups will be undertaken for early detection and control of communicable diseases.
- Medical facilities including first aid will be available in the workers camps for attending to injured workers.

4.2.3 Potential Impact due to Operation

4.2.3.1 Discharge on Land

After primary treatment of the wastewater generated in each industry, it will be sent to CETP for further treatment. The treated wastewater will be treated and recycled for use within the NIMZ only. There shall not be any contamination of soil in and around the project site as the project is designed to follow by reuse and recycle options.

4.2.3.2 Mitigation Measures

- Periodic maintenance and check of wastewater conveyance pipelines
- Attempt to restore by replacing a part or putting together the torn or broken parts of the conveyance pipeline in case of any leakage detected.
- Necessary preventive measures for spillage from pipelines
- Treated wastewater quality shall be ensured as per standards before using for greenbelt/land scape application

4.2.3.3 Soil Contamination

Potential impacts on land environment are envisaged due to hazardous and non-hazardous wastes generated due to operations of various industries. Sludge generated during production process, chemical waste including toxic waste, burnt fuel waste, oil slurry, etc., are the source of hazardous waste. CETP and STP sludge of municipal wastes to be generated in the project. Poor management of such wastes from the operation is a potential risk of soil contamination.

4.2.3.4 Mitigation Measures

Good housekeeping and best practices of waste handling shall be adopted to eliminate/minimise the risks of soil contamination. The wastes generated will be stored in temporary storage facility and then it has to be transferred to nearby Treatment, Storage and Disposal Facility (TSDF) and also to the approved vendors of Telangana State Pollution Control Board (TSPCB) and sanitary landfill or compost facility. However, waste minimisation techniques will be adopted in order to minimise the generation of wastes.

4.2.4 Impact significance

The residual impact significance will remain minor as the change in land-use will be evident when construction activities are ongoing. Long-term changes in land-use include roads, surface drainage network and power transmission towers would not create a significantly noticeable change in land use character.

Impact	Changes in Land Environment
Impact Nature	Negative
Impact Type	Direct
Impact Duration	Short-term & Long-term
Impact Extent	Local
Impact Magnitude	Small
Receptor Sensitivity	Medium
Impact Significance	Minor
Residual Impact Magnitude	Small
Residual Impact Significance	Minor

4.3 Water Environment

4.3.1 Potential impact due to Location

4.3.1.1 Impacts on Existing Water Resources

The water requirement during the construction phase for proposed NIMZ is ~1.0 MLD which will be met from Singur reservoir and Narinja reservoir. Partly ground water will also be used during construction phase or it will be sourced from authroised suppliers. During Operation phase, net water requirement of 57.71 MLD will be used for potable water demand. Water will be sourced from Singur reservoir. As per Section **2.5.2** water availability from Singur reservoir was ascertained after consideration of other allocations.

Groundwater and other small surface water bodies are not considered for water demand during operation phase which can be observed as a positive aspect as the local water resources are not impacted.

4.3.1.2 Mitigation Measures

Though the proposed development will not draw groundwater, considering the need of ground water during construction until water supply scheme is available, the following measures are proposed as a part of development to improve the ground water scenario.

- Strategic plans such as implementing following structures for rainfall harvesting and ground water recharging purposes in Project site
- Recharge pits
- Roof-top rain water harvesting
- Rainwater storage ponds/tanks
- Storage cum recharge ponds
- Recharge Shafts
- To step up the present level of rain water harvesting and conservation in the study area, the measures such as renovation/revamping of existing rain water harvesting structure
- Proposed to create awareness among farmers in the study area on advanced management methods in utilizing the ground water for irrigation and other purposes
- Monitoring of water quality and ground water level variations in and around the project site

4.3.2 Potential Impact during Construction

4.3.2.1 Impacts due to Wastewater Generation

During construction phase of the proposed project, sewage will be generated from construction workers camp and areas. Wastewater generation at construction site includes surface runoff also which may contain pollutants and traces of solvents, paints, metal compounds etc. which may impact the groundwater and nearby surface water resources if not managed properly. The impact is short term until the construction phase is completed as infrastructure for wastewater conveying network and treatment plants will be available.

4.3.2.2 Mitigation Measures

- An adequate drainage system will be provided at the site with separate collection streams to segregate the storm run-off from roads, open areas, material storage areas, vehicle wash water and other wastewater streams. Suitable measures will also be taken to prevent the washing away of construction materials into the drainage system.

- Sewage generated at site and at construction workers camp will be collected in holding tank and periodically transferred to temporary Sewage Treatment Plant (STP). In case of non-availability of nearby STP, mobile STP and septic tank with soak pits will be also be explored.
- No wastewater shall be disposed directly on land or on existing surface water resources without appropriate treatment

4.3.2.3 Impact on Existing Drainage Pattern

The existing drainage pattern in and around proposed project site is shown in **Figure 3-7**. A total of four watersheds are in the study area of which one watershed covers the entire project area. It can be assessed from the figure that four instances of drainage flow are observed in NIMZ layout. Three of them are originating within the project area and one instance of flow is entering from North of the site and carrying forward towards the Southern side to contribute water to Narinja reservoir. Out of the three originating drainage flows two instances are contributing to Karanja River and the remaining to Narinja reservoir.

Due to the proposed project, there will be change/obstruction to the natural drainage pattern and chances of flooding can be witnessed if any of the construction debris hinders the flow leading to submergence of low lying areas especially during rainy seasons.

4.3.2.4 Mitigation Measures

- Natural drainage where ever retained will be strengthened to receive the newly channelled drainage to withstand the increased flow rates
- Storm water drainage network is to be designed wherever diversion of the drains is proposed.
- Treated wastewater from CETP and STP can't be sent to storm water network as the pipeline network will be entirely different and network is proposed in such a way it will not interfere with storm water network.
- Outlets are to be proposed for the storm water towards natural sloping which can be used during monsoon
- Outlets will have to be connected to existing drainage network

4.3.2.5 Storm Water Management – Design of Drain Section

Based on the drainage pattern assessed storm water network was designed to collect the rainwater. The network lines will be separate from the sewerage lines and along the road network. The planned storm water network with discharge locations is shown in **Figure 4-1**.

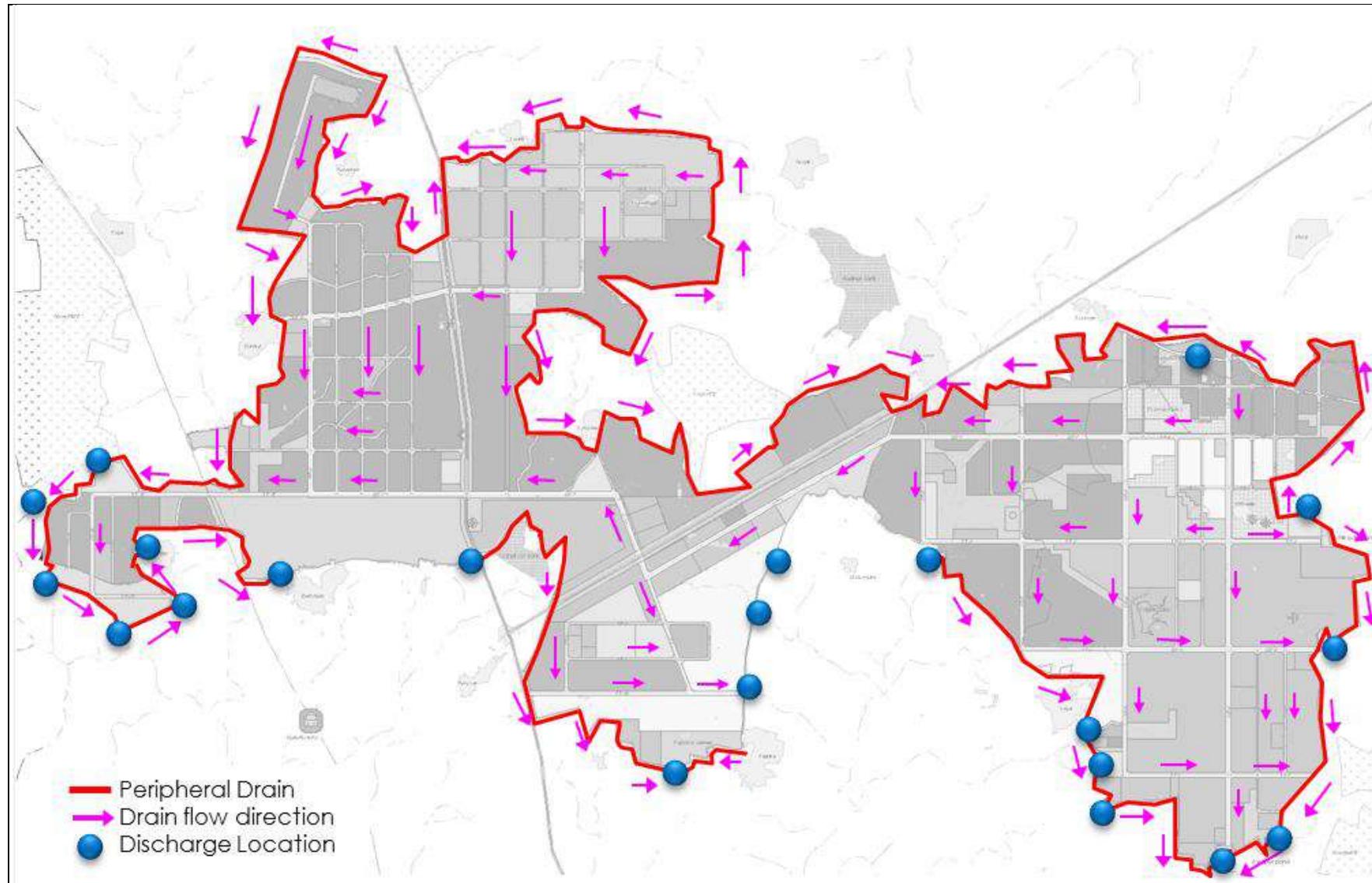


Figure 4-1: Storm Water Network Plan

At all drains located near the discharge points into natural drains a desilting and filter chambers as shown in **Figure 4-2** shall be provided at suitable intervals which shall be preferably located right below the manhole covers provided on top of the drain to enable periodic cleaning and de-silting of these wells.

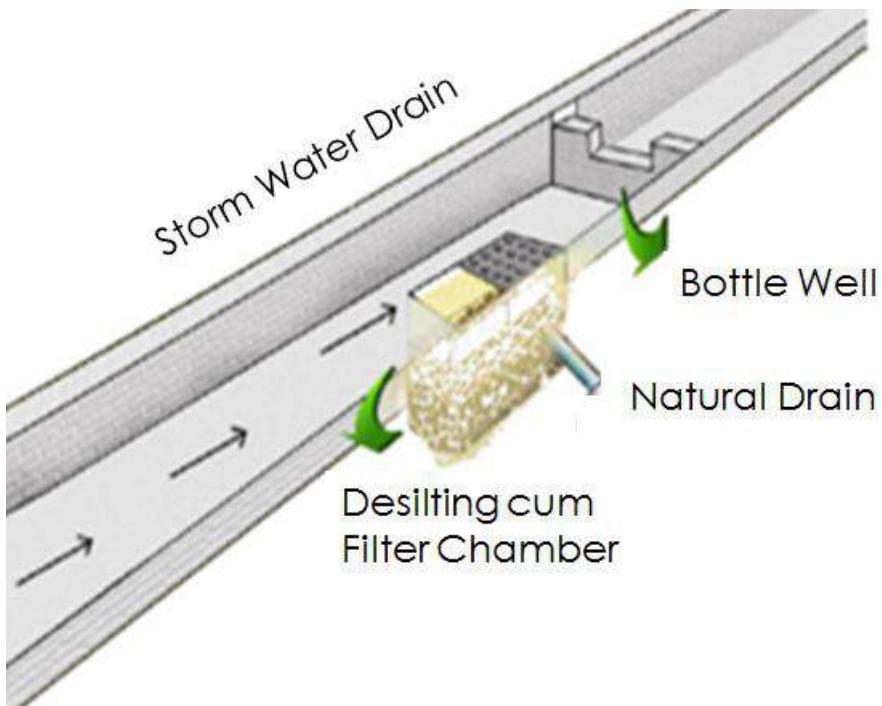


Figure 4-2: Desilting and Filter Chamber

4.3.3 Potential Impact during Operation

4.3.3.1 Impact due to Wastewater Generation

Typical wastewater discharges from manufacturing industries includes water-based cleaning and rinsing streams, cooling water; alternative cleaners; wastewater generated from cutting, blasting, deburring and mass finishing activities; and water-based metal working fluid operations. If it is to be listed as per the brief process the following type of process wastewater is generated:

Sintering: Metal oxides, phenols, grease, spilled oils, suspended and dissolved solids and metals (metal-bearing sludge)

Metal shaping: Waste machining fluids (e.g. ethylene glycol, oil-based fluids; oil-water-emulsions, synthetic emulsions) and acid (e.g. hydrochloric, sulfuric, nitric), alkaline, and solvent wastes

Surface Preparation: From solvent degreasing and emulsion, alkaline and acid cleaning processes - Surfactants, emulsifiers, detergents, terpenes, alkaline or acid wastes, metal salts, dissolved base materials; From welding processes – contaminated cooling bath used to quench after welding

Surface Finishing: From Anodizing, chemical conversion coating, electroplating – Acid/alkaline wastes, metals, metal salts, zinc, chromium (VI), cyanide; from Painting processes – Solvent wastes, spills and still bottom; from other metal finishing techniques (including polishing, hot dip coating and etching) – Metals like Zinc, chromium (VI) and acid or alkaline wastes

Other sources: From wet scrubbers used for fume control may generate wastewater that may contain metals and phenols which are highly alkaline or acidic, Fluids resulting from metal cutting, grinding and forming become contaminated due to extended use and reuse, metal machining fluids like petroleum base, oil-water emulsions and synthetic emulsions.

Specifically from Food processing industries the characteristics of wastewater varies from the rest of industries within NIMZ. Effluent streams from food processing industry may have a high BOD and COD resulting from organic wastes entering into the wastewater stream and from the use of chemicals and detergents in various processes including cleaning. In addition, effluent may contain pathogenic bacteria, pesticide residues, suspended and dissolved solids such as fibres and soil particles, nutrients and microbes, and variable pH.

Apart from industrial wastewater generation, domestic wastewater and other heterogeneous wastewater generation like floor washings, social infrastructure waste streams etc. These non-industrial wastewater streams are generally high in BOD but less than food processing wastewater streams.

4.3.3.2 Mitigation Measures

The following mitigation measures will be followed to handle the wastewater generated:

Oil based Effluents:

- Effluent separation from wastewater, and special disposal if recycling is not possible; standardization of use of oil types, and efficient scheduling of processes that require use of varying oil types;
- Extend the life of cooling liquid through use of centrifuges, introduction of periodical analyses, use of biocides and ultrafiltration, and removal of oils by disk or belt skimmers.
- Use appropriate housekeeping techniques to prevent cutting oils from being contaminated with solvents;
- Oil quench baths will be recycled by filtering out metals;
- Metal-working fluids should be recovered using collection (or drip) pans under machinery;
- In cold forming or other processes where oil is used, automatic oilers will be used to reduce grease accumulation. A stamping lubricant suitable for conditions leading up to thermal treatment processes can be considered.

Solvent and Water-based Effluents:

- Solvents shall carefully manage to prevent spills and fugitive emissions. Guidance on storage and handling of solvents is provided in the General EHS Guidelines;
- Less hazardous degreasing agents (e.g. petroleum solvents, vegetable cleaning agents (VCA) supercritical CO₂ or alkali washes) will be considered, in addition to the use of counter current solvent cleaning (two-stage: first cleaning with dirty solvent, followed by fresh solvent);
- Aqueous non-VOC-containing alkali washes will be used for metal cleaning whenever possible. Some of these can be regenerated by microfiltration;
- Spent degreasing solvents will be recycled on site, reusing batch stills and waste solvents;
- Cold cleaning with recycled mineral spirits will be implemented before final vapour degreasing;
- Acids in wastewaters will be recovered through evaporation;

- Reduce rinse contamination via drag-out by optimization of part operation, using surfactants and other wetting agents;
- Use mechanical cleaning techniques instead of chemicals where possible (e.g. a vibrating abrasion apparatus for brass rather than acid pickling; mechanical scraping instead of acid solution to remove oxides of titanium; and rotating brush machines with pumice to clean copper sheets);
- Concentrations of dissolved metal ions will be controlled and reduced (e.g. molybdenum concentration reduction through reverse osmosis / precipitation systems; use of non-chromate solutions for alkaline etch cleaning of wrought aluminium; use of sulfuric acid / hydrogen peroxide dip instead of cyanide and chromic acid dip for copper bright dipping process);
- Acid or alkaline pickling solutions will be replaced, if possible, with alternative cleaning agents (e.g. use of caustic wire cleaner with biodegradable detergent and use of linear alcohols instead of sulfuric acid to pickle copper wire, provided that adequate safety and fire prevention is implemented);
- Flow restrictors / control meters will be installed and a foot pump (or photo sensor for automatic lines) should be used to activate rinse;
- Process wastewaters will be treated and recycled, using ion exchange, reverse osmosis, electrolysis, and electro dialysis with ion exchange.

Surface Treatment/Finishing Wastewaters:

- Strong complexing agents like EDTA and toxic surfactants like NPE and PFOS will be substituted by less hazardous alternatives;
- Anodizing and alkaline silking baths should be regenerated by recuperation of metallic (e.g. aluminium) salts through use of hydrolysis of sodium aluminate;
- Limit stocks of finishing material with short shelf lives;
- Painting jobs (light to dark) and the selection of spraying techniques should minimize wastewater production (e.g. use of a spray gun for particular applications, use of an electrostatic finishing system instead of conventional air spray);
- Avoid and substitute the use of chlorinated solvents (including carbon tetrachloride, methylene chloride, 1,1,1- trichloroethane, and perchloroethylene) with non-toxic or less toxic solvents as cleaning agents;
- Chromic acid and trisodium phosphate will be substituted by less toxic and non-fuming cleaners (e.g. sulfuric acid and hydrogen peroxide), and cyanide cleaners substituted by ammonia;
- Less toxic bath components should be used (e.g. zinc in place of cadmium in alkaline / saline solutions; nitric or hydrochloric acids in place of cyanide in certain plating baths; zinc chloride in place of zinc cyanide);
- Drain boards, drip guards, drip bars, and dedicated drag out tanks will be installed, after process baths.

Metals in Wastewater:

- The management of water consumption is crucial, as it also reduces the usage of raw materials and their loss to the environment. Good process control and drag-out reduction are key factors for reducing the consumption of hazardous raw materials;
- Wastewaters with recoverable metals should be separated from other wastewater streams. Metals should be recovered from solution (e.g. using electrolytic cells or hydroxide precipitation);
- Used metal pickling baths will be sent to a continuous electrolysis process for regeneration and metal recovery;

- Metals from bright dipping solutions will be recovered using suitable processes (e.g. ion exchange system for copper, or segregating phosphates from treatment of aluminium based alloys);
- Solutions containing cyanide salts (e.g. for hardening processes) will be replaced with solutions using a fluidized bath of nitrogen and corundum;
- Hexavalent chromium will be substituted for plating, if this is not possible closed loops and covered vats should serve to minimize emissions.

Process Wastewater:

- Use of source segregation and pre-treatment of concentrated wastewater streams is suggested by following steps like grease traps, skimmers, dissolved air floatation/ oil water separators for separation of oils and floatable solids, flow and load equalization, sedimentation for suspended solids reduction using clarifiers, typically aerobic treatment for reduction of soluble organic matter (BOD), dewatering and disposal of residuals in designated hazardous waste landfills.
- Engineering controls are suggested for containment and treatment of volatile organics stripped from various unit operations in the wastewater treatment system, residual colour removal using adsorption or chemical oxidation, reduction in TDS in the effluent using reverse osmosis and containment and neutralization of nuisance odours.

Food processing industry specific:

- The effluent load will be reduced by preventing raw materials, intermediates, product, by-product and wastes from unnecessarily entering the wastewater system.
- Usage of grease traps, skimmers or oil-water separators for separation of floatable solids
- Flow and load equalization sedimentation for suspended solids reduction using clarifiers
- Biological treatment, typically anaerobic followed by aerobic treatment, for reduction of soluble organic matter (BOD) and biological nutrient removal for reduction in nitrogen and phosphorus
- Chlorination of effluent when disinfection is required
- Dewatering and disposing the residuals

General industry specific measures:

- Individual industries will pre-treat the wastewater up to design inlet characteristics of CETP and if possible sector specific CETPs' to treat homogenous nature of effluents
- Minimize water consumed during production processes:
 - Optimize product conveying systems to reduce contact of raw material and product with water, for example by using dry instead of wet conveying systems. Optimize process line operations to avoid spills of raw materials and water, reducing the need for wastewater treatment and associated energy consumption
 - Use dry methods, such as air classifiers, magnetic separators and vibration over sieving and screening devices, for the primary cleaning of robust raw materials with low moisture content
 - Where feasible, use a continuous / batch steam or a dry caustic process for peeling activities, or alternatively, consider dry caustic peeling; Minimize rate of make-up supply to continuously overflowing tanks, flumes etc.
 - Using taps with automatic shut-off valves and using high water pressure and optimized nozzles
 - Use counter-current wash techniques for primary wash of raw materials
 - Implement dry clean of equipment with scraper or broom before cleaning with water

- Minimize wet transport (pumping) of waste · Reuse water streams in the production processes to the maximum extent possible while avoiding water contamination or compromising food safety
- Separate and recirculate cooling water from process and wastewater streams. Recirculate and reuse thawing water in a closed circuit provided this practice does not compromise food safety
- Recirculate fluming water used in vegetable transfer provided this practice does not compromise food safety
- Reuse water streams in the production processes to the maximum extent possible while avoiding water contamination or compromising food safety:
 - Separate and recirculate cooling water from process and wastewater streams. Recirculate and reuse thawing water in a closed circuit provided this practice does not compromise food safety
 - Recirculate fluming water used in vegetable transfer provided this practice does not compromise food safety
 - Return condensate for use as boiler feed water. Alternative uses for condensate include as a sprinkling agent for dust suppression or in general factory wash down (e.g. cleaning the floor)
 - Where feasible, recycle low grade wash water and reusing it for the primary wash of raw materials or for wet transport
 - Explore opportunities collection and use of storm water consistent with food safety requirements
- Review process lines and operations to identify opportunities to reduce the effluent load by minimizing contact with water at every stage of the process, to avoid contamination of the water and the need for consequent treatment, including:
 - Use dry methods (e.g. vibration or air jet) to clean raw materials
 - Install grids to reduce or avoid the introduction of solid materials into the wastewater drainage system. Install trays to catch waste from trimming operations and juice / product on conveyors
 - Ensure regular integrity testing of bulk storage tanks for product and waste
 - Provide secondary containment for storage and process vessels to contain spills
 - Adopt best-practice methods for plant cleaning, which can be manual or automated Clean In Place (CIP) systems, using approved chemicals and (or) detergents with minimal environmental impact and compatibility with subsequent wastewater treatment processes
- Wastewater generated from non-industrial sources will have to be treated separately in STP for more efficient treatment
- An STP of ~44 MLD capacity to handle sewage waste from overall site development is proposed and the treated wastewater is stored in an underground retention tank for 24hrs before conveyance for non-potable usage
- The runoff from uncontaminated areas can be used for watering of green areas
- An individual storm water drainage system to be developed without combining it with sewerage system for the entire Project site

Specific suitable treatment systems are suggested in Figure 2-8 to Figure 2-10.

4.3.4 Impact significance

The residual impact significance will remain negligible assuming no ground water will be used and water will be only sourced to meet the demand of NIMZ from Singur reservoir.

Impact : Water resource availability	Construction Phase	Operation Phase
Impact Nature	Negative	Negative
Impact Type	Direct	Direct
Impact Duration	Short-term	Long-term
Impact Extent	Local	Local
Impact Magnitude	Small	Small
Receptor Sensitivity	High	High
Impact Significance	Moderate	Moderate
Residual Impact Magnitude	Negligible	Negligible
Residual Impact Significance	Negligible	Negligible

4.4 Air Environment

4.4.1 Potential Impact during Construction

4.4.1.1 Impact due to Transportation of Construction Material

Transportation of construction material results in use of public infrastructure like roads and during material transportation, there is a possibility of impact on air quality along the route due to exhaust emissions, fugitive dust suspension and traffic congestion. The windblown dust during the material movement could impact the road users and also habitations en-route. Fugitive dust could arise during material unloading. This can contribute towards slight build-up of pollutant concentration over the baseline levels. In case of requirement of quarry material, same will be sourced from approved/licensed quarries; the environmental management at the quarry site will be taken care by the quarry agencies.

4.4.1.2 Emissions during Construction at Site

During the construction activities, the sources of potential impacts on the air quality at the construction site can be categorised as:

- Exhaust emissions from diesel run engines, construction machinery and vehicles
- Dust suspension during site preparation, construction, trenching and material transport
- Soil grading and compaction will be involved as part of site preparation by using mechanical shovels and earthmovers for site clearance, cut and fill and other site levelling activities.

These activities could generate dust particles and affect the ambient air and noise quality. Area development will involve developing the internal roads, utilities, services and buildings, etc. Fugitive dust is expected particularly during dry weather conditions due to the site preparation and movement of transport vehicles for materials and personnel. Emissions from diesel power generators, construction equipment and transport vehicles will affect the air quality within the work areas, if not adequately managed. Movement of materials such as cement, steel, sand, etc. will cause disturbance to the adjoining communities/communities en-route.

The baseline concentrations of Particulate Matter (PM₁₀ and PM_{2.5}), SO₂, NO₂ and CO are within the limits of NAAQS stipulated by CPCB. With the present background concentrations of air quality parameters, it is expected that there will only be a mild build-up of air pollutants.

The impacts during construction are short-term in nature and will cease on completion of the construction. Further, adoption of suitable mitigation measures will ensure that these impacts are rendered insignificant.

4.4.1.3 Impact due to Drilling and Blasting

In case of any drilling and blasting involved in the project for liberation and splitting of rough stone. There will be slight increase in particulate matter concentrations in ambient air mostly within the active operational areas. Blasting with explosive will result in increase of nitrogen oxides which get diluted by the wind. Controlled blasting and optimization of use of explosive energy will help in reducing the above emissions.

Following measures shall be adopted to mitigate air pollution generated due to the blasting activities:

- The blasting shall be done by using explosives like Ammonium Nitrate/Fuel Oil (ANFO) based, ordinary detonators & substitutes. The explosive materials for the blasting operation will be brought from authorized explosive license holder during blasting. The requirement of explosives will be made with permission of Chief Controller of Explosives.
- No blasting under unfavourable wind and atmospheric conditions
- Drilling machines will be equipped with wet drilling arrangements or dust collector
- Regular sprinkling of water will suppress dust at points/places of generation
- Regular maintenance of vehicles and machinery
- Provision of PPEs such as dust masks or enclosure to workmen

4.4.1.4 Mitigation Measures

- Equipment and vehicles will be regularly maintained in accordance with the manufacturer's recommendations to maximise fuel efficiency and help minimise emissions and also will use fuel that has low sulphur content of 0.1%.
- A strict project speed limit of 30 km/hr will be enforced for vehicles using un-metalled tracks and the RoW.
- Water spraying the running track within the ROW and/or the surface of the access road with water
- Vehicles transporting soil and aggregate to be covered for example using tarpaulins or covers that prevent the escape of dust, and prohibiting such vehicles from stopping near settlements
- Keeping site roads and approaches to watercourse crossings free from deposits of mud and silty material
- Using windbreaks, netting screens or semi-permeable fences to reduce dust emissions from working areas close to sensitive residential or agricultural locations or natural habitats.
- In order to ameliorate the fugitive dust suspension, the surfaces near the proposed site and transport roads will be sprinkled with water to reduce dust generation.
- The earth material generated during excavation will be used in levelling, making embankments and landscaping the area.
- On-site vehicle speeds will be controlled to reduce excessive dust suspension in air and dispersion by traffic. However, such an impact can be minimized by restricting entry only to PUC certified vehicles. The construction equipment and transport vehicles will be periodically washed to remove accumulated dirt.

- Alignment connecting the construction material procurement site and the project site shall be selected to ensure that the impacts on the receptors en-route the material movement are minimised to a large extent.
- The baseline data will be used as reference to aid in selection of the least environmentally damaging alignment.
- To reduce impacts from exhausts, emission control norms will be enforced/ adhered.
- Adequately sized construction yard will be identified at the site for storage of construction materials, equipment tools, earthmoving equipment, etc.
- Fuel tanks adequately designed to minimize fugitive emissions and welding gas cylinders will be stored in a secluded area within project site.
- Welding personnel will be properly trained and will wear necessary Personal Protection Equipment

4.4.2 Potential Impact during Operation

The impact on air environment due to the operation of National Investment and Manufacturing Zone-Zaheerabad (NIMZ) has been predicted based on air quality modelling studies. The AAQ model studies carried out covering the following:

- Point sources of the Member industries' Plots proposed in NIMZ including process and boilers (By assuming coal as fuel for predicting the worst case, However, processes using other than coal as fuel will emit less emissions than worst case)
- DG sets of the member industrial plots as well as common areas like commercial plots, utilities and amenities, residential etc.
- Line source i.e., increased vehicular activity due to normal and generated traffic on NH65, SH14, SH16 and Jharasangam Road

4.4.2.1 NIMZ's Point Sources-Process Emissions

Following are the industrial sectors proposed as a part of development:

- Automobile
- Electrical equipment
- Transport equipment
- Food processing
- Machinery
- Metals
- Non-metallic minerals

The following assumptions were made while estimating emissions from proposed individual/member units of NIMZ:

- The number of plots in respective sectors delineated in the CMP is considered as Member Industry
- The emissions estimated for each sector is arrived on literature review of similar kind of industries and Consultant's experience
- Emissions of individual industrial units of the above proposed sectors were estimated based on its products by referring similar type of industry's emission with Air Pollution Control (APC) Measures and the land area occupied by them through available secondary data. Emissions estimated from the similar type of industrial units are transferred in terms of Emission per acre and used for emission estimations of the proposed plots as given in the Conceptual Master Plan.

The anticipated types of industries/activities or focus products for the proposed industrial sectors along with the sources of emissions are presented below.

4.4.2.1.1 Automobile

The majority of the emissions to air generated during motor vehicle assembly are volatile organic compounds (VOCs) emitted from painting and finishing operations (paint storage, mixing, applications and drying). The emissions are primarily organic solvents, which are used as carriers for the paint and solvents used for cleaning equipment between colour changes and to clean spray booths. Other emissions to air include:

- VOC emissions - use of solvent based adhesives during Soft Trim
- Particulates - Paint particulates from spray booths, dust from sanding. Spent filter material, ovens/burners of UBS/RPP, E-D, topcoat etc.
- Carbon dioxide, oxides of nitrogen, sulphur dioxide from ovens/burners of UBS/RPP, ED, topcoat and Regenerative Thermal Oxidizer

Motor vehicle assembly generates indirect greenhouse gas emissions through the use of its final products and specifically through the combustion of fossil fuels. The transport of products by road can also contribute to traffic congestion.

Dust created in the process can be inhaled and cause respiratory diseases including asthma in employees. Dust, vented fumes, smog caused by particulates, and odours can be a nuisance to neighbouring residential communities and industrial activities.

The emissions are envisaged from various processes such as body shop, paint shop, assembly shop and engine shop. Apart from these processes, emissions are also envisaged from Regenerative Thermal Oxidiser (RTO). The emissions estimated for the automobile sector in terms of Emission per acre averaged from all the shops along with the maximum values of stack height, diameter, flue gas flow rate etc., were used for the individual industrial units.

The VOCs generated in the various processes shall be controlled as much as possible by the installation of necessary air pollution control system such as

- Smog-Hog for gathering of fume gas at the arc welding station and particles of dust at the metal sanding station of body shop,
- Scrubber of circulation water for gathering of overspray paint in booth
- Venturi scrubber for capturing over-sprayed paint particles with atomized water, captured paint particles are collected in Circular water system for treatment with chemical materials to reduce the odour & Recovery of dumped thinner from spray robots to the tank after cleaning the paint applicators without spraying thinner in the booth (collected thinner is transferred to mixing room)
- Paint applicator to reduce the amount of paint and thinner discharging to the air by using electrostatic application with maximum paint transferring efficiency
- Exhaust filter for capturing sanding dust, wax over spray etc. by filter at the exhaust blowout panel and water pan on the floor
- Colour grouping for reducing the amount of paint (thinner) usage and emissions by colour grouping and
- RTO for incinerating collected exhaust gas (VOC) from oven with high temperature of around 820°C in the paint shop
- Central Mist Collector for gathering/inhaling of oil mist and dust generated from machine product line in machine line of Engine shop. The inhaled pollutant is treated through and inside filter of Mist/Dust collector and a fresh air exhausted through an outlet of fan

- Also, stack of required height shall be provided for the control and proper dispersion of all the air pollutants in the atmosphere

The estimated emission details from process point sources from the automobile sector are given in **Table 4-4**.

Table 4-4: Automobile Sector Point Sources Emission Details

Stack No.	Stack Height (m)	Stack Velocity (m/s)	Stack Dia. (m)	Exit Temp K	PM ₁₀ (g/s)	PM _{2.5} (g/s)	SO ₂ (g/s)	NO ₂ (g/s)
A1	30	14.4	2	434.15	0.163	0.065	0.073	0.094
A2	30	14.4	2	434.15	0.170	0.068	0.075	0.098
A3	30	14.4	2	434.15	0.106	0.042	0.047	0.061
A4	30	14.4	2	434.15	0.112	0.045	0.050	0.064
A5	30	14.4	2	434.15	0.160	0.064	0.071	0.093
A6	30	14.4	2	434.15	0.139	0.056	0.062	0.080
A7	30	14.4	2	434.15	0.126	0.050	0.056	0.073
A8	30	14.4	2	434.15	0.128	0.051	0.057	0.074
A9	30	14.4	2	434.15	0.123	0.049	0.055	0.071
A10	30	14.4	2	434.15	0.176	0.070	0.078	0.101
A11	30	14.4	2	434.15	0.118	0.047	0.052	0.068
A12	30	14.4	2	434.15	0.131	0.052	0.058	0.075
A13	30	14.4	2	434.15	0.137	0.055	0.061	0.079
A14	30	14.4	2	434.15	0.064	0.026	0.029	0.037
A15	30	14.4	2	434.15	0.121	0.048	0.054	0.070
A16	30	14.4	2	434.15	0.123	0.049	0.055	0.071
A17	30	14.4	2	434.15	0.160	0.064	0.071	0.093
A18	30	14.4	2	434.15	0.141	0.056	0.063	0.082
A19	30	14.4	2	434.15	0.134	0.054	0.059	0.077
A20	30	14.4	2	434.15	0.171	0.069	0.076	0.099
A21	30	14.4	2	434.15	0.091	0.036	0.040	0.052
A22	30	14.4	2	434.15	0.094	0.037	0.042	0.054
A23	30	14.4	2	434.15	0.178	0.071	0.079	0.103
A24	30	14.4	2	434.15	0.171	0.069	0.076	0.099
A25	30	14.4	2	434.15	0.189	0.076	0.084	0.109
A26	30	14.4	2	434.15	0.067	0.027	0.030	0.038
A27	30	14.4	2	434.15	0.071	0.028	0.032	0.041
A28	30	14.4	2	434.15	0.178	0.071	0.079	0.103
A29	30	14.4	2	434.15	0.103	0.041	0.046	0.059
A30	30	14.4	2	434.15	0.092	0.037	0.041	0.053
A31	30	14.4	2	434.15	0.077	0.031	0.034	0.045
A32	30	14.4	2	434.15	0.130	0.052	0.058	0.075
A33	30	14.4	2	434.15	0.052	0.021	0.023	0.030
A34	30	14.4	2	434.15	0.175	0.070	0.078	0.101
A35	30	14.4	2	434.15	0.116	0.046	0.052	0.067
A36	30	14.4	2	434.15	0.097	0.039	0.043	0.056
A37	30	14.4	2	434.15	0.180	0.072	0.080	0.104
A38	30	14.4	2	434.15	0.195	0.078	0.087	0.113
A39	30	14.4	2	434.15	0.175	0.070	0.078	0.101
A40	30	14.4	2	434.15	0.179	0.072	0.080	0.103
A41	30	14.4	2	434.15	0.174	0.070	0.077	0.100
A42	30	14.4	2	434.15	0.142	0.057	0.063	0.082
A43	30	14.4	2	434.15	0.136	0.054	0.060	0.078
A44	30	14.4	2	434.15	0.142	0.057	0.063	0.082
A45	30	14.4	2	434.15	0.149	0.060	0.066	0.086
A46	30	14.4	2	434.15	0.154	0.062	0.069	0.089
A47	30	14.4	2	434.15	0.154	0.062	0.069	0.089
A48	30	14.4	2	434.15	0.221	0.089	0.098	0.128

Stack No.	Stack Height (m)	Stack Velocity (m/s)	Stack Dia. (m)	Exit Temp K	PM ₁₀ (g/s)	PM _{2.5} (g/s)	SO ₂ (g/s)	NO ₂ (g/s)
A49	30	14.4	2	434.15	0.148	0.059	0.066	0.085
A50	30	14.4	2	434.15	0.148	0.059	0.066	0.085
A51	30	14.4	2	434.15	0.148	0.059	0.066	0.085
A52	30	14.4	2	434.15	0.142	0.057	0.063	0.082
A53	30	14.4	2	434.15	0.148	0.059	0.066	0.085
A54	30	14.4	2	434.15	0.148	0.059	0.066	0.085
A55	30	14.4	2	434.15	0.148	0.059	0.066	0.085
A56	30	14.4	2	434.15	0.148	0.059	0.066	0.085
A57	30	14.4	2	434.15	0.139	0.056	0.062	0.080
A58	30	14.4	2	434.15	0.142	0.057	0.063	0.082
A59	30	14.4	2	434.15	0.182	0.073	0.081	0.105
A60	30	14.4	2	434.15	0.088	0.035	0.039	0.051
A61	30	14.4	2	434.15	0.170	0.068	0.075	0.098
A62	30	14.4	2	434.15	0.159	0.064	0.071	0.092
A63	30	14.4	2	434.15	0.197	0.079	0.087	0.114
A64	30	14.4	2	434.15	0.188	0.075	0.084	0.109
A65	30	14.4	2	434.15	0.075	0.030	0.033	0.043
A66	30	14.4	2	434.15	0.152	0.061	0.068	0.088
A67	30	14.4	2	434.15	0.128	0.051	0.057	0.074
A68	30	14.4	2	434.15	0.129	0.052	0.058	0.075
A69	30	14.4	2	434.15	0.139	0.056	0.062	0.080
A70	30	14.4	2	434.15	0.168	0.067	0.075	0.097
A71	30	14.4	2	434.15	0.126	0.051	0.056	0.073
A72	30	14.4	2	434.15	0.137	0.055	0.061	0.079
A73	30	14.4	2	434.15	0.143	0.057	0.064	0.083
A74	30	14.4	2	434.15	0.194	0.077	0.086	0.112
A75	30	14.4	2	434.15	0.142	0.057	0.063	0.082
A76	30	14.4	2	434.15	0.077	0.031	0.034	0.045
A77	30	14.4	2	434.15	0.114	0.046	0.051	0.066
A78	30	14.4	2	434.15	0.136	0.054	0.060	0.078
A79	30	14.4	2	434.15	0.098	0.039	0.044	0.057
A80	30	14.4	2	434.15	0.139	0.056	0.062	0.080
A81	30	14.4	2	434.15	0.136	0.054	0.061	0.079
A82	30	14.4	2	434.15	0.141	0.056	0.063	0.082
A83	30	14.4	2	434.15	0.144	0.057	0.064	0.083
A84	30	14.4	2	434.15	0.187	0.075	0.083	0.108
A85	30	14.4	2	434.15	0.082	0.033	0.036	0.047
A86	30	14.4	2	434.15	0.195	0.078	0.087	0.112
A87	30	14.4	2	434.15	0.144	0.057	0.064	0.083
A88	30	14.4	2	434.15	0.144	0.057	0.064	0.083
A89	30	14.4	2	434.15	0.134	0.054	0.060	0.078
A90	30	14.4	2	434.15	0.134	0.054	0.060	0.078
A91	30	14.4	2	434.15	0.134	0.054	0.060	0.078
A92	30	14.4	2	434.15	0.134	0.054	0.060	0.078
A93	30	14.4	2	434.15	0.120	0.048	0.053	0.069
A94	30	14.4	2	434.15	0.100	0.040	0.045	0.058
A95	30	14.4	2	434.15	0.120	0.048	0.053	0.069
A96	30	14.4	2	434.15	0.120	0.048	0.053	0.069
A97	30	14.4	2	434.15	0.116	0.047	0.052	0.067
A98	30	14.4	2	434.15	0.141	0.056	0.063	0.081
A99	30	14.4	2	434.15	0.121	0.048	0.054	0.070
A100	30	14.4	2	434.15	0.083	0.033	0.037	0.048
A101	30	14.4	2	434.15	0.083	0.033	0.037	0.048
A102	30	14.4	2	434.15	0.106	0.042	0.047	0.061
A103	30	14.4	2	434.15	0.106	0.042	0.047	0.061

Stack No.	Stack Height (m)	Stack Velocity (m/s)	Stack Dia. (m)	Exit Temp K	PM ₁₀ (g/s)	PM _{2.5} (g/s)	SO ₂ (g/s)	NO ₂ (g/s)
A104	30	14.4	2	434.15	0.083	0.033	0.037	0.048
A105	30	14.4	2	434.15	0.083	0.033	0.037	0.048
A106	30	14.4	2	434.15	0.106	0.042	0.047	0.061
A107	30	14.4	2	434.15	0.106	0.042	0.047	0.061
A108	30	14.4	2	434.15	0.141	0.056	0.063	0.082
A109	30	14.4	2	434.15	0.137	0.055	0.061	0.079
A110	30	14.4	2	434.15	0.137	0.055	0.061	0.079
A111	30	14.4	2	434.15	0.150	0.060	0.067	0.087
A112	30	14.4	2	434.15	0.154	0.062	0.069	0.089
A113	30	14.4	2	434.15	0.185	0.074	0.082	0.107
A114	30	14.4	2	434.15	0.099	0.040	0.044	0.057
A115	30	14.4	2	434.15	0.112	0.045	0.050	0.064
A116	30	14.4	2	434.15	0.154	0.062	0.069	0.089
A117	30	14.4	2	434.15	0.154	0.062	0.069	0.089
A118	30	14.4	2	434.15	0.154	0.062	0.069	0.089
A119	30	14.4	2	434.15	0.176	0.070	0.078	0.101
A120	30	14.4	2	434.15	0.176	0.070	0.078	0.101
A121	30	14.4	2	434.15	0.176	0.070	0.078	0.101
A122	30	14.4	2	434.15	0.176	0.070	0.078	0.101
Total					16.709	6.683	7.432	9.650

All the above emissions are assumed to be continuous in nature; these are considered for Air Quality Modelling for prediction of impacts.

4.4.2.1.2 Electrical Equipment

The estimated emission details from process point sources from the electrical equipment sector are given in **Table 4-5**.

Table 4-5: Electrical Equipment Sector Point Sources Emission Details

Stack No.	Stack Height (m)	Stack Velocity (m/s)	Stack Dia. (m)	Exit Temp K	PM ₁₀ (g/s)	PM _{2.5} (g/s)	SO ₂ (g/s)	NO ₂ (g/s)
EE1	30	18	2	403	1.448	0.579	3.570	1.918
EE2	30	18	2	403	1.217	0.487	3.001	1.613
EE3	30	18	2	403	1.805	0.722	4.449	2.391
EE4	30	18	2	403	1.819	0.728	4.484	2.409
EE5	30	18	2	403	1.168	0.467	2.880	1.548
EE6	30	18	2	403	1.105	0.442	2.725	1.464
EE7	30	18	2	403	1.819	0.728	4.484	2.409
EE8	30	18	2	403	1.819	0.728	4.484	2.409
EE9	30	18	2	403	1.308	0.523	3.225	1.733
EE10	30	18	2	403	0.994	0.397	2.449	1.316
EE11	30	18	2	403	1.175	0.470	2.897	1.557
EE12	30	18	2	403	1.378	0.551	3.397	1.826
EE13	30	18	2	403	1.245	0.498	3.070	1.650
EE14	30	18	2	403	1.245	0.498	3.070	1.650
EE15	30	18	2	403	1.133	0.453	2.794	1.501
EE16	30	18	2	403	1.133	0.453	2.794	1.501
Total					21.815	8.726	53.772	28.895

All the above emissions are assumed to be continuous in nature; these are considered for Air Quality Modelling for prediction of impacts.

4.4.2.1.3 Transport Equipment

The estimated emission details from process point sources from the transport equipment sector are given in **Table 4-6**.

Table 4-6: Transport Equipment Sector Point Sources Emission Details

Stack No.	Stack Height (m)	Stack Velocity (m/s)	Stack Dia. (m)	Exit Temp K	PM ₁₀ (g/s)	PM _{2.5} (g/s)	SO ₂ (g/s)	NO ₂ (g/s)
TE1	32.5	18	2	418.58	1.040	0.416	2.392	1.311
TE2	32.5	18	2	418.58	1.021	0.408	2.348	1.287
TE3	32.5	18	2	418.58	0.769	0.308	1.770	0.970
TE4	32.5	18	2	418.58	0.845	0.338	1.945	1.066
TE5	32.5	18	2	418.58	0.811	0.324	1.866	1.023
TE6	32.5	18	2	418.58	0.990	0.396	2.278	1.249
TE7	32.5	18	2	418.58	0.636	0.254	1.463	0.802
Total					6.112	2.445	14.063	7.709

All the above emissions are assumed to be continuous in nature; these are considered for Air Quality Modelling for prediction of impacts.

4.4.2.1.4 Food Processing

The estimated emission details from process point sources from the food processing sector are given in **Table 4-7**.

Table 4-7: Food Processing Sector Point Sources Emission Details

Stack No.	Stack Height (m)	Stack Velocity (m/s)	Stack Dia. (m)	Exit Temp K	PM ₁₀ (g/s)	PM _{2.5} (g/s)	SO ₂ (g/s)	NO ₂ (g/s)
FP1	30	15	2	433	0.899	0.360	3.946	0.316
FP2	30	15	2	433	0.676	0.271	2.968	0.237
FP3	30	15	2	433	1.001	0.401	4.393	0.351
FP4	30	15	2	433	1.001	0.401	4.393	0.351
FP5	30	15	2	433	0.873	0.349	3.830	0.306
FP6	30	15	2	433	0.673	0.269	2.951	0.236
FP7	30	15	2	433	1.005	0.402	4.410	0.353
FP8	30	15	2	433	1.005	0.402	4.410	0.353
FP9	30	15	2	433	0.926	0.370	4.062	0.325
FP10	30	15	2	433	0.941	0.376	4.128	0.330
FP11	30	15	2	433	0.941	0.376	4.128	0.330
FP12	30	15	2	433	0.941	0.376	4.128	0.330
FP13	30	15	2	433	0.926	0.370	4.062	0.325
FP14	30	15	2	433	0.941	0.376	4.128	0.330
FP15	30	15	2	433	0.941	0.376	4.128	0.330
FP16	30	15	2	433	0.941	0.376	4.128	0.330
FP17	30	15	2	433	0.941	0.376	4.128	0.330
FP18	30	15	2	433	1.270	0.508	5.571	0.446
FP19	30	15	2	433	1.266	0.506	5.554	0.444
FP20	30	15	2	433	0.926	0.370	4.062	0.325
FP21	30	15	2	433	0.979	0.391	4.294	0.344
FP22	30	15	2	433	0.979	0.391	4.294	0.344
FP23	30	15	2	433	0.979	0.391	4.294	0.344
FP24	30	15	2	433	0.839	0.336	3.681	0.294
FP25	30	15	2	433	0.805	0.322	3.531	0.283
FP26	30	15	2	433	1.171	0.469	5.139	0.411
FP27	30	15	2	433	0.998	0.399	4.377	0.350
FP28	30	15	2	433	0.998	0.399	4.377	0.350

Stack No.	Stack Height (m)	Stack Velocity (m/s)	Stack Dia. (m)	Exit Temp K	PM ₁₀ (g/s)	PM _{2.5} (g/s)	SO ₂ (g/s)	NO ₂ (g/s)
FP29	30	15	2	433	1.050	0.420	4.609	0.369
FP30	30	15	2	433	0.729	0.292	3.200	0.256
FP31	30	15	2	433	1.171	0.469	5.139	0.411
FP32	30	15	2	433	0.998	0.399	4.377	0.350
FP33	30	15	2	433	0.998	0.399	4.377	0.350
FP34	30	15	2	433	0.729	0.292	3.200	0.256
FP35	30	15	2	433	1.013	0.405	4.443	0.355
FP36	30	15	2	433	1.171	0.469	5.139	0.411
FP37	30	15	2	433	0.850	0.340	3.730	0.298
FP38	30	15	2	433	0.850	0.340	3.730	0.298
FP39	30	15	2	433	0.926	0.370	4.062	0.325
FP40	30	15	2	433	1.107	0.443	4.858	0.389
FP41	30	15	2	433	0.975	0.390	4.277	0.342
FP42	30	15	2	433	1.050	0.420	4.609	0.369
FP43	30	15	2	433	0.809	0.323	3.548	0.284
FP44	30	15	2	433	0.809	0.323	3.548	0.284
FP45	30	15	2	433	0.809	0.323	3.548	0.284
FP46	30	15	2	433	0.809	0.323	3.548	0.284
FP47	30	15	2	433	0.809	0.323	3.548	0.284
FP48	30	15	2	433	0.990	0.396	4.344	0.347
FP49	30	15	2	433	0.756	0.302	3.316	0.265
FP50	30	15	2	433	1.073	0.429	4.708	0.377
FP51	30	15	2	433	0.525	0.210	2.304	0.184
FP52	30	15	2	433	0.525	0.210	2.304	0.184
FP53	30	15	2	433	0.661	0.265	2.901	0.232
FP54	30	15	2	433	0.754	0.302	3.308	0.265
FP55	30	15	2	433	0.754	0.302	3.308	0.265
FP56	30	15	2	433	0.525	0.210	2.304	0.184
FP57	30	15	2	433	0.525	0.210	2.304	0.184
FP58	30	15	2	433	0.393	0.157	1.724	0.138
FP59	30	15	2	433	0.393	0.157	1.724	0.138
FP60	30	15	2	433	0.401	0.160	1.757	0.141
FP61	30	15	2	433	0.616	0.246	2.702	0.216
Total					53.332	21.333	233.995	18.720

All the above emissions are assumed to be continuous in nature; these are considered for Air Quality Modelling for prediction of impacts.

4.4.2.1.5 Machinery

The estimated emission details from process point sources from the machinery sector are given in **Table 4-8**.

Table 4-8: Machinery Sector Point Sources Emission Details

Stack No.	Stack Height (m)	Stack Velocity (m/s)	Stack Dia. (m)	Exit Temp K	PM ₁₀ (g/s)	PM _{2.5} (g/s)	SO ₂ (g/s)	NO ₂ (g/s)
MA1	30	18	2	403	1.750	0.700	4.313	2.313
MA2	30	18	2	403	1.435	0.574	3.536	1.896
MA3	30	18	2	403	1.540	0.616	3.795	2.035
MA4	30	18	2	403	1.680	0.672	4.140	2.220
MA5	30	18	2	403	1.750	0.700	4.313	2.313
MA6	30	18	2	403	1.540	0.616	3.795	2.035
MA7	30	18	2	403	1.540	0.616	3.795	2.035
MA8	30	18	2	403	1.582	0.633	3.899	2.091

Stack No.	Stack Height (m)	Stack Velocity (m/s)	Stack Dia. (m)	Exit Temp K	PM ₁₀ (g/s)	PM _{2.5} (g/s)	SO ₂ (g/s)	NO ₂ (g/s)
MA9	30	18	2	403	1.652	0.661	4.071	2.183
MA10	30	18	2	403	1.526	0.610	3.761	2.017
MA11	30	18	2	403	1.533	0.613	3.778	2.026
MA12	30	18	2	403	1.190	0.476	2.933	1.573
MA13	30	18	2	403	1.414	0.566	3.485	1.869
MA14	30	18	2	403	1.575	0.630	3.881	2.081
MA15	30	18	2	403	1.897	0.759	4.675	2.507
MA16	30	18	2	403	1.162	0.465	2.864	1.536
MA17	30	18	2	403	0.798	0.319	1.967	1.055
MA18	30	18	2	403	1.421	0.568	3.502	1.878
MA19	30	18	2	403	1.029	0.412	2.536	1.360
MA20	30	18	2	403	0.861	0.344	2.122	1.138
MA21	30	18	2	403	1.624	0.650	4.002	2.146
MA22	30	18	2	403	2.114	0.846	5.210	2.794
MA23	30	18	2	403	2.156	0.862	5.313	2.849
Total					34.769	13.908	85.681	45.945

All the above emissions are assumed to be continuous in nature; these are considered for Air Quality Modelling for prediction of impacts.

4.4.2.1.6 Metals

The estimated emission details from process point sources from the metals sector are given in **Table 4-9**.

Table 4-9: Metals Sector Point Sources Emission Details

Stack No.	Stack Height (m)	Stack Velocity (m/s)	Stack Dia. (m)	Exit Temp K	PM ₁₀ (g/s)	PM _{2.5} (g/s)	SO ₂ (g/s)	NO ₂ (g/s)
ME1	40	18	2	403	1.365	0.546	3.364	1.804
ME2	40	18	2	403	1.904	0.762	4.692	2.516
ME3	30	18	2	403	1.400	0.560	3.450	1.850
ME4	30	18	2	403	1.421	0.568	3.502	1.878
ME5	35	18	2	403	1.904	0.762	4.692	2.516
ME6	30	18	2	403	1.512	0.605	3.726	1.998
ME7	30	18	2	403	1.491	0.596	3.674	1.970
ME8	30	18	2	403	0.994	0.398	2.450	1.314
ME9	30	18	2	403	0.784	0.314	1.932	1.036
ME10	30	18	2	403	1.085	0.434	2.674	1.434
ME11	30	18	2	403	1.239	0.496	3.053	1.637
ME12	30	18	2	403	1.470	0.588	3.623	1.943
ME13	30	18	2	403	1.295	0.518	3.191	1.711
ME14	30	18	2	403	1.344	0.538	3.312	1.776
ME15	30	18	2	403	1.246	0.498	3.071	1.647
ME16	30	18	2	403	1.547	0.619	3.812	2.044
ME17	30	18	2	403	1.806	0.722	4.451	2.387
ME18	30	18	2	403	2.170	0.868	5.348	2.868
ME19	30	18	2	403	2.065	0.826	5.089	2.729
ME20	30	18	2	403	1.547	0.619	3.812	2.044
ME21	30	18	2	403	2.247	0.899	5.537	2.969
ME22	30	18	2	403	1.393	0.557	3.433	1.841
ME23	30	18	2	403	1.484	0.594	3.657	1.961
ME24	30	18	2	403	2.121	0.848	5.227	2.803
ME25	30	18	2	403	1.484	0.594	3.657	1.961
ME26	30	18	2	403	2.030	0.812	5.003	2.683

Stack No.	Stack Height (m)	Stack Velocity (m/s)	Stack Dia. (m)	Exit Temp K	PM ₁₀ (g/s)	PM _{2.5} (g/s)	SO ₂ (g/s)	NO ₂ (g/s)
ME27	30	18	2	403	1.883	0.753	4.640	2.488
ME28	30	18	2	403	1.540	0.616	3.795	2.035
ME29	30	18	2	403	1.400	0.560	3.450	1.850
ME30	30	18	2	403	1.288	0.515	3.174	1.702
ME31	30	18	2	403	1.232	0.493	3.036	1.628
ME32	30	18	2	403	1.036	0.414	2.553	1.369
ME33	30	18	2	403	0.889	0.356	2.191	1.175
ME34	30	18	2	403	1.162	0.465	2.864	1.536
ME35	30	18	2	403	1.631	0.652	4.019	2.155
ME36	30	18	2	403	1.995	0.798	4.916	2.636
ME37	30	18	2	403	1.841	0.736	4.537	2.433
ME38	30	18	2	403	1.134	0.454	2.795	1.499
ME39	30	18	2	403	1.197	0.479	2.950	1.582
ME40	30	18	2	403	1.260	0.504	3.105	1.665
Total					59.836	23.934	147.453	79.069

All the above emissions are assumed to be continuous in nature; these are considered for Air Quality Modelling for prediction of impacts.

4.4.2.1.7 Non-metallic Minerals

- The estimated emission details from process point sources from the Non-metallic Minerals sector are given in **Table 4-10**.

Table 4-10: Non-metallic Sector Point Sources Emission Details

Stack No.	Stack Height (m)	Stack Velocity (m/s)	Stack Dia. (m)	Exit Temp K	PM ₁₀ (g/s)	PM _{2.5} (g/s)	SO ₂ (g/s)	NO ₂ (g/s)
NM1	30	13	0.2	418	0.002	0.001	0.711	0.500
NM2	30	13	0.2	418	0.001	0.001	0.707	0.497
NM3	30	13	0.2	418	0.002	0.001	0.817	0.575
NM4	30	13	0.2	418	0.002	0.001	0.783	0.551
NM5	30	13	0.2	418	0.002	0.001	0.768	0.540
NM6	30	13	0.2	418	0.001	0.001	0.688	0.484
NM7	30	13	0.2	418	0.001	0.001	0.654	0.460
NM8	30	13	0.2	418	0.002	0.001	0.855	0.602
NM9	30	13	0.2	418	0.002	0.001	0.889	0.626
NM10	30	13	0.2	418	0.002	0.001	0.889	0.626
NM11	30	13	0.2	418	0.002	0.001	0.942	0.663
NM12	30	13	0.2	418	0.002	0.001	0.992	0.698
NM13	30	13	0.2	418	0.001	0.000	0.540	0.380
NM14	30	13	0.2	418	0.002	0.001	0.920	0.647
NM15	30	13	0.2	418	0.002	0.001	0.711	0.500
NM16	30	13	0.2	418	0.002	0.001	0.714	0.503
NM17	30	13	0.2	418	0.002	0.001	0.711	0.500
NM18	30	13	0.2	418	0.002	0.001	1.117	0.786
NM19	30	13	0.2	418	0.002	0.001	0.904	0.636
NM20	30	13	0.2	418	0.002	0.001	1.007	0.709
NM21	30	13	0.2	418	0.002	0.001	1.007	0.709
NM22	30	13	0.2	418	0.002	0.001	0.783	0.551
Total					0.038	0.015	18.107	12.740

All the above emissions are assumed to be continuous in nature; these are considered for Air Quality Modelling for prediction of impacts.

4.4.2.2 NIMZ's Point Sources-Emissions from DG sets

The following assumptions were made while estimating emissions from DG sets of proposed NIMZ:

- Out of 678.63 mVA of total power requirement for the operation phase of NIMZ, power backup is assumed for 120 MVA and distributed among different land uses in NIMZ.
- Emissions from DG sets were estimated based on composition and by referring the literature review of similar type of DG set's emission and Consultant's experience with Air Pollution Control (APC) Measures and the land area occupied through available secondary data.
- The DG Set emissions are estimated by assuming that the Capacity of DG Set will be to meet the 15- 20% of total power requirement of the plots during emergency. These DGs will be operated during power failure only.

The emission details from DG sets of Zaheerabad NIMZ are given in **Table 4-11**.

Table 4-11: DG Set Emissions from Zaheerabad NIMZ

Stack Details					Emissions Details			
Stack Code	Stack Height (m)	Stack Velocity (m/sec)	Stack Diameter (m)	Exit Temp. (°K)	PM10 (g/s)	PM2.5 (g/s)	SO2 (g/s)	NO2 (g/s)
DGA1	30	22	0.4	754	0.0496	0.0198	0.469	2.602
DGA2	30	22	0.4	754	0.0496	0.0198	0.469	2.602
DGA3	30	22	0.4	754	0.0496	0.0198	0.469	2.602
DGA4	30	22	0.4	754	0.0496	0.0198	0.469	2.602
DGA5	30	22	0.4	754	0.0496	0.0198	0.469	2.602
DGA6	30	22	0.4	754	0.0496	0.0198	0.469	2.602
DGA7	30	22	0.4	754	0.0496	0.0198	0.469	2.602
DGA8	30	22	0.4	754	0.0496	0.0198	0.469	2.602
DGA9	30	22	0.4	754	0.0496	0.0198	0.469	2.602
DGA10	30	22	0.4	754	0.0496	0.0198	0.469	2.602
DGA11	30	22	0.4	754	0.0496	0.0198	0.469	2.602
DGA12	30	22	0.4	754	0.0496	0.0198	0.469	2.602
DGA13	30	22	0.4	754	0.0496	0.0198	0.469	2.602
DGA14	30	22	0.4	754	0.0496	0.0198	0.469	2.602
DGA15	30	22	0.4	754	0.0496	0.0198	0.469	2.602
DGA16	30	22	0.4	754	0.0496	0.0198	0.469	2.602
DGA17	30	22	0.4	754	0.0496	0.0198	0.469	2.602
DGE1	30	21	0.3	754	0.0126	0.005	0.237	1.314
DGE2	30	21	0.3	754	0.0126	0.005	0.237	1.314
DGE3	30	21	0.3	754	0.0126	0.005	0.237	1.314
DGT1	30	21	0.3	754	0.0126	0.005	0.237	1.314
DGT2	30	21	0.3	754	0.0126	0.005	0.237	1.314
DGF1	30	22	0.4	754	0.0496	0.0198	0.469	2.602
DGF2	30	22	0.4	754	0.0496	0.0198	0.469	2.602
DGF3	30	22	0.4	754	0.0496	0.0198	0.469	2.602
DGF4	30	22	0.4	754	0.0496	0.0198	0.469	2.602
DGF5	30	22	0.4	754	0.0496	0.0198	0.469	2.602
DGF6	30	22	0.4	754	0.0496	0.0198	0.469	2.602
DGF7	30	22	0.4	754	0.0496	0.0198	0.469	2.602
DGMA1	30	22	0.4	754	0.0496	0.0198	0.469	2.602
DGMA2	30	22	0.4	754	0.0496	0.0198	0.469	2.602
DGME1	30	22	0.4	754	0.0496	0.0198	0.469	2.602
DGME2	30	22	0.4	754	0.0496	0.0198	0.469	2.602
DGME3	30	22	0.4	754	0.0496	0.0198	0.469	2.602
DGME4	30	22	0.4	754	0.0496	0.0198	0.469	2.602

Stack Details					Emissions Details			
Stack Code	Stack Height (m)	Stack Velocity (m/sec)	Stack Diameter (m)	Exit Temp. (°K)	PM10 (g/s)	PM2.5 (g/s)	SO2 (g/s)	NO2 (g/s)
DGME5	30	22	0.4	754	0.0496	0.0198	0.469	2.602
DGN1	30	22	0.4	754	0.0496	0.0198	0.469	2.602
DGN2	30	22	0.4	754	0.0496	0.0198	0.469	2.602
DGL1	30	21	0.3	754	0.0126	0.005	0.237	1.314
DGR1	30	22	0.4	754	0.0496	0.0198	0.469	2.602
DGR2	30	22	0.4	754	0.0496	0.0198	0.469	2.602
DGR3	30	21	0.3	754	0.0126	0.005	0.237	1.314
DGR4	30	21	0.3	754	0.0126	0.005	0.237	1.314
DGR5	30	21	0.3	754	0.0126	0.005	0.237	1.314
DGR6	30	22	0.4	754	0.0496	0.0198	0.469	2.602
DGR7	30	22	0.4	754	0.0496	0.0198	0.469	2.602
DGR8	30	22	0.4	754	0.0496	0.0198	0.469	2.602
DGT1	30	22	0.4	754	0.0496	0.0198	0.469	2.602
DGU1	30	22	0.4	754	0.0496	0.0198	0.469	2.602
DGU2	30	22	0.4	754	0.0496	0.0198	0.469	2.602
DGU3	30	22	0.4	754	0.0496	0.0198	0.469	2.602
DGC1	30	22	0.4	754	0.0496	0.0198	0.469	2.602
DGC2	30	22	0.4	754	0.0496	0.0198	0.469	2.602
DGC3	30	22	0.4	754	0.0496	0.0198	0.469	2.602
DGC4	30	22	0.4	754	0.0496	0.0198	0.469	2.602
DGC5	30	22	0.4	754	0.0496	0.0198	0.469	2.602
DGC6	30	22	0.4	754	0.0496	0.0198	0.469	2.602
DGC7	30	22	0.4	754	0.0496	0.0198	0.469	2.602
DGC8	30	22	0.4	754	0.0496	0.0198	0.469	2.602
DGC9	30	21	0.3	754	0.0126	0.005	0.237	1.314
DGC10	30	21	0.3	754	0.0126	0.005	0.237	1.314
DGC11	30	22	0.4	754	0.0496	0.0198	0.469	2.602
DGC12	30	22	0.4	754	0.0496	0.0198	0.469	2.602
DGC13	30	22	0.4	754	0.0496	0.0198	0.469	2.602
DGC14	30	21	0.3	754	0.0126	0.005	0.237	1.314
Total					2.781	1.112	27.699	153.652

Though DGs will be operated during power failure only, all the above emissions are assumed to be continuous in nature during emergency; these are considered for Air Quality Modelling for prediction of impacts.

4.4.2.3 Line Sources

Vehicular traffic generated on Mumbai Highway (NH-65), Bidar Road (SH-14), Nizampet - Bidar Road (SH-16) and Jharasangam Road due to the existing traffic and the proposed development of NIMZ has been considered for Air Quality Modelling. The traffic estimated for the proposed development is for the fully developed scenario. The raw materials, products/ finished goods etc. will be evacuated/ transported through the existing road network. The number of vehicle trips per day due to heavy vehicles, light commercial vehicles and two/three wheelers on the above roads are estimated and has been considered for air quality modelling.

The details of the emissions from the heavy, light vehicles and two/three wheelers estimated are given in **Table 4-12** to **Table 4-15** respectively.

Table 4-12: Emission Details of Vehicles on NH65

Parameter	NH65		
	Heavy Vehicle	Light Vehicle	Two/Three Wheeler
Vehicle Trips per Day	7985	12887	13992
Emission factor of SO2 (g/km)	0.0043	0.00267	0.0006
Emission rate of SO2 (g/s)	0.008305694	0.008323302	0.002030783
Emission factor of PM (g/km)	0.03	0.0008	0.0096
Emission rate of PM10 (g/s)	0.034768021	0.001496324	0.01949552
Emission rate of PM2.5 (g/s)	0.013907208	0.00059853	0.007798208
Emission factor of NOx (g/km)	0.6887	0.0454	0.134
Emission rate of NOx (g/s)	1.330263108	0.141527301	0.453541611

Table 4-13: Emission Details of Vehicles on SH14

Parameter	NH65		
	Heavy Vehicle	Light Vehicle	Two/Three Wheeler
Vehicle Trips per Day	3114	6534	14265
Emission factor of SO2 (g/km)	0.0043	0.00267	0.0006
Emission rate of SO2 (g/s)	0.004494396	0.005855644	0.002872813
Emission factor of PM (g/km)	0.03	0.0008	0.0096
Emission rate of PM10 (g/s)	0.01881375	0.0010527	0.027579
Emission rate of PM2.5 (g/s)	0.0075255	0.00042108	0.0110316
Emission factor of NOx (g/km)	0.6887	0.0454	0.134
Emission rate of NOx (g/s)	0.719834979	0.099567875	0.641594792

Table 4-14: Emission Details of Vehicles on SH16

Parameter	NH65		
	Heavy Vehicle	Light Vehicle	Two/Three Wheeler
Vehicle Trips per Day	1263	3299	10577
Emission factor of SO2 (g/km)	0.0043	0.00267	0.0006
Emission rate of SO2 (g/s)	0.001225724	0.001987991	0.001432302
Emission factor of PM (g/km)	0.03	0.0008	0.0096
Emission rate of PM10 (g/s)	0.005130938	0.000357392	0.0137501
Emission rate of PM2.5 (g/s)	0.002052375	0.000142957	0.00550004
Emission factor of NOx (g/km)	0.6887	0.0454	0.134
Emission rate of NOx (g/s)	0.19631537	0.033803295	0.319880799

Table 4-15: Emission Details of Vehicles on Jharasangam Road

Parameter	NH65		
	Heavy Vehicle	Light Vehicle	Two/Three Wheeler
Vehicle Trips per Day	2028	2398	12815
Emission factor of SO2 (g/km)	0.0043	0.00267	0.0006
Emission rate of SO2 (g/s)	0.002324431	0.001706635	0.00204951
Emission factor of PM (g/km)	0.03	0.0008	0.0096
Emission rate of PM10 (g/s)	0.009730175	0.000306811	0.019675297
Emission rate of PM2.5 (g/s)	0.00389207	0.000122724	0.007870119
Emission factor of NOx (g/km)	0.6887	0.0454	0.134
Emission rate of NOx (g/s)	0.372287307	0.029019186	0.457723916

As these emissions are assumed as continuous in nature and this line source is considered as a string of volume sources for Air Quality modelling for prediction of impacts.

Other Emissions

Other emissions include process fugitive emissions from chemical handling, storage and transfer operations etc. Fugitive emissions can be controlled by selecting suitable equipment/Storage, appropriate handling methods etc., and hence no emissions were considered.

4.4.2.4 AERMOD Model

AERMOD is a ‘near-field, steady-state’ Gaussian model. It uses boundary-layer similarity theory to define turbulence and dispersion coefficients as a continuum, rather than as a discrete set of stability classes. Variation of turbulence with height allows a better treatment of dispersion from different release heights. AERMOD requires Surface as well as Upper Air data as meteorological input.

4.4.2.4.1 Model Assumptions

The following are the assumptions for the air quality modelling;

- Uses rural dispersion
- Stack-tip downwash
- Model assumes receptor on flat terrain
- Used calms processing routine
- Used missing data processing routine
- No exponential decay
- No Dry and Wet Depletion

Input Data: The following technical details are considered for Air Quality Modelling studies:

- Point Source: The point source inputs for process emissions are given in Table 4-4 to Table 4-10 and DG set emissions in Table 4-11 or all the sources identified in the study area.
- Line Source: The Line source inputs (Vehicular Emissions) are given in Table 4-12 to Table 4-15.

4.4.2.5 Meteorological Data Considered

For the purpose of carrying out the air quality modelling study, site specific meteorological data (pre-processed from MM5) for the complete year of 2017 (January to December) obtained from Lakes Environment was used. The raw met data have been processed in AERMET view to create surface and upper air data which can be used as inputs to AERMOD.

4.4.2.6 Wind Speed and Wind Direction

The overall wind pattern recorded for 24 hours during the year 2017 is given in **Figure 4-3**. The predominant wind directions observed were from West South West followed by South West and West; calm conditions prevailed for 3.61% of the total time. The average wind speed was observed to be 3.30 m/s.

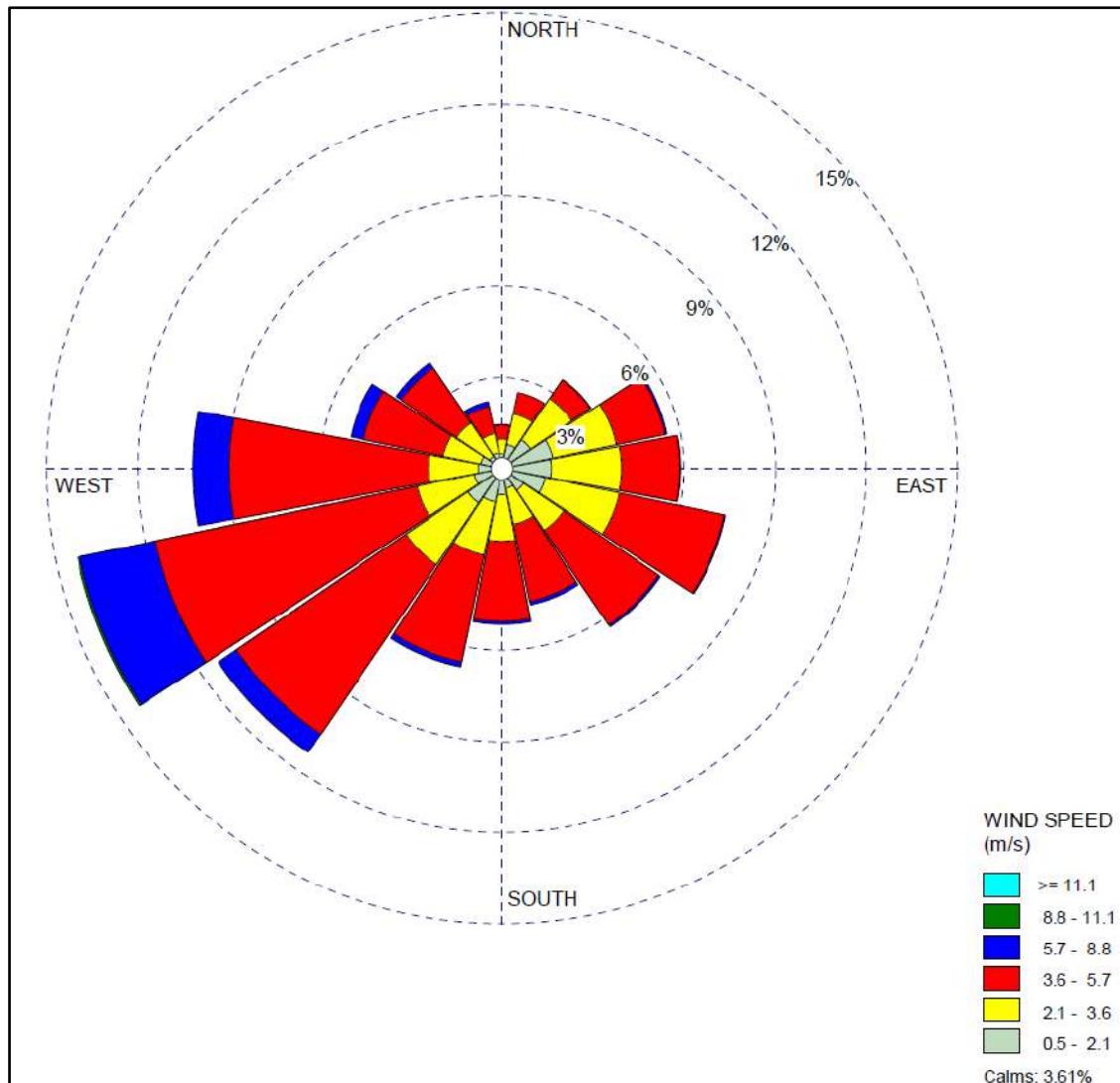


Figure 4-3: Annual Wind Rose Diagram (January – December 2017)

4.4.2.7 Receptors Locations

The details of the receptors which are monitored for the baseline data as a part of EIA Study and other Sensitive Receptors within 10.0 km radius of the boundary of the NIMZ are given in **Table 4-16**.

Table 4-16: Receptor Details

Station Code	Location	Distance (km) from Project boundary	Azimuth Directions
A1	Project Site	-	-
A2	Mettalkunta	Adjacent	S
A3	Yalgul	Adjacent	W
A4	Hadnur	0.3	N
A5	Rejantal	0.4	E
A6	Kalbemal	0.8	W
A7	Gunjetti	0.9	E
A8	Gunalli	1.7	W
A9	Waddi	2.6	N
A10	Tekur	2.8	NNE
A11	Manhalli	3.3	SSW
A12	Jharasangam	4.3	E

Station Code	Location	Distance (km) from Project boundary	Azimuth Directions
A13	Nyalkal	4.4	N
A14	Burdipar	4.9	S
A15	Zaheerabad	9.3	S

4.4.2.8 Model Results

Scenario 1- Considering point and line sources excluding DG sets:

As the DG sets are operated during power failure condition, we can consider the scenario- '**without DG sets**' as the normal operation condition. The 1st highest 24 hour, resultant concentration and annual average incremental concentrations for PM₁₀, PM_{2.5}, SO₂ and NO₂ are given in **Table 4-17** to **Table 4-21**.

Table 4-17: 1st 24-hour Average Incremental and Resultant Concentration of PM₁₀

Location No.	Receptors	1 st 24 Hour Average Incremental Concentration ($\mu\text{g}/\text{m}^3$)	Baseline Concentration ($\mu\text{g}/\text{m}^3$)	1 st 24Hour-Resultant Concentration ($\mu\text{g}/\text{m}^3$)	NAAQ Standards ($\mu\text{g}/\text{m}^3$)- 1 st 24 Hour
AQ1	Project Site	9.41	65.80	75.21	100
AQ2	Mettalkunta	6.66	70.40	77.06	
AQ3	Yalgul	9.23	61.20	70.43	
AQ4	Hadnur	8.85	59.70	68.55	
AQ5	Rejantal	5.13	57.70	62.83	
AQ6	Kalbemal	6.37	60.60	66.97	
AQ7	Gunjetti	14.60	62.90	77.50	
AQ8	Gunalli	13.97	62.60	76.57	
AQ9	Waddi	7.11	62.30	69.41	
AQ10	Tekur	8.38	64.20	72.58	
AQ11	Manhalli	7.25	68.50	75.75	
AQ12	Jharasangam	12.53	68.90	81.43	
AQ13	Nyalkal	8.83	68.30	77.13	
AQ14	Burdipar	6.83	63.40	70.23	
AQ15	Zaheerabad	5.36	62.80	68.16	

Table 4-18: 1st 24-hour Average Incremental and Resultant Concentration of PM_{2.5}

Location No.	Receptors	1 st 24 Hour Average Incremental Concentration ($\mu\text{g}/\text{m}^3$)	Baseline Concentration ($\mu\text{g}/\text{m}^3$)	1 st 24Hour-Resultant Concentration ($\mu\text{g}/\text{m}^3$)	NAAQ Standards ($\mu\text{g}/\text{m}^3$)- 1 st 24 Hour
AQ1	Project Site	3.76	33.50	37.26	60
AQ2	Mettalkunta	2.66	30.70	33.36	
AQ3	Yalgul	3.69	26.70	30.39	
AQ4	Hadnur	3.54	28.60	32.14	
AQ5	Rejantal	2.05	27.90	29.95	
AQ6	Kalbemal	2.55	28.70	31.25	
AQ7	Gunjetti	5.84	27.70	33.54	
AQ8	Gunalli	5.59	28.70	34.29	
AQ9	Waddi	2.84	30.20	33.04	
AQ10	Tekur	3.35	28.40	31.75	
AQ11	Manhalli	2.90	28.90	31.80	
AQ12	Jharasangam	5.01	28.80	33.81	
AQ13	Nyalkal	3.53	28.90	32.43	
AQ14	Burdipar	2.73	31.40	34.13	

Location No.	Receptors	1 st 24 Hour Average Incremental Concentration ($\mu\text{g}/\text{m}^3$)	Baseline Concentration ($\mu\text{g}/\text{m}^3$)	1 st 24Hour-Resultant Concentration ($\mu\text{g}/\text{m}^3$)	NAAQ Standards ($\mu\text{g}/\text{m}^3$)- 1 st 24 Hour
AQ15	Zaheerabad	2.14	27.80	29.94	

Table 4-19: 1st 24-hour Average Incremental and Resultant Concentration of SO₂

Location No.	Receptors	1 st 24 Hour Average Incremental Concentration ($\mu\text{g}/\text{m}^3$)	Baseline Concentration ($\mu\text{g}/\text{m}^3$)	1 st 24Hour-Resultant Concentration ($\mu\text{g}/\text{m}^3$)	NAAQ Standards ($\mu\text{g}/\text{m}^3$)- 1 st 24 Hour
AQ1	Project Site	26.73	20.10	46.83	80
AQ2	Mettalkunta	17.80	20.50	38.30	
AQ3	Yalgul	23.06	16.30	39.36	
AQ4	Hadnur	23.68	15.60	39.28	
AQ5	Rejantal	15.90	16.30	32.20	
AQ6	Kalbemal	19.83	16.90	36.73	
AQ7	Gunjetti	45.27	16.80	62.07	
AQ8	Gunalli	46.05	16.80	62.85	
AQ9	Waddi	25.04	18.30	43.34	
AQ10	Tekur	30.95	16.90	47.85	
AQ11	Manhalli	20.46	17.90	38.36	
AQ12	Jharasangam	40.05	18.90	58.95	
AQ13	Nyalkal	28.17	18.30	46.47	
AQ14	Burdipar	25.27	19.40	44.67	
AQ15	Zaheerabad	17.61	16.80	34.41	

Table 4-20: 1st 24-hour Average Incremental and Resultant Concentration of NO₂

Location No.	Receptors	1 st 24 Hour Average Incremental Concentration ($\mu\text{g}/\text{m}^3$)	Baseline Concentration ($\mu\text{g}/\text{m}^3$)	1 st 24Hour-Resultant Concentration ($\mu\text{g}/\text{m}^3$)	NAAQ Standards ($\mu\text{g}/\text{m}^3$)- 1 st 24 Hour
AQ1	Project Site	14.35	24.10	38.45	80
AQ2	Mettalkunta	6.61	24.80	31.41	
AQ3	Yalgul	10.23	21.60	31.83	
AQ4	Hadnur	5.65	20.40	26.05	
AQ5	Rejantal	10.06	28.50	38.56	
AQ6	Kalbemal	6.22	21.70	27.92	
AQ7	Gunjetti	13.94	21.40	35.34	
AQ8	Gunalli	13.99	21.30	35.29	
AQ9	Waddi	12.34	21.50	33.84	
AQ10	Tekur	4.48	21.30	25.78	
AQ11	Manhalli	9.61	22.10	31.71	
AQ12	Jharasangam	11.41	23.20	34.61	
AQ13	Nyalkal	3.56	22.70	26.26	
AQ14	Burdipar	5.11	23.70	28.81	
AQ15	Zaheerabad	14.59	22.30	36.89	

Table 4-21: Annual Average Incremental concentrations of PM₁₀, PM_{2.5}, SO₂, and NO₂

Location No.	Receptors	Annual Average incremental concentrations				NAAQ Standards ($\mu\text{g}/\text{m}^3$)- Annual concentrations			
		PM ₁₀	PM _{2.5}	SO ₂	NO ₂	PM ₁₀	PM _{2.5}	SO ₂	NO ₂
AQ1	Project Site	3.05	1.22	12.16	6.47	60	40	50	40
AQ2	Mettalkunta	0.82	0.33	2.48	1.95				
AQ3	Yalgul	1.60	0.64	5.17	3.47				

Location No.	Receptors	Annual Average incremental concentrations				NAAQ Standards ($\mu\text{g}/\text{m}^3$)- Annual concentrations			
		PM ₁₀	PM _{2.5}	SO ₂	NO ₂	PM ₁₀	PM _{2.5}	SO ₂	NO ₂
AQ4	Hadnur	2.43	0.97	7.00	4.50				
AQ5	Rejantal	0.95	0.38	2.68	4.03				
AQ6	Kalbemal	0.81	0.32	2.56	1.54				
AQ7	Gunjetti	2.79	1.11	10.63	6.00				
AQ8	Gunalli	1.46	0.58	4.77	2.52				
AQ9	Waddi	1.51	0.60	4.95	2.77				
AQ10	Tekur	2.42	0.97	7.14	3.26				
AQ11	Manhalli	0.58	0.23	1.90	1.18				
AQ12	Jharasangam	1.28	0.51	4.33	1.63				
AQ13	Nyalkal	2.08	0.83	6.33	3.34				
AQ14	Burdipar	0.49	0.20	1.64	1.61				
AQ15	Zaheerabad	0.38	0.15	1.03	2.82				

Scenario 2-Considering all point and line sources including DG sets:

For estimating the worst case scenario DG sets emissions are also considered along with process and line source emissions. The 1st highest 24 hour, resultant concentration and annual average incremental concentrations for PM₁₀, PM_{2.5}, SO₂ and NO₂ are given in **Table 4-22 to Table 4-26**.

Table 4-22: 1st 24-hour Average Incremental and Resultant Concentration of PM₁₀

Location No.	Receptors	1 st 24 Hour Average Incremental Concentration ($\mu\text{g}/\text{m}^3$)	Baseline Concentration ($\mu\text{g}/\text{m}^3$)	1 st 24Hour-Resultant Concentration ($\mu\text{g}/\text{m}^3$)	NAAQ Standards ($\mu\text{g}/\text{m}^3$)- 1 st 24 Hour
AQ1	Project Site	10.02	65.80	75.82	
AQ2	Mettalkunta	7.16	70.40	77.56	
AQ3	Yalgul	9.52	61.20	70.72	
AQ4	Hadnur	9.33	59.70	69.03	
AQ5	Rejantal	5.45	57.70	63.15	
AQ6	Kalbemal	6.79	60.60	67.39	
AQ7	Gunjetti	15.04	62.90	77.94	
AQ8	Gunalli	14.63	62.60	77.23	100
AQ9	Waddi	7.47	62.30	69.77	
AQ10	Tekur	8.83	64.20	73.03	
AQ11	Manhalli	7.77	68.50	76.27	
AQ12	Jharasangam	12.85	68.90	81.75	
AQ13	Nyalkal	9.20	68.30	77.50	
AQ14	Burdipar	7.14	63.40	70.54	
AQ15	Zaheerabad	5.54	62.80	68.34	

Table 4-23: 1st 24-hour Average Incremental and Resultant Concentration of PM_{2.5}

Location No.	Receptors	1 st 24 Hour Average Incremental Concentration ($\mu\text{g}/\text{m}^3$)	Baseline Concentration ($\mu\text{g}/\text{m}^3$)	1 st 24Hour-Resultant Concentration ($\mu\text{g}/\text{m}^3$)	NAAQ Standards ($\mu\text{g}/\text{m}^3$)- 1 st 24 Hour
AQ1	Project Site	4.01	33.50	37.51	
AQ2	Mettalkunta	2.86	30.70	33.56	
AQ3	Yalgul	3.81	26.70	30.51	60
AQ4	Hadnur	3.73	28.60	32.33	
AQ5	Rejantal	2.18	27.90	30.08	
AQ6	Kalbemal	2.71	28.70	31.41	

Location No.	Receptors	1 st 24 Hour Average Incremental Concentration ($\mu\text{g}/\text{m}^3$)	Baseline Concentration ($\mu\text{g}/\text{m}^3$)	1 st 24Hour-Resultant Concentration ($\mu\text{g}/\text{m}^3$)	NAAQ Standards ($\mu\text{g}/\text{m}^3$)- 1 st 24 Hour
AQ7	Gunjetti	6.02	27.70	33.72	
AQ8	Gunalli	5.85	28.70	34.55	
AQ9	Waddi	2.99	30.20	33.19	
AQ10	Tekur	3.53	28.40	31.93	
AQ11	Manhalli	3.11	28.90	32.01	
AQ12	Jharasangam	5.14	28.80	33.94	
AQ13	Nyalkal	3.68	28.90	32.58	
AQ14	Burdipar	2.86	31.40	34.26	
AQ15	Zaheerabad	2.22	27.80	30.02	

Table 4-24: 1st 24-hour Average Incremental and Resultant Concentration of SO₂

Location No.	Receptors	1 st 24 Hour Average Incremental Concentration ($\mu\text{g}/\text{m}^3$)	Baseline Concentration ($\mu\text{g}/\text{m}^3$)	1 st 24Hour-Resultant Concentration ($\mu\text{g}/\text{m}^3$)	NAAQ Standards ($\mu\text{g}/\text{m}^3$)- 1 st 24 Hour
AQ1	Project Site	32.87	20.10	52.97	
AQ2	Mettalkunta	22.76	20.50	43.26	
AQ3	Yalgul	25.92	16.30	42.22	
AQ4	Hadnur	28.27	15.60	43.87	
AQ5	Rejantal	19.02	16.30	35.32	
AQ6	Kalbemal	24.16	16.90	41.06	
AQ7	Gunjetti	49.44	16.80	66.24	
AQ8	Gunalli	52.40	16.80	69.20	
AQ9	Waddi	28.47	18.30	46.77	
AQ10	Tekur	35.36	16.90	52.26	
AQ11	Manhalli	25.72	17.90	43.62	
AQ12	Jharasangam	43.14	18.90	62.04	
AQ13	Nyalkal	31.83	18.30	50.13	
AQ14	Burdipar	28.36	19.40	47.76	
AQ15	Zaheerabad	19.29	16.80	36.09	

Table 4-25: 1st 24-hour Average Incremental and Resultant Concentration of NO₂

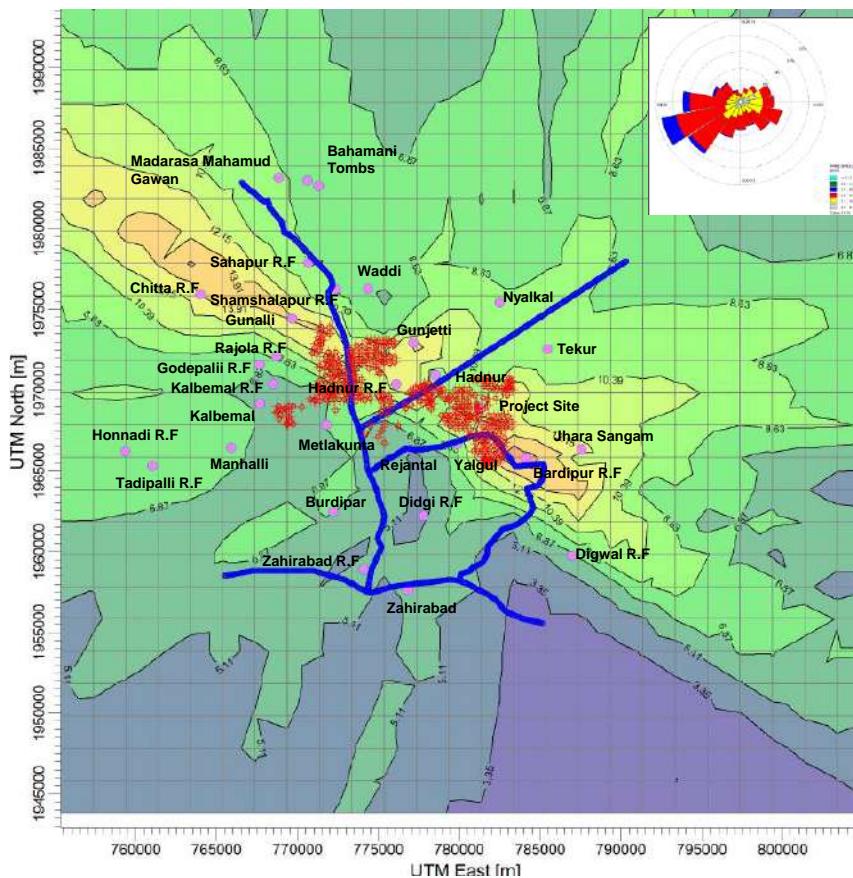
Location No.	Receptors	1 st 24 Hour Average Incremental Concentration ($\mu\text{g}/\text{m}^3$)	Baseline Concentration ($\mu\text{g}/\text{m}^3$)	1 st 24Hour-Resultant Concentration ($\mu\text{g}/\text{m}^3$)	NAAQ Standards ($\mu\text{g}/\text{m}^3$)- 1 st 24 Hour
AQ1	Project Site	48.37	24.10	72.47	
AQ2	Mettalkunta	34.07	24.80	58.87	
AQ3	Yalgul	26.12	21.60	47.72	
AQ4	Hadnur	31.15	20.40	51.55	
AQ5	Rejantal	27.33	28.50	55.83	
AQ6	Kalbemal	30.21	21.70	51.91	
AQ7	Gunjetti	37.09	21.40	58.49	
AQ8	Gunalli	49.20	21.30	70.50	
AQ9	Waddi	31.37	21.50	52.87	
AQ10	Tekur	28.96	21.30	50.26	
AQ11	Manhalli	38.76	22.10	60.86	
AQ12	Jharasangam	28.58	23.20	51.78	
AQ13	Nyalkal	23.82	22.70	46.52	
AQ14	Burdipar	22.23	23.70	45.93	
AQ15	Zaheerabad	23.90	22.30	46.20	

Table 4-26: Annual Average Incremental concentrations of PM₁₀, PM_{2.5}, SO₂, and NO₂

Location No.	Receptors	Annual Average incremental concentrations				NAAQ Standards ($\mu\text{g}/\text{m}^3$)- Annual concentrations			
		PM ₁₀	PM _{2.5}	SO ₂	NO ₂	PM ₁₀	PM _{2.5}	SO ₂	NO ₂
AQ1	Project Site	3.22	1.29	13.80	15.55	60	40	50	40
AQ2	Mettalkunta	0.87	0.35	2.97	4.68				
AQ3	Yalgul	1.66	0.66	5.75	6.71				
AQ4	Hadnur	2.60	1.04	8.66	13.68				
AQ5	Rejantal	1.00	0.40	3.18	6.79				
AQ6	Kalbemal	0.85	0.34	2.94	3.68				
AQ7	Gunjetti	2.92	1.17	11.94	13.25				
AQ8	Gunalli	1.52	0.61	5.43	6.18				
AQ9	Waddi	1.57	0.63	5.55	6.14				
AQ10	Tekur	2.52	1.01	8.12	8.68				
AQ11	Manhalli	0.60	0.24	2.14	2.56				
AQ12	Jharasangam	1.32	0.53	4.69	3.60				
AQ13	Nyalkal	2.15	0.86	7.03	7.27				
AQ14	Burdipar	0.51	0.20	1.83	2.68				
AQ15	Zaheerabad	0.40	0.16	1.13	3.42				

4.4.2.9 Isopleths

The Isopleths pertaining to scenario: 1- Normal condition i.e. considering process point sources and line sources excluding DG sets were presented. 1st incremental 24-hour average incremental concentrations of all the parameters are given in **Figure 4-4 to Figure 4-7**.

**Figure 4-4: Isopleth for 1st 24-Hr Average Incremental Concentration of PM₁₀**

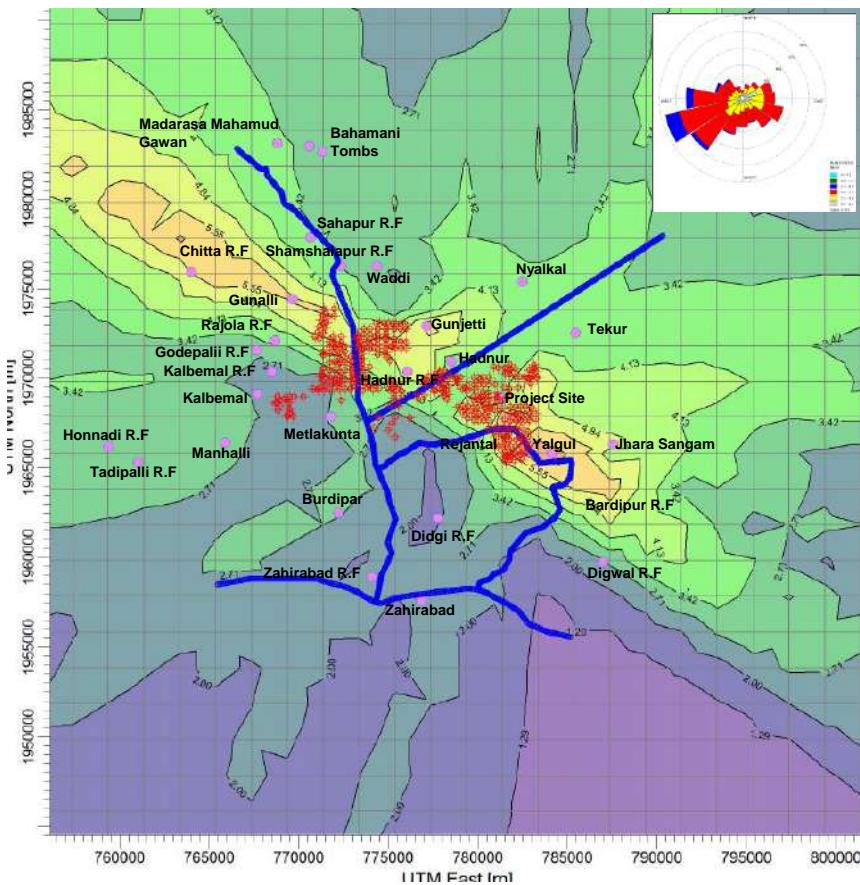


Figure 4-5: Isopleth for 1st 24-Hr Average Incremental Concentration of $\text{PM}_{2.5}$

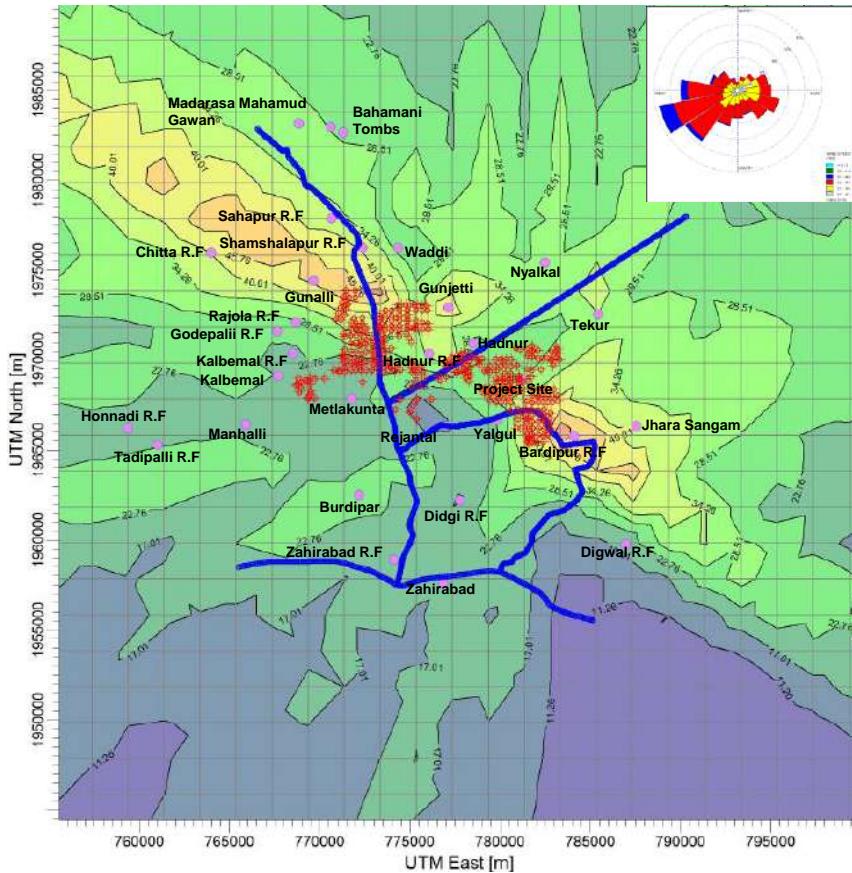


Figure 4-6: Isopleth for 1st 24-Hr Average Incremental Concentration of SO_2

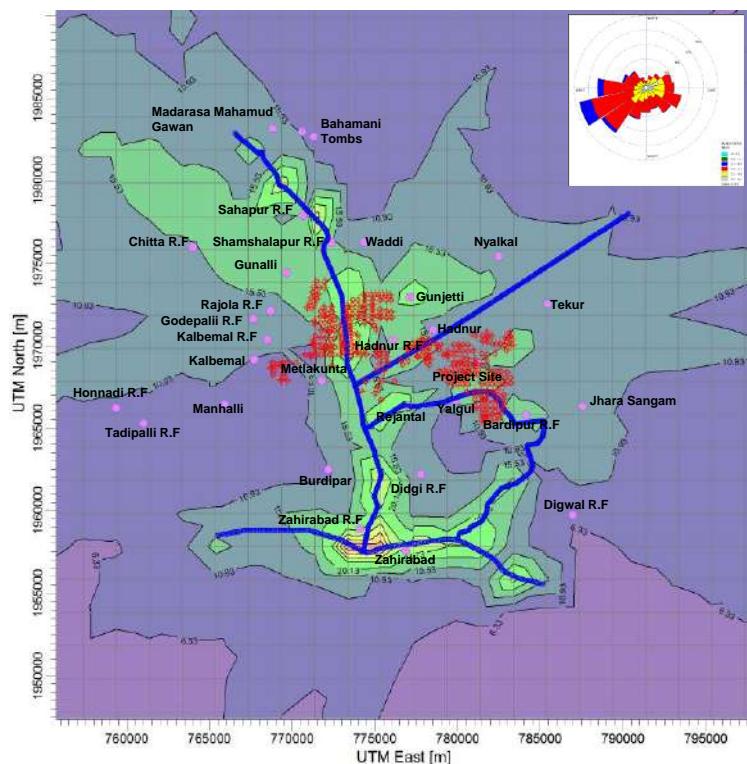


Figure 4-7: Isopleth for 1st 24-Hr Average Incremental Concentration of NO₂

The Isopleths pertaining to worst case scenario i.e. considering all point and line sources including DG sets were presented. 1st incremental 24-hour average incremental concentrations of all the parameters are given in **Figure 4-8** to **Figure 4-11**.

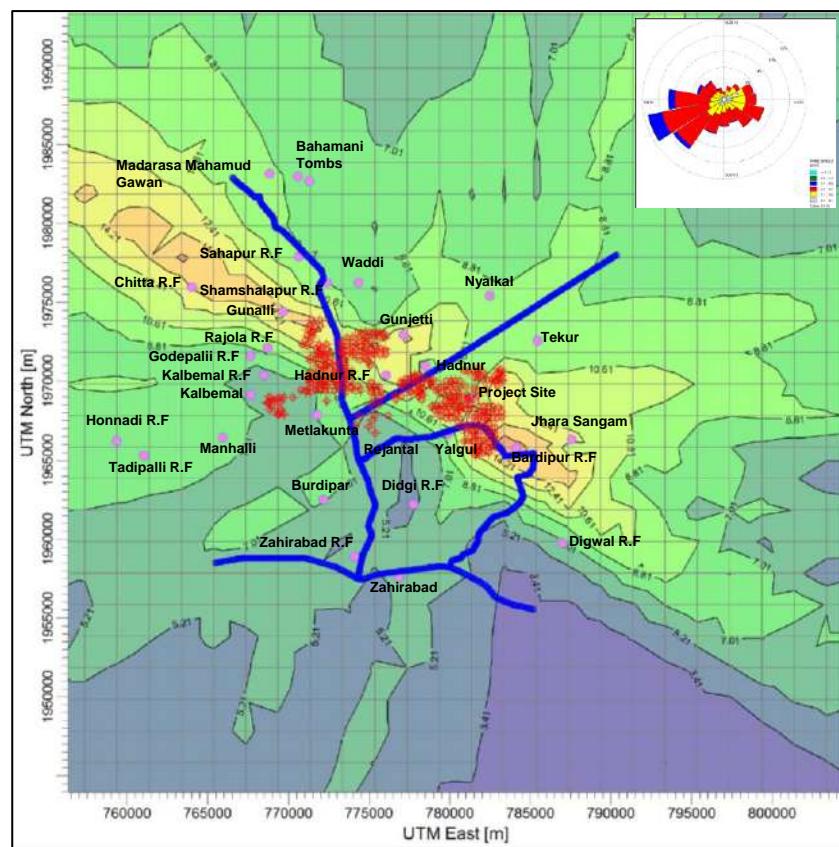


Figure 4-8: Isopleth for 1st 24-Hr Average Incremental Concentration of PM₁₀

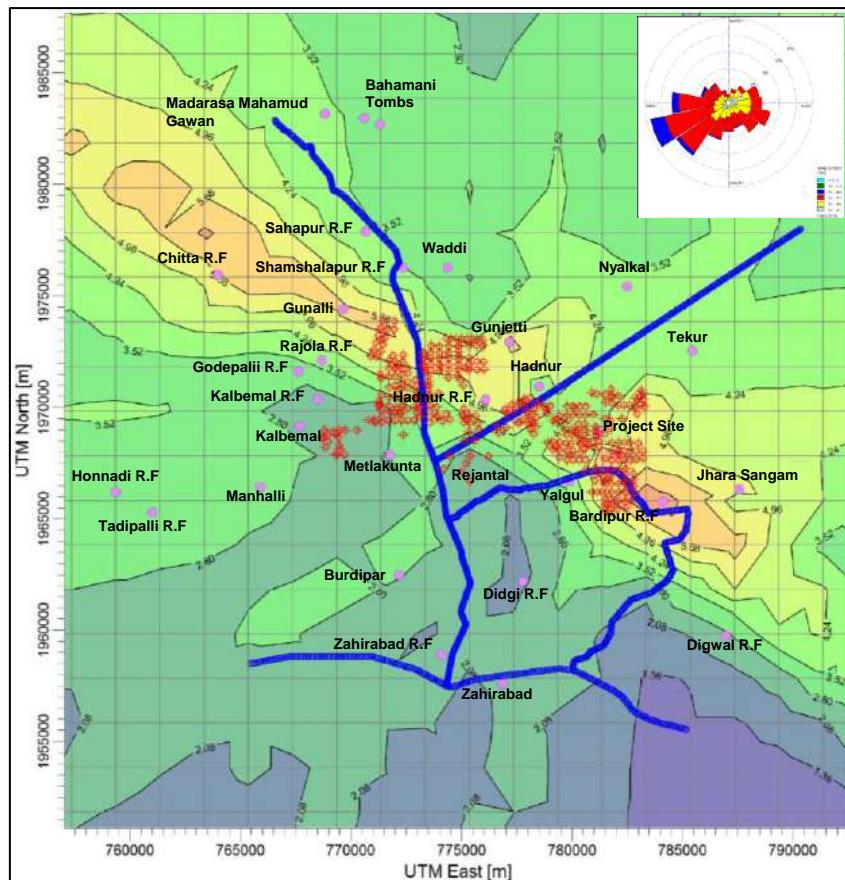


Figure 4-9: Isopleth for 1st 24-Hr Average Incremental Concentration of PM_{2.5}

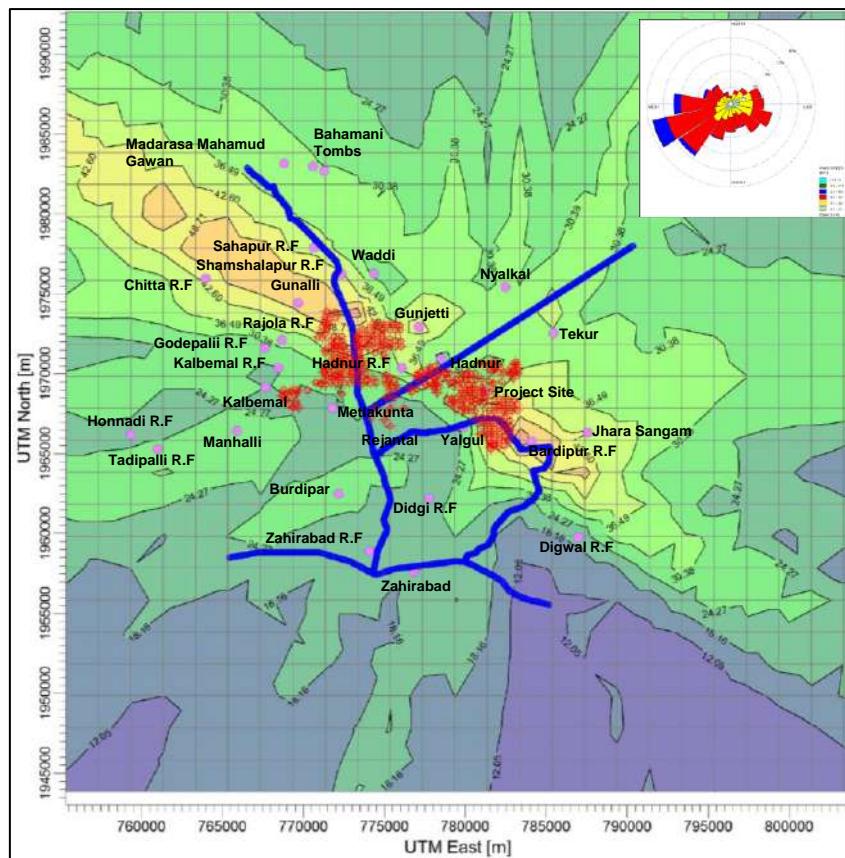


Figure 4-10: Isopleth for 1st 24-Hr Average Incremental Concentration of SO₂

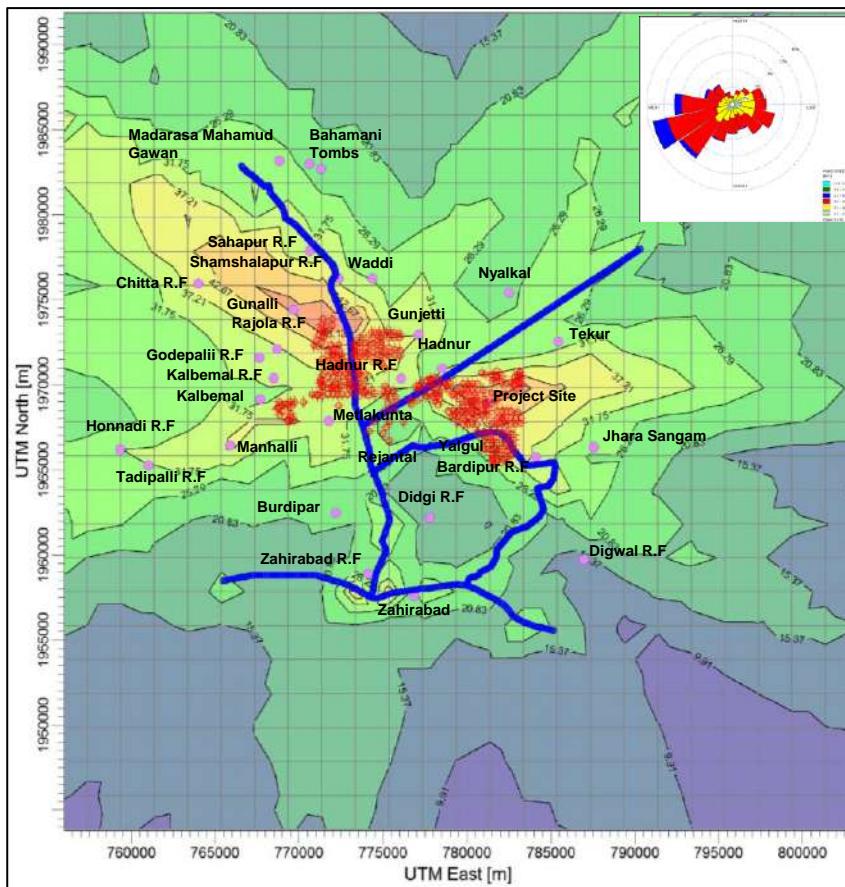


Figure 4-11: Isopleth for 1st 24-Hr Average Incremental Concentration of NO₂

4.4.2.10 Observations at Receptors

The 1st highest 24 hour average resultant concentrations of PM₁₀, PM_{2.5}, SO₂ and NO₂ for AAQ monitoring receptors locations are found to be well within the National Ambient Air Quality Standards (NAAQS), 2009.

Also, incremental concentration for the sensitive receptors is well below the National Ambient Air Quality Standards (NAAQS), 2009.

4.4.2.11 Mitigation Measures

Recommended mitigation measures to contain various air polluting emissions are:

- Volatile Organic Compounds (VOC):
- Installation of refrigerator coils (or additional coils) above the degreaser vapour zone;
- Application of an air flow over the top of the degreaser that should not typically exceed 40 m / minute;
- Rotation of parts before removal from the vapour degreaser, including:
 - Installation of thermostatic heating controls on solvent reservoirs and tanks
 - Installation of in-line filters to prevent particulate build-up
 - Use of solvent recovery to reduce emissions of VOC from curing ovens
 - Use of activated carbons to recover solvent vapours
- In order to reduce emissions during welding and coating metal surfaces should be carefully cleaned;
- Coatings should be removed from the base metal before welding preferably using mechanical cleaning instead of solvents

- Dust:
 - Installation of in-line aspirators with filters or scrubbers. ESP may also be explored;
 - Where possible, maintaining wetness on the metal surface in order to prevent or minimize dust production.
- Acid/Metal Content in Mists and Fumes:
 - Use of fume suppressants as additives to electroplating baths to reduce air emissions of electroplated metals (e.g. chromium);
 - Installation of in-line aspirators with filters to eliminate acid compounds.
 - For metals or metal oxides abatement, installation of filters capable of handling complex metals;
 - Welding fumes (a mixture of metals, oxides, and smoke from burning off oil) should be controlled by removing coatings from base metals. Chlorinated hydrocarbon solvents should not be used for this purpose, to prevent the risk of phosgene creation.
- Odours:
 - Industries generating wastes which will emit mercaptans have to treat them within the industry premises
 - Greenbelt development around the treatment facilities and member industries to be developed as per PCB/MoEF&CC norms
 - Source specific (point source as well as diffused source) standard for odour emission to be evolved
 - Industries generating odour pollution to adopt the following techniques:
 - Odour measurement through instrument method for known compounds and sensory method for unknown substances
 - In waste storage yard, collection sump and sorting areas, air will be collected through pre-suction pipes and connected to a blower.
 - A bio filter will be developed using wooden chips as media. Water will be sprinkled occasionally to keep the media under wet condition.
 - Odour from area sources will be minimised by atomized spray of water
 - Periodical checking of pipe and valve, i.e. to maintain leak proof system
 - Odour from area source will be minimised by atomized spray of water
 - Sludge from treatment plants and Solid waste management will be handled in most appropriate manner to avoid putrefied smell
 - Suitable odour mitigation plant species will be identified during greenbelt and green areas development
- General measures:
 - In case of coal transport, fugitive dust emissions are envisaged and it is recommended to use tarpaulin to cover the top of the truck or train and open storage of coal if envisaged, dust suppression system has to be provided to reduce the impact on air quality
 - FGD provision shall be made for future. If non availability of coal with committed Sulphur % (i.e. imported coal – 0.35% S and Indian coal -0.28% S), number of FGDs shall be worked out and implemented.

4.4.2.12 Air Pollution Control Equipment Recommended for industry level

Each industry and application releases unique toxins, odours or particulates of their own, forcing the need for diverse pollution control solutions. Pollution control equipment works through acts of absorption, extraction, filtration or a combination of all three. The most common types of industrial pollution control equipment are: air scrubbers, wet scrubbers,

mist collectors and electrostatic precipitators. These all employ multiple pollution control techniques. Following are the simpler oxidizers and air filtration systems.

Air Scrubbers:

Air scrubbers target chemicals, gases and particles, working either through dry scrubbing or wet scrubbing. Dry scrubbers collect chemicals and particulates by first introducing a dry reagent or slurry into a dirty exhaust stream or a gas stream, which catches larger contaminants, then forcing the stream through filters to catch smaller contaminants. Wet scrubbers, on the other hand, collect contaminants inside liquid droplets, and then clean them using either absorption in a saturation pool or dissolution in a liquid spray. Typical types of scrubbers used by the industries in shown in **Figure 4-12**.

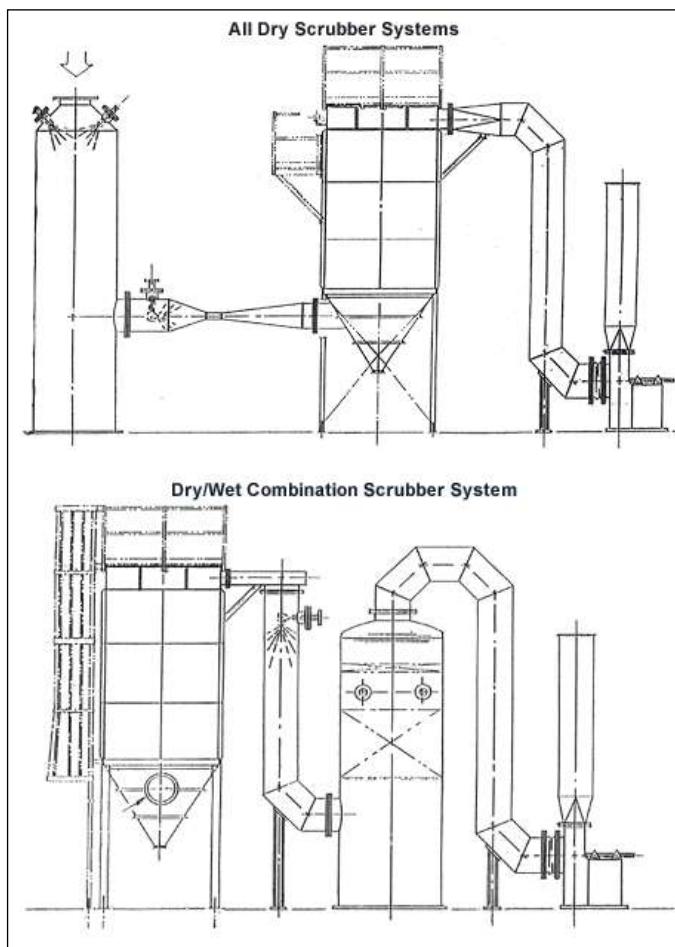


Figure 4-12: Typical scrubber Schematic diagram

Mist Collectors:

Mist collectors are made to specifically target mists and vapours within an air stream, such as smoke, coolant, oil, abrasives and water. Most often, they are utilized by industries and applications in which space and weight savings are highly important, and/or where vapour quality is key. Such industries and applications include: agriculture, paper and pulp, food processing, brine desalination, chemical processing and metal finishing and forming.

Electrostatic precipitators:

ESPs are highly efficient, quality-achieving pollution control equipment that works through ionization. Particulates in the air are charged inductively with an electric field as metal tubes or plates, called collection tubes or collection plates, respectively, are charged with a

negative voltage. The opposing charges attract, causing the particulates to stick to the collection tubes or plates. Once this happens, they are shaken, tapped, rapped or conditioned and rinsed into a bin for disposal or recycling. This method of pollution control is employed primarily by industries that produce a lot of smoke, dust and debris, industries like: material handling, textile manufacturing, petroleum processing, chemical processing, electronics and general manufacturing and machining. Conceptual diagram of an Electrostatic precipitator is given in **Figure 4-13**.

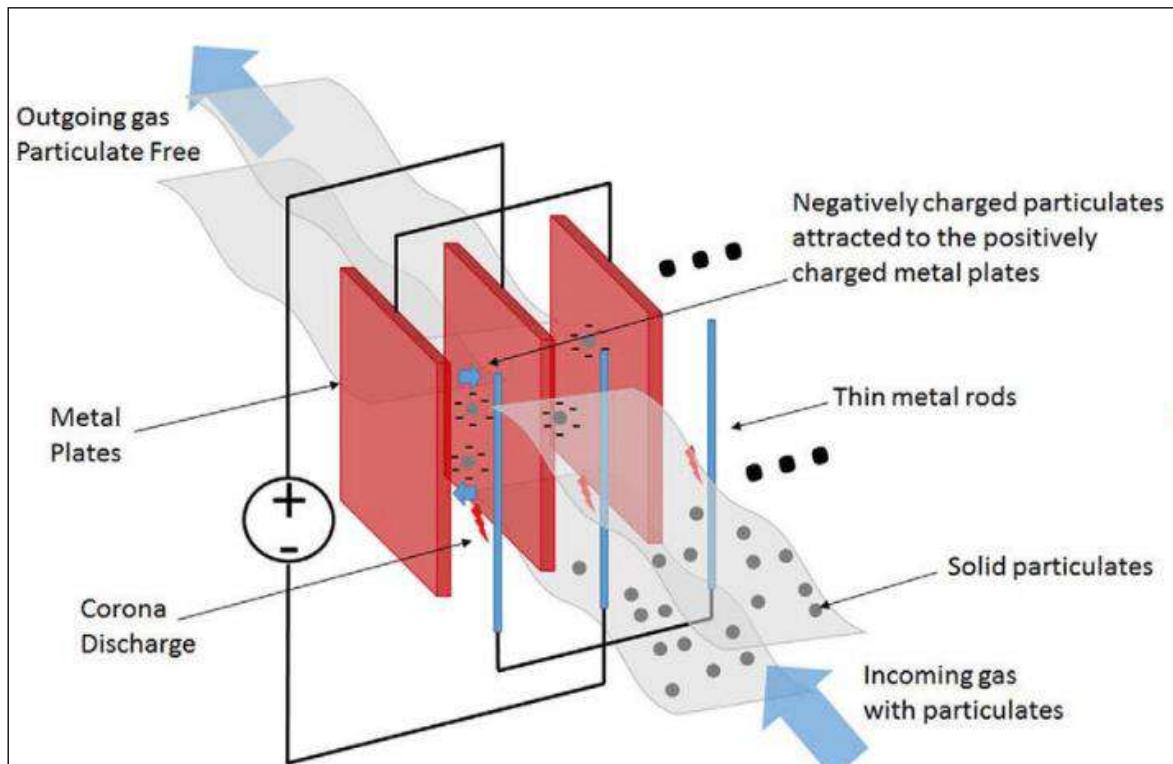


Figure 4-13: Conceptual diagram of an electrostatic precipitator

Oxidizers:

These perform cleaning simply, by heating air that has been forced into a main chamber with a catalyst, until the contaminants within it either burn or undergo a chemical reaction, and then convert into less harmful by-products that can be filtered further or disposed. Oxidizers are occasionally small enough for use in automotive exhaust systems. However, they are usually very large and used only with high emission industries like: agriculture, food processing, printing, paper and pulp, painting, pharmaceuticals and polymer and resin manufacturing.

Catalytic Oxidizers and Regenerative Thermal Oxidizers are two types of Thermal Oxidizers that are appropriate for treating the VOCs from paints and coatings, and exhaust generated by engine testing. This depends on the unique processing method of each facility.

Catalytic Oxidizers are a good treatment option for processes that have consistent VOCs. Since a catalyst bed is used in the air treatment equipment, oxidation is accomplished at much lower temperatures as compared to thermal oxidation. The airflow diagram for catalytic oxidizer is shown in **Figure 4-14**.

Regenerative Thermal Oxidizers (RTOs) use combustion to destroy the residue left from the coating process. They are most effective for vapours with low VOCs. Regenerative Thermal Oxidizers are energy-efficient as they use ceramic media to capture and re-use most of the

heat from combustion to pre-heat the incoming process exhaust. The airflow diagram for Regenerative Thermal Oxidizer (RTO) is shown in **Figure 4-15**.

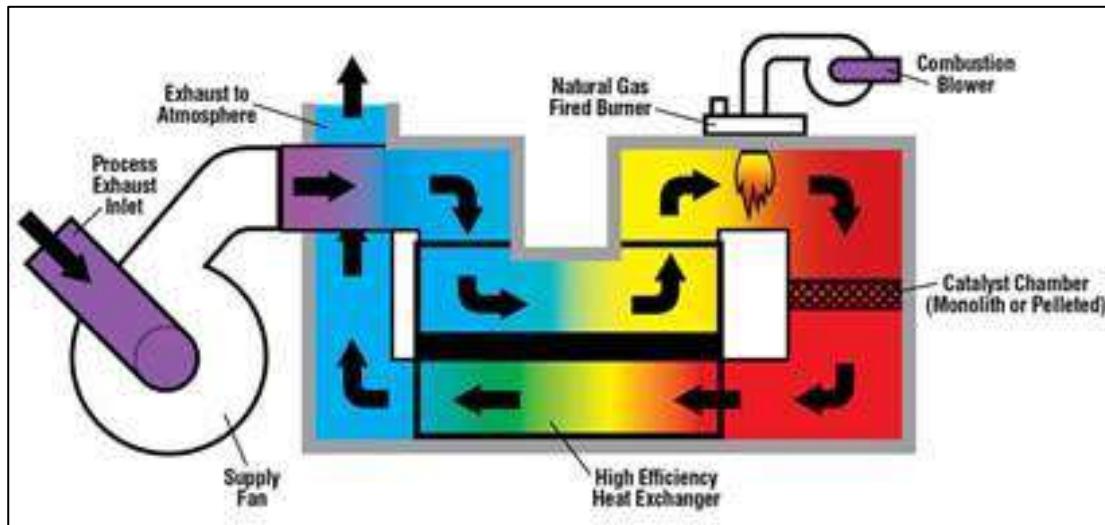


Figure 4-14: Catalytic Oxidizer Airflow diagram

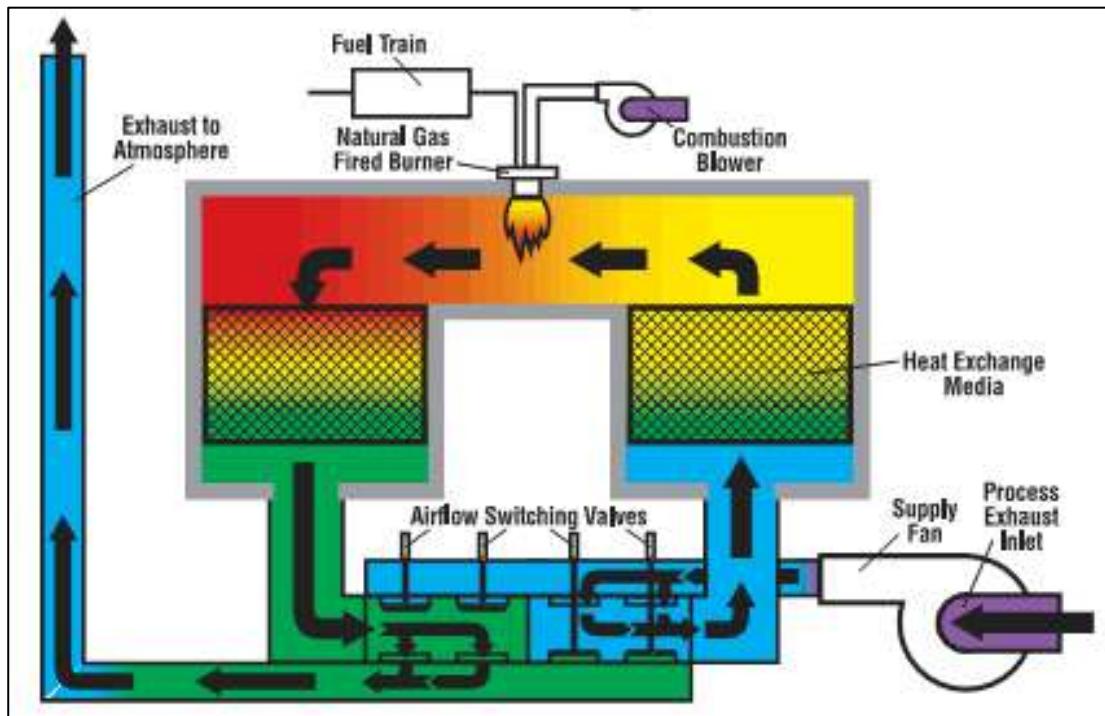


Figure 4-15: Regenerative Thermal Oxidizer (RTO) Air flow diagram

Air filtration systems:

Air filtration systems trap wide pollutants and other impurities in filters. They may aim to capture, dissolve or destroy pollutants. Common pollutants include: bacteria, pollen, mold, dust, metallic powder and gases and chemicals.

Air filtration systems serve a wide variety of applications; they may be designed with any number of porosity, flow rate, filter length, pressure drop and efficiency requirements in mind. Air filtration systems serve many industries, including: food and chemical processing, pharmaceutical, laboratory, clean room, electronics and commercial and residential ventilation.

4.4.2.13 NIMZ- park level control measures:

- Ambient air quality monitoring will be carried out regularly at selected locations in the predicted maximum impact zone in order to check and compare the predicted concentrations with the measured concentrations
- Monitoring of VOCs using online instruments is suggested in the post project air quality monitoring program
- Provision of avenue plantation along the roads and greenbelt development along the layout boundary
- Provisions of adequate green buffers between treatment facilities and industries/public utilities/common areas

4.4.3 Impact significance

The residual impact significance will be negligible if the preventive/mitigation measures are implemented.

Impact : Ambient Air Quality	Construction Phase	Operation Phase
Impact Nature	Negative	Negative
Impact Type	Direct	Direct
Impact Duration	Short-term	Short-term
Impact Extent	Local	Local
Impact Magnitude	Small	Small
Receptor Sensitivity	Medium	Low
Impact Significance	Minor	Minor
Residual Impact Magnitude	Negligible	Negligible
Residual Impact Significance	Negligible	Negligible

4.5 Noise Pollution

4.5.1 Potential Impact during Construction

Construction activities increase ambient noise levels. There would be impact on noise levels due to the following:

- Vehicles transporting construction material
- Handling of construction material
- Diesel run engines of construction machinery
- Welding and cutting operation of metal
- Pile driving activities during construction of heavy structure

Noise is an inherent part of construction activity and response of species / communities would be either attracted or diverted away from the region. Noise generated from diesel engines of etc. could result in movement of mobile faunal species away from area of operation.

Noise generated from construction activities will be predominantly confined within project site area and will impact construction workers at site. Impacts due to these activities would be short-term in nature and localised.

4.5.1.1 Noise-Mitigation Measures

The following mitigation measures will be followed to minimise the noise generation and the associated impacts.

- Exercise of route selection as well as measures such as traffic regulation, timings of transportation etc., will be followed to avoid congested built up areas.
- During construction, noise levels will be maintained below threshold levels stipulated by Central Pollution Control Board (CPCB) by selecting appropriate equipment, machinery and using enclosures. Procurement of machinery/construction equipment will be done in accordance with specifications conforming to source noise levels less than 75 dB (A).
- Only well-maintained construction equipment; which meets the regulatory standards for source noise levels, will be used. Any equipment producing high noise, wherever possible, will be oriented so that the noise is directed away from sensitive receptors.
- Noise attenuation will be practised for noisy equipment by employing suitable techniques such as acoustic controls, insulation and vibration dampers. The attenuation devices will be properly maintained throughout the construction period.
- High noise generating activities such as piling and drilling will not be scheduled during night time to minimise noise impacts.
- Time bound noisy construction activities will be carried out; so as to avoid concurrent effect from the construction site.
- Personnel exposed to noise levels beyond threshold limits will be provided with protective gears such as earplugs, muffs, etc. especially construction personnel involved in pile driving operations. Rotation of personnel will also be adopted. Also, no employee should be exposed to a noise level greater than 85 dB(A) for a duration of more than 8 hours per day without hearing protection.
- Temporary noise barriers will be used to break the propagation of sound from the construction site.
- Periodic maintenance of the equipment to be used in the developmental works will be carried out. Worn out parts will be replaced and rotating parts will be lubricated to minimise noise emissions.
- Ambient noise levels will be monitored at regular intervals during construction phase of the project.
- All haul roads (for truck transport and other vehicles) within the boundary and outside will be sealed and maintained properly to avoid excessive noise levels from Engine acceleration and deceleration.
- Drivers need to be trained / cautioned to avoid frequent horning unless otherwise it is required especially at Silent zones and off hours between midnight and 6 am.

4.5.1.2 Impact due to Vibration

During the construction activities, vibrations may be envisaged. The vibrations could be result of activities like excavation, piling, blasting (if required), movement of heavy equipment, etc.

4.5.1.3 Vibration- Mitigation Measures

- The machinery equipped with latest vibration-reduction technology shall minimise the vibrations
- The effects of vibrations will be minimised by ensuring construction works take place during daytime and weekdays

4.5.2 Potential Impact during Operation

During the operation phase, noise is likely to be generated due to industrial activities involved in raw material/product handling and transportation and same will be felt upon work

personnel and nearby settlements. Impacts are evaluated qualitatively taking into consideration the noise generating sources together with environmental conditions and the receptors in the project influence area.

Major sources of noise generation in the proposed NIMZ area are the industrial Manufacturing units. Noise generation sources during operational phase are classified into two categories:

- Stationary sources due to operation of heavy duty machinery at the project site like boilers, steam turbine generators, compressors, pumps etc.
- Mobile sources corresponding to mainly vehicular traffic for staff mobilization, materials, imported coal transportation, liquid fuel transportation to project site, fly ash transportation out of project site, etc.

Vibrations are expected to be generated by various activities associated within the proposed NIMZ layout during operational phase. The impact of vibrations beyond the site would be negligible during normal operation phase. However, the impacts on workers engaged in the plant area would be considerable due to occupational exposure. The proposed fixed major equipment/units such as crushers, conveyor, steam generators, compressors, pumps, etc., also generate vibrations during operational phase and may cause exposures to the workers/operators engaged at these units.

4.5.2.1 Mitigation Measures

- Any major noise generating equipment will be enclosed in an acoustic enclosure designed for an insertion loss of 25 dB (A) and silencers to other equipment etc.
- Major noise generating equipment will be designed with 85 dB (A) ensuring cumulative noise at 1.0 m remains at 85 dB (A)
- The occupational noise exposure to the workers in the form of eight hourly time weighted average will be maintained well within the prescribed Occupational Safety and Health Administration (OSHA) standard limits
- Acoustic silencers will be provided in equipment wherever necessary
- Acoustic design with sound proof glass panelling will be provided for critical operator cabins / control rooms of individual modules as well as central control facilities.
- Use of personal protective devices such as ear-muffs, ear plugs etc. will be strictly enforced for the workers engaged in high noise areas and conduct periodic medical hearing checks for them.
- Periodic maintenance of the equipment to be used in the developmental works will be carried out. Worn out parts will be replaced and rotating parts will be lubricated to minimise noise emissions.
- Implementation of greenbelt for noise attenuation will be undertaken: shrub plantation; landscaping with horticulture; and Tree plantation at vehicle parking areas and along approach roads.
- Ambient noise levels will be monitored at regular intervals during operational phase of the project.
- Low vibration generating machines/equipment will be selected to meet international standards and foundations will be so designed to minimise vibrations and secured properly
- Vibration generating sources and their platforms should be maintained properly to minimize vibrations and related impacts.

- Various standards pertaining to vibrations are formulated by statutory bodies like Bureau of Indian Standards (BIS) and Director General of Mines Safety (DGMS), which is being practiced would be continued to mitigate the workers' health effects due to vibrations.
- Vibration dampers shall be provided around the source of generation
- Recommendations of Transportation Management shall be implemented

4.5.3 Impact significance

The residual impact significance will be negligible if the preventive/mitigation measures are implemented.

Impact : Ambient Noise Levels	Construction Phase	Operation Phase
Impact Nature	Negative	Negative
Impact Type	Direct	Direct
Impact Duration	Short-term	Long-term
Impact Extent	Local	Local
Impact Magnitude	Negligible	Negligible
Receptor Sensitivity	Medium	Medium
Impact Significance	Negligible	Negligible
Residual Impact Magnitude	Negligible	Negligible
Residual Impact Significance	Negligible	Negligible

4.6 Solid Waste Management

4.6.1 Potential Impact due to Construction

4.6.1.1 Impact due to Solid Waste Generation

Solid waste is likely to be generated in significant amount during the construction phase of the development. Appropriate measures therefore need to be taken to cater for the adequate disposal of such solid wastes. Improper solid waste disposal may also lead to skin diseases. Moreover solid waste will attract vermins, rats and deteriorate the general aspect of the site and its surroundings. Organic wastes will comprise mainly of domestic refuse like food and garden debris such as fallen leaves. During the construction phase, the inorganic waste likely to be generated will include:

- | | |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> • Concrete rubbles and blocks • Cement sheets • Wooden and metallic beams • Paper, plastic, cartons | <ul style="list-style-type: none"> • Blocks, rocks, boulders • Broken tiles, glass debris • Metal debris, cans and tins • Wood, straw and timber remains |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Organic waste generated during the construction stage will be minimal and shall include leaves, branches, food consumed by workers on site.

Poor construction procedures that generate excessive wastes increase construction costs and results in disposal of otherwise valuable resources. The solid waste generated during construction phase may impact soil quality, water quality and public health if not regulated properly. Improper solid waste disposal may also lead to skin diseases. Moreover solid waste will attract vermins, rats and deteriorate the general aspect of the site and its surroundings. Appropriate measures therefore need to be taken to cater for the adequate disposal of solid wastes generated during construction phase of the project.

4.6.1.2 Mitigation Measures

- Construction waste will be re-used within Project site for filling of low lying areas. Other wastes which can be re-cycled will be sold. Recyclable wastes will be disposed through approved TSPCB vendors.
- Excavated soil will be stockpiled in a corner of the site in bunded area to avoid run off with storm water.
- Excavated stock piled top soil will be reused for horticultural/ agricultural purposes
- General refuse generated on-site will be collected in waste skips and separated from construction waste.
- A local authorised waste handler will be employed to remove general refuse from the site, separately from construction waste and municipal wastes, on regular basis to minimise odour, pest and litter impacts.
- The burning of refuse at construction sites will be prohibited. Appropriate fence should be used to prevent propagation of the debris via strong winds

4.6.1.3 Hazardous Material Management

- Hazardous materials such as lubricants, paints, compressed gases, and varnishes etc., will be stored as per the prescribed/approved safety norms.
- Hazardous wastes will be disposed through approved TSPCB vendors.
- Hazardous materials will be stored as per prescribed safety norms in locations with restricted entry and with fire-fighting facilities.
- Medical facilities including first aid will be available for attending injured workers

4.6.2 Potential Impact during Operation

4.6.2.1 Impact due to Solid Waste Generation

During operation phase of NIMZ it is likely to generate various types of solid waste which can be broadly categorized as Hazardous Wastes and Non-hazardous Wastes. Further the generated solid waste generated may include Biodegradable, Recyclable and inert compounds from municipal and non-industrial occupants and industrial occupants. These are given as **Figure 2-11** and **Figure 2-12**. Apart from those listed, E-waste from both domestic and industrial segments is also expected to be generated in NIMZ area. It is also anticipated that bio medical waste is also expected from health care segments inside NIMZ area.

If the solid waste generated is not properly managed and disposed in unauthorised manner, it will impact the air quality, soil quality and groundwater quality. Brief solid wastes generated from NIMZ industries based on the various processes are:

Sintering: Particulate Powders

Metal shaping: Metal particles like iron fillings and chips or swarf arising from machining operations, metal-bearing machining fluid sludges and solvent still-bottom wastes

Surface Preparation: From solvent degreasing and emulsion, alkaline and acid cleaning processes – Process sludges; From welding processes – Metal oxides like oxides of Ti, Al, Fe, Ni, Cr, Cu, Zn or Sn and slag drops

Surface Finishing: From Anodizing, chemical conversion coating, electroplating – Metal sludges, base metal and reactive compounds; From Painting processes – Still bottoms, sludges (dried), paint (dried) and metals

Other sources: Other metal finishing techniques like Polishing, hot dip coating and etching – Polishing sludges, metal (Zinc, chromium) dross, etching sludges, oxide dross and metal sludges.

In case of Food processing industries the characteristics of solid waste will be significantly volumes of organic, putrescible solid waste in the form of inedible materials and rejected products from sorting, grading and other production processes.

4.6.2.2 Solid Waste Management during Operation Phase

Strict guidelines will be put in place in order to manage the solid waste generation during the operational phase of the development along with statutory guidelines. The main goals of the guidelines will be to ensure adopting recycling techniques and encouraging sorting of solid waste at source into organic and inorganic wastes. Due to the high volume of solid waste generated, recycling and composting techniques will be encouraged to reduce amount of solid waste which will be carted away.

The compost from the on-site facility may be used for the landscaped areas and reduce the amount of fertilizers used. The proposed Waste management concept at NIMZ is given in **Figure 4-16**. Waste management proposed at NIMZ to handle treatment of wet MSW is given in **Figure 2-15**

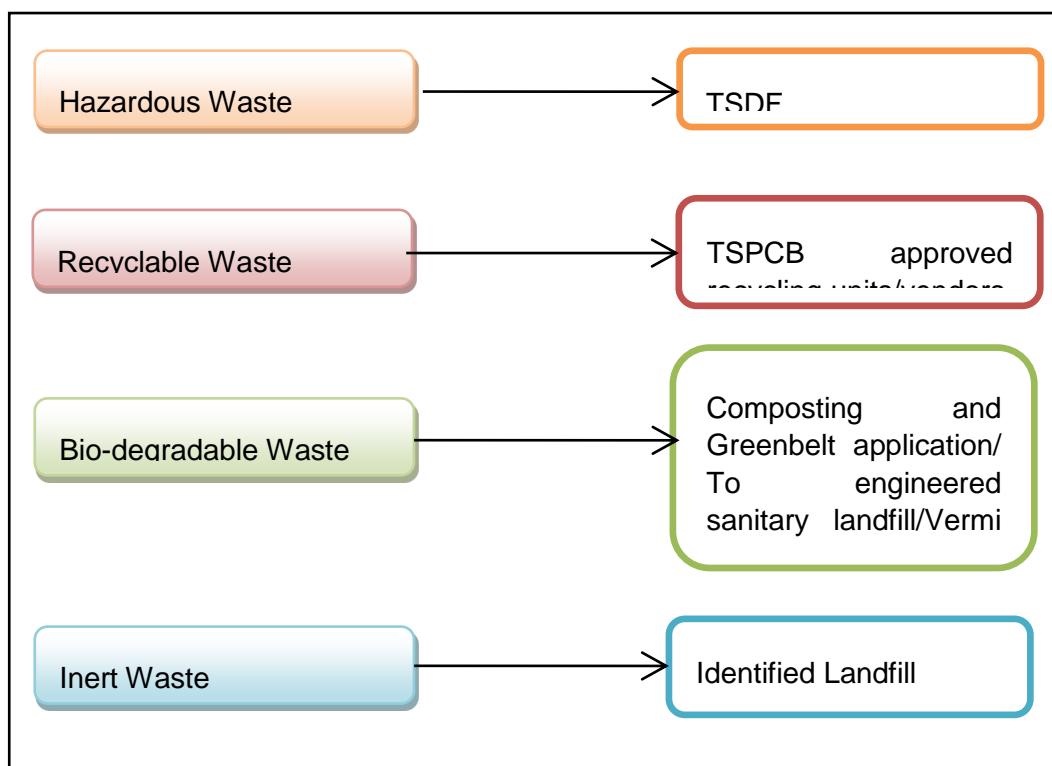


Figure 4-16: Waste management concept in NIMZ

Apart from the management processes below are the measures recommended to prevent and control solid waste generation:

- Separating metal dust or scrap by type to promote recovery and recycling
- Reducing and treating slags from welding, forging, machining, and mechanical finishing, which may contain metal ions
- Proper management of metals removed from wastewaters for recovery or disposal
- Disposal of sludge from surface finishing processes (e.g. galvanizing, painting, hot dip)
- Reuse or recycling of the solid wastes depending to specific process outputs
 -

- If reuse or recycling is not possible, the waste should be disposed of according to industrial waste management recommendations as given in **Figure 4-16**

In Food Processing Industry:

- Minimize inventory storage time for raw materials to reduce losses from putrefaction
- Monitor and regulate refrigeration and cooling systems during storage and processing activities to minimize product loss, optimize energy consumption, and prevent odours
- Consider use of enclosure techniques to minimize damage to raw materials stored outdoors
- Monitor and optimize process yields, e.g. during manual grading or cutting activities, and encourage the most productive employees to train others in efficient processing
- Clean, sort, and grade raw foodstuffs at an early stage (e.g. at the farm site), in order to reduce organic waste and substandard products at the processing facility
- Contain solid waste in dry form and consider disposal through composting and / or use for soil amendment
- Organic and non-organic debris / soil, solid organic matter, and liquid effluents, including sludge from wastewater treatment, which remain after the implementation of waste prevention strategies should be recycled as a soil amendment (based on an assessment of potential impacts to soil and water resources) or other beneficial uses such as energy production
- Collect and reuse rejected raw materials for manufacturing other products
- Provide leak-proof containers for collected solid and liquid waste
- Segregating individual by-products from each other and from waste to maximize their use and minimize waste

4.6.3 Impact significance

The residual impact significance will be negligible if the preventive/mitigation measures are implemented.

Impact : Ambient Noise Levels	Construction Phase	Operation Phase
Impact Nature	Negative	Negative
Impact Type	Direct	Direct
Impact Duration	Short-term	Short-term
Impact Extent	Local	Local
Impact Magnitude	Small	Small
Receptor Sensitivity	Medium	Medium
Impact Significance	Minor	Minor
Residual Impact Magnitude	Negligible	Negligible
Residual Impact Significance	Negligible	Negligible

4.7 Biological Environment

The proposed activities affect environmental segments of the surrounding region not very significant. The effect on biological environment can be divided into two parts, viz. the effect on flora and the effect on fauna.

4.7.1 Ecological Factors

Ecological Factors	Possible Impact on
Species diversity	Population and Diversity will be reduced.
Habitat loss or fragmentation	Local reptiles and Birds will lose their habitat.
Effect on any additional risk or threat to the rare or	One medicinal plant under Endangered category will be affected.

Ecological Factors		Possible Impact on							
endangered or endemic or threatened (REET) species		(Decalepis hamiltonii is found in the project site which comes under RED listed category by IUCN.)							
Any impairment of ecological functions such as (i) disruption of food chains, (ii) decline in species population and or (iii) alterations in predator-prey relationships		Yes							
Is it possible to attain the global objectives of "no net loss" of biodiversity		Yes, Only after taking more conservation steps.							
Is it possible to improve the biological diversity through the proposed mitigation activity		Yes. Only after taking more conservation steps.							

4.7.2 Impact Mitigation Matrix

Based on our observation, literature review and consultation with local people, NGO and forest department, following impact vs. mitigation matrix is formulated for probable impacts of the proposed activity up to radius of 10 km:

Impacts of the proposed activity is given below

Impact component	Project Phases			Study Zones			Impact quality			Mitigation Measures Needed
	Construction	Operation	Post Operation	On site	Core zone	Buffer zone	Magnitude	Duration	Direct or indirect	
Protected Areas (NP/ WLS)	-	-	-	-	-	-	-	-	-	-
Reserve Forests	Y	Y	-	-	Y	Y	L	L	I	-
Ramsar site	-	-	-	-	-	-	-	-	-	-
Wetlands of National Importance	-	-	-	-	-	-	-	-	-	-
Wetlands of International Importance	-	-	-	-	-	-	-	-	-	-
Lentic water bodies	-	-	-	Y	Y	Y	L	L	I	-
Lotic Water bodies	-	-	-	-	Y	Y	-	-	-	-
Flora and Fauna										
Endangered Fauna (Schedule-I)	-	-	-	-	-	Y	L	L	I	-
Endemic Species	-	-	-	-	-	-	-	-	-	-
Threatened / Near Threatened	-	-	-	-	-	-	-	-	-	-
Vulnerable species	-	-	-	-	-	-	-	-	-	-
Ecological Sensitivity										
Elephant corridors	-	-	-	-	-	-	-	-	-	-
Important Bird Migratory Path	-	-	-	-	-	-	-	-	-	-
Breeding/ Nesting habitats	-	-	-	-	-	-	-	-	-	-
Loss of fodder resources	-	-	-	-	Y	Y	M	L	I	-
Loss of carbon sink	-	-	-	Y	-	-	L	M	D	Y
Crop lands and plantations	-	-	-	Y	Y	Y	M	L	I	-

Note: Y=Yes; L=Low; I=Indirect; M= Medium

Based on the above analysis, it can be concluded that there are few ecologically sensitive habitats in core and buffer zones, the impact will be there on any such habitat. But to promote the environmental sustainability of the total area, the conservation measures could be taken up.

4.7.3 Potential Impact due to Location

There are no wildlife sanctuaries or biosphere reserves or nesting or breeding grounds for any of the rare species or other protected areas within the project area. There are no national parks or wildlife sanctuaries or biosphere reserves or nesting sites for threatened species

either in the study area or around it in a radius of over 10 km. There are no ecologically sensitive areas within the 10 km radius. The project site is not situated within or adjacent to any cultural heritage sites, protected areas, buffer zones of protected areas, or special areas for protecting biodiversity. As such the area identified for the project is not ecologically sensitive.

The primary survey reveals that there are specific patches for certain species and mass plantations such as Eucalyptus, mango etc. There are good number of plantations on the road side such as *Ficus*, *Polyalthia longifolia*, *Alstonia scholaris*, *Peltophorum pterocarpum*, *Samania saman*, *Delonix regia*, *Tectona grandis* and *Acacia auriculiformis*.

4.7.4 Potential Impact due to Construction

The impacts caused by construction activities include the following:

- Exhaust emissions from diesel run engines, construction machinery and vehicles
- Dust suspension during site preparation, construction and material transport
- Noise caused by vehicles transporting construction material
- Noise caused by handling of construction materials
- Noise & exhaust emissions from diesel run engines of construction machinery

During construction the transport of construction material will cause dust emission, emission of exhaust gases from vehicles such as CO₂ CO and NO_x. The fugitive dust may coat the leaves of plants and trees. Fauna that occur in the project area and surroundings may be disturbed by the sound of vehicles, construction and construction equipment.

4.7.4.1 Mitigation Measures

Spraying of water during handling of construction materials like sand and gravel will minimise dust emission. Properly maintained vehicles will produce reduced noxious emission. And the temporary labour camps must have proper sanitation facilities. The impacts caused by construction to fauna are temporary and not long term and most (if not all) the observed and documented flora and fauna of the project area will adapt to these impacts.

4.7.4.2 Impacts on Flora

There are no national parks, wildlife sanctuaries or biosphere reserves within 10 km radius from the project site.

Baseline status of vegetation reveals that there are specific patches for certain species and mass plantations such as Eucalyptus, mango, Coconut etc. the presence of certain very common species such as *Borassus Sp.* and *Phoenix Sp.* dominant throughout the region. The larval and nectar host plants are very common. The proposed project construction activities may involve removal or thinning of some vegetation. Under the Greenbelt development plan suitable species of herbs and trees will be used for plantations based on "Guidelines for Developing Greenbelt" published by Central Pollution Control Board (CPCB) by involving local forest department or local community people.

Since patches of forest areas are located in study area, it will be taken utmost precautions not to further degrade these areas by constructing temporary roads, dumping materials, solid wastes, garbage or any other form of material in to the surrounding grasslands. Project activities may not have any significant impacts on the vegetation of project area and surrounding area.

4.7.4.3 Impact on Endangered Species

Decalepis hamiltonii is found in the project site which comes under RED listed category by IUCN. As per the present study, the population trend of this species is vulnerable. Hence the during the construction activities, loss of this species may lead to extinction of this species in this area.

4.7.4.4 Mitigation measures

Setting up of nurseries and plantation of *Decalepis hamiltonii* species shall be taken up in consultation with Forest department in the selected common conservation zone.

4.7.4.5 Impacts on Fauna

The large scale construction activities in the proposed core area and related roads and transmission lines would involve movement of vehicle and people, digging of soil, material loading, and erection of towers and stringing of conductors, etc.

It is observed that there are number of small to medium seasonal water bodies and forest plantation patches present in 10 km periphery of the proposed project and therefore envisaged that during winter season, birds may move between these water bodies.

In the project area only domestic and feral animals such as cattle, goats, crows, dogs and cats were observed.

Power lines are often known to be the main reason for bird collision and death. The bird collision incidences are normally species specific and vary seasonally. It is therefore recommended that power transmission lines shall be laid carefully. It is suggested that maximum precautions should be taken during construction phase and as well as during operational phases.

4.7.4.6 Mitigation measures

- Ensure no pollutants discharged into water bodies, No power lines be laid near or over water bodies.
- Do not cause any direct or indirect disturbances to forest plantation and water bodies located in study area

4.7.4.7 Mitigation Measures

- Discharge of wastes/wastewater without treatment into the water bodies during the construction and operation would not be allowed
- Awareness will be given to workers about the importance and conservation of terrestrial ecology and biodiversity

4.7.5 Potential Impact due to Operation

During the Operation phase, movement of vehicles may cause the fauna to flee because of the noise. In addition to the above; dust from vehicles may be resired by the fauna, if not handled properly.

4.7.5.1 Mitigation Measures

Impact : Flora & Faunal species	Construction & Operation Phase
Impact Nature	Negative
Impact Type	Direct & Indirect
Impact Duration	Short-term

Impact Extent	Local
Impact Magnitude	Small
Receptor Sensitivity	Low & Medium
Impact Significance	Minor
Residual Impact Magnitude	Small
Residual Impact Significance	Negligible

It is proposed that all the vehicles in handling the goods will conform to Pollution under Control (PUC) norms and vehicles will be driven on paved surface throughout the access road.

The activities associated with the proposed activity will have very less impacts on terrestrial flora and fauna of the core area and buffer zone area.

The overall impact of the project is:

Magnitude:	less
Extent:	The extent of the impact is on-site as the impacts will be limited to the boundaries of the Site.
Duration:	The duration would be short-term as the natural vegetation of the site would be affected during the construction phase.
Intensity or magnitude:	The intensity is moderate during construction and operation phases.
Reversible or Irreversible:	All the activities will impact on local biodiversity in irreversible way.

The project area and the adjoining areas shares similar habitat and thus clearing of ground will not eliminate habitat of any species permanently. Ecological restoration is about a broad set of activities (enhancing, repairing, or reconstructing degraded ecosystems and optimizing biodiversity returns). In essence, the restoration of the habitat loss due to the present project activity is based on ecosystem reconstruction at the project site. In this view, it is proposed to plant the trees and undertake development of green belt in the project area at all possible places. This will also enhance the native faunal population.

CHAPTER 5

ANALYSIS OF ALTERNATIVES

Chapter 5 Analysis of Alternatives

The analysis of alternatives was an integral part of the project development process throughout the project cycle. Site and master plan layout alternatives considered in this project are discussed in this chapter.

5.1 Alternatives considered for Site Selection

Keeping in view the requirements as per the GOI's National Manufacturing Policy for NIMZs and future industrial requirements for the newly carved state of Telangana, TSIIC had identified three locations for development of NIMZ in the state and analysed to select the most suitable site location for development. The three alternatives considered were:

- Site 1: Siddipet District
- Site 2: Nalgonda District
- Site 3: Sangareddy District

5.2 Criteria for Alternative Site Evaluation

The identified land parcels were preliminarily evaluated based on the following parameters.

- As per the NIMZ policy, minimum size of land area shall not be less than 5000 acres.
- Minimise adverse environmental impacts
- Suitability of land in terms of topographical and geological aspects.
- As much as possible, Land shall be free from habitation, forest land agricultural activity, and archaeological/historical monuments
- No/Minimum Rehabilitation and Resettlement (R&R)
- Suitability for phased and integrated development
- Scope for future development
- Site slope and drainage pattern
- Connectivity:
 - **Road:** Transportation of goods and movement of people from/to the NIMZ to the hinterland. Further, connectivity to nearby State/ National Highways is desirable to provide cost effective and efficient transportation solutions.
 - **Seaport:** To provide an access to international markets in terms of import and export. Seaports providing dry bulk and break bulk cargo handling facilities with ample storage facilities to handle the cargo movement required for NIMZ.
 - **Rail:** Transportation of goods and movement of people from/to the NIMZ to the hinterland. Further, connectivity to nearby main railway line is desirable to provide cost effective and efficient transportation solutions.
 - **Airport:** Import and export of airborne cargo and movement of people.
- Availability of water and power
- Proximity to domestic markets: As the units in NIMZ will avail/provide goods from/to Domestic Tariff Area, it is important to consider easy access to domestic markets.
- Distance from Eco-sensitive areas: Site shall be devoid of eco-sensitive areas like wild life sanctuaries, national parks, biosphere reserves, etc., and shall be far away as much as possible.

5.3 Evaluation of Alternative Sites

Evaluation of alternative sites is given in **Table 5-1**.

Table 5-1: Evaluation of Alternative Sites

Detail	Site 1 (Siddipet District)	Site 2 (Nalgonda District)	Site 3 (Sangareddy District)
Location	In Cheriyal and Kondapak Mandals Komaravalli and other (9) villages in Cheriyal mandal and Kondapak and other (6) villages in Kondapak Mandal	In Chintapalli Mandal Vinjamur, Anaboinapalli, Ramanapadu, Muddapalli, Warukalu, Mallepalli, Ailapur, Kurmapalli of Chintapalli Mandal	In Nyalkal and Jharasangam Mandals 14 villages of Nyalkal and 3 villages of harasangam Mandal
Latitude	17°57'12.00"N	16°51'25.00"N	17°47'24.00"N
Longitude	78°55'26.00"E	78°48'43.00"E	77°39'1.00"E
Land availability (acres) - As per the NMP, Size of land for NIMZ (An NIMZ would have an area of at least 5000 hectares (12355 acres) in size)	~13,500 acres	~ 3,200 acres- contiguous land is not available more than 3200 acres	~12,635 acres
Land Use	Agricultural Fallow land, Agricultural Crop land	Agricultural Fallow land, Agricultural Crop land	Agricultural Fallow, crop & Barren/Uncultivable/Waste land. No Forest land is involved.
R&R Issues	Land acquisition and R&R (More) is envisaged. Land to be acquired from private parties Two to three settlements are within the boundary and R&R issues will be more	Land acquisition and R&R (Less) is envisaged. Site has smaller settlements/villages	Land acquisition and R&R (Moderate) is envisaged. About 2897.35 acres of land is already in possession of TSIIC
Road	SH 1: adjacent SH 9: adjacent	SH 19: Adjacent Outer Ring Road: ~52km NH 65 : ~64 km	SH-14: Adjacent/passing through SH-16: Adjacent/passing through NH-65: ~10 km from Hyderabad Outer Ring Road: ~80km
Railway Line (in km)	Nearest SCR line: ~37 km, Nearest Station: ~35 km (Janagaon)	Nearest Station: Jadcherla ~117 km	Passing through the site. Nearest Station: Metalkunta ~1.4 km
Seaports (in km)	Machilipatnam Port: ~312km Krishnapatnam Port: ~426km Mumbai Port: ~645Km Mangaluru Port: ~710Km	Machilipatnam: ~263km Krishnapatnam: ~316 Mumbai Port ~665 Mangaluru Port ~610	Machilipatnam: ~420 km Krishnapatnam: ~465 km Mumbai Port ~510km Mangaluru Port ~612km
Airports (in km)	Hyderabad (aerial ~94 km)	Hyderabad (aerial ~53 km)	Hyderabad (aerial ~100 km)
Sensitive Areas such as National Parks/Wildlife Sanctuaries/Biospheres within 25 km Radius	Nil	Nil	Nil
Nearest major Settlement distances	Siddepet ~11 km, Cherital ~3 km	Devarakonda ~20 km	Zaheerabad ~10km Bidar ~10km
Areas which are important or sensitive for	Reserve Forests (RF) Marpadiga RF	Reserve Forests (RF) Godkondla no 1 RF	Reserve Forests (RF) Shamshalaipur R.F (TS)
	4.2 km NW	6.1 KM NW	Adjacent, N

Detail	Site 1 (Siddipet District)		Site 2 (Nalgonda District)	Site 3 (Sangareddy District)	
ecological reasons - Wetlands, watercourses or other water bodies, coastal zone, biospheres, mountains, forests	Kondapak RF	1.8 km W	Takkallapalli RF 7.5 KM N	Rajola R.F Kalbewal RF	1.1 km, W Adjacent, W
	Gurannapet RF	4.6 km SW	Kurmapalli RF 2.9 KM N	Sahapur R.F Godepalli	1.5 km, N 2.8 km, W
	Nagpur RF	9.0 km S	Kondur RF 6.1 KM N	Didgi R.F Digwal R.F	2.8 km, S 4.7 km, SE
			Yeragandlapalli RF 11.2 KM N	Zahirabad R.F (TS)	4.9 km, S
			Ghade gauraram RF 4.5 KM NE	Chitta R.F (KA)	6.1 km, W
			Krishtaram palli RF 2.6 KM NE	Tadapalli R.F (KA)	7 km, SW
			Edlugandi RF 3.7 KM NE	Honnadi R.F (KA)	9.5 km, SW
			Marrigudem RF 4.3 KM NE	Hadnuri RF	Adjacent, S
			Potti gutta RF 2.6 KM NE	Vadirupur RF	0.1 km, SE
			Tungapati gauraram RF 2.3 KM E	Sirsangandla RF 9.7 KM S	
			Mudigonda no1 RF 6.7 KM SE		
			Mallareddipalli RF 6.4 KM SE		
			Mudigonda no2 RF 8.8 KM SE		
			Vavilikole RF 7.5 KM SW		
			Sirsangandla RF 9.7 KM S		
Inland, coastal, marine or underground waters	Two streams are following through the site connecting to Chital Nala Dumat Nala – Adjacent N Chital Nala – Adjacent E Oganiayan Cheruvu: ~3.0Km NE Siddipeta Vagu: ~11.5kmN Oracheruvu: ~12km N Komati Cheruvu: ~12 km NW Kureli Vagu: ~13km W		One stream is passing through the site Bhimanapalli Vagu: ~8.0km		Madhura Nadi, 0.2 km, S Manjira River, 12.5 km, NE Kotturu reservoir, 13.7 km, SE Singuru Reservoir, 13.0 km, NE Narinja Reservoir, 1.5 km, S
State, National boundaries	-		-		Telangana – Karnataka State Boundary adjacent to project site
Routes or facilities used by the public for access to recreation or other tourist, pilgrim areas	SH-1: Passing through project site SH-9: Passing through project site		-		SH-14; Passing through project site SH-16; Passing through project site NH-9 (NH-65), 8.4 km, S South Central Railway, passing across project site
Densely populated or built-up area	Siddipet: ~11.5km NW		Devarakonda: ~20km SE		Zaheerabad (Telangana State), 9 km, S Bidar (Karnataka), 8 km, NW
Environmental Setting for Manufacturing Activities	-		-		Existing industrial base near Zaheerabad will be added advantage. More favourable Eco System to setup manufacturing industries due to proximity to Hyderabad
Water Availability	No perennial surface water		No perennial surface water		Availability of Water from

Detail	Site 1 (Siddipet District)	Site 2 (Nalgonda District)	Site 3 (Sangareddy District)
	resource nearby	resource nearby	Singur reservoir
Areas already subjected to pollution or environmental damage. (those where existing legal environmental standards are exceeded)	Nil	Nil	Nil Patancharu which was declared as CPA is around 70 km away from proposed site
Areas susceptible to natural hazard which could cause the project to present environmental problems (earthquakes, subsidence, landslides, erosion, flooding or extreme or adverse climatic conditions)	Proposed development area falls under Seismic Zone II (Low Damage Risk Zone) as per IS 1893 (Part I).	Proposed development area falls under Seismic Zone II (Low Damage Risk Zone) as per IS 1893 (Part I).	Proposed development area falls under Seismic Zone II (Low Damage Risk Zone) as per IS 1893 (Part I).

Considering the sufficient Land availability, Minimal R&R, Involvement of Scrub land, Barren/Uncultivable/Waste land, Better connectivity and without Environmental Sensitive Areas, Site 3 (Near Zaheerabad) has been selected for the Development of NIMZ. Site 2 mainly not meeting criteria fixed in national manufacturing policy (NMP) i.e., area of at least 5000 hectares (12355 acres) shall be minimum size of NIMZ area. Site 1 has more resettlement & rehabilitation, less government land availability and no reliable water resource is not a good option for this large scale development of NIMZ.

After selection of Site 3 at Zaheerabad, TSIIC along with their project consultants IL&FS Infrastructure Development Corporation (IIDC) has carried out thorough analysis of land delineation with an aim to eliminate R&R, to include mostly scrub land and waste land etc. It is pertinent to mention that there is no forest land involved in the area proposed for NIMZ development. Though there are Reserve Forests are observed in the study area, there is no Flora and Fauna of conservation significance is observed.

After elimination of unsuitable sites, the residue sites were assessed (with regard to connectivity, physical site features, impact on adjoining land use, etc.) for suitable integration to form into a single NIMZ region. In order to assimilate the land parcels into a contiguous land parcel, intermittent areas were identified, by excluding settlements / gaonthan lands, and conforming to the NMP guidelines.

The land delineated for the NIMZ therefore primarily includes government-owned lands. Areas in proximity to eco-sensitive areas like Manjira River and Singur Reservoir have been avoided and adequate buffer has been provided between the NIMZ lands and these eco-sensitive zones.

The selected site was approved by the High Level Committee (HLC) including Ministry of Environment and Forests, chaired by Secretary to GoI (DIPP) as per NIMZ Scheme and final approval for the Zaheerabad NIMZ was accorded on January 22, 2016.

5.4 Master Plan Options

Three Conceptual Master Plan (CMP) needs to be prepared for NIMZ. Three CMP are prepared for NIMZ based on the following outline.



5.4.1 Conceptual Master Plan

5.4.1.1 Approach

Based on the spread and shape of the project site, regional linkages, proposed entry exit points, wind directions, terrain, and existing features in and around the project site.

Option -1: Developed with North-South road pattern, retaining all the existing features within the site (settlements, wind turbine, streams, etc.). Main road network connects the eastern and western part. Entry for the phase 1 area is planned from existing Bardipur village road which needs to be strengthened and few of the existing roads are planned to be retained within the CMP with proper strengthening. Rail siding is branched from the main line and extended till the central zone near SH-16 and provide suburban connectivity for NIMZ. Residential Zone is planned in two parcels major one in the central portion in upwind direction and other near to the existing settlements. Large land parcels are zoned for few industrial sectors to accommodate large enterprises in this option which will act as anchor industries.

Option -2: Entire eastern layout/master plan road network is planned parallel to SH-16, so it can accommodate large industries. This approach also minimises realignment of natural streams, since they become nearly parallel or perpendicular to proposed road network. This also gives advantage to have Badripur-Chilepalle-Rukmapur road nearly parallel to road network and can act as internal road. Entry area is planned from existing Bardipur road which needs to be strengthened and few of the existing roads will be retained with proper strengthening.

All the existing access to the road will be appropriately connected to the internal roads. Main entry /exist at the ultimate phase will be from SH-14 and SH-16. Rail siding is branched from the main line and extended till the central zone near SH-16 and provide suburban connectivity for NIMZ. Residential Zone is planned in two parcels major one in the central portion in upwind direction and other near to the existing settlements. Amenities and utilities are zone based on their requirements.

Existing Rukmapur and Mungi settlement (within the project boundary) will be relocated between settlement of Chillepalle and Mungi. This will give continuous residential development and at periphery of eastern boundary it can have dedicated access from Badripur Chillepalle to Rukmapur. This will facilitate continuous industrial plots and segregation of traffic for industries and settlements.

Industrial area is planned in uniform zones to have mid to small size plots. Master plan is flexibly planned, in case large land parcels are required, internal roads can be clubbed to arrive at large zones. This can accommodate large enterprises.

Option -3: Developed with North-South road pattern. Existing roads will be terminated near the settlements/ NIMZ boundary. Existing settlements are retained. Existing streams will be

diverted through the road side drains. Residential area is planned and zoned in three locations in upwind directions. The parcellation of plots is done depending upon the types of industries to be accommodated.

Occupant units can merge or sub-divide the plotted land into appropriate sizes to meet their own requirements. Conversely, the larger plots can be subdivided by introducing some minor roads if the demand is for small plots.

5.4.1.2 Land use pattern

The land use pattern of the NIMZ is determined considering the land requirement for various industrial units, logistics requirements, industrial infrastructures, technical infrastructure residential zone, various social amenities and commercial spaces etc.

5.4.2 Rational for Conceptual Master Plan Options

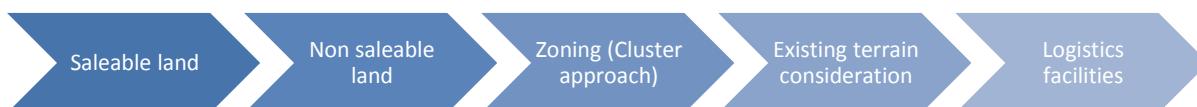
The major parameters described based on the common basic zoning principles given in **Table 5-2**.

Table 5-2: Conceptual Master Planning Parameters

Parameters	Option 1	Option 2	Option 3
Road network	Grid is aligned North South	Grid is aligned parallel to SH16	Grid is aligned North South
Railway siding	Alignment runs parallel to primary road and crosses SH14 near entry/exit. Siding is extended near initial development area.	Alignment has few curvatures and runs around the existing religious structure (Multani baba dargha). Siding is extended near Initial area.	Alignment planned with connection on both sides of existing line. Shortest rail siding and planned only in overall development area.
Residential	Zoned in central (for Overall development) and near Yelgoi (for Initial).	Zoned in central (for Overall development) and near Yelgoi (for Initial).	Zone in Southeast, Central and Southwestern portion.
Existing streams of Lower Order	Zoned as green buffers and retained.	Zoned as green buffers as continues green corridor with walkways.	Planned to retrench and divert along the road side drains.
Existing roads within the project site	Partly to be retained (strengthened) and partly to be terminated (by diverting to nearest road). Internal road network connects to all existing roads at project boundary.	Partly to be retained (strengthened) and partly to be terminated (by diverting to nearest road). Internal road network connects to few existing roads at project boundary.	Existing road to be terminated up to the settlements (within the project site).
Existing settlements	Are retained with appropriate green buffers	Few settlements are to be relocated and others are retained	Are retained with appropriate green buffers

5.5 Recommended Conceptual Master Plan Option

The three master plan options as discussed in detailed in the Conceptual Master Plan Report are compared and evaluated to arrive at the recommended or consultant preferred conceptual master plan option for NIMZ Zaheerabad. These conceptual master plans were evaluated and ranked based on the following parameters /criteria



Consolidated evaluations of the options are presented in **Table 5-3**.

Table 5-3: Evaluation of Conceptual master Plan Options

Parameters	Option 1		Option 2		Option 3	
	%	Marks	%	Marks	%	Marks
Saleable Areas						
Industrial Zone	49.6	7	49.7	7	54.6	8
Commercial	2.2	6	1.3	5	5.1	7
Residential Zone	5.5	6	6.6	7	4.2	5
Logistic Zone (Warehousing)	2.4	7	2.5	7	0.8	4
Logistics (Parking)	0.5	6	1.0	7	0.4	6
Logistics (Rail)						
Length of yard	2.85	6	3.1	7	2	5
Scope for future expansion of Rly yard	2.85	6	3.1	7	1.4	4
Amenities	1.1	6	0.7	5	1.3	6
Non saleable Areas						
Green Zone	16.6	7	17.7	8	16.4	6
Utility	7.4	7	5.8	6	1.0	4
Roads	9	7	8.5	8	8.7	8
Diversion of existing road		6		7		4
Diversion of existing stream		6		6		4
Terrain						
Obstacle of natural features		6		7		5
Cutting		6		7		5
Filling		6		6		5
Master plan						
Orientation & formation of odd areas		6		7		8
Vastu (for Plots)		7		5		7
Total		114		119		101

Out of the three options, Option 1 is the preferred based on the above parameters with certain suitable improvements.

5.6 Sewage treatment plant technology

Sewage treatment is the process of removing contaminants from wastewater, comprising of storm run-off, domestic sewage from both non industrial & industrial consumers. It includes physical, chemical and biological processes to remove various contaminants.

Various sewerage treatment systems considered for selection of treatment system are given in **Table 5-4**

Table 5-4: Various sewerage treatment systems

S. No.	Process	Units required	Accessories
1	Activated sludge – extended aeration	Aeration tank & secondary clarifier	Surface aerators or membrane diffuser system for oxygen supply
2	Aerated lagoon	Earthen bund basins	Fixed or floating aerators for oxygen supply
3	Up-flow Anaerobic Sludge Blanket (UASB)	Reactor with liquid, solid & gas separation facilities	Gas collector, burner and influent distribution system
4	Trickling filters	Circular tanks with media, under drain & secondary clarifier	Rotary distributor for influent and re-circulation pumps
5	Rotating Biological Contactors (RBC)	Trough with PVC/plastic discs, secondary clarifier	Drive mechanism for rotating the discs
6	Fluidized aerobic bio reactor	Reactor tank with poly propylene media and diffusers followed by secondary clarifier	Blowers for supply of oxygen through membrane diffusers
7	Sequencing Reactor (SBR)	Batch It uses deep RCC basins, and very efficient oxygen transfer equipment's (diffused aeration mechanism)	Diffusers, blowers and aeration grid, which provides highest aeration and oxygen transfer efficiency. Decanter assembly in Stainless steel equipped with variable frequency drive to

S. No.	Process	Units required	Accessories
			automatically control rate of decanting based on input feed condition
8	Membrane Bio Reactor (MBR)	Aeration tanks followed by balancing tank and membrane bio reactor	Diffusers, blowers to supply oxygen, air compressors for backwashing, chemical dosing for pre-treatment.

Table 5-5: General comparison of STP technologies

S. No.	Description	Conventional Type (Extended aeration / activated sludge process)	FABR / MBBR (Fluidised Aerobic Bio reactor / Moving Bed Bio reactor)	SBR (Sequential Batch Reactor)	MBR (Membrane Bio Reactor)
1 Major Components					
A	Primary treatment	Screen chambers, stilling chamber, grit chamber	Screen chambers, stilling chamber, grit chamber	Screen chambers, stilling chamber, grit chamber	Screen chambers, Grit chamber, Aeration tank, balancing tank
B	Secondary treatment	Aerator (surface), clarifier	Reactor with diffuser, clarifier	C-tech basin (both aeration and clarification in one tank)	Membrane Reactor, TSE Back pulse tank
C	Tertiary treatment	Pressure sand filter, activated carbon filter / dual media filter	Pressure sand filter, activated carbon filter / dual media filter	Not required	Not required
2	Process	Continuous	Continuous	Batch	Continuous
3	Area requirement	High	Medium (about 70% of conventional type)	Medium (about 60% of conventional type)	Medium (about 80% of conventional type)
4	Power requirement	High	Less compared to conventional type	Less compared to conventional type and FABR	High
5	Operational power	Constant – for different inflow capacity	Constant – for different inflow capacity	Vary according to the inflow capacity	Constant for different inflow capacity
6	Minimum operating capacity	70-80% of designed capacity	40-50% of designed capacity	30-40% of designed capacity and 20% with 30% power consumption	70-80% of designed capacity
7	Output Quality control	Manual checking and manual adjustment	Manual checking and manual adjustment	Partially automatic	Manual checking
8	Output quality	Varies	Remains constant for maximum extend	Remains constant	Remains constant. Membrane need to be replaced once in 5 years
9	Fouling	Un avoidable due to surface aerator	Very minimal	Very minimal	Very minimal
10	Future expansion	Additional units need to be added	By adding more media up 50% capacity can be enhanced. More than this capacity additional units need to be added	Additional units need to be added	Additional units need to be added
11	Treatment plant suppliers - technology	No patent and can be designed by anybody	Only few companies have expertise in this field	Technology being supplied by C-TECH and any construction contractors can offer treatment plant as	Only few companies have expertise in this field

S. No.	Description	Conventional Type (Extended aeration / activated sludge process)	FABR / MBBR (Fluidised Aerobic Bio reactor / Moving Bed Bio reactor)	SBR (Sequential Reactor)	Batch	MBR (Membrane Bio Reactor)
				turnkey jointly with C-TECH / AMRENVERGYS		
12	Capital cost	Low	Higher than conventional type	Construction cost is lower and mechanical instrumentation cost is higher than two process	Higher than conventional type	
13	Operating cost	Very high	high	Low (will vary depending upon the inflow capacity)	High	

5.6.1 Sewage treatment plant technology selection

Factors considered for selection of appropriate treatment system:

- Reliability
- Vector nuisance
- Area availability
- Power requirement
- Capital cost
- Operation & maintenance cost

The above process technologies are analysed in terms of the performance and both capital and operating cost. Based on the above analysis Sequential Batch Reactor (SBR) system is proposed.

This system has been widely used for municipal and industrial wastewater treatment applications to meet specific discharge requirements.

SBR technology advantages/benefits:

- Consistent high-quality, low nutrient level effluent
- Tolerates wide swings in flow and organic loading
- No clarifier required
- Better control over filamentous growth and settling problems
- Nutrient removal without chemicals – nitrification and de-nitrification, phosphate removal
- The system can also work with sewage in flow of 20 to 30 percentage of designed capacity due to presence of variable frequency drive (VFD)

SBR system is a fill and draw activated sludge system. SBR process uses high-efficiency oxygen transfer aeration equipment to satisfy the high-rate oxygen consumption requirement at the beginning of the “fill” and “aeration” cycles. SBR is efficient in carbonaceous pollutant removal and is easily modified to satisfy nutrient removal of nitrogen (N) and phosphorous (P). Because the fill, aeration, settlement and draw take place in the same reaction tank, SBR tank itself would serve as the clarifier.

CHAPTER 6

ENVIRONMENTAL MONITORING

PROGRAMME

Chapter 6 Environmental Monitoring Programme

In this chapter, environmental monitoring programme for the proposed Zaheerabad NIMZ is formulated. Environmental Monitoring Programme is an important component during environmental management of the project. The institutional mechanism to implement the planned mitigation and monitoring measures during all stages of the project is discussed in **Chapter 9**. The project management especially the Environmental Management Cell (EMC) (described in **Chapter 9**) should always go for a rational approach with regards to environmental monitoring. This includes judicious decision making in consultation with institutional stakeholders e.g. Telangana State Pollution Control Board (TSPCB) or reputed environmental consultants for appropriate changes in the monitoring strategy, i.e., changes in the sampling frequency, sampling location, monitoring parameters and any new/additional requirements.

6.1 Environmental Monitoring Programme

The following are the main objectives of the environmental monitoring program:

- Reuse of treated wastewater from CETP & STP and thus reduction in usage fresh water resources
- Provide information for documentation of monitoring of mitigation measures and impacts
- Tool for the statutory authority of unanticipated adverse impacts or sudden changes in the environmental condition due to the proposed project
- Provides information that could be used for evaluating the effectiveness of implemented mitigation measures
- Provides information that could be used to verify predicted impacts and thus validate impact prediction techniques
- The efficacy of the mitigation measures being followed during construction and operational phases can be assessed and the measures can be revised, made more stringent and reinforced based on the monitoring results
- Environmental Monitoring can also serve a basic component of a periodic environmental regulatory auditing program for the proposed project
- Coordination with local bodies with regards to solid waste management

The following programme as detailed in the **Table 6-1** for construction as well as operation phases shall be implemented by the NIMZ authority. Besides the monitoring, the compliances to all environmental clearance conditions and regular permits from TSPCB/MoEF&CC shall be monitored and reported periodically. The likely significant impacts and mitigation measures will also be monitored.

The environmental attributes to be monitored during construction and operational phases of the project, specific description along with technical details of environmental monitoring including the monitoring parameters, methodology, sampling locations and frequency of monitoring are presented in Section below.

The environmental monitoring programme proposed to be followed by NIMZ authority has been formulated in **Section 6.1**. Member industry shall monitor all environmental parameters such as air quality, noise levels, treated wastewater, water quality, etc., within their industry premises as per the stipulations laid by TSPCB/MoEF&CC in their respective Environmental Clearance/Consent for Establishment (CFE)/ Consent For Operation (CFO).

Table 6-1: Environmental Monitoring Programme

Environmental Attributes	Parameters to be monitored	No. of Sampling Locations	Frequency of Monitoring	Standards Methods for Sampling & Analysis	Compliance
Construction Phase					
Air Quality	PM ₁₀ , PM _{2.5} , SO ₂ , NO ₂ , CO, O ₃ , Pb, NH ₃ , C ₆ H ₆ , BaP, As, Ni, and VOCs	Two (02) <ul style="list-style-type: none"> • Hadnur Village • Metalkunta Village Five (05) Continuous AAQ monitoring stations in the project site	Once a month during construction	As per standard methods of measurement as suggested in NAAQS (2009).	National Ambient Air Quality Standards released during November, 2009 is given as Appendix E
Noise Levels	Day and night noise levels	Three (03) <ul style="list-style-type: none"> • Project site • Hadnur Village • Metalkunta Village 	Once a month during construction	Portable hand-held noise level meter.	National Ambient Noise Standards is given as Appendix F
Water Quality	Physical, Chemical and Biological	Groundwater (02) <ul style="list-style-type: none"> • Hadnur Village • Metalkunta Village Surface water (01) <ul style="list-style-type: none"> • Narinja Reservoir • 	Once a month during construction	Sampling and analysis by using standard methods.	IS10500, 2012 drinking water standards for Groundwater is given as Appendix G Designated Best Use Classification of Inland Surface Water of National Rivers Conservation Directorate, MoEF&CC for Surface Water is given as Appendix H
Soil	Soil texture, type, electrical conductivity, pH, infiltration, porosity, etc.,	Three (03) <ul style="list-style-type: none"> • Project site • Hadnur Village • Metalkunta Village 	Once a year during construction	Collection and analysis of samples as per IS 2720	Baseline Soil Quality data as provided in Chapter 4 .
Meteorology	Wind speed, wind direction, rainfall, temperature, humidity.	Two stations within the project site	Hourly measurement during construction	IMD/CPCB manual	-
Stack Monitoring	PM ₁₀ , PM _{2.5} , SO ₂ , NO ₂ , NMHC (as C) and CO	At DG sets stacks used for Construction	Periodic	Standard Stack emission monitoring and analysis methods	Emission limits for new diesel engine more than 800 kW for generator set is given as

Environmental Attributes	Parameters to be monitored	No. of Sampling Locations	Frequency of Monitoring	Standards Methods for Sampling & Analysis	Compliance
Drinking Water Supply	Physical, Chemical and Biological	Drinking Water supply Source within Project Site (at Construction Site if any)	Periodic	Grab Sampling and Analysis	IS10500:2012 drinking water standards Appendix G
Groundwater level	GW level monitoring	Two (02) <ul style="list-style-type: none"> • Hadnur Village • Metalkunta Village 	Once a quarter during construction	Water level monitoring	-
Operation Phase					
Air Quality	PM ₁₀ , PM _{2.5} , SO ₂ , NO ₂ , CO, O ₃ , Pb, NH ₃ , C ₆ H ₆ , BaP, As, Ni, and VOCs	Two (02) <ul style="list-style-type: none"> • Hadnur Village • Metalkunta Village Five (05) Continuous AAQ monitoring stations in the project site	Once a month	As per standard methods of measurement as suggested in NAAQS (2009).	National Ambient Air Quality Standards released during November, 2009
Stack Emissions	PM ₁₀ , PM _{2.5} , SO ₂ , NO ₂ , CO and VOCs	Industrial Stacks to be monitored by respective industries	Periodic/Continuous	Standard Stack emission monitoring and analysis methods	Industrial Standards as prescribed by TSPCB/CPCB
Noise Levels	Day and night noise levels	Three (03) <ul style="list-style-type: none"> • Project site • Hadnur Village • Metalkunta Village 	Once a month	Portable hand-held noise level meter.	National Ambient Noise Standards
Water Quality	Physical, Chemical and Biological In addition to the above, Alpha, Beta emitters (surface water)	Groundwater (02) <ul style="list-style-type: none"> • Hadnur Village • Metalkunta Village Surface water (03) <ul style="list-style-type: none"> • Narinja Reservoir • At two (02) Storm water outlet locations 	Once a month	Sampling and analysis by using standard methods.	IS10500, 2012 drinking water standards for Groundwater Designated Best Use Classification of Inland Surface Water of National Rivers Conservation Directorate, MoEF&CC for Surface Water
Soil	Soil texture, type, electrical conductivity, pH, infiltration, porosity, etc.,	Three (03) <ul style="list-style-type: none"> • Project site • Hadnur Village • Metalkunta Village 	Once a year	Collection and analysis of samples as per IS 2720	Baseline Soil Quality data as provided in Chapter 4 .
Meteorology	Wind speed, wind direction, rainfall,	Two stations within the project site	Hourly measurement	IMD/CPCB manual	-

Environmental Attributes	Parameters to be monitored	No. of Sampling Locations	Frequency of Monitoring	Standards Methods for Sampling & Analysis	Compliance
	temperature, humidity.				
Treated Wastewater Quality	Physical, Chemical and Biological	<ul style="list-style-type: none"> • CETP Inlet • CETP outlet • STP inlet • STP outlet 	Daily	Sampling and analysis by using standard methods.	CETP and STP outlet standards given as Appendix J
WTP	Physical, Chemical and Biological	Outlet	Daily	Sampling and analysis by using standard methods.	Drinking water standards
Stack Monitoring	PM ₁₀ , PM _{2.5} , SO ₂ , NO ₂ , NMHC (as C) and CO	At Emergency DG sets Stack	Periodic	Standard Stack emission monitoring and analysis methods	Emission limits for new diesel engine up to and more than 800 kW for generator set
Groundwater level	GW level monitoring	Two (02) <ul style="list-style-type: none"> • Hadnur Village • Metalkunta Village 	Once a quarter	Water level monitoring	-

6.2 Wastewater Treatment and Disposal - Monitoring Mechanism

Considering the heterogeneous effluent characteristics from various sectors of NIMZ and in order to achieve most effective treatment of wastewater from all industrial zones, multiple CETPs will be developed. The CETP will be designed to reuse the treated wastewater into the system and thereby reduce the fresh water requirement. In order to have an effective functioning of CETPs, the following monitoring mechanism was proposed to be adopted for the industries which plan to utilise the CETP facility.

In order to have an effective functioning of CETPs, the following **Figure 6-1** monitoring mechanism was proposed to be adopted:

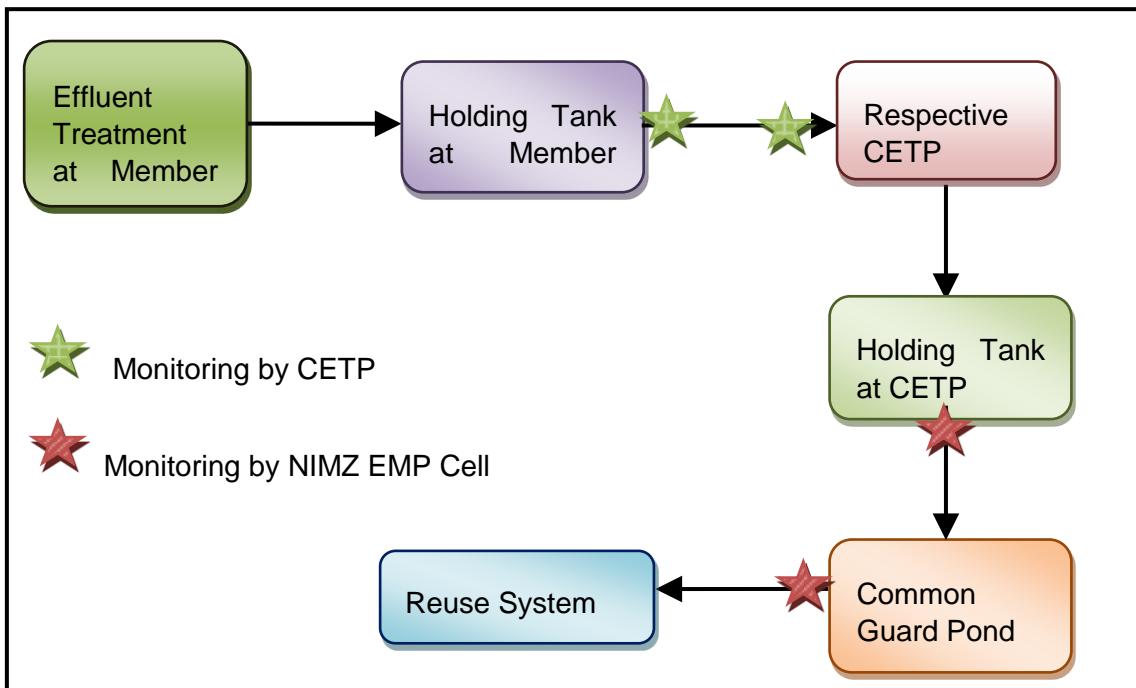


Figure 6-1: Wastewater Monitoring Mechanism

6.2.1 Monitoring Mechanism at Industry Level

- The member industry will treat the wastewater to pre-treatment standards i.e., CETP influent characteristics.
- Each industry shall have a minimum of 2 tanks for wastewater generated and the holding capacity of each tank shall be for a flow of 1 day.
- The wastewater outlet of each industry is connected from holding tank to respective CETP, holding tank will be having online monitoring facility for parameters like pH, TDS, COD, TOC and results will be displayed at respective industry premises and CETP monitoring room.
- The parameters such as heavy metals shall be monitored by manual sampling and results shall be recorded by respective CETP authority.
- Once the inlet effluent from industry is meeting the desired CETP inlet characteristics, valve will be opened and wastewater will be released to CETP for treatment.
- The lock and key operation of the valve will be totally controlled by respective CETP authority.
- Each industry shall maintain a log sheet of effluent quality/quantity on daily basis and same shall be maintained for future inspections by PCB and CETP authority.

- In case of non-compliance to meet the inlet characteristics of CETP found by CETP authority during the monitoring, member industry shall treat the wastewater until it meets inlet characteristics of CETP

6.2.2 Monitoring at CETP Level

- A monitoring point at inlet of CETP is also suggested to ensure the compliance of CETP inlet characteristics
- Holding tank will be having online monitoring facility for parameters like pH, TDS, COD, TOC and results will be displayed at respective CETP.
- The parameters such as heavy metals shall be monitored by manual sampling and results shall be recorded by respective NIMZ EMP cell.
- If the treated wastewater is meeting the reuse standards, valve will be opened and treated wastewater will be released to common guard pond.
- The lock and key operation of the valve at CETP holding tank will be totally controlled by NIMZ EMP Cell.
- Each CETP shall maintain a log sheet of inlet/outlet wastewater quality/quantity on daily basis and same shall be maintained for future inspections by PCB and NIMZ EMP cell.

In case of non-compliance to meet the reuse standards at CETP found by NIMZ EMP cell during the monitoring, CETP shall treat the wastewater until it meets reuse standards.

6.2.3 Environmental Monitoring by Member Industries

The environmental monitoring shall be carried out by each member industry as applicable within their industry premises:

- Stack monitoring
- ETP inlet/outlet
- Boiler/Cooling tower blow down, if any
- Industry specific pollutants

The plot allotment guidelines should clearly indicate the conditions of discharge and the consequences with regards to the penal action and the impact to ground water resources of the region. The member industries should not only limit the environmental monitoring as stated above, environmental monitoring programme in terms of parameters, location and frequency shall be formulated as per the stipulations laid by TSPCB/MoEF&CC in their respective Environmental Clearance/Consent For Establish (CFE)/Consent For Operate (CFO).

6.3 Compliance Reports

As a part of environmental monitoring programme, following compliance reports shall be submitted to TSPCB and Regional Office of MoEF&CC.

COMPLIANCE REPORTS	SCHEDULE
Half yearly compliance report	<ul style="list-style-type: none"> On 1st June and 1st December of every calendar year
Environmental statement	<ul style="list-style-type: none"> For the financial year ending 31st March to TSPCB on or before 30th September every year
Format for maintaining records of hazardous waste	<ul style="list-style-type: none"> In Form 3 as per Hazardous and Other Wastes (Management and Trans-boundary Movement) Rules, 2016.
Format for Manifest system (Movement Document)	<ul style="list-style-type: none"> For hazardous and other waste to be used within the country only in Form 10 as per Hazardous and Other Wastes (Management and Trans-boundary Movement) Rules, 2016.
Safety data sheet	<ul style="list-style-type: none"> For hazardous chemicals shall be maintained as per schedule 9 of MSIHC rules, 1989 (amended 2000)

COMPLIANCE REPORTS	SCHEDULE
Format for maintaining notification	<ul style="list-style-type: none">• Of major accident in schedule 6 as per MISHC rules, 1989 (amended 2000)
Water Cess returns in Form 1	<ul style="list-style-type: none">• As per Rule 4 (1) of Water (Prevention & Control of Pollution) Cess Rules 1978 on or before the 5th of every calendar month.

6.4 Plantation Monitoring Programme

Environmental Management team will monitor the following activities of greenbelt and landscape development:

- Development of nursery
- Treatment and sowing of seeds
- Watering
- Transport of seedlings
- Planting of seedlings
- Fencing of plantation area
- Weeding and soil working
- Pruning (trimming of plant)
- Replacement/Inter planting
- Watch and ward of plantation

During operation phase periodic monitoring of plantation growth, manuring, watering, pruning, and replacement will be performed in order to properly maintain vegetation, greenbelt, landscape and green cover.

6.5 On-site Mock Drills Requirements

On-site mock drills are very important as it helps employees to be aware of the safety procedures and how to react during the time of crisis. Conducting mock drills at regular intervals enhances preparedness and checks the viability of environmental/ disaster management plan. Mock drills are essential for the following reasons:

- Helps in revising/ improving the environmental/ disaster management plan
- Helps to evaluate whether the responsible officials are trained efficiently for the unforeseen event
- Helps in evaluating whether the emergency equipment are being maintained at Port premises

To ensure efficient environmental/disaster management, NIMZ authority/EHS department/EMP cell shall conduct periodic on-site mock drills in case of occurrence of the following activities:

- Fire; Natural calamities (cyclones, floods, earthquakes)
- Power break down
- Accidents
- Bomb threats; War alerts/terrorist attacks

Mock drills should also involve fire department, police, municipal authorities, hospitals and other department/ agencies that are mandated to provide emergency support. Documenting the outcome of mock drills is an important aspect as this helps in revising the existing plan more efficiently.

CHAPTER 7

ADDITIONAL STUDIES

Chapter 7 Additional Studies

7.1 Risk Analysis

The proposed NIMZ will have the following sub sectors of the industries

- Automobile
- Electrical Machinery
- Machinery
- Transport equipment
- Food Processing
- Metals
- Non-metallic minerals

Some of the major hazards identified from the sample industries are as follows:

Automobile

The assembly of motor vehicles can potentially create a number of E&S risk issues. Most of these risks are associated with substances which are used during the manufacturing process as well as hazards arising from waste and emissions. Automobile manufacturing industry involves organic solvents and significant volatile organic compound (VOC) emissions. Hazardous chemicals and process gases may be used in the assembly process of motor vehicles

Electrical Machinery

The semiconductors and electronics manufacturing process may include the use of numerous potentially hazardous chemicals. Metallic powders also may be present in the manufacture of passive components and magnetic devices.

A sample list includes: acetone, ammonia, ammonium hydroxide, arsine, boron trifluoride, carbon dioxide chlorine, chlorine trifluoride, diborane, dichlorosilane, disilane, fluorine, gallium arsenide, germane, hydrochloric acid, hydrofluoric acid, hydrogen, indium phosphide, methane, nitric acid, nitric oxide, nitrogen fluoride, nitrous oxide, ozone, phosphorus oxychloride, phosphine, phosphoric acid, silane, sulfuric acid, tetrafluoro methane, trichlorosilane, trimethyl arsenic, and trimethyl Indium etc. Proper mitigation measures have to be followed to reduce the risks associated with handling of these chemicals.

Food and Agro Processing Industry

Anhydrous ammonia is a popular refrigerant in food processing and manufacturing facilities. Especially in meat processing plants and other food processing plant it is found to be used. Despite that ubiquity, ammonia poses numerous risks to workers. Those hazards include:

- **Corrosive:** Ammonia can cause damage to the skin, eyes, and lungs.
- **Flammable:** Ammonia can be lethal at concentrations of roughly 15% to 28% by volume in air.
- **Explosive:** If released in enclosed spaces with a source of ignition present, ammonia can cause life-threatening explosions.

Food processing and manufacturing plants using ammonia as refrigerant must label all pipes that transport ammonia and hazard mitigation measures to be followed

Metals

Chemicals used during metal product manufacturing, in particular during sintering, surface preparation and finishing and also contact with allergenic elements (e.g. chromium, nickel, lead, and beryllium) will cause dermal hazards. Fumes containing metals, metal oxides, organic and inorganic compounds, particulates, dust, and VOC will cause inhalation hazards.

Certain welding techniques (including all the arc, plasma, laser and electron beam welding methods) use significant energy and generate radiation that may be dangerous for the operator. Another source of radiation involves X-ray stations for continuous monitoring of product quality.

Non-metallic minerals (except glass)

Cement dust is a particularly alkaline and irritant dust, and might therefore be considered to pose a greater risk of respiratory tract damage than many other poorly soluble dusts (generically often referred to as “low toxicity dusts”).

Hazardous properties relating to these substances are many and varied and include flammability, combustion potential, toxicity, corrosive potential and oxidising potential. Chemicals with such properties should be labelled with the appropriate internationally recognised hazard symbol. Some chemicals may only possess a hazard potential if they have the opportunity to react with other compounds.

Inadequate control or accidental releases of hazardous substances on site or in transit may result in significant environmental impacts in relation to soil, groundwater and surface water contamination and occupational health and safety, e.g. disposal of empty drums and packaging of fuel and chemicals.

A systematic Risk Analysis will help in identification of the hazards and associated risk. This study assesses risks associated with the construction and operation of the proposed NIMZ member industries or units coming up in the NIMZ has to carry out risk analysis by considering the hazards associated with handling of different chemicals or hazardous materials which will be used as per requirement of production/manufacturing process may include the use of numerous potentially hazardous chemicals. Material specific chemical protection programs shall be developed and implemented. Worker shall be protected from exposure to process chemicals including but not limited to acids, bases, solvents and metal sludge etc. Risks associated with handling storage of paints/chemical/equipment at proposed NIMZ are considered and accordingly mitigation measures are suggested in this DMP. This study provides inputs for formulating the onsite Disaster Management Plan (DMP) at NIMZ level. The Risk Analysis has been broadly divided into three categories.

- Hazard Identification
- Failure Frequency
- Risk Reducing Measures

7.1.1 Hazard Identification

A classical definition of hazard states “hazard is in fact the characteristic of system/ plant/ process that presents potential for an accident.” Hence, all the components of a system such as process, storage of chemicals, handling, etc., need to be thoroughly examined to assess their potential for initiating or propagating an unplanned event/ sequence of events, which can be termed as an accident.

Identification of hazards is of primary significance in the analysis, quantification and cost effective control of accidents. Potential Hazards identified in the proposed NIMZ have been broadly classified as below:

- Hazards during Construction Phase
 - Mechanical Hazards
 - Transportation Hazards
 - Physical Hazards
 - Storage and Handling of Hazardous Materials
- Hazards during Operation Phase
 - Material Hazards
 - Mechanical Hazards
 - Handling, Storage and Transportation Hazards
 - Plant Hazards
- Hazards due to Natural Calamities
 - Earthquake
 - Flood

7.1.1.1 Hazards during Construction Phase

Mechanical Hazards: Mechanical hazards during the construction phase arise due to the moving parts in the machinery, especially the belts and bolts of the construction equipment, which are heavy and pose a threat to the work personnel. Other hazards include falling (during working at heights), falling objects like hand held tools, etc., failure of slips and traps created for scaffolding, and due to faulting of electrical equipment.

Transportation Hazards: The planning of access/ egress to the construction site also plays a significant role in minimizing the associated hazards such as vehicles collision.

Physical Hazards: The noise and vibrations generated during the construction phase may affect the worker's health, hinder effective communication and may jeopardise sensitive organs. In addition to noise and vibration, hot works also pose a considerable hazard to the workers.

Storage and handling of hazardous materials: During the construction period, storage of hazardous materials like fuel for the engines, lubricants, paints and other flammable materials are likely to pose a fire and explosion risk. Due care shall be taken in locating these materials away from the work place, free of any influence of temperature or sparks or fire. Proper wiring of the electrical appliances like lights, exhausts, etc., would be made to ensure that there are no live wires causing short circuits to ignite these materials.

7.1.1.2 Hazards during Operation

The proposed NIMZ will house different type of industries and hazards associated during operation phase are discussed below:

Material Hazards: During operation, various types of raw materials, products and other materials will be handled at industrial units. Industrial plants deal with materials, which are generally hazardous in nature by virtue of their intrinsic chemical properties or their operating temperatures or pressures or a combination of these. Fire, explosion, toxic release or combinations of these, are the hazards associated with industrial plants using hazardous chemicals. Some of these materials can be flammable, explosive, toxic or corrosive etc. Hazardous substances may be classified into three main classes namely, flammable substances, unstable substances and toxic substances.

- Flammable substances require interaction with air for their hazard to be released. Under certain circumstances the vapours arising from flammable substances when mixed with air may be explosive especially in confined spaces. However, if present in sufficient quantity such clouds may also explode in open air.
- Unstable substances are liquids or solids, which may decompose with such violence, so as to give rise to blast waves.
- Toxic substances are dangerous and can cause substantial damage to life when released into the atmosphere at certain concentrations.

The ratings for a large number of chemicals based on flammability, reactivity and toxicity are given in NFPA (National Fire Protection Association) Codes and Material Safety Data Sheets (MSDS). The proposed industries shall maintain the records of NFPA classification and hazards due to exposure of materials to be handled.

Mechanical and Physical Hazards: Injuries may be caused to working personnel due to the operations like cutting, lifting, and rotating machinery. Lifting and carrying heavy or awkwardly shaped objects, such as bags, can result in manual handling injuries.

Handling, Storage and Transportation Hazards: Proposed NIMZ will involve handling of various materials in the form of Solid, Liquid and Gases which are required for the operations. The individual industry may have material transport from the nearest road/rail route. The hazards related to material transport may be due to accidents of vehicles, failure in mechanical transmission components etc., The Handling hazards include:

- Insufficient knowledge on hazardous nature of chemical in use leading to inappropriate handling of the chemical.
- Failure to use appropriate control measures and Personal Protective Equipment (PPE).
- Use of expired/ worn Personal Protective Equipment (PPE's).
- Failure of liquid/solid or gas delivery tools.
- Using of container with narrow opening for a process that evolves heat and/or gases.
- Mixing of oxidizing agents with flammable / combustible substances, etc.

Storage and Handling of Chemicals: A storage and Handling of Hazardous chemical is inevitable, they carry inherent characteristic risk to the employees due to the properties of chemicals such as toxicity and flammability. Chemicals are to be handled in standard containers like MS, HDPE, GI Drums, PVC Carboys, etc. All the chemicals, if any are to be arranged and stored in accordance with their compatibility, dry, well ventilated, with flameproof electrical equipment's and lighting. All the chemicals are to be provided with identification labels. Eye wash/Drench shower is to be provided at a strategic location for emergency purpose. Chemical Safety Data Sheets and handling procedure, First Aid measures are to be prepared and displayed for information and safety of the working personnel.

Plant/Industry Hazards: The various types of hazards in the plant/industries are as follows

- **Fire Hazard:** Flammable chemicals are used in the manufacturing process of the chemicals. So it is susceptible to catch fire either at the places of storage, transportation and processing if source of ignition is available. These chemical fires may cause to catastrophic effects. The sudden development of pressure ruptures the container and causes shock waves which cause the structure damage and outburst of reaction vessel. Fire is considered very dangerous if occurs in uncontrolled manner. It should be clearly understood that when a liquid is used having flash point below the normal ambient temperature, it could, in suitable circumstances, liberate a sufficient quantity of vapour to give rise to flammable mixtures with air

- **Explosion Hazard:** Release of energy in a rapid and uncontrolled manner gives rise to explosion. Extra care shall be taken by providing rupture disc, pressure release valve and temperature controller
- **Corrosion Hazard:** Most corrosive substances will produce chemical burns, while certain chemicals produce deep ulceration. Others have a detailing effect on skin and may cause dermatitis. This has adverse effects on weakening the strength of material in contact.
- **Electric Hazard:** Electrical power is the main driving force of the industry. There is a potential hazard in electrical equipment like electric cables, motors, heaters, lights, electrical major equipment/ machinery, operations, welding, motors, and heavy lift devices, cabling, human intervention (short circuit possibility), maintenance work (due to machinery breakdown etc.), plant lighting related electrical hazards etc. There will be a fire hazard due to sparks and short circuits in the electrical systems. Static electricity may develop during the transfer of solvent from one vessel to another vessel and may lead to sparks, if there is no proper earthing system, the electrical sparks will act as ignition source for flammable chemicals.
- **Other Hazards:**
 - Other toxic hazards due to acids/other toxic spillages (mainly limited to spillage area). The spillage if comes in contact with metal parts will produce hydrogen which is highly flammable gas. Any person moving in area and getting splash will get the injury. In addition the spillage will cause pollution problem. The spillage is to be collected and neutralized for toxic contents before disposal.
 - Hazards due to individual soft spots like walking casually and not noticing a pit and falling or colliding/stumbling or slipping (not noticing a wet place, etc.).

The indicative list of major plant/industrial hazards and their details are given in **Table 7-1**.

Table 7-1: Details of Indicative Major Plant/Industrial Hazards

Plant/Industrial Hazards	Details
Leaks/ruptures	Fracture: Breaking open of a containment system by the propagation of a crack
	Puncture: a perforation or hole in a containment system as a result of impact
	Relief device stuck open
	Seal/gasket/flange failure
	Corrosion/erosion
	Flow surge or hydraulic hammer
Incorrect actions or inactions by people	Operator opens a valve, etc.
Exceeding process limits	Over/under pressuring
	Over heating
	Over cooling
	Over filling
Control system failure	Sensors
	Logic solver
	Final elements
	Communication interface
	Field wiring
	Power source
Reactivity	Runaway reactions
	Air ingress
	Inadvertent mixing of chemicals
Structural Failure	Equipment support
	Foundations/floor
	Cyclic loading
	Pressure fluctuations
Utility failure	Electricity
	Instrument air

Plant/Industrial Hazards	Details
	Plant nitrogen
	Cooling water
Human external events	Vehicle impacts
	Dropped objects from lifting devices
Knock-on effects	Incident in adjacent processes
	Incident with process
	Combinations of equipment failures
Multiple failure	Combinations of human failure
	Combinations of external events
	Combination of any of these

7.1.1.3 Hazards due to Natural Calamities

In case of natural disasters such as earthquake, flood etc., occurring at the proposed NIMZ, may result in fire and explosions/toxic gas release due to failure of equipment. The damage consequences will be similar whether the damage is because of man-made disaster or natural calamity for the worst cases.

7.1.2 Damage Criteria

The nature of damage and extent of damage resulting from an accidental release of a chemicals in proposed NIMZ depends on several factors like nature of material, storage conditions, release conditions, atmospheric conditions etc.

The accidental release of hazardous chemicals during the operation of industries in the proposed NIMZ leads to subsequent events, which actually cause the damage. The damages are caused by

- Heat radiation
- Over pressure effects from explosions and
- Toxic effects

These events are applicable in case of any industrial units handling flammable materials and Toxic materials.

7.1.2.1 Thermal Radiation

The damages that may be caused due to heat radiation effect are given in **Table 7-2**.

Table 7-2: Damage due to Incident Radiation

Radiation level within the Fire (kW/m ²)	Degree of injury
37.5	Severe damage to unprotected plant
12.5	Initiation of secondary fires
4.0	Injury to people
1.75	Pain threshold reached after 60 seconds
0.7	Exposed skin reddens and burns on prolonged exposure

7.1.2.2 Over Pressure

When a flammable vapour cloud ignites, under certain conditions it may result in deflagration thus causing damage due to over pressure effects. The damage depends on the level of over pressure as indicated in **Table 7-3**.

Table 7-3: Effect of Over Pressure

Over pressure	Damage
0.3 bar	Heavy structure damage
0.1 bar	Repairable structure damage

Over pressure	Damage
0.03 bar	Major glass damage
0.01 bar	10% glass damage

7.1.2.3 Impact of Toxic Effects

A material may be considered as toxic or poisonous, when a small quantity can cause injurious effect on an average normal adult human being. There are several ways of expressing the severity of the toxic nature of the chemicals. These are:

- TLV - Threshold Limit Value.
- IDLH -Immediately dangerous to life and health
- LD_{LO} - Lethal dose low
- LD₅₀ -Median lethal dose

The Immediately Dangerous to Life and Health (IDLH) value which is a limit for personal exposure to a substance defined by the United States National Institute for Occupational Safety and Health (NIOSH), normally expressed in parts per million (ppm) can be considered as the reference concentration.

7.1.3 Typical Failure Frequencies

The hazardous material release scenarios can be broadly divided into two categories (i) catastrophic failures which are of low frequency and (ii) ruptures and leaks which are of relatively high frequency. Vapour or liquid releases from failure of gasket, seal and rupture in pipe lines and storage tanks fall in second category whereas catastrophic failure of storage tanks and full bore rupture of pipelines, etc. fall into first category. Typical failure frequencies are given in **Table 7-4**.

Table 7-4: General failure frequencies

Item	Mode of failure	Failure Frequencies
Atmospheric vessel	Serious leak catastrophic	1x10 ⁻⁴ / yr 5x10 ⁻⁶ / yr
Pressure vessel	Serious leak	1.0 x 10 ⁻⁵ /yr
	Catastrophic	3x10 ⁻⁶ /yr
Process pipe lines		
=50 mm dia	Full bore rupture	8.8 x 10 ⁻⁷ /m.yr
	Significant leak	8.8 x10 ⁻⁶ /m.yr
> 50 mm = 150 mm dia	Full bore rupture	2.6 x 10 ⁻⁷ /m.yr
	Significant leak	6x10 ⁻⁵ /m.yr
> 150 mm dia	Full bore rupture	8.8 x10 ⁻⁸ /m.yr
	Significant leak	6x10 ⁻⁶ /m.yr
Hoses	Rupture	3.5 x10 ⁻² /yr
Check valve	Failure on demand	1x10 ⁻⁴ /demand
Motor operated valve	Failure on demand	1x10 ⁻³ /demand
Flange	Leak	3 x10 ⁻⁴ /yr
Gasket failure	Failure	5 x 10 ⁻⁵ /yr
Pump seal	Leak	5 x10 ⁻³ /yr
Process Safety Valve	Lifts heavily	4 x10 ⁻³ /yr
	Blocked	1 x10 ⁻³ /yr
	Lifts lightly	2 x10 ⁻² /yr

Ref: 1) Loss Prevention in the Process Industries -Frank P. Ieles. Vol.2 & 3, 2nd edition.

2) TNO communication

7.1.4 Risk Mitigation Measures

- Consider feasibility of substitution of hazardous chemicals such as solvent based paints with less hazardous alternatives. Label chemicals with appropriate, internationally recognised, hazard symbols.
- Chemicals with different hazard symbols should not be stored together - clear guidance on the compatibility of different chemicals can be obtained from the Materials Safety Data Sheets (MSDS) which should be readily available from the manufacturer and on site.
- Store chemicals in a dedicated, enclosed and secure facility with a roof and a paved/concrete floor. Chemical tanks should be completely contained within secondary containment such as bonding.
- Install devices to prevent spills and overfills, e.g. alarms to warn of overfilling and automatic shut-off devices or secondary spill containment.
- Maintain and inspect storage units regularly.
- Consider installation and use of groundwater monitoring points on site to check for contamination. Implement a Solvent/Hazardous Materials Management Plan to monitor and control the use of solvents and hazardous materials on site.
- Necessary arrangement of firefighting facility as per various national and international codes for the facilities to avoid any major incident.
- To identify the hazards present in the system, a hazard identification study such as a Hazard and Operability study (HAZOP) should be undertaken by the individual industries. All hazards identified should be examined and appropriate mitigating measures developed and implemented.
- For all the hazardous material tanks where there is a single in/outlet line, a Remotely Operated Vehicle (ROV) (or an equivalent design to allow isolation of the tank from the line in an emergency) should be provided.
- First aid equipment and manpower resources are at place to deal with emergencies, in consultation with emergency services to rescue any personnel, trapped or immobilized by an accident scenario.
- Implement and maintain appropriate safety management systems to control the managerial and organizational factors that can impact on the overall risk associated with the hazardous materials.
- Carryout regular checks/maintenance and testing of instruments, valves and flange joints as per strict schedule. Pipelines, flanges and valves require special attention to minimize the failure rate.
- Prevention of potential ignition sources such as:
 - Proper grounding to avoid static electricity build up and lightening hazards (including formal procedures for the use and maintenance of grounding connections)
 - Use of intrinsically safe electrical installations and non-sparking tools.
 - Implementing permit systems and formal procedures for conducting any hot work during maintenance activities, including proper tank cleaning and venting.
- Facilities should also be equipped with Fire Detection and suppression equipment such as Fire tenders, all types of fire extinguishers like DCP, CO₂, water CO₂ foam types in adequate numbers, Fire Hydrant and monitor system as per TAC guidelines to take care of any fire hazard.
- Fire Detection/alarm system to be provided for Control Rooms, cable Galleries, Transformers area and Administrative building and these may be of ionization, optical and heat sensing type.
- All fire systems should be located in a safe area of the proposed facility

- Firefighting equipment shall be provided as per applicable standards and guidelines.
- Consider linking foam and fire water system. Considerations should be given to directly inject AFFF (Aqueous Film Forming Foam) compound into the respective fire mains (at 6 percent strength), which can act as a vehicle to transport foam solution to user points on either site for mobile response foam branches / cannons.
- Facilities should be properly equipped with fire suppression equipment that meets internationally recognized technical specifications for the type and amount of flammable material stored at the facility.
- Preparation of a fire response plan supported by the necessary resources and training, including training in the use of fire suppression equipment and evacuation. Procedures may include coordination activities with local authorities or neighbouring facilities.
- Provision of fire safety training and response as part of workforce health and safety induction/training, including training the use of fire suppression equipment and evacuation, with advanced fire safety training provided to a designated firefighting team.
- It is recommended that all electrical fittings in the system should conform to flame/explosion proof regulations.
- It is recommended to carryout regular maintenance and testing of instruments, valves and flange joints as per strict schedule. Pipelines, hoses, PSV's require special attention to minimise the failure rate.
- Pipeline should be protected against external / internal corrosion
- Do's and Don'ts shall be displayed prominently in the site near the pipelines and at all workplaces. Regular maintenance shall be carried out under the supervision of an authorized person.
- Important telephone numbers of emergency shall be displayed prominently in bold letters in the plant site and administration building.
- Caution boards shall be displayed for all working person.
 - No smoking signs
 - No flames or pilot lights or electrical gadgets.
 - Emergency contact numbers.
- All electrical equipment shall be provided with proper earthing. Earthed electrode should be calibrated, periodically tested and maintained.
- Emergency lighting shall be available at all critical locations including the operator's room to carry out safe shut down of the plant, ready identification of firefighting facilities such as fire water pumps and fire alarm stations.
- All electrical equipment shall be free from carbon dust, oil deposits, and grease.
- Use of approved insulated tools, rubber mats, shockproof gloves and boots, tester, fuse tongs, discharge rod, safety belt, hand lamp, wooden or insulated ladder and not wearing metal ring and chain is insured.
- Flame and shock detectors for fire safety shall be provided.
- Danger from excess current due to overload or short circuit is prevented by providing fuses, circuit breakers, thermal protection.

7.2 Disaster Management Plan

A disaster is a terrible situation in which suddenly, people are plunged into helplessness and suffering and, as a result, need protection, clothing, shelter, medical & social care and other necessities of life.

The Disaster Management Plan (DMP) is aimed to ensure safety of life, protection of environment, protection of installation, restoration of production and salvage operations in this same order of priorities. For effective implementation of DMP, it should be widely

circulated and a personnel training is to be provided through rehearsals/drills. To tackle the consequences of a major emergency at the project location or its immediate vicinity, a DMP has to be formulated.

The objective of the DMP is to make use of the combined resources of the NIMZ and the outside services to achieve the following:

- Effective rescue and medical treatment of casualties
- Safeguard other people
- Minimize damage to property and the environment
- Initially contain and ultimately bring the incident under control
- Identify any dead
- Provide for the needs of relatives
- Provide authoritative information to the news media
- Secure the safe rehabilitation of affected area
- Preserve relevant records and equipment for the subsequent inquiry into the cause and circumstances of the emergency

7.2.1 Causes of Disaster

- Natural: Flood, Earth Quakes, Lightning, Cyclonic winds
- System failure, design deficiency, bad operating practice, sabotage resulting in
- Fire
- Explosion
- Release of toxic/ inflammable gases

DMP for proposed NIMZ shall be formulated with an integrated approach to address all individual industrial units also. The DMP shall include onsite and offsite emergency plan for individual industrial units as well as NIMZ as a whole unit. A broad framework of DMP is presented in this Chapter. The specific industrial team where the emergency has arisen would be in charge of the situation while the other teams would assist them as and when required.

7.2.2 Categorisation of Emergency

Any emergency situation has to be first categorised as an onsite emergency or an offsite emergency, the difference being that the effects of the onsite emergency are confined within the premises while those of an offsite emergency spill over beyond the NIMZ premises or even beyond the project site premises. Thus, the onsite and offsite emergency plans are detailed below:

7.2.2.1 Onsite Emergency Plan

The plan would have the following components:

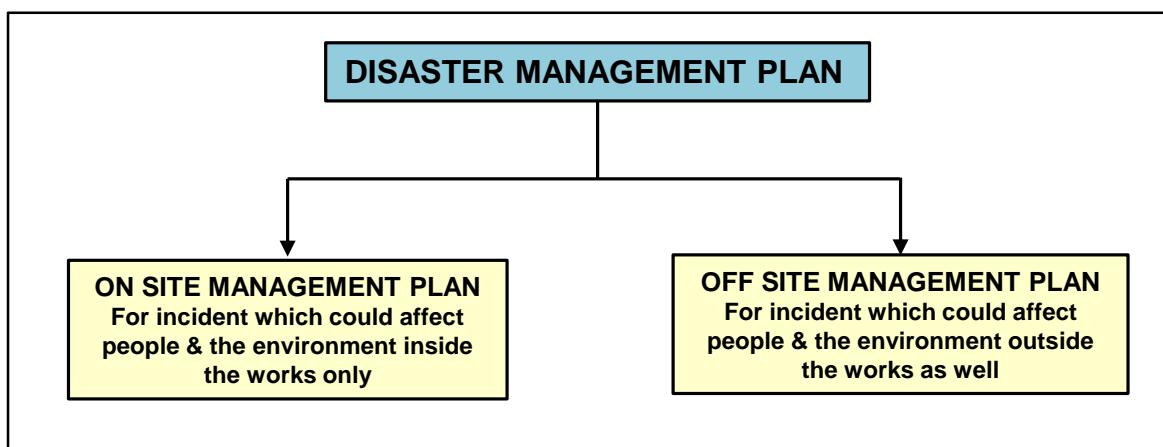
- Formulation of Disaster Management Plan and Emergency Services
- Organization Structure
- Roles and Responsibilities of Emergency Teams
- Communication
- Emergency Control Centre
- Alarm Systems & Assembly Points
- Mutual Aid Scheme
- Onsite Emergency Plan and Rehearsals
- Spillage & Contingency Plan

- Formulation of Disaster Management Plan for Cyclones

7.2.2.2 Offsite Emergency Plan

The components of an offsite emergency plan outlined in would include:

- Identification of location of hazardous or dangerous substances, personnel and emergency control rooms.
- Technical information such as chemical and physical properties, dangers, etc. Background information, past accidents, control techniques and effects of hazardous materials of relevance
- Identification of facilities and transport routes for toxic materials
- Contact for further advice such as meteorological information, transport, temporary food and accommodation, first aid and hospital services, water, etc.
- Establishing communication links including firefighting materials, damage control and repair items
- Detailing emergency response procedures
- Notification to public at large
- Evacuation arrangements
- Press / media handling
- Addressing longer term environmental clean-up



7.2.3 Onsite Emergency Plan

7.2.3.1 Formulation of Disaster Management Plan and Emergency Services

The assessment of the risks and hazards leads either to improvements being made at the installation in the form, for example, of additional safeguards or better procedures, or the decision being taken that the risk is sufficiently small to be accepted.

The Disaster Management Plan must be related to the final assessment and it is the responsibility of the NIMZ management and Industries/units located within NIMZ to formulate it. The plan will include the following elements.

- Assessment of the magnitude and nature of the events foreseen and the probability of their occurrence
- Formulation of the plan and liaison with outside authorities, including the emergency services
- Procedures for raising the alarm and communication both within and outside the NIMZ
- Appointment of key personnel and their duties and responsibilities (organizational structure)

- Emergency Control Centre
- Action on site and Action off site

7.2.3.2 Organization Structure

The first few minutes after the incident / accident are invariably the most critical period in prevention of escalation. Therefore, the personnel available at or near the incident site (and often responsible for or carrying out that particular activity) and on a round the clock basis play a vital role in an emergency. This concept is made use of in nominating the KEY PERSONS.

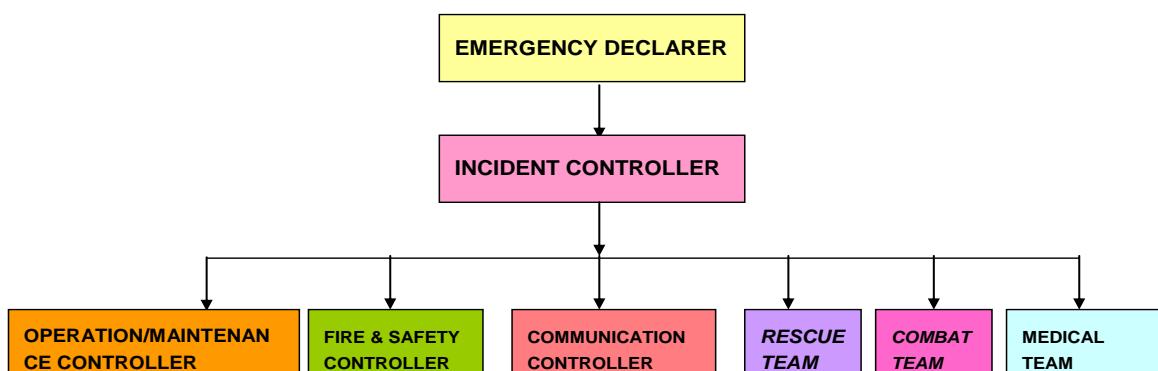
In each hazardous location it is necessary to nominate a functionary as the "*Incident Controller*" who is invariably in charge of the facility. The Incident Controller tackling the emergency in real terms requires support from various other services e.g. fire & safety, medical services, security, engineering, administration, technical services covering communication, transport and personnel functions, etc. A KEY PERSON for each one of these services, therefore, should be nominated.

The "SITE MAIN CONTROLLER" (SMC) will be the Unit In-charge. The various controllers selected to carry out the work will co-ordinate with the SMC through the functional KEY PERSONS at the incident site. The KEY PERSONS will generally be at the site of incident and the CONTROLLERS will report at the EMERGENCY CONTROL CENTRE.

The duties and responsibilities of various KEY PERSONS AND CONTROLLERS will be written down ensuring no grey areas or overlapping responsibilities. Various Controllers will be drawn from the organisation and clear-cut responsibilities will be spelt out for the following controllers:

- Operation Controller
- Maintenance Controller
- Fire and Safety Controller
- Communication Controller
- Environment Controller

A Succession chart will be developed as above nominating second-line controller who would act as controller in the absence of any of the above officials. An emergency organisation chart is as follows:



7.2.3.3 Roles and Responsibilities of Emergency Team

- (i) Site Main Controller (In-charge)
- To assess the extent and magnitude of the damage and by maintaining communication with the Site Incident Controller (SIC).

- To determine how far the emergency control plan can be extended
- Prepare action for monitoring and controlling the emergencies
- To decide whether any section / process / area to be shut down / isolated in the event of any accident
- To finalise the means of evaluation and explore the possibilities of taking help from offsite sources
- Review the firefighting operations in consultation with Safety Coordinator
- Co-ordination with the safety officer regarding evacuation and shelter rehabilitation aspects
- Arrange for restoration and normalcy in consultation with Incident Controller
- Announcement of conclusion of emergency.
- Issuance of authorised statements and ensures that all evidences of the incident are preserved.

(ii) Site Incident Controller (Shift in-charge/Unit In charge)

- Establish Emergency Control Centre and inform SMC
- Ensure availability of Controllers/Team members
- Priority decisions for strategy for development of resources for incident control
- Periodic assessment of actual disaster zone and resource deployment (own / external)
- Periodic status report of SMC
- Seek help for:
 - Fire Fighting
 - Medical Aid
 - Rescue
 - Transport
 - Traffic Arrangement
 - Law and Order
- Inform the following authorities about the incident through zonal/sector authorities:
 - District Collector
 - Superintendent of Police
 - District Environmental Engineer
 - District Health Officer
 - Inspector of Factories
 - Neighbouring Installations
- Establish contacts with the following, through controllers:
 - Superintendents of nearby hospitals
 - Chief Fire Officer of nearby fire services
 - Insurance Company
 - Establish First Aid Centre through Safety Coordinator
- Establish Information Centres

7.2.3.4 Emergency Co-ordinators

Logistics Coordinator: The duties and responsibilities in the event of any emergency include:

- Report at the affected area to the SMC & SIC
- Arrange to attend all maintenance jobs as instructed by SIC

- Ensure that all essential services like power, water etc. are maintained without interruption
- Ensure adequate manpower availability at the affected area
- Reporting all the incidents to SIC
- Arrange for all the tools, materials at the site of emergency

Communication Coordinator: Responsibilities include:

- Report to SMC & SIC
- Removal of non-essential personnel from the emergency area in consultation with SIC
- Contact with SIC and arrange for necessary facilities
- Control over entry and maintain law & order and arrange for police help in consultation with SMC
- Liaison with external agencies in consultation with SMC
- Co-ordination of transportation requirements for moving personnel for first aid, evacuation, rehabilitation etc.
- Maintenance of inventory systems in the Emergency Control Centre

Safety Coordinator: Responsibilities include:

- Immediate Reporting to SIC
- Co-ordination with Security officer and security personnel
- Ensure availability of all safety equipment at site
- Co-ordination of all rescue operations
- Co-ordination of availability of first aid to all injured personnel
- Advice to SIC on firefighting operations
- Ensure availability of necessary antidotes/medicines in case of toxic release

7.2.3.5 Communication

An essential component of any emergency preparedness programme is the communication links for gathering information needed for overall co-ordination e.g. emergency control centre with in-house as well as outside emergency services. Too much reliance on the telephone system, fixed lines/mobile phones is risky as it can soon be overloaded in an emergency situation. A computer with internet and printer facility and photocopying machine with scanner, wireless networks, fax and intercom units are recommended for higher reliability. Help line numbers will be setup for emergency related queries.

The description of the tasks and responsibilities, reporting place, etc. for each key functionary will be, as far as possible, so drafted as to reduce the communication needs between the interacting groups and permit good mutual understanding and well-co-ordinated independent actions to tackle emergency situations.

7.2.3.6 Emergency Control Centre

The emergency control centre shall be established for NIMZ and shall be equipped with the following:

- An adequate number of external telephones. If possible, one should for outgoing calls only, in order to bypass jammed switchboards during an emergency.
- An adequate number of internal telephones, Radio equipment/pager system.
- A layout plan of the facility showing.
 - Location of possible spillage/fire points.
 - Sources of safety equipment and other fire-fighting system elements.

- Escape Routes.
- A nominal role of employees at the facility.
- A list of KEY PERSONNEL with addresses, telephone numbers, etc.
- An adequate number of personnel protective/safety equipment available on site / back up in warehouse or with other member groups of mutual aid programme.
- Locations of various firefighting arrangements at the facility.

7.2.3.7 Alarm Systems

The emergency (due to fires or spillages) should be initiated by the first person noticing it by activating the fire alarm from the nearest call-point or by contacting the fire control room immediately on the internal telephone in case of any emergency.

If in the opinion of the shift in-charge/In charge in consultation with the fire safety officer, the severity of the emergency is such that it can primarily be coped with by available own resources (aided by firefighting appliances from the fire brigade, if required) the siren code for ONSITE CRISIS will be sounded through the hooter. The siren codes for distinguishing between an ONSITE & OFFSITE CRISIS will be clearly established. The onsite/ offsite siren codes should be informed to the neighbouring population of the facility.

7.2.3.8 Mutual Aid Scheme

Assistance in terms of equipment and manpower will be taken from the neighbouring installations under a Mutual Aid Scheme / Zonal Disaster Management Plan.

7.2.3.9 Onsite Emergency Plan and Rehearsals/Mock Drills/ Training

Once the emergency programme is finalised, it should be made known to all personnel so that each one knows his or her role in the event of an emergency. The plan will be regularly tested through the rehearsals, at a regular frequency and updated accordingly.

Mock drills on the overall emergency response plan may be carried out once in 6 months to ensure continued familiarity of the Key Personnel with the emergency procedure and to check if the hardware infrastructure provided for emergency management is in good Emergency Operations centre once in every three months, to familiarize him/herself with the facilities available.

The key personnel will be required to undergo a special in – plant training programme to understand clearly their role in On-site emergency management and to develop the skills required for the purpose.

Most of the employees are to be given “Basic Fire Fighting” training, for operating portable extinguishers in an emergency. The rest of the employees including supervisory and management personnel will be required to undergo this course. Also, the emergency response team members will be required to undergo annual training including refresher courses on the following areas:

- Use of specialized protection equipment including practical drills
- Emergency communication
- Firefighting using equipment like fire hydrant, portable pumps, monitors etc.
- Any other specialized training commensurate with the defined role
- Information on the extent of spill of materials
- Measures to contain spill to a limited area
- Measures to remove spilled materials

- Measures to dispose the spilled materials.
- Mock drills will be carried out to test the effectiveness of the contingency plan

7.2.3.10 Evacuation plan for Emergency and Assembly Points

In order to manage emergencies more effectively, decision makers may benefit from having in-place evacuation plans for scenarios which are most likely to happen, even though real-time design or re-evaluation of evacuation plans may be required after the disaster strikes.

Based on the disaster scenarios, pre-warning for sudden/onset of disasters can leave enough time for evacuations prior to the event. In the case of natural disasters is the probability of their occurrence and effects is one of the influential factor. Seasonal disasters, even if sudden, pose lesser problems than non-seasonal disasters so though evacuation plans can be in place for either situation.

Building Evacuation

As soon as the pre-warning is given the first step is to evacuate the buildings. The Evacuation action plan which includes following steps to follow during a disaster,

- On the sound of an alarm, begin immediate evacuation
- In case of fire, activate the nearest pull station and call Emergency
- Evacuate via the nearest stairwell or grade level exit.
- Go to your pre-determined Evacuation Assembly Point/Shelter Area.
- If trapped by smoke, stay low, cover your mouth with wet cloth, stay near a window,
- Open it but do not break it, hang something out the window to let fire personnel know you are there and put something in cracks around the door, phone emergency if possible.
- The layout maps showing exit routes will be placed at all important places also pamphlets indicating same will be placed with the First Aid Kit.
- Be familiar with the location of first aid kits, fire alarms, and extinguishers, as well as persons with first aid skills.
- Do not use the elevators.

Site Evacuation

The process involved in the evacuation from the source is as follows,

- Identify the area vulnerable to disasters to which the evacuation plan will be applied
- Identify number of shelters surrounding the source of origin
- Identification and choice of the evacuation routes

A map showing the Emergency Assembly Points and the road network connecting each Emergency Assembly point is prepared and shown in **Figure 7-1** which is based on the location of industries/units, location of free space in the plan along the nearest main exit route and some assumptions made based on its criticality. There are more than 10 entry/exits in addition to the main entry/exit point which can be used for easy evacuation during emergency situation.

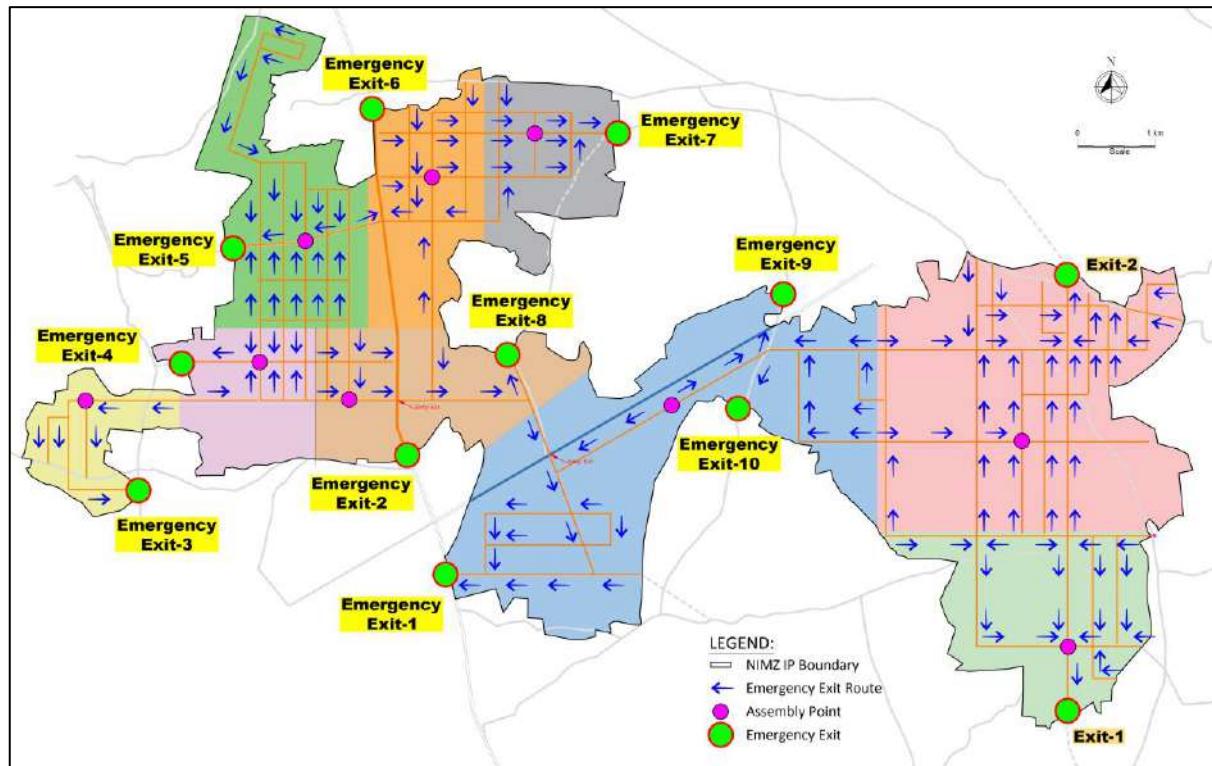


Figure 7-1: Emergency Evacuation Plan and Assembly & Emergency Exit Points

7.2.3.11 Spillage and Contingency Plan

The purpose of this plan is to identify, prevent and control all probable spillages in the NIMZ area for safe and healthy working of personnel and machinery.

Probable materials for spillage:

- Electrical equipment area (Transformer oil and cable filling compounds)
- Liquid/oil storage areas/liquid wastes
- Oil system area (Lubricant oil, Hydraulic oil and control oil), etc.
- Water and Wastewater treatment chemicals
- Other chemical to be used in Electronic Manufacturing industry

Spillages in the plants can lead to:

- Causing loss of property
- Interfaces with safe moving of personnel
- Damage to equipment when left unattended
- Health hazard i.e., toxic when released in air or mixes with town drain
- Fire hazard

Prevention of spillage:

Routine checks of the system have to be made to ensure that no leak or spill starts. Any minor leakage has to be reported to the concerned person (Shift In-charge, Operation & Maintenance team member). Leakage has to be arrested in the shortest possible time. Necessary arrangements have to be made to collect the leakage and to store in proper place.

- In case of spillage the following measures would be adopted:

- Oil spill on the land should be properly cleaned using absorbents, cotton waste, sand, saw dust, etc.
- The collected oil is disposed to TSPCB/CPCB authorized agency

7.2.4 Management Plan for Natural Hazards

NIMZ shall develop a customised Disaster Management Plan (DMP) to cope during disasters from natural calamities such as cyclones, Floods and earthquakes, etc. Proper planning can reduce the potential damage from disasters in terms of losses to human lives, assets, and environmental damage and rehabilitation costs. The proposed NIMZ is located in Sangareddy district, Telangana. As per the Seismic zoning Map, project location falls in zone-II (Low Risk Zone), and also the project area does not fall under area prone to flooding.

The average annual rainfall of the Medak district is 910 mm, which ranges from nil rainfall in December, January, and February to 229 mm in July. July is the wettest month of the year.

7.2.4.1 Disaster Management Plan for Floods/ Cyclones

Though the study area experiences no flood and moderate cyclone damage zone with the wind velocity of 39-44 m/s, the following management plan is proposed in case of any Floods/Cyclones occurs.

Community awareness should be built up so that people respond effectively to the flooding. Persons living in the low lying parts of floodplains, areas below unsafe. Some aspects of flood planning and response are:-

- Issuing warnings at the local levels
- Participating in flood fighting by organizing work parties to repair
- Embankments or clear debris from drainage areas, pile sandbags
- Stockpile needed materials
- Facilitating agricultural recovery
- Planning emergency supplies of flood and clean drinking water
- To conduct trainings on search and rescue for Search and Rescue
- Terms formed at District, Taluka and Village level from time to time

The rough weather operations will be controlled in three stages:

- Green Status – The operations will be carried out as planned.
- Yellow Status – This is an alert stage indicating possibility of rough weather. Still operations can be continued with all emergency precautions
- Red Status – Emergency situations or rough weather; operation will be suspended.

The main components of the DMP for cyclones will include the following:

- Pre-Disaster (or Pre-Cyclone/Flood) Plan
- On (or During Cyclone/Flood) Disaster Plan
- Post (or After Cyclone/Flood) Disaster Plan

Pre-Cyclone/Flood Plan

Pre-Cyclone/Flood Measures: The proposed NIMZ will maintain and exchange information continuously with the local IMD authorities for continuous updates of meteorological conditions in general and emerging / predicted weather phenomenon such as cyclones and rainfall in particular. Upon issue of a cyclone/flood warning by the IMD, the management would immediately initiate the Pre-Cyclone/flood Measures.

Pre-Cyclone/Flood Exercise: On signalling of a cyclone alert, the Control Room will be manned 24 hours a day for disaster management. The 'Weather Signals' depending on the data available about the cyclone and its threat perception will be informed to all personnel. The different personnel of NIMZ would assume their roles and responsibilities as previously identified for disaster management. The standby arrangement for power supply will be checked. Pre-identified 'Rescue Centres' will be kept ready. A pre-alert will be issued regarding suspension of all operations in case of emergency and to await instructions regarding the same. Communication system including standby arrangement will be tested for working condition. Vehicles involved in rescue operations will be checked for working condition.

The following Flood warning messages will also be given:

- Flood Alert – Flooding is possible
- Flood Warning – Flooding of homes, businesses and main roads is expected
- Severe Flood Warning – Severe flooding may cause Imminent danger
- All Clear – No Flood Alerts or Warnings are in force
- When a flood warning message is received, an Emergency team In-charge shall alert relevant agencies. The following advice shall be given to the Public:
 - Flood warning: 'GO IN, STAY IN, TUNE IN'
 - Stay calm
 - Ensure that neighbours know of the warning, and be prepared to help them
 - Monitor local radio
 - Make a flood kit: medications, warm clothing, sealed food, blankets, matches, candles, flashlights, portable radio, spare batteries, rubber gloves, personal documents.

During Cyclone/Flood Plan: The emergency alarm siren will be raised as per the 'Alarm System'. All personnel will be evacuated except essential operational personnel and personnel dealing with disaster management. Power supply will be disconnected and alternative power supply will be restored in essential operational areas. Depending upon the scale of potential flooding, the following steps shall be taken:

- Care of evacuated, hurt or homeless people
- Protecting of utilities
- Availability of transport
- Flood alleviation e.g. clearing blocked culverts and drains
- Providing emergency health advice
- Providing road barriers and signs
- Coordinating emergency support

Post Cyclone/Flood Plan: This would be the rescue and rehabilitation stage after passing of the cyclone/floods. The damages would be assessed and rehabilitation work initiated to restore operations at the earliest. The records of the events during the cyclone will be maintained and reviewed for possible enhancements to the DMP.

The important Do's and Don'ts after Flood

- There is a possibility of spread of water borne diseases after flood, and hence medical treatment should be taken immediately.
- Do not go near the riverbank even after the floodwater has receded.
- Sprinkle medicines in the stagnant dirty water.
- Check properly all the electric circuits or electric like motor pump etc. Check whether any inflammable or explosive item has not entered along with the floodwater.
- Switch off the main electric supply, if any damage is noticed to the electric equipment.

- Sewerage system should be checked and any damage should be repaired immediately so as to curtail spread of diseases.
- Check gas leakage which can be known by smell of gas
- Rescue work should be undertaken immediately after flood situation as per the instruction. Do not follow any shortcut for rescue work.

7.2.4.2 Earthquakes

Proposed site and entire Sangareddy district falls under Zone-II (Low Risk Zone), the site is not highly sensitive to earthquakes. Apart from all design & structural measures following are important for management of earthquakes:

Before Earthquake:

- All employees shall be familiar with the location of first aid kits, fire alarms, and extinguishers, as well as personnel with first aid skills.
- Site evacuation plan and emergency assembly points shall be available at all locations.

During Earthquake:

- Do not panic

Inside a Building:

- Take cover immediately under a desk, table, or chair, in a corner away from windows, along a wall in a hallway, or in a structurally strong location such as a hall by a pillar.
- Watch for falling objects such as light fixtures, bookcases, cabinets, shelves, and other furniture that might slide or topple. Stay away from windows. Do not run outside.
- Do not dash for exits since they may be damaged and the building's exterior brick, tile, and decorations may be falling off.
- Do not use the elevators.
- If fire breaks out, drop on the floor and crawl towards the exit

Outside a Building:

- Remain outside, preferably in a vehicle.
- Stay clear of electrical wires, poles, trees, or anything that might fall.

After a MAJOR Earthquake:

- Listen to radio -TV and other media for Government Announcement
- Examine walls, floors, doors, staircases and windows to make sure that the building is not in danger of collapsing
- Do not enter into the unsafe or risky houses or buildings

The site emergency controller shall:

- Check for injuries to personnel in your area. Do not attempt to move seriously injured persons unless they are in immediate danger. Render first aid assistance if required.
- Check for fires or fire hazards, spills of flammable or combustible liquids, or leaks of flammable gases. These activities must not significantly delay departure from the building or put the Evacuation Warden in danger.
- For small isolated spills, use spill clean-up procedures as outlined in Standard Operating Procedures (SOPs). If SOP or chemical spill (if any) clean up kit is not available, then

- evacuate personnel and notify authorities. For larger spills, evacuate building and notify authorities.
- Turn off ignition and heat sources if properly trained and it is safe to do so.
 - Shut off all gas sources if trained to do so.
 - Exit the building, if possible, and go to the EAP to report on injuries, damages, and potentially hazardous conditions. Take emergency/first aid kit and personal belongings.
 - Switch off all electric lines

7.2.4.3 Thunderstorm and Lightning strikes

Thunderstorm is invariably accompanied by lightning. A single stoke of lightning has 125,000,000 volts of electricity. That's enough power to light a 100 watt light bulb for more than three months or enough to seriously hurt or kill someone. Knowing what steps to take in the event of an oncoming thunderstorm or lightning can save lives. Better management practices such as turnoff electric transmission, supply etc. shall be followed.

7.2.5 Fire Protection Facilities

7.2.5.1 Fire Protection Facilities

In order to provide the best facilities to fight the hazards related to fire, the following fire protection services with automated response system are conceived:

- Dedicated firefighting water network
- Fire stations strategically located within NIMZ

In addition to this, the statutory requirements (as per Development Control Rules) for firefighting provisions within individual industrial plots to be enforced as a part of the development guidelines. As per this, each industrial unit should have storage tank + fire pumps + hydrants.

Fire mitigation system consists of Fire station, firefighting facilities, fire water storage and Distribution system is proposed in NIMZ.

7.2.5.2 Fire Detection and Alarm System

Fire detection and alarm system can be provided for the entire area which will be microprocessor based Intelligent Analog Addressable type. The system will consist of central monitoring station located in unit control room. A comprehensive fire detection and protection system will be envisaged for the complete power station. This system will generally conform to the recommendations of TAC and NFPA (latest edition).

7.2.5.3 Automated Response System

An automated firefighting system for the NIMZ will be conceived to respond to fire outbreak without any delay in response time. The automated system mainly includes means of detection, actuation and delivery. The fire detectors could be operated mechanical or electrical means as explained below:

- Mechanical detection uses fusible-link or thermo bulb detectors that are designed to separate at specific temperatures and thus actuate alarm system
- Electrical detection uses heat detectors equipped with self-restoring, normally open contacts which close when a predetermined temperature is reached. These detectors are connected to alarm systems which activate the delivery system.

The fire detectors along with an alarming system shall continuously monitor facilities throughout the project site in case of a fire outbreak. The fire detection devices (smoke detector, thermal detector, infrared flame detector, manual alarm, limit switch, flow switch, etc.) to be placed at identified locations. Signals are then transferred by local fire control panels to the main fire control. The main control room/ fire stations are alerted of the need for fire-fighting or evacuation efforts once the signal has been processed by software in the main fire control panel.

The delivery system will be accomplished by means of piping and nozzles or sprinkler system. Though commonly water is used as the exclusive fire suppression agent, it still has its limitations. Different extinguisher types along with water and firefighting media are given in the **Table 7-5**.

Table 7-5: Fire Extinguishing Agents – Forms and Ranges of Application

Extinguish Agent	Extinguish Device	Extinguish Effect	Typical Application
Water	Water extinguishers	Cooling effect	Small fires
	House steams	Cooling effect	Small and large fires
	Water curtains	Cooling effect	Preventing the spread of openings and cooling exposed surfaces
	Sprinkler systems	Cooling effect	Controlling fires at early stage
	Deluge systems	Cooling effect	Where very rapid development and spread of fires to be expected
Aqueous film forming agent	Fixed and mobile extinguish system	Smoothing effect and cooling effect	Flammable liquid fires and covering large fires
Foam - high density foam	Portable extinguishers and fixed extinguishers systems	Cooling effect and smoothing effect	Flammable liquid fires
Foam- medium density foam	Portable extinguishers and fixed extinguishers systems	Cooling effect smoothing effect	Flammable liquid fires
High expansion foam	Fixed extinguishers systems	Smoothing effect minor cooling effect	Fire in storage tanks
Dry chemical	Portable extinguishers and fixed and mobile extinguishers systems	Anti-catalytic effect, I.E, oxidation reaction stopped	Small and large fires
Gas	Portable extinguishers	Displacement of oxygen/ air	Fires involving electrical and electronics equipment, flammable liquid fires
Co ₂	Fixed and mobile extinguishers systems	Smoothing effect	Fires involving electrical and electronics equipment, flammable liquid fires
Halons	Portable fixed and mobile extinguishers systems	Anti-catalytic effect	Fires involving electrical and electronics equipment, flammable liquid fires
Vaporizing liquids	Portable extinguishers and fixed and mobile extinguishers systems	Cooling and smoothing	Small to large fires
Wet chemical agents	Portable extinguishers, fixed & mobile extinguishers systems	Cooling and smoothing	Small to large fires

7.2.6 Offsite Emergency Plan

Under the Environmental Protection Act, the responsibility of preparation of Off-Site Emergency plan lies with the State Government. The Collector/Deputy Collector is ordinary nominated by State Government to plan Off-Site Emergency Plan. The District Collector or his nominated representative would be the team leader of planning team, who shall conduct the planning task in a systematic manner.

The members of planning team for off-site emergencies are Collector/Deputy Collector, District Authorities in charge of Fire Services and police and members drawn from Medical Services, Factory Inspectorate, Pollution Control Board, Industries and Transport. In addition to these members, there are Co-opted Members also from district authorities concerned, civil defence, publicity department, Municipal Corporation, and non-official such as elected representative (MPs, MLAs, voluntary organization, non-governmental organizations, etc.).

Offsite emergency plan for proposed NIMZ shall be prepared based on consultation with district authorities, district Disaster Management Plan. Off-site emergency plan would follow the on-site emergency plan. When the consequences of an emergency situation go beyond the proposed NIMZ boundaries, it becomes an off-site emergency. Off-site emergency is essentially the responsibility of the public administration. However, the NIMZ management will provide the public administration with the technical information relating to the nature, quantum and probable consequences on the neighbouring population.

The components of an offsite emergency plan would include:

- Identification of locations of hazardous or dangerous substances, personnel and emergency control rooms.
- Technical information such as chemical and physical properties, dangers etc. Background information, past accidents, control techniques and effects of hazardous materials of relevance.
- Identification of facilities and transport routes for toxic materials if any.
- Contact for further advice such as meteorological information, transport, temporary food and accommodation, first aid and hospital services, water, etc.
- Establishing communication links including firefighting materials, damage control and repair items.
- Detailing emergency response procedures.
- Notification to public at large.
- Evacuation arrangements.
- Press/media handling.
- Addressing longer term environmental clean up

7.2.6.1 District Disaster Management Committee

Under the provisions of the Telangana Disaster Management Rules 2015, besides setting up State Disaster Management Authority (SDMA), district level District Disaster Management Authority (DDMA) under the chairmanship of the District Collector is mandated. The composition of the DDMA is given in **Table 7-6**

Table 7-6: Disaster Management Authority – District Level

S. No	Personal responsible	Designation
1.	The Collector and Magistrate of the district	Chairperson, ex officio
2.	Chairperson of the Zilla Parishad of the district	Co-Chairperson
3.	Superintendent of Police of the district	Ex officio
4.	Joint Collector	Chief Executive Officer
5.	Project Director, District Rural Development Agency (DRDA) of the district	Ex officio
6.	Chief Executive Officer of the Zilla Parishad of the district	Ex officio
7.	District Medical and Health Officer of the district	Ex officio

7.2.7 Conclusion

The Disaster Management Plan (DMP) is prepared in conjunction with and taking into consideration all technical reviews and suggestions as per acceptable norms. These details shall be considered as guidelines for preparation of individual DMP by other member industries based on respective (industry specific) detailed risk analysis.

7.3 Traffic and Transportation Management

Traffic surveys were undertaken to assess the existing traffic on external roads and forecast the traffic from the proposed development on these external roads as well as internal roads of NIMZ. The future traffic will comprise of two components, namely, normal traffic and generated traffic. Normal traffic is the existing traffic on the access roads. Generated traffic is the traffic generated due to the proposed development (NIMZ). The traffic thus estimated is assigned on to the road/ rail network and adequacy of the same is evaluated and appropriate transport infrastructure to cater to NIMZ is suggested.

Details of the different traffic surveys conducted are given in **Table 7-7** and the location of traffic survey is shown in **Figure 7-2**.

Table 7-7: Traffic survey details

S. No	Type of Survey	Duration	Dates	Survey Locations
1	Classified Volume Count (CVC)	7 days	31/08/2017 to 06/09/2017	On NH-65 (old NH-9) near Ranjol
2	CVC	1 day	04/09/2017	On Jharasangam Road near Zaheerabad Rural Police Station
3	Turning Movement Count (TMC)	3 days	30/08/2017 to 05/09/2017 06/09/2017	Metalkunta Junction
4	TMC	1 day	01/09/2017	NH-65 and SH-14 Junction
5	OD with CVC	1 day	06/09/2017	On SH-14 before Metalkunta Junction

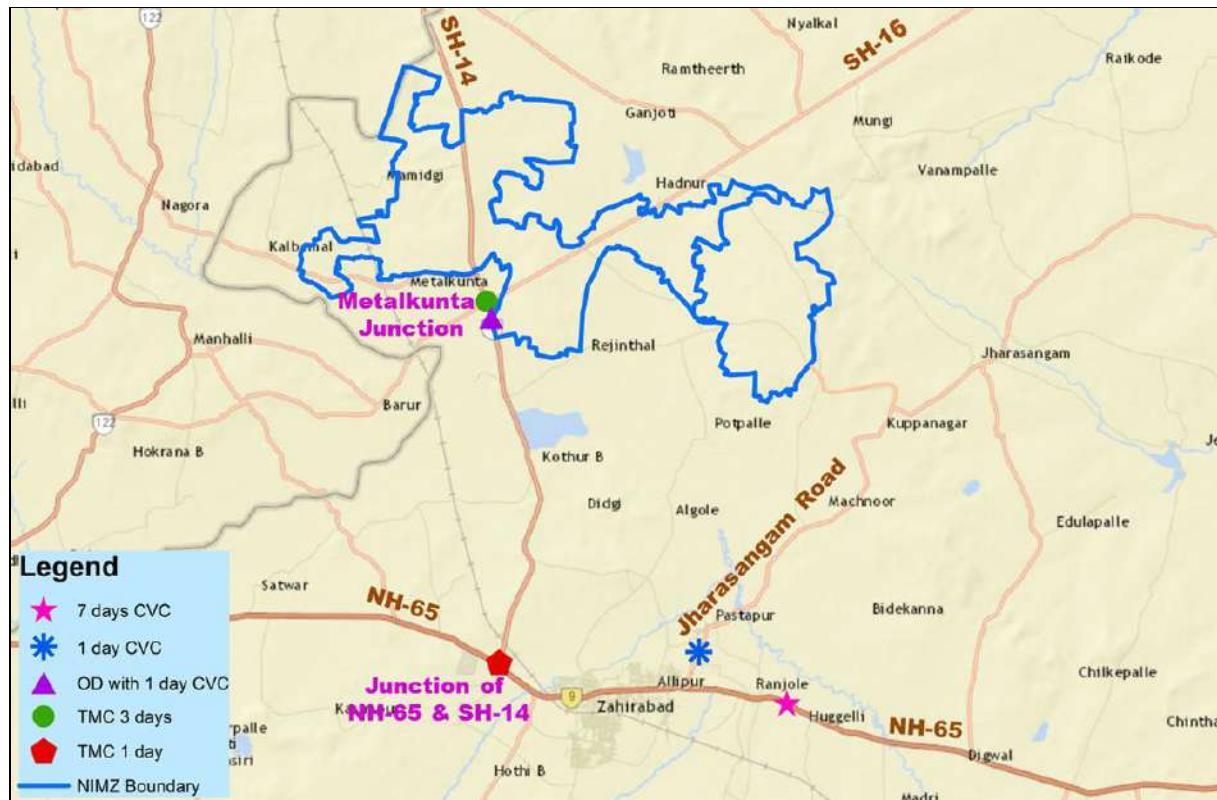


Figure 7-2: Traffic Survey Locations

Classified Traffic volume counts (CVC) are conducted for a period of 7 days. The data is used to estimate Average Daily Traffic (ADT) on the road. ADT derived is converted to Annual Average Daily Traffic (AADT) using seasonal correction factors.

Origin – Destination (OD) surveys are conducted for a period of 24 hours to study the origin destination pattern, type of commodities carried and frequency of movement. This survey also helps in identifying the influence zones of traffic which is an input for traffic projections

Turning Movement Counts (TMC) are conducted at junctions along existing road network. The survey is conducted for a period of 3 days. The data is used to understand the traffic volume at junction and different roads joining at the junction.

7.3.1 Traffic Survey Analysis

Traffic assessment includes both internal as well as external traffic assessment. Internal traffic assessment is required to assess the transport network within the development and external traffic analysis is required to assess the adequacy of the existing transport network to cater to the future traffic.

Internal traffic analysis includes the estimation of generated traffic (trip generation) from the proposed development and lane capacity assessment of the road infrastructure proposed within the development.

7.3.1.1 Average Daily Traffic (ADT)

The location-wise average daily traffic (ADT) on NH-65 and Jharasangam Road is presented in **Table 7-8**.

Table 7-8: Average Daily Traffic (ADT) on access roads

Vehicle Type	NH-65 (Old NH-9)	Jharasangam Road
Two-wheelers	4,437	3,387
Auto rickshaws	2,811	1,272
Car	4,961	420
Mini Bus	113	3
Bus	1,154	157
Goods Auto	816	586
Light Commercial Vehicle	1,011	87
2 Axle Truck	1,225	239
3 Axle Truck	1,310	116
Multi Axle Vehicle	1,253	33
Others	182	149
Total Vehicles	19,273	6,449
Total PCUs	29,786	6,069

7.3.1.2 Traffic Composition

The traffic composition along the access roads is shown in **Figure 7-3** and **Figure 7-4**.

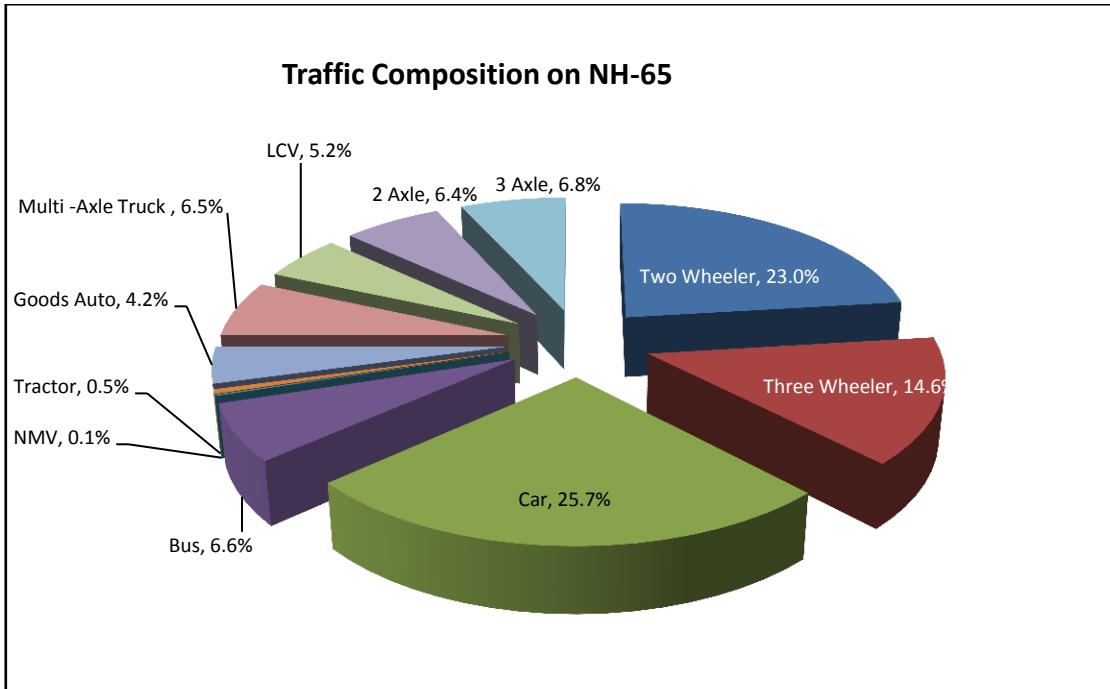


Figure 7-3: Vehicle Composition on the Access Roads – NH-65

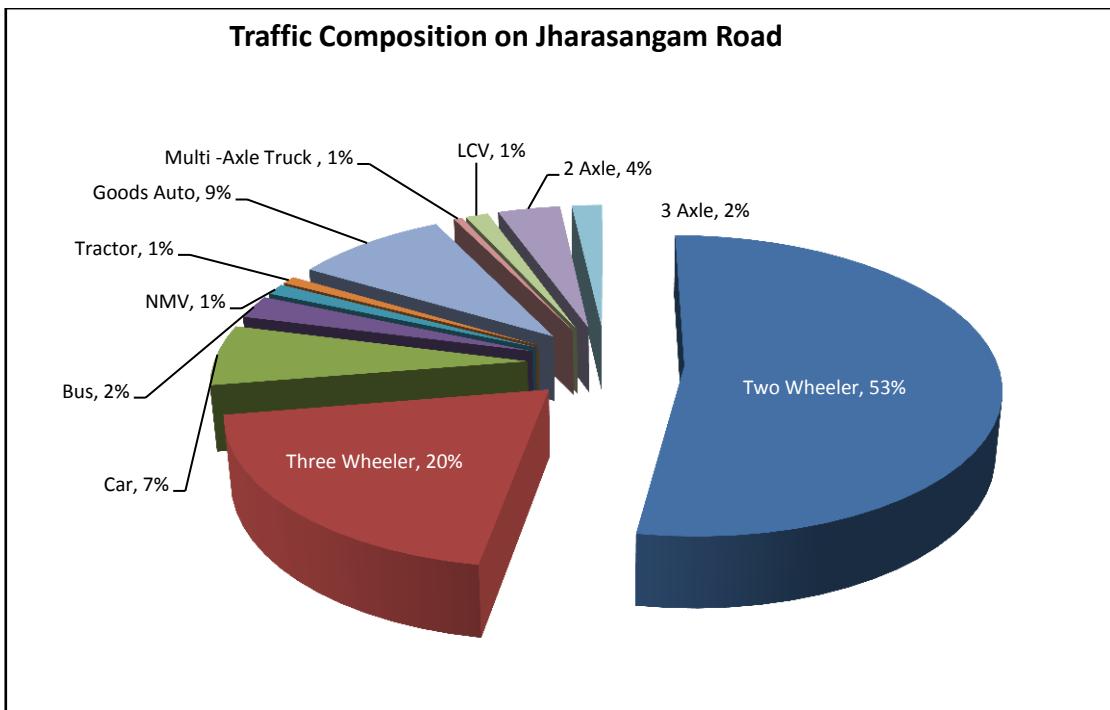


Figure 7-4: Vehicle Composition on the Access Roads – Jharasangam Road

Observations:

- Cars (25.7%) and two wheelers (23.0%) constitute the major share on NH-65 whereas on Jharasangam road, two wheelers constitute the major share at 53%.
- The hourly variation of traffic on access roads shows a general pattern of peaks in the morning and evening and an off-peak period in between.
- The peak hour traffic for the locations has been estimated and is presented in **Table 7-9**. The peak hour traffic is observed to be 7% of the total traffic for NH-65 and 9% for Jharasangam Road.

Table 7-9: Peak Hour Traffic

Location	Daily Traffic (PCUs)	Peak Hour	Peak Hour Traffic (PCUs)	Peak Hour Share
NH-65 (Old NH-9)	29,786	10:15-11:15	1,351	7.01%
Jharasangam Road	6,069	10:00-11:00	553	9.11%

- From the above table, it can be observed that the peak hour for NH-65 is from 10:15 AM-11:15 AM and for Jharasangam Road it is from 10:00 AM to 11:00 AM.

7.3.1.3 Annual Average Daily Traffic (AADT)

In order to estimate Annual Average Daily Traffic (AADT) from ADT, monthly fuel sales for the past 3 years and secondary data available with the Consultant have been used to derive the location-wise seasonal correction factors (SCFs). The SCF adopted for petrol vehicles is 1.11 and for diesel vehicles is 1.15. AADT on access roads is given in **Table 7-10**.

Table 7-10: Annual Average Daily Traffic (AADT) on access roads

Vehicle Type	NH-65 (Old NH-9)	Jharasangam Road
Two-wheelers	4,926	3,760
Auto rickshaws	3,234	1,463
Car	5,627	476
Mini Bus	130	3
Bus	1,328	181
Goods Auto	939	674
Light Commercial Vehicle	1,163	100
2 Axle Truck	1,409	275
3 Axle Truck	1,507	133
Multi Axle Vehicle	1,441	38
Others	201	158
Total Vehicles	21,905	7,261
Total PCUs	34,083	6,891

7.3.1.4 Turning Movement Counts

To assess the traffic on various roads in the study area and to understand the impact of major junctions along the access roads, turning movement surveys have been carried out at two junctions. Based on the analysis, the major findings such as total junction traffic, arm-wise influence, etc. are presented in **Table 7-11**.

Table 7-11: Turning Movement Counts along Access Roads

S. No.	Junction	Total Junction Traffic in Vehicles (PCUs)	Arm-wise Influence		
			Direction	Passenger Traffic	Goods Traffic
1	Metalkunta Junction	13,785 (15,783)	Bidar	32%	38%
			Hadnoor	23%	20%
			Zaheerabad	33%	38%
			Metalkunta	12%	4%
2	NH-65 and SH-14 Junction	22,605 (28,560)	Zaheerabad	45%	40%
			Mumbai	31%	32%
			Bidar	24%	28%

Based on the above table it can be noted that:

- The traffic on Bidar and Zaheerabad arms is high when compared to the other arms at Metalkunta Junction
- The traffic on Zaheerabad arm is high when compared to other arms at NH-65 and SH-14 Junction

The flow diagrams representing the turning movement volumes are shown below in **Figure 7-5**. It shows the turning volumes at Metalkunta Junction and NH-65 and SH-14 Junction respectively.

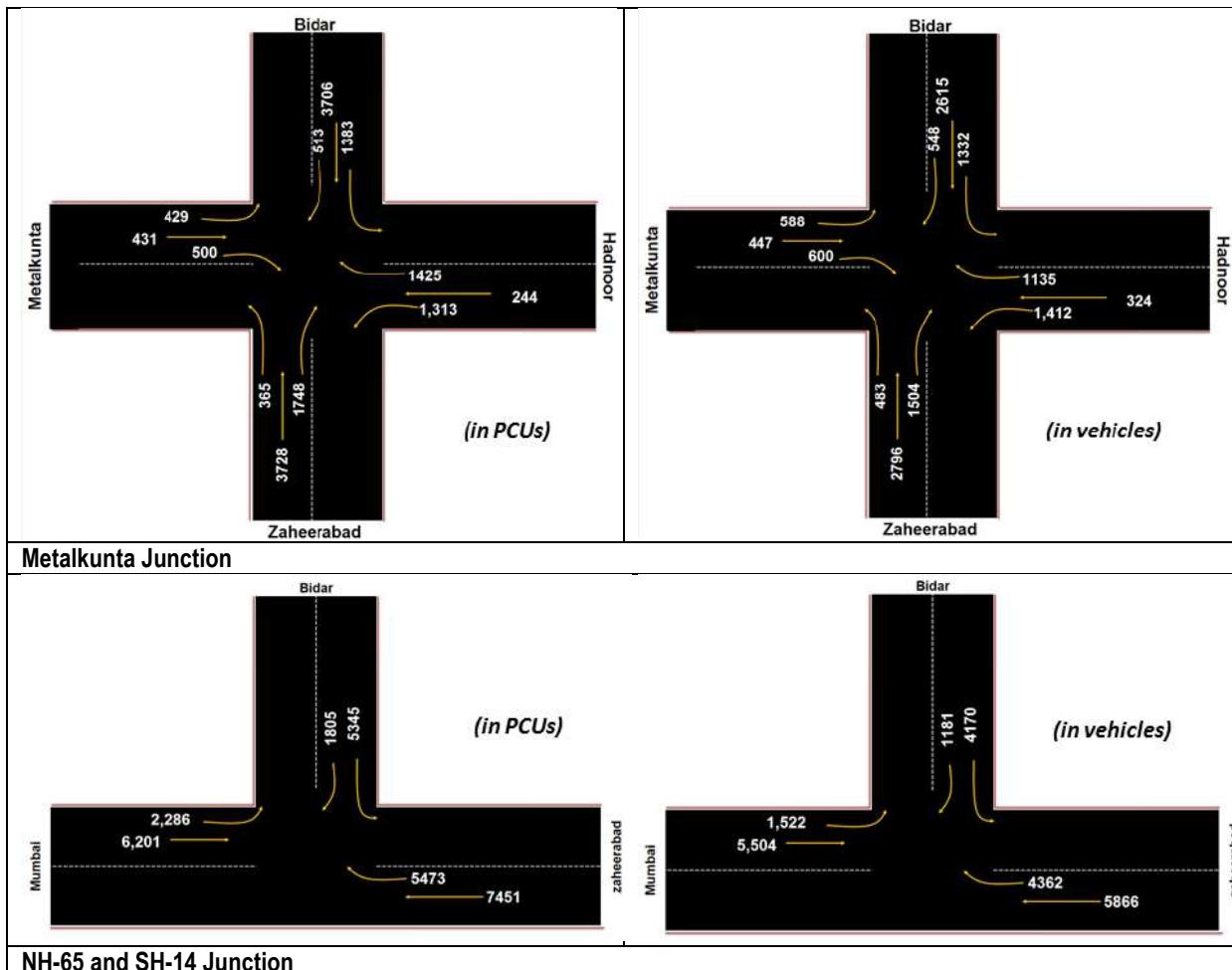


Figure 7-5: Turning Volumes in PCUs and Vehicles

From turning movement count at Metalkunta Junction, ADT on SH-14 and SH-16 is estimated and presented in **Table 7-12**. SH-14 and SH-16 forms the primary road network within NIMZ.

Table 7-12: Average Daily Traffic (ADT) on internal roads

Vehicle Type	SH-14	SH-16
Two-wheelers	3,275	2,619
Auto rickshaws	1,642	1,402
Car	1,808	905
Mini Bus	42	26
Bus	598	187
Goods Auto	497	269
Light Commercial Vehicle	213	111
2 Axle Truck	269	175
3 Axle Truck	281	175
Multi Axle Vehicle	283	118
Others	304	169
Total Vehicles	9,213	6,154
Total PCUs	11,636	6,820

The composition of traffic on various internal roads is represented in **Figure 7-6**.

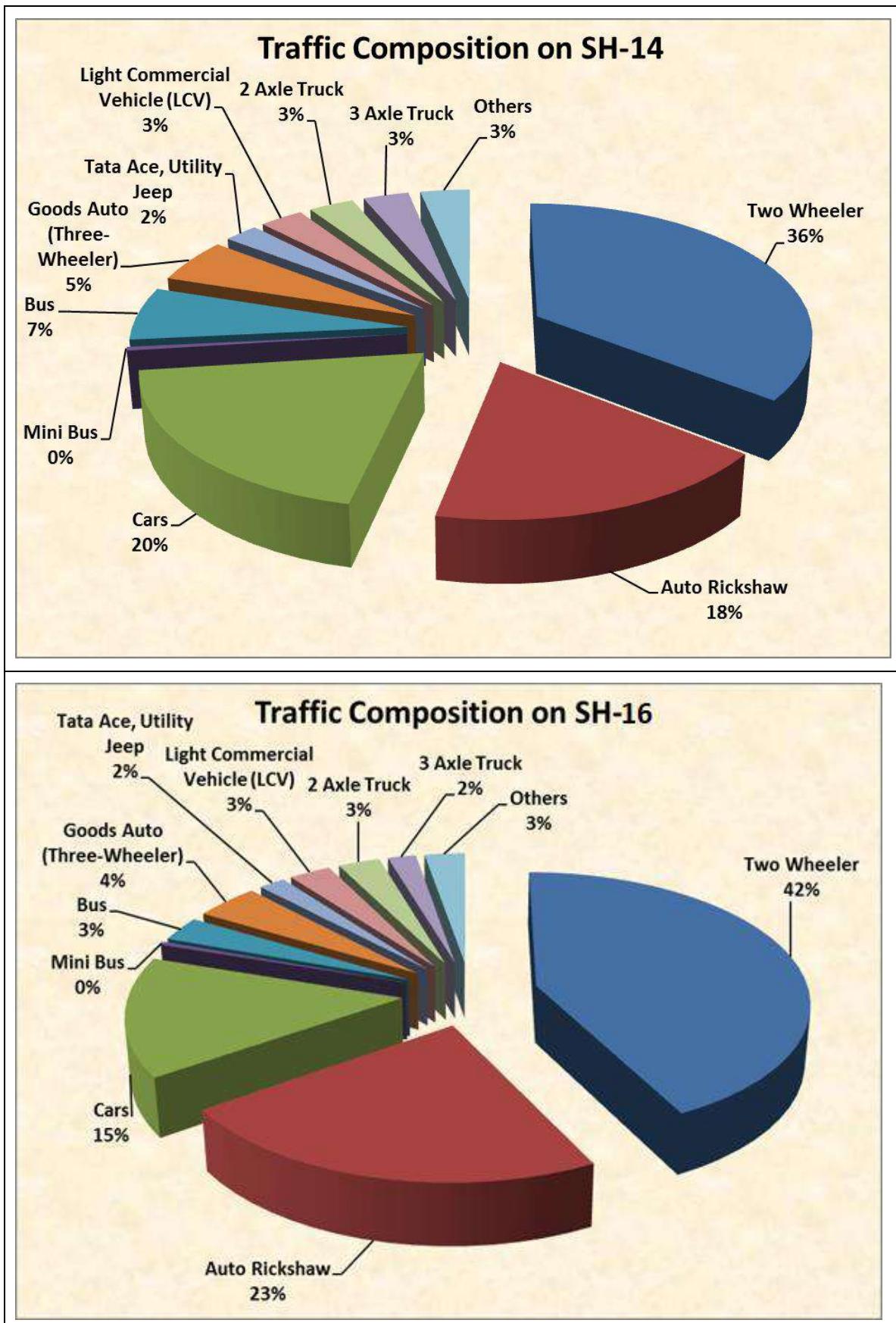


Figure 7-6: Vehicle Composition on internal roads

From the above figures, it can be understood that the share of goods vehicles is less on SH-16 when compared to SH-14.

In order to estimate Annual Average Daily Traffic (AADT) from ADT, monthly fuel sales for the past 3 years and secondary data available with the Consultant have been used to derive the location-wise seasonal correction factors (SCFs). The SCF adopted for petrol vehicles is 1.11 and diesel vehicles are 1.15. AADT on access roads are presented in **Table 7-13**.

Table 7-13: Annual Average Daily Traffic (AADT) on internal roads

Vehicle Type	SH-14	SH-16
Two-wheelers	3,636	2,907
Auto rickshaws	1,888	1,613
Car	2,050	1,026
Mini Bus	49	30
Bus	687	215
Goods Auto	571	309
Light Commercial Vehicle	245	127
2 Axle Truck	310	201
3 Axle Truck	323	201
Multi Axle Vehicle	325	135
Others	329	179
Total Vehicles	10,414	6,943
Total PCUs	13,316	7,724

7.3.1.5 Origin-Destination (OD) Surveys

To understand the existing travel pattern, information such as origin, destination and type of commodity are collected during the OD survey near Gangwar on SH-14.

In order to assess the traffic pattern on the project influence area, influence area has been divided into 50 zones. The O-D zoning system adopted is presented in **Table 7-14**.

Table 7-14: O-D Zoning System

Zone No	Zone Name	Zone No	Zone Name
1	Zaheerabad	26	Nanded
2	Metalkunta, Gangwar, Mirzapur	27	Adilabad
3	Kothur	28	Warangal
4	Rejithal, Potapalle	29	Mahabubnagar
5	Waddi, Huselli, Dapur, Gunjoti	30	Rest of Telangana
6	Rajoli, Basanthpur, Mamidigi, Ganeshpur	31	Vijayawada
7	Hadnoor, Nayakal	32	Rajamundry
8	Digwal	33	Bhimavaram
9	Jharasangam, Kuppanagar	34	Nellore
10	Sangareddy	35	Rest of Andhra Pradesh
11	Sadashivpet	36	Bidar, Bhalki
12	Patancheru, Lingampally, RC puram, Isnapur	37	Udgir
13	Rest of Hyderabad	38	Kalaburgai (Gulbarga)
14	Tandur	39	Aurad
15	Vikarabad	40	Bangalore
16	Malchella, Gotiparpally	41	Rest of Karnataka
17	Chevella	42	Lathur
18	Alladurg	43	Napur
19	Narayankhed, Manoor	44	Bombay
20	Nizampet, Husanpur	45	Rest of Maharashtra
21	Medak	46	Tamil Nadu
22	Kamareddy	47	Kerala
23	Nizamabad	48	Goa

24	Karimnagar	49	MP, Oddisha, Chattighar, Gujarat
25	Siddipet	50	Rest of India

The collected data is coded, processed and expanded to the total traffic using the expansion factors for each vehicle type. The percentage samples collected is 37% of the total traffic on the survey date.

The O-D survey results provide an indication of the region, which contribute to the traffic on the existing roads in the project influence area. Number of trips originating from and destined to any zone represents the influence of that zone on the traffic. Sum of trips originating from and destined to any zone divided by total number of observed trips in percentage gives the influence factor (I.F) of that particular zone.

The influence factors indicate the relative importance of the zones. Based on the OD survey on SH-14 near Metalkunta junction, estimated state-wise influence factors for passenger and goods vehicles are given in **Figure 7-7** and **Figure 7-8** respectively.

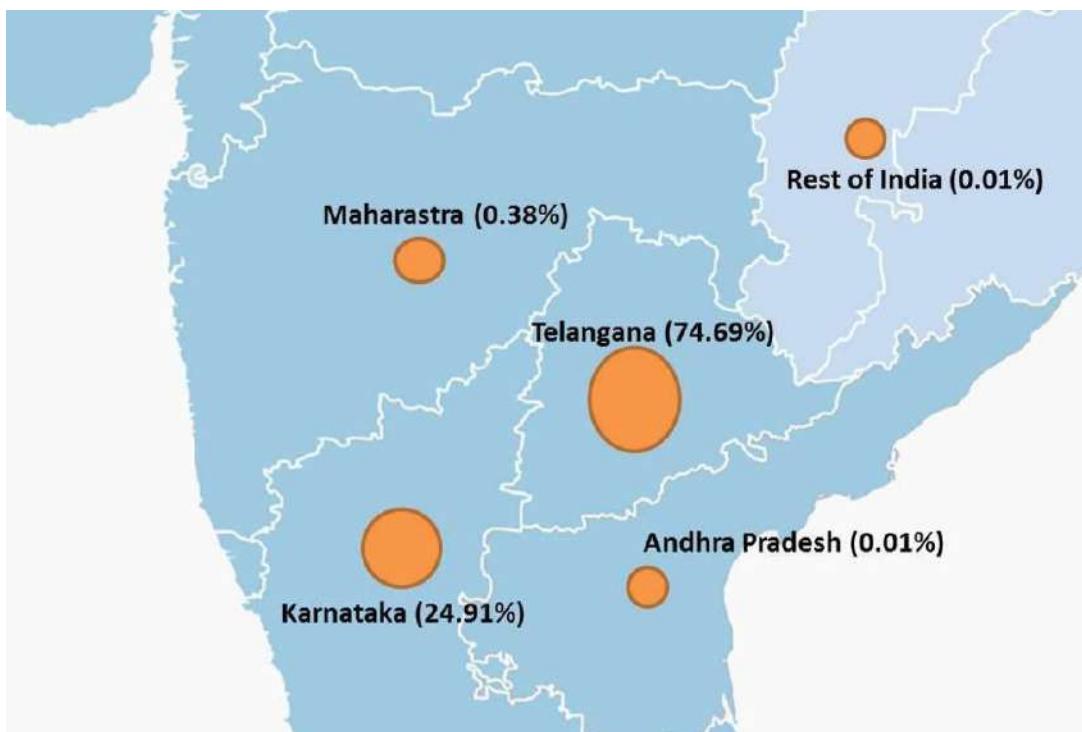


Figure 7-7: State-wise influence factors for Passenger traffic

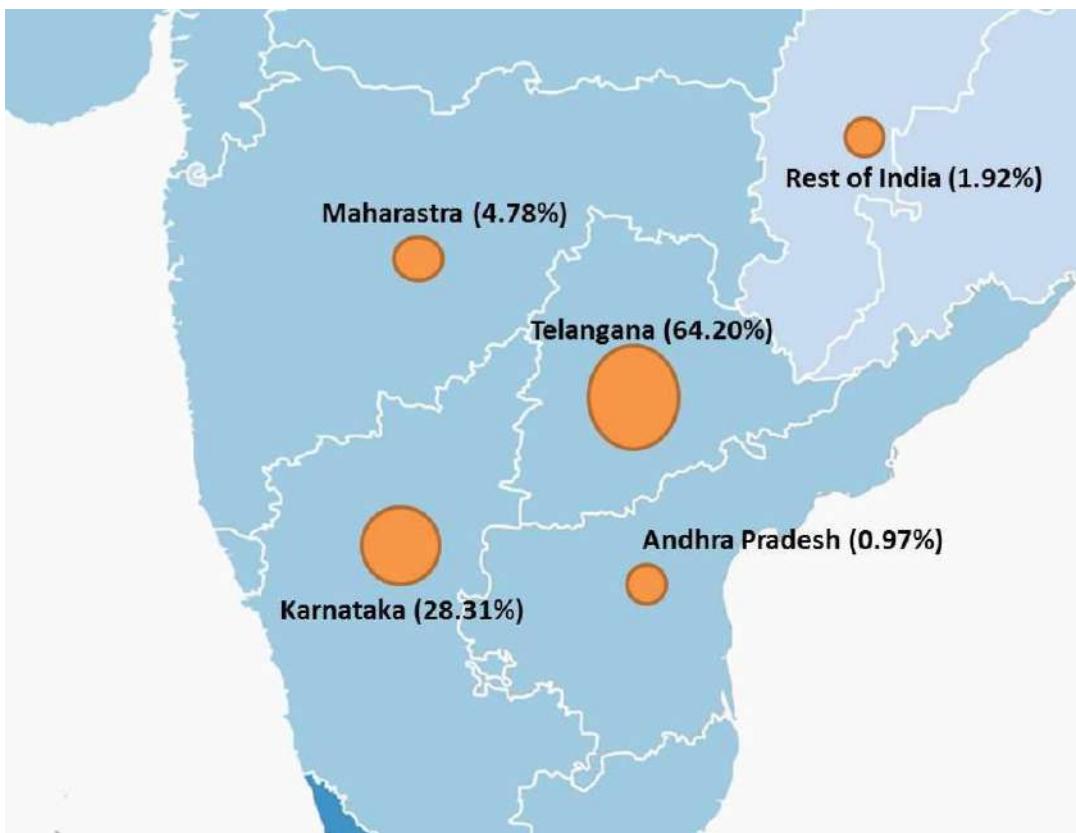


Figure 7-8: State-wise influence factors for Goods traffic

From the above figures, it can be observed that Telangana and Karnataka are the most influencing states for all the vehicle categories.

7.3.1.6 Trip Generation Surveys

Trip generation survey is carried out by the Consultants' to understand the trips generated from various industries along the project corridor. It is an interview survey carried out by consulting various industries. The details collected includes gross area, net area of industry, sources of raw materials, destination of finished products, mode of transport for both raw materials and finished products, route of transport and number of vehicles entering and leaving the industrial area per day. The list of major industries around the project site is:

- Mahindra & Mahindra (Tractor Vehicle Manufacture Industry)
- Allana Food processing Unit (Meat and Fruit)
- Trident Sugar factory
- Sri Venkateshwara Agro Board cutting

Mahindra & Mahindra is located along NH-9 near the junction of NH-9 and SH-14. The total number of commercial vehicles generated by day (both IN and OUT) is around 400 trucks from 22 places all over India including major cities.



Allana Food Processing Unit is located along a local street connecting NH-9 and SH-14. It is involved in processing of meat and fruits. The main vehicle movement to this industry is during night time when all the suppliers from across the state send meat produce to the factory. The facility generates around 30 trucks per day.

7.3.2 Internal Traffic Assessment-Roads

Internal traffic analysis comprises of the estimation of generated traffic from the proposed development and lane capacity assessment for the road network proposed within the NIMZ.

7.3.2.1 Basic Assumptions

Commercial Traffic:

The following assumptions are made to estimate the commercial (trucks) traffic generation potential of the NIMZ:

- The trip generation rates for various industrial sectors are considered based on the database of trip generation rates from the secondary data. The trip generation rates considered for various industrial sectors are given in **Table 7-15**.

Table 7-15: Commercial Trip Generation Rate for Various Sectors

S. No.	Sector	Trip Generation Rate (Trips/ Ha)
1	Automobile	1.5
2	Electrical equipment	1.2
3	Food Processing	1.2
4	Machinery	1.5
5	Metals	1.2
6	Non-metallic minerals	1.2
7	Transport Equipment	1.2
8	Others	1.0

- The mode share for various sectors would be different based on the size of the product to be transported and the type of industry. The assumed mode share for various sectors is given in **Table 7-16**.

Table 7-16: Mode Share of Commercial Vehicles

S. No.	Sector	LCV	2 Axle Truck	3 Axle Truck	MAV
1	Automobile	0%	0%	0%	100%
2	Electrical equipment	30%	40%	20%	10%
3	Food Processing	70%	30%	0%	0%
4	Machinery	0%	25%	35%	40%
5	Metals	10%	20%	30%	40%
6	Non-metallic minerals	10%	40%	25%	25%
7	Transport Equipment	0%	0%	0%	100%
8	Others	70%	30%	0%	0%

- The share of road and rail in the transport of the generated commercial traffic which is given in **Table 7-17**.

Table 7-17: Road/Rail Share of Commercial Vehicles

S. No.	Sector	Road	Rail
1	Automobile	60%	40%
2	Electrical equipment	100%	0%
3	Food Processing	100%	0%
4	Machinery	80%	20%
5	Metals	80%	20%
6	Non-metallic minerals	80%	20%
7	Transport Equipment	80%	20%
8	Others	100%	0%

- The estimated truck traffic also accounts for the empty truck trips. Empty truck traffic is assumed as 50% of the estimated commercial truck traffic.

- The peak hour truck traffic is assumed to be 15%.

Passenger Traffic:

The following assumptions are made to estimate the passenger traffic generation potential of the proposed development:

- The employees who are expected to work in the proposed development include those who reside outside and travel on a daily basis to and from the development and those who reside within the development. It is assumed that the employment generation rate in the existing settlements is 1 employee per household.

The modal share of passenger vehicles used by the employees and the occupancy and PCU values of each mode are presented in **Table 7-18**.

Table 7-18: Mode Share of Passenger Vehicles

Mode	Mode Share				PCU Factor	Occupancy		
	Direct Employees		Indirect Employees	Family Members				
	From outside	From within NIMZ						
Walk	0%	15%	35%	20%	0.00	1.00		
Cycle	5%	35%	5%	20%	0.50	1.00		
Two-wheeler	35%	45%	5%	30%	0.75	1.25		
Car	10%	5%	0%	5%	1.00	1.50		
Bus *	50%	0%	60%	25%	3.00	40.00		

* Since buses will not enter inside the campus, the same is not considered for trip generation

- It is assumed that the employees in the NIMZ will work as per the shift schedule presented in
- The share of direct and indirect employees who work in each sector is assumed as given below **Table 7-19**.

Table 7-19: Assumed Shift Schedule

Shift No.	Description	Shift Timings	Direct Employees	Indirect Employees
1	General Shift	9.00 a.m. - 6.00 p.m.	60%	40%
2	Noon Shift	4.00 p.m. - 01.00 a.m.	20%	40%
3	Night Shift	12.00 a.m. - 9.00 a.m.	20%	20%

- The trip rate for other family members who are non-employees is assumed to be 0.5 trips per household and their peak hour share to be 30%
- The assumed household size for different types of household units is given in **Table 7-20**.

Table 7-20 Assumed Household Size

Type of Household Unit	Household Size
One room unit	3
Two rooms unit	4
Three rooms unit	5
Four room unit	5

- The trip generation rates assumed for non-industrial area is as given in **Table 7-21**.

Table 7-21: Trip Generation rate for Non-industrial area

Sector	Trip Generation Rate
Primary school	0.10 PCU/hr/Student
Secondary school	0.12 PCU/hr/Student
Hospitals	0.70 PCU/hr/bed

Sector	Trip Generation Rate
Commercial & retail space	0.30 PCU/hr/100 Sq.m

- The peak hour traffic for employees is assumed to be 60%.

7.3.2.2 Estimation of Generated traffic by road

Based on the above assumptions and the sector-wise area statement and employment statement of the proposed development, the commercial trips and passenger trips which will be generated from each sector is estimated.

The total generated traffic and the peak hour traffic from the proposed development for both Business As Usual (BAU) and Business Induced (BI) scenarios are shown in **Table 7-22**.

Table 7-22: Total generated traffic for the proposed NIMZ

Traffic (PCU/day)		Peak Hour Traffic (PCU/hr)	
Commercial Traffic	Passenger Traffic	Commercial Traffic	Passenger Traffic
13,330	46,082	2,000	24,449

7.3.3 External Traffic Forecast - Roads

External traffic analysis is carried out to assess the adequacy of the external road network to cater to the generated traffic from the proposed NIMZ.

7.3.3.1 Traffic Growth Rates

The existing traffic on various access roads to the NIMZ is derived from the primary traffic surveys. The traffic on various roads is forecasted for future years based on traffic growth rates.

- Most widely used method for the macro level forecasts of the traffic is Elasticity Approach.
- Elasticity is defined as rate of change of traffic with 1% change in potential variables such as NSDP, per capita income and population.

Traffic growth estimation based on the Elasticity method comprises of multiplying the growth rate of potential economic variables influencing the project road traffic with elasticity of traffic. The elasticity values of traffic with respect to GDP for the period 2001-2021 given in Journal of the Indian Roads Congress, is given in **Table 7-23**. These values have been used with minor modifications as indicated in following sections.

Table 7-23: Values of Elasticity for the period 2001-2021

S. No.	Vehicle Type	Elasticity Value
1	Car	1.20
2	Two-Wheeler	1.50
3	Bus	0.875
4	Goods Vehicles	1.10
5	Auto rickshaw	1.45

Source: Road Transport Demand for 2000 AD revisited and demand forecast for 2021, Journal of the Indian Roads Congress, Oct-Dec, 2009.

Growth Estimation for Commercial Vehicles:

An elasticity value of 1.1 for commercial vehicles is adopted. The product of the weighted growth rate of economic indicators and elasticity value is the growth rate of the vehicle type on the project road.

In commercial vehicles, growth of 2-Axle trucks has been negative and growth in 3-Axle trucks is almost close zero based on the past traffic trends all over India on National Highways. This is due to the increased preference for LCVs and Multi-axle vehicles which are economical to operate as compared to 2-Axle trucks and Multi-axle trucks.

Growth Rate for Passenger Vehicles

The growth in passenger traffic, especially cars, mainly depends on the growth in per capita income and the growth in population of the project influence area. The influence of each zone is multiplied by the combined growth in income and population of that particular zone and added up, to obtain the weighted growth rate.

This weighted growth rate of socio-economic indicators is multiplied by the elasticity values to obtain the growth rate of passenger vehicles. The elasticity value of 1.2 for passenger car and 1.5 for two-wheelers is adopted.

The moderated estimated traffic growth rates are presented in **Table 7-24**.

Table 7-24: Traffic Growth Rate

Vehicle Type	2017-2020	2021-2025	2026-2030	2030-2035
Two Wheeler	7.50%	7.13%	6.77%	6.09%
Auto	5.00%	4.75%	4.51%	4.06%
Car	7.00%	6.65%	6.32%	5.69%
Mini Bus	5.50%	5.23%	4.96%	4.47%
Bus	5.00%	4.75%	4.51%	4.06%
LCV	6.00%	5.70%	5.42%	4.87%
2 Axle Truck	2.50%	2.38%	2.26%	2.03%
3 Axle Truck	3.00%	2.85%	2.71%	2.44%
MAV	8.50%	8.08%	7.67%	6.90%
LMV, Goods Auto	2.00%	1.90%	1.81%	1.62%
Agricultural Tractor/ Trailers	2.00%	1.90%	1.81%	1.62%
Army/ Govt. Vehicles	2.00%	1.90%	1.81%	1.62%
Cycle, Animal Drawn	2.00%	1.90%	1.81%	1.62%

The primary roads in NIMZ are SH-14 and SH-16. The total future traffic on these roads will include the generated traffic from NIMZ and the forecasted existing traffic. The generated traffic from NIMZ will join NH-65 through SH-14 and through Jharasangam Road. Some of the traffic will move towards northern side through SH-16.

The traffic forecast along NH-65, SH-14, SH-16 and Jharasangam Road for Option 1 is shown in **Table 7-25**.

Table 7-25: Traffic Forecast on External Roads

Year	Car	Two-Wheelers	Auto rickshaws	Mini Bus	Bus	LCV	2-Axle Trucks	3-Axle Trucks	Multi Axle Vehicles	Total Vehicles	Total PCUs
NH-65	16,364	16,806	5,346	322	3,288	3,121	2,138	2,483	5,761	55,628	91,801
SH-14	7,883	16,397	3,392	111	2,056	884	465	571	1,667	33,427	43,539
SH-16	3,986	12,407	2,690	88	629	408	329	363	694	21,595	25,160
Jharasangam Road	1,849	16,047	1,991	9	526	1,119	533	181	1,415	23,670	28,648

7.3.4 Capacity Assessment of Road Network

7.3.4.1 Internal road capacity assessment

The estimated generated traffic is used to assess the lane capacity required for the road network within NIMZ. For this the internal road network is classified into primary, secondary

and tertiary roads. The primary road network within NIMZ consists of the existing State Highways, SH-14 and SH-16 which passes through the proposed site.

The following assumptions were used for trip distribution:

Basic Assumptions:

- The network adequacy of internal roads is checked with a maximum capacity of 1200 PCU/lane/hr.
- Lane adequacy checks are done for BAU and BI scenarios for the design year and future years

The lane requirement for the internal road networks of the proposed NIMZ was checked at various sections as shown in **Figure 7-9**. The lane capacity requirement for the proposed road network within NIMZ is given in **Table 7-26**. This lane capacity is completely based on the future trips generated from NIMZ.

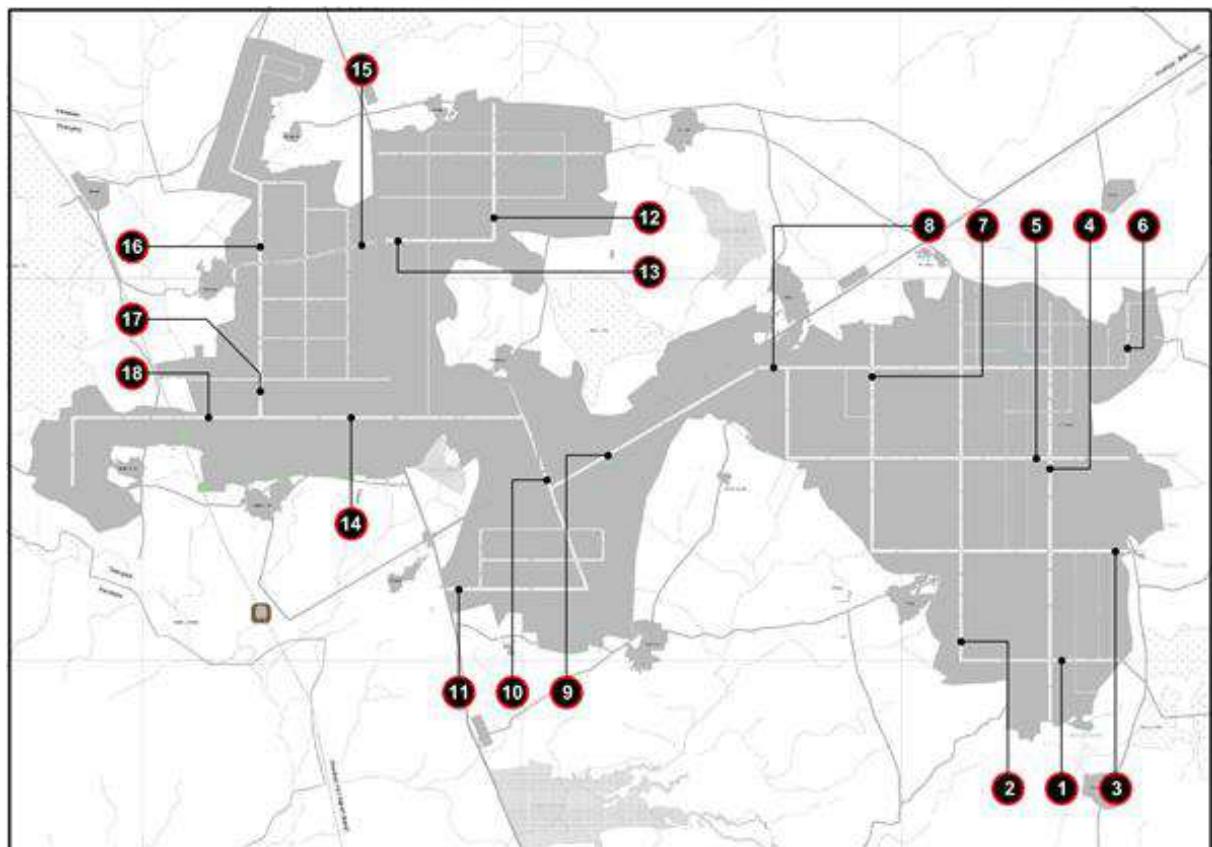


Figure 7-9: Sections considered for checking Lane Adequacy of Internal Road Network

Table 7-26: Lane Capacity Requirement for Internal Road Network

Section No	Peak hour traffic (PCU/hr)	No. of lanes required	RoW provided	Check for adequacy
1-1	389	2.0	60m	Adequate
2-2	1,516	2.0	45m	Adequate
3-3	2,797	3.0	45m	Adequate
4-4	1,378	2.0	45m	Adequate
5-5	383	2.0	45m	Adequate
6-6	536	2.0	30m	Adequate
7-7	867	2.0	45m	Adequate
8-8	5,253	6.0	60m	Adequate

Section No	Peak hour traffic (PCU/hr)	No. of lanes required	RoW provided	Check for adequacy
9-9	6,608	6.0	60m	Adequate
10-10	6,608	6.0	60m	Adequate
11-11	2,700	4.0	45m	Adequate
12-12	2,317	2.0	45m	Adequate
13-13	3,102	4.0	60m	Adequate
14-14	2,712	4.0	60m	Adequate
15-15	2,599	4.0	60m	Adequate
16-16	1,761	2.0	60m	Adequate
17-17	1,317	2.0	60m	Adequate
18-18	587	2.0	45m	Adequate
19-19	2,851	4.0	45m	Adequate

7.3.4.2 External road capacity assessment

After assigning the total forecasted traffic on to the road network, the capacity analysis is carried out to check the adequacy of the road network to cater to the current and forecasted traffic. Based on the analysis, capacity augmentation of existing roads or proposals for new roads is suggested to cater to the projected traffic demand.

Capacity of Rural Roads for various lane configurations based on IRC is considered. Since the IRC 64-1990 has not provided the capacity of multi-lane highways, design service volumes have been estimated based on IRC-SP:84-2014 and rounded off to the nearest values. The capacity of roads for LOS B and LOS C is presented in

Table 7-27: Capacity of Rural Roads

Lane configuration	Design Service Volume (in PCUs per day)	
	LOS 'B'	LOS 'C'
2-lane	17,500	-
4-lane	40,000	60,000
6-lane	60,000	90,000
8-lane	80,000	120,000
10-lane	120,000	150,000

Source: IRC 64-1990, IRC-SP: 84-2014

The findings from external road capacity assessment are shown in

Table 7-28: Required Lane Configuration

Name of Road	Lane configuration for NIMZ
LOS B	
NH-65	10
SH-14	6
SH-16	6
Jharasangam Road	4
LOS C	
NH-65	8
SH-14	4
SH-16	4
Jharasangam Road	4

7.3.5 External Traffic Assessment-Railways

Railway network is necessary for the evacuation of the cargo produced from NIMZ partly. The proposed site falls in the Secunderabad Division of Southern Central Railway (SCR). The following sections of this division as shown in **Figure 7-10** are relevant to the proposed site:

- Vikarabad-Parlivaijnath: connects Latur, Aurangabad and Manmad where it joins the Mumbai-Itarsi line
- Vikarabad-Lingampalli: connects to Hyderabad
- Wadi-Vikarabad: connects to Wadi

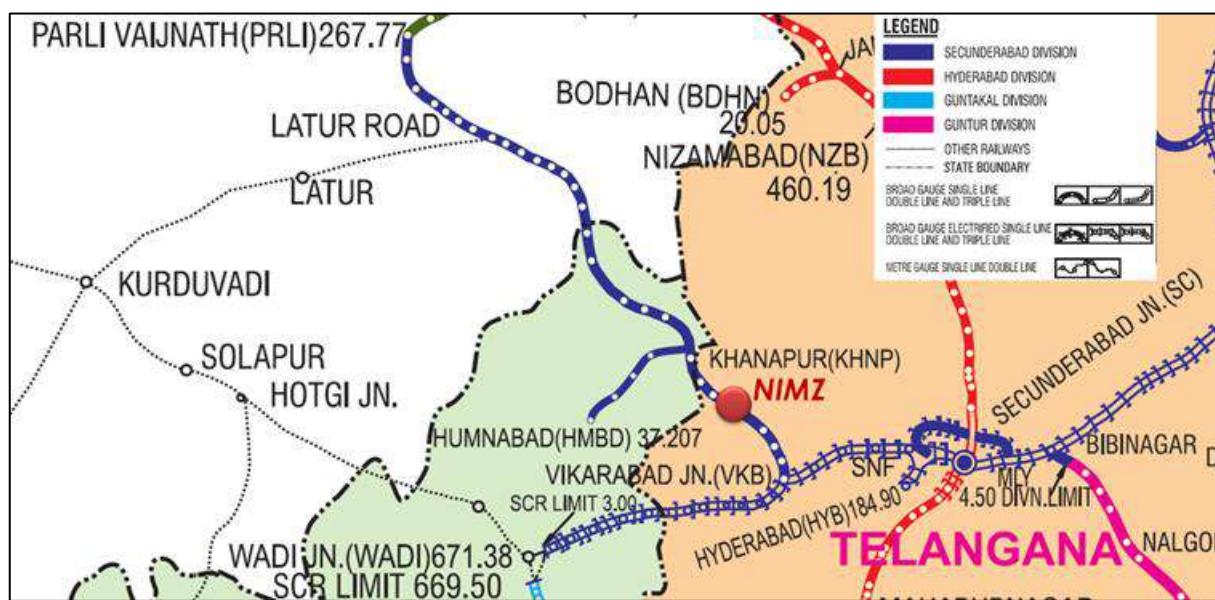


Figure 7-10: Secunderabad Railway Division Map

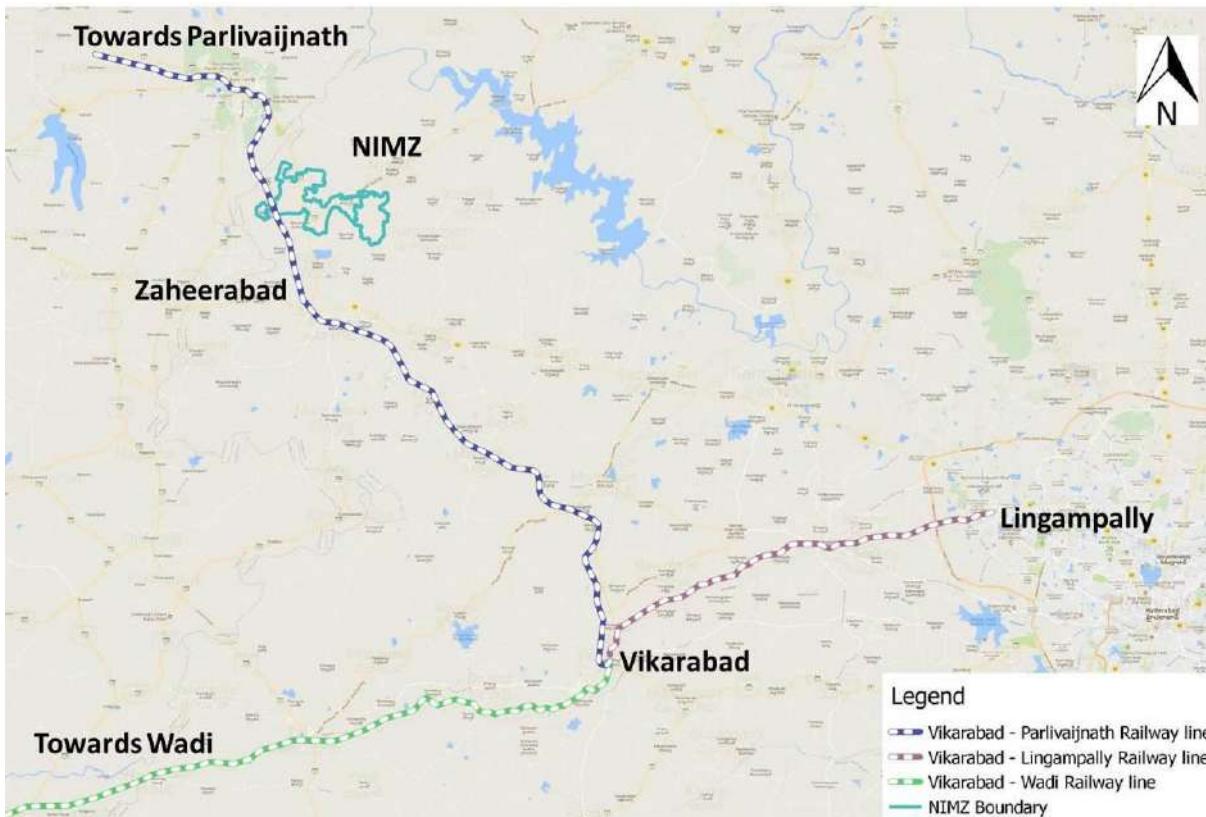
7.3.5.1 Existing Rail Infrastructure

The infrastructure details of the relevant sections of rail network such as length, number of lines and type of traction is given in **Table 7-29**.

Table 7-29: Details of Rail Network

Railway Zone	Railway Division	Railway Section	Length (km)	Single Line/ Double Line	Traction
South Railway	Central Secunderabad	Vikarabad-Parlivaijnath	268	Single Line	Diesel
		Vikarabad-Lingampalli	49	Double Line	Diesel
		Wadi-Vikarabad	112	Double Line	Diesel

The existing rail network in influence area is shown in **Figure 7-11**.

**Figure 7-11: Railway Network in Region**

The details of the rail network such as section name, length, traction type, no. of lines, charted capacity, average no. of trains operating and utilized capacity is presented in

Table 7-30: Existing Line Capacity Utilization (2014-2015)

S. No.	Section	Charted Line Capacity (with Maintenance Block)	Average Nos. of Train Services				Utilisation of Charted Capacity (%)
			Passenger	Goods	Others	Total	
1	Vikarabad-Parlivaijnath	46	30	24	4	58	126
2	Vikarabad-Lingampalli	50	27	24	4	55	110
3	Wadi-Vikarabad	26	22	10	2	34	131

It can be observed that all three sections are running above line capacity. The congestion in Wadi-Vikarabad section is highest at 131% and Vikarabad-Lingampalli section is lowest at 110%.

7.3.5.2 Review of rail traffic trend in South Central Railway

Freight Traffic:

South Central Railway (SCR) reached the landmark of 100 million tonnes of originating freight loading during 2012. The trends of freight Loading is presented in **Table 7-31**. It can be noted that freight traffic in SCR has grown at the rate of about 3% per annum in last 8 years which is about 1.6 times that growth observed at the national level. The significance of freight traffic for south central railway zone can be gauged from the fact that 70% earnings to SCR comes from freight traffic.

Table 7-31: Trends of Freight Traffic in SCR

Year	Originating Freight Loading (in MTs)	Growth Rate
2008-09	73.8	
2009-10	85.9	16%
2010-11	96.2	12%
2011-12	103.2	7%
2012-13	111.5	8%
2013-14	107.2	-4%
2014-15	116.8	9%
2015-16	107.2	-8%
2016-17	96.83	-10%
Average growth over last 8 years		3%

Passenger Traffic:

The growth of passenger traffic has been negative during last few years. While SCR has carried 387 millions of originating passengers during 2012-13 which has been reduced to 363 million passengers in 2014-15.

7.3.5.3 Basic Assumptions

The following assumptions are made to estimate the rail traffic generation potential of the NIMZ:

- The sector-wise share of road and rail trips is given in **Table 7-17**. The sectors such as Automobiles, Machinery, Metals and Non-metallic minerals contribute to rail traffic
- The trip generation is estimated in equivalent number of truck trips per day. A trip generation rate of 1.5 trips/ hectare has been assumed.
- The equivalent number of truck trips is converted into tonnage by considering the load carried by one truck to be 15 tonnes.
- The load carried by 1 train rake is assumed to be 3,500 tonnes.
- Empty train rakes are assumed to be 100%.

7.3.5.4 Traffic forecast of freight trains

Generated traffic is assigned on to the rail network based on the consideration of likely O-D pattern that has been derived based on the market demand analysis. The estimated requirement of rakes for the rail traffic generated from NIMZ is 8 (including empty rakes).

7.3.5.5 Proposals for development of rail infrastructure around NIMZ

The following proposals have been suggested in the Pink Book 2017-18 of South Central Railway for the corresponding rail network of NIMZ:

- Signalling arrangements for interlocking of level crossings in Vikarabad Parli Vaijnath Section
- Track renewal for 122.875 km stretch of Vikarabad-Parli Vaijnath section

Although this rail section is oversaturated with 126% utilisation of charted capacity, there are no proposals for capacity augmentation. Hence this rail line will not be able to cater to the traffic generated NIMZ, once the development becomes functional. Therefore, the direct rail connectivity from NIMZ to Hyderabad is recommended.

7.4 Social Impact Assessment

The proposed project is spread in more than **~12,635 acres** (Ac. 12365.14 guntas). The land acquisition process of the project is undergoing in two phases namely Parcel I & II. The present site conditions are present in **Figure 7-12**.

At present 17 villages are impacted due to land acquisition. In the site there are 4 hamlets/settlements with combining of all types of castes and religion are living since many years. The settlements will be retained in the project site by providing certain green buffer and area around it is earmarked for settlement expansion Due to land acquisition there is only economic displacement of the population but no physical displacement within the project site. The socio economic survey was conducted during March 16-17, 2018 and from April 16-17, 2018. In the survey local administration, teachers, sarpanches, anganawadi teachers, panchayat secretaries and others were involved. During the survey there was not much objection on the project rather there was certain obligations and suggestions were brought to the notice of the social experts.

The major findings and magnitude of impacts of the proposed project are discussed. The project impacts have been classified into different categories such as impacts on land, impacts on the affected families and their livelihood resources, impacts on agriculture lands.

The proposed project will have a number of positive and negative impacts. In general the proposed project shall bring following positive impacts:

- Safety in travelling, and easy access of roads
- Mobility in the project area,
- Traffic decongestion,
- Generate employment opportunity,
- Save fossil fuel,
- Economic growth,
- Reduce levels of air pollution

The proposed project is not so positive for a section of people / project affected families. The anticipated negative impacts on these people include:

- Loss of Agriculture lands
- Loss of Livelihood of land losers and dependents
- Loss of other social amenities and infra within the site access
- Loss of daily wagers employment for time being till they are hired by proponent.

During the survey the locals objected the survey, one Thanda i.e., Suryanaik Tanda (Rukmapur Tanda) could only be surveyed and other villagers and settlements were boycotted survey and they even tried to physical handle to the enumerators and social experts. All the impacted and affected villagers agitated to withdraw the project as people of the surrounding area are losing their agricultural land.

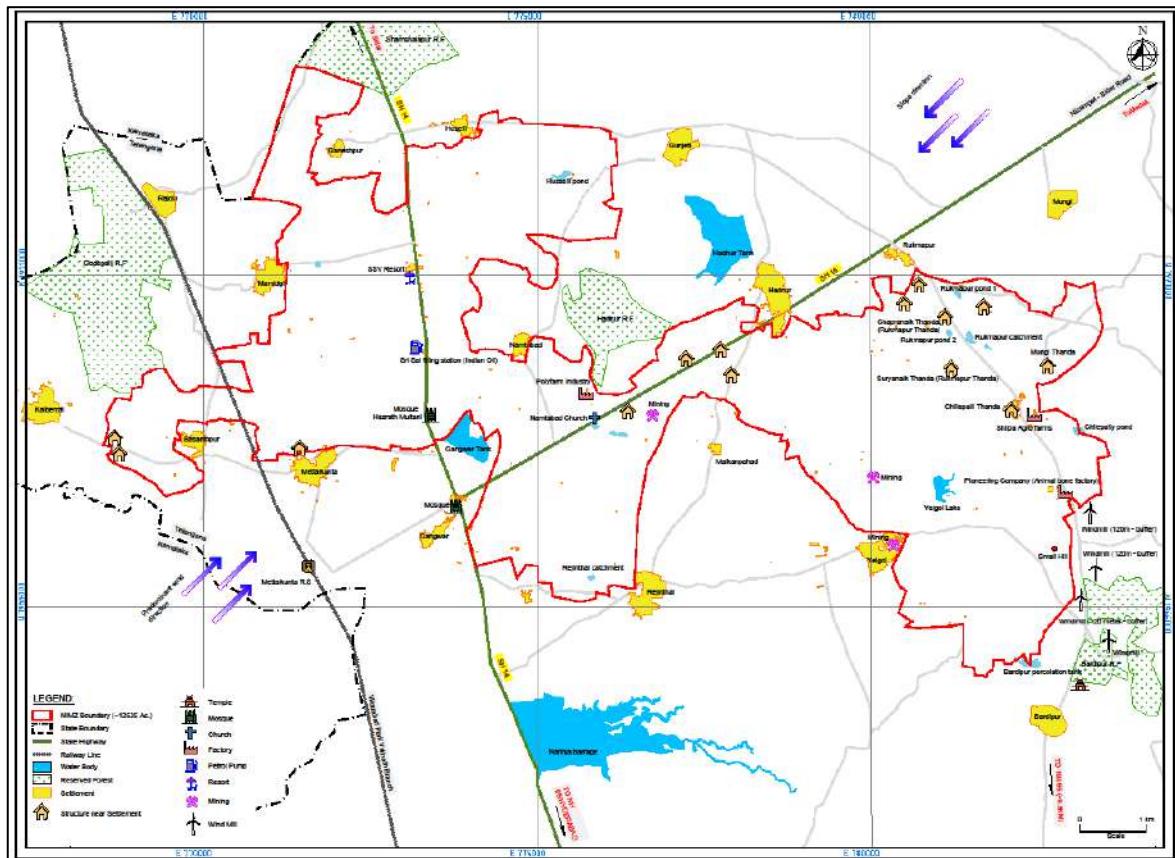


Figure 7-12: Existing Social Infrastructure in and around the site

7.4.1 Land Acquisition Details and Its Impacts

An area of Acres **12,635.14 guntas** of identified land parcel at Nyalkal and Jharasangam Mandals of Sangareddy district has been proposed for the development of Industrial Park.

The proposed project site has no R&R, the existing settlements within the site boundary left as it is with giving ~50m green buffer zone and some are integrated with proposed residential area. The proposed land details along with extent, ownership classification, and acquisition details are provided in **Table 7-32**. Survey numbers falling in project site are given as **Appendix K**.

Table 7-32: Land Details of NIMZ IP Project (in acres)

S.No	Name of the Village	Private Land			Assigned Land			Un-Assigned Land			Grand Total		
		Acquired	To be Acquired by TSIIC	Total	Acquired	To be Acquired by TSIIC	Total	Acquired	To be Acquired by TSIIC	Total	Acquired	To be Acquired	Total
1	2	3	4	(5=3+4)	6	7	(8=6+7)	9	10	(11=9+10)	(12=3+6+9)	(13=4+7+10)	14=12+13)
1.	Bardipur	138.38	91.16	230.14	202.24	13.29	216.13	0.00	0.00	0.00	341.22	105.05	446.27
2.	Chilepally	250.15	195.37	446.12	102.00	9.00	111.00	59.11	0.00	59.11	411.26	204.37	616.23
3.	Yelgoi	709.06	742.38	1452.04	785.19	108.11	893.30	37.36	0.00	37.36	1532.21	851.09	2383.30
4.	Rukmapur	109.08	161.01	270.09	156.06	28.36	185.02	5.30	0.00	5.30	271.04	189.37	461.01
5.	Mungi	104.11	167.03	271.14	229.03	19.08	248.11	34.31	0.00	34.31	368.05	186.11	554.16
6.	Mulkanpahad	0.00	145.39	145.39	0.00	54.12	54.12	0.00	15.34	15.34	0.00	216.05	216.05
7.	Hadnoor	0.00	512.31	512.31	0.00	51.35	51.35	0.00	26.17	26.17	0.00	591.03	591.03
8.	Nyamthabed	0.00	768.03	768.03	0.00	255.28	255.28	0.00	187.19	187.19	0.00	1211.10	1211.10
9.	Husselli	0.00	594.13	594.13	0.00	108.07	108.07	0.00	25.09	25.09	0.00	727.29	727.29
10.	Rejinthal	0.00	1481.14	1481.14	0.00	191.09	191.09	0.00	62.11	62.11	0.00	1734.34	1734.34
11.	Gunjetti	0.00	291.33	291.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	291.33	291.33
12.	Ganqwar	0.00	38.17	38.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	38.17	38.17
13.	Kalbemal	0.00	171.16	171.16	0.00	73.38	73.38	0.00	110.02	110.02	0.00	355.16	355.16
14.	Ganeshpur	0.00	433.00	433.00	0.00	118.01	118.01	0.00	70.14	70.14	0.00	621.15	621.15
15.	Mamidigi	0.00	1214.31	1214.31	0.00	200.09	200.09	0.00	53.00	53.00	0.00	1468.00	1468.00
16.	Metalkunta	0.00	318.10	318.10	0.00	303.07	303.07	0.00	59.00	59.00	0.00	680.17	680.17
17.	Basenthpur	0.00	132.24	132.24	0.00	85.25	85.25	0.00	18.09	18.09	0.00	236.18	236.18
	Total	1311.38	7461.06	8773.04	1475.12	1621.15	3096.27	137.28	627.35	765.23	2924.38	9710.16	12635.14

(Source: TSIIC)

7.4.2 Entitlement Matrix

The Entitlement Matrix for the proposed project has to be prepared as per the G.O. 123 and **Telangana State RFCCT LAR&R Act 2016** in line with RFCT LAR&R Central Act, 2013. The land acquisition compensation and budgetary provisions will be added.

7.4.2.1 Rules and Regulations

Social regulations for land acquisition and to suggest appropriate mitigation measure are given in **Table 7-33**. The spirit of these policies will be followed during land acquisition for this project.

Table 7-33: Rules and regulations

Land Acquisition Policies & Regulations	Year	Objective	Applicability
Land Acquisition, Rehabilitation and Resettlement (LARR)	2013	<p>To provide just and fair compensation to the affected families whose land has been acquired or proposed to be acquired or are affected by such acquisition and make adequate provisions for such affected persons for their rehabilitation and resettlement and for ensuring that the cumulative outcome of compulsory acquisition should be that affected persons become partners in development leading to an improvement in their post-acquisition social and economic status and for matters connected therewith or incidental thereto.</p> <p>The Act is to ensure consultation with institutions of local self-government and Gram Sabhas established under the Constitution</p> <p>Land Acquisition for industrialisation, development of essential infrastructural facilities and urbanisation with the least disturbance to the owners of the land</p>	Principal Act Applicable
Procurement of land and other structures thereon from Willing Land Owners by the Procuring Agencies for public places G.O. 123	2015	<p>Telangana state Government Order (G.O.) 123 "Procurement of land and other structures thereon from Willing Land Owners by the Procuring Agencies for public places, dated July 30, 2015, the NIMZ project land acquisition was conducted under G.O. 123 for Parcel I. Willing land owners can negotiate for land with the district collector approved land acquisition agency.</p>	Applicable for Parcel I
Telangana State LAAR Act, 2016	2016	<p>Presently the state of Telangana land acquisition acts "An Act to Amend the Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013 in its Application to the state of Telangana". The act can also be called as "The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement (Telangana Amendment) act, 2016.</p>	Applicable for balance land of both Parcel I & Parcel II
Land to land provision for SC/ST	2013	<ul style="list-style-type: none"> • Acquisition of land as last resort • Development plan must be prepared to clearly delineate the rights of those 	Primary Census & Land Acquisition details the present situation of land acquisition

Land Acquisition Policies & Regulations	Year	Objective	Applicability
		<p>belonging to SC/ST communities that have not yet been settled</p> <ul style="list-style-type: none"> • One-third amount as first instalment • Land for community gatherings • Resettlement in the same area or Additional benefits if resettled outside scheduled areas • SC/ST communities will be provided the same quantity of land that is acquired or 2.5 acres, (whichever is lower) • No acquisition in contravention of existing laws 	

7.4.2.2 Land Acquisition Process

The land acquisition for the NIMZ project is divided into two Parcels I & II of which 65% which is partly of Parcel I land has been acquired through G.O. 123. The G.O. 123 is to procure the land and other structures from willing land owners. The GO was to expedite the process for the land acquisition. The willing land owners to sell their land and properties will be in agreement with the Procuring Agency. The procuring agency will be approved by District Level Land Procurement Committee (DLLPC).

7.4.3 Key Social Impacts

7.4.3.1 Economic Displacement

The land acquisition for the project has led to economic displacement of the affected communities. It means that the communities have lost their livelihood options. At the household level they selling cow milk, working as labourers etc. but the permanent source of income for the people have been lost. The type of land people were holding was patta land as well as assigned land. Some of the persons were also cultivating on government land.

7.4.3.2 Impact on Nearby Settlements

The Tandas located in the project site will be retained by providing 50 m buffer zone. The pollution control measures will be taken into account and also water conservation programs will be introduced. Appropriate road network within the site as well as the people will get livelihood options also in the region.

7.4.3.3 Reduction in Landholding

The land owners are divided into two parts, one is patta land owners, who owns all right and some are assigned land owners who received lands from government under the landless poor farmer's status. The assigned lands given to the farmers were not allowed to sell to anyone private parties except to cultivate and enhance their livelihood generation together. But the government may take back land at any movement for development or for any reasons to make necessary changes by providing better compensation. But now, the assigned land is divided themselves (land owners with small patches with all the children) which affects them that they cannot purchase a new land for livelihood due to insufficient amount.

7.4.3.4 Impact due to change in land Use

The Land use pattern will change due to the manufacturing zone. The agriculture crop lands will be turned out into industrial/commercial area and new sources of income will generate.

7.4.3.5 Livelihood of Local communities

The primary source of livelihood of the affected/impacted families is agriculture, agricultural labourer and its related activities. With the proposed development, it is expected less of agriculture would be practised and newer employment options will come among the project affected people. But there are chances of loss of livelihood due to the change of land use in the initial stages of the project. The secondary option the people chosen was working in NREGA scheme in which they will get 100 days of employment and wages as per their experience and skill set.

7.4.3.6 Impact on Common Property

At present on the project site, there are some religious (temple, mosque) structures which will be retained and not disturbed. These structures belong to land owners also but people worship there. No disturbance will be ensured during construction and operation phases.

7.4.3.7 Impact due to in-migration

It is expected that due to the new development migration of people from different areas into the NIMZ and nearby areas is anticipated. Also the industries will require highly skilled and semi-skilled labour which is expected to migrate from other places. It could lead to disturbances on existing social infra and amenities. NIMZ is planned with lot of emphasis on social, amenities and commercial infrastructure which will reduce stress on local infrastructure due to the development.

7.4.3.8 Construction workers camp

Construction phase requires large work force. Worker camps at the construction site will be given the facility of temporary housing facility to the migrant workers with water, sanitation and refreshments facility. They will be working in shifts and it will be made sure that the minimum wages is given to the workers. The security of the people around the construction camps will be ensured by restricted movement through this area. Regular health check-ups will be provided to them.

To ensure that there is no strain on the existing infrastructure, worker camps will be self-sufficient and would not rely on local resource. This would also ensure that there will be no conflict with the local population. Further the worker camp will be located well within the project boundary. The basic infrastructure facilities like water supply, sanitation, power supply etc., will be provided in the workers camp. And it is also suggested that the proponent may requested to take locals for work and may provide employment.

7.4.3.9 Social Conflict

The proximity of the states, the migration is happening from long time. While the agitation faced is due to the land prices. The area has been peaceful and some industries are plying in the region. Social conflicts are expected due to industry unions and industries will also face social conflicts with local people, if local resources are exploited etc.

7.4.3.10 Increase in crime and violence, especially against women

As per the survey conducted and during consultations it was enquired with the women participants about the violence faced. They reported that no violence is being faced by them. Due to increase in migrant population and increase in economic development etc., violence may be expected which need to be controlled.

7.4.3.11 Spread of communicable disease

Due to influx of people it is suspected that diseases especially communicable nature may spread. Health check-up camps shall be conducted on regular basis. Also the local medical units shall educate the local people.

7.4.3.12 Creation of Economic Opportunities

It is expected that the region will be flourished with many newer economic opportunities in the region. Many direct and indirect jobs will be created. The locals have understood the value of high education and they are keen to send their children for higher qualifications. Local employable youth shall be given importance in the various industrial, commercial and social infrastructures coming up in NIMZ.

7.4.3.13 Community Health

The industries proposed to be developed in the NIMZ will adopt suitable safety/mitigation measures and procedures during the operation of these industries.

The solid waste generated from the proposed project will be segregated as municipal waste, hazardous waste, e-waste and biomedical waste. Municipal waste generated will be disposed to local bins for further treatment and disposal. Individual industries generating hazardous waste shall be sent through authorized waste handler for further treatment and disposal. E-Waste generated will be collected, stored and transported to authorised recyclers. Biomedical waste shall be handled as per Bio-Medical Waste Management Rules, 2016.

An effective Disaster Management Plan (DMP) which includes Onsite and Offsite emergency plan shall also be prepared and will be followed to minimize the probability of occurrence of emergency situations and mitigate the impacts. The waste management should not cause more health complication to the locals.

The health issues people refer to hospital near towns or developed villages which are 3-4 km away from the village area. The health check-up camps are also organized by the government. As part of the provision of NIMZ PHC will be built in the area which will be accessible to all the locals who are residing and as well as people of the surrounding areas.

7.4.4 Mitigation Measures

Mitigation is the stage when measures are identified to avoid and minimize the impacts. These measures are implemented as part of the process of impact management, together with any necessary adjustments to respond to unforeseen impacts. Both elements are integral to ensuring that leads to practical action to offset the adverse environmental impacts of proposed developments. The adverse impacts of the project can be managed and reduced by the mitigation plan. As part of mitigation management, Corporate social Responsibility (CSR) is proposed to meet necessary needs. These plans will help in mitigating the impacts. Key performance indicators are also given to measure the

development through CSR activities proposed. **Table 7-34** shows the proposed mitigation measures.

Table 7-34: Proposed Mitigation Measures

A. Livelihood Development	B. Sustainable Measures
<ul style="list-style-type: none"> Vocational Training for skill development Supporting SHG groups New Employment Generation Programs Direct & Indirect Job Opportunities Employment Migration Shifting focus from primary & secondary sector to tertiary sector 	<ul style="list-style-type: none"> Installation of Rainwater Harvesting System Promoting renewable energy Installation of STPs & ETPs Waste Segregation & disposal appropriately
C. Infrastructure Development	D. Human Capital Development
<ul style="list-style-type: none"> Village Internal Roads Drainage Sewerage Street lights Drinking Water Supply Community Infrastructure School Infrastructure Hospital and Health centres Sanitation Infrastructures 	<ul style="list-style-type: none"> Education Construction of Computer labs and library Health Potable drinking water through supply of RO water systems, If necessary Sanitation and Latrine Facility Education/Girl child education
E. Safety & Security	F. Common Property & Local Resources
<ul style="list-style-type: none"> Security Personnel's Installation of CCTV Camera and monitoring personnel Restricted Movement of labourers Restricted entry in residential areas Facilities for migrant workers to be provided in the labour camps Health Camps 	<ul style="list-style-type: none"> Religious properties will be retained Pressure on local resources will be retained through sustainable measures Food security Landholding reduced but employment opportunities will increase

(Source: Collected Information during the consultation)

7.4.5 Stakeholder Consultation

The stakeholder consultation is an important aspect to know about people's perception related to the project as well as the impacts they perceived. Informal consultations were conducted on **March 16 & 17, 2018 and from April 16 & 17, 2018** and details are as given below:

7.4.5.1 Stakeholder Identified

The stakeholders identified are as follows:

- Land Affected Persons
- Settlements within the project site
- Social & Economic Vulnerable affected such as women, children, handicapped, BPL etc.
- Local Governance, hospitals, schools and Panchayats

Social/stake holder Consultation Outcome and Consultants Suggestions were given in Table 7-35 and consultations were shown from Exhibit 7-1 to Exhibit 7-6.

Table 7-35: Stakeholder Consultation with Project Affected and Impacted Persons

Name of the Villages	Inadequacies or needs identified	Suggestions
Consultations at Rukmapur Thanda on March 16, 2018	<ul style="list-style-type: none"> Employment for the youth as per educational qualification 	<ul style="list-style-type: none"> To equip as well as enhance employable skills, skill development training programme shall be conducted among women and

Name of the Villages	Inadequacies or needs identified	Suggestions
	<ul style="list-style-type: none"> • Compensation for trees and structures are not paid • Most of the people are unemployed • Children are going to schools. • Girls are not supported or obtaining higher education due to insecurity feeling and antisocial activities. • Lack of Transport facilities • Locals are demanding more compensation for their lands • Farmers are not in any other work force other than farming and agricultural activities not much alcohol consumption is found this Tanda. • The settlement or Tanda is retained within the site. 	<ul style="list-style-type: none"> • youth. . • Cement concrete, B.T road to be provided in the required places for the convenient of villagers. • APRTC buses has to be operated for the convenient of school going children • Compensation may be paid for trees and structures. • Provide encouragement to girls for higher education with social support
Rukmapur Tanda- Women Informal Consultations on March 16, 2018	<ul style="list-style-type: none"> • Women participate in decision making process, but mostly at household level • Women are also having land on their name • Women don't face domestic violence in their region • No additional skills were found among the women • Women were still found in Tribal dress and no changes in their livelihood activities; however, present new generation is not interested to follow so. • Most of the houses don't have toilets and sanitation facilities • Women are most interested in celebration of Festivals (Tulaja Bhavani Festival) • Waste garbage are collected and burned at open places. • Marriages of girl child age should be above 18 years, some were found minors. 	<ul style="list-style-type: none"> • Toilets and sanitation facilities should be provided, • Should provide awareness training programme on sanitation • Schools and education promotion programme for women shall be conducted. • Drinking Water supply should be provided with in the Tanda or settlements, • PHC should be built for women health safety, which is very helpful especially during pregnancy.
Mungi Tanda-Informal Consultations on March 16, 2018	<ul style="list-style-type: none"> • Refuse to share information and details during socio-economic survey • Men and women were participated in the consultation • Many of the Tanda people are working in BEL area/company • Some are informed that they are engaged with agriculture and some are not having regular source of income. • Children are encouraged for education • Some are studying in ITI technical courses 	<ul style="list-style-type: none"> • Health Department has to explore the feasibility of setting up the PHC. • Improve the road condition within the villages. • Concerned government authorities should provide necessary training and financial support to the SHGs • Individual/Community Toilets to be provided • Employment opportunities to be given to the villagers under The Mahatma Gandhi National Rural Employee Guarantee Act, 2005 (MGNREGA) • Eligible youth to be selected for skill training.



Exhibit 7-1: Rukmapur Tanda



Exhibit 7-2: Rukmapur Tanda



Exhibit 7-3: Consultation with Women



Exhibit 7-4: Consultation with Women



Exhibit 7-5: Mungi Tanda consultation



Exhibit 7-6: Mungi Tanda consultation

CHAPTER 8

PROJECT BENEFITS

Chapter 8 Project Benefits

8.1 Introduction

Government of India (GoI) announced National Manufacturing Policy (NMP), 2011, with the objective of enhancing the share of manufacturing in Gross Domestic Product (GDP) to 25% within a decade and creating 100 million jobs in next ten years in the manufacturing sector. The policy is the first of its kind for the manufacturing sector as it addresses areas of regulation, infrastructure, skill development, technology, availability of finance, exit mechanism and other pertinent factors related to the growth of the sector.

The policy also outlines the creation of National Investment and Manufacturing Zones (NIMZ) with minimum size of 5,000 Hectares as giant industrial Greenfield townships to promote world-class manufacturing activities. The likely focus sectors with details of such industries are given in **Table 2-4** Proposed land use for the Project site is presented in **Chapter 2**. Government has to setup IPs, SEZs, Industrial Estates (IEs), etc., in order to further progress the growth and provide an internationally competitive environment for companies. In order to augment the growth, the state has planned multitude of development options in industrial sector. The proposed NIMZ is one such development to improve economy and employment generation with sustainable development.

8.2 Induced Development

The proposed NIMZ is expected to bring several benefits in the region as well lead to the development of the country. Some of the expected benefits are:

- Innovative ideas
- Skill development and enhancement
- Training to the local population
- New Income generation sources
- Increase in trade activities
- Increase in Foreign Direct Investment
- Technology transfer
- State of the art infrastructure for working
- Manpower to increase from low productive activities to high productive activities
- Existing industries to gain benefit
- Regional business to be diversified
- Shifting activities from unorganized to organized sector
- Sustainable development
- Enhanced local consumption
- Increase in living standards
- Increase in savings and increased purchasing power

8.3 Economic Impact of the NIMZ

The economic impact of the development in terms of output and investments envisaged by 2040 is around INR ~**117,570 Cr** and INR ~**44,000 Cr** respectively.

8.4 Generation of Employment

The proposed project is likely to bring one of the most significant alterations of generation of employment. The manufacturing SEZ will bring multitude level of employment opportunities in the region. It is expected that proposed NIMZ Zaheerabad may contribute to annual

industrial output of ~INR ~**44,000 crore** and employment for ~2.66 lakh¹¹ people by 2040 as projected in **Table 8-1** and **Figure 8-1**. Industrial output of Telangana state is sum the total of the focus sectors selected for NIMZ proposed project. It doesn't include Industrial output of all the sectors which are present. The expected job creations will be of technical skilled labour, semi-skilled labour and unskilled labour.

Table 8-1: Employment Projections for NIMZ Zaheerabad

Parameters	Scenario	Unit	2025	2030	2035	2040
Cumulative Employment (Direct + Indirect)	BAU	No. of people	79,486	128,578	158,639	180,485
	BIS		96,893	152,730	198,294	230,846
	BIS 2		113,925	175,925	227,892	266,466
Industrial output	BAU	INR Crore	21,708	43,124	51,337	60,322
	BIS		31,402	62,718	77,360	92,429
	BIS 2		53,047	85,145	100,954	117,570

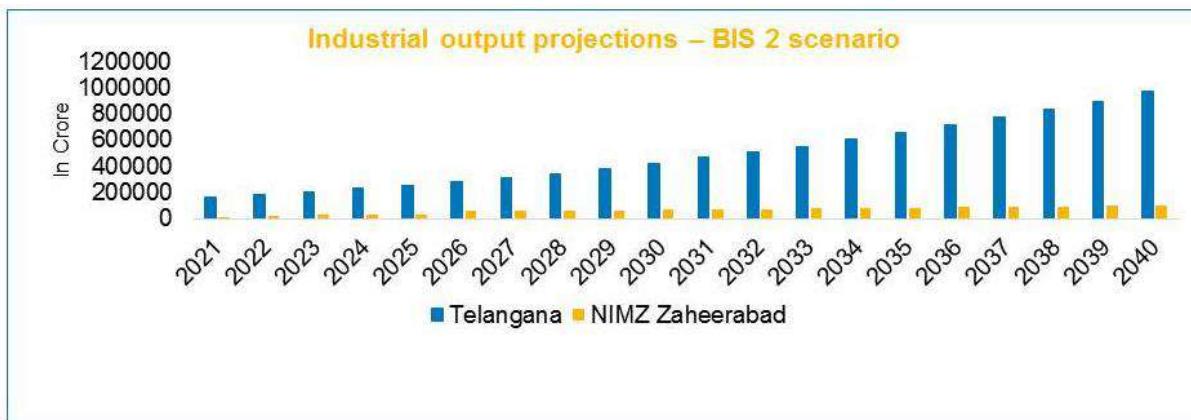


Figure 8-1: Industrial output Projections

8.5 Enhanced Local Infrastructure

The proposed project will enhance the local infrastructure of the region. The road network is proposed to be increased; existing rail network to be strengthened, communication facilities such as telecommunication, internet, networking to be upgraded. There will be increase in the infrastructure resources due to the project in the region such as additional/improved transport and other basic facilities being created. The proposed project thus will cater to the growing demand-supply gap further acting as catalyst to industrialization and urbanization of the region. Implementation of the project thus is expected to benefit the region.

8.6 Enhanced Social Infrastructure

The proposed project aims at overall development of the area. The social infrastructure of the area will be enhanced by state of the art facilities of educational institute, health care

¹¹¹) Business As Usual (BAU) scenario, 2) Business Induced Scenario 1 (BIS 1) and 3) Business Induced Scenario (BIS 2). The BAU scenario assumes that the sector growth would be aligned to its historical growth, whereas BIS 1 scenario assumes that by undertaking certain strategic interventions, the sector can achieve a much higher growth trend in future. The BIS 2 scenario assumes that the sector would consistently achieve higher growth which will lead to higher demand for land in addition to implementation of all the proposed strategic interventions; the consultant believes that such kind of scenario is very unlikely to happen.

facility, hospitality, residential areas and many more. The development may lead to many newer residential areas, educational institutes, health facilities to be established around. The potential for development will increase manifolds.

8.7 Training Facility

The locals will be given training for different types of employment options as per the training suggested. The locals are literate but many are not qualified for the skilled jobs and illiterate people will be provided with training. The training increases the possibility for acquiring the job opportunity.

8.8 Women Empowerment

The proposed project will enhance the status of women as they will be engaged in different types of employment opportunities. They will be given training for the job opportunities. Women earning capacity will help them in participating the decision making process in the family as well as community level.

8.9 Enhanced Socio-Economic Conditions

The project is expected to enhance the socio-economic conditions of the region. The proposed project will generate newer employment opportunities. Proposed development will also create several direct and indirect job opportunities. Locals will have higher earning and increased purchasing capacities. It is expected to raise their standard of living. Also that in every household the dependency over earning members is more. Generation of employment facilities will facilitate more earning members in the family.

The quality of life in the region is likely to improve due to increased earning capacity of the local people. This will result in more than one earning member in the family. It will reduce the dependency on a single earner and enable them economic freedom.

8.10 Corporate Social Responsibility

"Corporate Social Responsibility (CSR)" referred as corporate initiative to assess and take responsibility for the company's effects on the environment and impact on social welfare. The term generally applies to companies efforts that go beyond what may be required by regulators or environmental protection groups. The primary purpose of this plan is to allow the company to meet the requirements of the Companies act 2013.

Corporate Social Responsibility (CSR) activities are the mitigation measure to curb the adverse impacts on community and environment as whole. CSR activities helps in binding the community and sustainability together if planned the right way. The planning of CSR activities involve assessing of impacts with the help of primary and secondary data.

As mentioned by United Nations Industrial Development Organization (UNIDO), CSR is generally understood as being the way through which a company achieves a balance of Economic, Environmental and Social imperatives ("Triple Bottom-Line- Approach"), while at the same time addressing the expectations of shareholders and stake holders. **Figure 8-2** represents the Triple Bottom Line Approach.

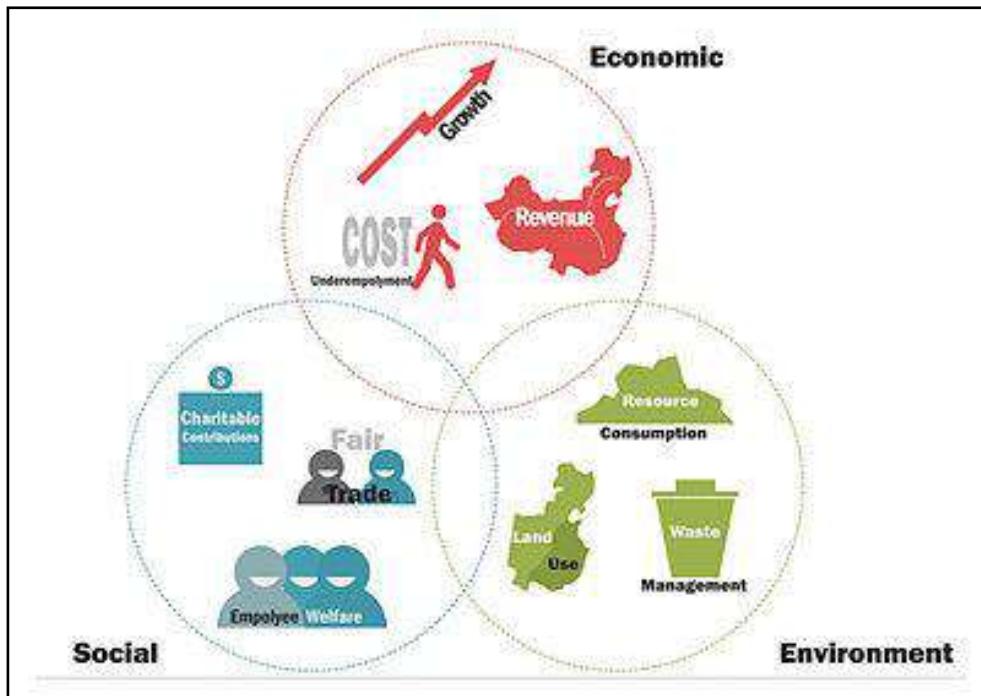


Figure 8-2: Triple Bottom Line Approach

8.1 CSR Regulations

Ministry of Corporate Affairs, Government of India has notified the Section 135 of the Companies Act, 2013 along with Companies (Corporate Social Responsibility Policy) Rules, 2014 "hereinafter CSR Rules" and other notifications related thereto which makes it mandatory (with effect from April 1, 2014) for certain companies who fulfill the criteria as mentioned under Sub Section 1 of Section 135 to comply with the provisions relevant to Corporate Social Responsibility.

The CSR provisions within the Act is applicable to companies with an annual turnover of INR10,000 Million (INR 1,000 crore) and more, or a net worth of INR 5,000 Million (INR500 crore) and more, or a net profit of INR 50 million (INR 5.0 Crore) and more. The new rules, which will be applicable from the fiscal year 2014-15 onwards, also require companies to set-up a CSR committee consisting of their board members, including at least one independent director. The Act encourages companies to spend at least 2% of their average net profit in the previous three years on CSR activities. The Act lists out a set of activities eligible under CSR. Companies may implement these activities taking into account the local conditions after seeking board approval. The indicative activities which can be undertaken by a company under CSR have been specified under **Schedule VII of the Companies Act, 2013**.

Few highlights from the Schedule VII of the Companies Act, 2013 are:

- Surplus arising out of CSR activities will have to be reinvested into CSR initiatives, and this will be over and above the 2% figure
- The company can implement its CSR activities through the following methods:
 - Directly on its own
 - Through its own non-profit foundation set- up so as to facilitate this initiative
 - Through independently registered non-profit organization's that have a record of at least three years in similar such related activities
 - Collaborating or pooling their resources with other companies
- Only CSR activities undertaken in India will be taken into consideration

- Activities meant exclusively for employees and their families will not qualify
- A format for the board report on CSR has been provided which includes amongst others, activity-wise, reasons for spends under 2% of the average net profits of the previous three years and a responsibility statement that the CSR policy, implementation and monitoring process is in compliance with the CSR objectives, in letter and in spirit. This has to be signed by either the CEO, or the MD or a director of the company
- The CSR committee will be responsible for preparing a detailed plan on CSR activities, including the expenditure, the type of activities, roles and responsibilities of various stakeholders and a monitoring mechanism for such activities.
- The CSR committee can also ensure that all the kinds of income accrued to the company by way of CSR activities should be credited back to the community or CSR corpus

The new Act requires that the board of the company shall, after taking into account the recommendations made by the CSR committee, approve the CSR policy for the company and disclose its contents in their report and also publish the details on the company's official website, if any, in such manner as may be prescribed. If the company fails to spend the prescribed amount, the board, in its report shall specify the reasons.

The Activities mentioned in **Table 8-2** are based on the need based assessment sample survey conducted, informal consultations, observations as well as secondary data available. The CSR activities shall be carried out by the industries attracting the CSR act.

Table 8-2: CSR Activities

S No	CSR Activities as per Schedule VII of Companies Act 2013	Project Specific Areas Identified	Project Specific Activities	Key Performance Indicators
1	Eradication of extreme hunger and poverty	<ul style="list-style-type: none"> • Employment Generation • Water conservation • Clean Drinking Water Facility 	<ul style="list-style-type: none"> • Employment Opportunities • Training of local people • Newer business opportunities • Promotion of health care facilities • Minimum wages are paid • Regular income • Clean Drinking Water Facility • Stakeholder Engagement 	<ul style="list-style-type: none"> • Regular income generation • Health records to be maintained • Minimum wages record to be maintained • Clean drinking water usage and its maintenance • Stakeholders are involved at various stages
2	Promotion of education	<ul style="list-style-type: none"> • Promoting Higher Education • Vocational Skill Development Programs to be promoted • Increasing infrastructure of Educational Institute 	<ul style="list-style-type: none"> • Higher education to merit students • ITIs to be promoted • Vocational Skill Development • Educational Building Renovations • Promoting education for special children • Teacher Training Programs • Stakeholder 	<ul style="list-style-type: none"> • Students enrollment • Drop-out rates of students to reduce • Renovated educational institutions and its maintenance • Teachers performance for training programs • Enrollment of special students • Feedbacks to be recorded

S No	CSR Activities as per Schedule VII of Companies Act 2013	Project Specific Areas Identified	Project Specific Activities	Key Performance Indicators
			<ul style="list-style-type: none"> engagement Grievance to be addressed 	<ul style="list-style-type: none"> Stakeholders are involved at various stages Grievance are addressed
3	Gender equity and women empowerment	<ul style="list-style-type: none"> Promoting Education Women Promoting Training for Women 	<ul style="list-style-type: none"> Promoting girls higher education More employment oriented programs for women Training to be provided for women oriented programs 	<ul style="list-style-type: none"> Women participation in decision making at various levels Girls enrollment and drop-out rates to be maintained Feedbacks to be recorded Grievance to be addressed
4	Combating HIV-AIDS, malaria and other diseases	<ul style="list-style-type: none"> Promoting Health Services Promoting Health camps 	<ul style="list-style-type: none"> Promoting health camps Community check-ups camps 	<ul style="list-style-type: none"> Medical Records to be maintained Medical Checkups feedbacks to be recorded
5	Reducing child mortality and improving maternal health	<ul style="list-style-type: none"> Induced Participation Among People 	<ul style="list-style-type: none"> Awareness Camps 	<ul style="list-style-type: none"> Feedbacks to be recorded
6	Contribution to Prime Minister's relief fund and other such state and central funds	<ul style="list-style-type: none"> District Collectors (DC) Fund for CSR activities Companies can deposit their CSR fund in DCs' fund Fund can be allocated to relief fund projects also 	<ul style="list-style-type: none"> DC CSR Fund for promotion of activities Promoting government schemes such as Swatch Bharat Abhiyan PM or state relief fund for disaster management 	<ul style="list-style-type: none"> CSR activities to be suggested PM relief fund requires funding
7	Employment enhancing vocational skills	<ul style="list-style-type: none"> Training to the Locals Vocational Skill Development Programs to be promoted Vocational Skill Development Programs to be promoted 	<ul style="list-style-type: none"> Training to be provided for employment enhancing skills Promoting ITIs Vocational Skill Development 	<ul style="list-style-type: none"> Records of enrollment and drop-outs Record of trained personnel's employment status Increase in number of seats in vocational skill development institutes Feedbacks to be recorded Grievance to be addressed
8	Social business project	<ul style="list-style-type: none"> Promoting self-sustainable business opportunities 	<ul style="list-style-type: none"> Promote Self Help Groups by women 	<ul style="list-style-type: none"> Records of data to be maintained Feedbacks to be recorded Grievance to be addressed

S No	CSR Activities as per Schedule VII of Companies Act 2013	Project Specific Areas Identified	Project Specific Activities	Key Performance Indicators
9	Environmental Sustainability	<ul style="list-style-type: none"> • Sustainable development 	<ul style="list-style-type: none"> • Optimum use of water resources and other available resources • Water Conservation Programs • Promoting sustainable development • Waste segregation & its appropriate disposal • Green belt development • Development of Cultural and Heritage Sites 	<ul style="list-style-type: none"> • Maintenance of records of increase in available water resources • Water Conservation programs to be promoted among industries as well domestic level locally • Maintenance of waste segregation and its disposal • Places of interest to be developed

The following are the areas/activities identified under Corporate Social Responsibility

- Support for Female Literacy
- Support to Swach Bharat Abhiyan
- Skill development training programmes
- Support to Enhancing the School and Collage Lab and Library facilities
- Promotion of Sports among youth
- Support to Solid waste Management Programmes
- Support to Forest Department for wildlife conservation plan
- Support to refurbishment of medical facilities construction of ward in the hospital
- Support to development of infrastructure facilities for educational institutes, medical facilities, purchasing of ambulance
- Training /Awareness to farmers in the nearby Areas to increase Crop Yield
- Contribution to Disaster Management Fund
- Support to improvement of roads to villages
- Support to drinking water facilities and supply network in the project villages

The above identified activities may be revised based on the consultations during the public hearing according to its merits and priority. The activities and budget will be allocated as per district administration directives. The CSR activities will be taken up in a phased manner as per project development activities.

CHAPTER 9

ENVIRONMENTAL MANAGEMENT

PLAN (EMP)

Chapter 9 Environmental Management Plan

The Environmental management plan assumed special significance in industrial areas because of the pollution potential especially in terms of Air, Water and Solid waste management. This chapter presents an overview of Environmental Management Plan.

The main objectives of Environmental Management Plan are to:

- Identify key environmental issues envisaged to be encountered during construction and operation phases of the project.
- Provide guidelines for appropriate mitigation measures.
- Establish systems and procedures for implementing mitigation measures
- Ensure that the mitigation measures are being implemented
- Monitor the effectiveness of mitigation measures
- Institutional framework includes the responsibilities for environmental management as well as responsibility for implementing environmental measures
- Take necessary prompt action when unforeseen impacts occur

The anticipated environmental impacts and mitigation measures for each likely impact on the prevailing environment have been discussed in detail at the respective sections in **Chapter 4**. The Environmental Monitoring Programme for implementation of proposed mitigation measures have been discussed in **Chapter 6**. Following specific environmental management plan/measures are discussed:

- Administrative and Technical Setup for Environmental Management
- Greenbelt development
- Solar power harnessing
- Rainwater harvesting
- Occupational health and safety
- Institutional arrangements/framework for environmental management
- Summary of project activities, associated impacts and mitigation measures

9.1 Administrative and Technical Setup for Environmental Management

Highly qualified and experienced persons in the field of Environmental Management of industrial areas shall be considered for the positions of General Manager (GM) and Deputy General Managers (DGMs) for overall Environmental management for NIMZ. Well qualified personnel with minimum qualification of graduation in the respective discipline and minimum of seven (7) years of experience in relevant field shall be considered for the third level positions as mentioned in the organisational setup. However the right person for the right job with right attitude need to be the focus while selecting such personnel as qualification criteria alone has the potential to fail because of lack of concerns and negative attitude towards environmental management.

All other member industries shall appoint experienced persons for the position of Manager (Environment) for management of environmental aspects within the individual industrial plant premises and coordination with NIMZ Environmental Management Cell (EMC). Administrative relationship between NIMZ and other individual industrial unit is given in **Figure 9-1**.

The responsibilities of the Environmental Management Team/Cell shall be as follows:

- Identify environmental aspects, normal, abnormal and emergency conditions
- Ensure implementation of standard operating procedures as updated from time to time

- Evaluate any non-conformity to the environmental standards, as stipulated by different regulatory agencies
- Ensure and implement necessary corrective actions
- Establish procedures for reporting, document and record control
- Establish and implement procedures for incident and near miss reporting, investigation and root cause analysis and prescribe corrective action

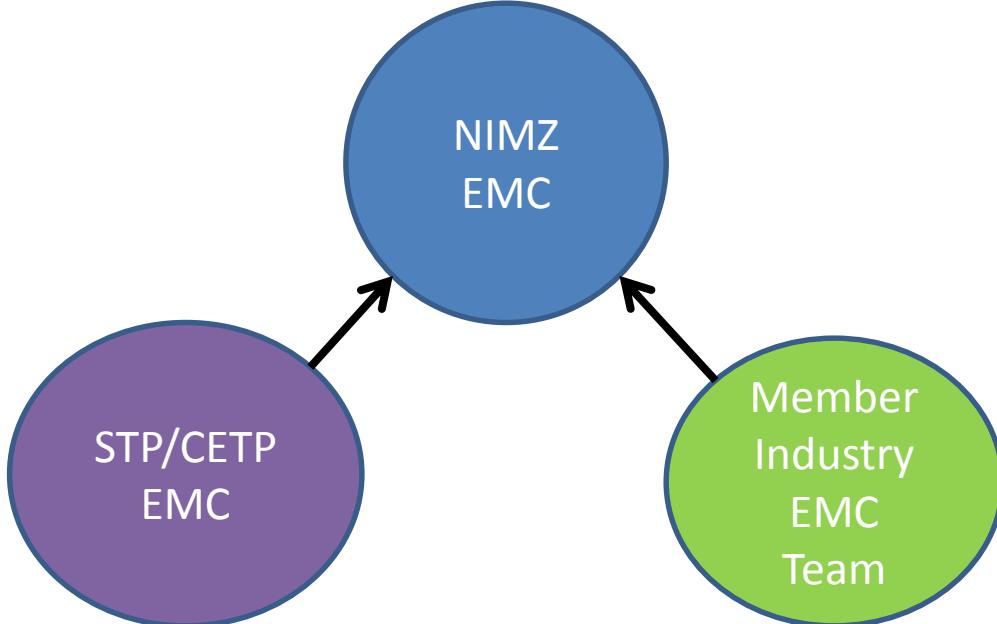


Figure 9-1: Coordination of EMC of NIMZ with other industries

9.1.1 Roles and Responsibilities for Environmental Management

The roles and responsibilities of Developer/NIMZ authority and Member Industry coming up in the NIMZ are brought out in **Table 9-1**. These roles and responsibilities can be shared by NIMZ developer as a part of agreement with member industry and shall have clear terms on environmental management responsibilities.

Table 9-1: Roles and Responsibilities of Developer and Member Industry

S. No.	Component	Responsibility of Developer	Responsibility of Member Industry
1.	General agreement	Evolve very specific plot allotment guide lines with proper Environmental impact mitigation clauses especially with regards to CETP and other water pollution efforts. Any violations need proper penal clauses with adequate notice. Three time violators need to be taken to PCB and later judicial process prior to allowing continuation in the NIMZ.	Strictly adhere to the plot allotment guidelines and agreement. No pollutant shall be released to Natural water systems that affect the common people of the region.
2.	Water supply	Required water for the member industries for process, cooling and domestic usage shall be supplied by developer. The bulk water for the NIMZ will be sourced from Singur reservoir Singur dam across river Manjeera is at a distance of about 27 km towards east. Water and respective pipelines shall be laid. Groundwater shall not be withdrawn during operation stage of the project. Groundwater shall not be contaminated by discharge of pollutants in to streams, ponds and other surface water bodies.	Water requirement shall be met from NIMZ water supply scheme. Groundwater shall not be withdrawn during operation stage of the project. Groundwater shall not be contaminated by discharge of pollutants in to streams, ponds and other surface water bodies.

S. No.	Component	Responsibility of Developer	Responsibility of Member Industry
3.	Water recycle/reuse	Treated sewage from the STP shall be reused for non-potable application. CETP is proposed in NIMZ shall ensure the reuse of treated wastewater from CETP.	Member industry should adopt recycle/reuse methodologies to the extent possible.
4.	Wastewater collection/conveyance	NIMZ Developer/CETP operator will provide the wastewater conveyance system from the member industry holding tank to respective CETP.	The wastewater conveyance (pipeline) within industry shall be provided by member industry.
5.	Wastewater treatment and disposal	NIMZ Developer shall provide the CETP for treatment of effluents based on type of industry as per the project development plan.	Industries shall pre-treat the effluent up to CETP influent characteristics. Industries which would like to have their own treatment shall adhere to reuse of treated wastewater into system
6.	Treated wastewater monitoring protocol	CETP authority shall monitor member industry wastewater holding tank. EMP cell shall monitor the treated wastewater at following locations on daily basis: <ul style="list-style-type: none"> • Respective CETP holding tank • Common Treated WW Tank/guard pond 	Industries proposed to utilise the Developer CETP facility, monitoring of wastewater on daily basis by member industry shall be carried out as per CETP inlet characteristics at their respective holding tanks with online monitoring facility for pH, TDS, COD and TOC etc.
7.	Rainwater harvesting	Rainwater harvesting pits/recharge wells shall be provided at identified locations as per development plan.	Rainwater harvesting in industry premises shall be adopted.
8.	Waste management	Sludge generated from CETP shall be disposed to TSDF and the same shall not be used as manure for greenbelt/green areas development. CETP shall have a temporary storage facility for 30 days; wastes shall be periodically disposed to nearby TSDF.	Member industry shall have their independent Hazardous/Non-hazardous waste collection and segregation system. Industries shall have a temporary storage facility for 90 days detention which will be designed as per the requirement. Wastes shall be periodically disposed to nearby TSDF by the member industry. Industries shall follow Solid waste management rules, 2016 covering municipal, hazardous, E-waste and Bio-medical waste.
9.	Post project environmental monitoring	NIMZ EMC shall conduct post project environmental monitoring as per the environmental monitoring programme suggested for construction and operation phases in Chapter 6. Specific requirement of monitoring shall be carried out as a part of compliance to EC/CFE/CFO Emissions/Discharges and Solid and Hazardous waste generation and the air quality results of NIMZ area shall be displayed at main entrances.	Industry specific critical pollutants shall be monitored at industry level. Specific requirement of monitoring shall be carried out as a part of compliance to CFE/CFO.
10.	Stack monitoring	Developer need to ensure that all regulator measures are properly incorporated and all institutional arrangements by developer as well as member industries are in place.	Stack monitoring shall be carried out by member industry.
11.	Greenbelt development	Greenbelt development along NIMZ boundary and green areas in common areas and open spaces shall be developed.	Greenbelt and green areas shall be developed in the industry level as per TSPCB norms.
12.	Storm water management	Storm water collection along roads, common areas and utilities shall be provided. Ensure no pollutants are discharged to the nearby water bodies by member industries in a clandestine environment.	Storm water collection within the industry shall be provided and discharge facility into the common storm water drains shall be provided.

S. No.	Component	Responsibility of Developer	Responsibility of Member Industry
13.	Truck parking	Logistic zones meant for truck parking are provided	Member industry shall provide on-site parking spaces for trucks within the industry premises.

9.2 Greenbelt Development

Trees play a vital role in the environment in preventing the horizontal dispersion of the pollutants to the surrounding areas. Trees are very suitable and effective for detecting, recognizing, reducing and controlling air pollution, minimising noise pollution and will also check soil erosion, make the ecosystem more complete and functionally more stable and conducive.

Owing to their large surface area besides their bio-aesthetical values trees are to be used as indicators of biological effects of pollutant.

9.2.1 Objectives of Greenbelt Plan

The objectives of greenbelt development are as follows:

- Mitigation of Fugitive dust Emissions and improve ambient air quality
- Provide a shelter belt around the project area for dust absorption and noise reduction
- Prevention of land degradation due to activities during construction phase
- Balancing Eco Environment
- Enhancement of the overall environmental quality
- Provide adequate shelter and habitat to the local fauna
- Enhancing the ecological equilibrium of the area
- Providing aesthetic value to the project area
- Prevention of negative impacts on reserve forests
- Conserve soil quality and improve moisture level in ambient atmosphere
- Compliance of the conditions stipulated in the environment clearance
- Improving the tree cover and maintaining the biodiversity of the region
- Create awareness for environmental conservation and tree planting
- Generate employment for the local people

9.2.2 Plant Species for Green Belt development

Greenbelt/green area development will be carried out in and around the NIMZ along the boundary, roadside and on the vacant areas with above objectives. Emphasis shall be on native plant species on the basis of air pollution tolerance index of tree.

The selection of plant species for the development depends on various factors such as climate, elevation and soil. The plant species should exhibit the following desirable characteristic in order to be selected for plantation.

While selecting the plant species for the proposed green belt the following guidelines will be considered:

- Tolerance to specific conditions or alternatively wide adaptability to eco-physiological conditions
- Fast growing type and providing optimum penetrability
- Capacity to endure water stress and climate extremes after initial establishment
- Should be wind-firm and deep-rooted
- Should form a dense canopy and perennial green
- Species tolerant to air pollutants like PM, SO_x and NO_x should be preferred

- Be able to attenuate noise generated within the area
- Native origin and locally available
- Be well adapted to the existing soil conditions
- Should have a large leaf area index.
- Should be permeable to help create air turbulence and mixing within the belt
- Introduction of monocultures and alien plant species would be avoided to the maximum possible extent
- Should be able to thrive along with diverse species

9.2.3 Greenbelt Development Plan

- The greenbelt development plan for the proposed NIMZ is based on “*Guidelines for Developing Greenbelt*” published by Central Pollution Control Board (CPCB). Greenbelt is proposed along the NIMZ boundary. Green areas are also proposed near the common utilities to serve as recreational facilities and breathing spaces and also to create buffer zones. The three tier tree plantation shall be ideal recommendation for greenbelt around the boundary of the proposed NIMZ.

An area of 799 ha (1974.4 ac) was earmarked for greenbelt development, buffers and open space. In addition to this, individual industries shall develop green belt around their industrial plot as per TSPCB guidelines.

9.2.3.1 Design of Green Belt

While the green belt will be developed as per CPCB guidelines with concept of three tiers greenbelt development with tall, medium and short height permanent trees in general. A survey was conducted with respect to existing forest types and vegetation diversity in the project area for development of greenbelt around project components.

The following guidelines will be considered in green belt development.

- The spacing between the trees will be maintained slightly less than one meter to increase the density
- Planting of trees in each row will be in staggered orientation
- In the front row shrubs will be grown.
- The short trees (< 10 m height) will be planted in the first two rows (towards plant side) of the green belt. The tall trees (> 10 m height) will be planted in the outer three rows (away from plant side)
- Tall trees one line and short trees one line will be planted around the industries blocks to control the fugitive emissions and to reduce the noise.
- Pits measuring approximately 2'x2'x2' may be dug where the soil is reasonably deep, and, pits measuring approximately 3'x3'x3' where the soil is shallow or gravelly.
- Expose the pits to direct sunlight for about 15 days and
 - If the soil at the site is reasonably good, pits may be filled with 80% site-soil + 20% composted cow-dung. About 200 gm Neem-cake and leaf-litter, grass or agricultural residue may be added
 - If the soil at the site is poor, pits may be filled with 35% site-soil + 35% fertile soil (from an external source) +30% composted cow-dung. Neem-cake and other organic matter may be added as in the previous instance
- Saplings should ideally be planted after the annual rains begin. The saplings would need to be watered once the rains cease.
- Saplings shall be suitably nurtured and maintained. Soil conditioning and fertiliser application shall be undertaken. If required, suitable soil treatment shall be provided to ensure good growth of tree cover.

- Construction of temporary shelters of locally available materials such as bamboo and grass around the growing saplings is recommended in the summer, to help the plants withstand the hot sun.
- During construction period
 - Ground-vegetation should be allowed to shed seeds before cutting or moving it for mulch. This would leave behind a seed-bank to flourish in the next growing-season, providing a natural source of mulch for the following year.
 - Open Burning of bushes and other waste on land must be avoided, as it reduces soil-quality, and harms the ground-vegetation, amphibians, reptiles and ground-nesting birds.
- Development of greenbelt shall start with construction phase and shall be continued full fledge with operation phase of the proposed NIMZ.
- As a part of improving biodiversity areas need to be earmarked for the growth of creepers that are always neglected in green belt development category. Creepers are becoming increasingly threatened due to lack of concerns and selective dereliction of this species.

The indicative sketch of three tier greenbelt development is given in **Figure 9-2**.

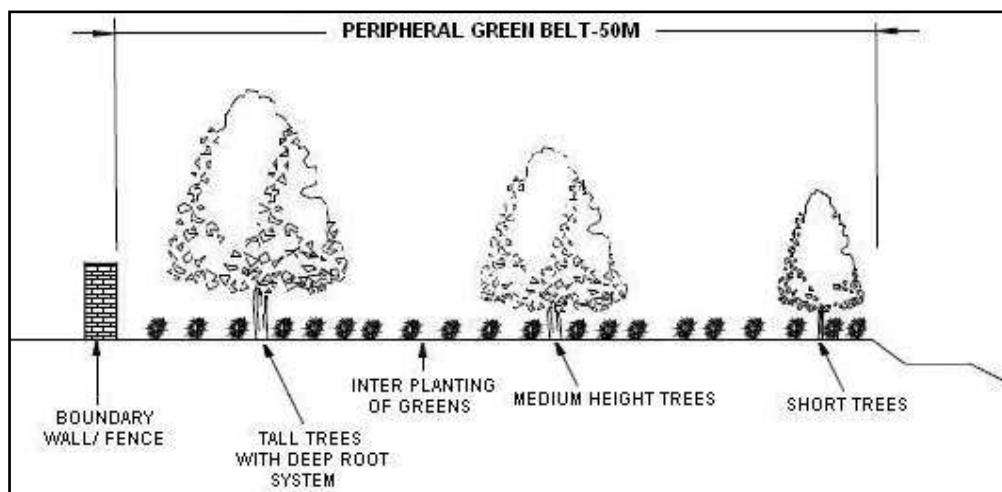


Figure 9-2: Hypothetical representation of three tier greenbelt development

9.2.3.2 Cost estimations for Green Belt development

Approximately 8, 87,000 no. of trees are proposed to be planted in entire NIMZ at park level. The survival of the plantation shall be monitored frequently and survival rate of the plantation during operational phase shall not be less than 80%.

A capital cost of **INR 135 million (13.5 Crores)** shall be earmarked for this purpose and INR of **6.75 million (0.675 Crores)** shall be allocated for recurring expenses towards green belt development and maintenance. The lay out plan of the greenbelt and green areas in project site is depicted in the **Figure FD0204**. In addition to this, all other industrial units shall develop green areas within their premises as per the prevailing TSPCB provisions.

9.2.3.3 Recommended Species for Plantation

Based on climate and soil characteristics of the study area, some species are recommended for plantation. The climate of the region is extreme where there is rainfall as well as extreme heat and soil temperature is very high in summer. The pollutants namely stack, dust/fugitive emissions, sulphur dioxide, smoke and carbon dioxide along with the noise pollution can be effectively curbed by planting specific floral species. The recommended species for greenbelt and plantation are given from **Table 9-2** to **Table 9-4**.

Table 9-2: Species to be planted near buildings and other construction activity zones near the site

S.No	Botanical Name	Common Name	Habit	Preferred site of planting
1	Caryotaurens	Fish tail palm	Tree	Boundary wall
2	Roystonearegia	Royal palm	Tree	Boundary wall
3	Polyalthialongifolia	Indian mast tree	Tree	Boundary wall
4	Neriumindicum	Ganneru	Tree	Boundary wall
5	Bauhinia recemosa	Are	Tree	Boundary wall
6	Acalyphahispida		Shrub	Next row to Hedges
7	Tecomastans	Patchaturai	Tree	Boundary wall
8	Thevetianeriifolia	Pachaganneru	Tree	Boundary wall
9	Plumariapudica		Tree	Garden Centre
10	Plumeriaalba	Deva ganneru	Tree	Garden centre
11	Melaleucacitrina	Crimson bottle brush	Shrub	Garden centre
12	Tabernaemontanadivaricata	Nandivardhanam	Shrub	Garden Centre
13	Caesalpinia pulcherrima	Ratnagandhi	Shrub	Next row to Hedges
14	Allamandaschottiicompacta		Hedge	Towards paths
15	Begonia semperflorens		Hedge	Towards paths
16	Caladium hortulanum	Fancy Leaved Caladium	Hedge	Towards paths
17	Euphorbia geraldii	Kiss Me Quick	Herb	Near Corridor
18	Catharanthusrosea	Vinca Ordinary	Herb	Near Paths
19	Crinum asiaticum	Blood Lily	Herb	Near Corridor
20	Crossandraundulæfolialutea	Crossandra Yellow	Herb	Near Corridor
21	Eranthemumpurpureum	Kodia Purple Leaves	Hedge	Towards paths
22	Gerbera jamesonii	Transvaal Daisy	Herb	Near Corridor
23	Lantana camaraerecta	Lantana Red	Shrub	Next row to Hedges
24	Kalanchoetubiflora	Chandelier Plant	Herb	Near Corridor
25	Buddlejadavidii	Butterfly bush	Shrub	Next row to Hedges
26	Asystasiagangetica	Creeping foxglove	Hedge	Near Paths
27	Bauhinia Scarlet		Climbing shrub	Entrance to Garden
28	Ixoracoccinea	jungle flame	Shrub	Next row to Hedges
29	Pennisetumclandestinum	Lawn Grass	Grass	Rest of all

Table 9-3: Species to be planted near Wastelands

Botanical name	Importance
Casuarinaequisetifolia	Pulp and construction material
Mangiferaindica	Fruits and shade
Anacardiumoccidentale	Soil binder, fruits
Azadirachtaindica	Neem oil &neem products
Pongamiapinnata	Source of biodiesel
Borassusflabellifer	Multipurpose
Cocosnucifera	Grown commercially for coconut

Table 9-4: Species to be planted near Road side and Water Bodies

Botanical name	Importance
Ficusbenghalensis	Shade and a source of food for birds
Ficusracemosa	Edible fruits
Ficusreligiosa	Shade and a source of food for birds
Ailanthus triphysa	Shade
Alangiumsalviifolium	Shade
Albiziaamara	Shade
Albizialebbeck	Shade
Alstoniascholaris	Shade
Bauhiniapurpurea	Shade and flowers
Tecomastans	Shade and flowers
Tectonagrandis	Shade and Wood
Terminaliaarjuna	Shade and wood

Botanical name	Importance
Terminaliabellarica	Shade and fruits
Peltophorumpteroocarpum	Shade
Samaniasaman	Shade, timber and fruits are a good livestock feed.

9.2.3.4 Nursery Development within NIMZ

Nurseries would be developed in open areas with six to eight seedlings per m² for potted plants.

9.2.3.5 Vermiculture Development and Usage

Vermicomposting is natural organic manure and its chemical composition is much more superior to compost made either in conventional composting pits or by bacterial decomposition. Vermicomposting consists of humus, which is the basic building block of fertile soil. It contains all essential macro and micronutrients for plants in readily available form due to which plants are able to easily absorb them. Vermicomposting is prepared with the aid of earthworms. Vermicomposting pits shall be developed and biodegradable waste from project premises shall be utilized for manure production.

9.2.3.6 General Guidelines Regarding the Plantation-plan

The original topography and vegetation of the site must be retained that newly-planted saplings may get the benefit of their natural micro-climate and may survive with relatively less inputs. Soil from the site should be used for the plantation, as far as possible, and supplemented with external nutrients only where necessary. Chemical fertilizers or pesticides must be avoided, as they reduce soil-quality and integrity, as also, the food/medicinal value of plants. Locally available leaf-litter, grass-cuttings, agricultural residue, compost or other organic material may be used as supplementary plant-nutrients.

9.3 Wildlife Conservation Plan

9.3.1 List of IWPA Scheduled/IUCN Species reported in the study area

Flora: Among the 282 plant species recorded in the study area. Three species were listed in the IUCN threatened category list, reported near the Reserve forest of the 10 km radius of the study area.

Table 9-5: IUCN listed Flora species at Reserve Forest in the Study area

Scientific Name	Common Name	IUCN
<i>Saraca asoca</i>	Asoka chettu	Vulnerable
<i>Swietenia mahagoni</i>	Magagani	Endangered
<i>Decalepis hamiltonii</i>	Maredu gaddalu	Endangered

Fauna: Among the 152 fauna species reported in the study area. Four species were listed in IUCN/IWPA threatened category list.

Table 9-6: IWPA listed Fauna species at Reserve Forest of the Study area

Scientific Name	Common Name	IUCN	IWPA Schedule
<i>Pavo cristatus</i>	Indian peafowl	Least concern	I
<i>Mycteria leucocephala</i>	Painted stork	Near Threatened	IV
<i>Ciconia episcopus</i>	Asian Woollyneck stork	Vulnerable	IV
<i>Psittacula eupatria</i>	Alexandrine Parakeet	Near Threatened	IV
<i>Varanus bengalensis</i>	Common Indian monitor	Least concern	I

Apart from this IWPA Schedule II species such as Indian Jackal, Deccan Hanuman Langur, Common Indian Mongoose, Indian Cobra & Russel Viper were also reported in the reserve forest blocks of the study area.

Except from the above listed species as per IUCN and IWPA Schedule and no other rare or endangered, endemic species were observed and no other migratory route were not inhabitants of the area.

9.3.1.1 Conservation Plan for Maredu Gaddalu (*Decalepis hamiltonii*)

Introduction: *Decalepis hamiltonii* is a source of Indian plant drug ‘Sariba’ (also known as Indian Sarsaparilla). Its underground parts are used by the Indian drug industries for preparation of Ayurvedic formulations and even sold in the vegetable market for preparation of pickle. This has put tremendous pressure on the species. The wild population is inferred to have declined by more than 50% in last three generations (66 years). People are collecting *Decalepis hamiltonii* as a substitute of *Hemidesmus indicus* which is advantageous in the sense that the roots are comparatively stouter, thicker and yields sometimes even 40-45 kg per plant. Land degradation and land conversion for settlement are major threats to this species. It is assessed as Endangered.

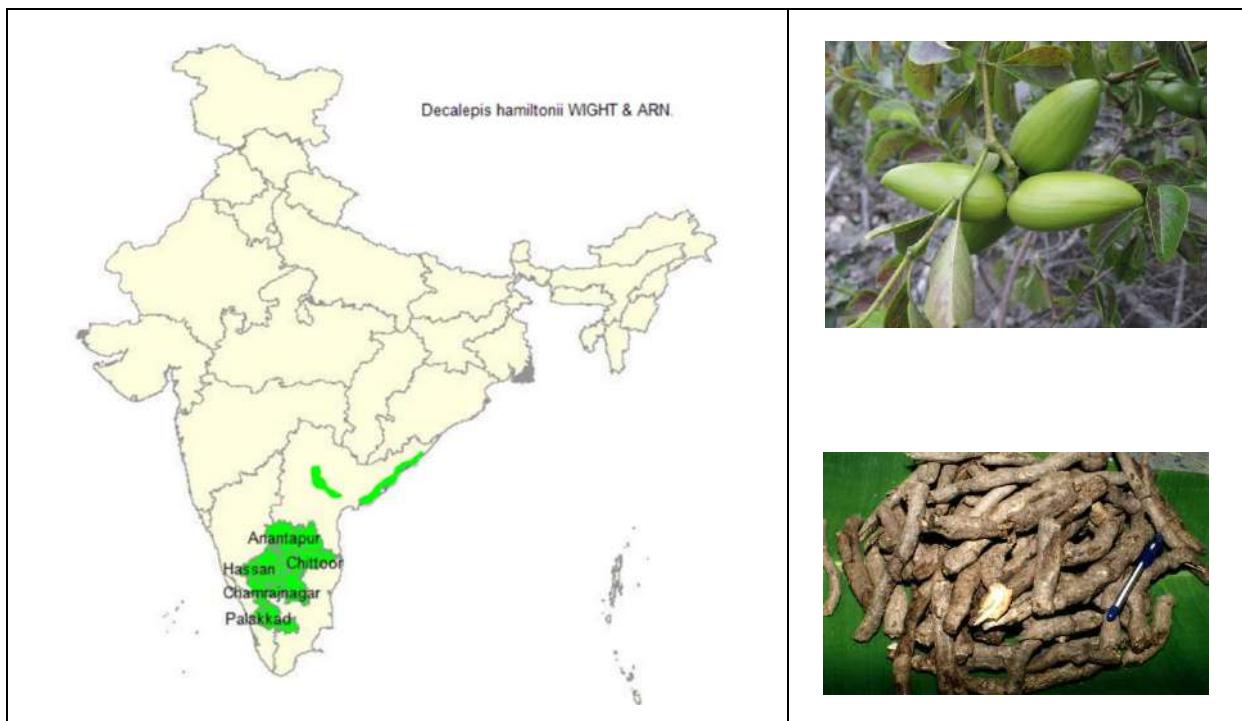
Status: The species is globally assessed as Near Threatened as it almost qualifies for Vulnerable B1ab (iii,v). The species is currently protected under national and international trade regulations.

Habitat Types and Range: The species is endemic to peninsular India. It has been recorded in the dry and moist deciduous forests of Karnataka, Andhra Pradesh and Tamil Nadu (Anburaja et al. 2012). Global distribution of the species is shown in the **Figure 9-3**

Habitat and Ecology: It is found in dry and moist deciduous forests. This species grows on rocky habitat, sometimes in the crevices of big stones. Flowering occurs during the months of February to April and fruiting occurs during May to August (Reddy and Murthy 2013). It has a generation length of 22 years.

Major Threats: Unsustainable collection of multiple parts of the plant for medicine is the main threat. Land degradation and land conversion for human settlements and road construction, as well as agricultural invasion, are other threats to this species.

Conservation Actions: The species is threatened due to unsustainable collection of its root. To conserve the species from the unsustainable collection of its roots and habitat destruction, efforts have been taken through harvest regulation and establishment of Medicinal Plant Conservation Area (MPCAs) in various parts of Karnataka.



Copy Right: FRLHT, Bengaluru and MoEFCC, Gol.

Figure 9-3: Global distribution of *Decalepis hamiltonii*

9.3.1.2 Conservation plan for Indian peafowl (*Pavo cristatus*)

General Description: Indian Peafowl (*Pavo cristatus*) is the largest of all pheasants and has been declared as the National bird of India since 1963 due to its flagship value founded on its glorious position in Indian mythology. It is believed to be widely distributed (IUCN Red List) and is fully protected under the Indian Wildlife Protection Act, 1972. Despite the immense protection and wide distribution, the species is becoming locally extinct from several parts of its former range due to habitat conversion and changes in the cropping pattern, human interference, poaching, and pesticide-related issues.

Distribution: The Indian peafowl is a resident breeder across the Indian subcontinent and is found in the drier lowland areas of Sri Lanka. Besides its native habitat, the bird has been introduced by humans to the United States, Mexico, Brazil, Uruguay, Argentina, South Africa, Madagascar, Mauritius, Indonesia, Papua New Guinea and Australia. Global distribution of Indian peafowl is shown in the **Figure 9-4**.

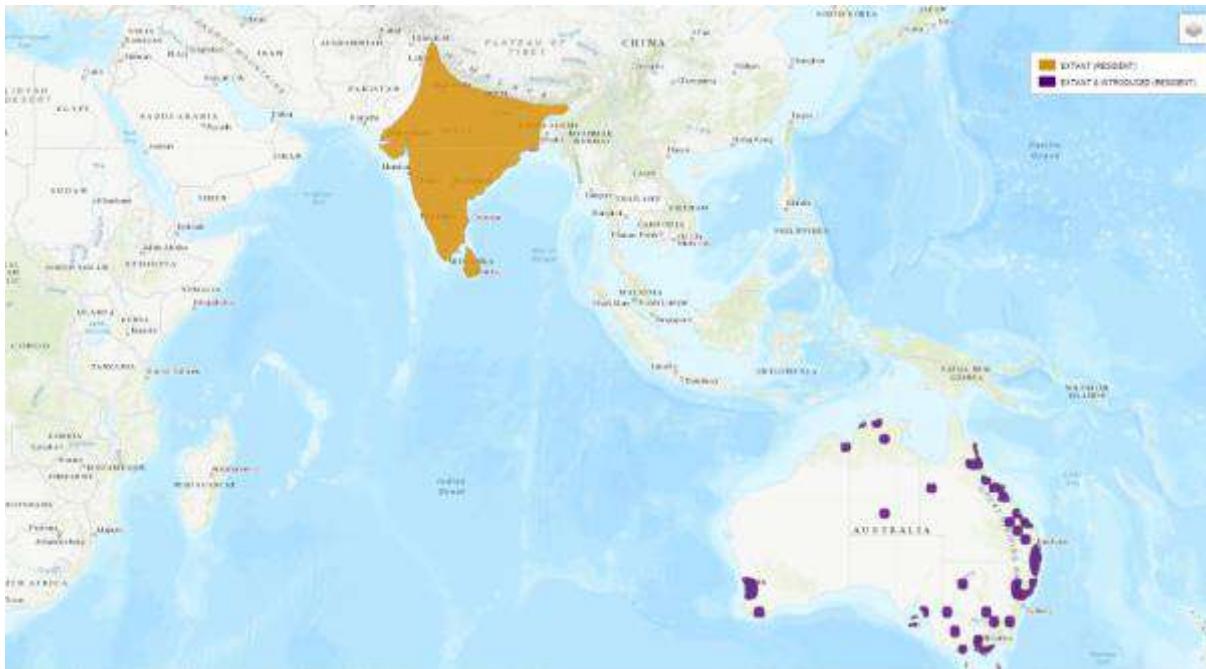


Figure 9-4 Global distribution of Indian peafowl (*Pavo cristatus*)

Habit and Habitat: Peacocks are commonly found in dry areas, Forest areas and near the settlements. The male peacock has enormous tail feathers that fan out behind the peacock and can be nearly two meters in length. The peacock is an omnivorous bird and feeds on insects, plants, seeds, small mammals, reptiles and flowers.

Population Status: In the absence of reliable information and data, it is hard to place the current distribution status and population size of the species; although a conservative ‘guesstimate’ suggests that the population may exceed 100,000. While the species is becoming locally extinct from several parts of its former range due to habitat conversion and changes in the cropping pattern, poaching and pesticide related issues.

Conservation Status: The Indian peafowl is listed as least concern species in the red list of international union for conservation of nature (Bird Life International, 2008), probably owing to its widespread distribution, occurrence of locally abundant semi-feral populations, and protection from people on religious grounds. In India, it is given the utmost protection by inclusion in the Schedule-I of Wild Life Protection Act in 1972.

Major Threats: The demand for feathers and wild meat, conflict with farmers during cropping season. Increased use of chemical fertilizers and pesticides in the agricultural practices Causalities caused by eating chemically treated agricultural crop seeds, Habitat degradation and Fragmentation by conversation of forest habitat into agriculture, habitation and mining activities.

Conservation Measures for Indian peafowl: Adjacent to the reserve forest tracks artificial water holes will be created along the natural drained canals which can provide sufficient drinking water up to summer of the region. Habitat improvement programme will be undertaken through plantation of suitable tree, shrubs and grass species in the surrounding villages adjacent to the reserve forest blocks. While selecting the tree/ shrub species care shall be provided for fruit bearing which attract these birds for roosting. During summer period, local villagers will be encouraged to use the old earthen pots to fill with water for drinking these birds.

9.3.1.3 Conservation plan for Large Bengal Monitor Lizard (*Varanus bengalensis*)

General Description: Bengal monitors or common Indian monitors (*Varanus bengalensis*) occur across much of southern Asia. Compared to other varanid lizards, Bengal monitors have a much larger geographic range, where they are considered less restricted both geographically and environmentally.

Habitat & Habit: Many different types like forests, valleys, farmlands, desert like areas and so on. It seems to be most common in farmlands and dry, open forests. Although these creatures are relatively large in size, especially for a lizard, they mostly feed on insects such as ants and beetles scorpions, They also eat animals such as ground birds, and their eggs, fish, frogs, snakes, other lizards, snails and small mammals like rodents. Monitors are reported to have a very special preference for eggs.

Distribution: South Eastern Iran, through south central Asia (ranging from Afghanistan in the north as far south as Sri Lanka) and eastwards throughout Southeast Asia, as far as Java and the Anambas Islands in Indonesia. However, certain threats are affecting the species, and this has led to eradication in parts of its range. Global distribution of Large Bengal Monitor Lizard is shown in **Figure 9-5**.

Threats: It is hunted for food, for its fat which is used for medicinal purposes, and for its skins which are sold commercially. With increasing human population pressures across this species' range, these threats are likely to become more severe in the future.



Figure 9-5: Global distribution of Large Bengal Monitor Lizard

Conservation Measures for Large Bengal Monitor Lizard: Safe guarding the habitat suitability areas and improving the corridor between these targeted areas by planting the local grass species. Strengthening of anti-poaching team. Creating community-managed conservation of Large Bengal Monitor Lizard and other associated wildlife populations. Creating awareness programme on its ecosystem roles in the environment.

9.3.1.4 Conservation plan for the painted stork (*Mycteria leucocephala*)

General Description: The painted stork (*Mycteria leucocephala*) is a large wader in the stork family. It is found in the wetlands of the plains of tropical Asia south of the Himalayas in the Indian Subcontinent and extending into Southeast Asia. Their distinctive pink tertial feathers of the adults give them their name. They forage in flocks in shallow waters along rivers or lakes. They immerse their half open beaks in water and sweep them from side to side and snap up their prey of small fish that are sensed by touch. As they wade along they also stir the water with their feet to flush hiding fish. They nest colonially in trees, often along with other water birds. The only sounds they produce are weak moans or bill clattering at the nest. They are not migratory and only make short distance movements in some parts of their range in response to changes in weather or food availability or for breeding.

Distribution and Population Status: This species occurs in Pakistan, Nepal, India, Bangladesh, Sri Lanka China Myanmar and Thailand. There are an estimated 15,000-25,000 individuals in South Asia and fewer than 10,000 in South-East Asia), with populations declining throughout. Although it is considered one of the most numerous and secure of Asian storks, this is more a reflection of the rarity and endangerment of most storks in the region, than the security of this species.

Global distribution of Painted stork is shown in the **Figure 9-6**.

Habit and Habitat: reported as piscivorous bird including shell fish in the study area. It frequents freshwater marshes, lakes and reservoirs, flooded fields, rice paddies, irrigation canals, freshwater swamp forest, river banks, intertidal mudflats and salt pans.

Major Threats: The increasing impacts of habitat loss, disturbance, pollution, wetland drainage and the hunting of adults and collection of eggs and nestlings from colonies are cause for concern particularly in south-east Asia. In northern India conversion of wetland habitat to fishing ponds has reduced their value as water bird habitat. Eggs of the species are collected for food in parts of the range.

9.3.1.5 Conservation Measures for Painted stork:

Regularly monitor known colonies throughout the species range. Ensure complete and permanent protection of all breeding congregations. Encourage farming systems that create and not destroy suitable foraging habitat. Mitigate against development schemes which destroy sites where it is found. Conduct awareness campaigns involving residents to engender pride in the species and other large water birds and prevent hunting.

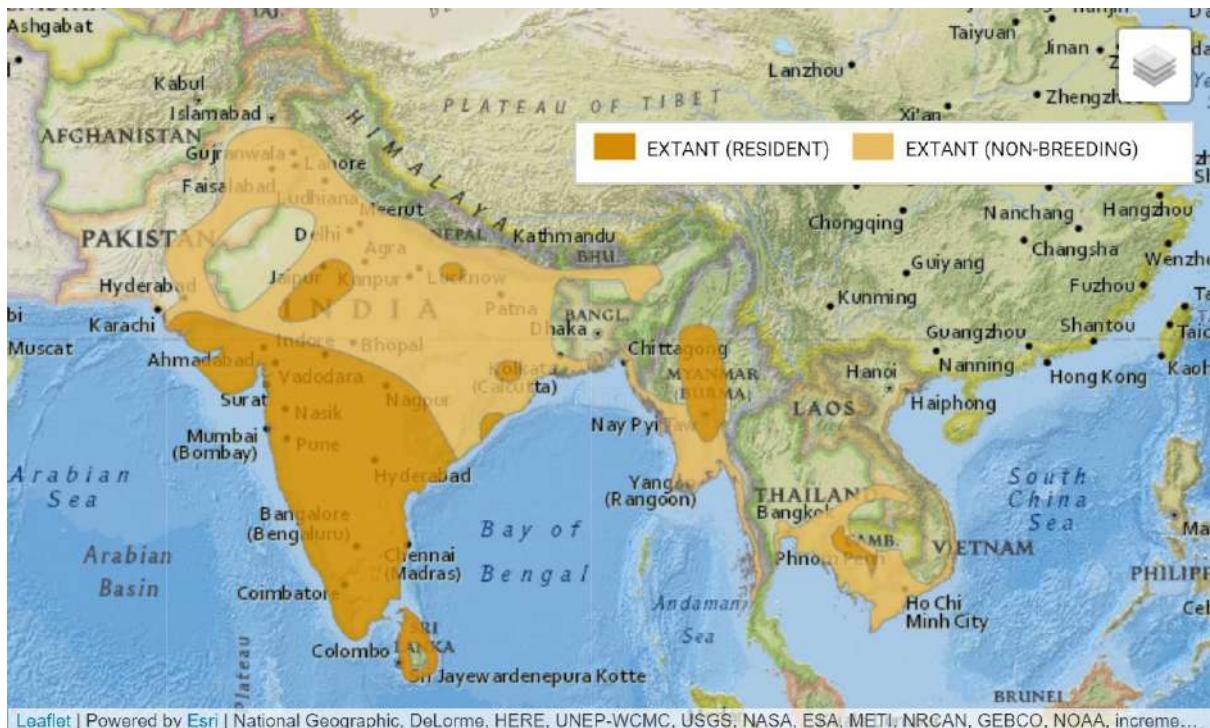


Figure 9-6: Global distribution of Painted stork

9.3.2 Conservation Plan for IUCN listed, IWPA Schedule I & II Fauna

The measures recommended for improvement of habitats are:

Reducing man wildlife conflicts: Unauthorized entry in to forest for illegal grazing, cutting or poaching are the major causes for Man-Wildlife conflicts. These practices will be reduced as negative impact on the wildlife.

Conservation of Inland Water bodies: A Protection and Conservation of Inland water body in the study area is a prerequisite to safeguard the bird population in the region. The following lake restorations programs are suggested in the study area.

- Water Bodies should be properly fenced/demarcated to protect it from encroachment
- The inlet and outlet of the Water Body should be identified and need to be monitored at a frequent interval. Any obstruction in the inlet and outlet should be recorded and be removed.
- Any outfall of domestic/ industrial sewage into the Water Body should be prevented and only treated effluent, as per effluent standard of the State Pollution Control Board, may be allowed to dispose into the Water Bodies.
- Catchment area treatment like afforestation programmes like planting native flowers tree, suitable for nesting for birds, storm water drainage management may be undertaken.

Training and Awareness Programme: This is the most important aspect of wild life conservation. People will be educated regarding the importance of wild life conservation through mass publicity by installing sign-boards, conducting audio visual classes and distributing literature in respective villages in the buffer zone.

Conservation plan:

- Provision of drinking water facility for the wildlife by constructing small ponds / tanks.

- Plantation of fruit bearing trees to attract avifauna which will also be useful for roosting, breeding and hiding cover for migratory birds etc.
- Removal of weeds and promoting native grass species for effective utilization for wildlife grazing.
- Education and awareness tours/ visits for school children and celebration of wildlife week
- Display of Sign Boards:** Sign-boards should be in local language as well as in English placed in protected areas.

9.3.3 Monitoring Mechanism

Proposed monitoring mechanism for conservation activities is as below:

- A special emphasis on ecological conservation shall be monitored by the project proponent
- A senior ecologist shall be employed / consulted on regular basis to oversee ecological/wildlife conservation activities.
- The senior personal responsible for conservation of ecology shall report directly to the head of the organization.
- Substantial budget to carry out ecological conservation activities including plantation development in degraded forest areas.
- Compliance report for conservation activities shall be submitted to Chief Wildlife Warden, Telangana Forest Department and MoEF&CC along with other environmental compliances.

9.3.4 Implementation Schedule & Tentative Financial Budget

Implementation plan along with proposed budget allocation for 10 years after approval from all statutory bodies permitting the construction is as given in **Table 9-7**.

Table 9-7: Budget Estimation

S. No.	Activity	Agency	Duration	Total Amount (INR) for 10 years
A Conservation Activities				
1	Providing fund to the Forest/wildlife Department for the awareness generation of local people, labour, different age groups, distribution of poster, pamphlets, fixing of signage and organizing awareness camp etc.	Forest/Wildlife Department	10 Years	10,00,000/-
2	Construction of water holes (small water points) in the surrounding buffer area and their regular filling water	Forest/Wildlife Department	10 Years	20,00,000/-
3	Habitat improvement activities and food availability for herbivores like development of grassland/ pasture land in surrounding buffer area, creation of bushy structures for black partridges, development of suitable roosting and nesting sites for peacock inside and nearby forest areas, creation of tree grooves at suitable places in buffer areas.	Forest/Wildlife Department	10 Years	35,00,000/-
5	Plantation of Suitable plant species in the buffer areas so that wild animals could reside within the forest areas	Forest/Wildlife Department	10 Years	30,00,000
6	De-silting, de-weeding of water bodies in	Revenue/Forest	10 Years	30,00,000

S. No.	Activity	Agency	Duration	Total Amount (INR) for 10 years
	the study area	Department		
Total				1,25,00,000/- ¹²

The year wise split of the cost to the Wildlife Department by the Project Proponent is given below:

Year wise Split of Budget in INR									
1 st	2 nd	3 rd	4 th	5 th	6 th	7 th	8 th	9 th	10 th
12,50,00 0	12,50,00 0	12,50,00 0	12,50,00 0	12,50,00 0	12,50,00 0	12,50,00 0	12,50,00 0	12,50,00 0	12,50,00 0

9.4 Rainwater Harvesting¹³

Rainwater harvesting (RWH) refers to collection of rain falling on earth surface for beneficial uses before it drains away as run-off. The recent groundwater estimation as in September 2013, by Central Groundwater Board, Govt. of India has classified Jharasangam and Nyalkal Mandal's, in which the project area is situated, under "**Critical category**". The recent groundwater estimation has classified Nyalkal Mandal, in which the project area is situated, under "**Over Exploited category**"¹⁴. However as a developmental activity to improve groundwater in the region rainwater harvesting is proposed within the NIMZ. Rainwater harvesting and conservation practices reduce the soil erosion, increases soil moisture and enhance recharge to groundwater body.

Concept of rainwater harvesting lies in

- Tapping the rainwater from where it falls
- Techniques of rainwater harvesting involve

Catch the rainwater from localized catchment surfaces such as roof of a house, plain and sloping ground surfaces etc. It is easy process to collect Rainwater and diverted into ponds, vessels or underground tanks to store for longer periods and to recharge by construction of RWH Structures in a suitable sites.

Rainwater harvesting is in two ways

- **Direct Use:** The process of collecting and storing the rainwater by construction of sump through filters for future productive use and
- **Artificial recharge to groundwater:** Recharge the rainwater in a scientifically planned way by construction of rain / roof top water harvesting structures to augment the groundwater.

The objectives of rain water harvesting proposed for the NIMZ are as follows:

- Rainfall – runoff management
- Control soil erosion
- Increase the soil moisture
- Prevent rush of surface flow of water
- Recharge to groundwater in favourable areas

¹² This budget is considered in the CSR category

¹³ Ref: Concepts & Practices for Rainwater Harvesting- CPCB 2001

¹⁴ Ref: DYNAMIC GROUND WATER RESOURCES OF INDIA (As on 31st March 2013) by Central Ground Water Board Ministry of Water Resources, River Development & Ganga Rejuvenation Government of India, Faridabad, June 2017.

- Direct use of harvested rainwater
- Saving in pumping cost

9.4.1 Estimation of Rainwater Harvesting Potential

Rainwater Harvesting shall be implemented at NIMZ to conserve rainwater. Roof top area, greenbelt/green area, road/paved area and open areas proposed in the NIMZ are considered for estimating the rainwater which can be harvested.

The approximate quantities of rainwater that can be harvested at NIMZ are given in **Table 9-8**. The equation used for run off estimation is based on CPCB guidelines¹⁵. The calculations are based on the following:

- Average annual rainfall is 911.6 mm based on 1981-2010 IMD data
- Average No of rainy days are 53.4
- Run off coefficient are considered as given by CPCB guidelines

Table 9-8: Estimated Volume of run-off that can be harvested

S. No	Land Use	Area (m ²) ¹⁶	Volume (m ³)	Coefficient	m ³
1	Industrial Zone	1301924	1186834	0.6	712101
2	Warehousing	26709	24348	0.7	17044
3	Parking	33022	30103	0.7	21072
4	Green Zone	1997513	1820933	0.1	182093
5	Residential Zone	468380	426975	0.6	256185
6	Technical Infrastructure	155277	141550	0.5	70775
7	Utilities & Amenities	234271	213561	0.2	42712
8	Commercial Zone	186437	169956	0.7	118969
9	Social Zone	37393	34087	0.4	13635
10	Roads	777355	708636	0.7	496046
	Total	5218279.667	4756983.75		1930631.34

9.4.2 Harvesting Plan and Recharge Structures

9.4.2.1 Roof-top Rainwater Harvesting

Roof-top rain-water harvesting is one of the appropriate options for augmenting groundwater recharge/storage where natural recharge is considerably reduced and not much land is available for implementing any other artificial recharge measure.

In a typical roof top rain-water harvesting system, rain-water from the roof is collected in a storage vessel or tank for use during periods of scarcity. Such systems are usually designed to support the drinking and cooking needs of the family and comprise a roof, a storage tank and guttering to transport the water from the roof to the storage tank. In addition, a first flush system to divert the dirty water, which contains debris, collected on the roof during non-rainy periods and a filter unit to remove debris and contaminants before water enters the storage tank are also provided. Therefore, a typical Roof top Rain-water Harvesting System comprises following components:

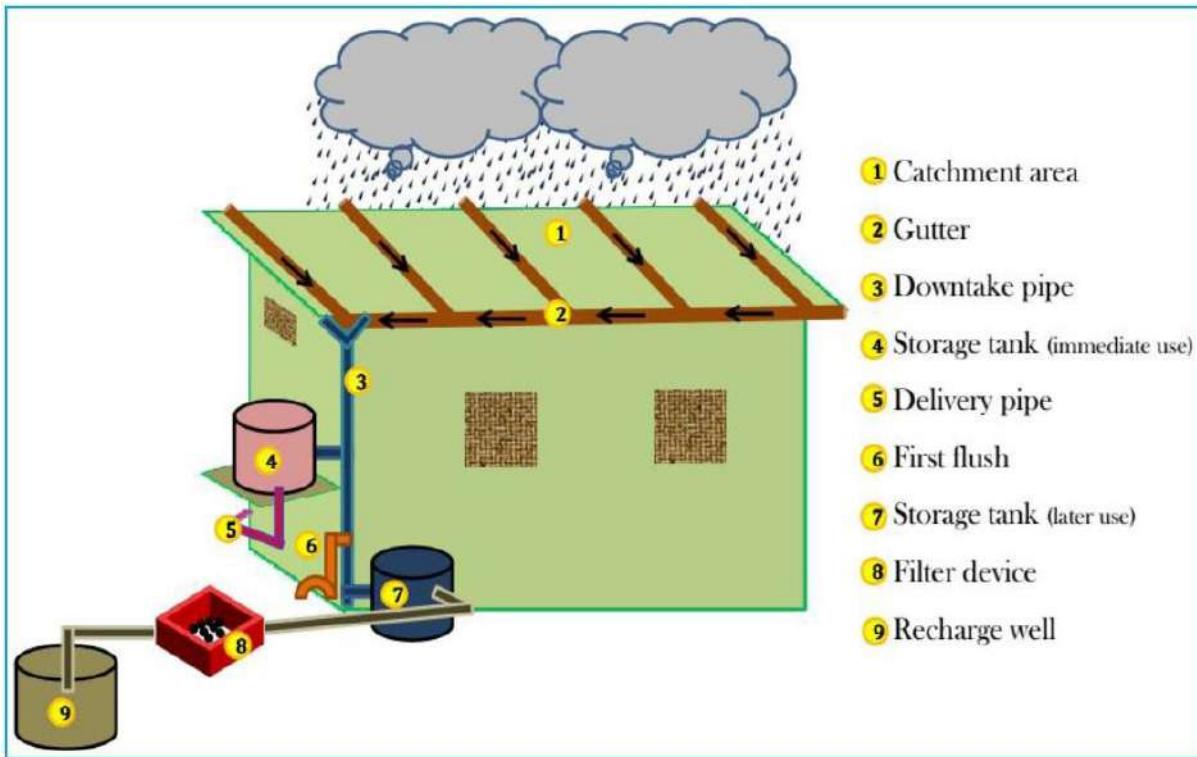
- Roof catchment
- Filter unit
- Drain pipes
- Storage tank.
- Collection sump.
- Down pipe
- Pump unit
- First flush pipe

¹⁵ Rainwater Harvesting in India – An Appraisal – Hosted by CPCB & MoEF&CC, Compiled, Prepared, Published by ENVIS Centre at CPCB on Control of Pollution, e-book@2016.

¹⁶ Certain percentage (5-25%) of area is considered for calculation of rainwater harvesting as entire area can't be considered.

- Gutters

A typical Roof-top rainwater harvesting system is given in **Exhibit 9-1**. However, during detailed engineering of the industries suitable structure will be arrived for rainwater harvesting.



(Source: Rainwater Harvesting in India – An Appraisal, CPCB)

Exhibit 9-1: A Typical Rainwater Harvesting System

Filtration forms the most important process in the purification of water. It usually involves allowing water to pass through a filter media e.g. sand. Filtration essentially involves removal of suspended and colloidal impurities present in water. Depending on the type of filtration, the chemical characteristics of water may be altered and the bacterial content may be considerably reduced. These effects take place due to various processes such as mechanical straining, sedimentation, biological metabolism and electrolytic changes.

The sand being used for filter in roof top rain-water harvesting systems should be free from clay, loam, vegetable matter, organic impurities etc. and should also be uniform in nature and grain size. There are three types of filters i.e.

- i) Slow Sand Filters,
- ii) Rapid Sand Filters (gravity type) and
- iii) Pressure Filters.

9.4.2.2 Storage Ponds/Tanks

In addition to roof top rainwater harvesting, industries in NIMZ will also adopt storage tank /pond system for storm water storage. Storage ponds/tanks are civil structures to store harvested rainwater. From these storage facilities, water can be pumped directly to points of demand or supplied through over-head tanks. Silt trap pits and filter beds have to be maintained before letting the water to the storage pond / tank. The storage tanks may be properly cemented to avoid leakage or seepage into ground. Dimensions of these structures

may be maintained at 20 m x 10 m x 2 m. A model of the storage pond / tank is shown in **Exhibit 9-2** for storing harvested rainwater.



(Source: Google)

Exhibit 9-2: A Model Storage Pond/Tank

9.4.2.3 Recharge pits- typical arrangements

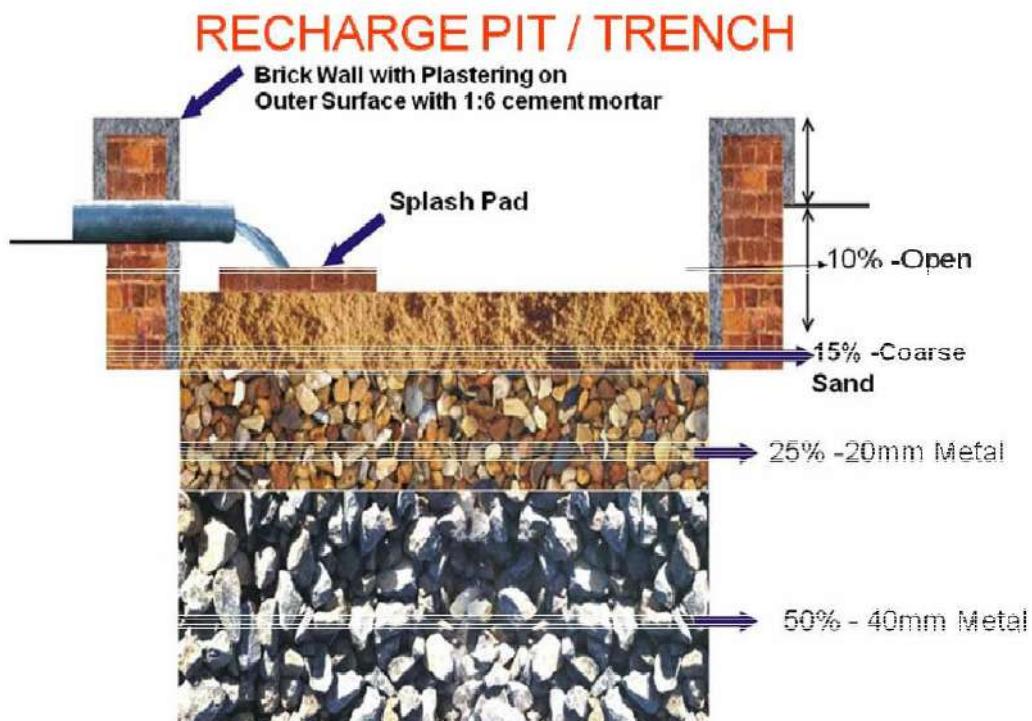
In the project area, recharge pits are recommended to be constructed near the roof-top harvesting structures. Due to enhanced vertical hydraulic conductivity through the recharge pit structure, natural recharge process of aquifer system gets enhanced, especially when storms are of short duration and rainfall days are less as in case of project area, and sustainability of the aquifer is ensured for a long period. The benefit accrued during heavy rains in non- rainy (summer) season or during draught time will be worth mentioning. In such circumstances recharge will be at its peak stage. As a result all shallow open wells and ponds will get adequate quantity of water as huge relief for farmers and poor landless villagers.

In addition to Roof-top rain water harvesting, recharge pits will be planned by the industry and NIMZ authorities for roof top harvesting. In the NIMZ area, Recharge pits of 2.0 m diameter with a depth of 3.0 m will be constructed. The pit has to be back filled with a sequence of boulders, gravel, pebbles and coarse sand from bottom to top. A constructed model recharge pit is shown in **Exhibit 9-3**. A schematic diagram of the Recharge Pit is given in **Exhibit 9-4**. It is recommended to dig a trial pit of 5.0 m before constructing the Recharge pit. The site may be avoided if groundwater table is encountered within a depth range of 5 m.



(Source: Google)

Exhibit 9-3: Model Recharge Pit



(Source: <https://www.hyderabadwater.gov.in/en/rainwater1/aboutus.aspx>)

Exhibit 9-4: Schematic of Recharge Pit

9.4.2.4 Recharge Wells- Typical arrangements

Recharge wells are the structures to recharge water in the sub-surface levels directly to the aquifer. In the project area, the piezometric level of the deeper aquifer is expected to be in the range of 20 to 30 m below ground level. Gravity recharge wells in the vicinity of storage ponds are useful in recharging the deeper aquifer system.

A schematic design of the recharge well is presented in **Exhibit 9-5**. The collected rain water in the pond may be diverted through well maintained channels, two desilting pits and two filter beds into each recharge well by gravity. From bottom of last filter bed, pipe carrying the recharge water may have to go down the recharge well upto piezometric surface.

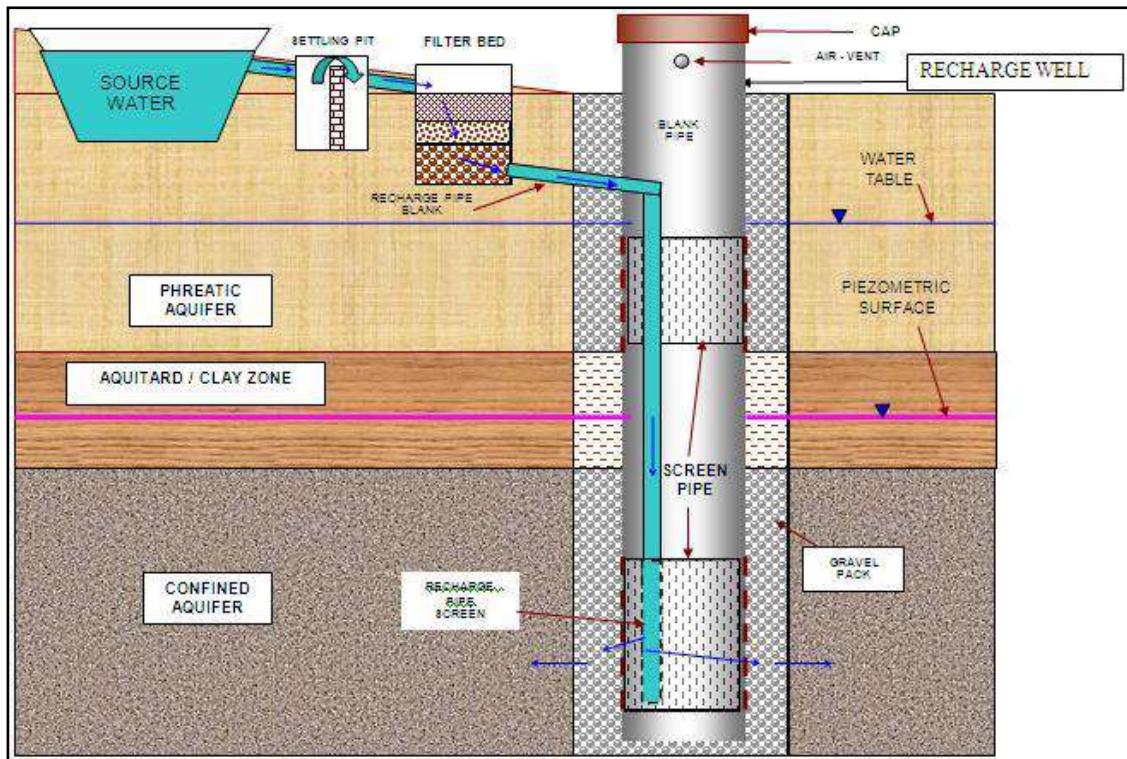


Exhibit 9-5: Schematic Diagram of Recharge Well

9.4.3 Monitoring wells for Impact Assessment

The effectiveness of artificial recharge structures is known by closely monitoring the groundwater levels of the phreatic and confined aquifer systems. Monitoring of the groundwater regime is done by establishing a network of observation wells tapping the shallow and deeper aquifer systems separately.

The phreatic aquifer can be monitored by measuring groundwater levels in the open dug wells or dedicated shallow water table wells. The existing dug wells may also be selected for monitoring. Piezometric surface in the deeper aquifer may have to be monitored by installing dedicated piezometers. Piezometer is a small diameter (38 mm) tube with a 2 to 3 m perforated pipe at the bottom lowered in a borehole (100 to 150 mm) drilled down into the confined aquifer. The perforated portion of the tube has to be positioned against the bottom of the confined aquifer with clean sorted gravel shrouded between the tube and the borehole surface. Rest of the borehole may be filled with unsorted gravel or clay.

The observation wells/piezometers are to be monitored at least four times in a year, i.e. in the months of January, May, August and November. Data collected from these wells, provide more meaningful record / database and clarity in the changes in the ground water regime in the Project area.

Digital water level recorders, which collect water level information automatically ranging in time from 1 hour to 1 month, provide accurate and valuable data for groundwater management. The recorder is an electronic device which is installed within the water column of the observation well. The device collects the groundwater level data at the desired interval of time and stores the digital data on board which can be retrieved through data retrieval systems or hand held computers and can be downloaded directly into office computers for further analysis. Groundwater chemical quality monitoring also can be done through these devices with appropriate add-on probes.

9.5 Solar Power Harnessing

Solar Power Harnessing can be adopted within NIMZ built up areas particularly at available roof tops. The available technologies for generating solar power are mainly Solar Photo Voltaic (PV) Cells and Solar Thermal. Technology of Solar PV Cells is suitable for solar power generation with proper utilization of the roof top areas available on the roofs of buildings/structures within the industry premises. The off grid solar PV system will be used for the solar power harnessing in the proposed power plants.

Basic components that are used to build a solar PV system are as follows:

- Flat Roof Solar PV Panel mounting systems
- Solar PV Panels and solar modules
- Solar PV Charge Controllers
- Solar Batteries
- PV Junction Boxes/PV Combiner Boxes
- Off-Grid Solar PV Power Inverters
- Solar PV Cables & Connectors
- Solar PV Generation Meters
- AC & DC Isolators
- Solar PV System monitoring

For the purpose of installation of off grid solar PV cells, the suitable buildings and structures are identified and the roof top areas are considered for calculation of total possible capacity of installed solar PV.

The calculation for installed capacity and cost is based on following assumption:

- 100 sq.m area is required for the installation of 10 kWp capacity
- Capital cost including batteries and other accessories is INR 1 lakh/kWp.

The installed capacity and approximate cost details for NIMZ area are as given in **Table 9-9**.

Table 9-9: Estimated Installation Capacity and Cost for Solar Power Harness

Project	Total roof top area (m ²)	Actual area (considering 75% of total area) (m ²)	Installation capacity (Considering 100 sq.m for 10kWP) kWp	Installation capacity in MW	Cost for installation (considering 8 cr/MW) Crores
NIMZ	1770304	265546	26555	26.55	212.44

The above mentioned roof top areas are approximate and can be firmed up after the concrete design and engineering of the industries. Based on various technology options considered, it is recommended that the solar PV cells shall be installed in the available area of roof tops within the industry premises for the purpose of harnessing solar power by means of utilizing the available roof top area. Once the final designs for the industries are available, an implementing agency will be hired for the execution of the project at proper time. The status of implementation and execution will be submitted to MoEF&CC at regular intervals of six months during the execution phase.

9.6 Occupational Hazards

Project developer, Employers and supervisors are obliged to implement all reasonable precautions to protect the health and safety of workers. This section provides guidance and examples of reasonable precautions to implement in managing principal risks to occupational health and safety.

Preventive and protective measures should be introduced according to the following order of priority:

- Eliminating the hazard by removing the activity from the work process. Examples include substitution with less hazardous chemicals, using different manufacturing processes, etc;

- Controlling the hazard at its source through use of engineering controls. Examples include local exhaust ventilation, isolation rooms, machine guarding, acoustic insulating, etc;
- Minimizing the hazard through design of safe work systems and administrative or institutional control measures. Examples include job rotation, training safe work procedures, lock-out and tag-out, workplace monitoring, limiting exposure or work duration, etc.
- Providing appropriate personal protective equipment (PPE) in conjunction with training, use, and maintenance of the PPE.

9.6.1.1 Occupational Health Hazards

The application of prevention and control measures to occupational hazards should be based on comprehensive job safety or job hazard analyses.

A qualitative risk ranking or analysis matrix to help identify priorities¹⁷ is described in **Table 9-10**.

Table 9-10: Risk Matrix for Worker Scenarios Based on Likelihood and Consequence

Likelihood	Consequences				
	Insignificant	Minor	Moderate	Major	Catastrophic
Almost certain	L	M	E	E	E
Likely	L	M	H	E	E
Moderate	L	M	H	E	E
Unlikely	L	L	M	H	E
Rare	L	L	M	H	H

Legend:

- E: extreme risk; immediate action required
- H: high risk; senior management attention needed
- M: moderate risk; management responsibility should be specified
- L: low risk; manage by routine procedures

9.6.2 Personal Protective Equipment

The personal protective equipment (PPE) offers adequate protection to worker, co-workers and visitors. Proper use of PPE shall be part of recurrent training programs for employees.

Table 9-11 provides the list of PPE which shall be provided in industrial premises:

Table 9-11: Personnel Protective Equipment

Protection for	Workplace Hazards	Protection Equipment
Hand	Hazardous materials, cuts or lacerations, vibrations, Heat radiation, Electrical shock, Contact with oil & grease, Falling of hot slag etc.	<ul style="list-style-type: none"> Gloves made of rubber or synthetic materials (Neoprene), leather, steel, insulating materials, etc. Asbestos gloves Electrical resistance gloves Hand sleeves
Foot	Falling or rolling objects, pointed objects. Corrosive or hot liquids eg. Welding sparks, Striking by objects, Heat radiation, stepping hot or sharp objects and stepping on sharp or hot objects	<ul style="list-style-type: none"> Safety shoes and boots for protection against moving & falling objects, liquids and chemicals such as Leg-guards, Leather safety boots, Asbestos safety boots etc.

¹⁷Environmental, Health, and Safety (EHS) Guidelines; General EHS Guidelines: Occupational Health and Safety, IFC and World Bank Group

Protection for	Workplace Hazards	Protection Equipment
EYE and Face	Flying particles, molten metal, liquid chemicals, gases or vapors, light radiation entering eyes and reflected arc rays	<ul style="list-style-type: none"> Safety Glasses with side-shields Protective shades, Plain shatter proof lens etc.
Head	Falling objects, inadequate height clearance, and overhead power cords during construction, maintenance etc.	<ul style="list-style-type: none"> Plastic Helmets with top and side impact protection
Ear	Noise, ultra-sound	<ul style="list-style-type: none"> Ear plugs or muffs
Respiratory	Fine dust particles, Dust, fogs, fumes, mists, gases, smokes, vapours, Oxygen deficiency	<ul style="list-style-type: none"> Facemasks with appropriate filters for dust removal and air purification (chemicals, mists, vapours and gases). Single or multi-gas personal monitors. Portable or supplied air (fixed lines).On-site rescue equipment
Body	Extreme temperatures, hazardous materials, biological agents, cutting and laceration	<ul style="list-style-type: none"> Insulating clothing, body suits, aprons etc. of appropriate materials.
Fire	Fire	<ul style="list-style-type: none"> Fire Extinguishers Fire Jackets Fire Suits etc.

9.6.3 Health Monitoring

Medical surveillance has been prescribed in the Factories Act, 1948 (Amended). Under section 41C, it is stated that "every occupier of a factory involving any hazardous process shall:

"Maintain accurate and upto-date health records or, as case may be, medical records of workers in factory who are exposed to any chemical, toxic or any other harmful substances which are manufactured, stored, handled or transported and such records shall be accessible to the workers subjected to such conditions as may be prescribed and provide for medical examination of every worker, (a) before such worker is assigned to a job involving the handling of or working with a hazardous substance and b) while continuing in such job and after he has ceased to work in such job, at intervals not exceeding twelve months, in such manner as may be prescribed."

Every member industry will establish an occupational health service centre inside industry premises to promote and maintain physical, mental and social well-being of the employees. The unit shall be equipped to detect and prevent occupational/work related diseases and shall offer effective emergency and injury care at work. The centre will develop health education training packages including use of personal protective equipment for all employees and impart training accordingly. Occupational Health Service shall arrange to provide adequate number of First Aid Boxes with approved contents on the shop floor. Ambulance shall be available to meet any emergency situation. The health centre proposed at non processing area of NIMZ shall also in case of emergency situation.

The records of health check-up of all employees have to be maintained. The occurrence of occupational health hazards and diseases shall also be maintained. The records may be reviewed at intervals of two years to check the effectiveness of various measures implemented. Based on the review, action plan to improve the effectiveness of occupational health and safety measures shall be prepared.

9.6.4 Safety

Overall safety of man and material is an important aspect of industry performance. The safety policy of the industry shall be clearly defined. The developer shall implement separate safety measures for construction and operation phases and a safety officer shall be employed by the member industry which shall also coordinate with NIMZ EMC safety officer.

9.6.4.1 Safety Circle

In order to fully develop the capabilities of the employees in identification of hazardous processes and improving safety and health, safety circles would be constituted in each area of work. The circle would consist of 5-6 employees from that area. The circle normally shall meet for about an hour every week.

9.6.4.2 Safety Training

A full-fledged training centre shall be set up at the industry. Safety training shall be provided by the Safety Officer with the assistance of faculty members called from Professional Safety Institutions and Universities. In addition to regular employees, limited contractor labours shall also be provided safety training.

9.6.5 Endemic Disease Mitigation Plan

During consultation with villagers in the study area it is understood that there are no major epidemics in recent years in the study area but the occurrence of certain major diseases such as TB, Cancer, Fluorosis and kidney problems are prevalent.

Considering the possibility of increase the above diseases due to development of Industrial area in the study area, it is necessary to have an Action plan to mitigate the issue beforehand.

9.6.5.1 Possible Health Hazards

Industrial Units: The possible Health hazards which may become an Endemic disease or Occupational illnesses in Long term during construction and operational phase of NIMZ area are given below:

- Chemical hazards, including heavy metals, such as lead & mercury, organic solvents, and many other chemicals including paints that are used in NIMZ.
- Physical hazards, such as excessive noise, vibration, extremes of temperature and pressure, and ionizing and non-ionizing radiation.
- Biomechanical hazards, such as heavy lifting, repetitive or awkward or forceful movements that result in musculoskeletal disorders, like carpal tunnel syndrome and low back pain.
- Biologic hazards, such as Human Immunodeficiency Virus (HIV), hepatitis B and hepatitis C viruses, the tubercle bacillus, and many other bacteria, viruses, and other microorganisms that may be transmitted through air, water, food, or direct contact.
- Psycho-social hazards, such as workplaces where there is high stress due to excessive demands on, and low control by, workers; stress and hostility resulting from urban congestion, such as "Road Traffic".

9.6.5.2 Occupation Health & Endemic Disease Mitigation Action Plan

Data Collection: Occupational and environmental diseases and injuries can be recognized at the individual level, which depends on obtaining and assessing an occupational and environmental history. Before implementation of the Mitigation Action Plan, the health

information of the people in the project area upto 10 km shall be collected from respective departments (Government/Hospitals). The data shall be collected and the report should be documented & updated every year.

Mitigation Measures: The following are some of the mitigation measures for Occupational Health and Endemic diseases:

Immediate Actions:

- Ensure through proper support and training that all employees are aware of hazards and accept responsibility for working safely during Construction and Operational phases. This will significantly reduce Occupational Health hazards and illness.
- Ensure presence of a key staff/doctor at the time of emergency to know, what to do if they suspect a notifiable disease in the surrounding.
- Community based participatory research to identify issues and to assess change for developing problem/location specific plans.

Long Term Actions:

- It shall be ensured that the respective Government department of Municipality disinfects residential areas which lie around the project site regularly.
- Ensuring provision of necessary medical facilities in the study area. Necessary guidance shall be provided to enhance the medical facility in the area.
- Periodic health awareness camps and health check-ups should be organised in the study area to ensure better health standards of the people.

Basic Information Requirements

The following shall be understood before implementing a mitigation measure;

- Possibility of providing additional responsibilities to EHS to take necessary immediate actions during emergencies.
- Animal welfare – for example, access to feed, provision of sufficient appropriate shelters shall be analysed.
- Potential alternative methods to control various diseases out breaks.
- Consideration of other induced developments.
- Possibilities to dissipate information quickly.

Monitoring for Endemic Disease Mitigation Activities

- Frequent health check-ups shall be carried out for the workers. Thus the health related issues within each industrial unit can be analysed.
- Mitigation measures as suggested above shall be updated every year based on the collected data/information on health conditions of the people living in the study area.
- Information obtained from monitoring of Environmental parameters as provided in **Chapter 6** shall be correlated with the health information to provide a clear understanding of pollutant impacts.

9.7 Institutional Mechanism for Implementation of Mitigation Measures

The effective implementation and close supervision of the environmental management to mitigate the environmental impacts, which are likely to arise due to the construction and operational phases of the NIMZ could be achieved through a suitable institutional mechanism. The proposed institutional mechanism recommended for the implementation of the mitigation measures is presented in **Figure 9-7**.

A proper institutional mechanism to understand and implement appropriate environmental management measures during various stages of the project is a pre requisite and has a

strong bearing for the overall success of the project management. Implementation of the Environmental Management measures shall become easy once an environmentally responsible Team is in place.

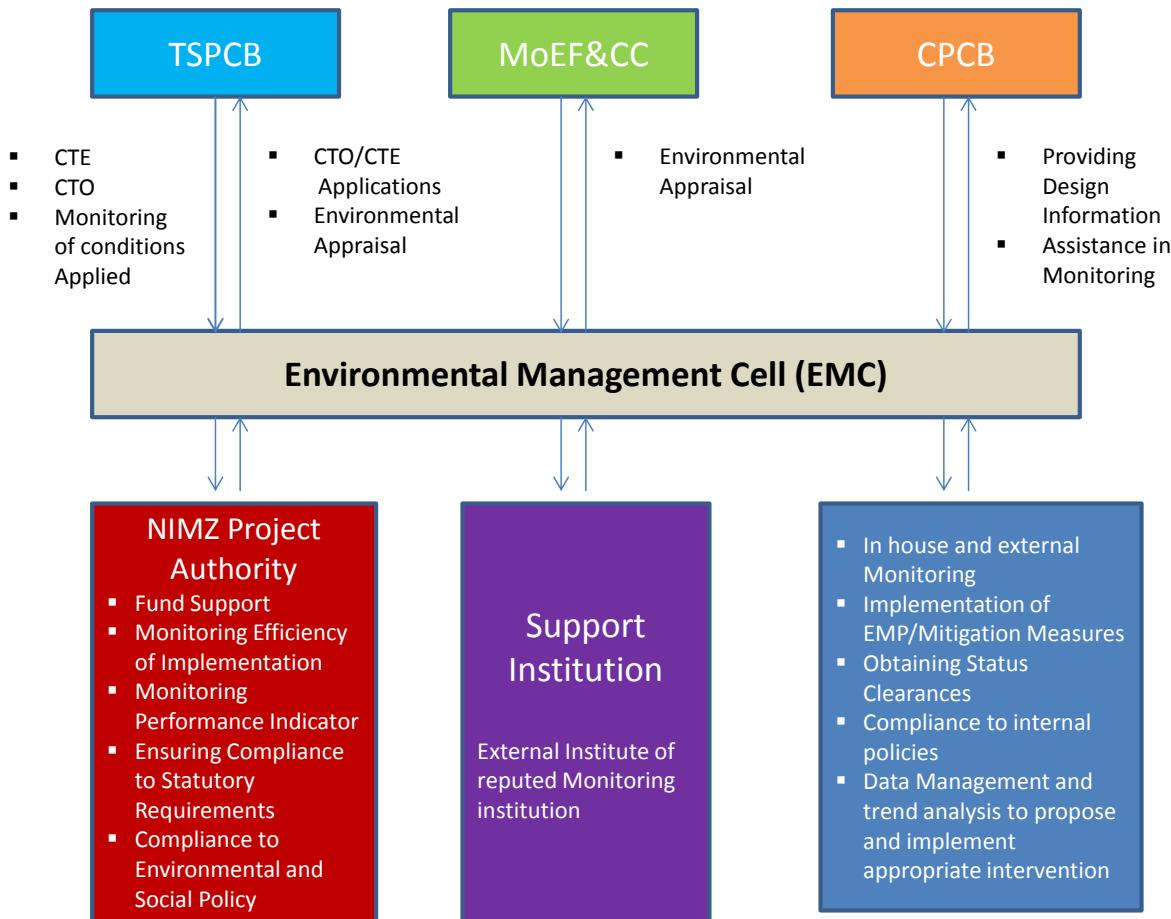


Figure 9-7: Implementation Arrangement

9.8 Environmental Management Cell (EMC)

Apart from having an Environmental Management Plan, it is also necessary to have a permanent organizational set up charged with the task of ensuring its effective implementation of mitigation measures and to conduct environmental monitoring. The major duties and responsibilities of Environment Management Cell are:

- To implement the environmental management plan
- To assure regulatory compliance with all relevant rules and regulations
- To ensure regular operation and maintenance of pollution control devices
- To minimize environmental impacts of operations as by strict adherence to the EMP
- To initiate environmental monitoring as per approved schedule
- Review and interpretation of monitoring as per approved schedule
- Review and interpretation of monitoring results and corrective measures in case monitored results are above the specified limit
- Maintain documentation of good environmental practices and applicable environmental laws as ready reference
- Maintain environmental related records
- Coordination with regulatory agencies, external consultant, monitoring laboratories
- Maintain log of public complain and the action taken

The proposed environmental management cell should have all basic record keeping facilities such as hard ware/software facilities, adequate space, vehicle (transport) and basic furniture and all simple instruments such as GPS, Digital camera, Hand held noise metre etc.

The cell should have all basic environmental management data of the project that includes but not limited to the following

- Environmental Impact Assessment Reports (both well preserved soft and hard copy)
- All valid and up to date environmental clearance and consent papers
- All latest Environmental legislations, policies, codes and manuals for ready references
- A list of consultants on environmental management need to be kept with yearly revision of the list. This will help to receive proper advice in case of an emergency or a requirement and also to implement day to day environmental management activities.

Over a period of time a system to understand and absorb the new revisions and changes in the environmental requirements and practices are to be established. This can only be achieved by regular training and genuine capacity building initiatives. The organizational set up for Environmental Management Cell is given as **Figure 9-8**.

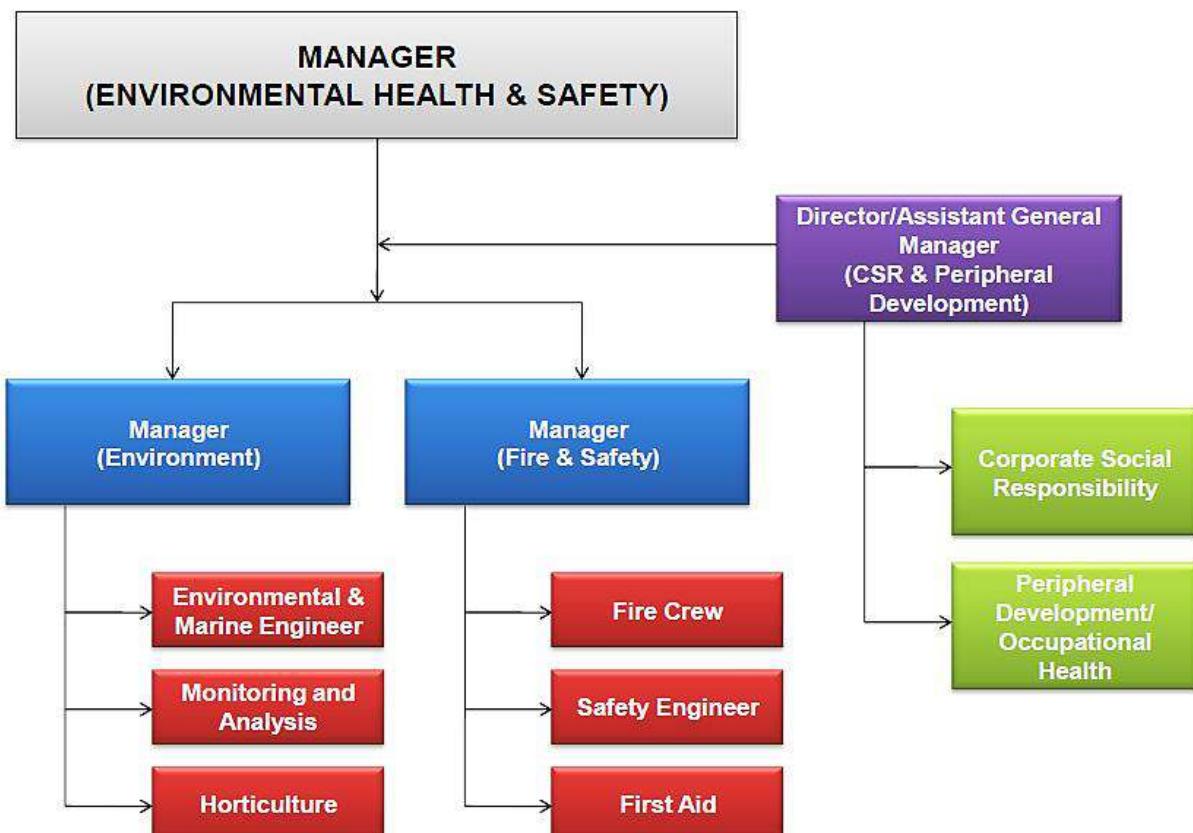


Figure 9-8: Organizational Setup for Environmental Management Cell

9.9 Approach towards Voluntary Compliance

During operational phase, NIMZ may adopt an Environmental Management System (EMS) based on recognized international standards for environmental and safety management systems (ISO 14001 – 2008; OHSAS 18001- 2007, 2008, Social Accountability (SA) 8000. The objective is to establish a system to assess, monitor and manage environmental performances, which can be used to promote continual environmental improvement and

prevention of pollution. The typical procedure that can be adopted in formulating the EMS is presented below:

- Identify and list out environmental aspects due to the operation of the proposed project
- Determine the key operations that have significant environmental impacts
- Identify and track environmental legislations, policies, codes and other relevant requirements
- Establish objectives and targets (Environmental Management Plan)
- Formulate an Environmental Management System (EMS)

For successful implementation of the formulated Environmental Management System, the NIMZ authority shall ensure that the essential resources (with defined roles and responsibilities) are made available to implement, maintain and improve the Environmental Management System.

9.10 Audits and Inspections

In addition, the EMC (EHS) Department shall be responsible for implementing Compliance Assurance activities, namely environmental audits. Internal audits and reviews of environmental procedures shall be conducted annually.

The EMC (EHS) Steering Committee, made up of Management Team members, shall conduct quarterly EHS performance reviews. Any change to the environment wholly or partial is identified, evaluated and equally corrective actions are taken to better the environmental performance.

A vital part of EMC (EHS) practice is to learn from experience, using it as basis to improve the system. To this effect, periodic inspections and record keeping provides a measure of how effective programs are and facilitates identification of areas where improvement will be necessary. Environmental inspections consist of examining all activities and documenting those actions that are carried out in compliance with environmental clearances, specifications relating to environmental protection, and mitigation plans approved.

9.11 Summary of Impacts and Mitigation Measures

Various project activities, associated impacts and mitigation measures are summarised in **Table 9-12**.

Table 9-12: Project Activities, Associated Impacts, and Mitigation Measures

S. No.	Activity	Relevant Environmental components likely to be impacted	Likely Impacts and their significance in the absence of Mitigation Measures	Proposed Mitigation Measures	Responsible Agency for Implementation
Construction Phase					
1.	Site levelling/ Material transport and construction activities	Air Quality	Air pollution due to <ul style="list-style-type: none"> – Exhaust emissions from vehicles – Windblown dust during material movement – Fugitive dust during material unloading – Dust suspension during site preparation, construction and trenching – Emissions from DG sets 	<ul style="list-style-type: none"> – To reduce impacts from exhausts, emission control norms will be enforced/adhered. – All the vehicles and construction machinery will be periodically checked to ensure compliance to the emission standards – Construction equipment and transport vehicles will be periodically washed to remove accumulated dirt – Providing adequately sized construction yard for storage of construction materials, equipment tools, earthmoving equipment, etc. – Provide enclosures on all sides of construction site – Movement of material will be mostly during non-peak hours. – On-site vehicle speeds will be controlled to reduce excessive dust suspension in air and dispersion by traffic – Water sprinkling will be carried out to suppress fugitive dust in the project site – Environmental awareness program will be provided to the personnel involved in developmental works – Use of tarpaulin covers and speed regulations for vehicles engaged in transportation 	– Construction Contractors/NIMZ developer/member industries
		Noise	Noise /Vibration from following activities <ul style="list-style-type: none"> – Vehicles transporting construction material – Diesel run engines of construction machinery – Drilling/Pile driving activities 	<ul style="list-style-type: none"> – Noise levels shall be maintained below threshold levels stipulated by Central Pollution Control Board (CPCB) time to time – Procurement of machinery/construction equipment in accordance with specifications conforming to source noise levels less than 75 dB (A) – Well-maintained construction equipment, which meets the regulatory standards for source noise levels, shall be used – Any equipment emitting high noise, wherever possible, shall be oriented so that the noise is directed away from sensitive receptors – Noise attenuation will be practised for noisy equipment by employing suitable techniques such as acoustic controls, insulation and vibration dampers – High noise generating activities such as piling and drilling shall be scheduled in day time – Personnel exposed to noise levels beyond threshold limits shall be 	

S. No.	Activity	Relevant Environmental components likely to be impacted	Likely Impacts and their significance in the absence of Mitigation Measures	Proposed Mitigation Measures	Responsible Agency for Implementation
1.		Disturbance to Natural Drainage pattern	– Impact to natural flow of runoff due to blockage and change of drainage course	provided with PPE. – The drains passing through the area shall be routed as per the proposed drain routing plan – Adequate storm water drainage system shall be provided. – Drainage system will be provided at construction yard. Measures will be taken to prevent silting of natural drainage due to runoff from construction areas – Due care will be taken during construction to avoid spillage of construction materials.	– Construction Contractors/NIMZ developer/member industries
		Vegetation and Strain on existing infrastructure	– Loss of vegetation and strain on existing infrastructure.	– Commencement of greenbelt development during construction phase especially in terms of nursery development and identification of indigenous species – Temporary workers camp with self-sufficient infrastructure facilities.	– Construction Contractors/NIMZ developer/member industries
		Existing Traffic	– Increase in Traffic addition	– NH9 (NH65) is at a distance of 10 km, South and SH14 and SH16 are crossing the NIMZ project site and the Transportation of construction materials will be carried out on these highways. – Regularization of truck movement	– Construction Contractors/NIMZ developer/member industries
2.	Solid Waste Management	Soil quality	– Impacts due to disposal of solid waste on ground	– Construction waste shall be used within project site for filling of low lying areas. – Excavated soil shall be stockpiled in a corner of the site in bonded area to avoid run off with storm water. – General refuse generated on-site shall be collected in waste skips and separated from construction waste. – Local authorised waste recycler shall be employed to remove general refuse from the site, separately from construction waste and hazardous wastes – Recyclable wastes will be disposed through TSPCB approved vendors – Burning of refuse at construction sites shall be prohibited.	– Construction Contractors/NIMZ developer/member industries
3.	Handling of hazardous materials	Human safety and property loss	– Fire accidents due to hazardous material handling – Health Issues	– Adequate safety measures as per OSHA standards will be adopted – Construction site will be secured by fencing with controlled/limited entry points. – Hazardous materials such as lubricants, paints, compressed gases, and varnishes etc., will be stored as per the prescribed/approved safety norms.	– Construction Contractors/NIMZ developer/member industries

S. No.	Activity	Relevant Environmental components likely to be impacted	Likely Impacts and their significance in the absence of Mitigation Measures	Proposed Mitigation Measures	Responsible Agency for Implementation
				<ul style="list-style-type: none"> – Construction site will be secured by fencing with controlled/ limited entry points – Medical facilities including first aid will be made available for attending to injured workers. – Handling and storage as per statutory guidelines. – Positive isolation procedures will be adhered – Handling and storage as per MSIHC rules, MoEF&CC guidelines with Fire protection system. – Hazardous wastes, if any, shall be disposed to nearby TSDF 	
4.	Water Resources	Water scarcity /Pollution to the nearby water bodies	Impacts to the surface water body	<ul style="list-style-type: none"> – Water Requirement during the construction will be met through authorised suppliers/partially from ground water. – During operation fresh water will be sourced from singur reservoir – Care should be taken to prevent the contaminated runoff from the construction site to the nearby natural streams, if any – Optimized utilization of the water – Wastewater and sewage generated shall be treated at modular STP or septic tank with soak pits 	– Construction Contractors/NIMZ developer/member industries
			–	–	–
Operational Phase					
1.		Air Quality	– Air pollution due to fugitive and stack emissions	<ul style="list-style-type: none"> – Member industry shall use air pollution control equipment/measures – DG set emissions shall be within prescribed standards – Stack height of all industries shall be as per CPCB guidelines – Periodical Monitoring of pollutants 	– NIMZ Developer/Member Industries
			– Traffic addition & Vehicular emissions	<ul style="list-style-type: none"> – NH9 (NH65) is at a distance of 10 km, South and SH14 and SH16 are crossing the NIMZ project site. – Speed of the trucks shall be controlled by providing speed breakers, sign boards and other appropriate speed control techniques – Proper lighting, signboards shall be provided at required locations. – Geometrics of the existing roads shall be improved at wherever required (sharp curves, junctions, etc.). – Internal roads are planned with sufficient Lane Adequacy <ul style="list-style-type: none"> ○ Sufficient parking facility shall be provided 	– NIMZ Developer/Member Industries

S. No.	Activity	Relevant Environmental components likely to be impacted	Likely Impacts and their significance in the absence of Mitigation Measures	Proposed Mitigation Measures	Responsible Agency for Implementation
				<ul style="list-style-type: none"> ○ Use of PUC certified vehicles - Use of tarpaulin covers and speed regulations for vehicles engaged in transportation 	
2.	Operation of generators, Pumps, AC, Industrial equipment used for manufacturing	Noise	<ul style="list-style-type: none"> - Increased noise levels due to equipment handling and vehicular movement 	<ul style="list-style-type: none"> - Acoustic Barriers and Enclosures - All transportation vehicles, machinery will be periodically checked to ensure minimal noise generation to comply OHSAS and ambient noise standards in the surrounding area - Personal Protecting Equipment (PPE) - Greenbelt Development - Counselling and traffic regulation 	<ul style="list-style-type: none"> - NIMZ Developer/Member Industries
		Vibration	<ul style="list-style-type: none"> - Temporary perplexity - Health implication on working continuously in vibrating environment 	<ul style="list-style-type: none"> - Machine and equipment likely to generate vibration shall be fixed based on the detail designing of foundation. - Machinery equipped with latest vibration-reduction technology shall minimise the vibrations. - Vibration dampers shall be provided around the source of generation 	<ul style="list-style-type: none"> - NIMZ Developer/Member Industries
3.	Water Supply	Water resources	<ul style="list-style-type: none"> - Impact on existing water resources 	<ul style="list-style-type: none"> - The water requirement is estimated at 110.974 MLD during operational stage and this will be sourced from Singur Reservoir. - No dependent on Ground water or other surface water sources. 	<ul style="list-style-type: none"> - NIMZ Developer
4.	Solid waste management	Groundwater and Soil quality	<ul style="list-style-type: none"> - Impact due to disposal of solid waste on ground without treatment 	<ul style="list-style-type: none"> - MSW will be given to municipal solid waste handler 	<ul style="list-style-type: none"> - NIMZ Developer/Member Industries
5.	Wastewater Discharge	Water Quality of nearby streams	<ul style="list-style-type: none"> - Impact due to untreated discharges 	<ul style="list-style-type: none"> - STP & CETP with Reuse option - No untreated Wastewater will be sent out - Storm Water Drainage System 	<ul style="list-style-type: none"> - NIMZ Developer/Member Industries
6.	Handling of hazardous wastes	Fire accidents due to products handling	<ul style="list-style-type: none"> - Human life and loss of property 	<ul style="list-style-type: none"> - Hazardous materials will be stored as per the prescribed/approved safety norms. - Temporary storage of hazardous waste within the industry premises for a period of 30 days. - Hazardous wastes will be sent to nearby TSDF through TSPCB approved vendors. - Medical facilities including first aid will be available for attending to injured workers - Emergency alarms, provision of fire hydrant system and fire station. - Effective Disaster Management Plan (DMP) which covers onsite and 	<ul style="list-style-type: none"> - NIMZ Developer/Member Industries

S. No.	Activity	Relevant Environmental components likely to be impacted	Likely Impacts and their significance in the absence of Mitigation Measures	Proposed Mitigation Measures	Responsible Agency for Implementation
				<ul style="list-style-type: none"> – offsite emergency plans. – Recovery of spills to the extent possible 	
7.	Operation of NIMZ	Socio-economic conditions of the region	<ul style="list-style-type: none"> – During operational phase, the NIMZ and associated facilities is likely to generate direct employment of 1,33,233. In addition, there is wide variety of jobs that are generated in form of indirect employment (e.g. hotel business, small eateries, construction, transport, etc.). This project may generate indirect employment of around 1,33,233 people. Local people will be given preference based on their qualification and skill set. Together with this employment potential, project will help to enhance the socio economic conditions of the area with better schooling, communication and transport facilities that will be developed/ triggered as a part of overall economic development of the region – General welfare will improve in the area as per capita income will go up in the post project period. 	–	
		Natural Hazards	As given in Disaster Management Plan (DMP) prepared; Site Main controller will act as the overall in-charge of the control of educative, protective and rehabilitation activities to ensure least damage to life and property.		
		Induced Development	Offers an efficient and cost effective supply chain/ value proposition to the local importers and exporters.		

9.12 Budgetary Estimates

9.12.1 Budgetary Estimate for Environmental Management

The budgetary estimate (Capital Cost) for Environmental Management is **INR 3000 Million (INR 300 Crores)** and the annual recurring cost is **INR 297 Million (INR 29.7 Crores)**. The breakup of cost is given in **Table 9-13** and **Table 9-14**.

Table 9-13: Environmental Management - Capital Cost

S.No.	Purpose	Cost items	Amount (Rs.)	Million (INR)	CRORE (INR)
1	Greenbelt development	Tree (Greenbelt) Plantation	135093099	135.09	13.5
2	Solid Waste Management	Waste dustbin	63,17,570	6.318	0.63
3	Capacity building	Training workshop	2,00,000	0.2	0.02
4	CETP*		2144000000	2144.00	214.4
5	STP*		688000000	688.00	68.8
6	Environmental Monitoring Construction Phase	Terrestrial Environment	27072000	27.10	2.71
Total Capital Cost				3000.708	300.07
Round off				3000	300

*-cost of CETP and STP is already included in project cost

Table 9-14: Environmental Management - Annual Recurring Cost

S. No.	Purpose	Items	Amount (Rs.)	Million (INR)	CRORE (INR)
1	EMC Running expenditure	Salary of Env. Eng.	400000	0.4	0.04
		Doc Asst.	125000	0.1	0.01
		Support Staff	100000	0.1	0.01
		Office Expenses	1200000	1.2	0.12
		House Keeping	500000	0.5	0.05
2	Green Belt Maintenance	General Maintenance	6754654.94	6.75	0.675
3	Maintenance of Dust bins		6,31,757	0.63	0.063
4	Awareness campaigns- Training	Two Workshop programs	2,00,000	0.2	0.02
5	CETP		214400000	214.4	21.44
6	STP		68800000	68.8	6.88
7	Statutory compliance for environmental protection	Environmental Monitoring	4016500	4.02	0.4
Total Annual Recurring Cost			297127911.94	297.13	29.71
Round off				297	29.7

CHAPTER 10

SUMMARY AND CONCLUSION

Chapter 10 Summary and Conclusion

10.1 Introduction

In order to promote manufacturing in India, Government of India (GoI) has announced a National Manufacturing Policy (NMP), 2011, with the objective of enhancing the share of manufacturing in Gross Domestic Product (GDP) to 25% within a decade and creating 100 million jobs by 2022 in the manufacturing sector.

TSIIC intends to provide world class eco system for manufacturing industries and proposes to establish infrastructure facilities for the proposed NIMZ. The processing area includes manufacturing zone for different manufacturing industries and service industry selected based on the market and demand assessment study undertaken. The estimated investment in the proposed NIMZ will be in the range of Rs. **44,000 Crores**.

Telangana State Industrial Infrastructure Corporation Limited (TSIIC) proposed to establish NIMZ at Nyalkal and Jharasangam mandals near Zaheerabad in Sangareddy District of Telangana in an area of **~12,635 acres** (Acres 12,635.14 guntas, 5,113 ha) in pursuit of NMP of Department of Industry and Policy Promotion (DIPP) of Government of India. DIPP has in principle approved the establishment of NIMZ near Zaheerabad in January, 2013 and subsequently issued the Final Approval in December, 2015.

In order to assess the potential environmental impacts due to the proposed NIMZ, TSIIC appointed L&T Infrastructure Engineering Limited (LNTIEL), Hyderabad to carry out the EIA/EMP Study for seeking Environmental Clearances from Statutory Authorities.

This is an ESIA/EMP report addressing all aspects of NIMZ for obtaining Environmental Clearance from MoEF&CC. The project was accorded Terms of Reference vide letter no. F.No.21-237/2017-IA.III dated March 01, 2018.

10.2 Project Site

The project site is located in Nyalkal and Jharasangam Mandals of Sangareddy District, Telangana. This Project site falls between Latitude 17°47'24.00"N and Longitude 77°39'1.00"E with almost flat terrain with levels varying from 605m to 660m.

10.2.1 Salient Features of Project Site

The project site is having a rolling terrain with varying levels. It is observed that general slope in the project region is towards SW. The salient features of project site are given in **Table 1-2**.

Table 10-1: Salient Features of Project Site¹⁸

S. No	Details	Description
1.	Location	Nyalkal & Jharasangam mandals near Zaheerabad
2.	District	Sanga Reddy
3.	State	Telangana
4.	Karnataka State Border	Adjacent to project site
5.	Topography	Almost Flat terrain with levels varying from 605m to 660m
6.	Temperature ¹⁹	<ul style="list-style-type: none">• Mean Daily Maximum: 32° C• Mean Daily Minimum: 20.6° C

¹⁸ Distances mentioned are from project boundary

¹⁹ Source for Temperature, Wind Speed, Rainfall and Relative Humidity Data: IMD station, Bidar

S. No	Details	Description																					
7.	Wind Speed	<ul style="list-style-type: none"> The predominant wind direction is south-west 																					
8.	Rainfall	<ul style="list-style-type: none"> Annual rainfall: 911.6 mm 																					
9.	Relative Humidity	<ul style="list-style-type: none"> Annual Mean-Morning: 67% Annual Mean-Evening: 52% 																					
10.	Present Land use	The site is mostly comprised of barren and vacant lands. Few pockets of farmlands are also located within the site																					
11.	Seismicity	Seismic Zone II (Least Active zone) ²⁰																					
12.	Nearest Road Connectivity	<ul style="list-style-type: none"> SH-14 and SH-16 -passes through site. NH-65 (Pune – Machilipatnam Road) - 10km south 																					
13.	Nearest Rail Connectivity	<ul style="list-style-type: none"> Metalkunta (1.4 km) Zaheerabad (10 km) 																					
14.	Nearest Seaport	<ul style="list-style-type: none"> JNPT (600 km) on west coast Krishnapatnam Port (465 km) on east coast 																					
15.	Nearest Airport	<ul style="list-style-type: none"> The nearest airport is Rajiv Gandhi International Airport (RGIA) at Shamshabad, Hyderabad. It is located to the southeast of the site at a distance of 125 km by road (105 km aerial distance). Bidar Airport is located at 17 km by road from the NIMZ site and is currently under Indian Air Force Station. 																					
16.	Nearest Town/ Village	<table border="1"> <thead> <tr> <th colspan="3">Nearest villages</th> </tr> </thead> <tbody> <tr> <td>Ganeshpur</td> <td>Hadnoor</td> <td>Gangwar</td> </tr> <tr> <td>Husselli</td> <td>Namtabad</td> <td>Rejinthal</td> </tr> <tr> <td>Ganjoti</td> <td>Mamidgi</td> <td>Malkanpahad</td> </tr> <tr> <td>Mungi</td> <td>Kalbemal</td> <td>Chilepalle</td> </tr> <tr> <td>Rukmapur</td> <td>Basanthpur</td> <td>Yelgoi</td> </tr> <tr> <td>Metalkunta</td> <td>Bardipur</td> <td></td> </tr> </tbody> </table> <ul style="list-style-type: none"> Zaheerabad (TS) - 9 km, S Bidar (KA)- 8 km, NW 	Nearest villages			Ganeshpur	Hadnoor	Gangwar	Husselli	Namtabad	Rejinthal	Ganjoti	Mamidgi	Malkanpahad	Mungi	Kalbemal	Chilepalle	Rukmapur	Basanthpur	Yelgoi	Metalkunta	Bardipur	
Nearest villages																							
Ganeshpur	Hadnoor	Gangwar																					
Husselli	Namtabad	Rejinthal																					
Ganjoti	Mamidgi	Malkanpahad																					
Mungi	Kalbemal	Chilepalle																					
Rukmapur	Basanthpur	Yelgoi																					
Metalkunta	Bardipur																						

10.2.2 Need and Justification of Project Development

Indian economy has witnessed tremendous growth in the last decade primarily due to the contributions made by the exports. In order to augment the growth of the exports the Government has to setup IPs, SEZs, Industrial Estates (IEs), NIMZs etc., which would provide a hassle free and internationally competitive environment for companies. The exports have been facilitated by the growth in a number of industries such as chemical industries, pharmaceutical, textiles, engineering industries, etc.

10.2.3 Location Advantage/Justification

Telangana is rich in labour pool, with large base of skilled labour, making it an ideal destination for knowledge-intensive sectors. The state also has well developed physical infrastructure in the form of Airports and Railway network. The state is now aggressively promoting industrial development.

The site is located at a distance of about 80 km west of the state capital, Hyderabad; 65 km to the Hyderabad Outer Ring Road (ORR); 50 km to Sangareddy; and 10 km north of Zaheerabad, a major commercial centre of the district. Bidar is located 10 km northwest of the site.

²⁰ Project site falls in seismic zone II (Least Active Zone). During the design stage, the effects from natural disasters will be considered as per IS:1893 (Part-1):2002 and necessary precautionary measures would be built-in/ implemented.

A study of the critical and high parameters indicate that Telangana has a very high ranking among various states for attracting investments in the field of manufacturing due to following advantages:

- Relatively lower land cost.
- Power Availability.
- Availability of Engineering and Technical Manpower.
- Proximity to Hyderabad – major end user market.
- Linkage to Supply chains.
- Visionary government with Regulatory Scenario and Policies for manufacturing Industry.

10.2.4 Project Development Concept

The core principles for evolving the project is based on the overall vision laid out for NIMZs in the NMP, 2011 and on the broad objective of establishing a world class business environment targeted essentially at high growth industrial & infrastructure sectors.

10.2.4.1 Objectives of Zaheerabad NIMZ

- Sustainable Development Plan for Work, Live and Learn
- Inclusive Planning
- Cluster approach to industrial zoning
- Eco-friendly integration of national features and cultural spaces
- Disaster-Risk Consideration
- Conservation of resources/facilities
- Green Space/Lung Space
- Settlements

NIMZ development plan identifies the constraints and appropriate road network including the approach roads, road congestion removal by augmentation / widening of existing roads is considered.

10.2.5 Project Description

A two-pronged approach has been adopted to shortlist the focus sectors for NIMZ viz. traditional sectors and sun-rise Sectors.

10.2.5.1 Focus Sectors for NIMZ

Only those industries have been shortlisted which contribute majorly to the global trade, having shown substantial growth in the last 5 years and the industries which contribute majorly to Telangana's output in each sector, while also taking into account the location of Telangana, its sources for raw materials required for these industries and destination of the finished good. The industries from the shortlisted sectors are given in **Table 10-2**.

Table 10-2: Final Short-listed Sectors and Industries for NIMZ Zaheerabad

Sector	Industry
Electrical Machinery	Manufacture of electric motors, generators, transformers
	Manufacture of batteries and accumulators
	Manufacture of wiring and wiring devices
Metals	Manufacture of basic iron and steel (ferro alloys, wire of steel by cold drawing, tube and tube fittings etc.)
	Manufacture of basic precious and other non-ferrous metals (includes manufacture of copper from ore, lead etc.)
	Casting of metals (includes manufacture of tubes, pipes and hollow profiles, casting of non-ferrous metals)
Food	Processing and preserving of meat (includes production, processing and preserving of meat and meat)

Sector	Industry
Processing	products
	Manufacture of dairy products (includes manufacturing of milk, milk powder, ice cream etc.)
	Manufacture of grain mill products, starches and starch products (includes flour milling, rice milling, milling of other grains)
	Manufacture of other food products (includes manufacture of bakery products, noodles, Processing of edible nuts etc.)
	Manufacture of prepared animal feeds (manufacture of cattle feed, poultry feed, feed for pets etc.)
Non-metallic minerals	Manufacture of non-metallic mineral products i.e. (includes manufacture of refractory products, clay building materials, ceramic products etc.)
Automobiles	Manufacture of motor vehicles (such as manufacturing of Tractors, Buses etc.)
Machinery	Manufacture of general purpose machinery (includes manufacture of hydraulic and pneumatic components, pumps, compressors, taps, valves, lifts, etc.)
	Manufacture of special-purpose machinery (includes manufacture of agriculture implants, machine tools for drilling, milling, industrial machinery etc.)
Transport equipment	Manufacture of Railway locomotives and rolling stock
	Manufacture of Military fighting vehicles

10.2.6 Project Cost

The estimated internal infrastructure development cost for the development of Zaheerabad NIMZ by TSIIC is around **Rs. 3,095 Crores**

10.3 Description of Environment

Project Influence Area (PIA)/Study Area: An area covering 10 km radius from project boundary has been earmarked for the study as the PIA/study area.

Study Period: The baseline terrestrial environmental surveys were carried out during winter season (December 2017–February 2018).

10.3.1 Terrestrial Environment

- Ecologically sensitive areas like Biosphere Reserves, National Parks, Wildlife Sanctuaries protected sites as per Ramsar convention and other protected areas (PA) are not found within 10 km radius of the project site.
- Elevation in the proposed site varies from 605m to 660m MSL. The general land slopes towards South West.
- Proposed NIMZ site falls under Seismic Zone II (Least Active Zone) as per IS 1893 (Part I).
- The total area considered for land use study is 71299.702 Ha (~10 km radius). Out of which, Built-up: Urban 1.70%, Built-up: Rural 1.59%, Agriculture: Crop Land 62.62%, Agriculture: Plantation 0.53%, Agriculture: Fallow 9.80%, Forest: Deciduous 0.71%, Forest: Plantation 1.89%, Forest: Scrub 3.01%, Barren: Scrub Land 16.75%, Barren: Rocky 0.59%, Water bodies: Streams 0.08%, Water bodies: Lakes 0.74%. Although during site visit, the project site was observed to be mostly fallow with scanty crop area (including Plantation).
- As per the Project site specific meteorological data, the predominant wind directions observed were from West South West (WSW) followed by South West (SW) and West (W);
- Soil types are clay, loam clay, sand clay, silty clay and sandy clay and soil of area is predominantly red laterite. The soil samples are neutral to slightly alkaline nature.
- Groundwater samples are within the limits specified for drinking water quality standards as per IS: 10500 (2012) except Hardness, Alkalinity, TDS, Calcium at some villages. But these exceeded values are within the permissible limits in the locations. Iron values at all

- the locations are exceeded the desirable limits this is probably due to laterite soils in the PIA
- Surface water samples are within the permissible limits as per ISI-IS2296-1982 (Tolerance Limits for Inland Surface Waters - Outdoor bathing) Class – B, except Hardness. But these exceeded values are within the permissible limits in the locations. Iron at Singur Reservoir and Manjeera River exceeded the desirable limits.
 - Ambient air quality parameters like Particulate Matter (PM₁₀), Particulate Matter (PM_{2.5}), Oxides of Sulphur (SO₂), Nitrogen Di-oxide (NO₂), Carbon Mono Oxide (CO), Ozone (O₃), Mercury (Hg) and Hydro Carbons (C₆H₆) were monitored and found to be within limits prescribed by NAAQS.
 - PM₁₀ ranged between 51.4 µg/m³ to 70.4 µg/m³. NAAQ stipulated standard for PM₁₀ for 24 hr. average is 100 µg/m³.
 - PM_{2.5} values varied from 20.6 µg/m³ to 33.5 µg/m³. NAAQ stipulated standard for PM_{2.5} for 24 hr. average is 60 µg/m³.
 - SO₂ ranged between 12.4 µg/m³ and 20.5 µg/m³. NAAQ stipulated standard for SO₂ for 24 hr. average is 80 µg/m³.
 - NO₂ ranged between 15.6 µg/m³ to 28.5 µg/m³. NAAQ stipulated standard for NO₂ for 24 hr. average is 80 µg/m³.
 - O₃ ranged between 19.2 µg/m³ to 26.2 µg/m³. NAAQ stipulated standard for O₃ for 8 hr. average is 100 µg/m³.
 - CO, NH₃, Pb, C₆H₆, BaP, As, and Ni were observed below detectable limits.
 - Noise levels were monitored as per CPCB guidelines and are found to be well within the limits.
 - Day equivalent noise levels (Ld) ranged between 50.38 dB(A) to 53.05 dB (A) for Residential areas
 - Day equivalent noise levels (Ld) recorded as 54.12 dB (A) for commercial areas
 - Night equivalent noise levels (Ln) ranged between 41.19 dB(A) to 42.45 dB (A) for Residential areas
 - Night equivalent noise levels (Ln) recorded as 43.18 dB (A) for commercial areas
 - None of the plant species recorded either from the core area or Project influence area belongs to the Rare/Endangered/Endemic/Threatened category. However a few specimens of *Decalepis hamiltonii* an endangered plant as per IUCN is present in small numbers in the buffer area; especially in the reserve forest regions.

10.3.2 Socio-economic Conditions

In the study area 110 census villages are falling in the study area. The total population of the study area is 479268 of which male population constitutes of 51.13% and females population constitute of 48.87% with respect to the total population. The sex ratio of the study area is 956 of females over 1,000 males.

10.3.3 Archaeological Places

It was studied that the no archaeological sites were found with in or around the project affected and influenced area. But there historical places like Bahmani Tombs; Chaukhandi of Hazrat Khalil Ullah is located at Ashtur.

10.4 Anticipated Environmental Impacts with Mitigation Measures

Anticipated impacts on the environmental and social attributes, which are likely to arise due to construction and operation of proposed project have been identified, predicted and evaluated and are presented in **Chapter 4**.

- The land use of site is mostly barren, partly open scrub and some plantations. The site is habituated with all types of ecosystems predominantly terrestrial. Most of the region is open forest and under agricultural practice. There are certain thorny scrub patches and grassland. The common native species such as *Vitex negundo*, *Prosopis juliflora*, *Azadirachta indica*, *Borassus flabellifer*, *Tamarindus indica* and *Acacia nilotica* are observed as predominant species.
- Natural drains are observed in the site. The development shall be carried out in such a way to ensure proper drainage by providing surface drainage systems including storm water network, etc.
- The wastewater generated in industries will be treated in STP/CETP. A part of the treated wastewater will be used for maintaining the greenbelt within the NIMZ and the balance will be reused at the units as non-potable water for various applications. Discharge of wastewater on land is not permitted.
- Water requirement will be met from Singur reservoir. No dependent on Ground water or surface water sources near to the project site.
- Though the proposed development will not draw Ground water during its operation stage, rain water harvesting system is suggested to utilise rainwater within the project site.
- Construction camps will be provided with self-sufficient infrastructure to minimise impact/strain on the existing infrastructure.
- All the necessary Air pollution control measures will be adopted by member industries to control the fugitive emissions of VoCs, particulates, organic vapours etc., shall be followed.
- The impact on air environment due to the stack emissions, vehicular emissions, DG sets was carried out. The 1st highest 24 Hour average and Annual Average resultant concentrations of NO_x, PM₁₀, PM_{2.5} and SO₂ at all receptor locations are found to be well within the National Ambient Air Quality Standards (NAAQS), 2009.
- The solid waste generated during construction phase may impact soil quality, water quality and public health if not regulated properly. Construction waste will be re-used within plant site for filling of low lying areas. Other wastes which can be re-cycled will be sold and hazardous waste shall be stored as per prescribed safety norms and disposed through approved TSPCB vendors. Also, strict guidelines will be put in place in order to manage the solid waste generation during the operational phase of the development.

10.5 Analysis of Alternatives

10.5.1 Site Alternatives

TSIIC had identified three locations for development of NIMZ in the state and analysed to select the most suitable site location for development. The three alternatives considered were:

- Site 1: Siddipet District
- Site 2: Nalgonda District
- Site 3: Sangareddy District

Considering the sufficient Land availability, Minimal R&R, Involvement of Scrub land, Barren/Uncultivable/Waste land, Better connectivity and without Environmental Sensitive Areas, Site 3 (Near Zaheerabad) has been selected for the Development of NIMZ. Site 2 mainly not meeting criteria fixed in national manufacturing policy (NMP) i.e., area of at least 5000 hectares (12355 acres) shall be minimum size of NIMZ area. Site 1 has more

resettlement & rehabilitation, less government land availability and no reliable water resource is not a good option for this large scale development of NIMZ.

The land delineated for the NIMZ therefore primarily includes wastelands and government-owned lands. Areas in proximity to eco-sensitive zones like Manjira River and Singur Reservoir have been avoided and adequate buffer has been provided between the NIMZ lands and these eco-sensitive zones.

10.5.2 Conceptual Master Plan

Based on the spread and shape of the project site, regional linkages, proposed entry exit points, wind directions, terrain, and existing features in and around the project site. The three master plan options are discussed in detailed, compared and evaluated to arrive at the recommended for NIMZ Zaheerabad. Out of the three options, Option 1 is preferred.

10.6 Environmental Monitoring Programme

Environmental monitoring programme has been formulated and the same will be implemented. The effective implementation and close supervision of the environmental management to mitigate the environmental impacts, which are likely to arise due to the construction and operation phases of the project could be achieved through a suitable institutional mechanism.

10.7 Additional studies

10.7.1 Risk Analysis

Risk analysis study was carried out to assess risks associated with the construction and operation of the proposed NIMZ by considering the hazards associated with handling of chemicals. A systematic risk analysis will help in identification of the hazards and associated risk. The risk assessment thus carried out also provides inputs for formulating the onsite Disaster Management Plan (DMP).

The Risk Analysis can be broadly divided into three basic steps.

- Hazard Identification
- Failure Frequency
- Consequence or Effect and Damage calculations

10.7.2 Disaster Management Plan

The Disaster Management Plan (DMP) is aimed to ensure safety of life, protection of environment, protection of installation, restoration of production and salvage operations in this same order of priorities. For effective implementation of DMP, it should be widely circulated and a personnel training is to be provided through rehearsals/drills. To tackle the consequences of a major emergency inside the industry or immediate vicinity of the industry, a DMP has to be formulated.

A framework for DMP was prepared to minimise damages in the event of a disaster. An On-Site Emergency Preparedness Plan and Off-Site Emergency Preparedness Plan were broadly prepared to deal with emergencies and prevent disasters.

An institutional framework with clear assignment of roles and responsibilities was broadly prepared with which location of Emergency Control Centre and Assembly Points will be identified. Communication system and alarm systems for effective communication in the

event of a disaster are broadly identified. DMP for natural hazards such as cyclones was broadly prepared. Mutual aid scheme, composition of District Level Emergency Committee and aspects relating to community involvement for dealing with off-site disasters were broadly prepared.

10.7.3 Traffic and Transportation Management Plan

The primary roads in NIMZ are SH-14 and SH-16. The total future traffic on these roads will include the generated traffic from NIMZ and the forecasted existing traffic. Based on the primary traffic survey, traffic management plan is prepared to assess the adequacy of the circulation network (both internal and external) of the NIMZ. The trips generated from NIMZ are estimated considering the industrial product mix of the NIMZ. Commercial traffic and passenger traffic has been estimated separately & the total generated traffic is presented in terms of passenger car units (PCUs). The management plan covers estimation of Trip Generation of the NIMZ (from commercial as well as passenger traffic), followed by estimation of Peak Hour Trips and assumptions taken on Trip Distribution. Based on this, Lane Adequacy checks are presented for the existing and proposed road network within and around the NIMZ. The analysis of critical junctions in the study area is also presented along with appropriate recommendations for each junction. Recommendation for traffic management for NIMZ is also covered. The generated traffic from NIMZ will join NH-65 through SH-14 and through Jharasangam Road. Some of the traffic will move towards northern side through SH-16.

10.7.4 Social Impact Assessment

This assessment is specifically addressing the potential impacts which will be generated as a result of proposed development.

- Land Acquisition: The NIMZ in Zaheerabad is proposed to be developed in an area of about ~12,635 acres. An area of Ac 2,924.38 gts. is under possession of TSIIC, out of which patta/private land is Ac.1311.38 gts of and government land is Ac. 1613.
- The impact on nearby settlements during construction phase will be due to air pollution and the noise generating activities. However, the activities are limited to the construction phase and will cease upon completion of the construction. Necessary mitigation measures are proposed to be adopted.
- Construction of NIMZ requires large work force. To ensure that there is no strain on the existing infrastructure, worker camps will be self-sufficient and would not rely on local resource.
- During the operation phase the NIMZ is expected to bring an employment (direct and indirect) of ~2,66,000 personnel. This includes Skilled (Engineers and other officials), semiskilled and unskilled labour. The local employment could be higher for unskilled labour due to the availability of this category at local level

10.8 Project Benefits

The development of the NIMZ is being envisaged by TSIIC taking into consideration the overall development of Industries in the state. Similar such initiatives are undertaken across the state. The Nation, the State and the region will have impetuous benefits from such development, such as:

- Skill development and Training to the local population
- Localizing the global/domestic value chain
- Technology transfer

- Foreign Direct Investment
- Improved working condition
- Shifting of manpower resources from low productivity to high productive activities
- Augmentation of existing clusters
- Diversifying the local industrial base
- Shifting activities from unorganized to organized sector
- Convergence of population and thereby enhanced local consumption and spending
- Project development will also attract hotel business, banking sector, small eateries, construction, transport and other supply services
- Better quality of educational and medical facilities to the local people
- Improved Local Infrastructure
- Improved socio-economic conditions
- Health facilities
- Education Facilities
- Employment Opportunities
- Increase in Per Capita Income
- Revenue Generation

10.9 Corporate Social Responsibility (CSR)

As a responsible company towards the conservation, restoration and redevelopment of ecosystem and environmental conditions in the vicinity of the NIMZ, TSIIC shall implement the Corporate Social Responsibility (CSR) activities.

The following are the areas/activities considered under Corporate Social Responsibility.

- Support for Female Literacy
- Support to Swach Bharat Abhiyan
- Skill development training programmes
- Support to Enhancing the School and Collage Lab and Library facilities
- Promotion of Sports among youth
- Support to Solid waste Management Programmes
- Support to Forest Department for wildlife conservation plan
- Support to refurbishment of medical facilities construction of ward in the hospital
- Support to development of infrastructure facilities for educational institutes, medical facilities, purchasing of ambulance
- Training /Awareness to farmers in the nearby Areas to increase Crop Yield
- Contribution to Disaster Management Fund
- Support to improvement of roads to villages
- Support to drinking water facilities and supply network in the project villages
- The above identified activities may be revised based on the consultations during the public hearing according to its merits and priority. The activities and budget will be allocated as per district administration directives. The CSR activities will be taken up in a phased manner as per project development activities.

10.10 Environment Management Plan

The main objectives of Environmental Management are to:

- Identify key environmental issues envisaged to be encountered during construction and operation phases of the project.
- Provide guidelines for appropriate mitigation measures

- Establish systems and procedures for implementing mitigation measures
- Ensure the mitigation measures are being implemented
- Monitor the effectiveness of mitigation measures
- Institutional framework includes the responsibilities for environment management as well as responsibility for implementing environmental measures
- Take necessary prompt action when unforeseen impacts occur

Based on the above objectives in mind, the following specific environmental management plan/measures are provided

- Administrative and Technical Setup for Environmental Management
- Greenbelt development
- Solar power harnessing
- Rainwater harvesting
- Occupational health and safety: Occupational health & safety needs attention both during construction, erection, operation and maintenance phases.
- Institutional arrangements/framework for environmental management.

The effective implementation and close supervision of the environmental management to mitigate the environmental impacts, which are likely to arise due to the construction and operational phases of the NIMZ could be achieved through a suitable institutional mechanism. The proposed institutional mechanism with budgetary estimate (Capital Cost) for Environmental Management is **INR 3000 Million** and the annual recurring cost is **INR 297 Million** is recommended for the implementation of the mitigation measures is presented in EIA report.

10.11 Conclusion

In order to meet the growing needs of the industrial sector, it is necessary to identify new sites for industrial development. On the basis of the market analysis, area strengths and likely investment proposals in pipeline, it has been proposed to have all high market potential and high growth areas of automobile sector. Proposed development will not envisage any resettlement.

Typically any developmental projects also trigger a set of environmental and social impacts. These environmental and social impacts (proposed development will not envisage any resettlement) due to infrastructure development projects occur in different forms. An Environmental Impact Assessment has been carried out to study the potential environmental and social impacts due to the proposed NIMZ. Potential environmental and social impacts due to the proposed development on attributes like air quality, noise, water quality, soil, flora, socio-economic, etc. have been assessed as part of this EIA study. Appropriate mitigation measures to help minimize/avoid impacts from the development have been recommended. The measures include avoidance measures, mitigation measures and environmental enhancement measures.

Anticipated project impacts and prevailing environmental issues are manageable and can be avoided or mitigated or minimized to acceptable standards. Potential impacts have been identified attributable to the proposed project and most of which are localized and temporary in nature and can be mitigated with minor to negligible residual impacts.

The effective implementation and close supervision of environmental management to mitigate the environmental impacts could be achieved through a suitable institutional mechanism proposed.

The proposed **NIMZ near Zaheerabad is strategically located in one of the most promising manufacturing and trading centres of India** and will be developed as world class destination for attracting the major investors. Based on the region's/state's and country's strengths, a number of activities can be planned. In fact the strengths provide the flexibility of getting into wide array of manufacturing activities and products.

The vision is to develop the NIMZ with integrated well planned infrastructure and an efficient management structure which shall ensure continual global competitiveness. The proposed NIMZ shall emerge as a benchmark in the State and the Country both in terms of market relevance and in terms of environmental sustainability.

CHAPTER 11
DISCLOSURE OF CONSULTANTS

Chapter 11 Disclosure of Consultants Engaged

TSIIC has taken up the task of development of Industrial hubs in the newly formed state of Telangana and as part of their mandate they are promoting sector specific Industrial Parks. As part of this initiative, TSIIC has identified a parcel of land at Nyalkal and Jharasangam mandals near Zaheerabad in Sangareddy District of Telangana.

TSIIC have chosen L&T Infrastructure Engineering Ltd (LNTIEL), to carry out the EIA Study for the proposed development of NIMZ.

11.1 Brief Profile of L&T Infrastructure Engineering Limited

L&T Infrastructure Engineering Ltd., a subsidiary of Larsen & Toubro Limited is a leading multi-disciplinary Indian Consultancy firm. LNTIEL has made a distinctive mark by creating new standards in providing sustainable solutions. Today, LNTIEL is distinguished from others not limited to its lineage but its relentless quest for quality - a unique tradition of placing client's needs above all.

LNTIEL offers a diverse array of talents together with practical experience. We assure our clients a professional approach by innovation and evolving optimal solutions. At LNTIEL, we recognise that human resources are the key to organisational success. LNTIEL's expertise ranges across a broad spectrum of sectors with special forte in Infrastructure Projects and Industrial Parks/SEZs. LNTIEL has expertise in carrying out Techno-Economic Feasibility Studies, Preparation of Master Plans & Detailed Project Reports and Bid Process Management. LNTIEL is rendering the following services for Specialised Industrial Clusters/SEZs/Industrial Parks/Investment Regions:

- Environmental and Social Impact Assessment including assistance to Client in obtaining necessary clearances/approvals from various statutory authorities: State PCB's, MoEF&CC (GoI)
- Field surveys (Terrestrial & Marine Environments) and investigations
- Numerical modelling especially for the marine projects
- Project formulation/conceptualisation & configuration
- Market study and demand assessment
 - Master planning, Urban planning, Environmental planning and Tourism planning
 - Infrastructure design and engineering
 - Block cost estimation
 - Economic and financial analysis
 - Bid Process Management
 - Assistance in domestic and international marketing including road shows/investors conference (or meet) for marketing the project.
 - Assistance to Client in achieving technical and financial closures

Strengths of LNTIEL

LNTIEL has a well-equipped Corporate Office at Chennai. LNTIEL's staffs is replete with a wide range of professionals – Urban Planners, Engineers, Designers, Environmental and Social Specialists, Financial Analysts, Project Structuring, Marketing and Privatisation Experts, Construction Supervision Managers – covering a wide spectrum of services. The skills of the Experts are continuously aligned to suit the changing Client requirements. LNTIEL has strategic tie-ups with Associates for specialized services. Services of an eminent group of Expert Consultants are also available to LNTIEL. Our clients value the highly

motivated and dedicated team of professionals who assure them international quality service through focused and optimal solutions.

LNTIEL provides a stimulating working environment. We have assembled a team of skilled, creative and dynamic professionals who strive to translate the organisational ethos into reality. To enhance the efficiency of the personnel and enable them to be updated with the latest developments in technology, we organise comprehensive technical training programmes and organisational development programmes at regular intervals. A creative work environment, motivated staff, structured training, latest methodologies and tools, continuous adherence to quality, adoption of best ethical standards and a keen client orientation are the factors that spur on LNTIEL's journey into the future. Our driving philosophy is 'Client First'. We work towards complete satisfaction of our clients by adopting good work practices and meeting their requirements through timely delivery of appropriate solutions. Further for achieving this objective, we have acquired state-of-the-art IT facilities and software to ensure quality in all spheres of our activity.

LNTIEL has modern fully computerized offices with latest computational and communication facilities. A large number of high-end computers are available and are connected by a network. Further, Internet connectivity enables fast exchange of information with the clients, as well as within the offices and the parent companies. These facilities help us to provide our clients high quality services within the shortest possible time. LNTIEL has more than three hundred regular employees at four offices forming a leading consulting group with extensive operations at Chennai, Hyderabad, Delhi and Mumbai.

Quality Policy of LNTIEL

LNTIEL is committed to achieve and sustain excellence in consultancy services to customers world-wide through an in-house Quality Management System that conforms to ISO 9001:2008. The commitment stated above will be fulfilled by:

- Working towards complete satisfaction of LNTIEL's customers by adopting good work practices and meeting their requirements through timely delivery of appropriate solutions.
- Striving to achieve continual improvement of quality management system through periodic review of quality policy, processes and quality objectives.
- Striving to maintain well-qualified and motivated staff by empowering them and providing a stimulating work environment.
- Adhering to the best ethical standards for business behaviour by respecting the rules of law governing LNTIEL's business and presenting a well-audited financial statement every year.
- Impelling employees at all levels in achieving the objectives of the organisation and ensuring that all employees are aware of and act within the policy framework of LNTIEL.
- Propagating our quality policy and procedures to our sub-consultants and associates and ensuring adherence to the relevant components of the quality system.

QCI-NABET - EIA Accreditation

National Accreditation Board for Education & Training (NABET) is a constituent board of the Quality Council of India (QCI). QCI, NABET has accredited LNTIEL for carrying out EIA studies in the following Ten (10) sectors:

S. No.	Sector
1	Industrial Estates/Parks/Complexes/Areas, Export Processing Zone (EPZs), Special Economic Zones (SEZs), Biotech Parks and Leather Complexes
2	Ports, Harbours, Break Waters and Dredging
3	Highways

S. No.	Sector
4	Airports
5	Thermal Power Plants
6	River Valley Projects
7	Common Effluent Treatment Plants (CETPs)
8	Common Municipal Solid Waste Management Facility (CMSWMF)
9	Building and Construction Project
10	Townships and Area Development Projects

NABET Certificate was given as **Attachment 1**. Further details may be seen on the following URL: www.intiel.com

11.2 Other Consultants Engaged

11.2.1 Kiwis Labs

Nature of Consultancy Services Rendered: baseline environmental surveys

M/s. KIWIS was set up in the year 2013. The agency is offering consultancy services in generation of baseline terrestrial environmental data for the detailed EIA studies. The organization has attained the recognition from the MoEF&CC, Gol (vide letter Q.15018/27/2013-CPW), dated 10.09.2014). KIWI Labs is also an NABL Certified agency (ISO/IEC 17025:2005) in the field of chemical testing. It is also certified by ISO 9001:2008 & OHSAS 18001:2007. NABL Certificate was given as **Attachment 2**. Further details on the agency may be seen on the following URL: www.kiwisecolabs.com.

APPENDICES

APPENDIX A

APPROVED TERMS OF REFERENCE

F.No. 21-237/2017-IA.III

Government of India
Ministry of Environment, Forest and Climate Change
Impact Assessment Division

Indira Paryavaran Bhawan,
Jor Bagh Road, Aliganj
New Delhi - 110 003

Dated: 1st March, 2018

To

The Chief Engineer
Telangana State Industrial Infrastructure Corporation Limited
Parisrama Bhavanam, 6th Floor, Basheerbagh
Hyderabad-500 004
Telagana State

Sub: Development of Zaheerabad National Investment and Manufacturing Zone (NIMZ) in Sangareddy District of Telangana by M/s Telangana State Industrial Infrastructure Corporation Limited – Terms of Reference reg.

Sir,

This has reference to your proposal No IA/TG/NCP/71421/2017 dated 7th December, 2017 submitting the above proposal to this Ministry for seeking Terms of Reference (ToR) as per the provisions of the Environment Impact Assessment (EIA) Notification, 2006 and subsequent amendments under the Environment (Protection) Act, 1986.

2. The proposal for development of NIMZ, Zaheerabad, District Sangareddy of Telangana promoted by M/s Telangana State Industrial Infrastructure Corporation Limited (TSIICL), was considered by the Expert Appraisal Committee (EAC) for Industrial Estate/Area, SEZ and Highways projects, in its meetings held 21st December, 2017 and 24th January, 2018 in the Ministry of Environment, Forest and Climate Change, New Delhi.
3. The details of the project, as per the documents submitted by the project proponent, and also as informed during the above said meeting along with EIA Consultant M/s L&T Infrastructure Engineering Limited, are reported to be as under:

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- (i) Development of Zaheerabad National Investment and Manufacturing Zone (NIMZ) in Nyalkal and Jharasangam Mandals of Sangareddy District, Telangana by M/s Telangana State Industrial Infrastructure Corporation Limited (TSIIC).
- (ii) The project is proposed in area of ~12,635 acres (~5,113 ha) in pursuit of National Manufacturing Policy of Department of Industrial Policy & Promotion (DIPP), Government of India. DIPP, Ministry of Commerce and Industry, Government of India has accorded Final Approval for Zaheerabad NIMZ on 22nd January, 2016.
- (iii) No forest land is involved in this project.
- (iv) The site is mostly comprised of barren and vacant lands. Few pockets of farmlands (agricultural fallow) are also located within the site.
- (v) Total water (one time) requirement for the proposed development is 110 MLD and 2.0 ML of fire water demand. Considering recycling of about 53 MLD into the system, net fresh water requirement is 57 MLD. The fresh water in the order of 57 MLD will be sourced from the Singur reservoir located at 13 km. Government of Telangana State proposes to allocate up to 10% of Singur's Water for NIMZs which is in line with the existing industrial water supply policy of the state.
- (vi) The estimated wastewater generated from NIMZ will be 41 MLD of industrial wastewater and 24 MLD of sewage. Individual industries will treat upto primary level/CETP inlet standards and Common Effluent Treatment Plant (CETP) of 41 MLD capacity and Sewage Treatment Plant (STP) of 24 MLD capacity will treat up to tertiary level. Treated wastewater will be reused in the system and Zero liquid discharge will be adopted.
- (vii) Total **municipal solid waste** generation is estimated at 102 TPD for NIMZ which includes both biodegradable and Non-bio Degradable/Recyclable waste. Industrial waste is estimated to be 162 TPD which includes both non-hazardous and hazardous wastes. Wastes generated shall be segregated into industrial (hazardous & non-hazardous) and MSW (bio-degradable, recyclable and inert wastes).
- (viii) The Environmental Management Plan will be proposed for the park envisages a comprehensive waste management system comprising collection & segregation, reuse/ recycling, temporary storage and disposal. A Solid Waste Treatment facility at NIMZ or use of existing Solid Waste Management facility is being explored.
- (ix) The overall power load demand is estimated as 551 MVA and proposed to have feeder mains from the nearest TSTRANSCO's 400/220kV substation for uninterrupted power supply (nearest 220/132 kV substation located at Sadasivpet and 400kV substation (SS) at Shankarapally).

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- (x) NIMZ is planned with water recycling, waste management, rainwater harvesting, use of non-renewable energy like solar powered street lights, etc. for efficient use of resources.
- (xi) Sufficient parking Facilities are considered in the land use/Master Plans of NIMZ.

- (xii) **Water Requirement:**
 - (a) Construction phase: 1MLD water will be sourced from Singur reservoir or authorised water suppliers.
 - (b) Operation phase: Total water (one time) requirement for the proposed development is 110 MLD and 2.0 ML of fire water demand. Considering recycling of about 53 MLD into the system, net fresh water requirement is 57 MLD. The fresh water in the order of 57 MLD will be sourced from the Singur reservoir located at 13 km.
- (xiii) It is not located within 10 km of any Eco Sensitive areas. There are following other features are observed within 10 km radius:

Reserved Forests (RF)	
Shamshalapur RF (TS)	Adjacent, North
RajolaRF	1.1 km, West
Kalbewal RF	Adjacent, West
Sahapur RF (TS)	1.5 km, North
Godepalli RF (KA)	2.8 km, West
Didgi RF (TS)	2.8 km, South
Digwal RF (TS)	4.7 km, South East
Zahirabad RF (TS)	4.9 km, South
Chitta RF (KA)	6.1 km, West
Tadapalli RF (KA)	7 km, South East
Honnadi RF (KA)	9.5 km, South East
Hadnuri RF	Adjacent, South
Badripur RF	0.1 km, South East

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- (xiv) Government of Telangana State proposes to allocate up to 10% of Singur's Water for NIMZs which is in line with the existing industrial water supply policy of the State.
- (xv) The water bodies observed are Madhura Nadi, 0.2 km, S and Narinja Reservoir, 1.5 km, S. Also Telangana – Karnataka State Boundary adjacent to project site.
- (xvi) **Investment/Cost:** The total cost of the project is Rs. 4,704.90 crores. The details are as below:
- (a) Preliminary Cost estimate for Internal Infrastructure Development Rs. 4,500 Cr.
 - (b) Cost for external linkages is estimated at Rs. 6,100 Cr. (including upgradation of NH-65 from Zaheerabad to last mile connectivity to western ports including JNPT).
- (xvii) **Employment potential:** Direct and indirect employment of about 2.44 lakhs will be generated during construction and during operation phases.
- (xviii) **Benefits of the project:**
- (a) The proposed NIMZ is estimated to bring around Rs. 37,740 crores of total investments by manufacturing industries at the ultimate phase with Rs. 96,778 crores of estimated industrial output by 2040.
 - (b) Proposed NIMZ is likely to generate direct and indirect employment potential of about 2.44 lakhs respectively, thereby opening up employment opportunities for the youth in the catchment region.
 - (c) Employment opportunities to the local people for skilled, semi-skilled and unskilled work force during the construction and operation phases.
 - (d) As a part of the Corporate Social Responsibility (CSR) initiatives, it is envisaged to create better and quality Education, Health, Hygiene and Sanitation, Empowerment and Livelihoods and Community Development Initiatives.
 - (e) The proposed project shall further act as a catalyst to industrialization and urbanization of the region.
 - (f) There will be improvement in living standards. General welfare will improve in the area as per capita income will go up in the post project period.
- (xix) Overall economic growth of Sangareddy District, in particular and State of Telangana and Nation in general.
- (xx) Submitted the latest Toposheet map (1:50,000 scale) (on A0 size paper) showing reserved forest boundaries, industrial area and surrounding 10 km radius.

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(xi) Submitted the Detailed land use plan for core (project site) and buffer (10 km radius around project site) zones as under:

a. Core Zone, i.e., Project site:

Classes	Area (Ha)	%
Scrub Land	2291.6	44.82
Agriculture: Crop Land	1408.7	27.55
Agriculture: Fallow	1354.9	26.50
Agriculture: Plantation	35.4	0.69
Barren: Rocky	21.8	0.43
Waterbodies: Pond/tank	0.9	0.02
Total	5113.3	100

b. Buffer zone, i.e., 10 km radius around project site:

Classes	Area (Ha)	%
Agriculture: Crop Land	44650.24	62.62
Barren: Scrub Land	11946.24	16.75
Agriculture: Fallow	6985.46	9.80
Forest: Deciduous	503.22	0.71
Forest: Plantation	1348.41	1.89
Forest: Scrub	2147.23	3.01
Agriculture: Plantation	374.74	0.53
Barren: Rocky	418.66	0.59
Waterbodies: Streams	53.99	0.08
Waterbodies: Lakes	527.71	0.74
Built-up: Urban	1210.77	1.70
Built-up: Rural	1133.03	1.59
Total	71299.70	100

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- (xxii) Submitted details justification and criteria followed for selection of proposed site out of three alternate sites.
- (xxiii) Submitted the copy of letter from I&CAD Department, Government of Telangana for allocation of 1.42 TMC water from Singur Reservoir.
- (xxiv) Submitted detailed catchment area plan of the proposed project site along with the Singur reservoir location.
- (xxv) Submitted detailed information about types of industries/activities proposed along with the use of raw materials/chemicals & processing details. Various sectors include Automobile, Machinery, Transport Equipment, Metals, Electric Equipment, Food & Agro Processing, and non-metallic minerals. Of these, Transport equipments and Metals sectors involves category A and Category B projects.
- (xxvi) Submitted detailed layout plan showing all industrial sectors & amenities like road, storm water drains, parking, CETP, STP, solid waste disposal facilities & plantation/green.
- (xxvii) Submitted detailed justification for water requirement of 110 MLD for industrial sectors wise and non-processing areas.

4. The proposal was considered by the EAC in the meeting held on 24th January, 2018 and recommended for grant of ToR and the Ministry of Environment, Forest and Climate Change hereby accords ToR for development of NIMZ, Zaheerabad, District Sangareddy of Telangana promoted by M/s TSIICL, for preparation of the Environment Impact Assessment Report and Environment Management Plan (EMP) with public consultations subject to compliance of all conditions following specific and general conditions as under:

A. Project Specific Conditions

- (i) Proper storm water drainage plan shall be prepared including management of storm water to prevent any untreated effluent and contaminated storm water discharge into surface water bodies downstream of the project site. At the outlet i.e before leaving the industrial premises, there should be provision for guard pond (with two compartments) of capacity based on peak daily rainfall so that quality of storm water can be checked.
- (ii) The original flow of streams passing through project site should not be disturbed. Any construction of buildings and roads should be planned in such a way that original flow of stream including its floodplain area remains undisturbed.
- (iii) Red category industries of above identified industrial sectors should not be established within 500 m of Madhura nalla.

[Signature]

- (iv) Wildlife conservation plan in study area of the project site should be prepared in consultation with the State Forest and Wildlife Departments.

B. General Conditions

- (i) Reasons for selecting the site with details of alternate sites examined/rejected/selected on merit with comparative statement and reason/basis for selection. The examination should justify site suitability in terms of environmental damage, 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.
- (ii) Submit the details of the land use break-up for the proposed project. Details of land use around 10 km radius of the project site. Analysis should be made based on latest satellite imagery for land use with raw images. Check on flood plain of any river.
- (iii) Submit details of environmentally sensitive places, land acquisition status, rehabilitation of communities/ villages and present status of such activities.
- (iv) Examine the impact of proposed project on the nearest settlements.
- (v) Examine baseline environmental quality along with projected incremental load due to the project taking into account of the existing developments nearby.
- (vi) Environmental data to be considered in relation to the project development would be (a) land, (b) groundwater, (c) surface water, (d) air, (e) bio-diversity, (f) noise and vibrations, (g) socio economic and health.
- (vii) Submit a copy of the contour plan with slopes, drainage pattern of the site and surrounding area, and any obstruction of the same by the project.
- (viii) Details regarding project boundary passing through any eco-sensitive area and within 10 km from eco-sensitive area.
- (ix) Green buffer in the form of green belt to a width of 15 meters should be provided all along the periphery of the industrial area. The individual units should keep 33% of the allotted area as a green area.
- (x) Submit the details of the trees to be felled for the project.
- (xi) Submit the details of the infrastructure to be developed.
- (xii) Submit the present land use and permission required for any conversion such as forest, agriculture etc.
- (xiii) Submit details regarding R&R involved in the project

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- (xiv) Zoning of the area in terms of 'type of industries' coming-up in the industrial area based on the resource requirement along with likely pollutants with quantity from the various industries.
- (xv) The project boundary area and study area for which the base line data is generated should be indicated through a suitable map. Justification of the parameters, frequency and locations shall be discussed in the EIA.
- (xvi) Submit Legal frame work for the implementation of Environmental Clearance conditions - to be clearly spelt out in the EIA report.
- (xvii) Submit Roles and responsibility of the developer etc for compliance of environmental regulations under the provisions of EP Act.
- (xviii) Site justification of the identified industry sectors from environmental angle and the details of the studies conducted if any.
- (xix) Ground water classification as per the Central Ground Water Authority.
- (xx) Submit the source of water, requirement vis-à-vis waste water to be generated along with treatment facilities, use of treated waste water along with water balance chart taking into account all forms of water use and management.
- (xxi) Rain water harvesting proposals should be made with due safeguards for ground water quality. Maximize recycling of water and utilization of rain water. Examine and submit details.
- (xxii) Examine soil characteristics and depth of ground water table for rainwater harvesting.
- (xxiii) Examine details of solid waste generation treatment and its disposal.
- (xxiv) Examine and submit details of use of solar energy and alternative source of energy to reduce the fossil energy consumption.
- (xxv) In case DG sets are likely to be used during construction and operational phase of the project, emissions from DG sets must be taken into consideration while estimating the impacts on air environment. Examine and submit details.
- (xxvi) Examine road/rail connectivity to the project site and impact on the traffic due to the proposed project. Present and future traffic and transport facilities for the region should be analysed with measures for preventing traffic congestion and providing faster trouble free system to reach different destinations in the city.
- (xxvii) A detailed traffic and transportation study should be made for existing and projected passenger and cargo traffic.
- (xxviii) Examine the details of transport of materials for construction which should include source and availability.
- (xxix) Examine the details of National Highways/State Highways/ expressways falling along the corridor and the impact of the development on them.

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- (xxx) Examine noise levels - present and future with noise abatement measures.
- (xxxi) Identify, predict and assess the environmental and sociological impacts on account of the project. A detailed description with costs estimates of CSR should be incorporated in the EIA/EMP report.
- (xxxii) Examine separately the details for construction and operation phases both for Environmental Management Plan and Environmental Monitoring Plan with cost and parameters.
- (xxxiii) Submit details of a comprehensive Disaster Management Plan including emergency evacuation during natural and man-made disaster.
- (xxxiv) Details of litigation pending against the project, if any, with direction /order passed by any Court of Law against the Project should be given.
- (xxxv) The cost of the Project (capital cost and recurring cost) as well as the cost towards implementation of EMP should be clearly spelt out.
- (xxxvi) Any further clarification on carrying out the above studies including anticipated impacts due to the project and mitigative measure, project proponent can refer to the model ToR available on Ministry website "[http://moef.nic.in/Manual/Industrial Estate](http://moef.nic.in/Manual/Industrial%20Estate)".

General Guidelines

- (i) The EIA document shall be printed on both sides, as far as possible.
- (ii) All documents should be properly indexed, page numbered.
- (iii) Period/date of data collection should be clearly indicated.
- (iv) Authenticated English translation of all material provided in Regional languages.
- (v) The letter/application for EC should quote the MoEF&CC File No. and also attach a copy of the letter prescribing the TOR.
- (vi) The copy of the letter received from the Ministry on the TOR prescribed for the project should be attached as an annexure to the final EIA-EMP Report.
- (vii) The final EIA-EMP report submitted to the Ministry must incorporate the issues in TOR and that raised in Public Hearing. The contents sections of the final EIA-EMP report must indicate the specific chapter and page no. of the EIA-EMP Report where the specific TOR prescribed by Ministry and the issue raised in the P.H. have been incorporated. Questionnaire related to the project (posted on MoEF&CC website) with all sections duly filled in shall also be submitted at the time of applying for EC.
- (viii) Grant of TOR does not mean grant of EC.

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- (ix) Grant of TOR/EC to the present project does not mean grant of approvals in other regulations such as the Forest (Conservation) Act 1980 or the Wildlife (Protection) Act, 1972.
- (x) Grant of EC is also subject to Circulars issued under the EIA Notification 2006, which are available on the MoEF&CC website: www.envfor.nic.in.
- (xi) The status of accreditation of the EIA consultant with NABET/QCI shall be specifically mentioned. The consultant shall certify that his accreditation is for the sector for which this EIA is prepared.
- (xii) On the front page of EIA/EMP reports, the name of the consultant/consultancy firm along with their complete details including their accreditation, if any shall be indicated. The consultant while submitting the EIA/EMP report shall give an undertaking to the effect that the prescribed ToR (ToR proposed by the project proponent and additional ToR given by the MoEF&CC) have been complied with and the data submitted is factually correct (Please refer MoEF&CC OM dated 4th August, 2009).
- (xiii) While submitting the EIA/EMP reports, the name of the experts associated with/involved in the preparation of these reports and the laboratories through which the samples have been got analysed should be stated in the report. It shall clearly be indicated whether these laboratories are approved under the Environment (Protection) Act, 1986 and the rules made there under (Please refer MoEF&CC OM dated 4th August, 2009). The project leader of the EIA study shall also be mentioned.
- (xiv) All the TOR points as presented before the Expert Appraisal Committee (EAC) shall be covered.

5. A detailed draft EIA/EMP report shall be prepared in terms of the above additional ToRs and should be submitted to the State Pollution Control Board for Public Hearing. Public Hearing to be conducted for the project in accordance with the provisions of Environmental Impact Assessment Notification, 2006 and the issues raised by the public should be addressed in the Environmental Management Plan. The Public Hearing shall be conducted based on the ToR letter issued by the Ministry and not on the basis of Minutes of the Meeting available on the web-site.

6. The project proponent shall submit the detailed final EIA/EMP report prepared as per ToR including issues raised during Public Hearing to the Ministry for considering the proposal for environmental clearance within 3 years, i.e., before expiry of this ToR, as per the MoEF&CC OM No J-11013/41/2006-IA-II(I) (Part) dated 29th August, 2017.

PRK

7. The consultants involved in preparation of EIA/EMP report after accreditation with Quality Council of India/National Accreditation Board of Education and Training (QCI/NABET) would need to include a certificate in this regard in the EIA/EMP reports prepared by them and data provided by other Organization(s)/Laboratories including their status of approvals etc. vide notification of the MoEF dated 19th July, 2013.

Revised
01/03/2018
(Raghu Kumar Kodali)
Scientist F/Director

Copy to: The Member Secretary, Telangana State Pollution Control Board, Paryavaran Bhawan, A-3, Industrial Estate, Sanath Nagar, Hyderabad - 500 018.

Revised
01/03/2018
(Raghu Kumar Kodali)
Scientist F/Director

APPENDIX B

COMPLIANCE TO ADDITIONAL AND

STANDARD TOR

Appendix B Compliance to Standard ToR issued by MoEF&CC

S. NO.	TERMS OF REFERENCE	COMPLIANCE
Government of India Ministry of Environment, Forest and Climate Change Impact Assessment Division		
F. No. 21-237/2017-IA.III Dated March 01, 2018		
A. Project Specific Conditions		
(i)	Proper storm water drainage plan shall be prepared including management of storm water to prevent any untreated effluent and contaminated storm water discharge into surface water bodies downstream of the project site. At the outlet i.e before leaving the industrial premises, there should be provision for guard pond (with two compartments) of capacity based on peak daily rainfall so that quality of storm water can be checked.	Storm Water Management is provided in section 4.3.2.5 of Chapter 4 . At all drains located near the discharge points into natural drains a desilting and filter chambers as shown in Figure 4-2 shall be provided at suitable intervals which shall be preferably located right below the manhole covers provided on top of the drain to enable periodic cleaning and de-silting of these wells.
(ii)	The original flow of streams passing through project site should not be disturbed. Any construction of buildings and roads should be planned in such a way that original flow of stream including its floodplain area remains undisturbed.	The master plan and storm water drainage was designed in such a way that original flow of major drains was not disturbed and green areas are proposed along the drainage. This can be evidenced in master plan given as Figure FD0202 .
(iii)	Red category industries of above identified industrial sectors should not be established within 500 m of madhura nallah and only Logistics Zone is proposed in that area.	No red category of industries were planned within 500 m of madhura nallah and only Logistics Zone is proposed in that area.
(iv)	Wildlife conservation plan in study area of the project site should be prepared in consultation with the State Forest and Wildlife Departments.	There are no scheduled wildlife species are observed in the project site. However in the study area few scheduled species were observed and Wildlife conservation plan is prepared and presented in Section 9.3 of Chapter 9. Same is submitted and be strengthened in consultation with Forest/wildlife department during implementation.

S. NO.	TERMS OF REFERENCE	COMPLIANCE
B. General Conditions		
(i)	Reasons for selecting the site with details of alternate sites examined/rejected/selected on merit with comparative statement and reason/basis for selection. The examination should justify site suitability in terms of environmental damage, 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.	Site Alternative Analysis is presented in Section 5.3 of Chapter 5 .
(ii)	Submit the details of the land use break-up for the proposed project. Details of land use around 10 km radius of the project site. Analysis should be made based on latest satellite imagery for land use with raw images. Check on flood plain of any river.	Details of the land use break-up for the proposed project site and land use around 10 km radius of the project site is given Section 3.4.2 of Chapter 3 .
(iii)	Submit details of environmentally sensitive places, land acquisition status, rehabilitation of communities/villages and present status of such activities.	Environmental Sensitivity details are given in Section 3.3 of Chapter 3 . Status of Land Acquisition is given in section 7.4.1 of Chapter 7 . There is no R&R is envisaged and settlements are retained and integrated in the master plan.
(iv)	Examine the impact of proposed project on the nearest settlements.	Impact of proposed project on the nearest settlements is discussed in Section 7.4.3.2 of Chapter 7 .
(v)	Examine baseline environmental quality along with projected incremental load due to the project taking into account of the existing developments nearby.	Baseline environmental quality was examined and the details are provided in Section 3.6 of Chapter 3 . Projected incremental load due to proposed project is discussed in Section 4.4.2 of Chapter 4 .
(vi)	Environmental data to be considered in relation to the project development would be (a) land, (b) groundwater, (c) surface water, (d) air, (e) bio-diversity, (f)	Baseline environmental quality was examined and the details are provided in Chapter 3 .

S. NO.	TERMS OF REFERENCE	COMPLIANCE
	noise and vibrations, (g) socio economic and health.	
(vii)	Submit a copy of the contour plan with slopes, drainage pattern of the site and surrounding area, and any obstruction of the same by the project.	Contour plan with slopes of the site is given as Figure 2-12 in Chapter 2 and the drainage pattern in the study area is given as Figure 3-7 in Chapter 3 .
(viii)	Details regarding project boundary passing through any eco-sensitive area and within 10 km from eco-sensitive area.	There are no ecologically sensitive areas such as Biosphere Reserves, National Parks, Wildlife Sanctuaries protected sites as per Ramsar convention and other protected areas (PA) are within 10 km radius of project site.
(ix)	Green buffer in the form of green belt to a width of 15 meters should be provided all along the periphery of the industrial area. The individual units should keep 33% of the allotted area as a green area.	Greenbelt details are discussed in Section 9.2 of Chapter 9 .
(x)	Submit the details of the trees to be felled for the project.	The common native species such as <i>Vitex negundo</i> , <i>Prosopis juliflora</i> , <i>Azadirachta indica</i> , <i>Borassus flabellifer</i> , <i>Tamarindus indica</i> and <i>Acacia nilotica</i> are observed as predominant species
(xi)	Submit the details of the infrastructure to be developed.	Details of the infrastructure to be developed are discussed in Section 2.5 of Chapter 2 .
(xii)	Submit the present land use and permission required for any conversion such as forest, agriculture, etc.	Present Land Use is given in section 3.4.2 of Chapter 3 . No forest area is involved in the project area.
(xiii)	Submit details regarding R&R involved in the project	Status of Land Acquisition is given in section 7.4.1 of Chapter 7 . There is no R&R is envisaged and settlements are retained and integrated in the master plan.
(xiv)	Zoning of the area in terms of 'type of industries' coming-up in the industrial area based on the resource requirement along with likely pollutants with quantity from the various industries.	Master Planning Consideration, Zoning details are presented in section 2.4 of Chapter 2 .

S. NO.	TERMS OF REFERENCE	COMPLIANCE
(xv)	The project boundary area and study area for which the base line data is generated should be indicated through a suitable map. Justification of the parameters, frequency and locations shall be discussed in the EIA.	Relevant environmental components monitored and frequency etc., are provided in the Chapter 3 with essential maps.
(xvi)	Submit Legal frame work for the implementation of Environmental Clearance conditions - to be clearly spelt out in the EIA report.	Institutional Mechanism for Implementation of all Mitigation Measures/other clearance conditions etc., are discussed in section 9.1, 9.6 and 9.7 of Chapter 9 .
(xvii)	Submit Roles and responsibility of the developer, etc. for compliance of environmental regulations under the provisions of EP Act.	Roles and responsibility of the developer is discussed in section 9.1.1 of Chapter 9 .
(xviii)	Site justification of the identified industry sectors from environmental angle and the details of the studies conducted if any.	TSIIC proposed to establish NIMZ at Nyalkal and Jharasangam mandals near Zaheerabad in Sangareddy District of Telangana in an area of 5,113 ha (ac.12,635.14 guntas) in pursuit of NMP of Department of Industry and Policy Promotion (DIPP) of Government of India. The processing area includes manufacturing zone for different manufacturing industries and service industry selected based on the market and demand assessment study. Some of the important features of the Site making it suitable for NIMZ are presented Chapter 5 .
(xix)	Ground water classification as per the Central Ground Water Authority.	The proposed site is falling in Nyalkal and Jarasangham mandals of Sangareddy district which are classified under "Critical" Category as per CGWB.
(xx)	Submit the source of water, requirement vis-à-vis waste water to be generated along with treatment facilities, use of treated waste water along with water balance chart taking into account all forms of water use and management.	Details of water supply along with source and wastewater management are provided in 2.5.1 and 2.5.5 sections of Chapter 2 .
(xxi)	Rain water harvesting proposals should be made with due safeguards for ground water	Rainwater harvesting details are provided in section 9.4 of Chapter 9 . Water balance diagram considering recycle/reuse is given as Figure 2-7

S. NO.	TERMS OF REFERENCE	COMPLIANCE
	quality. Maximize recycling of water and utilization of rain water. Examine details.	in Chapter 2 .
(xxii)	Examine soil characteristics and depth of ground water table for rainwater harvesting.	Soil quality in the study area is given in section 3.8 of Chapter 3 . As CGWB, the Depth to groundwater table is varying from 5 to 20 m bgl.
(xxiii)	Examine details of solid waste generation treatment and its disposal.	Solid waste generation treatment and its disposal are discussed in section 2.5.7 of Chapter 2
(xxiv)	Examine and submit details of use of solar energy and alternative source of energy to reduce the fossil energy consumption.	Proposed Solar Power Harnessing details are given in section 9.5 of Chapter 9 .
(xxv)	In case DG sets are likely to be used during construction and operational phase of the project, emissions from DG sets must be taken into consideration while estimating the impacts on air environment. Examine and submit details.	Impact on air environment due to proposed DG Sets is estimated and provided in section 4.5.2 of Chapter 4 .
(xxvi)	Examine road/rail connectivity to the project site and impact on the traffic due to the proposed project. Present and future traffic and transport facilities for the region should be analysed with measures for preventing traffic congestion and providing faster trouble free system to reach different destinations in the city.	Detailed traffic and transportation study has been carried out considering passenger and cargo traffic (Both existing and projected). Details are given in section 7.3 of Chapter 7 .
(xxvii)	A detailed traffic and transportation study should be made for existing and projected passenger and cargo traffic.	
(xxviii)	Examine the details of transport of materials for construction which should include source and availability.	The construction materials will be sourced from nearby villages and will be transported through state highways and national highway.

S. NO.	TERMS OF REFERENCE	COMPLIANCE
(xxix)	Examine the details of National Highways/State Highways/expressways falling along the corridor and the impact of the development on them.	Detailed traffic and transportation study has been carried out considering passenger and cargo traffic (Both existing and projected). Details are given in section 7.3 of Chapter 7 .
(xxx)	Examine noise levels - present and future with noise abatement measures.	Ambient baseline noise level details are provided in section 3.7 of Chapter 3 and impact during construction operation phase is given in section 4.5 of Chapter 4 .
(xxxi)	Identify, predict and assess the environmental and sociological impacts on account of the project. A detailed description with costs estimates of CSR should be incorporated in the EIA / EMP report.	Anticipated Environmental Impacts and Mitigation Measures are provided in Chapter 4 . The CSR details are provided in Chapter 8 .
(xxxii)	Examine separately the details for construction and operation phases both for Environmental Management Plan and Environmental Monitoring Plan with cost and parameters.	Anticipated Environmental Impacts and Mitigation Measures are provided in Chapter 4 . Environmental Monitoring plan is provided in Chapter 6 & for Environmental Management Plan is given Chapter 9 .
(xxxiii)	Submit details of a comprehensive Disaster Management Plan including emergency evacuation during natural and man-made disaster.	Disaster Management Plan including emergency evacuation is discussed in section 7.2 of Chapter 7
(xxxiv)	Details of litigation pending against the project, if any, with direction/order passed by any Court of Law against the Project should be given.	NIL
(xxxv)	The cost of the Project (capital cost and recurring cost) as well as the cost towards implementation of EMP should be clearly spelt out.	The cost of the Project is given in section 2.6 of Chapter 2 and Budgetary estimate for Environmental Management is given in section 9.12 of Chapter 9 .
(xxxvi)	Any further clarification on carrying out the above studies including anticipated impacts due to the project and mitigative	Noted.

S. NO.	TERMS OF REFERENCE	COMPLIANCE
	measure, project proponent can refer to the model ToR available on Ministry website " http://moef.nic.in/Manual/Industrial_Estate ".	
General Guidelines		
(i)	The EIA document shall be printed on both sides, as far as possible.	Complied
(ii)	All documents should be properly indexed, page numbered.	Complied
(iii)	Period/date of data collection should be clearly indicated.	Complied
(iv)	Authenticated English translation of all material provided in Regional languages.	Complied
(v)	The letter/application for EC should quote the MoEF&CC File No. and also attach a copy of the letter prescribing the TOR.	Complied
(vi)	The copy of the letter received from the Ministry on the TOR prescribed for the project should be attached as an annexure to the final EIA-EMP Report.	Complied
(vii)	The final EIA-EMP report submitted to the Ministry must incorporate the issues in TOR and that raised in Public Hearing. The contents sections of the final EIA-EMP report must indicate the specific chapter and page no. of the EIA-EMP Report where the specific TOR prescribed by Ministry and the issue raised in the P.H. have been incorporated. Questionnaire related to the project (posted on MoEF&CC website) with all sections duly filled in shall also be submitted at	Will be Complied

S. NO.	TERMS OF REFERENCE	COMPLIANCE
	the time of applying for EC.	
(viii)	Grant of TOR does not mean grant of EC.	Noted
(ix)	Grant of TOR/EC to the present project does not mean grant of approvals in other regulations such as the Forest (Conservation) Act 1980 or the Wildlife (Protection) Act, 1972.	Noted
(x)	Grant of EC is also subject to Circulars issued under the EIA Notification 2006, which are available on the MoEF&CC website: www.envfor.nic.in .	Noted
(xi)	The status of accreditation of the EIA consultant with NABET/ QCI shall be specifically mentioned. The consultant shall certify that his accreditation is for the sector for which this EIA is prepared	Complied
(xii)	On the front page of EIA/EMP reports, the name of the consultant/consultancy firm along with their complete details including their accreditation, if any shall be indicated. The consultant while submitting the EIA/EMP report shall give an undertaking to the effect that the prescribed ToR (ToR proposed by the project proponent and additional ToR given by the MoEF&CC) have been complied with and the data submitted is factually correct (Please refer MoEF&CC OM dated 4 th August, 2009).	Complied
(xiii)	While submitting the EIA/EMP reports, the name of the experts associated with/involved in the preparation of these reports and the laboratories through which the samples have been got analysed	Complied

S. NO.	TERMS OF REFERENCE	COMPLIANCE
	should be stated in the report. It shall clearly be indicated whether these laboratories are approved under the Environment (Protection) Act, 1986 and the rules made there under (Please refer MoEF&CC OM dated 4 th August, 2009). The project leader of the EIA study shall also be mentioned.	
(xiv)	All the TOR points as presented before the Expert Appraisal Committee (EAC) shall be covered.	Complied

APPENDIX C

WATER CONSENT ORDER FROM TS

I&CAD DEPARTMENT



GOVERNMENT OF TELANGANA
IRRIGATION & CAD DEPARTMENT

From:

Sri C.Muralidhar, B.Tech.
Engineer-in-Chief (Irrigation)
Irrigation & CAD Department
2nd Floor, Jalasoudha Building,
Errummanzil, Hyderabad.

To:

The Spl.Chief Secretary to Govt.,
I&CAD Dept., B' Block, 5th Floor,
Telangana Secretariat,
Hyderabad.

Lr.No.ENC(I)/DCE-I/OT1/AEE5/NIMZ - Zaheerabad /2018, dt: 12.01.2018

Sub:- Development of National Investment & Manufacturing Zone near Zaheerabad ,Sangareddy Dist. Telangana – Request for allocation of 1.42 TMC per annum of Industrial water – Detailed report – Furnished -Reg.

- CEO
CE
Pl. PWD P.W.D
M.C.P. 1911
At capacity 2nd floor
Not 1st & 2nd floor*
- Ref:-**
1. GOI,Establishment of National Investment & Manufacturing Zone near Zaheerabad, Sangareddy vide LrNo.15/4/2015-MPS Dt:22-01-2016
 2. Minutes of meeting held on 03-07-2013 with Hon'ble Chief Minister on NIMZs.
 3. TSIIC Lr.No. TSIIC/Projects/NIMZs/2011, dt:09.01.2018.
 4. G.O Ms No.9 (Industries & Commerce) Dept., dt.05.01.2001.

In the ref 1st cited, Department of Industrial Policy & Promotion (DIPP), Ministry of Commerce& Industry, Government of India have accorded final approval to the world class National Investment & Manufacturing Zone (NIMZ) near Zaheerabad in an area of 12,635 acres falling in Nyalkal and Jharasangam Mandal of Sangareddy District (erstwhile Medak Dist). In the reference 3rd cited, the VC & MD, TSIIC has stated that the TSIIC has prepared integrated master plan and designs for NIMZ and the total water requirement (ultimate phase) for NIMZ operations has been estimated as 110 MLD (1.42 TMC per annum) and the construction water demand is about one (1) MLD. The identified nearest source of water supply to NIMZ site is the Singur Reservoir which is located at about 13 KM east of site and requested to allocate water from Singur Reservoir.

Further, it is to inform that during the review meeting held on 03/07/2013, the Hon'ble Chief Minister had stated that as per the existing industrial water supply policy, 10% of Singur Reservoir i.e., up to 3 TMC can be allocated from Singur Reservoir for the NIMZ project.

In this connection , the status of water allocation made from Singur Project against the gross capacity of 29.91 TMC at FRL of (+) 523.60 M is as detailed below.

1	Existing water supply to twin cities of Hyderabad and Secunderabad through Manjira Phase I & II:	2.96 TMC.
2	Additional water supply to twin cities of Hyderabad and Secunderabad phase III and IV:	4.00 TMC.
3	Irrigation for lower riparian rights :	
i)	<u>Ghanpur Anicut:</u>	
a)	Fathenahar canal:	1.36 TMC
b)	Mahaboob Nahar canal:	2.70 TMC
	Total:	<u>4.06 TMC</u>
		4.06 TMC
ii)	<u>Nizamsagar Project:</u>	8.35 TMC
4	Evaporation, silting and carry over capacity to the Next season:	<u>10.54 TMC.</u>
	TOTAL:	<u>29.91 TMC</u>

Subsequently, the following further allocations were made:

- a. 2 TMC was allotted vide G.O Ms No. 455 Dt: 31.10.1980 for providing Irrigation facilities in Medak District.
- b. 0.7 TMC was allotted vide G.O Ms No.128 I&CAD (PW.Major VIII) dept., Dt: 18.05.2007 for supply towards drinking water to Gazwel, Narsapur, Ramayampet and Dommata constituencies in Medak district under CPWS Schemes.
- c. 1.45 TMC of water was allotted to CPWS Schemes in Medak and Ranga Reddy Districts in 05/2013 vide Government memo No.26825/M&MI – T.1.A1/2012 Dt. 17.11.2012.

The above allocations of 4.15 TMC (2+0.70+1.45) are done out of the provision of 10.54 TMC made for evaporation, silting and carry over capacity to the next season.

Further, Govt vide G.O.Rt No 885 dt 30-10-2017, has allocated 5.70 TMC of water for Mission Bhagiratha from Singur Project. Thus the total commitments as on date would be 9.85 TMC (4.15+5.70) against the provision of 10.54 TMC for Evaporation, silting and carry over capacity to the next season. Already silting has occurred in the reservoir which may be in the range of 3 to 4 TMC. Thus, allocation of 10% of Singur water for industrial water may not be possible.

However it is to inform that, 16 TMC of water is allocated for industrial purpose out of the total allocation to Kaleswaram project. As it is proposed to supplement Singur project by Kaleswaram project, the requirement of 1.42 TMC of water of NIMZ can be met from supplements from this water. This supplementation link may take some time in future which has to be dovetailed with the implementation of NIMZ complex.

Further it is to inform that, as per G.O reference 4th cited, upto 10% of the water from existing and new projects is reserved for industrial purpose. As on date no water is allocated to industries from Singur project. Hence, the requirement of NIMZ is to be considered from Singur project against the supplemented water from Kaleswaram Project.

In view of the above, it is recommended to consider allocation of 1.42 TMC of water from Singur project to the NIMZ complex.

Yours faithfully,

Sd/- C.Muralidhar, 12.01.2018
Engineer-in-Chief (Irrigation)

Copy to

1. VC & MD, TSIIC Limited, Parishrama Bhavan, 6th floor, 6th floor, Basheerbagh, Hyderabad for information.
2. Commissioner, Planning & Development, Godavari Basin, Ground floor, Jalasoudha, Errummanzil, Hyderabad for information and necessary action.


for Engineer-in-Chief (Irrigation)


9/1/2018

APPENDIX D

BASELINE ENVIRONMENTAL

MONITORING RESULTS

Appendix D Terrestrial Environmental Monitoring Results

D.1 Ground Water Monitoring Results

S. No	Parameter	Unit	GW-1	GW-2	GW-3	GW-4	GW-5	GW-6	GW-7	GW-8	GW-9	GW-10	Desirable Limit as per IS 10500	Permissible Limit as per IS 10500
1	Color	CU	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	5	15
2	pH @ 27.2°C	-	7.21	7.38	7.66	7.51	7.48	7.21	7.11	7.56	7.87	7.01	6.5-8.5	NR
3	Temperature	°C	26.4	26.7	26.9	26.9	26.8	27.1	26.8	26.2	26.8	26.9	NS	NS
4	Electrical Conductivity	µMho/cm	756	657	712	821	965	902	758	853	712	860	NS	NS
5	Turbidity	NTU	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1	5
6	Total Dissolved Solids	mg/L	469	407	441	509	598	559	470	529	441	533	500	2000
7	Alkalinity as CaCO ₃	mg/L	221.76	249.48	166.32	273.24	289.08	225.72	257.4	194.04	186.12	281.16	200	600
8	Hardness as CaCO ₃	mg/L	294.92	274.72	185.84	230.28	286.84	226.24	165.64	298.96	206.04	222.2	200	600
9	Calcium as Ca	mg/L	79.34	80.96	53.43	66.38	90.67	46.95	34	74.48	42.1	61.53	75	200
10	Magnesium as Mg	mg/L	23.56	17.67	12.76	15.71	14.72	26.51	19.63	27.48	24.54	16.68	30	100
11	Chlorides as Cl-	mg/L	84.56	96.65	62.42	72.48	92.62	126.85	48.32	82.55	197.32	70.47	250	1000
12	Nitrate as NO ₃	mg/L	3.05	4.27	4.28	3.44	3.45	4.24	3.74	3.88	4.3	3.98	45	NR
NS	Total Solids	mg/L	521	628	445	579	736	654	475	509	765	538	NS	NS
14	Sodium as Na	mg/L	82.4	78.3	143	67.4	154.6	92.4	42.6	53.4	172.3	49.2	NS	NS
15	Potassium as K	mg/L	2.3	3.2	1.2	2.2	3.5	3.1	1.5	4.8	3.8	2.1	NS	NS
16	Fluoride as F	mg/L	0.37	0.78	0.72	0.7	0.69	0.7	0.69	0.69	0.66	0.61	1	1.5
17	Iron as Fe	mg/L	0.59	0.6	0.5	0.54	0.49	0.45	0.39	0.47	0.48	0.28	0.3	NR
18	Chemical Oxygen Demand	mg/L	6	8	4	4	6	10	4	8	14	6	NS	NS
19	Biochemical Oxygen Demand (3 Days at 27°C)	mg/L	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	<4.0	NS	NS
20	Dissolved Oxygen	mg/L	4.8	5.3	4.7	5.2	5.2	5.5	4.8	5.1	4.9	5.2	NS	NS
21	Sulphates as SO ₄	mg/L	75.73	80.67	95.49	76.55	102.07	104.54	55.56	67.51	120.59	59.27	200	400

S. No	Parameter	Unit	GW-1	GW-2	GW-3	GW-4	GW-5	GW-6	GW-7	GW-8	GW-9	GW-10	Desirable Limit as per IS 10500	Permissible Limit as per IS 10500
22	Zinc as Zn	mg/L	0.34	0.68	0.74	0.29	0.81	0.97	0.46	0.52	0.49	0.27	5	15
23	Phosphorous as P	mg/L	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	NS	NS
24	Residual Chlorine as Cl	mg/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.2	1
25	Taste	-	Agreeable	Agreeable										
26	Nickel	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.02	NR
27	Odour	-	Agreeable	Agreeable										
28	Salinity	mg/L	41.6	39.46	69.7	70.6	81.9	96.7	41.6	39.46	69.7	70.6	NS	NS
29	Phenolic Compounds as Phenols	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.002
30	Lead as Pb	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	NR
31	Manganese as Mn	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	0.3
32	Cadmium as Cd	mg/L	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	0.003	NR
33	Chromium as Cr+6	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	NR
34	Copper as Cu	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	1.5
35	Cyanide as CN-	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	NR
36	Anionic Detergents (as MBAS)	mg/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.2	1
37	Mercury (as Hg)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	NR
38	Selenium (as Se)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	NR
39	Total arsenic (as As)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.05
40	Total Nitrogen	mg/L	3.05	4.27	4.28	3.44	3.45	4.24	3.74	3.88	4.3	3.98	NS	NS
41	Free Ammonia	mg/L	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	NS	NS
42	Total Coliform	MPN/100mL	Absent	Shall not be detectable in any 100 ml	Shall not be detectable in any 100 ml									

S. No	Parameter	Unit	GW-1	GW-2	GW-3	GW-4	GW-5	GW-6	GW-7	GW-8	GW-9	GW-10	Desirable Limit as per IS 10500	Permissible Limit as per IS 10500
													sample	sample
43	Faecal coli forms	MPN/100m l	Absent	Shall not be detectable in any 100 ml sample	Shall not be detectable in any 100 ml sample									

Note: NS-Not Specified; NR-No Relaxation;

GW1-Project Site, GW2-Yalgul, GW3-Rejantal, GW4-Tekur, GW5-Gunalli, GW6-Gunjetti, GW7-Waddi, GW8-Hadnur, GW9-Mettalkunta, GW10-Kalbemal

D.2 Surface Water Monitoring Results

S. No	Parameter	Unit	SW-1	SW-2	SW-3	SW-4	SW-5
1	Color	CU	<5.0	<5.0	<5.0	<5.0	<5.0
2	pH @ 27.2°C	-	7.26	7.36	7.48	7.32	7.46
3	Temperature	oC	26.2	26.8	26.5	26.3	26.4
4	Electrical Conductivity	µMho/cm	639	560	764	485	610
5	Turbidity	NTU	<1.0	<1.0	<1.0	<1.0	<1.0
6	Total Dissolved Solids	mg/L	396	347	474	301	378
7	Alkalinity as CaCO3	mg/L	190.08	178.2	126.72	178.2	182.16
8	Hardness as CaCO3	mg/L	234.32	228.73	323.2	214.12	234.32
9	Calcium as Ca	mg/L	61.53	58.9	74.48	61.53	59.91
10	Magnesium as Mg	mg/L	19.63	19.8	33.37	14.72	20.61
11	Chlorides as Cl-	mg/L	36.24	50.33	64.43	52.35	44.29
12	Nitrate as NO3	mg/L	1.52	1.42	1.23	1.16	1.09
13	Total Solids	mg/L	402	349	554	306	384
14	Sodium as Na	mg/L	37.8	19.3	38.2	29.4	29.7
15	Potassium as K	mg/L	1.4	1.8	1.2	1.1	1.7
16	Fluoride as F	mg/L	0.68	0.65	0.64	0.66	0.65
17	Iron as Fe	mg/L	0.33	0.33	0.28	0.26	0.3
18	Chemical Oxygen Demand	mg/L	8	10	14	12	10
19	Biochemical Oxygen Demand (3 Days at 27°C)	mg/L	<4.0	<4.0	<4.0	<4.0	<4.0
20	Dissolved Oxygen	mg/L	4.6	4.8	4.9	4.7	4.5
21	Sulphates as SO4	mg/L	45.27	22.22	87.25	39.1	48.56
22	Zinc as Zn	mg/L	<0.2	<0.2	<0.2	<0.2	<0.2
23	Phosphorous as P	mg/L	<1.0	<1.0	<1.0	<1.0	<1.0

S. No	Parameter	Unit	SW-1	SW-2	SW-3	SW-4	SW-5
24	Residual Chlorine as Cl	mg/L	<0.2	<0.2	<0.2	<0.2	<0.2
25	Taste	-	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
26	Nickel	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05
27	Odour	-	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
28	Salinity	mg/L	61.4	52.9	61.4	52.9	52.9
29	Phenolic Compounds as Phenols	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
30	Lead as Pb	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
31	Manganese as Mn	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
32	Cadmium as Cd	mg/L	<0.003	<0.003	<0.003	<0.003	<0.003
33	Chromium as Cr+6	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05
34	Copper as Cu	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05
35	Cyanide as CN-	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05
36	Anionic Detergents (as MBAS)	mg/L	<0.2	<0.2	<0.2	<0.2	<0.2
37	Mercury (as Hg)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
38	Selenium (as Se)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
39	Total arsenic (as As)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
40	Total Nitrogen	mg/L	1.52	1.42	1.23	1.16	1.09
41	Free Ammonia	mg/L	<10	<10	<10	<10	<10
42	Total Coliform	MPN/100ml	Absent	Absent	Absent	Absent	Absent
43	Faecal coli forms	MPN/100ml	Absent	Absent	Absent	Absent	Absent

Note: NS-Not Specified; NR-No Relaxation;

SW 1- Singur Reservoir, SW 2- Manjeera River, SW 3- Madhura Nadi near Mettakunta R.S., SW 4- Check dam near Hadnur, SW 5- Narinja Reservoir

D.3 Ambient Air Quality Monitoring Results

Location	No. of Samples	PM ₁₀ (µg/m ³)				PM _{2.5} (µg/m ³)				SO ₂ (µg/m ³)				NO ₂ (µg/m ³)			
		Max.	Min.	Mean	98 th Percentile	Max.	Min.	Mean	98 th Percentile	Max.	Min.	Mean	98 th Percentile	Max.	Min.	Mean	98 th Percentile
		NAAQ Standard -100*				NAAQ Standard -60*				NAAQ Standard- 80*				NAAQ Standard- 80*			
A1	24	65.8	51.4	59.73	65.57	33.5	20.6	29.00	33.36	20.1	14.5	17.30	19.78	24.1	16.9	20.49	23.82
A2	24	70.4	64.2	68.24	70.31	30.7	27.6	29.26	30.61	20.5	17.3	18.72	20.18	24.8	21.5	23.09	24.75
A3	24	61.2	57.5	59.37	60.97	26.7	23.5	25.33	26.61	16.3	12.4	14.45	16.30	21.6	15.6	19.08	21.46
A4	24	59.7	56.4	57.62	59.47	28.6	25.2	26.84	28.37	15.6	13.4	14.34	15.60	20.4	17.6	19.10	20.31
A5	24	57.7	54.2	56.08	57.61	27.9	24.4	26.29	27.81	16.3	13.4	14.55	16.07	28.5	17.6	19.49	24.87
A6	24	60.6	57.3	59.04	60.55	28.7	26.1	27.48	28.70	16.9	14.7	15.83	16.81	21.7	19.2	20.53	21.70
A7	24	62.9	59.3	61.06	62.85	27.7	25.4	26.70	27.65	16.8	14.2	15.68	16.75	21.4	18.4	20.16	21.35
A8	24	62.6	57.4	60.22	62.23	28.7	26.3	27.60	28.70	16.8	14.6	15.82	16.75	21.3	18.9	20.19	21.25

Location	No. of Samples	PM ₁₀ ($\mu\text{g}/\text{m}^3$)				PM _{2.5} ($\mu\text{g}/\text{m}^3$)				SO ₂ ($\mu\text{g}/\text{m}^3$)				NO ₂ ($\mu\text{g}/\text{m}^3$)			
		Max.	Min.	Mean	98 th Percentile	Max.	Min.	Mean	98 th Percentile	Max.	Min.	Mean	98 th Percentile	Max.	Min.	Mean	98 th Percentile
		NAAQ Standard -100*				NAAQ Standard -60*				NAAQ Standard- 80*				NAAQ Standard- 80*			
A9	24	62.3	57.3	60.28	62.25	30.2	25.4	28.37	30.20	18.3	14.2	16.30	18.12	21.5	17.2	19.56	21.32
A10	24	64.2	59.3	61.83	64.02	28.4	25.5	27.01	28.40	16.9	13.1	15.21	16.72	21.3	17.6	19.40	21.07
A11	24	68.5	63.6	66.28	68.22	28.9	26.2	27.68	28.81	17.9	15.4	16.48	17.72	22.1	19.7	20.85	21.92
A12	24	68.9	65.6	66.90	68.44	28.8	26.2	27.48	28.71	18.9	16.1	17.52	18.81	23.2	20.3	21.76	23.06
A13	24	68.3	64.2	65.90	68.02	28.9	25.4	27.28	28.85	18.3	15.6	16.87	18.07	22.7	19.8	21.22	22.61
A14	24	63.4	55.7	60.05	63.12	31.4	26.7	29.45	31.26	19.4	14.2	16.65	19.35	23.7	16.7	19.58	23.47
A15	24	62.8	58.6	60.79	62.71	27.8	24.9	26.53	27.75	16.8	14.5	15.78	16.75	22.3	18.7	20.51	22.02

Location	No. of Samples	CO				O ₃				NH ₃				Pb	Ni	As	C ₆ H ₆	BaP
		Max	Min	Mean	98 th Percentile	Max	Min	Mean	98 th Percentile	Max	Min	Mean	98 th Percentile					
		NAAQ Standard- 2**				NAAQ Standard- 100**				NAAQ Standard- 400*				NAAQ Standard)- 1.0***	NAAQ Standard)- 20***	NAAQ Standard)- 06***	NAAQ Standard)- 05***	NAAQ Standard- 01***
A1	24	0.5	0.2	0.33	0.5	26.2	20.5	23.57	26.2	17.9	12.5	15.14	17.76	BDL	BDL	BDL	BDL	BDL
A2	24	0.6	0.3	0.45	0.6	25.7	23.4	24.56	25.56	15.5	13.4	14.54	15.41	BDL	BDL	BDL	BDL	BDL
A3	24	0.4	0.2	0.27	0.4	22.7	20.6	21.57	22.61	12.9	10.5	11.84	12.9	BDL	BDL	BDL	BDL	BDL
A4	24	0.4	0.2	0.28	0.4	23.8	19.5	21.35	23.75	13.8	11.6	12.72	13.66	BDL	BDL	BDL	BDL	BDL
A5	24	0.4	0.2	0.27	0.4	21.9	20.2	21.15	21.9	13.7	11.4	12.73	13.61	BDL	BDL	BDL	BDL	BDL
A6	24	0.4	0.2	0.26	0.35	22.9	20.3	21.92	22.81	12.7	10.3	11.65	12.65	BDL	BDL	BDL	BDL	BDL
A7	24	0.4	0.1	0.27	0.4	22.7	19.4	21.17	22.56	13.2	10.2	11.75	12.97	BDL	BDL	BDL	BDL	BDL
A8	24	0.3	0.1	0.21	0.3	22.9	19.2	21.15	22.72	13.8	11.5	12.55	13.62	BDL	BDL	BDL	BDL	BDL
A9	24	0.5	0.2	0.32	0.5	23.8	19.7	21.91	23.71	14.5	11.5	12.65	14.13	BDL	BDL	BDL	BDL	BDL
A10	24	0.5	0.2	0.35	0.45	24.6	20.5	22.8	24.42	14.5	12.5	13.61	14.5	BDL	BDL	BDL	BDL	BDL
A11	24	0.5	0.1	0.31	0.45	24.5	21.2	22.71	24.36	14.7	12.7	13.53	14.65	BDL	BDL	BDL	BDL	BDL
A12	24	0.4	0.2	0.28	0.4	23.7	21.5	22.85	23.65	14.6	12.2	13.27	14.42	BDL	BDL	BDL	BDL	BDL
A13	24	0.5	0.2	0.3	0.5	22.7	20.4	21.65	22.65	13.8	11.2	12.59	13.66	BDL	BDL	BDL	BDL	BDL
A14	24	0.5	0.2	0.34	0.5	26	22.7	24.28	25.95	17.2	12.5	14.9	17.06	BDL	BDL	BDL	BDL	BDL
A15	24	0.4	0.2	0.3	0.4	24.9	22.1	23.58	24.81	14.6	12.5	13.41	14.46	BDL	BDL	BDL	BDL	BDL

Note: BDL- Below Detectable Limit; * Value is for 24 hours; ** Value is for 8 Hours; *** Value is for Annual

A1- Project Site,A2- Mettakkunta, A3- Yalgul, A4- Hadnur, A5- Rejantal, A6- Kalbemal, A7- Gunjetti, A8- Gunalli, A9-Waddi, A10- Tekur, A11- Manhalli, A12- Jhara Sangam, A13- Nyalkal, A14- Burdipar, A15- Zaheerabad

D.4 Soil Quality Monitoring Results

S. No	Parameter	UNIT	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15
1	Texture																
	Sand	%	17.2	21.5	12.3	22.4	14.1	17.3	22.6	16.4	22.3	16.7	11.7	19.7	48.7	33.7	55.6
	Silt	%	48.3	55.2	59.1	44.5	55.2	58.4	54.3	42.3	50.6	48.4	56.7	57.9	24.9	37.6	17.7
	Clay	%	34.5	23.3	28.6	33.1	30.7	24.3	23.1	41.3	27.1	34.9	31.6	22.4	26.4	28.7	26.7
2	Soil Type	-	Slit Clay Loam	Slity Loam	Slit Clay Loam	Clay Loam	Slit Clay Loam	Slity Loam	Slity Clay Loam	Clay Loam	Slit Clay Loam	Slit Clay Loam	Slity Loam	Sandy Clay Loam	Clay Loam	Sandy Clay Loam	
3	Colour	-	Red	Light Red	Red	Light Red	Red	Light Red	Red	Red	Red	Light Red	Red	Light Red	Red	Red	
4	Electrical conductivity	µMoh s/Cm	271	320	293	401	212	196	256	224	326	351	409	328	186	358	232
5	pH		7.06	7.28	7.12	7.43	7.64	7.54	7.12	6.91	7.44	7.05	7.61	7.19	7.26	7.86	6.94
6	Nitrates as NO ₃	mg/100gm	5.09	6.221	7.493	9.191	8.624	11.734	4.948	8.766	6.927	4.383	4.807	5.09	6.787	5.937	8.059
7	Phosphates as PO ₄ ⁻²	mg/100gm	2.399	4.198	5.599	3.399	2.199	4.399	5.197	6.197	3.598	4.398	5.799	3.198	4.398	2.598	4.998
8	Potassium as K	mg/100gm	7.14	8.35	10.2	6.35	9.29	6.45	9.15	9.85	7.05	6.9	8.4	7.85	8.55	6.84	8.05
9	Sodium absorption Ratio (SAR)	-	0.52	0.45	0.52	0.4	0.61	0.37	0.55	0.5	0.68	0.44	0.52	0.68	0.56	0.3	0.42
10	Bulk density	gm/cc	1.47	1.98	1.54	1.25	1.77	1.08	1.74	1.29	1.44	1.19	1.24	1.67	1.47	1.46	1.84
11	Infiltration	Cm/hr	2.3	2.1	2.4	1.9	2.2	2.4	2.3	1.7	1.6	2.2	2.1	1.9	2.3	1.8	2.3
12	Cation exchange capacity	meq/100gm	8.077	6.878	7.439	6.599	8.919	10.239	7.278	8.52	5.639	10.518	4.919	7.758	8.479	4.72	10.837
13	Alkali Metals	mg/kg	176.41	178.45	213.45	141.44	202.89	125.97	186.46	189.44	185.97	155.45	177.96	191.43	190.46	181.81	185.94
14	Permeability	Cm/s	8.28x10 ⁻³	6.01x10 ⁻³	1.74x10 ⁻⁴	7.47x10 ⁻³	6.29x10 ⁻³	2.38x10 ⁻³	7.38x10 ⁻³	4.11x10 ⁻⁴	1.84x10 ⁻³	6.49x10 ⁻³	3.28x10 ⁻⁴	7.19x10 ⁻⁴	9.98x10 ⁻³	6.09x10 ⁻⁴	4.44x10 ⁻⁴
15	Water Holding Capacity	%	26.74	28.45	22.14	18.54	25.77	45.98	22.38	19.64	19.54	27.13	26.49	20.11	26.44	18.34	28.81
16	Porosity	%	38.41	33.49	41.78	31.25	47.89	125.97	37.12	34.56	39.77	41.64	32.24	36.42	42.54	39.31	38.4
17	Cadmium as	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	

S. No	Parameter	UNIT	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15
	Cd																
18	Chromium as Cr	mg/kg	3.67	4.21	5.56	3.11	7.24	4.16	5.87	3.55	7.86	8.52	4.21	3.22	2.26	3.89	6.62
19	Copper as Cu	mg/kg	4.68	3.21	4.19	3.89	4.18	4.77	3.21	3.57	3.88	4.09	4.84	3.54	4.71	5.29	4.16
20	Iron as Fe	mg/kg	52363.85	54857.37	62337.92	59844.4	104727.7	42389.79	37402.75	57350.89	47376.82	84779.57	52363.85	44883.3	42389.79	10974.76	57350.89
21	Manganese as Mn	mg/kg	32.4	39.7	21.8	25.8	33.8	37.4	22.9	34.7	38.1	24.2	36.5	31.4	23.7	86.1	27.6
22	Lead as Pb	mg/kg	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	
23	Zinc as Zn	mg/kg	20.99	26.47	21.45	28.47	31.24	24.78	22.46	20.46	23.48	22.76	24.86	25.11	28.47	22.16	22.14
24	Nickel as Ni	mg/kg	7.28	3.26	6.58	4.16	7.84	8.91	5.11	4.64	3.39	4.92	5.77	6.45	6.73	5.12	3.31

Note: S1 - Project Site,S2 - Yalgul, S3 - Rejantal, S4- Jhara Sangam, S5 - Tekur, S6 - Gunalli, S7- Gunjetti, S8 -Waddi, S9 - Nyalkal, S10- Hadnur, S11 – Zaheerabad, S12 -Burdipar, S13 - Manhalli,S14 – Mettakunta, S15 - Kalbemal

D.5 Flora and Fauna Survey Results

D.5.1 List of Flora observed in the study area

S. No.	Botanical Name	Common name	Family	Status	Core	Buffer
Trees						
1	<i>Acacia auriculiformis</i> Benth.	Australia thumma	Leguminosae	Common	P	P
2	<i>Acacia leucophloea</i> (Roxb.)	Tella thumma	Leguminosae	Dominant	P	P
3	<i>Acacia nilotica</i> (L.) Delile	Nalla thumma	Leguminosae	Dominant	P	P
4	<i>Achrus zapota</i>	Sapota	Sapotaceae	Dominant	P	P
5	<i>Aegle marmelos</i> (L.) Corrêa	Maredu	Rutaceae	Rare	P	P
6	<i>Ailanthus excelsa</i> Roxb	Pedda manu	Simaroubaceae	Dominant	P	P
7	<i>Alangium salviifolium</i> (L.f.) Wangerin	Vuduga chettu	Cornaceae	Sparse	A	P
8	<i>Albizia amara</i> (Roxb.) B.Boivin	Konda sigara	Leguminosae	Sparse	P	P
9	<i>Albizia lebbeck</i> (L.) Benth.	Dirisanam	Leguminosae	Dominant	P	P
10	<i>Alstonia scholaris</i> R.BR	Edakula pala	Apocynaceae	Dominant	P	P
11	<i>Anacardium occidentale</i>	Jeedi mamidi	Anacardiaceae	Sparse	P	P
12	<i>Annona squamosa</i> L.	Seethapalam	Annonaceae	Common	P	P
13	<i>Anogeissus latifolia</i> (Roxb. ex DC.)	Tiruman	Combretaceae	Sparse	P	P
14	<i>Anthocephalus cadamba</i> (Roxb.) Miq.	Kadambe	Rubiaceae	Rare	A	P
15	<i>Azadirachta indica</i> A.Juss.	Vepa	Meliaceae	Dominant	P	P
16	<i>Balanites egyptiaca</i> (L.) Delile	Gara	Zygophyllaceae	Dominant	P	P
17	<i>Bauhinia purpurea</i> L.	Bodhanta	Leguminosae	Dominant	P	P
18	<i>Borassus flabellifer</i> L.	Thadi chettu	Arecaceae	Dominant	P	P
19	<i>Boswellia serrata</i> Triana & Planch.	Anduga	Burseraceae	Sparse	P	P
20	<i>Buchanania lanza</i>	Sara	Anacaradaceae	Sparse	P	P
21	<i>Butea monosperma</i> (Lam.) Taub.	Modhuga	Leguminosae	Sparse	P	P
22	<i>Carica papaya</i> L.	Bopaya chettu	Caricaceae	Common	P	P
23	<i>Cassia fistula</i> L.	Rela	Leguminosae	Sparse	P	P
24	<i>Cassia siamea</i> Lam.	Seema thangedu	Leguminosae	Common	P	P
25	<i>Ceiba pentandra</i> (L.) Gaertn	Tella buruga	Malvaceae	Sparse	P	P
26	<i>Chloroxylon swietenia</i>	Billudu	Flindasiaceae	Common	P	P
27	<i>Chukrasia tabularis</i>	Konda vepa	Meliaceae	Dominant	P	P
28	<i>Citrus limon</i> (L.) Burm. f.	Nimma	Rutaceae	Sparse	P	P
29	<i>Cocos nucifera</i> L.	Kobbari	Arecaceae	Dominant	P	P
30	<i>Commiphora wightii</i>		Burseraceae	Common	P	P
31	<i>Dalbergia latifolia</i> Roxb	Jiteegi	Leguminosae	Sparse	P	P
32	<i>Dalbergia sissoo</i> DC.	Sisu	Leguminosae	Dominant	P	P
33	<i>Delonix regia</i> (Hook.) Raf.	Chittikesaram	Leguminosae	Dominant	P	P
34	<i>Dendrocalamus strictus</i>	Sanna vedru	Graminae	Dominant	P	P
35	<i>Diospyros melanoxylon</i> Roxb.	Tuniki, Beedi Aaku	Ebenaceae	Sparse	P	P
36	<i>Dolichandrone falcata</i> Seem.	chittiniruddi	Bignoniaceae	Sparse	A	P
37	<i>Eucalyptus globulus</i> Labill.	Neelagiri thylam	Myrtaceae	Common	P	P
38	<i>Euphorbia tirucalli</i> L.	Tirukalli	Euphorbiaceae	Dominant	P	P
39	<i>Ficus benghalensis</i> L.	Marri	Moraceae	Dominant	P	P
40	<i>Ficus hispida</i> L.f.	Medipandu	Moraceae	Sparse	P	P
41	<i>Ficus racemosa</i> L.	Medi	Moraceae	Common	P	P
42	<i>Ficus religiosa</i> L.	Ravi	Moraceae	Sparse	P	P
43	<i>Gardenia latifolia</i>	Pedda Karinga	Rubiaceae	Common	P	P
44	<i>Gardenia resinifera</i>	Karinga	Rubiaceae	Sparse	P	P
45	<i>Gmelina asiatica</i> L.	Peddagumudutekku	Lamiaceae	Rare	P	P
46	<i>Gyrocarpus americanus</i>		Hernandiaceae	Common	P	P
47	<i>Hardwickia binata</i> (Roxb.)	Yepi	Leguminosae	Sparse	P	P
48	<i>Holarrhena pubescens</i>	Istari Pala	AscleStudy Areadaceae	Common	P	P
49	<i>Holoptelea integrifolia</i> Planch.	Nemali nara	Ulmaceae	Rare	A	P

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50	<i>Lagerstroemia parviflora</i>	Chinagoranta	Lythraceae	Sparse	P	P
51	<i>Lannea coromandelica (Houtt.) Merr.</i>	Gumpena	Anacardiaceae	Rare	P	P
52	<i>Lawsonia inermis</i>	Gorinta	Lythraceae	Common	P	P
53	<i>Leptadenia reticulata</i>		Asclepiadaceae	Sparse	P	P
54	<i>Leucaena leucocephala (Lam.) de Wit</i>	Jabarichettu	Leguminosae	Dominant	P	P
55	<i>Limonia acidissima L.</i>	Velaga	Rutaceae	Dominant	P	P
56	<i>Madhuca indica Gmel.</i>	Ippa	Sapotaceae	Common	P	P
57	<i>Mangifera indica L.</i>	Mamidi	Anacardiaceae	Common	P	P
58	<i>Maytenus emarginata</i>	Danti	Celastraceae	Sparse	P	P
59	<i>Mimosa polyancistra</i>	Thumma	Mimosaceae	Common	P	P
60	<i>Mimosops elangi</i>	Pogada	Sapotaceae	Sparse	P	P
61	<i>Mitragyna parvifolia</i>	Battaganike	Rubiaceae	Common	P	P
62	<i>Morinda pubescens</i>	Togaru	Rubiaceae	Common	P	P
63	<i>Morinda tinctoria Roxb.</i>	Maddichettu	Rubiaceae	Sparse	P	P
64	<i>Murraya paniculata (L.) Jack</i>	Golimi	Rutaceae	Common	P	P
65	<i>Musa paradisiaca L.</i>	Arati	Musaceae	Common	P	P
66	<i>Nerium odoratum Lam.</i>	Erra ganneru	Apocynaceae	Dominant	P	P
67	<i>Ougenia oojeinensis</i>	Adavichikkudu	Papilionaceae	Sparse	P	P
68	<i>Parkinsonia aculeata L.</i>		Leguminosae	Dominant	P	P
69	<i>Pavetta indica L.</i>	Lakkapapidi	Rubiaceae	Dominant	P	P
70	<i>Peltophorum pterocarpum (DC.) K.Heyne</i>	Kondachinthia	Leguminosae	Dominant	P	P
71	<i>Phoenix sylvestris (L.) Roxb.</i>	Eethachettu	Arecaceae	Dominant	P	P
72	<i>Phyllanthus emblica L.</i>	Usiri	Phyllanthaceae	Dominant	P	P
73	<i>Pithecellobium dulce (Roxb.) Benth.</i>	Sima chinta	Leguminosae	Dominant	P	P
74	<i>Plumeria alba L.</i>	Tella devaganneru	Apocynaceae	Sparse	P	P
75	<i>Plumeria rubra L.</i>	Modu Ganneru	Apocynaceae	Rare	A	P
76	<i>Polyalthia longifolia (Sonn.) Thwaites</i>	Naramamidi	Annonaceae	Dominant	P	P
77	<i>Pongamia pinnata (L.) Pierre</i>	Adivi ganuga	Leguminosae	Dominant	P	P
78	<i>Prosopis chilensis (Molina) Stuntz</i>	Mulla thumma	Leguminosae	Sparse	P	P
79	<i>Prosopis juliflora</i>	English tumma	Mimosaceae	Dominant	P	P
80	<i>Psidium guajava L.</i>	Jama	Myrtaceae	Common	P	P
81	<i>Pterocarpus marsupium</i>	Yegisa	Papilionaceae	Rare	A	P
82	<i>Pterospermum acerifolium</i>	Muchkund	Malvaceae	Common	P	P
83	<i>Pterospermum heyneanum G.Don</i>	Duddika	Malvaceae	Sparse	A	P
84	<i>Pterospermum xylocarpum</i>	Noliki	Malvaceae	Common	P	P
85	<i>Randia uliginosa</i>	Nalla manga	Rubiaceae	Sparse	A	P
86	<i>Salvadora oleoides</i>		Salvadoraceae	Common	P	P
87	<i>Samanea saman (Jacq.) Merr.</i>	Nidraganeeru	Sapindaceae	Dominant	A	P
88	<i>Sapindus emarginatus Vahl</i>	Kunkudu	Sapindaceae	Common	P	P
89	<i>Saraca asoca (Roxb.) Willd</i>	Asoka chettu	Leguminosae	Sparse	A	P
90	<i>Semecarpus anacardium</i>	Nalla Jeedi	Anacardiaceae	Common	P	P
91	<i>Soymida febrifuga (Roxb.) A. Juss.</i>	Somi	Meliaceae	Rare	A	P
92	<i>Spathodea campanulata</i>		Bignoniaceae	Common	P	P
93	<i>Sterculia urens</i>	Tapasi	Sterculiaceae	Common	P	P
94	<i>Strychnos nux-vomica</i>	Mushti	Loganiaceae	Rare	A	P
95	<i>Strychnos potatorum</i>	Chilla	Loganiaceae	Common	P	P
96	<i>Swietenia mahagoni</i>		Meliaceae	Rare	A	P
97	<i>Syzygium cumini (L.) Skeels</i>	Neredu	Myrtaceae	Common	P	P
98	<i>Tamarindus indica L.</i>	Chintha	Leguminosae	Dominant	P	P
99	<i>Tamarix aphylla</i>		Tamaricaceae	Sparse	P	P
100	<i>Tecomia stans (L.) Juss. ex Kunth</i>	Pasupu ganneru	Bignoniaceae	Dominant	P	P
101	<i>Tectona grandis L.f.</i>	Teak	Lamiaceae	Dominant	P	P
102	<i>Terminalia arjuna</i>	Tella Maddi	Combretaceae	Common	P	P
103	<i>Terminalia bellirica</i>	Tani	Combretaceae	Common	P	P

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104	<i>Terminalia catappa L.</i>	Badham	Combretaceae	Dominant	P	P
105	<i>Terminalia chebula</i>	Karaka	Combretaceae	Sparse	A	P
106	<i>Terminalia tomentosa</i>	nallamaddhi	Combretaceae	Common	P	P
107	<i>Thespesia populnea</i>	Ganga Raavi	Malvaceae	Dominant	P	P
108	<i>Thevetia nerifolia</i>	Pacha ganneru	Apocynaceae	Dominant	P	P
109	<i>Trema orientalis</i>	Boggu chettu	Ulmaceae	Sparse	A	P
110	<i>Vitex altissima</i>	Nemali adugu	Verbenaceae	Sparse	A	P
111	<i>Vitex negundo L.</i>	Vaavili	Verbenaceae	Dominant	P	P
Shrubs						
112	<i>Abutilon indicum (L.) Sweet</i>	Thutturubenda	Malvaceae	Dominant	P	P
113	<i>Agave americana L.</i>	Gitta nara	Asparagaceae	Dominant	P	P
114	<i>Caesalpinia bonduc (L.) Roxb.</i>	Gacha podha	Leguminosae	Sparse	P	P
115	<i>Caesalpinia pulcherrima (L.) Sw.</i>	Rathna gandhi	Leguminosae	Dominant	P	P
116	<i>Calotropis gigantea (L.) Dryand.</i>	Tella jilledu	Apocynaceae	Dominant	P	P
117	<i>Calotropis procera (Aiton) Dryand.</i>	Erra jilledu	Apocynaceae	Sparse	P	P
118	<i>Capparis aphylla</i>		Capparaceae	Dominant	P	P
119	<i>Capparis decidua</i>		Capparaceae	Dominant	P	P
120	<i>Capparis saStudy Arearia</i>		Capparaceae	Dominant	P	P
121	<i>Capparis zeylanica L.</i>	Aarudonda	Capparaceae	Dominant	P	P
122	<i>Carissa carandas L.</i>	Vakkaya	Apocynaceae	Dominant	P	P
123	<i>Cassia alata</i>		Leguminosae	Sparse	P	P
	<i>Catunaregam spinosa (Thunb.) Tirveng.</i>	Manga	Rubiaceae	Dominant	P	P
125	<i>Clerodendrum phlomidis L.f.</i>	Kond-takal	Lamiaceae	Rare	A	P
126	<i>Clerodendrum serratum</i>		Verbenaceae	Rare	A	P
127	<i>Datura stramonium</i>	Ummetha	Solanaceae	Dominant	P	P
128	<i>Dodonaea viscosa Jacq.</i>	Bandaru	Sapindaceae	Dominant	P	P
129	<i>Erythroxylon monogynum</i>	Dedaraaku	Erythroxylaceae	Sparse	P	P
130	<i>Euphorbia cactus</i>	Jemudu	Euphorbiaceae	Sparse	P	P
131	<i>Euphorbia caudifolium</i>		Euphorbiaceae	Sparse	A	P
132	<i>Euphorbia nerifolia</i>	Jemudu	Euphorbiaceae	Dominant	P	P
133	<i>Euphorbia nivulia</i>	Vad Thor	Euphorbiaceae	Dominant	P	P
134	<i>Euphorbia trans</i>	Jemudu	Euphorbiaceae	Sparse	P	P
135	<i>Grewia flavescens Juss.</i>	Jana	Malvaceae	Sparse	P	P
136	<i>Gymnosporia montana</i>	Danti	Verbenaceae	Common	A	P
137	<i>Helicteres isora L.</i>	Gooba thadu	Malvaceae	Dominant	P	P
138	<i>Holarrhena antidyserterica</i>		Apocynaceae	Dominant	P	P
139	<i>Ipomoea carnea Jacq.</i>	Rubber mokka	Convolvulaceae	Dominant	P	P
140	<i>Ixora coccinea</i>	Ramabanam	Rubiaceae	Dominant	P	P
141	<i>Jasminum cuspidatum</i>	Adavi malli	Oleaceae	Dominant	P	P
142	<i>Jasminum roxburghianum Wall. ex C.B.Clarke</i>	Garuda malli	Oleaceae	sparse	P	P
143	<i>Jatropha curcas L.</i>	Nepalam	Euphorbiaceae	Sparse	P	P
144	<i>Jatropha glandulifera Roxb.</i>	Yerranepalamu	Euphorbiaceae	Dominant	P	P
145	<i>Lantana camara L.</i>	Pulikampa	Verbenaceae	Dominant	P	P
146	<i>Leonotis nepetifolia (L.) R.Br.</i>	Rana bheri	Lamiaceae	Sparse	P	P
147	<i>Morinda pubescens Sm.</i>		Rubiaceae	Sparse	P	P
148	<i>Opuntia dillenii (Ker Gawl.) Haw.</i>	Naga jamudu	Cactaceae	Common	P	P
149	<i>Opuntia elatior</i>		Cactaceae	Dominant	P	P
150	<i>Phoenix acaulis</i>	Chitteetha	Palmae	Sparse	P	P
151	<i>Randia dumetorum</i>		Rubiaceae	Dominant	P	P
152	<i>Salicornia brachiata</i>		Chenopodiaceae	Sparse	P	P
153	<i>Salvadora persica</i>	Khari Zar, Pailu	Salvadoraceae	Sparse	A	P
154	<i>Scirpus tuberosus</i>	-	Cyperaceae	Dominant	P	P
155	<i>Senna auriculata (L.) Roxb.</i>	Tangedu	Leguminosae	Dominant	P	P
156	<i>Solanum pubescens Willd.</i>	Uchintha	Solanaceae	Dominant	P	P

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157	<i>Tamarix troupii</i>	Lai, Ratilai	Tamaricaceae	Sparse	P	P
158	<i>Xanthium indicum</i>	Maralu Teege	Asteraceae	Dominant	P	P
159	<i>Xanthium strumarium</i>	Marula-Mathangi	Asteraceae	Dominant	P	P
160	<i>Ziziphus oenopolia (L.) Mill.</i>	Parimi	Rhamnaceae	Dominant	P	P
Hydrophytes						
161	<i>Azolla pinnata subsp. africana (Desv.)</i>		Salviniaceae	Sparse	A	P
162	<i>Eichornia crassipes Solms</i>		Pontederiaceae	Sparse	A	P
163	<i>Hydrilla Rich.</i>		Hydrocharitaceae	sparse	A	P
164	<i>Ipomoea aquatica</i>	Thooti Koora	Convolvulaceae	Common	A	P
165	<i>Lemna minor Hegelm.</i>		Araceae	Common	A	P
166	<i>Limnophila heterophylla R. Br.</i>		Plantaginaceae	Common	A	P
167	<i>Marsilea quadrifolia L.</i>		Marsileaceae	Sparse	A	P
168	<i>Neptunia oleracea Lour.</i>		Leguminosae	Common	A	P
169	<i>Operculina turpethum (L.) Silva Manso</i>	Erra Tegada	Convolvulaceae	Common	A	P
170	<i>Typha angustata</i>	Jammu	Typhaceae	Dominant	A	P
171	<i>Vallisneria L.</i>		Hydrocharitaceae	Sparse	A	P
161	<i>Azolla pinnata subsp. africana (Desv.)</i>		Salviniaceae	Sparse	A	P
162	<i>Eichornia crassipes Solms</i>		Pontederiaceae	Sparse	A	P
163	<i>Hydrilla Rich.</i>		Hydrocharitaceae	sparse	A	P
164	<i>Ipomoea aquatica</i>	Thooti Koora	Convolvulaceae	Common	A	P
165	<i>Lemna minor Hegelm.</i>		Araceae	Common	A	P
166	<i>Limnophila heterophylla R. Br.</i>		Plantaginaceae	Common	A	P
167	<i>Marsilea quadrifolia L.</i>		Marsileaceae	Sparse	A	P
168	<i>Neptunia oleracea Lour.</i>		Leguminosae	Common	A	P
169	<i>Operculina turpethum (L.) Silva Manso</i>	Erra Tegada	Convolvulaceae	Common	A	P
170	<i>Typha angustata</i>	Jammu	Typhaceae	Dominant	A	P
171	<i>Vallisneria L.</i>		Hydrocharitaceae	Sparse	A	P
Herb						
172	<i>Acalypha indica L.</i>		Euphorbiaceae	Dominant	A	P
173	<i>Achyranthes aspera L</i>	Uttareni	Amaranthaceae	Dominant	P	P
174	<i>Aerva lanata (L.) Juss</i>	Thelaga pindi	Amaranthaceae	Dominant	P	P
175	<i>Aeschynomene aspera L</i>	Neeti jeeluga	Leguminosae	Dominant	P	P
176	<i>Ageratum conyzoides (L.) L.</i>	Vasavi	Asteraceae	Dominant	P	P
177	<i>Aloe vera</i>	Kithanara	Tiliaceae	Rare	A	P
178	<i>Alternanthera sessilis (L.) R.Br. ex DC.</i>	Ponagantiaku	Amaranthaceae	Sparse	P	P
179	<i>Amaranthus spinosus L.</i>	Mulla thotakoora	Amaranthaceae	Sparse	P	P
180	<i>Amaranthus viridis L.</i>	Chilakathotakoora	Amaranthaceae	Sparse	P	P
181	<i>Apium graveolens L.f.</i>		Poaceae	Sparse	P	P
182	<i>Argemone mexicana L.</i>	Brahmadandi	Papaveraceae	Dominant	P	P
183	<i>Aristida hystrix L.f.</i>		Poaceae	Common	A	P
184	<i>Barleria prionitis L.</i>	Pachagorinta	Acanthaceae	Sparse	P	P
185	<i>Blumea mollis (D. Don) Merr.</i>	Kukkapogaku	Asteraceae	Dominant	P	P
186	<i>Boerhaavia diffusa L.</i>	Atikimamidi	Nyctaginaceae	Dominant	P	P
187	<i>Borreria hispida Spruce ex K.Schum.</i>		Rubiaceae	Sparse	P	P
188	<i>Cassia occidentalis</i>	Adavi Chennangi	Leguminosae	Dominant	P	P
189	<i>Cassia tora</i>	Tagarisa	Caesalpiniaceae	Dominant	P	P
190	<i>Catharanthus roseus (L.) G.Don</i>	Billaganneru	Apocynaceae	Dominant	P	P
191	<i>Celosia virgata Jacq.</i>	Guruga	Amaranthaceae	Common	P	P
192	<i>Chrysopogon lancearius (Hook.f.) Haines</i>		Poaceae	Sparse	A	P
193	<i>Cleome aspera J.König ex DC</i>		Cleomaceae	Common	P	P
194	<i>Cleome viscosa L.</i>	Kukka vominthra	Cleomaceae	Dominant	P	P
195	<i>Colocasia esculenta</i>	Atuka tiga	Araceae	Sparse	A	P
196	<i>Crotalaria juncea L</i>	Janumu	Leguminosae	Common	P	P
197	<i>Croton bonplandianus Baill.</i>	Vana mokka	Euphorbiaceae	Dominant	P	P
198	<i>Cynodon dactylon</i>	Garika	Poaceae	Sparse	P	P

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199	<i>Cyperus castaneus</i>		Poaceae	Dominant	P	P
200	<i>Cyperus rotundus L.</i>		Cyperaceae	Sparse	P	P
201	<i>Desmodium dichotomum (Willd.) DC.</i>		Leguminosae	Sparse	A	P
202	<i>Eclipta alba (L.) Hassk.</i>	Guntagalagara	Asteraceae	Sparse	P	P
203	<i>Euphorbia antiquorum</i>	Bontha Jemudu	Euphorbiaceae	Common	P	P
204	<i>Euphorbia hirta L.</i>	Nanubalu	Euphorbiaceae	Dominant	P	P
205	<i>Evolvulus alsinoides (L.) L</i>		Convolvulaceae	Dominant	P	P
206	<i>Fimbristylis cymosa R.Br.</i>	Pulupu gaddi	Cyperaceae	Sparse	A	P
207	<i>Gomphrena serrata L.</i>	Tella bendumalli	Amaranthaceae	Common	A	P
208	<i>Heteropogon contortus (L.)</i>		Poaceae	Common	P	P
209	<i>Hygrophila auriculata (Schumach.) Heine</i>	Mundla gobbi	Acanthaceae	Dominant	P	P
210	<i>Hyptis suaveolens</i>	Maha beera	Lamiaceae	Dominant	P	P
211	<i>Indigofera hirsuta L.</i>	Kolapattitulu	Leguminosae	Common	P	P
212	<i>Indigofera linnaei Ali</i>		Leguminosae	Common	P	P
213	<i>Justicia procumbens L.</i>		Acanthaceae	Sparse	P	P
214	<i>Leucas aspera</i>	Tummi	Lamiaceae	Dominant	P	P
215	<i>Ludwigia perennis L.</i>	Lavangakaya mokka	Onagraceae	Common	A	P
216	<i>Mimosa pudica</i>	Atthi pathi	Leguminosae	Dominant	P	P
217	<i>Mollugo cerviana (L.) Ser.</i>		Molluginaceae	Sparse	P	P
218	<i>Ocimum canum Sims</i>	Kukka Tulasi	Lamiaceae	Dominant	P	P
219	<i>Ocimum sanctum</i>	Tulasi	Lamiaceae	Common	P	P
220	<i>Oldenlandia umbellata L.</i>	Chiru veru	Rubiaceae	Dominant	P	P
221	<i>Oxalis corniculata</i>	Indian Sorrel	Oxalidaceae	Dominant	P	P
222	<i>Parthenium hysterophorus L.</i>	Vayyaribhama	Asteraceae	Dominant	P	P
223	<i>Pavonia zeylanica Cav.</i>	Karubenda	Malvaceae	Common	P	P
224	<i>Phyllanthus amarus</i>	Nela Usiri	Euphorbiaceae	Dominant	P	P
225	<i>Phyllanthus maderaspatensis L.</i>		Phyllanthaceae	Sparse	P	P
226	<i>Phyllanthus reticulatus</i>	Pulasari / Puliseru	Euphorbiaceae	Common	P	P
227	<i>Plumbago zeylanica L</i>	Agnimaata	Plumbaginaceae	Common	P	P
228	<i>Portulaca oleracea L.</i>	Pappu Kura	Portulacaceae	common	P	P
229	<i>Portulaca quadrifida</i>	Goddu pavali	Portulacaceae	Rare	A	P
230	<i>Rhynchosia beddomei Baker</i>		Leguminosae	Sparse	P	P
231	<i>Ruellia tuberosa L.</i>	Jurbula gadda	Acanthaceae	Dominant	P	P
232	<i>Scoparia dulcis L.</i>	Potti boli	Plantaginaceae	Common	P	P
233	<i>Sesamum alatum</i>	Rekka nuvvulu	Pedaliaceae	Common	A	P
234	<i>Sesuvium portulacastrum (L.) L.</i>	Thikka Kura	Aizoaceae	Dominant	P	P
235	<i>Sida acuta Burm.f.</i>	Medabirusaku	Malvaceae	Dominant	P	P
236	<i>Sida cordifolia L.</i>	Chiru Benda	Malvaceae	Dominant	P	P
237	<i>Sida spinosa L.</i>	Naga bala	Malvaceae	Common	P	P
238	<i>Solanum surattense Burm. f.</i>	Nela vakudu	Solanaceae	Dominant	P	P
239	<i>Sonchus oleraceus (L.) L.</i>		Compositae	Dominant	P	P
240	<i>Sphaeranthus indicus L.</i>	Bodasaramu	Asteraceae	Dominant	P	P
241	<i>Tephrosia purpurea (L.) Pers.</i>	Vempali	Leguminosae	Dominant	P	P
242	<i>Trianthemum portulacastrum L.</i>	kadaraku	Aizoaceae	sparse	P	P
243	<i>Tribulus terrestris L</i>		Zygophyllaceae	Dominant	P	P
244	<i>Tridax procumbens (L.) L.</i>	Gaddichamathi	Asteraceae	Dominant	P	P
245	<i>Triumfetta pentandra A.Rich.</i>	Chirusitrika	Malvaceae	Dominant	P	P
246	<i>Urena lobata L.</i>	Pedda benda	Malvaceae	Dominant	P	P
247	<i>Vanda tessellata</i>	Kodikalla chettu	Orchidaceae	Dominant	P	P
248	<i>Vernonia cinerea (L.) Less.</i>		Compositae	Dominant	P	P
249	<i>Waltheria indica L.</i>	Nalla Benda	Malvaceae	Dominant	P	P
250	<i>Ziziphus mauritiana Lam.</i>	Reni	Rhamnaceae	Dominant	P	P
Grass						
251	<i>Brachiaria eruciformis</i>		Poaceae	Sparse	P	P

S. No.	Botanical Name	Common name	Family	Status	Core	Buffer
252	<i>Chloris barbata</i> Sw.	Uppu Gaddi	Poaceae	Common	A	P
253	<i>Chloris virgata</i> Sw.		Poaceae	Common	P	P
254	<i>Cymbopogon citratus</i>		Poaceae	Rare	P	P
255	<i>Cyperus flavidus</i>		Cyperaceae	Common	P	P
256	<i>Digitaria ciliaris</i>		Poaceae	Common	P	P
257	<i>Eragrostis tenella</i>		Poaceae	Common	P	P
258	<i>Fimbristylis cymosa</i>	Pulupu gaddi	Cyperaceae	Common	P	P
259	<i>Saccharum spontaneum</i>	Kaki Cheraku	Poaceae	Sparse	A	P
260	<i>Spinifex littoreus</i>		Poaceae	Common	P	P
261	<i>Zizania latifolia</i>		Poaceae	Common	P	P
Climbers						
262	<i>Abrus precatorius</i> L.	Gurivinda	Leguminosae	Dominant	P	P
263	<i>Asparagus racemosus</i> Willd.	Pilli Gaddalu	Asparagaceae	Dominant	P	P
264	<i>Cissus quadrangularis</i> L.	Nalleru	Vitaceae	Dominant	P	P
265	<i>Clitoria ternatea</i> L.	Sanku-Pushpamu	Leguminosae	Sparse	P	P
266	<i>Cuscuta reflexa</i> Roxb.		Convolvulaceae	Sparse	P	P
267	<i>Decalepis hamiltonii</i>	Maredu kommulu	Periplocaceae	Sparse	P	P
268	<i>Desmodium triflorum</i>	Munta Mandu	Leguminosae	Common	A	P
269	<i>Dioscorea hispida</i>		Dioscoreaceae	Rare	A	P
270	<i>Dioscorea oppositifolia</i> L.	Adda dumpa	Dioscoreaceae	Sparse	A	P
271	<i>Dioscorea pentaphylla</i>	Adavi gunusuthega	Dioscoreaceae	Sparse	A	P
272	<i>Evolvulus alsinoides</i>	Vishnukrantha	Convolvulaceae	Dominant	P	P
273	<i>Hemidesmus indicus</i> (L.) R. Br. ex Schult		Apocynaceae	Dominant	P	P
274	<i>Ipomoea macrantha</i>		Convolvulaceae	Sparse	P	P
275	<i>Ipomoea nil</i> (L.) Roth.		Convolvulaceae	Dominant	P	P
276	<i>Ipomoea obscura</i> (L.) Ker Gawl.		Convolvulaceae	Sparse	P	P
277	<i>Merremia tridentata</i> (L.) Hallier f.		Convolvulaceae	Dominant	P	P
278	<i>Mucuna pruriens</i> (L.) DC.	Dulagondi	Leguminosae	common	A	P
279	<i>Passiflora edulis</i> Sims.	Fashion fruit	Passifloraceae	Sparse	A	P
280	<i>Pergularia daemia</i> (Forssk.) Chiov.	Dustapu-Teega	Apocynaceae	Dominant	P	P
281	<i>Rivea hypocrateriformis</i> Choisy.	Bodditeega	Convolvulaceae	Dominant	P	P
282	<i>Tinospora cordifolia</i> (Willd.) Miers.	Tippa teega	Menispermaceae	Dominant	P	P

Note A= Absent & P= present

D.5.2 List of Reptiles and Amphibian Fauna observed in the study area

S. No.	Scientific Name	Common Name	IUCN	IWPA
1.	<i>Ahaetulla nasutus</i>	Green whip snake	LC	
2.	<i>Naja naja</i>	Indian Cobra	LC	II
3.	<i>Vipera russelli</i>	Russel Viper	LR	II
4.	<i>Dendrelaphis tristis</i>	Tree Snake	LC	
5.	<i>Ptyas mucosus</i>	Common Rat snake	LC	II
6.	<i>Amphiesma stolata</i>	Buffstriped keelback	LC	
7.	<i>Trimeresurus gramineus</i>	Green pit viper	LC	IV
8.	<i>Typhlops hypomethes</i>	Common blind snake	LC	IV
9.	<i>Enhydris enhydris</i>	Common Smooth Water Snake	LC	
10.	<i>Varanus bengalensis</i>	Common Indian monitor	LR	II
11.	<i>Chamaeleon zeylanicus</i>	Chameleon*	LC	II
12.	<i>Mabuya carinata</i>	Common Skink*	LC	
13.	<i>Calotes rouxi</i>	Forest Calottes*	LC	
14.	<i>Calotes versicolor</i>	Common garden lizard*	LC	
15.	<i>Hemidactylus brooki</i>	House gecko*	LC	
16.	<i>Hemidactylus frenatus</i>	Southern House Gecko	LC	
Amphibians				
17.	<i>Bufo melanostictus</i>	Common toad	LC	Sch-IV

S. No.	Scientific Name	Common Name	IUCN	IWPA
18.	<i>Rana hexadactyla</i>	Commn green frog *	LC	Sch-IV
19.	<i>Rana leptodactyla</i>	Small forg	LC	Sch-IV
20.	<i>Rana tigrina</i>	Bullfrog	LC	Sch-IV
21.	<i>Rhacophorus maculatus</i>	Common Tree Frog*	LC	Sch-IV

D.5.3 List of Birds observed in the study area

Scientific name	Common Name	Family	IUCN Status	IWPA Status
<i>Accipiter badius</i>	Shikra	Accipitridae	LC	IV
<i>Accipiter nisus</i>	Eurasian Sparrow Hawk	Accipitridae	LC	IV
<i>Accipiter virgatus</i>	Besra Sparrow Hawk	Accipitridae	LC	IV
<i>Acrocephalos tristis</i>	Common Myna	Sturnidae	LC	IV
<i>Acrocephalus aedon</i>	Thickbilled Warbler		LC	IV
<i>Acrocephalus agricola</i>	Paddy field Warblers	Acrocephalidae	LC	IV
<i>Acrocephalus stentoreus</i>	Reed Warbler	Acrocephalus	LC	IV
<i>Actitis hypoleucos</i>	Common Sandpiper	Scolopacidae	LC	IV
<i>Aegithina tiphia</i>	Common Iora		LC	IV
<i>Alcedo atthis*</i>	Common Kingfisher		LC	IV
<i>Amaurornis phoenicurus</i>	White Breasted Water Hen	Rallidae	LC	IV
<i>Anas poecilorhyncha</i>	Spot Billed Duck*	Anatidae	LC	IV
<i>Anastomus oscitans</i>	Open Billed Storks	Ciconiidae	LC	IV
<i>Anthus rufulus</i>	Paddy pipet	Motacillidae	LC	IV
<i>Apus affinis</i>	House Swift	Apodidae	LC	IV
<i>Ardea alba</i>	Large Egrets	Ardeidae	LC	IV
<i>Ardea cinerea</i>	Grey Heron *	Ardeidae	LC	IV
<i>Ardea intermedia</i>	Medium Egret	Ardeidae	LC	IV
<i>Ardeola grayii</i>	Pond Heron	Ardeidae	LC	IV
<i>Bubulcus ibis</i>	Cattle Egret	Ardeidae	LC	IV
<i>Calidris temminckii</i>	Temminck's Stint	Scolopacidae	LC	IV
<i>Centropus sinensis</i>	Crow Pheasant	Cuculidae	LC	IV
<i>Ceryle rudis</i>	Pied Kingfisher	Cerylidae	LC	IV
<i>Charadrius alexandrinus</i>	Kentish Plovers	Charadriidae	LC	IV
<i>Charadrius hiaticula</i>	Ringed Plover	Charadriidae	LC	IV
<i>Cinnyris asiaticus</i>	Purple Sunbird	Nectariniidae	LC	IV
<i>Cisticola juncidis</i>	Streaked Fantail Warbler	Cisticolidae	LC	IV
<i>Columba livia*</i>	Rock Pigeon		LC	IV
<i>Copsychus saularis</i>	Oriental Magpie Robin	Muscicapidae	LC	IV
<i>Coraciiformes benghalensis</i>	Indian Roller	Coraciiformesidae	LC	IV
<i>Corvus splendens*</i>	House Crow		LC	IV
<i>Cypsiurus balasiensis</i>	Asian Palm Swift	Apodidae	LC	IV
<i>Delichon urbicum</i>	Northern House Martin	Hirundinidae	LC	IV
<i>Dendrocitta formosae</i>	Grey Treepie	Corvidae	LC	IV
<i>Dicrurus macrocercus</i>	Black Drongo	Dicruridae	LC	IV
<i>Dinopium benghalense</i>	Lesser Golden Backed Woodpecker	Picidae	LC	IV
<i>Egretta garzetta</i>	Little Egret	Ardeidae	LC	IV
<i>Elanus caeruleus</i>	Black Shouldered Kite	Accipitridae	LC	IV
<i>Eremopterix grisea</i>	Ashy crowned Sparrow lark	Alaudidae	LC	IV
<i>Eudynamys scolopacea</i>	Asian Koel	Cuculidae	LC	IV
<i>Euodice malabarica</i>	White Throated Munia	Estrildidae	LC	IV
<i>Francolinus pondicerianus</i>	Grey Partridge	Phasianidae	LC	IV
<i>Fulica atra</i>	Common Coot	Rallidae	LC	IV
<i>Gallinago gallinago</i>	Common Snipe	Scolopacidae	LC	IV
<i>Gallinula chloropus</i>	Common Moorhen	Rallidae	LC	IV
<i>Gracupica contra</i>	Asian Pied starling	Sturnidae	LC	IV
<i>Halcyon smyrnensis</i>	White Breasted Kingfisher	Halcyonidae	LC	IV
<i>Haliastur indus</i>	Brahminy Kite	Accipitridae	LC	IV
<i>Himantopus himantopus</i>	Black winged stilt	Recurvirostridae	LC	IV

Scientific name	Common Name	Family	IUCN Status	IWPA Status
<i>Hirundo daurica</i>	Red Rumped Swallows	Hirundinidae	LC	IV
<i>Hydrophasianus chirurgus</i>	Pheasant Tailed Jacana	Jacanidae	LC	IV
<i>Lanius cristatus</i>	Brown shrike	Laniidae	LC	IV
<i>leptocoma zeylonica</i>	Purple Rumped Sunbird	Nectariniidae	LC	IV
<i>Lonchura atricapilla</i>	Black Headed Munia	Estrildidae	LC	IV
<i>Lonchura punctulata</i>	Spotted Munia	Estrildidae	LC	IV
<i>Megalaima haemacephala</i>	Copper Smith Barbet	Megalaimidae	LC	IV
<i>Merops orientalis</i>	Small Bee eater	Meropidae	LC	IV
<i>Metopidius indicus</i>	Bronze winged Jacana	Jacanidae	LC	IV
<i>Milvus migrans</i>	Black kite	Accipitridae	LC	IV
<i>Motacilla alba</i>	White wagtail	Motacillidae	LC	IV
<i>Motacilla cinerea</i>	Grey Wagtail	Motacillidae	LC	IV
<i>Motacilla flava</i>	Yellow wagtail	Motacillidae	LC	IV
<i>Motacilla maderaspatensis</i>	Pied wagtail/ White browed wagtail	Motacillidae	LC	IV
<i>Nettapus coromandelianus</i>	Cotton Teal	Anatidae	LC	IV
<i>Nyctyornis athertoni</i>	Blue tailed Bee eaters	Meropidae	LC	IV
<i>Ocypteros birostris</i>	Grey Hornbills	Bucerotidae	LC	IV
<i>Oriolus oriolus</i>	Eurasian Golden Oriole	Oriolidae	LC	IV
<i>Orthotomus sutorius</i>	Tailor bird	Cisticolidae	LC	IV
<i>Passer domesticus</i>	House Sparrow	Passeridae	LC	IV
<i>Pavo cristatus</i>	Indian Peafowl		LC	I
<i>Pellorneum ruficeps</i>	Puff-throated Babbler		LC	IV
<i>Pericrocotus cinnamomeus</i>	Small Minivet		LC	IV
<i>Pericrocotus flammeus</i>	Scarlet Minivet		LC	IV
<i>Phalacrocorax niger</i>	Little Cormorant	Phalacrocorax	LC	IV
<i>Phylloscopus affinis</i>	Tickell's Warbler		LC	IV
<i>Phylloscopus maculipennis</i>	Ashy Warblers	Phylloscopidae	LC	IV
<i>Pitta brachyura</i>	Indian Pitta		LC	IV
<i>Ploceus philippinus</i>	Baya Weaver	Ploceidae	LC	IV
<i>Porphyrio porphyrio</i>	Purple Moorhen	Rallidae	LC	IV
<i>Prinia hodgsonii</i>	Grey Breasted Prinia	Cisticolidae	LC	IV
<i>Psittacula eupatria</i>	Alexandrine Parakeet	Psittacidae	LC	IV
<i>Psittacula krameri</i>	Rose ringed Parakeet	Psittacidae	LC	IV
<i>Pycnonotus cafer</i>	Red Vented Bulbul	Pycnonotidae	LC	IV
<i>Saxicola caprata</i>	Pied bush chat	Muscicapidae	LC	IV
<i>Saxicoloides fulicata</i>	Indian Robin	Muscicapidae	LC	IV
<i>Sterna hirundo</i>	Common Terns	Sternidae	LC	IV
<i>Streptopelia decaocto</i>	Eurasian Collared Dove		LC	IV
<i>Streptopelia orientalis</i>	Spoted dove	Columbidae	LC	IV
<i>Streptopelia tutur</i>	Turtle Doves	Columbidae	LC	IV
<i>Sturnus vulgaris</i>	Common Starling		LC	IV
<i>Sturnia pagodarum</i>	Brahminy Starlings	sturnidae	LC	IV
<i>Sylvia althaea (S.curruca)</i>	Lesser Whitethroat		LC	IV
<i>Sylvia communis</i>	common whitethroat		LC	IV
<i>Sylvia nana</i>	Desert Warbler		LC	IV
<i>Tachybaptus ruficollis</i>	Little Grebe	Podicipedidae	LC	IV
<i>Tephrodornis pondicerianus</i>	Common Wood Shrike	Prionopidae	LC	IV
<i>Turdoides caudata</i>	Common Babbler	Timaliidae	LC	IV
<i>Turdoides malcolmi</i>	Large Grey Babblers	Timaliidae	LC	IV
<i>Turdoides striata</i>	Jungle Babbler	Timaliidae	LC	IV
<i>Upupa epops</i>	Hoopoe	Upupidae	LC	IV
<i>Vanellus indicus</i>	Red wattled Lapwing	Charadriidae	LC	IV

D.5.4 List of Mammals observed in the study area

Scientific Name	Common Name	Family	WPA Status	IUCN
<i>Canis aureus indicus</i>	Indian Jackal	Canidae	Part-II of Sch-II	LC

Scientific Name	Common Name	Family	WPA Status	IUCN
<i>Semnopithecus entellus</i>	Deccan Hanuman Langur	<i>Cercopithecidae</i>	Part-II of Sch-II	LC
<i>Herpestes javanicus</i>	Common Indian Mongoose	<i>Herpestidae</i>	Part II of Schedule II	LC
<i>Rhinopoma hardwickii</i>	Lesser Mouse-Tailed Bat	<i>Chiroptera</i>		LC
<i>Cynopterus sphinx</i>	Short-Nosed Fruit Bat	<i>Chiroptera</i>	Schedule V	LC
<i>Pipistrellus coromandra</i>	Indian Pipistrelle	<i>Chiroptera</i>		LC
<i>Taphozous melanopogon</i>	Black-Bearded tomb bat	<i>Chiroptera</i>		LC
<i>Hipposideros speoris</i>	Schneider's Leaf-Nosed Bat	<i>Chiroptera</i>		LC
<i>Lepus nigricollis</i>	Black-naped Hare	<i>Leporidae</i>	Schedule IV	LC
<i>Bendicota bengalensis</i>	Indian mole rat	<i>Muridae</i>		LC
<i>Bendicota indica</i>	Bandicoot rat	<i>Muridae</i>		LC
<i>Mus booduga</i>	Little Indian Field mouse	<i>Muridae</i>	V	LC
<i>Mus musculus</i>	House Mouse	<i>Muridae</i>	V	LC
<i>Rattus rattus</i>	House rat	<i>Muridae</i>		LC
<i>Funambulus palmarum</i>	Three striped palm squirrel	<i>Sciuridae</i>		LC

D.5.5 List of Butterflies observed in the study area

Scientific Name	Common Name
<i>Acraea violae</i>	Tawny Coster
<i>Danaus chrysippus chrysippus</i>	Plain Tiger
<i>Danaus genutia genutia</i>	Striped Tiger
<i>Euploea core core</i>	Common Crow
<i>Phalanta phalantha phalantha</i>	Common Leopard
<i>Precis lemonias lemonias</i>	Lemon Pansy
<i>Precis orithya ocyale</i>	Blue Pansy
<i>Chilades laius</i>	Lime Blue
<i>Everes lacturnus syntala</i>	Indian Cupid
<i>Freyeria trochylus</i>	Grass Jewel
<i>Jamides celeno aelianus</i>	Common Cerulean
<i>Tarucus nara Kollar</i>	Rounded Pierrot
<i>Colotis etrida</i>	Small or Little Orange Tip
<i>Colotis eucharis eucharis</i>	Plain Orange Tip
<i>Catopsilia pomona</i>	Common Emigrant
<i>Eurema hecate simulata</i>	Common Grass Yellow
<i>Papilio demoleus</i>	Lime Butterfly
<i>Papilio polytes polytes</i>	Common Mormon
<i>Papilio polytes stichius</i>	Common Mormon

APPENDIX E
NATIONAL AMBIENT AIR QUALITY
STANDARDS



भारत का राजपत्र

The Gazette of India

असाधारण

EXTRAORDINARY

भाग III—खण्ड 4

PART III—Section 4

प्राधिकार से प्रकाशित

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राष्ट्रीय परिवेशी वायु गुणवत्ता मानक

केन्द्रीय प्रदूषण नियंत्रण बोर्ड

अधिसूचना

नई दिल्ली, 18 नवम्बर, 2009

सं. बी-२९०१६/२०/९०/पी.सी.आई.-L—वायु (प्रदूषण नियंत्रण एवं नियन्त्रण) अधिनियम, १९८१ (१९८१ का १३) की धारा १६ की उपधारा (२) (एच) द्वारा प्रदत्त शक्तियों का प्रयोग करते हुए तथा अधिसूचना संख्या का.आ. ३८४(ई), दिनांक ११ अप्रैल, १९९४ और का.आ. ९३५ (ई) दिनांक १४ अक्टूबर १९९८ के अधिक्रमण में केन्द्रीय प्रदूषण नियंत्रण बोर्ड इसके द्वारा तत्काल प्रभाव से राष्ट्रीय परिवेशी वायु गुणवत्ता मानक अधिसूचित करता है, जो इस प्रकार है:-

राष्ट्रीय परिवेशी वायु गुणवत्ता मानक

क्र. सं.	प्रदूषक	समय आधारित औसत	परिवेशी वायु में सान्द्रण		
			औद्योगिक, रिहायशी, ग्रामीण और अन्य क्षेत्र	पारिस्थितिकी य संवेदनशील क्षेत्र (केन्द्र सरकार, द्वारा अधिसूचित)	प्रबोधन की पद्धति
(1)	(2)	(3)	(4)	(5)	(6)
1	सल्फर डाई आक्साइड (SO_2), $\mu\text{g}/\text{m}^3$	वार्षिक* 24 घंटे**	50 80	20 80	-उन्नत वैस्ट और गाईक -पराबैगनी परिवीप्ति
2	नाइट्रोजन डाई आक्साइड (NO_2), $\mu\text{g}/\text{m}^3$	वार्षिक* 24 घंटे**	40 80	30 80	-उप्रांतरित जैकब और हॉवाइजर (सोडियम-आर्सेनाईट) -रासायनिक संदाहि
3	विविक्त पदार्थ (१०माइक्रोन से कम आकार)या PM_{10} , $\mu\text{g}/\text{m}^3$	वार्षिक* 24 घंटे**	60 100	60 100	-हरात्मक विश्लेषण -टोयम -बीटा तनुकरण पद्धति

4	विविक्त पदार्थ (2.5 माइक्रोन से कम आकार या $PM_{2.5}$, $\mu\text{g}/\text{m}^3$)	वार्षिक* 24 घंटे**	40 60	40 60	-हरात्मक विश्लेषण -टोयम -बीटा तनुकरण पद्धति
5	ओजोन (O_3) $\mu\text{g}/\text{m}^3$	8 घंटे** 1 घंटा**	100 180	100 180	-पराबैगनी द्विपदिकाल -रासायनिक संदीधि -रासायनिक पद्धति
6	सीसा (Pb) $\mu\text{g}/\text{m}^3$	वार्षिक* 24 घंटे**	0.50 1.0	0.50 1.0	ई.पी.एम 2000 या समरूप फिल्टर पेपर का प्रयोग करके AAS/ICP पद्धति -टेफलोन फिल्टर पेपर का प्रयोग करते हुए ED-XRF
7	कार्बन मोनोक्साइड (CO) mg/m^3	8 घंटे** 1 घंटा**	02 04	02 04	-अविपेक्षी अवरक्त (NDIR) स्पैक्ट्रम मापन
8	अमोनिया (NH_3) $\mu\text{g}/\text{m}^3$	वार्षिक* 24 घंटे**	100 400	100 400	-रासायनिक संदीधि -इंजोफिनॉल ब्ल्यू पद्धति
9	बैन्जीन (C_6H_6) $\mu\text{g}/\text{m}^3$	वार्षिक*	05	05	- गैस क्रोमेटोग्राफी आधारित सतत विश्लेषक -अधिशोषण तथा निशोषण के बाद गैस क्रोमेटोग्राफी
10	बैन्जो (ए) पाईरीन (BaP) केवल विविक्त कण, ng/m^3	वार्षिक*	01	01	-रिसायक निष्कर्षण के बाद HPLC/GC द्वारा विश्लेषण
11	आसैनिक (As) ng/m^3	वार्षिक*	06	06	-असंवितरक अवरक्त स्पैक्ट्रामिट्री ई.पी.एम. 2000 या समरूप फिल्टर पेपर का प्रयोग करके ICP/AAS पद्धति
12	निकिल (Ni) ng/m^3	वार्षिक*	20	20	ई.पी.एम. 2000 या समरूप फिल्टर पेपर का प्रयोग करके ICP/AAS पद्धति

* वर्ष में एक समान अतंरालों पर सप्ताह में दो बार प्रति 24 घंटे तक किसी एक स्थान विशेष पर लिये गये न्यूनतम 104 मापों का वार्षिक अंकगणीतीय औसत ।

** वर्ष में 98 प्रतिशत समय पर 24 घंटे या 8 घंटे या 1 घंटा के मानीटर मापमान, जो लागू हो, अनुपालन करे जाएंगे । दो प्रतिशत समय पर यह मापमान अधिक हो सकता है, किन्तु क्रमिक दो मानीटर करने के दिनों पर नहीं ।

टिप्पणी:

- जब कभी और जहां भी किसी अपने-अपने प्रवर्ग के लिये दो क्रमिक प्रबोधन दिनों पर मापित मूल्य, उपर विनिर्दिष्ट सीमा से अधिक हो तो इसे नियमित या निरंतर प्रबोधन तथा अतिरिक्त अन्वेषण करवाने के लिये पर्याप्त कारण समझा जायेगा ।

संत प्रसाद गौतम, अध्यक्ष

[विज्ञापन-III/4/184/09/असा.]

टिप्पणी: राष्ट्रीय परिवेशी वायु गुणवत्ता मानक संबंधी अधिसूचनाएँ, केन्द्रीय प्रदूषण नियंत्रण बोर्ड द्वारा भारत के राजपत्र आसाधरण में अधिसूचना संख्या का.आ. 384 (ई), दिनांक 11 अप्रैल, 1994 एवं का.आ. 935 (ई), दिनांक 14 अक्टूबर, 1998 द्वारा प्रकाशित की गयी थीं ।

NATIONAL AMBIENT AIR QUALITY STANDARDS
CENTRAL POLLUTION CONTROL BOARD
NOTIFICATION

New Delhi, the 18th November, 2009

No. B-29016/20/90/PCB-L—In exercise of the powers conferred by Sub-section (2) (h) of section 16 of the Air (Prevention and Control of Pollution) Act, 1981 (Act No.14 of 1981), and in supersession of the Notification No(s). S.O. 384(E), dated 11th April, 1994 and S.O. 935(E), dated 14th October, 1998, the Central Pollution Control Board hereby notify the National Ambient Air Quality Standards with immediate effect, namely:-

NATIONAL AMBIENT AIR QUALITY STANDARDS

S. No.	Pollutant	Time Weighted Average	Concentration in Ambient Air		
			Industrial, Residential, Rural and Other Area	Ecologically Sensitive Area (notified by Central Government)	Methods of Measurement
(1)	(2)	(3)	(4)	(5)	(6)
1	Sulphur Dioxide (SO ₂), $\mu\text{g}/\text{m}^3$	Annual*	50	20	- Improved West and Gaeke -Ultraviolet fluorescence
		24 hours**	80	80	
2	Nitrogen Dioxide (NO ₂), $\mu\text{g}/\text{m}^3$	Annual*	40	30	- Modified Jacob & Hochheiser (Na- Arsenite)
		24 hours**	80	80	- Chemiluminescence
3	Particulate Matter (size less than $10\mu\text{m}$) or PM ₁₀ $\mu\text{g}/\text{m}^3$	Annual*	60	60	- Gravimetric - TOEM
		24 hours**	100	100	- Beta attenuation
4	Particulate Matter (size less than $2.5\mu\text{m}$) or PM _{2.5} $\mu\text{g}/\text{m}^3$	Annual*	40	40	- Gravimetric - TOEM
		24 hours**	60	60	- Beta attenuation
5	Ozone (O ₃) $\mu\text{g}/\text{m}^3$	8 hours**	100	100	- UV photometric
		1 hour**	180	180	- Chemiluminescence - Chemical Method
6	Lead (Pb) $\mu\text{g}/\text{m}^3$	Annual*	0.50	0.50	- AAS /ICP method after sampling on EPM 2000 or equivalent filter paper
		24 hours**	1.0	1.0	- ED-XRF using Teflon filter
7	Carbon Monoxide (CO) mg/m^3	8 hours**	02	02	- Non Dispersive Infra Red (NDIR) spectroscopy
		1 hour**	04	04	
8	Ammonia (NH ₃) $\mu\text{g}/\text{m}^3$	Annual*	100	100	- Chemiluminescence
		24 hours**	400	400	- Indophenol blue method

(1)	(2)	(3)	(4)	(5)	(6)
9	Benzene (C_6H_6) $\mu g/m^3$	Annual*	05	05	- Gas chromatography based continuous analyzer - Adsorption and Desorption followed by GC analysis
10	Benzo(a)Pyrene (BaP) - particulate phase only, ng/m^3	Annual*	01	01	- Solvent extraction followed by HPLC/GC analysis
11	Arsenic (As), ng/m^3	Annual*	06	06	- AAS /ICP method after sampling on EPM 2000 or equivalent filter paper
12	Nickel (Ni), ng/m^3	Annual*	20	20	- AAS /ICP method after sampling on EPM 2000 or equivalent filter paper

* Annual arithmetic mean of minimum 104 measurements in a year at a particular site taken twice a week 24 hourly at uniform intervals.

** 24 hourly or 08 hourly or 01 hourly monitored values, as applicable, shall be complied with 98% of the time in a year. 2% of the time, they may exceed the limits but not on two consecutive days of monitoring.

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.

SANT PRASAD GAUTAM, Chairman
[ADVT-III/4/184/09/Exty.]

Note: The notifications on National Ambient Air Quality Standards were published by the Central Pollution Control Board in the Gazette of India, Extraordinary vide notification No(s). S.O. 384(E), dated 11th April, 1994 and S.O. 935(E), dated 14th October, 1998.

APPENDIX F
NATIONAL AMBIENT NOISE
STANDARDS

THE NOISE POLLUTION (REGULATION AND CONTROL) RULES, 2000

(The Principal Rules were published in the Gazette of India, vide S.O. 123(E), dated 14.2.2000 and subsequently amended vide S.O. 1046(E), dated 22.11.2000, S.O. 1088(E), dated 11.10.2002, S.O. 1569 (E), dated 19.09.2006 and S.O. 50 (E) dated 11.01.2010 under the Environment (Protection) Act, 1986.)

Whereas the increasing ambient noise levels in public places from various sources, inter-alia, industrial activity, construction activity, fire crackers, sound producing instruments, generator sets, loud speakers, public address systems, music systems, vehicular horns and other mechanical devices have deleterious effects on human health and the psychological well being of the people; it is considered necessary to regulate and control noise producing and generating sources with the objective of maintaining the ambient air quality standards in respect of noise;

Whereas a draft of Noise Pollution (Control and Regulation) Rules, 1999 was published under the notification of the Government of India in the Ministry of Environment and Forests vide number S.O. 528 (E), dated the 28th June, 1999 inviting objections and suggestions from all the persons likely to be affected thereby, before the expiry of the period of sixty days from the date on which the copies of the Gazette containing the said notification are made available to the public;

And whereas copies of the said Gazette were made available to the public on the 1st day of July, 1999;

And whereas the objections and suggestions received from the public in respect of the said draft rules have been duly considered by the Central Government;

Now, therefore, in exercise of the powers conferred by clause (ii) of sub-section (2) of section 3, sub-section (1) and clause (b) of sub-section (2) of section 6 and section 25 of the Environment (Protection) Act, 1986 (29 of 1986) read with rule 5 of the Environment (Protection) Rules, 1986, the Central Government hereby makes the following rules for the regulation and control of noise producing and generating sources, namely:-

The Noise Pollution (Regulation and Control) Rules, 2000

1. Short-title and commencement.-

(1) These rules may be called the 'Noise Pollution (Regulation and Control) Rules, 2000.

(2) They shall come into force on the date of their publication in the Official Gazette.

2. Definitions- In these rules, unless the context otherwise requires,-

- (a) "Act" means the Environment (Protection) Act, 1986 (29 of 1986);
- (b) "area / zone" means all areas which fall in either of the four categories given in the Schedule annexed to these rules;
- (c) "authority" means and includes any authority or officer authorized by the Central Government, or as the case may be, the State Government in accordance with the laws in force and includes a District Magistrate, Police Commissioner, or any other officer not below the rank of the Deputy Superintendent of Police designated for the maintenance of the ambient air quality standards in respect of noise under any law for the time being in force;
- (d) "court" means a governmental body consisting of one or more judges who sit to adjudicate disputes and administer justice and includes any court of law presided over by a judge, judges or a magistrate and acting as a tribunal in civil, taxation and criminal cases;
- (e) "educational institution" means a school, seminary, college, university, professional academies, training institutes or other educational establishment, not necessarily a chartered institution and includes not only buildings, but also all grounds necessary for the accomplishment of the full scope of educational instruction, including those things essential to mental, moral and physical development;
- (f) "hospital" means an institution for the reception and care of sick, wounded, infirm or aged persons, and includes government or private hospitals, nursing homes and clinics;
- (g) "person" shall include any company or association or body of individuals, whether incorporated or not;
- (h) "State Government" in relation to a Union territory means the Administrator thereof appointed under article 239 of the Constitution.
- (i) "public place" means any place to which the public have access, whether as of right or not, and includes auditorium, hotels, public waiting rooms, convention centres, public offices, shopping malls, cinema halls, educational institutions, libraries, open grounds and the like which are visited by general public; and
- (j) "night time" means the period between 10.00 p.m. and 6.00 a.m.

3. Ambient air quality standards in respect of noise for different areas/zones.-

(1) The ambient air quality standards in respect of noise for different areas / zones shall be such as specified in the Schedule annexed to these rules.

(2) The State Government shall categorize the areas into industrial, commercial, residential or silence areas / zones for the purpose of implementation of noise standards for different areas.

(3) The State Government shall take measures for abatement of noise including noise emanating from vehicular movements, blowing of horns, bursting of sound emitting firecrackers, use of loud speakers or public address system and sound producing instruments and ensure that the existing noise levels do not exceed the ambient air quality standards specified under these rules.

(4) All development authorities, local bodies and other concerned authorities while planning developmental activity or carrying out functions relating to town and country planning shall take into consideration all aspects of noise pollution as a parameter of quality of life to avoid noise menace and to achieve the objective of maintaining the ambient air quality standards in respect of noise.

(5) An area comprising not less than 100 metres around hospitals, educational institutions and courts may be declared as silence area / zone for the purpose of these rules.

4. Responsibility as to enforcement of noise pollution control measures.-

(1) The noise levels in any area / zone shall not exceed the ambient air quality standards in respect of noise as specified in the Schedule.

(2) The authority shall be responsible for the enforcement of noise pollution control measures and the due compliance of the ambient air quality standards in respect of noise.

(3) The respective State Pollution Control Boards or Pollution Control Committees in consultation with the Central Pollution Control Board shall collect, compile and publish technical and statistical data relating to noise pollution and measures devised for its effective prevention, control and abatement.

5. Restrictions on the use of loud speakers / public address system and sound producing instruments:-

- (1) A loud speaker or a public address system shall not be used except after obtaining written permission from the authority.
- (2) A loud speaker or a public address system or any sound producing instrument or a musical instrument or a sound amplifier shall not be used at night time except in closed premises for communication within, like auditoria, conference rooms, community halls, banquet halls or during a public emergency.
- (3) Notwithstanding any thing contained in sub-rule (2), the State Government may subject to such terms and conditions as are necessary to reduce noise pollution, permit use of loud speakers or public address system and the like during night hours (between 10.00 p.m. to 12.00 midnight) on or during any cultural or religious festive occasion of a limited duration not exceeding fifteen days in all during a calendar year. The concerned State Government shall generally specify in advance, the number and particulars of the days on which such exemption would be operative.
- (4) The noise level at the boundary of the public place, where loudspeaker or public address system or any other noise source is being used shall not exceed 10 dB (A) above the ambient noise standards for the area or 75 dB (A) whichever is lower;
- (5) The peripheral noise level of a privately owned sound system or a sound producing instrument shall not, at the boundary of the private place, exceed by more than 5 dB (A) the ambient noise standards specified for the area in which it is used.

5A. Restrictions on the use of horns, sound emitting construction equipments and bursting of fire crackers:-

- (1) No horn shall be used in silence zones or during night time in residential areas except during a public emergency.
- (2) Sound emitting fire crackers shall not be burst in silence zone or during night time.
- (3) Sound emitting construction equipments shall not be used or operated during night time in residential areas and silence zones.

6. Consequences of any violation in silence zone / area.-

Whoever, in any place covered under the silence zone / area commits any of the following offence, he shall be liable for penalty under the provisions of the Act:-

- (i) whoever, plays any music or uses any sound amplifiers,
- (ii) whoever, beats a drum or tom-tom or blows a horn either musical or pressure, or trumpet or beats or sounds any instrument, or
- (iii) whoever, exhibits any mimetic, musical or other performances of a nature to attract crowds.
- (iv) whoever, bursts sound emitting fire crackers; or
- (v) whoever, uses a loud speaker or a public address system.

7. Complaints to be made to the authority.-

(1) A person may, if the noise level exceeds the ambient noise standards by 10 dB (A) or more given in the corresponding columns against any area / zone or, if there is a violation of any provision of these rules regarding restrictions imposed during night time, make a complaint to the authority.

(2) The authority shall act on the complaint and take action against the violator in accordance with the provisions of these rules and any other law in force.

8 Power to prohibit etc. continuance of music sound or noise.-

(1) If the authority is satisfied from the report of an officer incharge of a police station or other information received by him including from the complainant that it is necessary to do so in order to prevent annoyance, disturbance, discomfort or injury or risk of annoyance, disturbance, discomfort or injury to the public or to any person who dwell or occupy property on the vicinity, he may, by a written order issue such directions as he may consider necessary to any person for preventing, prohibiting, controlling or regulating:-

- (a) the incidence or continuance in or upon any premises of
 - (i) any vocal or instrumental music,
 - (ii) sounds caused by playing, beating, clashing, blowing or use in any manner whatsoever of any instrument including loudspeakers, public address systems, horn, construction

equipment, appliance or apparatus or contrivance which is capable of producing or re-producing sound, or

(iii) sound caused by bursting of sound emitting fire crackers, or,

(b) the carrying on in or upon, any premises of any trade, avocation or operation or process resulting in or attended with noise.

(2) The authority empowered under sub-rule (1) may, either on its own motion, or on the application of any person aggrieved by an order made under sub-rule (1), either rescind, modify or alter any such order:

Provided that before any such application is disposed of, the said authority shall afford to the applicant and to the original complainant, as the case may be, an opportunity of appearing before it either in person or by a person representing him and showing cause against the order and shall, if it rejects any such application either wholly or in part, record its reasons for such rejection.

SCHEDULE

(see rule 3(1) and 4(1))

Ambient Air Quality Standards in respect of Noise

Area Code	Category of Area / Zone	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:-
1. Day time shall mean from 6.00 a.m. to 10.00 p.m.
 2. Night time shall mean from 10.00 p.m. to 6.00 a.m.
 3. Silence zone is an area comprising not less than 100 metres around hospitals, educational institutions, courts, religious places or any other area which is declared as such by the competent authority
 4. Mixed categories of areas may be declared as one of the four above mentioned categories by the competent authority.

* dB(A) Leq denotes the time weighted average of the level of sound in decibels on scale A which is relatable to human hearing.

A “decibel” is a unit in which noise is measured.

“A”, in dB(A) Leq, denotes the frequency weighting in the measurement of noise and corresponds to frequency response characteristics of the human ear.

Leq: It is an energy mean of the noise level over a specified period.

APPENDIX G
IS 10500-2012, DRINKING
WATER STANDARDS

भारतीय मानक
पीने का पानी — विशिष्ट
(दूसरा पुनरीक्षण)
Indian Standard
DRINKING WATER — SPECIFICATION
(*Second Revision*)

ICS 13.060.20

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

**AMENDMENT NO. 1 JUNE 2015
TO
IS 10500 : 2012 DRINKING WATER — SPECIFICATION**

(Second Revision)

[*Page 2, Table 2, Sl No. xii), col 3*] — Substitute ‘1.0’ for ‘0.3’.

[*Page 3, Table 3, Sl No. x), col 4*] — Substitute ‘No relaxation’ for ‘0.05’.

(FAD 14)

Publication Unit, BIS, New Delhi, India

FOREWORD

This Indian Standard (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Drinking Water Sectional Committee had been approved by the Food and Agriculture Division Council.

This standard was originally published in 1983. A report prepared by the World Health Organization in cooperation with the World Bank showed that in 1975, some 1 230 million people were without safe water supplies. These appalling facts were central to the United Nations decision to declare an International Drinking Water Supply and Sanitation decade, beginning in 1981. Further, the VI Five-Year Plan of India had made a special provision for availability of safe drinking water for the masses. Therefore, the standard was formulated with the objective of assessing the quality of water resources, and to check the effectiveness of water treatment and supply by the concerned authorities.

The first revision was undertaken to take into account the up-to-date information available about the nature and effect of various contaminants as also the new techniques for identifying and determining their concentration. Based on experience gained additional requirements for alkalinity; aluminium and boron were incorporated and the permissible limits for dissolved solids, nitrate and pesticides residues modified.

As per the eleventh five year plan document of India (2007-12), there are about 2.17 lakh quality affected habitations in the country with more than half affected with excess iron, followed by fluoride, salinity, nitrate and arsenic in that order. Further, approximately, 10 million cases of diarrhoea, more than 7.2 lakh typhoid cases and 1.5 lakh viral hepatitis cases occur every year a majority of which are contributed by unclean water supply and poor sanitation. The eleventh five year plan document of India (2007-2012) recognizes dealing with the issue of water quality as a major challenge and aims at addressing water quality problems in all quality affected habitations with emphasis on community participation and awareness campaigns as well as on top most priority to water quality surveillance and monitoring by setting up of water quality testing laboratories strengthened with qualified manpower, equipments and chemicals.

The second revision was undertaken to upgrade the requirements of the standard and align with the internationally available specifications on drinking water. In this revision assistance has been derived from the following:

- a) EU Directives relating to the quality of water intended for human consumption (80/778/EEC) and Council Directive 98/83/EC.
- b) USEPA standard — National Primary Drinking Water Standard. EPA 816-F-02-013 dated July, 2002.
- c) WHO Guidelines for Drinking Water Quality. 3rd Edition Vol. 1 Recommendations, 2008.
- d) Manual on Water Supply and Treatment, third edition — revised and updated May 1999, Ministry of Urban Development, New Delhi.

This standard specifies the acceptable limits and the permissible limits in the absence of alternate source. It is recommended that the acceptable limit is to be implemented as values in excess of those mentioned under 'Acceptable' render the water not suitable. Such a value may, however, be tolerated in the absence of an alternative source. However, if the value exceeds the limits indicated under 'permissible limit in the absence of alternate source' in col 4 of Tables 1 to 4, the sources will have to be rejected.

Pesticide residues limits and test methods given in Table 5 are based on consumption pattern, persistence and available manufacturing data. The limits have been specified based on WHO guidelines, wherever available. In cases where WHO guidelines are not available, the standards available from other countries have been examined and incorporated, taking in view the Indian conditions.

In this revision, additional requirements for ammonia, chloramines, barium, molybdenum, silver, sulphide, nickel, polychlorinated biphenyls and trihalomethanes have been incorporated while the requirements for colour, turbidity, total hardness, free residual chlorine, iron, magnesium, mineral oil, boron, cadmium, total arsenic, lead, polynuclear aromatic hydrocarbons, pesticides and bacteriological requirements have been modified.

In this revision, requirement and test method for virological examination have been included. Further, requirements and test methods for cryptosporidium and giardia have also been specified.

Routine surveillance of drinking water supplies should be carried out by the relevant authorities to understand the risk of specific pathogens and to define proper control procedures. The WHO Guidelines for Drinking Water Quality, 3rd Edition, Vol. 1 may be referred for specific recommendations on using a water safety approach incorporating risk identification. Precautions/Care should be taken to prevent contamination of drinking water from chlorine resistant parasites such as cryptosporidium species and giardia.

Indian Standard

DRINKING WATER — SPECIFICATION

(Second Revision)

1 SCOPE

This standard prescribes the requirements and the methods of sampling and test for drinking water.

2 REFERENCES

The standards listed in Annex A contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated in Annex A.

3 TERMINOLOGY

For the purpose of this standard the following definition shall apply.

3.1 Drinking Water — Drinking water is water intended for human consumption for drinking and cooking purposes from any source. It includes water (treated or untreated) supplied by any means for human consumption.

4 REQUIREMENTS

Drinking water shall comply with the requirements given in Tables 1 to 4. The analysis of pesticide residues given in Table 3 shall be conducted by a recognized laboratory using internationally established test method meeting the residue limits as given in Table 5.

Drinking water shall also comply with bacteriological requirements (see 4.1), virological requirements (see 4.2) and biological requirements (see 4.3).

4.1 Bacteriological Requirements

4.1.1 Water in Distribution System

Ideally, all samples taken from the distribution system including consumers' premises, should be free from coliform organisms and the following bacteriological quality of drinking water collected in the distribution system, as given in Table 6 is, therefore specified when tested in accordance with IS 1622.

4.2 Virological Requirements

4.2.1 Ideally, all samples taken from the distribution

Table 1 Organoleptic and Physical Parameters
(Foreword and Clause 4)

Sl No.	Characteristic	Requirement (Acceptable Limit)	Permissible Limit in the Absence of Alternate Source	Method of Test, Ref to Part of IS 3025	Remarks
(1)	(2)	(3)	(4)	(5)	(6)
i)	Colour, Hazen units, Max	5	15	Part 4	Extended to 15 only, if toxic substances are not suspected in absence of alternate sources
ii)	Odour	Agreeable	Agreeable	Part 5	a) Test cold and when heated b) Test at several dilutions
iii)	pH value	6.5-8.5	No relaxation	Part 11	—
iv)	Taste	Agreeable	Agreeable	Parts 7 and 8	Test to be conducted only after safety has been established
v)	Turbidity, NTU, Max	1	5	Part 10	—
vi)	Total dissolved solids, mg/l, Max	500	2 000	Part 16	—

NOTE — It is recommended that the acceptable limit is to be implemented. Values in excess of those mentioned under 'acceptable' render the water not suitable, but still may be tolerated in the absence of an alternative source but up to the limits indicated under 'permissible limit in the absence of alternate source' in col 4, above which the sources will have to be rejected.

Table 2 General Parameters Concerning Substances Undesirable in Excessive Amounts
(Foreword and Clause 4)

Sl No.	Characteristic	Requirement (Acceptable Limit)	Permissible Limit in the Absence of Alternate Source	Method of Test, Ref to	Remarks
(1)	(2)	(3)	(4)	(5)	(6)
i)	Aluminium (as Al), mg/l, Max	0.03	0.2	IS 3025 (Part 55)	—
ii)	Ammonia (as total ammonia-N), mg/l, Max	0.5	No relaxation	IS 3025 (Part 34)	—
iii)	Anionic detergents (as MBAS) mg/l, Max	0.2	1.0	Annex K of IS 13428	—
iv)	Barium (as Ba), mg/l, Max	0.7	No relaxation	Annex F of IS 13428* or IS 15302	—
v)	Boron (as B), mg/l, Max	0.5	1.0	IS 3025 (Part 57)	—
vi)	Calcium (as Ca), mg/l, Max	75	200	IS 3025 (Part 40)	—
vii)	Chloramines (as Cl ₂), mg/l, Max	4.0	No relaxation	IS 3025 (Part 26)* or APHA 4500-Cl G	—
viii)	Chloride (as Cl), mg/l, Max	250	1 000	IS 3025 (Part 32)	—
ix)	Copper (as Cu), mg/l, Max	0.05	1.5	IS 3025 (Part 42)	—
x)	Fluoride (as F) mg/l, Max	1.0	1.5	IS 3025 (Part 60)	—
xi)	Free residual chlorine, mg/l, Min	0.2	1	IS 3025 (Part 26)	To be applicable only when water is chlorinated. Tested at consumer end. When protection against viral infection is required, it should be minimum 0.5 mg/l
xii)	Iron (as Fe), mg/l, Max	0.3	No relaxation	IS 3025 (Part 53)	Total concentration of manganese (as Mn) and iron (as Fe) shall not exceed 0.3 mg/l
xiii)	Magnesium (as Mg), mg/l, Max	30	100	IS 3025 (Part 46)	—
xiv)	Manganese (as Mn), mg/l, Max	0.1	0.3	IS 3025 (Part 59)	Total concentration of manganese (as Mn) and iron (as Fe) shall not exceed 0.3 mg/l
xv)	Mineral oil, mg/l, Max	0.5	No relaxation	Clause 6 of IS 3025 (Part 39) Infrared partition method	—
xvi)	Nitrate (as NO ₃), mg/l, Max	45	No relaxation	IS 3025 (Part 34)	—
xvii)	Phenolic compounds (as C ₆ H ₅ OH), mg/l, Max	0.001	0.002	IS 3025 (Part 43)	—
xviii)	Selenium (as Se), mg/l, Max	0.01	No relaxation	IS 3025 (Part 56) or IS 15303*	—
xix)	Silver (as Ag), mg/l, Max	0.1	No relaxation	Annex J of IS 13428	—
xx)	Sulphate (as SO ₄) mg/l, Max	200	400	IS 3025 (Part 24)	May be extended to 400 provided that Magnesium does not exceed 30
xxi)	Sulphide (as H ₂ S), mg/l, Max	0.05	No relaxation	IS 3025 (Part 29)	—
xxii)	Total alkalinity as calcium carbonate, mg/l, Max	200	600	IS 3025 (Part 23)	—
xxiii)	Total hardness (as CaCO ₃), mg/l, Max	200	600	IS 3025 (Part 21)	—
xxiv)	Zinc (as Zn), mg/l, Max	5	15	IS 3025 (Part 49)	—

NOTES

1 In case of dispute, the method indicated by '*' shall be the referee method.

2 It is recommended that the acceptable limit is to be implemented. Values in excess of those mentioned under 'acceptable' render the water not suitable, but still may be tolerated in the absence of an alternative source but up to the limits indicated under 'permissible limit in the absence of alternate source' in col 4, above which the sources will have to be rejected.

Table 3 Parameters Concerning Toxic Substances
(Foreword and Clause 4)

SI No.	Characteristic	Requirement (Acceptable Limit)	Permissible Limit in the Absence of Alternate Source	Method of Test, Ref to	Remarks
(1)	(2)	(3)	(4)	(5)	(6)
i)	Cadmium (as Cd), mg/l, Max	0.003	No relaxation	IS 3025 (Part 41)	—
ii)	Cyanide (as CN), mg/l, Max	0.05	No relaxation	IS 3025 (Part 27)	—
iii)	Lead (as Pb), mg/l, Max	0.01	No relaxation	IS 3025 (Part 47)	—
iv)	Mercury (as Hg), mg/l, Max	0.001	No relaxation	IS 3025 (Part 48)/ Mercury analyser	—
v)	Molybdenum (as Mo), mg/l, Max	0.07	No relaxation	IS 3025 (Part 2)	—
vi)	Nickel (as Ni), mg/l, Max	0.02	No relaxation	IS 3025 (Part 54)	—
vii)	Pesticides, µg/l, Max	See Table 5	No relaxation	See Table 5	—
viii)	Polychlorinated biphenyls, mg/l, Max	0.000 5	No relaxation	ASTM 5175*	—
ix)	Polynuclear aromatic hydro- carbons (as PAH), mg/l, Max	0.000 1	No relaxation	APHA 6440	or APHA 6630 —
x)	Total arsenic (as As), mg/l, Max	0.01	0.05	IS 3025 (Part 37)	—
xi)	Total chromium (as Cr), mg/l, Max	0.05	No relaxation	IS 3025 (Part 52)	—
xii)	Trihalomethanes:				
a)	Bromoform, mg/l, Max	0.1	No relaxation	ASTM D 3973-85* or APHA 6232	—
b)	Dibromochloromethane, mg/l, Max	0.1	No relaxation	ASTM D 3973-85* or APHA 6232	—
c)	Bromodichloromethane, mg/l, Max	0.06	No relaxation	ASTM D 3973-85* or APHA 6232	—
d)	Chloroform, mg/l, Max	0.2	No relaxation	ASTM D 3973-85* or APHA 6232	—

NOTES

1 In case of dispute, the method indicated by '*' shall be the referee method.

2 It is recommended that the acceptable limit is to be implemented. Values in excess of those mentioned under 'acceptable' render the water not suitable, but still may be tolerated in the absence of an alternative source but up to the limits indicated under 'permissible limit in the absence of alternate source' in col 4, above which the sources will have to be rejected.

Table 4 Parameters Concerning Radioactive Substances
(Foreword and Clause 4)

SI No.	Characteristic	Requirement (Acceptable Limit)	Permissible Limit in the Absence of Alternate Source	Method of Test, Ref to Part of IS 14194	Remarks
(1)	(2)	(3)	(4)	(5)	(6)
i)	Radioactive materials:				
a)	Alpha emitters Bq/l, Max	0.1	No relaxation	Part 2	—
b)	Beta emitters Bq/l, Max	1.0	No relaxation	Part 1	—

NOTE — It is recommended that the acceptable limit is to be implemented. Values in excess of those mentioned under 'acceptable' render the water not suitable, but still may be tolerated in the absence of an alternative source but up to the limits indicated under 'permissible limit in the absence of alternate source' in col 4, above which the sources will have to be rejected.

Table 5 Pesticide Residues Limits and Test Method
(Foreword and Table 3)

Sl No.	Pesticide	Limit µg/l	Method of Test, Ref to	
			USEPA (4)	AOAC/ ISO (5)
(1)	(2)	(3)		
i)	Alachlor	20	525.2, 507	—
ii)	Atrazine	2	525.2, 8141 A	—
iii)	Aldrin/ Dieldrin	0.03	508	—
iv)	Alpha HCH	0.01	508	—
v)	Beta HCH	0.04	508	—
vi)	Butachlor	125	525.2, 8141 A	—
vii)	Chlorpyriphos	30	525.2, 8141 A	—
viii)	Delta HCH	0.04	508	—
ix)	2,4- Dichlorophenoxyacetic acid	30	515.1	—
x)	DDT (<i>o</i> , <i>p</i> and <i>p</i> , <i>p</i> – Isomers of DDT, DDE and DDD)	1	508	AOAC 990.06
xi)	Endosulfan (alpha, beta, and sulphate)	0.4	508	AOAC 990.06
xii)	Ethion	3	1657 A	—
xiii)	Gamma — HCH (Lindane)	2	508	AOAC 990.06
xiv)	Isoproturon	9	532	—
xv)	Malathion	190	8141 A	—
xvi)	Methyl parathion	0.3	8141 A	ISO 10695
xvii)	Monocrotophos	1	8141 A	—
xviii)	Phorate	2	8141 A	—

NOTE — Test methods are for guidance and reference for testing laboratory. In case of two methods, USEPA method shall be the reference method.

Table 6 Bacteriological Quality of Drinking Water¹⁾
(Clause 4.1.1)

Sl No.	Organisms	Requirements	
		(1)	(2)
i)	All water intended for drinking:		
	a) <i>E. coli</i> or thermotolerant coliform bacteria ^{2), 3)}	Shall not be detectable in any 100 ml sample	
ii)	Treated water entering the distribution system:		
	a) <i>E. coli</i> or thermotolerant coliform bacteria ²⁾	Shall not be detectable in any 100 ml sample	
	b) Total coliform bacteria	Shall not be detectable in any 100 ml sample	
iii)	Treated water in the distribution system:		
	a) <i>E. coli</i> or thermotolerant coliform bacteria	Shall not be detectable in any 100 ml sample	
	b) Total coliform bacteria	Shall not be detectable in any 100 ml sample	

¹⁾Immediate investigative action shall be taken if either *E.coli* or total coliform bacteria are detected. The minimum action in the case of total coliform bacteria is repeat sampling; if these bacteria are detected in the repeat sample, the cause shall be determined by immediate further investigation.

²⁾Although, *E. coli* is the more precise indicator of faecal pollution, the count of thermotolerant coliform bacteria is an acceptable alternative. If necessary, proper confirmatory tests shall be carried out. Total coliform bacteria are not acceptable indicators of the sanitary quality of rural water supplies, particularly in tropical areas where many bacteria of no sanitary significance occur in almost all untreated supplies.

³⁾It is recognized that, in the great majority of rural water supplies in developing countries, faecal contamination is widespread. Under these conditions, the national surveillance agency should set medium-term targets for progressive improvement of water supplies.

system including consumers' premises, should be free from virus.

4.2.2 None of the generally accepted sewage treatment methods yield virus-free effluent. Although a number of investigators have found activated sludge treatment to be superior to trickling filters from this point of view, it seems possible that chemical precipitation methods will prove to be the most effective.

4.2.3 Virus can be isolated from raw water and from springs, enterovirus, reovirus, and adenovirus have been found in water, the first named being the most resistant to chlorination. If enterovirus are absent from chlorinated water, it can be assumed that the water is safe to drink. Some uncertainty still remains about the virus of infectious hepatitis, since it has not so far been isolated but in view of the morphology and resistance of enterovirus it is likely that, if they have been inactivated hepatitis virus will have been inactivated also.

4.2.4 An exponential relationship exists between the rate of virus inactivation and the redox potential. A redox potential of 650 mV (measured between platinum and calomel electrodes) will cause almost instantaneous inactivation of even high concentrations of virus. Such a potential can be obtained with even a low concentration of free chlorine, but only with an extremely high concentration of combined chlorine. This oxidative inactivation may be achieved with a number of other oxidants also, for example, iodine, ozone and potassium permanganate, but the effect of the oxidants will always be counteracted, if reducing components, which are mainly organic, are present. As a consequence, the sensitivity of virus towards disinfectants will depend on the *milieu* just as much as on the particular disinfectant used.

4.2.5 Viruses are generally resistant to disinfectants as well as get protected on account of presence of particulate and organic matter in water. Because the difference between the resistance of coliform organisms and of virus to disinfection by oxidants increases with increasing concentration of reducing components, for example, organic matter, it cannot be assumed that the absence of available coliform organisms implies freedom from active virus under circumstances where a free chlorine residual cannot be maintained. Sedimentation and slow sand filtration in themselves may contribute to the removal of virus from water.

4.2.6 In practice, >0.5 mg/l of free chlorine for 1 h is sufficient to inactivate virus, even in water that was originally polluted provided the water is free from particulates and organic matter.

4.2.7 MS2 phage are indicator of viral contamination in drinking water. MS2 phage shall be absent in 1 litre of water when tested in accordance with USEPA method 1602. If MS2 phage are detected in the drinking water, virological examination shall be done by the Polymerase Chain Reaction (PCR) method for virological examination as given in Annex B. USEPA method in Manual of Method for Virology Chapter 16, June 2001 shall be the alternate method. If viruses are detected, the cause shall be determined by immediate further investigation.

4.3 Biological Requirements

4.3.1 Ideally, all samples taken including consumers premises should be free from biological organisms. Biological examination is of value in determining the causes of objectionable tastes and odours in water and controlling remedial treatments, in helping to interpret the results of various chemical analysis, and in explaining the causes of clogging in distribution pipes and filters. In some instances, it may be of use in demonstrating that water from one source has been mixed with that from another.

4.3.2 The biological qualities of water are of greater importance when the supply has not undergone the conventional flocculation and filtration processes, since increased growth of methane-utilizing bacteria on biological slimes in pipes may then be expected, and the development of bryozoal growths such as *Plumatella* may cause operational difficulties.

4.3.3 Some of the animalcules found in water mains may be free-living in the water, but others such as *Dreissena* and *Asellus* are more or less firmly attached to the inside of the mains. Although these animalcules are not themselves pathogenic, they may harbour pathogenic organisms or virus in their intestines, thus protecting these pathogens from destruction by chlorine.

4.3.4 Chlorination, at the dosages normally employed in waterworks, is ineffective against certain parasites, including amoebic cysts; they can be excluded only by effective filtration or by higher chlorine doses than can be tolerated without subsequent dechlorination. *Amoebiasis* can be conveyed by water completely free from enteric bacteria; microscopic examination after concentration is, therefore, the only safe method of identification.

4.3.5 Strict precautions against back-syphonage and cross-connections are required, if amoebic cysts are found in a distribution system containing tested water.

4.3.6 The cercariae of *schistosomiasis* can be detected by similar microscopic examination, but there is, in

any case, no evidence to suggest that this disease is normally spread through piped water supplies.

4.3.7 The cyclops vector of the embryos of *Dracunculus medinensis* which causes dracontiasis or Guinea-worm disease can be found in open wells in a number of tropical areas. They are identifiable by microscopic examination. Such well supplies are frequently used untreated, but the parasite can be relatively easily excluded by simple physical improvements in the form of curbs, drainage, and apron surrounds and other measures which prevent physical contact with the water source.

4.3.8 Cryptosporidium shall be absent in 10 liter of water when tested in accordance with USEPA method 1622 or USEPA method 1623* or ISO 15553 : 2006.

4.3.9 Giardia shall be absent in 10 liter of water when tested in accordance with USEPA method 1623* or ISO 15553 : 2006.

4.3.10 The drinking water shall be free from microscopic organisms such as algae, zooplanktons, flagellates, parasites and toxin producing organisms. An illustrative (and not exhaustive) list is given in Annex C for guidance.

NOTE — In case of dispute, the method indicated by '*' in **4.3.8** and **4.3.9** shall be referee method.

5 SAMPLING

Representative samples of water shall be drawn as prescribed in IS 1622 and IS 3025 (Part 1).

ANNEX A

(Clause 2)

LIST OF REFERRED INDIAN STANDARDS

IS No.	Title	IS No.	Title
1622 : 1981	Methods of sampling and microbiological examination of water (<i>first revision</i>)	(Part 41) : 1992	Cadmium (<i>first revision</i>)
3025	Methods of sampling and test (physical and chemical) for water and waste water:	(Part 42) : 1992	Copper (<i>first revision</i>)
(Part 1) : 1987	Sampling (<i>first revision</i>)	(Part 43) : 1992	Phenols (<i>first revision</i>)
(Part 2) : 2002	Determination of 33 elements by inductively coupled plasma atomic emission spectroscopy	(Part 46) : 1994	Magnesium
(Part 4) : 1983	Colour (<i>first revision</i>)	(Part 47) : 1994	Lead
(Part 5) : 1983	Odour (<i>first revision</i>)	(Part 48) : 1994	Mercury
(Part 7) : 1984	Taste threshold (<i>first revision</i>)	(Part 49) : 1994	Zinc
(Part 8) : 1984	Tasting rate (<i>first revision</i>)	(Part 52) : 2003	Chromium
(Part 10) : 1984	Turbidity (<i>first revision</i>)	(Part 53) : 2003	Iron
(Part 11) : 1983	pH value (<i>first revision</i>)	(Part 54) : 2003	Nickel
(Part 16) : 1984	Filterable residue (total dissolved solids) (<i>first revision</i>)	(Part 55) : 2003	Aluminium
(Part 21) : 1983	Total hardness (<i>first revision</i>)	(Part 56) : 2003	Selenium
(Part 23) : 1983	Alkalinity (<i>first revision</i>)	(Part 57) : 2005	Boron
(Part 24) : 1986	Sulphates (<i>first revision</i>)	(Part 59) : 2006	Manganese
(Part 26) : 1986	Chlorine residual (<i>first revision</i>)	(Part 60) : 2008	Fluoride
(Part 27) : 1986	Cyanide (<i>first revision</i>)	13428 : 2003	Packaged natural mineral water — Specification (<i>first revision</i>)
(Part 29) : 1986	Sulphide (<i>first revision</i>)	14194	Radionuclides in environmental samples — Method of estimation:
(Part 32) : 1988	Chloride (<i>first revision</i>)	(Part 1) : 1994	Gross beta activity measurement
(Part 34) : 1988	Nitrogen (<i>first revision</i>)	(Part 2) : 1994	Gross alpha activity measurement
(Part 37) : 1988	Arsenic (<i>first revision</i>)	15302 : 2002	Determination of aluminium and barium in water by direct nitrous oxide-acetylene flame atomic absorption spectrometry
(Part 39) : 1989	Oil and grease	15303 : 2002	Determination of antimony, iron and selenium in water by electrothermal atomic absorption spectrometry
(Part 40) : 1991	Calcium		

ANNEX B

(Clause 4.2.7)

POLYMERASE CHAIN REACTION (PCR) METHOD

B-1 GENERAL

The method involves the concentration of viruses from 100 litre of drinking water to 1 ml by membrane filter technique. The concentrate is subjected to amplification using polymerase chain reaction (PCR) and primers based on highly conserved regions of viral genomes. This method can detect as low as 10 genome copies. Stringent precautions are needed to avoid contamination with amplified DNA products leading to false positive reactions. Detection of hepatitis A virus (HAV) RNA and enterovirus (EV) RNA is considered as an indication of presence of viruses in water. Steps involved include concentration of water, RNA extraction, complementary DNA (cDNA) synthesis and PCR.

B-2 CONCENTRATION OF DRINKING WATER

B-2.1 Apparatus

B-2.1.1 Pressure Pump

B-2.1.2 Membrane Filter Assembly with 144 mm Diameter with Tripod Stand

B-2.1.3 Pressure Vessel (50 litre capacity) with Pressure Gauge

B-2.1.4 Inter-connecting Pressure Tubes

B-2.2 Reagents

Autoclaved double distilled water shall be used for the preparation of reagents/buffers in this study.

B-2.2.1 Aluminium Chloride

B-2.2.2 HCl/NaOH Urea (Extra Pure)

B-2.2.3 Disodium Hydrogen Phosphate ($Na_2HPO_4 \cdot 2H_2O$) — 0.2 M, filter sterilized.

B-2.2.4 Sodium Dihydrogen Phosphate ($NaH_2PO_4 \cdot 2H_2O$) — 0.2 M, filter sterilized.

B-2.2.5 Citric Acid — 0.1 M, filter sterilized.

B-2.2.6 L-Arginine — 0.5 M, filter sterilized.

B-2.2.7 Urea-Arginine Phosphate Buffer (U-APB) — Mix 4.5 g of urea with 2 ml of 0.2 M NaH_2PO_4 and 2 ml of 0.5 M L - Arginine and make up the volume to 50 ml with sterile distilled water. The pH of the eluent shall be 9.0.

B-2.2.8 Magnesium Chloride ($MgCl_2$) — 1 M.

B-2.2.9 McII Vaines Buffer (pH 5.0) — Mix 9.7 ml of

0.1 M citric acid with 10.3 ml of 0.2 M $Na_2HPO_4 \cdot 2H_2O$ under sterile conditions.

B-2.3 Procedure

Filter 100 litre of drinking water sample through membrane filter assembly using either positively charged membrane of 144 mm diameter or 0.22 micron diameter pore size nitrocellulose membrane. For positively charged membrane the test water pH need not be adjusted. But for the 0.22 micron nitrocellulose membrane adjust the pH to 3.5 after adding the aluminium chloride as a coagulant to a final concentration of 0.000 5 M.

At lower pH pass the water through the membrane. The flow rate shall be 40 litre/h approximately. After the completion of the filtration, elute the adsorbed particles using 100 ml of urea-arginine phosphate buffer (U-APB). Precipitate the suspended particles using 1 ml of magnesium chloride (1 M). Dissolve the resultant precipitate centrifuged out of the sample in 800-1.0 ml of McII vaines buffer. The processed sample can be stored at refrigerator until required.

B-3 RNA EXTRACTION

B-3.1 Apparatus

B-3.1.1 Cooling Centrifuge

B-3.1.2 Deep Freezer (-20°C)

B-3.1.3 Vortex Mixer

B-3.1.4 Pipette Man

B-3.2 Reagents

B-3.2.1 Cetyl Trimethyl Ammonium Bromide (CTAB) Buffer

CTAB	: 1 percent
Sodium Dodecyl Sulphate (SDS)	: 1 percent
EDTA	: 20 mM
Sodium Chloride	: 1 M

B-3.2.2 Phenol, Chloroform and Isoamylalcohol in the ratio of 25:24:1 (PCI)

B-3.2.3 Ethanol

B-3.2.4 TE Buffer (pH 8.0)

Tris base	:	1 M
EDTA	:	0.5 M

B-3.2.5 Sodium Acetate — 3 M.

B-3.3 Procedure

Treat 300 µl of concentrated water sample with equal volume of CTAB and 1/10th volume of PCI. Vortex and centrifuge at 5 000 × g for 30 min at 4°C. Add 1/10th volume of 3 M sodium acetate and double the volume of cold ethanol to the aqueous layer. Keep the mixture at either at -20°C for overnight or in liquid nitrogen for 2-5 min. Centrifuge at 10 000 × g, for 30 min at 4°C. Discard the supernatant and air dry the pellet and dissolve it in 20 µl TE buffer.

B-4 COMPLEMENTARY DNA (c DNA) SYNTHESIS**B-4.1 Apparatus****B-4.1.1 PCR Machine****B-4.1.2 Deep Freezer (-20°C)****B-4.2 Reagents****B-4.2.1 cDNA Synthesis Kit****B-4.3 Procedure**

Suspend the extracted RNA in 20 µl of cDNA reaction mixture, which consists of 4 µl of 5X reverse transcriptase reaction buffer [250 mM TRIS-HCl (pH 8.5), 40 mM KC1, 150 mM MgCl₂, 5 mM dithiothreitol (DTT)], 0.5 µl of 10 mM deoxynucleotide phosphate (dNTP), 2 µl of hexa nucleotide mixture, 1 µl of 25 U of Maloney Murine Leukaemia Virus (M-MuLV) reverse transcriptase, 0.5 µl of 20 U of human placental RNase inhibitor. Heat the reaction mixture to 95°C for 5 min and rapidly chill on ice, this is followed by the addition of 1 µl (25 U/µl) of M-MuLV reverse transcriptase. Incubate the reaction mixture as given by the manufacturer of the kit and quickly chill the reaction tube on ice.

B-5 PCR AMPLIFICATION**B-5.1 Apparatus****B-5.1.1 PCR Machine****B-5.1.2 Deep Freezer (-20°C)****B-5.1.3 Micropipette****B-5.2 Reagents****B-5.2.1 Primers for EV and HAV**

EV	sense primer, 5' — TCC TCC GGC CCC TGA ATG CG — 3'
	antisense primer, 5' — ATT GTC ACC ATA AGC AGC CA — 3'
HAV	sense primer, 5' — GTTTT GCTCC TCTTT ATCAT GCTAT G-3'

antisense primer, 5' — GGAAA TGTCT
CAGGT ACTTT CTTTG-3'

B-5.2.2 PCR Master Mix**B-5.2.3 Mineral Oil****B-5.3 Procedure****B-5.3.1 PCR Amplification for Hepatitis A Virus (HAV)**

In 5 µl of cDNA, add 95 µl of a PCR Master Mix (10 mM TRIS-HCl (pH 8.3), 50 mM KCl, 2.5 mM MgCl₂, 0.01 percent gelatin (1× PCR buffer), 200 µM of each dNTP, 1.5 U of *Thermus aquaticus* polymerase). Add 25 pico moles of sense and antisense oligonucleotide primers of HAV and overlay with mineral oil. Appropriate positive and negative controls shall be included with each run. Set the following reaction at thermo cycler:

Denaturation at 94°C for 2 min

Denaturation for	1.0 min	at 94°C	} 35 cycles
Annealing for	1.0 min	at 57°C	
Extension for	1.3 min	at 72°C	

Final extension at 72°C for 7 min.

B-5.3.2 PCR Amplification for Enterovirus (EV)

In 5 µl of cDNA, add 95 µl of a PCR Master Mix (10 mM TRIS-HCl (pH 8.3), 50 mM KCl, 2.5 mM MgCl₂, 0.01 percent gelatin (1X PCR buffer), 200 µM of each dNTP, 1.5 U of *Thermus aquaticus* polymerase). Add 25 pico moles of sense and antisense oligonucleotide primers of EV and overlay with mineral oil. Appropriate positive and negative controls shall be included with each run. Set the following reaction at thermo cycler:

Denaturation at 94°C for 2 min

Denaturation for	1.0 min	at 94°C	} 35 cycles
Annealing for	1.0 min	at 42°C	
Extension for	2.0 min	at 72°C	

Final extension at 72°C for 7 min.

B-6 AGAROSE GEL ELECTROPHORESIS**B-6.1 Apparatus****B-6.1.1 Micropipette****B-6.1.2 Electrophoresis Apparatus****B-6.1.3 Gel Documentation System****B-6.2 Reagents****B-6.2.1 Running Buffer — 50X TAE buffer**

Tris base/Tris buffer : 121.00 g

Glacial acetic acid : 28.55 ml
 0.5 M EDTA : 50.00 ml
 Distilled water : 300.45 ml
 (autoclaved)

Make the final volume upto 1 000 ml with deionised distilled water, sterilize and store at 4°C. The final concentration for the preparation of agarose gel and to run the gel shall be 1X.

B-6.2.2 Tracking Dye — 6X bromophenol blue.

B-6.2.3 Ethidium Bromide — 0.5 µg/ml.

B-6.3 Procedure

Run the PCR amplified product of EV and HAV on 1.5 percent agarose gel using 1X TAE buffer. Load 10 µl of amplified product after mixing it with 1 µl 10X loading dye. Run the molecular weight marker along with the samples. Run the electrophoresis at 100 V for 30 min. Stain the gel with ethidium bromide (0.5 µl/ml) for 20 min. Wash it with distilled water and view under UV transilluminator and photograph the gel to analyse the band pattern. EV gives the band as 155 base pair and the HAV gives band as 225 base pair.

ANNEX C

(Clause 4.3.10)

ILLUSTRATIVE LIST OF MICROSCOPIC ORGANISMS PRESENT IN WATER

Sl No.	Classification of Microscopic Organism	Group and Name of the Organism	Habitat	Effect of the Organisms and Significance
(1)	(2)	(3)	(4)	(5)
i) Algae	a) Chlorophyceae:			
	1) <i>Species of Coelastrum, Gomphosphaerium, Micractinium, Mougeotia, Oocystis, Euastrum, Scenedesmus, Actinastrum, Gonium, Eudorina Pandorina, Pediastrum, Zygnema, Chlamydomonas, Careteria, Chlorella, Chroococcus, Spirogyra, Tetraedron, Chlorogonium, Stigeoclonium</i>	Polluted water, impounded sources		Impart colouration
	2) <i>Species of Pandorina, Volvox, Gomphosphaerium, Staurastrum, Hydrodictyon, Nitella</i>	Polluted waters		Produce taste and odour
	3) <i>Species of Rhizoclonium, Cladothrix, Ankistrodesmus, Ulothrix, Micrasterias, Chromulina</i>	Clean water		Indicate clean condition
	4) <i>Species of Chlorella, Tribonema, Clostrum, Spirogyra, Palmella</i>	Polluted waters, impounded sources		Clog filters and create impounded difficulties
	b) Cyanophyceae:			
	1) <i>Species of Anacystis and Cylindrospermum</i>	Polluted waters		Cause water bloom and impart colour
	2) <i>Species of Anabena, Phormidium, Lyngbya, Arthospira, Oscillatoma</i>	Polluted waters		Impart colour
	3) <i>Species of Anabena, Anacystis, Aphanizomenon</i>	Polluted waters, impounded sources		Produce taste and odour
	4) <i>Species of Anacystis, Anabena, Coelosphaerium, Aphanizomenon</i>	Polluted waters		Toxin producing
	5) <i>Species of Anacystis, Rivularia, Oscillatoria, Anabena</i>	Polluted waters		Clog filters

<i>Sl No.</i>	<i>Classification of Microscopic Organism</i>	<i>Group and Name of the Organism</i>	<i>Habitat</i>	<i>Effect of the Organisms and Significance</i>
(1)	(2)	(3)	(4)	(5)
		6) <i>Species of Rivularia</i>	Calcareous waters and also rocks	Bores rocks and calcareous strata and causes matted growth
		7) <i>Species of Agmenellum, Microcoleus, Lemanea</i>	Clean waters	Indicators of purification
	c) Diatoms (Bacillareophyceae):			
		1) <i>Species of Fragillaria, Stephanodiscus, — Stauroneis</i>		Cause discoloration
		2) <i>Species of Asterionella, Tabellaria</i>	Hill streams high altitude, torrential and temperate waters	Taste and odour producing clog filters
		3) <i>Species of Synedra and Fragillavia</i>	Polluted waters	Taste and odour producing
		4) <i>Species of Nitzchia, Gomphonema</i>	Moderately polluted waters	Cause discoloration
		5) <i>Species of Cymbela, Synedra, Melosira, Navicula, Cyclotella, Fragillaria, Diatom, Pleurosigma</i>	Rivers and streams impounded sources	Clog filters and cause operational difficulties
		6) <i>Species of Pinularia, Surinella, Cyclotella, Meridion, Cocconeis</i>	Clean waters	Indicators of purification
	d) Xanthophyceae:			
		<i>Species of Botryococcus</i>	Hill streams, high altitude and temperate waters	Produces coloration
ii) Zooplankton	a) Protozoa:			
		1) Amoeba, Giardia, Lamblia, Diffugia, Actinophrys	Arcella, Polluted waters	Pollution indicators
		2) Endamoeba, Histolytica	Sewage and activated sludge	Parasitic and pathogenic
	b) Ciliates:			
		Paramoecium, Vorticella, Carchesium, Stentor, Colpidium, Coleps, Euplotes, Colopoda, Bodo	Highly polluted waters, sewage and activated sludge	Bacteria eaters
	c) Crustacea:			
		1) Bosmina, Daphnia	Stagnant polluted waters	Indicators of pollution
		2) Cyclops	Step wells in tropical climate	Carrier host of guinea worm
iii) Rotifers	a) Rotifers:			
		Anurea, Rotaria, Philodina	Polluted and Algae laden waters	Feed on algae
	b) Flagellates:			
		1) Ceratium, Glenodinium, Dinobryon	Peridinium	Rocky strata, iron bearing and acidic waters
		2) Euglena, Phacus	Polluted waters	Impart colour and fishy taste

<i>Sl No.</i>	<i>Classification of Microscopic Organism</i>	<i>Group and Name of the Organism</i>	<i>Habitat</i>	<i>Effect of the Organisms and Significance</i>
(1)	(2)	(3)	(4)	(5)
iv)	Miscellaneous Organisms	a) Sponges, Hydra b) Tubifex, Eristalls, Chironomids c) Plumatella c) Dreissena, Asellus	Fresh water Highly polluted waters, sewage and activated sludge and bottom deposits Polluted waters Polluted waters	Clog filters and affect purification systems Clog filters and render water unaesthetic Produces biological slimes and causes filter operational difficulties Harbour pathogenic organisms

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APPENDIX H

ISI-IS2296-1982 STANDARDS

FOR USE BASED CLASSIFICATION

OF INLAND SURFACE WATER

Tolerance and Classification

As per ISI-IS: 2296-1982, the tolerance limits of parameters are specified as per classified use of water (Table 1,2,3,4,5 below) depending on various uses of water. The following classifications have been adopted in India.

Class of Water

Classification	Type of use
Class A	Drinking water source without conventional treatment but after disinfection
Class B	Outdoor bathing
Class C	Drinking water source with conventional treatment followed by disinfection.
Class D	Fish culture and wild life propagation
Class E	Irrigation, industrial cooling or controlled waste disposal

TABLE- 2: TOLERANCE LIMITS FOR INLAND SURFACE WATERS, CLASS – B

S. (1)	Characteristic (2)	Tolerance Limit (3)
(i)	pH Value	6.5 to 8.5
(ii)	Dissolved Oxygen, mg/l, Max	5.0
(iii)	Biochemical Oxygen Demand (5 days at 20 °C), Max	3.0
(iv)	Total Coliform Organisms, MPN/100 ml, Max	500
(v)	Fluorides (as F), mg/l, Max	1.5
(vi)	Colour, Hazen units, Max	300
(vii)	Cyanides (as CN), mg/l, Max	0.05
(viii)	Arsenic (as As), mg/l, Max	0.2
(ix)	Phenolic Compounds (as C ₆ H ₅ OH) mg/l, Max	0.005
(x)	Chromium (as Cr ⁶⁺), mg/l, Max	1.0
(xi)	Anionic detergents (as MBAS), mg/l, Max	1.0
(xii)	Alpha emitters, $\mu\text{c}/\text{ml}$, Max	10^{-8}

TABLE - 3: TOLERANCE LIMITS FOR INLAND SURFACE WATERS, CLASS – C

S.No.	Characteristic	Tolerance Limit
(1)	(2)	(3)
(i)	pH Value	6.5 to 8.5
(ii)	Dissolved Oxygen, mg/l Minimum	4.0
(iii)	Biochemical Oxygen Demand	3.0
(iv)	Total coliform organisms, MPN/100 ml, Max	5000
(v)	Colour, Hazen units, Max	300
(vi)	Fluorides (as F), mg/l ,Max	1.5
(vii)	Cadmium (as Cd), mg/l, Max	0.01
(viii)	Chlorides (as Cl), mg/l, Max	600
(ix)	Chromium (as Cr ⁶⁺), mg/l, Max	0.05
(x)	Cyanides (as CN), mg/l, Max	0.05
(xi)	Total Dissolved Solids, mg/l, Max	1500
(xii)	Selenium (as Se), mg/l, Max	0.05
(xiii)	Sulphates (as SO ₄), mg/l, Max	400
(xiv)	Lead (as Pb), mg/l, Max	0.1
(xv)	Copper (as Cu),mg/l,Max	1.5
(xvi)	Arsenic (as As), mg/l, Max	0.2
(xvii)	Iron (as Fe), mg/l, Max	50
(xviii)	Phenolic compounds (as C ₆ H ₅ OH), mg/l, Max	0.005
(xix)	Zinc (as Zn), mg/l, Max	15
(xx)	Insecticides, mg/l, Max	Absent
(xxi)	Anionic detergents (as MBAS), mg/l, Max	1.0
(xxii)	Oils and grease, mg/l, Max	0.1
(xxiii)	Nitrates (as NO ₃), mg/1,Max	50
(xxiv)	Alpha emititers, μ c/mg, Max	10 ⁻⁹
(xxv)	Beta emitters, μ c/ml, Max	10 ⁻⁸

APPENDIX I

EMISSION LIMITS FOR NEW DIESEL

ENGINE UP TO AND MORE THAN

800 KW

EMISSION STANDARDS FOR DIESEL ENGINES (ENGINE RATING MORE THAN 0.8 MW (800 KW) FOR POWER PLANT, GENERATOR SET APPLICATIONS AND OTHER REQUIREMENTS

(Emission Standards for Diesel Engines (Engine Rating more than 0.8 MW (800 KW) were notified by the Environment (Protection) Third Amendment Rules 2002, vide G.S.R. 489 (E), dated 9thJuly, 2002 at serial no. 96, under the Environment (Protection) Act, 1986.)

EMISSION STANDARDS FOR DIESEL ENGINES (ENGINE RATING MORE THAN 0.8 MW (800 KW)) FOR POWER PLANT, GENERATOR SET APPLICATIONS AND OTHER REQUIREMENTS

TABLE

Parameter	Area Category	Total engine rating of the plant (includes existing as well as new generator sets)	Generator sets commissioning date					
			Before 1.7.2003	Between 1.7.2003 and 1.7.2005	On or after 1. 7. 2005			
NOx (as NO ₂) (AT 15% O ₂), dry basis, in ppmv	A	Upto 75 MW	1100	970	710			
	B	Upto 150 MW						
	A	More then 75 MW	1100	710	360			
	B	More then 150 MW						
NMHC (as C)(at 15% O ₂), mg/Nm ³	Both A and B		150	100				
PM (at 15% O ₂), mg/Nm ³	Diesel Fuels-HSD & LDO	Both A and B	75	75				
	Furnace Oils-LSHS & FO	Both A and B	150	100				
CO (at 15% O ₂), mg/Nm ³	Both A and B		150	150				
Sulphur Content in fuel	A		< 2%					
	B		< 4%					
Fuel specification	For A only	Up to 5MW	Only Diesel fuels (HSD, LDO) shall be used.					
Stack height (for generator sets commissioned after 1.7.2003)	Stack height shall be maximum of the following, in meter: (i) 14 Q ^{0.3} , Q= Total SO ₂ emission from the plant in kg/hr. (ii) Minimum 6 m. above the building where generator set is installed. (iii) 30 m.							

Note:

1. Acronyms used :

MW	:	Mega(10^6) Watt	FO	:	Furnace Oil
NO _x	:	Oxides of Nitrogen	HSD	:	High Speed Diesel
NO ₂	:	Nitrogen Dioxide	LDO	:	Light Diesel Oil
O ₂	:	Oxygen	LSHS	:	Low Sulphur Heavy Stock
NMHC	:	Non-Methane Hydrocarbon	kPa	:	Kilo Pascal
C	:	Carbon	mm	:	Milli (10^{-3}) metre
PM	:	Particulate Matter	kg/ hr	:	Kilo (10^3) gram per hour
CO	:	Carbon Monoxide	mg/Nm ³	:	milli (10^{-3}) gram per Normal meter cubic
SO ₂	:	Sulphur Dioxide			
ppmv	:	parts per million (10^6) by volume			

2. Area categories A and B are defined as follows:

Category A: Areas within the municipal limits of towns/cities having population more than 10 lakhs and also upto 5 km beyond the municipal limits of such towns/cities.

Category B: Areas not covered by category A.

3. The standards shall be regulated by the State Pollution Control Boards or Pollution Control Committees, as the case may be.
4. Individual units with engine ratings less than or equal to 800 KW are not covered by this notification.
5. Only following liquid fuels viz. High Speed Diesel, Light Diesel Oil, Low Sulphur Heavy Stock and Furnace Oil or liquid fuels with equivalent specifications shall be used in these power plants and generator sets.
6. For expansion project, stack height of new generator sets shall be as per total Sulphur Dioxide emission (including existing as well as additional load).
7. For multi engine plants, flues shall be grouped in cluster to get better plume rise and dispersion. Provision for any future expansion should be made in planning stage itself.
8. Particulate matter, Non- Methane Hydrocarbon and Carbon Monoxide results are to be normalized to 25° C, 1.01 kilo Pascal (760 mm of mercury) pressure and zero percent moisture (dry basis).
9. Measurement shall be performed at steady load conditions of more than 85% of the rated load.

10. Continuous monitoring of Oxides of Nitrogen shall be done by the plants whose total engine capacity is more than 50 Mega Watt. However, minimum once in six month monitoring for other parameters shall be adopted by the plants.

11. Following methods may be adopted for the measurement of emission parameters:-

Sl. No.	Emission Param eters	Measurement Methods
1.	Particulates	Gravimetric
2.	SO ₂	Barium Perchlorate - Thorin indicator method
3.	NO _x	Chemiluminescence, Non Dispersive infra Red, Non Dispersive Ultra-violet (for continuous measurement), Phenol disulphonic method
4.	CO	Non Dispersive Infra Red
5.	O ₂	Paramagnetic, Electrochemical sensor
6.	NMHC	Gas Chromatograph – Flame Ionisation Detector



भारत का राजपत्र

The Gazette of India

असाधारण

EXTRAORDINARY

भाग II—खण्ड 3—उप-खण्ड (i)

PART II—Section 3—Sub-section (i)

प्राधिकार से प्रकाशित

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पर्यावरण और वन मंत्रालय

अधिसूचना

नई दिल्ली, 11 दिसम्बर, 2013

सा.का.नि.771(अ).- केन्द्रीय सरकार, पर्यावरण (संरक्षण) अधिनियम, 1986 (1986 का 29) की धारा 6 और धारा 25 द्वारा प्रदत्त शक्तियों का प्रयोग करते हुए, पर्यावरण (संरक्षण) नियम, 1986 का और संशोधन करने के लिए निम्नलिखित नियम बनाती है, अर्थात् :-

1. (1) इन नियमों का संक्षिप्त नाम पर्यावरण (संरक्षण) (तीसरा संशोधन) नियम, 2013 है।
(2) ये राजपत्र में इनके प्रकाशन की तारीख को प्रवृत्त होंगे ।
2. पर्यावरण (संरक्षण) नियम, 1986 की अनुसूची 1 में क्रम संख्या 95 और उससे संबंधित प्रविष्टियों के स्थान पर निम्नलिखित क्रम संख्या और प्रविष्टियां रखी जाएंगी, अर्थात् :-

“95. जेनरेटर सेट (जेनसेट) के लिए 800 किलोवाट तक के नए डीजल इंजन के लिए लागू उत्सर्जन सीमा.- जेनरेटर सेट (जिसे इसमें इसके पश्चात् जेनसेट कहा गया है) के लिए 800 किलोवाट तक के नए डीजल इंजन के लिए लागू उत्सर्जन सीमा 1 अप्रैल, 2014 से उसमें अंतर्विष्ट साधारण शर्तों के अध्यधीन सारणी में यथा विनिर्दिष्ट होंगी, अर्थात् :--

सारणी

शक्ति प्रवर्ग	उत्सर्जन सीमा (ग्रा/कि.वा प्रतिघंटा)			धुआं सीमा (प्रकाश अवशोषण सह दक्षता, मी. ⁻¹)
	NO _x + HC	CO	PM	
19 कि.वा. तक	≤ 7.5	≤ 3.5	≤ 0.3	≤ 0.7
19 कि.वा. से अधिक 75 कि.वा. तक	≤ 4.7	≤ 3.5	≤ 0.3	≤ 0.7
75 कि.वा. से अधिक 800 कि.वा. तक	≤ 4.0	≤ 3.5	≤ 0.2	≤ 0.7

टिप्पण :

1. सारणी में प्रयुक्त संक्षेपाक्षरों का निम्नलिखित अभिप्राय होगा : NO_x- नाइट्रोजन के आक्साइड्स ; HC- हाइड्रोकार्बन ; CO -कार्बन मोनोक्साइड ; और PM- विविक्त पदार्थ ।
2. परीक्षण चक्र के प्रचालित भार बिंदुओं के दौरान धुआं उपरोक्त मूल्य से अधिक नहीं होगी ।
3. ISO : 8178-भाग 4 के डी 2-5 प्रकार चक्र के अनुसार परीक्षण किया जाएगा ।
4. ऊपर उल्लिखित संनियम प्राधिकृत अभिकरणों द्वारा किए गए किस्म अनुमोदन और उत्पादन की अनुरूपता (सीओपी) को लागू होंगे ।
5. भारत में विनिर्मित या आयातित जेनसेट उपयोजनों के लिए डीजल इंजन (जिन्हें इसमें इसके पश्चात् ‘इंजन’ कहा गया है) के प्रत्येक विनिर्माता या आयातकर्ता या संयोजनकर्ता (जिसे इसमें इसके पश्चात् विनिर्माता कहा गया है) या भारत में संयोजित या आयातित डीजल जेनसट (जिन्हें इसमें इसके पश्चात् उत्पाद कहा गया है) उत्सर्जन सीमाओं के लिए किस्म अनुमोदन अभिप्राप्त करेंगे और अपने उत्पादों के सीओपी के अनुसार होंगे और वे अगले सीओपी वर्ष या ऊपर विनिर्दिष्ट पुनरीक्षित संनियमों के कार्यान्वयन की तारीख, जो भी पहले हो, के लिए वैध होंगे ।
स्पष्टीकरण -‘सीओपी वर्ष’ पद का अभिप्राय 1 अप्रैल से 31 मार्च की अवधि से है ।
6. जेनसेट के लिए चिमनी की ऊंचाई (मीटर में) केन्द्रीय प्रदूषण नियंत्रण बोर्ड (सीपीसीबी) के मार्गदर्शक सिद्धांतों के अनुसार शासित होगी ।

साधारण शर्तें

1. लागू होना- ये शर्तें भारत में यथास्थिति, विनिर्मित, संयोजित या आयातित जेनसेट उपयोजनों और उत्पादों के लिए सभी नए इंजनों को लागू होंगी :

परंतु ये नियम निम्नलिखित को लागू नहीं होंगे :-

- (क) किसी भी ऐसे इंजन या उत्पाद को जिसका यथास्थिति, संयोजन, विनिर्माण या आयात भारत के बाहर निर्यात करने के प्रयोजन के लिए किया गया है ।
- (ख) किसी भी ऐसे इंजन या उत्पाद को जो चार तक सीमित नमूने के प्रयोजन के लिए आशयित है और जिसे तीन मास के भीतर वापिस निर्यात किया जाना है और जो भारत में विक्रय के लिए नहीं है ।

2. प्रमाणन की अपेक्षाएं - यथास्थिति, इंजन या उत्पाद के प्रत्येक विनिर्माता के पास ऊपर यथा विनिर्दिष्ट उत्सर्जन सीमाओं की प्रभावी तारीख के पश्चात् विनिर्मित सभी इंजन माडलों या आयात किए गए सभी इंजनों या उत्पाद माडलों के लिए प्रत्येक सीओपी वर्ष के लिए विधिमान्य किस्म अनुमोदन प्रमाण पत्र और उत्पादन की अनुरूपता प्रमाण (सीओपी) पत्र होंगे और 1 अप्रैल, 2014 को या उसके पश्चात् विक्रीत जेनसेट के लिए सीओपी 1 अप्रैल, 2015 से प्रभावी पुनरीक्षित उत्सर्जन सन्नियमों के अनुसार प्रभावी और प्रवृत्त होंगे ।

3. उस इंजन या उत्पाद का विक्रय, आयात या उपयोग जो इन नियमों का अनुपालन नहीं कर रहे हैं - कोई भी व्यक्ति जेनसेट उपयोजन के लिए ऐसे किसी इंजन का या उत्पाद का विक्रय, आयात या उपयोग नहीं करेगा जिसके पास शर्त 2 में निर्दिष्ट विधिमान्य किस्म अनुमोदन प्रमाण पत्र और सीओपी प्रमाणपत्र नहीं है ।

4. अनुरूपता लेबल की अपेक्षा - (1) सभी इंजनों पर पृथकतः या उत्पाद के भाग रूप में सिलेण्डर ब्लाक पर स्पष्ट रूप से 'जेनसेट इंजन' उत्कीर्त होगा ।

(2) इंजन या उत्पाद पर निम्नलिखित अपेक्षाओं को पूरा करते हुए अनुरूपतः लेबल लगा होगा, अर्थात् :-

(क) लेबल टिकाऊ और पठनीय होगा ;

(ख) लेबल इंजन या उत्पाद के सामान्य प्रचालन के लिए आवश्यक भाग पर लगाया जाएगा और उसे सामान्यतः इंजन या उत्पाद के जीवन काल में बदलने की अपेक्षा नहीं होगी ;

(3) समरूपता लेबल पर निम्नलिखित जानकारी अंतर्विष्ट होगी :-

(क) यथास्थिति, इंजन या उत्पाद के, विनिर्माता का नाम और पता ;

(ख) यह विवरण कि इंजन या उत्पाद पर्यावरण (संरक्षण) नियम, 1986 के अनुरूप है ;

(ग) किस्म अनुमोदन और प्रमाण पत्र संख्या ;

(घ) इंजन और उत्पाद के विनिर्माण की तारीख या आयात की दशा में इंजन और उत्पाद के आयात की तारीख ; और

(ङ) निर्धारित गति और किलोवाट में तत्त्वानी कुल शक्ति ।

5. नोडल अभिकरण- (1) इन नियमों के कार्यान्वयन के लिए केन्द्रीय प्रदूषण नियन्त्रण बोर्ड नोडल अभिकरण होगा ।

(2) इन नियमों के किसी विवाद या कठिनाई की दशा में, मामला नोडल अभिकरण को निर्दिष्ट किया जाएगा ।

(3) नोडल अभिकरण इन नियमों के कार्यान्वयन से संबंधित सभी मामलों के संबंध में जिसके अंतर्गत विवादित मामले भी हैं, सलाह देने के लिए एक समिति का गठन करेगा ।

6. प्रमाणन के लिए प्राधिकृत अभिकरण- निम्नलिखित संस्थाएं डीजल इंजनों या उत्पादों के लिए किस्म अनुमोदन और उत्पादन की अनुरूपता परीक्षणों के प्रमाण पत्र देने के लिए ऐसे परीक्षण करने के लिए, जो वे उचित समझें और ऐसे प्रमाण पत्र देने के लिए प्राधिकृत हैं, अर्थात् :-

(क) द आटोमोटिव रिसर्च आफ एसोसिएशन आफ इंडिया, पुणे (महाराष्ट्र) ;

(ख) द इंटरनेशनल सेंटर फार आटोमोटिव टेक्नोलॉजी, मानेसर (हरियाणा) ;

(ग) द इंडियन आयल कार्पोरेशन, रिसर्च एंड डेवलेपमेंट सेंटर, फरीदाबाद (हरियाणा) ;

(घ) द इंडियन इंस्टीट्यूट आफ पेट्रोलियम, देहरादून (उत्तराखण्ड) ; और

(ङ) द व्हीकल रिसर्च डेवलेपमेंट एस्टेबलिशमेंट, अहमदनगर (महाराष्ट्र)

7. अनुपालन और परीक्षण प्रक्रिया- (1) केन्द्रीय प्रदूषण नियंत्रण बोर्ड द्वारा यथा प्रकाशित अनुपालन और परीक्षण प्रक्रिया का अनुसरण किया जाएगा ।

(2) प्रमाणन के लिए प्राधिकृत अभिकरण उत्सर्जन की बाबत परीक्षण और प्रमाणन व्यौरे वार्षिक रूप से केन्द्रीय प्रदूषण नियंत्रण बोर्ड को भेजेगा ।

8. **ईंधन विर्निर्देश-**डीजल जेनरेटरों को लागू वाणिज्यिक ईंधन के विनिर्देश वही होंगे जो, भारत सरकार की नीति के अनुसार समय समय पर उस क्षेत्र में जहां उत्पाद प्रचालित किया जाए, डीजल यानों के लिए लागू वाणिज्यिक उच्च गति डीजल को लागू हैं ।

9. **इंजन घटक या भाग पहचान-** उत्सर्जन क्रिया के लिए उत्तरदायी इंजन घटकों या भागों के सभी व्यौरे अंग्रेजी भाषा में स्पष्टतः चिन्हित किए जाएंगे ।’।

[फा. सं. क्यू-15017/08/2012-सीपीडब्ल्यू]

डा. राशिद हसन, सलाहकार

टिप्पण : मूल नियम भारत के राजपत्र में सं. का.आ. 844(अ), तारीख 19 नवंबर, 1986 द्वारा प्रकाशित किए गए थे और उनके पश्चात्वर्ती संशोधन का.आ. 433 (अ), तारीख 18 अप्रैल, 1987, सा.का.नि. 01(अ), तारीख 1 जनवरी, 2010, सा.का.नि. 61(अ), तारीख 5 फरवरी, 2010, सा.का.नि. 485(अ), तारीख 9 जून, 2010, सा.का.नि. 608(अ), तारीख 21 जुलाई 2010, सा.का.नि. 739(अ), तारीख 9 सितंबर, 2010, सा.का.नि. 809(अ), तारीख 4 अक्टुबर, 2010, सा.का.नि. 215(अ), तारीख 15 मार्च, 2011, सा.का.नि. 221(अ), तारीख 18 मार्च, 2011, सा.का.नि. 354(अ), तारीख 2 मई, 2011, सा.का.नि. 424(अ), तारीख 1 जून, 2011, सा.का.नि. 446(अ), तारीख 13 जून, 2011, सा.का.नि. 152(अ), तारीख 16 मार्च, 2012, सा.का.नि. 266(अ), तारीख 30 मार्च, 2012, सा.का.नि. 277(अ), तारीख 31 मार्च, 2012, सा.का.नि. 820(अ), तारीख 9 नवंबर, 2012, सा.का.नि. 820(अ), तारीख 18 मार्च, 2013, और सा.का.नि. 535 (अ), तारीख 7 अगस्त, 2013 द्वारा किए गए ।

MINISTRY OF ENVIRONMENT AND FORESTS

NOTIFICATION

New Delhi, the 11th December, 2013

G.S.R. 771(E). – In exercise of the powers conferred by sections 6 and 25 of the Environment (Protection) Act, 1986 (29 of 1986), the Central Government hereby makes the following rules further to amend the Environment (Protection) Rules, 1986, namely:—

1. (1) These rules may be called the Environment (Protection) (Third Amendment) Rules, 2013.
(2) They shall come into force on the date of their publication in the Official Gazette.
2. In the Environment (Protection) Rules, 1986, in Schedule I, for serial number 95 and entries relating thereto, the following serial number and entries shall be substituted, namely:-

“95. Emission limits for new diesel engine up to 800 kW for generator set (Genset) application.- The emission limits for new diesel engine upto 800 kW for generator set (hereinafter referred to as Genset) application shall be effective from 1st April, 2014 as specified in the Table below subject to the general conditions contained therein, namely:-

TABLE

Power Category	Emission Limits (g/kW-hr)			Smoke Limit (light absorption coefficient, m ⁻¹)
	NOx+HC	CO	PM	
Upto 19 KW	≤ 7.5	≤ 3.5	≤ 0.3	≤ 0.7
More than 19 KW upto 75 KW	≤ 4.7	≤ 3.5	≤ 0.3	≤ 0.7
More than 75 KW upto 800 KW	≤ 4.0	≤ 3.5	≤ 0.2	≤ 0.7

Note:

1. The abbreviations used in the Table shall mean as under: NO_x – Oxides of Nitrogen; HC – Hydrocarbon; CO – Carbon Monoxide; and PM – Particulate Matter.
 2. Smoke shall not exceed above value throughout the operating load points of the test cycle.
 3. The testing shall be done as per D2 – 5 mode cycle of ISO: 8178- Part 4.
 4. The above mentioned emission limits shall be applicable for Type Approval and Conformity of Production (COP) carried out by authorised agencies.
 5. Every manufacturer, importer or, assembler (hereinafter referred to as manufacturer) of the diesel engine (hereinafter referred to as ‘engine’) for genset application manufactured or imported into India or, diesel genset (hereinafter referred to as ‘product’), assembled or imported into India shall obtain Type Approval and comply with COP of their product(s) for the emission limits which shall be valid for the next COP year or, the date of implementation of the revised norms specified above, whichever earlier.
- Explanation.-* The term ‘COP year’ means the period from 1st April to 31st March.
6. Stack height (in metres), for genset shall be governed as per Central Pollution Control Board (CPCB) guidelines.

General Conditions

- 1. Applicability.-** These conditions shall apply to all new engines for genset application and products manufactured, assembled or, imported into India, as the case may be :

Provided that these rules, shall not apply to,-

- (a) any engine or, product, assembled or manufactured or imported, as the case may be, for the purpose of export outside India, or;
- (b) any engine or product intended for the purpose of sample limited to four in number and to be exported back within three months, and not for sale in India.

- 2. Requirement of certification.-** Every manufacturer of engine or product, as the case may be, shall have valid certificate(s) of Type Approval and COP for each COP year, for all engine models being manufactured or, for all engine or product models being imported, after the effective date for the emission limits, as specified above and the COP for the genset sold on or after 1st April, 2014 shall be effective and in force as per revised emission norms with effect from 1st April, 2015.

- 3. Sale, import or use of engine or product not complying with these rules.-** No person shall sell, import or use an engine for genset application or, a product which is not having a valid Type Approval certificate and certificate of COP referred to in condition 2.

- 4. Requirement of conformance labeling.-** (1) All the engines, individually or as part of the product shall be clearly engraved ‘Genset Engine’ on the cylinder block.

- (2) the engine or the product shall be affixed with a conformance label meeting the following requirements, namely:-

- (a) the label shall be durable and legible;

- (b) the label shall be affixed on a part necessary for normal operation of the engine or the product and not normally requiring replacement during the life of the engine or the product.
- (3) The conformance label shall contain the following information, namely:-
- (a) name and address of the manufacturer of engine or product, as the case may be;
 - (b) statement that the engine or product conforms to the Environment (Protection) Rules, 1986;
 - (c) Type Approval certificate number;
 - (d) date of manufacture of engine and the product or in case of import, the date of import of the engine and the product; and
 - (e) rated speed and corresponding gross power in kW.

5. Nodal Agency.- (1) The Central Pollution Control Board shall be the nodal agency for implementation of these rules.

(2) In case of any dispute or difficulty in implementation of these rules, the matter shall be referred to the nodal agency.

(3) The nodal agency shall constitute a Committee to advise it on all matters, including the disputed matters, related to the implementation of these rules.

6. Authorised agencies for certification.- The following institutions are authorised to carry out such tests as they may deem necessary, for giving certificates of Type Approval and Conformity of Production tests for diesel engines or products and to give such certificates, namely:-

- (i) the Automotive Research Association of India, Pune (Maharashtra);
- (ii) the International Centre for Automotive Technology, Manesar (Haryana);
- (iii) the Indian Oil Corporation, Research and Development Centre, Faridabad (Haryana);
- (iv) the Indian Institute of Petroleum, Dehradun (Uttarakhand); and
- (v) the Vehicle Research Development Establishment, Ahmednagar (Maharashtra).

7. Compliance and testing procedure.- (1) The Compliance and Testing Procedure, as published by the Central Pollution Control Board shall be followed by all concerned.

(2) The authorised agencies for certification shall submit the testing and certification details in respect of the emission to the Central Pollution Control Board annually.

8. Fuel Specification.- The specification of commercial fuel applicable for diesel gensets shall be the same as applicable for commercial High Speed Diesel applicable for diesel vehicles in the area where product would be operated, from time to time, as per policy of Government of India.

9. Engine component or parts identification.- All the details of engine components or parts responsible for the emission performance shall be clearly marked in English language. ".

[F.No. Q-15017/08/2012-CPW]

Dr. RASHID HASAN, Advisor

Note: - The principal rules were published in the Gazette of India vide number S.O. 844 (E), dated the 19th November, 1986 and subsequently amended vide notification numbers S.O. 433 (E), dated the 18th April 1987; G.S.R. 01 (E), dated the 1st January, 2010; G.S.R. 61 (E), dated the 5th February, 2010; G.S.R. 485 (E), dated the 9th June, 2010; G.S.R. 608 (E), dated the 21st July, 2010; G.S.R. 739 (E), dated the 9th September, 2010; G.S.R. 809(E), dated, the 4th October, 2010, G.S.R. 215 (E), dated the 15th March, 2011; G.S.R. 221(E), dated the 18th March, 2011; G.S.R. 354 (E), dated the 2nd May, 2011; G.S.R. 424 (E), dated the 1st June, 2011; G.S.R. 446 (E), dated the 13th June, 2011; G.S.R. 152 (E), dated the 16th March, 2012; G.S.R. 266(E), dated the 30th March, 2012; G.S.R. 277 (E); dated the 31st March, 2012; G.S.R. 820(E), dated the 9th November, 2012; G.S.R. 176(E), dated the 18th March, 2013; and G.S.R. 535(E), dated the 7th August, 2013.

APPENDIX J
CETP AND STP OUTLET
STANDARDS



भारत का राजपत्र

The Gazette of India

असाधारण

EXTRAORDINARY

भाग II—खण्ड 3—उप-खण्ड (i)

PART II—Section 3—Sub-section (i)

प्राधिकार से प्रकाशित

PUBLISHED BY AUTHORITY

सं. 843]

नई दिल्ली, शक्रवार, अक्टूबर 13, 2017/आश्विन 21, 1939

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NEW DELHI, FRIDAY, OCTOBER 13, 2017/ASVINA 21, 1939

पर्यावरण, वन और जलवायु परिवर्तन मंत्रालय

अधिसूचना

नई दिल्ली, 13 अक्टूबर, 2017

सा.का.नि. 1265(अ).—केन्द्रीय सरकार, पर्यावरण (संरक्षण) अधिनियम, 1986 (1986 का 29) की धारा 6 और धारा 25 द्वारा प्रदत्त शक्तियों का प्रयोग करते हुए, पर्यावरण (संरक्षण) नियम, 1986 का और संशोधन करने के लिए निम्नलिखित नियम बनाती है, अर्थात् :—

1. संक्षिप्त नाम और प्रारम्भ :—(1) इन नियमों का संक्षिप्त नाम पर्यावरण (संरक्षण) संशोधन नियम, 2017 है।
(2) ये राजपत्र में उनके प्रकाशन की तारीख को प्रवृत्त होंगे।
2. पर्यावरण (संरक्षण) नियम, 1986 की अनुसूची-1 में, क्रम संख्यांक 104 और उससे सम्बन्धित प्रविष्टियों के पश्चात्, निम्नलिखित क्रम संख्यांक और प्रविष्टियां अन्तःस्थापित की जाएंगी, अर्थात् :—

क्र. सं.	उद्घोग	मानदंड	मानक
1	2	3	4
बहिस्त्रीवि निस्सारण मानक (निपटान के सभी ढंगों को लागू)			
“105	मल उपचार संयंत्र (एसटीपी)	मांग	अवस्थान
			(क) देश में कहीं भी
	जैव-रासायनिक आँकसीजन (बीओडी)	मांग	6.5-9.0
			महानगर* अरुणाचल प्रदेश, असम, मणिपुर, मेघालय, मिजोरम, नागालैण्ड, त्रिपुरा, सिक्किम, हिमाचल प्रदेश, उत्तराखण्ड, जम्मू-कश्मीर राज्यों और

		अंदमान और निकोबार द्वीप, दादरा और नागर हवेली, दमण और दीव और लक्षद्वीप के सिवाय, सभी राज्यों की राजधानी।	
		ऊपर उल्लिखित से भिन्न क्षेत्र/प्रदेश	30
		कुल निलंबित ठोस पदार्थ (टीएसएस)	महानगर* अरुणाचल प्रदेश, असम, मणिपुर, मेघालय, मिजोरम, नागालैण्ड, त्रिपुरा, सिक्किम, हिमाचल प्रदेश, उत्तराखण्ड, जम्मू-कश्मीर राज्यों और अंदमान और निकोबार द्वीप, दादरा और नागर हवेली, दमण और दीव और लक्षद्वीप के सिवाय, सभी राज्यों की राजधानी।
		ऊपर उल्लिखित से भिन्न क्षेत्र/प्रदेश	<100
		फैकल कौलीफॉर्म (एफसी) (अतिसंभाव्य संघ्या प्रति 100 मीलीलिटर एमपीएन/100 मीलीलिटर	देश में कहीं भी

*मुम्बई, दिल्ली, कोलकाता, चेन्नई, बैंगलूरू, हैदराबाद, अहमदाबाद और पुणे महानगर हैं।

टिप्पण :

- (i) पीएच और फैकल कौलीफॉर्म के सिवाय, मिलीग्राम/लिटर में सभी मूल्य।
- (ii) ये, मानक जलाशयों में निस्सारण और भूमि निपटान/अनुप्रयोगों के लिए लागू होंगे।
- (iii) फैकल कौलीफॉर्म के लिए मानक औद्योगिक प्रयोजनों के लिए उपचारित बहिर्स्वाव के उपयोग के सम्बन्ध में लागू नहीं होंगे।
- (iv) ये मानक 1 जून, 2019 को या उसके पश्चात् कमीशन किए जाने वाले सभी मल उपचार संयंत्रों (एसटीपी) को लागू होंगे और पुराने/विद्यमान मल उपचार संयंत्र (एसटीपी) राजपत्र में इस अधिसूचना के प्रकाशन की तारीख से पांच वर्ष की अवधि के भीतर इन मानकों को प्राप्त करेंगे।
- (v) समुद्र में उपचारित बहिर्स्वाव के निस्सारण के मामले में, इसे उचित समुद्री मुहाने के माध्यम से किया जाएगा और विद्यमान तट निस्सारण को समुद्री मुहानों में संपरिवर्तित किया जाएगा और उन मामलों में, जहां समुद्री मुहाना निस्सारण के बिन्दु पर 150 गुणा न्यूनतम आरम्भिक तनुकरण और निस्सारण बिन्दु से दूर 100 मीटर के किसी बिन्दु पर 1500 गुणा न्यूनतम तनुकरण प्रदान करता है, तब विद्यमान सन्नियम साधारण निस्सारण मानकों में विनिर्दिष्ट किए गए अनुसार लागू होंगे।
- (vi) उपचारित बहिर्स्वाव का पुनःउपयोग/पुनःचक्रण तथा उन मामलों में, जहां उपचारित बहिर्स्वाव के भाग का पुनःउपयोग और पुनःचक्रण किया जाता है जिसमें मानवीय सम्पर्क की सम्भावना अन्तर्वलित है, ऊपर यथा विनिर्दिष्ट मानक लागू होंगे।
- (vii) केन्द्रीय प्रदूषण नियंत्रण बोर्ड/राज्य प्रदूषण नियंत्रण बोर्ड/प्रदूषण नियंत्रण समितियां, पर्यावरण (संरक्षण) अधिनियम, 1986 के धारा 5 के अधीन स्थानीय परिवेश को ध्यान में रखते हुए, अधिक कठोर सन्नियम जारी कर सकेगा/कर सकेंगी।

[फा. सं. क्यू-15017/2/2008/-सीपीडब्ल्यू]

अरुण कुमार मेहता, अपर सचिव

टिप्पण : मूल नियम भारत के राजपत्र, असाधारण, भाग II, खंड 3, उप-खंड (i) में का.आ. सं. 844(अ), तारीख 19 नवम्बर, 1986 द्वारा प्रकाशित किए गए थे और तत्पश्चात् उनमें निम्नलिखित अधिसूचनाओं द्वारा संशोधन किए गए थे, अर्थात् :— का.आ. 433(अ), तारीख 18 अप्रैल, 1987; सा.का.नि. 176(अ), तारीख 2 अप्रैल, 1996; सा.का.नि. 97(अ), तारीख 18 फरवरी, 2009; सा.का.नि. 149(अ), तारीख 4 मार्च, 2009; सा.का.नि. 543(अ), तारीख 22 जुलाई, 2009; सा.का.नि. 739(अ), तारीख 9 सितम्बर, 2010; सा.का.नि. 809(अ), तारीख 4 अक्टूबर, 2010; सा.का.नि. 215(अ), तारीख 15 मार्च, 2011; सा.का.नि. 221(अ), तारीख 18 मार्च, 2011; सा.का.नि. 354(अ), तारीख 2 मई, 2011; सा.का.नि. 424(अ), तारीख 1 जून, 2011; सा.का.नि. 446(अ), तारीख 13 जून, 2011; सा.का.नि. 152(अ), तारीख 16 मार्च, 2012; सा.का.नि. 266(अ), तारीख 30 मार्च, 2012; सा.का.नि. 277(अ), तारीख 31 मार्च, 2012; सा.का.नि. 820(अ), तारीख 9 नवम्बर, 2012; सा.का.नि. 176(अ), तारीख 18 मार्च, 2013; सा.का.नि. 535(अ), तारीख 7 अगस्त, 2013; सा.का.नि. 771(अ), तारीख 11 दिसम्बर, 2013; सा.का.नि. 2(अ), तारीख 2 जनवरी, 2014; सा.का.नि. 229(अ), तारीख 28 मार्च, 2014; सा.का.नि. 232(अ), तारीख 31 मार्च, 2014; सा.का.नि. 325(अ), तारीख 7 मई, 2014; सा.का.नि. 612(अ), तारीख 25 अगस्त, 2014; सा.का.नि. 789(अ), तारीख 11 नवम्बर, 2014; का.आ. 3305(अ), तारीख 7 दिसम्बर, 2015; का.आ. 4(अ), तारीख 1 जनवरी, 2016; सा.का.नि. 35(अ), तारीख 14 जनवरी, 2016; सा.का.नि. 281(अ), तारीख 7 मार्च, 2016; सा.का.नि. 496(अ), तारीख 9 मई, 2016; सा.का.नि. 497(अ), तारीख 10 मई, 2016; सा.का.नि. 978(अ), तारीख 10 अक्टूबर, 2016; और अंतिम बार अधिसूचना संख्यांक सा.का.नि. 1016(अ), तारीख 28 अक्टूबर, 2016 द्वारा संशोधित किए गए थे।

MINISTRY OF ENVIRONMENT, FOREST AND CLIMATE CHANGE NOTIFICATION

New Delhi, the 13th October, 2017

G.S.R. 1265(E).—In exercise of the powers conferred by sections 6 and 25 of the Environment (Protection) Act, 1986 (29 of 1986), the Central Government hereby makes the following rules further to amend the Environment (Protection) Rules, 1986, namely:—

1. Short title and commencement.—(1) These rules may be called the Environment (Protection) Amendment Rules, 2017.

(2) They shall come into force on the date of their publication in the Official Gazette.

2. In the Environment (Protection) Rules, 1986, in Schedule – I, after serial number 104 and the entries relating thereto, the following serial number and entries shall be inserted, namely:—

Sl. No.	Industry	Parameters	Standards	
1	2	3	4	
Effluent discharge standards (applicable to all mode of disposal)				
“105	Sewage Treatment Plants (STPs)		Location	Concentration not to exceed
			(a)	(b)
		pH	Anywhere in the country	6.5-9.0
		Bio-Chemical Oxygen Demand (BOD)	Metro Cities*, all State Capitals except in the State of Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Tripura, Sikkim, Himachal Pradesh, Uttarakhand, Jammu and Kashmir, and Union territory of	20

		Andaman and Nicobar Islands, Dadar and Nagar Haveli Daman and Diu and Lakshadweep	
		Areas/regions other than mentioned above	30
	Total Suspended Solids (TSS)	Metro Cities*, all State Capitals except in the State of Arunachal Pradesh, Assam, Manipur, Meghalaya Mizoram, Nagaland, Tripura Sikkim, Himachal Pradesh, Uttarakhand, Jammu and Kashmir and Union territory of Andaman and Nicobar Islands, Dadar and Nagar Haveli Daman and Diu and Lakshadweep	<50
		Areas/regions other than mentioned above	<100
	Fecal Coliform (FC) (Most Probable Number per 100 milliliter, MPN/100ml)	Anywhere in the country	<1000

*Metro Cities are Mumbai, Delhi, Kolkata, Chennai, Bengaluru, Hyderabad, Ahmedabad and Pune.

Note :

- (i) All values in mg/l except for pH and Fecal Coliform.
- (ii) These standards shall be applicable for discharge into water bodies as well as for land disposal/applications.
- (iii) The standards for Fecal Coliform shall not apply in respect of use of treated effluent for industrial purposes.
- (iv) These Standards shall apply to all STPs to be commissioned on or after the 1st June, 2019 and the old/existing STPs shall achieve these standards within a period of five years from date of publication of this notification in the Official Gazette.
- (v) In case of discharge of treated effluent into sea, it shall be through proper marine outfall and the existing shore discharge shall be converted to marine outfalls, and in cases where the marine outfall provides a minimum initial dilution of 150 times at the point of discharge and a minimum dilution of 1500 times at a point 100 meters away from discharge point, then, the existing norms shall apply as specified in the general discharge standards.
- (vi) Reuse/Recycling of treated effluent shall be encouraged and in cases where part of the treated effluent is reused and recycled involving possibility of human contact, standards as specified above shall apply.
- (vii) Central Pollution Control Board/State Pollution Control Boards/Pollution Control Committees may issue more stringent norms taking account to local condition under section 5 of the Environment (Protection) Act, 1986”.

[F. No. Q-15017/2/2008-CPW]

ARUN KUMAR MEHTA, Addl. Secy.

Note : The principal rules were published in the Gazette of India, Extraordinary, Part II, Section 3, Sub-section (i) *vide* number S.O. 844 (E), dated the 19th November, 1986 and subsequently amended *vide* the following notifications, namely:—

S.O. 433 (E), dated the 18th April 1987; G.S.R. 176(E) dated the 2nd April, 1996; G.S.R. 97 (E), dated the 18th February, 2009; G.S.R. 149 (E), dated the 4th March , 2009; G.S.R. 543(E), dated the 22nd July,2009; G.S.R. 739 (E), dated the 9th September, 2010; G.S.R. 809(E), dated the 4th October, 2010, G.S.R.

215 (E), dated the 15th March, 2011; G.S.R. 221(E), dated the 18th March, 2011; G.S.R. 354 (E), dated the 2nd May, 2011; G.S.R. 424 (E), dated the 1st June, 2011; G.S.R. 446 (E), dated the 13th June, 2011; G.S.R. 152 (E), dated the 16th March, 2012; G.S.R. 266(E), dated the 30th March, 2012; and G.S.R. 277 (E), dated the 31st March, 2012; and G.S.R. 820(E), dated the 9th November, 2012; G.S.R. 176 (E), dated the 18th March, 2013; G.S.R. 535(E), dated the 7th August, 2013; G.S.R. 771(E), dated the 11th December, 2013; G.S.R. 2(E), dated the 2nd January, 2014; G.S.R. 229 (E), dated the 28th March, 2014; G.S.R. 232(E), dated the 31st March, 2014; G.S.R. 325(E), dated the 7th May, 2014; G.S.R. 612, (E), dated the 25th August 2014; G.S.R. 789(E), dated the 11th November 2014; S.O. 3305(E), dated the 7th December, 2015; S.O.4(E), dated the 1st January 2016; G.S.R. 35(E), dated the 14th January 2016; G.S.R. 281 (E), dated the 7th March, 2016; G.S.R. 496(E), dated the 9th May, 2016; G.S.R.497(E), dated the 10th May, 2016; G.S.R.978(E), dated the 10thOctober, 2016; and lastly amended vide notification G.S.R. 1016(E), dated the 28th October, 2016.



भारत का राजपत्र

The Gazette of India

असाधारण

EXTRAORDINARY

भाग II—खण्ड 3—उप-खण्ड (ii)

PART II—Section 3—Sub-section (ii)

प्राथिकार से प्रकाशित

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पर्यावरण, वन और जलवायु परिवर्तन मंत्रालय

अधिसूचना

नई दिल्ली, 1 जनवरी, 2016

का.आ. 4(अ).-- केन्द्रीय सरकार, पर्यावरण (संरक्षण) अधिनियम, 1986 (1986 का 29) की धारा 6 और धारा 25 द्वारा प्रदत्त शक्तियों का प्रयोग करते हुए, पर्यावरण (संरक्षण) नियम, 1986 का और संशोधन करने के लिए निम्नलिखित नियम बनाती है, अर्थात् :-

1. संक्षिप्त नाम और प्रारम्भ.—(1) इन नियमों का संक्षिप्त नाम (पर्यावरण) मंशोधन नियम, 2015 है।
(2) ये राजपत्र में प्रकाशन की तारीख को प्रवृत्त होंगे।
2. पर्यावरण (संरक्षण) नियम, 1986 की अनुसूची 1 में,-
(क) क्रम संख्या 41 और उससे संबंधित प्रविष्टियों का लोप किया जाएगा;
(ख) क्रम संख्या 55 और उससे संबंधित प्रविष्टियों के स्थान पर, निम्नलिखित क्रम संख्या और प्रविष्टियां रखी जाएंगी:-

क्रम संख्या	उद्योग	पैरामीटर	मानक
(1)	(2)	(3)	(4)
“55.	सामान्य वहिःस्राव उपचार संयंत्र (सीईटीपी)		
	क. अंतर्गम क्वालिटी मानक	प्रत्येक सामान्य वहिःस्राव उपचार संयंत्र (सीईटीपी) के लिए, राज्य बोर्ड सामान्य वहिःस्राव उपचार संयंत्र (सीईटीपी) तथा स्थानीय आवश्यकताओं और दशाओं की अभिकल्पना के अनुसार साधारण पैरामीटर, अमोनियम - नाइट्रोजन और भागी धातुओं के लिए अंतर्गम क्वालिटी मानक विहित करेगा।	

ख. उपचारित बहिःस्वाव क्वालिटी मानक		अधिकतम अनुज्ञेय मान (पीएच और तापमान के सिवाय मिलीग्राम/लीटर में)		
		अंतर्देशीय भूपृष्ठ-जल में	सिंचाई के लिए भूमि पर	समुद्र में
	साधारण पैरामीटर			
	पीएच	6-9	6-9	6-9
	जैव आक्सीजन मांग, बीओडी ³ , 27 ⁰ सेंटीग्रेड	30	100	100
	रासायनिक आक्सीजन मांग (सीओडी)	250	250	250*
	कुल निलंबित ठोस पदार्थ (टीएमएस)	100	100	100
	नियत विघटित ठोस पदार्थ (एफडीएस)	2100*	2100*	एनएस*
	विनिर्दिष्ट पैरामीटर			
	तापमान, 0 सेंटीग्रेड	परिवेशी जल तापमान के ऊपर 5 ⁰ सेंटीग्रेड से अधिक नहीं होगा	परिवेशी जल तापमान के ऊपर 5 ⁰ सेंटीग्रेड से अधिक नहीं होगा	परिवेशी जल तापमान के ऊपर 5 ⁰ सेंटीग्रेड से अधिक नहीं होगा
	तेल और ग्रीज	10	10	10
	अमोनियामय नाइट्रोजन	50	एनएस*	50
	कुल जेलडेहल नाइट्रोजन (टीकेएन)	50	एनएस*	50
	नाइट्रेट नाइट्रोजन	10	एनएस*	50
	फास्फेट, पी के रूप में	5	एनएस*	एनएस*
	क्लोराइड	1000	1000	एनएस*
	सल्फेट एसओ ⁴ के रूप में	1000	1000	एनएस*
	फ्लोराइड	2	2	15
	सल्फाइट, एस के रूप में	2	2	5
	फैनोलिक यौगिक मिश्रण	1	1	5

	(सी6एच5ओएच) के रूप में			
योग अवशिष्ट क्लोरीन	1	1	1	
जस्त	5	15	15	
लौहा	3	3	3	
तांबा	3	3	3	
त्रिसंयोजक क्रोमियम	2	2	2	
मैग्नीज	2	एनएस*	2	
निकिल	3	एनएस*	3	
आर्सेनिक	0.2	एनएस*	0.2	
साइनाइड सीएन के रूप में	0.2	एनएस*	0.2	
वेनेडियम	0.2	एनएस*	0.2	
सीसा	0.1	एनएस*	0.1	
हैक्सावेलेट क्रोमियम	0.1	एनएस*	0.1	
सेलेनियम	0.05	एनएस*	0.05	
कैडमियम	0.05	एनएस*	0.05	
पारा	0.01	एनएस*	0.01	
जैव आमापन परीक्षण	उद्योग विनिर्दिष्ट मानकों के अनुसार	उद्योग विनिर्दिष्ट मानकों के अनुसार	उद्योग विनिर्दिष्ट मानकों के अनुसार	

एनएस* विनिर्दिष्ट नहीं है

टिप्पणी:

1. *समुद्र में उपचारित बहिःस्राव का निस्सरण उचित समुद्री मुहाने के माध्यम से होगा। विद्यमान अपतट निस्सरण समुद्री मुहाने में संपरिवर्तित किया जाएगा। उन मामलों में जहां निस्सरण के बिंदु पर समुद्री मुहाना 150 गुणा न्यूनतम आरंभिक तत्त्वकरण का और निस्सारण बिंदु से 100 मीटर दूर किसी बिंदु पर 1500 गुणा न्यूनतम तत्त्वकरण का उपवंध करता है वहां राज्य बोर्ड सीओडी सीमा में छूट दे सकेगा :

परंतु उपचारित बहिःस्राव में रासायनिक आक्सीजन मांग के लिए अधिकतम अनुज्ञेय मान 500 मिलिग्राम/लीटर से अधिक नहीं होगा।

2. #मामान्य बहिःस्राव उपचार संयंत्र (सीईटीपी) की संघटक यूनिटों द्वारा अधिकतम अनुज्ञेय योगदान नियत विधिटि ठोस पदार्थ (एफडीएस) 1000 मिली ग्राम/लीटर होगा। उन मामलों में जहां संघटक यूनिटों द्वारा प्रयोग किए गए कच्चे पानी में नियत विधिटि ठोस पदार्थ (एफडीएस) पहले से ही अधिक है (अर्थात् यह 1100 मिली ग्राम/लीटर से अधिक है) वहां उपचारित बहिःस्राव में नियत विधिटि ठोस पदार्थ (एफडीएस) के लिए अधिकतम अनुज्ञेय मान राज्य बोर्ड द्वारा तदनुसार उपांतरित किया जाएगा।

3. सिंचाई के लिए भूमि पर उपचारित बहिःस्राव के निस्सारण की दशा में, मृदा और भूजल क्वालिटी पर समाधान समान्य बहिःस्राव उपचार संयंत्र (सीईटीपी) प्रवंध द्वारा वर्ष में दो बार (मानसून से पूर्व और उसके पश्चात) मानीटर किया जाएगा। सिंचाई के लिए भूमि पर उपचारित बहिःस्राव और मल जल के संयुक्त निस्सारण के लिए, मलजल के साथ मिश्रण अनुपात राज्य बोर्ड द्वारा विहित किया

जाएगा।	
4. सेक्टर विनिर्दिष्ट मानकों से चयनित कुछ महत्वपूर्ण सेक्टरों के लिए विनिर्दिष्ट पैरामीटर।	विनिर्दिष्ट पैरामीटर
सेक्टर	
टैक्सट्राइल	जैव आपन परीक्षण, कुल क्रोमियम, सल्फाइड, फैनोलिक यौगिक मिश्रण
इलैक्ट्रोप्लेटिंग उद्योग	तेल और ग्रीज, अमोनिया, नाइट्रोजन, निकिल, हैक्सावेलेंट क्रोमियम, कुल क्रोमियम, तांबा, जस्त, सीसा, लोहा, कैडमियम, सायनाइड, फ्लोराइड, सल्फाइड, फास्फेट, सल्फेट
चर्म शोधनशाला	सल्फाइड, कुल क्रोमियम, तेल और ग्रीज, क्लोराइड
रंजक और रंजक इंटरमिडिएट	तेल और ग्रीज, फैनोलिक यौगिक मिश्रण, कैडमियम, तांबा, मैग्नीज, सीसा, पारा, निकिल, जस्त, हैक्सावेलेंट क्रोमियम, कुल क्रोमियम, जैव-आमापन परीक्षण, क्लोराइड, सल्फेट
जैविक रासायनिक विनिर्माण उद्योग	तेल और ग्रीज, जैव-आमापन परीक्षण, नाइट्रोट, आर्सेनिक, हैक्सावेलेंट क्रोमियम, कुल क्रोमियम, सीसा, साइनाइड, जस्त, पारा, तांबा, निकिल, फैनोलिक यौगिक मिश्रण, सल्फाइड
भेषजी उद्योग	तेल और ग्रीज, जैव-आमापन परीक्षण, पारा, आर्सेनिक, हैक्सावेलेंट क्रोमियम, सीसा, साइनाइड, फैनोलिक यौगिक मिश्रण, सल्फाइड, फास्फेट

[फा.सं. क्यू-15017/18/2014-सीपीडब्ल्यू]

डा. राशिद हसन, सलाहकार

टिप्पण: मूल नियम भारत के राजपत्र, असाधारण, भाग II, खंड 3, उपखंड (i) में का.आ. सं. 844(अ), तारीख 19 नवंबर, 1986 द्वारा प्रकाशित किए गए थे और तत्पश्चात उनमें निम्नलिखित अधिसूचनाओं के द्वारा संशोधन किए गए :

का.आ. सं. 433(अ), तारीख 18 अप्रैल, 1987; सा.का.नि. सं. 176(अ), तारीख 2 अप्रैल, 1996; सा.का.नि. सं. 97(अ), तारीख 18 फरवरी, 2009; सा.का.नि. सं. 149(अ), तारीख 4 मार्च, 2009; सा.का.नि. सं. 543(अ), तारीख 22 जुलाई, 2009; सा.का.नि. सं. 739(अ), तारीख 9 सितंबर, 2010; सा.का.नि. सं. 809(अ), तारीख 4 अक्टूबर, 2010; सा.का.नि. सं. 215(अ), तारीख 15 मार्च, 2011; सा.का.नि. सं. 221(अ), तारीख 18 मार्च, 2011; सा.का.नि. सं. 354(अ), तारीख 2 मई, 2011; सा.का.नि. सं. 424(अ), तारीख 1 जून, 2011;

सा.का.नि. सं. 446(अ), तारीख 13 जून, 2011; सा.का.नि. सं. 152(अ), तारीख 16 मार्च, 2012; सा.का.नि. सं. 266(अ), तारीख 30 मार्च, 2012; सा.का.नि. सं. 277(अ), तारीख 31 मार्च, 2012; सा.का.नि. सं. 820(अ), तारीख 9 नवंबर, 2012; सा.का.नि. सं. 176(अ), तारीख 18 मार्च, 2013; सा.का.नि. सं. 535(अ), तारीख 7 अगस्त, 2013; सा.का.नि. सं. 771(अ), तारीख 11 दिसंबर, 2013; सा.का.नि. सं. 2(अ), तारीख 2 जनवरी, 2014; सा.का.नि. सं. 229(अ), तारीख 28 मार्च, 2014; सा.का.नि. सं. 232(अ), तारीख 31 मार्च, 2014; सा.का.नि. सं. 325(अ), तारीख 7 मई, 2014; सा.का.नि. सं. 612(अ), तारीख 25 अगस्त, 2014; सा.का.नि. सं. 789(अ), तारीख 11 नवंबर, 2014; और अंत में अधिसूचना का.आ. सं. 3305(अ), तारीख 7 दिसंबर, 2015 द्वारा मंशोधन किए गए थे।

MINISTRY OF ENVIRONMENT, FOREST AND CLIMATE CHANGE

NOTIFICATION

New Delhi, the 1st January, 2016

S.O. 4(E).—In exercise of the powers conferred by sections 6 and 25 of the Environment (Protection) Act, 1986 (29 of 1986), the Central Government hereby makes the following rules further to amend the Environment (Protection) Rules, 1986, namely:—

1. **Short title and Commencement.**—(1) These rules may be called the Environment (Protection) Amendment Rules, 2015.
 (2) They shall come into force on the date of their publication in the Official Gazette.
2. In the Environment (Protection) Rules, 1986, in Schedule-I,—
 - (a) the serial number 41 and the entries relating thereto, shall be omitted;
 - (b) for serial number 55 and the entries relating thereto, the following serial number and entries shall be substituted, namely:—

S. No.	Industry	Parameter	Standards		
(1)	(2)	(3)	(4)		
“55.	Common Effluent Treatment Plants(CETP)				
	A. Inlet Quality Standards	For each Common Effluent Treatment Plant (CETP), the State Board will prescribe Inlet Quality Standards for General Parameters, Ammonical-Nitrogen and Heavy metals as per design of the Common Effluent Treatment Plant (CETP) and local needs & conditions.			
	B: Treated Effluent Quality Standards		Max. permissible values (in milligram/litre except for pH and Temperature)		
			Into inland surface water	On land for irrigation	Into sea
	General Parameters				
	pH	6 - 9	6 - 9	6 - 9	
	Biological Oxygen Demand, BOD ₃ , 27 °C	30	100	100	*
	Chemical Oxygen Demand (COD)	250	250	250	*
	Total Suspended Solids (TSS)	100	100	100	
	Fixed Dissolved Solids (FDS)	2100*	2100*	NS*	

Specific parameters				
Temperature, °C		Shall not exceed more than 5°C above ambient water temperature	Shall not exceed more than 5°C above ambient water temperature	Shall not exceed more than 5°C above ambient water temperature
Oil & Grease	10	10	10	
Ammonical -Nitrogen	50	NS*	50	
Total Kjeldahl Nitrogen (TKN)	50	NS*	50	
Nitrate- Nitrogen	10	NS*	50	
Phosphates, as P	5	NS*	NS*	
Chlorides	1000	1000	NS*	
Sulphates, as SO ₄	1000	1000	NS*	
Flouride	2	2	15	
Sulphides, as S	2	2	5	
Phenolic compounds (as C ₆ H ₅ OH)	1	1	5	
Total Res. Chlorine	1	1	1	
Zinc	5	15	15	
Iron	3	3	3	
Copper	3	3	3	
Trivalent Chromium	2	2	2	
Manganese	2	NS*	2	
Nickel	3	NS*	3	
Arsenic	0.2	NS*	0.2	
Cyanide, as CN	0.2	NS*	0.2	
Vanadium	0.2	NS*	0.2	
Lead	0.1	NS*	0.1	
Hexavalent Chromium	0.1	NS*	0.1	
Selenium	0.05	NS*	0.05	
Cadmium	0.05	NS*	0.05	
Mercury	0.01	NS*	0.01	
Bio-assay test	As per industry-specific standards	As per industry-specific standards	As per industry-specific standards	

* NS-Not specified

Notes:

- Discharge of treated effluent into sea shall be through proper marine outfall. The existing shore discharges shall be converted to marine outfalls. In cases where the marine outfall provides a minimum initial dilution of 150 times at the point of discharge and a minimum dilution of 1500 times at a point 100 m away from discharge point, then, the State Board may relax the Chemical Oxygen Demand (COD) limit:

	Provided that the maximum permissible value for Chemical Oxygen Demand (COD) in treated effluent shall be 500 milligram/litre.
2.	*Maximum permissible Fixed Dissolved Solids (FDS) contribution by constituent units of a Common Effluent Treatment Plant (CETP) shall be 1000 milligram/litre. In cases where Fixed Dissolved Solids (FDS) concentration in raw water used by the constituent units is already high (i.e. it is more than 1100 milligram/litre) then the maximum permissible value for Fixed Dissolved Solids (FDS) in treated effluent shall be accordingly modified by the State Board.
3.	In case of discharge of treated effluent on land for irrigation, the impact on soil and groundwater quality shall be monitored twice a year (pre- and post-monsoon) by Common Effluent Treatment Plants (CETP) management. For combined discharge of treated effluent and sewage on land for irrigation, the mixing ratio with sewage shall be prescribed by State Board.
4. Specific parameters for some important sectors, selected from sector-specific standards	
Sector	Specific Parameters
Textile	Bio-assay test, Total Chromium, Sulphide, Phenolic compounds
Electroplating Industries	Oil & Grease, Ammonia-Nitrogen, Nickel, Hexavalent Chromium, Total Chromium, Copper, Zinc, Lead, Iron, Cadmium, Cyanide, Fluorides, Sulphides, Phosphates, Sulphates,
Tanneries	Sulphides, Total Chromium, Oil & Grease, Chlorides
Dye & Dye Intermediate	Oil & Grease, Phenolic compounds, Cadmium, Copper, Manganese, Lead, Mercury, Nickel, Zinc, Hexavalent Chromium, Total Chromium, Bio-assay test, Chlorides, Sulphates,
Organic chemicals manufacturing industry	Oil & Grease, Bio-assay test, Nitrates, Arsenic, Hexavalent Chromium, Total Chromium, Lead, Cyanide, Zinc, Mercury, Copper, Nickel, Phenolic compounds, Sulphides
Pharmaceutical industry	Oil & Grease, Bio-assay test, Mercury, Arsenic, Hexavalent Chromium, Lead, Cyanide, Phenolic compounds, Sulphides, Phosphates.”

[F. No. Q-15017/18/2014-CPW]

Dr. RASHID HASAN, Advisor

Note- The principal rules were published in the Gazette of India, Extraordinary, Part II, Section 3, Sub-section (i) *vide* number S.O. 844(E), dated the 19th November, 1986 and subsequently amended *vide* the following notifications:—

S.O. 433(E), dated the 18th April 1987; G.S.R. 176(E) dated the 2nd April, 1996; G.S.R. 97(E), dated the 18th February, 2009; G.S.R. 149(E), dated the 4th March, 2009; G.S.R. 543(E), dated the 22nd July, 2009; G.S.R. 739(E), dated the 9th September, 2010; G.S.R. 809(E), dated the 4th October, 2010, G.S.R. 215(E), dated the 15th March, 2011; G.S.R. 221(E), dated the 18th March, 2011; G.S.R. 354(E), dated the 2nd May, 2011; G.S.R. 424(E), dated the 1st June, 2011; G.S.R. 446(E), dated the 13th June, 2011; G.S.R. 152(E), dated the 16th March, 2012; G.S.R. 266(E), dated the 30th March, 2012; and G.S.R. 277(E), dated the 31st March, 2012; and G.S.R. 820(E), dated the 9th November, 2012; G.S.R. 176(E), dated the 18th March, 2013; G.S.R. 535(E), dated the 7th August, 2013; G.S.R. 771(E), dated the 11th December, 2013; G.S.R. 2(E), dated the 2nd January, 2014; G.S.R. 229 (E), dated the 28th March, 2014; G.S.R. 232(E), dated the 31st March, 2014; G.S.R. 325(E), dated the 07th May, 2014, G.S.R. 612(E), dated the 25th August, 2014; G.S.R. 789(E), dated the 11th November, 2014 and lastly amended *vide* notification S.O. 3305(E), dated the 7th December, 2015.

APPENDIX K
NIMZ SURVEY NUMBERS

NIMZ Survey Numbers

Ganeshpur: 9, 10, 15, 33-40, 42-44, 54-58, 70-83

Basanthpur: 2, 5-8, 10-17, 57, 61-63, 68

Metalkunta: 3-26, 279, 280, 283-300

Kalbemal: 33-40, 50, 54-57

Husseli: 26-29, 49-107

Rejinthal: 180-203, 204/1, 204/2, 204, 205, 205/1, 205/2, 206-212, 213/1, 213/2, 214/1, 214/2, 215-237

Nyamathabad: 26-32, 37, 39-49, 51/1, 51-96, 101-104, 107, 108

Mamidgi: 22-67, 84-88, 92-98, 102

Gunjeti: 74-82

Gongwar: 31, 32

Hadnoor: 83-85, 88-97, 110-116, 141-145, 157-159

Malkanpahad: 1-12, 26-28,

Mungi: 58-67, 148-151

Rukmapur: 42-55, 58

Bardipur: 14-22, 157-166

Chilepally: 101-104, 106-127, 144, 145, 148-150

Yelgoi: 31-100, 103, 105-111, 125, 245, 249-276, 279-297

ATTACHMENT

ATTACHMENT 1
LNTIEL NABET CERTIFICATE



Quality Council of India



National Accreditation Board for Education & Training

CERTIFICATE OF ACCREDITATION

L & T Infrastructure Engineering Ltd., Hyderabad

House No. 6-3-1192/1/1, 5th Floor, Block No. 3, White House, Kundan Bagh, Begumpet, Hyderabad – 500016

Accredited as Category - A organization under the QCI-NABET Scheme for Accreditation of EIA Consultant Organizations: Version 3 for preparing EIA-EMP reports in the following Sectors:

Sl. No.	Sector Description	Sector (as per)		Cat.
		NABET	MoEFCC	
1	River Valley Projects	3	1 (c)	A
2	Thermal power plants	4	1 (d)	A
3	Airports	29	7 (a)	A
4	Industrial estates/ parks/ complexes/areas, export processing Zones(EPZs), Special Economic Zones (SEZs), Biotech Parks, Leather Complexes	31	7 (c)	A
5	Ports, harbours, break waters and dredging	33	7 (e)	A
6	Highways	34	7 (f)	A
7	Common Effluent Treatment Plants (CETPs)	36	7 (h)	B
8	Common Municipal Solid Waste Management Facility (CMSWMF)	37	7 (i)	B
9	Building and construction projects	38	8 (a)	B
10	Townships and Area development projects	39	8 (b)	B

Note: Names of approved EIA Coordinators and Functional Area Experts are mentioned in RAAC minutes dated June 05, 2020 posted on QCI-NABET website.

The Accreditation shall remain in force subject to continued compliance to the terms and conditions as per the Scheme. The accreditation needs to be renewed before the expiry date by L & T Infrastructure Engineering Ltd., Hyderabad following due process of assessment.

Sd/-

Sr. Director, NABET

Dated: July 01, 2020

Certificate No.

NABET/EIA/2023/RA 0175

Valid till

March 02, 2023

For the updated List of Accredited EIA Consultant Organizations with approved Sectors please refer to QCI-NABET website.

ATTACHMENT 2
KIWI NABL CERTIFICATE



**National Accreditation Board for
Testing and Calibration Laboratories**
(A Constituent Board of Quality Council of India)



CERTIFICATE OF ACCREDITATION

KIWIS ECO LABORATORIES PRIVATE LIMITED

has been assessed and accredited in accordance with the standard

ISO/IEC 17025:2017

**"General Requirements for the Competence of Testing &
Calibration Laboratories"**

for its facilities at

**PLOT NO.19, ALEAP INDUSTRIAL ESTATE,SY NO. 342,, GAJULARAMARAM VILLAGE, QUTBULLAPUR
MANDAL & MUNICIPALITY, HYDERABAD, RANGA REDDY, TELANGANA, INDIA**

in the field of

TESTING

Certificate Number: TC-8699

Issue Date: 24/10/2019

Valid Until: 23/10/2021

This certificate remains valid for the Scope of Accreditation as specified in the annexure subject to continued satisfactory compliance to the above standard & the relevant requirements of NABL.
(To see the scope of accreditation of this laboratory, you may also visit NABL website www.nabl-india.org)

Signed for and on behalf of NABL



**N. Venkateswaran
Chief Executive Officer**



L&T Infra Engineering

L&T INFRASTRUCTURE ENGINEERING LIMITED

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