Draft Environmental Impact Assessment Report

Baseline Monitoring: Winter 2023

PM MITRA Textile Park
adjacent to @Addl. Amravati Industrial Area

Dist. Amravati, Maharashtra

Project Proponent

Maharashtra Industrial Development Corporation (MIDC), Amravati Division

January 2024

Environmental Consultant

Aditya Environmental Services Pvt. Ltd., Mumbai

QCI- NABET Accredited EIA Consultant

Accreditation No.: NABET/EIA/2225/RA 0262

dated 18th October 2022, valid up to 1st May 2025

Environmental Laboratory

Aditya Environmental Services Pvt. Ltd.

MOEFCC approval valid upto 24/04/2024

NABL Certification No.- TC-7085, valid upto 27/04/2025

Horizon Services

MOEFCC approval valid upto 05/02/2024

NABL Certification No.- TC-7064, valid upto 05/02/2024

MAHARASHTRA INDUSTRIAL DEVELOPMENTCORPORATION
(A Government of Maharashtra Undertaking)

TO WHOMSOEVER IT MAY CONCERN

This is to confirm that we have checked the Draft EIA report prepared by M/s Aditya Environmental Services Pvt Ltd for our proposed project of "Environmental clearance for PM MITRA Textile Park adjacent to @Addl. Amravati Industrial Area".

We also confirm that the data/information related to our project is correct as per our understanding of the project at the moment.

We also confirm that Environmental Management Plan included as a part of Draft EIA report, will be implemented.

Date : 29.01.2024
Place : Amravati .

Executive Engineer
MIDC Division, Amravati

No./EE/AMT/TB/I-38464 / of'2024
Executive Engineer, MIDC Dn
Dated :- 29/01/2024
M.I.D.C.Amravati Industrial Area,
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Declaration by Experts contributing to the Draft EIA "PM MITRA Textile Park adjacent to @Addl. Amravati Industrial Area, Dist. Amravati, Maharashtra", by Maharashtra Industrial Development Corporation (MIDC), Amravati Division.

TO WHOMSOEVER IT MAY CONCERN

This is to confirm that the Draft EIA Report for the project "Proposed PM MITRA Textile Park adjacent to @Addl. Amravati Industrial Area, Dist. Amravati, Maharashtra", by Maharashtra Industrial Development Corporation (MIDC), Amravati Division, has been prepared by me in the capacity of EIA Coordinator.

The Standard ToR as prescribed by MoEFCC vide Notification dated 10^{th} April 2015 and Additonal TOR issued by the EAC Infra I Committee, MoEFCC, on date 17.12.2023, have been complied with in preparing the EIA/EMP.

We also confirm that the EIA prepared is based on factual data and all due diligence has been followed in preparing the same.

Signature & Date: January, 2024

Name: Bela Pharate

Name of the EIA Consultant Organization: Aditya Environmental Service Pvt. Ltd.

NABET Certificate No.: NABET/EIA/1922/SA 0129

Place : Mumbai

Period of involvement: Since May, 2023

Contact information: 02042127500 **E-mail:** bela@aespl.co.in

Functional Area Experts:

S.N.	Functional Areas*	Name of the Expert/s	Involvement (Period& Task**)	Signature & Date
1	AP	Kavita Takale	since September, 2023	
2	WP	Rajiv Aundhe	since September, 2023	
3	SHW	Rajiv Aundhe	since September, 2023	
4	SE	Mamta Bodhale assisted by Sawak Tarapurwala	since September, 2023	
5	EB	Dhan Thapa	since September, 2023	
6	HG	Dr.Suresh Pawar	since September, 2023	
7	GEO	Dr.Suresh Pawar	since September, 2023	
8	AQ	Kavita Takale	since September, 2023	
9	NV	Rajiv Aundhe	since September, 2023	
10	LU	Bela Pharate	since September, 2023	
11	RH	Nitin K Tiwari	since September, 2023	
12	SC	Dr Ratnakar Mudliar assisted by Radhika Powar	since December 2019	

NOTE :

(*) Full forms of abbreviations given on Next Page

(**) Tasks for each Functional Area Expert given on Next Page

S.N.	Functional Area Code	Complete Name of the Functional Areas	Tasks
1	AP	Air Pollution Prevention, Monitoring & Control	Assessing baseline ambient air quality, stack emission, possible impacts and control measures
2	WP	Water Pollution Prevention, Control & Prediction of Impacts	Assessing baseline surface/ ground water quality, stack emission, possible impacts and control measures
3	SHW	Solid Waste and Hazardous Waste Management	Assessing solid/hazardous waste generation, treatment and disposal
4	SE	Socio-Economics	Assessing baseline Socioeconomic, demographic situation, impacts and CSR plan/ measures for upliftment
5	EB	Ecology and Biodiversity	Assessing baseline biodiversity situation in study area, impacts and Biodiversity management plans
6	HG	Hydrology, ground Water & Water Conservation	Assessing baseline hydrogeological situation in study area, impacts and management plans
7	GEO	Geology	Assessing baseline geological situation in study area, impacts and management plans
8	AQ	Meteorology, Air Quality Modeling & Prediction	Assessing nature and scale of impacts on ambient air quality through modelling and management plans
9	NV	Noise/ Vibration	Assessing baseline ambient noise quality, possible sources, impacts and control measures
10	LU	Land Use	Assessing baseline Land use Land cover possible impacts and control measures
11	RH	Risk Assessment & Hazard Management	Assessing safety meausres taken up by company modelling to assess scale of impacts, disaster management and control measures
12	SC	Soil conservation	Assessment of fertility/productivity of soil, nutrient availability, assessment of impact of gaseous, liquid and solid pollutants on soil and remediation techniques

Plagiarism Check Sheet

Title of EIA Report	Proposed PM MITRA Textile Park adjacent to @Addl. Amravati Industrial Area, Dist. Amravati, Maharashtra
Name of Accredited Organization	Aditya Environmental Service Pvt. Ltd.
Unique Identification Number	AESPL/BLD-E/23-24/EIA/004
Name of EIA Coordinator (EC)	Bela Pharate
Name of the Software	Plagiarism Checker X
Date of Check	2nd February, 2024
Time of Check	IST 14.30

Declaration by the Head of the Accredited Consultant Organization

I hereby certify that this EIA Report has been evaluated using online/ in-house software viz., Plagiarism Checker X. The report produced has been analyzed by the system and based on it, I certify that the EIA Report has been produced in accordance with good scientific practice.

Date and Sign of EIA Coordinator: February 2024

Name: Bela Pharate

Designation: EIA Coordinator

Date and Sign of Head of Accredited Organization: February 2024

Rajiv Aundhe

Aditya Environmental Services Pvt. Ltd.

NABET Certificate No. and Issue Date: QCI- NABET Accreditation No.: NABET/EIA/2225/RA 0262 dated 18th October 2022, valid up to 1st May 2025

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Abbreviations

Abbreviation	Full Form
AAQM	Ambient Air Quality Monitoring
BDL	Below Detection Limit
BOD	Biological Oxygen Demand
CBMWTSDF	Common Biomedical Waste Treatment, Storage & Disposal Facility
CER	Corporate Environmental Responsibility
CFC	Common Facility Centre
CGWB	Central Ground Water Board
CHWTSDF	Common Hazardous Waste Treatment, Storage & Disposal Facility
CETP	Common Effluent Treatment Plant
COD	Chemical Oxygen Demand
CMD	Cubic Metre per Day
CPCB	Central Pollution Control Board
CSR	Corporate Social Responsibility
CSTP	Common Sewage Treatment Plant
DCR	Development Control Regulations
DEM	Digital Elevation Model
DG	Diesel Generator
DMP	Disaster Management Plan
DP	Development Plan
EIA	Environmental Impact Assessment
EMC	Environment Management Cell
EMP	Environment Management Plan
ESA	Eco-Sensitive Areas
HH	Household
IMD	Indian Meteorological Department
LULC	Land Use and Land Cover
MCM	Million Cubic Metre
MEE	Multiple Effect Evaporation
MIDC	Maharashtra Industrial Developemnt Corporation
MLD	Million Litre per Day
MoEFCC	Ministry of Environment, Forests and Climate Change
MPCB	Maharashtra Pollution Control Board
MSEDCL	Maharashtra State Electricity Distribution Company Limited
MSW	Municipal Solid Waste
NAAQS	National Ambient Air Quality Standards
NABET	National Accreditation Board for Education & Training
NGT	National Green Tribunal
NGO	Non Governmental Organization
NH	National Highway
NHAI	National Highway Authority of India
NMHC	Non Methane Hydrocarbons
PAP	Project Affected Persons
PCU	Passenger Car Unit
PM_{10}	Particulate Matter less than 10 micron/cubic meter
$PM_{2.5}$	Particulate Matter less than 2.5 micron/cubic meter
PM MITRA	Prime Minister Mega Integrated Textile Region and Apparel
QCI	Quality Council of India
RCC	Reinforced Cement Concrete
R&R	Rehabilitation and Resettlement
RO	Reverse Osmosis
ROW	Right of Way
RSPM	Respirable Particulate Matter

Abbreviation	**Full Form**
SEZ	Special Economic Zones
SH	State Highway
SIA	Social Impact Assessment
SOI	Survey of India
SS	Suspended Solids
SSHEHS	Soil Sand High Efficiency Hybrid System
SWD	Storm Water Management
TDS	Total Dissolved Solids
TOR	Terms of Reference
TSS	Total Soluble Solids
ZLD	Zero Liquid Discharge

1 INTRODUCTION

1.1 Purpose of Environmental Impact Assessment (EIA) Report

Environmental Impact Assessment (EIA), as the name suggests is, a process of meticulous assessment of environmental impacts for the purpose of identifying /evaluating the potential benefits or adverse impacts of development projects on the surrounding environment, consisting of land, air, water and biological factors, taking in to account environmental, economic, social, cultural and aesthetic considerations. For evaluating the impacts of the proposed activities, all activities associated with planning, design, site preparation, construction, operation and maintenance within the proposed project are included. All of these considerations help decision makers and project planners to develop proper mitigation measures at an early stage in the project.

The aim of an EIA is to ensure that potential impacts are identified and addressed. With this aim, an Environmental Impact Assessment (EIA) Report has been prepared to assess baseline environmental conditions at the site and an Environment Management Plan (EMP) has been prepared to execute the project with minimum pressure on the natural resources and negligible impacts on the environment.

The purpose of this Environmental Impact Assessment Report is to investigate the principal environmental concerns, assess the magnitude of impact and suggest suitable adequate measures in the Environmental Management Plan (EMP) for the proposed PM MITRA Textile Park planned by Maharashtra Industrial Development Corporation (MIDC).

1.2 Identification of Project & Project Proponent

1.2.1 Project

The Government of India plans to set up Seven (07) Mega Integrated Textile Region and Apparel Parks on Greenfield/Brownfield sites in partnership with the State Governments. The Scheme would lead to creation of a modern, integrated large scale, world class industrial infrastructure including plug and play facilities. The scheme offers domestic manufacturers a level-playing field in the international textiles market & pave the way to become a global champion of textiles exports across all segments. The Scheme also focused to attract investment, to generate employment and augment export potential. Maharashtra has clearly understood the requirements mentioned as per the challenge matrix for the Brownfield Park and decided to suggest Additional Amravati (Nandgaonpeth) Industrial area as the proposed location.

The mission of this proposed project for setting up the prestigious Prime Minister Mega Integrated Textile Region and Apparel (PM MITRA) parks scheme by Ministry of Textile, Government of India inspired by the 5F vision of Hon’ble Prime Minister – Farm to Fibre to Factory to Fashion to Foreign.

PM MITRA Park sites approved by Government of India:7 sites namely at Tamil Nadu, Telangana, Gujarat, Karnataka, Madhya Pradesh, Uttar Pradesh and Maharashtra were chosen out of 18 proposals for PM MITRA parks which were received from 13 States.

These PM MITRA Parks will help in creating world-class industrial infrastructure that would attract large scale investment including foreign direct investment (FDI) and encourage innovation and job creation within the sector. The parks will offer an excellent infrastructure, plug, and play facilities as well as training and research facilities for industry.

The Maharashtra state is one of the fast-emerging states and an industrial hub of India and is well known globally for its skills in all sectors with major being the agriculture and engineering production sectors. Maharashtra Industrial Development Corporation (MIDC) is proposing to develop the PM MITRA Textile Park adjacent to the Additional Amravati Industrial Area. The proposed textile park will be of 410.02 ha. The development of the park is based on the 5F vision of our hon'ble Prime Minister Minister – Farm to Fibre to Factory to Fashion to Foreign.

Integrated Textile to add value chain (from spinning, weaving, processing/ dyeing, and printing of garment manufacturing) at a single location in each park reducing the logistics cost of Industry. The development of the textile park area also includes a great development in infrastructure side also including construction of 60 m, and 45 m wide roads for better connectivity also.

The proposed development will include units for Ginning, Spinning, weaving, Garmetting, Knitting etc. The basic zoning of the proposed park will include a technical textile zone, Processing zone, Textile manufacturing and printing machinery within the proposed area. The proponent will carry out the overall area development and land infrastructure like roads, water lines, SWDs, power lines, MSW management facility, utility areas etc

1.2.2 Project Proponent

The proposed development will be carried out by the Maharashtra Industrial Development Corporation (MIDC), a premier industrial infrastructure development agency of the Government of Maharashtra established in 1961 by the MIDC Act. MIDC has vast experience in developing Industrial estates and has established 289 Industrial Areas over 89,000 hectares of land. MIDC has developed specialized parks for different industrial sectors including Chemicals, Engineering, Textile, Information Technology (IT) , Biotechnology (BT), Special Economic Zones, (SEZ), Wine (Grape Processing) Park, Silver Zone, and Gems. MIDC has 16 Regional Offices spread all over Maharashtra to manage the various Industrial areas. MIDC has one of the largest industrial land banks amongst all the industrial development corporations in India.

The head office of MIDC is located at Andheri (East), Mumbai. The proposed development will be carried out by the MIDC Nandgaonpeth, Subdivision Amravati, District Maharashtra under the jurisdiction of the Executive Engineer, Amravati.

1.3 Brief Description of Nature, Size, Location of the Project and its Importance in the Country, Region

1.3.1 Nature and Size of the Project

The Brownfield Mega Integrated Textiles region & Apparel Park is proposed for development at Amravati Industrial Area under the PM MITRA scheme. The site for the proposed PM MITRA scheme is a Brownfield project and will comprise of 410.02 Ha industrial land located in Nandgaonpeth village of Amravati district of Maharashtra. Addl.

Amravati (Nandangaonpeth) Industrial area is an existing textile industrial park and major companies already operating in the area are Shyam Indofab, Siyaram's, Raymond, VHM Industries,etc. The effluent from these existing parks is treated in an existing Common Effluent Treatment Plant (CETP) of capacity 5 MLD. The proposed units will include Ginning, Spinning, weaving unit, Garmetting, Knitting technical textile zone, Processing zone, Textile manufacturing and printing machinery. It is proposed to provide space to set up small and medium-scale multi-sector industries and commercial establishments related to textiles under one roof.

Proposed Textile Park will house all types of manmade fibre units including Rayon (Category 5d as per EIA Notification) under Red category as per CPCB classification under Category A, Activity 7c as per the Schedule to the EIA Notification.

Following are the highlights of the project:

- An approved layout taking into consideration all the statutory requirements.
- Sufficient area to accommodate a good number of industries related to textile under one roof.
- Commercial area
- Well-planned infrastructure facilities like roads, storm water drains, rainwater harvesting pits and greenbelt development plan etc.
- Well-planned water supply and sewerage system
- Power supply lines for individual units and common facilitites including streetlights.
- Solid waste and liquid effluent management facilities like CETP

*(Proposed Layout Plan is enclosed as **Annexure I**.)*

1.3.2 Location of the Project

The proposed project site is located on the National Highway-53 at MIDC, Amravati, Maharashtra. Amravati (Nandangaonpeth) Industrial area is an existing textile industrial park next to the proposed site. Development of PM MITRA Textile Pak will be taken up in 2 villages Pimpalvihir and Dighargavhan *(Village wise Survey Numbers are listed out and enclosed as **Annexure III**)*.

1.3.3 Importance of the Project to the Country, Region

A world-class industrial infrastructure would attract cutting-edge technology and boost FDI and local investment in sectors giving more opportunities for exporting the finished products. The setting up of Textile Units will reduce the demand supply gap in the domestic market & will also boost the exports. The products manufactured in the proposed industrial area are to be expected to meet both the demand -supply gap to meet both domestic and export markets.

1.4 Scope of the Study

The proposed project is covered under Category 7(c) A as per the EIA Notification of Ministry of Environment Forest & Climate Change (MoEFCC), dated 14/09/2006 and subsequent amendments. Therefore, the proposed development requires obtaining Environmental Clearance from Ministry of Environment & Forest (MoEFCC). The project will undergo the due procedure of obtaining prior environmental clearance from the MoEFCC.

As a part of application for obtaining Environmental Clearance, the development authority (MIDC) has submitted Form 1 and Pre-Feasibility Report of the proposed project requesting the MoEFCC for the grant of Terms of Reference (TOR), and TOR has been granted.

1.4.1 Objective of the EIA Study

The primary objective of the EIA study is to safeguard the environment during planning, design, construction and operation of the proposed project activities and associated facilities by mitigating environmental impacts envisaged during various phases of the project.

The study is designed to evaluate the proposed project activities considering environmental factors and prepare an Environment Management Plan (EMP) for the project.

Specific objectives of the EIA study are to:

- Determine the baseline environmental conditions of the site and the study area.
- Identify, predict and assess environmental impacts that might arise during the construction and operation of the proposed industrial park and activities associated with it.
- Suggest environmental impact mitigation measures and appropriate technologies to suit local conditions, keeping in mind the proximity of sensitive biosphere reserve and other environmental features within study area, in order to eliminate or reduce the negative impact on the environment (if any), as part of the Environmental Management Plan.
- Enable the project proponent to comply with environmental rules and train operating personnel to operate pollution control facilities in order to protect the environment during consturion and operation phases of the industrial estate.

1.4.2 Scope of work for EIA

The scope of work for EIA includes:

- Delineation of the study area (as specified in the Standard Terms of Reference for EIA / EMP report for projects / activities requiring environment clearance under EIA Notification, 2006, published by MoEFCC vide order dated 10.04.15)
- Assessment of the present status of air, water, marine environment, noise, land, biological and socio-economic components of the environment.
- Identification and quantification of impacts due to the proposed project on environmental components (during the pre-construction, construction and operation phases).
- Assessment of the identified environmental impacts.
- Preparation of Environmental Management Plan (EMP) outlining additional control technologies to be adopted for mitigation of adverse impacts, if any.
- Delineation of post-project environmental quality monitoring to be pursued by the project proponent.
- Any other studies specified in the additional TOR granted by the Expert Appraisal Committee (EAC) of the MoEF & CC.

1.4.3 Regulatory Scoping and its Compliance

The MoEFCC has prescribed the Standard Terms of Reference vide SO no. 996(E), dtd. 10th April 2015, for conducting EIA studies.

The Standard Terms of Reference for category A, activity 7(c) have been complied with and a summary of the same is presented in the following table (**Table 1.1).**

Table 1-1: **Compliance to Standard ToR for 7(f) category projects**

Sr. No.	Action Point	Compliance
	Project details	
1.	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.	Please refer Draft EIA report, Chapter 5: Analysis of Alternative Sites
2.	The analysis should include parameters considered along with weightage criteria for short-listing selected site.	Please refer Draft EIA report, Chapter 5: Analysis of Alternative Sites
3.	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	Likely pollutants and pollution potential is given in Draft EIA report, Chapter

Sr. No.	Action Point	Compliance
	with quantity from the various industries.	2, Section 2.7. also refer to section 2.6 for technology and process.
4.	Submit Roles and responsibility of the developer etc for compliance of environmental regulations under the provisions of EP Act.	Please refer Draft EIA report, Chapter 10 Environmental Management Plan, Section 10.2
5.	Examine the details of National Highways/ State Highways/ expressways falling along the corridor and the impact of the development on them.	Traffic studies conducted for the project are mentioned under Section 7.1 of Chapter 7.
6.	Submit the details of the infrastructure to be developed.	Please refer Draft EIA report, Chapter 2, sections 2.8 and 2.9
7.	Justification of the parameters, frequency and locations shall be discussed in the EIA.	Please refer Draft EIA report, Chapter 3: Description of Baseline Environment
	Environment Status/ Baseline Data Methodology	
1.	Examine baseline environmental quality along with projected incremental load due to the project taking into account of the existing developments nearby. 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.	Please refer Draft EIA report, Chapter 3: Description of Baseline Environment
2.	Site justification of the identified industry sectors from environmental angle and the details of the studies conducted if any.	Please refer Draft EIA report, Chapter 5
3.	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.	Impacts on sociological environment are mentioned in draft EIA report under chapter 4: Anticipated Environmental Impacts and Mitigation Measures. For costs estimates of CER please refer Draft EIA report, Chapter 6
	Remote Sensing/ GIS	

Sr. No.	Action Point	Compliance
1.	Analysis should be made based on latest satellite imagery for land use with raw images.	Please refer Draft EIA report, Chapter 3: Description of the Environment, Section 3.2.6 which gives the landuse landcover study (LULC) for the study area of 10km.
2.	Check on flood plain of any river.	No river in close vicinity of site
	Land Use, Land Acquisition, R&R	
1.	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.	Please refer Draft EIA report, Chapter 3: Description of the Environment, Section 3.2.6 which gives the landuse landcover study (LULC) for the study area of 10km.
2.	Submit details of environmentally sensitive places, land acquisition status, rehabilitation of communities/ villages and present status of such activities.	Please refer Draft EIA report, Chapter 3: Description of the Environment, Section 3.2.1
3.	Examine the impact of proposed project on the nearest settlements.	Please refer Draft EIA report, Chapter 4: Description of the Environment, Section 4.3.5
4.	Submit details regarding R&R involved in the project	R&R is not applicable
5.	The project boundary area and study area for which the base line data is generated should be indicated through a suitable map.	Please refer Draft EIA report, Chapter 3: Description of the Environment, Section 3.2.1 indicating the study area.
	ESZ, CRZ Details	
1.	Details regarding project boundary passing through any eco- sensitive area and within 10 km from eco-sensitive area.	Please refer Draft EIA report, Chapter 3: Description of the Environment, Section 3.2.1
	Forest and Wildlife Related Details	
1.	An overall green area of at-least 33% of the Industrial Area should be developed with native species. The green area shall be 40% in case of critically polluted area. Green buffer in the form of green belt to a width of 15 meters should be	Please refer Draft EIA report, Chapter 2, Section 2.8.8: Green belt

Sr. No.	Action Point	Compliance
	provided all along the periphery of the industrial area.	
2.	Submit the details of the trees to be felled for the project.	Please refer Draft EIA report, Chapter 2, Section 2.8.8: Green belt
3.	Submit the present land use and permission required for any conversion such as forest, agriculture etc.	Present land use is tabulated under section 3.7.2 of Chapter 3
	Court/ Litigation Related	
1.	Submit Legal frame work for the implementation of Environmental Clearance conditions - to be clearly spelt out in the EIA report.	Legal frame work for the implementation of Environmental Clearance conditions given in EMP under Chapter 10
2.	Details of litigation pending against the project, if any, with direction /order passed by any Court of Law against the Project should be given.	NA. There is no litigation pending against the project.
	Water Environment/ Quality/ Hydrology	
1.	Ground water classification as per the Central Ground Water Authority.	Please refer Draft EIA report, Chapter 3, Section 3.5.2
2.	Submit the source of water, requirement vis-à-vis wastewater to be generated along with treatment facilities, use of treated wastewater along with water balance chart taking into account all forms of water use and management.	Please refer Draft EIA report, Chapter 2, Section 2.9.6 and section 2.9.7.
	Rain Water Harvesting	
1.	Rain water harvesting proposals should be made with due safeguards for ground water quality.	Please refer Draft EIA report, Chapter 4, Section 4.3.3.4
2.	Maximize recycling of water and utilization of rain water. Examine details.	Please refer Draft EIA report, Chapter 4, Section 4.3.3.4
3.	Examine soil characteristics and depth of ground water table for rainwater harvesting.	Please refer Draft EIA report, Chapter 4, Section 4.3.3.4
	Waste Management, Drainage and STPs Details	
1.	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.	Please refer Draft EIA report, Chapter 3, Section 3.2.2 for Topography and site contour and section 3.2.3 for existing drainage details

Sr. No.	Action Point	Compliance
2.	Examine details of solid waste generation treatment and its disposal.	Please refer Draft EIA report, Chapter 2, Section 2.9.9
	Energy and Resources	
1.	Examine and submit details of use of solar energy and alternative source of energy to reduce the fossil energy consumption.	Please refer Draft EIA report, Chapter 2, Section 2.9.8
	Air Environment	
1.	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.	Please refer Draft EIA report, Chapter 4, Section 4.3.2
	Road/ Transport Safety and Traffic Aspects	
1.	Examine road/ rail connectivity to the project site and impact on the traffic due to the proposed project.	Please refer Draft EIA report, Chapter 7, Section 7.1
2.	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.	Please refer Draft EIA report, Chapter 7, Section 7.1
3.	A detailed traffic and transportation study should be made for existing and projected passenger and cargo traffic.	Please refer Draft EIA report, Chapter 7, Section 7.1
4.	Examine the details of transport of materials for construction which should include source and availability.	Please refer Draft EIA report, Chapter 2, Section 2.8.11
	Noise Environment	
1.	Examine noise levels - present and future with noise abatement measures.	Please refer Draft EIA report, Chapter 4, Section 4.3.2
	Environmental Management Plans and Mitigative Measures	
1.	Examine separately the details for construction and operation phases both for Environmental Management Plan and Environmental Monitoring Plan with cost and parameters.	Please refer Draft EIA report, Chapter 10 for Environmental Management Plan and Chapter 6 for Environmental Monitoring Plan with cost and parameters
2.	Submit details of a comprehensive Disaster	Please refer Draft EIA

Sr. No.	Action Point	Compliance
	Management Plan including emergency evacuation during natural and man-made disaster.	report, Chapter 7, Section 7.2
3.	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".	--

The EIA also complies to the Additional TOR granted by the EAC during its 345th meeting held on 10th November, 2023 and granted by MoEFCC MoEF & CC vide letter No. 10/69/2023-IA.III dt 17.12.2023. (**Annexure II**). Compliance to the Additional TOR granted by the EAC is given in the following table (**Table 1.2**).

Table 1-2: **Compliance to Additional ToR**

Sr. No.	Action Point	Compliance
1.	Water balance chart be prepared and submitted along with EIA/EMP report.	Please refer Draft EIA report, Chapter 2, section 2.9.6 and 2.9.7
2.	The Industrial complex to achieve the Zero Liquid Discharge, waste water generated from various industrial operations shall be properly collected, treated to the prescribed standards and then recycled or reused for the identified uses shall be explored	Please refer Draft EIA report, Chapter 2, section 2.9.7 and section 2.9.3
3.	Detailed land use breakup of proposed Industrial area with green belt implementation details has to be submitted to meet out the MoEF & CC requirement of 33%	Please refer Draft EIA report, Chapter 2, section 2.8.3 and 2.8.4
4.	Protection measures to ensure that waste water will not be discharged in the river at any circumstances shall be submitted	Please refer Draft EIA report, Chapter 2, section 2.8.10: Storm Water Drainage
5.	While planning, industries creating Air/Noise pollution has to be avoided near villages	Please refer Draft EIA report, Chapter 2, section 2.8.3: Proposed Zoning
6.	While preparing the green belt development plan for the park it shall be ensured that open spaces and lawns are not included in the green belt. Entire industrial park shall have a continuous green belt of minimum 15-	Please refer Draft EIA report, Chapter 2, section 2.8.3: Proposed Zoning and 2.8.8: Green Belt.

Sr. No.	Action Point	Compliance
	meter width with provision of wider green belt in the area adjacent to any habitation, if any, and around the waterbodies within the park or closer to industrial park	
7.	Feasibility of excluding the forest area, if any, from industrial development and using it as a green belt shall be explored.	Please refer Draft EIA report, Chapter 2, section 2.8.3 Area Statement for details of green belt.
8.	An adequate drainage system shall be provided at the site with separate collection streams to segregate the storm runoff from roads, open areas, material storage areas, vehicle wash water and other wastewater streams	Please refer Draft EIA report, Chapter 2, section 2.8.10: Storm Water Drainage
9.	Prepare biodiversity conservation plan through a nationally reputed institutes like Jhunjhunwala College, University of Mumbai	Please refer Draft EIA report, Chapter 3 section 3.6: Biological Environment for detauiled EB study. Biodiversity Conservation Plan is under preparation by the nationally reputed institute Jhunjhunwala College (University of Mumbai) and report will be submitted shortly. Enclosed in Draft EIA, please find detailed Ecology and Biology study carried out by NABET approved Functional Area Expert for EB from accredited EIA consultant organization.
10.	Submit the details of the storm water management and impacts due to contamination of storm water with affluent/ chemicals and mitigation measures at industrial estate developer level and unit level	Please refer Draft EIA report, Chapter 2, section 2.8.10: Storm Water Drainage for planning of SWD within the proposed industrial area. Impacts on water environment due to industries are given in Chapter 4, Section 4.3.3 Water Environment
11.	Submit the details impacts due to liquid waste discharge, air emissions, solvent emissions, handling of hazardous waste and chemical odour	Impacts due to industries are given in Chapter 4 of Draft EIA report. impacts due to liquid waste discharge are mentioned under section 4.3.3.3. Impacts due to air emissions, solvent emissions are mentioned under section 4.3.2.3. Measures for handling of hazardous waste are given under section 2.9.9 and for chemical odour are given in Section 4.3.2.4.
12.	Submit the details of the common	Solvents recovery system is given in Chapter

Sr. No.	Action Point	Compliance
	solvents recovery system planned at Industrial estate with anticipated efficiencies	4, section 4.3.3.4 of Draft EIA report
13.	The PP may use sulphuric acid, HCl acid chromium salt and ammonium chloride for dying/ colouring during the production. Therefore, airborne exposure to acid fumes and chromium dust assessment has to be carried out	Please refer Draft EIA report, Chapter 4, Section 4.3.2.3 for mitigation measures for air pollutants.

Environmental Impact Assessment (EIA) study includes impact assessment and preparation of Environmental Management Plan (EMP) for proposed development. The study area to be considered for the purpose of assessing the impacts on the environment is determined as per the applicable EIA guidelines.

1.4.4 Applicability of EIA Notification, 2006

Proposed Textile Park will house all types of manmade fibre units including Rayon (Category 5d as per EIA Notification) under Red category as per CPCB classification and hence it falls under Category A, Activity 7c as per the Schedule to the EIA Notification which consists of Industrial estates/ parks/ complexes/ areas, Export Processing Zones (EPZs), Special Economic Zones (SEZs), Biotech Parks, Leather Complexes etc. The Proposed Project requires clearance from MoEFCC.

As a part of Environmental Clearance process, MIDC has uploaded and submitted relevant documents, namely Form–1, along with Pre-feasibility Report for carrying out EIA studies on the online parivesh portal on 9th October, 2023.

The project has been given proposal number IA/MH/INFRA1/447555/2023 and File No.: 10/69/2023-IA.III. The MOEF&CC has issued TOR for carrying out EIA/EMP vide letter dated 17th December, 2023. (Refer **Annexure II.**)

For conducting EIA as per the TORs, the MIDC has appointed M/s. Aditya Environmental Services Private Limited, Mumbai, NABET accredited EIA Consultant Organization for the sector 31: Industrial estates/ parks/ complexes/ areas, Export Processing Zones (EPZs), Special Economic Zones (SEZs), Biotech Parks, Leather Complexes etc.

For conducting the baseline monitoring during winter 2023 for the EIA studies, M/s. Aditya Environmental Services Pvt Ltd has appointed M/s Horizon Services, which is an approved lab (*recognized by MOEFCC as "Environmental Laboratory" valid upto 05/02/2024 as per MOEF Gazette and having NABL Certification No. TC-7064, valid upto 05/02/2024)* to undertake Ambient Air Quality Monitoring and Noise Monitoring. Other environmental parameters were collected and analysed by M/s Aditya Environmental Services Pvt Ltd at its own MoEFCC recognized laboratory (*recognized by MOEF&CC as "Environmental Laboratory" valid upto 24/04/2024 as per MOEFCC Gazette and having valid NABL accreditation vide NABL Certification No.- TC-7085, valid upto 27/04/2025)*.

1.4.5 Permits and Approvals

The proposed development is a designated Textile Park and will be planned taking into account the guidelines of CPCB's Zoning Atlas for Siting of Industries and the criteria mentioned in this Ministry's Technical EIA Guidance Manual for Industrial Estates (2009).

This site is notified under MIDC Act, 1961 by the GoM vide notification dated 5th September 2019 and No. IDC 2018/(C.R. 363)/Ind 14. The Act shall take effect in certain areas of village Pimpalvihir, Dighargavhan, Kapustalani, Dawargaon, Malegaon, Chinchkhed, Kekatpur and Wagholi In Taluka Amravati, District Amravati mentioned in the schedule appended hereto and declares the said area to be an industrial area under clause (g) of section 2 of the said Act.

Details of general permits and clearances as applicable to the proposed industrial estate project are provided in table below.

Table 1-3: Statutory Clearances / Permissions required

No	Legal requirement
1	Environmental Clearance under Environmental Impact Assessment Notification, 2006 as amended to date
2	Combined Consent to Establish under
2.1	The Water (Prevention and Control of Pollution) Act, 1974, amended 1988 and Rules, 1975, as amended 2011.
2.2	The Air (Prevention and Control of Pollution) Act, 1981, amended 1987 and Rules, 1982, as amended to date.
2.3	The Hazardous and Other Wastes (Management and Transboundary Movement Rules), 2016
3	Irrigation Department for approval 10 MCM reserved for the industrial area from the Upper Wardha Reservoir dated 09.02.2004
4	MSEDCL for approval of 30MWA electricity dated 04.07.2023
5	Tree Cutting approval
6	Adequacy Certificate for CETP

The MoEFCC has stipulated general discharge standards for water effluents, and general emission standards for air and noise emissions. These standards limit the concentration and volumes of the effluents and emissions released to the atmosphere. After the establishment of the industrial estate, the individual Industries will be required to obtain "Consent to Establish" and "Consent to Operate" (under the Water Pollution Act (1974), Air Pollution Act (1981) and Authorization under The Hazardous and Other Wastes (Management and Transboundary Movement Rules), 2016) for their individual unit before commissioning.

In addition to the above, the Central Pollution Control board (CPCB) has also specified National Ambient Air Quality and Noise Standards for residential, commercial, industrial and sensitive zones for the country as a whole to be followed by MIDC as well as individual unit owner as may be applicable.

1.4.6 Methodology of EIA

The methodology adopted for the environmental impact study consists of the following stages:

- Identification of significant environmental components and assessment of their baseline (pre-project or existing) status within the study zone. This was carried out by extensive site visits by Functional Area Experts to assess geographical/ topographical features/ existing traffic levels along with simultaneous/ concurrent field monitoring by MoEFCC recognized laboratory followed by a study of environmental conditions viz. air quality, water quality (surface and ground), noise levels etc. in the study area.
- Prediction of impacts on various identified and significant environmental parameters due to the proposed alignment. Data pertaining the proposed construction activities, road design, water consumption, solid waste/ sewage generation, characteristics of disposal medium etc. are to be studied to identify those activities causing environmental impacts through an environmental impact matrix.
- Evaluation of most significant impacts and delineation of an Environmental Management Plan to mitigate adverse impacts (if any) on the quality of surrounding environment.

The detailed methodology for the environmental impact study is outlined below:

1.4.6.1 Baseline Environmental Studies

This study includes an understanding of environmental conditions within 10 km study area around the site and as specified in the Standard TOR.

Details of various components covered therein are as under:

Land Environment

It includes study of preliminary information regarding topography of the study area, location aspects of site, land-use pattern (using Satellite imagery), sub-stratum characteristics (through resistivity surveys and studying the soil investigation reports), development pattern and landscape features within the study zone (through reconnaissance survey) etc. and review of data obtained through various primary / secondary sources.

Analysis of soil was carried out through sampling undertaken during winter season of 2023.

Air Environment

Preliminary information regarding the location of the proposed project and possible air pollution sources is gathered through reconnaissance survey as well as data obtained through primary and secondary sources.

Major project related primary air pollutants identified for construction phase are Respirable Particulate Matter (RSPM or PM10), Particulate Matter less than 2.5 µ (PM2.5), Sulfur Dioxide (SO2), Carbon Monoxide (CO), and Oxides of Nitrogen (NOx), mainly generated due to vehicular emissions and construction activities The rest of the NAAQS parameters were also monitored to understand baseline values. Assessment of the baseline status of these parameters in ambient air within the impact zone was undertaken during winter season of 2023.

Data on micro-meteorological parameters such as wind speed, wind direction, temperature and relative humidity was obtained from secondary sources.

Noise Environment

Noise level measurements undertaken on the proposed site and within the study area during winter season of 2023 to identify existing baseline status.

Water Environment

Reconnaissance studies, for identification of available water resources (ground/ surface) were carried out in the study area. Analysis of water samples- surface and ground were undertaken during the winter season of 2023. The sampling is an assessment for potability and also to establish baseline characteristics.

Biological Environment

Assessment of the baseline status of flora and fauna in the study area was carried out through various primary and secondary sources and through field surveys conducted winter season (2023).

Socioeconomic Environment

The social analysis study was carried out through a questionnaire-based survey. The social analysis report provides a socio-economic profile of the project area and addresses local population, industry, agriculture, employment, health, education, health, land acquisition and resettlement. Data on demographic pattern, population density, educational facilities, employment opportunities, health status, water & sanitation and transport facilities in the study zone was collected through secondary sources such as, census records and other information available from local Government offices.

A baseline socio-economic survey was conducted to assess the needs, aspirations of the people affected by the project, impacts on the people, properties and loss of livelihood. The inputs so obtained will be used to develop a site specific CER Plan.

1.4.6.2 Impact Assessment Matrix

From a study of the nature of activities during construction phase & after completion & knowledge of existing baseline/ background levels of various environmental parameters viz. Air/ Water/ Noise level/ Soil/ Socio Economic status in and around the site, the nature & severity of impact on environment will be estimated.

Impact Matrix is prepared delineating activities v/s tangible impacts. Environmental Management Plan is prepared for the project to reduce negative impacts of the project.

1.4.6.3 Environmental Management Plan

From the identified impacts, Environmental Management Plan is prepared to outline pollution control measures to be implemented in order to ensure minimum impact on environment due to proposed project.

1.4.6.4 Public Hearing

As per clause 7(III) of the EIA Notification, the project requires Public Hearing. The Additional TOR granted by MoEFCC also requires a Public Hearing to be conducted. This Draft EIA Report is accordingly been submitted to MPCB in order to conduct a Public Hearing for the project.

1.5 REPORT ORGANIZATION AND STRUCTURE

The structure of the EIA report is based on the guidelines given in the EIA Notification at APPENDIX III under "Generic Structure of Environmental Impact Assessment Document".

Accordingly, the report has been organized in 12 chapters as below.

Chapter 1: Introduction gives the purpose of the report along with the identification of project and project developing authority. A brief description of nature, size, location of the project and its importance is also mentioned. The scope of the study – details of regulatory scoping carried out (as per Terms of Reference) is also covered in this chapter.

Chapter 2: Project Description gives a condensed description of those aspects of the project, likely to cause environmental effects. Details include a description of the type and need of project, location maps and project specific project boundary and site layout. The project description, size of the project and associated activities required for the project including technology, drawings showing master plan, components of project etc. and schematic representations of the feasibility drawings which give information important for EIA purpose are mentioned in this chapter. The proposed schedule for approval and implementation are also covered.

Chapter 3: Description of the Environment describes the study area, period of monitoring of environmental aspects, components and methodology. It establishes the baseline for valued environmental components, as identified in the scope, both in the core zone and the impact zone. Also gives the base maps of all environmental components.

Chapter 4: Anticipated Environmental Impacts gives the detailed assessment of environmental impacts due to project location, project construction, regular operations, final decommissioning or rehabilitation of the completed project. It also gives briefly the measures for minimizing and/ or offsetting adverse impacts identified. An assessment of significance of impacts (criteria for determining significance, assigning significance) has also been made.

Chapter 5: Analysis of Alternatives (Technology and Site) gives the analysis of alternatives which includes a description of each alternative, summary of adverse impacts of each alternative, mitigation measures proposed for each alternative and the selection of alternatives.

Chapter 6: Environmental Monitoring Program Technical aspects of monitoring the effectiveness of mitigation measures are outlined in this chapter, including monitoring of environmental aspects during construction phase and operation phase.

Chapter 7: Additional Studies pertaining to Traffic and Transportation, Disaster Management Plan and any other are covered in this chapter.

Chapter 8: Project Benefits This chapter covers the benefits due to the project under improvements in the physical infrastructure, improvements in social infrastructure and employment potential.

Chapter 9: Environmental Cost Benefit Analysis: As recommended at the scoping stage.

Chapter 10: Environmental Management Plan gives a comprehensive Environment Management Plan which states the administrative aspects of ensuring that mitigative measures are implemented and their effectiveness monitored, after approval of the EIA; along with the budgetary requirements for environmental protection.

Chapter 11: Summary and Conclusion summarizes the findings of the study and gives an overall justification for implementation of the project. An explanation of how adverse effects have been mitigated has been given in conclusion.

Chapter 12: Disclosure of Consultants Engaged outlines the names of the consultants engaged and nature of consultancy rendered in preparation of this document.

2 PROJECT DESCRIPTION

2.1 Type of Project

The proposal is for the development of the PM MITRA Textile Park. The processing zone of the proposed textile park will consist of manufacturing units for Ginning, Spinning, Weaving, Garmetting, Knitting, Textile manufacturing and printing machinery. MIDC will develop the land infrastructure for proposed development comprising of plotting and zoning and will also propose residential zone within the proposed area of 410.02 Ha. The development will include area development and land infrastructure..

The proposed project is development of an industrial estate of less than 500 Ha. However, the Textile Park will house all types of manmade fibre units including Rayon (Category 5d as per EIA Notification) and falling under Red category as per CPCB classification. Hence the project falls under Category A, Activity 7c as per the Schedule to the EIA Notification of Ministry of Environment Forest & Climate Change (MoEF & CC), dated 14/09/2006 and subsequent amendments. Therefore, the proposed development requires obtaining Environmental Clearance from Ministry of Environment & Forest & Climate Change (MoEFCC).

2.2 Need for the Project

The Government of India plans to set up Seven (07) Mega Integrated Textile Region and Apparel Parks on Greenfield/Brownfield sites in partnership with the State Governments.

The mission for setting up the prestigious Prime Minister Mega Integrated Textile Region and Apparel (PM MITRA) park scheme by Ministry of Textile, Government of India is inspired by the 5F vision of Hon'ble Prime Minister – Farm to Fibre to Factory to Fashion to Foreign. Textile Parks offer an opportunity to create an integrated textiles value chain right from spinning, weaving, processing/ dyeing, and printing to garment manufacturing at a single location. The park will offer an excellent infrastructure, plug, and play facilities as well as training and research facilities for industry.

The identified project comprises of establishing a Textile Park based on the vision of Hon'ble Prime Minister of 5F's as mentioned above under Ministry of Textiles (MOT). The primary objective of the Scheme is to provide the industry with world-class state-of-the-art infrastructure facilities for setting up their textile units. Therefore, to meet this demand, the identified project is envisaged.

2.3 Location Details

The site is located adjacent to the National Highway-53 adjacent to proposed project site MIDC, Amravati, Maharashtra. The nearest Railway Stations are Badnera Railway Station; whereas the nearest Airport is the Dr. Babasaheb Ambedkar International Airport, Nagpur at about 125 km from site boundary. (*Please refer **Table 2.1** below*).

Table 2-1: Site Connectivity

Location	Name	Approx. distance (km)
Nearest national highway	National Highway -6	Adjacent to site
Nearest airport	Dr. Babasaheb Ambedkar International Airport, Nagpur	125
Nearest railway station	Amravati (Central Railway)	19
Nearest port	Jawaharlal Nehru Port Trust or Nhava Sheva	Approx. 550

Site address is as follows: Additonal Amravati Industrial Area near Nandgaon peth, Tal Amravati, Dist Amravati, Maharashtra 444607.

The figure below (Fig. 2.1) shows the proposed project site boundary and 10 km surrounding area. Geographical location (site coordinates) of the proposed site are as below:

Table 2-2: Geo Coordinates of project site

S.No	Latitude	Longitude
A	21° 1' 51.735" N	77° 53' 45.287" E
B	21° 2' 29.151" N	77° 54' 12.039" E
C	21° 2' 27.332" N	77° 55' 46.335" E
D	21° 2' 22.917" N	77° 55' 52.687" E
E	21° 2' 1.152" N	77° 55' 56.626" E
F	21° 1' 54.633" N	77° 55' 23.244" E
G	21° 1' 46.328" N	77° 54' 42.584" E
H	21° 1' 34.036" N	77° 54' 20.594" E
I	21° 1' 29.447" N	77° 53' 57.822" E

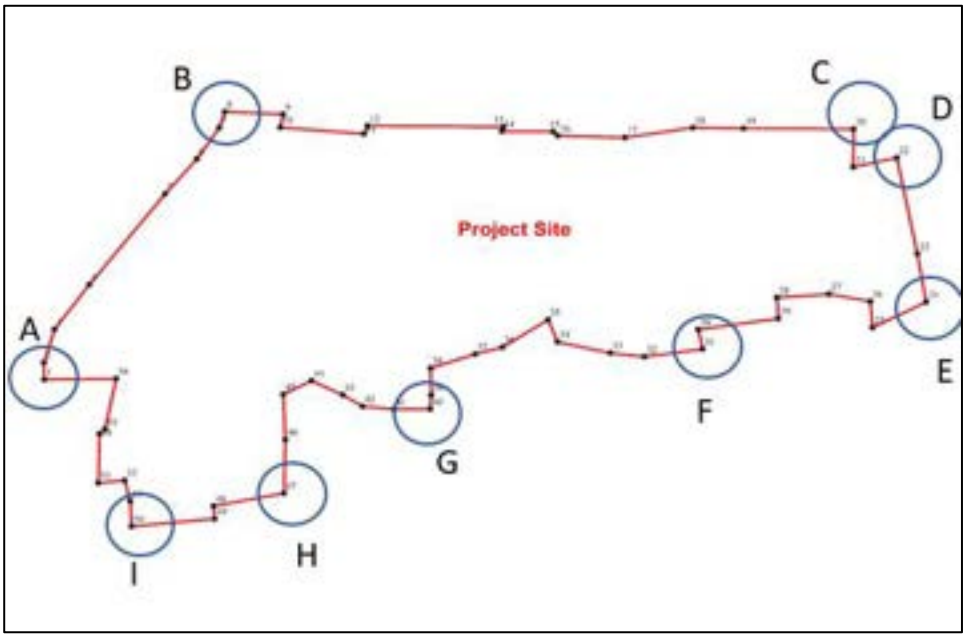


Figure 2-1 Geo Coordinates of Project Site

2.4 Size/ Magnitude of Operation

2.4.1 Magnitude of Operation

The proposed industrial area development has a plot area of 410.02 ha. The Textile Park will house all types of manmade fibre units including Rayon under Red category as per CPCB classification.

The proposed Layout Plan demarcating all the proposed land parcels is presented as **Fig. 2.3** below. The development will have in different zones viz. Ginning, spinning and weaving units, Garmenting, knitting, Processing Zone, Textile Manufacturing, Processing and Printing machinery.

2.4.2 Associated activities required for the project

Wastewater generated from the processes in the proposed textile park will be treated in the existing CETP located in the Additonal Amravati Textile Park at a distance of 2 km from the present site. At present, this CETP is 5 MLD capacity and it is proposed to expand it to a 15 MLD capacity. Existing project area is over 18.75 acre (7.59 Ha).

Existing 5 MLD CETP system consists of 60 % i.e. 2.7 MLD recycling and 40% over land disposal SSHEHS, and 0.5 % dye bath for ZLD (2.7 MLD+ 1.8 MLD + 0.5 MLD = 5 MLD capacity). Since July 2019, MPCB have directed MIDC, Amravati to run the CETP on 100% ZLD bases. MIDC is following this scrupulously.

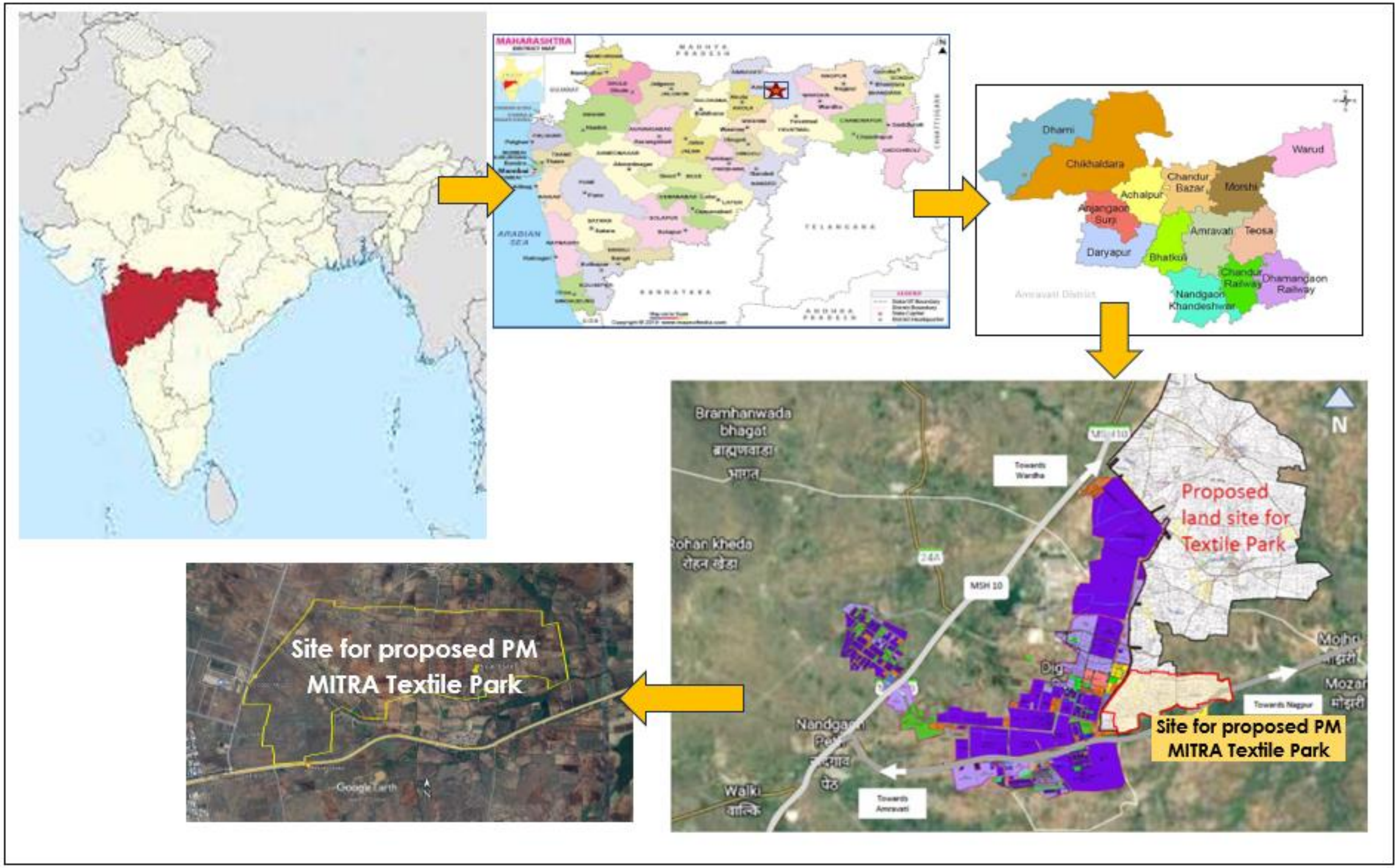


Figure 2-2 Regional Connectivity and Location of proposed PM MITRA Textile Park

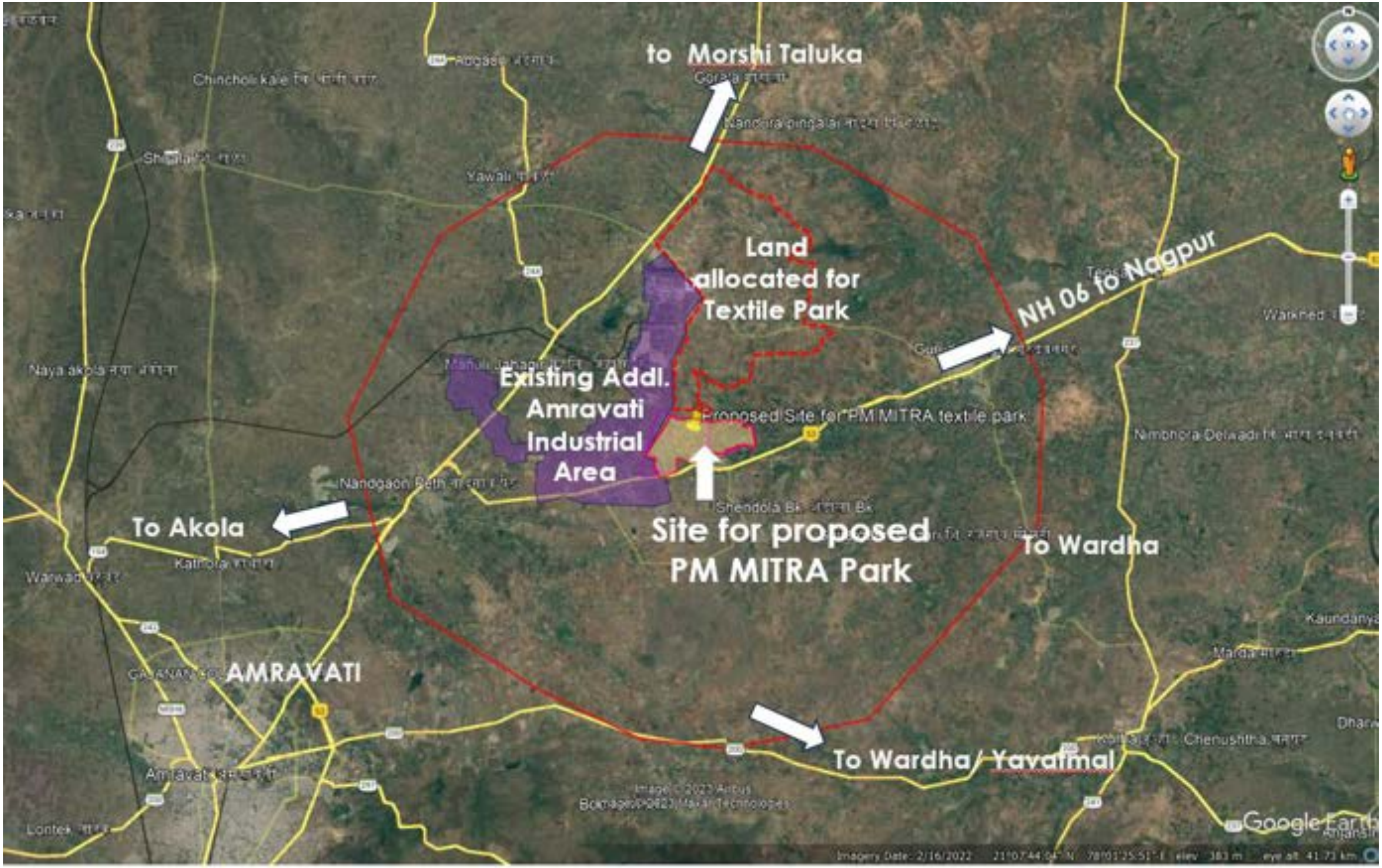


Figure 2-3: Proposed Site and 10 km study area in Regional Context

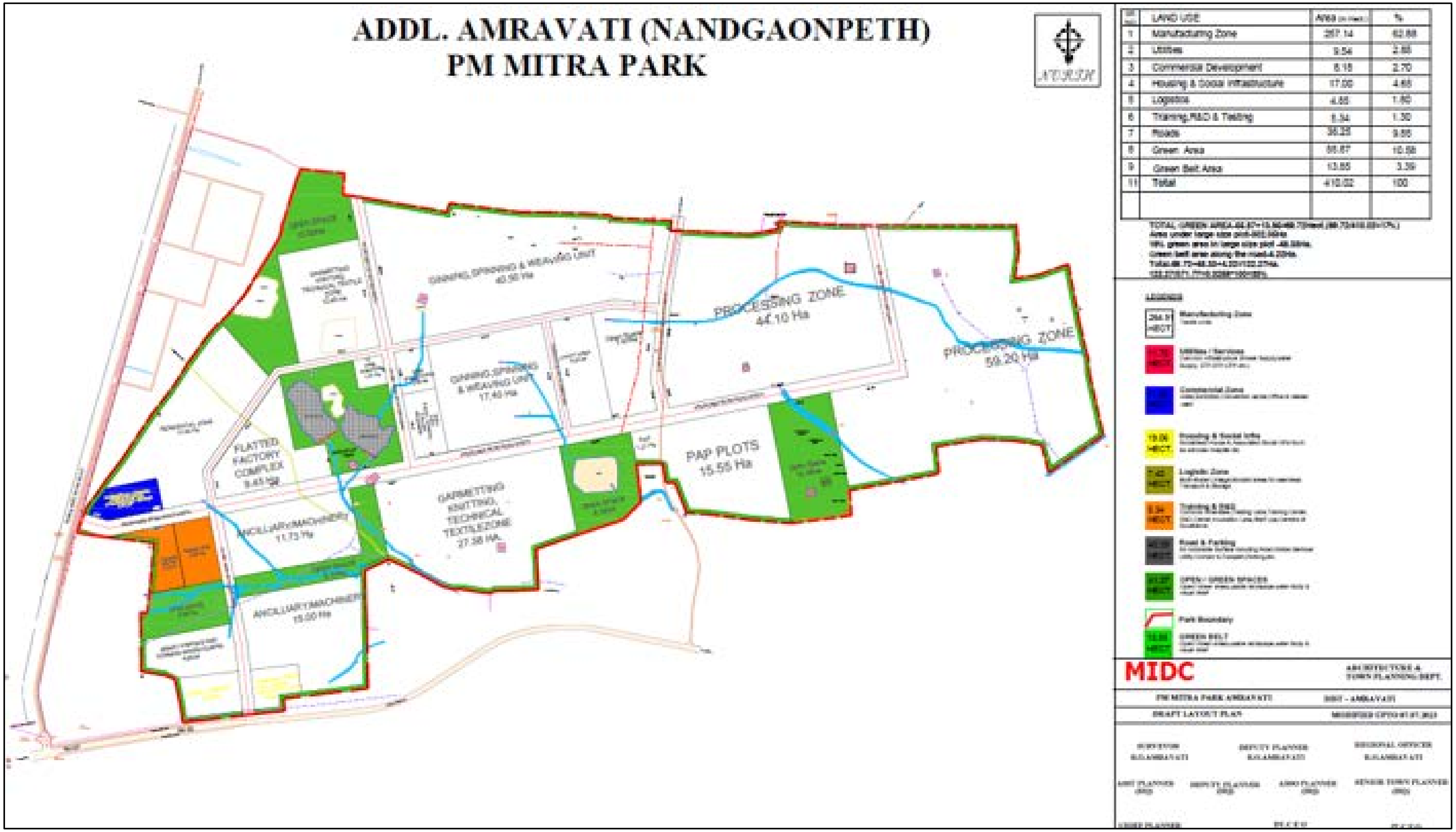


Figure 2-4: Proposed Master Plan

2.5 Proposed schedule for approval and implementation

2.5.1 Likely date of start of construction and likely date of completion

The proposed development will take about 1 year for the operative phase for the development. The construction activities and installation of plant and machineries of the units within the MIDC will start after obtaining necessary approval from MPCB and MoEFCC as applicable.

MIDC will start plotting based on demand as the construction phase begins. Plots will be sold on "as is" basis and Operation Phase of the Industrial Estate will begin after five years (initial construction phase) and will involve development of plot by individual Industries, construction of manufacturing plants and their operation.

2.5.2 Estimated project cost

Estimated Capital Cost for the project and its break up is as follows:

Table 2-3: Estimated Capital Cost for the project

Sr. No.	Item	Cost (Rs crore)
A	**Land**	**206.8**
B	**Infrastructure development**	**407.2**
1.	Roads, Street lights and Tree Plantataion	87.1
2.	Water Supply	10
3.	Power supply	45
4.	CETP	153.3
5.	Amenities Like training centre, Skill Development, etc	19.3
6.	Plug and Play Infrastructure	23.6
7.	Providing and appointment of consultant	6.8
8.	GST	62.1
	Total	**614.0**

2.6 Technology and Process Description

2.6.1 Process Description

2.6.1.1 Typical processing steps

Processing of textile comprise various processes like –

a) Spinning & Fiber processing

b) Sizing, Weaving, Knitting

c) Processing (Bleaching, Dyeing, Printing & finishing)

d) Industrial Textile / Garmenting

Above processes are further categorized depending upon difference in production lines & raw material involved.

1) Cellulosic Material (Woven, Knitting, Non-woven)

2) Technical Textiles Manmade Material (Woven, Knitting, Non-woven)

3) Wool/ Silk Material (Woven, Knitting, Non-woven)

4) Cotton/ Synthetic Mixed Material (Woven, Knitting, Non-woven)

Above mentioned broad segments may have various processes depending upon the end-product. Typical processing steps involved in producing different end-products from cellulosic and man-made fibers and wool and silk can be categorized as given in the following tables.

Table 2-4: General Processing Steps for Cellulosic Fiber, Man-Made Fiber, Cellulosic + Man Made Fiber Blend based, Carpet and Technical Textiles

Steps	Woven	Hosiery	Hosiery	Carpet / Tech Textile	100% Synthetic & others
Fibers used	**Cellulosic & Manmade Blends**	**Cellulosic**	**Cellulosic & Manmade Blends**	**Mix**	**Polyester / Acrylic/ Others**
1. Ginning Industry	Ginning	Ginning	Ginning	Ginning	
2. Spinning Industry	Carding/ Combing Blending	Carding/ Combing	Carding/ Combing Blending	Carding/ Combing Blending	
	Spinning	Spinning	Spinning	Spinning	Spinning
3. Fabric Making – Loom Shed	Sizing			Weaving	Weaving
	Weaving	Knitting	Knitting	Non-Woven	
4. Wet Processing Industry / ProcessHouse	De-sizing				
	Scouring / Bleaching	Scouring / Bleaching	Scouring / Bleaching	Scouring / Bleaching	Scouring (Removal of lubricants)
	Dyeing / Printing	Dyeing / Printing	Dyeing / Printing	Dyeing / Printing	Dyeing / Printing
	Finishing	Finishing	Finishing	Finishing	Finishing
5. Garment industry	Garmenting	Garmenting	Garmenting	End Product	Garmenting
6. Laundry	Garment washing	Garment washing	Garment washing		Garment washing if required

Table 2-5: General Processing Steps for wool & silk industry

Industry	Process
Fibre cleaning	Scouring De-gumming, Bleaching
Fibre colouring	Dyeing
Spinning	Blending

Industry	Process
	Spinning
Fabric making	Weaving
	Knitting
Wet Processing	Scouring / Bleaching
	Dyeing / Printing
	Finishing
Garment industry	Garmenting / End Product
Laundry	Garment washing

Proceses followed by different type of Industries

All finished textile products, whether clothing, carpeting, or tire cord, have their origin in wool, cotton, synthetic fibers, or combinations of these. These fibers are processed to make them suitable for their end uses.

These processes include: removal of natural impurities from wool and cotton (dirt, grit, grease); removal of process impurities (sizing, metallic contaminants); and finishing, to impart particular qualities of appearance, feel, and durability.

2.6.1.2 Cotton

The three basic steps in processing cotton (Figure 2.5) are spinning, weaving, and finishing. Cotton spinning and weaving are dry processes. Foreign matter is removed from the raw cotton by opening and cleaning, picking, carding, and combing. The individual fibers are joined, straightened, spun into thread, and wound on spools.

To improve strength and stiffness of lengthwise (warp) yarn, it is passed through a sizing solution that controls abrasion and reduces friction. Starch, polyvinyl acetate (PA), and carboxymethyl cellulose (CMC) are the sizing agents.

This yarn is woven into cloth known as greige goods, which is sent to the finishing mill to process into salable products.

The finishing process, mostly wet, begins with the removal of sizing, natural wax, pectins, alcohols, dirt, oil, and grease to prepare the cloth for the following steps:

Singeing: The cloth passes between heated plates or rollers, or across an open gas flame to burn off loose fibers. Sparks are extinguished as the cloth passes through a water box.

Desizing: Starch is solubilized by enzymes or acid by a 3 to 12 h soaking. Excess liquor is removed. The cloth is then freshwater rinsed and processed through a caustic or penetrant bath.

Caustic scouring: Greige goods are cooked to remove cotton wax, dirt, and grease. The cotton cloth is saturated with liquor consisting of caustic soda, soda ash, pine oil soap, and surfactants and scoured in a steam bath for 1 h. Finally, the cloth is rinsed to remove the scour liquor. This develops a yellow, absorbent pure cellulose fiber.

Bleaching: Peroxide, hypochlorite, or chlorine in combination with sodium Silicate and caustic soda are applied as bleach liquor, and the cloth passes into a steam chamber (J-Box) for approximately 1 h. The bleached cloth is rinsed in water and stored for further processing.

Dyeing: Many different chemicals are used for dyeing:

a. Direct dyes are applied directly to the cloth.
b. Vat dyes and sulfur dyes are applied to cloth in a reduced state and then oxidized.

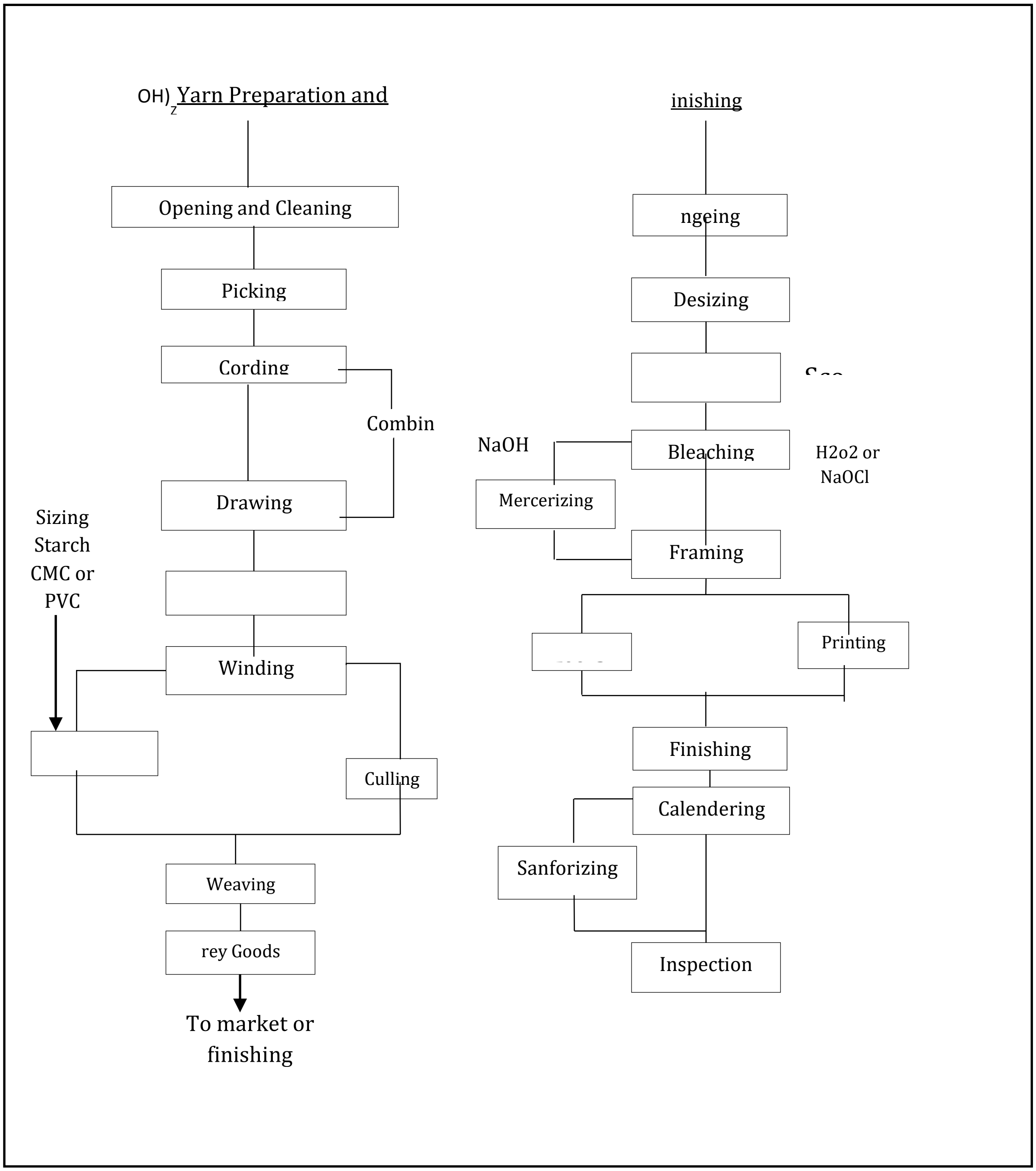


Figure 2-5: Cotton processing flow sheet

Usually the greige mill that produces cloth is separate from the finishing mill. The finishing mill uses large volumes of water, often as much as 10 mg, and requires a complex waste treatment system. The finishing mill usually has a large boiler house because of its need for steam for process equipment, and often cogenerates power for its machinery requirements.

c. Developed dyes and naphthol dyes are applied to cloth and developed with a secondary chemical.

d. Aniline black dye is oxidized on the cloth by air or steam.

Printing: This process imparts a colored pattern or design to the cloth by a roller or screen print machine. The colors are fixed by steaming or other treatment.

Final fishing: This process involves sizing (starch or resin), waterproofing, fireproofing, or preshrinking.

WOOL

Raw wool, a protein (keratin), contains glandular secretions (suint and wool grease) and feces from the sheep, plus dirt, straw, and vegetable matter. Residues of treatments applied for disease control or for identification of the animal may also be present. Wool is normally insoluble in water, but above 250°F (121°C) some fractions dissolve. Wool fiber expands upon wetting, but contracts to its original size when dried. Being amphoteric, wool is damaged by caustic or acid solutions, so special care must be taken when subjecting it to such treatments in processing.

2.6.1.3 Wool Processing

Sorting and blending: Raw fibers are sorted into lots according to fineness and length. Fibers from different lots are blended to maintain uniformity.

Scouring and desuinting: Foreign matter is removed by washing with soaps, alkalies, or other chemicals, or by solvent extraction. Scouring the fleece reduces weight by 35 to 65%. The extracted material is processed to recover lanolin.

Washing: The scour is followed by a clean water rinse.

Carding: The wool fibers are disengaged and rearranged into a web.

Oiling: An antistatic agent is applied to the fibers.

Backwashing: Removing oil that has been put into worsted stock in the blending, oiling, and mixing operations.

Gilling: A special procedure for carding which separates the long, choice fibers of the same length from the shorter fibers.

Top dyeing: The application of a tint to the choice, long fibers (called "wool top") used for production of worsted, a tightly spun yarn. The tinting is for identification only.

Roving: Narrow strips of web are gently meshed together and wound onto spools for the spinning frames.

Spinning: The rovings are drawn through small rollers which further extend the web by pulling the fibers apart lengthwise.

Winding: The spun rovings are twisted and wound onto bobbins as finished yarn.

Wool processing (**Fig. 2.6**) process is not always fully integrated into a single mill. For example, wool scouring may be carried out in a separate plant, and independent dye. houses may process the fiber or fabric.

Scouring (or slashing) prepares the wool for weaving. In detergent scouring the predominant method, the wool is treated in successive bowls with capacities of 1000 to 3000 gal (3.8 to 10 m°) each. The first bowl is used for steeping (desuinting); the next two contain soap alkali for grease removal; and the final bowls are for rinsing.

Batch or continuous solvent scouring produces less water pollution than detergent scouring. Grease laden solvent is distilled to recover the solvent. A final detergent washing removes residual solvent and grease. Dyeing is performed in open or pressure-type machines. The pollution loading is related to the dye used.

Fulling is a process of shrinking the woven fabric by subjecting it to moisture, heat, and friction to produce a feltlike texture. Soap is the felting agent and water is evaporated during the process. Following fulling the wool cloth contains considerable process chemical and must be washed. The cloth passes through a "first soap," is squeezed between rollers, washed in a "second soap," and finally rinsed in a water bath.

In the carbonizing process for removing residual impurities, the wool fabric is impregnated with 4 to 6% sulfuric acid and oven dried at 212 to 220°F (100 to 105°C). The evaporation of the water concentrates the acid, charring organic contaminants. Rollers crush the charred matter, which is then removed by a mechanical dusting machine. The cloth is rinsed, neutralized by soda ash solution, washed again, and dried. Sulfur dioxide or hydrogen peroxide bleaches the natural yellow tint of the wool to white.

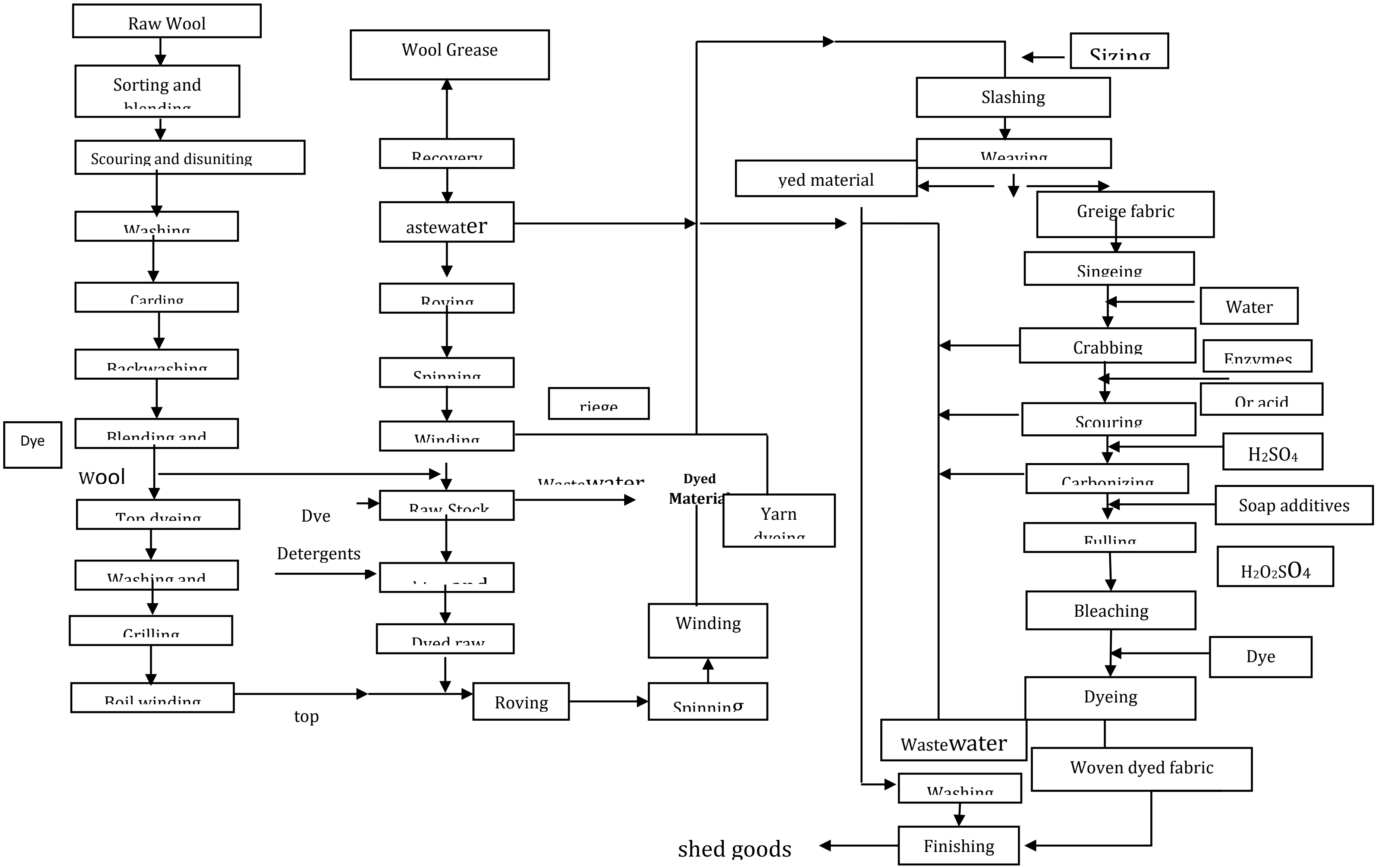


Figure 2-6: Wool-processing

2.6.1.4 Synthetics

The most common synthetic fibers are cellulose base (acetate/rayon) and polymer base (acrylic, nylon, polyester, and orlon). Spun yarn is processed like natural fibers requiring size to impart strength and to provide a protective coating for weaving. Continuous filament yarn requires less sizing.

Static charges build up on synthetic yarn during most processing steps so anti-static oils and lubricants are applied to the fiber before weaving. These include polyvinyl alcohol, styrene-based resins, polyalkylene glycols, gelatin, and polyvinyl acetate.

Synthetic fabric finishing processes are similar to those used with cotton, and include scouring (removal of process chemicals from weaving), initial rinsing, bleaching, second rinsing, dyeing, and final finishing (waterproofing, shrink proofing, etc.).

2.6.1.5 Cellulosic Fibers

Rayon and Acetate

High tenacity viscose yarn is used mainly in cords for tires, hose, and belting. The difference in strength between ordinary and high tenacity viscose depends on the amount of orientation? imparted to the fiber molecules when they are made. The hydroxyl groups in the cellulose (**Fig. 2.7**) molecules enable the fiber to absorb water, resulting in low wet strength. Hydroxyl groups also serve as sites for hydrogen bonding, and thus in the dry state, serve to hold molecules together despite strong bending, resulting in fibers which tend to maintain their dry strength well even at high temperatures. The price of rayon and acetate varies according to the size of the filaments, process of manufacture, and type of finish. Textile rayon and acetate are used primarily in women's apparel, draperies, upholstery, and blends with wool in carpets and rugs. In 1981 cotton, wool, and silk accounted for 55 percent of the fibers produced worldwide. It has been predicted that by 1985 new, improved rayons will take over a large part of cotton's market because of increases in the price of cotton, shift of land devoted to growing cotton to growing food, and, in the United States, the large expenditures that mill owners must make to comply with the stringent government cotton dust regulations.

RAW MATERIALS

The viscose process is based on sulfite, and a little sulfate wood pulp. If sheet cellulose, the form used in viscose manufacture, is desired, the sulfate pulp, after the bleaching treatment has been completed, is blended with several other batches, passed successively through a beater and a refiner and formed into sheets on a Fourdrinier[13]. Viscose rayon is a major consumer of sulfuric acid, caustic soda, and carbon disulfide. Titanium dioxide is added to deluster the yarn. Cellulose acetate employs large quantities of acetic anhydride, glacial acetic acid, sulfuric acid, and acetone to swell the wood pulp. In addition to this important consumption of basic chemicals, the fiber industry needs significant quantities of dyes and other chemicals.

The viscose process produces filaments of regenerated cellulose, and the acetate forms a thread that is a definite chemical compound of cellulose, cellulose acetate. Although each of these processes is quite different as far as details of procedure are concerned, they all follow the same general outline: solution of the cellulose through a chemical reaction, ageing or ripening of the solution (peculiar to viscose), filtration and removal of air, spinning of the liber, combining the filaments into yarn, purifying the yarn (not necessary for acetate), and finishing (bleaching, washing, oiling, and drying).

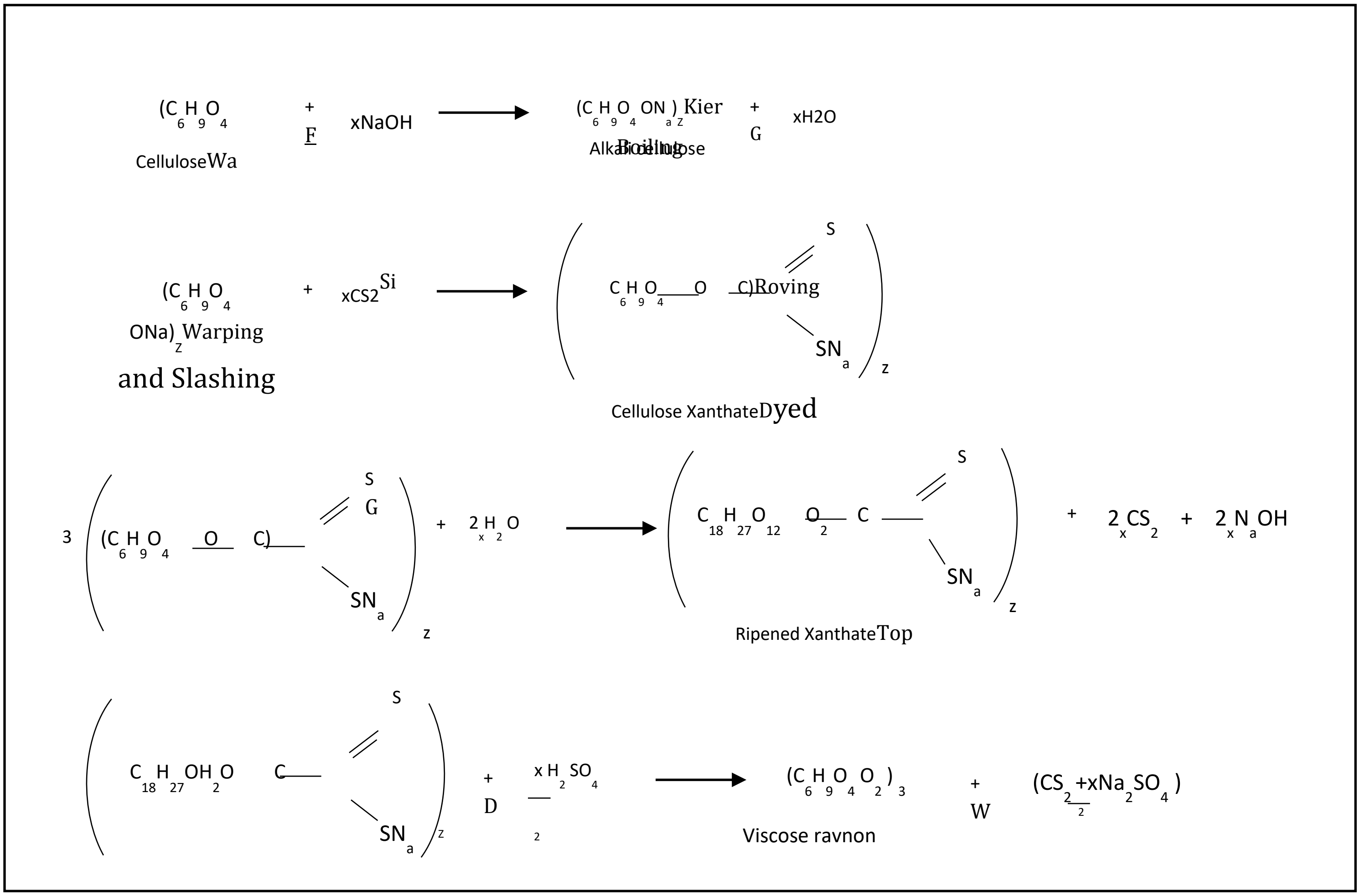


Figure 2-7: Viscose Process

Chem. Week 129 (5) (1981); Textile Ind. 146 (6) 60 (1982); Layman, Rayon Aims for Specialty Niches in Low-Growth Market, Chem. Eng. News 61 (8) 10 (1983).

[14]The cellulose molecule is composed of a large, undetermined number of glucose units, here represented as $(C_6H_9O_4OH)_x$. The value of ^{x} ⇔does not remain constant throughout these reactions.

Each reaction causes a reduction in the molecular weight of the cellulose molecule, so that the viscose-rayon molecule is considerably smaller than the cellulose originally fed in.

Some CS_2 breaks away from the cellulose xanthate during the ripening process.

$[C_6H_7O_2 . (OH)_3]_x + 3_x(CH_3CO)_2 \rightarrow [C_6H_7O_2(O_2CCH_3)_3]^x + 3^xCH_3CO_2H$

Cellulose Cellulose acetate

VISCOSE MANUFACTURING* The finished filament is pure cellulose, as shown by the equations, but, because it consists of smaller molecules than the cellulose of the original wood pulp or cotton, it possesses different physical properties.

The process as shown in **Fig. 2.7** can be broken down into the following sequences:

The cellulosic raw material (sheets made from sulfite or sulfate pulp) is charged to a steeping press containing vertical perforated steel plates and is steeped either batchwise or continuously in a caustic soda solution (17 to 20%) for about 1 h at 13 to 17^0C to dissolve the cellulose.

The excess liquor is drained off, removing impurities such as cellulose degradation products. The soft sheets of alkali cellulose are reduced to small crumbs in a shredder. This requires 2 to 3 h, and the temperature is maintained at 18 to 20^0C. (**ECT, 3d ed., vol. 19, 1982, p. 855; Chapman, op. cit.*).

The crumbs of alkali cellulose are aged either batchwise or continuously for 24 to 48 h at 24°C in large steel cans. Some oxidation and degradation occur, although the actual chemical change is unknown. Physically, correct aging produces a solution of suitable viscosity for spinning after xanthation.

The aged crumbs are dropped into large, cylindrical xanthating churns. Carbon disulfide weighing between 30 to 40% of the dry recoverable cellulose is slowly added under carefully controlled temperature and reduced pressure during 2 h of churning, during which time the crumbs gradually turn yellow and finally deep orange, and coagulate into small balls.

Still in batch form, the cellulose xanthate balls are dropped into a jacketed dissolver (vis-solver) containing dilute sodium hydroxide. The xanthate particles dissolve in the caustic, and the final product, viscose solution, contains 6 to 8% cellulose xanthate and 6 to 7% sodium hydroxide. This reaction takes 2 to 3 h. If desired, delustering agents, such as titanium dioxide or organic pigments, are added to the viscose solution in the mixer. The result is a viscous, golden-brown liquid. The remainder of the process (Fig. 2.8) through ripening and spinning is continuous. DuPont has developed a continuous belt xanthation process 16 that is claimed to cut costs and produce a higher quality product.

The vessel used is completely enclosed which cuts carbon disulfide losses.

During the ripening the proportion of combined sulfur decreases and the ease of coagulation increases. Thirty years ago, this conversion took 4 to 5 days, but now improved technology has reduced it to about 24 h. In a series of tanks (only one is shown in **Fig. 2.8**) the reaction proceeds under deaeration and continuous blending with modifiers (viscose additives, mainly amines and ethylene oxide polymers) that control neutralization and regeneration rates.

Finally, in two continuous vacuum-flash boiling deaerators (at high vacuum and below room temperature), small air bubbles are removed that would either weaken the final yarn or cause breaks during spinning.

In spinning, viscose is forced by gear pumps through thimble-like spinnerets of noble metal, each with from 750 to 2000 holes. The fine streams thus formed are injected into the spin bath where they coagulate and the cellulose is regenerated to form fiber. Sulfuric acid in the spinning bath neutralizes free NaOH and decomposes xanthate and various viscous by-products containing sulfur, thus liberating CS_2, H_2S, CO_2, and S. Salts such as $ZnSO_4$ and Na_2SO_4, coagulate the xanthate, forming relatively stable metal complexes. The sulfuric acid salts ratio is a key control point, which, although coagulation and regeneration take place together, ensures that the xanthate gels before the acid can attack and decompose it. Four percent or more glucose prevents crystallization of salts in the filaments (*How to Make Viscose Rayon Continuously, Chem. Week. 129 (5) 25 (1981)*.

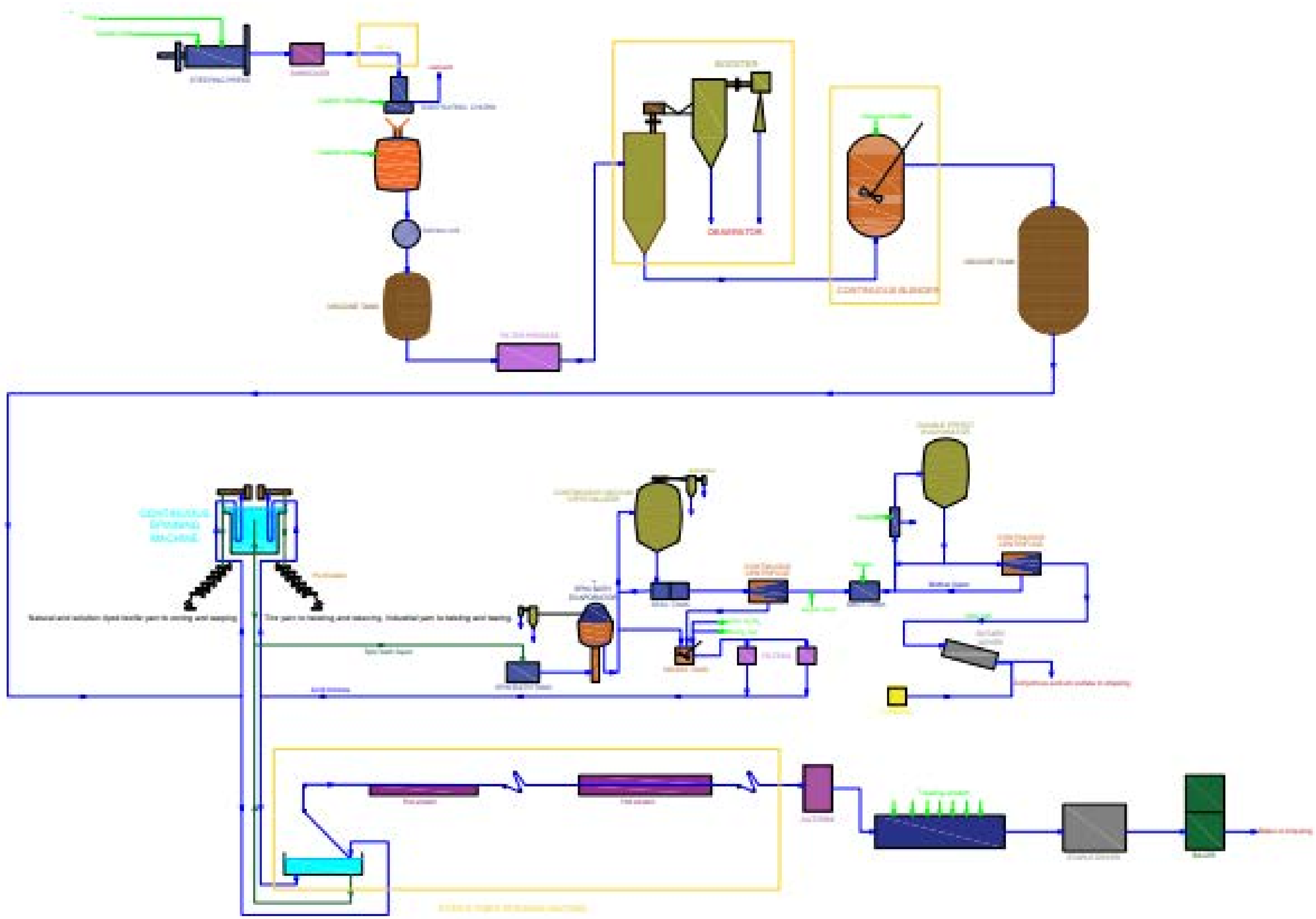


Figure 2-8: Flowchart for viscose rayon production

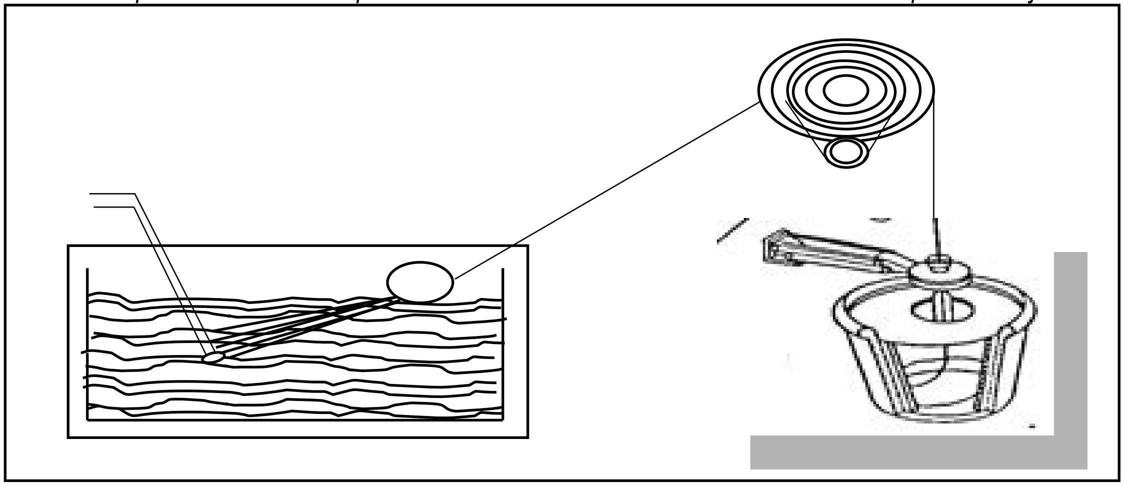


Figure 2-9: Spinning in the viscose process

Three separate continuous spinning and treating procedures are outlined in **Fig. 2.9**.

1. Textile yarns are twisted into continuous yarn as the filaments leave the spinneret. They are dyed (then or later) and sent to coning and warping.
2. Tire yarns are stretched to impart strength over a series of thread-advancing rolls where wash and other treatments are applied, such as deacidifying, desulfurizing, and bleaching.
3. Staple yarns are spun on the machine in the lower part of Fig. 35.7 by combining filaments from many spinnerets without twisting and cutting them into uniform lengths. Each year more viscose filaments are made into staple fiber.

The actual process of continuous spinning has reduced the elapsed time from hours to minutes. The types of machines in general use are continuous, bucket, and bobbin (**Fig. 2.9**). If a bucket machine is used, the spinneret head dips horizontally into the spinning solution, and several of the filaments are gathered into a thread and ted down to a small centrifugal bucket spinning at about 7500 rpm. The bucket imparts one twist to the filaments per revolution and removes a greater portion of the occluded bath liquor through perforations in the periphery. If a bobbin machine is used, the spinnerets point vertically upward into the spinning bath, and the filaments are wound on a revolving bobbin. No twist is imparted to the thread.

Yarn from either type is washed to remove the spinning liquor and desulfurized by treating with a 1% sodium sulfide solution. They are then washed in hypochlorite solution, washed again in water, dried, and coned.

Originally rayon filaments had a cylindrical cross section and a silky appearance and feel. In an effort to produce a rayon that is more like cotton, the shape of the fiber has been modified. Avril Ill and Avril-Prima are highly crimped, very high wet modulus fibers that have irregularly shaped cross sections and have many cottonlike properties.

CELLULOSE ACETATE MANUFACTURE

Cellulose acetate and its homologs are esters of cellulose and are not regenerated cellulose. The raw material for the spinning solution is prepared by charging acetic anhydride, glacial acetic acid, and a small quantity of sulfuric acid as a catalyst to a jacketed, glass-lined, agitated, cast-iron acetylator (see **Fig. 2.10**). The mixture is cooled to 7°C, and the wood pulp is added slowly. The acetylation requires S to & h, and the temperature is maintained below 50°C. The viscous fluid is diluted with equal parts of concentrated acetic acid and 10% sulfuric acid and allowed to age for 15 h at 38°C. Hydration of some of the acetate groups occurs. No method has been devised whereby cellulose can be converted directly to a product of the desired acetyl content. It is necessary to transform it first to the triacetate and partly hydrolyze off the required proportion of acetate groups.

The desired material is usually about halt way between triacetate and diacetate.

The hydration is stopped by running the mixture into a large volume of water and precipitating the secondary acetate. The secondary acetate is centrifuged to separate it from the still strong acetic acid which is recovered, concentrated, and used over.

In order to produce 1 kg of acetate rayon the following materials and utilities are required.

Table 2-6: Materials and Utilities to produce acetate rayon

Pulp	0.70 kg	Sulfuric acid	0.1 kg
Acetic anhydride	0.2 kg	Direct labor	0.09 work-h
Acetic acid	3.25 kg	Acetone loss	0.2 kg

Flowchart for cellulose acetate manufacture

The flakes are washed several times by decantation and are then ready to be used in preparing the spinning solution by dissolving the dry flakes in acetone in a closed, agitated mixer. If desired, a delustering pigment is added. Several batches are blended, filtered, and sent to the spinning machine. The solution is forced through spinnerets into a current of warm, moist air. The acetone evaporates and is recovered, leaving a filament of cellulose acetate.

These filaments are twisted and coned in the same manner as those of the previously described rayons. Some yarns are sold without a twist. Filament yarn is made by twisting the threads before winding on the bobbin. Tow consists of threads gathered without twisting and is cut into short lengths for use as staple fibers.

The economical operation of the process depends on the recovery of as many of the chemicals as possible. For every kilogram of cellulose acetate about 4 kg of 30 to 35% aqueous acetic acid is obtained. Dilute acetic acid from various parts of the process is run through a thickener to remove the last traces of cellulose acetate and then concentrated in a distilling unit and reconverted to acetic anhydride. The acetone-laden air from the spinning machines may be passed through activated charcoal to absorb the solvent (which is subsequently recovered by steaming and rectification) or by cooling the air in water towers and simultaneously dissolving out the acetone, the water-acetone mixture later being rectified. Liquid absorption and distillation are also employed.

Cellulose triacetate fiber, Arnel, is made by Celanese Corp. It is reported to possess resistance to glazing at high ironing temperatures, complete machine washability, low shrinkage in stretching, good crease and pleat retention, and an adaptability to a wide range of colors, designs, and prints. 18 It is prepared by dissolving the triacetate in dichloromethane instead of acetone as is used for the diacetate.

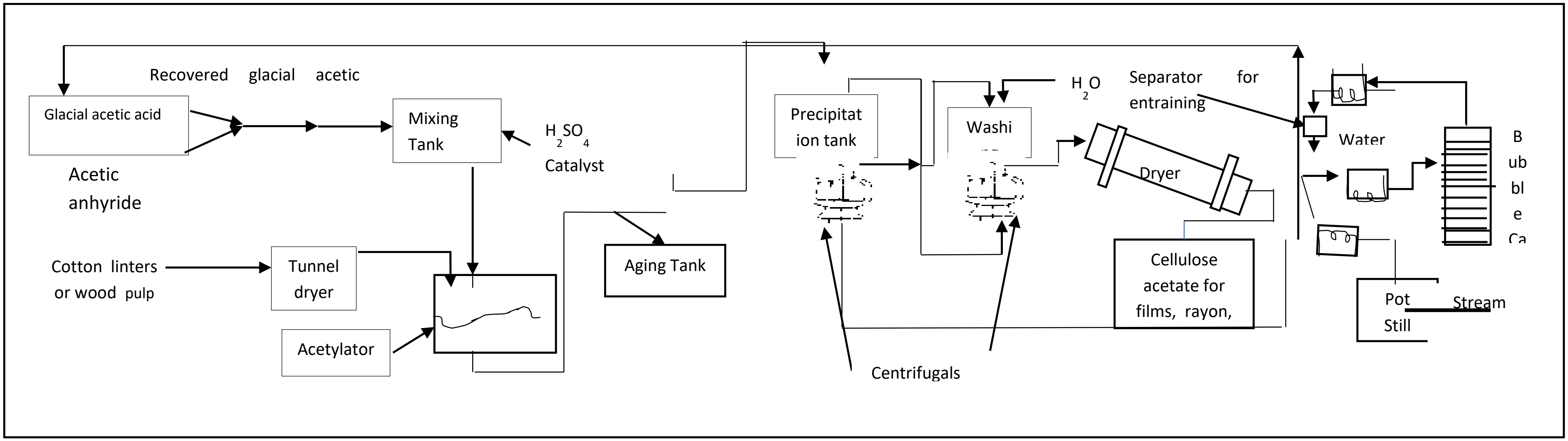


Figure 2-10: Manufacture of Cellulose acetate

2.6.2 Finishing and Dyeing of Textiles

Many of the textile industries mill operations abound in chemical engineering problems Dyeing, bleaching, printing, special finishing (such as for crease recovery, dimensional stability, resistance to microbial attack and ultraviolet light), flame resistance, scouring, water treatment, and waste disposal are examples of mill treatments where unit operations as filtering, heating, cooling, evaporation, and mixing are involved.

The modification[21] of fibers and fabrics by special treatments to change their properties and to improve their usefulness is increasing. Three important finishes consist of flameproofing or fire retarding, mildew or rotproofing, and water repellency. Temporary flame proofing of cellulosic fibers is achieved by the application of ammonium salts or borax and boric acid.

Ideal fabric flame proofing, which allows cleaning or laundering and yet maintains desirable fabric characteristics is difficult, although much research is directed toward this aim, and some processes are finding commercial acceptance. Mildew proofing of cellulosic fabrics may be obtained by the use of many organic and inorganic compounds. Commonly used materials include acrylonitrile, chlorinated phenols, salicylanilide, and organic mercurial compounds, copper ammonium fluoride, and copper ammonium carbonate.

To produce water-repellent finishes durable to the usual cleaning processes, special quaternary ammonium compounds are heat-treated onto the fiber. Shrink proofing of wool employs various chlorinating processes, especially for socks, shirts, knitting yarns, and blankets. Another method for shrink proofing woven fabrics is to coat them with a melamine-formaldehyde product. Thermosetting resins are being widely used to impart crease or wrinkle resistance to cellulosic fibers commonly used products include urea-formaldehyde and melamine-formaldehyde resins.

The fabric is treated with water-soluble precondensates, together with a condensation catalyst. The treated fabric is dried and heated at an elevated temperature to set the resin within the fiber structure. Many other special treatments for fabrics include mothproofing, improving of resiliency, stiffening, softening, eliminating electrostatic charge during processing, sizing, lubricating, and inhibiting atmospheric gas fading of dyes. In recent years chemical finishes have been used to react with the fiber material, e.g., cotton, and thereby to change its properties by esterification (carboxy methylation) r amination (2-aminosulfuric acid).

2.6.3 Water Uses in Textile Industry

Clean air, free from debris, and controlled at precise temperature and humidity levels is vital to textile processing. The industry is one of the largest users of air-washing equipment to clean and temper air in the processing areas. Tempering requires heating in the winter and cooling in the summer.

Air washers are used throughout cotton mills producing woven fabric; in blending plants where cotton is blended with synthetic staple into yarn and then woven; and in synthetic fiber plants. Air washers also find extensive use in knitting plants, including hosiery and carpet mills. The material removed from the air is transferred to the water, so there are many problems requiring water treatment technology.

The cooling capacity for a typical textile refrigeration unit is 300 to 1200 tons, depending on the size of the plant. Total plant capacity may be from 300 tons in a very small mill up to 18,000 tons. In large plants, the total tonnage may be supplied by a single cooling tower circuit and a single chilled-water system. However, in most cases there are several smaller systems. The tonnage and number of air-conditioning systems operating in a plant depend on the combination of textile processes.

New textile plants are designed to consolidate chilled-water systems into as few independent units as possible to maximize efficiency and reduce maintenance.

Chilled water is piped around the average textile plant for use in air washers, process-heat exchangers, and small office air-conditioning units. By far, the largest user of chilled water is the air washer. The average plant with 1200 to 2400 tons of air-conditioning capacity may have six to eight air washers.

When refrigeration units are operating during warm weather (Figure 33.3), air washer units are supplied with chilled water, 40 to 50°F (5 to 10°C). Most textile chilled-water systems have high-level float switches on the chilled-water sumps.

During summer operation, when the chilled water is dehumidifying plant air, the volume of water in the chilled-water system increases as water condenses from the makeup air. When this occurs, the level in the sump rises until it hits a limit switch which diverts excess chilled water (which is essentially condensate) to the cooling tower as makeup. This procedure conserves treatment chemicals, water, and energy, avoiding wasting excess chilled water and increasing the efficiency of the condenser unit.

Chilled-water sumps contain filters for suspended solids removal. Many potential fouling problems in the air-washer systems can be avoided by removing suspended solids in the chilled-water sump in this manner.

In plants where refrigeration is not required during winter months (Figure 33.4), washers operate independently, continually recirculating water from the sump through the spray nozzles. During these months, there is usually evaporation in the air-washer system, eliminating overflow and requiring makeup.

In a typical textile mill air washer, air entering from the plant first passes through a fine mesh screen or drum roll filter to remove lint, dust, oil, and other debris.

Some units have moving paper media while others have stationary synthetic media which are replaced two or three times per year. Some large rotating drum filters have vacuum attachments to continually remove contaminants from the filter medium. A knitting plant or a package dyeing plant with winding operations has oil in the air. However, lint is the major problem in cotton mills.

Most textile air-washer systems automatically blend outside air with in-plant air. The temperature and humidity needs may vary from one department to another in the same plant, requiring separate chilled-water systems.

The mixture of air enters the washing section where several vertical headers with spray nozzles are spaced evenly across the area of air flow. The nozzles spray water against each other so that the incoming air must pass through a barrier of water droplets 2 or 3 ft thick.

The spray nozzle headers are connected to a recirculating pump that has a capacity of 250 to 1200 gal/min (1 to 5 m^3/min). The main pump located at the chilled-water sump continually supplies each individual air-washer sump. Overflow and gravity return the water to the main refrigeration unit and chilled-water sump. Capacities of air-washer sump pans range from 600 to 2500 gal (2 to 10 m^3).

After the spray section of the washer unit, the air passes through mist eliminator blades to remove moisture. Some washers are designed with steam reheat coils to temper the cooled air to suit a particular textile process. Bypass ductwork is sometimes designed into a unit to allow for simple heating of the air without washing. Large fans or blowers take the air from the end of the washer unit and distribute it through the plant ductwork.

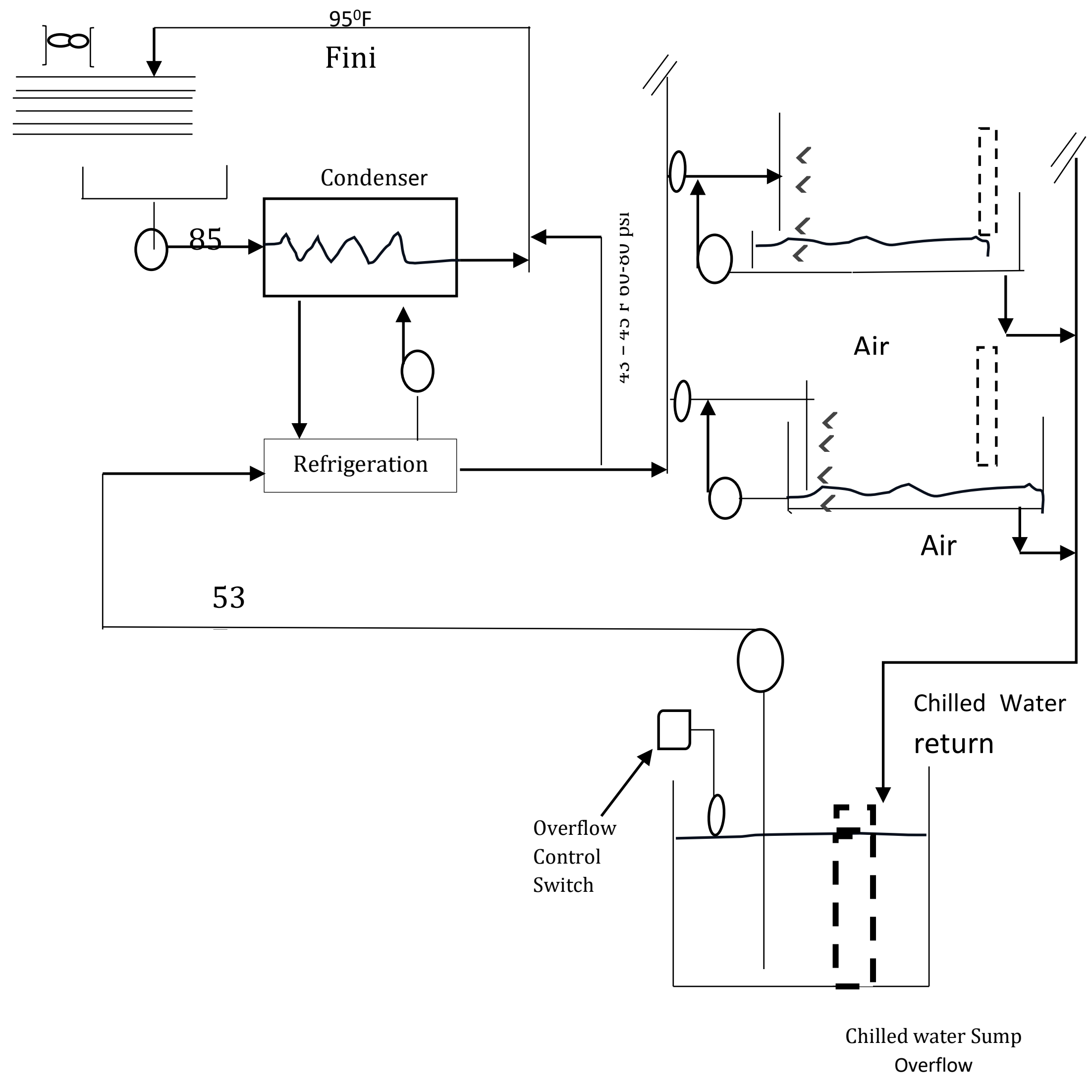


Figure 2-11: Typical textile air-washer system - Summer Operation

Most textile mills use compressed air to control water atomizers and for other purposes. Cooling water must be supplied to the air-compressor heads, oil coolers, and aftercoolers. The cooling water may come from the main cooling tower system in large plants where there are several air conditioning units, or there may be a separate small tower provided for these units.

The few plants set up for once-through cooling water on air-compressor systems conserve this by sending the spent water into one of the cooling towers during summer operations as makeup.

Some air washer units, particularly in synthetics plants, do not use chilled water for the washing process. The eliminator sections of these washers are followed by steam reheat coils, and chilled water coils to adequately control temperature and humidity.

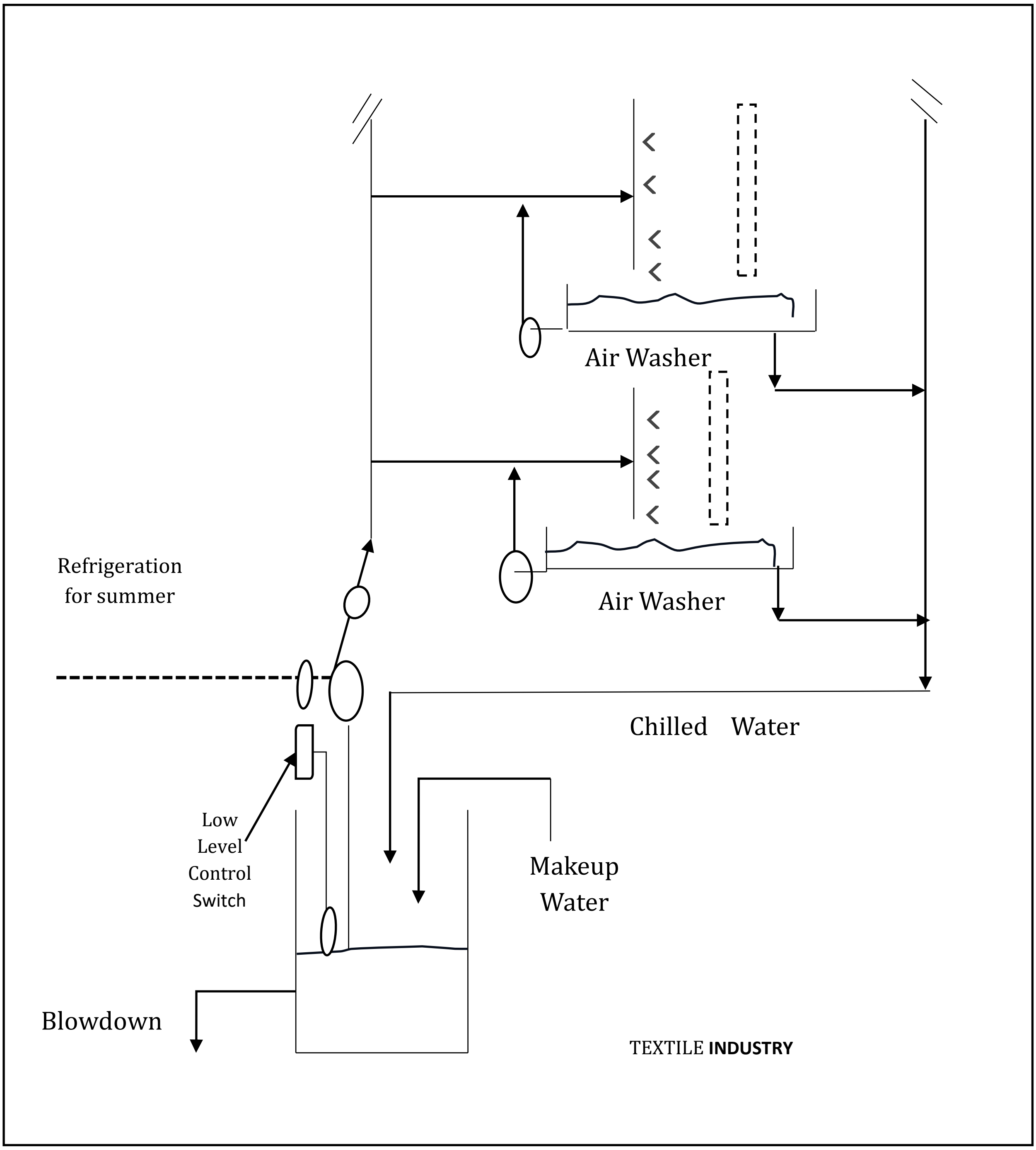


Figure 2-12: Typical textile air-washer system – Winter Operation

Rotospray systems, similar in principle to the packaged air washer units, are housed in a cylindrical casing slightly larger than the supply ductwork and are generally located on the roof of the mill. They have stationary spray nozzles and rotating eliminator blades that look like the compressor stages in a gas turbine.

There is very little water in these units, and they are somewhat difficult to treat because the dirt is concentrated in a small amount of water.

2.6.4 Air Washer Maintenance

Air washers are periodically shut down and washed out to control the severe fouling and deposition problems that occur. The frequency of shutdown and washout depends on the type of textile process being run, and the severity of the problem.

It may be weekly in some plants, while in others S- to 6-week intervals between washouts may be acceptable.

The high degree of recirculation in air washers leads to a variety of water problems including slime formation, deposits, corrosion, and odors. The major part of most deposits is microbial (slime masses). Microbial activity produces a sticky slime that combines with dirt, corrosion products, and crystalline matter to form hard encrusted deposits above the water level and thick slimy masses below the water on metal surfaces inside the washer. Controlling microbial growth in a chilled-water or air-washer system is the key to an effective treatment program.

Microbe growth also causes odors, carryover, encrustation, and corrosion under deposits. Oil and other organic matter picked up from the plant air provide food for these microbes. Even though some removal of oil may be accomplished with air filters, residual oil will be present in the washer.

Carryover caused by foaming or by biological growth on eliminator blades disrupts air flow and allows solids to pass into plant ductwork. This can cause a variety of problems in the plant from spotting of the product to disrupting the temperature and humidity controls. Severe damage can be done to the plant ductwork. Most textile plant ductwork contains a mat of lint and fiber. When this becomes wet, it becomes encrusted with the dirt present in the washer water and severe corrosion can result.

Corrosion is most severe in textile air-washer and chilled-water systems during summer operations when the water in the systems deconcentrates. Chiller tube sheets and heads are the most vulnerable areas. Dirt, fiber, oil, and microbiological deposits combine in some cases to totally slime over areas of the tube sheet. Severe pitting occurs under deposits of this nature. Corrosion inside the air washer units themselves may occur on any mild steel structures.

Table 2-7: Representative Mill Average Raw Waste Characteristics for Various Textile Operations

Variable	Wool and animal hair scouring	Wool dyeing and finishing	Cotton and synthetic woven fabric finishing	Cotton and synthetic knit fabric finishing	Dyeing and printing of carpet (cotton, wool, syn.)	Cotton and syn. Raw stock and yarn dyeing
Water use (gal/Ib)	4.3	40	13.5	18	8.3	18
Production		2-20	6-180	8-40		

Variable	Wool and animal hair scouring	Wool dyeing and finishing	Cotton and synthetic woven fabric finishing	Cotton and synthetic knit fabric finishing	Dyeing and printing of carpet (cotton, wool, syn.)	Cotton and syn. Raw stock and yarn dyeing
(med. size)						
1000 Ib/day	80	3-20	7-15	9-60	60	60
BODs, range	4740-6220	150-700	250-850	100-650	144-630	75-340
median	5480	300	550	250	340	200
TSS, range	5000-24,500	45-300	45-475	40-485	75-150	25-75
Median	7500	130	185	300	120	50
COD, range	29,600-31,300	280-5000	425-1440	450-1440	570-1360	220-1010
Median	30,500	1041	850	850	925	524
Oil and grease, range	5000-5600					
median	5340					
Total chromium	0.05	4	0.04	0.05	NI*	0.013
Phenol	1.50	0.5	0.04	0:27	NI	0.12
Sulfide	0.20	0.1	2.72	0.2	NI	NI
Color (ADMI)	2000	500-1700	325	400	600	600
pH (units)	6-9	6-11	7-11	6-9	6-9	7-12

**NI: No information available.*

Note All above, except color and pH, are reported in mg/L; ranges and medians are given.

Sorrow Lockwood Green Engineers, Inc. "Textile Industry Technology and Costs of Wastewater Control,"

National Comm. on Water Quality Contract WQSACo-21, June 1975.

2.6.5 Developing a Treatment Program

A complete equipment survey and a thorough understanding of equipment operations are needed to design an effective water treatment program for air-washer and chilled-water systems.

The selection of an effective biocide and dispersant is generally the starting point in developing a water treatment program for air washers and chilled-water systems. Corrosion control is closely related to the effectiveness of the microbicide and dispersant. There are no easy answers to the selection of a corrosion inhibitor for air-washer and chilled-water systems because of the differences between textile plants. The most important part of controlling corrosion is keeping the system clean.

The static charge on textile fiber as it passes through the various textile processes has a great deal to do with their efficiency. For example, if a carding machine is processing staple that has just been brought in from a cold warehouse, the fibers will be negatively charged and will stick to the steel rolls of the card machine rather than smoothly rolling into a sliver of yarn. Fibers that develop 100 great a negative charge on spinning frames are subject to excessive breaks.

Quaternary ammonium compounds may be used to control static charges in air, because they have the added benefits of being good biocides and cleaning agents.

Steam generation facilities in a textile plant will normally be quite simple.

Condensate is usually not more than 25% of total feed water. The boilers are generally low pressure and the steam is rarely used for power generation except in the largest integrated mills.

Effluent treatment may be quite complicated because of the residues of processing chemicals present in the raw wastewater. In-plant containment and process modifications are increasingly necessary to meet effluent restrictions. Typical wastewater characteristics are listed in **Table 2.7**.

A treatment scheme for a large finishing plant is shown in the figure below. The large equalization basin is provided to even out changes in composition and temperature, and to reduce the heat load on the aeration basin. In some plants the presence of strong waste (caustic from mercerizing, dyes, sizing agents) requires segregation and separate treatment of these streams. Activated carbon has been used as part of the treatment where dyes are a problem.

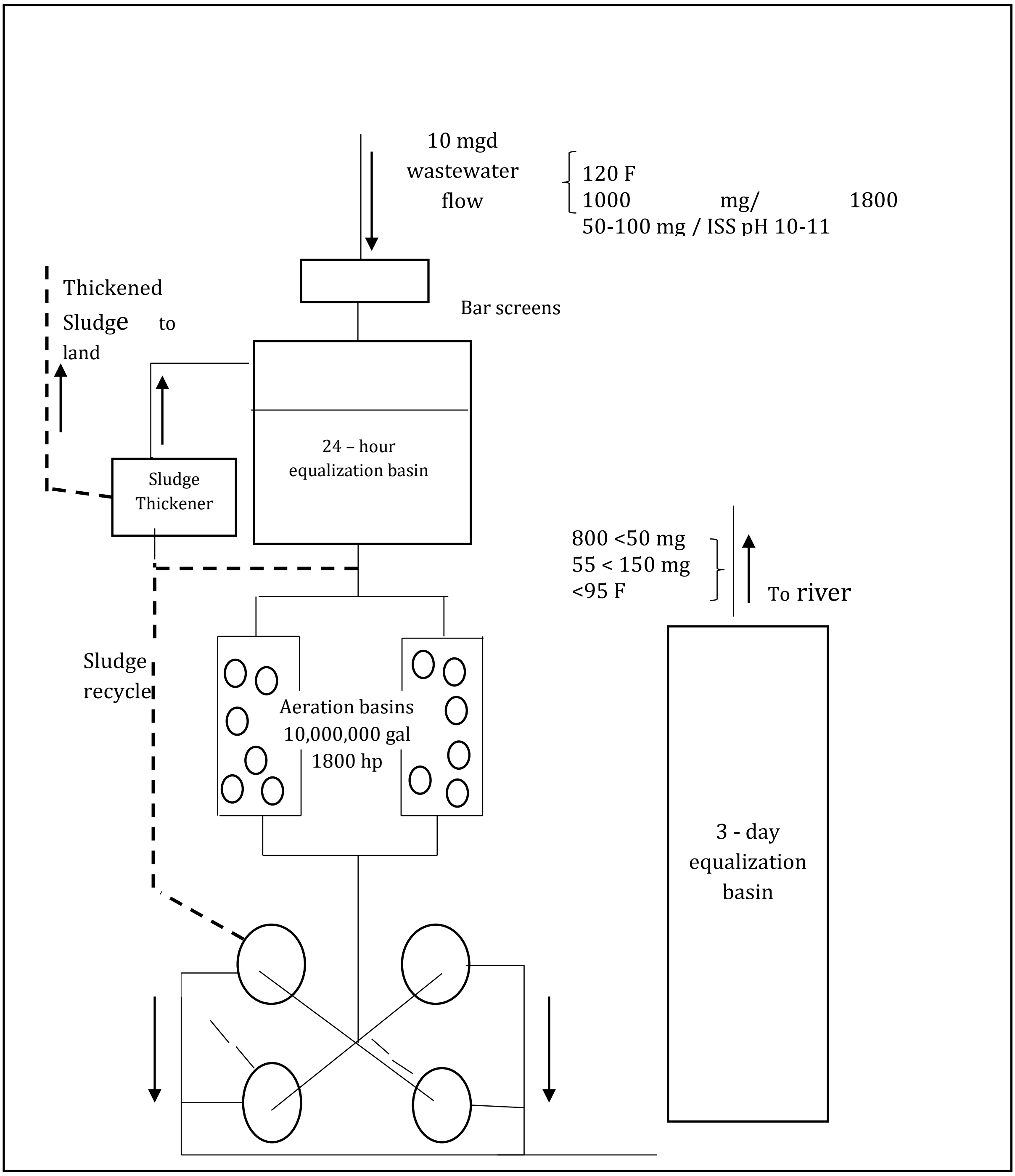


Figure 2-13: Cotton finishing mill effluent treatment scheme

2.6.6 Textile Processing Operations

2.6.6.1 Processing in Large Composite Units

The production processes involved in the manufacture of textile are specialized and complex. These operations can be broadly divided into two categories namely:

I. Dry Processes

II. Wet Processes

I. Dry Process

The operations involved in the dry process, as the name suggests, are not water intensive and contribute little or no pollution. The dry process in a textile industry typically consists of the following operations:

i) Mixing and blending of cotton,

ii) Opening and loosening of fibres,

iii) Mechanical cleaning (using special, machines)

iv) Carding,

v) Combing

vi) Spinning,

vii) Splashing and/or sizing and

viii) Weaving and Knittting.

II. Wet Process

The woven cloth which is referred to as grey cloth contains sizing material which have to be removed before the wet processes are carried out. Hence beginning from the sizing, the operations involved are discussed briefly. Each of these operations contribute different levels of pollution involved are discussed briefly. Each of these operations contribute different levels of pollution (**Fig. 2.14**).

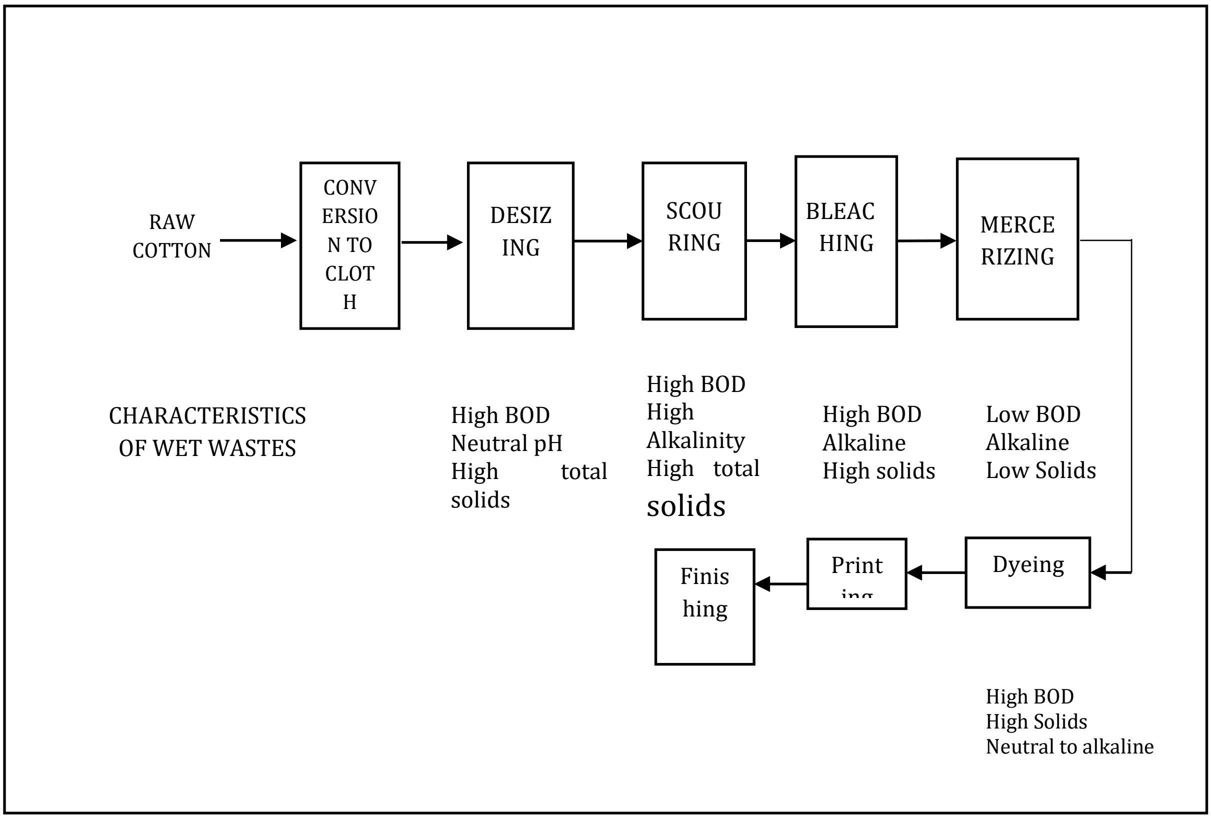


Figure 2-14: Main Process Stream And Respective

Main Process Stream and Respective Pollution Characteristics

i. **De-sizing:** This is carried out with enzymes or by dilute acids for solubilizing the slashing material and its removal by scouring.

ii. **Kiering:** This operation is designed to remove the natural impurities in the cotton. This is achieved by the digestion of cloth and alkali containing caustic soda, soda ash, sodium. silicate, sodium peroxide-and steam. The complete process is carried out on a batch basis or on a continuous basis in special equipment.

iii. **Bleaching:** In this process the cloth is bleached with alkaline solution of hypochlorite or chloride or peroxide. After bleaching, the cloth is washed with plain water and then scoured with dilute acid and sodium bi-sulphite. Finally, the cloth is soaped and treated with optical whitening agents.

iv. **Mercurisation:** In this process the cloth is processed with cold concentrated solution of caustic soda to give lustre, strength and dye affinity to the cloth. The process is followed by e washing. These caustic wastes discharged is collected, recovered and can be reused. The traces of alkali are removed by scouring with dilute acid solution followed by washing.

v. **Dyeing:** There are a number of dyes which are used in dyeing processes. The nature of dyeing differs with the types of dye used. Some of the commonly used dyes are a) Naphthol dyes 2) Sulphur dyes 3) Developed dyes 4) Direct dyes 5) Vat dyes and 6) Basic dyes. Application of different dyes require different chemicals and various kinds of salts and ancillaries are also used to aid the dyeing process.

vi. **Printing:** There are mainly two methods of printing used in the textile industry today. These are i) Manual printing and ii) Machine printing. Manual printing is done by screens on printing tables and as the name suggests this process is carried out manually. In machine printing different machines such as, Flat Bed Auto printing Machine, Roller Printing Machines, Rotary screen printing machines etc. are used. Also various types of pigment and metal complexes are used for printing. In the printing of synthetic textiles, cotton polyester and printed fabric, the process of printing is followed by ageing, steaming and carborising.

vii. **Finishing:** This is the final treatment given to impart various kinds of finishes to the fabric to obtain certain desired properties such as stiffness, wash & wear properties, anticrease and permanent press.

2.6.6.2 Textile Processing in the Small Scale Sector

Textile processing in the small scale sector is mainly concentrated in Rajasthan, Gujarat and parts of Uttar Pradesh. These units can be mainly classified into

i) Complete processing units and

ii) Printing and Finishing units.

A complete processing unit is one which carries out all the processes from desizing to packing.

These units require large amounts of water for different processes and hence, waste water generation is also high. Typically water consumed per 'than' (1 than = 80 mtrs) ranges from 800 – 1200 litres.

A brief description of various processes in a small scale textile processing unit is given below:

i. **Desizing:** The object of the process is to remove desizing material from the cloth so that the colour which is applied at later stages in the processing, gets penetrated and develops uniformly. The waste water generated from this process is not high in BOD but has high levels of COD.

ii. **Mercerization:** The object of this process is to provide lustre, strength and dye affinity to the fabric as already mentioned in the previous sections.

iii. **Kiering:** After mercerisation the cloth is fed into the kier. The object of this process is to remove the natural impurities in the cotton by digestion of the cloth. The waste water in this process mainly consists of Kier water which is characterised by high alkaline and BOD. The total waste water generated from the mercerisation and kiering is about 200 - 250 litres per 'than' processed.

iv. **Bleaching:** After kiering the cloth is washed and then subiected to bleaching operation.

v. The waste water generated in this process contains high pH and very low BOD. The quantity of waste water generated is around 200 - 500 litres per than of cloth processed.

vi. **Printing:** Cloth obtained from bleaching process is first dried and placed over printing tables (about 45 mts in length). Printing is done using colours with the help of screens. Water used in this process is about 5 - 10 litres per one screen washed. In small textile industry about 15 screens are washed per day whereas in a complete textile unit there may be typically 150 screens and hence the waste water generated in the printing unit ranges from 150 to 500 litres per day. Waste water discharged in this process is highly coloured, neutral and has high BOD, COD and total dissolved solids.

vii. **Dyeing:** In this process, the bleached cloth is wound on rollers and then passed through a tray of colour solution. This process is repeated several times and chemicals to fix the colours are also added. The waste water from this process is characterised by high BOD levels and has neutral pH. The quantity of waste waters ranges from 100 - 500 litres per than dyed. After dyeing the cloth, it is washed with water and left to dry. The waste water resulted is similar to printing wastes but the hydraulic load in dyeing process is high.

viii. **Silicate Washing:** This process is mainly for printed cloth. The dyed cloth need not undergo this process. The colour in the printing process does not get completely fixed and silicate washing is adopted to fix the colour. The waste water discharged in this process is normally in the range of 500 - 600 litres per than of cloth silicated. The cloth is dried and sent for finishing.

ix. **Finishing:** There are mainly three types of finishing adopted in the small scale textile units, namely a Stentering b) Felt finishing and c) Calendering. In these three finishing processes, the water is used for making steam or giving slight moisture to the cloth which gets evaporated during the process itself. Hence, there is virtually no waste water generated in this process. However, the ash coming out of the boiler will range from 3 – 5 Kg per day. This ash is collected and disposed by either landfilling method or can be used in building material.

2.6.6.3 Printing Units in Small Scale Sector

Printing units are those in which the cloth is printed with the help of screens. In this waste water is generated from washing of screens. The quantity of waste water generated depends upon the number of screens washed per day. Normally, the maximum number of screens washed per day in a small scale sector, typically range from 10 – 40 screens and the waste water generated is about 50-400 litres per day.

2.6.6.4 Finishing Units

These units consume water either for making steam to heat rollers or for giving moisture to the cloth which gets evaporated in the process itself and hence no waste water is discharged. Only make-up water is added in steam making process.

2.7 ENVIRONMENTAL IMPACT BY TEXTILE WASTES

2.7.1 Effluent Generation

The textile processing effluent when discharged into the receiving body of water without adequate treatment can cause irreversible changes.

The effluent discharged with high temperature will increase the temperature of the receiving body thereby reducing the solubility of oxygen in the water. High alkalinity of the waste water causes increase in pH value of the receiving stream. If the pH value exceeds 9 or falls below 5 on the pH scale, it will have adverse effect on aquatic biota. The soluble colours and dyes present in the waste water will persist in the stream and interfere with the penetration of sunlight essential for photosynthesis.

The colloidal organic matter in the waste water will increase its turbidity along with dyes. The oily material in the waste water will produce an unsightly appearance. Oily scum formed on the surface of the water will interfere with the mechanism of oxygen transfer at the air-water interface.

One of the deleterious effects of the textile process effluents is that it will deplete the dissolved oxygen of the receiving water body. Organic matter such as starch, dextrin and inorganic. chemicals like sulphide, hydrosulphide and nitrite will exert an immediate oxygen demand.

Dyes and colours also introduce a long term biological oxygen demand in the receiving body.

Such drastic changes in the oxygen balance of the receiving body will be detrimental to the aquatic life. This will also affect the carrying capacity of the receiving water.

In addition to the above, toxicity effect of the textile effluent can be severe on the receiving bodies. For example, sulphide, free residual chlorine, aniline dyes and heavy metals like chromium will be toxic to fish. Some of the chemical substances used as dye carriers in the dyeing of the fabrics made from the synthetic fibres are reported toxic, such as, Bi-phenyl, 1-2-4-Trichlorobenzene and O-Phehyl Phenol and quite stable and resistant to biodegradation and have tendency for bioconcentration (*Rajasthan State Board For Prevention and Control of Water Pollution, 1983*).

If the textile process effluents are let out in to the public sewer systems, it will cause a number of effects both on the sewer pipes as well as on the sewerage treatment plants. The high levels of pH, alkalinity and TDS have a tendency of incrustation of sewer pipes. The sulphur dyes and other sulphur compounds present in the waste may gradually lead to corrosion.

Secondly, the high levels of pH and alkalinity of the waste waters may inhibit the growth and activity of micro-organism in aerobic biological treatment plants. The generation of hydrogen sulphide from sulphide and sulphur dyes may have corrosive action on the plant and equipment thus increasing the cost of maintenance and repairs.

The effects of the textile waste water are severe on land also. The high suspended solids and colloidal substances may clog the pores of the soil thus reducing permeability levels of the soil. The high alkalinity will harm the crops and high salinity will impair third growth. The high sodium content of the effluent displaces the divalent cations such as Catt and Mgt. It also hardens the texture of the soil and prevents the penetration of the roots.

Sodium also acts as deflocculating agent and deprives the soil of its water holding capacity

2.7.2 Processes Generating Pollution Load and level of their Impact on Ambient Water Quality

Various processes in textile industries generate liquid pollutants. Please see table below.

Table 2-8: Processes Generating Pollution Load and level of their Impact on Ambient Water Quality

Process	Steps	Impact	Remarks/Comments
Cleaning of Fibre	Wool, Silk, Jute, Raw cotton package dyeing	Major	Effluent Generation
Ginning Industry	Raw cotton mechanical cleaning	Minor	Major Solid Waste Generation
Spinning Industry	Yarn making	Minor	Major Solid Waste Generation
Fabric Making-Loom shed	Sizing	Major	Effluent Generation
	weaving	None	
Wet Processing Industry/Process-House	De-sizing	Major	Effluent Generation
	Scouring/Bleaching	Major	Effluent Generation
	Dyeing & Printing	Major	Effluent Generation
	Finishing	Minor	Effluent Generation
Garment Industry	Garment making	Minor	Solid Waste Generation
Laundry	Garment, Washing, Dyeing, Printing	Major	Effluent Generation

Quantity of wastewater from different processes in textile industries and their characteristics are presented in the table below.

Table 2-9: Waste Water from different processes

Process	Quantity of Waste Water	Characteristics
1. Desizing	40-50 ltrs/Than	BOD 50-500 mg/l, TSS, TDS, Strongly alkaline
2. Mercerisin	500-800 ltrs/Than	Low BOD. 100-150 mg/l and low TDS, strongly alkaline
3. Kiering	- do -	Strongly alkaline, High BoD 200-3000 mg/l and TSS, TDS.
4. Bleaching	- do -	Low BOD, TSS & TDS
5. Printing	5-10 ltrs/Screen washed	Colours, Chemicals
6. Dyeing	100-500 ltrs/Than	High BOD, COD, TSS & TDS. Colour and Chemicals
7. Silicating	500-600 ltrs/Than	TSS and high Sodium percentage.
8. Finishing	- do -	- do -
The quantity of printing waste water depends on the number of screens washed.		

Table 2-10: Chemical Characteristics of the combined Waste Water

Colour	High coloured.
pH	7-12
Sulphates	150 - 1000 mg/l
Chlorides	500 - 7000 mg/l
Total Suspended Solids	100 - 4000 mg/l
Total Dissolved Solids	800 - 15000 mg/l
C O D	700 - 2000 mg/l
B O D (5 days at 20°C)	200 - 2000 mg/l
In addition to these, metals have also been observed.	

2.7.3 Pollution Control in Textile Industry

The waste water of textile processing units can be treated in a number of ways. The first method deals with in-plant modification so as to reduce the pollutional load and the second method treats the effluent in stages viz. primary, secondary and tertiary treatment.

In-plant Modifications

The major pollutant in the textile process effluent, excess percent sodium can be avoided to be mixed with the outgoing waste water by recovering caustic and using steam agers in place of silicate process.

Caustic Recovery: Caustic is used in the process of mercerisation and is subsequently discharged with the waste water. It is possible to collect the caustic bearing effluent at one place, remove its impurities and then make up its concentration to the requisite level. Thereafter, it can be reused in the process thus saving continuous cost of caustic. Another way is to install caustic recovery plants where the effluents bearing caustic can be collected from different plants, caustic recovered and then returned to respective plants. This will entail the exercise of collection and transportation from various plants.

Recovery of sizing agents: The synthetic sizing agents from desizing unit waste liquor can be segregated by chemical precipitation with metallic salts e.g. alluminium sulphate and its conversion into sodium salt by treatment with caustic soda.

Recovery of dyes: in the Vat dyeing process only about 65 to 75 percent of the dye is absorbed by the fibre and the remaining is drained out. This category of dyes may be recovered and reused in the same dyeing process. Similarly, bright coloured lacquers etc. may be recovered from basic azo and reactive dye waste liquors by precipitation of their metallic derivatives.

Use of Steam agers: For fixing of colour, silicate process is normally adopted in textile dyeing & printing houses. About 2 - 10 kg per than of sodium silicate is used for fixing of colour.

After the colour is fixed, the effluent containing sodium silicate is discharged. If this process is replaced by steam agers, in which, the colour is fixed using steam - the quantity of sodium in the waste waters can be reduced by about 80 per cent. Another, inherent advantage with steam agers is that water consumption gets reduced by about 80 per cent. The colour fixed by using steam agers is better than that fixed by silicate process. Also, it works out to be cheaper than silicate process. Resorting to caustic recovery and steam agers would help reduce sodium content in the effluents of these units.

Flow Reduction: If the quantity of water used in the process is less, reduced quantity of waste water will have to be treated prior to discharge. Keeping this point in view, the processes where water use can be minimised have to be closely studied. On the other hand, as the price of treated water goes up and the price of waste treatment increases water conservation should be encouraged.

Water Reuse: Water reduction is the use of less water in production i.e., per kilogram of product. Water reuse is the use of same water for more than once. For example, use of rinse water from one operation for make up water in second operation. This results in a net reduction in water use for total production but does not necessarily reduce the amount of water used per kg. of product. In water use planning, one has to review various processes and their water quality requirement and then tailor the uses to the minimum quality requirement for each process. This can involve in collection of all clean water for reuse without treatment or with only minimum treatment.

2.7.3.1 Primary Treatment

Prior to discharge to the main sewers/drain, it is desirable to provide primary treatment like neutralization, sedimentation etc. is provided by individual units to reduce the ultimate load on the terminal treatment facility. Various stages in primary treatment are detailed below:

Segregation: Some textile waste liquors such as desizing - mercerising washes, Kier discharges, dyeing and printing wastes are quite concentrated and may contain substances that will interfere with the operation of the treatment unit. It is essential to separate them from the main flow and distribute them uniformly so that their effect on the main stream be reduced. This process may help in the recovery of caustic chemicals.

Screening: Screening of the effluent helps in the removal of fibrous materials, rags, solids etc. thus minimising the choking up of water ways. Self-cleaning device will reduce the frequency of screen changing thus increasing the overall efficiency of the screening process. Most commonly, vibrating screens are used for removal of short fibers.

Equalization: For this process, a storage tank, pond or lagoon with a capacity equivalent to one day's effluent is desired. Uniform treatment will help the further treatment and make it more efficient with an advantage of removal of substantiative percentage of BOD. If this equalization system is provided with the needed aeration, the pre-aeration will be beneficial to prevent septic condition and to oxidize the easily oxidizable substances such as hydrogen sulphide.

Neutralization: The effluent from a textile unit having mercerization plant, can be neutralized if it is brought in contact with wash liquor from polyester or cotton carbonization units. Textile units having both mercerization as well as carbonization plants normally discharge an effluent having a pH range of 6.5 - 8.0. In such cases no aids or alkali agents need be added to correct the pH level. Otherwise, the alkalinity level is usually brought down to neutral by adding Hydrochloric acid, Sulphuric acid or compressed carbon-di-oxide gas.

Coagulation and Sedimentation: The colloidal solids which demand oxygen and produce turbidity, can be effectively removed by chemical coagulation followed by sedimentation, for the reduction of BOD and colour. Normally, chemicals like iron salts, alum, lime and calcium chloride are used for this purpose. To make the process of sedimentation easy and effective pH between 6 to 7 will have to be maintained. Most commonly, coagulants ate added with the help of automatically controlled device quite rapidly so that they are well dispersed before the precipitation takes place and this is followed by slow stirring over a long period of time so as to allow the flocs to settle down.

The major benefit of proper primary treatment can be effective in reducing the pollutional load on the secondary treatment plant thereby increasing the efficiency of the system. Also, statutory requirements laid down for discharge of effluents can be satisfactorily achieved during this stage itself, though partially.

2.7.3.2 Secondary Treatment

Generally primary treatment is provided at the manufacturing units where the effluents get generated and the secondary treatment is normally provided at a central facility either by the textile unit or by regulatory civic bodies, where facilities are available.

The secondary treatment for BOD reduction is carried out by either trickling filters or by activated sludge process. The latter is commonly adopted in the efficiency range of 85 to 90 percent. Cotton textile waste, after making it free from high hydroxyl alkalinity and toxic substances is easily treatable for biological oxidation, because of high content of nitrogen, phosphate, starch and other nutrients. The biological treatment is carried out by pretreatment and using sewage as admixture for initial seeding. Commonly used biological treatment processes, in the order of increasing detention time are given below:

a) Trickling filter b) Activated Sludge c) Rotating biological discs d) Extended aeration e) Aerated lagoons.

2.7.3.3 Tertiary Treatment

These processes are under study for the performance evaluation in terms of removal of organics and inorganics and the removal of certain objectionable substances that are resistant to secondary treatment. For example, organic removal processes are adsorption, foam separation and chemical oxidation where as inorganic processes include anaerobic denitrification, algae harvesting, reverse osmosis etc.

There are no industry specific effluent standards evolved by Indian Standards Institution (ISI).

However, standards for effluent discharge for various industries based on ultimate disposal are available. These details are given in the Table below and the Figure shows the treatment processes as suggested by ISI for discharge into public sewers, water streams and for land disposal.

Table 2-11: Effluent Standards for Discharge to Stream

1.	pH	5.5 to 9.0
2.	Colour	75 units on platinum cobalt scale
3.	Temperature	Shall not exceed 40°C in any section of the stream within 15 m downstream from effluent outlet.
4.	Total Suspended Solids, mg/1	100
5.	BOD (5-days, 20°C), m/1	30
6.	COD, mg/I	250
7.	Total dissolved solids, mg/I	2100
8.	Oils & Grease, mg/I	10 (for Woolen Industries only)
9.	Total residual chlorine mg/1	1.0
10.	Particle size of TSS	Shall pass 850 micron I $ Sieve

Table 2-12: Effluent Standards for Irrigation on Land

1.	pH	5.5 to 9.0
2.	TDS, mg/I	2100
3.	BOD (5-days, 20°C). mg/I	300
4.	Percent Sodium	60
5.	Boron, mg/1	2
6.	Oil & Grease, mg/I	30
7.	Sulphates, mg/I	1000
8.	Chlorides, mg	600

Table 2-13: Effluent Standards for Discharge in Sewer

1.	pH	5.5 to 9.0
2.	Total Suspended Solids, mg/l	600
3.	Total Dissolved Solids, mg/l	2100
4.	BOD (5-days, 20°C), m/l	500
5.	Oil & Grease, mg/l	100
6.	Sulphates, mg/l	1000
7.	Chlorides, mg/l	600

2.7.3.4 Conclusion

Considering the large number of textile processing units - both large and small - existing in the country, due importance should be given to analysis of quantity and characteristics of waste discharged, possible environmental impact by the waste water and alternative treatment and in implementing applicable standards.

1. For disposal into public sewers: The suggested minimum treatment will be screening, grit removal, chemical coagulation, flocculation and sedimentation

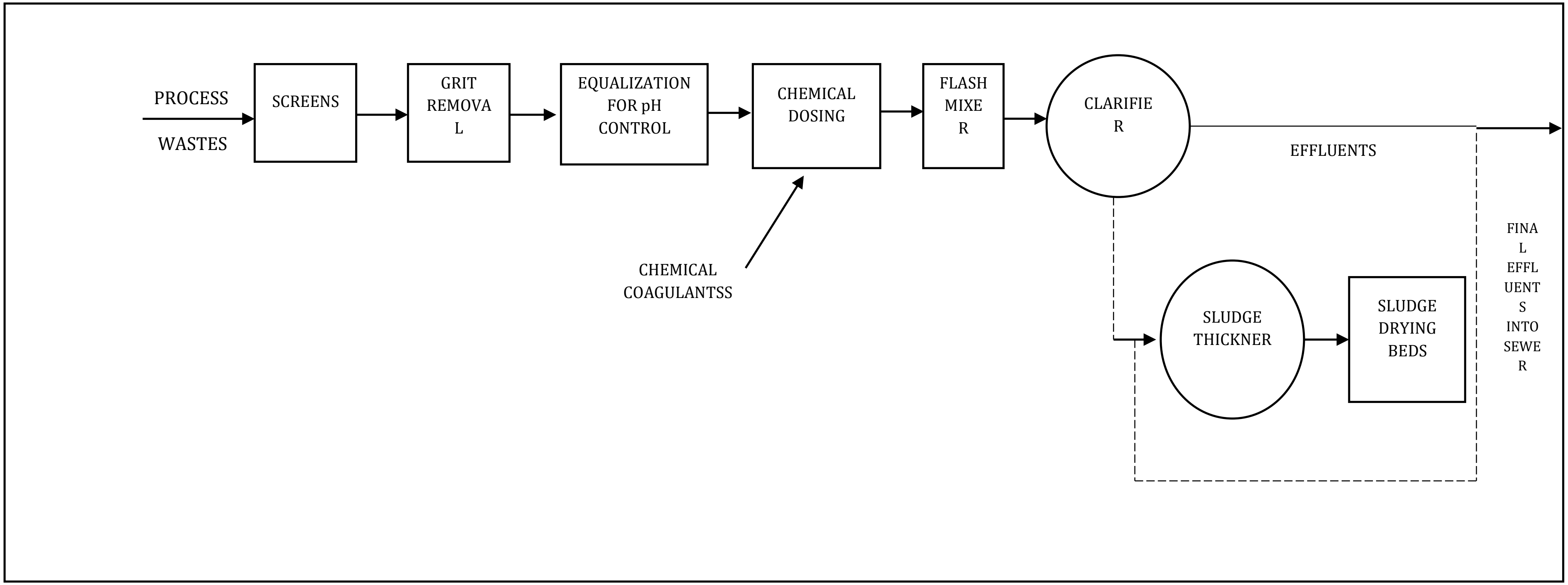


Figure 2-15: Minimum Treatment Discharge into Public Sewer

2. For disposal into streams: Primary treatment and secondary treatment for BOD reduction.

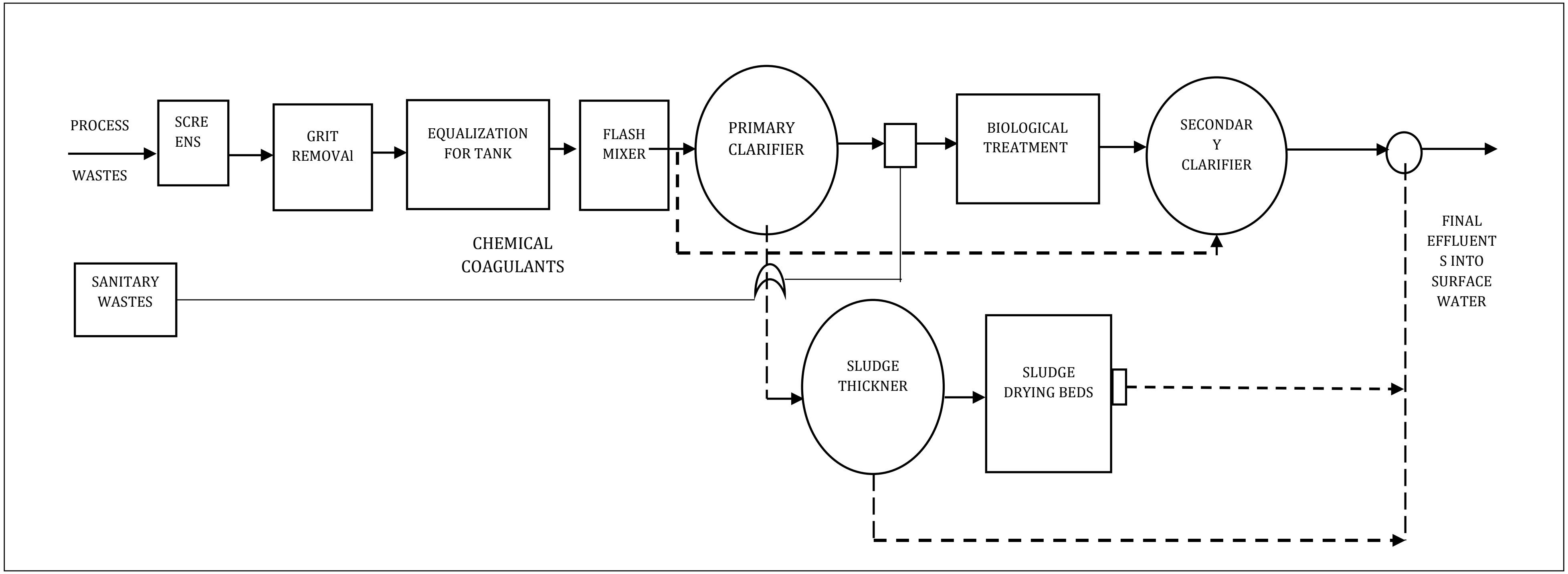


Figure 2-16: Primary and secondary treatment for discharge into Inland Surface

3. For land disposal: Primary treatment or secondary treatment or both followed by treatment with gypsum.

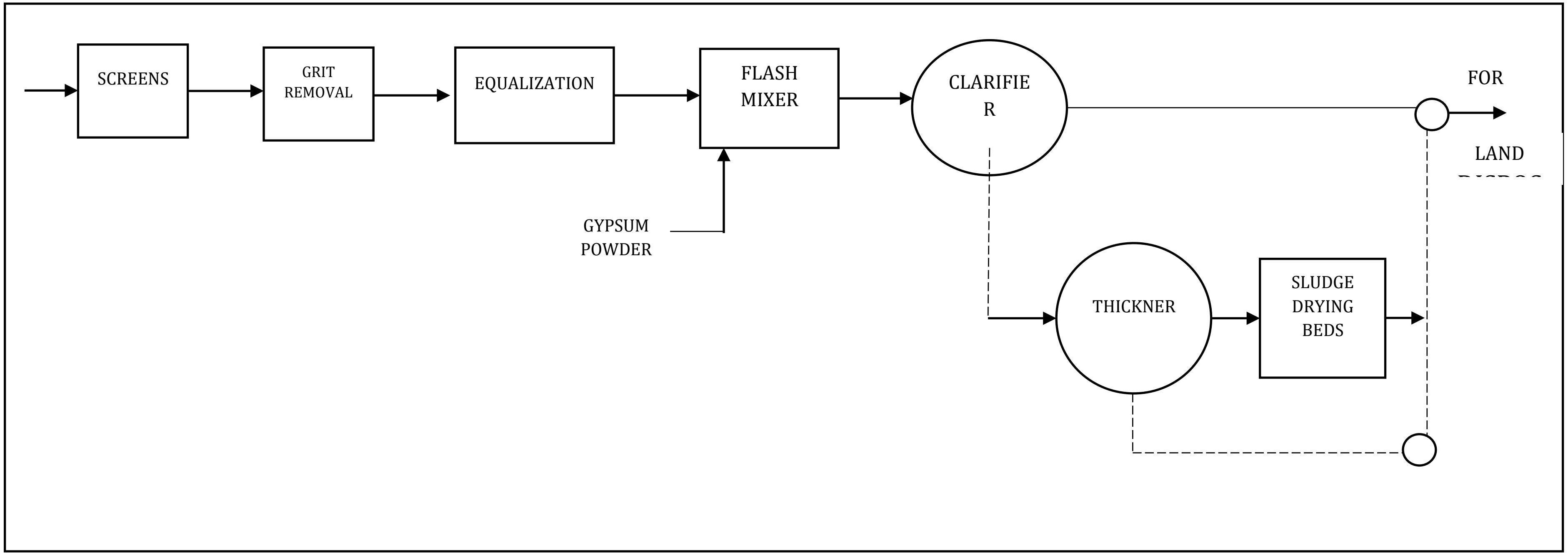


Figure 2-17: Primary treatment or secondary treatment or both for disposal on Agricultural Land

2.8 Project Description: Construction Phase

2.8.1 Land Acquisition

The project does not involve any compulsory land acquisition. MIDC carries out land acquisition for industrial purpose as per the provisions of the Maharashtra Industrial Development (MID) Act, 1961. This site is notified by the Government of Maharashtra vide notification No. IDC 2018/(C.R.363)/Ind 14 dated 5th September 2019 (***Annexure IV***).

Development will be taken up in 2 villages as follows: Pimpalvihir and Dighargavhan *(Village wise Survey Numbers are listed out and enclosed as **Annexure III**)*.

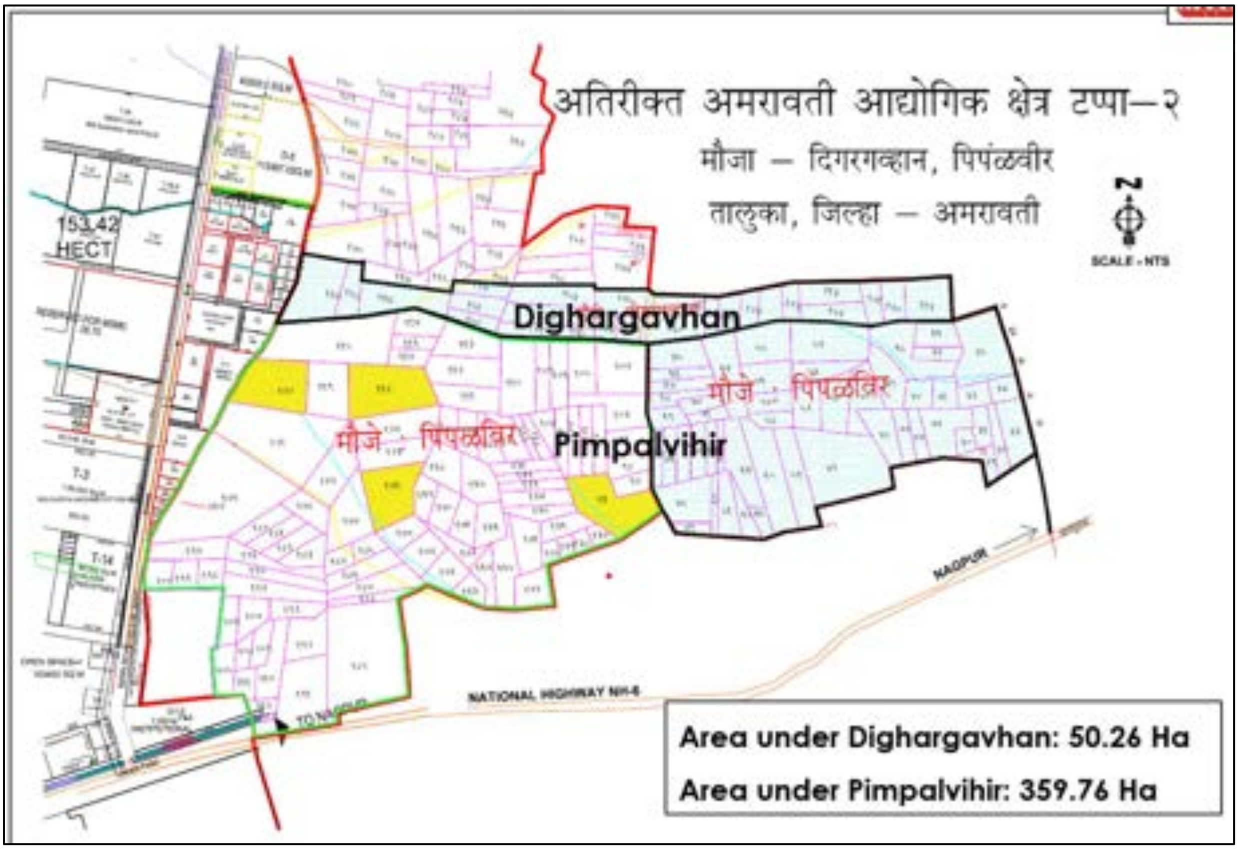


Figure 2-18: Site map with existing Village Boundaries

2.8.2 Proposed Master Plan

The planning of the proposed industrial development project is based on the siting criteria mentioned in the MoEFCC's Technical EIA Guidance Manual for Industrial Estate – 2009.

The Guidelines of CPCB Zoning atlas for Siting of Industries are taken into account for finalization of location of the proposed industrial area. In the proposed textile park project, the areas have been categorized in to different zones. Industry category permitted will be as per the Zoning Atlas Guidelines.

There are 2 villages partly falling within the demarcated plot boundary and land acquisition is under MIDC. The existing village settlements within the plot will be preserved with a minimum buffer zone of 50m.

In order to ensure sustainable development, buffer zones are maintained as below:

a) Buffer zone of 10m around secondary streams / nallahs as per MIDC DCR, 2009 (Sec 17.1) provisions
b) Buffer zone/Green belt around all water reservoirs ensuring that they are protected
c) Amenity space around all village settlements to ensure minimum buffer zone of 50m between settlements and industries
d) Buffer zone of about 300m width between Highway/railway and industrial area
e) Buffer zone will be maintained around Overhead electric lines as per MIDC DCR Rules, 2009 (Sec 22.2)
f) Overhead electric lines: Buffer zone as per MIDC DCR Rules, 2009 (Sec 22.2)
g) Residential zone will be well separated from the industrial zones and will have its own open space of 10% as per MIDC DCR 2009
h) Roads will have avenue plantation & along Median verge

2.8.3 Proposed Zoning

Development proposal includes area development plotting and zoning and development of land infrastructure over entire area of 410.02 Ha which will have the following zones:

- Manufacturing Zone
- Utilities
- Commercial Development
- Housing & Social Infrastructure
- Logistics
- Training, R&D & Testing
- Roads
- Green Area

(*Please refer to* ***Fig. 2.4*** *Proposed Master Plan*).

Support infrastructure comprising Residential zone is proposed to facilitate planned development zone for staff Members of MIDC and Member Industries and make the development sustainable.

A brief description of the zones is as follows:

- Manufacturing Zone of 257.14 Ha to house textile industries
- Supporting infrastructure within Utility (9.54 Ha) and Logistics Zone (4.85 Ha)
- Housing & Social Infrastructure zone of over 17 Ha to help create good residential facilities for MIDC staff and employees. This zone is planned in the upward wind direction so that air/ noise pollution due to the proposed industries is avoided near villages .
- Developing Green Belt and green spaces over 122.27 Ha area. A green belt of 15 m has been proposed along the site boundary to prevent any noise and air pollution from the industrial zone to affect surrounding area.

- Upgradation of access to MIDC from the existing National Highway (NH53) and providing internal roads of spine road of 60 m RoW of 4 lanes, other 45 m and 30 m width roads. Total area under roads over 38.25 Ha area
- Construction of Training and R & D, Incubation labs, testing zone of 5.34 Ha area
- Common Sewage Treatment Plant (STP) only for resi zone and Municipal Solid Waste Treatment (MSW) facility to treat 5.1 TPD biodegradable solid waste will be developed for residential area
- Internal water supply network (to provide water to Member industries and residential zone)
- External water supply network (Jackwell from upper Wardha reservoir). Irrigation department has approved abstraction of 10 MCM from Upper Wardha Reservoir).
- Streetlighting power supply upto plot etc.

Details of these infrastructure facilities are described in the following sections.

2.8.4 Proposed Area Statement

Zone wise Areas proposed are as mentioned in the following table (*please refer* ***Fig. 2.4*** *Proposed Zoning Plan*).

Table 2-14: Zone wise Areas proposed

Sr. No.	Zone/ Land use	Area	
		Ha	%
1.	Manufacturing Zone	257.14	62.88
2.	Utilities	9.54	2.85
3.	Commercial Development	8.18	2.70
4.	Housing & Social Infrastructure	17.00	4.65
5.	Logistics	4.85	1.80
6.	Training, R&D & Testing	5.34	1.30
7.	Roads	38.25	9.85
8.	Green Area	69.72	13.97
	Total	**410.02**	**100.00**
	Area under Green Belt		
	Green Area	55.87	**17.00**
	Green Belt Area	13.85	
	Green area in large size plot (Area = 302.05 Ha)	48.33	16.00
	Green belt area along the road	4.22	
	Total Green Area	**122.27**	**33.00**

2.8.5 Manufacturing Zone

On the basis of raw materials to finished products, the textile mills can be grouped as composite mills where final products (Garment or cloth) are produced by the use of raw material (fibers), these are large units. There are certain small segments of large industry like ginning, spinning, weaving, processing, garmenting, laundry etc. (Please refer to **Section 2.6)**.

2.8.6 Housing & Social Infrastructure (Non Processing Area)

As part of the layout plan, it is proposed to have Housing and Social Infrastructure zone as support infrastructure within the plot proposed boundary. Part of this will be used to house MIDC staff quarters. Part of this will be leased to Member industries so as to enable them to bring in well trained experienced employees to operate and maintain the industries. This is a long standing demand of industries in remote MIDC areas. Due to the proposed development, there will be influx of people employed within the residential zone of the industrial areas. With an average household family size of 4, population influx over next 10-15 years is expected to be 11,092.

2.8.7 Utility Zone

Space of 9.54 Ha will be kept reserved for Utilities within the proposed layout. Activities permissible within amenity area as per MIDC DCR, 2009 (Sec 21.6) are: MIDC offices, Local Area offices, Post Offices, Telephone exchange, Truck Terminus, Fire station, Police station/ chowkies, Electric sub- stations, Water supply works, Drainage works, Power Infrastructure, Common Facility Centre/ Recreation center – which will include CFC & Office Building along with allied infrastructure, Industries Association offices, Staff Quarters, Schools/ Colleges, Educational Institutes, Training Centre, Pollution Control Laboratories, Sulabh Shauchalya, Informal shopping, stall sites, plots for PAPs, Communication centers, Milk booths etc.

On commencement of the manufacturing units within the site, further amenities will be identified and incorporated by individual units as per their requirements. Facilities like drinking water, canteen, and sanitation facility will be provided within the units as basic requirements for workers.

2.8.8 Green Belt

Green belt of 33% 122.27 Ha is proposed. Green area of 69.72 Ha will be planned as part of the Master Plan of which 55.87 Ha is proposed as a green zone around the various processing and non-processing zones. The existing natural streams and percolation tanks will also be surrounded by a green zone. The entire plot will have a 15 m wide Green Belt area of 13.85 Ha. Roads will have avenue plantation as well as green medians of about 4.22 Ha. An additional green area will be developed by individual plot (Indutrial unit) owners. This will comprise of 48.33 Ha which is about 16% of the plotted development.

Table 2-15: Green Area details

Sr. No.	Area under Green belt	Area	
		(Ha)	(%)
1.	Green Area as part of Master Plan	55.87	
2.	Green Belt around the proposed plot	13.85	
		69.72	**17.00**
3.	Green area in large size plot (Area = 302.05 Ha)	48.33	16.00
4.	Green belt area along the road	4.22	
	Total Green Area	**122.27**	**33.00**

This will be developed as green belt by planting trees which are indigenous to the local area.

- The proposed plot will have a 15 m wide Green Belt area of 13.85 Ha.

- Buffer zone of 10m is left for all seasonal streams in order to protect the streams as per MIDC DCR, 2009 (Sec 17.1) provisions Buffer zone/Green belt around all water reservoirs ensuring that they are protected
- Avenue plantation along all roads and plantation on median verge
- In addition, open space will be provided in 16% of total area in large size plot (Area = 302.05 Ha) of 48.33 Ha area.

Existing trees at site

Summary of trees existing at the proposed site for PM Mitra Textile Park in the Additional Amravati Industrial Area is as follows:

1. In all, there are 945 trees within the area proposed for PM Mitra Textile Park.
2. Out of these 945 trees,
   - 91 trees are within the land width of the proposed roads,
   - 42 trees are within the 15m wide periphery of the proposed green belt along the periphery of PM Mitra Textile Park and
   - 812 trees are within the plots, PAP plots, open spaces, and utility areas of the PM Mitra Textile Park.
3. 812 trees are within the plots which will be handed over for various development and to individual industry units. The no. of trees to be felled within these plots cannot be estimated at this stage.

2.8.9 Roads

- Access roads to MIDC 60 m RoW of 4 lanes connecting Proposed Project site to MIDC (length: 5.5 km).
- Construction of 7.50 m. metal width two lane road for a length about 2490 m
- Construction of 5.50 m. metal width service road for a length of 450 m along National Highway.
- Strengthening of existing service road of N.H. for a length of about 500 m. by providing 60 mm DBM & 40 mm BC.

Please see figure below for Proposed Road Layout (Fig. 2-6).

Schematic cross section of 60m ROW 4 lane and 45m and 30m ROW 2 lane is indicated below **(Fig. 2-7**).

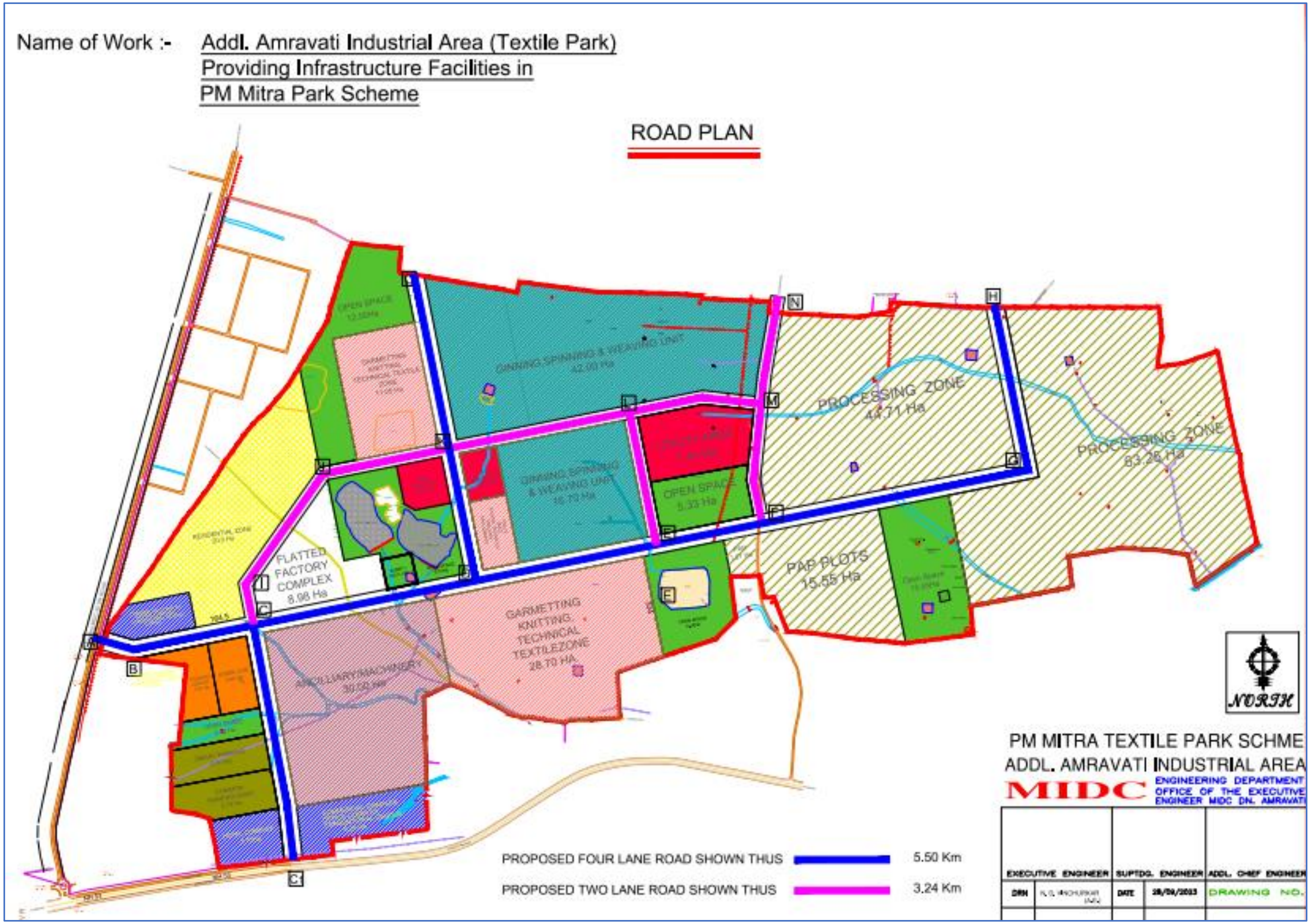
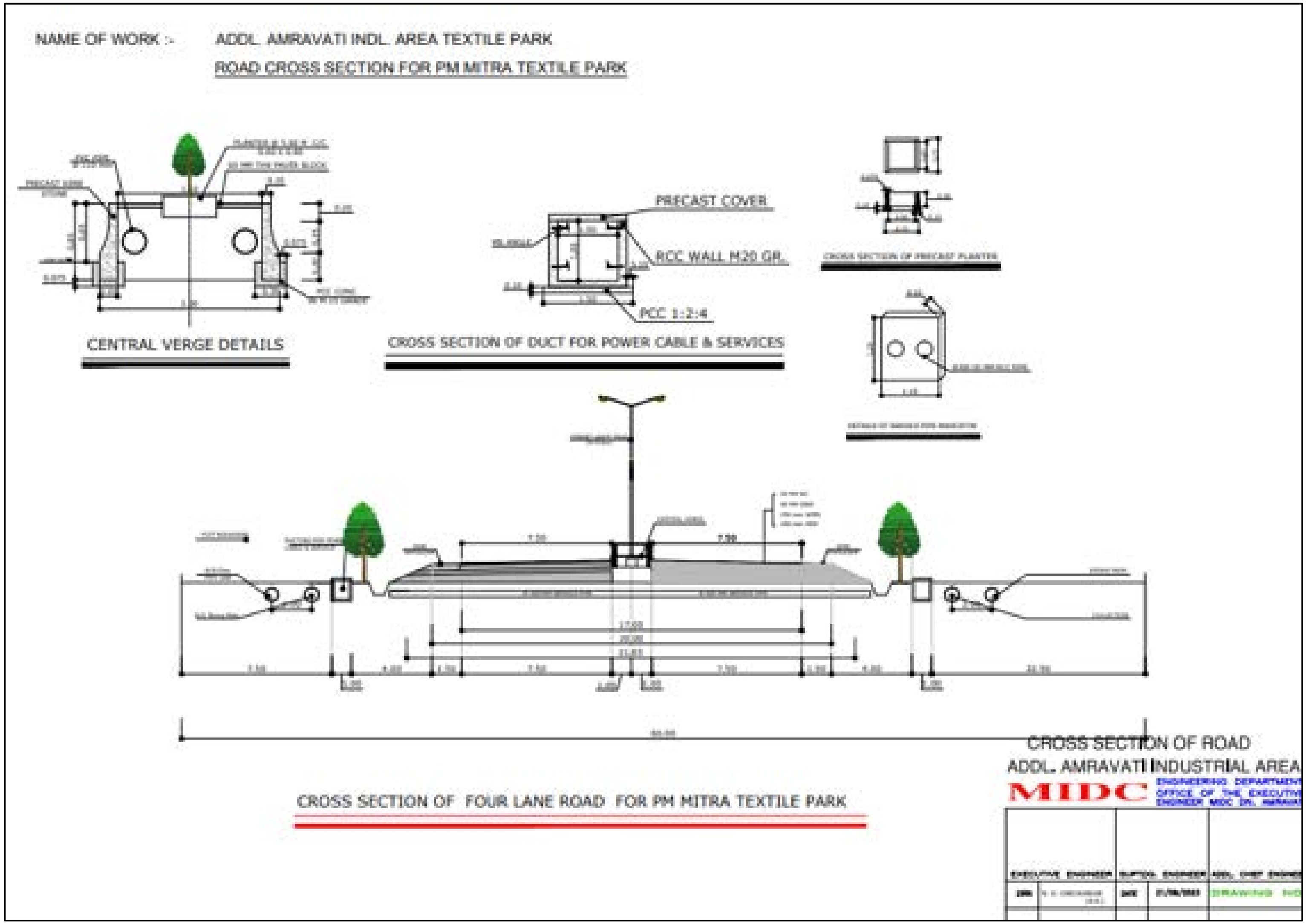
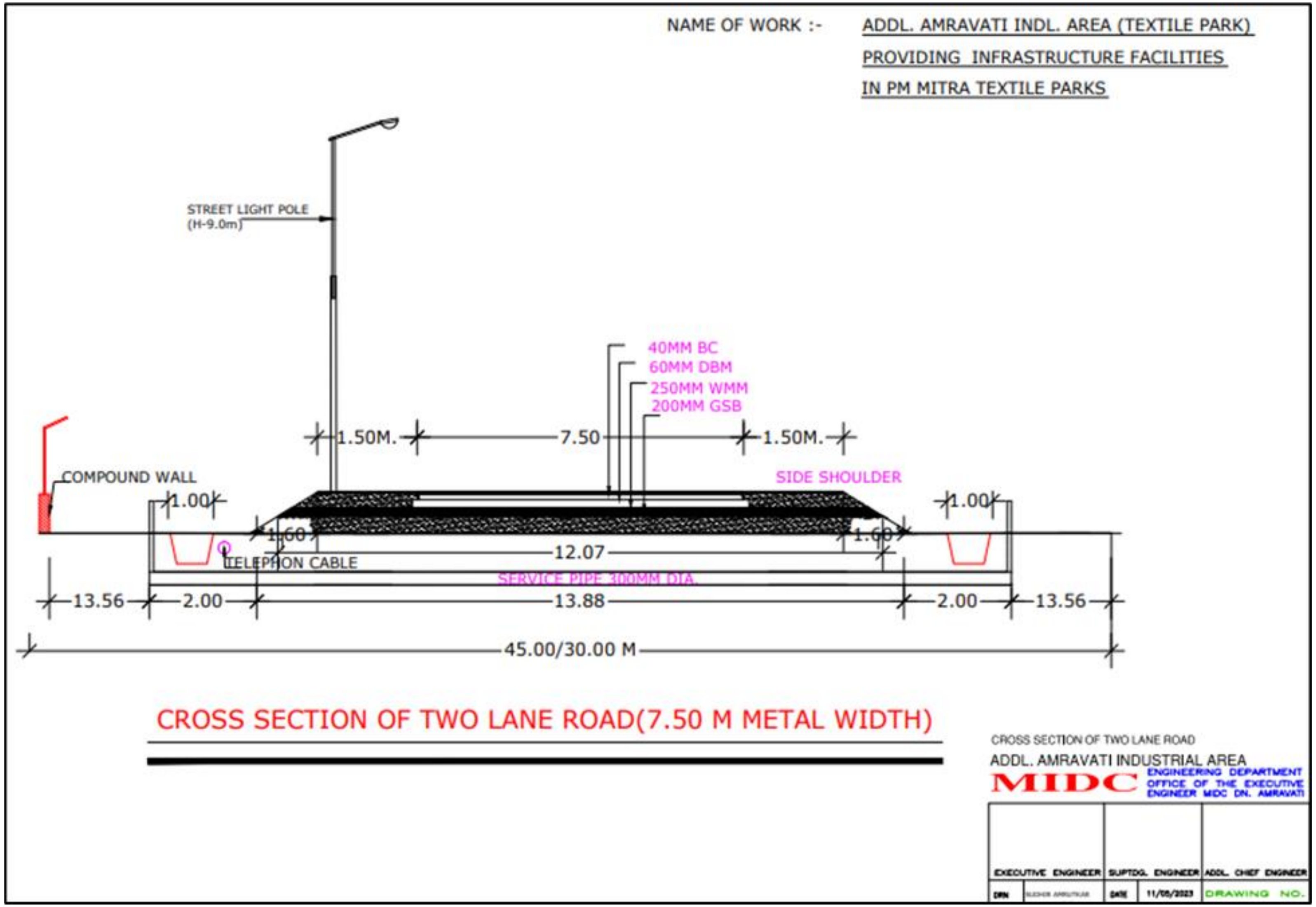


Figure 2-19: Proposed Road Layout



Schematic cross section of 60m ROW 4 lane



Schematic cross section of 45m and 30m ROW 2 lane

Figure 2-20: Schematic sections through proposed 60m ROW road

2.8.10 Storm Water Drainage

Following are the brief highlights of the study conducted for development and design of proposed Storm Water Drainage system for the Master layout of the industrial estate.

Initial desk study was first conducted, the area thoroughly studied using satellite imageries, Google Maps and Survey of India Toposheets and all the streams draining the area were identified. A Digital Elevation Model (DEM) was created from the survey data and the catchments of all the streams draining the area were delineated. A site reconnaissance was then carried out to have an idea of the site condition in terms of project location, possible drainage outfall locations, general topography, land use, soil type, etc. The site visit with GPS was carried out after going through the area's topographical survey, satellite imageries, and all other relevant information available.

Rainfall data for the region was studied. Daily/ hourly hydrological and meteorological data was collected from Meteorogical Department, Maharashtra. During the site visit, the upstream and downstream boundary conditions, as well as other governing parameters, were also assessed. The local populace was questioned about local flooding, the historical floods/ High Flood Levels, general drainage problems, etc.

During the master planning, the guidelines for siting of industries with respect to nallas and streams were studied**.** While designing SWD system for the proposed project, storm depths for durations of 1, 3, 6, 9, 12 and 24 hours corresponding to return periods of 10, 25, 50, and 100 years are considered. The time of concentration of each of the catchments was estimated. Based upon the Time of Concentration, the Design Storm Duration was estimated.

Design of storm water drainage network

The storm water drainage network layout was prepared considering the subdivision of catchment areas. The total area contributing to the flows in the site area were delineated into sub-catchments using the Digital Elevation Model (DEM). The catchment delineation is based on points of confluences of streams and nalla segments for better representation of the contributing area. Physiographic parameters of catchments such as catchment area, length of the longest flow path, and stream slope are estimated in terms of design flood estimation. The layout is based on the proposed road network, simulated high flood levels, and possible outfall locations. **Figure 2.8** below shows the example of a modelled storm water drainage network along the proposed road network.

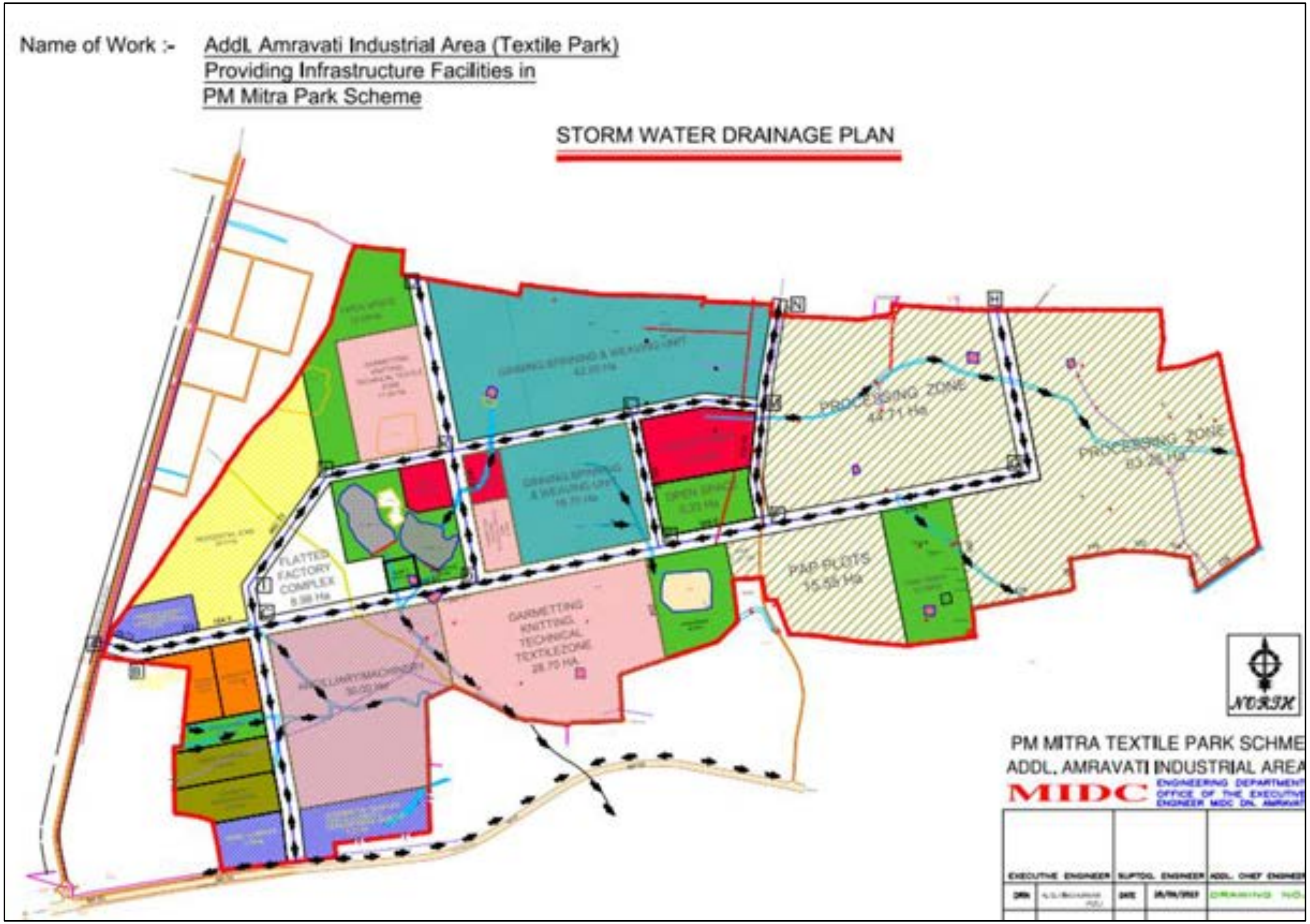


Figure 2-21: Proposed Storm Water Drainage Plan

2.8.11 Resource Requirements

2.8.11.1 Construction Phase

This development of industrial estate over a five year period will involve construction of road infrastructure, streetlights, providing water/sewage treatment plant, residential quarters, plotting, laying sewage network, solid waste management facility, and other civil works etc. Minor Land cutting/filling envisaged for above activities. No plot development will be undertaken as plots are sold on an “as is” basis.

A. Raw Materials

Material Selection: Various raw materials will be required for the construction of the proposed infrastructure. Details of raw material requirement for proposed project are given below:

Table 2-16: Raw Material Requirement

Sr No	Material	Quantity Required (MT)	Average Lead (km)
1	Aggregate	172000	20
2	Sand	8000	20
3	Cement	30000	20
4	Steel	700	20

Source for Raw Material Procurement: Metal/Murrum/Sand and soil will be sourced by Contractor from Government approved quarries and borrow areas. A condition to that effect will be inserted in the Contract documents.Sources will be located in such a way as to ensure that:
- material quality meets construction requirement
- Sufficient reserves of each material type are identified, and
- sources are located in such a way to minimize haulage.

Other Raw materials (like steel, cement, asphalt etc) are easily available in the local market and/ or will be sourced from Mumbai/ Pune.

Mode of Transport of Raw Materials: Raw materials will be transported through Trucks/ Tankers from suppliers’ factories or traders go-downs. Those, which are in house will be transported through internal roads as per the requirements.

Storage at the site: Raw materials will be stored in storage yards in the respective zones at the project site.

B. Power requirement

During the construction phase, power will be required for operating machinery for construction activity. It is proposed to use DG sets for the requirement. The power requirement is estimated at about 1MVA through generator sets and temporary power connections from MSEDCL.

C. Water Requirement & Wastewater Generation

During construction stage around 300 to 350 nos. of labours will be there on site for development of infrastructure for the period of 5 years. Assuming around 50 nos. of MIDC personnel will supervise the development, the water requirement during construction stage for domestic activities will be around 30 cmd.

Thus, total construction water requirement is about 50 cmd and 30 cmd for domestic requirement of labourers. This will be sourced from the backwater of Upper Wardha Reservoir as permit for the same is already obtained by MIDC.

Sewage generation will be around 25.5 cmd. Sewage will be treated in package type sewage treatment plant of approx. 30 cmd capacity.

D. Municipal Solid Waste and Hazardous Waste

Municipal waste generated will be 5 kg/day from the labour camp. Other wastes will include substratum removed during construction of foundations and minor cutting required as also debris from construction activities like broken tiles, glass, scrap, packagaing material etc. Hazardous wastes include Paint cans, Used oil etc.

E. Manpower Requirement

50 MIDC staff and 300-350 contractual labourers will be engaged for the construction activity.

2.9 Project description – Operation Phase

The plots will be sold on "as is" basis by MIDC. The Operation Phase will begin when plotting is completed & basic infrastructure is in place (expected after five years) and Member Industries approach MIDC for space. This phase thus involves handover of plots to Member Industries who will then initiate development and construction after obtaining necessary approvals. The industries will later go into operation once construction is completed. During this phase, MIDC will employ about 300-350 staff to operate and maintain the water supply, sewerage nateworks, street lighting, maintain roads and other buildings (CFC, Fire station etc) and to ensure that the construction is undertaken by Member Industries as per DCR Rules, 2009 and address local concerns.

2.9.1 Industries to be set-up and Status w.r.t. Environmental Laws

Category of Industries as per EIA Notification: However, the Textile Park will house all types of manmade fibre units including Rayon falling under Category 5d as per EIA Notification.

Category of Industries as per CPCB Classification: The industries to be set up will in the Red, Orange, Green and White category as per CPCB classification.

Typical categories of industries which may come up are:

- Ginning, spinning and weaving units
- Garmenting, knitting
- Processing Zone
- Textile Manufacturing
- Processing and Printing machinery

2.9.2 Pollution Potential

List of chemicals used in Textile Industry

There are various hazardous chemicals used in textile industry. These chemicals are categorized in to 11 priority groups as under;

1) Phthalates

2) Alkyl-phenol Ethoxylates (APEO),

3) Azo Dyes

4) Brominated & Chlorinated Flame Retardants

5) Chloro-phenols

6) Chlorinated Aromatics

7) Chlorinated Solvents

8) Organotin Compounds 9) Short Chain Chlorinated Paraffin's (SCCPs)

10) Heavy Metals

11) Per-fluorinated Chemicals (PFCs)

Major Constituents Involved in Various Textile Processes, their Characteristic Parameters and Pollution Impact

Pollution load from textile mills differ widely depending upon the nature of Fiber used and the level of processing employed. Process wise list of harmful constituents and related pollution parameter along with their characteristics and level of impact on environment is given in Table below:

Table 2-17: Major Constituents Involved in Various Textile Processes, their Characteristic Parameters and Pollution Impact

Process	Major Constituents	Characteristics	Pollution impact *(Low, Medium, High)*
Cleaning of Raw Fibres	◦ Oil ◦ Fats waxes ◦ Proteins & pectines	COD	H
		BOD	H
		Turbidity	H
Sizing	◦ Starch derivative ◦ Semi-synthetic sizing agents (CMC, CMS) ◦ Synthetic sizing agents (PVAs, polyacrylates) ◦ Additives: ◦ Urea ◦ Glycerine ◦ Waxes and oils ◦ Preserving agents	COD	H
		BOD	M
		Temperature	M
Desizing	◦ Acids or Enzymes	COD	H
		BOD (30-40% of total)	H
		Temperature	H

Process	Major Constituents	Characteristics	Pollution impact *(Low, Medium, High)*
		(60-70 °C)	
Scouring	◦ Saponified waxes, oils, fats ◦ Surfactants ◦ Alkali ◦ High temperature	Oil, fats	H
		BOD (30% of total)	H
		pH (high)	H
		Temperature (70-80°C)	H
		Dark Colour	H
Bleaching	◦ Residual Bleaching agents ◦ Stabilizers ◦ Surfactants ◦ Wetting agents ◦ Mild alkalinity		M
Mercerisation	◦ Alkali (NaOH) ◦ Surfactants ◦ Dissolved matter	BOD	H
		pH (high)	H
		TDS	H
Dyeing	◦ Dyestuffs (direct, wet, reactive, sulphur, pigment) ◦ Electrolyte ◦ Carriers ◦ Acids and alkali ◦ Heavy metals ◦ Oxidising agents ◦ Reducing agents ◦ Surfactants and levelling agents	Toxicity	H
		BOD	H
		Suspended solids	H
		pH	H
		Strong colour	H

2.9.3 Potential for Zero Liquid Discharge

The dyeing industry consumes large quantity of dyes & chemicals along with huge quantities of water. Detergents, caustic, soda ash is used to remove dirt, grit, oils and waxes. Hydrogen peroxide is used to improve whiteness and brightness of the end product. Dyes, dye-fixing agents and many inorganic salts are used to provide the brilliant array of colours as per demands from market. Processing of textile generates warm wastewater with heavy colour containing suspended solids, concentrated salt ($NaCl$ / Na_2SO_4).

Proper treatment of waste water will reduce these harmful effects and prevent environmental degradation and provide opportunities for further use of water through recycle. Some measures may also need to be adopted to reduce pollution load such as; Strong rinse waters from dye houses may be used to prepare fresh dye-baths whereas dilute waste waters may be recycled after appropriate treatment within the plant.

The effluent generated during textile production needs to be treated through various steps like Pre-treatment, anaerobic, aerobic (Biological) treatment, ultra-filtration with reverse osmosis and nano-filtration. At the end of this treatment, fresh water & recyclable brine solution is obtained which contains the total salt added in the initial dye bath, which is reusable for further operations. It also generates small volume of concentrated liquor containing hydrolysed reactive dyes and dyeing auxiliaries which is dried to get solid sludge for disposal in scientific manner.

ZLD for PM MITRA Textile Park has been based on the assumption that the effluent will be treated to obtain a TDS < 500 ppm. In this case, the treated effluent can be recycled back into the manufacturing zone for industrial process use. Please refer **section 2.9.3** for further details.

2.9.4 Common Effluent Treatment Plant

The existing Textile Park located at Additional Amravati Industrial Estate Nandagaonpeth, houses several textile units. The effluent from these existing parks is treated in an existing Common Effluent Treatment Plant (CETP) of capacity 5 MLD which is proposed to be expanded to 15 MLD.

The area of the existing CETP is 18.75 acre (7.59 Ha). Out of this area, CETP of capacity 5 MLD was commissioned in an area of 2.5 Ha and was made operational on November 1st, 2016. MIDC Division Amravati have obtained EC for this existing CETP vide letter No. SEAC-2012/CR466/TC-2 on dated 16th April 2015 for 15 MLD capacity.

This system consists of 60% i.e. 2.7 MLD recycling and 40% over land disposal SSHEHS (Soil sand high efficiency hybrid system), and 0.5 % dye bath for ZLD (2.7 MLD+ 1.8 MLD + 0.5 MLD = 5 MLD capacity). The schedule for attaining 15 MLD capacity is as under:

Table 2-18: Proposed schedule for CETP Expansion

Sr No.	No. of Phases	Capacity (MLD)	Year of Commissioning
1.	Phase I	5	2016 (Already existing)
2.	Phase II	10 (5+5)	2023-2024 (Proposed)
3.	Phase III	15 (10+5)	2026 onwards (Proposed)

Table 2-19: Water Balance for Existing 5.0 MLD CETP

Sl. No.	Particular	Existing Water Balance
1	Total CETP Input Water	5.0 MLD 4.5 MLD Direct to CETP + 0.5 MLD Tertiary stage of CETP
2	4.5 MLD Direct to CETP	CETP Inlet water = 4.5 MLD CETP Treats water = 4.5 MLD 2.7 MLD (60% of 4.5) = RO Plant **1.8 MLD (40% of 4.5) = goes to SSHEHS**

Sl. No.	Particular	Existing Water Balance
3	2.7 MLD (60% of 4.5) = RO Plant	RO – 1 Inlet Water = 2.7 MLD RO – 1 Permeate water = 2.025 MLD (75% effcn) recycle to Industry. RO – 1 Reject water = 0.675 MLD goes to RO-2. RO – 2 Inlet water = 0.675 MLD RO – 2 Permeate water = 0.337 MLD (50% Effcn) recycle to Industry. RO – 2 Reject water = 0.337 MLD goes to RO-3. RO – 3 Inlet water = 0.337 MLD RO – 3 Permeate water = 0.168 MLD (50% Effcn) recycle to Industry. RO – 3 Reject water = 0.168 MLD goes to MEE plant for evaporation.
4	0.5 MLD Tertiary stage of CETP	Addition of Input water at tertiary stage of ETP = 0.5 MLD CETP Treated water = 0.5 MLD RO Inlet Water = 0.5 MLD RO Permeate water = 0.275 MLD (55% Effcn) recycle to Industry. RO Reject water = 0.225 MLD goes to MEE plant
5	MEE Plant	MEE Inlet water = 0.394 MLD (0.168+0.225) MEE Condensate Water = 0.001 MLD
6	**Total Treated water (RO)**	Out of Total 2.8 MLD RO Water 2.305 MLD is recycled to industries and 0.50 MLD is utilized for gardening & filter backwashing.
7.	**Fresh Water used**	3.0 KLD for domestic and chemical preparation for CETP process. Domestic waste water generation = 2.4 KLD treated in soak pit followed by septic tank.

Table 2-20: Water Balance of CETP considering proposed expansion– 15.0 MLD CETP

Sl. No.	Particular	Proposed Water Balance
1	Total CETP Input Water (Effluent comes from Textile Industry)	15.0 MLD 13.5 MLD Direct to CETP + 1.5 MLD Tertiary stage of CETP
2	13.5 MLD Direct to CETP	CETP Inlet water = 13.5 MLD CETP Treated water = 13.5 MLD **goes to SSHEHS**
3	1.5 MLD Tertiary stage of CETP	Addition of Input water at tertiary stage of ETP = 1.5 MLD CETP Treated water = 1.5 MLD RO Inlet Water = 1.5 MLD RO Permeate water = 0.825 MLD RO Reject water = 0.675 MLD goes to MEE plant

Sl. No.	Particular	Proposed Water Balance
4	MEE Plant	MEE Inlet water = 0.675 MLD MEE Condensate Water = 0.003 MLD **goes to SSHEHS**
5	**Total Treated water (ETP + MEE)**	**13.5 MLD sends to SSHEHS and No waste water generation.**
6	**Fresh Water used**	**20.0 KLD for domestic and chemical preparation for CETP process.** **Domestic waste water generation = 16 KLD treated in STP of 20 KLD capacity and used for greenbelt development.**

For the existing CETP, MIDC has been regularly renewing Consent to Operate from MPCB Amaravati Maharashtra and the latest Consent letter was obtained vide letter No:- Format1.0/CC/UAN No.0000177820/CR/2401002433, dtd. 23/01/2024..

2.9.4.1 Description of Proposed CETP

The existing CETP was designed to treat total 5 MLD textile effluents to be received at the inlet of CETP. Out of total 5 MLD effluents, 4.5 MLD effluents (Stream 1) was received through drainage system. Balance 0.5 MLD effluent (Stream 2) which is high in TDS content was segregated at source (dye bath liquor) by each industry and was sent to CETP through tankers for separate treatment.

Stream 1 i.e. 4.5 MLD effluent was provided physico-chemical, biological and tertiary treatment. Out of total 4.5 MLD treated effluent, 60% i.e. 2.7 MLD effluent was subjected to Zero Liquid Discharge (ZLD) treatment where it was treated through membrane separation process consisting of RO plant. The reject from RO plant was subjected to Multiple Effect Evaporation (MEE) System to achieve zero discharge. Recovered water from the ZLD plant was recycled back to textile industries for reuse in process. The balance 40% of the stream 1 i.e. 1.8 MLD treated effluent after tertiary treatment was discharged to SSHEHS (Soil Sand High Efficiency Hybrid System). Stream 2 i.e. 0.5 MLD effluent which is high TDS dye bath liquor was treated through physico-chemical and tertiary treatment. Tertiary treated effluent was subjected to ZLD treatment where it was treated through membrane separation process consisting of RO plant. The reject from RO plant was subjected to Multiple Effect Evaporation (MEE) System to achieve zero discharge. Recovered water from the ZLD plant was recycled back to textile industries for reuse in the process.

The CETP will have ultimate capacity of 15 MLD which will be developed in phase wise manner. Required space is provided in layout for expansion of present 5 MLD CETP to 15 MLD CETP with ultimate goal of 100% reuse of treated effluent making it a Zero Liquid Discharge (ZLD) system. Development from 5 MLD to 15 MLD capacity will be on modular basis (2 modules of 5 MLD each).

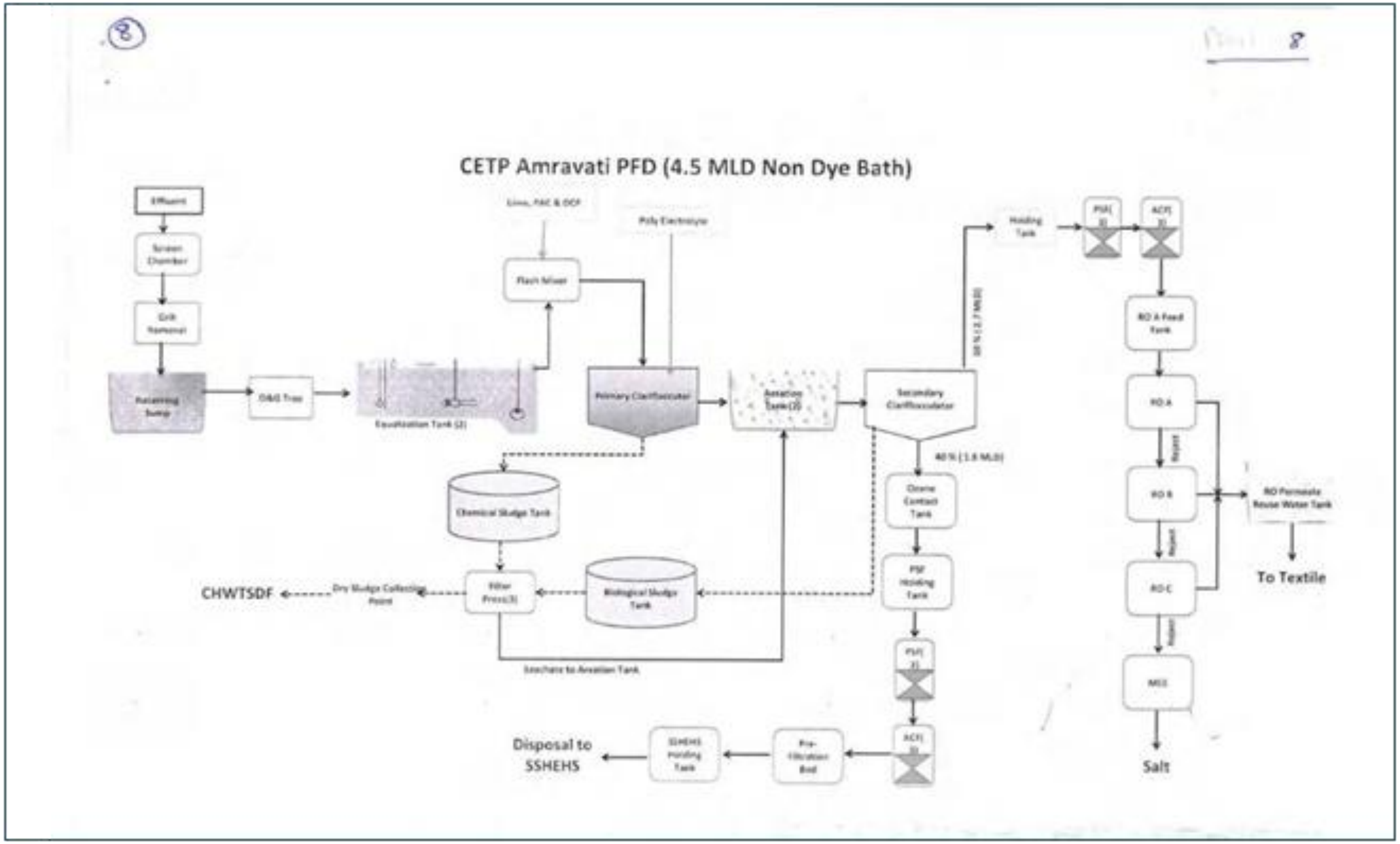


Figure 2-22: Process Flow Diagram of CETP (Non Dye Bath)

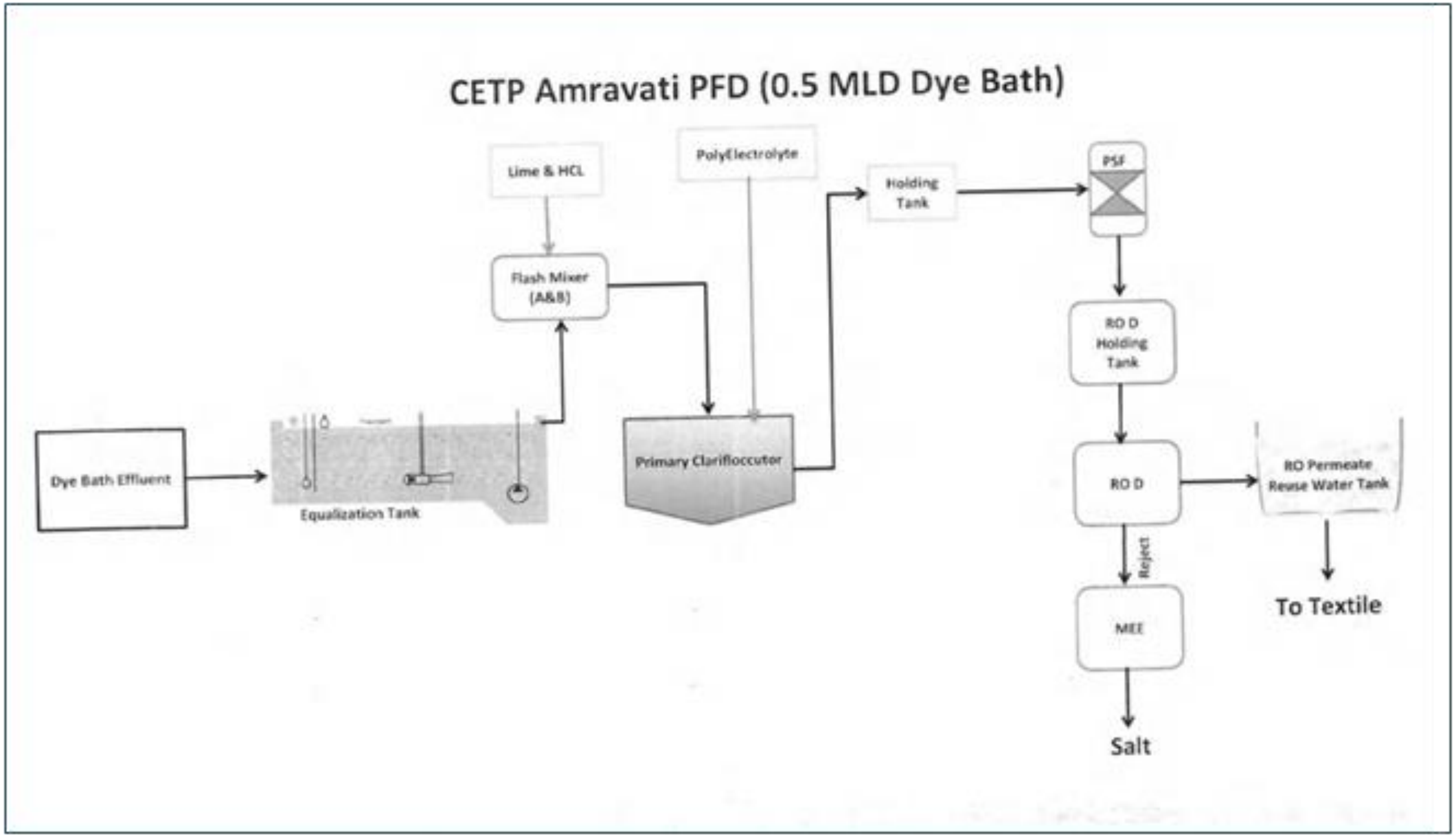


Figure 2-23: Process Flow Diagram of CETP (Dye Bath)

Advantages of existing CETP

- CETP facilitate better management of the industrial waste waters.
- It will minimize the pollution load on environment.
- Compliance with prescribed regulatory norms.
- Less expenses on neutralization of effluent as effluent is equalized before treatment.
- Treatment & management of Waste water is relatively easier & economically viable at CETP facility.
- Cost of Laboratory analysis is less at common facility.
- Operational cost per CMD of the effluent is less at CETP compared to individual ETPs at
- Industrial units.
- Better occupational health and safety.

Possible Benefits of Proposed CETP

- CETP being centralized common facility developed by MIDC, each member industry will be benefitted as the waste water treatment and over all control will be looked after by CETP management.
- Each member industry can focus on production and marketing in a focused manner there by additional employment and economic benefits can be achieved. Since they are not bothered for waste water treatment.
- The effluent discharge will comply with the guidelines given by CPCB/ MPCB and MoEFCC and will not be harmful to the local environment.
- The unskilled and skilled manpower requirement during the construction and operation phase for CETP will generate permanent jobs and temporary jobs for the operation and maintenance of the plant. This will increase the direct and indirect employment opportunities and ancillary business development to some extent for the local people. The employment opportunities as described above will create economic benefits in the region. Local economy will grow with the growth of PM MITRA Park.

2.9.4.2 Performance

Typical values at inlet and outlet of the existing CETP are given below:

Table 2-21: Characteristics at Inlet and outlet CETP (Non dye bath effluent)

S. No.	Parameters	Units	Inlet	Standard value (mg/l)
	Inlet			
1	PH		7.56	5.5 to 9.0
2	BOD (3 days 27 degree C)	mg/l	243	750
3	COD	mg/l	580	1500
4	TDS	mg/l	2896	4000
5	TSS	mg/l	238	300
6	Oil & Grease	mg/l	6.50	30
7	Ammonical Nitrogen	mg/l	37.62	50
8	Temperature	°C	27.20	45 Degree C
9	Phenonic Compounds	mg/l	4.81	5

S. No.	Parameters	Units	Inlet	Standard value (mg/l)
	Inlet			
10	Cyanide (as CN)	mg/l	Nil	2
11	Hexavalent Chromium (as Cr+6)	mg/l	0.86	2
12	Total Chromium (as Cr)	mg/l	0.84	2
13	Copper (asCu)	mg/l	0.96	2
14	Lead (as Pb)	mg/l	< 0.001	1
15	Nickel (as Ni)	mg/l	<0.01	3
16	Zinc (as Zn)	mg/l	9.23	15
17	Arsenic (as AS)	mg/l	< 0.001	0.2
18	Mercury (as Hg)	mg/l	< 0.001	0.01
19	Cadmium	mg/l	< 0.1	1
20	Selenium (as Se)	mg/l	< 0.004	0.05
21	Fluoride (as F)	mg/l	< 0.1	15
22	Boron (as B)	mg/l	< 0.1	2
	Outlet			
1	PH		7.6	7.0 to 8.5
2	BOD (3 days 27 degree C)	mg/l	2.1	5
3	COD	mg/l	10	30
4	TDS	mg/l	710	750
5	TSS	mg/l	4.2	100
6	Oil & Grease	mg/l	ND	0.01

2.9.5 Manpower Requirement

Around 300 MIDC personnel will be responsible for operation and maintenance and establishment activities. It is expected that the proposed PM MITRA Textile park along with the adjacent exting textile park in Additional Amfravati MIDC will lead to nearly 1 lakh direct and 2 lakh indirect employment generation by way of direct and indirect employment.

2.9.6 Water Requirement

Textile manufacturing processes require large amounts of water for dyeing, washing, and finishing.

Estimate Quantity: Water requirement for the proposed MIDC is estimated by two ways :

a) Average water requirement for Textile Parks is 50 cum/Ha/day as per MIDC norms (Circular no. CE(HQ)/40/of 2014 dtd. 18th Nov., 2014). Thus total water requirement is estimated at 13 MLD.
b) From available Consent to Operate of operational units, literature resources, reference books etc, water requirement is worked out for each zone separately and is broken up into process, domestic and cooling respectively and given in the table below.

Table 2-22: Water Requirement and its use

Zone	Area (Ha)	Estimated Water consumption				
		Basis Kl/ ha/ day	Total water (MLD)	Processs (MLD)	Domestic (MLD)	Cooling (MLD)
Manufacturing Zone	257.14	50.00	12.86	9.19	0.93	2.72
Utilities	9.54	16.00	0.15	--	0.15	0.01
Commercial Development	8.18	45.00	0.37	--	0.35	0.02
Housing and Social Infrastructure	17.00	88.08	1.50	--	1.50	0.00
Logistics	4.85	45.00	0.22	--	0.21	0.01
Training, R&D & Testing	5.34	45.00	0.24	--	0.23	0.01
Roads	38.25	5.00	0.19	--	--	--
Green Areas	55.87	5.00	0.28	--	--	--
Green Belt Area	13.85	5.00	0.07	--	--	--
Total	**410.02**	**--**	**15.87**	**9.19**	**3.36**	**2.77**

Water required will be catered through pumping from the existing jackwell in backwater of Upper Wardha Reservoir. An agreement has been signed with the Irrigation Department, GOI, dtd 09.02.2004 for supply of 10 MCM. (*copy enclosed as* ***Annexure V****)*.

2.9.7 Wastewater Generation & Disposal

2.9.7.1 Waste Water Generation

As per MIDC experience in developing various CETPs across Maharashtra, the effluent generation is generally about 80% of the water used by industry. Sewage generation is considered at 80%. The wastewater generated from each zone is worked out and is presented below:

Table 2-23: Waste Water Generation from Each Zone

Zone	Total water (MLD)	Water Break up			Estimated Waste Water Generation		
		Industrial (MLD)	Domestic (MLD)	Cooling (MLD)	Industrial (MLD)	Domestic (MLD)	Total Effluent (MLD)
Manufacturing Zone	12.86	9.19	0.93	2.72	7.35	0.84	**7.35**
Utilities	0.15	--	0.15	0.01	--	0.13	**0.14**
Commercial Development	0.37	--	0.35	0.02	--	0.31	**0.33**
Housing and Social Infrastructure	1.50	--	1.50	0.00	--	1.35	**1.35**
Logistics	0.22	--	0.21	0.01	--	0.19	**0.20**
Training, R&D & Testing	0.24	--	0.23	0.01	--	0.21	**0.22**
Roads	0.19	--	--	--	--	--	--
Green Areas	0.28	--	--	--	--	--	--
Green Belt Area	0.07	--	--	--	--	--	--
Total	**15.87**	**9.19**	**3.36**	**2.77**	**7.35**	**3.03**	**9.58**

As can be seen from the table, the total industrial effluent generation is 7.35 MLD and domestic wastewater (sewage) is about 3.03 MLD. Total wastewater from the project will be 9.58 MLD. The domestic sewage will be treated in STP. This will be designed on SBR technology as identified in the study presented under **Section 5.3**.

2.9.7.2 Waste Water Disposal

Expected type of effluent: Effluent to be received from textile industries only

a) Dye bath effluent having High TDS upto 34000 ppm.

b) Non Dye Bath effluent TDS value upto 4000 ppm.

Quantity of effluent: The existing CETP will be expanded suitably to take care of the effluent from proposed PM MITRA Park. Provision will be made to treat the high TDS effluent during the expansion.

The CETP is at present 5 MLD, which is proposed to be expanded to 15 MLD as part of Phase II.

The industrial effluent quantity as presented in the above table is 7.35 MLD considering the functioning of all the industries within the proposed PM MITRA Textile Park.

Effluent conveyance system: The industrial effluent will be disposed into the existing CETP. Effluent will be collected & conveyed through the underground HDPE collection lines diameter ranges from 200 mm to 500 mm.

Treatment and reuse of Effluent

The description and performance of the existing CETP is discussed under **Section 2.8.4** above. As per the discussions above, effluents from the textile industries proposed in Manufacturing zone of PM MITRA park will be treated in the CETP to obtain a TDS level < 500 and thus can be safely recycled back and reused for industrial processes, cooling and flushing. Recycled water from proposed STP will also be reused for flushing within premises, thus making the system ZLD.

Water requirement and waste water generation along with utilisation of treated effluent water back in process is worked out as below:

Table 2-24: Waste water Utilisation Scenario

Zone	Estimated Waste Water Generation			Recycled Water Use		
	Total Effluent (MLD)	Industrial (MLD)	Domestic (MLD)	Process (MLD)	Cooling (MLD)	Flushing (MLD)
Manufacturing Zone	7.35	7.35	0.84	5.79	2.72	0.41
Utilities	0.14	--	0.13	--	0.05	0.90
Commercial Development	0.33	--	0.31	--		
Housing and Social Infrastructure	1.35	--	1.35	--		
Logistics	0.20	--	0.19	--		
Training, R&D & Testing	0.22	--	0.21	--		
Roads	--	--	--	--	--	--

Zone	Estimated Waste Water Generation			Recycled Water Use		
	Total Effluent (MLD)	Industrial (MLD)	Domestic (MLD)	Process (MLD)	Cooling (MLD)	Flushing (MLD)
Green Areas	--	--	--	--	--	--
Green Belt Area	--	--	--	--	--	--
Total	**9.58**	**22.42**	**3.03**	**5.79**	**2.77**	**1.31**

To make the industrial estate ZLD, it is proposed that the above treated effluent will be made available to be used for process and cooling as well as flushing by Member industries in the Manufacturing zone and it will also be used for flushing and cooling in non processing zones.

Following Table explains how the treated sewage and effluent water will be utilised:

Table 2-25: Wastewater Management

Zones	Estimated Wastewater Generation MLD	Treatment of waste water / effluent	Treated water Reuse
Manufacturing zone	7.35	CETP	in process, cooling, flushing
Utilities	0.14	STP in Utility Zone	used for flushing, gardening and HVAC in corresponding facility or building.
Commercial Development	0.33	STP in Utility Zone	used for flushing, gardening and HVAC in corresponding facility or building.
Housing and Social Infrastructure	1.35	STP in Utility Zone	used for flushing, gardening and HVAC in corresponding facility or building.
Logistics	0.20	STP in Utility Zone	used for flushing, gardening and HVAC in corresponding facility or building.
Training, R&D & Testing	0.22	STP in Utility Zone	used for flushing, gardening and HVAC in corresponding facility or building.
Total	**9.58**		

Water balance diagram showing water requirement and reuse quantities is presented overleaf:

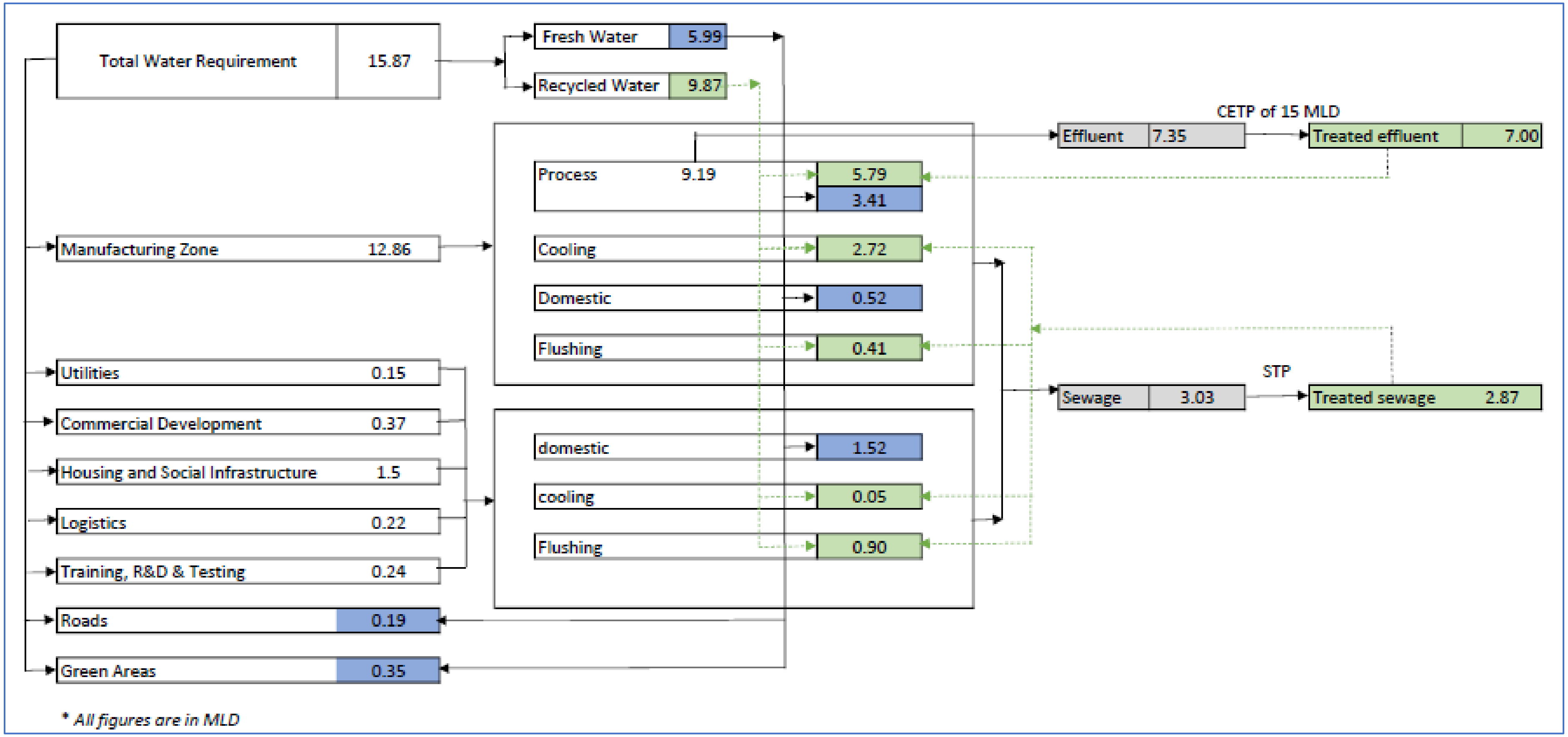


Figure 2-24: Water balance diagram for PM MITRA Textile Park

2.9.8 Power requirement

During the Operation Phase, power requirement of MIDC (as infrastructure provider) is estimated at 30 MVA (for water pumping, CSTP, WTP, MSW treatment facility, Common Facilities like Streetlighting, Fire station etc) and back up by DG sets.

- Total Electricity requirement (MW): 30MWA
- Two Substations of 15MVA i.e. Total 30MVA capacity
- 14kms of 11KV HT line along internal road in PM MITRA Park
- 10 kms of 132KV Transmission line from MSETCL 220KV Substation

Power will be sourced from Maharashtra State Electricity Distribution Co. Limited (MSEDCL).

MIDC will ensure energy efficient fixtures and use of solar energy for streetlighting, pumps for irrigation, admin buildings and common facility centre, fire station and public toilets etc.

Efforts to reduce Carbon Footprint through installation of Solar PV Systems, solar water heating system in order to conserve non-renewable energy and reduce air pollution will be made.

2.9.9 Waste Generation

A) From Member Industries

A-1) Construction Phase wastes

Wastes will be generated during plot development and construction by Member Industries. This will include municipal waste from the labour camp, substratum removed during construction of foundations and minor cutting required as also debris from construction activities like broken tiles, glass, scrap, packagaing material etc. Hazardous wastes include Paint cans, Used oil etc

A-2) Hazardous Waste during Operation Phase

During operation of Industrial units, hazardous waste (HW), e-waste & other wastes will be generated. Textile production generates a significant amount of waste, including fabric scraps, excess dye, and packaging materials.

HW generated from each type of industry is identified in the Schedule to the Hazardous Waste Rules 2016 and are broadly as follows: Used oil/ spent oil, Chemical sludge from ETP, Textile chemical residue, Discarded containers/ barrels/ liners. Hazardous and Non Hazardous Waste Generation from Manufacturing Zone is tabulated below:

Table 2-26: Hazardous and Non Hazardous Waste Generation from Manufacturing Zone

	Waste Type	Quantity (MT/ day)
1	**Non Hazardous waste types**	162.87
a	Fly ash/boiler ash	28.27
b	Cotton waste /textile waste	1.96
c	Packing waste /trash	2.32
d	Metal & scrap	8.95
e	STP sludge	2.20
f	Food waste /domestic waste from industries	6.43

	Waste Type	Quantity (MT/ day)
2	**Hazardous waste types**	0.14
a	used oil/ spent oil in ltr/day	71.18
b	chemical sludge from ETP	26.38
c	textile chemical residue	1.66
d	discarded containers/barrels/liners no.	0.29
3	E -waste	1.61
4	C & D waste /inert waste	0.26
5	Other Wastes	162.87

The total waste generated from the proposed development is classified as below:

Table 2-27: Solid Waste Quantities with type during Operation Phase

Type	Quantity (Kg/d)	Treatment / disposal
Dry waste	5631 kg/ day	Recyclable dry waste will be handed over to authorized recyclers. Inerts will be disposed to landfill site through local agencies.
Wet waste	5104 kg/ day	To be treated in proposed biomethanation plant at site
E-Waste	49 kg/ day	Sale to MPCB authorized vendor
STP Sludge (dry)	551 kg/ day	Dried sludge from STP will be used as manure
Hazardous Waste	• Used oil/ spent oil: 139 ltr/day • Chemical sludge from ETP: 71,181 kg/day • Textile chemical residue: 26,376 kg/day • Discarded containers/ barrels/ liners (no.): 1657	Disposal at CHWTSDF, Butibori, Nagpur

Before starting any plot development, Industries have to give details of their process and identified types of HW to MPCB who grants a Combined Consent for establishment specifying methodology to be adopted for HW Disposal. After industry is set up, Consent to Operate is granted. This includes details of HW identified and the quantity generated and the disposal methodology to be adopted. Generally HW treatment/disposal includes:

- Use within premises
- Disposal to MPCB authorized recycler/Cement plants etc
- Disposal to MPCB authorized Common Hazardous Waste Treatment, Storage and Disposal facility (CHWTSDF)

MIDC has developed CHWTSDF at CHWTSDF, Butibori, Nagpur (and HW will be disposed at this site. MPCB has also identified various recyclers for Drum decontamination, Solvent recycling, e-waste/battery recycling and Oil recycling and also authrozied Common Biomedical Waste Treatment, Storage and Disposal (CBMWTSDF). The various types of wastes generated will be required to be disposed off at these facilities.

Pending information on the industries likely to be set up, the quantum of waste generation is difficult to gauge. However, it can be safely said that the disposal will meet the requirements of Rules and Guidelines issued by the MPCB, CPCB and MOEF&CC in this regard.

A-3) MSW Generation Operation Phase

During the operation phase, MSW will be generated from industries in the form of canteen waste, scrap plastic, paper etc. This is segregated into Biodegradable (wet) waste and Non biodegradable (dry) waste. Biodegradable (wet) waste will be treated on the onsite Biomethanation plant, whereas the Non biodegradable (dry) waste will be disposed to landfill site.

2.10 Assessment of new and untested technology

2.10.1 Process Change and Recovery

The textile industry encompasses a range of industrial units, which use a wide variety of natural and synthetic fibers to produce fabrics. The textile industry can be broadly classified in two groups, namely cotton industry and woolen industry.

The effluent generated from textile industry contains various dyes, chemicals, auxiliary chemicals, sizing materials etc. The effluents is usually treated by physico-chemical treatment followed by biological treatment process. However, such treatment systems are not effective for removal of colour, dissolved solids, trace metals etc. In-plant control measures such as process change, recovery/reuse of chemicals, chemical substitutes can significantly reduce pollution from this sector. There are described below:

Table 2-28: Process Change/Recovery

Areas	Technologies/Current Practices	Requirements
Sizing	Starch is most commonly used as. sizing material for cotton textiles. During sizing, the starch eliminates the possibility of its recovery. It also contributes high BOD.	Recovery of Sizing material: The other types of sizing material, such as carboxymethyl cellulose (CWC), polyvinyl acetate (PVA) are comparatively more expensive but are recoverable.
Mercerising	Mercerising waste contains about 4% caustic. Few textile industries have provision for its recovery.	Recovery of Caustic: Spent caustic from mercerising as well as other units can be recovered and reused either by me separation technology or commonly used evaporation method .
Dyeing	The textile industry uses various types of dyes to impart the desired quality in the fabrics, which generates coloured effluent. No specific treatment is given before it is discharged.	Reuse of dye bath: Instead of the exhausted dyebath, it can be reconstituted by adding appropriate amount of make-up dyes and auxiliary chemicals. The reconstituted dyebath can be reused for dyeing successive batches.
Printing	The conventional printing involves colour paste	Transfer Printing: The

Areas	Technologies/Current Practices	Requirements
	application to fabric and subsequent dye fixation. After this, all chemicals other than the dye need to be removed from fabric. This increases effluent generation.	transfer printing transfers dyestuff, previously printed on paper, on the fabric. Only the dyestuff and other chemicals are transferred on the fabric thus eliminating the after-washing.
Wastewater Treatment	The wastewater is treated by _physicochemical and/or biological treatment process. Some industry uses filtration along with physico-chemical treatment to reuse the specific effluent streams.	Recycling of Treated Wastewater. The effluent can be further treated by activated carbon adsorption process or other advanced treatment process so that the treated effluent can be recycled/reused.

2.10.2 Chemical Substitutes

Following are the suggested chemical substitutes that can be used in various chemical proceses of textile mabnufacture.

Table 2-29: Suggested Chemical Substitutes

Area/Process	Chemical in Use	Substitute Required
Sizing/Process	Conventional Starch based size	Synthetic wrap sizes (PVA) Acrylates.
Desizing.	Enzymes.	Acids.
Soaping.	Conventional Soap	Synthetic Detergents
Good Scouring	Soda Ash	Sodium Acetate.
Disperse Dyeing & Pigment Printing.	Acetic Acid.	Ammonium Sulphate
Printing.	Gum.	Emulsion
Oxidation of vat dye.	Acetic Acid.	Sodium Bicarbonate
Screen Printing machines.	Conventional Gums.	Permanent Adhesives.
Finishing starch based.	Temporary Finishes	Durable Finishes
Dyeing	Two stages dye (Disperse, vat, etc.)	Single stage dyes (Tindigosol).
Dyeing	Solvent Pthalogen blue.	All aqueous Pthalogen blue.
Dacron Dyeing.	Conventional Carriers	Monochlorobenzene
Dye bath.	Acetic Acid	Formic Acid.
Lubricants used in textile machinery.	Carding oils anti-state lube.	Non-ionic emulsifiers

3 DESCRIPTION OF THE ENVIRONMENT

3.1 Introduction

The baseline data on the existing status of the terrestrial environment covering land environment, biological environment (flora & fauna) & socio-economic environment in the study area was collected by undertaking primary surveys through field visits, monitoring and laboratory analysis. Secondary data was collected from relevant agencies, such as Forest Department and Directorate of Census Operations.

The baseline data collected and generated, together with the relevant project activities will be considered for predicting the likely impacts of the project on the environment. Subsequently, an appropriate environmental management plan (EMP) will be presented to enable the project proponent to run the project within acceptable level of environmental impact and meet the compliance of the regulatory criteria (MOEFCC's Guidelines). An Environmental Impact Statement will be ultimately made to summarize the post project status of the terrestrial environment, with the project proponent incorporating the suggested EMP measures.

The environmental aspects were assessed through surveys, field monitoring and available existing secondary data and information. Reference to past studies and reports was also made.

3.1.1 Baseline Data Collection

For the purpose of assessing the environmental impact, a study area of 10 km radius around the proposed plot boundary has been identified for baseline studies as per the MoEF&CC guidelines. Survey of India (SoI) toposheets numbered 55H13, 55K4, 55G16 and 55L1 (1:50,000 scale) cover the project site and have been used to identify topographic features within the study area.

Existing MIDC Industrial Area at Add. Amravati (Nandangaonpeth) area is an existing textile industrial park and major companies already operating in the area (Shyam Indofab, Siyaram') and road traffic along NH53 are the major sources of pollution within study area.

Each of the environmental aspects, i.e., Land, Air & Noise, Ecology & Biodiversity and Socio Economics have been considered. A brief summary of the the parameters considered for their respective study are described in the following table.

Table 3-1: Baseline Data Collection for various Environmental Aspects

Sr. No.	Aspect	Mode of Collection	Parameters	Frequency of Collection	Source
1.	**Land Environment**				
	Landuse	Secondary	Landuse classification of 10km area surrounding the proposed alignment	--	RESOURCESAT-2 LISS-IV cloud free data, Path 98, Row 57 Sub scene D Date of Pass: 8th October 2023, Google earth
	Soil and Geology	Primary	Soil pH, moisture, water holding capacity, particle	Sampling in winter 2023 at	Field studies

Sr. No.	Aspect	Mode of Collection	Parameters	Frequency of Collection	Source
			size, texture, phosphate, chloride, sulfate, conductivity, etc.	07 locations	
	Topography and drainage	--	--	--	Contour Map/ DEM, Drainage map
2.	**Air Environment**				
	Meteorology	Secondary	Temperature, rainfall, humidity, wind speed and wind direction.	--	MPCB reports of nearest location if available.
	Ambient Air	Primary	SO_2, NO_X, PM_{10}, $PM_{2.5}$, CO, C_6H_6, Pb, NMHC, O_3, Pb, CO, NH_3, C_6H_6, BaP, As, Ni	Sampling in winter 2023 at 08 locations	Field studies
3.	**Noise Environment**				
	Noise	Primary	Leq [dB(A)] during day time and night time	Sampling in winter 2023 at 08 locations	Field studies
4.	**Water Environment**				
	Ground Water	Primary	Physico chemical Parameters pH, color, turbidity, Hardness (Ca, Mg & Fe), sulfates chlorides, TDS, alkalinity, iron, manganese, calcium, copper, magnesium, etc.	09 samples collected during winter 2023	Field studies
	Surface Water	Primary	Physico chemical Parameters pH, color, turbidity, Hardness (Ca, Mg & Fe), sulfates chlorides, TDS, alkalinity, iron, manganese, calcium, copper, magnesium, etc.	Sampling in winter 2023 at 11 locations	Field studies
5.	**Biological Environment**				
	Flora and fauna	Primary	• number of trees falling within proposed development • Location of national parks, sanctuary and wildlife migratory routes	Winter season, 2023	Field Survey during winter season
		Secondary	• Flora or fauna species, any protected or endangered species • If the proposed project site involves any breeding or nesting ground, details about the name of the species, type of habitat and	--	Classification as per Schedule given in the Wild Life Protection Act, 1972 (for fauna) and in the Red Book Data (flora)

Sr. No.	Aspect	Mode of Collection	Parameters	Frequency of Collection	Source
			period of year in which activity takes place • Information on dependence of local people on minor forest products if applicable		
6.	**Socio-Economic Environment**				
	Socio-economy	Primary	HH Questionnaire survey	10% of villages for survey.	Field Survey during 2023
		Secondary	• Demographic study • Projection for the year 2023 based on previous Census data	--	Census of India, 2011, District Statistical Handbook etc.

*Please refer **Annexure VII** for Monitoring reports conducted at site and study area during winter 2020 – 2021.*

3.2 Land Environment

3.2.1 Project Study Area

The study area includes a buffer zone of 10 km around the central co-ordinate of 77°54'45.04"E and 21°2'4.569"N for LULC study for proposed PM MITRA Textile Park Project by MIDC Division, Amravati, MIDC Industrial Area, Adjacent to Additional Amravati Industrial Area, Amravati.

The area covering 10 km radius falls majorly in the Amaravati, Tivsa and Morshi tehsils of Amaravati District in Maharashtra. The site under study is located within the Amaravati Industrial Area adjacent to Additional Amaravati Industrial Area. The site is located between Pimpalvihir village settlement and Digargavhan village from south to north respectively. The site is located between Shiwangaon village on east and Sawardi village on west. Pimpalvihir is a medium size village located in Amravati Taluka of Amravati district, Maharashtra. Nandgaon peth is a large village located in Amravati Taluka towards west side of the project site. Mahuli jahangir is a large village located in Amravati Taluka of Amravati district, Maharashtra.

Project site is located approximately 24 km from district headquarter; Amaravati whereas 676 km away from the State capital Mumbai by Hindu Hridaysamrat Balasaheb Thackeray Maharashtra Samruddhi Mahamarg. Amaravati is the nearest major city and a district headquarter located approx. 25km towards southwest of the project site.

A Survey of India (SOI) Toposheet with 1:50,000 scale is used to identify topographic features within 10 km radius around project site (**Fig. 3.1**). Survey of India toposheet numbers 55H13, 55K4, 55G16 and 55L1 cover the study area around proposed project site.

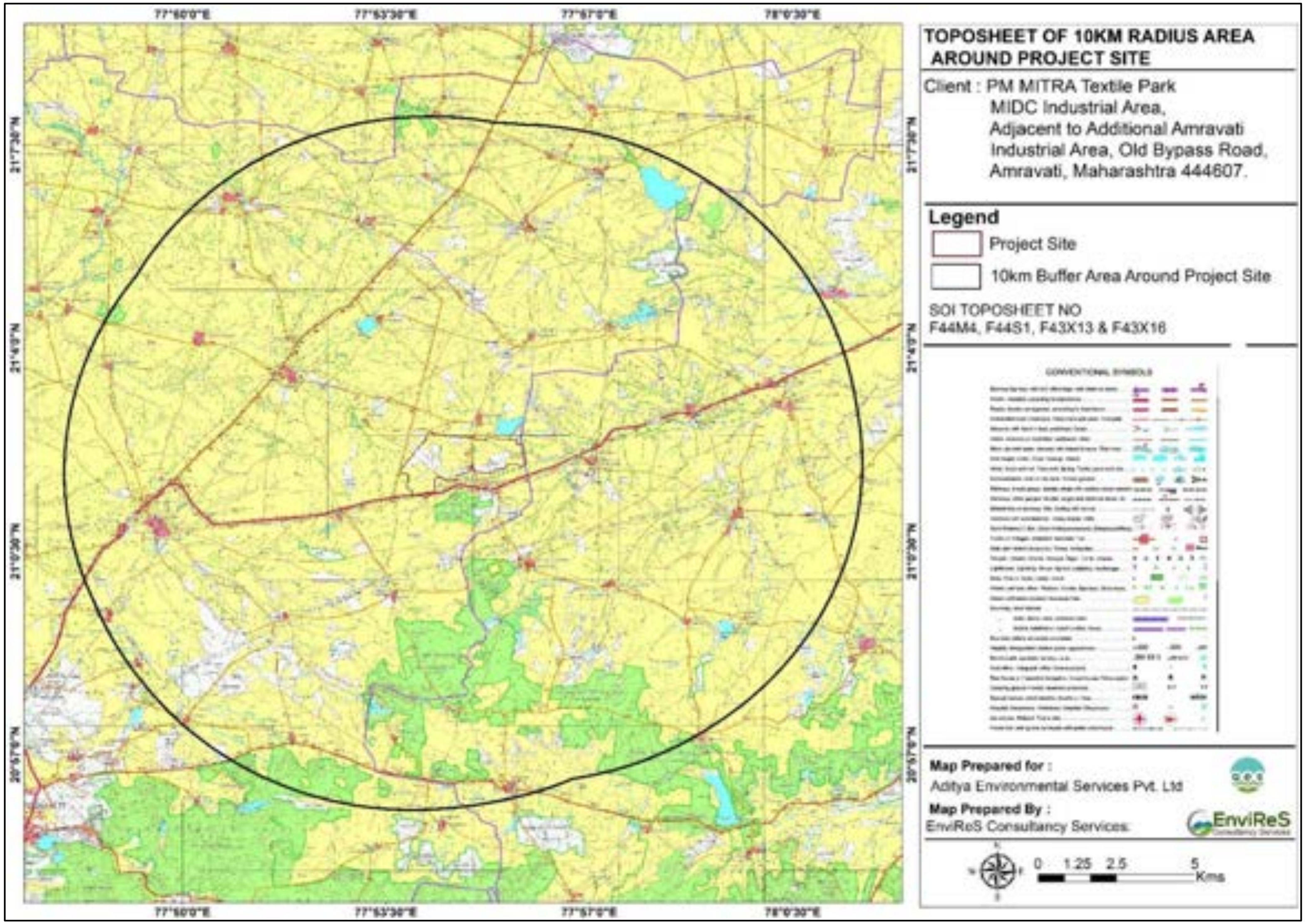
A detailed study area map for the site under reference is prepared (See **Figure 3.2**) that indicates minor roads, State Highways, National Highways, Village settlements, river and reservoirs.

Project site is located in the close proximity of Amaravati Additional MIDC area along NH53/ Old NH-6. In addition, MH SH200 (starts from Bazargaon at the junction of NH-6 and ends at Maharashtra–Madhya Pradesh border near Kelwad Village), MH SH10 (touches numerous cities and villages Viz. Nandgoan, Morshi, Warud and then proceeds north-west towards Maharashtra-Madhya Pradesh state border), MH SH 24A (Chandur to Chandur Bazar) & MDR 17 are some of the important roads within study area.

Minor dams and reservoirs like Malegaon Dharan, Dastapur Dam and Wagholi dams along with a number of lakes and ponds viz. Divankhed Talav, Dahigaon Dhanora Talav located within the study area.

Amaravati Railway station is located towards west of project site. A dedicated Amravati Powerhouse railway line from Walgaon/New Amaravati Outer Cabin is laid down for supplying coal to the Powerplant located approx. 3 km north of project site. Multiple patches of Reserved Forest is seen mostly in the southern periphery of the study area

The table on the following page lists out the areas around the project site which are environmentally sensitive.



Source: SOI Toposheet nos: F44M4, F44S1, F43X13 and F43X16

Figure 3-1: Survey of India Toposheet showing 10km study area around Project site

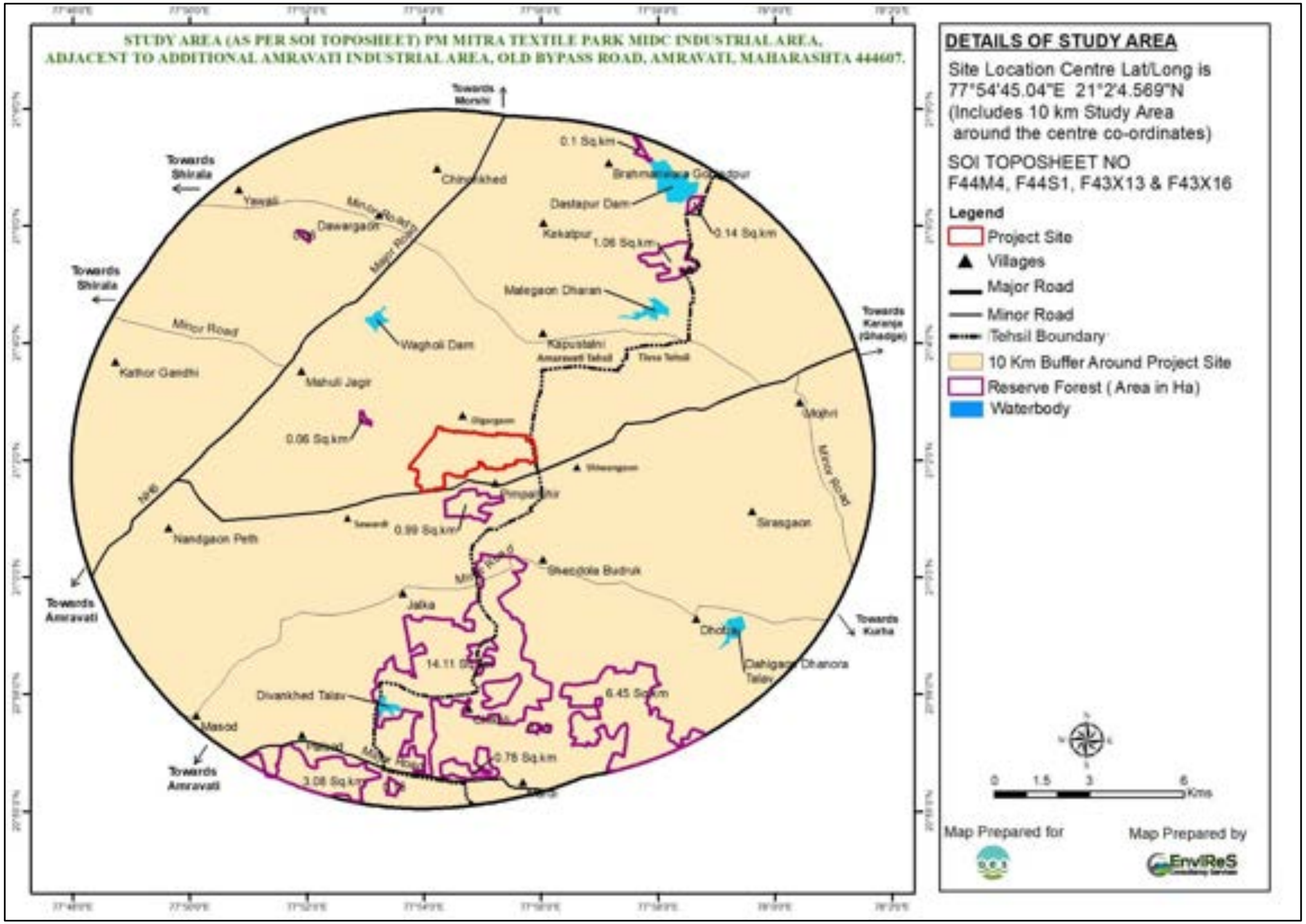


Figure 3-2: Survey of India Toposheet showing 10km study area around Project site

Table 3-2: Environmentally Sensitive Areas in surrounding

<table>
<tr><th>Sr. No.</th><th>Areas</th><th>Name/ Identity</th><th>Aerial distance (within 10 km.) Proposed project location boundary</th></tr>
<tr><td>1</td><td>Areas protected under international conventions, national or local legislation for their ecological, landscape, cultural or other related value</td><td>None</td><td>None</td></tr>
<tr><td>2</td><td>Areas which are important or sensitive for ecological reasons - Wetlands, watercourses or other water bodies, coastal zone, biospheres, mountains, forests</td><td colspan="2">
<table>
<tr><th>Sr. No.</th><th>Natural and Manmade Features</th><th>Distance and Direction</th></tr>
<tr><td>1</td><td>Karajgaon R.F</td><td>9.35 km (N)</td></tr>
<tr><td>2</td><td>Dastapur lake</td><td>8.3 km (NE)</td></tr>
<tr><td>3</td><td>Kekat R.F</td><td>6 km (NE)</td></tr>
<tr><td>4</td><td>Kekatpur lake</td><td>6.5 km (NE)</td></tr>
<tr><td>5</td><td>Wagholi dam</td><td>3.4 km (NW)</td></tr>
<tr><td>6</td><td>Malegaon Lake</td><td>5 km (NE)</td></tr>
<tr><td>7</td><td>Dadi river</td><td>4.10 km (NW)</td></tr>
<tr><td>8</td><td>Digargaon lake</td><td>180 m (N)</td></tr>
<tr><td>9</td><td>Fattepur lake</td><td>1.05 km (NE)</td></tr>
<tr><td>10</td><td>Bor river dam</td><td>8.5 km (WSW)</td></tr>
<tr><td>11</td><td>Shiwangaon lake</td><td>910 m (SE)</td></tr>
<tr><td>12</td><td>Pimpalvihir R.F.</td><td>500 m (ESE)</td></tr>
<tr><td>13</td><td>Sawardi lake</td><td>2.3 km (WSW)</td></tr>
<tr><td>14</td><td>Datpari river</td><td>7.62 km (WSW)</td></tr>
<tr><td>15</td><td>Bor river</td><td>9.86 km (WSW)</td></tr>
<tr><td>16</td><td>Borgaon Nalla</td><td>9.5 km (SW)</td></tr>
<tr><td>17</td><td>Jalaka lake</td><td>3.1 km (SW)</td></tr>
<tr><td>18</td><td>Surjatpur R.F.</td><td>2.5 km (SE)</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>Sr. No.</th><th>Areas</th><th>Name/ Identity</th><th>Aerial distance (within 10 km.) Proposed project location boundary</th></tr>
<tr><td></td><td></td><td colspan="2">
<table>
<tr><td>19</td><td>Chikhli R.F.</td><td>4 km (S)</td></tr>
<tr><td>20</td><td>Divankhed talav</td><td>6.74 km (SSW)</td></tr>
<tr><td>21</td><td>India Protected Forest</td><td>8.8 km (SSW)</td></tr>
<tr><td>22</td><td>Mardi R.F.</td><td>8 km (SSE)</td></tr>
<tr><td>23</td><td>Dhotra Protected Forest</td><td>7 km (SE)</td></tr>
<tr><td>24</td><td>Dahigaon Dhanora lake</td><td>7.4 km (SE)</td></tr>
<tr><td>25</td><td>Narayanpur Lake</td><td>3.7 km (WSW)</td></tr>
<tr><td>26</td><td>Bhivpur dam</td><td>3.5 km (NNW)</td></tr>
<tr><td>27</td><td>Shitoli Lake</td><td>6 km (SW)</td></tr>
<tr><td>28</td><td>Ramana R.F.</td><td>3.8 km (SW)</td></tr>
<tr><td>29</td><td>Dhotra R.F.</td><td>7 km (SE)</td></tr>
<tr><td>30</td><td>R.F. near Dastapur</td><td>8.2 km (NE)</td></tr>
</table>
</td></tr>
<tr><td>3</td><td>Areas used by protected, important or sensitive species of flora or fauna for breeding, nesting, foraging, resting, over wintering, migration</td><td>None</td><td>None</td></tr>
<tr><td>4</td><td>Inland, coastal, marine or underground waters.</td><td>Dams and Seasonal streams and nalla present within study area of project site</td><td>Seasonal streams and Nalla flows through the area of proposed Industrial area.</td></tr>
<tr><td>5</td><td>State, National boundaries.</td><td>None</td><td>None</td></tr>
<tr><td>6</td><td>Routes or facilities used by the public for access to recreation or other tourist, pilgrim areas.</td><td>NH 53/ Old NH 6
MH SH200 (starts from Bazargaon at the junction of NH-</td><td>All these Roads as well as Amravati Railway are adjacent to the proposed site boundary.
<table>
<tr><th colspan="3">Historical Places:</th></tr>
<tr><td>1)Tukdoji Maharaj Samadhi,</td><td>7.87</td><td>NE</td></tr>
</table>
</td></tr>
</table>

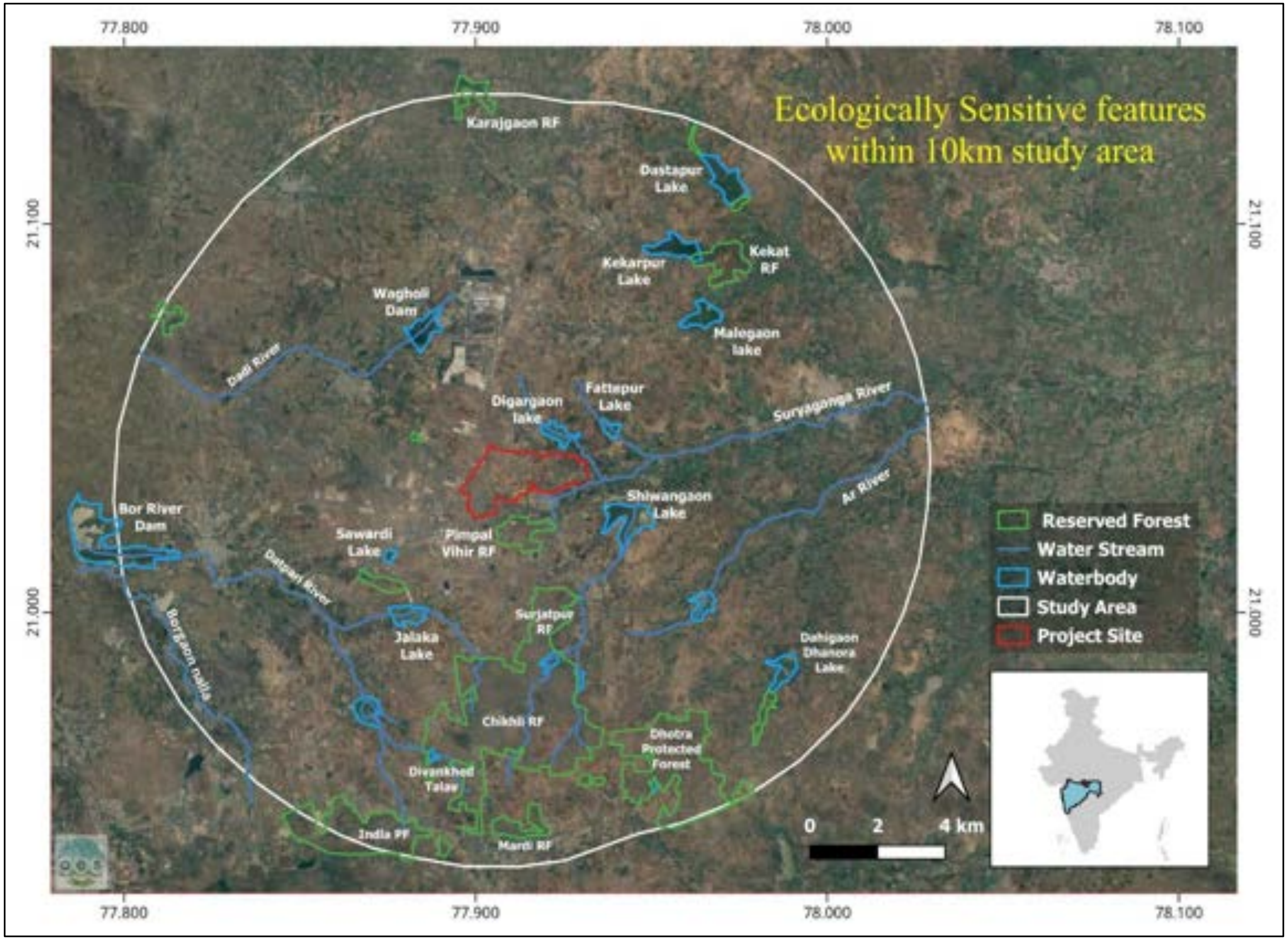
<table>
<tr><th>Sr. No.</th><th>Areas</th><th>Name/ Identity</th><th>Aerial distance (within 10 km.) Proposed project location boundary</th></tr>
<tr><td></td><td></td><td>6 and ends at Maharashtra–Madhya Pradesh border near Kelwad Village)

MH SH10 (touches numerous cities and villages Viz. Nandgoan, Morshi, Warud and then proceeds north-west towards Maharashtra-Madhya Pradesh state border)

MH SH 24A (Chandur to Chandur Bazar)

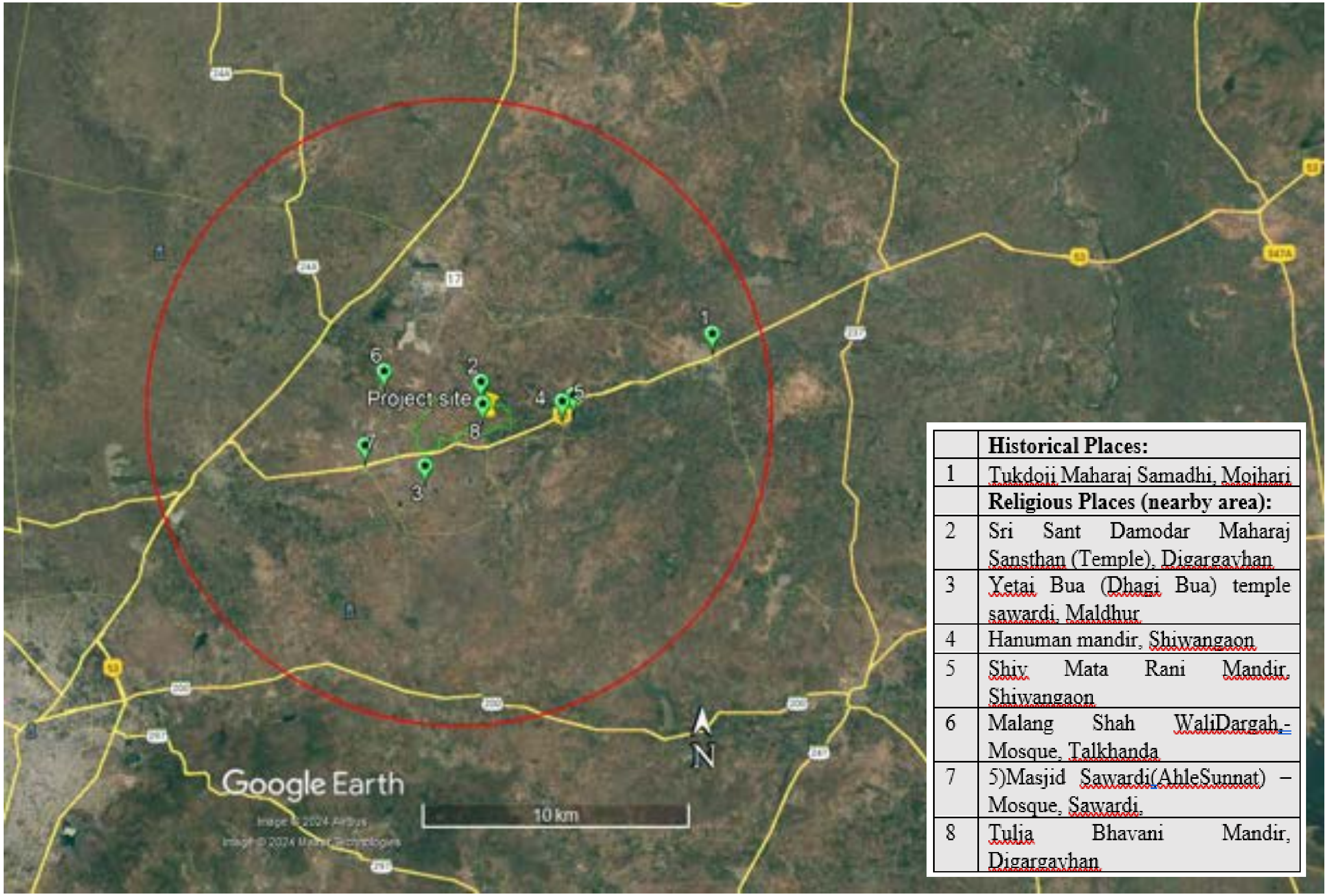
Amravati Railway Station</td><td><table>
<tr><td>Mojhari</td><td></td><td></td></tr>
<tr><td colspan="3">Religious Places (nearby area):</td></tr>
<tr><td>2)Sri Sant Damodar Maharaj Sansthan (Temple), Digargavhan</td><td>0.07</td><td>N</td></tr>
<tr><td>3)Yetai Bua (Dhagi Bua) temple sawardi, Maldhur</td><td>1.3</td><td>S</td></tr>
<tr><td>4)Hanuman mandir, Shiwangaon</td><td>2</td><td>E</td></tr>
<tr><td>5)Shiv Mata Rani Mandir, Shiwangaon</td><td>2.31</td><td>NE</td></tr>
<tr><td>6)Malang Shah WaliDargah,-Mosque, Talkhanda</td><td>1.63</td><td>NW</td></tr>
<tr><td>7)Masjid Sawardi (Ahle Sunnat) – Mosque, Sawardi,</td><td>2.08</td><td>SW</td></tr>
<tr><td>8)Tulja Bhavani Mandir, Digargavhan</td><td>Inside project area</td><td>--</td></tr>
</table></td></tr>
<tr><td>7</td><td>Defense installations</td><td>None</td><td>--</td></tr>
<tr><td>8</td><td>Densely populated or built-up area</td><td>Amravati (M. Corp.), as per census 2011 population-647057</td><td>At about 12 km from the site in Southwest direction</td></tr>
<tr><td>9</td><td>Areas occupied by sensitive man-made land uses (hospitals, schools, places of worship, community facilities)</td><td colspan="2"><table>
<tr><td colspan="3">Hospitals/Clinics (nearby area):</td></tr>
<tr><td>1)Dr. Khan Hospital, Mahuli Jahagir</td><td>4.3</td><td>NW</td></tr>
<tr><td>2)Rathi General Clinic - General hospital, Mojhri</td><td>7.36</td><td>NE</td></tr>
<tr><td>3)Radhey clinic, Nandgaon Peth</td><td>7.52</td><td>SW</td></tr>
<tr><td>4)Dr.Mundhada hospital, Mahuli Jahagir</td><td>4.62</td><td>NW</td></tr>
<tr><td>5)Deshmukh Clinic, Mozari</td><td>7.62</td><td>NE</td></tr>
<tr><td>6)Primary Health Centre, Mahuli Jahagir</td><td>4.38</td><td>NW</td></tr>
<tr><td>7Tukdojio Maharaj Hospital, Mojhari - Government hospital</td><td>7.72</td><td>NE</td></tr>
</table></td></tr>
</table>

Sr. No.	Areas	Name/ Identity	Aerial distance (within 10 km.) Proposed project location boundary
		8)Nandgaon Peth Primary Health Sub Centre	7.33 SW
		Schools/Colleges (nearby area):	
		1)Shri Shivchandjiladdha Vidyalaya Shivangaon - Middle school	1.56 NE
		2)Z P Primary High School, Sawardi	2.08 SW
		3)Z P School, Digargavhan	0.53 N
		4)Old Urdu School, Sawardi	2.12 SW
		5)Secondary govt school, Shendola Bk.,	3.07 S
		6)Sun-Bright School, MahuliJahagir	4.66 NW
		7)Z.P. Pre Middle school, Wagholi (Bk)	4.02 NW
		8)Shri GurudeoAyurved College, Mojhri	6.85 NE
		9)Govt ITI College, Mojhri	6.88 NE
10	Areas containing important, high quality or scarce resources.(ground water resources, surface resources, forestry, agriculture, fisheries, tourism, minerals)	Reserve Forest	Reserve Forest land is located adjoining the proposed layout of PM MITRA (Note: RF areas are excluded from proposed developable area)
11	Areas already subjected to pollution or environmental damage. (those where existing legal environmental standards are exceeded)	None	--
12	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)	Seismic Zone III (Moderately Damage Risk Zone)	Amravati district falls in the earthquake hazard zone III and construction will be carried out with due precautions.



Source: Prepared from Googleearth

Figure 3-3: Natural and Manmade Features within 10 km surrounding



	Historical Places:
1	Tukdoji Maharaj Samadhi, Mojhari
	Religious Places (nearby area):
2	Sri Sant Damodar Maharaj Sansthan (Temple), Digargavhan
3	Yetai Bua (Dhagi Bua) temple sawardi, Maldhur
4	Hanuman mandir, Shiwangaon
5	Shiv Mata Rani Mandir, Shiwangaon
6	Malang Shah WaliDargah - Mosque, Talkhanda
7	5)Masjid Sawardi(AhleSunnat) – Mosque, Sawardi.
8	Tulja Bhavani Mandir, Digargavhan

*Source: **Prepared from Googleearth***

Figure 3-4: Socio Economic features within 10 km radius

3.2.2 Hydrogeology

3.2.2.1 Regional geology

Deccan Trap Basalt belonging to upper Cretaceous to lower Eocene age occurs in the northwestern, southeastern and eastern parts of the district. The northwestern part, i.e., Dharni and Chikaldhara talukas, is hilly and rugged terrain where Basalt does not form potential aquifer due to limited thickness of weathered mantle.

3.2.2.2 Local geology

The core area of project is showing compound basalt exposed on the surface. The excavation faces and open well faces shows compound and jointed compact basalt.

The compound basalt is jointed, verticals joints are prominent, highly and moderate weathering it shows typical spheroidal weathering, fine grained, pink and Gary colour, few pockets shows amygdaloidal basaltic nature with pyroclastic material.

Figure 3-5: Compound basalt exposed on the surface

The compact basalt is fine gained, homogenous nature, columnar joints are prominent, amygdule's are absent.

Stratigraphic succession of the project area is as follows:

Table 3-3: Stratigraphic succession of the project area

Formation	Photo
Red soil consists of fine sand, silt and clay	

Formation	Photo
Black soil consists of fine sand, silt and clay	
Compound basalt Showing amygdule's	
Compound basalt Showing tuff cues	
Sheriodal weathering	
Jointedand highly watahered compact basalt	

Figure 3-6: Photos showing different flows and characteristics

3.2.2.3 Findings

In the study area, Compound basalt underlined by soil is exposed to the surface on few places and are having different characteristics. The rocks are grey, and pink colour. It is heterogamous nature and with varied thickness .The upper part is highly weathered. The compact basalt is fine grained without amygdales and having columnar joints.

3.2.3 Field Study

Hydro geology is a tool to understand subsurface setup and aquifer condition in and around the study area. During this study, a well inventory is carried out for existing wells and electrical resistivity was carried out within the project plot area. It is seen that bore wells are very less in numbers, in and around project area. Open wells are seen but not in use

3.2.3.1 Open Wells and Bore Wells Inventory

In the study area 12 numbers of wells are located as shown in the in Image. Both of them are dry and not in use. However we measured water table in three bore wells which are not in use and not packed. Nearby and few places in study area has may bore wells use for agricultural purpose. The bore well depth is varies from 100 to 350 meter and dimeter 0.160 to 0.200 meter

Figure 3-7: Locations open well and bore wells

Table 3-4: Well Inventory Data for Open Wells and Bore Wells

Type of well	Depth (m)	Diameter (m)	Depth to water table BGL
Ow 1	7	5.4	5.15 meter
Ow 2	10.5	6.85	2.10 meter
Ow 3	12.30	6.85	5.50 meter
Ow 4	6	4	5.50 meter
Ow 5	6.50	5.8	Below 6.50 m bgl
Ow 6	15	6.30	10 meter
Ow 7	6.50	5.80	3.50 meter

Type of well	Depth (m)	Diameter (m)	Depth to water table BGL
Ow 9	7.40	6.15	4.85meter
Ow 10	11.80	5.85	7.70 meter

3.2.3.1 Findings

The well inventory data shows that 12 numbers open well found in the study area. The depth of well varies from 6 to 15 meter and diameter varies from 4 to 6.85 meter. All bore wells are without pump and not in use. The study site and around has more than 5 deep bore well all of them fail to yield ground water. Most of the bore wells from this study area are fail to yield for agricultural purpose. It indicate very low potential of confided aquifer from the study area.

All wells are used for agricultural purpose. In this area ground water is only source for agricultural purpose. The water table is varies from 2.10 to 10 meter. From Well inventory data indicate only unconfined aquifer is seasonal yielding. The semiconfined aquifer from study area is low potential.

3.2.3.2 Geo Electrical Resistivity Studies (*IS:1892-1979 Appendix B clause 3.3 B-2*)

The geophysical explorations aim to determine geophysical structures by surface measurement. The usual geophysical method measures electrical resistivity. The presence of ground water is largely to be deduced from indicated geological structure and thus through the resistivity method one can give some indication of availability of ground water. The electrical resistivity method is thus most popular for groundwater study.

This method is based on injection of artificially generated low/high frequency current waves. Schlumberger arrangement is most suitable for field survey and measurement and thus was adopted in this study. In this method potential electrodes are kept much closer together and current electrodes are moved according to requirement.

Field technique of Vertical Electrical Sounding (VES) was adopted for homing on to potential sites. The vertical electrical soundings (VES) were carried out on different 10 locations. The maximum current electrodes were kept at 150m. The resistance measured East-West and North - South direction. The apparent resistivity and true resistivity were calculated for each VES point. Apparent resistivity and true resistivity was calculated for each VES point.

Figure 3-8: Vertical Electrical Sounding method

The apparent resistivity values were again calculated by using data obtained from vertical electrical sounding (VES). Apparent resistivity data were used to prepare resistivity graphs to get thickness of the different formation. (Refer VES Graphs No. date wise VES 1 to VES 9 in main report).

VES graphs for determining the apparent resistivity for various spacing of the electrodes by plotting the calculated resistivity values against the electrode spacing were plotted on a double log paper. These graphs depict the apparent resistivity at a particular depth i.e. the average depth obtained thorough resistivity method for the depth of exploration. The graphs can be analysed by studying resistivity of each layer using curve matching technique. The same procedure was carried out for 10 different VES. Each point was marked by stones.

Figure 3-9: Image showing vertical electrical sounding location with it number

3.2.3.3 Subsurface Setup

The outcome received after analysis and curve matching of vertical electrical soundings are correlated with litho logs.

Pseudo section crossing of VES points No. VES1, VES3, VES9 and VES 07 VES station which are same or near to the line for cross section, other VES stations are not selected for analysis. X axis is showing VES station numbers and Y axis is showing depth below ground level in meter.

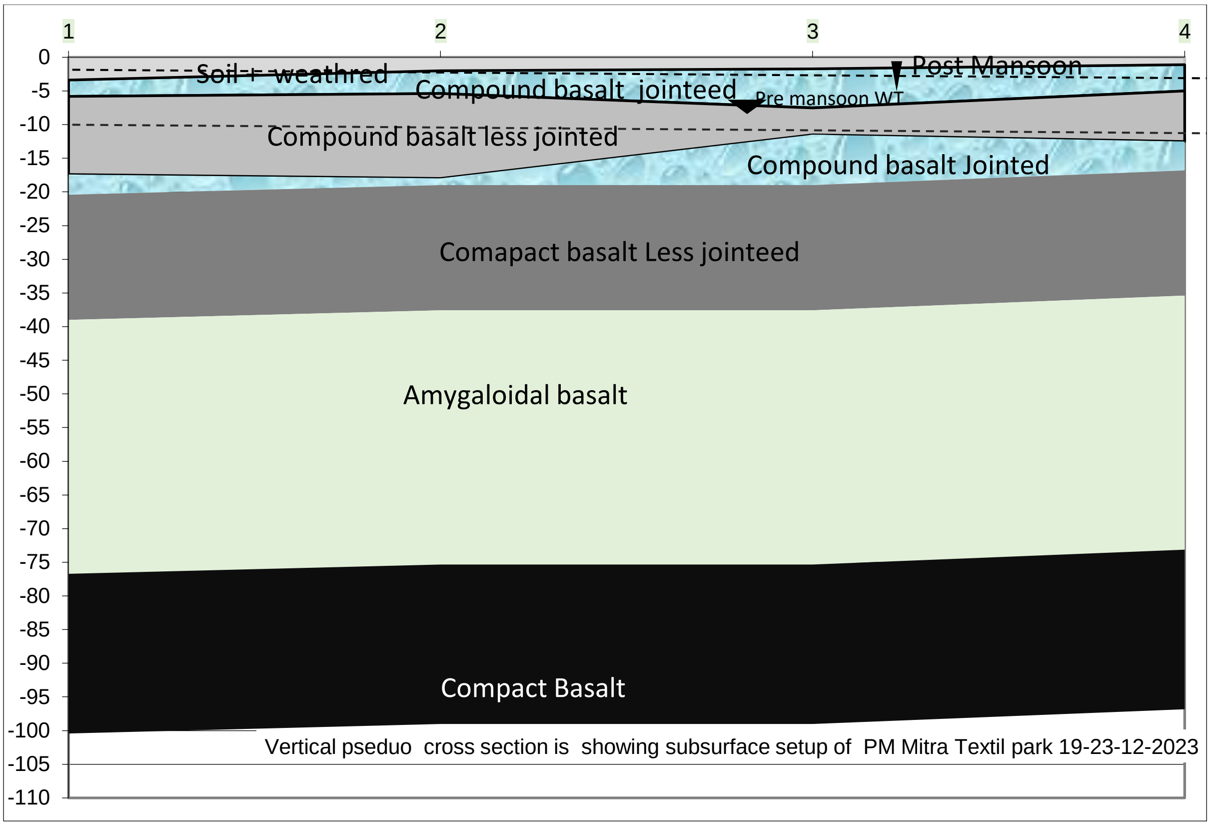


Figure 3-10: Cross Section

3.2.3.4 Findings

Correlating all the above information, one can evolve a subsurface Hydrogeological conditions of the area. Based on the resistivity study of the various aquifers which can be encountered at various depth within the area one can come up to the understanding that the surface and subsurface flow regime help in identifying areas which need to be protected and kept free of pollution as there would be a higher possibility of pollutants entering in to the groundwater system from this area through spillages or leakages.

The imaginary vertical cross section drawn with help of resistivity, geological, hydro geological data show comparatively low resistance for instance an average between 2 to 5.9,15.77 to 20 and 38.6 to 76.33 meters below ground level. It represent aquifer I. It represents that weathered and jointed rocks are water bearing formation forms unconfined aquifer. In between 5.9 to 15.77 and 20 to38.6 meters bgl shows less jointed and fractured basaltic rocks formation are may not water bearing formations . A comparatively high resistivity which itself indicates low porosity, impermeable and hard rock.

3.2.4 Topography and Contour

The study area consists of majorly flat terrain with a localized undulating terrain located at the southern periphery of study area around project site. Human settlement is visible mainly along the major roads passing the study area viz. NH 6/NH53, MH SH200, MH SH10, MH SH 24A & MDR 17.

Thematic manuscript for contour layer was generated from Survey of India toposheet at 1:50,000 scale. After scanning, coverage was generated. Coverage was edited to remove all errors of dangle. Attribute value was given to each contour in the coverage.

A 10 m interval contour map is prepared for the area covering 10 km radius around the project site (see **Figure 3.11**). As the project site is located on the deccan plateau it is observed that majority of the area is comparatively flat without any significant undulating feature throughout the study area. Overall terrain shows no undulations and predominant hilly structure is visible at the southern periphery of the study area. Highest point within the 10 km radius area around the project is 470 m above mean sea level whereas lowest point is at 315 m above mean sea level.

The following features can be seen from the Contour map of the site (**Fig 3.12**):

- Highest elevation: 382 m MSL and lowest: 344m MSL
- Overall slope towards the South and South East
- About 5 seasonal nallas flowing southward
- Small pockets of quarries of about 1.4 sq.km. area

The Digital Elevation Model (DEM) for the site is indicated in **Fig. 3.13** below.

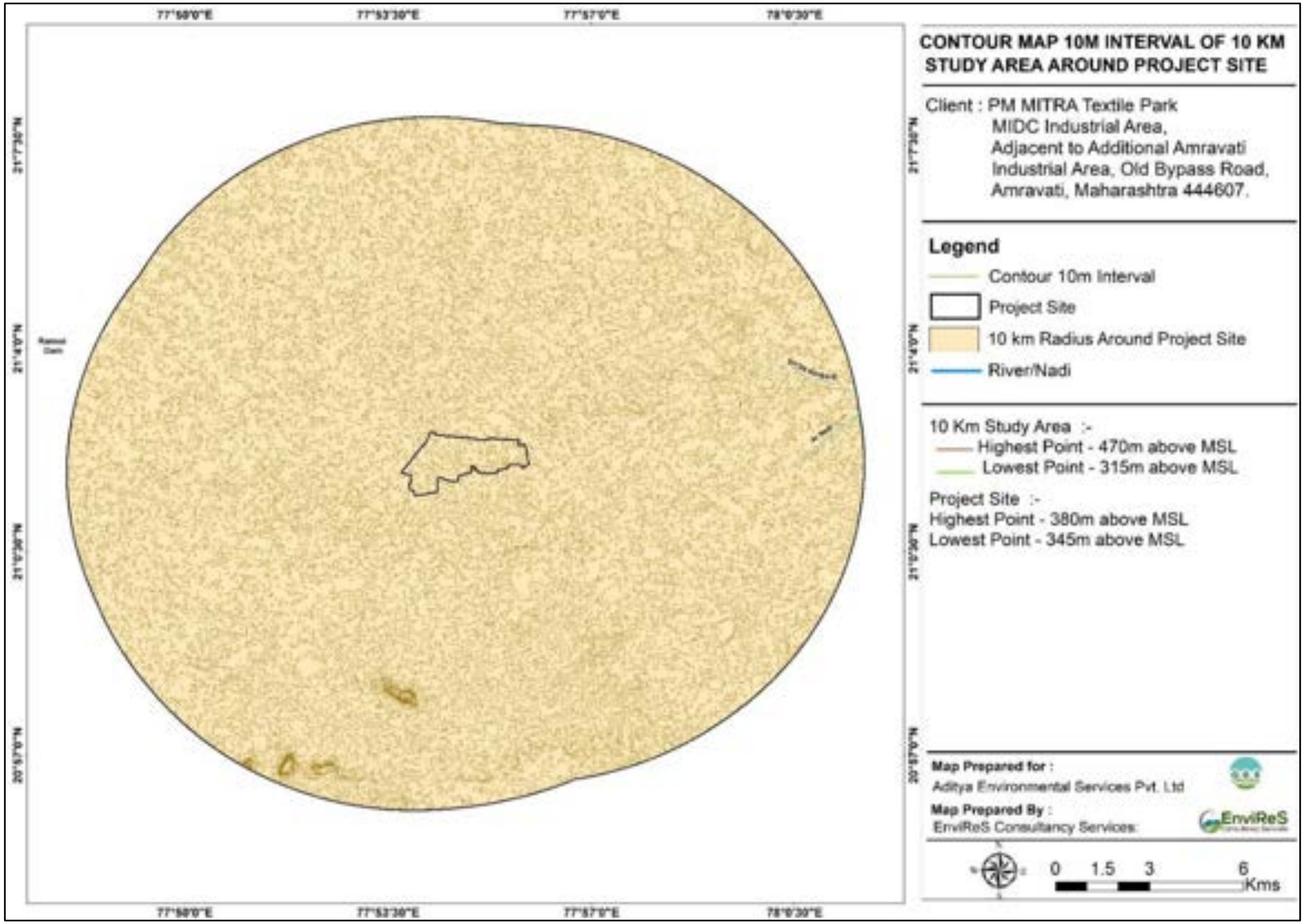
3.2.5 Drainage Map based on Satellite Imagery

Drainage layer is generated after scanning the thematic manuscripts which is further edited for line errors. Two different layers were made separately for line drainage. Drainage order was given to all the drain lines in the layer. Strahler's method of ordering is used for giving order to drainage. Wherein the smallest permanent streams are designated as the first order and the confluences of two first order streams give rise to second order stream and so on. The order of trunk stream is not altered by the addition of lower order. The order of the stream will increase only by the addition of streams of same order.

The study area covering 10 km radius around project site exhibits majority of third order drainage pattern as shown in **Figure 3.14.** Overall, the study area displays distinct and dendritic drainage pattern. The study area shows drainage pattern wherein there is a clear division of basins of Pedhi River; located on the west of study area and Wardha River; located east of study area. Surya Ganga Nadi ani Ar Nadi are some of the tributaries of Wardha River originate within study area on east side.

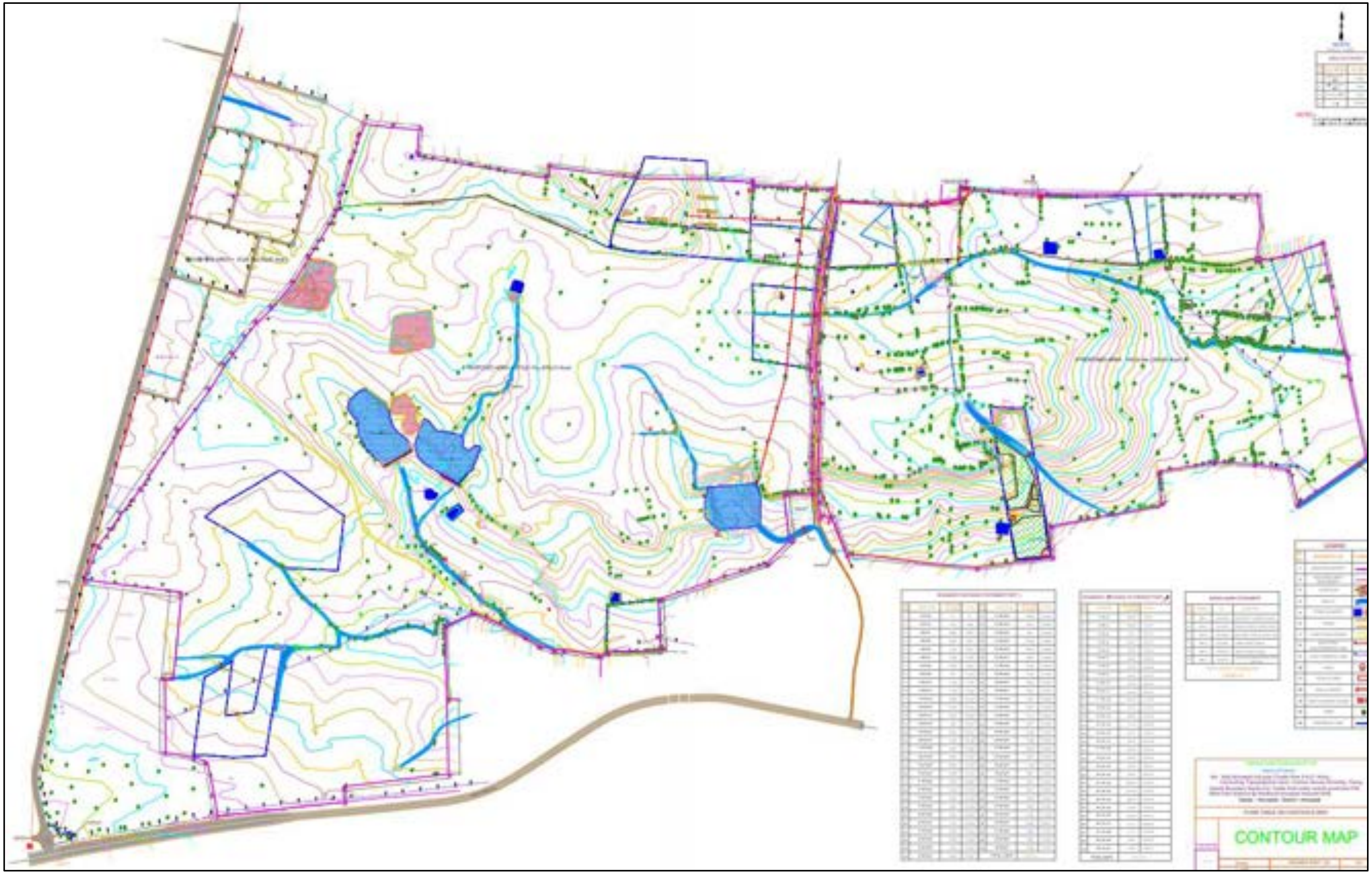
A clear divide between two basins is seen along the western boundary of project site in north south direction. These rivers are contributed by various seasonal streams i.e., odhas or Nallas. The proposed project site is topographically positioned at a Y junction where two second order streams are meeting at the eastern boundary of the project site. There are no major rivers or irrigation projects located within the study area. Minor dams and reservoirs like Malegaon Dharan, Dastapur Dam and Wagholi dams along with a number of lakes and ponds viz. Divankhed Talav, Dahigaon Dhanora talav are located within the study area. All the water bodies and river with sufficient width were put in a polygon layer and direction of rivers and streams is shown.

A detailed Drainage Map of the site and 1 km surrounding area is presented in **Figure 3.15**. To the north of the site is the Digargaon lake. The drainage map of the site inidcates a number of streams and nallas originating on the site and flowing south and south east direction to further meet the second order streams passing outside the site on the east as well as the south of the site. Three percolation tanks can be observed on the site, which collect storm water during the raining season



Source: ASTER GDEM

Figure 3-11: 5m interval contour map for 10 km radius area around the project site



Source: Site Survey by MIDC

Figure 3-12: Contour Map of Project Site

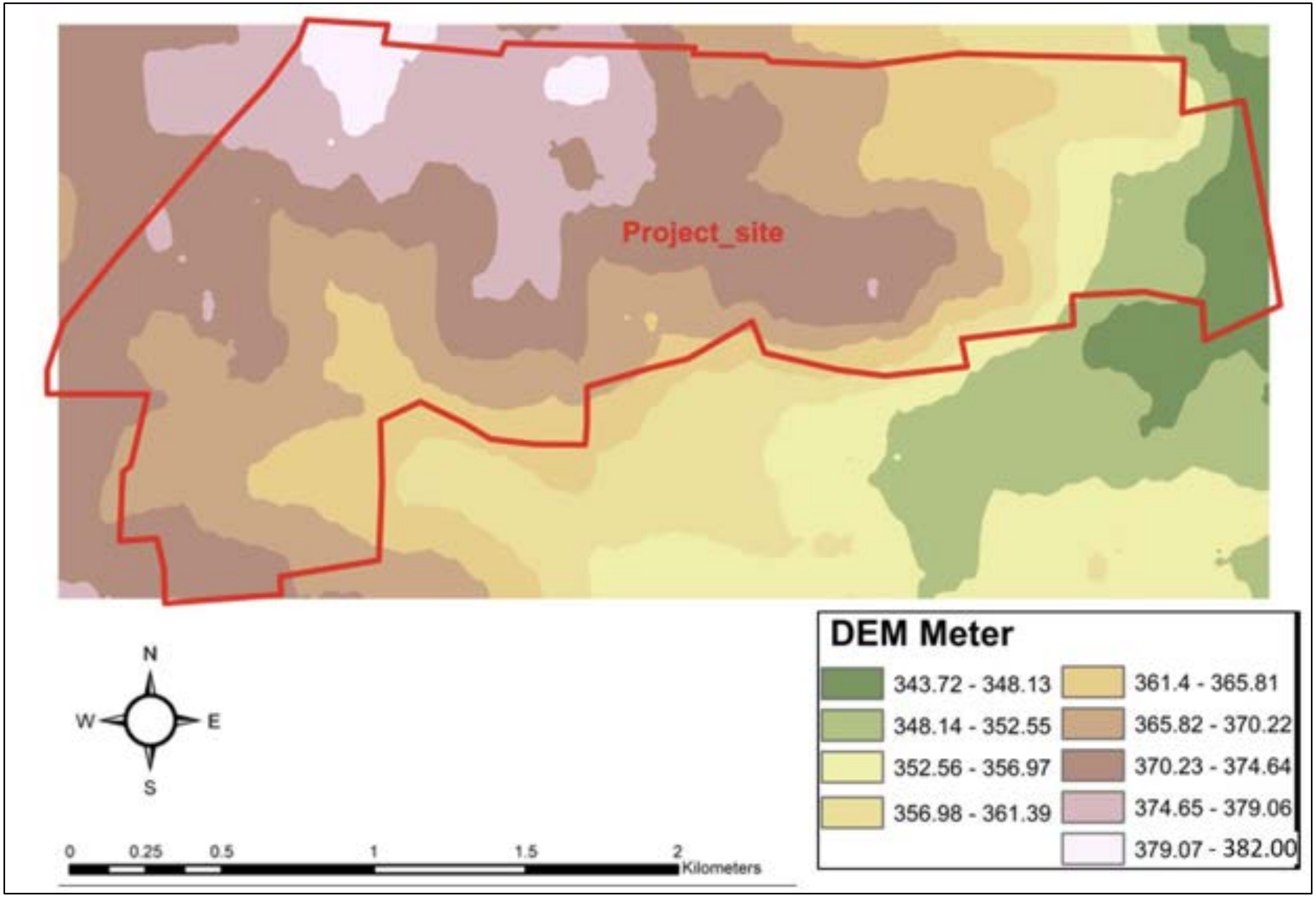
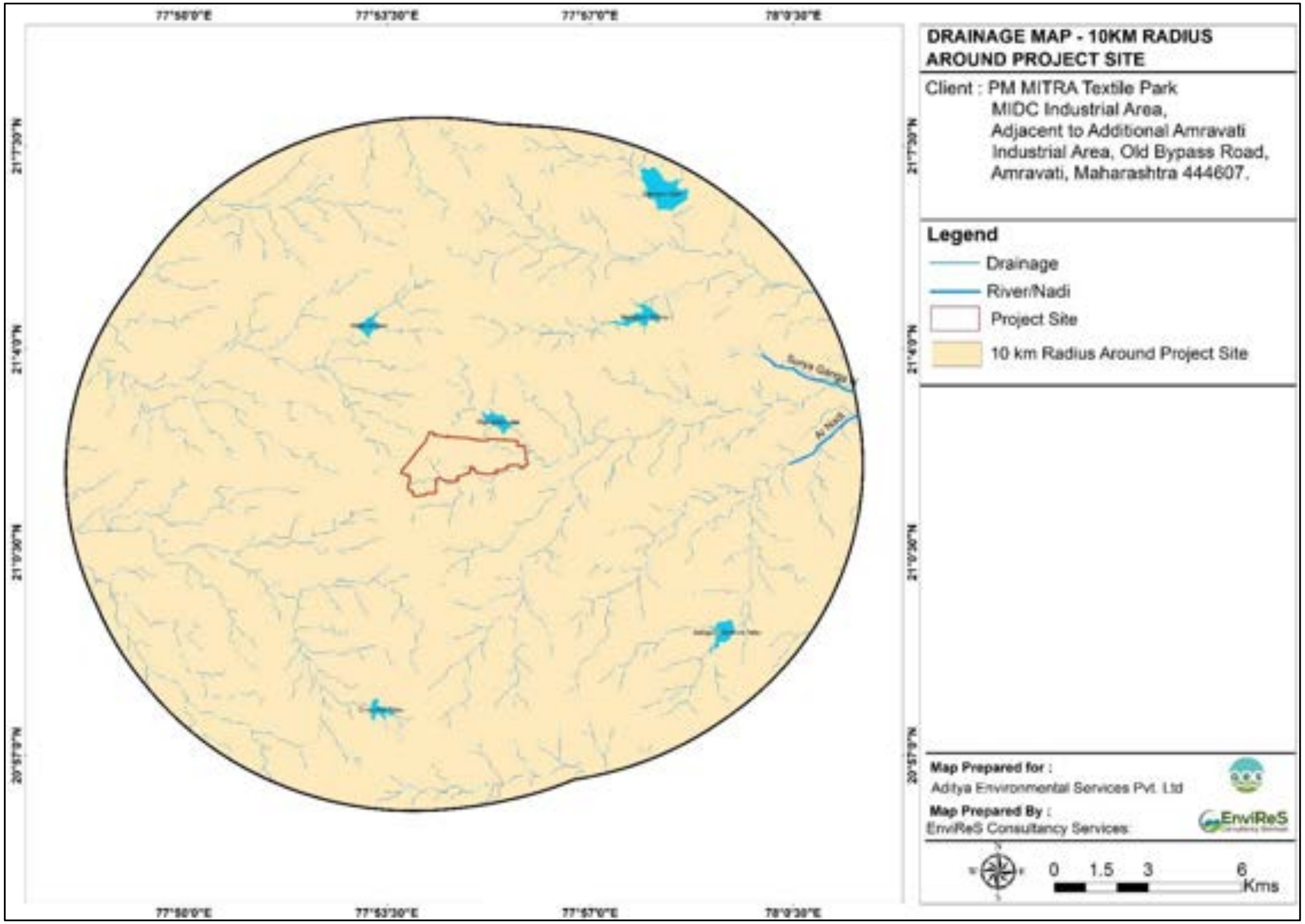
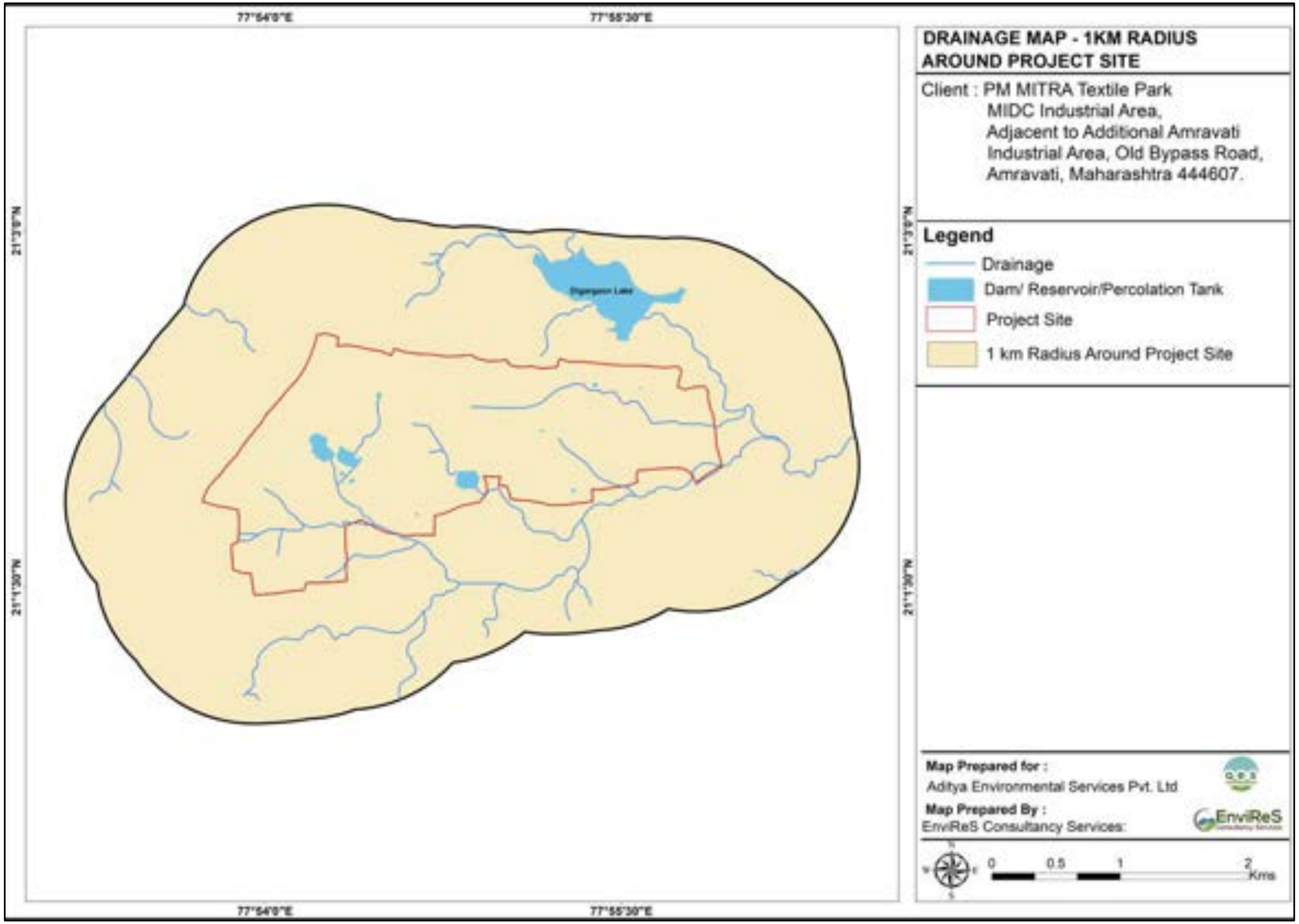


Figure 3-13: Project Site DEM



Source: ASTER GDEM

Figure 3-14: Drainage map of 10 km radius area around Project Site



Source: ASTER GDEM

Figure 3-15: Drainage map of 1 km radius area around Project Site

3.2.6 LULC studies for Study Area (10km radial distance from site)

1:50,000 scale mapping of Land Use/ Land Cover (LULC) with report delineation in the buffer area of 10 km around the Proposed Project site.

Overview of methodology

The satellite image procured from National Remote Sensing Centre (NRSC), Hyderabad was in raw format and few pre-processing procedures (georeferencing) were adopted to bring the image to the real world coordinate system.

Satellite Data: RESOURCESAT-2 LISS-IV cloud free data of Satellite Sensor: L4FMX having Resolution 5.8 m

Satellite Images: Date of Pass: 8th October 2023, Path and Row – Path 98, Row 57 Sub scene D.

Softwares used: ArcGIS 10.2.1, ERDAS IMAGINE 9.2, QGIS Chugiak (2.4 Desktop Version), Global Mapper 13.0, Google Earth and Microsoft Office.

Ancillary Data: GIS and image-processing software are used to classify the image and for delineating drainage and other features in the study area.

A buffer of 10 km is generated using ArcGIS 10.2.1 software from the center point of the project site. This image is further used to study the LULC of the project under consideration. Standard image interpretation elements like tone, texture, shape, size, association, shadow and pattern are useful to identify prominent LULC classes. A reconnaissance survey visit to the project site was carried out to identify the doubtful areas. Geographical coordinate of these locations were recorded using a Global Positioning System (GPS).

To achieve planimetric accuracy, the remote sensing scene was rectified with respect to SOI maps on 1:50,000 scales. The Ground Control Points (GCP) in the scene such as railroad intersections, corners of water reservoirs, canals etc. were identified on the image as well as on the reference map. Third order model was constructed and finally registration of image was carried out with nearest neighborhood resampling taking map as reference and one map registration was achieved.

ERDAS IMAGINE 9.2 is used primarily to process geospatial raster data that allows preparing, displaying and enhancing digital images. It is possible to see features that would not normally be visible and to locate geo-positions of features that would otherwise be graphical with the help of ERDAS IMAGINE. This software is of particular importance in vegetation analysis or linear feature extraction from the image.

Then the subset of image is taken according to the boundary of the study area. The digital classification technique is used for the extraction of the LULC information from the imagery. Thirteen different LULC classes have been identified in the area under study.

GIS data creation: Satellite data for the month of May 2020 was classified using supervised classification technique wherein maximum likelihood algorithm classifier is used for the analysis. A truth table is generated taking 0.95 as the conversion threshold. After aggregation, the final classified output is converted in raster format. The image is then converted in raster format.

Raster data creation: The data classification is based on National Natural Resources Information System (NNRIS) scheme of classification. The classification scheme is given in the table below.

Table 3-5: Land Use Land Cover Classes

Level I	Level II	Level III
Habitation	Residential	Urban
		Village
	Industrial Area	Industrial Area
Agriculture	Fallow land	Fallow land
	Agriculture	Agriculture
		Plantation
Vegetation land	Scrub land	Scrub land
	Vegetation	Degraded vegetation
		Dense vegetation
		Secondary vegetation
Wasteland	Roads	National Highways
		Minor Roads
	Railway	Rail Track
	Mining Area	Quarry
	Open land	Open land
Water	River	Stream
		River
	Reservoir	Ponds/Lakes
		Reservoir
Heritage Site, if any	Heritage Site	Heritage Site

Source: *National Natural Resources Information System (NNRIS) scheme of classification*

The digital classification technique is used for the extraction of the landuse/landcover information from the imagery. LULC map of 10 km radius around the project site is prepared and the same is shown as thirteen different LULC classes have been identified in the area under study.

Table 3-6: Definition of all Land Use Land Cover Classes

No	Class	Class Definition
1.	Dense vegetation	It is an area (within the notified forest boundary) bearing an association predominantly of trees and other vegetation types capable of producing timber and other forest produce.
2.	Moderate Dense Vegetation	It is described as a forest, which comprises of thick and dense canopy of tall trees, which predominantly remain green throughout the year. It includes both coniferous and tropical broad-leaved evergreen trees. Semi-evergreen forest is a mixture of both deciduous and evergreen trees but the latter predominate.
3.	Secondary Vegetation/Mixed Vegetation	It is described as openings amidst forests without any tree cover. It includes openings of assorted size and shapes as seen on the imagery.

No	Class	Class Definition
4.	Fallow Land	It is described as agricultural land which is taken up for cultivation but is temporarily allowed to rest un-cropped for one or more seasons, but not less than one year. These lands are particularly those which are seen devoid of crops at the time when the imagery is taken of both seasons.
5.	Plantation	It is described as an area under agricultural tree crops, planted adopting certain agricultural management techniques. It includes tea, coffee, rubber, coconut, areca nut, citrus, orchards and other horticultural nurseries.
6.	Scrub Land	Scrub is a stunted tree or bush/shrubs.
7.	Open land	It is described as land area without any tree cover.
8.	Mine/Quarry	Mine / quarry areas subject to removal of different earth material (both surface and sub-surface) by manual and mechanized operations.
9.	Residential Area (Rural and Urban)	It is defined as an area of human habitation developed due to non-agricultural use and that which has a cover of buildings, transport, communication utilities in association with water vegetation and vacant lands.
10.	Industrial Area	It is defined as an area of industrial activities.
11.	Water body/ River	It is a course of flowing water on the land along definite channels. It includes from a small stream to a big river and its branches. It may be perennial or non-perennial.
12.	Reservoir/Ponds	It is a natural or man-made enclosed water body with a regulated flow of water. Reservoirs are larger than tanks/lakes and are used for generating electricity, irrigation and for flood control.

Source: http://mospi.nic.in/mospi_new/upload/ax0406.htm

False Colour Composite (FCC) image of Satellite image

The Geo-referenced False Colour Composite (FCC) Resourcesat-2 RESOURCESAT-2 LISS- IV satellite imagery dtd. 8th October, 2023 was obtained from NRSC. FCC for the study area of 10 km around the project site is presented in the **Figure 3.16** below.

Landuse Land Cover Map layouts

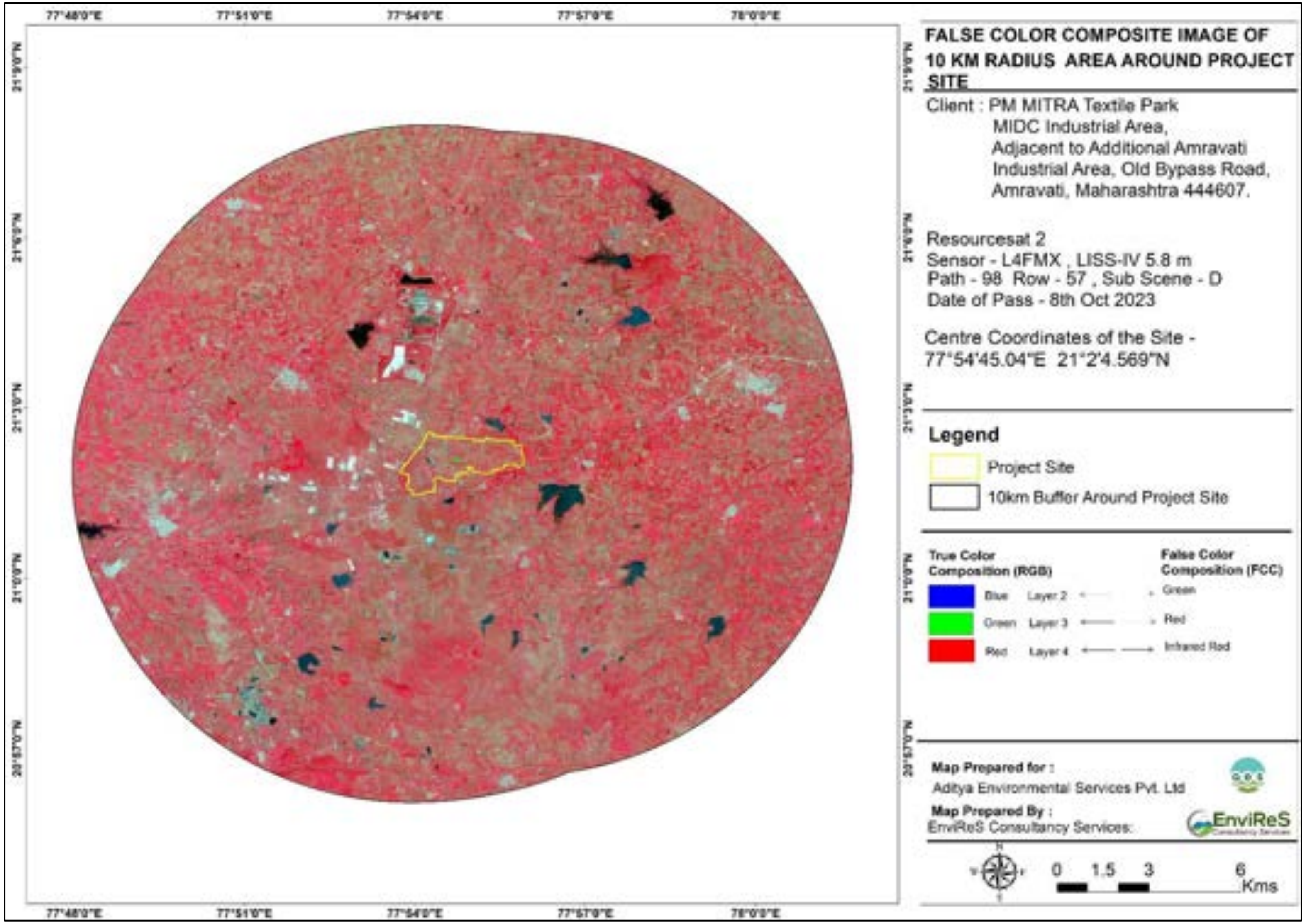
The digital classification technique is used for the extraction of the landuse/landcover information from the imagery. A landuse land cover map of 10 km radius around the project site is prepared and the same is shown as **Figure 3.17.**

A landuse land cover map of the project site is also prepared and is presented as **Figure 3.18**.

Area Distribution of LULC Classes for 10 km study area

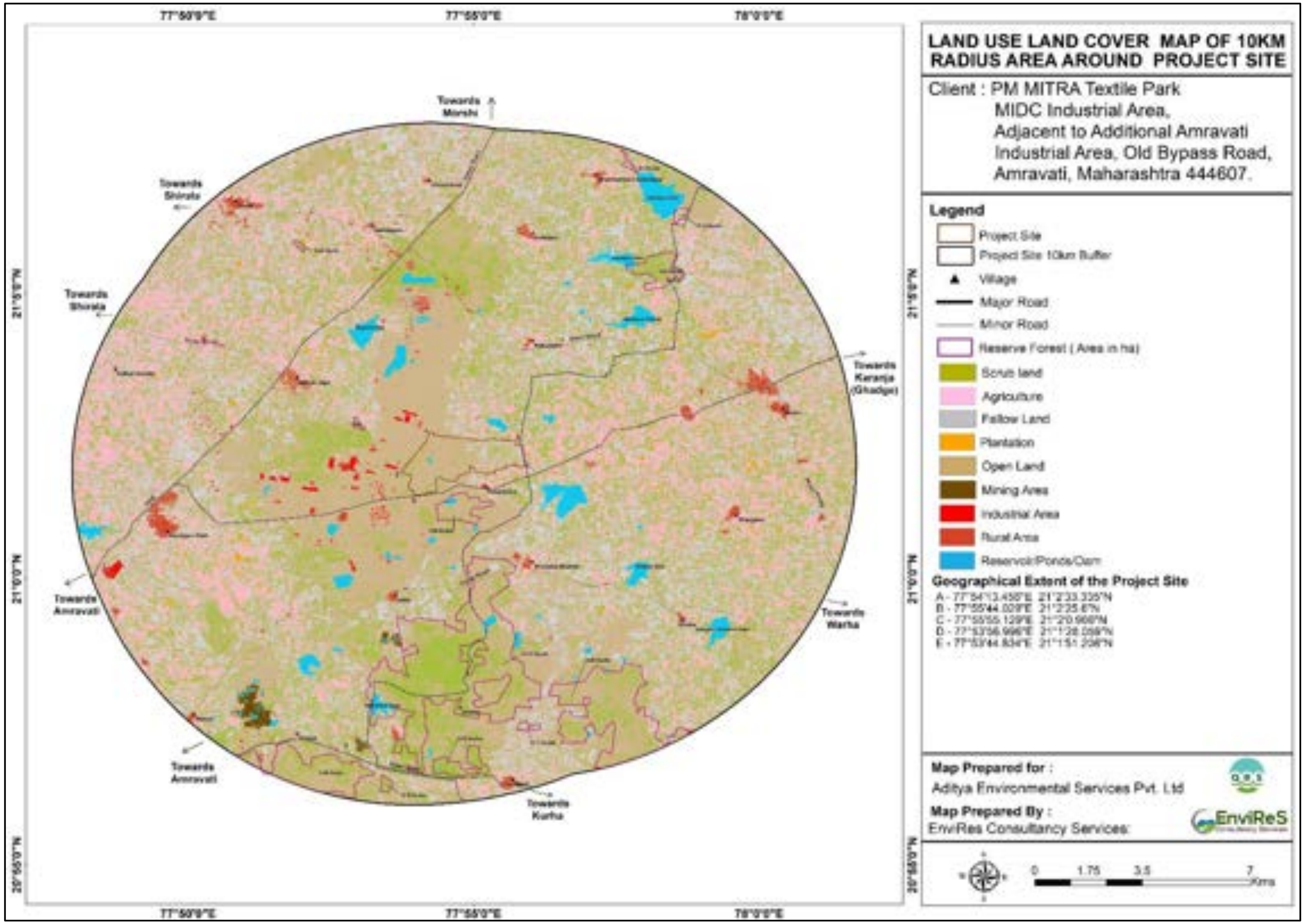
A landuse land cover map of 10 km radius around the project site is prepared and the same is shown as **Figure 3.17.** Nine different landuse/landcover classes have been identified in the area under study.

The area distributions along with percentage distribution of the different LULC classes within the study area of 10 km are shown in **Table 3.7** and **Figure 3.19** respectively.



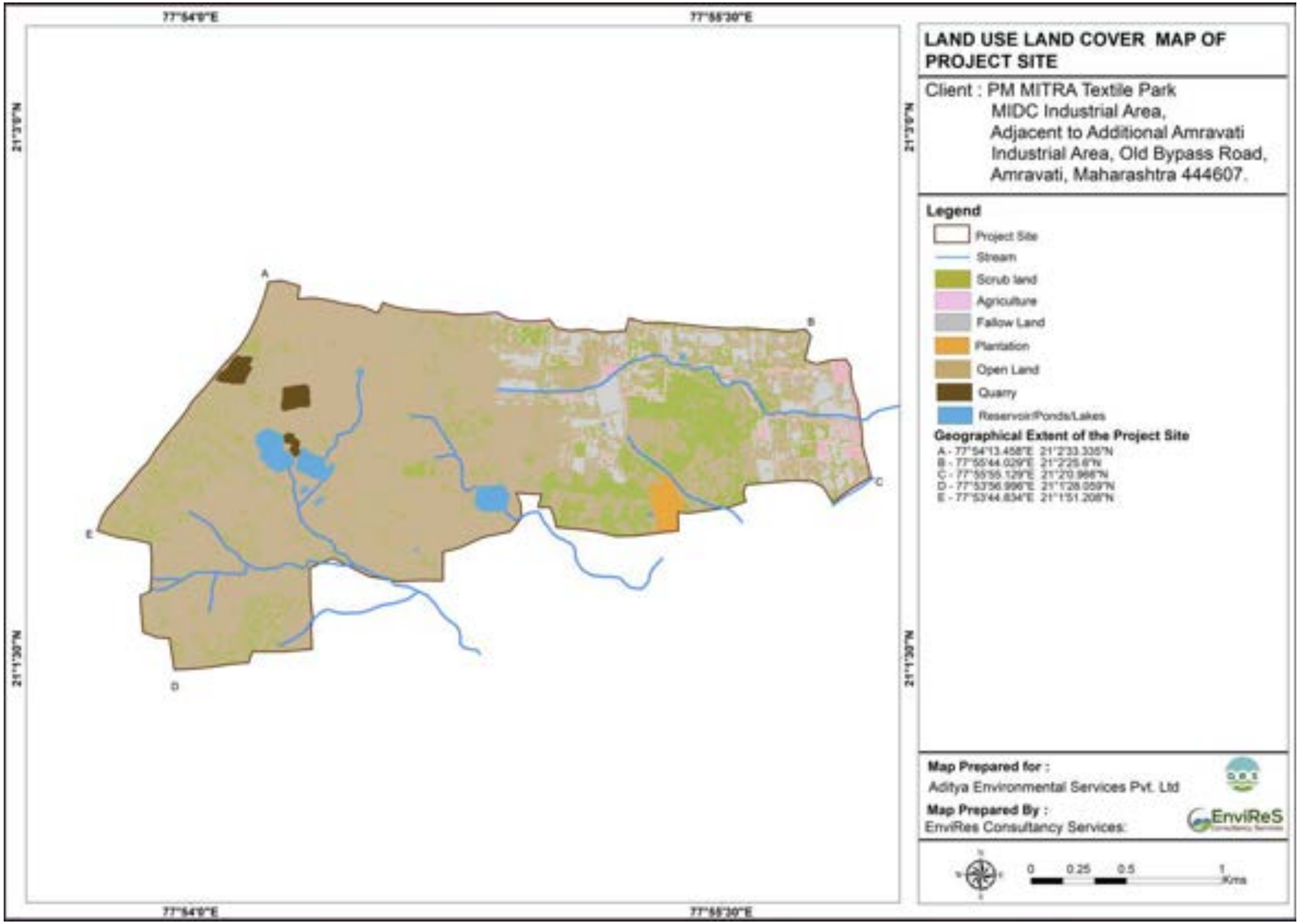
Source: RESOURCESAT-2 LISS- IV imagery dtd. 8th October, 2023 from NRSC

Figure 3-16: Geo-referenced False Colour Composite (FCC) Resourcesat-2 satellite image



Source: Map based on RESOURCESAT-2 LISS- IV imagery dtd. 8th October, 2023

Figure 3-17::Landuse/ landcover map of 10 km radius area around Project Site



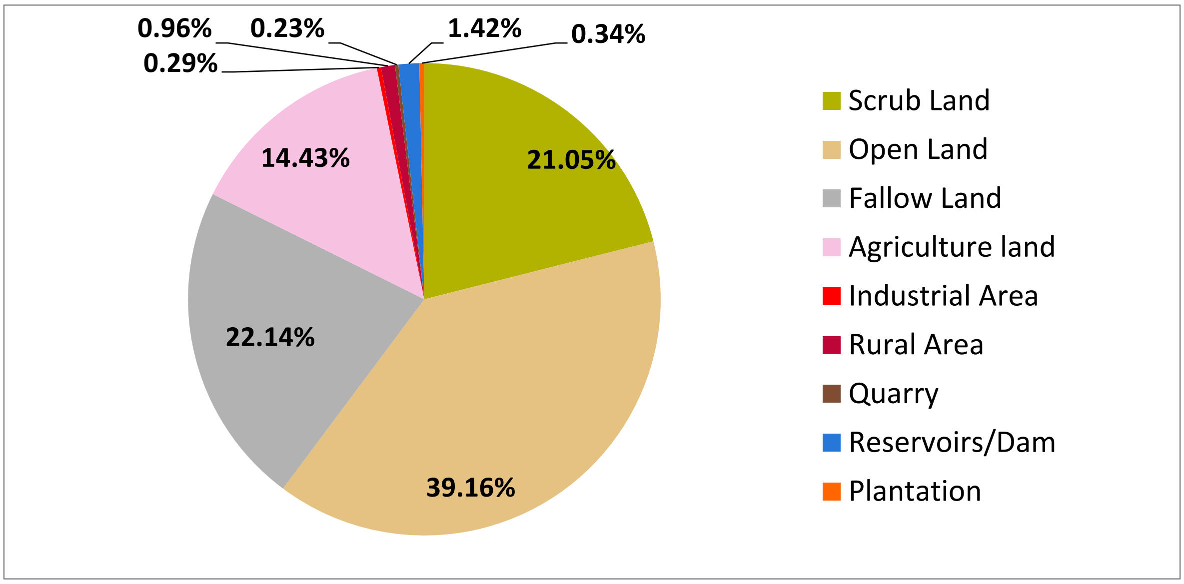
Source: Map based on RESOURCESAT-2 LISS- IV imagery dtd. 8th October, 2023

Figure 3-18: Landuse/ landcover map of Project Site

Table 3-7: Landuse/ Landcover Statistics of the 10 km radius Area

Sr No	Class_Name	Area (Ha)	Area (km^2)	Distribution (%)
1	Scrub Land	8725.215	87.25	21.05
2	Open Land	16231.2075	162.31	39.16
3	Agriculture	5980.04	59.80	14.43
4	Fallow Land	9177.765	91.78	22.14
5	Quarry/Mine	94.6275	0.95	0.23
6	Plantation	139.075	1.39	0.34
7	Industrial Area	118.51	1.19	0.29
8	Rural Area	396.11	3.96	0.96
9	Reservoirs/Dams	589.0525	5.89	1.42
	Total Area	**41451.61**	**414.52**	**100.00**

Source: Class distribution as per 10km LULC Map based on RESOURCESAT-2 LISS- IV imagery dtd. 8th Oct., 2023



Source: Land use/ Land cover Statistics for 10km area around site and LULC Map based on RESOURCESAT-2 LISS- IV imagery dtd. 8th Oct., 2023

Figure 3-19: Landuse/landcover statistics of 10 km radius area around Project Site

Six different land use land cover classes are extracted from the satellite image. The project area is has majorly open lands. As a result, Open land (39.16%) is the most predominant amongst the land use classes found within study area. Due to the semi-arid climate dense vegetation or mixed vegetation is not seen however, patches of scrub land (21.05%) are mostly observed within the study area. Small open quarries which are used to extract stone/sand for construction and filling purposes are seen within the south western periphery of the study area near Parsoda village settlement are classified as Quarry (0.23%).

Agriculture (14.43%) is one of the predominant classes along with fallow land (22.14%) indicating seasonal and annual cropping pattern within the study area. Together they constitute nearly 37% of the land use which is second most predominant class within study area. Rural habitation is classified under rural 0.96% within 10km radius around project site. Industrial area comprises of 0.29% of total land cover as the site is located within the Amaravati

Industrial and Additional MIDC area. Power plant located north of project site is also classified under industrial area.

Minor dams and reservoirs like Malegaon Dharan, Dastapur Dam and Wagholi dams along with a number of lakes and ponds viz. Divankhed Talav, Dahigaon Dhanora Talav located within the study area contribute to 1.42% of the land cover. There are no significant or major rivers located within 10 km radius Surya Ganga Nadi and Ar Nadi flow towards east and further meet Wardha River outside study area.

Area Distribution of LULC Classes for Project Site

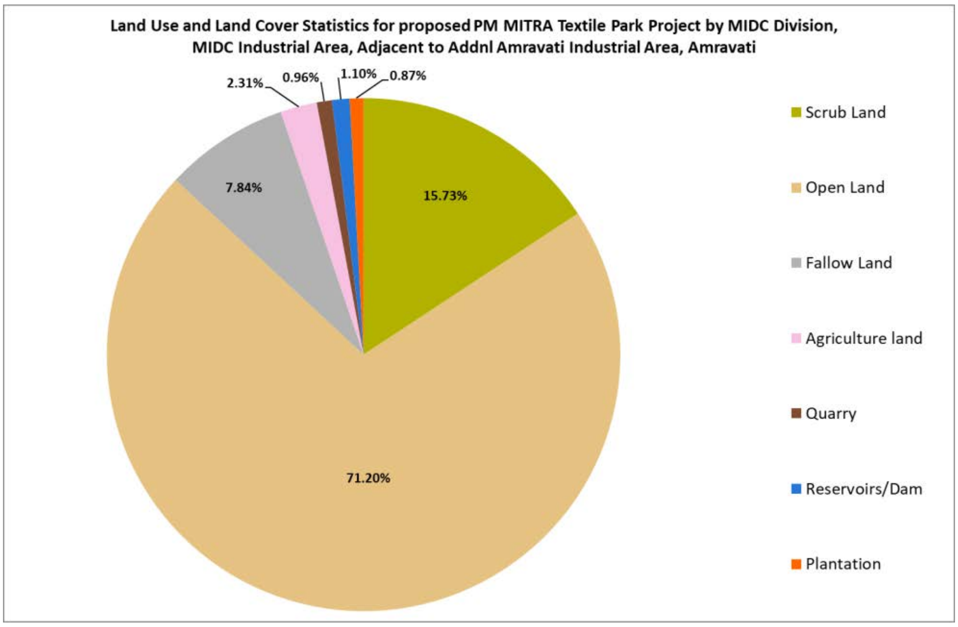
A landuse land cover map of the project site is also prepared and the same is shown as **Figure 3.16**. Seven different landuse/ landcover classes have been identified in the area under study.

The area distributions along with percentage distribution of the different LULC classes within the project site are shown in **Table 3.8** and **Figure 3.20** respectively.

Table 3-8: Landuse/ Landcover Statistics of the Project Site

Sr no	LULC Class	Area(ha)	Area (Sq.Km)	%
1	Scrub Land	66.16	0.66	15.73
2	Open Land	299.52	3.00	71.20
3	Fallow Land	32.98	0.33	7.84
4	Agriculture land	9.70	0.10	2.31
5	Quarry	4.02	0.04	0.96
6	Reservoirs/Dam	4.64	0.05	1.10
7	Plantation	3.65	0.04	0.87
	Total area	**420.67**	**4.21**	**100.00**

Source: Class distribution as per 10km LULC Map based on RESOURCESAT-2 LISS- IV imagery dtd. 8th Oct., 2023



Source: *Land use/ Land cover Statistics for 10km area around site and LULC Map based on RESOURCESAT-2 LISS- IV imagery dtd. 8th Oct., 2023*

Figure 3-20: Landuse/landcover statistics of Project Site

Seven different land use land cover classes are extracted from the satellite image.

The project site has mostly vacant land as it is not developed and the class Open land is the most dominating with 71.20%. Due to the semi-arid climate dense vegetation or mixed vegetation is not seen however, patches of scrub land (15.73%), Fallow land (7.84%), Plantation (0.87%) and Agricultural land (2.31%) are observed within the site. Small open quarries which are used to extract stone/sand for construction and filling purposes are seen at the western periphery of the site and are classified as Quarry (0.96%). A number of seasonal streams and nallas are seen on the site with a few percolation tanks which collect rainwater during the monsoons. Class under Reservoir/ Dam constitutes about 1.10% of the total landuse area.

3.2.1 Soil Monitoring

As a part of baseline studies, soil samples (up to 30 cm depth) were collected during the baseline monitoring period. Locations for soil monitoring stations covering different landuse classes such as agricultural land away from water source, agricultural land adjacent to water bodies, land under mixed vegetation and project site land, were selected. The table below shows the locations of soil sampling, and the same are indicated in **Fig. 3.12.**

Table 3-9: Schedule of soil monitoring

Locations of Soil Samples	7 samples as per figure below
Frequency of Sampling	Once during study period at each location
Parameters	As per Handbook of Agriculture from ICAR, Delhi

	
Sawardi Gaothan	MIDC Forest Pandharpur
	
Mukta Orange farm	Kapustalani

Figure 3-21: Team collecting Soil Sample

Table 3-10: Soil monitoring locations

Station Code	Station Name (Village)	Approx. distance from site boundary	Direction from site
S1	Within Industrial Area	Within the proposed Industrial area in Southeast direction	Within Industrial Area
S2	Sawardi Gaothan	At a distance of 2.28 km in Southwest direction	Sawardi Gaothan
S3	MIDC Forest Pandharpur	At a distance of 1.36 km in Northwest direction	MIDC Forest Pandharpur
S4	Mukta Orange farm	At a distance of 8.37 km in Northwest direction	Mukta Orange farm
S5	Pimpalvihir	At a distance of 0.52 km in South direction	Pimpalvihir
S6	Kapustalani	At a distance of 3.45 km in Northeast direction	Kapustalani
S7	Sawardi Shirajgaon	At a distance of 2.95 km in South direction	Sawardi Shirajgaon
S8	Agricultural fields near Village Potner	0.2 km from western site boundary	Between central part of site (western boundary) and NH536
S9	At green areas within Village Nizampur	70 m to south along SH97	Beyond site boundary

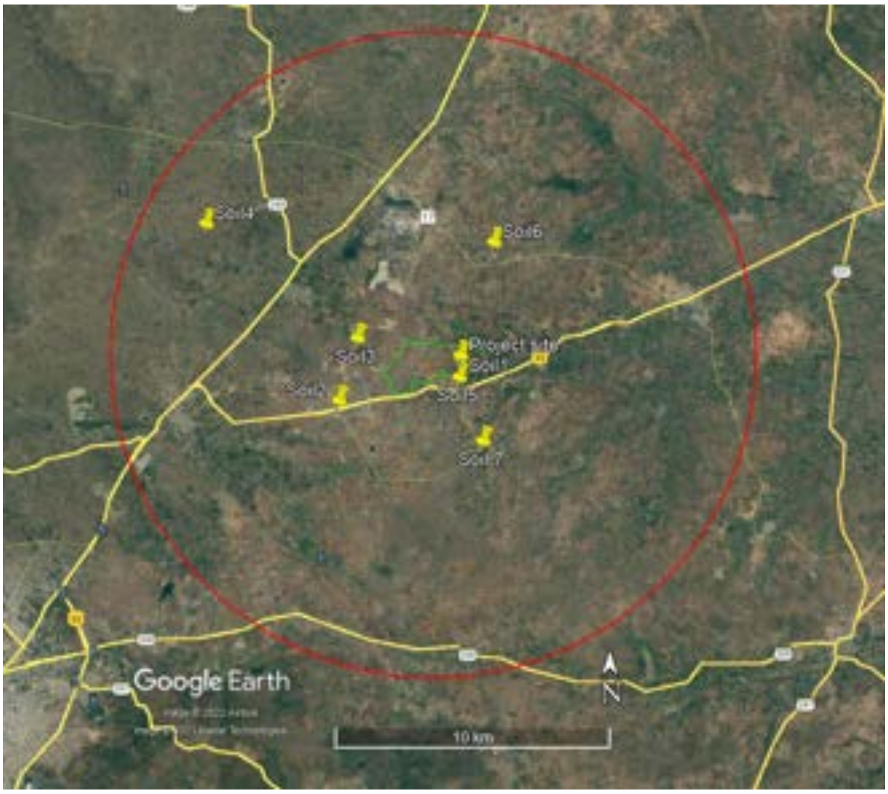


Figure 3-22: Map Showing Soil Sampling Locations

Table 3-11: Results for Soil Monitoring

Sr.No.	Parameter		Results							Method of analysis
			S1	S2	S2	S4	S5	S6	S7	
1	pH@25°C		6.91	7.25	7.79	7.97	7.61	7.73	7.63	IS 2720 (part 26); RA2011
2	Conductivity @25°C, µS/cm		68.65	130.4	196	250.8	370.8	1022	136.6	IS-14767; RA 2016
3	Texture		Clay	Clay	Clay	Clay	Clay	Clay	Clay	IS 2720 (part 4); RA2010
4	Water content, %		6.06	18.09	21.02	35.67	7.76	29.7	17.8	IS 2720 (part 2); RA2015
5	Particle size, %	Sand	14	12	16	14	10	6	10	IS 2720 (part 4); RA2010
6		Silt	14	18	12	14	12	12	16	
7		Clay	72	70	82	72	78	82	74	
8	Organic Carbon, %		0.38	0.47	0.87	0.62	3.95	1.53	0.74	IS 2720 (part 22); RA2015
9	Water Holding Capacity, %		32.6	34	40	38	38.2	40	32	AESPL/LAB/SOP/S-09; 02.05.18
10	Chloride, mg/kg		52	<10	< 10	< 10	49.6	14	<10	EPA Method 9253:1994
11	Available Phosphorus, kg/h		46.2	28	<11	28	43	35	55	AESPL/LAB/SOP/S-07; 02.05.18
12	Available Nitrogen, %		0.013	0.0106	0.021	0.018	0.0436	0.032	0.012	AESPL/LAB/SOP/S-05; 07.05.19
13	Available Sulphur, mg/kg		42	30	16	42	48	52	50	EPA Method 9038:1986
14	Potassium as K, kg/h		90	40	50	40	80	70	100	IS 9497: 1980: 2015
15	Iron, mg/kg		0.2	< 0.2	0.21	0.22	0.28	0.24	<0.2	EPA Method 3050 B.2:1996
16	Calcium, mg/kg		35	60	95	87	32	29	27	EPA Method 7000 B.2:2007
17	Magnesium, mg/kg		7	19	3.2	15	14	10	10	EPA Method 7000 B.2:2007
18	Sodium, mg/kg		70	70	70	80	70	90	80	IS 9497:1980:2015
19	CEC Cmol/kg		14	14	14	16	12	18	16	IS: 2720 (Part 24)
20	Bulk Density g/cm3		1.1	1.12	1.12	1.26	1.26	0.98	0.99	AESPL/LAB/SOP/S-16
21	Zinc as Zn mg/kg		0.26	0.28	0.28	0.26	0.24	0.3	0.28	EPA Method 3050 B. 2
22	Nickel as Ni mg/kg		< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2	EPA Method 3050 B. 2
23	Copper as Cu mg/kg		0.28	< 0.2	0.26	< 0.2	0.22	0.22	0.2	EPA Method 3050 B. 2
26	Porosity %		36	38	40	38	34	38	38	
27	Color		Brown	Grayish Brown	Brown	Brown	Grayish Brown	Grayish Brown	Dark Brown	AESPL/LAB/SOP/S-20
28	SAR %		0.0003	0.0002	0.0001	0.0001	0.0003	0.0005	0.0005	AESPL/LAB/SOP/S-19

Observations and Inferences

Physical characteristic

- Texture-Grain size distribution: Texture indicates relative proportion of various sizes of primary soil particles such as sand, silt and clay present in the soil. Mostly all samples contain clay, sand & silt in which Sand is highest at locations namely S3 (16%) to minimum at S6 (06%) and for highest silt at S- 2,(18%) & min of 12 at majority location S3,5,&6 (12%) whereas S3 &S6 (82%) max & min S2(70%) at project Site for Clay. The textural classes of seven soil samples are clayey (fine) Bulk density values confirm the textural class.
- Bulk Density: In case of bulk density total soil space (space occupied by solid and pore spaces combined) are taken in to consideration. Soil texture, soil structure and organic matter content are the factors influencing the bulk density of a soil. Bulk Density, besides being an interesting and significant physical characteristic, is very important as a basis for certain computations. The Bulk density of the seven soil sample under consideration ranges between minimum at S6 (0.98g/cm3) & max. at S4, S5 (1.26 g/cm3), and confirms the murum, clay type texture of the soils of the area under study.
- Porosity: The pore space of a soil is the space occupied by air and water and is expressed as percent pore space. The amount of this pore space is determined by structural conditions, that is by inter- related influence of texture, compactness and aggregation. Porosity is also related to aeration and retention and movement of water in the soil. The porosity of seven soil sample ranges minimum at S5 (34%) whereas, maximum at S3 (40%) and is good in accordance to the texture of soil, and considered good for air and water movement in the soil for crops.
- Water Holding Capacity (WHC): Water holding capacity of soil is the maximum amount of moisture, a dry soil is capable of holding, under given standard condition. If the moisture content is increased further percolation result WHC is of great value to practical agriculture, since it provides a simple means to determine moisture content. WHC required for good crop growth is 35 to 70%. The WHC of the seven soil samples is between 40% to 32% and is moderate to good indicating availability of water for crop growth indicating somewhat less frequent water application for growing crops. Drip irrigation could be alternate for optimum application of water.

Chemical Characters

- Soil reaction (pH): For the seven-soil sample under consideration the pH ranges between 7.97 to 6.91 indicating soils are neutral.
- Electrical conductivity (EC): The salt content of the soils are estimated by EC measurements, and is useful to designate soils as normal or sodic (saline). The EC of seven soil samples is between 1022 to 68.65 µS/Cm are near the limits to be called as saline and hence the soils are normal to hard for crop growth & germination as per soil classification table.

- Cation Exchange capacity (CEC): The total amount of exchangeable cations that a soil can retain is designated as cation exchange capacity (CEC) and usually expressed as Cmol/Kg of soil. CEC is directly related to fertility of soils. The CEC of the seven samples ranges between 12.00 to 18.00 Cmol/kg soil. A soil with low CEC indicates low fertility and soils with high CEC indicates high fertility. Seven soil samples are fine textured having high percentage of clay with dominating montmorrilonitic clay mineral, showing high CEC, in turn fertility is also high.
- Calcium (Ca++) Calcium, an essential part of plant cell wall structure, provides for normal transport and retention of other elements as well as strength in the plant. The exchangeable calcium content of seven soil samples ranges between 27 to 95 meq/l soil, and having good base saturation percentage (ranging from 50 to51 %). For normal crop growth a calcium base saturation percent of soils between 50 to 75% is required.
- Magnesium (Mg++): Magnesium is part of the chlorophyll in all green plants and essential for photosynthesis. It also helps activate many plant enzymes needed for growth. The magnesium content of the seven soil samples ranges 3.20 to 19 meq/l soil(BS % is 50%, which is further adding to base saturation. Magnesium base saturation percent of 5 to 15 % is normal.
- Potassium (K+): Potassium is absorbed by plants in larger amounts than any other mineral element except nitrogen and, in some cases, potassium Helps in the building of protein, photosynthesis, fruit quality and reduction of diseases. The Potassium content of one soil sample is 40 to 100 kg/ha and is low for crop growth
- Sodium (Na+): Though sodium is not an essential plant nutrient, but it has some role in potassium nutrition. Out of the seven samples sodium ranges between 70 to 90 mg/kg soil, which is below the content(i.e. ESP is below 15%) at which soil show, saline alkali or alkaline properties, hence no adverse effect on soils. The Potassium content of seven soil samples ranges between 40 to 100 kg/ha and is very less to less for crop growth.
- Available Nitrogen (N) The available nitrogen in the seven samples in question, as per analysis ranges between 0.01 to 0.04 % showing less to good nitrogen content for crop growth.Available The phosphorus content of soil of seven samples ranges between 28 to 55 % and falls under less or deficient category.
- The seven soil samples under consideration contain Organic carbon content in range of 0.38 to 3.95 %; OM is calculated from organic carbon estimation. As per crop requirements the soils are having more than sufficient organic matter content in different samples, required for growing crop in next season. In the seven samples the available sulphur in ranges between 16 to 52 mg/kg and medium to moderate.

From the interpretation of field data, physical and chemical data it can be concluded that: Soils are shallow black soils did not differ significantly in properties as that of shallow soils in scarcity area. As per the physical data soils are fine texture, having low bulk density, imperatively good water holding capacity, and slow permeability. As per physical characters soils are rated as moderate to good for agriculture.

As per chemical characters soil reaction (pH) soils are neutral, slightly to moderately alkaline and electrical conductivity (EC) is high to very low at one sample.Organic matter is better to sufficient. Macro nutrient like nitrogen is better to sufficient and phosphorus is medium to sufficient, potassium is low, calcium, magnesium are medium to good and base saturation is moderate to good Sodium is below the limit to make soil saline or sodic or alkali. Micro-nutrients, Mn (very low may cause deficiency), Zn, Fe ,Al (nil to low, will cause deficiency), B is low(may cause deficiency) SO_4 low to medium and Cl are medium to high. Cation Exchange capacity is high indicating to good fertility. Exchangeable Ca is moderate with good base saturation, Exchangeable K is low, and Exchangeable Na is also low not indicating any alkalinity. Sodium adsorption ratio indicates the soils are normal.

3.3 Air Environment

3.3.1 Meteorology

Rainfall

Rainfall is the most critical factor affecting agriculture in the region. Total rainfall and its month wise distribution is an important factor affecting crop production and land use intensity. Region receives the rainfall from the south-west monsoon. The average annual rainfall in the district is 870.5 mm in the plains. The rainfall generally increases from the southwest towards the northeast of the district. Daryapur near the southwest border of the district receives 698.6 mm of rainfall and Barud near the northeastern border receives 992.9 mm of rainfall. The rainfall during June to September constitutes 87% of the annual rainfall, July being the rainiest month. The variation in the rainfall from year to year in the district is not large.

Temperature

The summer season is from March to May followed by the south west monsoon season from June to September. The period from December to February is of winter season. The period from March to May is one of increasing temperatures. May is the hottest month of the year. The onset of south-west monsoon early in June brings down the temperature slightly. After the withdrawal of the south-west monsoon by the end of September the day temperature increase slightly and the weather in October and November is almost like summer months. The average minimum temperature is 11°C and maximum average temperature is 33.5°C.

Humidity

Except during the monsoon season when the humidity is high in the mornings (more than 70%), the air is generally dry. The summer months are the driest in the afternoons with relative humidity between 18 and 23%. The relative humidity during baseline study is average 47.2 %.

Wind speed and Wind Direction

Winds are generally moderate with some increase in speed in the latter part of the summer season and in the southwest monsoon season. During baseline monitoring season, average wind speed in study area is 3.2 m/s and maximum wind speed is 7.9 m/s. Out of total wind data, Predominant wind direction during baseline monitoring season is North-east.

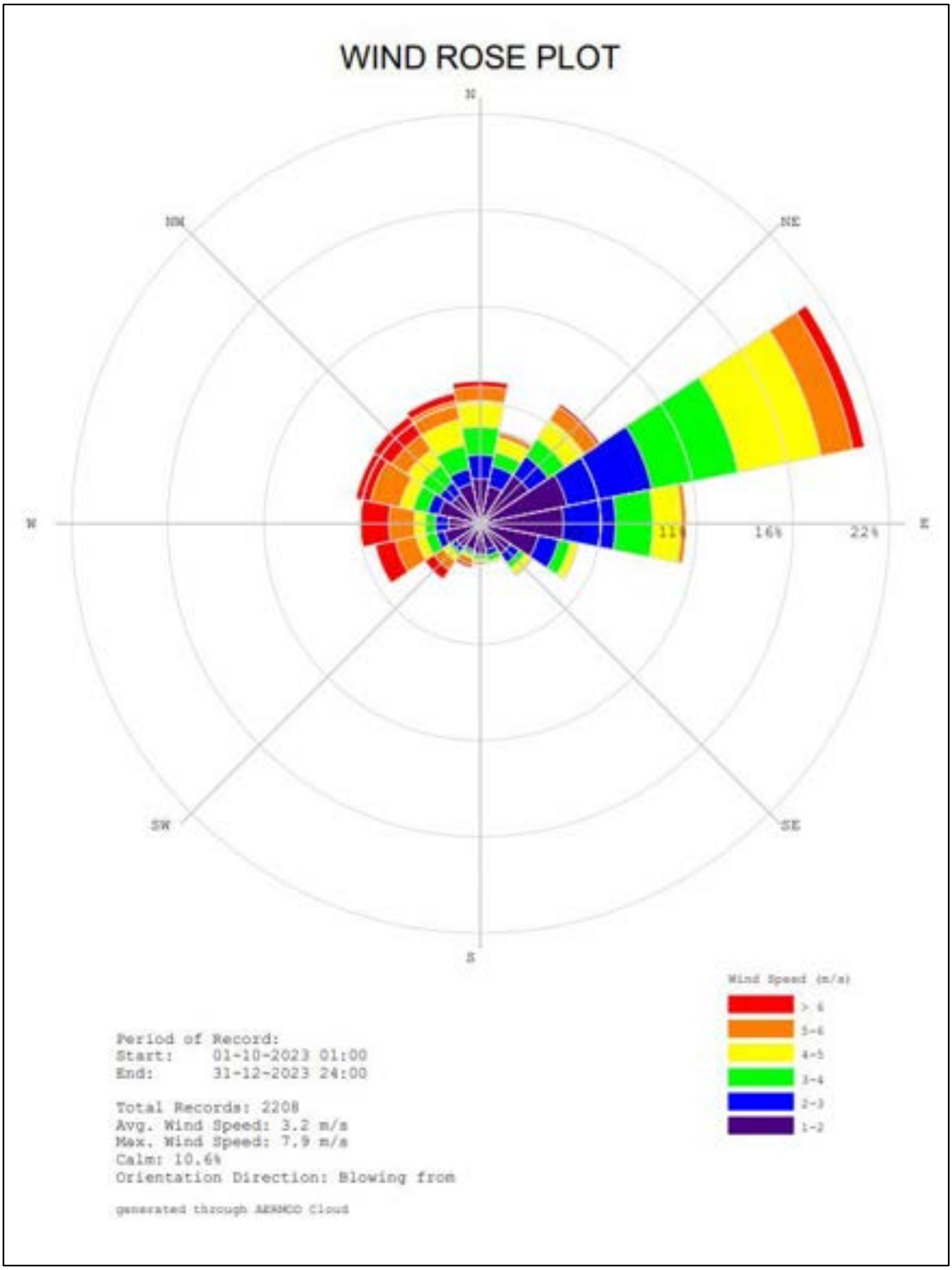


Figure 3-23: Windrose diagram for Winter Season

3.3.2 Air Monitoring

A methodically designed air quality monitoring program will form the basis to determine the impact assessment on air environment, which ultimately helps in formulating a sound Environmental Management Plan (EMP). The basic considerations for designing such program include:

- Representative selection of sampling locations (primarily guided by the topography & micrometeorology of the region)
- Adequate sampling frequency
- Inclusion of all the major pollution parameters

All these aspects were given due consideration for devising an optimal scheme for Environmental Impact Assessment (EIA) around the project site.

3.3.2.1 Reconnaissance Study

The problem of air pollution arises due to heavy traffic density near National Highway 6. There is typical problem of non-availability of buffer zone between the residential zone and the industrial zone, resulting in problems of air pollution. The study area is located in a non urbanized setting and comprises of mostly rural character. Sources of pollution are heavy traffic along NH53.

3.3.2.2 Ambient Air Quality Monitoring (AAQM)

The ambient air quality was assessed as per the limits prescribed under CPCB for National Ambient Air Quality Standards (NAAQS) parameters. Locations for AAQM stations covering different locations on windward and leeward directions, on (probable) routes of raw material transportation, main traffic corridors etc. were selected.

Table below shows the locations of AAQM stations, and the same are indicated in Fig overleaf.

Table 3-12: Schedule of Ambient Air Quality Monitoring

Selection of stations for Ambient Air Monitoring	Along transport routes for raw material transport, at traffic junctions- existing and proposed routes of heavy traffic, on windward and leeward directions.
Locations of AAQM Station	8 locations were monitored . Please refer to Figure and Table below for AAQM stations.
Parameters and No. of Samples at each location	SO_2, NO_x, PM_{10}, $PM_{2.5}$, CO, NMHC- Twice per week for 24 hours X 4 weeks per month for 3 months. Remaining NAAQS parameters - Twice per month X 3 months

Table 3-13: Description of Ambient Air Quality Monitoring Stations

Station Code	Station	Reason for selecting	Distance from site (km)
A1	South to Ramana RF	Residential area at the south of Ramana Forest in upwind Direction	At a distance of 3.68 km in South direction
A2	South to Adtl. MIDC	Residential area at the south west to ramana forest Forest in upwind Direction	At a distance of 1.15 km in Southwest direction

Station Code	Station	Reason for selecting	Distance from site (km)
A3	Shivangaon	Residential village area in downwind direction	At a distance of 1.82 km in East direction
A4	Talati karyalay Mahuli Jahangir	Residential village area near Adtl. MIDC in crosswind	At a distance of 4.06 km in Northwestwest direction
A5	Pimpalvihir	Residential village area near pimpalvihir in crosswind	At a distance of 0.50 km in South direction
A6	National Highway No. 6	Industrial area in upwind direction	At a distance of 5.65 km in East direction
A7	Within proposed site	Within proposed site near existing Adtl. MIDC in downwind direction	Within proposed site in West direction
A8	Digargavahan	Nearest residential area near proposed project site in in downwind direction	At a distance of 0.54 km in North direction

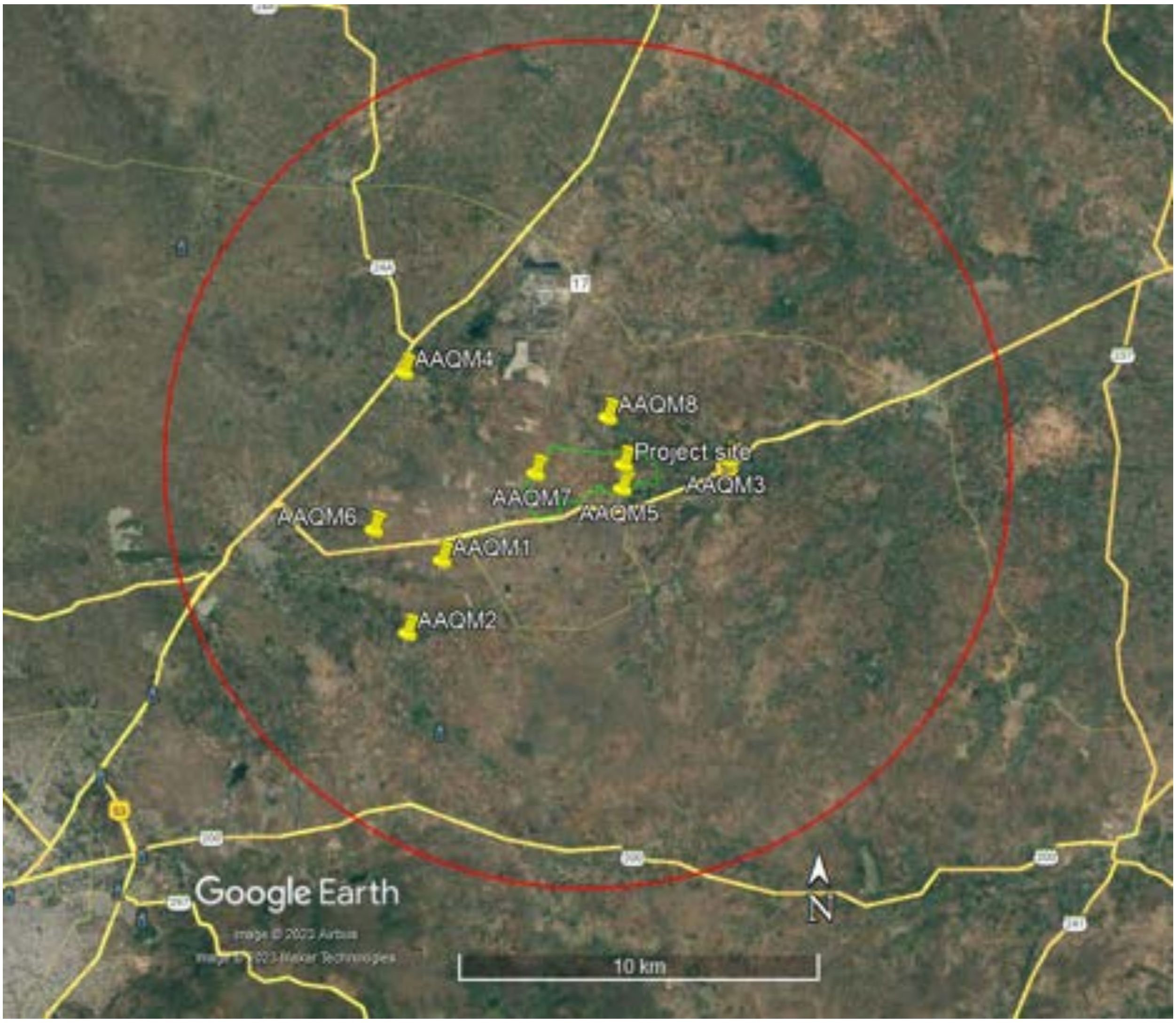


Figure 3-24: AAQM Locations within 10km study area

Table 3-14: Compilation of Ambient Air Quality reports

Location		PM_{10} (µg/m^3)	$PM_{2.5}$ (µg/m^3)	SO_2 (µg/m^3)	NOx (µg/m^3)	CO (mg/m^3)	NH_3 (µg/m^3)	NMHC (mg/m3)	O_3 (µg/ m^3)	Pb (µg/m3)	As (mg/m³)	Ni (mg/m^3)	Benzo-a- pyrene (ng/m^3)
A1	Minimum	95.35	36.08	12.75	17.71	0.24	9.45	0.11	12.48	<0.01	<0.01	<0.01	<0.01
	Maximum	62.33	20.47	7.83	9.89	0.14	6.00	0.04	10.16	<0.01	<0.01	<0.01	<0.01
	Average	72.36	27.32	10.27	13.71	0.19	7.68	0.08	10.98	<0.01	<0.01	<0.01	<0.01
	98th %ile	91.8	35.1	12.7	17.1	0.2	9.1	0.1	12.4	<0.01	<0.01	<0.01	<0.01
A2	Minimum	72.30	30.95	12.64	21.34	0.17	7.65	0.09	11.26	<0.01	<0.01	<0.01	<0.01
	Maximum	55.87	19.73	8.80	12.02	0.07	6.53	0.03	9.65	<0.01	<0.01	<0.01	<0.01
	Average	62.20	24.56	10.67	15.33	0.12	7.08	0.05	10.27	<0.01	<0.01	<0.01	<0.01
	98th %ile	70.6	29.7	12.6	20.9	0.2	7.6	0.1	11.2	<0.01	<0.01	<0.01	<0.01
A3	Minimum	74.10	31.34	13.02	17.79	0.19	6.73	0.08	11.24	<0.01	<0.01	<0.01	<0.01
	Maximum	49.14	16.51	8.04	11.14	0.09	5.74	0.02	8.23	<0.01	<0.01	<0.01	<0.01
	Average	62.70	24.09	10.35	15.09	0.14	6.23	0.05	10.01	<0.01	<0.01	<0.01	<0.01
	98th %ile	72.7	30.4	12.8	17.5	0.2	6.7	0.1	11.2	<0.01	<0.01	<0.01	<0.01
A4	Minimum	74.54	31.79	11.77	16.35	0.16	6.57	0.05	10.56	<0.01	<0.01	<0.01	<0.01
	Maximum	47.28	15.21	7.30	10.13	0.10	5.61	0.02	8.64	<0.01	<0.01	<0.01	<0.01
	Average	59.35	22.69	9.17	13.37	0.13	6.09	0.03	9.76	<0.01	<0.01	<0.01	<0.01
	98th %ile	73.6	30.9	11.5	16.0	0.2	6.6	0.0	10.5	<0.01	<0.01	<0.01	<0.01
A5	Minimum	78.45	29.53	12.96	23.31	0.26	8.53	0.11	12.46	<0.01	<0.01	<0.01	<0.01
	Maximum	56.39	19.34	10.21	18.53	0.15	7.28	0.04	10.72	<0.01	<0.01	<0.01	<0.01
	Average	69.77	25.19	11.43	20.62	0.21	7.90	0.08	11.62	<0.01	<0.01	<0.01	<0.01
	98th %ile	78.0	29.3	12.9	23.2	0.3	8.5	0.1	12.5	<0.01	<0.01	<0.01	<0.01
A6	Minimum	79.17	26.01	14.40	25.31	0.27	8.63	0.15	12.14	<0.01	<0.01	<0.01	<0.01
	Maximum	70.17	21.98	10.49	18.44	0.18	7.36	0.05	10.44	<0.01	<0.01	<0.01	<0.01
	Average	75.35	23.90	12.41	21.96	0.22	7.99	0.08	11.39	<0.01	<0.01	<0.01	<0.01
	98th %ile	79.0	25.8	14.3	25.0	0.3	8.6	0.1	12.1	<0.01	<0.01	<0.01	<0.01
A7	Minimum	61.59	25.86	9.17	19.41	0.18	7.10	0.12	9.14	<0.01	<0.01	<0.01	<0.01
	Maximum	43.42	16.43	6.93	14.66	0.12	6.06	0.04	7.92	<0.01	<0.01	<0.01	<0.01
	Average	56.38	23.53	7.89	16.88	0.14	6.58	0.08	8.49	<0.01	<0.01	<0.01	<0.01
	98th %ile	60.9	25.6	9.1	19.3	0.2	7.1	0.1	9.1	<0.01	<0.01	<0.01	<0.01
A8	Minimum	62.71	28.75	11.07	16.23	0.14	6.60	0.07	9.64	<0.01	<0.01	<0.01	<0.01
	Maximum	51.20	17.24	7.15	11.70	0.11	5.63	0.02	8.36	<0.01	<0.01	<0.01	<0.01
	Average	57.10	22.12	8.82	14.24	0.12	6.11	0.04	8.98	<0.01	<0.01	<0.01	<0.01
	98th %ile	61.7	27.1	11.0	16.2	0.1	6.6	0.1	9.6	<0.01	<0.01	<0.01	<0.01
NAAQ standards		**100**	**60**	**80**	**80**	**2**	**400**	**--**	**100**	**1**	**6**	**20**	**1**

Conclusion: Results are compared with National Ambient Air Quality Standards (NAAQ) in respect of monitored parameters as shown in above Table, it can be noted that all the parameters are within permissible limit. As can be seen from the results, ambient air is well within the NAAQS standards for Industrial and Residential areas.

3.4 Noise Environment

Reconnaissance of site and vicinity shows that there are few villages near the site area like Shivangaon and Dighargavhan. There is no existing industrial activity within the site. Primarily, it was observed that the source of noise is ongoing traffic along the existing roads.

Noise level readings were monitored at 8 locations along the major roads adjacent to the site and other locations sensitive features such as residential, hospitals, schools etc. Monitoring was carried out for 24 hrs at each location, day and night.

Table 3-15: Schedule of ambient air quality monitoring

Selection of stations for Noise monitoring	Stations were selected along major traffic junctions, railway line, on leeward as well as windward side.
Locations	8 Locations in Study area

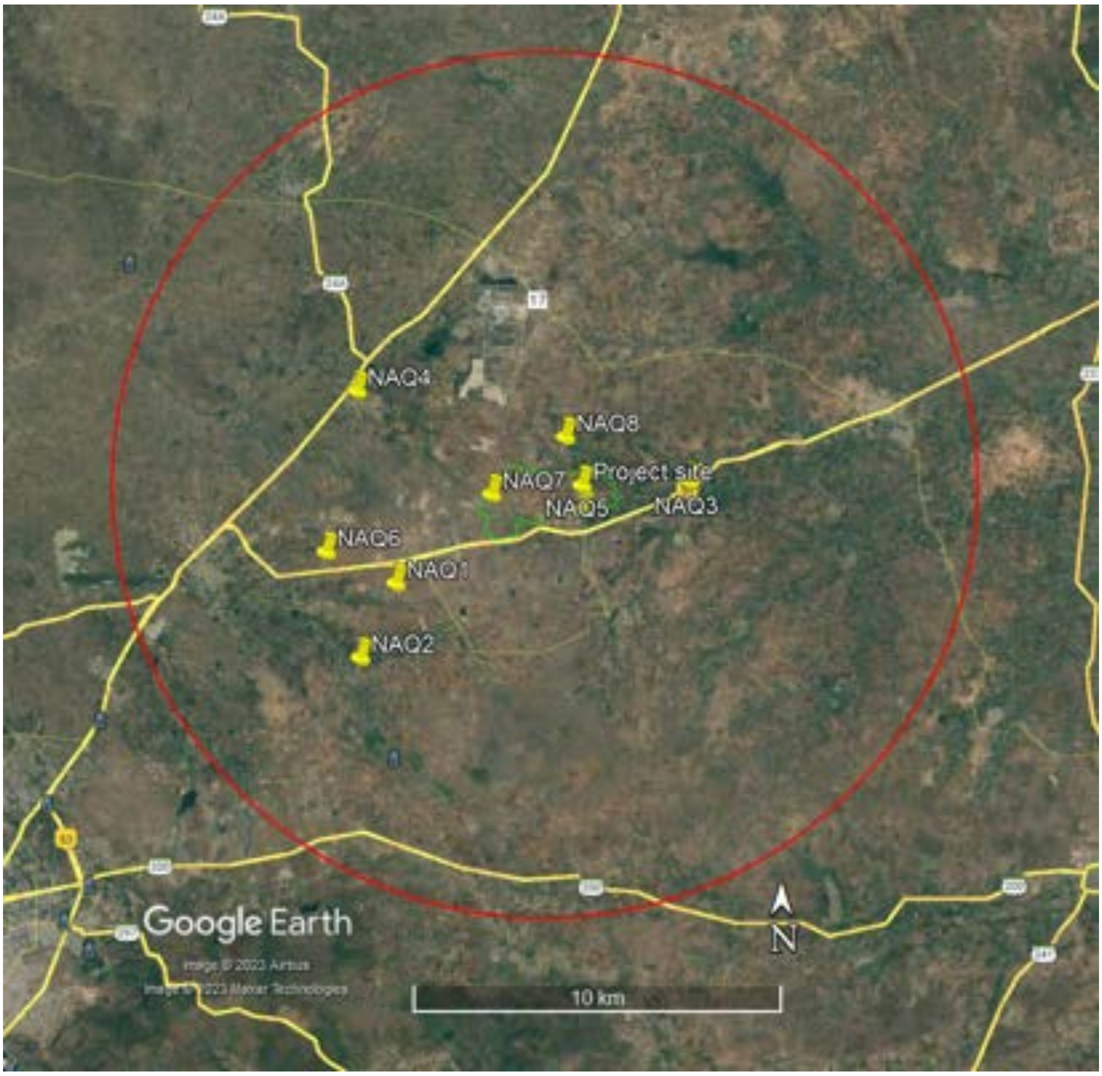


Figure 3-25: Locations of Noise monitoring stations

Table 3-16: Description of Noise monitoring stations

Station Code	Station	Distance from site (km)
N1	Near Ramana RF	At a distance of 3.17 km in Southwest direction
N2	Near Adtl. MIDC before the MIDC forest area	At a distance of 1.15 km in West direction
N3	Shivangaon	At a distance of 1.82 km in East direction
N4	Talati karyalay Mahuli Jahangir	At a distance of 4.06 km in Northwestwest direction
N5	Pimpalvihir near Mumbai-Kolkata Hwy	At a distance of 0.50 km in South direction
N6	Fattepur near Mumbai-Kolkata Hwy	At a distance of 2.16 km in West direction
N7	Within proposed site	Within proposed site in West direction
N8	Digargavahan	At a distance of 0.54 km in Northeast direction

Table 3-17: Compilation of Noise monitoring reports

Station No.	Noise Monitoring Location	Land Use	Day Time L_{eq} [dB(A)]	Night Time L_{eq} [dB(A)]
N1	Near Ramna RF (Jalaka Village)	Industrial	53.9	44.9
N2	Near Additional MIDC before the MIDC forest area (Shevti Village)	Industrial	51.4	41.3
N3	Shivangaon Village	Residential	55.8	45.3
N4	Talathi Village	Residential	52.6	45.0
N5	Pimpalvihir Village Near Mumbai-Kolkata Hwy.	Residential	52.3	47.8
N6	Fattepur Near Near Mumbai-Kolkata Hwy.	Industrial	54.5	47.1
N7	Within Proposed site	Industrial	47.8	39.8
N8	Digargavahan	Residential	54.2	43.8
		CPCB Standards for Residential Areas	**55**	**45**
		CPCB Standards for Commercial Areas	**65**	**55**
		CPCB Standards for Industrial Areas	**75**	**70**

Conclusion: It can be seen from the above table that the noise level reading at Shivangaon Village exceed the EP Act standards at day and night time due to high traffic near Highway. All the locations except Shivangaon are within the standardse.

3.5 Water Environment

3.5.1 Hydrogeology[1]

Basaltic lava flows are the major rock formations along with alluvium, Lameta beds, Gondwana Sediments and unclassified metamorphic rocks. About 70% of the area is underlain by Deccan Traps and remaining by other soft rock formations, particularly the alluvium. A map depicting the hydrogeological features is presented as figure below.

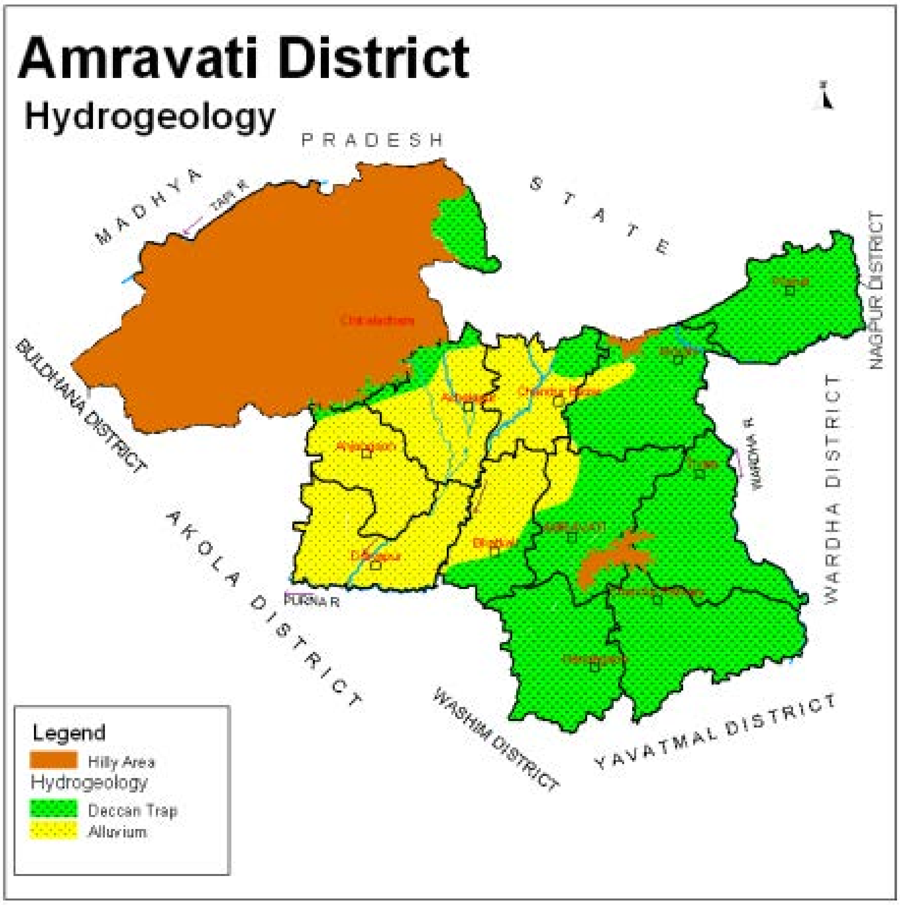
Hard Rock Areas (Deccan Trap Basalt)

Deccan Trap Basalt belonging to upper Cretaceous to lower Eocene age occurs in the northwestern, southeastern and eastern parts of the district. The northwestern part, i.e., Dharni and Chikaldhara talukas, is hilly and rugged terrain where Basalt does not form potential aquifer due to limited thickness of weathered mantle. Ground water in Deccan Trap Basalt occurs mostly in the upper weathered and fractured parts down to 15-20 m depth. At places potential zones are encountered at deeper levels in the form of fractures and inter-flow zones. The upper weathered and fractured parts form phreatic aquifer and ground water occurs under water table (unconfined) conditions. At deeper levels, the ground water occurs under semi-confined conditions.

Soft Rock Areas (Beach Sand/Alluvium)

The Alluvial deposits are termed as Purna Alluvial deposits, as they have been deposited in the Purna valley during Pleistocene to Recent period. Alluvium occupies nearly a third of the district on the northern side along Purna River system stretching over a width of 55 km and an area of 3500 sq. km. alluvium thickness ranges from 10-350 m and is divided into younger and older Alluvium with the younger one being more granular and the older more clayey. Ground water occurs under phreatic and semi-confined conditions down to a depth of 80 m i.e., in the younger Alluvium consisting of alternate beds of clay and sand. Two to five beds of coarse sand and gravel are encountered within the younger Alluvium, which form the productive aquifer. The older Alluvium is mostly clayey with only one or two thin beds of gravel at the base near the trap basement. In the deeper aquifers, ground water occurs in confined state. Younger Alluvium is lacustrine and older is marine in nature. The basement for Alluvium is Basalt met with at different depths, which may be due to pre-trappean topography or due to faults with up thrown and down thrown blocks. Predominant slope of trap basement is northwards.Hydraulic gradient is towards south in the northern part of Purna River and towards north in the southern part of Purna River. Hydraulic gradient is 3.5 m/km in north and about 2.5 m/km in south of Purna River.

[1] “Ground Water Information, Raigarh District, Maharashtra” report published by Central Ground Water Board, Ministry of Water Resources (2013)



Source:CGWA

Figure 3-26: Hydrogeology of Amravati District

3.5.2 Ground Water Scenario[2]

Depth to Water Level – Premonsoon (May – 2011)

The depth to water levels in the district during May 2011 ranges between 2.7 (Pohra) and 27.85 (Chandur bazar) m bgl. Depth to water levels during premonsoon (May 2011) has been depicted in Figure-3. Shallow water levels within 10 m bgl are observed in major parts of the district i.e., in southern parts of the district in parts of Daryapur, Bhatkuli, Amravati, Teosa, and Nandgaon Khandeshwar talukas; northeastern parts of the districts in Warud and Morshi talukas and in northwestern parts of the district in parts of Dharni and Chikaldhara talukas. In central and southern parts of the district comprising major parts of, Anjangaon, Achalapur, Chandur Bazar, Warud and small parts of Daryapur, Bhatkuli, Amravati, Morshi talukas, the water levels rests between 10 and 20 m bgl. Deeper water levels, i.e., more than 20 m bgl are observed in small isolated areas in parts of Anjangaon Surji, Achalpur, Chandur Bazar talukas in central part of the district.

Depth to Water Level – Postmonsoon (Nov. – 2011)

The postmonsoon (Nov. 2011) depth to water levels ranges between 1 m bgl (Kolwihir) and 25.70 m bgl (Chandur bazar). Spatial variation in postmonsoon depth to water level is shown in Figure-4. Shallow water levels within 5 m bgl are observed in major parts of the district i.e., in

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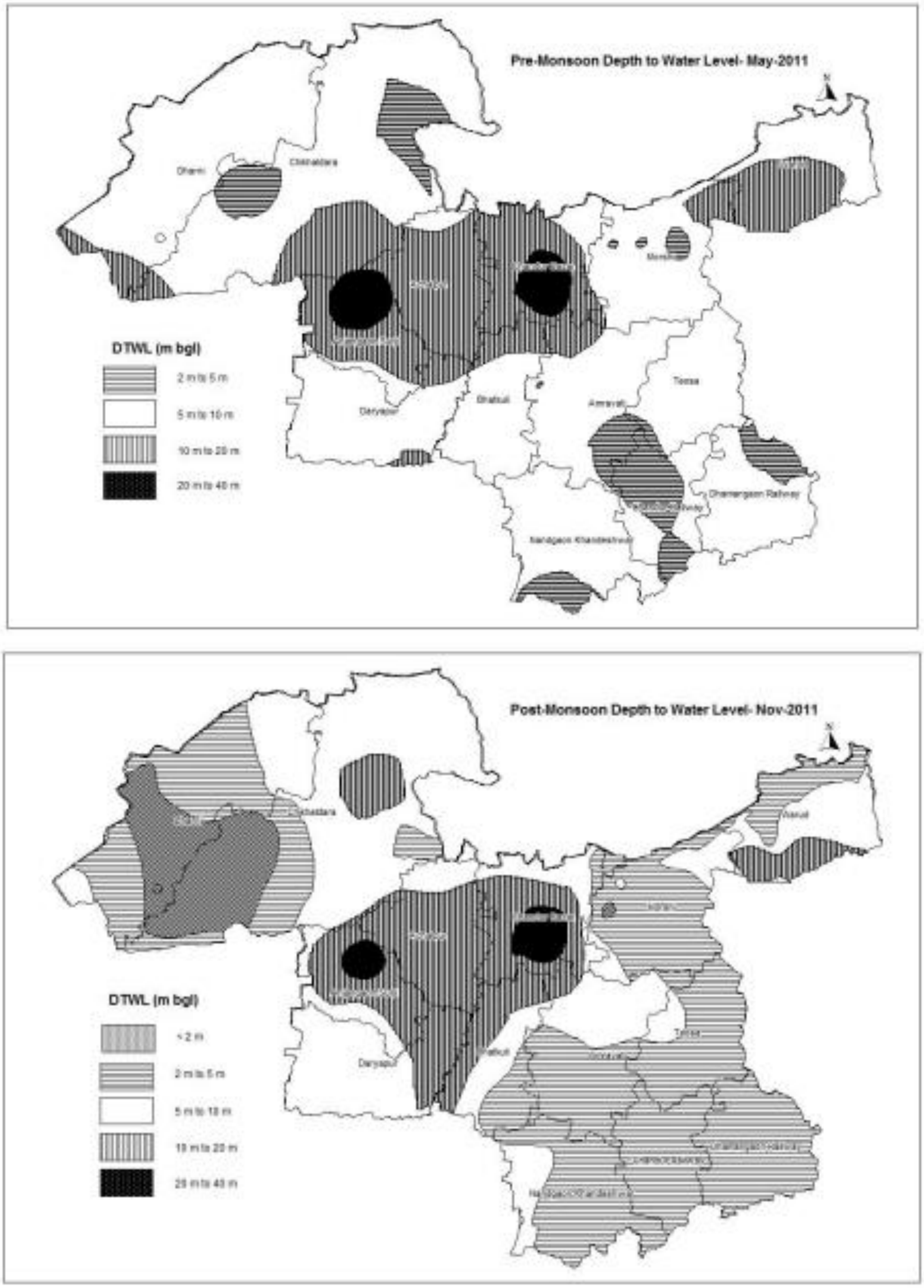
[2] "Ground Water Information, Raigarh District, Maharashtra" report published by Central Ground Water Board, Ministry of Water Resources (2013)

eastern parts of the disctricts in parts of Dharni, Chikhaldara, DTWL from 5m to 10 m bgl in southern part of the district is Daryapur, northern part of Amravati, eastern parts of Warud and morshi and parts of Chikhaldara talukas. In major parts of Anjangaon Surji, Chandur bazaar, Achalpur, parts of Daryapur, Bhatkuli, Warud and Morshi, the water levels are between 10 and 20 m bgl. The deeper water levels of more than 20 m bgl are observed in north central part of the district falling in major parts of Achalpur and Chandur Bazar talukas.

Ground Water Quality

The classification of ground water samples for drinking purpose was carried out based on the desirable and maximum permissible limits for the parameters viz., Ph, EC, TA, TH, NO3 and F prescribed in the IS 10500-91 standards. The study showed that the concentration of parameter such as TA and TH have crossed the maximum permissible limits. Overall, the potability of ground water in the monitored wells has been affected mainly due to high NO3 in ground water. Therefore, it can be concluded that the ground water quality in majority of the area is good for drinking purpose except those places where NO3 concentration crosses MPL.

The quality of water was also checked for irrigation purpose. The water used for irrigation is an important factor in productivity of crop, its yield and quality of irrigated crops. The suitability of irrigation water depends primarily on the presence of dissolved salts and their concentrations. Sodium Adsorption Ratio (SAR) and Residual Sodium Carbonate (RSC) are the most important quality criteria, which determine the water quality and its suitability for irrigation. Overall, the ground water quality in the wells monitored is good for irrigation purpose and there is a less possibility of developing sodium hazard.



Source:CGWA

Figure 3-27: PreMonsoon and Post Monsoon Ground Water Depths (2002-2011)

3.5.3 Surface Water Bodies

Exiting water bodies

Agriculture is the main occupation in Amaravati taluk. The amount of rainfall and its distribution throughout the season contributes to the cropping pattern in the area. There are two agricultural seasons namely Khariff (June - October) and Rabi season (Mid October - Mid

February). The perineal cropped are rare. In the study area, due to medium potential of the ground resource, now day's agricultural irrigation ground water scarcity. However, government of Maharashta constructed farm ponds, Nala bands, cement Nala bund and percolation tanks water for soil and water conservation purpose. In study site most of land fallow land few area has agricultural crops and planation.

The following image indicates the locations of man made surface water bodies like Farm Ponds, Check Dams, Percolation Tanks and water bodies created by excavation existing on the site as observed during field survey.

Figure 3-28: Image indicating locations of man made Surface Water Bodies on Site

Farm ponds

These are artificial created ponds. Three numbers of farm ponds were observed in the study area. All of them were unlined, and it was observed that two were without water and one was with water.

 Farm Pond No 1, Size 20*20*3 meter depth	 Farm Pond No 2, Size 20*20*3 meter depth

Farm Pond No 3, Size 12.15 * 0.750*1.30 meter depth

Check dam 1, Sizes 12.40 * 1.80*2.40 meter depth

Check dam 2 (Size 36*23*4 meter depth)

Check dam 3, Size Length 104 meter * Top width 5 meter * height 3 meter approx.

Percolation Tank

Quarry (Excavation) 1

Quarry (Excavation) 2

Quarry (Excavation) 3

Figure 3-29: Pictures of man made Surface Water Bodies on Site

Figure 3-30: Picture of Natural Spring on Site

The following image indicates locations of Surface Water Bodies on Site

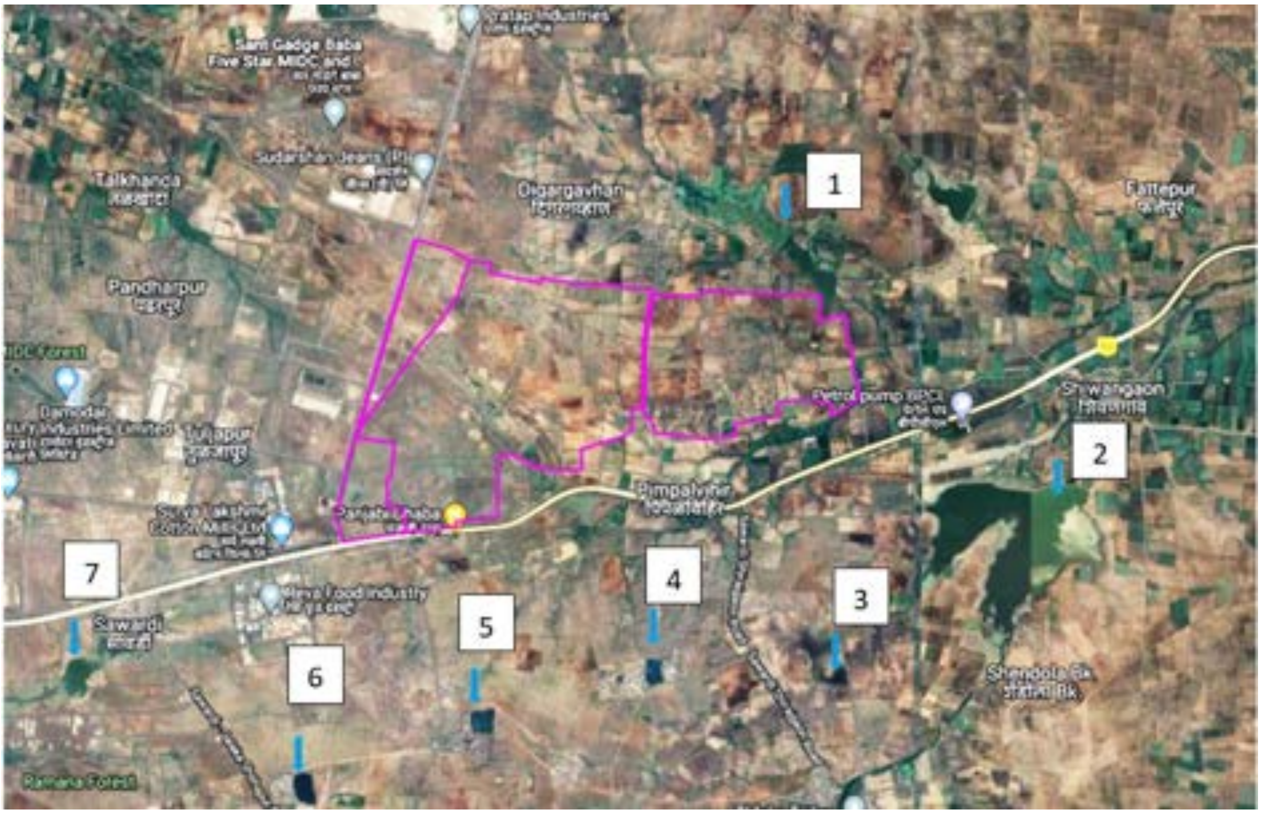


Figure 3-31: Image indicating locations of natural Surface Water Bodies on Site

The locational details and physical features of these surface water bodies are presented in the following table.

Table 3-18: Features of natural surface water bodies occuring on site

Water body no.	Distance from project site boundary	Lat. and Long.	Elevation	Area Sq. meter
1	500 meter	21 02’ 387’’ 77 55’ 34’’	376	50,509
2	1.08	21 01’ 38’’ 77 56’ 24’’	364	8,14,754
3	1.5	21 00’ 56’’ 77 55’ 01’’	395	25,456
4	1.6	21 00’ 55’’ 77 55’ 01’’	396	20,583
5	1.5	21 00’ 41’’ 77 54’ 17’’	397	667
6	2	21 00’ 26’’ 77 53’ 29’’	402	40,149
7	2.2	21 00’ 52’’ 77 52’ 30’’	377	1,15,157

Source: Field Survey

3.5.4 Ground Water Monitoring

Ground water was collected from open wells / borewells within study area. the results of the sample are given in the table below. The figure below shows snapshots of the monitoring team collecting well water samples.

Table 3-19: Schedule of ground water quality monitoring

Locations for Monitoring	8 samples of open wells / borewells within study area-Please refer to Figure and Table below for ground water monitoring stations.
Basis for Selection	To ascertain potability of water
Parameters to be Monitored	All parameters as per IS 10500: 2012

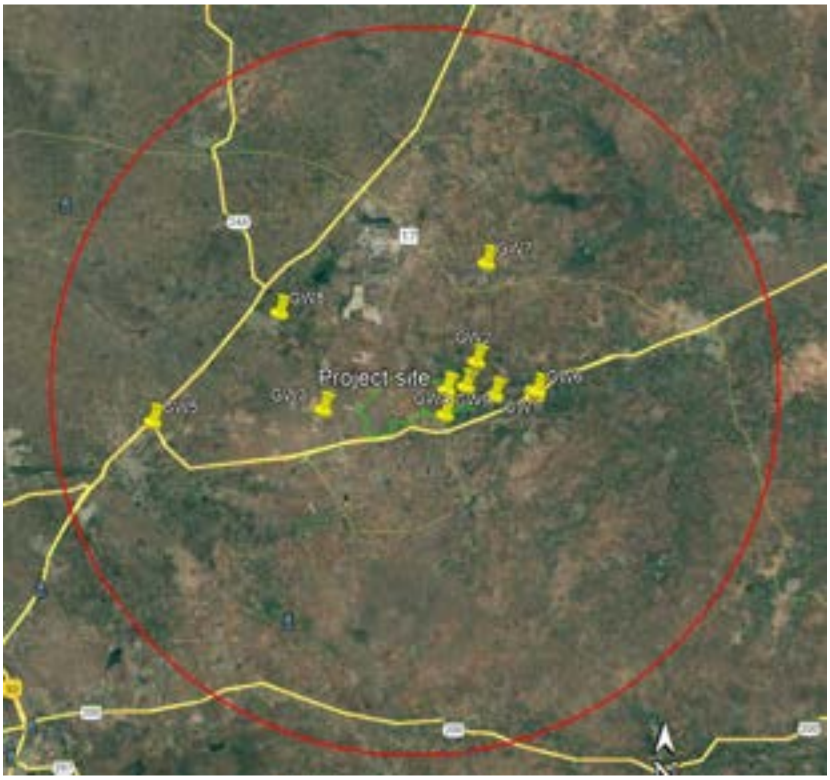


Figure 3-32: Locations of Ground Water sampling stations

Table 3-20: Description of Ground Water monitoring stations

Station Code	Station Name	Approx. distance from site boundary (km)
GW1	Open well near Petrol pump BPCL	At a distance of 0.45 km in East direction
GW2	Shiwangaon	At a distance of 0.22 km in Northeast direction
GW3	Open well within Proposed IA	Within the project site in East direction
GW4	Nandgaon Peth near Sarawati Gosavi Vidyaashram	At a distance of 6.79 km in West direction
GW5	Open well near Shiwangaon	At a distance of 1.82 km in East direction
GW6	Open well Near Nagdev temple, Kapustalani	At a distance of 3.41 km in Northeast direction
GW7	Open well near Mahuli Jahangir	At a distance of 3.86 km in Northwest direction
GW8	Open well near pimpalvihir	At a distance of 0.52 km in South direction

Nandgaon Peth near Sarawati Gosavi Vidyaashram

Open well Near Nagdev temple, Kapustalani

Open well near Mahuli Jahangir

Figure 3-33: **Photographs of Ground Water sampling within study area**

The water quality data for all the 17 stations is presented in table below and compared with IS 10500:2012 values.

Conclusion: Ground water quality meets most of the norms of Physico-chemical parameters as per IS 10500: 2012. However, the samples do not meet microbiological requirement in terms of Coliform content. This maybe due to washing of animals, bathing and/or presence of septic tanks at/near the open wells.

Table 3-21:: Analysis results of Ground Water Sample

Sr. No	Parameter	GW1	GW2	GW3	GW4	GW5	GW6	GW7	GW8	Limits as per IS 10500:2012		Method of Analysis
										Desirable	Acceptable	
1	Colour, Hazen	5	5	5	5	5	5	5	5	5 Max	15 Max	IS-3025(P-4) RA2017
2	pH@ 25°C	7.15	7.38	7.47	7.14	7.42	7.67	7.58	7.24	6.5 – 8.5	6.5 – 8.5	IS-3025(P-11) RA2017
3	Turbidity, NTU	2.4	2	2.2	2.4	2.4	2.4	2.2	2.2	1 Max	5 Max	IS-3025(P-10) RA2017
4	TDS, mg/l	680	700	570	420	740	700	580	480	500 Max	2000 Max	IS-3025(P-16) RA2017
5	NH3(as N)	< 0.56	< 0.56	< 0.56	<0.56	< 0.56	<0.56	< 0.56	< 0.56	0.5 Max	0.5 Max	IS-3025(P-34) RA2019
6	Boron	< 0.05	< 0.05	< 0.05	<0.05	< 0.05	<0.05	< 0.05	< 0.05	0.5 Max	2.4 Max	IS-3025(P-57) RA2017
7	Calcium as Ca, mg/l	139.2	128	89.6	81.6	130	115.2	92	96	75 Max	200 Max	IS-3025(P-40) RA2019
8	Chlorides, mg/l	110	92	80	45	135	120	120	60	250 Max	1000 Max	IS-3025(P-32) RA2019
9	Fluoride, mg/l	0.32	0.32	0.34	0.3	0.32	0.32	0.34	0.32	1.0 Max	1.5 Max	IS-3025(P-60) RA2019
10	Free ResCl2, mg/l	0.58	0.58	0.58	0.56	0.58	0.56	0.58	0.56	0.2 Min	1.0 Min	IS-3025(P-26) RA2019
11	Iron, mg/l	0.03	0.03	0.031	0.031	0.03	0.031	0.031	0.04	1.0 Max	1.0 Max	IS-3025(P-53) RA2019
12	Magnesium as Mg, mg/l	37.9	24.96	23.3	13.1	65	23.8	38.4	20.4	30 Max	100 Max	IS-3025(P-46) RA2019
13	Sulphate	120	104	98	50	165	115	100	80	200 Max	400 Max	IS-3025(P-24) RA2019
14	Alkalinity	520	438	328	360	480	372	350	396	200 Max	600 Max	IS-3025(P-23) RA2019
15	Hardness	504	424	320	258	430	386	388	324	200 Max	600 Max	IS-3025(P-21) RA2019
16	Odour	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable		IS-3025(P-5) RA2017
17	Aluminum, mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.03	0.2	IS-3025(P-55) RA2019
18	Detergents, mg/l	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	0.2	1.0	APHA-2017(5540-C)
19	Arsenic, mg/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.01 Max	No Relaxation	IS-3025(P-37) RA2019
20	Barium, mg/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.7	0.7	APHA-2017(3111-D)
21	Copper, mg/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.05	1.5	IS-3025(P-42) RA2019
22	Manganese, mg/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.1	0.3	IS-3025(P-59) RA2019
23	Chromium, mg/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.05 Max	No Relaxation	IS-3025(P-52) RA2019
24	Zinc, mg/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	5	15	IS-3025(P-49) RA2019

Sr. No	Parameter	GW1	GW2	GW3	GW4	GW5	GW6	GW7	GW8	Limits as per IS 10500:2012		Method of Analysis
										Desirable	Acceptable	
25	Nitrate, mg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	45	45	IS-3025(P-34) RA2019
26	Selenium, mg/l	<0.1	<0.7	<0.4	<0.7	<0.1	<0.5	<0.6	<0.3	0.01	0.01	IS-3025(P-56) RA2019
27	Lead, mg/l	<0.2	<0.7	<0.4	<0.7	<0.1	<0.5	<0.6	<0.1	0.01	0.01	IS-3025(P-47) RA2019
28	Molybdenum, mg/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.07 Max	No Relaxation	APHA-2017(3111-D)
29	Nickel, mg/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.02 Max	No Relaxation	IS-3025(P-54) RA2019
30	Sulphide, mg/l	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.05	0.05	IS-3025(P-29) RA2019
31	Cadmium, mg/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	0.003	0.003	IS-3025(P-41) RA2019
32	Phenolic comp, mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.001	0.002	IS-3025(P-43) RA2019
33	Mercury, mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.001 Max	No Relaxation	IS-3025(P-48) RA2019
34	Sodium as Na mg/l	10	10	12	10	6	24	15	10	NS	NS	APHA-2017(3111-B)
35	Potassium as K mg/l	12	6.8	14	15	5	22	12	8	NS	NS	APHA-2017(3111-B)
36	Conductance @ 25 °C, µS/cm	1062.5	1093.75	890.625	656.25	1156.25	1093.75	906.25	750	NS	NS	IS-3025(P-14) RA2019
37	Chloramines, mg/l	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	4.0	4.0	APHA-2017(4500CL-G)
38	Mineral oil, mg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.5	0.5	IS-3025(P-39) RA2019
39	Silver, mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	0.1	APHA-2017(3111-B)
40	Cyanide, mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	0.05	IS-3025(P-27) RA2019

Microbiological Analysis

Parameter	Result								Limit as per IS 10500:2012	Method of Analysis
	GW1	GW2	GW3	GW4	GW5	GW6	GW7	GW8		
Coliform	Present /100ml	Present /100ml	Present /100ml	Present /100ml	Present /100ml	Present /100ml	Present /100ml	Present /100ml	Absent	APHA 9221 B 23rd edition 2017
E. coli	Present /100ml	Present /100ml	Present /100ml	Present /100ml	Present /100ml	Present /100ml	Present /100ml	Present /100ml	Absent	APHA 9221 G-2 23rd edition 2017

***Note: BDL**: Below detection limit*

Remark: Water sample is potable as per IS 10500-2012 w.r.t. above mentioned test, NS - Not specified

3.5.5 Surface Water Monitoring

Samples from 10 locations was analysed for surface water quality. The same are described in the table below. The figure below shows snapshots of the monitoring team collecting surface and marine water samples on site.

Table 3-22: Schedule of surface water quality monitoring

Locations for Monitoring	10 samples from surface water bodies within study area. Please refer to the figure and the table presented below.
Basis for Selection	To estimate level of pollution in surface water bodies
Parameters to be Monitored	To analyse surface water quality as per IS 2296:1982 Surface Water Quality Standards

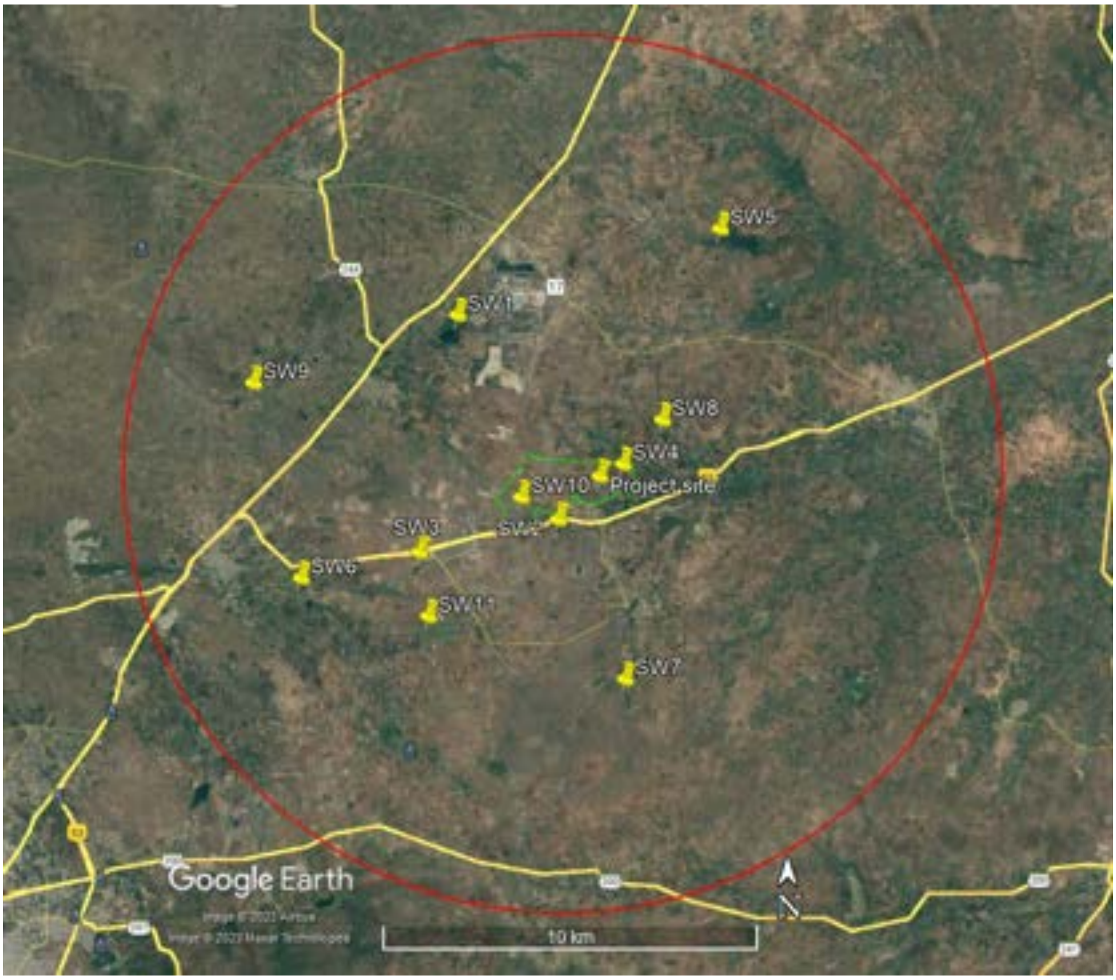


Figure 3-34: Locations of Surface Water sampling stations

Table 3-23: Description of Surface Water monitoring stations

Station Code	Station Name	Approx. distance from site boundary (km)
SW1	Wagholi Dam reservoir	At a distance of 3.90 km in Northwest direction
SW2	Pimpalvihir Reservoir	At a distance of 0.57 km in South direction

Station Code	Station Name	Approx. distance from site boundary (km)
SW3	Sawardi Reservoir	At a distance of 2.69 km in Southwest direction
SW4	Kekatpur dam, reservoir	At a distance of 6.38 km in Northeast direction
SW5	Bor River near Sangmeshwar Dam	At a distance of 5.90 km in West direction
SW6	Sawardi Shirajgaon reservoir	At a distance of 5.26 km in South direction
SW7	Digargavhan	At a distance of 1.12 km in Northeast direction
SW8	Natural drain near ukali	At a distance of 7.24 km in Northwest direction
SW9	Seasonal Nallah Inside the project Site	At a distance of 1.22 km in West direction
SW10	Jalaka Reservoir	At a distance of 3.65 km in Southwest direction


Wagholi Dam reservoir


Kekatpur dam, reservoir


Jalaka Reservoir


Sawardi Shirajgaon reservoir

Figure 3-35: Photographs of Surface Water sampling within study area

Table 3-24: Analysis Results of Surface Water Sampling

Sr. No	Parameter	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8	SW9	SW10
1	Colour, Hazen	5	5	5	5	5	5	5	5	5	5
2	pH@ 25°C	7.35	7.77	7.35	7.88	7.5	7.66	7.44	7.95	7.24	7.8
3	Turbidity, NTU	2.2	2.2	2.4	2.4	2.4	2.4	2.4	<2.0	2.2	2.4
4	Total Dissolved Solids, mg/l	740	160	290	230	420	210	210	580	460	170
5	Ammoniacal Nitrogen	< 0.56	< 0.56	< 0.56	< 0.56	<0.56	<0.56	< 0.56	< 0.56	< 0.56	< 0.56
6	Boron as B, mg/l	< 0.05	< 0.05	< 0.05	< 0.05	<0.05	<0.05	< 0.05	< 0.05	< 0.05	< 0.05
7	Calcium as Ca, mg/l	115.2	28	36	32	73.6	30.4	30.4	56	96	28
8	Chlorides as Cl-, mg/l	79	20	45	26	45	26	32	95	55	22
9	Fluoride as F, mg/l	0.32	0.32	0.32	0.34	0.32	0.32	0.32	0.34	0.34	0.34
19	Free ResCl2, mg/l	0.56	0.56	0.58	0.56	0.56	0.56	0.58	0.56	0.58	0.58
11	Iron as Fe, mg/l	0.031	0.04	0.03	0.031	0.031	0.031	0.03	0.031	0.031	0.031
12	Magnesium as Mg, mg/l	45.7	9.72	16.5	14.58	14	14	14	60.2	20.4	12.1
13	Sulphate as SO42-, mg/l	352	24	38	35	48	33	30	120	75	30
14	Alkalinity as CaCO3, mg/l	180	140	180	160	320	170	170	412	396	130
15	Hardness as CaCO3, mg/l	476	110	158	140	242	134	134	388	324	120
16	Odour	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
17	Aluminum as Al, mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
18	Detergents, mg/l	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
19	Arsenic as As, mg/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
20	Barium as Ba, mg/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
21	Copper as Cu, mg/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
22	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
23	Chromium as Cr, mg/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
24	Zinc as Zn, mg/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1

Sr. No	Parameter	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8	SW9	SW10
25	Nitrate as NO3-, mg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
26	Selenium as Se, mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
27	Lead as Pb, mg/l	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
28	Molybdenum as Mo, mg/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
29	Nickel as Ni, mg/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
30	Sulphide, mg/l	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
31	Cadmium as Cd, mg/l	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
32	Phenolic comp, mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
33	Mercury as Hg, mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
34	Sodium as Na mg/l	24	4	10	4	8	8	8	18	10	4
35	Potassium as K mg/l	22	4	12	6	6	6	6	20	8	2
36	Electrical Conductance @ 25 °C, µmhos/cm	1156.25	250	453.125	359.375	656.25	328.125	328.125	906.25	718.75	265.625
37	Chloramines, mg/l	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
38	Mineral oil, mg/l	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
39	Silver, mg/l	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
40	Cyanide, mg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
41	PCB, mg/l	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
42	PAH, mg/l	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
44	Bromoform	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
45	Dibromochloromethane	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
46	Bromodichloromethane	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
47	Chloroform	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
48	Alachlor, µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
49	Atrazine, µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0

Sr. No	Parameter	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8	SW9	SW10
50	Aldrin, µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
51	Alpha HCH, µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
52	Beta HCH, µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
53	Butachlor, µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
54	Chlorpyriphos, µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
55	Delta HCH, µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
56	2,4Dichloro PAA, µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
57	DDT, µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
58	Endosulphan, µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
59	Ethion, µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
60	Lindane, µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
61	Isoproturon, µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
62	Malathion, µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
63	Methyl parathion, µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
64	Monocrotophos, µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
65	Phorate, µg/l	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
66	DO,mg/l	6.2	6.4	6.4	6.1	6.8	6.6	6.6	6.6	6.2	6.4
67	BOD, mg/l	6.9	3.9	3.9	6.9	3.8	6.9	6.9	6.4	6.8	3.5
68	COD, mg/l	20	10	10	20	10	20	20	20	20	10

Microbiological Analysis

Parameter	Result									
	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8	SW9	SW10
Coliform	>1600 MPN/100ml	240 MPN/100ml	540 MPN/100ml	540 MPN/100ml	>1600 MPN/100ml	70 MPN/100ml	350 MPN/100ml	>1600 MPN/100ml	>1600 MPN/100ml	540 MPN/100ml

Note: BDL: Below Detection Limit DL- Detection Limit

*The test parameters marked with an * are not accredited by NABL*

NS - Not specified

Table 3-25: CPCB Criteria for Designated Best Use for Water Quality

Sr. No	Parameter	Designated Best Use Water Quality Criteria, CPCB				
		A	B	C	D	E
1	pH	6.5 to 8.5	6.5 to 8.5	6 to 9	6.5 to 8.5	6.0 to 8.5
2	Dissolved Oxygen, mg/l	>6	>5	>4	>4	NS
3	Ammonia as N, mg/l	NS	NS	NS	<1.2	NS
4	Boron (as B), mg/l	NS	NS	NS	NS	2
5	Electrical Conductance at 25 °C, µS/cm	NS	NS	NS	NS	2250
6	Biochemical Oxygen Demand @27°C 3 days, mg/l	<2	<3	<3	NS	NS
7	Sodium Adsorption Ratio, %	NS	NS	NS	NS	26
8	Total Coliform by MPN/100ml	<50	<500	<5000	NS	NS

Surface Water Observations:

- The pH value was observed to be ranging from 7.2 to 7.9, were meeting class A as per prescribed standards Designated Best use Water Quality criteria by CPCB.
- Dissolved oxygen is in range of 6.1 mg/l to 6.8 mg/l, were meeting class C as per prescribed standards Designated Best use Water Quality criteria by CPCB
- Electrical conductivity in all samples were ranging from 250 µS/cm to 1156.2 µS/cm, within standard. Electrical conductivity is specified only for Class E water quality.
- Biochemical Oxygen Demand ranging from 3.5 mg/l to 6.9 mg/l, were meeting class C as per prescribed standards Designated Best use Water Quality criteria by CPCB.
- Total coliform values ranging from 70 mg/l to <1600mg/l, were meeting class C as per prescribed standards Designated Best use Water Quality criteria by CPCB.

From above, it is observed that Samples were meeting class of C (Drinking water source after conventional treatment and disinfection) as per classification for use of water quality criteria by CPCB from Class A to E.

3.6 Biological Environment

3.6.1 Introduction

The study report comprises of findings of extensive ecology and biodiversity study carried out in the winter 2023. The report presents biogeographical features, forest types and forest fauna of Amravati and details from site survey. The abundance impacts, proposed conservation and management plan and mitigation measures to be implemented are also mentioned.

3.6.2 Biogeographical features and Forest Type of Amaravati Division

According to "India State of Forest Report, 2021", Forest survey of India; forest cover in Amaravti District is 25.95% of geographical area (km2) distribution of forest cover is presented below:

Table 3-26: Distribution of forest cover of Amaravati Division

District	Geographical Area	Very Dese Forest	Moderately Dense Forest	Open Forest	% of geographic area	Scrub
Amaravati	12210	618.47	1458.36	1091.28	25.95	112.82

Forest Types

The forests found in Amaravati Forest Division are classified as Tropical Deciduous Forest specifically Southern Tropical Dry Deciduous Forests according to Champion and Seth's revised classification of the forest types in India (5A/C). However due to factors like uncontrolled heavy grazing, illicit and frequent fires Certain local variations of subtypes are noticed.

The forest are found in undulating terrain. The soil is derived from the underlaying trap and general is highly compact with little sub-soil moisture. Majority of forest are belongs to all India Teak site qualities IV, III/IV and patches of III.

As per Champion and Seth's classification, following local sub types are distinguished in Amaravati.

Table 3-27: Forest Classification and Local Sub types

Group	Champion and Seth's Classification	Local Subtype
Group 5	Tropical Deciduous Forest	
Subgroup 5A	Southern Tropical Dry Deciduous Forests	
Climax Type		
5A/C i a	Southern Tropical Dry Deciduous Forests	Very Dry Teak Bearing Forests
5A C I b	Southern Tropical Dry Deciduous Forests	Dry Teak Bearing Forests
5A/E2	Southern Tropical Dry Deciduous Forests	Boswellia Forest (Sali Forest)
5A/E3	Southern Tropical Dry Deciduous Forests	Babul Forest
5A/E4	Southern Tropical Dry Deciduous Forests	Hardwickia Forest
5A/C3	Southern Tropical Dry Mixed Deciduous Forests	Open Mixed Forests
5A/DS4	Southern Tropical Dry Deciduous Forests	Dry Grassland
5A/DS2	Southern Tropical Dry Deciduous Forests	Dry Savanna Forest
5A/IS 1	Southern Tropical Dry Deciduous Forests	Dry Trpopical Riverian Forest

Storey of Amaravati Forest Division

A. **Top Storey**:

1. Principle Associates: Dhawada- *Anogeissus latifolia*, Ain – *Terminalia aalta*, Tiwas - *Ougeinia oojeinensis*, Lendia – *Lagerstroemia parviflora*, Tendu – *Diospyros melanoxylon*, Haldu – *Adina cordifolia*.

2. Other Associates: Satpuda – *Dalbergia paniculata*, Bhera – *Chloroxylon swietenia*, Kalam – Mitragyna parviflora, Rohan – Soyamida febrifuga, Salai- *Boswellia serrata*, Semal – *Bombax ceiba*, Beheda -*Terminalia belerica*, Shisham – *Dalbergia latifolia*, Bija – *Ptercarpus marsupium*, Bel – *Aegle mormelos*.

B. Under Storey:

1. Trees: Amaltas – *Cassia fistula*, Awala- *Emblica officinalis*, Char – *Buchanania lanzan*, Dudhi-*Wrightia tinctoria*, Ghoti – *Ziziphus xylopyrus*, Palas - *Butea monosperma*, Dhaman -*Grewia tiliifolia*, Moyen – *Lannea grandis*, Bartondi – *Morinda tinctoria*, Girguti - *Flacourtia indica*, Feta – *Gardenia turgida*.

2. Shrubs: Bharati – *Gymnosporia montana*, Parijatak – *Nyctanthes arbor tristis*, Murud sheng – *Helicteres isora*, Dhayati- *Woodfordia fruticosa*, Raimunia – *Lantana Camera*, Tendu – *Diospyros melanoxylon*, Nirgundi – *Vitex negundo*, Tarta – *Cassia tora*.

3. Grasses: Bhurbhusi – *Eragrostis tenella*, Kusal – *Andropogon contortus*, Pochati – *Apluda mutica*, Marvel – *Dichanthium annulatum*, Harali- *Cynodon dactylon*, Paonya – Sehima sulcatum.

4. Climbers: they are few and are confined to moist localities. Palasbel – *Butea superba*, Mahul – *Bauhinia vahlii*, Pivervel – *Combretum ovalifolium*, Chilati – *Acacia pennata*, Iruni – Ziziphus oenoplia, Gunj -Abrus precatorius, Kasu karanda - *Dioscorea bulbifera*, Nigud - Vitex trifolia, Raktipaiti – *Ventilago madraspatana*.

2. Degraded Scrub Forests

They are actually an extension of teak forests indicating their degradation to such an extent to be reduced to scrub forests with little or no growth of trees. Majority of this area lies adjoining or very near to the villages and so had been bearing acute pressure for long. So degradation of these forests has set in over the years mainly as a result of heavy unregulated grazing, frequent fires and heavy felling for wood and other purposes. The soil is generally murumy, very dry and highly compact and lies bare without any humus. The moisture content and moisture retention capacity of these forests are very low. Trees, if found stand a part singly or small groups. They are generally crooked and very low in height and quite often retain the shrubby character. Thorny shrubs are found scattered along with a variety of grasses.

Following species are generally found:

1) Trees and Shrubs: Teak – *Tectona grandis*, Tendu – *Diospyros melanoxylon*, khair – *Acacia catechu*, Amaltas -*Cassia fistula*, Palas – *Butea monosperma*, Bharat-*Gymnosporia montana*, Dhayati – *Woodfloridia fruticosa*, Hiwar – *Acacia leucophloea*, Ghoti – *Zizyphus xylopyra*, Nirgudi -*Vitex negundo*.

2) Grasses: Kusal – *Heteropogon contortus*, Kunda – Ischaemum pilosum, Bhurbhushi- *Eragrostis tenella*.

3. **Babul Forest**: these are widely scattered in strips and patches, occurring along river banks and small nalas near villages. The crop consist of pure Babul wherever the Babul has failed to establish itself, it has been replaced by other species. Generally, two species of babul are common 1. Babul (*Acacia nilotica*) and other is Kawarli (*Acacia planifrons*).

The pure patch of Babul occurs mostly in black cotton soil. They were planted under agri - silvicultural method. The plantation are mostly successful where there is black cotton soil, but at place where soil is poor and shallow it has been replaced by open scrub forest in which Hiwar (*Accacia leucophloea*), Khair (*Acacia catechu*), Bor (*Zizyphus jujuba*), Palas (*Butea monosperma*), Neem (*Azardirachta indica*)etc. have come up. Surviving Babul has become scrubby. In good black cotton soil the babul attain height of 10 to 12 m in thirty year. In poor soil the plantation of Anjan (*Hardwickia binata*), and neem have been raised successfully. Babul Forest situated on the banks of Nalas, the main species found are Shindi (*Phoenix sylvestris*), Arjun (*Terminalia arjuna*), Hiwar (*Accacia leucophloea)*, and Siris (I). Most of the babul Forests do not have under storey. In open and sparse area *Cassia tora*, *Gymnosporia spinosa* and *lantana camera* are found.

4. **Anjan Forest**

Hardwickia Forests are found in patches with babul forest along with nalas banks and near to villages and the areas where it has been planted. The established pure forests of Anjan are not common. Due to heavy lopping for leaves as fodder most of trees are found in pollarded conditions. It is mainly found on shallow hard gravelly soils over trap but occurs on variety of other rocks mixed with other trees. It is found in pure form as well as association with Salai, Babul, Neem, Tendu, Teak etc.

5. **Open Mixed Forests**:

These forests are generally open and are of site quality IV. These are ground over on tops of ridges, upper slopes and along the unfavorable aspects. It is also found on the hill slopes in shekhadi, Mehedari, Lakhara blocks of Salai as the predominant species. Heavy grazing has led to thorny plant population. Grasses are found in open area. The following species are found:

I. Dhawada, Ain, Anjan, Bhirra, Khair, Chandan (in sparse) etc.

II. Bharati, Borati

III. Kusal, Pochati, Paunya etc.

6. **Dry grassland and dry Savannah Forest**:

This forest represents the degradation stages where the forest cover has been destroyed. The soil is shallow with underlying impermeable rock bed. The common grass species found are *Heteropogon contortus*, *Sehima nervosum*, *Andropogon pumilus*, *Triandra quadrivalvis* etc. the woody species found : *Acacia catechu*, *Bauhinia racemosa*, *Butea Monosperma*, *Boswellia serrata*, Diospyros melanoxylon, Acacia leucophloea, *Flacourtia indica* etc.

3.8.1 Forest Fauna of Amaravati Forest Division

The Amaravati Forest Division is not very rich in wildlife. The bulk of forest lie in scattered blocks spread all over the division. As such these forests do not afford natural abode for variety of wildlife. The wildlife is mainly herbivores also occurs in Agricultural areas of district. The herbivores mainly Black bucks and Nilgai (Blue Bull) occurring in large number resulted in crop raiding and become perennial problem for farmers, thereby increasing main animal conflict.

1. Carnivore: Panther (*Panthera Pardus*), Hyena (*Hyaena hyaena*), Jackal (*Canis Lupus*), India Fox (*Vulpes bengalensis*), Jungle Cat (*Felis Chaus*) etc.
2. Herbivore: Sambar (*Cervus unicolor*), Barking Deer (*Muntiacus muntjak*), Spotted Deer (*Axix axis*), Blue bull (*Boselaphus tragocamelus*), common Langur (*Presbytis entellus*), Black Napped Hare (*Lepus nigricollis*), Black buck (*Antilope cervicapra*) Rhesus Macaque (*Macaca multta*), Common Grey Mongoose (*Herpestes edwardsii*)etc.

3. Omnivore: Civet Cat (*Paradoxurus hermaphroditus*), Sloth bear (*Melursus ursinus*), Wild Boar (*Sus scrofa*), Porcupine (*Hystrix indica*) etc.
4. Aves: Most common birds are common Babbler (*Turdoides caudatus*), Jungle babbler (Turdoides striatus), Small Bee Eater (Merops Orientalis), Red Vented Bulbul (Pycnonotus cafer), Spotted Dove (Streptopelia chinensis), Black Drongo (Dicrurus macrocercus), Cattle Egret (*Bubulcus ibis*), Little Egret (Egretta garzetta), grey Heron (Ardea cinerea), Pond Heron (*Ardeola gryayii*), Common Hoope (Upupa epops), Black ibis (*Pseudibis papillosa*), Grey Jungle fowl (Gallus sonnerati), Small Black King Fisher (Alcedo atthis) etc.

3.6.3 Survey Methodology

Desktop review was carried out before conducting actual on-site surveys to determine habitats or ecosystems for on-site ecology-biodiversity assessments. The study area was carefully scanned through using Google Earth Pro imagery to identify and locate the prominent ecological features such as agricultural lands, rivers, lakes, open habitats, human settlements and reserve forests.

Survey has been done by making field visit to various habitats within the study area by QCI-NABET accredited FAE. The observations recorded are site, time and season specific. The assessment of wild flora and fauna was mostly based on random sightings. For animals, other than directly sighted, secondary evidences were recorded through calls, dug holes, scats, and spoors, rub signs, drag mark etc. Secondary information from literatures like Study Reports, Surveys, Books prepared by other experts was used to identify & describe the species. Published literature as well as citizen science portals such as Flowers of India, ebird, Mammals of India, India Nature Watch and so on were scanned through for records of species observed or reported from the study area. For birds, actual observation at each sampling site were made, by walk through stretch of the site and the number of birds were identified and listed. A species list was prepared along with taxonomic position of each species. Listing of Flora and fauna was done based on actual sighting, interviewing locals.

The study was carried out by visiting locations at dusk, during the day and at dawn, taking care that representative locations of all habitats were covered. Geographic coordinates were marked at important locations and geo-tagged photographic evidence was collected using the Global Positioning System. To ensure maximum coverage of faunal species, observations were made 1.5 to 2 Km beyond the study area.

3.6.4 Baseline of Study area

The study area of 10 km radius from the project site encompassed major part of Amaravati and lesser part of Nivasa Taluka. The settlement around project site is rural in nature. Field visits to site and surrounding reveals that, study area is dominated by Agricultural lands. Besides agricultural lands, different habitats observed in study area like water bodies, human settlements and Reserve forests etc. These habitats possess different characteristic which supports typical composition of flora and fauna within them.

For phytosociological analysis, 10m X 10m and 5m X 5, 1mx1m quadrats were established using species-area relationship curves, for trees, shrubs and herbs respectively. Data collected were used to determine Species Richness, Species Composition, Shannon-Wiener Diversity Index by standard methods.

Ecology-Biodiversity studies to document the baseline environmental conditions were undertaken in Winter on December 2023.

Survey tracks and waypoints are marked on Google Earth and presented below:

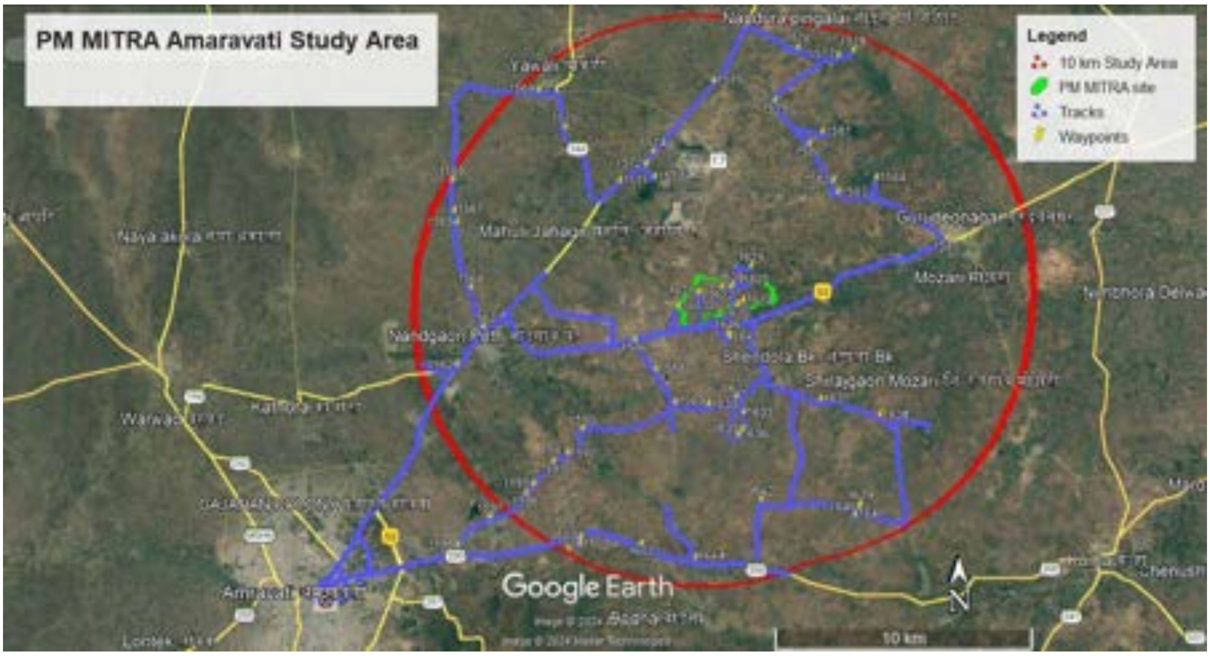


Figure 3.36*:* Tracks and waypoints for visiting locations within study area

3.6.5 Biogeographical profile of Study area

The study area is posses larger portion of open land (39.17%) followed by Scrub land (21.05%), Fallow Land (22.145%), Agriculture land (14.43%), Reservoirs/Dams (1.42%), Rural Area (0.96%), Plantation Land (0.34%), Industrial area (0.29%) and Quarry/Mine (0.23%) respectively.

Human Settlement

The human settlement is rural in nature. The populated area around the project site are Pimplivihar ~300 m (S), Dhigargaon ~340 m (N), Mahuli Jahagir ~4 km (NW), Shindola Bk. ~2.5 km (SSE), Fatepur ~2 km (E) and Sawardi ~2 km (WSW). The commonly found vegetations were *Mangifera indica*, *Azardirachta indica*, *Terminalia catappa*, *Ficus benghalensis, Ficus religiosa, Plumeria alba, Tamarindus indicus etc.* The major population mainly depends on agriculture, animal husbandry and working in nearby industrial area as their source of income.


Figure 3.37 Human Settlement within study area

Phyto-sociological study in this habitat was carried out to know species composition of trees, shrubs, herbs.

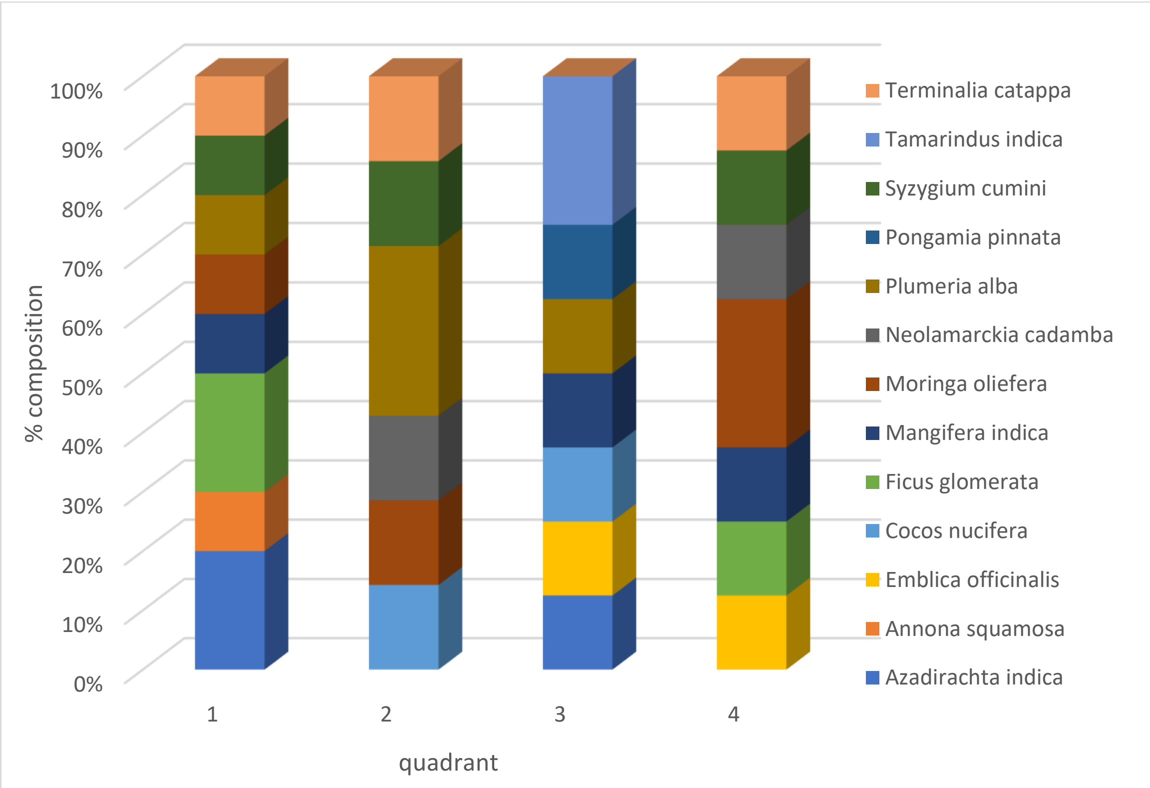


Figure 3.38 Graph showing trees species composition in Human settlement

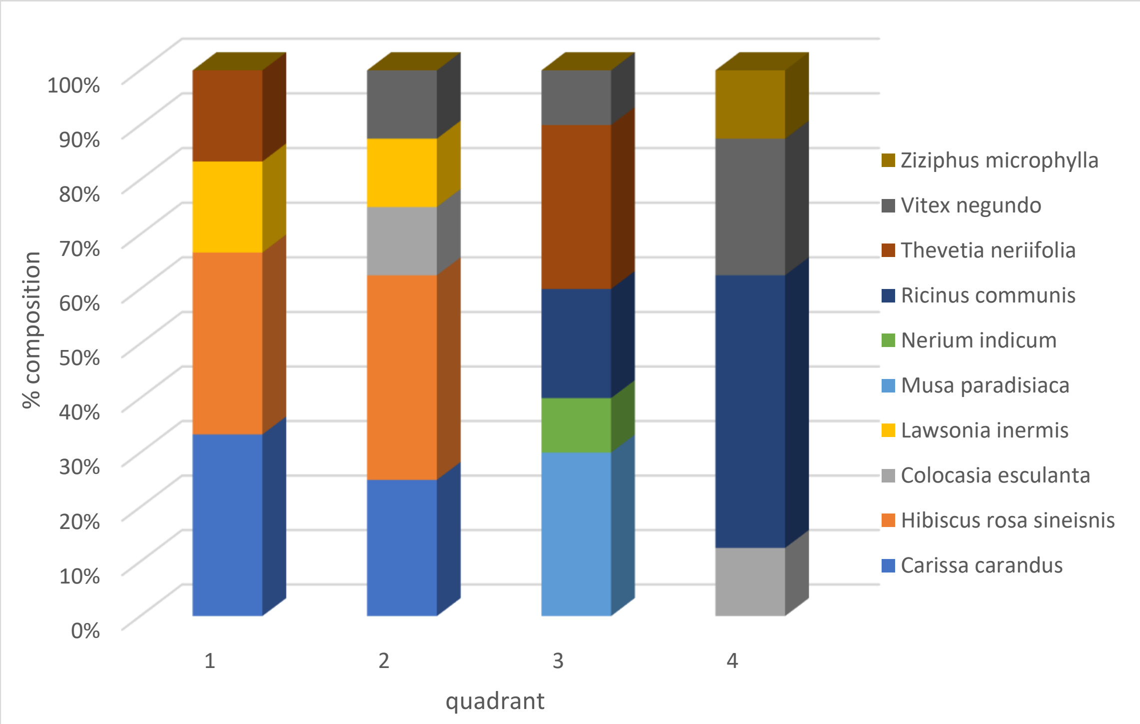


Figure 3.39 Graph showing shrubs species composition in Human settlement

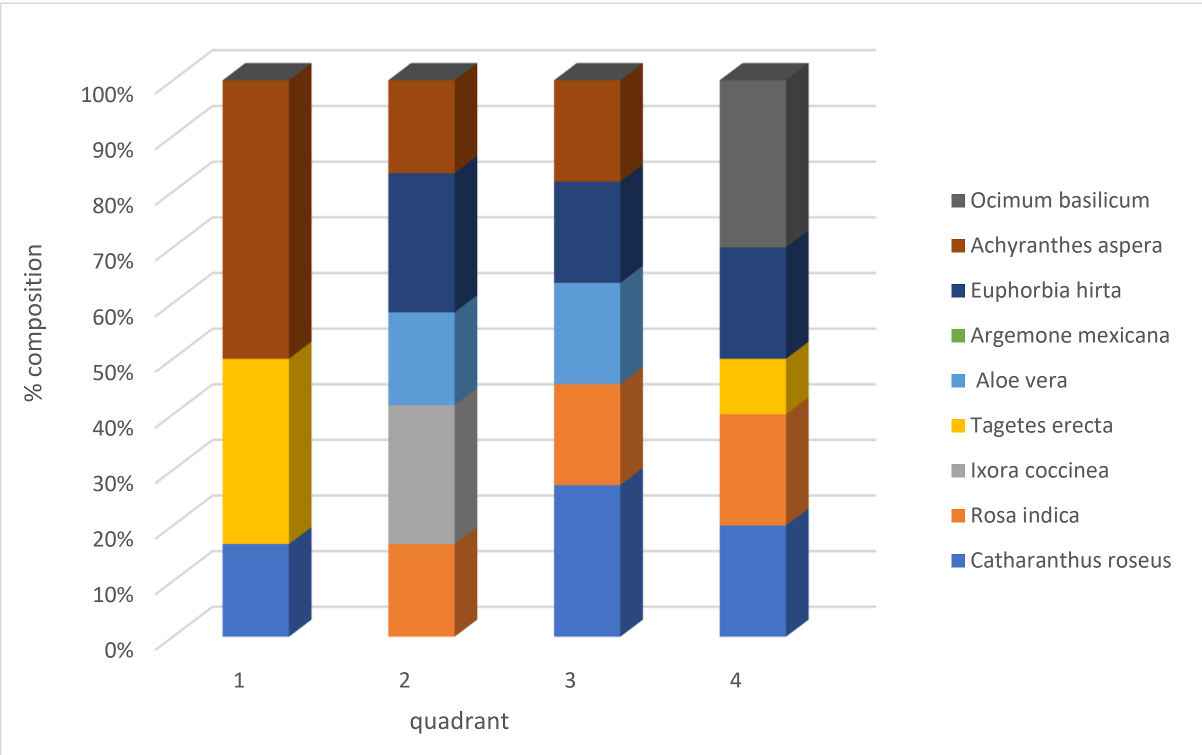


Figure 3.40 Graph showing herbs species composition in Human settlement

Floral composition in Human settlement is found to be contributed majorly by Trees followed by herbs and shrubs. This indicates Trees and herbs are plated mainly for beautification purpose. Species Richness and Shannon-Weiner diversity index for each habit is calculated separately for human settlement. It reveals poor health of ecosystem.

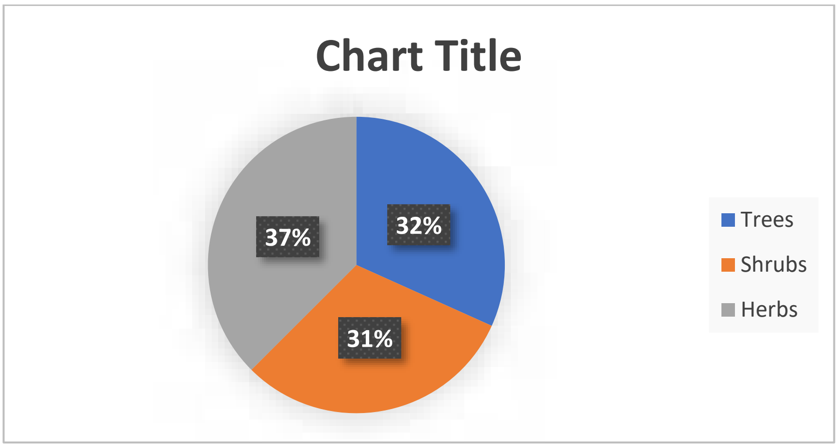


Figure 3.41 Graph showing overall composition in Human settlement

Table 3.28 Diversity index in Human Settlement

Sampling locations	Trees		Shrubs		Herbs	
	Species Richness	Diversity Index	Species Richness	Diversity Index	Species Richness	Diversity Index
1	8	2.03	4	1.33	2	0.66
2	6	1.75	5	1.49	5	1.59
3	7	1.91	5	1.50	5	1.37
4	7	2.91	4	1.21	5	1.56

Figure 3.42 Graphical representation of diversity index in Human settlement

Agricultural area

The agricultural lands are spread throughout the study area. The crops grown on these agricultural lands are Cotton (*Gossypium herbaceum*), Wheat (*Triticum aestivum*), Bajara (*Pennisetum glaucum*), black gram (Vigna mungo), Toor dal (Cajanus indicus), etc. the orchards of Seetaphal (*Annona squamosa*), Chiku (*Manilkara zapota*), Santra (*Citrus sinensis*) etc. were observed within study area. The number of pipes were observed connected with agricultural land from lakes present within study area as source of water for irrigation; well and Borewell is other source of water used for agricultural purpose.

The farmers also used to grow chara (Celosia sp.) at several places within study area.

There are tow types crops grown first kharif which includes crops of pulses like Cotton, Soyabean, Bhuimug, wali etc. Second is rabi crops such as Channa, Wheat, Onion, Turmeric & Fruits are grown in both seasons i.e., Kharif and Rabbi season. The project activity will not have impact on agricultural land.

Farmers informed that their crops get damaged by wild animals like Bores, Nilgai and Monkeys; they frequently visit on their farm at night.

Figure 3.43: Agriculture activities noted within study area

Figure 3.44 Orchards observed within study area

Floral composition in agriculture area is found to be contributed majorly by Shrubs followed by trees and herbs. Shrubs are grown due to availability of water. Trees are planted on agriculture land as hedge. Species Richness and Shannon-Weiner diversity index for each habit is calculated separately from all sampling locations. It reveals poor health of ecosystem.

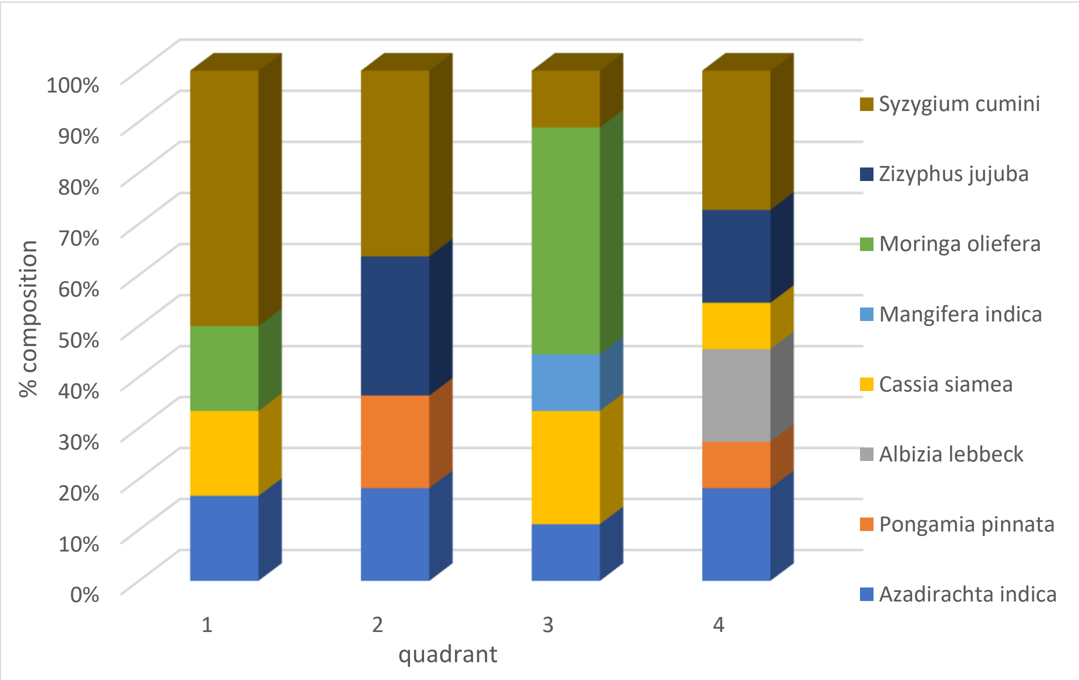


Figure 3.45 Graph showing trees species composition in Agricultural area

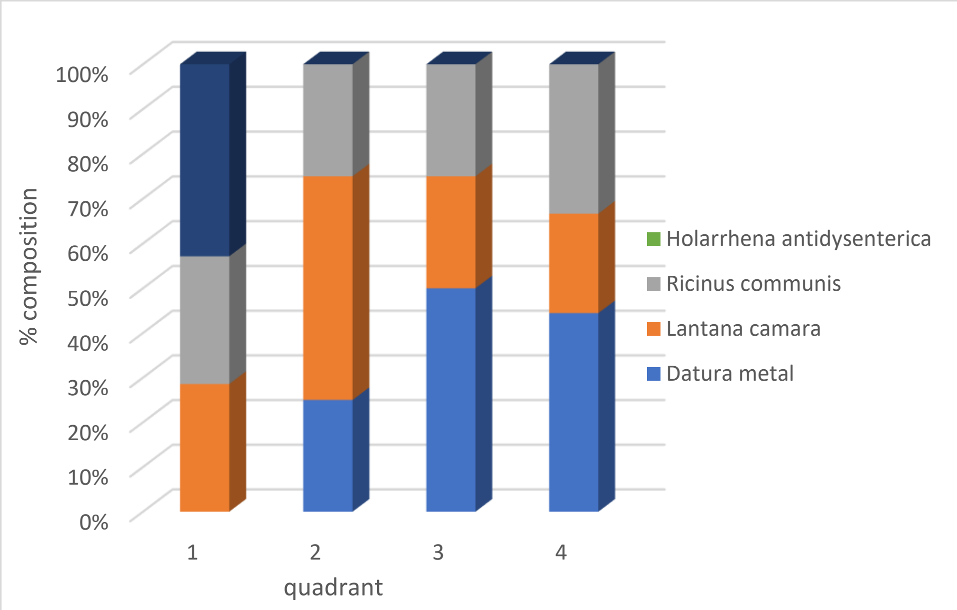


Figure 3.46 Graph showing Shrubs species composition in Agricultural area

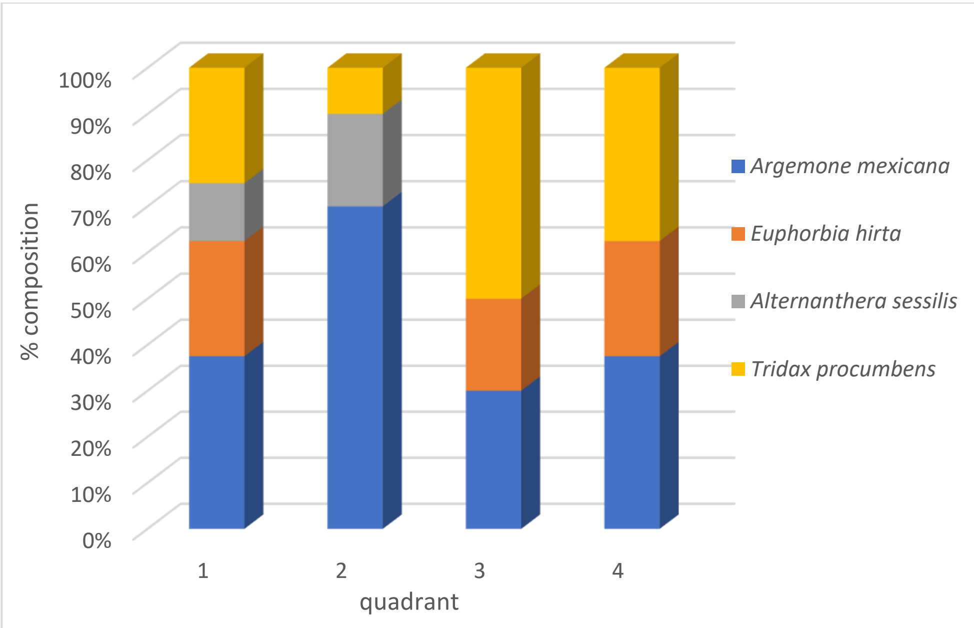


Figure 3.47 Graph showing herbs species composition in Agricultural area

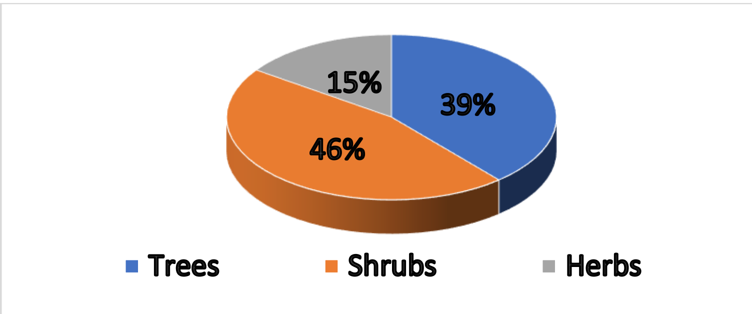


Figure 3.48 Graph showing overall composition in Agricultural area

Table 3.29 Diversity index in Agricultural area

Sampling locations	Trees		Shrubs		Herbs	
	Species Richness	Diversity Index	Species Richness	Diversity Index	Species Richness	Diversity Index
1	5	1.48	3	1.04	4	1.38
2	5	1.52	3	1.08	3	0.66
3	7	1.77	3	1.04	3	0.86
4	6	1.72	3	1.06	3	1.08

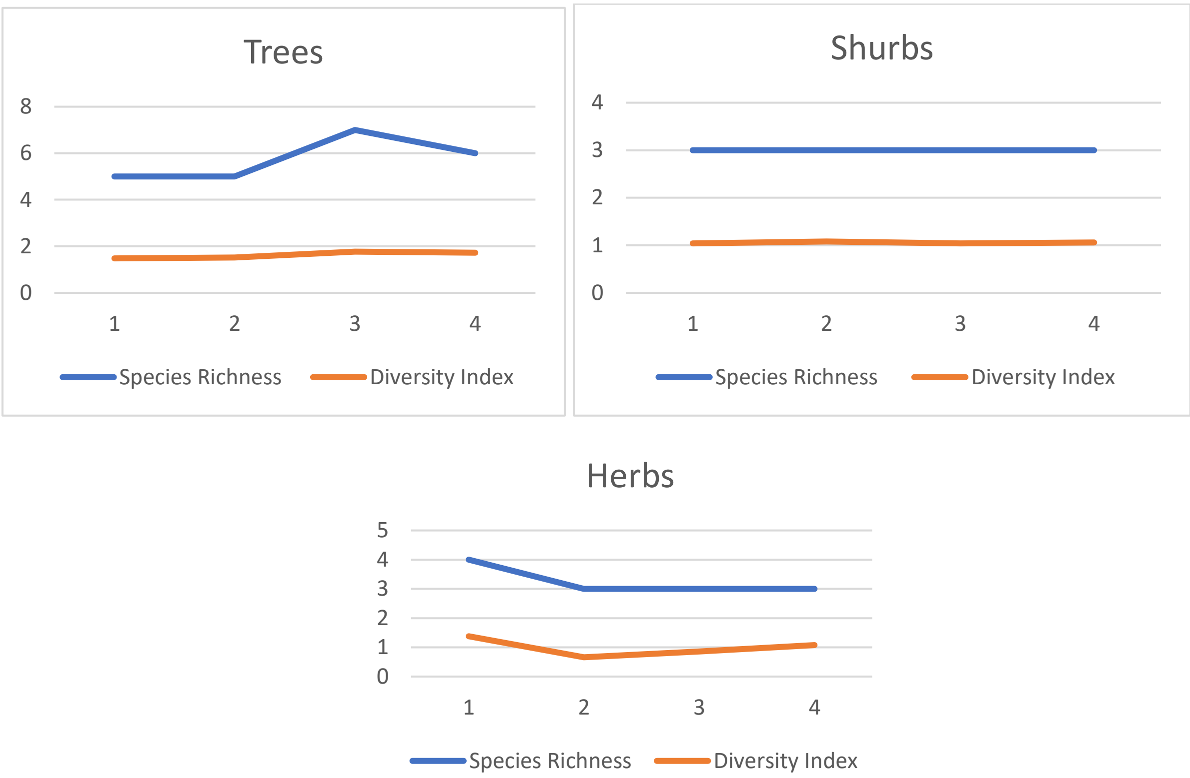


Figure 3.49 Graphical representation of diversity index in agricultural area

Reserve Forest (R.F.)

The study area possesses Reserve and Protected Forests within study area their distance and direction are as Pimli Vihir R.F. ~430 m (S), Surjapur R.F. ~2.5 km (SSE), Chikhali R.F. ~4.5 km (S), Dhotra P.F. ~7 km (SSE), Jawre Protected Forest ~8.8 km (SSE), Mardi PF. ~8.43 km (SSE), R.F. near Parsod ~9 km (SW), Kekat R.F. ~6.3 km (NE) respectively. *Butea monosperma* was the dominant species found in all reserve and protected Forests; dense vegetation along with grassland habitation was observed in all R.F. and P.F. The dominant species were *Acacia nilotica, Prosopis juliflora*, *Azardirachta indica*, were other dominant species. The trenches were observed within forest to accumulate rainwater for ground water recharge. The of proposed project activity will take place within proposed land of MIDC area and it will not directly impact flora and fauna resides at these forests.

Figure 3.50 Vegetation present within Reserve Forest

Tree plantation by forest department were noted on both the sides of road by Social forestry department from Shenola Phata to Malegoan Village in Tiwasa Taluka. Tree plantation is also observed at various locations with study area.

Figure 3.51 Tree plantation by Forest Department

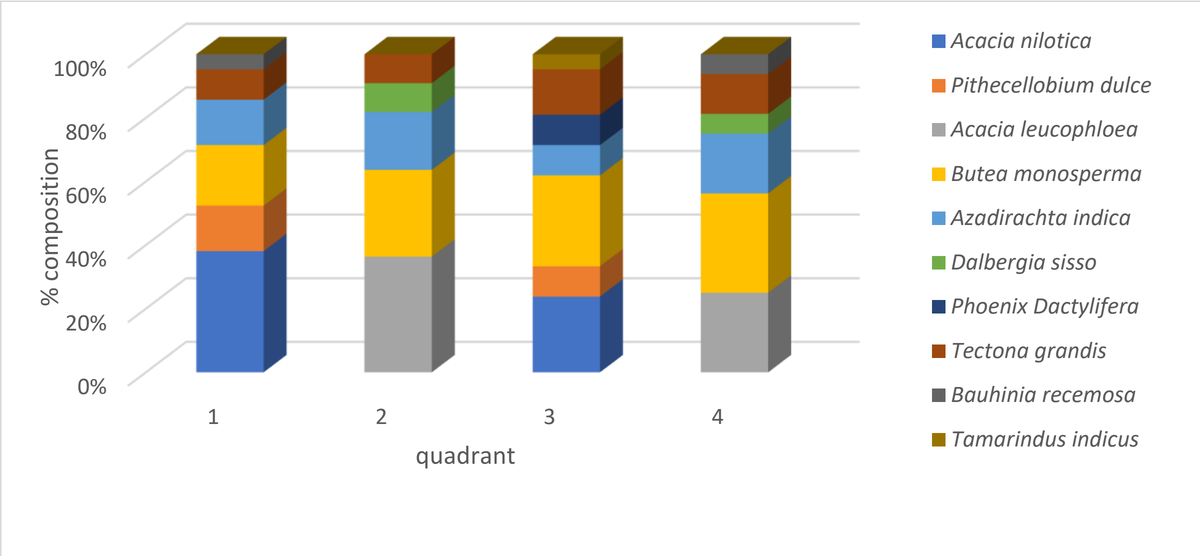


Figure 3.52 Graph showing trees species composition in Reserve Forest

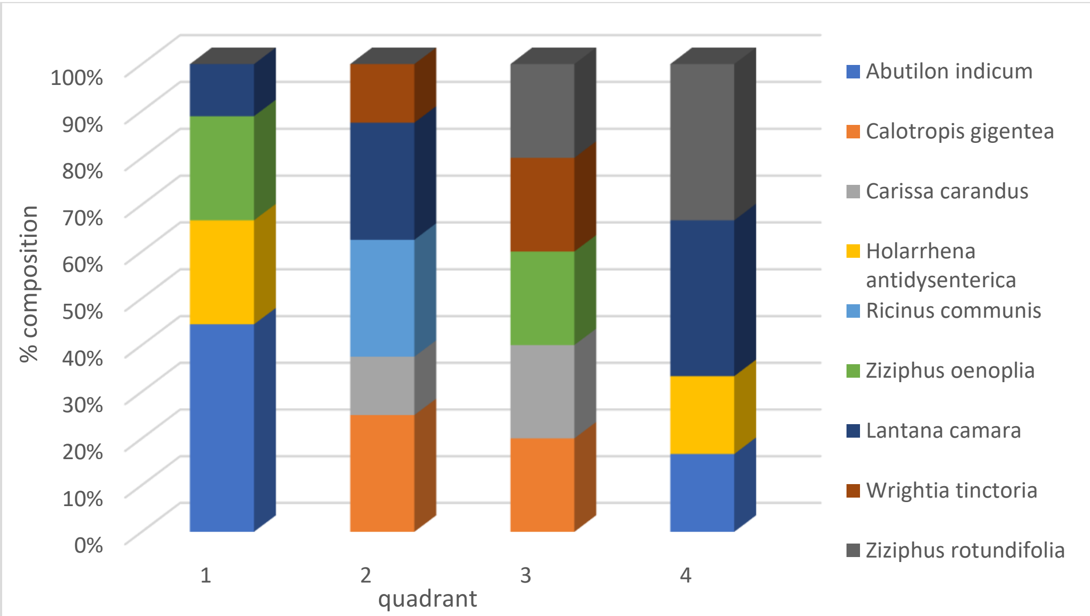


Figure 3.53 Graph showing Shrubs species composition in Reserve Forest

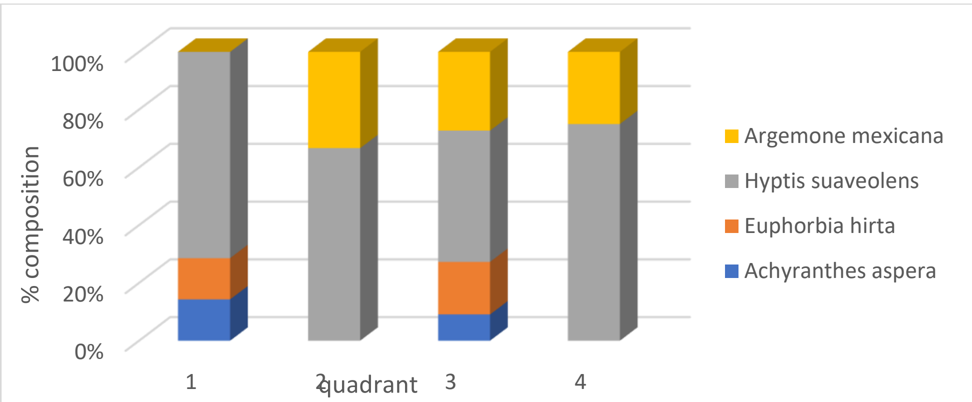


Figure 3.54 Graph showing herbs species composition in reserve forest

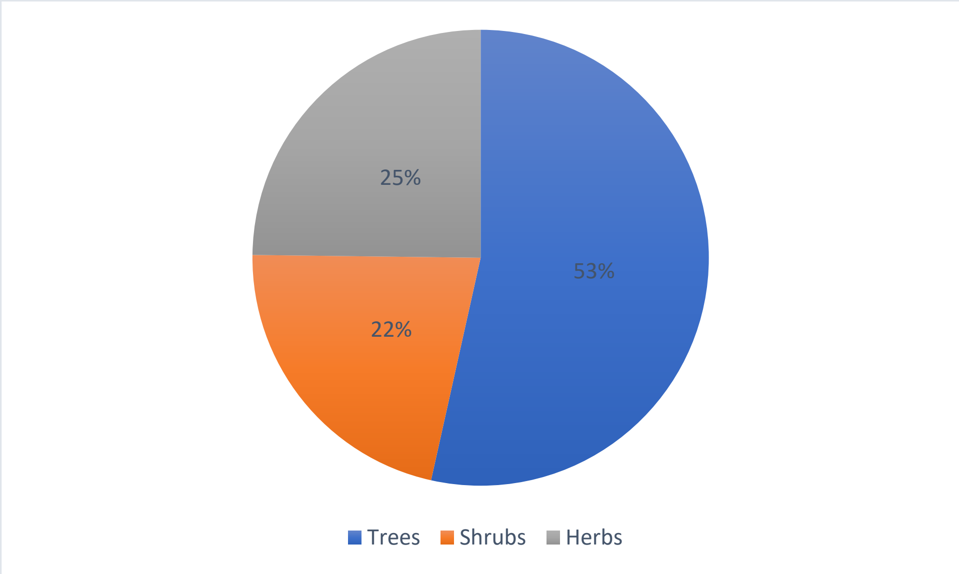
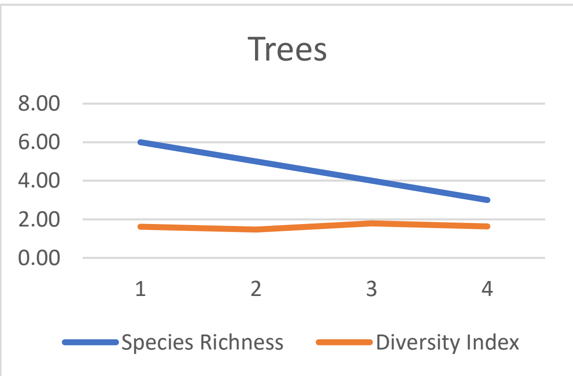


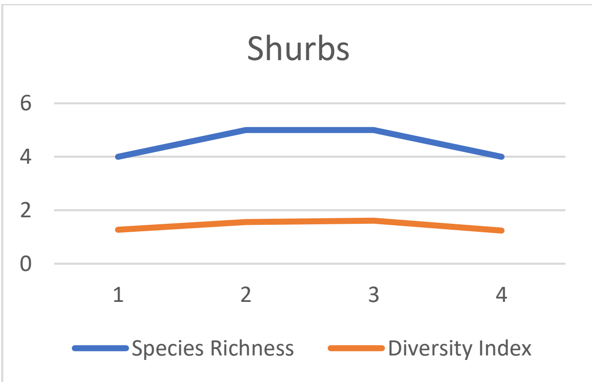
Figure 3.55 Graph showing overall composition in Reserve Forest

Floral composition in Forest area is found to be contributed majorly by Trees and herbs followed by shrubs. The Shrubs and herbs were found dried during survey time. Species Richness and Shannon-Weiner diversity index for each habit is calculated separately from all sampling locations. It reveals poor health of ecosystem.

Table 3.30 Diversity index in Reserve Forest

Sampling locations	Trees		Shrubs		Herbs	
	Species Richness	Diversity Index	Species Richness	Diversity Index	Species Richness	Diversity Index
1	6	1.61	4	1.27	3	0.80
2	5	1.47	5	1.56	2	0.64
3	7	1.79	5	1.61	4	1.24
4	6	1.63	4	1.33	2	0.56





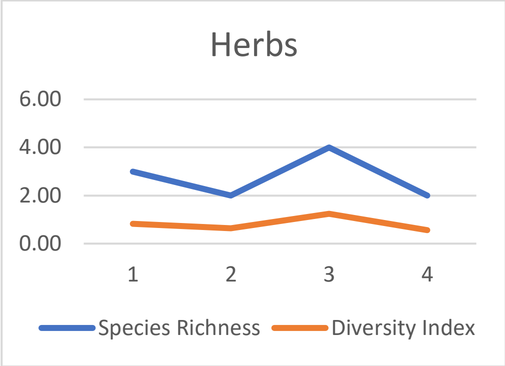


Figure 3.56 Graphical representation of diversity index in Reserve Forest

Water bodies

In the study area several Lakes and ponds located at various distances and directions from the project site. Digargaon lake is located ~300 m (N), its water used for irrigating nearby agricultural land. There are two water bunds present, one is located at Sujatpur ~4.4 km (SE) and another at Shendola bk. ~5.1 km (SE) respectively. Both of these are connected with Shiwangaon Lake ~ 1 km (SE). Their water is utilized for irrigating the agricultural lands in the vicinity through connecting odha/nalla. The local villagers have created reservoirs/dams to conserve water at Ketkar dam ~ 6 km and Dastapur dam ~ 8.4 km (NE); Kolwan Dam ~4.5 km (SE) respectively. Dhanova Dhanora, Divankhed ~7.53 km (SE) and ~6.6 km (SW) Respectively are other lakes present within study area. These lakes further contribute to the water resources in the area. Besides lakes and Ponds the Surya Ganga River is following within study area, where villagers of Shedola Bk. and Shiwangaon do fishing for their own consumption. The fishing also observed at Digargavan and Malegoan lake. The Bor and Daptaparni are other two River present within study area.

Dasturi Lake Wagholi Lake


Kekarpur Lake


Dighargavan Lake

Figure 3.57 Snapshot of Waterbodies within study area

The birds were observed at during site visit at various water bodies include Painted Stork, Black winged Stilt, Cattle Egret, River Tern, common coot, purple moorhen, Little cormorant, Great Egret, Red and Yellow Wattled lapwing etc. Species of butterfly also observed such as Peacock fancy, Plain tiger, Lemon Emigrant, Pennisetum glaucum etc.

Floral composition in agriculture area is found to be contributed majorly by Shrubs followed by Herbs and trees. These herbs and shrubs were grown large in number due to availability of water during summer season. It reveals poor health of ecosystem.

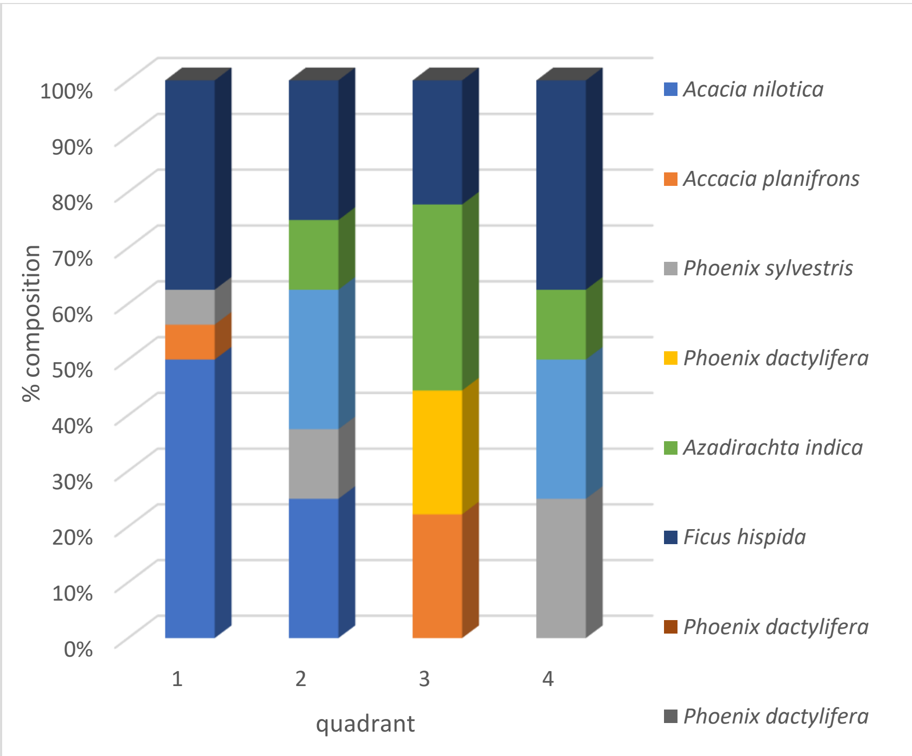


Figure 3.58 Graph showing trees species composition in water bodies

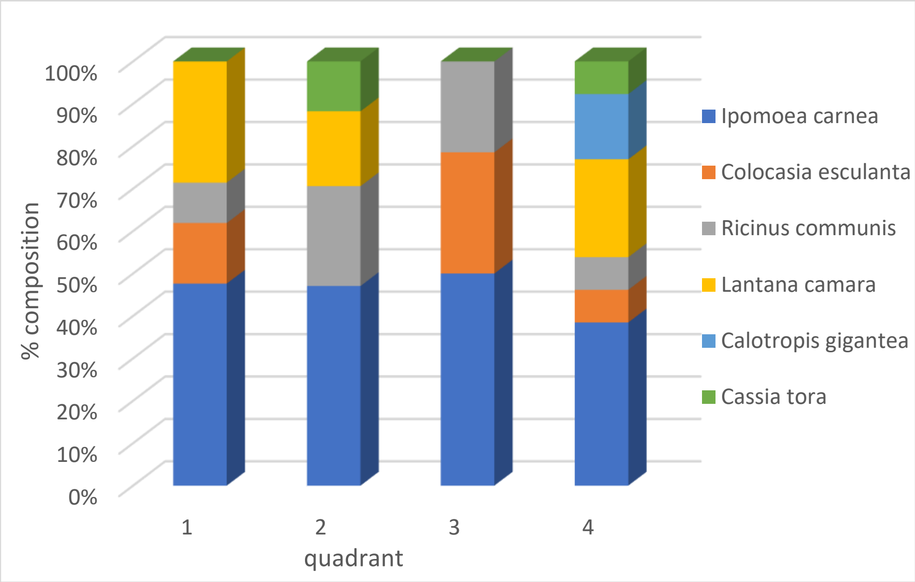


Figure 3.59 Graph showing shrubs species composition in water bodies

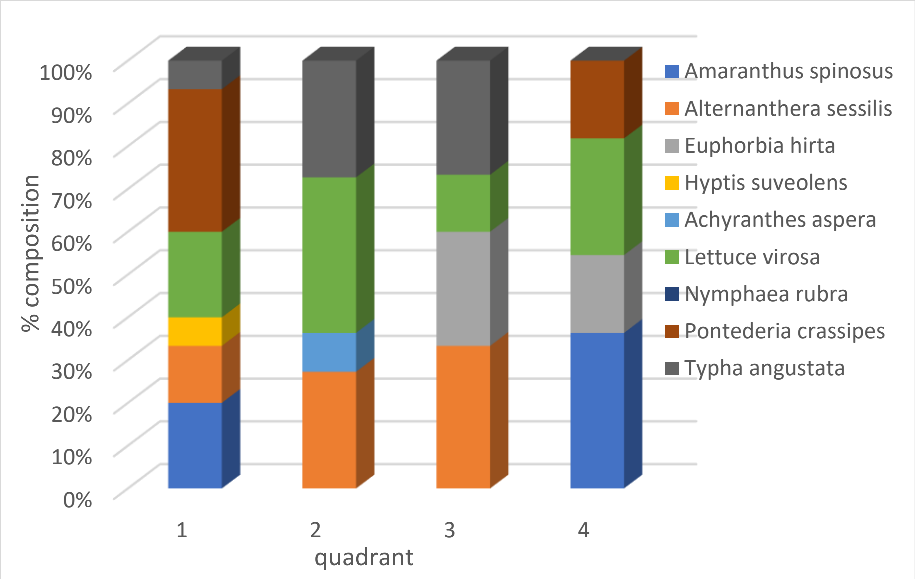


Figure 3.60 Graph showing herbs species composition in water bodies

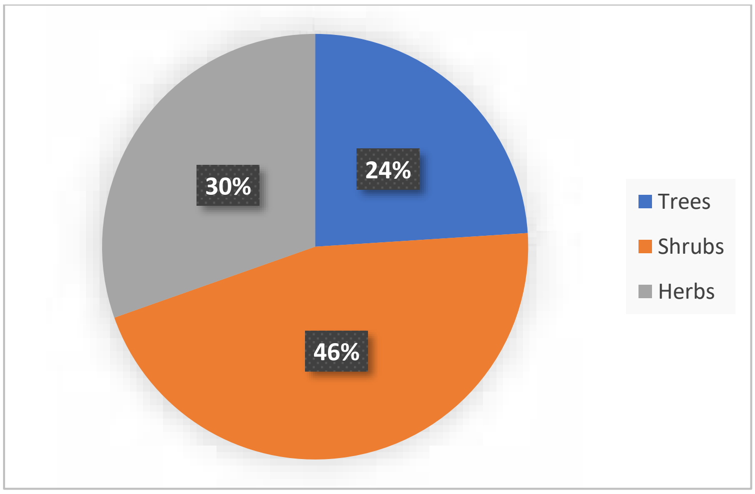


Figure 3.61 Graph showing overall composition in water bodies

Table 3.31 Diversity index in Water bodies

Sampling locations	Trees		Shrubs		Herbs	
	Species Richness	Diversity Index	Species Richness	Diversity Index	Species Richness	Diversity Index
1	4	1.06	4	1.21	6	1.64
2	5	1.56	4	1.25	3	0.94
3	4	1.37	3	1.03	3	0.99
4	4	1.32	6	1.64	5	1.49

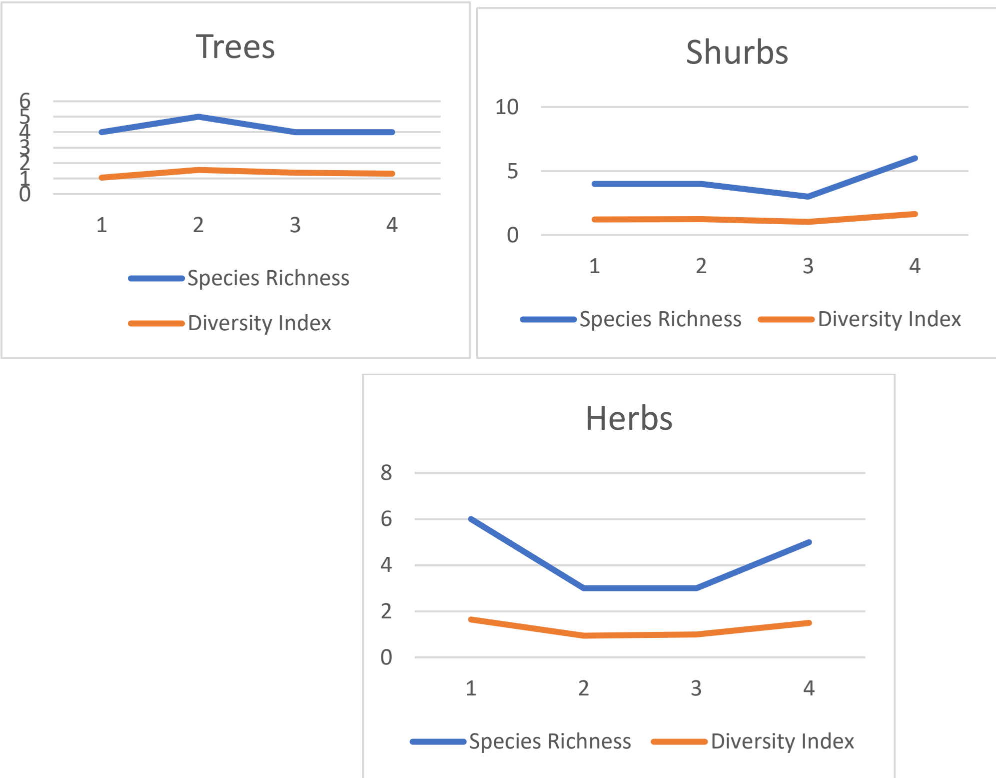


Figure 3.62 Graphical representation of diversity index in Water bodies

The various habitats present within study area support flora and fauna present within same locality.

Figure 3.63*:* Fauna observed within study area

Species and description of habitats mentioned in this report correspond to location, time and season during which study was carried out. These habitats may harbour/ support other set of species which may be found during different seasons of the year. Thus, species list given is not comprehensive.

3.6.6 Biodiversity of project site

The proposed project is for construction of PM MITRA Textile Park adjacent to additional Amaravati Industrial area having total plot area of 410.02 Ha. The present land use of proposed area is dominated by agricultural land, followed by open scrub and some unused land. There are 945 nos. trees present at project site. 91 trees are coming in the ROW of proposed road, which will be going to cut. The maximum number of trees will be transplanted to other location within project site to save them. The 15 m distance will be kept towards inside from project boundary to save tree cutting and at empty places tree plantation will be done. Within plot there are 832 trees, which will be going to cut for construction of different amenities within project site such as PAP plots, Proceeding Zone, Garmenting, knitting textile zone, Ginning spinning and weaving unit etc. To save maximum number of trees Open space for green belt is proposed. There are 6 nalas are present within project site during construction and operation phase their flow pattern will be maintained as it was previous to construction. There are two percolation tanks and 2 ponds besides them within project site they will not be disturbed during construction phase.

During the visit to site agricultural activities were noted within the project site the cotton and Toor Dal Crops, the orchards of Mosambi, Guava were observed within project. The Palas were noted as dominant tree, Teak and Neem were other dominant trees observed within project site. The local farmers bring their cattle to project site for feeding them.


MIDC

Figure 3.64 Snapshots of project site

Table 3.32 List of Flora Observed within project site

Sr. No.	Scientific Name	Common Name	Family
Tree			
1.	Acacia Dilbeta	-	Fabaceae
2.	Ailanthus Excelsa	Maharukh	Simaroubaceae
3.	Azadirachta Indica	Neem	Meliaceae
4.	Bambusa Vulgaris	Bamboo	Poaceae
5.	Bhaunia Racemosa	Apta	Caesalpiniaceae
6.	Bombax Ceiba	Sawar	Bombacaceae
7.	Butea Monosperma	Palas	Fabaceae
8.	Cordia dichotoma	Bhokar	Boraginaceae
9.	Delonix regia	Gulmohar	Caesalpinioideae
10.	Ficus carica	Ficus	Moraceae
11.	Ficus Racemosa	Umbar	Moraceae
12.	Ficus Religiosa	Pipal	Moraceae
13.	Leucaena leucocephala	Subabul	Fabaceae
14.	Mangifera Indica	Mango	Anacardiaceae
15.	Moringa Oleifera	Drum stick	Moringaceae
16.	Phoenix Dactylifera	Khazoor	Arecaceae
17.	Sarcomphalus	Kalamb	
18.	Senegalia golpini	Gum Arabic Tree	Mimosaceae
19.	Tamrindus indicus	Imali	Fabaceae
20.	Tectona grandis	Teak	Lamiaceae
21.	Vaccinium subg. Oxycoccus	Indian Cranberry	Ericaceae
22.	Vachellia Nilotica	Babul	Mimosaceae
23.	Ziziphus Mauritiana	Bor	Rhamnaceae
Shrubs			
1.	*Abutilon indicum*	Petari	Malvaceae
2.	*Bauhinia recemosa*	Apta	leguminosae
3.	*Calotropis gigentea*	Crown Flower, Safed aak	Asclepiadaceae

Sr. No.	Scientific Name	Common Name	Family
4.	*Carissa carandus*	Karawandi	Apocynaceae
5.	*Colocasia esculanta*	Alu	Araceae
6.	*Flueggea leucopyrus*	Indian snow berry/Pandharphali	Phyllanthaceae
7.	*Jasminum malbaricum*	Jsmine	Oleaceae
8.	*Lawsonia inermis*	Henna, Mehendi	Lythraceae
9.	*Musa paradisiaca*	Banana	Musaceae
10.	*Nerium indicum*	Kanher	Apocynaceae
11.	*Pavetta indica*	Pellet shrub	Rubiaceae
12.	*Ricinus communis*	Erund/ Castor	Euphorbiaceae
13.	*Saccharum arundinaceum*	--	Poaceae
14.	*Thevetia neriifolia*	Bitty	Apocynaceae
15.	*Urena sinuata*	hibiscus burr, Van Bhendi	Malvaceae
16.	*Ziziphus microphylla*	Jangli bor	Rhamnaceae
Herbs			
1.	*Argemone mexicana*	Satyanashi	Papaveraceae
2.	*Alternanthera sessilis*	--	Amaranthaceae
3.	*Amaranthus spinosus*	Prickly Amaranth	Amaranthaceae
4.	*Asparagus racemosus*	Shatavari	Asparagaceae
5.	*Asteracantha longifolia*	--	Acanthaceae
6.	Cajanus indicus	Toor	Fabaceae
7.	*Cassia tora*	Stiking Cassia	Fabaceae
8.	*Chromolaena odorata*	--	Asteraceae
Climbers			
1.	*Abrus precatorius*	Rosary pea/Hari-patti, Gunj	Fabaceae
2.	*Dioscorea bulbiferra*	Karanda	Dioscoriaceae
3.	*Dioscorea daemona*	Bitter Yam	Dioscoriaceae
4.	*Smilax zeylanica*	Ghotvel	Smilacaceae

Table 3.33 List of Fauna Observed within project site

Sr. No.	Scientific name	Common Name	Family	WPA Status
Mammals				
1.	*Boselaphus tragocamelus*	Nilgai	Bovidae	Schedule II
Insects				
1.	*Pareronia valeria*	Common Wonderer	Pieridae	NP
2.	*Catopsilia pomona*	Common Emigrant	Pieridae	NP
3.	*Junonia lemonias*	Lime Pansy	Nymphalidae	NP
4.	*Tarucus plinius*	Zebra Blue	Lycaenidae	NP
5.	*Byblia ilithyia*	Joker	Nymphalidae	NP
6.	*Junonia almana*	Peacock Pansy	Nymphalidae	NP
7.	*Danaus chrysippus*	Plain Tiger	Nymphalidae	NP

Sr. No.	Scientific name	Common Name	Family	WPA Status
Birds				
1.	*Merops orientalis*	Asian Green Bee-eater	Meropidae	Schedule II
2.	*Mycteria leucocephala*	Painted Stork	Ciconiidae	Schedule II
3.	*Phoenicurus ochruros*	Black Redstart	Muscicapidae	Schedule II
4.	*Cinnyris asiaticus*	Purple Sunbird	Nectariniidae	Schedule II
5.	*Bubulcus ibis*	Cattle Egret	Ardeidae	Schedule II
6.	*Pycnonotus cafer*	Red-vented Bulbul	Pycnonotidae	Schedule II
7.	*Streptopelia decaocto*	Eurasian Collared-dove	Columbidae	Schedule II
8.	*Cecropis daurica*	Red-rumped Swallow	Hirundinidae	Schedule II
9.	*Hirundo smithii*	Wire-tailed Swallow	Hirundinidae	Schedule II
10.	*Curruca curruca*	Lesser Whitethroat	Sylviidae	Schedule II
11.	*Ammomanes phoenicura*	Rufous-tailed Lark	Alaudidae	Schedule II
12.	*Tadorna ferruginea*	Ruddy Shelduck	Anatidae	Schedule II
13.	*Sterna aurantia*	River Tern	Laridae	Schedule I
14.	*Ardea cinerea*	Grey Heron	Ardeidae	Schedule II
15.	*Microcarbo niger*	Little Cormorant	Anatidae	Schedule II
16.	*Dendrocitta vagabunda*	Rufous Treepie	Corvidae	Schedule II
17.	*Actitis hypoleucos*	Common Sandpiper	Scolopacidae	Schedule II
18.	*Vanellus indicus*	Red-wattled Lapwing	Charadriidae	Schedule II
19.	*Motacilla alba*	White Wagtail	Motacillidae	Schedule II
20.	*Anas crecca*	Common Teal	Anatidae	Schedule II
21.	*Argya malcolmi*	Large Grey Babbler	Leiotrichidae	Schedule II
22.	*Alexandrinus krameri*	Rose-ringed Parakeet	Psittacidae	Schedule II
23.	*Pycnonotus cafer*	Red-vented Bulbul	Pycnonotidae	Schedule II
24.	*Bubulcus ibis*	Cattle Egret	Ardeidae	Schedule II
25.	*Merops orientalis*	Asian Green Bee-eater	Meropidae	Schedule II
26.	*Junonia orithya*	Blue Pansy	Nymphalidae	NP
27.	*Copsychus fulicatus*	Indian Robin	Muscicapidae	Schedule II
28.	*Lanius schach*	Long-tailed Shrike	Laniidae	Schedule II
29.	*Prinia socialis*	Ashy Prinia	Cisticolidae	Schedule II
30.	*Saxicola caprata*	Pied Bushchat	Muscicapidae	Schedule II
31.	*Aquila fasciata*	Bonelli's Eagle	Accipitridae	Schedule I
32.	*Argya malcolmi*	Large Grey Babbler	Leiotrichidae	Schedule II

3.6.7 Conclusion

The proposed project is for construction of Textile park at project site, which will change present agricultural Landuse into industrial park. To minimize this impact, a comprehensive land-use planning process should be followed, considering the availability of non-agricultural land and prioritizing the use of such land for industrial purposes. The conversation can leads to loss of natural habitats and biodiversity within project site. Pasture land of cattle will be lost completely.

3.7 Socio Economic Environment

Details covered in this section are based on secondary data (Census of India, 2011) and on primary survey & actual field investigations.

3.7.1 Introduction

Socio-economic study includes various facets such as demographic structure, population dynamics, infrastructure resources, status of human health and economic attributes like employment, income, agriculture, trade, industrial development, tourist attraction, historic and cultural monuments etc,.

For understanding the baseline status of the study area, the socio -economic data was collected & generated through secondary sources i.e. concerned office's documented records such as census records of 2001 & 2011 CDs from Directorate of Census Office, DCHB 2011,Town directory 2011, Google earth etc. The latest available data have been complied to delineate the existing baseline scenario of socio- economic environment in study area. Details of various facets of socio-economic environment are described in following sections.

Note: Due to covid pandemic, the 2021 census study was not performed by GOI. Census will be an e-survey and carried out by 2024. Due to the unavailability of the census 2021, the 2001 & 2011 census is being used for the census study.

3.7.2 Study Area

The study area for the project has been considered 10 km peripheral from the proposed project site. Total 410.02 Ha land area is proposed for the project from 2 villages from district and tehsil Amravati, state Maharashtra

3.7.2.1 Administrative details

Total 2 tehsil parts covered in 10 km radius study area. In the study area, 66% of the villages come from tehsil & district Amravati, other 34% villages comes from Teosa taluka. No urban part falls under the study area. Details of district and tehsils covered under the study area is presented in Table 3.2

Table 3-34: Administrative details

District	Tehsil	No of villages
Amravati	Teosa	16
	Amravati	31

Source: Primary census abstract 2011, District Amravati, state Maharashtra

3.7.2.2 Demographic Structure

Demographic details such as number of persons per household, total area, population density, sex ratio, SC and ST population, and literacy rate and employment pattern are summarized.

Population Structure of the study area

- As per 2011 census, total population of the study area was 69,220
- Total number of households were 16,310
- Total child (below 6 years of age) population was (10.40%)
- Total SC population was (20.72%) & ST population was 16,293(4.59%) of the total population
- Sex ratio (number of females to per 1000 males) of the total population was 912.

Demographic details presented in Figure 3.2 Demographic details with population projection presented in Table 3.3 and annexure I.

Table 3-35: Demographic Details of the study area

Total Households	Total Population	Total Male	Total Female	0-6 Child population	SC Population	ST Population
16310	69220	36210	33010	7205	14349	3184

Source: Primary Census Abstract 2011, District Amravati, Maharashtra

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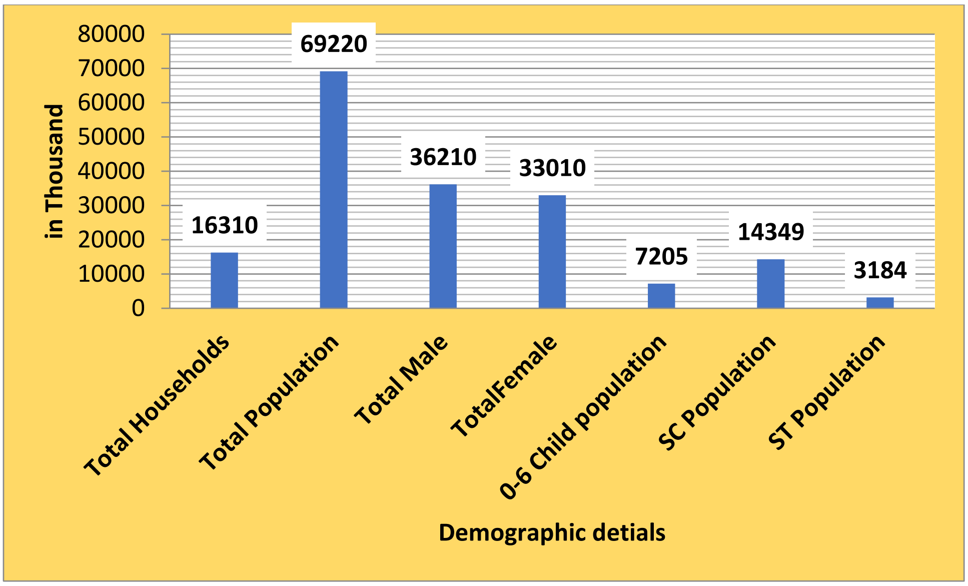


Figure 3.65 Demographic details

3.7.2.3 Literacy Details

According to the census 2011, overall literate population in the study area were (77.39%) and illiterate population was 19942(22.61%).

Out of total literates, male literates were (42.32%) and female literates were (35.07%).

Table 3-36: Literacy Details of the study area

Total Literate	Male Literate	Female Literate	Total Illiterate	Male Illiterate	Female Illiterate
53572	29294	24278	15648	6916	8732

Source: Primary Census Abstract 2011, District Amravati, Maharashtra

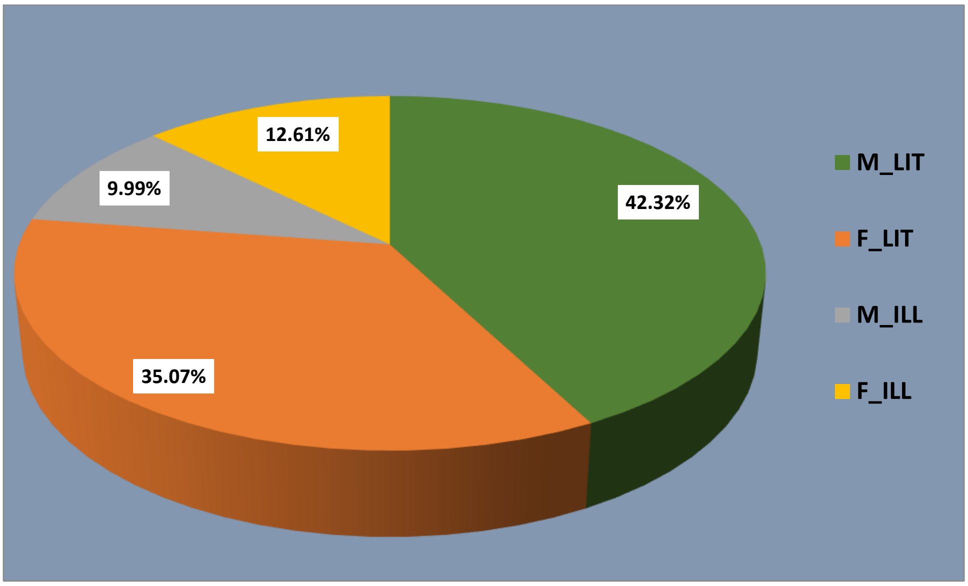


Figure 3.66 Male Female literacy rate

3.7.2.4 Employment Pattern

Economic resource base of any region mainly depends upon its economically active group i.e. the working population involved in the productive work. Work may be defined as participation in any economically productive activity. Such participation may be physical or mental in nature. Work not only involves actual work but also effective supervision and direction of work. It also includes unpaid work on farm or in family enterprise.

There are different types of workers which are classified according to the number of days they involved in work. A person who had worked for at least six months or 183 days are considered as main workers, on the other hand a marginal worker is a person who has participated in any economic or productive activity for less than six months or 183 days during the last one year. Non-workers are those who have not worked at all in the year preceding the enumeration.

The workers coming under the main and marginal workers category are those involved in activities such as cultivation, agriculture, livestock, forestry, fishing, hunting, plantations, orchards along with allied activities, mining and quarrying, manufacturing, processing, servicing and repairs in household industry, construction, trade and commerce, transport, storage and communication and other services.

According to the 2011 Census, total worker population in the study area was 28253(46.85%)

- Main workers were (41.19%) and marginal workers were (5.66%).
- Total non-working population was (53.15%).

Main Workers Employment Pattern

Main workers are classified in four categories as cultivators, agricultural workers, household industry workers and other workers.

As per 2011 Census, out of the total main workers in the study area, there were total cultivators (14.63%) agricultural workers (64.66%)

Household industry workers (1.61%) and other workers 11745 (19.10%). Majority of the main workers comes under other cultivator category.

Details of employment pattern present in Table 3.5 and Figure 3.4

Table 3-37: Employment Pattern

Workers population						Main workers classification			
Total	Male	Female	Main Worker	Marginal workers	Non Workers	Cultivator	Agriculture workers	Household industry workers	Other workers
32428	21618	10810	28509	3919	36792	4171	18434	460	5444

Source: Primary Census Abstract 2011, District Amravati, Maharashtra

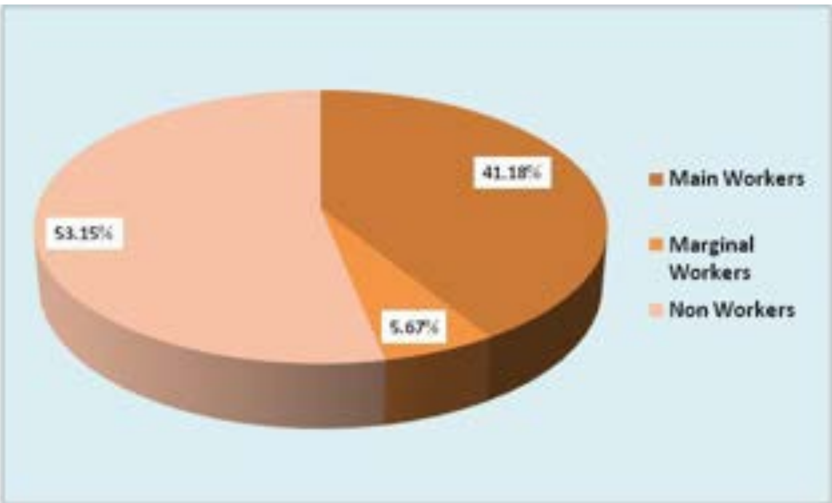


Figure 3.67 Employment Pattern

3.7.2.5 Census projection

Census 2021 yet not published; therefore 2001 and 2011 census has been studied for the projected population.

The overall data indicates that there is positive population growth in the study area. 5.87% decadal growth is expected in the census 2021 year. Household decadal growth rate is 19.77%, the fast growth in the households indicates there is increases in small/nuclear families. In 2001 average family size was 4.80 & in 2011 it was 4.24 & in 2021 it is expected that it will be 3.75.

In the census 2001 population density was 181 people to per sq km, in 2011 it was 193 people and in 2021 it is expected that it will be 203 people. Data indicates population density is increasing in the study area.

0-6 child population decadal growth rate in the study area is -14.13%. Reason behind the less population of 0-6 child group is small family trend, migration of families for employment etc.

SC population growth is negative and ST population is increasing in the study area

Literacy rate is increasing in the study area in both male & female category. In 2001 literacy rate was 72% and it is expected that in 2021 census year it could be 82.61%.

Total working population is also increasing positively in both male and female category. Marginal workers working percentage is decreasing in the study area.

In main workers category cultivator population is decreasing and agricultural workers growth is slow. The data indicates majority of the workforce is diverting in other workers category.

3.7.2.6 Project scenario

It is expected that due to the proposed project activities there will be population growth near to the project site, due to migratory workforce from other places, construction/operation phase workers etc.

Population density will increase due to the expected population growth in the study area.

Due to the project activities young students will divert to technical fields /courses which can help them to getting jobs in the proposed project, literacy rate will also increase due to the project activities. Literacy rate in technical fields/textile field will increase.

In the study area, other workers are increasing and agricultural related workers are decreasing, the data indicates there is need of jobs other than agriculture field. The project will help to provide job opportunities to the workforce for long term.

Project activities will help to reduce the non workers percentage in the study area by generating different kind of employment opportunities.

Table 3-38: Projectied data for the year 2021

Details	2001 census	2011 census	Decadal growth in %	Projected in 2021
Total Households	13618	16310	19.77	19535
Total Population	65380	69220	5.87	73283
Total Male	34004	36210	6.49	38560
Total Female	31376	33010	5.21	34730
0-6 Child population	8391	7205	-14.13	2741
Total SC	14663	14349	-2.14	14042
Total ST	2689	3184	18.41	3770
Total Literate	47409	53572	13.00	60536
Male Literate	26529	29294	10.42	32346
Female Literate	20880	24278	16.27	28228
Total Workers	28671	32428	13.10	36676
Male Workers	18418	21618	17.37	25373
Female Workers	10253	10810	5.43	11397
Main Workers	24041	28509	18.58	33806
Marginal Workers	4630	3919	-15.36	3317
Non Workers	36709	36792	0.23	36877
Cultivators	4821	4171	-13.48	3609
Agricultural Workers	15055	18434	22.44	22571
Household industry workers	447	460	2.91	473
Other Workers	3718	5444	46.42	7971

Source: Primary census abstract 2001 & 2011, district Amravati, Maharashtra

Note: The projected population for each category has been taken by population growth formula.

3.7.2.7 Infrastructure Resource Base

The infrastructure resources base of the study areas with reference to education, medical facility, water supply, post and telegraph, transportation, communication facility, power supply and existence of nearest town etc. taken from the District Census handbook 2011. The significant features of these important parameters summarized in Table 3.6.

Education: As per 2011 record, in 87% village's education facility present in the form of primary school. In 59% village's middle school facility was present. Other higher education facilities were present in the range of 5-10 km.

Medical/Primary Health Care: There were 2 primary health centre and 11 sub health centers were present in the study area providing health care facilities. Other medical facilities were maternity child welfare centers, TB clinics, allopathic hospitals, mobile health clinics etc.

Drinking Water: The water supplies in the study area were through Tap water, wells, hand pumps and other allied sources.

Drainage and Sanitation Facilities: Drainage and sanitation facilities were not adequate in the study area. Mostly open drainage, and open kuccha drainage were present in the village.

Communication: Communication facility were present in the form of post office, sub post office, landline etc.

Transportation: Public bus facility was available in 74% of the villages. Other facilities were in the form of auto, taxis, vans etc.

Road Approach: Black topped roads were present in 72% of the villages.

Bank Facilities: Out of 47 villages, banking facility was present only in 11 villages.

Power Supply: Almost all sampling locations were electrified in the study area and electricity is available for both domestic as well as agricultural purposes.

Table 3-39: Infrastructure Resource Base in Study Area

Education											
Nursery/LKG/UKG	Private Pre - Primary School	Govt Primary School	Private Primary School	Govt Middle School	Private Middle School	Govt Secondary School	Private Secondary School	Govt Senior Secondary School	Private Senior Secondary School	Private Degree College	Private Others
40	1	39	2	25	3	11	2	5	1	1	1
Health Care								**Communication**			
Primary Health Centre	Primary Health Sub Centre	Maternity And Child Welfare Centre	TB Clinic	Hospital Allopathic	Dispensary	Veterinary Hospital	Family Welfare Centre	Post Office	Sub Post Office	Telephone	PCO
2	11	2	2	2	7	6	2	15	6	34	21
Transportation					**Road Approach**						
Public Bus Service	Private Bus Service	Auto/Modified Autos	Taxi	Vans	Black Topped Road	Gravel Roads	Water Bounded Macadam	All Weather Road		Footpath	
35	2	36	10	2	34	26	20	44		47	
Drinking Water								**Sanitation**			
Tap Water-Treated	Covered Well	Uncovered Well	Hand Pump	Tube Wells/Borehole	Spring	River/Canal	Tank/Pond/Lake	Open Drainage	No Drainage	Open Kuccha Drainage	
26	13	39	34	26	2	9	11	34	13	32	
Bank					**Electricity**						
ATM	Commercial Bank	Cooperative Bank	Agricultural Credit Societies	Self - Help Group	Power Supply Domestic Use	Power Supply for Agriculture Use		Power Supply for Commercial Use		Power Supply for All Users	
2	7	4	16	31	41	45		39		39	

Source: District Census Handbook 2011, Maharashtra State

Health Status

The healthcare system of the country involves a three-tier system with Sub Health Centre (Urban and Rural), Primary Health Centre (Urban and Rural) and Community Health Centre (Urban and Rural) as the three pillars of Primary Health Care System in India. The Sub-Centre is the most peripheral and first contact point between the primary health care system and the community.

Each Sub-Centre is manned by one Auxiliary Nurse Midwife (ANM) and one Male Health Worker MPW(M). PHC is the first contact point between village community and the Medical Officer. The PHCs were envisaged to provide an integrated curative and preventive health care to the rural population with emphasis on preventive aspects of health care. The PHCs are established and maintained by the State Governments under the Minimum Needs Programme (MNP)/ Basic Minimum Services Programme (BMS).

At present, a PHC is manned by a Medical Officer supported by 14 paramedical and other staff. It acts as a referral unit for 6 Sub Centres. It has 4 - 6 beds for patients. The activities of PHC involve curative, preventive, primitive and Family Welfare Services.

The survey team visited the primary health center Mahuli Jahangir for a general discussion on prevalent diseases present in the study area. From the health data received from the PHC, it is revealed that most of the patients visited the PHC for Dysentery treatment. Asha workers are active in all villages in the study area. ASHA workers are volunteers from within the community who are trained to provide information and aid people in accessing benefits of various healthcare schemes of the government.

Table 3-40: Primary Health Center Mahuli Jahangir Data

Sr. No.	Disease	April To March 2020 To 2021	April To March 2021 To 2022	April To March 2022 To 2023
1	Malaria	0	0	0
2	Tuberculosis	36	37	49
3	Eye disease	42	75	88
4	Gastro	0	0	0
5	Diarrhea	12	15	18
6	Dysentery	92	168	60
7	Breathe	0	0	0
8	Jaundice	0	0	0
9	Typhoid	8	15	22

Source: Primary health center Mahuli Jahangi, Amravati taluka

Tourist places

In the study area, there are no archeological sites present. Tukdoji Maharaj Samadhi, Mojhari is famous religious place present in the study area; it is the place where Rashtrasant Tukadoji Maharaj lived. During the month of October, a large festival is held here. At Digargavhan village there is religious place namely Damodar maharaj seva sam shree kshetra, the place is famous religious place in Vidharbha region.

Shree sant Damodar maharaj sevashram ,Digargavhan, religious place Gurudev Seva Aashram, Mojhri

Note: Shree sant Damodar maharaj sevashram comes under Cat C grade under the state rural piligrimage site development scheme, it is temple of local importance where 1 lakh devotee visit annually.

Agriculture details

To know the crop pattern present in the study area, crop pattern data for the year 2022- 23 collected from Amravati tehsil agriculture dept. The data indicates that in the kharif season main crops were cotton and Soyabean (oilseeds) and in rabi season chickpea and wheat were the main crops.

On an average in total 9 surveyed locations, total 2675 (ha) land cultivated for cotton & 3532 ha land cultivated for Soyabean production.

It is expected that after the project implementation cotton cultivation can increase in the study area.

Note: At present the land which is acquired by the MIDC for Brownfield project, still in use for farming purpose by the farmers, it is expected that till MIDC not allotted the plots land to industries /demarcation of land, farmers will use the land for farming purpose. After the plot allotments, it is expected that Cotton & Soyabean cultivation land will be decrease.

Table 3-41: Cropping Pattern for Kharif season year 2022-23

Sr. No.	Taluka	Village	Plantation Area	Kharif season (Rainy Season)						
				Cotton	Soyabin	Tur	Groundnut	Vegetable	Other	Total
1	Amravati	Digargavhan	644	240	289	60	--	--	1	590
2	Tiwsa	Shivangaon	723	347	289	75	--	--	7	718
3	Amravati	Pimpalvihir	859.91	298	370	74	--	--	1	703
4	Amravati	Sawardi	7.41	1	1	1	--	--		3
5	Amrav	Mahuli	961.41	147	594	12	--		10	871

Sr. No.	Taluka	Village	Plantation Area	Kharif season (Rainy Season)						
				Cotton	Soyabin	Tur	Groundnut	Vegetable	Other	Total
	ati	Jehangir				0				
6	Tiwsa	Shendola Bk.	658.29	296	270	81	--	2		649
7	Tiwsa	Salora Bk.	653.98	306	261	80	--	--		647
8	Amravati	Nandgaon Peth	2002.19	590	773	154	--	--	12	1529
9	Amravati	Kekatpur	1490.63	450	685	290	8	--		1433

Source: Agriculture dept, Amravati

Table 3-42: Crop pattern Rabi Season year 2022-23

Sr. No.	Taluka	Village	Plantation Area	Rabi Season Winter Season)						
				Chickpea	Wheat	Onion	Vegetable	Turmeric	Other	Total
1	Amravati	Digargavhan	644	--	31	2		0.40		33.40
2	Tiwsa	Shivangaon	723	70	30		7	--		107
3	Amravati	Pimpalvihir	859.91	37	44	1	2		2	86
4	Amravati	Sawardi	7.41	3	--	--	--	--		3
5	Amravati	Mahuli Jehangir	961.41	95	27	--	--	--	0.80	122.80
6	Tiwsa	Shendola Bk.	658.29	68	38		1	--		107
7	Tiwsa	Salora Bk.	653.98	33	50		--	--		83
8	Amravati	Nandgaon Peth	1900	357	102	5	7	2	12	485
9	Amravati	Kekatpur	1490.63	90	20	1	--	--	1	112

Source: Agriculture dept, Amravati

Landuse pattern

Landuse pattern details have been taken from district census 2011.Lanuduse pattern has 9 types of the geographical area of the study area. According to the data 65.43% of landuse comes under net sown area.

Note: After project implementation, status lof anduse pattern will be change. Agricultural land will be converted into industrial area and cultivatable land area will decrease mainly in the Digargavhan and Pimplavihir village..

Table 3-43: Landuse pattern of the study area

Total Geographical Area	Forest Area	Area under Non-Agricultural Uses	Barren & Un-cultivable Land Area	Permanent Pastures and Other Grazing Land Area	Land Under Miscellaneous Tree Crops etc. Area	Culturable Waste Land Area	Fallows Land other than Current Fallows Area	Current Fallows Area	Net Area Sown
36161.2	3590.5	1858.04	1375.12	931.88	481.28	1349.97	1937.3	977.02	23660.09

Source: DCHB 2011, State Maharashtra

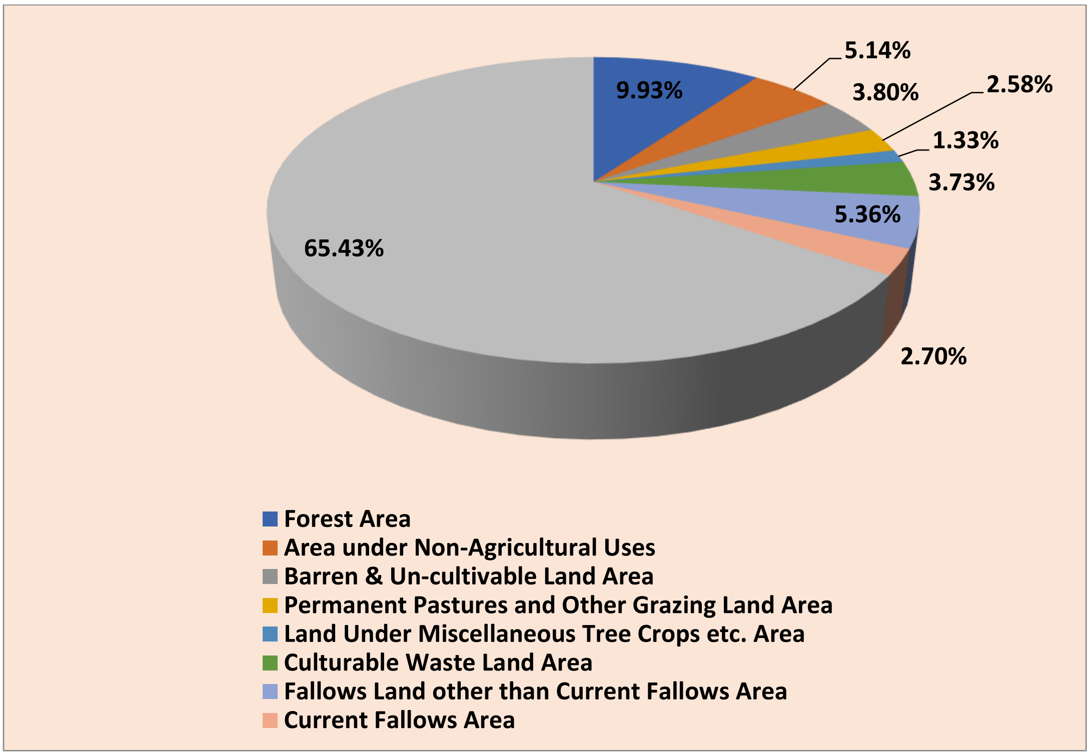


Figure 3.68 Landuse pattern

Migration of population

Migrants are those whose last usual place of residence is different from the present place of enumeration. Usual place of residence is the place (village/town) where the person stayed continuously for a period of 6 months or more or intends to stay for 6 months of more.

To know the migration trend Maharashtra handbook 2020(census 2011) data has been studied. The data shows that in urban area 36.75% male migrated for employment and in rural area 26.85% workforce migrated. In woman category marriage was the major reason for migrate in both urban and rural category.

As per the Report Migration in India, 2020-21, based on Periodic Labour Force Survey (PLFS) 2020-21, released by Ministry of Statistics and Programme Implementation (MoSPI), the total migration rate in India was 28.9% and in rural was 26.5%. Out of the total migrant persons, around 10.8% persons were migrated due to employment related reasons. The employment related reasons include in search of employment/better employment, for employment/ work (to take up employment/ to take up better employment/ business/ proximity to place of work/ transfer) and loss of job/closure of unit/lack of employment opportunities. State wise Number of persons who moved in for work & Employment as per Census – 2011 shows that Maharashtra is on rank 1 for migration of workforce.

(pib.gov.in/PressReleaseIframePage.aspx?PRID=1941077)

Table 3-44: Number of In-migrants in the state by gender

Reason of migration	Urban					Rural				
	Male	In%	Female	In%	Total	Male	In%	Female	In%	Total
Employment	4981	36.75	785	3.60	5766	2276	26.85	373	3.41	2649
Business	141	1.04	79	0.36	220	154	1.82	80	0.73	234
Education	517	3.81	273	1.25	790	234	2.76	139	1.27	2883
Marriage	429	3.16	14551	66.78	14980	125	1.47	3534	32.31	3659
Migrated after birth	4256	31.40	2366	10.86	6622	2149	25.35	1515	13.85	3664
Migrated with household	2149	15.85	2743	12.59	4892	2413	28.47	4377	40.01	7323
Other	1082	7.98	994	4.56	2076	1126	13.28	921	8.42	2047
Total	**13555**	**100**	**21791**	**100**	**35346**	**8477**	**100**	**10939**	**100**	**19416**

Source: Maharashtra handbook 2020(Directorate of Economics and Statistics)

3.7.3 Field Survey

3.7.3.1 Methodology

In order to access and evaluate the likely impacts arising out of any development projects on the socio-economic environment, it is necessary to gauge the apprehensions of the people in the study area. To know the overall status of the study area, a survey was performed by the socio-economic survey team.

For the primary data collection, a total of 9 sampling locations were taken from the study area, i.e. areas were selected at all distances and directions within the study area of 10 km. There is no urban area falls under the study area; therefore all sampling locations are rural area. Judgmental and purposive sampling methods were applied for the selection of respondents (representatives of local Gram Panchayat, i.e., Sarpanch, members, etc. and adult male and female groups, senior citizens, cultivators, businessmen, etc.). Data collection and processing include field surveys and observations made at each sampling area, and the socioeconomic status of that region is studied. At each sampling location, group discussions or group interviews were carried out with different sections of the community representing the study area. Structured interviews involve the use of a set of predetermined questions that include fixed and alternative questions. The questionnaire mainly highlights parameters such as income and employment, housing, water supply, sanitation, health, energy, transportation and communication, education, environment, pollution, etc. to assess the standard of living of that particular region and the general awareness, opinion, and expectations of the respondents about the proposed project or industrial development activity.

Table 3-45: Level of Consultation

Level	Type of survey format	Key participants
Individual	Household survey	Villagers
Settlement	FGD	Villagers, Fishermen Community, farmers etc.
Govt. office	Discussion	Gram Panchayat Sarpanch, Gram Panchayat Secretary, school teachers, Primary health center

3.7.3.2 Site Visit

For the primary data collection Socio-economic team of AESPL visit the study area in Dec 2023 for 4 days. Survey team performed the survey (FGD/GP visit for official data collection) at the sampling locations with the help of different types of survey format. In the study area, the villages were chosen by random sampling for socio-economic survey. Sampling location villages list is given in the Table 3.6.7.

Table 3-46: Socio-economic sampling location

Sr. No	Sampling Location	Gram Panchayat	Tehsil	Approx. Distance from project boundary in km	Direction
1	Digargavhan	Digargavhan	Amravati/Amravati	0.35	North
2	shiwangaon	Shivangaon	Tiwsa/Amravati	1.6	East
3	Pimpla Vihir	Pimpalvihir	Amravati/Amravati	0.35	South
4	Sawardi	Sawardi	Amravati/Amravati	0.9	South West
5	Mahuli Jahagir	Mahuli Jahagir	Amravati/Amravati	4.6	North West
6	Shendola bk	ShendolaBk.	Tiwsa/Amravati	3	South East
7	Salora Bk.	Salora Bk.	Tiwsa/Amravati	6	South East
8	Nandgaon Peth	Nandgaon Peth	Amravati/Amravati	6.75	West
9	Kekatpur	Kekatpur	Amravati/Amravati	6.6	North East

Source: Google earth

3.7.3.3 Primary findings

Population: All the religious and caste populations live at the sampling locations. The Muslim population was observed at 3 locations. At all sampling locations, the other backward class population is higher than the SC/ST caste population.

Note: To find out the present population of the villages, the surveyor asked the population related to details in each Gram Panchayat, but most of the GPs provided 2011 census details that were present in the official record of GPs.

Table 3-47: Caste wise Population of the sampling locations

Sr. No.	Sampling location	Cast wise Population Percentage (%) (Approx.)					
		SC	ST	OBC	NT	Open	Remarks if any
1	Digargavhan	30%	--	60%	10%	--	--
2	Shivangaon	20%	5%	45%	12%	15%	Muslim-3%
3	Pimpalvihir	35%	15%	50%	--	--	--
4	Sawardi	80%	--	10%	--	--	Muslim-10%
5	Mahuli Jehangir	20%	2%	50%	2%	2%	Muslim-24%
6	ShendolaBk.	20%	10%	65%	5%	--	--
7	Salora Bk.	30%	--	35%	35%	--	--
8	Nandgaon Peth	15%	5%	40%	10%	5%	Muslim-25%
9	Kekatpur	30%	10%	50%	10%	--	--

House pattern: The quality of houses is good, and most households have permanently cemented or semi-cemented houses. At 4 locations, migratory workforce is staying on rent basis. At Sawardi, Nandgaon Peth and Mahuli Jahangir rented families percentage is more than other sampling location. Average rent is in between 1500-6000 Rs/- per month.

Villagers earning income by providing house rooms to existing MIDC workers.

Housing pattern

Employment: The majority of the working population is engaged in farming, livestock rearing and labor work in the existing MIDC. The workers get a daily wage in the range of Rs. 400-600 Rs/-, depending on the type of work they do.

Migration of the local workforce into urban areas for employment is reported at all sampling locations. Cultivation was observed at all 9 sampling locations. At Digargavhan and Shivnagaon more than 90% workforce engaged in farming activities. It is expected that after project implementation Digargavhan & Shivangaon employment pattern will change due to land acquired for the project purpose.

At all villages livestock rearing observed (dairy/goat farming). Most of the livestock owners are engaged in selling livestock manure and earning income from that. At Sawardi village livestock rearing is in practice in most of the villages.

Most of the farmers are taking single crop (kharif season), for 4-5 months they don't have any work or income generation activities. Farmers who are dependent on rained activities works as a labor in industrial work for 3-4 months period.

At all sampling locations, workforce is engaged in existing MIDC, working as contractual/labor workers. At Nandgaon Peth (40%) & at Swardi villages(60%) workforce works in the existing MIDC area. Pratap Industries, Palak industries (Clothes and fabric manufacturer), Technocraft Industries Pvt.Ltd (Textile mill), Radhika Industries, G K INDUSTRIES, Shri Gajanan Industries, Innovation House Industries Pvt Ltd -Brick Manufacturer, Shree Gurunanak Industries, Sant Gadge Baba Five Star MIDC and Multimodal SEZ Nandgaon Peth/Sawardi are nearby industries from the sampling locations.

Table 3-48: Workforce engaged in industrial work/existing MIDC

Sr. No.	Village	Industrial Worker in %
1	Digargavhan	10%
2	Shivangaon	10%
3	Pimpalvihir	30%
4	Sawardi	60%
5	Mahuli Jehangir	25%
6	ShendolaBk.	10%
7	Salora Bk.	10%
8	Nandgaon Peth	40%
9	Kekatpur	15%

Source: Primary survey

Migration of workers: At most of the surveyed locations local respondents informed that in the study area there are migratory workforce present. Workers migrated from other district of Maharashtra and nearby states for employment purposes.

Unemployment: At all sampling locations majority of the youth's unemployed due to non-availability of jobs. At Digargavhan and Shivangaon most of the youths are unemployed. Majority of the unemployed youths are literate up to 12th & ITI. Proposed project can help to reduce the unemployment rate in the study area by the generation of employment opportunities.

Agriculture: In the study area, Cotton and Soyabean is the main Kharip crop, and its average production is 5-7 quintals per acre. The selling price of the cotton per quintal is 7000 Rs/- and for Soyabean 4000 Rs/-.

The second crops were taken in rabi season are chickpea, vegetables and wheat. Horticulture is also observed at some locations and crop taken are Orange and sweet limes. It is observed that majority of the farmers are using livestock organic manure for farming purpose.

During discussion with farmers regarding problems faced for cultivation, respondents informed that wild animal are present in nearby village area i.e. Nilgai (Rohi), Wild Boar, Deer, Monkey, Fox, Peacock etc. all animals are harmful for farming because they destroy/eat the crops.

For existing additional MIDC land was acquired from Sawardi, Nandgaon Peth etc. At present at both places agricultural activities is less and livestock rearing/dairy business and casual labor work activities performed by the workers.

Digargavahan farms- Wheat & Cotton cultivation

Livestock rearing at Sawardi

Livestock rearing at Digargavhan

Livestock rearing at Salora Bk

Women's status: Majority of the women workforce engaged as a lobor worker in the farms and livestock rearing. Female daily wage is in between 150 -250 Rs/-. Depend on the work they perform.

Women's participation in the Panchayat was observed at all sampling locations, and they are actively participating in the Panchayats work. As per the survey record, the majority of the women in the sampling locations are literate up to 12th grade.

A good numbers of self help groups present in the villages but there is no income generating activities in the SHG reported during the survey. Strengthening and new formation of SHG is required in the study area.

Fuel: The majority of households use LPG for cooking purposes, as well as electricity, which is also used as a fuel for cooking purposes. On average, 30% of households in rural areas use wood and cow dung as fuel. The majority of households use LPG for cooking purposes, and electricity is also used as a fuel for cooking purposes.

Language: The official and mother tongue in the study area is Marathi. With addition Hindi language is also spoken and understood by the large population.

Sanitation/garbage/drainage: Sanitation facilities are in good condition in the study area. Overall, at 8 location 90% of villagers use toilet facilities."Swacch Bharat Mission" scheme is implementing in the study area. At Digargavhan village75% families are using toilet facilities. At 4 locations community toilets are present (Kekatpur, Nandgaon Peth, Shendola Bk and Shivangaon)

At 7 sampling locations, garbage collection vehicles not present. No proper solid waste disposal presents in the villages. Villagers are self-disposing the garbage by dumping in open space or farm and burning.

The drainage pattern is mixed types: open, closed, cemented etc. In most places, drainage construction needs maintenance & closed drainage is required. Waste water management system is not present in most of the villages, improvement/management is needed.

Cemented open drainage at Sawardi

Community toilet at Shendola Bk

Open drainage at Kekatpur

Drinking Water Facilities: Tap water is a major source of drinking water. The majority of households have tap connections through Gram Panchayats (Jal jeevan mission). Respondents were not satisfied with the water supply's timing and quantity. Only Kekatpur village had daily water supply, at other sampling locations water supply was once in 2 days.

Common wells are present at all villages. Water scarcity in the summer season was reported by villagers. At all villages Gram Panchyat is supplying water facilities to the villagers. Water sources are Suryaganga River, well, borewell and hand pumps. RO water facility was present only at 1 village namely Shivangaon, at other villagers treated tap water provided by the Gram Panchyats.

At Digargavhan & Mahuli Jehangir villagers were not satisfied with the water facilities/availability.

	
Community tap water facility	Water tank

Education Facilities: Anganwadi centers are present at all sampling locations. The survey data indicated that in most of the village's primary and middle schools, facilities are present, but for higher education, students have to travel in the range of 5–20 km. At Shivangaon, Mozari, Nandgaon Peth and Bramhanwada villages' Jr. College facility is present. For all type of higher studies Amravati city is main center.

At most of the villages Schools and Anganwadis need to be renovated, class rooms are not up to the mark and quality furniture is required.

Textile related courses (graduation/post graduation) are offered by Sant Gadge Baba Amravati University (SGBAU), which is present in Amravati city. The university is accessible in the range of 10-25 km from the study area.

Road Connectivity and Transportation Facility: In the villages, approach roads are mainly cemented or pakka roads. Bus services and other private resources like taxis and autos for transportation are available. The village roads are well connected with the main Amravati city.

	
Sawardi access road	Digargavhan access road

	
Nandgaon Peth access road	Taxi service at Mahuli Jehangir

Communication Facilities: The communication facilities are good in the study area. Post offices and sub-post offices are present in the range of 1–4 km. The majority of households use mobile phones, television, and newspaper facilities. It indicates that the study area is well developed in the communication field.

Medical Facilities: Primary health centers and sub-centers are present in the range of 2–15 km in the study area. Mahuli Jahangir & Mardi PHC comes under the study area. At Nandgaon Peth clinics, medicals, hospitals are present for major illness or emergency health issues locals prefer Amravati city district hospital or private hospital.

During the discussion with villagers about the common diseases, it was observed that no major illness/diseases present in the study area. Common diseases like viral fever, cough, cold etc. reported by the respondents.

Respondents also added that few years back due to some industries in existing MIDC, air pollution faced by the villagers and it was affecting the respiratory system of the locals but after the complain registered by the villagers air pollution is decreasing and at present no major health issues affecting the locals health.

	
Clinic and medical at Nandgaon peth	Sub center facility at Kekatpur
	

Electricity: Electricity is available at all sampling locations; in most of the village's electricity available for domestic, agriculture and commercial purposes. Solar power is in use at Gram Panchyats/schools.

Recreation facilities: For recreation facilities temples, community halls were observed at all sampling locations. For malls, cinema hall, parks etc, Amravati city is preferred by the villagers of the study area.

It was observed that there are no parks; garden facility present in the sampling location, improvement in these field is required at the villages.

	
Baudh Vihar at Hivargavhan	Gym at Shendola Bk

Banking facility: At 3 sampling locations banking facility is present; credit societies were present in good number at the sampling locations. Mobile banking is also use by the villagers. At Nandgaon Peth and Shivangaon all type of banking facilities are present.

Existing running schemes: The survey outcome specify that at present Gharkul Yojna, Pension to Sr. Citizen, Pension to Widow, pension to Handicap etc. schemes are running by state/central government. During discussion with respondents about welfare activity/NGO active in the study area, at Shendola Bk. Respondents informed that Tata trust is working in their village. Tata trust has constructed cemented bandhara(dam) for Shendola Bk village.

Market Facility: Study area was predominantly rural type. In villages, small shops were available for daily needs. Weekly market facility was available at some of the sampling locations. Wholesale market was present at Nandgaon Peth, for wholesale markets, malls villagers prefer Amravati city (in the range of 10-25 km)

	
Market facility at Nandgaon Peth	



Gram Panchayat visit & FGD at Sawardi village

Gram Panchayat visit & FGD at DigargavhaN



Focus group discussion at Pimplavihir village

Gram Panchayat visit & Focus group discussion at Shivangaon village



FGD at Salora Bk village

FGD at Nandgaon Peth

FGD at Kekatpur

3.7.4 Awareness /Opinion/demand of People about the existing MIDC and proposed project

3.7.4.1 Existing MIDC

It was observed that all respondents are aware about the existing MIDC and type of industries present in the 5 star industrial area. Locals said that due to MIDC presence in the study area, infrastructure facilities are continually improving. Good roads, railway connectivity, employment opportunities are the beneficial side of the MIDC for the community.

Digargavhan Gram Panchyat is getting tax from Siyaram, Damodar Company. & Golden Company. No CSR activities reported by the villagers by the existing industries present in there surrounding area.

Villagers are positive about the additional MIDC because it is providing employment opportunities to locals, youths are diverting towards technical education for getting jobs in the MIDC. Although locals are getting employment but they complained that outsiders are getting more employment opportunities in the industries.

The study area is rural dominant; respondents also added that due to the additional MIDC, market area is developing in the study area, infrastructure facilities also improving.

At 5 sampling locations, respondents complained about the air pollution due to the existing industries.

During discussion with respondents it is observed that no major crimes registered in the police stations. Tanta Mukti sammiti is formed in every Gram Panchayats for resolving the matters at Panchyat level. At present due to MIDC existence villagers don't feel any increase in crime rate. Only at Shivangaon village respondents reported that crime can be increase in the study area due to migration of workforce from other places, conflict between locals and other state population etc.

3.7.4.2 Proposed Brown Field Project

An attempt was made during the site visit to find out the awareness and opinion of the local population about the proposed brown filed project. Interaction with the respective village Sarpanch, society heads, and villagers was carried out to understand the socio-economic issues of the region and their needs. Almost all surrounding villagers and locals were aware about the project site and its proposed activities.

Respondents from nearby villages near the project site were positive about the project because they felt that it would generate employment opportunities, locals could get income, and villages could develop through CSR activities. Respondents also added that there are fewer employment opportunities in farming due to insufficient facilities, e.g., irrigation, soil that is not fertile, rain-fed farming, etc. The local young workforce required jobs in other non-farming fields. Employment generation through MIDC will improve the income status of youth workers.

Farmers told that industries are not directly purchasing cotton, there should be direct contact of farmers with industries. At 2-3 locations respondents suggested that other than textile industry like Automobile, Cosmetic, Pharma industries will be beneficial for the study area.

Respondents main concerns were migratory workforce from other place will increase in the study area, locals may neglect by the industries while providing employment, local farmers not get any benefit from the textile industries.

Respondents suggested that more employment opportunities should be given to the locals based on educational and experience, for farmer's new schemes or direct contacts with industries will be beneficial.

Table 3-49: Awareness /Opinion/demand of the local population

Sr. No.	Village	project related concerns or grievances	Type of Positive Impact/ Benefit for Community	Type of Negative Impact/Effect for Community	Suggestion/Observation-address to MIDC	Expectations
1	Digargavhan	Migration of workers from other state	1)Employment 2) Infrastructure Development 3)Increase Market Area	Air Pollution	Give priority to local people for employment	Employment for each family, Recreation Centre (Garden),Paved Road, Medical Facility
2	Shivangaon	1)Farmer cannot sell cotton directly to companies 2)Increase in crime 3) Migration of workers from other state	1)Employment 2)Property rate will increase 3)QOL will improve 4)Nearby village development	--	Give priority to local people for employment ,Industry should purchase cotton by local farmer 3)Required other industry like-Automobile, Cosmetic, Medicine	Local Employment, Recreation Centre (Garden),Play Ground, New Gram Panchayat Building, Study Centre/Library for Students, River Cleaning, Paved Road, Drainage Line, High mass light
3	Pimpalvihir	--	1)Employment 2)Fast Urbanization 3)Infrastructure Development 4)Increase in Agriculture Activities 5) Increase Market	Air Pollution	Give priority to local people for employment , Required other industry like-IT, Automobile, Cosmetic, Medicine	Employment for local people, Medical Facility, Education Facility, Gym, New Gram Panchayat Building, Post Office Building, Library, gym, Internal Paved Road

Sr. No.	Village	project related concerns or grievances	Type of Positive Impact/ Benefit for Community	Type of Negative Impact/Effect for Community	Suggestion/Observation- address to MIDC	Expectations
			Area			
4	Sawardi	1)Industries purchase cotton from other states like-Kerla, Andra Pradesh, Telangana 2) Migration of workers from other state	1)Employment 2)Infrastructure Development 3) Increase Market Area 4) QOL will improve 5)Student will divert to textile industry education 6) Nearby village development	Air Pollution	1)Priority to local people for employment	Local Employment, Medical Facility ,Ambulance Facility ,Bus Stop at Highway (Amravati-Nagpur Highway)-MIDC Point, Play Ground, Gym
5	Mahuli Jehangir	Migration of workers from other state	1)Employment 2)Fast Urbanization 3)Infrastructure Development 4)Increase Market Area		1)Priority to local people for employment 2) Required other industry like- Automobile 3)Avoid Pollution (Strictly follow the rules for avoid pollution)	Local Employment, Paved Road in remaining area, ITI Education Facility, Adequate Water Supply , Hospital Facility
6	ShendolaBk.	--	1)Employment 2)Infrastructure Development 3)Increase Market Area	--	1)Priority to local people for employment 2)Industry also should come in our area/village	Adequate Drinking Water Supply, Employment for local people

Sr. No.	Village	project related concerns or grievances	Type of Positive Impact/ Benefit for Community	Type of Negative Impact/Effect for Community	Suggestion/Observation-address to MIDC	Expectations
7	Salora Bk.	Migration of workers from other state	1)Employment 2)Infrastructure Development 3)Increase Cotton Cultivation 4) Property rate will increase 5) Nearby village development	Air Pollution	1)Priority to local people for employment 2)Fulfill norm of waste materials & avoid pollution 3)Required other industry like-Food Industry	Employment for local people, Paved Road Adequate Drinking Water Supply , Recreation Centre (Garden), Library, Gym, Regular Medical Facility, Implementation of CSR activities.
8	Nandgaon Peth	Migration of workers from other state	1)Employment 2)Infrastructure Development	Water Pollution	1)Priority to local people for employment 2)Increase Cotton Cultivation 3)Property rate will increase 4) QOL will improve	1)Drainage Line 2)Paved Road 3)Recreation Centre (Garden) 4)Avoid Pollution like Waste Water
9	Kekatpur	Migration of workers from other state	1)Employment 2)Infrastructure Development 3)Increase Market Area	Air Pollution	1)Priority to local people for employment 2)Required other industry like-Food Industry	Local Employment, Library, Compound for School, Bore well for School , Solar Plant, Paved Road

Source: Primary survey by AESPL SE team

3.7.5 Quality of Life Assessment

Quality of life (QoL) indicates overall status of socio-economic aspects in a given area. Quality of life (QoL) is defined as a function between "objective conditions" and "subjective attitudes" involving a defined "area" of concern.

The "objective conditions" are numerically measurable artifacts of a physical, sociological event or economic event. Objective conditions may be defined as any number, which stands for a given quantity of a variable of interest as long as it is independent of subjective opinion.

"Subjective attitude" is primarily concerned with effective and cognitive dimensions. It is specifically concerned with 'how aspects of cognition vary as objective conditions vary'.

Once objective measures are obtained for each factor they are transformed to a normal scale varying from 0 to 1 (value function curve) in which 0 corresponds to the lowest or least satisfactory measure, and 1 corresponds to the highest. The weights are assigned to each factor by ranked-pair wise technique (by the expert group) based on the secondary data and general observations. For each objective measure, a corresponding subjective measure is developed for each individual of the sample population by asking him to rate his satisfaction scale (value function curve). It is used such that 0 corresponds to the lowest level of attitudinal satisfaction and 1 corresponds to the highest level of satisfaction. Weights are assigned to each factor using ranked - pair wise comparison techniques.

The socio-economic indicators used for computation of QoL are:

i. Employment
ii. Income
iii. Water Supply
iv. Food
v. Sanitation
vi. Fuel Availability
vii. Health
viii. Transportation
ix. Communication
x. Education
xi. Housing
xii. Clothing
xiii. Social Security
xiv. Human Rights
xv. Recreation
xvi. Environment

Assessment

Subjective, objective and cumulative quality of life is estimated as:

(I) Subjective QoL Calculations

$$QoLs = 1/p \sum_{i=1} \sum_{j=1} Ql_{ij} \times^{m} w_{i}^{n}$$

Where, QoLs = Subjective quality of life index

P = No. of respondents, j = 1, ..., p

m = No. of factors, i = 1, ..., m

QIij = Subjective quality index for ith factor assigned by jth respondent

$\sum$ Qiij = Subjective quality index for ith factor assigned by all respondents in an area

Wi = Relative weightage of the ith factor

(II) Objective Quality of Life

$$QoLo = \sum_{i=1}^{i=n} QI_i \times W_i$$

Where, QoLo = Objective quality of life index

n = No. of QoL Factors

i = 1, ..., n

QIi = Satisfaction level (assigned by the expert group) for the ith objective indicator

Wi = Normalized weight for its factor

(III) Quality of Life (Cumulative Index)

$$QoLc = \frac{QoLo + QoLs}{2}$$

The subjective and objective QoL indices prior to commissioning of the project are presented in Table

The average QoL index values were estimated as:

QoL (s) = 0.58

QoL (o) = 0.60

QoL (c) = 0.59

Result for quality of life: above 0.80 to 1: Highly satisfied, above 0.50 to 0.80 satisfied, below 0.5 to 0.30 Not Satisfied, below 0.3 to 0.20 unsatisfied, below 0.2 highly unsatisfied. The data indicates average QOL for sampling locations is falls under satisfaction level.

The following table shows the quality of life in the study area. from the table it can be seen that:

i. The average QoL index value for the study area is leading to satisfactory level due to satisfactory status like, educational facilities, roads; availability of basic needs viz., food, clothing & housing.
ii. Employment opportunities, sanitation, and recreation facilities, were not adequate in the study area as well as air pollution reported by most of the respondents. Improvement in these fields will help to increase the quality of life of the study area.

Table 3.50 shows quality of life in the sampling location.

Table 3-50: Existing Quality of Life in surveyed Villages

S. No.	Sampling location	QoL (s)	QoL (o)	QoL (c)
1	Digargavhan	0.54	0.56	0.55
2	Shivangaon	0.58	0.60	0.59
3	Pimpalvihir	0.56	0.58	0.57

S. No.	Sampling location	QoL (s)	QoL (o)	QoL (c)
4	Sawardi	0.58	0.59	0.585
5	Mahuli Jehangir	0.62	0.66	0.64
6	ShendolaBk.	0.60	0.63	0.615
7	Salora Bk.	0.54	0.58	0.56
8	Nandgaon Peth	0.64	0.66	0.65
9	Kekatpur	0.58	0.60	0.59
		0.58	**0.60**	**0.59**

Source: Primary data collection

(s) = Subjective, (O) = Objective, (c) = Cumulative

Note: Quality of life invented by Anuradha Gadkari (Former scientist at National environmental Engineering research institute, Nagpur. Quality of life calculated based on the satisfaction level of the respondents.

4 ANTICIPATED ENVIRONMENTAL IMPACTS & MITIGATION MEASURES

4.1 Introduction

Development of proposed industrial area includes roads, provision of infrastructure like water supply, electricity supply, common utilities, and planning for a residential zone. Other development will comprise of supporting utility and amenity areas like construction of MIDC offices, Local Area offices, Post Offices, Telephone Exchange, Fire station, Police station/ chowkies, Electric sub- stations, Water supply works, Drainage works, STP, Recreation center etc. Each industrial unit will have to develop/ construct their individual plots as MIDC will handover undeveloped land parcels. Therefore, impacts generated due to above development proposed by MIDC and utility zone or common facilities within this area have been considered.

The proposed project will have various impacts on environmental parameters like land environment, water quality, air quality of surrounding area due to increased quantities of solid waste, hazardous waste, sewage generation, air emissions, etc.

4.2 Identification of Impacts

Environmental impact identification is based on the type, scale and location of proposed project activity. Environmental components that may be affected negatively and positively due to proposed activity are identified.

Environmental impacts during the construction phase will be temporary and will include land degradation (due to extraction of raw material, and solid waste generation from construction activities), local air, water and noise pollution, irreversible impacts on biodiversity, and impacts on health and safety of workers.

When area development is completed, industrial units will be allotted plots to set up operations with FSI of 1 as permitted under the MIDC DC Regulations 2009. Thus, the overall development in all the proposed zones including the Housing and Social Infrastructure zone will lead to built up area in the range of 300 Ha. In addition, long internal road network comprising of 60 m RoW of 4 lanes of length 5.5 km, construction of 7.50 m two lane road for a length about 2.49 km and 5.50 m. service road for a length of 450 m along the National Highway. Thus, urbanization and densely built up area will increase.

Activities during operation phase will be of construction of manufacturing plants and associated infrastructure/buildings in the initial period followed by commissioning and operation of the plants. Thus, the environmental impacts in operation phase will be permanent and long term. They will lead to built up area in the now rural countryside due to industries been constructed, air, water, noise pollution, irreversible impacts on biodiversity, and on health and safety of workers.

Following parameters are selected for impact assessment due to proposed activity during various phases of the project cycle:

Table 4-1 Environmental Aspects and Impacts of Proposed Project

Sr. No.	Step/ Activity	Environmental Aspect	Impact	
			Type	Severity
1.	Construction	Air emission due to material handling, construction activities and transportation vehicles	Air Pollution	Temporary
		Use of manpower	Employment	Temporary
		Degradation of borrow areas and quarries due to use of borrow earth, aggregate and other raw materials	Land Pollution	Permanent
		Loss of top soil, especially agricultural land and loss of other assets	Socio-economic loss	Temporary
		Cutting of trees within proposed road alignments	Biodiversity loss	Permanent
2.	Commissioning of onsite pollution control devices and equipments	Use of water, energy and raw materials	Natural resources, conservation	Temporary
		Waste water discharge	Water Pollution	Temporary
		Drainage and Erosion	Water and Land Pollution	Temporary
		Construction waste disposal	Land Pollution	Temporary
		Traffic disruption due to construction activity	Sociol concern, Air Pollution	Temporary
		Air emission and vehicular pollution due to traffic	Air Pollution	Temporary
3.	Operation	Drainage and Erosion	Water and Land Pollution	Temporary (seasonal)
		Effluent and sewage generation	Water Pollution	Permanent
		Generation of MSW, hazardous waste	Water and Land Pollution	Permanent
		Air emission and vehicular pollution due to traffic	Air Pollution	Permanent
		Noise generation	Noise Pollution	Permanent
4.	De-commissioning	Air emission due to material handling, decommissioning activities and transportation vehicles	Air Pollution	Temporary
		Use of manpower	Employment	Temporary
		Disposal of earth, aggregate and other road construction materials	Land Pollution	Permanent

4.3 Impact Identification and Suggested Mitigation Measures during Construction, Commissioning, Operation and Decommissioning Phases

4.3.1 Land Environment

4.3.1.1 Impacts during Construction Phase

Change in Land use

Currently most of the land is either fallow or agricultural. Due to the proposed development, there will be a permanent change in the land use over the entire 410 Ha site area. Constructed area will increase manifold and the land will lose its rural character.

Site Preparation

The proposed site for the PM MITRA park is undulated terrain (contour varies from 382m to 344m) which would require cutting and grading to certain extent for road/ civil contruction. During construction phase the activities will be related to land de-weeding, levelling of site and construction of related structures and installation of related equipment premises.

Clearing of the site to be carried out prior to start of excavation and other construction activity involves removal of grass/ shrubs and leveling of land. At present, there are small temporary and permanant existing structures, including a temple on site, these will however be left out of proposed development, also, no R&R is anticipated.

Loss of Top Soil

Excavation and filing activity for the proposed development will result in the loss of top soil. Cutting will be undertaken on site for proposed roads.

Effect on natural drainage pattern

The proposal involes construction of roads and laying of infrastructure like water supply pipelines, electris cables etc. During the construction of roads or excavation for laying down of pipelines, debris may get deposited into the existing rivers/ streams. The natural drainage pattern where the roads cross existing natural water drains or streams may be affected.

Soil erosion

Accelerated soil erosion from unpaved roads and excavated areas is anticipated due to the natural gradient of the site. Pollution and siltation of adjacent agricultural fields, water bodies, streams and channels and blockage of existing natural water bodies in the adjoining areas, which is a potential negative impact.

Construction raw material

Raw materials brought to the site from far areas may have high embodied energy. Environmental impacts like pollution due to transportation of such materials from a distance are a concern. Extraction of stone/earth for construction raw material will lead to large scale quarrying activities and may impact the environment.

Transportation of Construction materials

As has been noted that the adjoining existing NH53 which provides site access, has considerable traffic. Transport of raw materials to site through trucks may affect the traffic pattern and cause temporary traffic congestion in the vicinity of the site. It may also cause localized short-term air pollution near the site during this period.

Construction Waste

Construction activity is limited to common / ammentiy space as the undeveloped plot will be sold off / leased out to individual units. The site will be cleared prior to start of excavation and other construction activity of common facilities / amenities. This involves removal of grass/ shrubs, trees and levelling of land.

Major impact on land environment, during construction phase, will be due to the waste generated from discarded construction material/ debris. Construction waste will consist of packaging materials (gunny bags, cardboard cartons, plastic bags etc), broken glass, cut aluminum sections debris, concrete, sludge of cement slurry, aggregate, discarded containers of bitumin, bituminous material (asphalt waste) etc. Approximately, 2-3 MT/ day debris will be generated.

Proper management of the waste material through segregation and reuse is required. Waste if left unattended will cause short term, temporary impact on the environment.

Resources such as water and fuel will be used in the labour camp and municipal waste will be generated. Total municipal solid waste (domestic and or commercial wastes) from labour camp will generated about 5 kg/ day. If not managed/ treated properly, this may lead to contamination of land. Biodegradable waste if not treated and disposed properly, may create rodents, flies and other insects which may directly or indirectly affect the human health.

Air and Noise Emissions

Construction of roads and other buildings will lead to fugitive dust emission and or noise pollution thereby affecting health of populace.

4.3.1.2 Mitigation Measures during Construction Phase

Site Preparation

To control dust pollution, water sprinkling will be done at regular intervals and excavated materials will be kept covered at all times. In the prevailing climate influenced by heavy seasonal rains, all the earthwork will be started and completed in the dry period, commencing immediately on completion of the monsoon season (in September-October) and extending till end of May.

Top Soil

While preparing the land for construction, the fertile top soil cover of the entire plot (up to 30 cm depth) shall be scraped and preserved separately to later fill the same in the area designated for establishment of green belt. Top soil may be protected by adopted the following measures:

- Activities to be carried out during dry season
- Stock pilling at a separate demarcated storage area
- Covered with plastic or tarpaulin sheet to prevent erosion

Natural drainage pattern

The planning phases of the project are to be properly timed such that major works are completed during the non monsoon season as mentioned above. The natural drainage pattern where the roads cross existing natural water drains or streams will be maintained, as far as possible and suitable culverts will be provided wherever required. The slope of the embankment will be protected by suitable means.

Management of construction material and construction waste

To avoid traffic disruption due to vehicles carrying raw materials, the resources such as sand, metal, bricks, etc. will be procured from nearest available government approved quarries and establishments. As the site has exposed rocks at certain locations, hence boulders available may also be used for construction purpose.

- Specific areas shall be demarcated on the site by the Contractor, for storage of this material and also for temporary collection of construction debris, prior to its disposal.
- Debris shall also be generated in the form of top soil and sub-stratum removed during excavation. Use of such material will also be made for filling of areas.
- Adequate covered facilities, such as sheds for storage of materials and storing of recyclable and reusable construction wastes shall be provided for.

For management of municipal solid waste generated from labour camps, the Contractor tender will have specifications to enforce that necessary measures for solid waste management are taken during construction phase.

Hazardous Waste Disposal

Discarded containers of bitumin, bitumen drums, bituminous material (asphalt waste), discarded paint containers and used oil and equipment are classified as hazardous waste and will need to be safely stored and disposed off as provided by MPCB through authorized recyclers. There will be separate storage area which shall be adequately covered and provided with impervious lining.

Similarly used oil/waste oil generated from the maintenance of equipment like breakers, road rollers, concrete mixtures etc and transport vehicles will need to be disposed off through MPCB authorized recyclers. No long term storage at site is to be made.

Disposal of hazardous waste generated is summarized below:

Table 4-2: Hazardous Waste Disposal

Type	Category	Disposal
Used Lead acid Batteries	B6, Schedule II	MPCB Authorised recyclers
Used Oil	5.1, Schedule I	MPCB Authorised recyclers
Bituminous material (asphalt waste) containing tar	A3200, Schedule VI	MPCB Authorised recyclers

Roads and Traffic

- The raw materials required for construction will be sourced from the nearest available government approved contractors/ suppliers, to avoid traffic disruption. Vehicles shall be parked away from free flowing traffic and not on public road.
- The transport of materials will be arranged during non peak hours.
- Existing utility services eg: electrical poles, telephone poles, etc. will be shifted and relocated to suitable places. This work will be done in co-ordination with concerned service departments and owners of the utility lines.

4.3.1.3 Impacts during Commissioning Phase

Impacts during commissioning phase will be due to:

Use of water for construction labourers and for construction activity about 53 cmd. This water supply will be met through from tanker water supply for construction work. Water for domestic requirement of construction labourers will also be sourced from tankers.

Similarly, electricity required (1 MVA) will be sourced from generator sets on site. Use of the same may lead to air pollution.

During commissioning stage the water and energy demands will be fluctuating as work proceeds from one location next.

Waste water generation will result in estimated 34.5 cmd of sewage from the labour camps and site offices etc. Disposal of this waste water will be in a well engineered manner so as to cause minimal environmental damage.

Soil contamination

Contamination of soil by fuel and lubricants from equipments such as DG sets, bitumen drums, vehicles as well as due to improper storage of waste may occur during this phase.

4.3.1.4 Mitigation Measures during Commissioning Phase

- Proper training to construction employees and labourers in handling of waste materials especially hazardous waste and other chemicals by hiring trained personnel well versed in handling such materials.
- Have a designated procedure to ensure waste generated during commissioning is collected and sent to authorized waste disposal site.
- DG sets to be located on leeward side in case settlements and other sensitive receptors like schools/ PHCs or hospitals are located close to the construction site.
- DG sets and oil drums to be located in demarcated area which shall be adequately covered and provided with impervious lining.
- Waste water will be disposed into local sewers or by constructing septic tank with soak pit arrangement or packaged type sewage treatment plant of 40 cmd capacity.

Hazardous Waste Generation and Disposal

- Used bitumen drums and equipment are classified as hazardous waste and will need to be safely stored and disposed off as provided by MPCB through authorized recyclers. There will be separate storage area which shall be adequately covered and provided with impervious lining.
- Similarly used oil/ waste oil generated from the maintenance of equipment like breakers, road rollers, concrete mixtures etc and transport vehicles will need to be disposed off through MPCB authorized recyclers.

4.3.1.5 Impacts during Operation Phase

Activities during operation phase will be of construction of manufacturing plants and associated infrastructure/buildings in the initial period followed by commissioning and operation of the plants.

Landuse changes

The changes in land use will be completed as industries start occupying various plots and undertake erection of plant and associated facilities, commissioning and operation of their units. Built up land will increase and land will lose its rural character.

Clearing of the sites allotted to individual units as per their requirement will have to be carried out prior to start of development. This involves removal of grass/ shrubs, cutting of existing trees and cutting and leveling of land, construction of storm water drainage as per the individual industry's requirement and may result in changing natural drainage pattern.

Soil erosion

Possibility of soil erosion during operation phase is low as most of the area will be developed and will have proper finishing. However, non paved areas will have to be maintained in order to prevent water logging which may lead to soil erosion.

Surface runoff

Pollution due to surface runoff is likely to take place as oil and grease from vehicles may get deposited on the road surfaces. During the monsoons, this oil and grease will find its way in the drain channels and into the surface water bodies/ rivers or streams in the vicinity.

Waste Generation and Disposal

- Removal of Soil/substratum will lead to loss of nutrients and generation of substratum.
- Extraction of stone/earth for construction activities will lead to large scale quarrying activities.
- Transportation of construction materials and raw materials/finished products for industries in operation will lead to traffic congestion.
- Types of wastes generated will include construction debris, concrete, steel and other metals, broken bricks/tiles/glass, pallets, packaging, metal scrap, used oils/paints and their discarded containers and HW, BMW, e-waste, battery waste etc. generated by operating industrial units, requiring disposal.
- Use of resources (water and fuel) in labour camp and MSW generation.
- Disposal of industrial effluents on land after treatment may affect the soil.
- There is a risk of possible spillage of chemicals during storage and handling
- It is estimated that municipal solid waste generation from the residential zone will be 10.1 TPD, of which biodegradable waste will be 5.1 TPD and non degradable waste will be 5.6 TPD.

4.3.1.1 Mitigation Measures during Operation Phase

Measures for soil protection and pollution due to surface runoff

Erosion protection measures to prevent soil erosion will be adopted. Soil contamination through fuel/ lubricant will be prevented by avoiding runoff from affected areas into natural drains. Use of silt traps is also suggested.

Pollution of surface water bodies/ rivers or streams in the vicinity due to runoff containing oil and grease from vehicles may be avoided by provision of oil and grease traps at the drainage sumps. Regular maintaenance of the sumps is recommended.

Solid Waste Management

Solid waste will be treated in proposed Common Municipal Solid Waste Treatment Facility within the Utility zone of the PM MITRA park site. Non-degradable waste will be disposed in closest landfill site and biodegradable waste will be treated in Bio methanation plant/anerobic digestor to be set up at site.

The sludge produced in primary and secondary settlers and tertiary treatments units is separately collected and suitably disposed of after appropriate treatment. In case it contains toxic chemicals it has to be disposed of at land-fill sites built specially for such wastes.

4.3.2 Air and Noise Environment

4.3.2.1 Impacts during Construction Phase

The proposed site is partly of undulated terrain which would require cutting and grading. The levelling of site will lead to fugitive dust. There would be an increase in particulate matter and dust generation, which would be of a short term and localized nature.

Construction Phase

- Ambient air quality will be affected due to fugitive dust generation, increased dust emissions and noise generation during the road construction. This will be a temporary and minor impact.
- Activities such as increased heavy vehicle traffic for construction related materials to and from the site, excavation for road, leveling/ cut & fill works, etc. may result in such impacts. The pollutants of concerns are NO_2, SO_2, CO, NH_3 and particulates etc.
- Use of diesel to run various construction machineries like stone breakers, road roller, concrete mixtures will lead to air emissions. Emissions from operation of DG sets of around 1 MVA capacity (which is required during construction).
- There will be generation of dust because project involves cutting and filling activities.
- There will be emission of pollutants due to burning of diesel from various construction machineries.
- Dust or odors will be generated from heating of bitumen/ tar on site.
- Sources of noise pollution e.g. noise generating machinery/ equipment (dumpers, bulldozers, compressors, compactors, breakers, road rollers, concrete mixtures etc.) as well as heavy vehicles used for transportation, will be marginal, temporary and controllable.
- Since blasting and piling work is not anticipated, no impacts due to vibration are anticipated.

4.3.2.2 Mitigation Measures during Construction Phase

Emissions from mobile sources:

- Idling of raw material delivery trucks or vehicles carrying other equipment will not be permitted, when not in active use.
- Dust covers will be provided on trucks used for transportation of materials prone to fugitive dust emissions.
- Cleaning of vehicles will be carried out periodically to reduce dust and vapour emissions.

Emissions from stationary sources

- Most of the machinery related to construction will be located close to construction area for ease of handling.
- Machinery such as mixers will be screened with sheets of suitable material to reduce the spread of suspended particulate matter and to reduce noise.
- All stationary construction equipment will be located as far away as possible from existing residential pockets. Hot mix plant, Crushers and RMC plants will be located as per MPCB guidelines. DG sets will meet EP Act Standards.

- Heating of bitumen/ tar on site will be carried out on leeward side of nearby residential pockets so that dust and fumes have minimal impact on local people.
- Areas of activities such as excavation/grading and routes of delivery vehicles across patches of exposed earth, will be frequently water sprinkled to prevent dust pollution till the road surfaces are asphalted.
- Appropriate containment arrangements around bulk storage tanks and material stores will be made to prevent spillages entering watercourses.
- Equipments/ machines and vehicles will always be kept in good state of repair to minimize emissions. Vehicles utilized for construction activities by contractors will be mandated to comply with Bharat/Euro emission standards
- Contractor tender will have specifications to enforce that necessary measures for air pollution control

For mitigation of Noise Levels

- Construction related contracts will make it obligatory to ensure that the noise levels during the operation of construction machinery will be maintained below the limits prescribed under the EP Act noise standards.
- Noise generating sources will be regularly oiled/ greased and their support platforms maintained properly so as to prevent vibratory noises.
- Workers working near high noise machinery will be provided with ear muffs/ ear plugs.

4.3.2.3 Impacts during Operation Phase

During this phase, there will be generation of air pollution due to:

- Transportation of raw materials, operation of heavy machinery such as excavators, bull dozers, tipper trucks, etc. for development of plots by individual units
- Operation of RMC plant/ hot mix plant and crusher
- Fuel use in labour camp
- Fugitive dust emission during road construction, land development and construction of buildings and traffic on kaccha roads within plots
- Air emissions due fuel burning in boilers (for steam generation in industries) and process vents and fugitive emissions
- Pollution load from textile mills differ widely depending upon the nature of Fiber used and the level of processing employed. Phenolic chemicals impart bad odour and taste to the water mass.
- High noise generation from operation of construction machinery such as excavators, bull dozers, dumpers, compressors, compactors, concrete plant, cranes, etc. as well as heavy vehicles transporting construction materials
- High noise generation due operation of various plant & machineries, DG sets, transportation

Sources of air pollution during operation stage will be:

Process Emissions

Textile Manufacturing Zone

Air emissions are due to use of boilers, ovens, and furnace. Generation of steam is from Boilers which releases nitrous oxides and sulphur dioxides, carbon monoxide from chimney. Certain other operations like sizing, bleaching release chlorine derivatives, and fabric printing releases hydrocarbons and ammonia. Fabric-finishing operations can release formaldehyde into the air without safeguards; these toxic vapors would remain suspended in the air and be carried by the wind to pollute other areas. Acid fumes and chromium dust are harmful because of its extreme toxicity.

Combustion Emissions

Combustion emissions are mainly from the burning of fuels, for production and transportation purposes. The nature and quantity of emissions depends upon the kind of fuel being used. In respect to proposed industrial park combustion emissions will be released from stationary fuel combustion sources like furnaces, heaters and steam boilers. Vehicular emissions also come under this category.

Fugitive Emissions

Fugitive emissions mainly due to storage and handling of raw materials, transportation as well as due to food processing industries. Handling mainly includes loading and unloading operations, material transfer to vehicles. There would be an increase in particulate matter and dust generation, which would be of a short term and localized nature.

Auxiliary Emissions

Emissions generated from units like cooling towers, boilers and wastewater treatment units of few industries. Atmospheric emissions from cooling towers mainly include gases, which are stripped when the water phase comes into contact with air during the cooling process.

4.3.2.4 Mitigation Measures during Operation Phase

- A well-developed road infrastructure will be put in place so as to have free flow of traffic and no traffic congestion.
- MIDC as operator of facility will provide DG sets meeting EP Act standards (to be used as an emergency power back up only) which will add to minor emission of air pollutants.
- The proposed industries have low air pollution potential
- Individual industrial units will provide Air Pollution Control facilities for fuel burning stacks, process vents and DGsets as per Consent to Operate granted by MPCB.
- Adequate greenbelt will be developed for further control of air pollution due to fugitive emissions at site. More than 33% of area of proposed industrial park will be developed as green belt by planting trees which are indigenous to this region and will be maintained to keep the ecological harmony. Each unit has to maintain requirement of green belt as per Consent conditions.
- Adequate stack height will be provided for better dispersion of flue gas as per the MPCB / CPCB guidelines.

The following measures are proposed for pollution control in the project area:

DG Sets: The running of DG sets will result in emission of various pollutants. To achieve adequate natural dispersion, adequate stack height will be provided to DG sets at common facilities area/ amenity zone as per MoEFCC regulations / CPCB guidelines.

Industrial emissions:

- All member industries should provide adequate stack heights for boilers, furnaces and DG sets.
- Phenolic chemicals which impart bad odour and taste to the water mass should be removed to prevent any chances of stream water becoming unsuitable for agricultural, domestic and industrial use. The operations should carry out pre-aeration for odour control. Pollutants,

coloured substances, odours and microorganisms are directly destroyed by oxidation, without creating harmful chlorinated by-products or significant residues, hence it is suggested to use ozonation process.

- Individual industrial units should install appropriate air pollution equipments viz. bag filters, scrubbers etc. for controlling emissions from process. Bulk material should be transported in closed trucks to avoid wind entrainment.
- specifically designed vacuums should be sued to safely vacuum toxic dusts. Equipped with filter with high efficiency (efficiency of 99.995% on 0.2 micron) so there is no risk of exposure or contamination for the operator or the environment.

Effective Traffic management: Internal roads would be maintained in good conditions to control the dust emissions. Awareness will be raised amongst the employees for use of low sulphur fuel.

Green belt development/plantation: Vegetation is an effective means for controlling air pollution due its dual action of acting as a barrier between the source of emission and receptors and also as a sink for various pollutants.

It is proposed to develop plantation of species effective in absorption of expected pollutants at site, along the internal roads and on the periphery of the Industrial Park. A green belt of 15m is recommended along all the boundaries of the proposed industrial area.

4.3.3 Water Environment

4.3.3.1 Impacts during Construction Phase

Impacts due to Construction Activity

Development activities involves various ground related activities viz. levelling, excavation, stockpiling, use of concrete, sprinkling, washing etc.

During construction activity, pollution from construction run-off is likely. Blocking of natural drains due to deposition of construction materials is a likely impact.

Wastewater from labour camps will contaminate ground water if not disposed in a well engineered manner.

4.3.3.2 Mitigation Measures during Construction Phase

- The proposed labour camp will be provided with adequate sanitation facilities like safe drinking water, toilets with septic tanks and soak pits. Temporary arrangement of drinking water will be made for workers.
- Sanitation provisions such as washrooms, toilets, dustbins for waste and other packing material brought by workers will be made available during the period and capacity will be adequate for the workers
- Construction area will be isolated and care will be taken to divert the run-off to storm water drainage, so as to prevent pollution from construction runoff. Also, subsurface work will be carried out only during non-monsoon period. A storm water management plan having limited impervious layer, will be implemented to promote infiltration.
- Precaution will be taken to ascertain that no waste materials such as cement, paint and solid material like iron rods and any other material are dumped into storm water system. No accumulation of stagnant water will be allowed within the construction area.

- Blocking of natural drains/ streams and percolation tanks on the site due to deposition of construction materials is a likely impact unless regular cleaning of drains is carried out. Other appropriate engineering measures are to be adopted to prevent construction related impacts.

4.3.3.3 Impacts during Operation Phase

Impacts on natural drains and percolation tanks due to proposed land development

Excess usage of water in manufacturing processes

The textile industry is water-intensive. Water is used for cleaning raw material and for the different steps in the textile process. Due to water scarcity and stricter environmental regulations, the cost of freshwater utilization as well as treatment of effluent has increased worldwide. In addition, the textile industry faces pressure from government regulators to move toward sustainability by reducing water consumption, while internal pressures to manage cut-throat competition in costs.

Various processes being carried out in textile industries generate liquid pollutants. Please refer the table given below.

Table 4-3: Processes Generating Pollution Load and level of their impact on Ambient Water Quality

Process	Steps	Impact	Remarks / Comments
Cleaning of Fiber	Wool, Silk, Jute, Raw cotton package dyeing	Major	Effluent generation
Ginning Industry	Raw cotton mechanical cleaning	Minor	Major solid waste generation
Spinning Industry	Yarn making	Minor	Major solid waste generation
Fabric Making – Loom Shed	Sizing	Major	Effluent generation
	Weaving	None	
Wet Processing Industry / Process-House	De-sizing	Major	Effluent generation
	Scouring / Bleaching	Major	Effluent generation
	Dyeing & Printing	Major	Effluent generation
	Finishing	Minor	Effluent generation
Garment industry	Garment making	Minor	Solid waste generation
Laundry	Garment Washing, Dyeing, Printing	Major	Effluent generation

It can be seen that almost all operations of textile industry generate different volumes of wastewater containing various pollutants that are likely to have various levels of adverse impact on water bodies if they are disposed on land or in water bodies.

Large volume of water and a variety of chemicals including dyes are used in textile mills at various stages from fiber processing to finished product manufacture.

Waste water from textile processing and dye containing residues requires appropriate treatment before being released into environment.

Organic ingredients in the waste water undergo bio-degradation and reduce dissolved oxygen content (DO) of the receiving water body and thus destroy the aquatic life.

Phenolic chemicals impart bad odour and taste to the water mass.

Textile mill waste water includes fibrous substrate and processing chemicals which increase Total suspended solids & reduce oxygen transfer capacity and light penetration and thus affect photosynthetic activity in the water-bodies.

Soluble inorganic salts may lead to pollute water bodies which are not suitable for domestic and industrial use.

Heavy metals are toxic to aquatic life.

4.3.3.4 Mitigation Measures during Operation Phase

a) SW Drainage & Rain Water Harvesting

Rain water harvesting may be proposed as part of the road design. To increase ground water recharge by percolation and decrease the flooding of storm water drains, it is suggested that an infiltration trench is built by the side of the drain along all the roads.

The storm water drainage arrangement within the individual plots will be got approved from the MIDC as per the MIDC DCR, 2009. Rainfall runoff will be maintained as previous through provision of drain lines within the industrial plots at the entry and exit points of the main nallas. Thre will be no change in natural drainage pattern.

b) Reduction of water consumption

Awareness will be spread amongst the management and maintenance team as well industrial units also during operation stage:

- Installation of water meters conforming to ISO standards 4064-1:2014 at inlet and outlet point of water supply.
- To further lower the water consumption, options of Low flow flushing systems, sensor based fixtures, waterless urinals, and tap aerators etc will be explored.
- Effective Leak detection system.
- Drip / sprinkler irrigation system for shrubs and lawns

c) **Reduction in fresh water consumption within processing units**

The reduction of water input can be done by two ways;
1. Optimization of process parameters: Optimization of process parameters will result in reduced water consumption which is quite possible by the use of latest developments in process technology and with low liquor ratio processing equipments, smart washing cycle, and proper controls.
2. Water recycling - Wxater recycling between several processes is possible, but its potential has not been exploited by textile units. This is possible at two stages:

- Recycling of water internally in selective processes.
- Recycling of treated effluent by setting a UF/RO/Nano filters at the end-of- pipe line

Such reduction in fresh water consumption within processing units at various stages will reduce the pollution load on ETP and improve the quality of treated effluent.

Table 4-4: Action to be taken for Reducing Water Consumption in Various Process Operations

Process	Suggested -Action	Steps to be Taken by Mill
Pretreatment (Desizing, Scouring & Bleaching)	1) Try to recycle internally	○ Can explore possibility to use bleaching water in scouring & desize. ○ Can use water from washes of each process wherever possible through counter current method in washer unit & also by storage in tank & re use.
	2) Avoid overflow rinses	○ Overflow rinses consumes 40% more water as compared to smart washing techniques.
	3) Combined Scouring & Bleaching process (Single bath scouring & Bleaching)	○ This will save water by 40% ○ Use counter current system for washing machines
	4) Use enzyme base technology	○ One can reduce water & energy consumption by reduction in temperature & number of washes.
		○ One can recycle this water back to process by topping-up of chemicals
Dyeing	1) Use single bath dyeing for PC blends	○ Saving of water, power , energy & time
	2) Use low salt dyes, 3) Use high exhaustion dyes, 4) Use of pad dry method instead of exhaustion method.	○ Approx. 20% to 60% water can be saved.
Finishing	1) Use of standing bath for batch wise application of finishing chemicals	○ Can save 15% of water. ○
	2) Can use hi suction slit on stenter	○ Can save 15% of water with compare to padding mangle. This also can reduce energy used in drying.
	3) To recycle cooling water on sanforise finish	○ 80% of water saving (Used in cooling)
New techniques	Use equipment's with low MLR	○ Can save 15% to 20% of water
	Recycle chiller plant water	○ Can save 80% of water
	Auto control of humidification room	○ Can save 25% to 30% of water
	Auto level control in processing machines	○ Can save 30% of water.
	Use nozzle with stop motion at the end of pipe during cleaning	○ Can save 25% of water
	Use of sensor for water flushing in toilets	○ Can save 50% of water.

d) For preventing water pollution

- The liquid effluent generated is required to be treated for recycle and reuse in the process to minimize the volume of discharge.
- It is also emphasized that efforts have to be made to use best practices and the processes to minimize water consumption besides using appropriate technology for wastewater treatment.

- CPCB has developed specific norms for treated effluent as notified under the Environmental (Protection) Rules 1986 that must be strictly monitored before discharge outside the mill premises.
- Implementation of effective Chemical Management System (CMS) can help to reduce NPO (Non Productive Output) and hence reduce pollution load on ETP
- Organic ingredients in the waste water should be removed to prevent any chances of stream water becoming unsuitable for agricultural, domestic and industrial use.
- Fibrous substrate and processing chemicals, TDS, Soluble inorganic salts, heavy metals are to be properly treated. This will reduce the concentration of these pollutants as well as their harmful effects and prevent adverse impact on environment. Correctly treated effluent provides opportunities for further use of the treated water back to process.
- Some measures may also need to be adopted to reduce pollution load (both in terms of concentration and volume) e. g. scouring & bleaching wash water (rinse water) from dye houses may be used for desizing & also back to scouring. Recycling of drain from one process may be used in starting of selected processes whereby, savings of chemicals may take place along with savings in water volume.
- Phenolic chemicals which impart bad odour and taste to the water mass should be removed to prevent any chances of stream water becoming unsuitable for agricultural, domestic and industrial use. The operations should include use of screens and grates for removal of large materials, pre-aeration for odour control.
- Pollutants, coloured substances, odours and microorganisms are directly destroyed by oxidation, without creating harmful chlorinated by-products or significant residues. Hence ozonation should be used.

e) **Solvent Recovery**

Solvent scouring is the treatments of fabrics in organic solvent medium to remove impurities such as lubricating oils and spin finishes. Some of the more common solvents used are mentioned below:

- Water
- Trichloroethylene
- 1,1,1 Trichloroethane
- Perchloro ethylene
- Trichlorofluoroethane

These solvents are safe as they are generally non-flammable. However, they must the handled with care because the chlorinated ones are on the suspect carcinogen list of regulated chemicals.

During the solvent scouring process, the solvent scouring range should be enclosed so the vapors are contained and not allowed to escape into the atmosphere. Recovery units are installed on the range to insure that. none of the solvent is allowed to vent to the environment. Usually carbon adsorption towers are use for this. Also a solvent distillation unit is needed to reconstitute the pure solvent and separate the removed contaminants.

The elimination of hazardous solvents is of prime concern. Some of the modified processes consuming lesser or eco-friendly chemicals thereby providing a safer and sustainable environment are as follows:

- Use of enzymes in wet processing,

- Reuse of water,
- eco-friendly auxiliaries,
- single step desizing,
- scouring and bleaching,
- elimination of carcinogenic dyes and pigments,
- use of low impact reactive and natural dyes,
- Use of low MLR equipments for processing,
- supercritical fluid dyeing (using liquid Carbon dioxide),
- Ultrasonic and Ultraviolet energy for dyeing,
- recycling system for organic solvent used in textile pigment printing,
- avoiding phthalate base pigments in printing/ digital printing/ heat transfer printing,
- formaldehyde free finishing and bio-polishing

f) Sewage Treatment Plant

MIDC, the proposed common Sewage Treatment Plant of 4 MLD for the sewage generated from the residential and other zones, will be set up on the Sequential Batch Reactor (SBR) or Cyclic Activated Sludge Process (Cyclic ASP) technology. While each SBR design is unique following points will be taken into consideration by MIDC at Tendering stage for implementation of STP:

Design Considerations for SBR

1. Inlet Flow equalization –has following distinct advantages:

- allows smaller SBR-basin size as it offers storage until the process cycle is complete.
- allows one basin to be taken off line for maintenance or for seasonal variations.
- ensures adequate amount of carbon available in the denitrification fill phase.
- allows for an equal flow volume into the basin, keeping the food to microorganism ratio (F/M) fairly stable

The influent-equalization basin will:

- have arrangement for mixing to keep the solids in suspension.
- have a mechanism for removing scum, grease, and floatables
- means to bypass the equalization basin and to dewater the basin
- be provided with pumps with stand by arrangement
- be designed to hold peak flows long enough to allow the active treatment cycle to be completed.

2. Spares supply: Plants operating with a two-basin system without influent-flow equalization, will maintain an adequate supply of essential spare parts onsite.

3. Alkalinity addition: Make provision for adding alkalinity at both the influent equalization basin and the SBR basin since Nitrification will cause the pH in the SBR unit to drop and cause process upsets. Alkalinity monitoring and addition ensures that a pH of less than 7.0 does not occur. If a plant has adequate alkalinity, pH does not change

4. Plant Design: Ideally, STP will have a minimum of two SBR basins and one flow equalization basin to allow for redundancy, maintenance and flow variations. With arrangement of transferring sludge between the two basins.

5. Blower design Provide multiple blowers to one large unit for better operational efficiency and reduced maintenance/energy costs. Single blower, if provided, will be sized for worst-case conditions (typically for the summer months, when higher temperatures decrease the amount of DO in wastewater).

6. Variable Frequency Drives will be provided to reduce energy costs and increase life of Aerators, Blowers and Pumps, variable frequency drives

7. Fine-bubble membrane diffusers transfer more oxygen to the water due to increased surface area in contact with water and are preferable to coarse-air bubble aeration.

8. Bottom slope All basins will have a sloped bottom (rectangular basins towards one corner and circular bottom towards center) with a drain and sump for routine tank maintenance and ease of cleaning.

9. Post-basin effluent equalization will be provided to enable treated sewage storage and a constant smooth flow and smaller sizes of downstream processes, such as disinfection of filtration. Basin size must be sufficient size to hold a minimum of two decantable volumes and will have means to return the liquid back to inlet equalization in case of sewage with poor decant quality. Basin will have sloped bottom to remove settled solids

10. SCADA (Supervisory Control and Data Acquisition System). SCADA is a computer monitored alarm, response, control and data acquisition to monitor and adjust treatment processes and facilities. SCADA gives the operator ability to fully control (i.e., modify) the plant-operating parameters, such as cycle times, volumes, and set points. Oxidation reduction potential (ORP), dissolved oxygen (DO), pH, and alkalinity are parameters that will be monitored by the SCADA system. MPCB is advising all Common Effluent Treatment Plants (CETPs) to have SCADA system to enable close control on the ETP.

Ensuring SBR Performance

Following paragraphs cover care to be taken during operational stage to ensure good performance by SBR:

1. Alkalinity

Maintain Alkalinity in a range of 40-70 mg/L as $CaCO_3$ prior to the decant phase to ensure completion of the nitrification cycle.

Alkalinity is added by addition of Sodium Bicarbonate, a.k.a. Baking Soda ($NaHCO_3$) (most preferred), Sodium carbonate Soda Ash (Na_2CO_3)and/or Calcium Oxide Lime ($Ca(OH)_2$).

2. Wet weather operation During storm events and high-flow periods, shorten the react cycle the fill phase and the idle cycle since the diluted flow treats the BOD.

3. Flow-paced batch operation

- SBR operation will be Flow-paced batch operation rather than time-paced batch so that the plant receives the same volumetric loading and approximately the same organic loading during every cycle. Supernatant in the SBR basin dilutes the batch of incoming influent.
- Plant under time-paced mode, receives different volumetric and organic loading during every cycle. Thus, different types of biomass development may take place in each basin, making the operations difficult.
- Also time paced operation may not bring in an adequate carbon source needed for the bacteria to strip oxygen from the nitrate during denitrification stage.

4. **Decanting** While operating under a flow-paced batch operation, no more than one third of the tank contents will be decanted each time in order to prevent disturbance of the sludge blanket so as not to impair effluent quality.

5. **Parameters to Monitor in SCADA System**

   Oxidation reduction potential (ORP), dissolved oxygen (DO), pH, and alkalinity are parameters that will be monitored by the SCADA system.

   ORP can be used to determine if a chemical reaction is complete and to monitor or control a process. For plants that nitrify and denitrify, ORP monitoring is desirable.

   On-line dissolved oxygen meters help adjust blower times to address the variable organic loads at inlet. This in turn reduces the energy cost.

   Alkalinity monitoring and addition ensures that a pH of less than 7.0 does not occur.

Achieving ZLD

Potential for ZLD from existing CETP is given under **section 2.8.3**.

Following measures will be taken to ensure ZLD from proposed STP:

- Sewage will be treated by establishing sequential batch reactor (or cyclic ASP) process plant of 4 MLD capacity in residential zone. The technology gives BOD < 5 mg/l and also offers benefit of nitrogen and phosphorous removal making water fit for any use. The treated sewage water from STP to be set up in MIDC will be reused for flushing, cooling, gardening and balance if any will be available for industrial use.

4.3.4 Ecological & Biological Environment

4.3.4.1 Impacts during Construction Phase

- Large-scale development of industrial larea will require felling of trees within site. Cutting of about 91 trees falling within the areas earmarked for roads, common facilities, etc. Trees which are within delineated industrial plots may additionally be cut. Loss of tree cover will lead to habitat destruction and degradation of biodiversity and is thus a major permanent impact during construction phase of the project.
- Habitat Degradation: Clearing land for construction purposes can lead to the destruction of natural habitats, including agricultural and grasslands. This can displace and disrupt the local flora and fauna, leading to a loss of biodiversity.
- Avifauna as well as arboreal fauna will be affected due to loss of space, tree cover and by the operation of heavy machinery
- Increase in levels of noise and concentrations of air pollutants in surrounding environment due to vehicular traffic will result in degradation of habitat value at site and surrounding. This is indirect, permanent, significant negative impact.
- Particulate emissions during construction will have some impact on trees located near construction sites. However, since the particulates will be non-toxic in nature and emission is temporary, no serious impacts are considered. This is direct, permanent, significant negative impact on flora. Thus there will be minor air, water, noise, light pollution impacts during construction
- Seasonal water bodies which serve as important habitats need to be protected from generated waste material during construction phase.

4.3.4.1 Mitigation Measures during Construction Phase

Protection of Existing Trees

Environmental impact assessment: Conduct a thorough assessment of the potential environmental impacts before construction begins. This will help identify sensitive areas and guide decision-making to minimize harm to flora, fauna, and agricultural land. Other precautionary measures:

1. To minimise the impact due to tree felling, it is suggested that the roads in the proposed industrial estate may be shifted/ re-aligned in such a way that it can save maximum number of trees falling within the foot-print of the proposed road area. This measure will be of significance where it passes through dense vegetation. It is recommended that maximum trees falling within the proposed development area are transplanted. While preserving trees, emphasis will be laid on preserving mature/ old trees having girth larger than 30 cm as part of compensatory plantation.

2. Habitat conservation and restoration: Identify and protect important habitats and wildlife corridors in the surrounding area. Where possible, implement restoration measures to compensate for any loss of flora and fauna habitats.

3. Sediment and erosion control measures: Implement erosion control practices, such as silt fences, sediment basins, and revegetation, to minimize soil erosion during construction. This will help protect nearby agricultural land from sediment runoff. Precaution will be taken to ascertain that no waste materials such as cement, paint and solid material like iron rods and any other material are dumped into the streams and percolation tanks. There will be restricted construction activity during monsoon season.

4. Water management: Implement measures to control and treat stormwater runoff from construction sites, ensuring that pollutants are captured and properly disposed of before reaching nearby water bodies.

5. Noise and dust control: Implement measures to minimize noise and dust pollution during construction, such as using barriers, dampening equipment, and regular watering of construction areas.

6. Monitoring and compliance: Regularly monitor construction activities to ensure compliance with environmental regulations and mitigate any unforeseen impacts. This can involve third-party audits and increased transparency in reporting on environmental performance.

7. Preserving existing trees from a 15-meter distance from the project boundary during the construction phase is an effective strategy to ensure that the trees remain unaffected by the construction activities.it will maintain the biodiversity and ecological balance in the area. It will result in cost saving for the project. It will demonstrates a commitment to sustainable development, environmental responsibility, and maintaining the natural characteristics of the area.

8. Greenbelt will be developed during construction phase, this helps to maintain biodiversity and prevents the loss of any valuable flora and fauna

4.3.4.2 Impacts during Operation Phase

Development of plots for industrial use will involve removal of grass/ shrubs and cutting of trees which will affect the flora and fauna of the site. Avifauna as well as arboreal fauna will be affected due to loss of space, tree cover and by the operation of heavy machines

- Textile manufacturing processes require large amounts of water for dyeing, washing, and finishing. Inadequate treatment of wastewater from the textile parks can lead to the release of harmful chemicals and dyes into water bodies, polluting rivers and other water sources.
- It involves burning fossil fuels for energy, generating emissions such as greenhouse gases, particulate matter, and volatile organic compounds. This can contribute to air pollution, causing respiratory problems and other health issues for nearby flora and local communities.
- Textile production generates a significant amount of waste, including fabric scraps, excess dye, and packaging materials. Improper disposal of these wastes can lead to environmental degradation and contribute to landfill pollution.
- Adopting waste reduction strategies, such as optimizing cutting patterns to minimize fabric waste and reducing packaging materials. Implementing waste segregation and recycling programs to divert textile waste from landfill. Partnering with recycling facilities or organizations specializing in textile recycling.

- Improving energy efficiency through the use of energy-efficient machinery and equipment. Implementing energy management systems to monitor and optimize energy usageHabitat Degradation: Loss of trees and increase in levels of noise and concentrations of air pollutants in surrounding environment due to vehicular traffic will result in degradation of habitat value at site and surrounding. This is indirect, permanent, significant negative impact. In the long term, overall development of the industrial estate will lead to reduction of green cover, air and noise pollution scaring away fauna from the area. The loss of humus and sub-surface soil layers may cause certain organisms that reside on upper layers, such as earthworms, which are important in maintaining soil fertility, to die.

4.3.4.3 Mitigation Measures during Operation Phase

1. Tree cutting to be kept minimal. Appropriate permissions by plot owners shall be taken from the concerned authority and the local administration. Similarly, the number of trees felled or cleared shall be recorded, and as many trees shall be planted through compensatory afforestation, at designated locations. Of the 91 trees falling within proposed roads, maximum will be transplanted and for trees to be cut, total 2 trees for every tree cut will be planted i.e. about 182 trees.
2. New trees to be planted @ minimum of 1 tree for every 80 sqm of land i.e. total 15,284.
3. It is recommended that the mandatory greenbelt is developed by plot owners.
4. The area supports percolation tanks during the monsoons. While these disappear after monsoon, these puddles, nonetheless, serve as important breeding grounds for invertebrate and amphibian species, and also support ephemeral diversity. The areas that support such percolation tanks need to be managed.

5. A greenbelt along the borders of the study site shall be developed. (*Details covered under EMP* ***Section 10.3.7***). The development of greenbelt will follow published protocols. Accordingly, planting saplings of trees that grow tall and produce thick canopy will be avoided along the immediate edges of the road, as such plantation could reduce on-road visibility, which may lead to accidents.
6. The species for greenbelt development must be meticulously chosen. Care must be taken to avoid plantation of exotic, invasive species. Native species which support multiple faunal and floral components (keystone species) could be chosen. A list of species that can be used for greenbelt development is provided (**Table 4.8**).
7. The industries could include the conservation of the Reserve Forests in vicinity as a part of their CSR activity, in co-operation with the Forest Department.
8. A part of the proposed area could be reserved for the establishment of nursery, which can serve as a reservoir of native plants for plantation purposes.
9. Implementing advanced water treatment technologies to remove harmful chemicals and dyes from wastewater. - Encouraging water recycling and reuse within the textile manufacturing process. Monitoring and regular testing of wastewater effluents to ensure compliance with water quality standards.
10. Investing in energy-efficient technologies and equipment to reduce emissions. Implementing air pollution control measures, such as installing filters and scrubbers to capture and remove pollutants from exhaust gases. Promoting the use of renewable energy sources, such as solar or wind power, to reduce reliance on fossil fuels

Table 4-5: List of tree species recommended for green belt development in individual industrial units

Sr. No.	Species	Sensitive to
1.	*Mangifera indica*	Coal dust, SO_2
2.	*Syzigium cumini*	Cement dust
3.	*Cassia fistula*	Cement dust
4.	*Dalbergia sissoo*	Cement dust
5.	*Tabernaemontana coronaria*	Polluted environment
6.	*Erythrina indica*	SO_2
7.	*Terminalia catapa*	SO_2
8.	*Terminalia arjuna*	SO_2
9.	*Terminalia tomentosa*	HF
10.	*Buchananaia lanzan*	HF
11.	*Madhuca indica*	Fly-ash, SO_2
12.	*Azadirachta indica*	Cement dust
13.	*Pongomia pinnata*	SO_2

Table 4-6: List of tree species recommended for green belt development

Sr. No.	Species	Common Name	Flowering	Fruiting	Ecological Significance	Height and spread	Type
1	*Albizia lebbeck*	Kaala Shirish	March to May	March to May	Shelter, erosion control, nitrogen fixation, tolerant	Height: 30 m, Width: 5 m, Growth rate: moderately fast	Avenue, inner row
2	*Artocarpus heterophyllus*	Jackfruit, Phanas	Summer	Summer	Wind tolerant, tree canopy provides perennial cover, minimises impact of rain on soil, increases sol fertility, provides shades, attracts birds and pollinators	Height: 8-25 m. Spread: 3-7 m, Growth rate: fast	Avenue, second row
3	*Azadirachta indica*	Neem, Kadulimb	February to May	Winter to summer	Grows in degraded conditions too, improves soil fertility, carbon sink, shade, air quality improvement, attracts birds, pollinators	Height: 12-15 m. Spread: 15-20 m, Growth rate: fast	Avenue, outer row
4	*Bauhinia variegata*	Kanchan	November to February	November to February	Deciduous tree, provides share, ornamentation, fragrant flowers attract butterflies, birds, bees, nectar food plant	Height: 6 m	Avenue, inner row
5	*Bombax ceiba*	Katesavar	February to March	February to March	Attracts insects, birds, mammals, ornamentation, butterfly larval food plant	Height: 30 m	Avenue, outer row
6	*Butea monosperma*	Flame of the forest, Palas	January to March	January to March	Deciduos, noise pollution reduction, attracts birds, mammals, insects	Height: 13-15 m, Width: 18 m, Growth rate: moderate	Avenue, outer row
7	*Cassia fistula*	Amaltash, golden shower	March to May	March to May	Deciduous tree, drought tolerant, pollution reduction, shade, air quality improvement	Height: 5 m, Growth rate: fast	Avenue, inner row
8	*Dalbergia sissoo*	Shisam	March to	Summer	Nectar plant, butterfly host, timber	Height: 30 m	Avenue, outer

Sr. No.	Species	Common Name	Flowering	Fruiting	Ecological Significance	Height and spread	Type
			May				row
9	*Ficus benghalensis*	Banyan, Wad	Throughout	Throughout	Keystone species, soil fertility, shade, water retention	Large	Avenue, outer row
10	*Ficus racemosa*	Indian Fig, Audumber	Throughout	Throughout	Shelter, wind protection, beautification	Moderate	Avenue, outer row
11	*Ficus religiosa*	Pipal, Pimpal	December to March	December to March	Religious significance, carbon sequestration, ozone layer preservation, attracts birds, mammals and insect pollinators	Height: 20 m, Grows large and at moderate rate	Avenue, outer row
12	*Lagerstroemia speciosa*	Pride of India, paper bark tree	March to June	March to June	Shade, drought tolerant, ornamentation, soil erosion control	Height: 20 m.	Avenue, outer row
13	*Mangifera indica*	Mango, Aamba, Aam	Winter to summer	Summer	Flood control, shade, attracts birds and pollinators	Height: 9-14 m. Spread: 9-12 m, Growth rate: moderate	Avenue, outer row
14	*Michelia champaca*	Chapha	December to April	December to April	Soil fertility, ornament, attracts brids	Height: 50 m, Grows large and at moderate rate	Avenue, inner row
15	*Pongomia pinnata*	Indian Beech, Ponga	March to April	Summer	Nitrogen-fixation, beautification, shade, tolerant to stress, erosion control, attracts birds and pollinators	Height 9-12 m, Spread 9-12 m, growth rate: fast	Avenue, outer row
16	*Syzigium cumini*	Jamun	Winter to summer	Winter to summer	Wind breaks, shade, attracts birds and pollinators	Height: 10-30 m. Spread: 11-12 m, Growth rate: rapid	Avenue, outer row
17	*Terminalia arjuna*	Arjun	April to July	April to July	Shade, flowers attract pollinators, fruits eaten by mammals, timber,	Height: 25 m	Avenue, outer row

Sr. No.	Species	Common Name	Flowering	Fruiting	Ecological Significance	Height and spread	Type
					sericulture		
18	*Gardenia gummifera*	Dikemal	February to October	February to October	Ornamental, attracts insect pollinators	Height: 3 m	Internal roads, inner row
19	*Gmelina arborea*	Kumbhari	April to May	May to June	Fruit edible, attracts birds, bats, other mammals	Height: 35 m, Widht 3 m	Internal roads, outer row
20	*Ixora brachiata*	Indian Ixora	December to January	December to January	ornamental, attracts birds, pollinators	Height: 10 m	Internal roads, inner row
21	*Moringa oleifera*	Shevga			Food, attracts pollinators, leguminous plant	Height: 15 m	Internal roads, outer row
22	*Nyctanthes arbor-tristis*	Har Singar	August to September	April to May	Ornamental, attracts buuterflies and other insect pollinators	Height: 10 m	Internal roads, outer row
23	*Pavetta indica*	Indian Pavetta	April to June	April to June	Fertility improvement, ornamental, attracts pollinators, birds	Height: 2-5 m	Internal roads, outer row
24	*Saraca asoca*	Sita Ashok	August to March	August to September	Evergreen perennial, air pollution tolerant, attarcts birds, butterflies, mammals	Height: 8.5 - 16 m, Growth rate: slow	Internal roads, outer row
25	*Madhuca longifolia*	Mahua			Attracts birds, mammals, insect pollinators; shade tree	Height: 20 m., Growth rate: fast	Outer row
26	*Ailanthus excelsa*	Maharukh			Shade tree	Height: 20 m., Growth rate: fast	Outer row
27	*Pongomia pinnata*	Karanj, Ponga			Shade tree, flowers attract birds and insects	Height: 6 m., Growth rate: Fast	Inner row, internal roads
28	*Diospyros melanoxylon*	Tandu patta			Medicinal, productive value	Height: 10 m., Growth rate: slow	Outer row
29	*Carissa carandas*	Karvand			Fruiting tree, attracts birds and insects, provides ground cover	Height: 3 m., Growth rate: Fast	First row plant, along all roads and periphery

4.3.5 Socio-economic Environment

4.3.5.1 Impacts during Construction Phase

Impacts on Project Affected Persons (PAPs)

The project may have an adverse impact on the income of the project-affected persons. Villagers living in the 2 adjoining village settlements within the site will lose their traditional livelihood. These PAPs will have to be provided with alternate source of income. They also have a negative impact on the socio- cultural systems of affected communities.

Road construction activity can create inconvenience for locals and impact their health due to air and noise pollution

Minor increase in population

There will be a minor influx of construction workers on the site who will be staying in temporary facilities during the course of the project implementation.

Health of construction workers

Health problems may affect the workers due to continuous usage of heavy construction equipment and exposure to dust and noise. The living conditions of workers staying temporarily within the plot also need to be hygienic; failing which, the health of people on site as well as in the surroundings will be affected. The construction site may pose unforeseen hazards such as, accidents and minor mishaps. These can be controlled by following normal safety precautions and strict supervision.

Therefore provision of first-aid kits and medical dispensary with full time services of a general physician will be necessary in the proposed labour camp. Workers need to be provided with clean drinking water and water for domestic use. Hygienic living conditions need to be maintained in the labour camp with proper sewage and garbage disposal arrangements.

Employment Generation

During the construction phase, contracts will be given locally. Deployment of labour for activities such as horticulture/ landscaping/ construction will provide better employment opportunities for the local youth.

4.3.5.2 Mitigation Measures during Construction Phase

Project Affected Persons (PAPs)

- In order to give the local populace an opportunity to PAP to help realize their entrepreneurial dreams, MIDC has scheme to give Project Affected Persons (PAPs) three different options:
- **Option 1** Complete Cash settlement (at rates more than LARR 2013 provisions)
- **Option 2** to take Cash settlement 90% of amount due and balance amount of 10% by giving a PAP plot (Plot can be used for Industrial/ Commercial activity)
- **Option 3** to take Cash settlement 85% of amount due and balance amount of 15% by giving a PAP plot (Plot can be used for Industrial/ Commercial/ Residential development activity)

Provisions at the construction labour camp

- Accommodation to the construction workers will be planned in such a way that they do not cause any nuisance whatsoever to local residents.

- Temporary housing facility with weather proof material will be provided for the construction workers on site. Facilities such as "fencing/ gate control", and site illumination will also be provided in the camp area.
- Provision of potable water supply will be made along with sufficient number of taps.
- Adequate sanitation facility to maintain health and hygiene will be established at the camp by providing toilet blocks connected to septic tanks/soak pits.
- Additionally, provision of 'doctor on call' facility will be made.
- Fuel (kerosene) will be supplied for cooking purposes.
- All necessary precautions to avoid accumulation of water in the open will be taken. This will ensure that no breeding of mosquitoes will take place at the site. However, to control the mosquitoes and other flying insects regular spraying of biodegradable insecticides will be carried to supplement use of conventional ones.
- Proper hygienic working conditions & safety measures will be provided to the labourers during the construction phase.
- To keep the area clean, temporary toilets with septic tanks, and clean drinking water facility will be provided. Rest rooms for lady workers will also be provided.
- Other general cleanliness measures such as regular collection of waste and its systematic disposal at frequent intervals will be scrupulously enforced. Regular spraying of biodegradable insecticides and fogging will be carried out to control mosquito menace
- Precautions to prevent water logging will be taken.

Health and Safety

The safety of workers, supervisors and all those who visit or move on the site will be given utmost importance. Accidents affect the progress of work, and finally lead to escalation of costs. To avoid this situation, all safety precautions will be taken. Safety rules for all situations will be drawn and workers will be made to follow them.

Management training will be undertaken to ensure that design details take account of safety concerns. All safety equipment and measures required during construction to avoid accidents shall be followed.

Health and safety of the workers for the construction project will be ensured by:
- Safety training and weekly tool box meetings will be conducted as required.
- Depending upon the nature of work and expected risks, all necessary safety equipments will always be available. Medical aid in case of unlikely accidents will be made available quickly.
- Provision will be made for a stand by ambulance and paramedic at the site.
- Use of safety equipment like helmets, shoes, goggles, gloves, ear muffs/plugs etc. will be made compulsory. All workers will be provided raincoats during the rainy season.
- Depending upon the expected risks, all necessary safety equipments will always be available.
- Insurance cover will be provided to the workers.
- Health cards will be issued to all laborers
- Periodic health check up of laborers

4.3.5.3 Operation Phase Impacts

Some of the negative impast are:
- People will lose their traditional livelihood either temporarily or permanently.
- People will lose their traditional cultivation land.
- Operation of industrial units may impact the health of populace

Some of the positive impacts are:

Improvement in quality of life

With technical and financial support, the PAPs can be rehabilitated in a meaningful way. They can positively use the opportunity to enhance their income and improve their quality of life. A customized training needs assessment followed by income restoration strategy will be required along with the compensation package for the land/ structure loss.

Other social upliftment initiatives like preference in local employment

Improvement in Employment generation

The proposed project is for textile industries and it is estimated that the development in the operation phase will have a potential for employment.

The industry will generate following types of jobs for the local populace:
1. General trade related jobs
2. Some general jobs related to arts/ commerce

The details of existing educational facilties for the skill development of jobs required for various types of proposed industrial zones is given in the baseline chapter (*please refer section 3.7.2*)

Following is an estimation of job potential:

Job potential is high within manufacturing zone. Locals can be given employment in maufacturing processing, and various other stages of the textile development in the industries. Different types of educational courses will help the local population to get jobs in infrastructure-related areas.

Additionally, In the proposed project, Utility and Logistics Zone will be proposed, which will house the common infrastructure facilities like Office, Guesthouse, Bank, post, etc., Water Treatment Plant, External Water supply network, Common Sewage Treatment Plant, etc., is planned.

Various types of employment opportunities will be generated in residential zone e.g., house helper, housemaids, gardener, cook, plumber, electrician, laundry-related jobs, baby sitter, etc. It is anticipated that, local womenfolk will get most of the jobs in residential zone as domestic workers.

In addition, at all zones office administration, clerical jobs, a driver for a four-wheeler, staff buses, canteen staff, security guards, etc., will be required. A trained untrained workforce will get employment in these sections, education background will be required are BA, MA, B Com, M. Com, BBA, MBA, BCA, MCA, Hotel management etc. Colleges for all education backgrounds are available at taluka places.

4.3.5.4 Impacts during Decommissioning Phase

- There will be a marginal and temporary impact on the air quality in the immediate vicinity of the industrial estate due to dust emissions and noise generation.
- Decommissioning of the project will create temporary employment opportunities.
- Closure of industries during de-commissioning of the project may an adverse impact on the local populace.

4.3.5.5 Mitigation Measures during De Commissioning Phase

- Mitigation measure for air and noise pollution as mentioned in section 4.3.2.2 may be followed.
- Proper procedure for safe decommissioning shall be established as part of project development with training to employees
- Wastes generated will have to be identified and disposed off safely
- Have a designated procedure to ensure that workers do not suffer in this eventuality

4.4 Issues of Concern

In order to prepare an Environment Impact Statement, environmental concerns and issues relevant to the construction, commissioning, operation and de commissioning phases have been identified on a broad scale. The details of activities are presented in the following table.

Table 4-7: Issues of Concern

Phase	Environmental Concern				
	Land	Air	Water	Biological Environment	Socio Economy
Construction	• Dust emissions during site preparation • Loss of Top Soil • Use of construction raw material • Transportation of Construction materials • Construction Waste management	• Fugitive dust generation and noise during the during site preparation and road construction • noise pollution from noise generating machinery/equipment • air emissions from DG sets • Dust or odors from heating of bitumen/ tar • movement of vehicles carrying raw material	• pollution from construction run-off • Blocking of natural drainage by construction material, • Contamination of ground water from wastewater from labour camps	• Loss of existing trees in developable areas and along proposed roads	• Impact on income due of PAPs • Loss of agricultural lands • Health and Safety of construction workers
Commissioning	• Use of water for construction labourers, power for construction, waste water generation from labour camps • Soil contamination from use of	• dust generation due to movement of vehicles carrying raw material	• Contamination of ground water from wastewater from labour camps	• Loss of existing trees along proposed roads	• Health and Safety of construction workers

Phase	Environmental Concern				
	Land	Air	Water	Biological Environment	Socio Economy
	DG sets				
Operation	• Soil erosion • Pollution due to surface runoff • Soil contamination from checmicals if secondary treated effluent is disposed on land	• air emissions, solvent emissions, chemical odour • NOx and CO pollutants generated from vehicles plying on the road • airborne exposure to acid fumes	• excessive usage of water • release of harmful chemicals and dyes into water bodies, polluting rivers and other water sources if disposed with tertiary treatment • Contamination of ground water from wastewater if disposed on land (TDS>500) • contamination of storm water with affluent/chemicals	• Loss of agricultural land and vegetative soil due to contamination of soil from effluent disposal on land	• Contamination of drinking water source, ground water
Decommissioning	• Construction waste, debris generation	• dust emissions and noise generation	--	--	--

4.5 Environmental Impact Assessment

This section deals with the analysis of the identified impacts in terms of their nature and significance. The significance of environmental impacts has been evaluated as under:

- The spatial extent (geographic distribution),
- Duration (short term and long term),
- Magnitude (measured level of change in parameters & whether thresholds are exceeded),
- Reversibility (reversible and irreversible), and
- Spatial sensitivity (whether an impact affects a sensitive area e.g.: a Nature Reserve within the impact zone).

The following matrices assess the impacts based on their severity.

4.6 Environmental Impact Matrix

The possible impacts of various constructional and operational activities as identified above have been denoted in a matrix form. A quantitative matrix rating has been devised to give severity of impacts in the following manner:

- Highly Negative Overall Impacts: Total Score= above -353
- Moderately Negative Overall Impacts: Total Score= -176 to - 352
- Slightly Negative Overall Impacts: Total Score= -1 to -176
- Neutral overall Impacts: Total Score = 0
- Slightly Positive Overall Impacts: Total Score= 1 to 176
- Moderately Positive Overall Impacts: Total Score= 176 to 352
- Highly Positive Overall Impacts: Total Score = above 353

The matrix system assumes the environmental indices into the following:

- Physical Parameters:
  - Surface water quality
  - Ground water quality
  - Air quality & Climate
  - Soil Quality
  - Land use pattern & Topography
- Ecological Parameters:
  - Forests/ Parks/ Sanctuary
  - Flora & Fauna
  - Aquatic ecosystem
- Social Parameters:
  - Aesthetics
  - Local Housing structure
  - Services
  - Health & Safety
- Economic Parameters:
  - Agriculture
  - Forest Produce
  - Industries
  - Employment

The assessment of the impact of the general impacting activities on the above parameters of environmental indices can be carried out by establishing a co-relation by "Cause and effect relationship" with the help of impact matrices. The matrices for construction as well as operation phase are presented below for two conditions:

- Without mitigation/control measures.
- With mitigation measures for adverse / beneficial effects.

The criteria for evaluation of qualitative matrix are presented herewith:

1. **No Impact (0):** This indicates that the project activity is unlikely to have any impact on an environmental attribute.

2. **Negligible Adverse Impact (-1) / Negligible Beneficial Impact (+1):** It signifies that the actions have minor effect, adverse or beneficial, on the environmental parameters concerned.
3. **Significant Adverse Impact (-2) / Significant Beneficial Impact (+2):** The activities and their environmental Impacts are judged to be significant if they create or have the potential to create concern in the public or professional community.
4. **High Adverse Impact (-3) / High Beneficial Impact (+3):** The action that can create or have a potential to create controversy in the public or professional community due to its long-term effect. They may be at times irreversible.

The environmental Impact matrix without mitigation / control measures during the construction phase and operation phase is given in **Table 4.7 below**, which shows the impact of the project is (-) 274 i.e. Moderately Negative Overall Impacts. The matrix with mitigation measures during the construction phase and operation phase is given in **Table 4.8 below**, which shows the overall impact with environmental controls is reduced to (+) 81 i.e. Slightly Positive Overall Impacts.

Table 4-8: Environmental Impact Matrix (Evaluation without Mitigation Measures)

PHASE -->	CONSTRUCTION PHASE										OPERATION PHASE										
Impact Source --> / Parameters ⇣	Development activity	Water requirement, wastewater generation & disposal	Stationary, process & fugitive emissions	Noise	Solid Waste generation & disposal	Material transportation, storage & handling	Hazards associated with construction activity	Breakdown of control equipment	End use of project site	Total	Development activity	Water requirement, wastewater generation & disposal	Stationary, process & fugitive emissions	Noise	Solid Waste generation & disposal	Material transportation, storage & handling	Hazards associated with & operation activity	Breakdown of control equipment	End use of project site	Total	Grand total
Physico-chemical parameters:																					
Surface water quality	-1	-1	0	0	-1	0	0	0	0	**-3**	-3	-3	0	0	-3	-1	-3	-3	-3	**-19**	**-22**
Ground water quality	0	-3	0	0	-1	0	0	0	0	**-4**	-3	-3	0	0	-3	-2	-3	-3	-3	**-20**	**-24**
Air quality & climate	-3	-1	-2	0	0	-2	-1	0	0	**-9**	-3	0	-3	-3	0	-3	-3	-3	-3	**-21**	**-30**
Soil quality	-1	-1	0	0	-1	0	0	0	0	**-3**	-2	-3	0	0	-3	-2	-2	-3	-3	**-18**	**-21**
Land use pattern	-3	0	0	0	-3	0	0	0	2	**-4**	1	0	0	0	-2	0	0	0	-2	**-3**	**-7**
Ecological parameters:																					
Forest/park/sanctuary	-2	-3	-3	0	-2	-2	0	0	0	**-12**	-3	-3	-2	-1	-1	-1	-3	-2	-3	**-19**	**-31**
Flora & fauna	-3	-3	-1	-1	-2	-3	0	0	1	**-12**	-3	-2	-2	-2	-3	-1	-3	-2	-3	**-21**	**-33**
Aquatic ecosystem	-1	-2	0	0	-1	0	0	0	0	**-4**	-2	-2	0	0	-2	0	-2	0	-2	**-10**	**-14**
Social parameters:																					
Aesthetics	0	-1	0	0	-3	0	-2	-1	1	**-6**	-2	-2	-1	-1	-2	-2	-2	-2	-2	**-16**	**-22**
Local housing structure	-2	0	0	-1	0	0	-1	-1	0	**-5**	1	-2	-1	0	-1	-1	-1	-2	-2	**-9**	**-14**
Service	-1	0	0	0	0	0	-1	-1	0	**-3**	-1	-2	-1	0	0	-1	-3	-2	1	**-9**	**-12**
Health & safety	-2	0	-1	-1	-3	-1	-1	-1	3	**-7**	-3	-3	-3	-3	-3	-2	-3	-1	-1	**-22**	**-29**
Economic parameters:																					
Agriculture	-1	-2	0	0	-1	0	0	0	0	**-4**	-2	-3	-3	0	0	-1	-2	-3	-3	**-17**	**-21**
Fisheries	0	-1	0	0	0	0	0	0	0	**-1**	0	0	0	0	0	0	0	-1	-1	**-2**	**-3**
Industries	-2	0	0	0	0	0	0	0	3	**1**	3	3	-1	-1	-2	-1	-1	-1	3	**2**	**3**
Employment	3	0	0	0	0	1	0	0	3	**7**	3	0	0	-1	-1	-2	-3	0	3	**-1**	**6**
Grand Total	**-19**	**-18**	**-7**	**-3**	**-18**	**-7**	**-6**	**-4**	**13**	**-69**	**-19**	**-25**	**-17**	**-12**	**-26**	**-20**	**-34**	**-28**	**-24**	**-205**	**-274**

Table 4-9: Environmental Impact Matrix (Evaluation with Mitigation Measures)

PHASE -->	**CONSTRUCTION PHASE**										**OPERATION PHASE**										
Impact Source --> **Parameters ⇣**	**Development activity**	**Water requirement, wastewater generation & disposal**	**Stationary, process & fugitive emissions**	**Noise**	**Solid Waste generation & disposal**	**Material transportation, storage & handling**	**Hazards associated with & construction activity**	**Breakdown of control equipment**	**End use of project site**	**Total**	**Development activity**	**Water requirement, wastewater generation & disposal**	**Stationary, process & fugitive emissions**	**Noise**	**Solid Waste generation & disposal**	**Material transportation, storage & handling**	**Hazards associated with & operation activity**	**Breakdown of control equipment**	**End use of project site**	**Total**	**Grand total**
Physico-chemical parameters:																					
Surface water quality	-1	-1	0	0	0	0	0	-1	3	**0**	0	3	0	0	0	-1	0	0	-1	**1**	**1**
Ground water quality	0	0	0	0	0	-1	0	-3	3	**-1**	0	3	0	0	0	-1	0	-1	-1	**0**	**-1**
Air quality & climate	-1	0	-1	0	0	-1	0	-2	2	**-3**	0	-1	-1	-1	0	0	-1	0	-1	**-5**	**-8**
Soil quality	0	0	0	0	0	-1	0	0	2	**1**	0	0	0	0	1	0	-1	0	0	**0**	**1**
Land use pattern	0	0	0	0	0	-1	0	0	3	**2**	3	1	0	0	2	0	0	0	3	**9**	**11**
Ecological parameters:																					
Forest/park/sanctuary	0	0	-1	-1	-1	0	0	-1	1	**-3**	0	0	0	0	-1	0	-1	0	0	**-2**	**-5**
Flora & fauna	0	0	-1	-1	-1	0	0	-1	2	**-2**	1	0	-1	-1	-1	0	-1	0	1	**-2**	**-4**
Aquatic ecosystem	0	0	0	0	0	0	0	-1	1	**0**	0	0	0	0	0	0	-1	0	0	**-1**	**-1**
Social parameters:																					
Aesthetics	0	-1	0	0	0	0	0	0	1	**0**	2	0	0	0	0	0	0	0	1	**3**	**3**
Local housing structure	2	0	0	0	0	0	0	0	1	**3**	3	0	0	0	0	0	0	0	2	**5**	**8**
Service	2	0	0	0	0	0	0	-1	3	**4**	3	2	0	0	0	0	0	-2	3	**6**	**10**
Health & safety	1	0	-1	-1	0	-1	0	-3	3	**-2**	3	2	-1	0	0	0	-1	-1	3	**5**	**3**
Economic parameters:																					
Agriculture	-1	0	0	0	0	0	0	0	0	**-1**	-1	1	0	0	0	0	0	0	0	**0**	**-1**
Fisheries	0	0	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	0	0	**0**	**0**
Industries	0	0	0	1	0	2	0	-1	3	**5**	3	3	2	1	3	3	3	2	3	**23**	**28**
Employment	3	1	0	0	2	1	0	-1	3	**9**	3	3	3	3	3	3	3	3	3	**27**	**36**
Grand Total	**5**	**-1**	**-4**	**-2**	**0**	**-2**	**0**	**-15**	**31**	**12**	**20**	**17**	**2**	**2**	**7**	**4**	**0**	**1**	**16**	**69**	**81**

4.7 Conclusions

The above table shows that no significant harmful impacts, on the surrounding environment, are anticipated due to the proposed project. This is because the development authority is planning to taking all precautions to ensure a well planned industrial estate.

During the construction phase, there are a few parameters that need to be considered for mitigation of adverse impacts (such as air pollution/ noise levels, health hazards for labor etc). However, the impacts of this nature will be easily controllable and of a short duration, if proper mitigation measures are taken as recommended.

It can also be observed from the above table, that there will be a positive long term impact on the socio-economic status of the area due to the proposed project. This will be in terms of direct employment generation for the native population, spin-off benefit of indirect entrepreneurship opportunities, improved infrastructure, and so on. The proposed development by MIDC will provide adequate measures for the prevention and control of pollution. The units proposed are in low polluting type. With the execution and operation of such control measures along with proper Environmental Management System, there will not be any major potential for negative impact on the environment due to proposed project.

Proposed development will generate employment, some permanent and secondary employment. The MIDC will carry out social welfare activities according to their needs as part of activities carried out by the proposed Industrial Association in the area. The proposed project will boost up ancillary industrial and commercial activity. Thus, it will improve the economic condition of the area.

5 ANALYSIS OF ALTERNATIVES

This chapter gives the Analysis of Site Alternatives.

The alternatives for Site includes a description of each site alternative, summary of adverse impacts of each alternative, mitigation measures proposed for each alternative and finally the selection of the alternative.

5.1 ANALYSIS OF SITE ALTERNATIVES

The objective of this study is to present the site alternatives and recommend the preferred site selection. The first step in this process is to study the alternative sites considered by proponent at the time of conceptual development of the project. An analysis of the alternatives will be performed on the different sites, based on which, the most feasible of the preferred alternative from environmental point of view will be demonstrated.

The methodology covers the alternatives for environmental parameters like: Availability of existing Physical Infrastructure, existing significant Biodiversity Parameters, Incompatible Land Use and Socioeconomic Parameters in the selection of alternatives.

Two alternate sites were identified by the state government for the PM MEGA Integrated Textile Region and Apparel (PM MITRA) Parks Scheme.

- Brownfield site located adjacent to existing Additional Amravati Industrial Area (S1)
- Greenfiield Site located at AURIC Bidkin Aurangabad, Maharashtra (S2)

5.1.1 METHODOLOGY

The criteria on which the decision matrix was formulated are mentioned below:

- Physical Infrastructure
- Biodiversity Parameters
- Incompatible Land Use
- Socioeconomic Parameters

Methodology for selection of Alternative option

The parameters were sub divided on several indicators, which were separately scored. Basis of Scoring is given in enclosed slides and is in tune with following :

- Guidelines for Zoning Atlas for Siting of industry by CPCB and
- Criteria for Industrial Estate Siting Studies by GTZ

Please see table below for various aspects covered under the selected criteria for evaluation.

Table 5-1: Scoring Based on Zoning Atlas: Criteria Considered

No.	Criteria	Aspects Covered	Marks
A	Physical Infrastructure	Connectivity, Resources (Water and Fuel availability) and Contiguous land availability	25
B	Biodiversity Parameters	Distance to Protected Areas, Biosphere Reserve, Reserve Forest, Wetlands/ Mangroves, Aquaculture	25

No.	Criteria	Aspects Covered	Marks
		Ponds/Fisheries	
C	Incompatible Land Use	Distance to Public Water supply points, Tourism Hot spots, Archaelogically important sites, Fresh water source, Hilly areas which may affect air dispersion	25
D	Socioeconomic Parameters	Existing Land Use, Social acceptability of project, Nature of land (slope etc)	25

The Rating Scale used for evaluation was as follows:

Excellent: +5 Moderate : +4 Fair : + 3 Poor : -3 Very Poor: -5

The criteria/ indicators were then evaluated considering that the indictors selected brings negative impact to the project, therefore the score obtained by any alternative was considered as per amount of constrains it involves.

5.1.2 OVERVIEW OF SELECTED SITES

The 2 sites selected for the proposed development of industrial estate are located in the talukas Amravati and Bidkin Aurangabad. The areas available for development under each of these sites is 410.02 Ha and 8020 acre (3245 Ha) respectively.

Following two alternate sites were identified by MIDC

1. Brownfield site located adjacent to existing Additional Amravati Industrial Area (S1)
2. Greenfiield Site located at AURIC Bidkin Aurangabad, Maharashtra (S2)

The following figure shows the locations of the 2 sites. (**Fig. 5.1** below).

Figure 5-1: Location of alternative sites in Maharashtra State

5.1.3 SCORING OF SELECTED SITES

5.1.3.1 Physical Infrastructure

The parameters/ indicators selected for assessment of the selected site alternatives based on available or non available Physical Infrastructure are:

- Connectivity (Connecting Major Roads, Rail line etc.)
- Resources (Fuel and Water)
- Contiguous land

Following table gives the scoring criteria for these parameters based on the Guidelines for Zoning Atlas for Siting of industry by CPCB and Criteria for Industrial Estate Siting Studies by GTZ.

Table 5-2: Scoring Criteria for Physical Infrastructure

	Excellent	Moderate	Fair	Poor	Very Poor
Connectivity					
Connecting Major Roads	< 1km	1-5 km	5-10 Km	10-15 km	> 15 km
Rail line	< 1km	1-2km	2-4 km	4-6 km	> 6 km
Resources					
- Fuel	< 5km	5 – 10 km	10- 15 km	15 – 25 km	> 25 km
- Water	< 5km	5 – 10 km	10- 15 km	15 – 25 km	> 25 km
Contiguous land	> 5000 Ha	4000- 5000 Ha	3000- 4000 Ha	2000- 3000 Ha	1000- 2000 Ha

The various criterias were scored and same are given in the following table.

Table 5-3: Scores for Physical Infrastructure Parameters

No.	Criteria	Site 1	Site 2
1	**CONNECTIVITY (Distance in km)**		
1- a	Connecting Roads	Excellent (< 1 km) (+5)	Moderate (1-5 km) (+4)
	National Highway	Adjacent to site on South	2.5 km on North NW
	State Highway	At 2- 5 km on N	Adjacent to site
1-b	Rail	Amravati Rlwy stn at 19 km	Aurangabad Rlwy stn: 20km
1-c	Airport	Amravati Airport 42 km	Aurangabad Airport: 29.4 km
2	**Resources Availability**	Excellent (< 5 km) (+15)	Good (+14)
2-a	Power	MSEDCL Distance from site: 8 km	Reliable Underground power distribution network
2-b	Water	Upper Wardha Dam Morshi Distance from site: 45 KM NOC available	Source: Jayakwadi Dam Distance from site: 26KM

No.	Criteria	Site 1	Site 2
2-c	Long term cost of Power and Water	Water: 15 Rs/KL Power: 8 Rs/Unit	Water: 20 Rs/KL Recycled Water 10 Rs/KL Power: Approx. 10 Rs/Unit (AURIC has applied for power distribution license)
2-d	Waste management	CETP within Addtnl Amravati Industrial area	CETP within AURIC city
3	**Contiguous land**	Excellent (+5)	Excellent (+5)
	Availability	6940 acre	8020 acre
	Total Score	**+ 25**	**+ 23**
	Maximum Points	**+ 25**	**+ 25**

5.1.3.2 Biodiversity Parameters

The biological parameters/ indicators selected for assessment of the selected site alternatives are:

- Terrestrial Biodiversity (Distance to Protected Areas, Distance to Biosphere Reserve, Reserve Forest)
- Marine Coastal Environment (Mangroves/ wetland, Aquaculture Ponds)

Following table gives the scoring criteria for these parameters based on the Guidelines for Zoning Atlas for Siting of industry by CPCB and Criteria for Industrial Estate Siting Studies by GTZ.

Table 5-4: Scoring Criteria for Biodiversity Parameters

	Excellent	Moderate	Fair	Poor	Very Poor
Terrestrial Biodiversity					
Distance to PA	> 15 km	7 – 15 km	5- 7 km	2 – 5 km	< 2 km
Distance to Biosphere Reserve	> 15 km	7 – 15 km	5- 7 km	2 – 5 km	< 2 km
Reserve Forest	> 5km from site	> 2km from site	<1km from site	Up to 5 % in site	More than 5 % in site
Marine Coastal Environment					
Mangroves/ wetland	> 15 km	7 – 15 km	5- 7 km	2 – 5 km	< 2 km
Aquaculture Ponds	> 15 km	7 – 15 km	5- 7 km	2 – 5 km	< 2 km

Based on the above assessments, the various criterias were scored and same are given in the following table.

Table 5-5: Scores for Biodiversity Parameters

Sr. No.	Criteria	Site 1	Site 2
1.0	**Biodiversity**		
1-a	National Park/ Sanctuary	None within site(+5)	None within site(+5)

Sr. No.	Criteria	Site 1	Site 2
1-b	Biosphere reserve	None within site(+5)	None within site(+5)
1-c	Reserve Forests	Poor (2-5 km) (+4)	None within site(+5)
1-d	Wetlands/ Mangroves, Aquaculture Ponds/ Fisheries	None within site(+5)	None within site(+5)
1-e	Wetlands/ Mangroves, Aquaculture Ponds/ Fisheries	None within site(+5)	None within site(+5)
	Total Score	**+ 24**	**+ 25**
	Maximum Points	**+ 25**	**+ 25**

5.1.3.3 Incompatible Land Use

The parameters/ indicators selected for assessment of the selected site alternatives from Incompatible Land Use are:

- Availability of water sources (Public water supply point, Fresh water source)
- Agricultural productivity
- Landuse and slope
- Hilly stretches that act as barriers for air dispersion

Following table gives the scoring criteria for these parameters based on the Guidelines for Zoning Atlas for Siting of industry by CPCB and Criteria for Industrial Estate Siting Studies by GTZ.

Table 5-6: Scoring Criteria for Incompatible Land Use

	Excellent	Moderate	Fair	Poor	Very Poor
Public water supply point	> 5 km	2-5 km	>2 Km	1-2 km	< 1 km
Fresh water source					
Class A-1	> 7 km	5-7 km	2-5 km	1-2 km	< 1 km
Class A-2	> 10 km	6-10 km	4-6 km	2-4 km	< 2 km
Agricultural Productivity					
Agriculture	< 3 %	3-5 %	5-10 %	10-20 %	>20%
Waste Land	> 50%	30-50%	20-30 %	10-20%	< 10 %
Slope	1 in 1000	1 in 500 to 1 in 1000	1 in 300 to 1 in 500	1 in 100 to 1 in 300	< 1 in 100
Hilly stretches that act as barriers for air dispersion	> 7 km	5-7 km	2-5 km	1-2 km	< 1 km

The various criterias for compatibility of Land Use were scored and same are given in the following table.

Table 5-7: Scores for Incompatible Land Use

No.	Criteria	Site 1	Site 2
1.0	Public Water supply Point	Moderate (> 2 km) (+4)	Moderate (> 2 km) (+4)

No.	Criteria	Site 1	Site 2
		Source: Upper Wardha Dam Morshi Distance from site: 45 KM NOC available	Source: Jayakwadi Dam Distance from site: 26KM
2.0	Fresh Water Source – Class A	Excellent (+5)	Excellent (+5)
		No perennial water body on site	No perennial water body on site
3.0	Agricultural Productivity	Excellent (+5)	Poor (-3)
4.0	Average slope/ Undulating	Moderate (+3)	Moderate (+4)
		Moderately undulating	Mostly level
5.0	Hilly stretches (as barriers for air dispersion)	None (>10 km) (+5)	None (>10 km) (+5)
	Total Score	**+ 22**	**+ 22**
	Maximum Points	**+ 25**	**+ 25**

5.1.3.4 Socio-Economic Parameters

The parameters/ indicators selected for assessment of the selected site alternatives based on Socio-Economic Parameters are:

- Scenic area, Tourism hot spots
- Archaeologically Important Monument
- Social acceptance
- Land acquisition

Following table (**Table 5.10)** gives the scoring criteria for these parameters based on the Guidelines for Zoning Atlas for Siting of industry by CPCB and Criteria for Industrial Estate Siting Studies by GTZ.

Table 5-8: Scoring Criteria for Socio-Economic Parameters

	Excellent	Moderate	Fair	Poor	Very Poor
Scenic area, Tourism hot spots	> 7 km	5-7 km	2-5 Km	1-2 km	< 1 km
Archaeologically Important Monument	> 7 km	5-7 km	2-5 Km	1-2 km	< 1 km
Social acceptance	> 50%	30-50%	20-30 %	< 20%	Wide resistance
Land acquisition	> 50%	30-50%	20-30 %	< 20%	Wide resistance

Locations under criteria of Scenic area, Tourism hot spots and Archaeologically Important Monuments were identified from authentic sources and proximity of these areas from the sites was assessed. Please see table below.

Table 5-9: Distances of Archaeological Important Sites (Notified Heritage Site) and Historical Sites

	Tourist Attraction (Up to 10 km of Nearest Boundary)	Distance (km) (Approximate) from Nearest Boundary	Direction (Approximate) from Nearest Boundary
Site 1	**Historical Places**		
	Sant Tukdoji Maharaj Samadhi	7.80	NE
Site 2	**Historical Places**		
	Stepwell, Shekta, Ranjani	6.45	SW
	Ancient Stepwell, Ghardon Tanda	6.65	E
	Bidkin Stepwell-2, Nijal Gaon, Bidkin	1.18	W
	Stepwell-1, Bidkin	1.25	SW
	Archeological Important Places		
	Khandoba Mandir, Satara, Aurangabad	9.26	NNW

Various criterias were scored and are given in the following table.

Table 5-10: Scores for Socio-Economic Parameters

Sr. No.	Criteria	Site 1	Site 2
1.0	Scenic areas	Excellent (> 7 km) (+5)	Excellent (> 7 km) (+5)
2.0	Tourism hot spots (> 5 lakhs tourists per year)	Excellent (> 7 km) (+5)	Fair (> 15 km) (+3)
		None	Several Tourism hot spots beyond 15 km
3.0	Archaeologically Important Monument	Excellent (5-7 km) (+4)	Fair (> 15 km) (+3)
		None	Several Notified Heritage sites beyond 15 km
4.0	Social Acceptance to the proposed development	Excellent (+5)	Excellent (+5)
5.0	Land acquisition	Excellent (+ 5)	Excellent (+5)
	Total Score	**+ 24**	**+21**
	Maximum Points	**+ 25**	**+ 25**

5.1.4 CONCLUSIONS

5.1.4.1 Final Scoring

Based on the above scoring for each criteria, the final scores are arrieved at. Please see table on the following page.

Table 5-11: Final Scoring for all Criteria

Criteria	Site 1		Site 2	
	Max	**Min**	**Max**	**Min**
A. Physical Infrastructure Parameters	25	25	23	25
B. Biodiversity Parameters	24	25	25	25
C. Incompatible Land Use	22	25	22	25
D. Socio Economic Parameters	24	25	21	25
Total Points	**95**	**100**	**92**	**100**

5.1.4.2 Conclusions

Based on the Guidelines for Zoning Atlas for Siting of industry by CPCB and Criteria for Industrial Estate Siting Studies by GTZ, both the sites at (1) and (2) above fit the criteria:

- Large contiguous land parcel available
- National Highway, State roads and railway at a short distance.
- Existing industrial areas, hence easily accessible utilities
- Water, fuel and power sources available in proximity, decreased cost of infrastructure.

5.2 ELIGIBILITY & SELECTION CRITERIA FOR PM MITRA TEXTILE PARK

MIDC has developed Textile Park at Additional Amravati Industrial Area on 2809.78 Hectares of land located on Amravati - Nagpur N.H.No.6 at 23.00 Km distance from Amravati city.

The major Industries i.e. M/s Shyam Indo fab, M/s V.H.M. Industries, M/s Golden fibre, M/s Siyaram Silk, M/s Baleshwar synthetic Textile, M/s Raymond Luxury Ltd., M/s Damodar Industries, M/s Suryalaxmi cotton Mills, M/s Pratap Industries, M/s Sudarshan Industries, M/S Dove Garment, M/S Palak Industries, M/s Verito Industries, M/s Technocraft Industries have set up their textile industries in this area and are in production.

MIDC has provided all infrastructure facilities such as road network, water supply scheme, power network, street lights etc. MIDC has also provided 5.00 MLD CETP with collection / conveyance and recycling network in this Textile Park.

Ministry of Textiles (GoI) has sanctioned 7 PM MITRA Mega Textile Parks at various States on 17/03/2023 . Maharashtra is one of the successful state where PM MITRA (Brown field) Textile Park is sanctioned at Amravati in Amravati District.

Amravati as brown field park was selected considering:

- It is adjacent to existing Textile Park

- Nearby area is having major crops such as cotton, the setting up of PM MITRA Park will be beneficial for farmers in the region & also will give employment to workforce in the region.
- Textile industry is operational in existing Textile Park with CETP.
- Availability of water and all other utilities

According to the Evaluation Criteria for Selection of Sites by the Ministry of Textiles, GOI, the site for the proposed PM MITRA Textile Park development and fulfilment of criteria by the State Government is given in the following table:

Table 5-12: Evaluation Criteria for Selection of Sites

Criteria for setting up of PM MITRA park	Fulfilment of Criteria by the State Government for selection of present site
Eligibility Criteria: Land Contiguous, Encumbrance Free, Location of the park site vis-à-vis Eco-Sensitive Zone, Site Layout Plan, Land Clearance (Land use), Ease of access	• Site for Amravati Industrial Area is **6940 acre industrial land** located near Nandgaonpeth village of Amravati district of Maharashtra which MIDC has developed as a **Textile Park.** • No ecologically sensitive features within 10 km of site • Land already acquired by MIDC
Selection Criteria **01. Connectivity to Site** Nearest Highway, Air cargo/ Airport/ Railhead, Sea port/ Dedicated Freight Corridor. Multi Modal Logistic Park /MIDC	• Site along NH 53 highway • Nearest railway station: Amravati Railway Station at 19 km • Nearest Airport: Dr. Babasaheb Ambedkar International Airport, Nagpur 125 km
02. Existing Ecosystem for Textiles Distance from existing Textile Cluster, Availability of raw material and skilled manpower, Skill Development Institutes	• Amravati was selected as brown field park • Site is adjacent to existing Textile Park and is operational in existing Textile Park with CETP. • Existing textile park is housing major Industries viz. Shyam Indo fab., Golden fibre, Siyaram Silk, Baleshwar synthetic Textile, Raymond Luxury Ltd. etc. • Site located within rich cotton belt of Maharashtra with Amravati procuring 0.226 lakh cotton bales, thus benefiting over 5000 farmers.
03. Availability of Utilities Services at Site: Assurance of availability of Power Source,	• MIDC has provided all infrastructure facilities such as road network, water

Criteria for setting up of PM MITRA park	Fulfilment of Criteria by the State Government for selection of present site
dedicated Water Source, Municipal & Solid Waste Management System in the area, Distance from Industrial waste recycling facility, Long term cost of Power and Water	supply scheme, power network, streetlights etc. • MIDC has also provided existing 5.00 MLD CETP with collection / conveyance and recycling network in this Textile Park. • Proposal for expansion of CETP to 15 MLD
04. State Industrial /Textile Policy for encouraging setting up of textile units	• Existing State Textile Policy with incentives for Ease of Doing Business in the state
05. Environmental & Social Impact: Site not impacted by any environmental sensitive area and support for expeditious Statutory Clearances - Undertaking from the State Government	• No ecologically sensitive features within 10 km from the site. • Undertaking from the Maharashtra Govt. for the site, not being impacted by any environmental sensitive area and support for expeditious Statutory Clearances
Water source & availability	• Source: Upper Wardha Dam, Morshi • Distance from site: 45 KM • Capacity: 504.05 MCM • Approval for 10 MCM reserved for the industrial area from Irrigation Department, GoM, dtd: 09.02.2004
Distance from Industrial waste recycling facility	• Type: CETP • Distance from site: 2 km • Capacity: 5 MLD to be expanded to 15 MLD
Power Source	• Source: Maharashtra State Electricity Distribution Company Limited • Distance from site: 8 km • Capacity: 220 KV
Long term cost of Power and Water	• Water: 15 Rs/KL • Power: 8 Rs/Unit

Thus from the above, it is concluded that the selected site at Amravati is more suitable for PM MITRA Textile Park due to the following conditions

- Contiguous land
- Water and power sources are nearer to site
- National Highway (NH53) is adjacent to the site
- More importantly the villagers are very much favouring industrialization

- ❑ Existing textile park is housing major textile Industries
- ❑ Site is located at Amravati which is the centre rich cotton belt of Maharashtra. Thus the 5F vision of – "Farm to Fibre to Factory to Fashion to Foreign" can be easily met with
- ❑ This site is notified by the GoM vide Notification dtd 5th Sept., 2019
- ❑ The present site fulfils the Evaluation Criteria for Selection of Sites by the Ministry of Textiles, GOI and has been selected for PM MITRA Textile Park development

Hence the present site is most suitable and has been selected for development.

5.3 ANALYSIS OF ALTERNATIVE TECHNOLOGIES

5.3.1 Technology for Sewage Treatment

5.3.1.1 Background

A STP of capacity 20 MLD will be provided at the proposed MIDC for taking care of sewage generated from residential zone. This section takes a look on the selection of Technology for STP and ensuring its adequacy for efficient Sewage Treatment and ensuring compliance to MPCB/MoEFCC norms with a view to consistently meet quality requirements to ensure full reuse/recycle of treated sewage.

Sewage Treatment Plant Treatment technologies adopted for large size plants can be classified in three broad groups:

- Natural systems (*Oxidation Pond, Waste stabilization Ponds* etc)
- Conventional technology (*Activated sludge process (ASP), Extended Aeration, Trickling Filter, Cyclic Activated sludge Process, Up flow Anaerobic Sludge Blanket (UASB*)
- Advanced Technology (*Sequential Bio Reactor (SBR), Fluidized Bed Reactor (FBR), Membrane Bio Reactor (MBR)*)

With such a range of technologies being available, this section examines the various technologies and their efficacy as also aspects like Capital Cost, Power requirement, Operation and Maintenance cost, Stability of performance to meet desired norms etc in order to select the most appropriate technology for the proposed development.

5.3.1.2 Need for Proper Sewage Treatment

There is a need to ensure the treated sewage quality with respect to BOD, COD, TSS, Nitrogen (Ammonia and Nitrates), and Phosphorous and Faecal coliform to protect the quality of waters quality of rivers and streams. Nitrogen and Phosphorous in treated sewage may lead to eutrophication of slow moving river streams (due to growth of algae and other vegetation in water bodies) which may further lead to :

- Large DO variation leading to fish kills
- Filling the water body with dead algae and other vegetation
- Decomposition of dead algae and vegetation leading to oxygen depletion at the bottom of water body
- Release of algal toxins and malodours leading to further rendering the water body unsuitable for any further use

Thus, it is very essential to control nutrient discharges into water bodies. Similarly, there is a need to control Faecal Coliform (FC) in case the water is to flow substantial distance to prevent any harm to downstream users.

5.3.1.3 Applicable Standards

Discharge of treated sewage are generally covered by the Standards prescribed under Schedule VI of the Environmental Protection Act, 1986 viz General Discharge Standards for Disposal of Treated Effluent dependant upon receiving water body (Inland Surface Waters, Marine Coastal Areas, On land for Irrigation or discharge into Public Sewers). However, these standards were aimed towards protection of the Natural resource and not for recycle/reuse of the treated water. MOEFCC prescribed fresh standards for treated sewage from Sewage Treatment Plants vide GSR 1265 (E) dt 13.10.2017 as amendment to Environment Protection rules by inserting Sr No. 105 of Schedule 1. However, these standards have been *struck down by Hon NGT in O. A 1069/2018 Order dt 30.04.2019.* The applicable standards for treated sewage with a view to reuse/recycle are summarized as below:

Table 5-13: Standards for Reuse/Recycle of Treated Sewage

No.	Parameter	CPHEOO Manual (#)	CPCB Directions (+)	Hon NGT Order dt 30.04.2019 (*)	MPCB Standards (&)
1.0	pH	NS	6.5 to 9.0	5.5 to 9.0	6.5 to 9.0
2.0	TSS, mg/l	< 10	< 10	< 20	< 20
3.0	BOD, mg/l	< 10	< 10	< 10	< 10
4.0	COD	NS	< 50	< 50	< 50
5.0	Total Nitrogen, mg/l	< 10	< 10	< 10	< 10
6.0	Ammoniacal Nitrogen, NH4-N, mg/l	NS	< 5	NS	< 5
6.0	Dissolved P, mg/l	< 2	< 2	< 1	NS
7.0	Faecal coliform, MPN/100ml	< 230	230	100 Permissible 230	100

Note :

(#) - Recommended Guidelines for Treated Sewage if discharged into Surface Water to be used as Drinking Water source, CPHEOO, 2013

(+) - Chairman CPCB, Directions to all SPCBs prescribing mandatory norms to be complied by all Urban Local Bodies

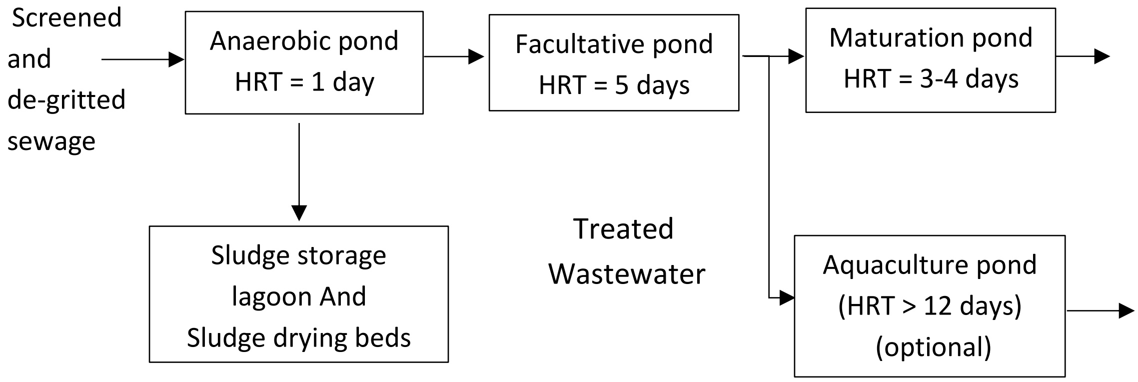
(*) - Standard approved by Hon NGT in 1069/2018 Order dt 30.04.2019

& - Standard specified by MPCB for recycle/reuse of Domestic sewage for flushing and gardening

5.3.1.4 Technologies for Sewage Treatment

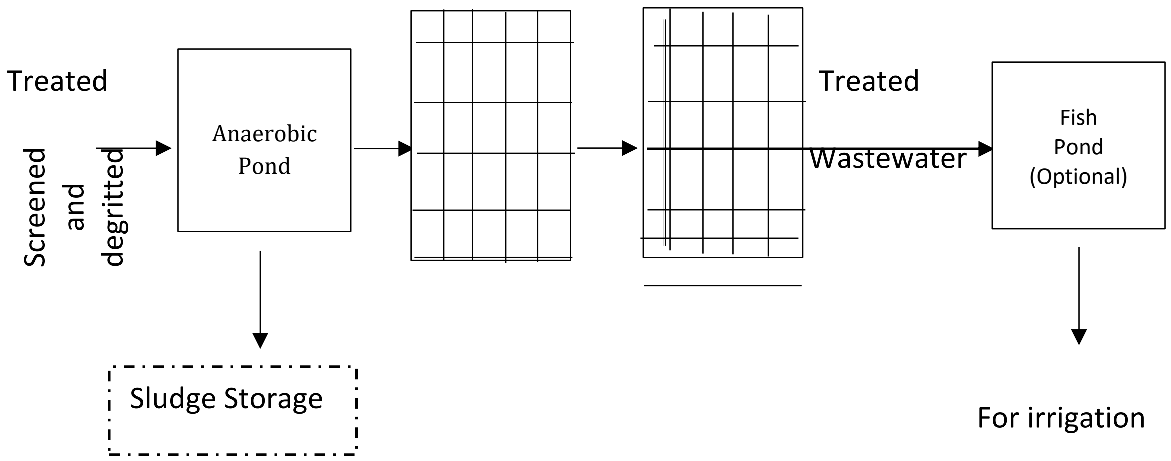
Brief of various popular technologies used for treatment of sewage are enclosed below. Most of the material used here is derived from CPCB Publication of Performance of Sewage Treatment Plants under NRCD, August 2013 and Lecture Notes Prof A Majumder, STP Technologies and Their Cost Effectiveness School of Water Resources Engineering, Jadhavpur University & Recent Trends in Technologies in Sewerage Systems, Ministry of Urban Development, March 2012.

A. Waste Stabilization Pond Systems



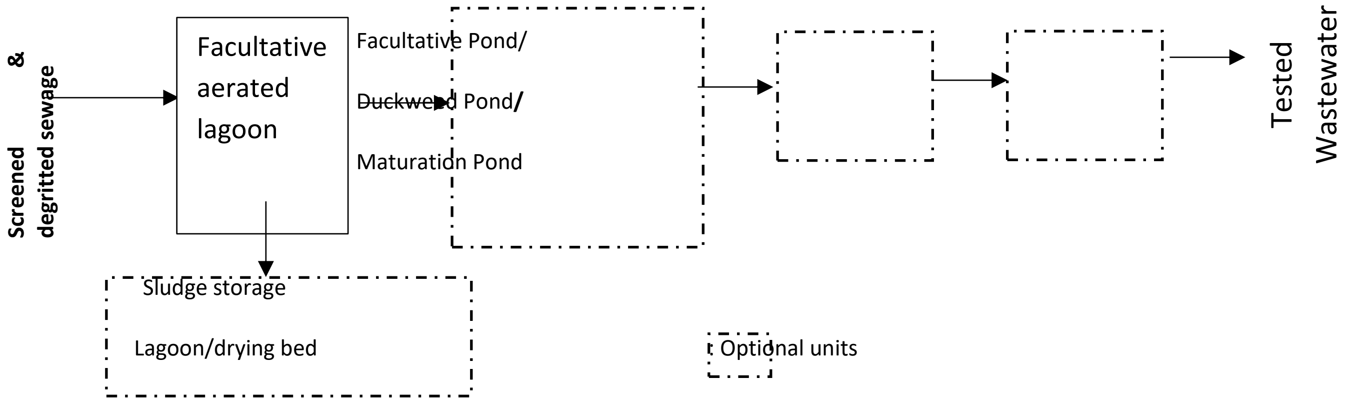
- Can reliably produce high quality effluent with low BOD, SS, Faecal coliform and high D.O.levels.
- BOD reduction of the order of 90% or so.
- Suspended solids reduction is somewhat low due to possible overflow of algae.
- Coliform reduction can be up to 6 units.
- Total Nitrogen removal between 70-90%.
- Total Phosphorus removal between 30-45%.
- Detention time: 6 to 8 days

B. Duckweed Pond System



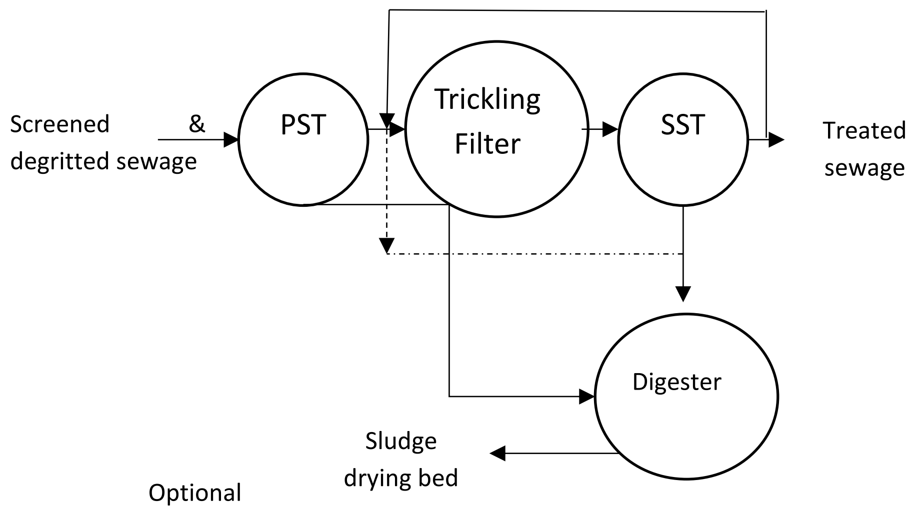
- Retention period 7-21 days
- Shallow depth of water from 1.25-2.0 m
- For settled wastewaters BOD and SS removal upto 30 mg/l is achievable
- High mineral and nutrient removal rate due to uptake of duckweeds.
- Capital cost of the same order of WSP with additional cost of floating cell material.

C. Facultative Aerated Lagoon (FAL)



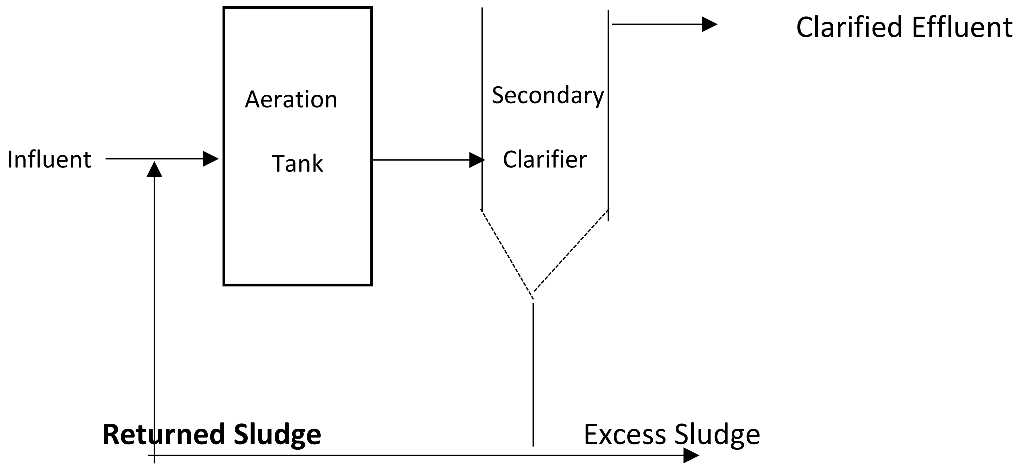
- No primary or secondary settling required with no sludge recirculation.
- Anaerobic bottom layer and aerobic top layer
- Simultaneous degradation of sludge in the bottom layer and organics in the top layer
- BOD removal 70-90%
- Suspended solids removal 70-80%
- Coliform removal 60-99%

D. Trickling filter



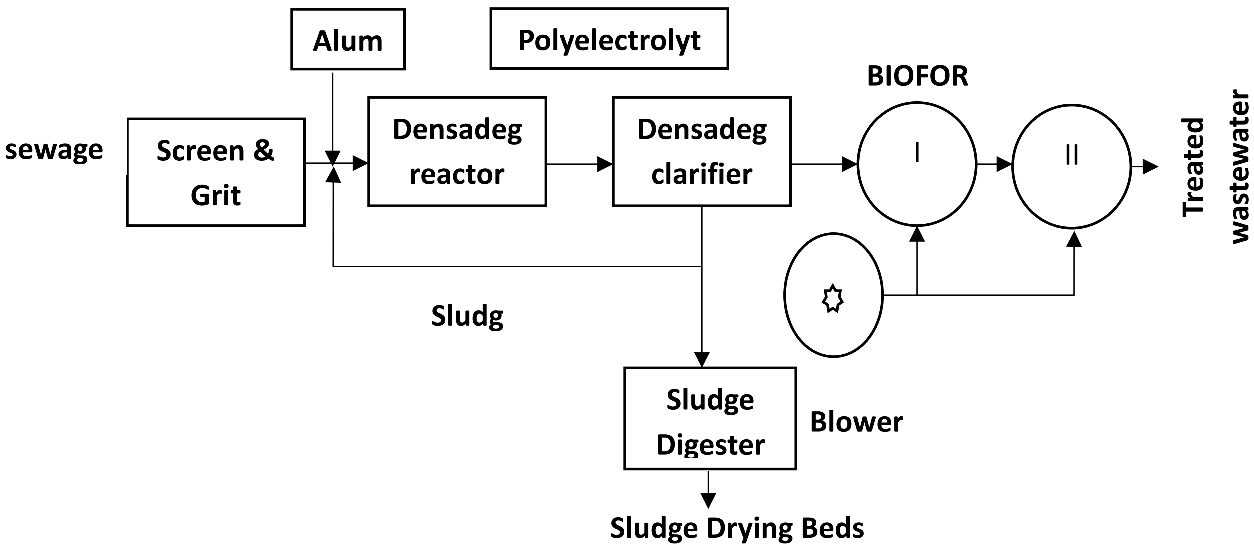
- Proven 100 year old technology
- Less monitoring required than ASP
- Rugged system with simple and silent operation.
- Consistent effluent quality
- Stand alone treatment process for sewage if operated at low rates.
- To be used in combination with ASP for efficient performance
- Low pathogen removal Bacteria, 20-90%, Viruses 50-90% Giardia cysts 70-90%

E. Activated Sludge Process (ASP)



- Proven and tested methodology all over the world for the last 7-8 decades.
- Several modifications available for specific requirements.
- Uninterrupted power supply required for aeration and sludge recirculation.
- Reactor sludge levels to be carefully monitored and sludge is to be withdrawn from the system.
- 80-90% removal of bacteria.
- 90-99% removal of viruses.

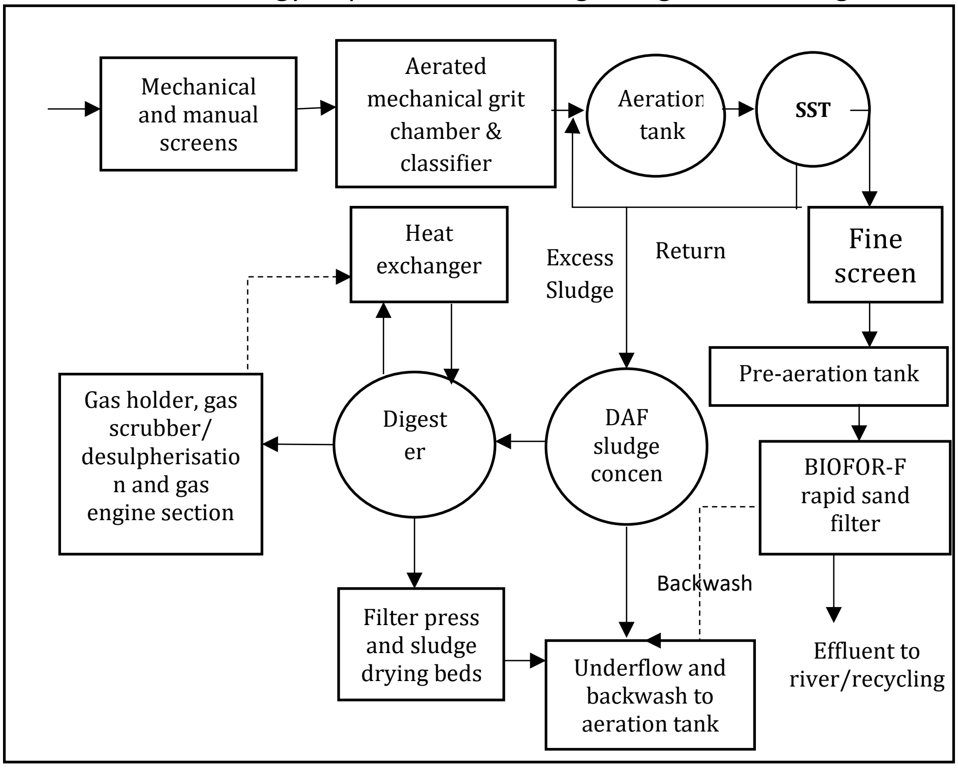
F. BIOFOR Technology (Biological Filtration and Oxygenated Reactor)



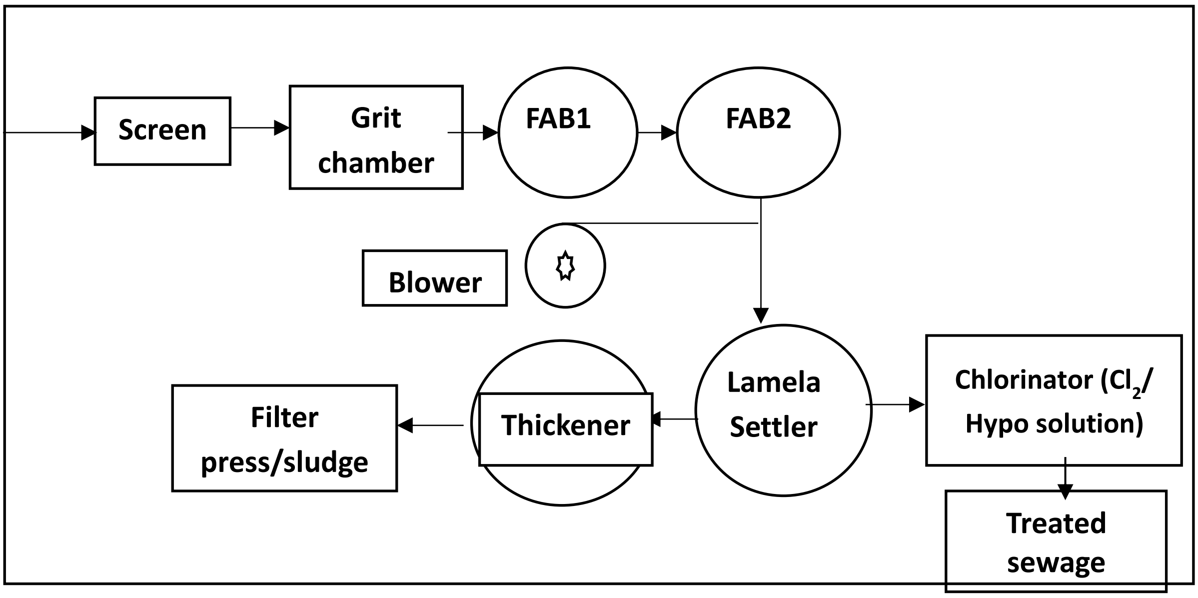
- Enhanced primary treatment with addition of chemicals and coagulants.
- High rate primary tube settlers and integrated thickening offering space economy.
- Suspended solids and BOD removal of the order of 90% and 70% respectively in the primary clarifier.
- Low turbidity with suspended solids under 15 mg/l and total system efficiency of 98%.
- Pathogen removal of 2 on the log scale.

G. High Rate Activated Sludge BIOFOR-F Technology

- Compact layout as a result of high rate processes.
- Higher aeration efficiency through diffused and tapered aeration system.
- Space saving as primary sedimentation is dispensed.
- Compliance with strict discharge standards.
- Absence of aerosol and odor nuisance in the working area.
- Self-sufficient in energy requirement due to gas engine based cogeneration system



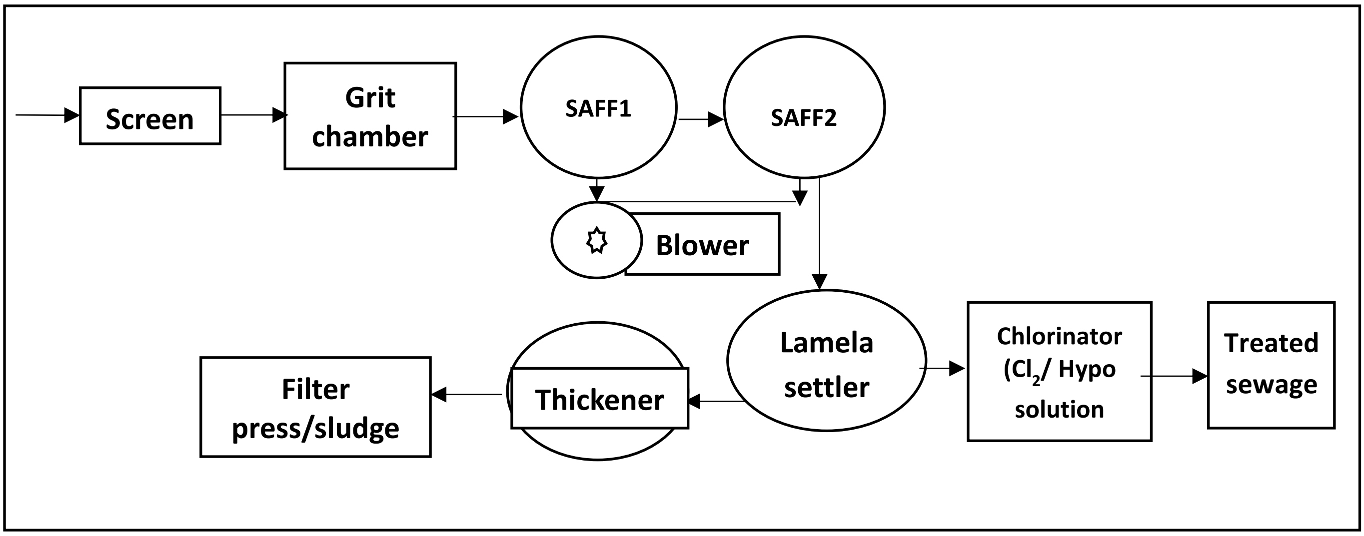
H. Fluidized Aerated Bed (FAB)



- Two stage biological oxidation.
- Treatment scheme without primary sedimentation and sludge digestion.

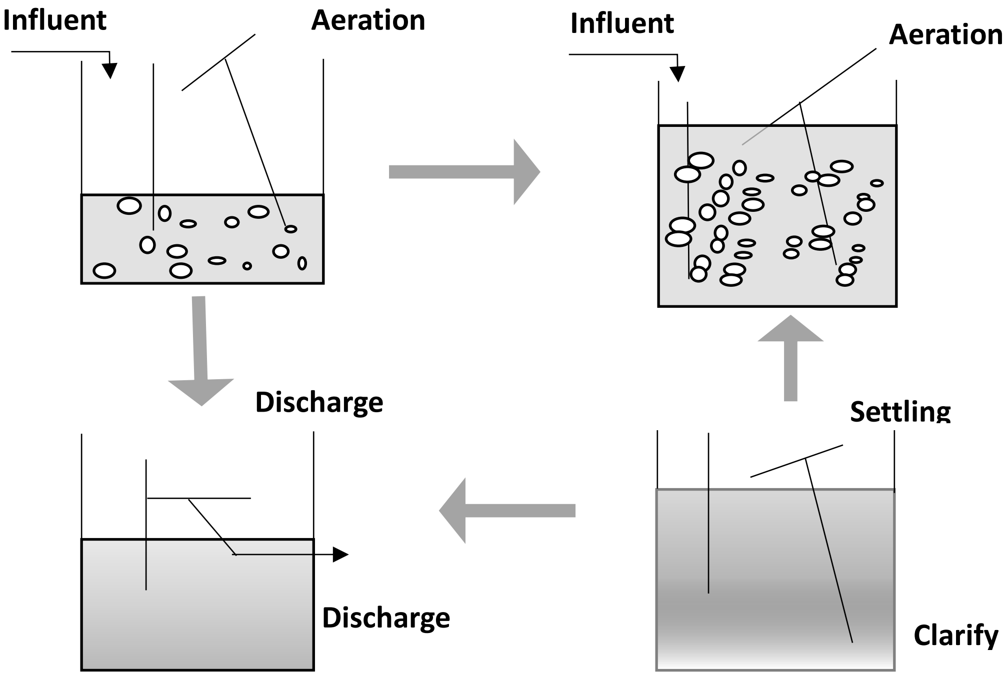
- Reactors upto depth 5m ensures low land requirement.
- High BOD removal with effluent concentration less than 10 mg/l
- High Suspended solids removal with effluent concentration less than 20 mg/l
- Faecal coliforms removal of the order of 2-3 on log scale

I. Submerged Aeration Fixed Film Technology (SAFF Technology)



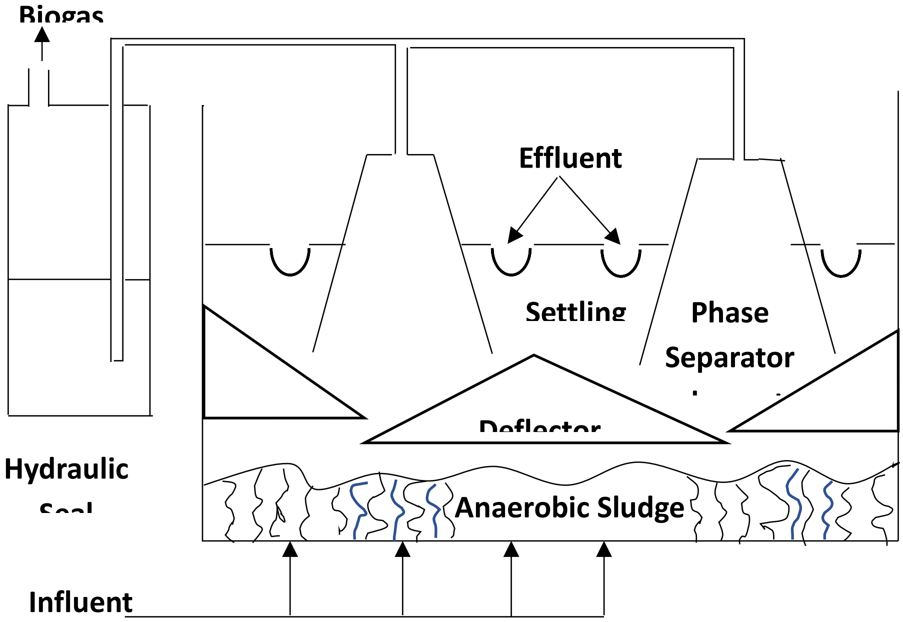
- Essentially a trickling filter with enhanced oxygen supply through submerged aeration.
- Unconventional plastic media with high void ratio and specific surface area.
- High BOD removal with 98% efficiency with effluent BOD concentration less than 10 mg/l.
- High Suspended solids removal with effluent concentration of 20 mg/l.
- Faecal coliforms removal of the order of 2-3 on log scale at SAFF 2 Stage.

J. Cyclic Activated Sludge Process (CASP)



- Essentially activated sludge process operated in batches through auto- control.
- Aeration and settling in one tank leading to lower plant foot print.
- Uninterrupted power supply is a must as the whole process is auto controlled.
- High BOD removal with effluent concentration less than 10 mg/l
- High Suspended solids removal with effluent concentration less than 20 mg/l
- Faecal coliforms removal of the order of 2-3 on log scale.

K. Upflow Anaerobic Sludge Blanket Process (UASB)



- F
- Recovery of gas with high calorific value.
- Low sludge production
- No primary treatment, suspended solids in the waste water acts as carrier material for microbial attachment.
- Recovery of gas with high calorific value.
- Low sludge production.
- Post treatment of UASB effluent is invariably required.

5.3.2 Comparison of Various STP Technologies

5.3.2.1 As Per Ministry of Urban Development, March 2012

Comparison of various STP Technologies, their land requirement, advantages and disadvantages is presented overleaf.

Table 5-14: Comparison of various STP Technologies

SN	STP Process	Land Area Ha/MLD	Advantage	Disadvantages	Applicability
1	Waste Stabilisation Pond System (WSPS)	0.80 to 1.5	i. Simple to construct- low cost technology option ii. High quality effluent at least operating costs iii. Low skill requirement for plant operation iv. Fish yield from aquaculture ponds around 4 - 7 MT/ha/year	i. Large land requirement ii. High cost of lining iii. Risk of odour nuisance and mosquito breeding iv. Risk of groundwater contamination in porous and fractured strata	i. Suitable under warm Indian climatic ii. For areas with easy availability of land iii. In areas with social preference for aquaculture iv. In areas with low, unreliable or expensive power supply
2	Duckweed Pond System (DPS)	1.5 to 2.0	i. Less sensitive to low temperature, high nutrient levels, pH fluctuations, pests and diseases compared to other aquatic plants ii. Simultaneous significant nutrient removal iii. Yield of highly protein containing vegetative material (35 - 45%) as animal feed iv. Duckweed as an excellent feed for poultry v. Realization of tangible economic returns from sale of raw or processed weed or fish	i. Low pathogen removal due to reduced light penetration ii. Duckweed die off in cold weather conditions	i. Low strength domestic Pond wastewater or after primary sedimentation with influent BOD <80 mg/L ii. In combination with existing WSP iii. Rural and semi urban settlements with easy land availability iv. As a polishing pond for an existing activated sludge plant or other technology based STPs
3	Facultative Aerated Lagoon (FAL)	0.27 to 0.4	i. Simple operation of the plant requiring lower skilled manpower ii. Minimum civil, electrical and	i. Possibility of groundwater contamination in porous and fractured strata	i. Stand alone system for sewage treatment ii. As an upgradation option

SN	STP Process	Land Area Ha/MLD	Advantage	Disadvantages	Applicability
			mechanical installation iii. Lower energy costs compared to other aerobic processes iv. Lower O&M cost	ii. High cost of lining	for overload WSPs
4	Trickling Filter (TF)	0.25 to 0.50	i. Simple operation of the plant requiring lower skilled manpower ii. Rugged system, less prone to hydraulic and organic over loading iii. Reduced requirement for process monitoring iv. Sludge with better settling characteristics	i. Blockage of ports in distribution arm. ii. Blockage of bio - filter due to excess biomass growth or floating matter iii. Risk of odour and filter fly	i. In combination with ASP for good and consistent performance
5	Activated Sludge Process (ASP)	0.15 to 0.25	i. Performance is not significantly affected due to normal variations in wastewater characteristics and seasonal changes	i. interruption in power supply even for a short period affects performance. ii. Foaming problem may occur iii. Requires elaborate sludge digestion/ drying/ disposal arrangement	The most widely used option for treatment of domestic wastewater for medium to large towns where land is scarce
6	BIOFOR Technology (Biological Filtration and Oxygenated Reactor)	0.08	i. Higher aeration efficiency through co - current diffused aeration system ii. Able to withstand fluctuations in flow rate and organic loads iii. Complies stricter discharge standards iv. Effluent suitable for UV disinfection without filtration	i. Continuous and high chemical dosing in primary clarification ii. Large sludge generation due chemical addition iii. Undigested sludge from primary clarification requiring post treatment	Not used in any large sized applications

SN	STP Process	Land Area Ha/MLD	Advantage	Disadvantages	Applicability
			v. Absence of aerosol and odour nuisance in the working area vi. Absence of corrosive gases in the area		
7	High Rate Activated Sludge Biofor - F Technology	0.10	i. Higher aeration efficiency through diffused and tapered aeration system ii. Complies stricter discharge standards iii. Stable digester performance and consistent gas production	i. high cost	Not used in any large sized applications
8	Fluidized Aerated Bed (FAB)	0.06	i. Deep reactors enable small space requirements ii. Eliminate the need for sludge recirculation and monitoring of MLSS in the reactor iii. Capacity to handle shock loads iv. Low & stabilised sludge production eliminating the need for sludge digestion	i. Reliance on patented filter media ii. Reliance on flocculants, polyelectrolyte and chemical disinfectant (optional) iii. Requires skilled manpower	The FAB technology based system is particularly applicable for: i. small to medium flows in congested locations ii. Sensitive locations iii. Decentralised approach iv. Reliving existing overloaded STPs
9	Submerged Aeration Fixed Film (SAFF) Technology	0.05	i. Deep reactors enabling small space requirements ii. Ability to effectively treat dilute domestic wastewaters Low & stabilized sludge production eliminating the need for sludge digestion	i. Clogging of reactor due to absence of primary sedimentation ii. Reliance on proprietary filter media iii. High reliance on external energy input Requires skilled manpower	The SAFF technology based Aeration Fixed system is particularly applicable for: i. Small to medium flows in congested ii. Sensitive locations iii. Locations Decentralized approach Relieving existing

SN	STP Process	Land Area Ha/MLD	Advantage	Disadvantages	Applicability
					overloaded trickling filters
10	Cyclic Activated Sludge Process (CASP)	0.12 -0.15	i. Can be designed to remove N and P along with carbon removal	i. No provision for sludge management ii. No provision of primary treatment iii. High reliance on external energy input iv. Requires skilled manpower	The Cyclic Activated Sludge Process (CASP) may be applicable for: i. small to medium flows in congested locations ii. Sensitive locations iii. decentralised approach iv. reliving existing overloaded trickling filter
11	Up flow Anaerobic Sludge Blanket (UASB) Process	0.2 - 0.3	i. Sludge handling is minimized ii. Power supply interruptions have minimal effect on plant performance iii. Can absorb hydraulic and organic shock loading	i. In general cannot meet the desired effluent discharge standard unless proper post treatment is adopted, which in turn may make the treatment scheme energy intensive or may require large land area ii. Effluent is anoxic and invariably exerts substantial initial/ instantaneous oxygen demand which may have adverse impact on receiving inland water bodies or when used for irrigation	The suitability of this technology is doubtful as a stand - alone secondary treatment option

***Source**: Lecture Notes Prof A Majumder, STP Technologies and Their Cost Effectiveness School of Water Resources Engg, Jadhavpur University & Recent Trends in Technologies in Sewerage Systems, Ministry of Urban Development, March 2012*

It is seen from the above that Cyclic Activated Sludge Process gives good quality sewage with removal of carbon as well as Nutrients (Nitrogen and Phosphorous).

5.3.2.2 Comparison of STP Technologies as given by CPCB

Comparison of Performance of various STP Technologies as given by CPCB is reproduced herewith:

Table 5-15: Performance for various technologies for Sewage Treatment Plant

Sr.No	Assessment Parameter/ Technology	ASP*,a	MBBR*,c	SBR*,a	UASB+EA*,b	MBR*,a	WSP**,b
1.0	**Performance after Secondary treatment**						
1.1	Effluent BOD (mg/l)	<20	<30	<10	<20	<5	<40
1.2	Effluent SS (mg/l)	<30	<30	<10	<30	<5	<100
1.3	Faecal coliform removal, Log unit	Upto2<3	Upto2<3	Upto3<4	Upto2<3	Upto5<6	Upto2<3
1.4	T-N removal Efficiency, %	10-20	10-20	70-80	10-20	70-80	10-20
2.0	**Performance after tertiary treatment**						
2.1	Effluent BOD (mg/l)	<10	<10	<10	<10	<10	<10
2.2	Effluent SS (mg/l)	<5	<5	<5	<5	<5	<5
2.3	Effluent NH_3N (mg/l)	<1	<1	<1	<1	<1	<1
2.4	Effluent Total Coliforms, MPN/100 ml	10	10	10	10	10	10

As can be seen from the above, SBR (Sequential Batch Reactor) or Cyclic ASP process and Membrane Bioreactor (MBR) have shown better performance to remove Nutrients and also to meet the recycle/ruse quality specifications for treated sewage.

5.3.2.3 Comparison of Treatment Costs

As per the Compendium of Sewage Treatment Technologies issued by National River Conservation Directorate (NRCD), Ministry of Environment and Forests (Aug, 2009), the various cost aspects to be looked into include Capital cost, O and M cost, Land cost, Reinvestment and Energy cost. This indicates that:

- Unlined WSP (Waste Stabilisation Ponds) have lowest treatment cost (Rs 1/KLD) but highest land requirement 20,000 sq.m/MLD)
- SBR (Sequential Batch Reactor) will have higher treatment cost (Rs 5/KLD) but lower land requirement (600sqm/MLD)
- Conventional ASP (Activated Sludge Process) will have moderate treatment cost (Rs 3.5/KLD) and moderate land requirement (2,000 sqm/MLD)

Amongst Treatment technologies which can give effluent of good recycle quality (BOD<5 and TSS< 5 mg/l),

- ASP+ C-F+RSF/DMF will have low treatment cost (Rs 6.5/KLD) but moderate land requirement (3,000 sqm/MLD)
- MBR will have high treatment cost (Rs 9/KLD) but lowest land requirement (600 sqm/MLD)
- SBR + C-F+RSF/DMF will have intermediate treatment cost (Rs 7.5/KLD) and intermediate land requirement (1,200 sqm/MLD)

5.3.3 Recent Experiences in Maharashtra

CIDCO was earlier doing the Sewage Treatment at various nodes in Navi Mumbai using Waste Stabilisation Ponds. It has now established Modern STPs at various Nodes like Ghansoli, Kamothe (25 MLD), Kalamboli (25 MLD x 2 Nos), Ulwe (32 MLD), Dronagiri and Kharghar (25 MLD) using “C-Tech”, an advanced Cyclic Activated Sludge process / Sequential Batch Reactor (SBR) which are performing excellently to treat and recycle/reuse the treated sewage. The entire plant is automated (PLC based) requiring minimum manual intervention. The systematically purified water is later used for horticulture, construction, and other development purposes (for eg for supplying water to nearby Public Parks like Kharghar Golf Course from its Kharghar STP and also planning to supply treated sewage water to Industrial units in Taloja MIDC from its Kalamboli STP).

Results of analysis of treated sewage as available from CIDCO STP at Kalamboli shows that the treated sewage meets standards for all parameters as given in Table 5.1 above.

TRANS THANE CREEK WASTE MANAGEMENT ASSOCIATION
(PROMOTED BY THANE BELAPUR INDUSTRIES ASSOCIATION)

TTCWMA

RINA

ANALYSIS REPORT

Code. No/ Report No.: TTCWMA/LAB/02-19/OTH/158	Sample Received Date 18.02.2019
SAMPLE NOT DRAWN BY TTCWMA LABORATORY	Analysis Complete Date 15.03.2019
ULR NO-XT236119100000462P	Report Date 15.03.2019
Name of Organization	M/s. City & Industrial Development Corporation of Maharashtra Limited.
Address	CIDCO Bhavan, CBD Belapur, navi Mumbai-400614
Kind Attention	Executive Engineer (KLM-I&NAINA)
Sample Name	STP Water From 50 MLD STP at sector- 12, Kalamboli
Batch No./ID No.	-----

Test Parameter	Method	Unit	Results	Limits
Biological Oxygen Demand	IS 3025 (Part 44)1993(RA2014)	mg/l	5.0	5 Max
Chemical Oxygen Demand	IS 3025 (Part 58)2006(RA2012)	mg/l	16	50 Max
Total Suspended Solid	IS 3025(Part-17)1984(RA2012)	mg/l	6.0	10 Max
Ammonical Nitrogen	IS 3025(Part-34)1988(RA2014)	mg/l	<0.5	2 Max
Nitrate Nitrogen	IS 3025(Part-34)1988(RA2014)	mg/l	<0.1	NS
Total Phosphate as PO_4	IS 3025 (Part-31)1988(RA2009)	mg/l	<0.1	1 Max
pH	IS 3025 (Part 11)1983(RA2012)	---	7.35	7 – 9
Oil & Grease	IS 3025 (Part 39)1991(RA2014)	mg/l	<0.5	5 Max
Chloride as Cl	IS 3025 (Part 32)1988(RA2012)	mg/l	27	NS
Sulphate as SO_4	IS 3205 (Part 24)1986(RA2014)	mg/l	18	50 Max
Bacteriology				
Total Coliform	IS 1622:1981 (MPN Method)	MPN/100ml	34	NS
Fecal Coliform	IS 5401 (Part 1):2002 (Plate count Method)	Cfu/100 ml	30	NS

Note: - This Certificate may not be produced in part, without the permission of this Laboratory.
This Certificate refers only to the sample submitted for the testing.
Protocol of Analysis as Per IS: 3025 & Protocol of Analysis as Per IS 1622:1981.
The given STP water sample conforms. / Limits as per Costumer Specification.

Authorized Signature (Chemicals)
Mandhare
Dr. Datta Mandhare
(Laboratory Manager)

Authorized Signature (Microbiologist)
Ms. Sophila Gaikwad

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FRM-24/02/2018

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5.4 Conclusion

Considering the above, the Cyclic ASP (Activated Sludge process) / Sequential Batch Reactor (SBR) has been selected for use in Sewage Treatment plant of 20 MLD capacity at DPIA.

6 ENVIRONMENTAL MONITORING PLAN

Based on the predicted & assessed impacts as well as the baseline environmental status of the project area, an environmental monitoring program is suggested for implementation during various stages of the project cycle.

6.1 Objective of Environmental Monitoring Program

For tracking of the effectiveness of mitigation measures & EMP at specific interval, regular monitoring of the necessary environmental parameters is required. With this vision, an environment monitoring program is prepared with due consideration of the baseline status of the expansion project area, various components of the project and environmental attributes likely to be affected.

Major objectives of the Environmental Monitoring Program are as under:
- To comply with the statutory requirements of monitoring for compliance with conditions of EC (if applicable).
- Assessment of the changes in environmental conditions, if any, during the project operation/activities.
- Monitoring & tracking the effectiveness of Environment Management Plan and implementation of the mitigation measures planned.
- Identification of any significant adverse transformation in environmental condition to plan additional mitigation measures; if and as required.

The developing authority will implement the environment monitoring programs in line with the planned schedule. They will ensure that the necessary requisite facilities are made available and budgetary provision is made as and when required to ensure regular and efficient environmental monitoring activities.

6.2 Environmental Monitoring Program

In case of accidental spill & leak of hazardous chemicals, monitoring of the environment for detection of the spilled/leaked chemical will be carried out in the affected area. In such case, soil & groundwater sample of the affected area will be collected and analyzed for detection of the spilled / leaked chemicals at regular interval for the period as required to ensure safe level of contamination.

Environmental monitoring parameters and frequencies of monitoring are given below in Table 6.1.

Table 6-1 Environment Monitoring Plan for the Project

SN	Project Phase	Environmental Component	Parameters	Frequency	Locations	Conducted by
1	**Construction**	**Air Environment**				
		Ambient air	PM_{10} / $PM_{2.5}$/ SO_2/ NOx / CO	Once/Month	Construction site	MoEF&CC approved Laboratory
		Ambient Noise Level	Leq day and nighttime or over one work shift	Once/Month	Construction site	
		Water Quality				
		Drinking Water Quality	Microbiological parameters as per IS 10500: 2012	Once/month	Construction site - each drinking water locations.	MoEF&CC approved Laboratory
2	**Commissioning Stage**	**Air Environment**				
		Stacks and Vents (at CFC)	Boilers - NOx	Once/Month	at Utility Zone	MoEF&CC approved Laboratory
			Incinerator – Nox, SO2, TPM, HCl, Cl2, VCM, CO and CO2	Once/Month	at Utility Zone	MoEF&CC approved Laboratory
		Ambient air	PM_{10} / $PM_{2.5}$/ SO_2/ NOx/ CO/ NMHC	Once/Month	at Utility Zone	MoEF&CC approved Laboratory
		Ambient Noise Level	Leq day and nighttime or over one work shift	Once/Month	at Utility Zone / and its periphery	MOEF approved lab
		Water Quality				
		Drinking Water Quality	Microbiological (as per IS 10500: 2012)	Once/month	at each drinking water location	MOEF&CC approved lab
		STP	pH, TSS, TDS, COD, BOD and Oil and Grease, VCM	Once/shift	at Utility Zone	In house lab and periodically through MOEF approved lab
3	**Operation Phase**	**Air Environment**				
		Stacks and Vents	Gas Turbines and Boilers - NOx	Once/Month	at Utility Zone	MoEF&CC approved Laboratory
			Incinerator – Nox, SO2,	Once/Month	at Utility Zone	MoEF&CC approved

SN	Project Phase	Environmental Component	Parameters	Frequency	Locations	Conducted by
			TPM, HCl, Cl2, VCM, CO and CO2			Laboratory
		Ambient Air	PM_{10} / $PM_{2.5}$/ SO_2/ NOx/ CO/ NMHC	Once/ Three month	At 5 locations	MoEF&CC approved Laboratory
		Workroom environment	SOx/ TPM/ NOx/ CO/ nMHC	Once/ Three month	Plant/ Storage/ handling Area	
		Water Environment				
		CSTP	pH, TSS, TDS, COD, BOD and Oil and Grease, VCM.	Daily	at Utility Zone	Own QC lab
			As per MPCB existing Consent to Operate	Once/month	At inlet and outlet of STP	MoEF&CC recognized laboratory
		Drinking water	Microbiological parameters as per IS 10500: 2012	Once / Three month	at each drinking water locations	MoEF&CC recognized laboratory
		Noise Environment				
		Ambient Noise	Leq (day & night)	Once / Three month	at boundaries of plot and, near nearest habitat.	MoEF&CC approved Laboratory
		Workroom noise	Leq (8 hours)	Once / Three month	near noise producing sources like DG set, Boiler house, Gas engine etc.	
		Biological Environment				
		Ecological survey	Study growth of trees at site as per plan and identify new species for plantation	Once every 3 years	At site	QCI NABET approved Ecology and Biodiversity expert
		Land Contamination				
		Soil / Ground water Quality	For specific contaminants of spilled chemicals	Regularly until no traces noticed	At/ near site of spillage	MOEF approved laboratory

SN	Project Phase	Environmental Component	Parameters	Frequency	Locations	Conducted by
4	**Decommissioning Stage**	Ambient air	PM_{10} / $PM_{2.5}$/ SO_2/ NOx / CO / NMHC	Once/Month	Adjacent to project site	MoEF&CC approved Laboratory
		Ambient Noise Level	Leq day and nighttime or over one work shift	Once/Month	Adjacent to project site	MOEF&CC approved lab
		Soil /Ground water Quality	For specific contaminants of spilled chemicals	Regularly until no traces noticed	At/near site of spillage	MOEF&CC approved laboratory
		CSTP	pH, TSS, TDS, COD, BOD, Oil and Grease	Daily until sewage stops completely	At various stages in STP system as in 2 above	

6.2.1 Measurement Methodologies

Monitoring of environmental samples will be carried out as per the methods/guidelines provided by MoEF&CC/CPCB and/or relevant Indian Standards or methods as specified by Standard Methods for Water and Wastewater Treatment by American Public Health Association (APHA). Methodology of monitoring (sampling & analysis) will be documented as SOP (standard Operating Procedure) for parameters analyzed through in-house laboratory and will be subjected to internal audit and review.

For monitoring of workplace area, methods suggested / published by National Institute of Occupational Safety and Health (NIOSH), USA or as specified in Standard Methods for Air Analysis published by APHA will be adopted.

Monitoring of environmental samples shall be done as per the methods/guidelines provided by MoEF/ CPCB and /or relevant Indian Standards. Monitoring shall be conducted by a NABL accreditated/ MoEFCC recongnized laboratory.

6.2.2 Reporting Schedules

The records of the monitoring program viz water, wastewater, solid waste, air, emission, soil shall be prepared and preserved properly. The records showing results/ outcome of the monitoring programs will be submitted as per the schedule below.

Monitoring reports will be reviewed regularly by MIDC's Facilities Management team along with Environmental Consultant for necessary improvement of the monitoring plan/ mitigation measures/ environmental technologies as well as for necessary actions of the proposed Environmental Management Cell.

Table 6-2: Reporting Schedule for EC Compliance

Sr. No.	Monitoring During	Reporting Schedule	Applicable Statute	Compliance Reporting To
1	Construction Phase	1st June and 1st December of each year till	EIA Notification Clause 10	• MPCB – Sub-Regional Office (Amravati) and Head Office Sion,

Sr. No.	Monitoring During	Reporting Schedule	Applicable Statute	Compliance Reporting To
		end of construction		Mumbai • MOEF- Western Zone office (Nagpur) and Monitoring Cell • CPCB Zonal office, Vadorara
2	Commissioning Phase	1st June and 1st December of each year till end of construction	EIA Notification Clause 10	• MPCB – Sub-Regional Office (Amravati) and Head Office Sion, Mumbai • MOEF- Western Zone office (Nagpur) and Monitoring Cell • CPCB Zonal office, Vadorara
3	Operation Phase	1st June and 1st December of each year	EIA Notification Clause 10	• MPCB – Sub-Regional Office (Amravati) and Head Office Sion, Mumbai • MOEF- Western Zone office (Nagpur) and Monitoring Cell • CPCB Zonal office, Vadorara
		Before 10th of next month in respect of stack/ vents, AAQ, STP inlet/ outlet, Noise levels	Combined Consent & Authorization (CC & A)	• MPCB – Sub-Regional Office (Amravati) and Head Office Sion, Mumbai •
4	Decommissioning Phase	1st June and 1st December of each year	EIA Notification Clause 10	• MPCB – Sub-Regional Office (Amravati) and Head Office Sion, Mumbai • MOEF- Western Zone office (Nagpur) and Monitoring Cell • CPCB Zonal office, Vadorara

The development authority will also file returns under HW Rules (yearly), annual Environmental statements &/ or performance report/ compliance report/ audit report as per conditions of EC (if applicable) and submit to MPCB within the stipulated timeframe. CC&A and other statutory permission/ consents must be obtained & renewed timely as per legal provision & guidelines. Similarly, all necessary report & forms will be prepared and submitted to the concern authority as per the statutory requirement of Environmental Acts/ Rules, Factory Act & MSIHC Rules. Reporting of accident & other requirements will be made in prescribed format well within stipulated time frame as per statutory requirements & guidelines.

Similarly, all necessary report & forms will be prepared and submitted to the concern authority as per the statutory requirement of Environmental Acts/ Rules.

Reporting of accident & other requirements will be made in prescribed format well within stipulated time frame as per statutory requirements & guidelines.

6.3 Budgetary Provisions for EMP

Environment Management Cell will inspect the necessity & availability of the materials, technologies, services & maintenance works regularly. The cell will make appropriate budget for the purpose. Regular record review for change in financial requirement of environment management will be done and appropriate budgetary provisions will be made. Budget for environmental management will be prepared and revised regularly.

The developing authority [MIDC, Amravati Sub Division] has made budgetary provision for the proposed project as a part of their initial planning. The environment protection measures of proposed development are to be initited during the construction stage itself.

The budgetary provision for the envisaged environment protection measures during the construction phase is presented below.

Table 6-3: Budget for Environment Protection Measures (construction phase)

Environment Protection Measure	Capital Cost (Rs. In lakh)	O & M Cost (Rs in Lakhs)
Safety measures for Traffic like crash barriers etc	80.00	8.00
Provision of silt traps/ embankments/ tree protection measures etc.	120.00	12.00
Labour camp (Toilets + drinking water + first aid arrangement + SWM)	20.00	2.00
Landscape Development (approx. 70 Ha with 80% survival rate)	154.66	15.47
Construction of STP (4 MLD)	6.00	0.60
Construction of MSW Management Facility (5 acre)	30.00	3.00
Construction of Truck Parking Terminus (5 acre)	30.00	3.00
Environmental monitoring	2.50	0.25
Environment Monitoring Cell	5.00	0.50
Total	**448.16**	**44.82**

The budgetary provision for the envisaged environment protection measures during the operation phase is presented below.

Table 6-4: Budget for Environment Protection Measures (operation phase)

Environment Protection Measures	Capital Cost (Rs. In lakh)	Recurring Cost per annum (Rs. In lakh)
Maintenance of green belt (roads)	-	15.00
Maintenance of green belt (GB)	-	15.47
Yearly monitoring for impact on ecology and biodiversity (by WWF or an NGO)	85.00	-
Conservation fund for wildlife: to Forest Department or Grant to an academic institution/ NGO for initiating program on Wildlife Conservation	122.80	-
CER INR 10.03 cr @0.75% of project cost to be spent during 5 years	460.50	92.10
MSW management, Waste Transfer Station	4.50	30.00
Environmental monitoring	10.00	1.00
Environment Monitoring Cell	6.50	0.65
Total	**689.30**	**154.22**

7 ADDITIONAL STUDIES

7.1 Traffic Management

The study is carried out on the basis of existing traffic on the adjoining roads and on the basic assumptions made for proposed parking requirements. The report also includes the management plan for internal traffic movement. Study of internal as well as external roads with reference to IRC guideline and in form of V/c Ratios is carried out.

The traffic study has taken the following aspects into consideration:
- Vehicular traffic on the main access road (NH53) to project site
- Vehicles converted into equivalent PCUs
- V/c ratio for present and future scenario
- Suggestions are given to mitigate the traffic congestion on possible locations

7.1.1 Exisitng Traffic

The site is located along NH 53 (the Surat-Kolkata Highway also known as the Nagpur- Amravati highway) which is a four lane road. The site is accessible from the MSH 10 located at about 5.5 km from the site which joins the NH at Nandgaopeth. Assessment of the existing traffic on the Nagpur- Amravati Highway indicates the following traffic count mentioned in Table 7.1 below.

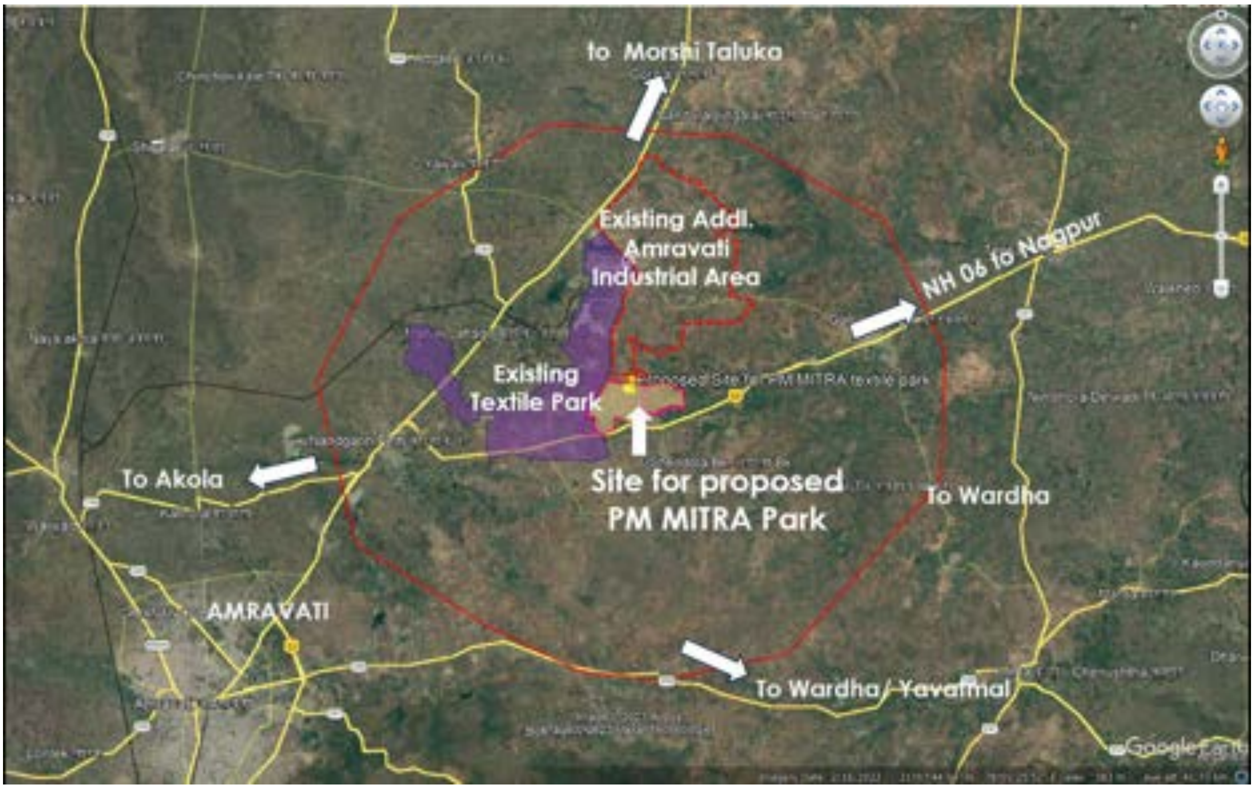


Figure 7-1: Site Connectivity

Table 7-1: Existing traffic count on NH53

S. No.	Vehicles Distribution	Number of Vehicles Distribution/Day	Passenger Car Unit (PCU)	Total Number Of Vehicle (PCU)/day
		National Highway – 6		
1.	Cars	4018	1	4018
2.	Buses	256	3	768
3.	Two wheelers	1536	0.5	768
4.	Three wheelers	724	1.5	1086
5.	Trucks	2815	3	8445
	Total			15085

7.1.2 Study of traffic load due to project

The study of traffic load is estimated based on the transport of raw materials required for manufacturing and the estimated workforce and their commutation to the construction site.

The following table shows PCUs that will be generated in different zones of the proposed development. The estimate is based on the type of the zone, parking requirement and its distribution on the access roads.

Table 7-2: Zonewise total PCU count

Sr. No.	Vehicle Type	Vehicle Count	PCU Factor	Operating Hours	Total Vehicles per hour	Total PCUs per hour
1	Manufacturing Zone					
	2 wheeler	7714	0.75	4	1929	1446
	4 wheeler	7200	1	4	1800	1800
	2 axil Truck	3857	2	4	964	1929
	3 axil Truck	110	3.7	16	7	25
	Multi axil Truck	27	4	16	2	7
	Buses	68	3.7	4	17	63
	Total	**21033**			**4718**	**5270**
2	Utilities					
	2 wheeler	875	0.75	4	219	164
	4 wheeler	145	1	4	36	36
	2 axil Truck	6	2	4	2	3
	3 axil Truck	3	3.7	16	0	1
	Multi axil Truck	0	4	16	0	0
	Buses	0	3.7	4	0	0
	Total	**1028**			**257**	**204**
3	Commercial Development					
	4 wheeler	252	1	4	63	63
	2 wheeler	273	0.75	4	68	51
	2 axil Truck	4	2	16	0	1
	3 axil Truck	3	3.7	16	0	1
	Total	**555**			**132**	**115**

Sr. No.	Vehicle Type	Vehicle Count	PCU Factor	Operating Hours	Total Vehicles per hour	Total PCUs per hour
4	Housing and Social Infrastructure					
	4 wheeler	2360	1	4	590	590
	2 wheeler	215	0.75	4	54	40
	Total	**4285**			**644**	**630**
5	Logistics					
	2 wheeler	200	0.75	4	50	37
	4 wheeler	138	1	4	35	35
	2 axil Truck	1	2	4	0	1
	3 axil Truck	1	3.7	16	0	0
	Multi axil Truck	0	4	16	0	0
	Buses	1	3.7	4	0	1
	Total	**341**			**85**	**73**
6	Training, R&D & Testing					
	2 wheeler	220	0.75	4	55	41
	4 wheeler	152	1	4	38	38
	2 axil Truck	1	2	4	0	0
	3 axil Truck	0	3.7	16	0	0
	Multi axil Truck	0	4	16	0	0
	Buses	1	3.7	4	0	1
	Total	**375**			**94**	**81**
	Total	27,618			5,929	6,374

It can be seen from the above table that the maximum PCUs will be generated in the Manufacturing zone (5270 PCU/hr). These PCUs will impact on external road after completion of project.

PCU Count Impact on External Roads

The following estimates are made for the zonewise total PCU count considering actual vehicle movement. The assumption made are as follows:

1. In the proposed development, two wheelers, cars, bicycle, Light Commercial Vehicles will operate for 4 hours, whereas Heavy Commercial Vehicles and Trailers will operate for 16 hours.
2. From residential zone 30% traffic will impact the external road and remaining 70% traffic will impact on internal roads of the proposed development. Thus, from manufacturing zone, the overall traffic reduces by 70%.
3. After reducing 70% residential traffic from all industry, only 40% industry traffic will impact on external road.
4. In the proposed development, within the manufacturing zone, the parking area estimated for 2 wheeler parking can be considered for bicycle parking. Bicycle use will be encouraged to reduce pollution.

Below table shows PCUs generated from different zones considering the above assumptions.

7.1.3 V/C Ratio

V Computation of v/c ratio based on existing and proposed traffic scenarios is given in the table below.

Table 7-3: Current and project V/c ratio

	PCU	V	C	V/C	LOS
For current traffic on NH53	15085	15085	35000	0.43	C
After operation Phase	6374	21459	35000	0.61	C

It can be seen that the existing NH53 has the capacity to accommodate the traffic arising due to the proposed project.

7.1.4 Recommendations

The suggested traffic management measures during construction and operation are as follows:

Steps to be taken for smooth flow of traffic during construction phase

- PP shall appoint traffic warden at all the entry and exit points to the site to ensure smooth traffic movement.
- Contractor to maintain an up to date database of all vehicles and construction equipment's deployed across various project component locations to be maintained. The database to contain details about the periodical maintenance, schedule of maintenance, vehicular emission and noise emission testing done as per Indian regulatory requirements, copy of PUC certificates etc.
- PP shall try to avoid the trailers/ heavy vehicles to flow on the road during peak traffic hours. Construction vehicles will be routed only during non- peak hours i.e. other than during 08.30 to 10.00 hours and 17.30 to 19.30 hours. Heavy vehicles will operate only after 21.00 hours.
- PP shall ensure sufficient parking inside the site premises during the construction phase for staff as well as visitors.
- PP shall encourage the staff of contractor and self to use public transport.
- PP shall maintain signage, flagmen and signal posts within the premises wherever required.
- As far as possible, PP shall maintain the two different lanes for up and down direction for flow of vehicles during construction phase within site premises.
- PP shall strictly avoid the use of phone calls while driving within and outside premises.
- PP shall ensure that the stacking of material which takes more time for unloading will have in some different area within the site premises so as to avoid waiting of other vehicles.
- Avoidance of vehicle passage through settle area during night time.
- All noise and emission caused by vehicles limit to permissible range as per norms so that it will not cause nuisance to workers and other people.
- All heavy vehicles like JCB, cranes, battery operated trolleys to be provided with reversing siren.
- Necessary training to the driver of construction vehicles for speed restrictions and to crew members on do's and don'ts during construction vehicles movements.
- If road closures are required, diversions to be planned and communicated to the authorities and affected communities in advance. All diversion to be constructed to the specifications of the applicable road authority and to be maintained in good drivable conditions until the completion of the reinstatement work.

- There will be separate road for construction vehicles so that it will not affect residential vehicles from project. If separate road is not possible then proper barricading will be provided to separate construction vehicles from residential vehicles from site.
- Within the construction areas, a speed limit of 20 km/hr will be defined for movement of vehicles.

Internal Traffic Movement Plan

Proposed development consists of Manufacturing Zone, Logistics Zone, Training R&D Testing Zone, Commercial Zone and Residential Zone. Considering that this is an industrial area, it may be assumed that there will be heavy traffic in the morning from 9 to 11 Am and in the evening four hours from 6. to 9 Pm.

Pedestrian Safety: For safety of pedestrians, the following safety measures are suggested:
- Speed breakers to ensure the speed limits to be controlled on the road crossings so as to allow safe road crossing to the pedestrians.
- PP shall ensure the separate footpaths throughout the road network.
- Level difference between the road and foot path shall be well maintained.
- PP shall provide concave mirror wherever there are sharp turnings.
- Traffic signages shall be maintained.
- PP shall provide the concave mirror wherever there are sharp turnings.
- It is also recommended to have zebra crossing of 3000 mm.

Internal Road Signages

For smooth and safe flow of vehicles, signage will be placed at various locations within the premises like Speed limit, Concave mirrors speed breakers, boom barriers etc.

The internal roads will be as per IRC guidelines. The roads will be separated by dividers to facilitate hassle free vehicular movement in project. Also speed restrictions will be followed in the premises. A dedicated parking area is also recommended provided so that there are very less chances of congestion due to haphazard parking pf vehicles.

Measures to be taken during Operation Phase
- People will be encouraged to park their vehicles on provided parking areas only.
- Entry of vehicles into the site premises from the main roads will be properly managed to avoid queuing on the main roads.
- Internal signage's plan showing the locations of traffic signage's like speed limit etc. with location of concave mirrors.
- It will be ensured that all fleet vehicles comply with environmental regulations with regards emission and noise.
- Strict compliance in accordance to the measures delineated in the Traffic Management Plan
- Encourage people to use public transport. It will help to reduce traffic to some extent.

Suggestions and Recommendations
- In the proposed zones of the industrial estate, bicycle parking may be provided to encourage its usage in order to reduce air pollution.
- Electric Car Charging Points can be provided, which will help to reduce pollution levels and improve air quality.

7.2 Disaster Management Plan for proposed Industrial Area

Detailed Disaster Management Plan for Construction Phase and Operation Phase is attached as ***Annexure XIII****.*

7.2.1 Construction phase DMP

A detailed DMP for the construction phases of the project has been prepared with reference to the project site and all stakeholders. The stakeholders i.e. MIDC, local Municipal Councils, Gram Panchayats, EPC contractors, sub-contractors and other vendors to be appointed by MIDC are to be made aware of their Roles and Responsibilities in order to successfully implement the DMP. The plan will facilitate effective implementation of environmental safeguards, monitoring and assessment at macro and micro levels at the site.

This document applies to the approved Master Layout and its execution within the project site of 410.02 Ha upto the construction phase. It has been prepared based on the existing environmental conditions and impacts of the proposed activities at site.

This document details the project activities, the proposed measures to be implemented for environmental impact management and mitigation and compliance with the relevant applicable conditions, guidelines and standards. It has been prepared to ensure that all contractors, sub-contractors, sub- concessionaire/s, employees and visitors comply with environmental requirements and that environmental risks are adequately managed for the life of the project.

7.2.2 Operation Phase DMP

The disaster management plan (DMP) provides for a framework of actions to handle various emergency situations at the proposed MIDC area. It also provides for on-site resources and appropriate outside assistance in case of any incident at the facility. The DMP will be in place before the commencement of operations at site, and all personnel will have undergone a comprehensive training in emergency response.

The primary objective of the plan is:

- Minimization of the risks to lives and safety of plant personnel and of the neighboring community.
- Containing and minimizing environmental damage, to surroundings, and to site property, and equipment, this could occur from emergency or accidental situations beyond the normal operations of the plant.
- Coordinating appropriate and effective actions with outside regulatory agencies during and after their involvement in on-site emergencies.
- Maintaining effective trained personnel capable of performing the established emergency response procedures when it is required.

The purpose of this plan is to provide the development authority with the means to effectively utilize all the resources at its disposal for the protection of life, environment and property.

MIDC will develop elaborate Onsite Disaster Management Plan based on guidelines outline in the DMP (Operation Phase) well in advance.

7.3 Rain Water Harvesting

7.3.1 Ground water Scenario

Ground water in Deccan Trap Basalt occurs mostly in the upper weathered and fractured parts down to 3-20 m depth. At places potential zones are encountered at deeper levels in the form of fractures and inter-flow zones. The upper weathered and fractured parts form phreatic aquifer and ground water occurs under water table (unconfined) conditions. At deeper levels, the ground water occurs under semi-confined and confined conditions.

12 number of open well from study area shows seasonal yielding. The perineal crops are not observed. During field survey, it was observed that bore well water was not being used for agricultural purpose.

7.3.2 Rain water Harvesting Potential

Average rainy days for the years 2002 to 2011 were 53 days

Average rainfall (2002-2011) 857 mm

Before project completion:

Annual potential of rain water = Area × Average annual rainfall × Runoff coefficient Maximum peak runoff per hrs(6) = Area × Maximum intensity of rainfall per hrs × Runoff coefficient

Table 7-4: Runoff Calculations before Project

Type of Land	Area (sq. m) 1	Runoff of coefficient 2	Average annual rainfall (m) 3	Runoff per year (m3)4	Runoff per Day (considered rainy 53 day)(m3)
N A	41,00,200	0.7	0.857	24,59,709.98	46,409.62

Runoff coefficient for calculating flow for rainwater design are considered based on Central Pollution Control Board, Ministry of Environmental and Forest Department data. They are as follows:

Table 7-5: Runoff Coefficients

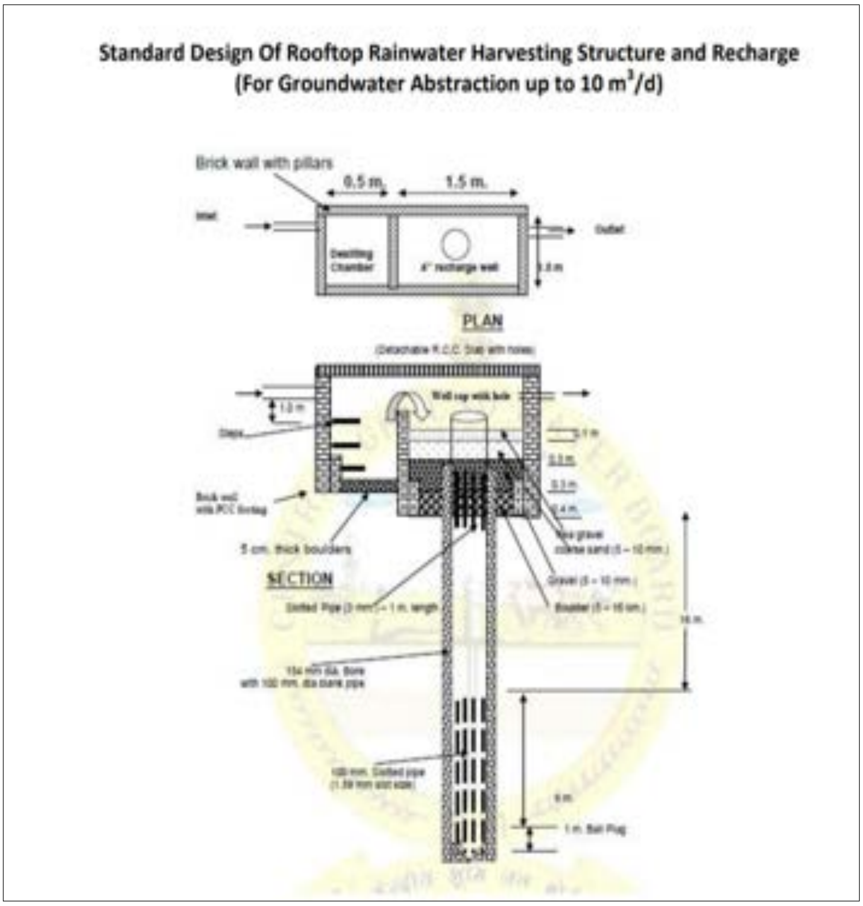
Surface type	Runoff coefficient (Range)
Roof (Metal, gravel, asphalt, shingle, fibre-glass, asbestos, concrete)	0.95-0.90
Pavement (Concrete, asphalt, Gravel bricks)	1.0-0.90
Ground Surface (Hard flat ground without vegetation)	0.75-0.25
Ground Surface (Hard flat ground with vegetation)	0.60-0.15
Lawns (Flat sandy soil) (Flat heavy soil)	0.10-0.05 0.20-0.15

B) Estimation of runoff after project completion

Table 7-6: Runoff Calculations after project completion

Type of surface	Area (sq. m)	Runoff coefficient	Average annual rainfall (m)	Runoff per year (cum)	Runoff per Day (considering 53 rainy days) (cum)
Industrial + Commercial + Manufacturing+ Commercial + Housing social infra + Logistic+ Utilities	3020500	0.85	0.857	2200283	41514.8
Road	382500	0.9	0.857	295022	5566.45
Green area	558700	0.3	0.857	143641	2710
Green belt area	138500	0.4	0.857	47477.8	895.81
Total	4100200	….	…..	2686423.8	50687.06
Increase in runoff and intensity runoff	….	…	…	A = 226714 9.22%	B-A= 4277.44

Due to the increase in paved surface (9.22%), artificial recharge to groundwater aquifer system through recharge pits is suggested.



Source: CGWA

Figure 7-2: Typical Rain water Harvesting Structure

7.3.3 Findings

The proposed project will be effect on runoff. After project completion, the runoff will increase by 9.23% and recharge to aquifer will decrease. It is also suggested to use soil conservation structures to preserve the exiting two water bodies within the project site. During project development, soil erosion will increase and problem like silting will affect nearby water bodies mainly the ones in the low lying areas. The ground water potential is low and the water table fluctuation shows that the area has scope for rain water recharge.

7.3.4 Conclusion

i. The study area is a gently plain land covered with land use type namely, agriculture and covered with red and black soil on a Deccan trap terrain.

ii. The climate of the district is characterized by a hot summer and general dryness throughout the year except during the south-west monsoon season, i.e., June to September. The mean minimum temperature is 15.1°C and mean maximum temperature is 42.2°C. The average annual rainfall in Amaravati Taluka is 856 mm.

iii. The major water bearing formation is weathered fractured and jointed basaltic flow; and the water is mostly occurring in the fractured and jointed zones as unconfined semi-confined condition presently at the core area and its surroundings.

iv. A geophysical investigation was conducted at nine numbers surface accessible or possible locations within the project area (proposed industrial area boundary) up to a depth of 85 to 100 meters from the ground surface. The analysis and interpretation of the investigated data (**Section 3.2.3**) revealed, that the project area and its surrounding land area is covered predominantly with hard rock formation; it is consisting of 4 major lithological layers, they namely are: the top-soil, weathered rock, fractured of jointed rock and hard rock compound basalt, existing at surface level to deep depth below the ground surface. The weathered and fractured rock areas existing below the ground surface are acting as water bearing zones or mostly aquifers. The individual layers thickness in general is: the top-soil up to 0.2 to 2 metres, weathered rock is between 2 to 15 metres. The fractured rock lying at deep depth can be considered as a potential water-bearing zone for the abstraction of groundwater.

v. The depth to groundwater level, obtained by measuring with a submersible water-level indicator probe, in the open-wells located within the core area and is varying with 2 to 10 metres below ground level, during the pre-monsoon (December month year 2023) season.

vi. The abstraction of groundwater is mostly through open-well in this area. Open wells (agriculture used) are sustaining up to or more than 2 hours of water withdrawal in a day at presently.

vii. The groundwater potentiality at the project area surrounding, it is occurring in the hard rock formation, and should not abstracted. The limited potential water-bearing zones would be occurring in the deep depth fracture and jointed zones as semi-confined to confined condition, are expected with poor yield under permissible sustainable conditions without causing water withdrawal issues.

viii. Regarding groundwater resource use and level depletion, the abstraction for use for construction and process operation (for the proposed industrial area) is not recommended, and should be sourced from outside water-tanker supply.

ix. The storm water system should be integrated with rainwater harvesting (for reuse) and artificial recharge structures (for groundwater augmentation) should be constructed and maintained.

x. for protection from wastewater, both process and domestic also sewage type, a system will be constructed and maintained; and collected, treated and reused to prevent and/or to minimize on surface water bodies water quality, and no wastewater will be released to outside natural drains, zero liquid discharge system should be implemented.

xi. Water will be conserved, use minimized with good practices and measures, practicing cascade and recycled or treated water reuse. So it is anticipated that there will be no major environmental impact on both the surface and ground water resource and quality.

xii. The review assessment of surface and groundwater quality indicate most of the parameters are within the permissible and/or acceptable limits of the standards.

xiii. It is recommended to plan for restoration of the exiting stream courses, check dams and percolation tanks.

8 PROJECT BENEFITS

8.1 Project Requirement

The PM MITRA Textile park is being developing World class state-of-the-art based Textile Park with Textile value chains right from spinning, weaving, processing/dyeing printing to garment manufacturing at a single location in the State of Maharashtra. The total land available for development comprises of 410.02 Ha.

The proposed PM MITRA Textile Park is located adjacent to National Highway-53 and nearest Railway station is Amravati railway station. This area is proposed to promote the economic development of the region by enhancing the investment and by optimal usage of the potential. The objectives also include developing and improving the industrial infrastructure, to increase employment opportunities and also exports. The site is thus well connected by State and National Highways & Railways, which will provide easy ingress and egress for raw material and products.

There is no heritage site in 5 km radius from the proposed site for PM MITRA Textile park at Additional Amaravati MIDC. Thus, there will be no impact on local heritage. All the RF areas are excluded from the project area.

8.2 Benefits due to the Project

The proposed development by MIDC will provide adequate measures for the prevention and control of pollution. The units proposed are in low polluting category. The effluents from the industries will be recycled with tertiary treatment in the already functioning CETP of existing Amravati MIDC. STP will be provided by individual industry units to treat and recycle all sewage generated in residential zone and reused back for flushing, cooling and gardening. With the execution and operation of such control measures for treatment of effluent as well as sewage along with proper Environmental Management System, there will not be any major potential for negative impact on the environment due to proposed project.

The benefits of Proposed Project to the country are as follows:

Proposed Project benefits

Demand Supply Gap	The nearby area has major crop are cotton, and with increasing temperature demand increases and with the demand supply of raw material for production into fabric increases
Imports vs indigenous production	World-class industrial infrastructure would attract cutting-edge technology and boost FDI and local investment in sectors giving more opportunities for exporting the finished products
Export Possibility	The setting up of Textile Units will reduce the demand supply gap in the domestic market & will also boost the exports
Domestic / Export Markets	The proposed industrial area are to be expected to meet both the demand -supply gap to meet both domestic and export markets.
Employment Generation	The Proposed project will increase the employment in construction as well as operation phase

Following are some other benefits due to the project:

Financial Benefits

The proposed PM MITRA Park will help in creating world-class industrial infrastructure that would attract large scale investment including foreign direct investment (FDI) and encourage innovation and job creation within the sector,

Nearly 1 lakh direct & 2 lakh indirect employment due to business, leading to stimulation of economic growth within the area,

Stimulating local economy due to direct & indirect impact of industries and related business.

Social Benefits

Provide alternate employment opportunity to population in Amravati Region,

Creation of new jobs (training, and social upliftment),

Skill development and technical expertise enhancement possibilities due to influx of industries and skilled manpower.

Environmental Benefits

Reducing transportation costs of raw material transport since proposed site is within cotton belt,

Creation of environmentally friendly and sustainable development in and around existing Amravati MIDC.

9 ENVIRONMENTAL COST BENEFIT ANALYSIS

Environmental cost benefit studies have not been conducted for this project.

However, all the required environmental protection measures will be implemented as part of the proposed development to ensure compliance with the local and national norms.

10 ENVIRONMENTAL MANAGEMENT PLAN

10.1 Introduction

Description of the administrative aspects for ensuring that the mitigative measures are implemented and their effectiveness monitored, after the approval of the EIA report are presented in this chapter.

Once mitigative measures are identified, an EMP is drafted as a joint activity by project developing authority [MIDC] and EIA consultant organization to detail out each activity required to accomplish the mitigation delineated in Impact Assessment section of this report.

- An EMP assures that the desired environmental management is communicated by the management to the executing teams and members of the EHS (Environment, health and safety) cell in a systematic manner without missing any vital/critical information.
- It helps the EHS cell in streamlining the role and responsibilities of the members and their respective departments.
- The EMP also helps in formulating preventive measures in terms of inspections, preventive maintenance, monitoring, etc. so that the performance of equipment and manpower are verified periodically.

Objective & Scope of EMP

Environmental Management Plan is prepared with the main objective of enlisting all the requirements to ensure effective mitigation of adverse impacts for all the components of the proposed project. The objectives taken into account in preparation of EMP are summarized here as follows:

a) The prevention, control and abatement of pollution, i.e. air pollution, water pollution, hazardous/ non-hazardous wastes and noise pollution,
b) To comply with the stipulated enviro-legal requirements and standards,
c) To direct the steps to be followed, for effective maintenance and regulation of environmental management system,
d) To ensure the better and safe work environment through pre-meditated planning of prevention and control of hazards,
e) To direct the investments towards sustainable development by considering the cost of emission control, waste disposal, social development, green belt development and health & safety in the planning and construction stages,
f) To account for recycling and reusing measures, proposed or required to be adopted for minimization of consumption of resources and generation of pollutants.

A detailed EMP for the project has been prepared with reference to the project site and all stakeholders. The stakeholders i.e. MIDC, local Municipal Councils, Gram Panchayats, Contractors, sub-contractors and other vendors to be appointed by MIDC are to be made aware of their Roles and Responsibilities in order to successfully implement the DMP. The plan will facilitate effective implementation of environmental safeguards, monitoring and assessment at macro and micro levels at the site.

This document applies to the approved Master Layout and its execution within the project site of 410.02 Ha for the proposed PM MITRA park. This document details the project activities, the proposed measures to be implemented for environmental impact management and mitigation and compliance with the relevant applicable conditions, guidelines and standards. It has been prepared to ensure that all contractors, sub-contractors, sub- concessionaire/s, employees and visitors comply with environmental requirements and that environmental risks are adequately managed for the life of the project.

Through this EMP, the MIDC Amravati Division, will commit to establishing and maintaining a system that strives to:

- Identify and mitigate environmental impacts associated with the proposed industrial estate activities;
- Ensure compliance with applicable environmental laws and regulations, and adopt best practices;
- Prepare, Issue, communicate and implement an EMP and identify to the industrial estate community on opportunities for improvement;
- Regularly monitor and report on environmental performance;
- Integrate environmental considerations into processes, decision making and work practices related to planning, design, construction, maintenance and operation of industrial estate facilities and services as part of the EMP;
- Make sincere efforts to prevent pollution and minimize release of pollutants into air, noise, water and ground;
- Monitor pollutant levels in air, noise, water and ground and in surrounding areas;
- Minimize consumption of non- renewable energy and enhance usage of renewable energy;
- Assist all staff and stakeholders to accept responsibility for their actions, and to comply with their environmental obligations through promotion of this policy and it’s implementation;
- Develop Environment Management System assigning responsibilities within the organization for monitoring environmental performance;
- Be sensitive to the expectations of stakeholders and the community regarding environment aspects related to this industrial estate.
- Take social initiatives for welfare of local community, promote co-operation with local authorities and community around the proposed industrial estate.

10.2 Institutional Framework for Environment and Safety Management

Basic responsibility for implementation of environmental protection measures will be with Dy. Engineer and Executive Engineer. Superintendent Engineer, MIDC Amravati Division, will oversee Project Implementation and any serious issues will be escalated to his senior level. Engineering staff will also be responsible for compliance to conditions of various clearances/ approvals and adherence to EMP prepared as part of EIA. The Regional Officer, Amravati will be responsible for administrative matters.

Key environmental issues addressed in the EMP include:

- Air Quality and Dust Management
- Water Quality Management
- Noise and Vibration Management
- Erosion and Sediment Control and its Management
- Waste Management
- Hazardous Waste Management
- Flora and Fauna Management

- Fire and Safety Management

10.2.1 Roles and Responsibilities of MIDC and of Contractors

Responsibilities of MIDC

- Planning and implementation of overall Storm Water Drainage network in area around the site
- Provide improved connectivity by construction of roads, upgradation of existing roads and upgradation of transport network around the site
- Plant and maintain the green belt areas and buffer zones as per the Master Layout and as committed in the EMP
- Compliance with the requirements as per EC and other applicable legislation for proposed site area of 410.02 Ha;
- Oversee the compliance of contractors with environmental norms and applicable permits;
- Development of all required infrastructure for MIDC and its maintenance as per the project plan;
- Preparation of Environment Management Strategy;
- Formulation, development and updation of Environment Management Plan for successive phases of construction including specific provisions for Contractors;
- Overall implementation, reporting and maintenance of EMP;
- Provision of necessary resources and staff to meet contractual terms
- Coordination and monitoring of responsibilities and compliances by the Contractor for monitoring the progress of implementation of EMP for its project obligations as per EC;
- Coordination of, sourcing and monitoring the progress of implementation of EMP by other agencies for its project obligations;
- Establishment of Environment Management Cell within MIDC to manage the implementation of EMP;
- Holding Stakeholder Consultations every six months;
- Setting up Monitoring systems (including reporting, compliance, auditing, and document management procedures) and Grievance Redressal Cell

Broad Responsibilities of Contractors

MIDC Amravati will appoint Contractors for execution of construction work within the site and the same Contractor shall be responsible for implementation of all project construction activities, including environmental protection measures.

- Understanding the EMP prepared as part of EIA and studying the clauses of the environmental clearance granted for the project;
- Have inhouse staff for ensuring compliance to the EMP and environmental clearance;
- Preparation of EMP for the area of work in accordance with Contract and submission to MIDC for approval of the same before commencement of Project;
- Ensuring that all of their activities including those of sub-contractors are carried out in accordance with it;
- Ensuring waste segregation and proper disposal in environmentally sound manner;
- Ensuring compliance at all times with the requirements of applicable legislation;
- Induction programmes and training of staff in environment management;
- Establishment of monitoring and implementation system for EMP;

- Regular liaison with MIDC EM Cell regarding progress on implementation of EMP;
- Obtaining permits and licenses as required for construction work and /or as directed by MIDC and ensuring compliance thereof (eg. For operation of hot mix plant, RMC etc.);
- Ensuring that toolbox talks and EM Cell meetings are regularly conducted;
- Reporting to MIDC of any change in the conditions of the environment or construction practices change materially from that as anticipated under the EMP;
- Undertake corrective and preventative measures in response to complaints brought to their notice and ensure that required measures are implemented in a timely manner; and,
- Monitor air quality, water quality and noise & vibration levels on daily basis to ensure adherence to the Standards, specifically to check workzone pollutants (Dust, PM10, PM2.5) levels, noise levels, vibration levels near blasting sites, STP inlet-outlet quality in labour camp, etc., through MoEFCC recognized laboratory.

During the construction phase, the Contractor will be required to have an in-house Environment Management Cell (EMC). Day to day environment management and monitoring of safety will be the responsibility of the contractor's in-house team.

In addition to the contractor, certain specialized jobs are likely to be awarded to other contractors, for example:

1. Separate contractor will be appointed by MIDC for the planning, design, construction and operation of common utilitiy facilities.
2. Landscape/ Horticulture contractor will be appointed by MIDC for implementation of landscape, horticulture works, and their maintenance.

10.2.2 Stakeholder Meetings

MIDC Amravati will be responsible for holding Stakeholder Consultations. These meetings will be attended by nearby local people, complainaints, Contractors and Sub Contractors etc. Stakeholder Consultations will be held every six months.

Contractors will be responsible for holding weekly toolbox meetings under the overall supervision of MIDC.

Community Engagement

Community Engagement shall be led by the Regional Officer (Amravati) and local Area Manager in coordination with the Executive Engineer.

Based on the nature of issues, these shall be escalated with MIDC, Collector, or other authorities as applicable. Any intervention/ decision required to be taken by MIDC shall be conveyed to the concerned stakeholder or community member.

10.2.3 Grievance Redressal

A Grievance Redressal Cell will be set up by MIDC to address any grieviances of the stakeholders/ local people. Grieviances related to on going construction activity, Contractor/ Labour activity, land related issues will be addressed by this cell.

The Deputy Engineer, Amravati will be incharge of the Grievance Redressal Cell. Information regarding the Cell will be displayed all across the site, especially at locations with ongoing construction work.

10.3 Environmental Management Cell (EMC)

10.3.1 Functions of EMC

The Environmental Management Cell (EMC) will keep close watch on the performance of the pollution control equipment, emissions from the sources and the quality of surrounding environment in accordance with the monitoring program. MIDC will carry out detailed inspection/ survey report in respect of Accident & Safety aspect through Directorate of Industrial Safety & Health, Maharashtra State (DISH).

The EMC will report directly to the Superintendent Engineer (Amravati) who will oversee all environmental issues including non-compliances and all senior level officers of MIDC will be appraised through emails and other communication means.

Overall development will be undertaken by MIDC (except for plotting) which will be entirely as per the MIDC DCR Rules, 2009.

Responsibilities of Environmental Management Cell (EMC) will be:

- Collect information from regular monitoring and create database.
- Analyze the data and decide thrust area.
- Carry out “project” in each thrust area to arrive at practical solutions to environmental problems.
- Discuss the reports of study on environment and disseminate the information.
- Work out action plan for implementation of the recommendations made in the report.
- Prepare Management Information System (MIS) reports and budget for Environment management program.
- To deal with the environmental issues and for ensuring compliance with the Conditions prescribed by State Pollution Control Board.
- Air Pollution Control Devices, hazardous waste management, green belt development, housekeeping, ambient air management, work area monitoring, safety department and OHC/ facilities etc. The activities will be managed by systematic assignment of responsibilities to each member.
- Monitor Health, Safety and Environment standards and practices.
- Maintaining records of all the data, documents and information in line with the statutory requirements and regularly furnish the same to the State regulatory authorities.
- General prevention and maintenance of pollution control system be carried out by the maintenance department, to achieve optimum efficiency of the control equipment and to maintain the quality of the environment.

EM cell will also look after disaster management and safety with defined role and responsibilities and defined framework.

10.3.2 Proposed Environment Management Cell

The present organizational set-up of MIDC can be seen in the following chart (See figure 10.1).

The suggested setup of institutional arrangement of the Environmental Management Cell (EMC) is given in the following pages *(Please refer **Fig. 10.3** on following pages*).

MIDC EMC will be led by Executive Engineer, Amravati and shall coordinate with Technical Advisor, Environment and Divisional Fire Officer (DFO).

MIDC Environment Management Cell will comprise the following:

- Executive Engineer, Amravati who will undertake and complete all environment related compliances.
- Deputy Engineer will undertake timely submission to the applicable relevant statutory authorities of the compliances/ returns and related documents. He will be responsible to obtain or renew all required environmental permits and clearances in a timely manner.
- Assistant Engineer and his staff will be responsible for day-to-day implementation on field and checking the compliances of works carried out by the Contractor.
- The MIDC EM Cell shall engage approved and accredited Third-Party Consultants to undertake environmental monitoring and analysis, for required assistance for regulatory compliances, conducting studies and obtaining clearances.
- Area Manager who will look after grievances of the local populace during ongoing construction phase and other land related issues.

EM Cell will supervise and monitor the functioning of Contractors. This Team will conduct regular inspections and audits to ensure that the EMP and the individual Contractor's EMPs are fully implemented. It will also ensure compliance with safety norms as per the relevant applicable law and conduct various HSE related training programs regularly to cover the entire work force, including that of the Contractor.

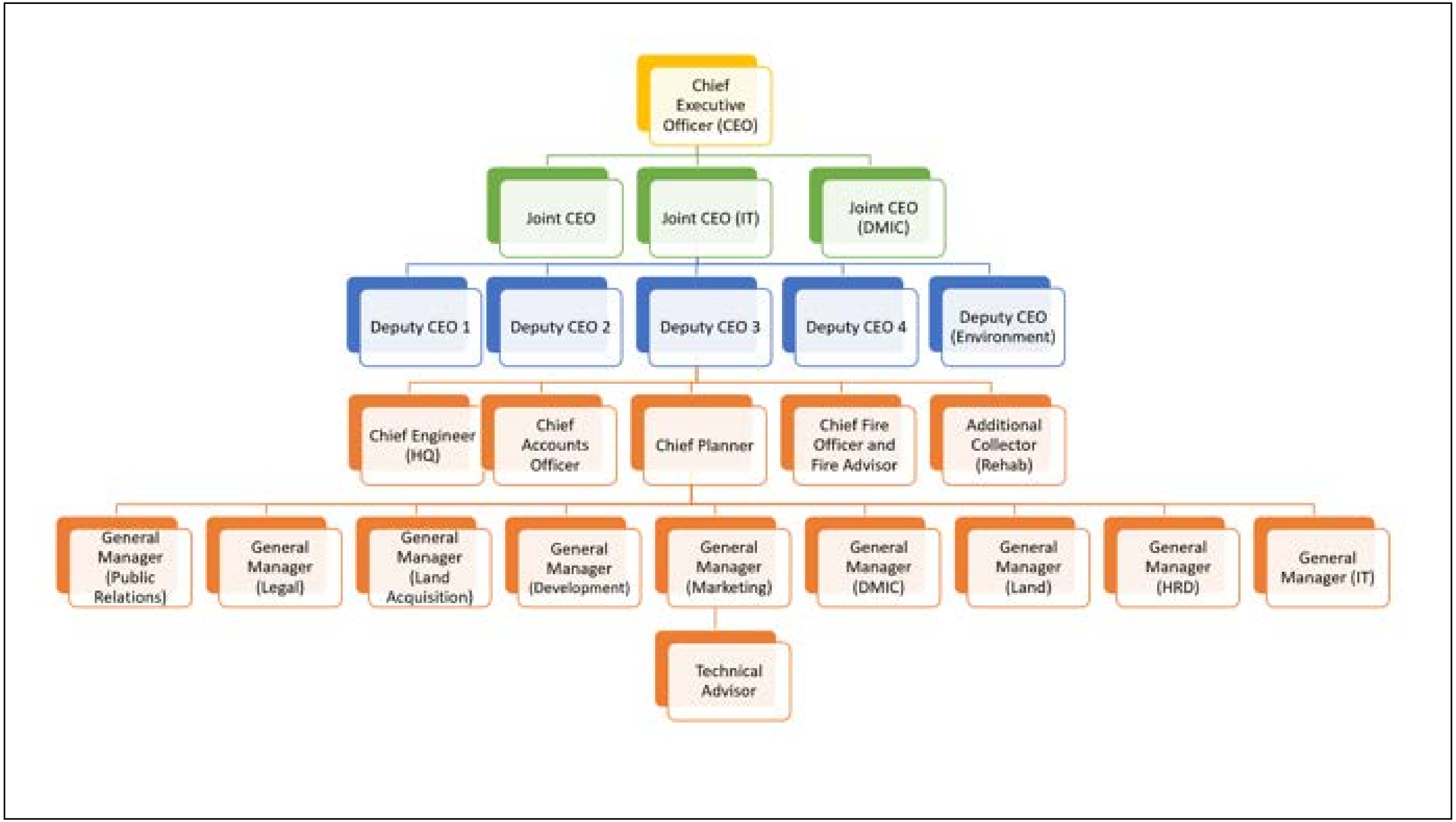


Figure 10-1: Organizational set-up of MIDC

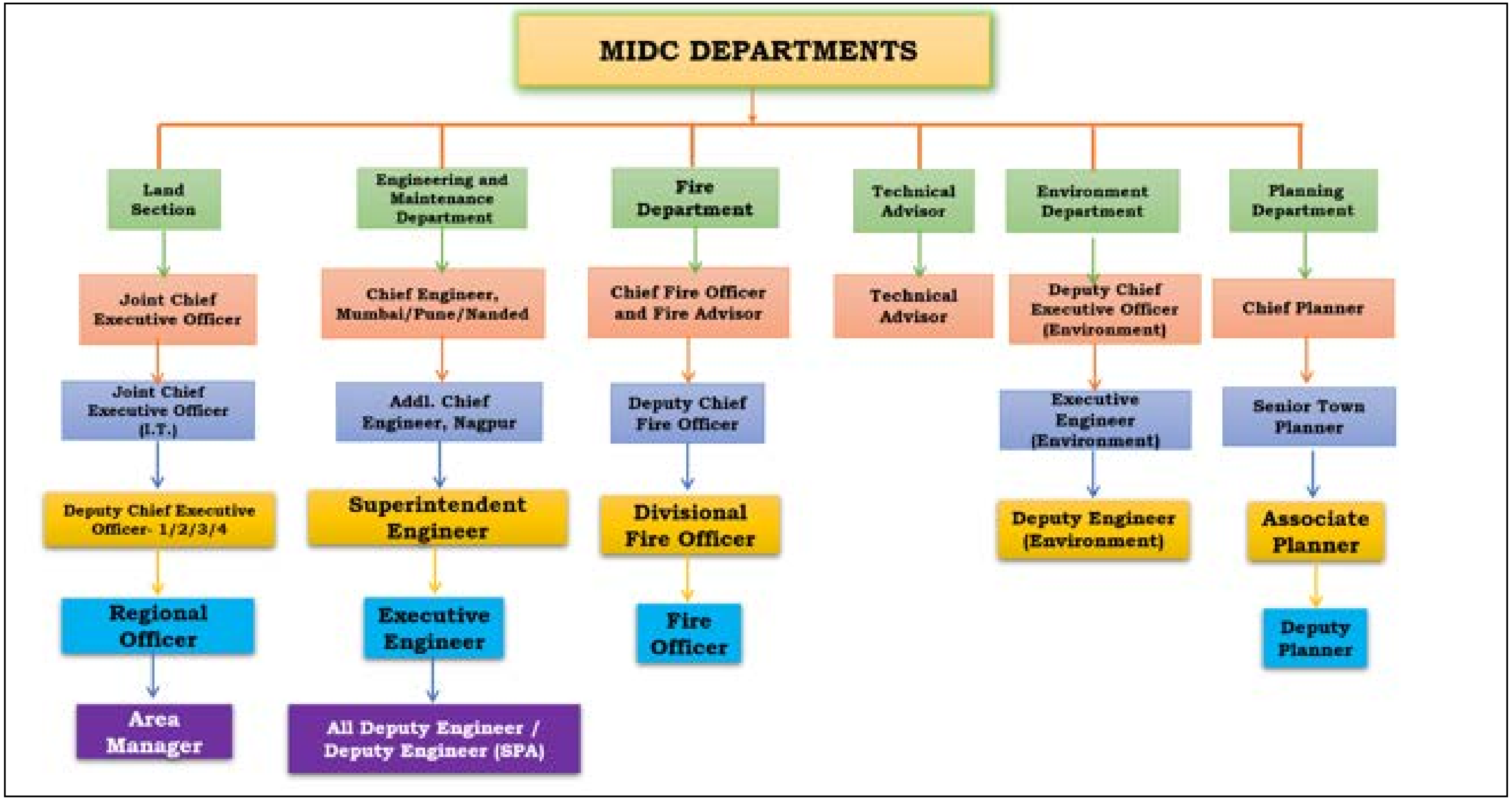


Figure 10-2: Departmental set-up of MIDC

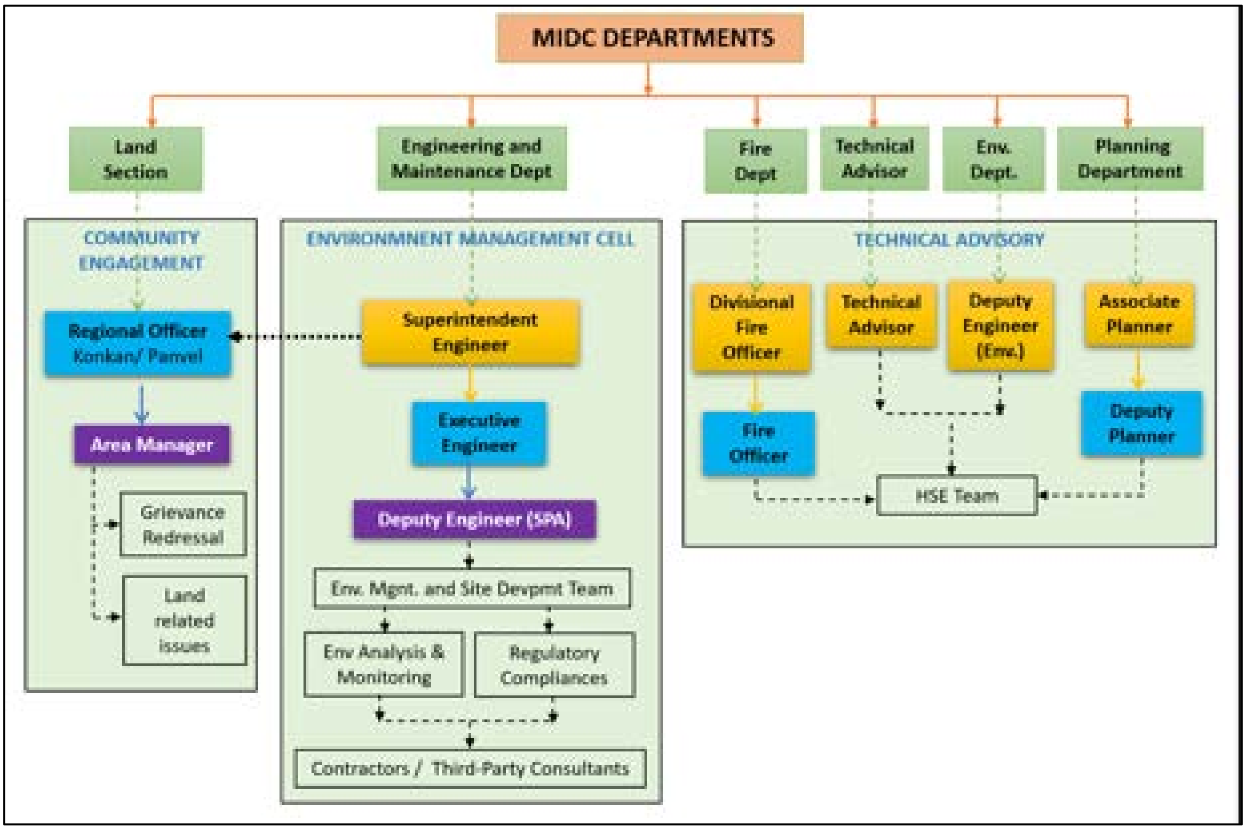


Figure 10-3: Suggested Organizational set-up of Environmental Management Cell (EMC)

10.3.3 Reporting and Updating of EMP

MIDC will prepare and submit quarterly/ half yearly reports regarding implementation of the environmental management program as described in conditions of various licenses/ certificate of clearance like Environmental clearances, Consent conditions, will be submitted to concerned authorities.

Implementation of EMP effectively is important but updating of EMP as and when required is the key of effecting environment management plan. Hence, it is suggested that the Developing authority [MIDC] will improve the EMP periodically which will enable effective management of environmental aspects.

ISO – 14001 – 2004 system can be used as reference for continual improvement in EMP and overall environmental performance.

10.4 Environmental Management Plan (EMP) Construction Phase

Environmental pollution during construction phase will be considerably less than that when the development will be fully operational. However, it is a good practice to develop procedures for control of pollution for the entire phasing of the project. This section covers the care to be taken during the construction and operation phases of the project for environmental management.

10.4.1 EMP for Impacts on Land Environment

- MIDC will develop the industrial estate, roads, infrastructure (streetlighting/water treatment plant/water supply network/sewage networks), common facilities building – no land development will be undertaken by MIDC (except for plotting) and the entire development has to be done as per DCR Rules 2009.

- While planning the textile park, the planning principles are adopted from the Zoning Atlas for Siting of Industries published by Central Pollution Control Board (CPCB, New DelhI) and the IL&FS Guidance Manual Development of Industrial Estates to ensure protection of forest areas, natural water bodies, transportation links and human habitation as summarized below:
  i. **Nallas/ streams passing through site**: buffer zone of 100m and about 10m around secondary streams / nallahs as per MIDC DCR, 2009 (Sec 17.1) provisions
  ii. **All water reservoirs**: buffer zone/ green belt around
  iii. **Highway/ Railway**: Buffer zone of about 300m width
  iv. **Overhead electric lines**: Buffer zone as per MIDC DCR Rules, 2009 (Sec 22.2)
  v. **Residential zone**: own open space of 10% as per MIDC DCR, 2009

Construction contracts will have conditions for reducing environmental impacts such as:
- To use substratum which has removed from within the site in areas where filling is required.
- To transplant at least 20% of fully grown trees which have to be removed.
- To store topsoil separately and use in plantation done on median verge or shoulder areas of roads for avenue trees plantation or in area earmarked for green belt development.
- To source construction raw material (stone/earth) from approved quarries.
- To transport construction material in tarpaulin covered trucks/dumpers, using existing roads to a minimum, and where used, with bypass arrangement for local traffic.
- To segregate and store wastes as required under applicable norms.
- Not to dump waste/debris in waterways or on nearby land.
- To provide mobile toilet and STP for sewage treatment.
- To provide composting of degradable municipal waste.
- To dispose recycable material and scrap through MPCB authorized scrap dealers.

10.4.2 EMP for Impacts on Air and Noise Environment

Construction contracts will have conditions for reducing environmental impacts such as:
• To use tipper trucks and other construction machinery such as excavators, bull dozers, etc. having valid PUC and meeting EP Act standards for air and noise emissions.
• To place RMC plant/ hot mix plant and crusher only as per MPCB Guidelines.
• To operate RMC plant/ hot mix plant and crusher only after getting Consent/NOC from MPCB.
• To conduct water sprinkling to reduce fugitive dust emission during road construction, land development and construction of buildings and traffic on kaccha roads.
• To provide construction workers with PPE such as helmet, dust masks and ear plugs.
• To screen of construction sites to reduce fugitive dust and noise impact on neighbourhood.

During construction phase, the developing authority [MIDC] is committed for the following:
- Ordering and procuring equipment meeting EP Act norms
- Carrying out construction activities and operations to ensure no disturbance to nearby area
- Installing acoustic enclosures, mufflers, vibration dampening etc
- Providing PPEs (ear muffs and ear plugs) and undertake yearly hearing loss test
- Preventive and operational maintenance of equipment
- Providing sufficient green belt and barriers to control noise
- Undertake work room and ambient level noise monitoring from MoEF&CC accredited lab
- Take all steps to control and minimize noise impacts to workers, surrounding populace and fauna

10.4.3 EMP for Water Environment Management

Topographical survey of the site has been done and catchments identified. This enables detailed hydrological studies and proper storm water drainage system design.

Storm water drains along the roadsides will be designed based on the hydrological study of the catchment area of the project. Culverts will be sized to ensure that natural drainage on the upstream side will not be hampered and there will be no hindrance to the natural drainage pattern.

As per the MIDC DC Rules 2009, a 10 m buffer zone is provided for all seasonal streams in order to protect the streams. There will be no change or alteration of existing seasonal streams in the entire development.

Water consumption

Water requirement for the project is anticipated to be 45.98 MLD. It will be sourced from recycle of treated effluent and sewage (23.59 MLD + 1.70 MLD). Rain Water harvesting will be implemented to trap water falling on roof tops and other paved areas. Ground water will not be used and Ground water levels will not be affected. Ground water recharge will be carried out through borewells.

Water conservation measures

The process water consumption will be optimized by the developing authority team by applying reuse and recycling techniques, wherever possible.

Following measures are proposed to reduce freshwater consumption

- Water meters will be provided at main areas of consumption to maintain records and to conduct water audit from time to time.
- Drip irrigation for watering of green belt within plant premises.
- Water saving faucets in toilets and washrooms.

Wastewater generation, treatment and disposal

Construction contracts will have conditions for reducing impacts such as:

- To meet water requirement for construction through road tankers and for labour from drinking water wells.
- To provide mobile toilets and STP/septic tank, soak pit for treatment of sewage of 25.5 cmd capacity.
- To store construction wastes under covered roof so that run-off will not affect surface water and soil.
- Also, debris disposal will be allowed only in identified low lying lands or abandoned quarries.

Monsoon preparedness will be implemented for following compliances

- Gate valves with will be installed at all storm water outlets
- Maintenance of adequate freeboard in all open tanks / containers to prevent overflow during monsoon.
- General Housekeeping in chemical storage areas to ensure that there is no spillage on the ground which can mix with rainwater and flow out of the site
- periodic monitoring of storm water will be carried out to ensure that it is not contaminated.

10.4.4 EMP for Impacts on Ecological Environment

Management of air, water, and land environment as mentioned in the previous sections will ensure that there is no adverse impact on the terrestrial ecology of the area.

MIDC will undertake planning and development as per the relevant CPCB and ILFS Guidelines (as enumerated in the section pertaining to land environment) so as to ensure sufficient buffer zone to protect natural streams in area.

Additionally, the following measures are recommended.

Conservation Plan

1. **Tree cutting:** Tree cutting will be kept at minimal levels. Appropriate permissions shall be taken from the concerned authority and the local administration. Similarly, the number of trees felled or cleared shall be recorded, and as many trees shall be planted through compensatory afforestation, if required, at designated locations
2. **Greenbelt Development:**

- Green belt along the borders of the site is proposed.
- Native, endemic and sturdy species for plantation recommended for green belt. The saplings and plants at the nursery will serve as reservoir of genetic and species diversity.
- Plantation of keystone species will ensure maintenance of ecosystems.
- Plantation of exotic, fast-growing and frail trees is discouraged.
- Nursery will be developed within the site for the plant species recommended for plantation. Saplings from this nursery can be used for plantation periodically, wherever needed. Also, these can be sold outside.
- Green belt will be developed in identified areas near water bodies during the construction phase, so that the trees will be sufficiently developed by the time the industries are set up.
- New Miyawaki type of plantation technique (developed by Japanese botanist Akira Miyawaki) will be adopted to develop dense forests. This has following benefits over conventional green belt:
  i. ten times faster growth of trees
  ii. 30 times denser plantation
  iii. 30% absorption of Carbon dioxide over conventional forests
  iv. 3000% increase in dust and noise pollution
- Local indigenous types of trees will be planted (Adulsa, Karvand, Nirgundi, Red Sanders, Hibiscus, Lemon, Guava, Banyan, Indian almond, Neem etc).

While undertaking road designs, speed brakers will be provided at regular intervals and restriction in vehicle speed mandated to slow the vehicles down to reduce on-road mortalities of animals. Drainages provided parallel to the roads will help reptiles migrate and disperse.

Construction contracts will have conditions for reducing environmental impacts such as:

- To transplant atleast 20% of fully grown trees that have to be removed.
- To store top soil separately and use in median verge or shoulder areas for avenue trees plantation or in other areas for green belt development.

To use construction machinery meeting EP Act norms for noise and also screen construction sites to reduce impacts on noise so as not to scare away avifauna.

Details of proposed green belt

A greenbelt along the borders of the study site shall be developed. it is recommended that greenbelt be developed along this periphery. Additionally, all the internal roads will have adequate tree cover at the boundaries. The total area under the project site is around 410.02 Ha. Approximately 33% area, i.e., 122.27 Ha. must be brought under greenbelt development. According to the guidelines issued by the MoEFCC, 1 plant for every 80 sq.m. of area must be planted.

The species for greenbelt development must be meticulously chosen. Care must be taken to avoid plantation of exotic, invasive species. Native species which support multiple faunal and floral components (keystone species) could be chosen. A list of species that can be used for greenbelt development is provided in Section 4.4.

The development of greenbelt will follow published protocols. Accordingly, planting saplings of trees that grow tall and produce thick canopy will be avoided along the immediate edges of the road, as such plantation could reduce on-road visibility, which may lead to accidents. It is therefore recommended that plantation for greenbelt be carried out in three layers. The first layer that lies at the immediate boundary of roads will be composed of shrub or short trees. The taller trees will be planted in the outer row. Planting of short trees or shrub species along the roads will also ensure to give foliage coverage to the intermediate bark levels of the taller trees in the outer rows, which are generally devoid of foliage.

The area will support multiple seasonal puddles during the monsoons. While these disappear after monsoon, these puddles, nonetheless, serve as important breeding grounds for invertebrate and amphibian species, and also support ephemeral diversity. The areas that support such puddles need to be managed.

Construction of speed-breakers across roads at specific intervals is recommended and also provision of drainages along the sides of the road. It is also recommended to install signage boards instructing drivers to drive slowly. These actions could reduce on-road mortalities of animals.

3. The industries could include the conservation and restoration of the Reserve Forests in the vicinity as a part of their CSR activity, in co-operation with the local Forest Department.
4. A part of the proposed area could be reserved for the establishment of nursery, which can serve as a reservoir of native plants for plantation purposes.
5. During the construction phase, enough care will be taken to ensure that the concrete and the other building materials is contained in dedicated spaces, and that it will not spread or flow away from those spaces, where its presence is not intended. This will ensure that the ephemeral and the grass species will survive in the patches that are not brought under development.

10.4.5 EMP for Impacts on Socio Economic Environment

MIDC has set aside plots for Housing & Social Infrastructure which will occupy 17 Ha and provide opportunity to local PAPs to attain their entrepreneurial dreams. MIDC gives three different options:

- Option 1: Complete Cash settlement (at rates more than LARR Act 2013 provisions)

- Option 2: to take Cash settlement (at rates more than LARR Act 2013 provisions) for 90% of amount and balance 10% be given via a land parcel in the form of a PAP plot (PAPs opting for this scheme can use the PAP plot for Industrial/ Commercial activity).
- Option 3: to take Cash settlement (at rates more than LARR Act 2013 provisions) for 85% of amount and balance 15% be given via a land parcel in the form of a PAP plot (PAPs opting for this scheme can use the PAP plot for Industrial/ Commercial/ Residential development activity).

Activities permissible within amenity area as per MIDC DCR 2009 are: MIDC offices, local area offices, post offices, telephone exchange, fire station, police station/ chowkies, electric sub-stations, water supply works, drainage works, Common Facility Centre/recreation center, industries association offices, schools/ colleges, educational institutes, training centre, pollution control laboratories, sulabh shauchalya, informal shopping, stall sites, plots for PAPs, communication centers, milk booths etc.

Employment Generation and Skill Development:
- MIDC will engage about 300 persons for operation and maintenance activities in MIDC. Preference will be given to PAPs/eligible members of the local population.
- Numerous new employment opportunities will be created for locals in terms of contracting, material and manpower supply, green belt development, courier agencies, retail shops, etc. to service the visitors/contractors likely to visit the area. Thus, migration to cities will be lowered and the quality of life will be improved.
- Locals will be made aware how to enhance their Skill sets and technical expertise to meet the needs of industries – the EIA Report encloses a list of local colleges and Institutions which offer courses relevant to the projects to be set up.
- PAPs will be given preference in local employment.

Large investment around the site for ancillary activities will stimulate development in the Konkan region and increase land rates. This will stimulate the local economy due to direct and indirect business opportunities to locals.

All applicable clauses of labour laws, prevention of sexual harassment etc. will be complied with and efforts will be made to ensure that inclusive and diverse opportunities are available for the local population.

10.5 Environmental Management Plan (EMP) Operation Phase

Environmental pollution during construction phase will be considerably less than that when the development will be fully operational. However, it is a good practice to develop procedures for control of pollution for the entire phasing of the project. This section covers the care to be taken during the construction and operation phases of the project for environmental management.

10.5.1 EMP For Impacts on Land Environment

- The development within the allotted plot has to be done by the industry as per MIDC DCR Rules 2009 which ensures that ground coverage is restricted to 50% of the plot and 9 m is left all along the boundary.
- The site layout has to adhere to DISH (under Factories Act 1948) and MPCB (under Water and Air Acts) requirements and also has to be approved by the respective authorities.
- While cutting and levelling the plot, SW drainage arrangement within individual plot must be approved by MIDC as per the MIDC DCR Rules 2009.

- Industries will be directed to store topsoil and substratum removed from construction sites and use for green belt.
- Industries will be directed to source their construction raw material requirements from approved quarries and borrow areas.
- Roads to be constructed by MIDC have been planned to be sufficiently wide to avoid traffic congestion.
- Industries will be directed to segregate wastes generated including HW, SW, BMW, construction debris, concrete, steel and other metals, broken bricks/tiles/glass, pallets, packaging, metal scrap, used oils/paints and their discarded containers and dispose off as directed by MPCB through approved parties.
- MIDC has developed Common Hazardous Waste Treatment, Storage and Disposal Facilities at Butibori, Nagpur, and HW will be disposed there.
- Industries will be directed to provide clean water and clean fuel in labour camp and treat MSW generated.
- For management of MSW, facilities will be provided for segregation of waste and collection of inert wastes like Plastic waste, e-waste in each sector of residential zone and also in common collection area. The biodegradable waste will be treated in Biomethanation/ anaerobic digestor to be located within the common utility zone provided by MIDC and inert waste disposed to nearest landfill. Segregated recyclable waste will be disposed of to MPCB authorized recyclers. MIDC will provide area of 5 acre in Utility Zone for Municipal Waste Management.
- Industries will be permitted to dispose of industrial effluents on land after treatment only if authorized by MPCB.
- Industries will be required to prepare plan for spillage of chemicals during storage and handling and submit to relevant authorities.

10.5.2 EMP for Impacts on Air and Noise environment

Project Proponents will be directed to reduce impacts during construction as follows:

- Use of tipper trucks and other construction machinery such as excavators, bull dozers, etc having PUC and meeting EP Act standards for air and noise emissions.
- Location of RMC plant/ hot mix plant and crusher only as per MPCB Guidelines.
- Operation of RMC plant/ hot mix plant and crusher only after getting Consent/NOC from MPCB.
- Water sprinkling to reduce fugitive dust emission during road construction, land development and construction of buildings and traffic on kaccha roads.
- Providing construction workers with PPE such as helmet, dust masks and ear plugs.
- Screening of construction sites to reduce fugitive dust and noise impact on neighbourhood.
- Transportation of construction materials under tarpaulin cover.

Mitigation measures to be taken by MIDC will be as follows:

- Industries will be required to obtain timely Consents from MPCB
- Provision of DG set enclosures and stack heights etc shall be as stipulated in the Consents.
- MIDC will ensure energy efficient fixtures and use of solar energy for streetlighting, pumps for irrigation, admin buildings and common facility centre, fire station and public toilets etc.

10.5.3 EMP for Water Environment Management

The storm water drains along roadsides will be maintained based on the hydrological study of the catchment area of the project.

Industries will be required to develop the SW drainage design as per provisions in MIDC DCR 2009 and get the same approved from MIDC before construction begins at the site. There will be no change in natural drainage pattern as the entry and exit points of the nallas within each industrial plot carved out has to be maintained by industry.

There will be no change or alteration of existing seasonal streams in the entire development.

Industries will have to comply with construction phase water environmental impacts as follows:

- To meet water requirement through road tankers.
- To provide clean drinking water for labour.
- To provide mobile toilets and STP/septic tank, soak pit for treatment of sewage.
- To store construction Wastes under covered roof so that run-off will not affect surface water and soil.

Also, debris disposall will be allowed only in identified low lying lands or abandoned quarries.

Water saving techniques

Water saving techniques which can reduce water consumption are listed under section 4.3.3.4.

To ensure ZLD, sewage will be treated by establishing sequential batch reactor (or cyclic ASP) process plant of 4 MLD capacity in residential zone. The technology gives BOD < 5 mg/l and also offers benefit of nitrogen and phosphorous removal making water fit for any use. The treated sewage water from STP to be set up in MIDC will be reused for flushing, cooling, gardening and balance if any will be available for industrial use.

10.5.4 EMP for Impacts on Ecological Environment

- Since greater proportion of the proposed industrial site is covered with grassland or scrubland, excessive is not necessary.
- For tree cutting if proposed by the individual plot owners, due permission of Tree Authority (MIDC) has to be taken by industries and for each tree cut, the industry will be required to compensate with new plants – also 10 % of plot has to be under open space/green belt (33% for units going in for EC).
- Industries will be encouraged to plant native, endemic and sturdy species for plantation recommended for green belt and use techniques like Miyawaki forestation for faster and denser growth of green belt.
- Industries will be directed to store top soil separately and use within the plot for green belt development.
- Industries will also be directed to screen construction sites and undertake water sprinkling to ensure low fugitive dust and noise generation.

10.5.5 EMP for Socio Economic Environment

Employment generation:

- MIDC will engage about 300 persons for operation and maintenance activities in MIDC. Preference will be given to PAPs/eligible members of the local population.
- Industrialization in the area will bring in large employment opportunities in the region Nearly 1 lakh direct & 2 lakh indirect employment generation is expected. Approximately 40-50 employees to be employed through direct employment by MIDC during Operation phase. Jobs will be created in Industries to be set up and will offer alternative job opportunity to local populace particularly when they are unable to practice farming.

- Locals will get numerous new employment opportunities in terms of contracting, material and manpower supply, green belt development, courier agencies, retail shops etc to service the visitors/contractors likely to visit the area. Thus, migration to cities will be lowered.
- Industrialization will lead to overall socioeconomic upliftment and improvement in quality of life by making available better infrastructure facilities in the villages.
- Skill development and technical expertise enhancement possibilities will be created for the local population due to influx of industries and skilled manpower.
- Large investment around the site for ancillary activities will stimulate development in Konkan region and increase land rates, which will stimulate the local economy due to direct and indirect business opportunities to locals.

10.6 Corporate Environment Responsibility

In order to mitigate adverse impact likely to arise in social, cultural and economic aspects in the surrounding region, the project authority is expected to contribute towards upliftment of local people and their quality of life.

Corporate Environment Responsibility Plan

As per OM F. No. 22-65/2017-IA. III issued by MoEF&CC on 1st May 2018 on Corporate Environment Responsibility (CER) the some of the activities which can be carried out in CER, are infrastructure creation for drinking water supply, sanitation, health, education, skill development, roads, cross drains, electrification including solar power, solid waste management facilities, scientific support and awareness to local farmers to increase yield of crop and fodder, rain water harvesting, avenue plantation, plantation in community areas etc.

The fund allocation for the CER is based on criteria such as percentage of capital investment for green field/ brown field project. For brownfield projects, the fund allocation is 0.75 % of project capital investment.

Approximate project cost is Rs. 614 crore and the project is brownfield. Therefore, as per the Ministry's O.M No 22-65/2017-IA.III dated 1st May, 2018, CER applicably for the proposed project is INR 460.50 crore (0.75% of the effective cost of the proposed brownfield project).

CER Plan proposal for improvement in nearby vicinity will include creation of infrastructural facilities which are lacking with special emphasis on health, education, environment, water, Sanitation & hygiene, road & skill development.

Following activities are outlined under the proposed CER program. A component of the water supply scheme which will be developed for the proposed PM MITRA Textile Park will cater to provide clean drinking water throughout the year (at concessional rate) to the 2 villages within the site. Also, fire station will be set up will cater to fight fire in affected villages and nearby areas and also help to fight accidents due to truck/ tanker movement.

Table 10-1: Proposed activities under CER

Area of Concern	Activities	Frequency	Coverage
Water supply	Provision of water pipeline and Water Treatment Plant	Permanent	2 villages located within the proposed PM MITRA Textile Park area

Area of Concern	Activities	Frequency	Coverage
Water conservation	creating water storage structures and irrigation sources, implementing watershed works, desilting village tanks, ponds and irrigation canals, carrying out land levelling and afforestation	Permanent	Areas around and within proposed PM MITRA Textile Park project site

In addition, following activities are being considered under available CER funds.

Table 10-2: Additional activities being considered under CER

Area of Concern	Activities	Frequency	Coverage
Livelihood Enhancement	Establish Skill Development Centre with Computers, Labs and Workshops, and install e-learning setup in local schools with tie-up with local ITI and colleges. The courses to be developed will focus on the textile industries being established to give better job opportunity to the local youth.	Need Based	Villages located within and around proposed PM MITRA Textile Park
Health	Upgrade healthcare infrastructure facilities to the government hospitals (PHCs and PHS) in the project affected areas in light of COVID 19 pandemic and in view of the health hazards likely due to the new industries being set up.	Need Based	Villages located within proposed PM MITRA Textile Park area
	Ambulance, Mobile health care clinic/unit.	Need Based	2 villages located within the PM MITRA Textile Park area
Environment	Waste Management – compost bins & Ghanta Gadis	Need Based	Villages located within PM MITRA Textile Park area
Socio Economic Development	Upgradation of local educational institutions by construction of toilets, classrooms, school building, compound wall, playground, community hall etc.	Need Based	Villages located within PM MITRA Textile Park area
	Assistance to SHGs for business development		

The budgetary allocation of INR 92.10 lakh will be spread out over 5 years – project implementation period and yearly amount will be spent on pro-rata as capital investment in the project progresses. Activities pertaining to water supply will be taken up within first two years, whereas the other activities will be need based.

11 SUMMARY AND CONCLUSIONS

11.1 PROJECT SUMMARY

The area of 410.02 ha. is selected for setting up of prestigious Prime Minister Mega Integrated Textile Region and Apparel (PM MITRA) Park scheme by Ministry of Textile Government of India. The area was selected as brown field park & is adjacent to existing Textile Park. As the nearby area is having major crops such as cotton, the setting up of PM MITRA Park will be beneficial for farmers in the region & also will give employment to workforce in the region. The industries expected in the park will also add to the foreign reserves of the country by exporting the products of their units.

The total investment of about Rs 614 crore & nearly 1 lakh direct & 2 lakh indirect employment generation is expected. Integrated Parks will offer an opportunity to create integrated Textile value chain right from spinning, weaving, processing/dyeing printing to garment manufacturing at a single location. World class industrial infrastructure would attract cutting edge technology and boost FDI and local investment in sector.

Proposed Textile Park will house all types of manmade fibre units including Rayon (Category 5d as per EIA Notification) under Red category as per CPCB classification and hence it falls under Category A. Hence the project requires Environmental Clearance from MoEFCC.

The project brief is summarized in the following table.

Table 11-1: Project Summary

Sr. No.	Description	Details
I.	Proposal Number	IA/MH/INFRA1/447555/2023 and File No.: 10/69/2023-IA.III
II.	Name of Project	PM MITRA Textile Park adjacent to @Addl. Amravati Industrial Area at MIDC Industrial Area, Old Bypass Road, Amravati, Maharashtra 444607
III.	Project category	7(c) Industrial estates / parks / complexes / areas, Export Processing Zones (EPZs), Special Economic Zones (SEZs), Biotech Parks, Leather Complexes
IV.	Project Proponent	Maharashtra Industrial Development Corporation (MIDC), Amravati Division
V.	Location of the project	Additional Amravati Industrial Area at MIDC Industrial Area, Old Bypass Road, Amravati, Maharashtra 444607 Taluka Amravati, Villages Digargavhan and Pimpalvihir
VI.	Connectivity	Site is adjacent to Site along NH 53 highway Nearest railway station: Amravati Railway Station at 19 km Nearest Airport: Dr. Babasaheb Ambedkar International Airport, Nagpur 125 km
VII.	Government Order relating to the site	Land acquisition Notifications for Additional Amravati Industrial Area, dtd. 5th Sept., 2019
VIII.	Project Cost	Rs 614.00 crore
IX.	Latitude and	Between 77° 53' 45.287" and 77° 55' 56.626" East Longitude

<table>
<tr><th>Sr. No.</th><th>Description</th><th colspan="3">Details</th></tr>
<tr><td></td><td>Longitude</td><td colspan="3">Between 21° 2' 29.151" and 21° 1' 29.447" North Latitude</td></tr>
<tr><td>X.</td><td>Plot Area</td><td colspan="3">410.02 Ha</td></tr>
<tr><td>XI.</td><td>Area Statement</td><td colspan="3"><table>
<tr><th rowspan="2">Sr. No.</th><th rowspan="2">Zone/ Land use</th><th colspan="2">Area</th></tr>
<tr><th>Ha</th><th>%</th></tr>
<tr><td>1.</td><td>Manufacturing Zone</td><td>257.14</td><td>62.88</td></tr>
<tr><td>2.</td><td>Utilities</td><td>9.54</td><td>2.85</td></tr>
<tr><td>3.</td><td>Commercial Development</td><td>8.18</td><td>2.70</td></tr>
<tr><td>4.</td><td>Housing & Social Infrastructure</td><td>17.00</td><td>4.65</td></tr>
<tr><td>5.</td><td>Logistics</td><td>4.85</td><td>1.80</td></tr>
<tr><td>6.</td><td>Training,R&D & Testing</td><td>5.34</td><td>1.30</td></tr>
<tr><td>7.</td><td>Roads</td><td>38.25</td><td>9.85</td></tr>
<tr><td>8.</td><td>Green Area</td><td>69.72</td><td>13.97</td></tr>
<tr><td></td><td>Total</td><td>410.02</td><td>100.00</td></tr>
</table></td></tr>
<tr><td>XII.</td><td>Water Requirement</td><td colspan="3">15.87 MLD</td></tr>
<tr><td>XIII.</td><td>Source of water</td><td colspan="3">Irrigation Department, Government of Maharashtra dtd 09.02.2004 for supply of 10 MCM</td></tr>
<tr><td>XIV.</td><td>Sewage Generation</td><td colspan="3">3.06 MLD (to be treated in STP)</td></tr>
<tr><td>XV.</td><td>Effluent generation</td><td colspan="3">7.35 MLD (to be treated in existing CETP)</td></tr>
<tr><td rowspan="4">XVI.</td><td rowspan="4">Solid Waste Management during Construction Phase</td><td>Type</td><td>Quantity (Kg/d)</td><td>Treatment / disposal</td></tr>
<tr><td>Dry waste</td><td>As & when generated</td><td>Recyclable dry waste will be handed over to authorized recyclers. Inerts will be disposed to landfill site through local agencies.</td></tr>
<tr><td>Wet waste</td><td>As & when generated</td><td>Composting</td></tr>
<tr><td>C&D waste</td><td>2715 kg/ day</td><td>Disposal in compliance with Construction & Demolition Waste Management Rules, 2016 and through MPCB authorized recycler</td></tr>
<tr><td rowspan="6">XVII.</td><td rowspan="6">Total Solid Waste Quantities with type during Operation Phase</td><td>Type</td><td>Quantity (Kg/d)</td><td>Treatment / disposal</td></tr>
<tr><td>Dry waste</td><td>5631 kg/ day</td><td>Recyclable dry waste will be handed over to authorized recyclers. Inerts will be disposed to landfill site through local agencies.</td></tr>
<tr><td>Wet waste</td><td>5104 kg/ day</td><td>To be treated in proposed biomethanation plant at site</td></tr>
<tr><td>E-Waste</td><td>49 kg/ day</td><td>Sale to MPCB authorized vendor</td></tr>
<tr><td>STP Sludge (dry)</td><td>551 kg/ day</td><td>Dried sludge from STP will be used as manure</td></tr>
<tr><td>Hazardous Waste</td><td>• Used oil/ spent oil: 139 ltr/day</td><td>Disposal at CHWTSDF, Butibori, Nagpur</td></tr>
</table>

<table>
<tr><th>Sr. No.</th><th>Description</th><th>Details</th></tr>
<tr><td></td><td></td><td>• Chemical sludge from ETP 71,181 kg/day
• Textile chemical residue: 26,376 kg/day
• Discarded containers/ barrels/ liners (no.): 1656.6</td></tr>
<tr><td>XVIII.</td><td>Green belt details</td><td>
<table>
<tr><th>Area under Green Belt</th><th>(Ha)</th><th>(%)</th></tr>
<tr><td>Green Area</td><td>55.87</td><td></td></tr>
<tr><td>Green Belt Area</td><td>13.85</td><td></td></tr>
<tr><td>Total</td><td>69.72</td><td>17%</td></tr>
<tr><td>Green area in large size plot (Area = 302.05 Ha)</td><td>48.33</td><td rowspan="2">16%</td></tr>
<tr><td>Green belt area along the road</td><td>4.22</td></tr>
<tr><td>Total Green Area</td><td>122.27</td><td>33%</td></tr>
</table>
Existing trees on plot: 945
Number of trees to be cut: 91
New trees against trees to be cut: 182
Number of trees to be planted: 15,466</td></tr>
<tr><td>XIX.</td><td>Power requirement</td><td>Total Electricity requirement during operation phase is 30MWA</td></tr>
<tr><td>XX.</td><td>Energy Efficiency</td><td>Energy efficient fixtures and use of solar energy for streetlighting, pumps for irrigation, admin buildings and common facility centre, fire station and public toilets etc.
Efforts to reduce Carbon Footprint through installation of Solar PV Systems, solar water heating system in order to conserve non-renewable energy</td></tr>
<tr><td>XXI.</td><td>EMP Cost</td><td>a) Construction Phase:
Capital Cost: Rs 448.16 lakh, O&M Cost: Rs. 44.82 lakh/annum
b) Operation Phase:
Capital Cost: Rs. 689.30 lakh, O&M Cost: Rs. 154.22 lakh/annum</td></tr>
</table>

11.2 FINDINGS AND RECOMMENDATIONS

The upcoming project is notable on account of the following:

1. This will be a large textile park development housing entire value chain at one location, attract investment, generate employment and augment export potential.
2. The scheme will develop integrated and modern industrial infrastructure facility would attract large scale investment including foreign direct investment (FDI) and encourage innovation and job creation within the sector.
3. The park will offer an excellent infrastructure, plug, and play facilities as well as training and research facilities for industry.

4. With a vision to be located at a site having inherent strength for textile industry to flourish and the necessary linkages to succeed, this textile park will offer an opportunity to create an integrated textiles value chain right from spinning, weaving, processing/ dyeing, and printing to garment manufacturing at a single location.
5. Large green spaces (73.94 Ha) (>17%) will be provided as per CPCB/ILFS Guidelines for development of Industrial Estates to protect forest patches and rivers/water bodies and ensure continuity of green patches.
6. Elaborate mitigation measures prescribed during construction phase for controlling water pollution will ensure low impact during construction.
7. MIDC will install infrastructure to reduce pollution during operation phase include:
   - setting up STP, MSW treatment facility in utility zone
   - solar power generation and energy efficient fixtures for use in infrastructure facilities
8. Improvements in the physical infrastructure available to the local populace

11.3 CONCLUSION

The positive impacts of the project include:
1. Improvements in the infrastructure and quality of life for the local populace
2. Huge employment potential during construction and operational phase for skilled, semi-skilled and unskilled labour
3. Huge entrepreneurial opportunity in supply and service industries, contracting, etc.
4. Improvement of the economic condition of the area.

The negative impacts identified are:
1. The area will lose its rural character and the local population may lose their traditional livelihood/lands
2. Reduction of open spaces
3. Pollution may impact health and vegetation

The impacts are manageable and almost all of them can be minimized through solutions incorporated in the design and implementation of the EMP and monitoring plan.

With the implementation of appropriate mitigation measures, the project will be socio economically viable and environmentally sustainable.

MIDC undertakes to take efforts to protect the environment and ecology of the surrounding area.

In view of this, it may be concluded that proposed project presents no major environmental and ecological concerns.

12 DISCLOSURE OF CONSULTANTS ENGAGED

ENVIRONMENTAL CONSULTANT

ERVICES PVT. LTD.

, Mogul Lane, Mahim, Mumbai – 400016

id : contact@aespl.co.in

ces pvt ltd

Rasayani, Dist. Raigad Pin 410207

id : pglab@aespl.co.in

lhi & Vadodara

y Organization Accredited by QCI-NABET

IA/2225/RA 0262; dated 18th October 2022; Valid up to 1st May 2025)

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studies

r CPCB, MPCB and other agencies like World Bank.

sessment (EIA) & Environment Management Plan (EMP)

n Site/Off Site Emergency Management Plan.

fety audits & Due Diligence audits

& Treatability Studies

nsultancy for Effluent Treatment Plants

ir quality surveys

em design

ng entire spectrum of environmental analysis

ring

monitoring

ater analysis

iment analysis

rsity surveys

veys

rveys

astal process studies & management plans

QUALITY COUNCIL OF INDIA
QCI Creating an Ecosystem for Quality

NABET

National Accreditation Board for Education and Training

Certificate of Accreditation

Aditya Environmental Services Pvt. Ltd., Mumbai

110, Hiren Light Industrial Estate, Mogul Lane, Mahim, Mumbai- 400016

*The organization is accredited as **Category-A** under the QCI-NABET Scheme for Accreditation of EIA Consultant Organization, Version 3: for preparing EIA-EMP reports in the following Sectors –*

S. No	Sector Description	Sector (as per) NABET	Sector (as per) MoEFCC	Cat.
1	Mining of minerals opencast only	1	1 (a) (i)	A
2	Onshore oil and gas exploration, development & production	2	1 (b)	A
3	River Valley projects- Irrigation only	3	1 (c)	B
4	Thermal power plants	4	1 (d)	A
5	Metallurgical industries (ferrous only)	8	3(a)	A
6	Cement plants	9	3(b)	A
7	Petroleum refining industry	10	4 (a)	A
8	Chemical fertilizers	16	5 (a)	B
9	Pesticides industry and pesticide-specific intermediates	17	5 (b)	A
10	Petrochemical based processing	20	5 (e)	A
11	Synthetic organic chemicals industry	21	5 (f)	A
12	Air ports	29	7 (a)	A
13	Industrial estates/ parks/ complexes/areas, export processing Zones, Special Economic Zones, Biotech Parks, Leather Complexes	31	7 (c)	A
14	Common hazardous waste treatment, storage and disposal facilities	32	7 (d)	A
15	Bio-medical waste treatment facilities	32A	7 (da)	B
16	Ports, harbours, break waters and dredging	33	7 (e)	A
17	Highways,	34	7 (f)	A
18	Common Effluent Treatment Plants (CETPs)	36	7 (h)	B
19	Common Municipal Solid Waste Management Facility (CMSWMF)	37	7 (i)	B
20	Building and construction projects	38	8 (a)	B
21	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 Sept 30, 2022 and posted on QCI-NABET website.

The Accreditation shall remain in force subject to continued compliance to the terms and conditions mentioned in QCI-NABET's letter of accreditation bearing no QCI/NABET/ENV/ACO/22/2557 dated Oct 18, 2022. The accreditation needs to be renewed before the expiry date by Aditya Environmental Services Pvt. Ltd., Mumbai following due process of assessment.

Sr. Director, NABET
Dated: Oct 18, 2022

Certificate No.
NABET/EIA/2225/RA 0262

Valid up to
May 01, 2025

For the updated List of Accredited EIA Consultant Organizations with approved Sectors please refer to the QCI-NABET website.

ANNEXURES