DRAFT
Rapid Environment Impact Statement & EMP

AND

Risk Assessment & DMP

OF

ADANI GROUP

MUNDRA SEZ LTD.

Special Economic Zone

Taluka Mundra,
Dist. Kutch, Gujarat

Study conducted by –
TELOS Consultancy Services Pvt. Ltd.
Mumbai

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EXECUTIVE SUMMARY

1.0 Introduction to Adani Group

Adani Group is one of the most diversified and fastest growing, Gujarat focused MNC, based in Ahmedabad, Gujarat, with a wide range of endeavours in Ports and Infrastructure (Mundra Port and Special Economic Zone Ltd. - erstwhile Gujarat Adani Port Ltd.), Adani Petronet (Dahej) Port Pvt. Ltd., Special Economic Zones (Mundra Special Economic Zone), Commodity and Power Trading (Adani Enterprises Ltd., earlier known as Adani Exports Ltd.), FMCG (Adani Wilmar Ltd.), Fuel Gas Networks (Adani Energy Ltd.), Logistics (Adani Logistics Ltd.), Agrilogistics (Adani Agrifresh Ltd.), Supermarket retail (Adani Retail Ltd.), BPO (ICall India Ltd.) and so forth.

Adani Enterprises Ltd., the flagship company of the Adani Group has been accorded the status of Five Star Trading House, the highest by the Ministry of Commerce, Govt. of India.

Adani Group's focus in Mundra

Apart from the Mundra Port and the Mundra SEZ, Adani Wilmar, India's largest edible oil refinery is located in Mundra.

Adani Power Pvt. Ltd. - Co-developer of Mundra SEZ

Adani Power Pvt. Ltd. has been incorporated by Adani Group as a co-developer of the Mundra Special Economic Zone, for developing and operating a dedicated power plant for the Special Economic Zones at Mundra, as well as contributing to the state power grids. This shall be a coal based thermal power plant of 2 x 330 MW capacity, to be located at Tunda village.

Inception of Mundra SEZ Ltd.

Mundra Special Economic Zone Ltd. has been incorporated in 2003 under the provisions of The Companies Act, 1956 for the development, operation and maintenance of the Mundra SEZ. This project has also been approved in principle for setting up of Special Economic Zone (SEZ) from Ministry of Commerce (MoC), Government of India (GoI). Copy of the approval letter is vide **Annexure - A**.

Purview

Only the infrastructure in the SEZ shall be provided, operated and maintained by Mundra Port and SEZ Ltd., while the remaining area shall be laid out into plots for various purposes like industrial, commercial, residential, recreational, etc. and sold /leased for development. Hence, for the preparation of this Rapid Environmental Impact Assessment Report, the various impacts (environmental as well as socio-economic) expected from the infrastructure and amenities only under the purview of Mundra Port and SEZ Ltd. have been considered.

If the industries to be set up in the Mundra SEZ generate any kind of environmental pollution in the form of air, water and / or solid, they shall have to appropriately manage and handle the same in compliance with the prevailing environmental norms of the Gujarat State Pollution Control Board and all applicable local authorities. This responsibility shall entirely lie with the corresponding industries.

Location

The site of Mundra SEZ is located in the district of Kuchchh, bordered by the northern coastline of the Gulf of Kutch. Gandhidham railway station is the nearest passenger rail head 50 km away. Mandavi airstrip (about 30 km), Kandla airstrip (about 45 km) and Bhuj Airport (about 70 km) are the airstrips/airports in the vicinity. Mundra was a small town with agriculture and minor commerce dominating its socio-economic character about a decade back. Mundra was devastated like other towns and villages in the earthquake that struck Kuchchh on January 26, 2001. With the reconstructive spirit of the people and economic incentive packages given by the Govt. of Gujarat as well as Govt. of India for the Kachchh distt., Mundra is now witnessing a spate of industrial activity. The industrial and entrepreneurial potential of the town started unfolding with the Adani Group setting up its Port on the Mundra sea front in 1998.

Salient Features of Mundra SEZ

Project Site	**Taluka : Mundra, District : Kutch**
Total Area under the project	Approx. 18000 Ha
Total No. of Villages in the vicinity	14 villages of Mundra taluka
Connectivity	
Nearest town	Mundra
Nearest railway station	Gandhidham approximately 50 km
Nearest sea port	Mundra Port
Nearest air port	DGCA approved airstrip (within Mundra SEZ) Bhuj (42 km) and Kandla Airstrip (45 km)
Access roads	NH-8A Extn. (6.5 km from Mundra) SH-6 (through Mundra)
Socio Economic Settings	
Basic Amenities	
Medical	PHCs and lower facilities, RMP doctors
Educational	Primary schools and few secondary schools
Transport	State Transport Buses and local service providers
Water Supply	Mostly dependent on Bore wells & dug wells
Power Supply	All villages are electrified, no industrial users
Irrigation	Narmada canal is already supplying water in the study area
Features of Impact Zone	* as per data and maps provided by EIC
Present Land Use*	Western, Central & Central-Eastern zones are mainly barren land Eastern zone is mainly dry cultivated agricultural land
Land area	Identified as Mundra SEZ - 18000 ha, Notified SEZ area 8481.2784 ha.
Water bodies*	Ephemeral rivers like Khari, Dhaneshwari and Nagavanti Gulf of Kutch from Arabian Sea forms about 43.88 % of the study area
Forests*	Reserved forests like Danderi, Baroi, Luni, Bhadreshwar, Mundra Dhuo and Mundra mangrove are existing in the proposed site 10 other reserved forests are existing in the study area
Vegetative Classification*	50.77 % non vegetative area, 45.83 % total water bodies, 2.72 % scrubs, 0.41 % degraded vegetation, 0.26 % sparse & dense mangroves-along coastline and 0.01 % marshy vegetation & plantation
Geology*	Western, Central & Central-Eastern zones are mainly Undifferentiated fluvial / Aeolian / Coastal Sediments Eastern zone is mainly Kankawati Formation
Soil Type*	Mainly Coarse Loamy

Crops	Ground Nut, Maize, Millet & Green Gram
Seismic Zone	Zone 5, as per IS : 1893 -2002

Meteorological data

(IMD, Kandla - Climatological Table & Statistical Handbook 2002-Dist. Kutch data)

Ambient air temperature

Climate	Dry, Arid Coastal Climate
Highest daily maximum temperature	46.1 °C
Max. dry & wet bulb temperature	37.7 / 26.8 °C
Min. dry & wet bulb temperature	14.8 / 9.8 °C
Wind Regime	Summer - SW & W, Monsoon - SW, Winters - N, NW

Rainfall

Average annual rainfall	268.5 mm
Period of water scarcity	Dec to May, in summer season the area is drought prone

Wind velocity

Max. wind velocity	32.4 km/hr study period (Dec-05 to Feb 06).
Predominant Wind direction	N, NE and SW (Study Period)

Relative humidity

Annual mean humidity	60%
Max. Humidity	80%
Min. Humidity	22%

Purpose of Rapid Environment Impact Assessment

The Special Economic Zone is specified as: Project / Activity – 7 (C), Category – A, in Notification vide S.O. 1533 dated 14th September, 2006 issued by the Ministry of Environment and Forests therefore is required to obtain prior Environmental Clearance form the Ministry of Environment and Forests, Govt. of India. The present Rapid Environmental Impact Statement has been prepared for the perusal of the MoEF.

This Rapid Environmental Impact Assessment Report has been prepared based on the study of impacts due to all the possible pollution loads from the infrastructure facilities to be provided by Mundra SEZ Ltd. in the SEZ. The report has been prepared based on the guidelines recommended by the Ministry of Environment and Forests (MoEF).

For the preparation of this report, a specific study area was studied for a given study period. This **study area** has been identified as the area falling within a radius of 10 km with the proposed site at the center. The base-line datum was collected over a period of 3 months, starting from April 2006 through June 2006, which is the summer season in the study area. This period is referred to as the **study period**.

Existing Environmental Status of Study Area

Climate and Meteorology

The meteorological data consisting of wind speed, wind direction, temperature, relative humidity and rainfall data were collected, by installing a micro-meteorological station near the proposed site throughout the study period.

Air Environment

Ambient air quality in the study area was studied by setting up monitoring stations based on the following considerations:

- Predominant wind speed and wind direction
- Location of sensitive receptors and industrial establishments
- Availability of infrastructure facilities like electricity, approach, safety of equipment, etc.

Water Environment

Gulf of Kutch covers about 43.88 % of the study area. The surface and ground water in the study area is mostly brackish under the effect of the Gulf. The physico-chemical characteristics of representative ground and surface water samples from different locations in the study area were collected and analysed.

Land Environment

The proposed site of SEZ is mostly barren with sparse vegetation. The proposed SEZ shall convert this into a collage of industrial, commercial, residential and other units interspersed with green patches and green-belt shall be developed so as to cover upto 30 % of the entire proposed land area for SEZ. Thus the landuse pattern of the proposed site shall be improved, creating scope for improved flora-fauna in the region.

The soil samples were collected and analysed for study of its physico-chemical characteristics. The soil is under the influence of the Gulf, making it mostly unsuitable for agricultural purposes.

Noise Environment

Noise levels in the study area have been measured with the help of noise meter, at selected stations, to provide the baseline data. The noise levels were measured at the project site, some human settlements and sensitive areas during the study period.

Expected Environmental Pollution Load from SEZ & Its Mitigation Measures

Air Pollution

There shall be no sources of air pollution from the infrastructure facilities to be provided by Mundra SEZ Ltd., on regular basis.

For emergency purpose, 10 number of DG sets (each of 750 KVA) are proposed to be provided in the SEZ. Hence, very short-term impact on the air environment is expected.

Water Pollution

No industrial / domestic effluent is envisaged from the proposed activities of Mundra SEZ Ltd.

For the treatment of the sewage from the SEZ, Common Sewage Treatment Plants (CSTPs) are proposed. The treated sewage water shall conform to prescribed standards for reuse within SEZ premises.

To meet the waste water disposal standards, Mundra SEZ envisages developing 67 MLD (50 MLD and 17 MLD) Common Effluent Treatment Plant (CETP) facilities. The CETP will be built in modular and expandable manner. The treated effluent shall either be reused within SEZ premises or shall be discharged into the Gulf of Kutch after obtaining the required approvals / permissions from regulating authorities like GPCB, MoEF or any other prevailing authority.

As there is no disposal of waste water / solid waste into surface and / or ground water sources, no water pollution load is envisaged.

Solid Waste Pollution

Solid waste can be classified into two main categories, namely municipal solid waste and Industrial waste. Solid waste shall be sorted out for recycling and non-recycling material.

Solid waste needs to be put through a number of processing operations before it can be handled for formal disposal or re-use. Emphasis of the processes to is to reduce volume, increase homogenization, reduce moisture and convert most of the material to a usable form so that burden on land filling is reduced.

Non-hazardous solid municipal waste (garbage) along with sludge from CSTPs generated from SEZ shall be composted and used as manure within SEZ premises.

The used / spent oil to be generated from the DG sets shall be sent to MoEF approved recycler for suitable treatment. The bio-medical wastes to be generated from the nursing homes, clinics, hospitals, medical college etc. shall be incinerated in the proposed incinerator to be set up in medical college.

As there is no disposal of waste water / solid waste into land, no land pollution load is envisaged.

Noise Pollution

There shall be no sources of noise pollution from the infrastructure facilities to be set up by Mundra SEZ Ltd., on regular basis. Hence, no noise pollution load is envisaged from the facilities of Mundra SEZ Ltd.

Disaster Management Plan

A full-fledged fire station shall be provided with all necessary fire fighting equipments. A proper fire detection and alarm system shall be installed. For fast and effective communication, an advanced communication system shall also be installed. For proper handling and management of any eventuality, an Emergency Control Center shall be established. Emergency power supply shall be provided at all vulnerable points.

Considering all the above aspects of employment, environment and economic concerns, the proposed SEZ project envisaged by Mundra SEZ Ltd. can be justified.

1. PREFACE

Telos Consultancy Services (P) Limited (TELOS) has been appointed by Mundra SEZ Ltd. to carry out Rapid Environment Impact Assessment (REIA) Study for their proposed Special Economic Zone at Mundra.

Telos is managed by professional managers comprising former employees of Tata AIG Risk Management Services Ltd., Nuclear Power Corporation of India Ltd. and Bhabha Atomic Research Centre.

Telos technical team comprises of experienced engineers from various disciplines such as Chemical, Electrical, Environment, Industrial Safety, Mechanical, etc.

Telos has offices at Mumbai, Hyderabad, Jaipur and Mangalore.

Telos sectoral clientele includes Real Estate, Power, Engineering, Petrochemical, Design Consultants, Port, Airports, Cement, Pharmaceutical, Paper, Chemical, Corporate Offices, Hotel, IT Enabled Services, Fertilizer, Rubber Industry, Steel, Textile, Telecommunication, Automobile, etc.

Telos services include Valuation of Assets, Risk Surveys, Safety Audit, HAZOP Study, Risk Analysis, Quantitative Risk Assessment, Fire Detection & Protection System, On-site & Off-site Disaster Management Plan, Occupational Health & Safety Management System, Environmental Impact Assessment, Environmental Due Diligence Audit, Environmental Management System, Waste Minimization & Pollution Prevention, Energy Management, Quality System, Project Management, etc.

1 INTRODUCTION

1.1 BACKGROUND

In April 2000 Government of India announced the policy for setting up of Special Economic Zones (SEZ) in India.

The SEZ policy aims at creating competitive, convenient and integrated Zones offering World Class Infrastructure, Facilities & Utilities and Services for globally oriented businesses. SEZs have been declared as **"Deemed Foreign territories"** to be duty free enclaves with no restrictions on investments and import of goods and services. To attract foreign investors and Corporates, the Government has offered several incentives such as access to the Domestic Tariff Area (DTA), 100 per cent Foreign Direct Investment under the automatic route, greater flexibility with respect to foreign exchange earnings and procedural ease.

Gujarat being the pioneer in SEZ legislation passed the Gujarat Special Economic Zone Act, 2004 making the benefits from the State Government, the law of the land.

The Government of India and the State Government of Gujarat has accorded approval to the Adani Group to Develop, Operate and Maintain a SEZ at Mundra in Gujarat. The Project is referred to as **"Mundra SEZ".**

Mundra SEZ would provide integrated infrastructure encompassing all infrastructure relating to business, living, learning, as well as recreation facilities so as to make the zone self-sufficient. Mundra SEZ will have world-class Industrial, Business, and Social infrastructure like development of Industrial plots, Commercial and Residential buildings, Schools, Colleges, Hospital, Entertainment, Sports and Recreation facilities. The SEZ will have all essential utilities such as power generation, transmission & distribution network, water desalination plant and supply network, sewage, water recycling plant, telecom network and multi-modal connectivity viz. roads, airport, seaport & rail.

1.2 SPECIAL ECONOMIC ZONES

The Kyoto Convention of GATT describes the "free zone" as a part of the territory of a State where any goods introduced are generally recorded, in so far as import duties and

taxes are concerned, as being outside the customs territory and are not subject to the usual customs control". The special Economic Zone is a more evolved and integrated version of the free zones.

The minimum features of free zones are :

- The entry and exit points are supervised
- The zones are treated as a territory beyond the jurisdiction of the customs authorities of the host country
- The economic activities of this territory to the extent it exploits the international markets are exempted from the various duties, tariffs, levies of the federal, state and local governments.

Beginning at Shannon in Ireland in 1956 these zones under varying names have evolved to become the gateway of the global trade in each country.

The various versions of the Free Zones include :

- Export Processing Zones
- Free Trade Zones / Free Port
- Economic & Technology Development Zones
- Activities Specific Export Promotion Zones/ Parks (Garments, Gems, Electronics, Software, Biotech, etc.

The most evolved and robust of these zones in the version commonly referred to as Special Economic Zones (SEZ). Essential difference between other Free Zones and the SEZ is in its integrated nature.

1.3 SEZ POLICY OF THE GOVT. OF INDIA

The Government of India through the SEZ Policy has made available a basket of Incentives, Exemptions, Concessions and Privileges (IECP) to the **SEZ "Developers"** and the **SEZ "Units"**. The benefits available under the SEZ Policy essentially translate into Reduced Cost of Infrastructure, Utilities, Raw Material, Capital, Manpower and Operation Ease. These Baskets of Benefits available to the Developer and the Units are aimed at enabling Global competitiveness.

Requirement of one thousand hectares of contagious land and provision of 25% land for processing area are the broad basis of approval for a multi product SEZ.

1.4 LEGISLATION GOVERNING SEZs

The SEZs in India are governed under the following legislation of the Govt. of India.

- SEZ Act of the Govt. of India, June 2005
- SEZ Rules, February 2006 (under the SEZ Act, June 2005)

Mundra SEZ in addition to the above is also regulated by the Gujarat State SEZ Act, March 2004.

1.5 MUNDRA

Located about 9 km from the Gulf of Kachchh, the ancient Mundra Town is the headquarter of the Mundra Taluka, about 70 km away form the Dist. Headquarter of Bhuj, Dist. Kachchh. Mundra is directly linked to the National Highway NH-8A (ext.), State Highway SH-6 and SH-48. Gandhidham railway station is the nearest passenger rail head 50 km away. Mandavi airstrip (about 30 km), Kandla airstrip (about 45 km) and Bhuj Airport (about 70 km) are the airstrips/airports in the vicinity. Mundra was a small town with agriculture and minor commerce dominating its socio-economic character about a decade back. Mundra was devastated like other towns and villages in the earthquake that struck Kuchchh on January 26, 2001. With the reconstructive spirit of the people and economic incentive packages given by the Govt. of Gujarat as well as Govt. of India for the Kachchh distt., Mundra is now witnessing a spate of industrial activity. The industrial and entrepreneurial potential of the town started unfolding with the Adani Group setting up its Port on the Mundra sea front in 1998.

Today Mundra town is a vibrant, service and transport driven town, expanding and developing in the civic amenities and witnessing cultural expansion.

1.6 ADANI GROUP - THE PROMOTERS OF MUNDRA SEZ

The Prime Promoter of Mundra SEZ, the Adani Group of Companies has the expertise and experience in the key components of the SEZ. Adani Group today is one of the fastest growing Corporate Groups in India, consists of a professionally managed network of companies and assets, across the country and abroad.

With a turn-over in excess of US$ 3 Billion, Adani Group it is one of the highest foreign exchange earners in the private sector today with interests in the following sectors:

1.7 GLOBAL COMMERCE

Adani Enterprises Ltd. is the largest private sector players in global commerce and is rated among top 50 companies of India. The Group's business portfolio includes Commodity Trading, Agro Products, Textiles, Metals, Fertilizer, Energy trading and so on.

1.8 PRIVATE INFRASTRUCTURE DEVELOPMENT

1.8.1 Sea Port

Mundra Port and Special Economic Zone Ltd. (MPSEZL) operates India's largest private sector, mechanized, multipurpose all weather sea -port at Mundra. The Port infrastructure was set up in 1998 and is in an planned expansion mode since 2000 with two multipurpose mechanized jetties, over 2 km continuous quay berths, port backup operations such as open storages and hard stands, covered/closed godowns, chemical and POL storage tank farm, Single Buoy Mooring for crude oil import, and several Container Freight Stations (CFS) operated by private parties on land leased from MPSEZL. The Board of Approvals of Ministry of Commerce and Industry, Govt. of India has accorded MPSEZL the status of an SEZ owing to 2406 Ha Land under its possession, in June 2006.

1.8.2 Adani Petronet (Dahej) Port Pvt. Ltd.

is a SPV venture between Adani Group and Petronet LNG ltd. incorporated for development of a Solid Cargo Port and Terminal at Dahej, Distt. Bharuch, Gujarat for bulk and break bulk solid cargo targeted to catering the central Indian hinterland.

1.8.3 Mundra International Container Terminal

an international container terminal with a capacity of 1.2 million TEUs built by the Adani Group is currently managed by P&O Ports, Australia.

1.8.4 Railway

MPSEZ has also built India's first private rail link (57 km) that connects the Mundra Port to the broad-gauge rail network of India at Adipur, near Gandhidham.

1.8.5 Energy

Gujarat Adani Energy Ltd. is engaged in the project of distributing piped natural gas to industrial and individual users.

1.8.6 Power

Adani Power Private Limited (APPL) – a co-developer of the Mundra SEZ is developing a 2 x 330 MW coal based power plant in the Mundra SEZ as a dedicated power source.

1.8.7 FMCG

Adani Wilmar Ltd.'s first, flagship and India's largest edible oil refinery is located within the Mundra SEZ.

1.8.8 Retail

Adani Retail Ltd. is successfully running a chain of more than 50 Retail Super Markets in Gujarat.

1.8.9 Info-Comm

I-Call India Ltd. is the Business Process Outsourcing venture in the ITES sector.

1.8.10 Logistics and Agri-logistics

The group is developing multi-modal logistics of cargo and food grains by way of developing Inland Container Depots (ICDs) and bulk grain storage and distribution system, as well as Food Perenniation and distribution of high value fruit crops by investing in Controlled Atmosphere Storages.

1.9 MUNDRA SEZ LTD. - THE SEZ COMPANY

Mundra Special Economic Zone Ltd. has been incorporated in 2003 under the provisions of The Companies Act, 1956 for the development, operation and maintenance of the Mundra SEZ.

1.9.1 Regulatory Permission to the Mundra SEZ

The Inter-Ministerial Committee setup by the Department of Commerce, Ministry of Commerce & Industries, Government of India (the Board of Approvals) has issued the Letter of Approval (formal & final approval) on 23rd June, 2006 to the Mundra Special Economic Zone Ltd. for setting up a multi-product SEZ at Mundra over an area of 8481.2784 ha.

1.9.2 Status of Land Holding

Mundra Special Economic Zone Ltd. holds title to and is in possession of 8481.2784 ha. allotted Government Land, contagious and free form all encumbrances for first phase development as approved by the BoA, MoCI. Mundra SEZ has identified an area of approximately 18000 Ha in the vicinity which will be converted / acquired in a phased manner for future expansion of the SEZ. The master plan prepared by Mundra SEZ Ltd. corresponds to this **identified stretch of land** as overall master planning can not be done in a phased or incremental manner.

As a larger SEZ at Mundra would better serve the needs of industry and commerce, and as Mundra Port and rail/road connectivity have much greater potential to serve than what is minimum required by the BoA for approval/notification (1000 Ha) of an SEZ, the Mundra SEZ has been conceived on approximately 18000 Ha of land. More land than what is approved for the Mundra SEZ and MPSEZ is under acquisition or transfer from other companies of the Adani Group with land holdings at Mundra. With gradual development of the SEZ/(s) at Mundra, the Developer might acquire contiguous land from local land-owners.

1.9.3 Studies Available

Studies for land survey, assessment of geo-physical character of the land, detailed project report, master planning, studies for water availability, desalination and recycling, etc. have been conducted by Mundra SEZ. This EI statement is based on the Mundra.

The Master plan of Mundra SEZ is prepared by renowned planning firm**"M/S/ Sharat Das and Associates Private Limited".** The development plan of first

phase of the aforementioned project is prepared by world class consultancy firm **"M/S. CPG Consultants".** The urban planning and design of the residential area is done by **"M/S. P.K.Das and Associates."**

The total area bounded by the N.H.8A and the Coast, as well as river Khari in the west and river Mithi in the East is approximately 468 Square Km., out of which the area of proposed Mundra SEZ is 18,000 Ha approximately. Out of 18,000 Ha square km Govt. of India has notified 6472.8684 Ha land under Multi-Product SEZ (MPSEZ Part - I – Notified Area 4846.6007 Ha, MPSEZ Part - II – Notified Area 1074.1755 Ha further with a merging of already notified sector specific SEZ of Adani Power Limited – Notified Area 293.8810 Ha, subsequently additional area of 258.2112ha was notified).

Further an application to BoA has already been made for notifying 2008.41 ha (1840ha and 168.41ha).

The SEZ development for the first phase would come over a total area of 8481.2784ha of land.

With the above reason, to study the impact of activities of the 18000 Ha scenario for the MSEZ of current configuration carries merit even though Port activities are not part of it now.

1.9.4 Scope of Mundra SEZ

Only the infrastructure in the SEZ shall be provided, operated and maintained by Mundra Port and SEZ Ltd., while the remaining area shall be laid out into plots for various purposes like industrial, commercial, residential, recreational, etc. and sold /leased for development. Hence, for the preparation of this Rapid Environmental Impact Assessment Report, the various impacts (environmental as well as socio-economic) expected from the infrastructure and amenities only under the purview of Mundra Port and SEZ Ltd. have been considered.

If the industries to be set up in the Mundra SEZ generate any kind of environmental pollution in the form of air, water and / or solid, they shall have to appropriately manage and handle the same in compliance with the prevailing environmental norms of the Gujarat State Pollution Control Board and all applicable local authorities. This responsibility shall entirely lie with the corresponding industries.

1.9.5 MUNDRA SEZ Implementation Plan

Mundra SEZ enjoys several unique advantages over the other existing and planned SEZs in the country. Mundra SEZ is visualized to transform an arid, brown-field site into a vibrant, thriving, modern, eco-friendly, state-of-the-art, self sufficient city with world class standards of infrastructure for the best in industrial, modern business and living environment. Mundra SEZ would soon become a self-contained human habitat with social, cultural and recreational activities alongwith being an industrial hub having trading centres.

The Mundra SEZ is expected to achieve its full physical development over a time frame of approximately 25 years, during which the realities of today may undergo unforeseen planning changes. Therefore, flexibility in the entire planning and development management process is incorporated, so that the development can respond to changing scenario without sacrificing the basic concept of structure, the environmental paradigms, or socio-economic concerns.

The underlying philosophy of Mundra SEZ is to be able to attract investment, particularly relating to industrial development, from both domestic as well as international entrepreneurs, by offering not only financial tax incentive, which are inherent in the Government of India policies for SEZs, but also the physical infrastructure facilities of international standards.

1.9.6 Project Completion Schedule

The estimated period over which the entire Mundra SEZ shall be developed is 25 years. The proposed development of Mundra SEZ is in succession to the recently cleared Waterfront Development Plan, Mundra Project which was apprised by the Expert Committee by the MoEF covering the following;

- The four cluster of Ports viz. (West Port, South Port, North Port and East Port).
- Two identical Shipyards on the west and the east.
- Supporting Infrastructure including road, rail utility corridors to all Ports.
- A Desalination Plant with a capacity of 300 MLD for Bulk users.
- Sea-water Intake for Power Plants, Heavy Engineering and Shipyards.

- Common Disposal site is proposed for disposing the rejects from Power plants, Desalination plants and for other treated effluents.
- LNG storage & regasification facilities at South Port with send out facilities.
- Other utilities and amenities along with fire fighting facilities and safety.
- Dredging and Reclamation
- Maintenance Dredging and Disposal facilities

Table 1-1 Proposed MPSEZ development in coming 25 Years

Sr. No.	Supporting Infrastructure facilities	Brief Description
1	Social Infrastructure	• Housing projected for approx. 50,000 dwellings spread over an area of 255 ha. will come up in sectors that will cater to human habitation projected due to the proposed SEZ development. • Associated amenities to match the facilities meeting the best standards in terms of urban planning design. • The social infrastructure will have a well planned Transportation Network having 50m Arterial Road, 30m Sub Arterial Road and 15m Collector Streets adding total upto 43.91 ha of land area. • The social infrastructure will piped natural gas line network with a daily demand of ~ 25000 CuM/day. • Power demand of 5 MWH would be met from the Adani Power Limited. • Water demand of 9 MLD will be met by existing Narmada water supply initially which would later have water supply from the proposed 150 MLD desalination plant in a modular & expandable manner. • The sewerage generated would be drained through common drainage network line leading to a proposed STP of 6 MLD for further treatment. • Solid wastes approx. 15MT/day will be disposed as per the MSW guidelines 2000 at an identified site of 6.25 ha. • Other facilities like IT and Telecommunication network will follow to meet the demands.
2	Common Effluent Treatment Plants	• CETPs are proposed in a phase wise manner to treat the effluent that would be generated from the proposed multi-product SEZ. Presently the predicted number of CETPs. • The CETPs with a total capacities that are envisaged are as under; 1. 50 MLD

Sr. No.	Supporting Infrastructure facilities	Brief Description
		2. 17 MLD • The effluents required to be treated would be brought through a dedicated pipeline network at the CETPs which eventually after treatment would be discharged at a identified location into deep sea. • The sludge formed after the treatment would be dried and sent to TSDF site.
3	Sewage Treatment Plants	• A sewage treatment plant is proposed in a phase wise manner to treat the effluent generated from the proposed social infrastructure facilities. For supporting the entire population of the MSEZ we require to build STPs of total capacity 62 MLD. • All the suspended solids would be filtered and sent to MSW site.
4	Desalination Plant	• Fresh water would be met using the SWRO technique for which intake of sea water would be approx. 150 MLD. • Additional fresh water demand will be met by set of proposed desalination plants to meet the demands of the processing, non processing zones as well as the social infrastructure facilities. • A desalination plant proposed on the eastern end of the SEZ; 1. 150 MLD • The immediate fresh water requirement in the coming 5 years would be ~50 MLD.
5	Drainage network	• A drainage network would be proposed to discharge the treated effluents and RO reject from the CETPs and Desalination plants. • A dedicated drainage network at the social infrastructure facilities leading to STP for further treatment. • The treated effluents and rejects from the plants would be further discharged to the sea at a suitable location.
6	Rain/Storm water harvesting plan	• Rain water harvesting techniques would be adopted for water conservation. • Storm water would be canalized in a systematic manner to avoid any clogging during natural disasters.

Sr. No.	Supporting Infrastructure facilities	Brief Description
7	Airport connectivity & the Airport	• In order to facilitate handling of air cargo, a full fledged airport hub is proposed to enhance SEZs trade & commerce. • The proposed airport is spread with an area of 1200 ha.
8	Freight management, Logistics & supporting infrastructure.	• With the influx of hub airport more efficient freight management and logistics would be developed. • A dedicated freight corridor will be built to facilitate the incoming and outgoing cargo through air route. • Cargo handling at the site based on 25 year plan.
9	Waste management & Disposal	• The SEZ and its supported infrastructure would generate solid wastes approx. 28 t/day that would be disposed to a landfill site as per the MSW guidelines. • The solid waste generated by industrial units would be identified as hazardous and non-hazardous wastes which would be disposed to landfill sites.
10	Power supply network	• The power demand for the proposed SEZ would be met by Adani Power Limited. Adani power will generate 660 MW. • Electrical transmission and distribution would be through an underground cable network spread across the entire SEZ area there by meeting the demands on need basis. • The expected power demand in the final phase is predicted as 1592 MW, both for industrial and domestic usage.
11	IT-Telecommunication network	• In order to have efficient communication spread throughout the proposed SEZ IT along with telecommunication network will be spread to various zones on need basis.
12	Natural Gas line network	• Natural Gas used for housing and industrial use would be piped over the entire SEZ to meet the social & industrial demands. • The final demand of natural gas for the processing and non processing zones would be ~25000 Cu.m/day.

In essence to the above following Mundra SEZ development activities have been envisaged in next 5 year.

- Road Network
- Rail Network
- IT-Telecommunication network
- Electrical Network
- Water supply, conservation & drainage Network
- River Training
- Desalination Plant with proposed intake & outfall locations
- Common Effluent Treatment Plant & Sewage Treatment Plant
- Natural Gas line network
- Social Infrastructure
- Existing Aerodrome
- Waste Management & Disposal site

Industries & Commercial activities coming inside the SEZ will seek EC and other permissions/clearances separately, as applicable.

Following table summarizes the proposed MPSEZ development.

Table 1.2 Proposed MPSEZ development in coming 5 Years

Sr. No.	Supporting Infrastructure facilities	Brief Description
1	Social Infrastructure	• Housing projected for approx. 10,000 dwellings spread over an area of 255 ha will come up in sectors that will cater to human habitation projected due to the proposed SEZ development. • Associated amenities to match the facilities meeting the best standards in terms of urban planning design. • The social infrastructure will have a well planned Transportation Network having 50m Arterial Road, 30m Sub Arterial Road and 15m Collector Streets adding total upto 43.91 ha of land area. • The social infrastructure will piped natural gas line network with a daily demand of ~ 5000CuM/day. • Power demand of 5 MWH would be met from the Adani Power Limited. • Water demand of 9 MLD will be met by existing Narmada water supply initially which

Sr. No.	Supporting Infrastructure facilities	Brief Description
		would later have water supply from the proposed 150 MLD desalination plant as per demand. • The sewerage generated would be drained through common drainage network line leading to a proposed STP of 6 MLD for further treatment. • Solid wastes approx. 28MT/day will be disposed as per the MSW guidelines 2000 at an identified site of the 62.5 ha. • Other facilities like IT and Telecommunication network will follow to meet the demands.
2	Common Effluent Treatment Plants for Industrial wastes	• CETPs are proposed in a phase wise manner to treat the effluent that would be generated from the proposed multi-product SEZ. • The CETPs with a total capacities that are envisaged are as under; 1. 50 MLD 2. 17 MLD • These CETPs are phased out would initially be constructed based on the actual effluent discharges from the industries. • The effluents required to be treated would be brought through a dedicated pipeline network at the CETPs which eventually after treatment would be discharged at an identified location into sea. • The sludge formed after the treatment would be dried and sent to TSDF site.
3	Sewage Treatment Plants	• A sewage treatment plant is proposed in a phase wise manner to treat the effluent generated from the proposed social infrastructure facilities. For supporting the entire population of the MSEZ we require to build STPs of total capacity 62 MLD. In the first phase a STP with an initial size of 6 MLD will take care of the sewerage and the recycled water would be helpful for horticulture purpose. • All the suspended solids would be filtered and sent to MSW site.
4	Desalination Plant	• Fresh water would be met using the SWRO technique for which intake of sea water would be approx. 150 MLD.

Sr. No.	Supporting Infrastructure facilities	Brief Description
		• Additional fresh water demand will be met by set of proposed desalination plants to meet the demands of the processing, non processing zones as well as the social infrastructure facilities. • A desalination plants proposed on the eastern end of the SEZ of 150 MLD which would come up in modular & expandable manner. • These plants capacities are based on the fresh water requirement as a part of master planning exercise that would come up in a phase wise manner to meet fresh water demands. • The immediate fresh water requirement in the coming 5 years would be ~50 MLD. • Intake & outfall will be done as per the NIO recommendations.
5	Drainage network	• A drainage network would be proposed to discharge the treated effluents and RO reject from the CETPs and Desalination plants. • A dedicated drainage network at the social infrastructure facilities leading to STP for further treatment. • The treated effluents and rejects from the plants would be discharged to the sea at a suitable location as suggested by National Institute of Oceanography.
6	Rain/Storm water harvesting plan	• Rain water harvesting techniques would be adopted for water conservation. • Storm water would be canalized in a systematic manner to avoid any clogging during natural disasters.
7	Airport connectivity	• With the SEZ development, requirement of better road connectivity to the existing airport.
8	Freight management, Logistics & supporting infrastructure.	• With the influx of SEZ development more efficient freight management and logistics would be developed. • A dedicated freight corridor will be built to facilitate the incoming and outgoing cargo through air route.
9	Waste management & Disposal	• The SEZ and its supported infrastructure would generate solid wastes approx. 28 t/day

Sr. No.	Supporting Infrastructure facilities	Brief Description
		that would be disposed to a landfill site as per the MSW guidelines. • The solid waste generated by industrial units would be identified as hazardous and non-hazardous wastes which would be disposed to approved TSDF landfill & Disposal sites.
10	Power supply network	• The power demand for the proposed SEZ would be met by Adani Power Limited. Adani power will generate 660 MW. • Electrical transmission and distribution would be through an overhead & underground cable network spread across the entire SEZ area there by meeting the demands on need basis. • The expected power demand in the first phase is predicted as 525 MW, both for industrial and domestic usage.
11	IT-Telecommunication network	• In order to have efficient communication spread throughout the proposed SEZ IT along with telecommunication network will be spread to various zones on need basis.
12	Natural Gas line network	• Natural Gas used for housing and industrial use would be piped over the entire SEZ to meet the social & industrial demands. • The initial demand of natural gas for the processing and non processing zones would be ~5000 Cu.m/day.

1.10 SCOPE OF RAPID ENVIRONMENTAL IMPACT ASSESSMENT STUDY

The Special Economic Zone is specified as:

- Project / Activity – 7 (C)
- Category – A

- in Notification vide S.O. 1533 dated 14th September, 2006 issued by the Ministry of Environment and Forests therefore is required to obtain prior Environmental Clearance form the Ministry of Environment and Forests, Govt. of India. The present Rapid Environmental Impact Statement has been prepared for the perusal of the MoEF.

1.10.1 Study Area and Study Period

The Rapid Environmental Impact Assessment (REIA) for the proposed Mundra SEZ has been carried out for the identified stretch of land as per Master Plan Figure 1-1. Owing to geographical spread of the development, the identified boundary of the a Mundra SEZ has been considered as a core **study area** and impacts to the adjacent habitations receptors within 10 km band from the identified Mundra SEZ boundary are termed as buffer study area.

The base-line for environmental parameters and site specific meterology has been collected for a three months **study period** between April and June, 2006, corresponding to the pre-monsoon season as in the EIA Guidelines issued by the MoEF. Receptor based monitoring has been conducted in the nearby habitations for Air and Noise with prescribed frequencies throughout the study period owing to the wide geographical spread of the study area. Surface water and Soil sampling has been done towards the end of the study period to reflect the most scare phase of the pre-monsoon season.

Micro-meteorological data like temperature, relative humidity, wind speed, wind direction and rainfall have been collected throughout the study period on hourly basis on the Adani Wilmar Ltd. plant gate which is approximately in the centre of the study area.

Information on ecological components and socio-economics have been compiled from various sources and publications including Environment Information Centre (EIC), an MoEF initiative.

On studying the details of the proposed project, all possible significant, non-significant, positive, negative, short term and long term impacts have been identified, predicted and assessed. Finally an Environmental Management Plan (EMP) has been prepared recommending measures to be implemented for mitigation of adverse impacts, as described in chapter five.

1.11 METHODOLOGY FOR REIA STUDY

The methodology adopted for carrying out this study is based on the guidelines recommended by Ministry of Environment and Forests (MoEF). The total REIA study can be divided into the following three phases :

(i) Identification of significant environmental parameters and preparing baseline data of the existing status within the study area with respect to air, noise, water, land and socio-economic environment.

(ii) Prediction of impacts due to the proposed Mundra SEZ on the identified environmental parameters.

(iii) On evaluation of total impacts by super-imposing the predicted impacts over the baseline data, Environmental Management Plan (EMP) has been prepared, which would help in incorporating proper mitigation measures wherever necessary for preventing deterioration in environmental quality.

1.12 SALIENT FEATURES OF THE PROJECT - MUNDRA SEZ

Project Site	**Taluka : Mundra,** **District : Kutch**
Total Area under the project	Approx. 18000 Ha
Total No. of Villages in the vicinity	14 villages of Mundra taluka
Connectivity	
Nearest town	Mundra
Nearest railway station	Gandhidham approximately 50 km
Nearest sea port	Mundra Port
Nearest air port	DGCA approved airstrip (within Mundra SEZ) Bhuj (42 km) and Kandla Airstrip (45 km)
Access roads	NH-8A Extn. (6.5 km from Mundra) SH-6 (through Mundra)
Socio Economic Settings	
Basic Amenities	
Medical	PHCs and lower facilities, RMP doctors
Educational	Primary schools and few secondary schools
Transport	State Transport Buses and local service providers
Water Supply	Mostly dependent on Bore wells & dug wells
Power Supply	All villages are electrified, no industrial users
Irrigation	Narmada canal is already supplying water in the study area
Features of Impact Zone	* as per data and maps provided by EIC

Present Land Use*	Western, Central & Central-Eastern zones are mainly barren land Eastern zone is mainly dry cultivated agricultural land
Land area	Identified as Mundra SEZ - 18000 ha, Notified SEZ area 8481.2784 ha.
Water bodies*	Ephemeral rivers like Khari, Dhaneshwari and Nagavanti Gulf of Kutch from Arabian Sea forms about 43.88 % of the study area
Forests*	Reserved forests like Danderi, Baroi, Luni, Bhadreshwar, Mundra Dhuo and Mundra mangrove are existing in the proposed site 10 other reserved forests are existing in the study area
Vegetative Classification*	50.77 % non vegetative area, 45.83 % total water bodies, 2.72 % scrubs, 0.41 % degraded vegetation, 0.26 % sparse & dense mangroves-along coastline and 0.01 % marshy vegetation & plantation
Geology*	Western, Central & Central-Eastern zones are mainly Undifferentiated fluvial / Aeolian / Coastal Sediments Eastern zone is mainly Kankawati Formation
Soil Type*	Mainly Coarse Loamy
Crops	Ground Nut, Maize, Millet & Green Gram
Seismic Zone	Zone 5, as per IS : 1893 -2002

Meteorological data

(IMD, Kandla - Climatological Table & Statistical Handbook 2002-Dist. Kutch data)

Ambient air temperature

Climate	Dry, Arid Coastal Climate
Highest daily maximum temperature	46.1 °C
Max. dry & wet bulb temperature	37.7 / 26.8 °C
Min. dry & wet bulb temperature	14.8 / 9.8 °C
Wind Regime	Summer - SW & W, Monsoon - SW, Winters - N, NW

Rainfall

Average annual rainfall	268.5 mm
Period of water scarcity	Dec to May, in summer season the area is drought prone

Wind velocity

Max. wind velocity	32.4 km/hr study period (Dec-05 to Feb 06).
Predominant Wind direction	N, NE and SW (Study Period)

Relative humidity

Annual mean humidity	60%
Max. Humidity	80%
Min. Humidity	22%

1.12.1 Site Approach

The site of Mundra SEZ is located in the district of Kuchchh, bordered by the northern coastline of the Gulf of Kutch. Ancient Mundra Town is adjacent to the port. The proposed site is directly linked to the National Highway NH-8A (extension), State Highway SH-6 and SH-48. Airport at Kandla, servicing only chartered flights at present, is 18.6 km from the proposed site boundary. Bhuj airport is located at a distance of 41.3 km. The newly constructed airport at Mandvi is 40 km from the Mundra Port. Mundra Port has an airstrip for its private use located in the Central-Eastern zone of Mundra SEZ.

1.12.2 Siting Criteria

The core points of the proposed Mundra SEZ are the existing and fully operational Mundra Port and Mundra Container Terminal.

Mundra Port is an all-weather port with deep draught, comprising an operational multi-purpose terminal, with mechanized handling and storage facilities for various cargo types.

Mundra Container Terminal is a state-of-the-art container terminal operated and managed by internationally renowned terminal operator P&O. The terminal is capable of berthing up to fifth generation 8000 TEU container vessels.

The Special Economic Zone at Mundra will further intensify the development of this otherwise marginal-economy stretch of the Kachchh region. The infrastructure and living standard of the residents of the Mundra SEZ will be at par with international SEZs. The development of this magnitude and character can be made possible only by a developer with commensurate project implementation experience and financial resources.

KEY INFRASTRUCTURE MAP

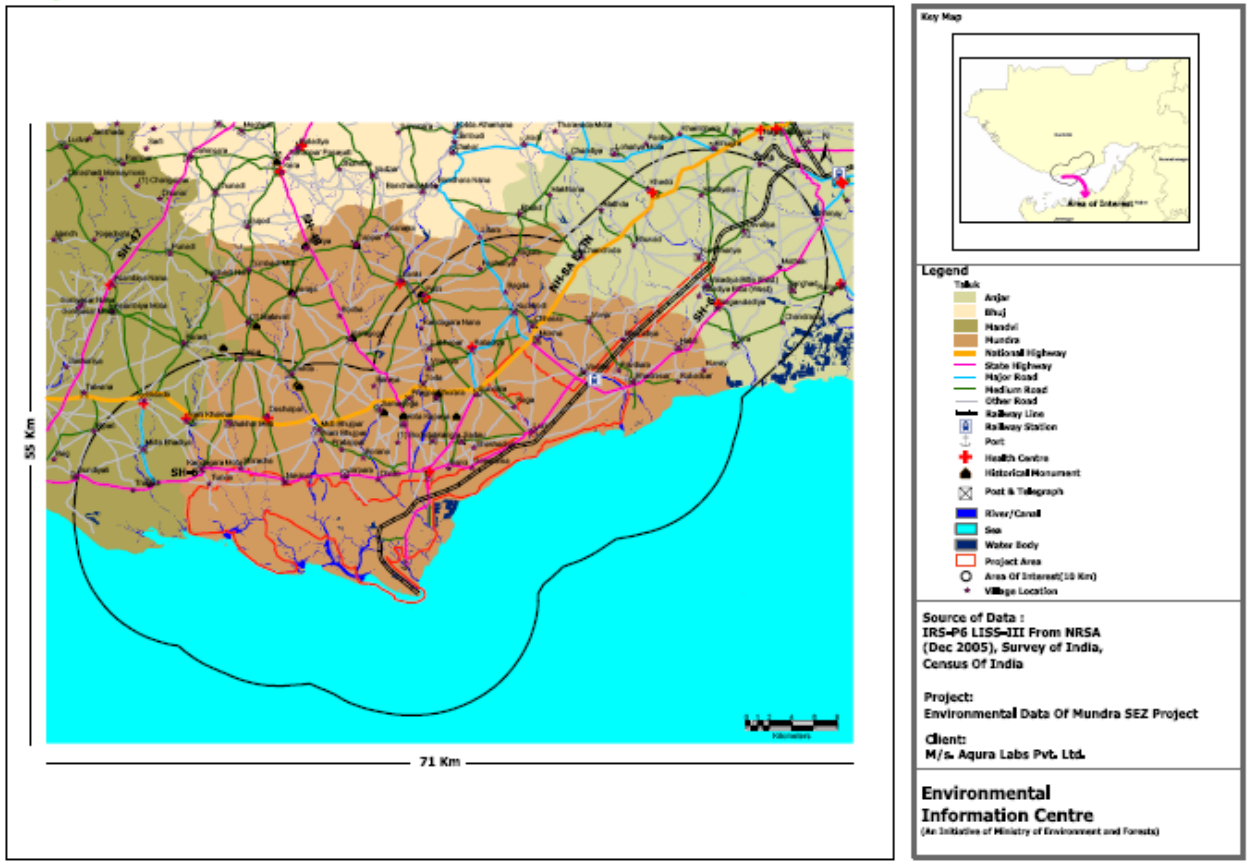

Figure 1-1 : Key Infrastructure Map

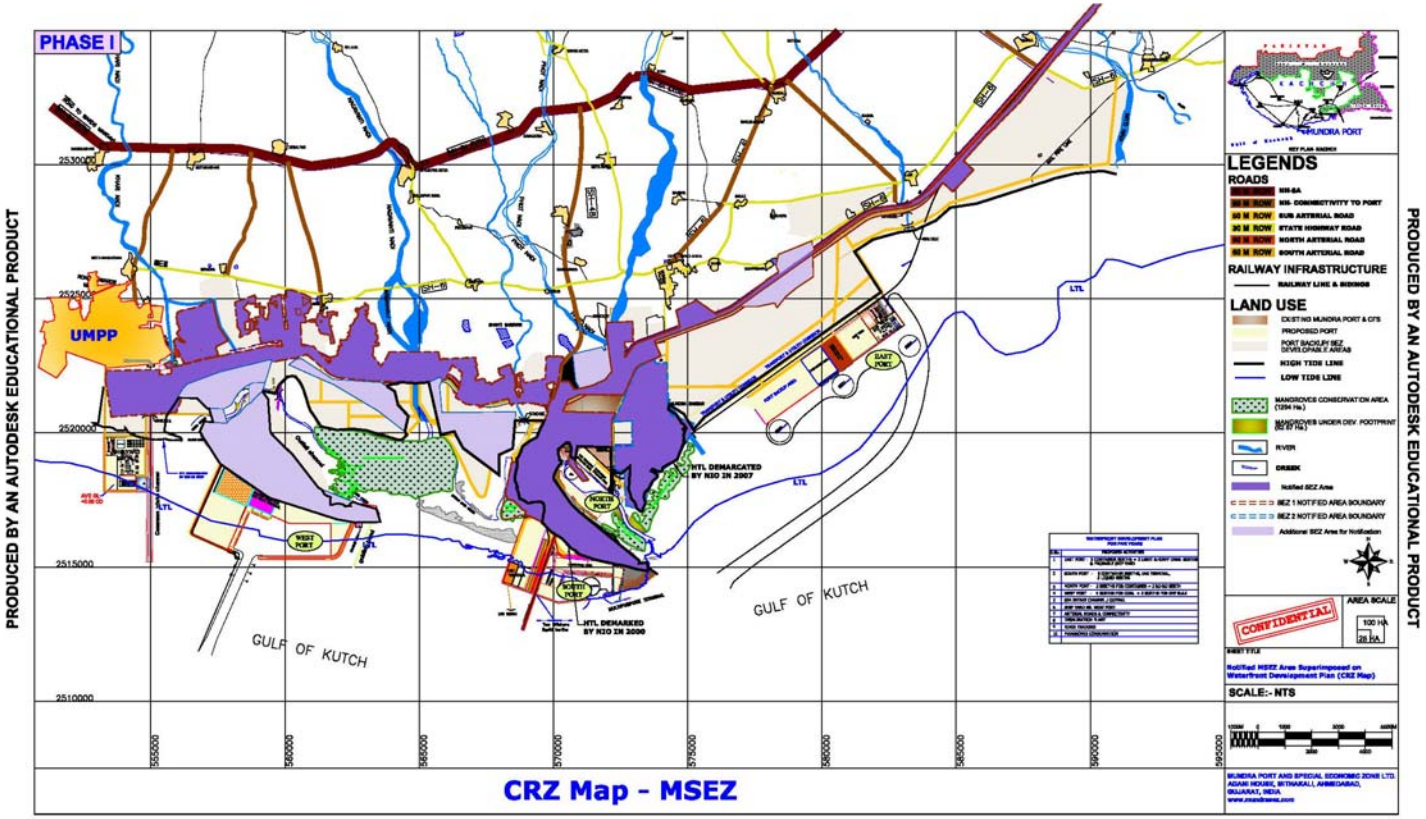

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Figure 1-2 : Future Development Area & Notified Area with proposed Utilties

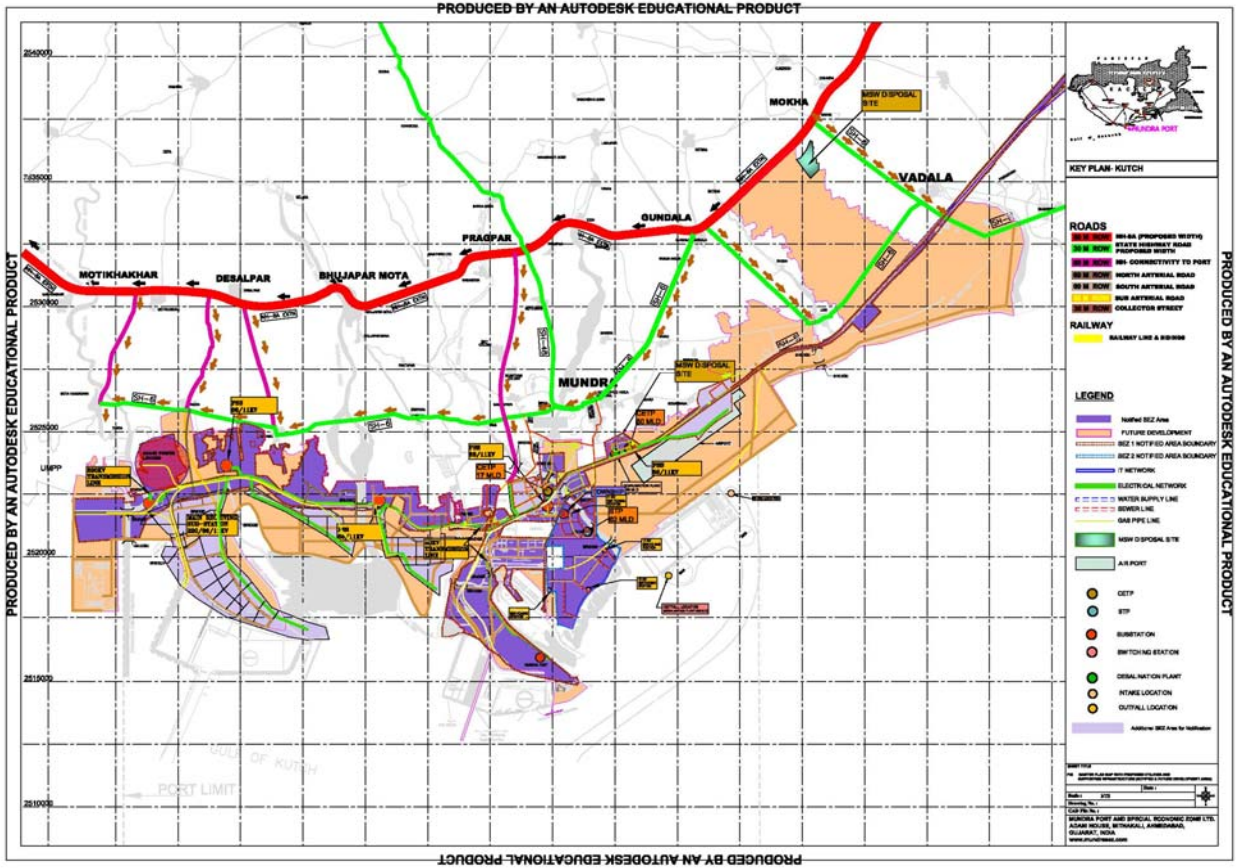
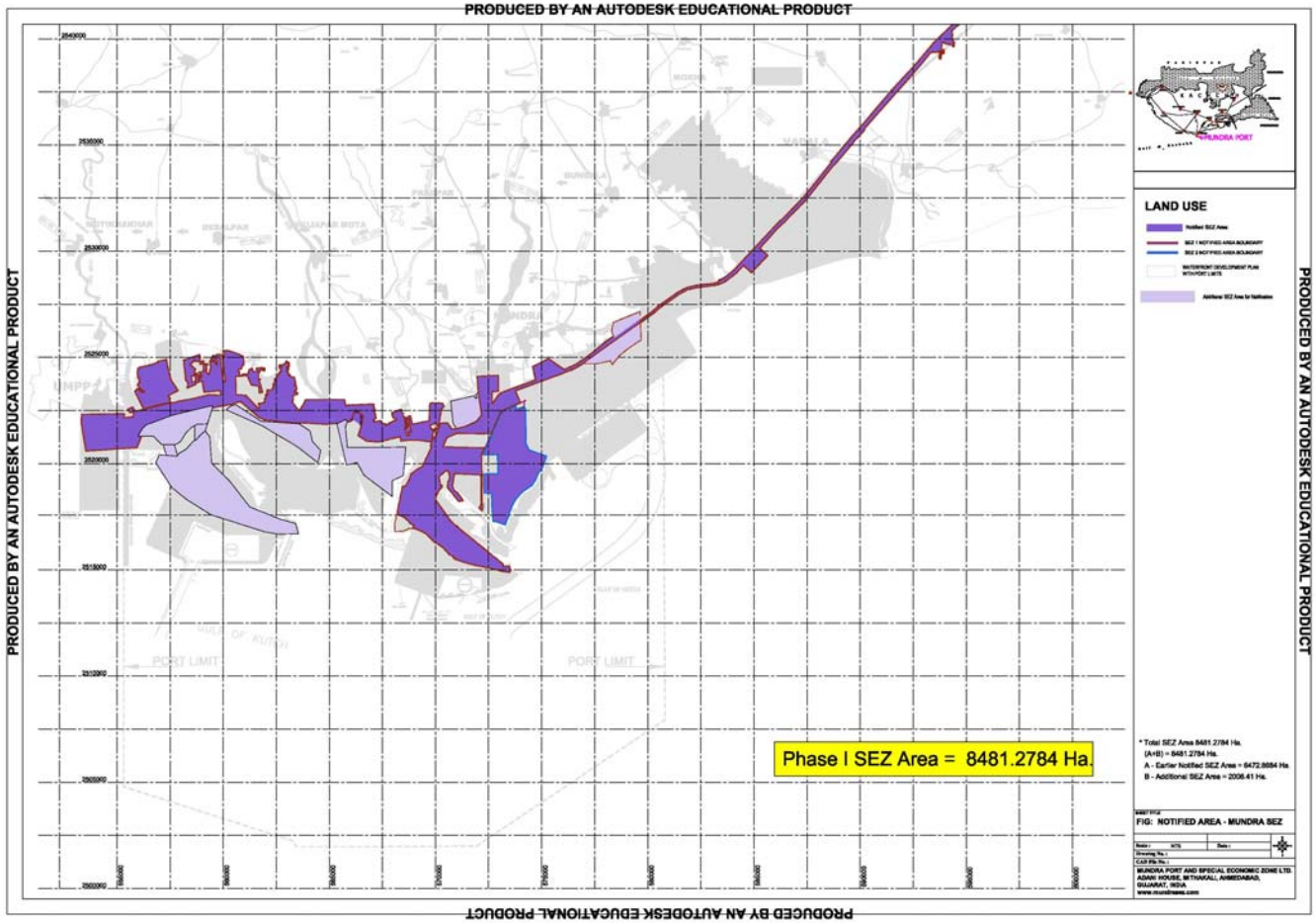


Fig. 1.3 Notifed SEZ Area for Phase I development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PRODUCED BY AN AUTODESK EDUCATIONAL PRODUCT
PRODUCED BY AN AUTODESK EDUCATIONAL PRODUCT
PRODUCED BY AN AUTODESK EDUCATIONAL PRODUCT
LAND USE
Phase I SEZ Area = 8481.2784 Ha.
FIG: NOTIFIED AREA - MUNDRA SEZ
MUNDRA PORT AND SPECIAL ECONOMIC ZONE LTD.
ADANI HOUSE, MITHAKALI, AHMEDABAD,
GUJARAT, INDIA

Owing to land holdings and possession of land of contagious nature, Mundra SEZ is uniquely capable of preparing a regional level master plan for the Mundra SEZ. This will facilitate holistic and long-term planning and phased execution of the master plan.

The land identified for the Mundra SEZ is non-agricultural, saline and in-fertile land. This can be better utilized for processing, residential and warehousing uses in the Mundra SEZ. **There are no issues of Resettlement and Rehabilitation on the identified stretch of land.**

The climatic conditions of Mundra will ensure pleasant and non-extreme weather condition throughout the year. Due to meagre rainfall, minimum interruption in traffic, production or living is expected in comparison to any place on the main land. The region has had no events of social unrest in the past. The SEZ development being on the landward side does not envisage any land reclamation.

1.12.3 Major Components of Mundra SEZ

The major components involved for Mundra SEZ are pointed out below, however these Components are described in depth in Chapter -2.

- Various processing zones
- Social infrastructure
- Roads (trunk as well as internal)
- Storm water drainage
- Cumulative desalination faciltity of 150 MLD
- Water supply network
- Power supply network
- Effluent collection network
- Distributed Common Effluent Treatment Plant 67 MLD
- Recycled water supply network
- Municipal solid waste management facility 28 tonnes/day
- Natural gas supply network
- Telecommunication network

2 PROJECT DESCRIPTION

2.1 VISION

Mundra SEZ has been conceived as a model industrial development of international standards, with emphasis on port oriented activities as the hub. This zone will be enjoying free trade status, having the following features:

- Modern port with potential for progressive quantitative and qualitative up-gradation dictated by market demand and technology advancement.
- Comprehensive and integrated infrastructure within the SEZ comparable to the best practices of planning and provision of infrastructure in similar situations.
- Infrastructure sensitive to local conditions as well as conducive to conduct international business.
- Ideal living and working conditions for its working and complementary population. Endeavouring to preserve and enhance the natural ecosystem of the area.

Mundra SEZ shall offer to its users the best infrastructure available in the surroundings that shall be sensitive to local conditions as well as conducive to conduct international business. At the same time, it shall strive to preserve the natural ecosystem of the area and offer ideal living and working conditions for its inhabitants. Mundra town in the vicinity, a vibrant human habitat of the past, would act as a catalyst between the old and the new, integrating the age-old values, cultures and traditions of India into a contemporary living and working society. Keeping this vision in mind, the Mundra SEZ is conceived as a rich mix of state-of-the-art services and amenities and green environs. Blending the two shall require careful balancing of this age-old feud. However, it is in this very mix that the foundations of all new system of thought lie.

2.2 PROJECT DETAILS

The proposed Mundra SEZ shall be divided into discernible land-pockets considering the existing linkages and proposed transport structure. The land-pockets shall be delineated by the boundaries created by topography, drainage, watercourses, forestlands, movement patterns and other distinctive natural or man-made features. The highlight of

the project is that major part of the identified land is under the possession of the developers and has been notified by Govt. of India under the SEZ Regulations.

The broad structure of the proposed development takes cue from linear east-west alignment of the National Highway 8A (extension), the State Highway, the Railway corridor and the mud flats, all positioned parallel to each other.

- Land available for development could be conceived as four interlinked areas, the Central, Western, Central-Eastern and the Eastern area, each being a self contained entity in terms of its economic activity and support functions.
- The Central area shall command the area to the east and west of the line joining Mundra Town to the Port. Landscape development in this 'show-case' zone would be primarily in the form of green corridors along major movement arteries, rotary junctions, grade separators and the protected areas of the Navinal creek and the Bocha Island. The proposed CBD would also contribute largely to the image of the SEZ through its high standard of open spaces, parking lots, public squares, avenues and commercial streets.
- This area would boast of containing the heritage core of Mundra Town as well as the Port. Commensurate with the character of the same, the CBD, a multi-modal transport hub and trading & processing zones would be set up within the area. Other proposed functions within the zone would be port-based activities, educational infrastructure and a Knowledge Park.
- The Central-Eastern area, a narrow neck joining the eastern to the central area, would accommodate the existing DGCA approved air strip and profile development, which together with the multi-modal transport hub, would provide enviable accessibility to the SEZ.
- The Eastern area shall comprise of large tracts of consolidated land to the north of linear forest lands and mud flats, which would serve as the predominant features of the open space structure herein. Recreational and open space needs would also be fulfilled by the vast shores that surround the area to its south. Large consolidated processing areas would be supported by residential, commercial and social infrastructure within the zone.
- This area shall also contain the scenic sandy beach to the south of village Kukersar that could serve as a major landscape asset.

The Mundra SEZ has been so conceived that it shall encompass certain existing and fully operational elements and infrastructure, apart from providing space and more infrastructure facilities to both existing and proposed elements. Moreover, land area identified for the various projects and different industries have been distributed percentage wise.

2.2.1 Existing Elements

Major existing elements in the Mundra SEZ are the fully operational Mundra Port, Edible Oil Refinery of Adani Group (Adani Wilmar Ltd., owners of "Fortune" brand), Jindal Groups (steel pipe manufacturing plant) and IFFCO (fertilizer bagging plant). Other activities like salt manufacturing, packaging materials re-processing (wooden crates), transport, etc. are pursued in un-organized sector. Basic infrastructure like water, electricity, roadways, railways, port, airstrip etc. alongwith social infrastructure like residential colonies, shopping places, banks, post offices, educational facilities, medical facilities etc. are already available.

MUNDRA PORT

Adani Group has already established a Port - Mundra Port of the Mundra Port and Special Economic Zone (earlier known as Gujarat Adani Port Ltd. (GAPL)), for which site with 4000 ~ 5000 m of water front with 8.5 m draft near the shoreline was identified. GAPL has 5000 ha of port and back up land available for its associated operations (including 2000 ha area of Bharat Salt Works - a salt manufacturing company).

The mechanized material handling systems of fairly large size are already operational, viz. :

- **Inward -** 400 TPH for wheat and de-oiled cake, plus 600 TPH pay loader, Mobile Harbour Cranes 2 x 1500 TPH, Bulk Materials, Container Boxes, Palets, Steel Products, Heavy Lifts, Timber Logs, Scraps, Machinery Components as well as Unitized Goods viz. bags, boxes and barrels, Two mobile rail mounted hoppers, 1500 TPH, enclosed system capable of handling cargo like coal, fertilizers, FRM, etc.

- **Outward -** 1000 TPH of wheat and de-oiled cake, 3700 m length connecting godowns to jetty, Ship Loader - for de-oiled cake, Wheat, Salt, Bentonite (1000 to 2500 THP).
- **Dry Bulk Cargo** Coal & Coke Yards 520,000 m^2, additional 26,000 m^2 near rail head.
- **Dedicated Rail Sidings** in the Cargo Complex to handle coal loading in the rail wagons with handling equipment like dumpers, pay loaders, stackers, 73,000 m^2 of closed godowns, 2500 TPD mobile bagging unit for bulk cargo, and five 40 T, one 60 TPH computerized weigh bridges, 12000 TPD wheat cleaning and 500 TPD rice sorting & bagging facility synchronized with conveyors
- **Liquid Cargo** handling system (271,000 KL) presently supports following activities -
    1. **Single Point Mooring (SPM) & Pipeline** 9 MTPA, feeding to Bhatinda Refinery, through pipeline of 48" dia having 7.5 km on-shore and 9.0 km off-shore length, the SPM has enabled oil import in VLCC vessels requiring 15 to 32 m draft
    2. **Chemicals Tank Farm** (100,000 KL) assorted, POL (150,000 KL) Naphtha, Furnace Oil, LSHS, Kerosene, Diesel, etc. (white POL product tanks with floating roof, Black POL products with fixed roof)
    3. **Edible Oil** import system supports Adani Groups unit known as Adani Willmar Ltd. (45,000 KL),
    4. **Bitumin Terminal** (6000 KL) - only one on western coast
    5. **MICT (container terminal)** 632 m quay length, 17.5 m draft, Ultimate 1200 m quay and 18.5 m draft (accommodate 8000 TEUs Post-Panamax or Fifth generation vessel)
    6. **Container Freight Stations (CFS) -** several CFSs' presently operating in Port Back Area are as follows -
        a) P&O at Navinal Island 50 acre
        b) Mundra CFS has 15 Acre
        c) Central Wearhousing has 50 Acre,
        d) CONCOR is developing a large CFS & a LCL hub
- **Power supply** a 66 KVA GSS for port operations has been created which is fed by a 220 KVA line at Moti Khakhhra. Water supply for the port is obtained from

Narmda canal piped water supply for Kutch by creating a tapping from pipe at Zarpara village.

TRANSPORT INFRASTRUCTURE

4 lane Approach Road - Mundra Port to Mundra Village 14 km, (Mundra provides inland transport savings of 300 km from Mumbai / JnPT and 100 km from Pipavav) was constructed by GAPL

State Highway - Anjar - Mundra SH is widened by Gujarat Govt. from 3.6 to 5.6 m by providing 1 m shoulder on either sides of the road

National Highway - Existing NH 8A (extension) from Ahmedabad to Kandla is extended via Mundra to Mandvi

Railway Line - 57 km, Mundra Port to Adipur (8 km from Gandhidham) is constructed by Adani Group, which is first private service railway line in the country

Air Port - Domestic and Defence Air Port at 60 km Bhuj and a Landing Strip Kandla at 50 km is available presently DGCA approved airstrip is already operating located in the Central-Eastern zone of the proposed SEZ, which is presently used by Mundra port. On obtaining approval form DGCA for commercial operation, this airstrip can be upgraded and used for commercial use by Mundra SEZ occupants / users.

SOCIAL INFRASTRUCTURE

Housing Colony (300 families of Adani Staff) , Markets, Cinema, Hospital, Children Park, Community Center, DAV School, Port colony, Water supply (RO plant for water treatment), Power supply through GVVNL

2.2.2 Proposed Elements

In order to meet with the projected demand in view of the proposed elements of Mundra SEZ, the existing elements may require expansion as under:

Table 2-1 : Proposed Elements of Mundra SEZ

S.No.	Elements	Capacity Required
1	Port	Cluster of Ports under approved WFDP.
2	Power Plant	A total of ~15000 MW coal based thermal power plants. The Adani's have proposed a ~5000MW of thermal power plant which is being set up at Tunda village by Adani Power Ltd., which shall be sufficient to cater for the entire calculated power required for Mundra SEZ

3	Water Supply (Desalination Plant, CETP)	Approximately 150 MLD, depending on industries within Mundra SEZ. Approx. 67 MLD of CETP facilities so as to cater to effluents that are generated by the SEZ industries.
	Transport Infrastructure	
4	Roads Network	Certain existing roadways may require upgradation and certain new road links might be required
5	Railway Lines (will save 110 km Mundra Port - New Delhi distance inland transport)	Gauge conversion of Palanpur-Bhildi-Gandhidham section. Alternative route development - Delhi-Jaipur-Viramgam will de-congest the present Mumbai-Delhi corridor. A double lane is also proposed so as to manage logistics more efficiently.

6	Air Port	The existing DGCA approved air strip being handled by Mundra Port shall require approval for commercial operation to facilitate commercial use by Mundra SEZ occupants / users In order to facilitate handling of air cargo, a full fledged hub airport is proposed to enhance SEZs trade & commerce. The proposed airport is spread with an area of 430sq km.
7	Social Infrastructure	Housing projected for approx. 40,000 people spread over an area of 255 ha will come up in sectors that will cater to human habitation projected due to the proposed SEZ development. Projected MSW disposal capacity of 28t/day along municipal infrastructure like water supply and sewerage (STP), solid waste collection, treatment and disposal, power supply, domestic transport infrastructure (roads, rail & air), market places, communication network (phone and data), and amenities like medical & educational facilities.

INDUSTRIAL

As per the study in Detailed Project Report (DPR), the following industrial sectors are dominant in Gujarat.

The demand assessment for the proposed SEZ was based on the historical trends exhibited by the export focused **units** (viz. SEZ and EOU units). However, the historical trends of the units established were based on the export performance of the SEZ/ EOU units. Eventually, market shares were allotted for Mundra SEZ supported by the findings of the previous modules of analysis.

Thus primary variable selected was units established *(based on export performance)*. A separate assessment was undertaken for Gujarat and Rest of India by allocating differing market shares in different growth phases.

In order to make the analysis robust from statistical forecasting errors, viz. to safeguard the model from any statistical forecasts that might be divergent from the market facts, various checks and balances were factored in at every stage. Additionally, the entire analysis was sanitized through fundamental findings of Industry Review and SEZ attractiveness.

Based on the above analysis the Mundra SEZ is expected to attract Industries in various sectors is given below:-

Table 2-2 : Details on landuse in development plan/master plan-Mundra SEZ

LANDUSE	AREA IN HA	AREA IN HA	% AREA
INDUSTRIES			
HEAVY ENGINEERING	424.06		5
STEEL AND CEMENT PLANT	593.69		7
MINERALS AND METALS	593.69		7
TEXTILE & APPAREL PARK	84.81		1
CHEMICAL PARK	84.81		1
PHARMA PARK	84.81		1
PLASTICS PARK	84.81		1
PETROCHEMICAL HUB	508.88		6
AUTO/AUTO ACESSORIES	169.63		2
LIGHT ENG.	169.63		2
POWER PLANT	763.32		9
CFS	84.81		1
FTWZ / LOGISTICS	424.06		5
TOTAL		**4071.01**	**48**
MUNDRA PORT		339.25	**4**
PORT BACKUP INDUSTRIES		508.88	**6**
PORT EXPANSION		169.63	**2**
RESIDENTIAL AREA		424.06	**5**
TRANSPORTATION CORRIDOR		**1696.26**	**20**
INSTITUTIONAL		**84.81**	**1**
OPEN SPACE		**1102.57**	**13**
GREEN BELT DEVELOPMENT	430.00		
OPEN SPACE	336.28		
WATER BODY	336.28		
UTILITY		**84.81**	**1**
TOTAL		**8481.2784**	**100.00**

These manufacturing, warehousing and service industries shall be so set up that they can either operate as stand-alone units or may be integrated into multi-functional industrial parks within the SEZ.

Other than industrial sector, other components shall also be included in the Mundra SEZ. The allocated land area for each component as per the master plan is as under:

Figure 2-1 : Percentage of Proposed Industris as per Table no. 2-3, Mundra SEZ

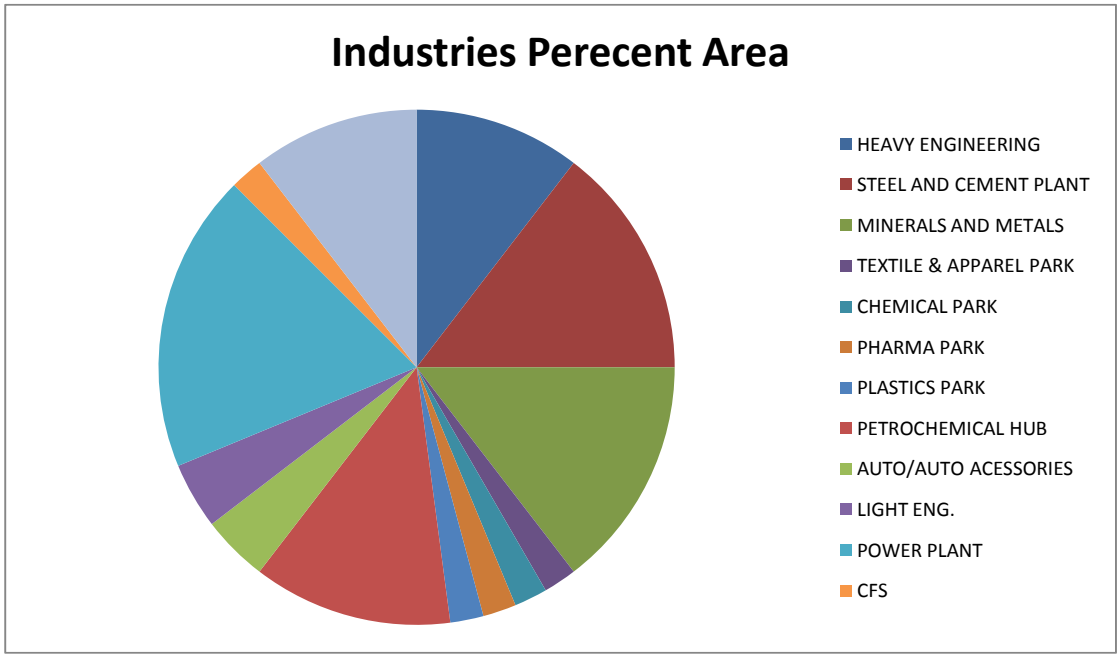


Table 2-3: Type & Nature of Industries likely -MundraSEZ

LANDUSE	AREA IN HA	(%)PERCENT AREA
HEAVY ENGINEERING	424.06	5
STEEL AND CEMENT PLANT	593.69	7
MINERALS AND METALS	593.69	7
TEXTILE & APPAREL PARK	84.81	1
CHEMICAL PARK	84.81	1
PHARMA PARK	84.81	1
PLASTICS PARK	84.81	1
PETROCHEMICAL HUB	508.88	6
AUTO/AUTO ACESSORIES	169.63	2
LIGHT ENG.	169.63	2
POWER PLANT	763.32	9
CFS	84.81	1
FTWZ / LOGISTICS	424.06	5
TOTAL	**4071.01**	**48**

RESIDENTIAL

The population density and the work force for Mundra SEZ have been computed on the following basis

- Planning standards adopted by the Bureau of Public Enterprises for development of Industrial townships and similar other areas.
- Workers population has been taken on the basis of the study conducted by the Price Water House Coopers (PWC) for similar developments.
- UDPFI (Urban Development Plan Formulation and Implementation) guidelines for arriving at the workforce, tertiary force, and the Participation Rate (PR) to work out quantum of land for different land-uses

Table 2-3 : Population projection for First Phase

Total Industrial Area (Ha)	2500
Number of Industrial Worker @ 20-25 workers / Ha. Number of Tertiary Workers @ 1.6 workers/industrial worker **Total Workers**	50,000 80,000 **1,30,000** **(Say 1,00,000)**
Number of Single Workers @ 20 % of total workforce Married Workers	20,000 80,000
Population generated based on 40 % Participation Rate Single Workers **Total Population**	2,00,000 20,000 **2,20,000**
Population for which Residential Accommodation is to be provided within the SEZ Population to be accommodated in settlements around the SEZ	 **10,000** **2,10,000**

Table 2-4 : Population projection for Final Development

Total Industrial Area (Ha)	6068
Number of Industrial Worker @ 20-25 workers / Ha. Number of Tertiary Workers @ 1.6 workers/industrial worker **Total Workers**	1,21,360 1,94,176 3,15,536 (Say 3,00,000)
Number of Single Workers @ 20 % of total workforce Married Workers	60,000 2,40,000
Population generated based on 40 % Participation Rate Single Workers **Total Population**	6,00,000 60,000 **6,60,000**
Population for which Residential Accommodation is to be provided within the SEZ Population to be accommodated in settlements around the SEZ	**4,00,000** **2,60,000**

- **Residential Land Requirements:**

  First Phase:

  Housing projected for approx. 10,000 dwellings spread over an area of 255 Ha will come up in sectors that will cater to human habitation projected due to the proposed SEZ development.

  Final Phase:

  The proposed Gross Residential Density is 200 persons per hectare. While making the detailed plans, gross density will have a variation factor of +/- 15%. Accordingly, the residential land requirement has been worked out to house about 4, 00,000 population consisting of single workers (about 80,000), population of married workers (about 2, 50,000) and floating population (70, 00). Land required for this population varies between 2285 ha to 2628 ha, whereas the land provided is 2,035 hectares.

SOCIAL INFRASTRUCTURE

Social Infrastructure enhances the quality of life in the settlements. It is provided to serve the population at different level, viz. at the City Level, Zonal level and the

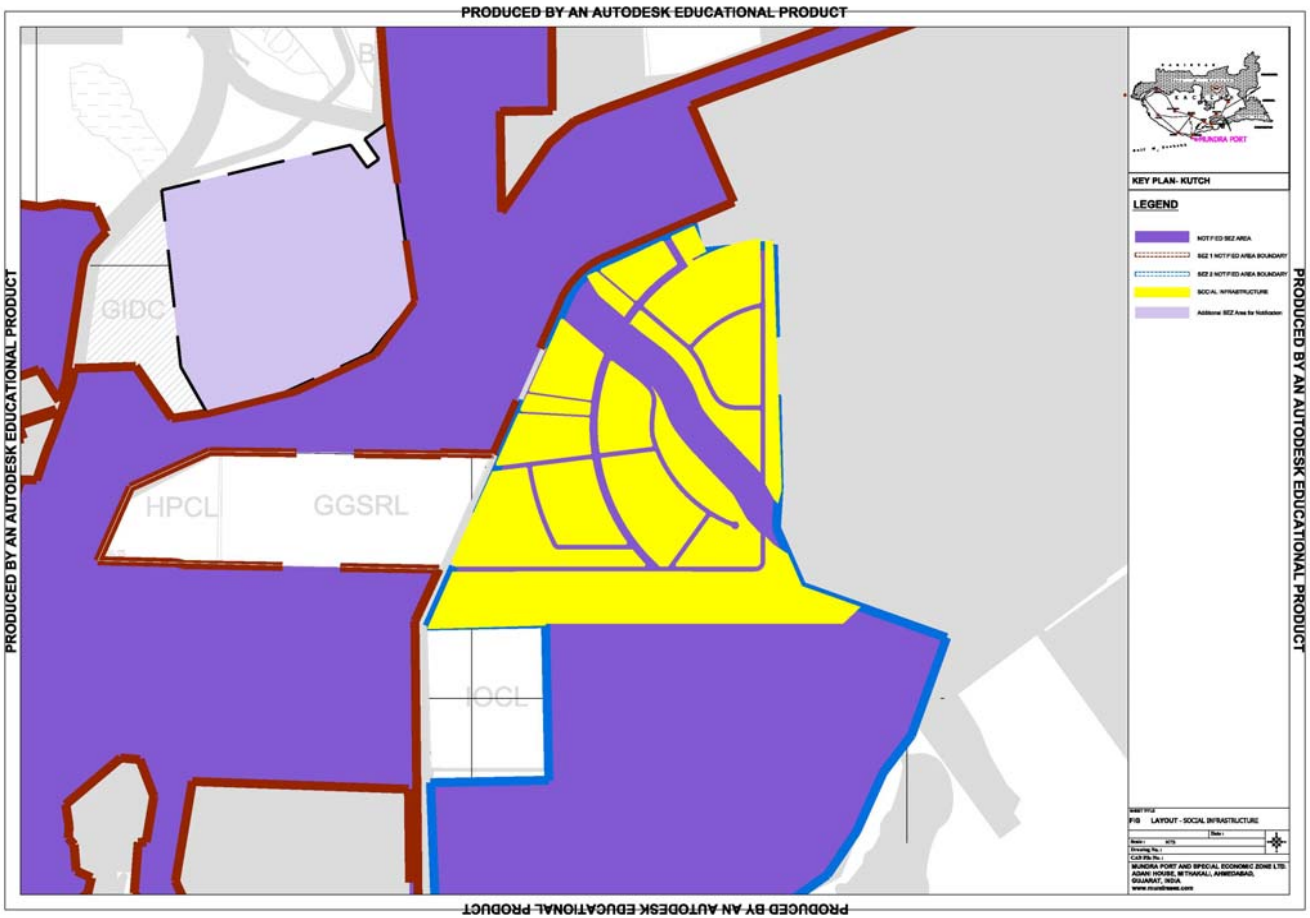
Layout Plan Level. It is evident that the available land cannot accommodate the estimated demand. Various options were formulated to house the maximum population. While carrying out this exercise, due consideration was given to the implications on the quality of built environment, this being the first and foremost important goal for the master planning exercise. In the present case, Social Infrastructure is to be provided to serve a population of 4,00,000.

Following strategies were formulated to optimize the available land without compromising on the quality of built environment.

- Prioritize and safeguard sufficient land for transportation corridors, commercial & social amenities.
- Reserve minimum 10% of land towards parks, open spaces, promenades and green connectors.
- Rationally distribute the balance land for residential use among different densities based on site potentials, urban design intent, vistas and waterfront views.
- Maximize the land usage for high-density housing so as to house more families.
- Intensify the land use around major transport nodes, commercial and institutional uses
- Integrate complementary land uses so as to save on land for common facilities (Ex: community center and school together to share playfield)

SEZ development calls for high density high-rise urban development in residential areas. Although industrial developments are low rise and medium density, the residential zones and commercial centers provide key locations for high-rise, high density developments. Since Mundra is a cyclone prone area there is height restriction of 15m as per GoG guidelines. So low rise high density development is the most feasible option. Land usage is optimized by well organized built forms contrasted by parks, plazas, leisure and recreational zones.

Fig 2.1a Social Infrastructure



Planning Norms for Social infrastructure

Within this planned township there will be a wide range of residential densities proposed. Higher density housing is located at the transportation nodes and further away inland from the water bodies. Along the waterfront, lower density housing is located. With this sort of height profile, all the residential blocks will enjoy the waterfront view. The planning rationale for this is to allow for the enjoyment of good scenic vistas for the greatest number of people. In addition, there is a need to increase the density around the transportation modes to maximize the usage and accessibility for the greatest number of people. The worker dormitory housing is the highest density development type proposed within Mundra SEZ. This being the case, the parcel that has been earmarked for the worker dormitory housing development is closer to the public road outside Mundra SEZ's processing area. This is to reduce the commuting time between the dormitory housing to the work place for its workers.

Residential Distribution

Mundra SEZ will generate about 4, 00,000 numbers of workers. In terms of total population, it is about 6, 60,000. It is estimated that out of 6, 60,000 supported population, about 4, 00,000 (corresponding to about 60% of the population) population can be housed within the Mundra SEZ. Rest of the population will commute daily from neighbourhoods in the vicinity of Mundra SEZ. In order to accommodate this huge population residential development needs to taken up in the surrounding villages with proper town planning schemes.

Commercial Development

The aim of the proposed commercial areas within the development is to provide shopping and marketing convenience for residents living in and around the general vicinity of Mundra SEZ. In line with this objective, pockets of commercial use are proposed along major road network and intersections accessible from the DTA. Within the non-processing area, the commercial areas take the form of town centre, neighborhood centers and the wholesale centre. There is also a beach resort cum club facility being planned at the southern strip of seafront land near North Port

within the non processing area. This unique land parcel with its sea frontage is to capitalize on the future development of a beach resort, water sports and golf course.

Institution Development

The primary objective of providing sufficient and high quality social institutions within Mundra SEZ is to be able to give a better quality and modern life style to the residents here. Necessary land have been set aside for institutional uses such as schools (primary and secondary), community centers, polyclinic, and library, religious institution, swimming complex, sports complex and an indoor stadium.

Facilities at Regional Level

The regional based facilities that will be provided in the Mundra SEZ are the regional college and the regional hospital. Both of these facilities are located adjacent to GMB Road.. As such, these facilities will not only serve people working within the Mundra SEZ but also beyond the Mundra SEZ boundaries. The ITI located near the Mundra SEZ will not only complement the industrial activities within the Mundra SEZ but also be able to tap on or supply the intellectual resources within the Industrial Park itself.

Facilities at Town/Neighborhood Level

The principle of provision depends on two approaches: the quantitative approach vis-à-vis the provision standard and the qualitative approach vis-à-vis the catchments area to be served. The former will ensure that enough of the facilities are provided for the given population. The latter ensure that the facilities are evenly spread out geographically throughout the population served. Primary schools are to be provided within the residential neighborhood settings. Their locations are to be determined by service catchments radius and preferably sited adjacent to open space or main circulation routes. These primary schools are planned so that they are within walking distance from the residential developments. Reason being, primary school going children are young, so proximity of these schools to home is the primary concern in the locations of these primary schools. Also, located within town and neighborhood centers there will be the other social institutional such as the polyclinic, the library and a community centre. In addition, the swimming complex, sports complex and the indoor stadium will be added as the active elements for the benefit of the community here.

TRANSPORTATION

The proposed Mundra SEZ aims at formulating an efficient transportation system providing quick access, safe, energy efficient and economical transportation of goods and passengers, pollution and congestion free travel.

Keeping this in view, the following key objectives are sought to be achieved:

- Serving the needs of settlements, nodal developments and industrial concentrations, providing high level of access to Port and processing zone in SEZ and areas with potential for growth in the influence area of SEZ.
- Giving high priority and complete emphasis on transport orientation without restraint or restriction and facilitating optimal functioning of the system.
- Developing high / medium capacity bus transport and structuring development keeping in view public as well as personalized modes of transport, minimizing restrictions or restraints and ensuring free flow of vehicles.
- Rational placement of workers' high-density residential neighborhoods to minimize travel. In the short range (say 10 years), areas will be zoned for this purpose in the vicinity of work places and industrial areas on modular basis to contain work trip journeys.
- To promote incremental network development to conserve resources and ensuring reservation of land for corridors and terminal facilities.
- Improving connectivity to settlements in the influence area of the SEZ extending up to NH-8A through spines, north-south mixed -use streets and high streets.
- Developing multi-modal freight and passenger transport infrastructure.
- Configuring network on hierarchy basis for signal free movement linked with port and processing zones. This will involve developing arterial roads at a high level of service with grade-separators and multi-modal passenger terminal in the central area and property development around terminals, station and nodes.
- Developing east-west and north-south predominantly freight – oriented corridors of transport infrastructure as key links in the emerging national transport network

and also to provide relief to the existing highway network in the periphery of the SEZ.

- Developing self-contained direction-oriented freight villages/ transport nagars.

The proposed SEZ is envisaged to be developed as a vibrant city with focus on port, industrial and trading activities, with support physical and socio-economic infrastructure. The poly- nuclear development of the city along with the ring of nodal developments makes it a very transport intensive city. As such, a multimodal transport system is an integral part of this scale of development. This system shall comprise of a mix of road and rail transport – rail based system, high and medium capacity bus-ways and dedicated truck / freight corridors.

Integration among the various modes has been addressed in the Master Plan by proposed interchanges at the intersections between rail corridor and major arterial roads. Spatially, Mundra is a linear conglomerate of nodal and contiguous developments with road networks ensuring looping around developments.

Details on Traffic Studies:

As per initial estimate approximately 3 lac workers per day will be employed in the SEZ area when it will be fully operational. It is assumed that 1.2 lac family workers and 0.60 lac single will reside in residential area. The remaining will be commuting from settlements in the vicinity of SEZ. It is assumed that about 5500 pcu traffic will be generated on main corridor of the SEZ.

The cargo generated at the Port/SEZ is projected considering 2008-09 as base year.The existing model split between road and rail is adopted for projection. Two projections 5yrs (2013-14) and 25 yrs(2034-35) are considered.The cargo splited into mode of transportation is further converted into number of road commercial vehicle and rail-rakes.The Passenger Car Unit [PCU] are converted from commercial vehicles. The base year detail of traffic and projected detail are shown below.

Table 2-7 : Cargo Traffic Projection

SOURCE	NUMBER OF VEHICLES PER DAY								
	2008 – 09			2014 - 15			2034 – 35		
	CV/D	R/D	Total Cargo in tons	CV/D	R/D	Total Cargo in tons	CV/D	R/D	Total Cargo in tons
PORT	2746	31	134190	6793	95	386895	18250	285	1128750
SEZ	0	0	0	3393	17	101895	10333	52	310995
TOTAL (CV/D)	2746	31	134190	10186	112	488790	28583	337	1439745
PCU	10984			40744			114332		

Road Network

The state and national highway system in the north provides access to the port and proposed SEZ. The road network within the SEZ has been designed for predominantly freight traffic, in order to provide high level access to the port, processing zone, non-processing zone, commercial and warehousing areas and potential growth areas in the influence area of the SEZ.

In keeping with the form of the proposed development, a road network with high level of service has been designed in the east-west and north-south directions. Connectivity to settlements in the influence area of the SEZ, extending up to NH-8A has been provided through spines, north south mixed use streets and high streets.

For signal-free and uninterrupted flow of freight and passenger traffic, the network has been configured with arterial roads with grade-separated interchanges. ROBs and grade separated interchanges have been proposed at railway line crossings. Land reservation in form of squares has been done along intersections for minimizing signal phases and future development of grade-separators. This has been linked with property development for optimum land utilization. The transportation network in Mundra SEZ is shown in Figure 2-2 and Figure 2-3.

The Road Connectivity:

NATIONAL AND STATE HIGHWAYS

There are existing National Highway NH-8A, State highway SH-6 and SH- 48. Expansion (four laning / six laning exclusive mundra to NH-8 corridor for port traffic) details

PORT CONNECTIVITY

The Master Plan provides for arterial roads for access to the port and SEZ from NH-8AE and freight movement within the SEZ, with RoWs 60m. Arterial roads linking with NH-8AE are access controlled and grade separated interchanges are proposed at the intersections.

ARTERIAL ROADS

The Master Plan provides for arterial roads parallel the railway line of RoW 60m on the North and South of the railway. It connects the major ports and forms the backbone for Mundra SEZ traffic movement.

SUB ARTERIAL ROADS

The sub arterial roads with RoWs 50m provides access to the different land parcels originating from the arterial roads.

COLLECTOR STREETS

The collector streets with RoWs 30m provides access to the different plots originating from the arterial roads.

The proposed road network to be executed in phases accordingly with the build up traffic movement by the stakeholders.

Railways

Following the form and scale of the proposed development, north-south rail corridors are envisaged comprising of two rail links, to provide a high level of access to port and processing zone in the SEZ. Apart from the existing link between Adipur Station and Mundra Port, an additional link is proposed, extending to the western extremity of the SEZ. Reservation of 30m RoW along the entire corridor has been provided to

enable development of multiple tracks for future expansion. Further it is also proposed to double the lane so as to manage the rail logistics more efficiently.

Air Strip

An airstrip has been developed in predominant transportation hub between the central and eastern part of the proposed development to link the SEZ through air transport. The development of the airstrip is to be as per standards and norms laid down by the Airports Authority of India and other bodies governing air transport in India. It is also proposed to develop this in to an International Airport.

Special Transport Components

Squares at Intersections

Mundra SEZ Master Plan provides for special transport components at the intersections of arterial – arterial and arterial – sub arterial roads, in the form of squares. These squares fulfill the multiple functions of reserving land for up gradation of these intersections to grade-separated full clover-leaf intersections in the long run and in the short run, provide for two-phase signalized intersections and commercial development.

Contained Communities - Special Transportation Centers

The Master Plan for Mundra SEZ provides also for pockets of land exclusively for transportation usage, comprised of components such as truck terminals, bus terminals, warehousing, railways, etc. These special centers are located along the primary freight corridor and are to be designed as contained entities.

Truck Terminals / Transport Nagars

Self-contained direction oriented truck terminals / freight villages are to be designed along predominant corridors of freight movement for facilitating inter-modal transfers of goods, idle truck parking facilities, servicing and repairs, etc. These truck terminals are to be equipped with following facilities:

- Adequate facilities for office/storage activities for trucks operators operating at terminal
    - Godowns / warehousing Space

- Office space
- Loading / unloading facilities
- Weighing of goods vehicles

- Adequate facilities for wholesale trade activities that include,
  - Auction areas
  - Wholesale shops & subsidiary storage facilities
  - Packaging facilities
  - Wholesale Godowns, cold storage etc. together with handling facilities & equipment.
- Adequate facilities for trucks expected to utilize terminal,
  - Parking spaces
  - Services / repair facilities
  - Rest / recreation for drivers; and weighing of trucks

In addition, the freight village must provide for a number of associated facilities and services.

- Provision for goods movement within the freight complex in terms of truck movement, loading/unloading and stacking of goods
- Buildings and amenities for administration and security measures necessary for the complex,
  - Facilities for banking, postal etc. required for business transaction
  - Amenities for wholesalers, truckers and their employees
  - Areas for shops, eating houses and other services and establishments
  - Provision of lighting, water supply and garbage / sewerage disposal.

In addition to the above-mentioned usages, state-of-the-art warehousing facilities and modern logistics hubs are to be developed in these transportation centers.

Bus terminals and Bus-ways

The modal split for person movement has been estimated at 60% for road based public transport. To cater to this volume of passenger traffic, high and medium capacity bus-ways are to be developed within the RoWs of arterial and sub-arterial roads for passenger movement. At the local level, IPT services such as electricity or

gas-powered minibuses and vans are to provide connections to these bus-ways. This system is to be so designed such that it is accessible to commuters within 5 minutes walking distance and is attractive to both the worker class as well as the executive class.

Bus terminal facilities in the special transport centers are to be developed in a progressive manner, based on market demand.

Pedestrian sub-systems and cycle tracks

In keeping with the objective of development of contained communities and minimizing workers' workplace and residence travel, pedestrian subsystems and cycle routes assume great importance. As such, facilities such as pedestrian zebra crossings at intersections, grade separated facilities across heavy vehicular traffic routes, well designed user friendly pathways, segregated cycle tracks, etc. are to be provided.

- The cycle tracks are to be segregated from the motorized vehicular routes and are to be provided along the green spines. These are to be integrated with the public transport systems and at the interchange points, cycle users are to be facilitated with safe park and ride systems.

Parking policy

Within the SEZ, adequate parking spaces are to be provided, based on traffic impact studies. All traffic intensive developments such as commercial and office complexes, transportation centers, high density residential complexes, etc. are to have adequate parking provisions and Traffic Impact Assessment is to be mandatory for approval. Adequate public parking areas are to be provided to avoid unwanted situations such as congestion on major transportation corridors and parking encroachments on residential streets. On-street parking is to be restricted to the industrial sectors, where roads have been designed to accommodate such parking in the short term.

In the residential areas, no on-street parking is to be allowed. Centralized parking areas with park-and-ride schemes are to be developed near major trip attraction points such as commercial and business centers. At the neighborhood / sector

level, adequate space for taxi / auto / rickshaw / IPT modes are to be reserved within the local / community level commercial areas.

Figure 2-2 : Rail Corridor Cross-section

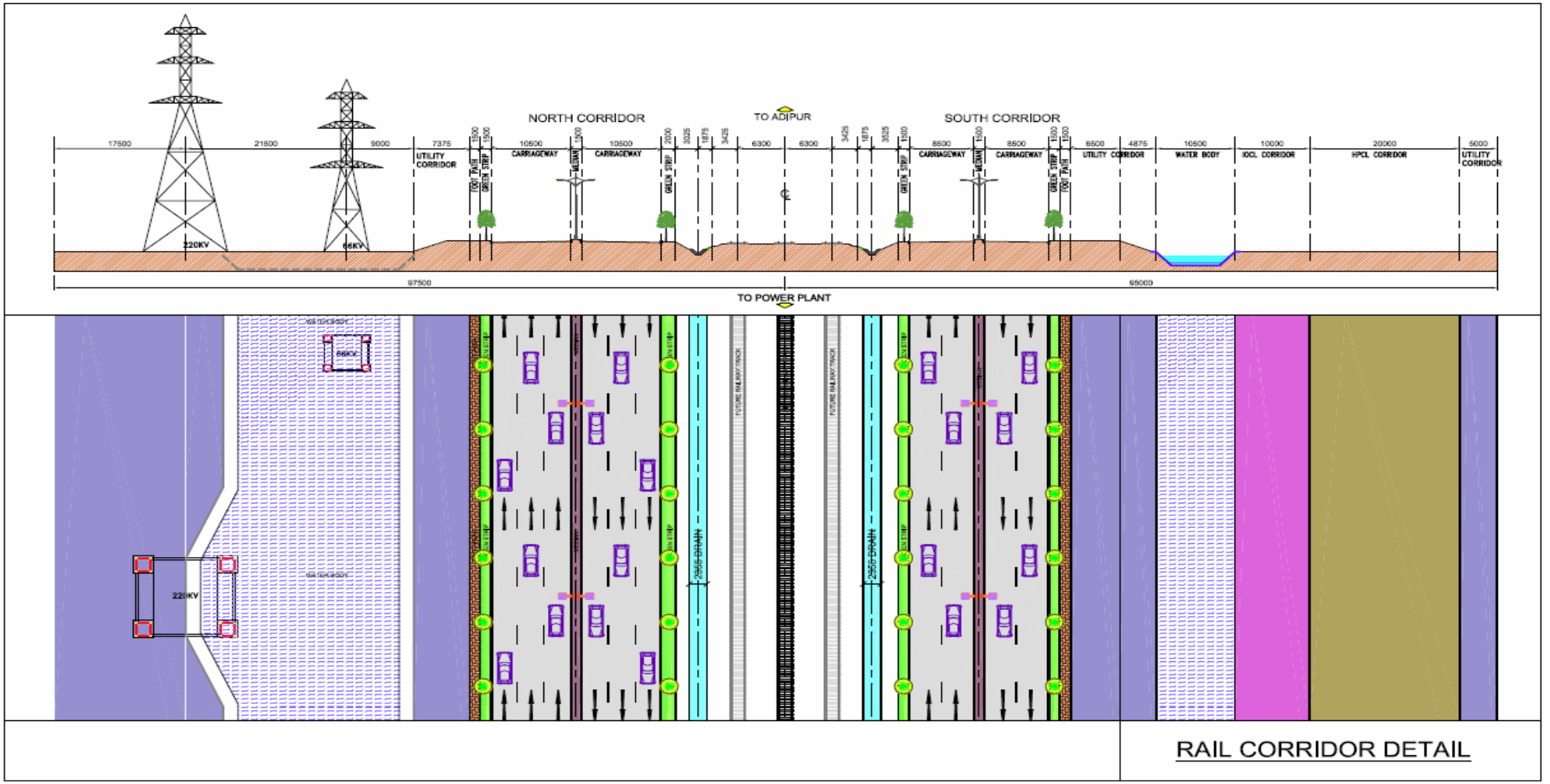


Figure 2-3 : Road Cross section

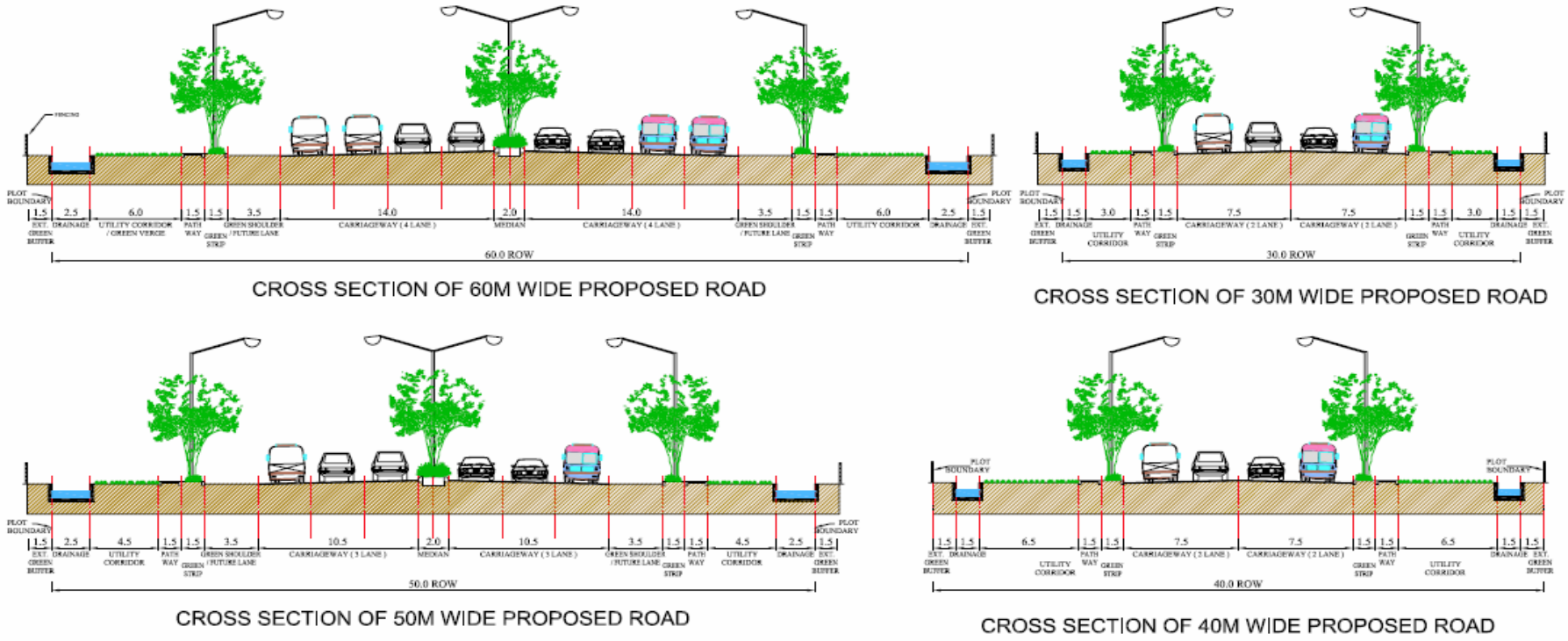
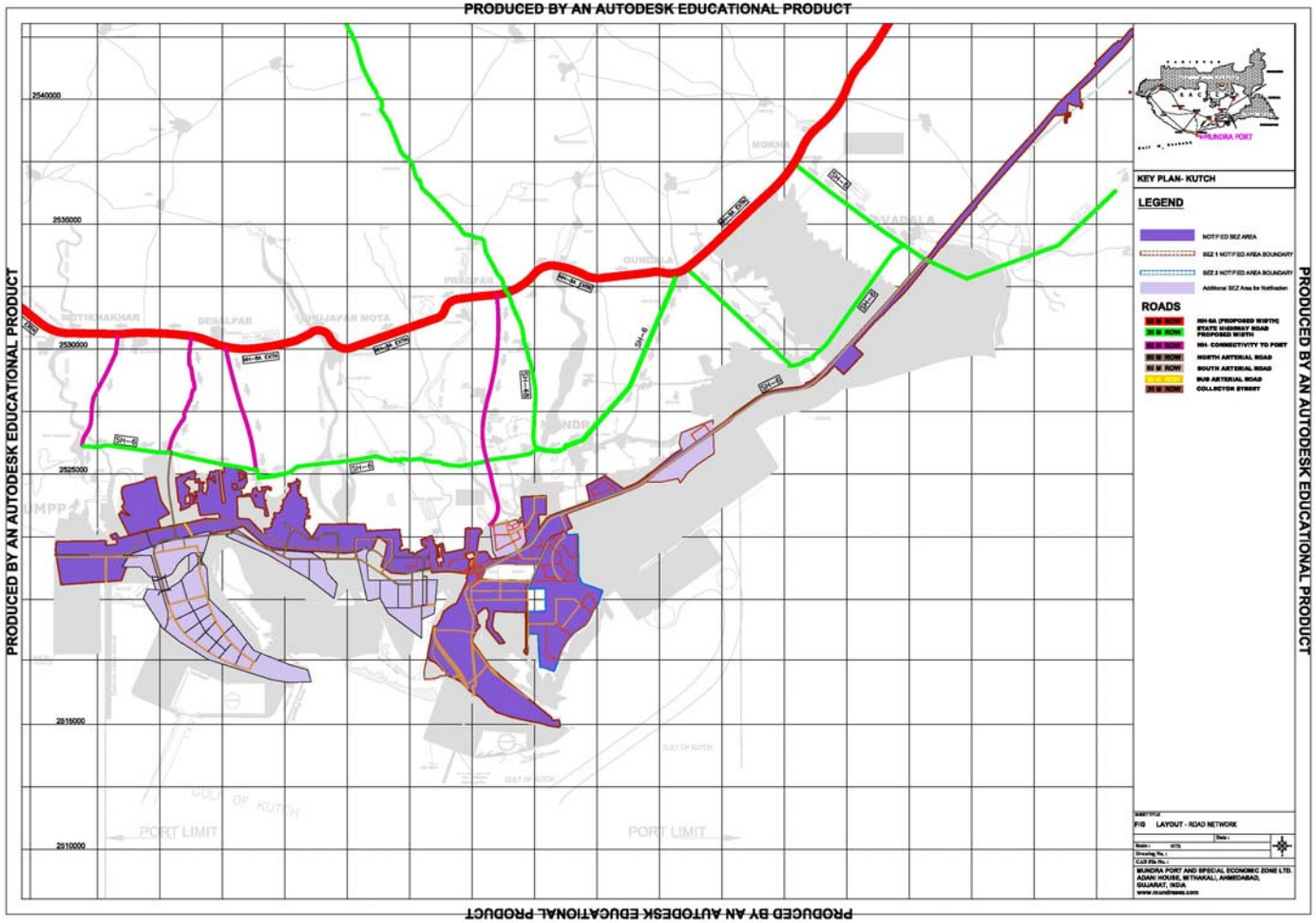


Figure 2-2 : Road Connectivity & Road Network in Mundra SEZ



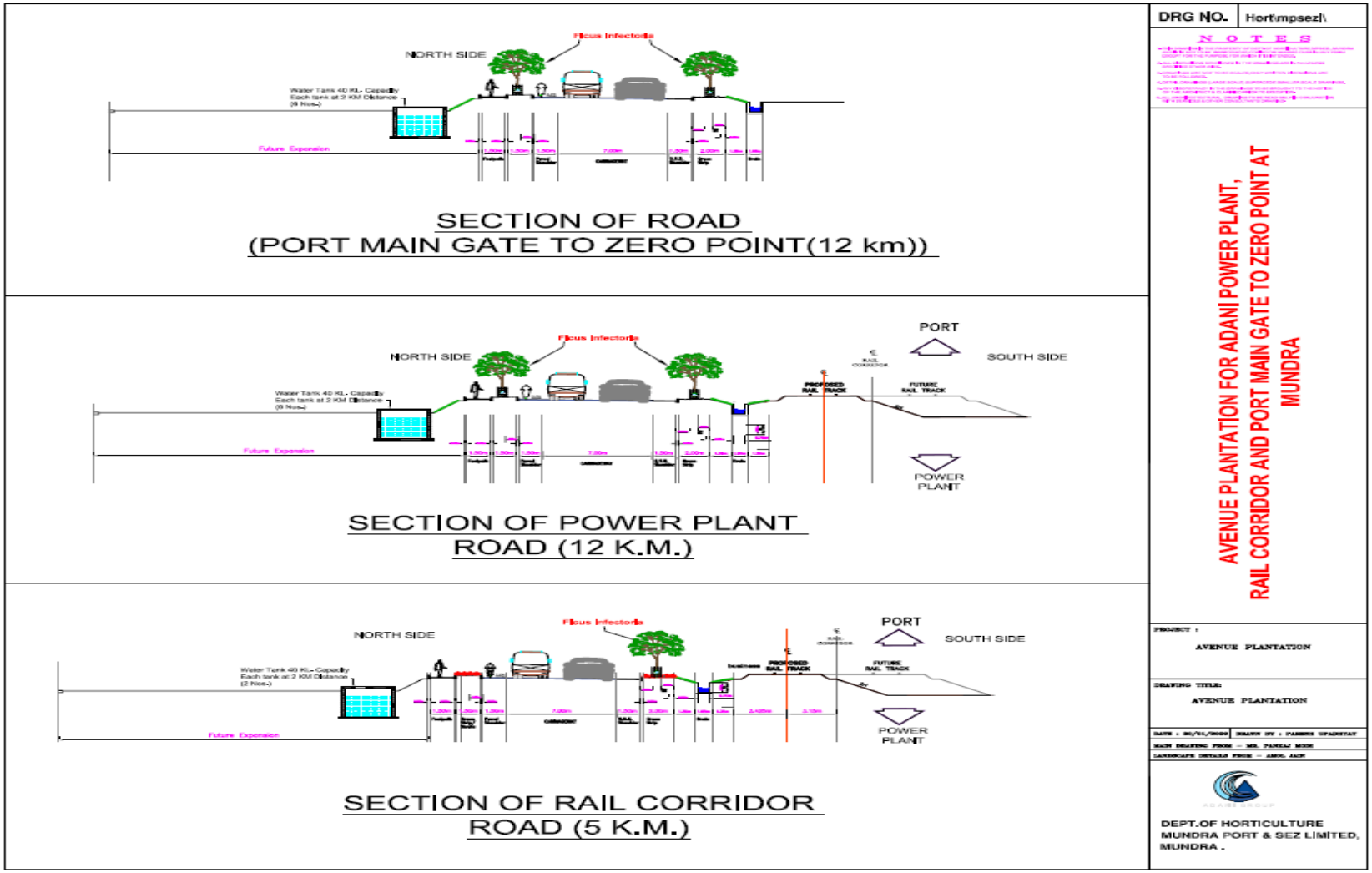


Figure 2-3a: Avenue Plantation in Mundra SEZ (Road Network)

Figure 2-4b: Master Plan for Traffic in Mundra SEZ (Rail Network)

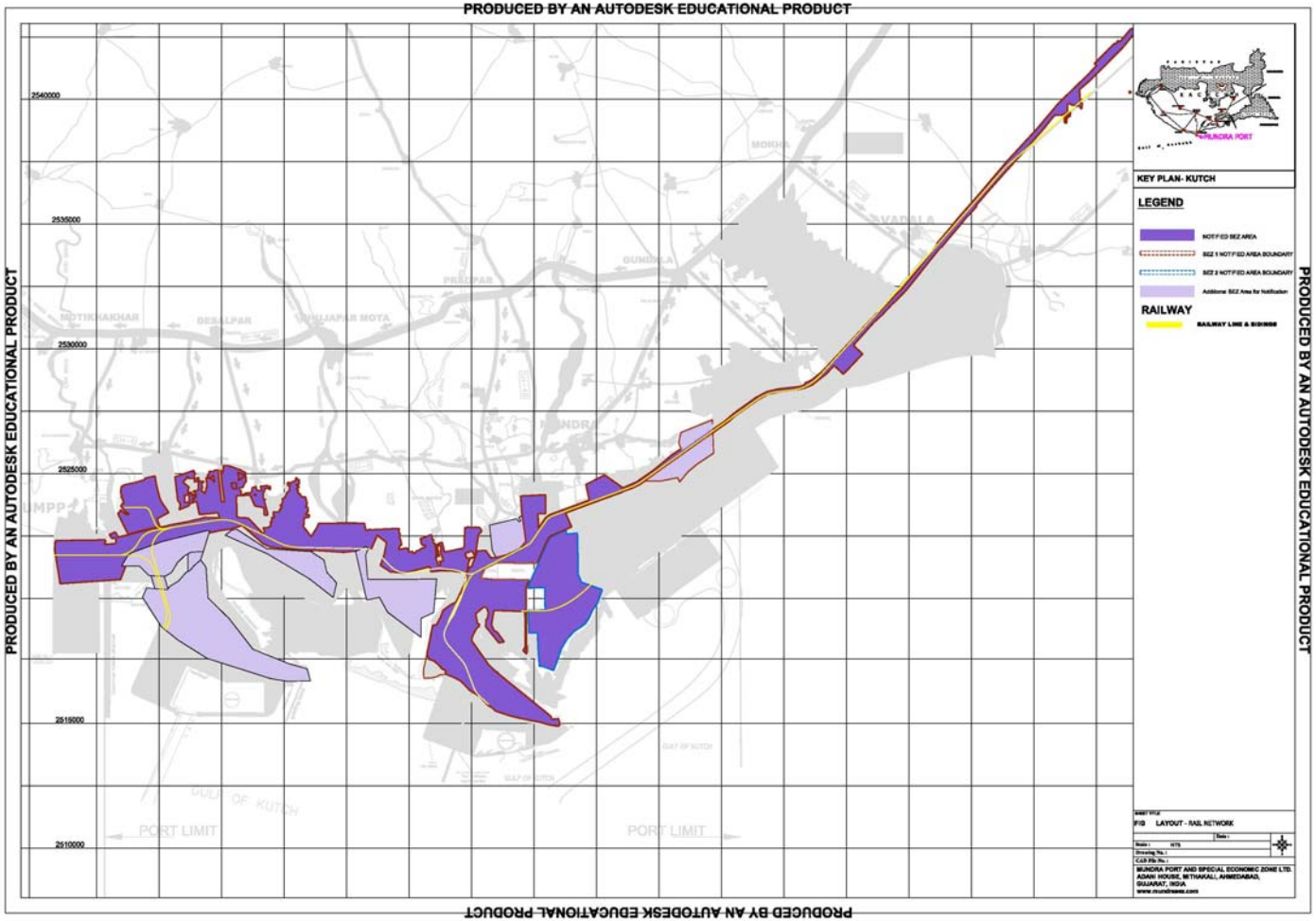


Fig 2.4c Air Connectivity – Exsisting Aerodrome

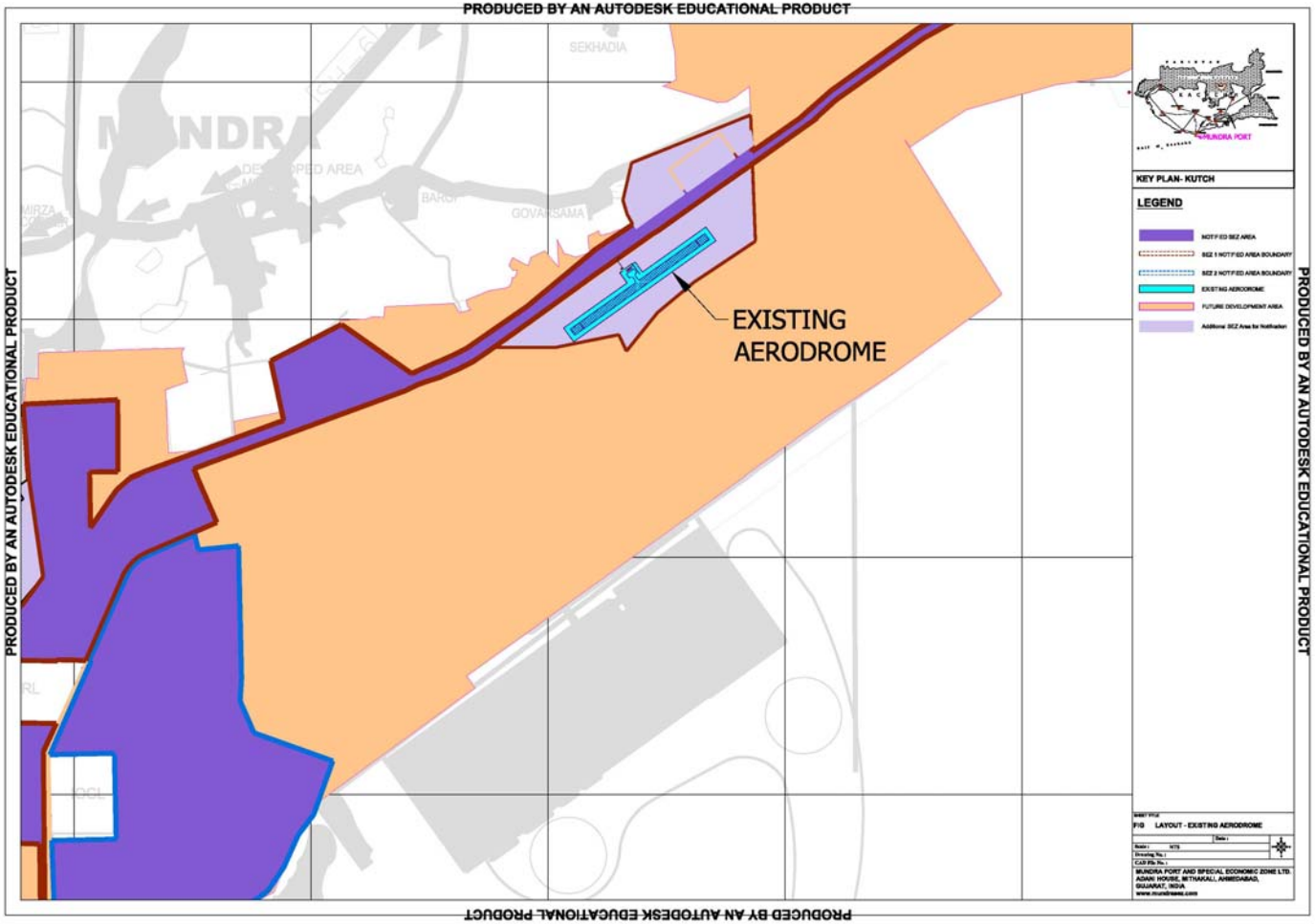


Fig 2.4d Proposed Airport

2.3 UTILITIES IN MUNDRA SEZ

The infrastructure in the Mundra SEZ area shall be provided keeping the various planning principles of sustainability, resource conservation and to provide state-of-the-art infrastructure.

2.3.1 Water Requirement & Source:

SOURCES

Narmada water (piped & canal), seawater (desalinated), harvested water (rainwater harvesting) and recycled water (STP) are the sources of water supply for Mundra SEZ project.

The details and estimated quantum of the above water resources are as under:

1. **Narmada Water:** Presently, GWIB are supplying 9 MLD water through pipeline and they have assured supply upto 11 MLD water in future.
2. **Desalinated Water:** It will be necessary to provide substantial volume of desalinated water, in phases, to bridge the gaps and for assured uninterrupted water supply to Mundra SEZ. Sea water shall be treated by desalination plants to the standards of potable water and supplied primarily for domestic use.
3. **Recycled Water:** Domestic and other waste water shall be collected and treated at strategically placed treatment plants, up to tertiary treatment level and shall then be re-circulated for industry and non-domestic uses. **The wastewater treated shall be used by the Horticulture Department to develop Green Cover over the Mundra SEZ there by reducing the net fresh water demand and minimize impacts on the competitive users.** ***(An enclosed copy of suitability of treated effluent from Agriculture University is referred as on page no. 111-112.)***

DISTRIBUTION

The water distribution scheme has been based on independent storage and distribution of treated water from the above three different sources, for domestic, non-domestic and industrial uses. The water is being pumped into the distribution system by hydro-pneumatic pumps, which also ensure the desired residual pressure.

Most part of the water supply is designed as loop system to ensure maximum head of water.

WATER REQUIREMENT

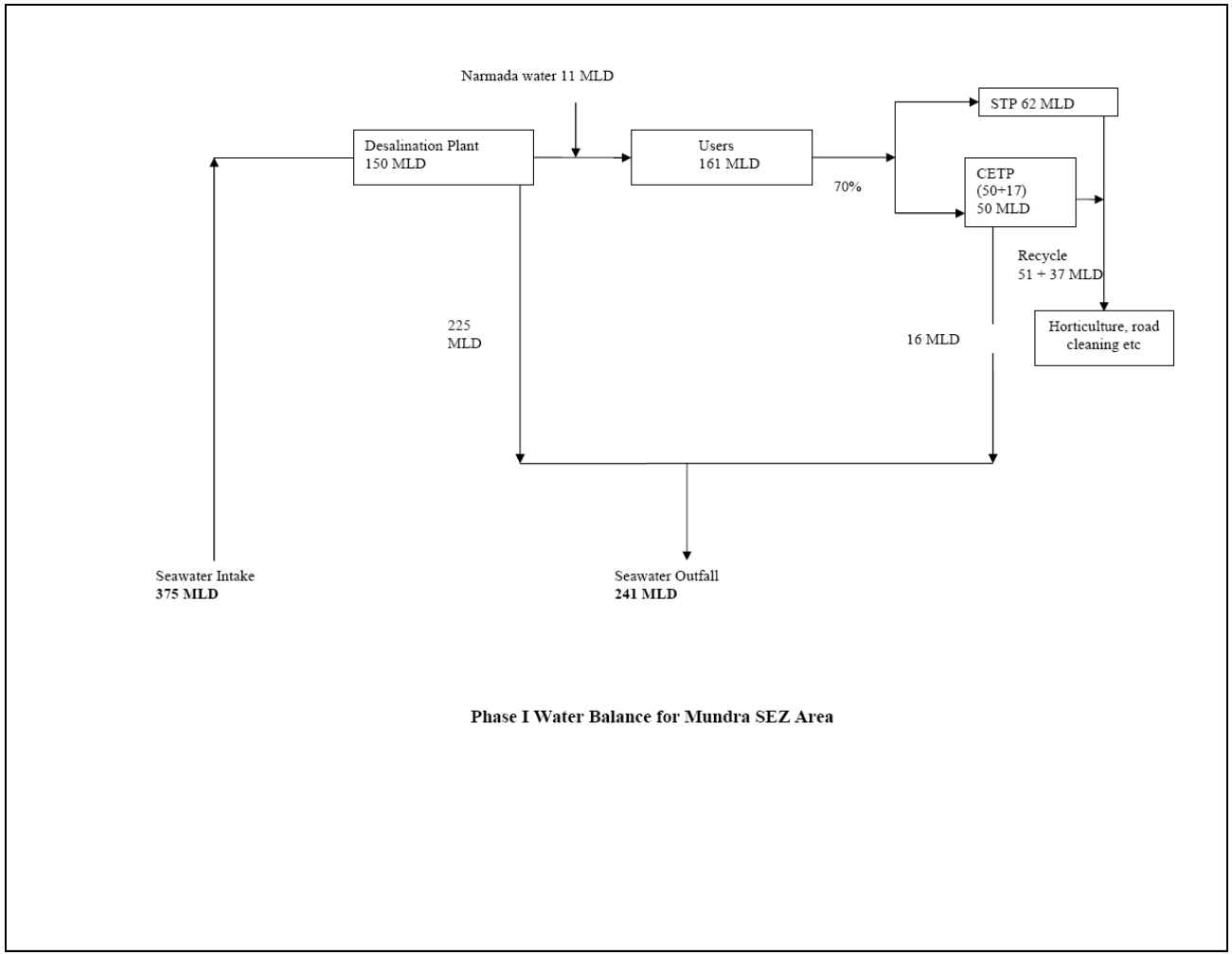
1. Daily Average Water Demand

First Phase

Daily average water demand has been estimated as 134 MLD as shown in the Table 2-8. So to ensure continuous supply of quality water, Desalination Plant of 150 MLD is required to meet the estimated demand. The desalination plant will be built in modular and expandable manner.

Table 2-8: Estimated Daily Average Water Demand (First Phase)

Item No.	Type of area	Site area (ha)	Demand (cum/ha/d)	Average Demand (cum/d)	Loss 15% (cum/d)	Total Demand (cum/d)
1	**Industrial Zone**					
	a) Industries	2500	31.4	78500	11775	90275
	c) Warehousing	192	17.4	3340.8	501.12	3841.92
2	**Sea Port and Port Backup**	941	17.4	16373.4	2456.01	18829.41
3	**Power Plant**	294	-	10000	1500	11500
4	**Social Infrastructure**	255	17.4	4437	665.55	5102.55
5	**Recreation**					
	a) Sports	50	17.4	870	130.5	1000.5
	b) Parks and Open Spaces	100	45.0	4500	675	5175
6	**Transport**	607	5.0	3035	455.25	3490.25
7	**Utilities**	146	35.0	5110	766.5	5876.5
	Total					**145091**



Phase I Water Balance for Mundra SEZ Area

A Report on Mathematical Model study attached, 1st phase of MSEZ Development.

Final Phase

Daily average water demand has been estimated as 450 MLD as shown in the Table 2-9. So to ensure continuous supply of quality water, Desalination Plant of 450 MLD is required to meet the estimated demand. The desalination plant will be built in modular and expandable manner.

Table 2-9: Estimated Daily Average Water Demand (Final Phase)

Item No.	Type of area	Site area (ha)	Demand (cum/ha/d)	Average Demand (cum/d)	Loss 15% (cum/d)	Total Demand (cum/d)
1	**Industrial Zone**					
	a) Industries	6068	31.4	190535	28580.28	219115.48
	c) Warehousing	740	17.4	12876	1931.4	14807.4
2	**Sea Port and Port Backup**	2960	17.4	51504	7725.6	59229.6
3	**Airport and Cargo Hub**	833	17.4	14494.2	2174.13	16668.33
4	**Power Plant**	555	60	33300	4995	38295
5	**Commercial**	370	17.4	6438	965.7	7403.7
6	**Residential**	2035	17.4	35409	5311.35	40720.35
7	**Recreation**					
	a) Sports	400	17.4	6960	1044	8004
	b) Parks and Open Spaces	450	45.0	20250	3037.5	23287.5
8	**Transport**	2405	5.0	12025	1803.75	13828.75
9	**Institution**	185	17.4	3219	482.85	3701.85
10	**Utilities**	370	35.0	12950	1942.5	14892.5
	TOTAL					**459954.46**

2. Design Parameters for Distribution System

The planning for the proposed water supply and distribution system shall cater to phase wise development. Water requirement for domestic use in table 2-10 are based on the Manual on "Water Supply and Treatment", published by CPHEEO, Ministry of Urban Development, New Delhi, 1991 and market research of water requirement for various industries.

In addition, the following parameters shall be adopted for water distribution network for Mundra SEZ:

a) Peak factor for transmission main - 1.5
b) Peak factor for distribution system - 2.25 for Residential and 1.5 for Industrial
c) Water loss due to leakage - 15%
d) Minimum residual pressure at ferrule point - 7m for single storey, 12m for two storey and 17m for three storey
e) Pipe material proposed- Ductile Iron / Mild Steel / DI (K – 9) / and HDPE pipes (PE 100) pipes are used for water distribution.
f) Minimum diameter- 100mm

3. Fire Protection Demand

The quantity of water required for fire fighting operations shall be planned based on the Manual on "Water Supply and Treatment", published by CPHEEO, Ministry of Urban Development, New Delhi, 1991, using the following empirical formula:

Fire demand in liters per day = Q =100000x (P) 0.5

Where P = population in thousands

Q = quantity in lpd

For SEZ project, the fire protection system shall be designed for a total population of 300000. Therefore,

P = 400,000

Q = 100000 x (400) 0.5

= 2000000 lpd

= 2 MLD

DISTRIBUTION SCHEME

The water is being pumped into the distribution system by hydro-pneumatic pumps, which also ensure the desired residual pressure. Most part of the water supply is designed as loop system to ensure maximum head of water.

The water distribution pipes are laid along the defined utility corridor and away from sewerage system to avoid any possibility of contamination.

A gridiron system of pipelines shall be used for water distribution network, compatible with the sector planning of SEZ. Within the gridiron system of pipe

network, all arterial and secondary mains shall be looped and interconnected. This arrangement eliminates dead ends and permits water circulation such that a heavy discharge from one mains allows draining water from other pipes. This also helps in preventing water from developing tastes and odors due to stagnation. In addition to the water supply for domestic, non-domestic and industrial uses, piping system shall also cater for water supply for fire fighting, including necessary pressure boosting measures.

DETAILS ON DESALINATION PLANT USING REVERSE OSMOSIS (RO) SYSTEM

It will be necessary to provide substantial volume of desalinated water, in phases, to bridge the gaps and for assured uninterrupted water supply to Mundra SEZ. For this total 300 MLD of sea water desalination facilities has been approved for Waterfront Development Plan.

So to ensure continuous supply of quality water Desalination Plant of 150 MLD capacity is required to meet the estimated demand. The desalination plant will be built in modular and expandable manner.

Technical features of the plant

- ✓ Sea water intake
- ✓ Pre-treatment
- ✓ Filtration
- ✓ RO system
- ✓ Post treatment
- ✓ Automation

After review various technology, Mundra SEZ has chosen Sea Water Reverse Osmosis Desalination Technology to implement this project.

The Reverse Osmosis process uses a semi-permeable membrane to separate and remove dissolved solids, organics, pyrogens, submicron colloidal matter, viruses, and bacteria from water. The process is called "reverse" osmosis since it requires pressure to force pure water across a membrane, leaving the impurities behind.

Reverse Osmosis is capable of removing 98%-99.5% of the total dissolved solids (TDS) and 99% of all bacteria, thus providing safe, pure water.

Sea water intake

- Sea water is drawn from a depth of 6 M below the Chart DatumMtr. and flows a distance of 8000 Mtr. to reach the plant
- Sea water intake system is an open intake system of 200 Mtr top width and the water flows by tidal forces to the intake reservoir.
- Stream is bifurcated and each stream passes through a mechanical bar screen to trap the debris, rubbish and seaweeds of particle size greater than 50 mm and followed by a screen to trap particle greater than 5 mm

Pre-treatment

From the pumping station, raw seawater flows to the pre-treatment facilities. After stilling chamber, it passes through two separate lines. This ensures that the plant can at least continue to operate at half-capacity in the event of blockage or failure in one of the line. The dosing pumps at the chemical treatment facility are each equipped with real-time flow-rate adjustment and adequate redundant capacity has again been factored in to guard against down-time.

- Chlorination for effective disinfection is done in stilling chamber.
- The disinfected water is then flow to the 2 No Flash Mixers each of 20 M3 capacities for coagulation and 4 No flocculation chambers each of 375 M3 capacity. For chemical treatment using coagulants and flocculants.
- Clarification and gravity settlers 2 No each of 750 M3/Hr capacities are used to settle and remove the heavier suspended and settable solids.
- The sludge from the gravity settler are drawn into the sludge pit @20 M3/Hr and 1-2% sludge consistency will discharged through the pipe to Sludge Drying Bed.

Filtration

Filtration is performed in two stages, starting with gravity filters containing gravel, quartz sand and anthracite media. The filters, which have an automatic backwash facility, offer a 12.5% standby overcapacity and have a proven ability to cope with storm turbidity levels. Four parallel batteries of cartridge filters form the second stage, with a built-in spare capacity of 33% are employed to remove the finer suspended solids present in the seawater to achieve the required SDI.

- The clarified water from gravity settler passes through six number of Gravity sand filter of 350 M^3/Hr capacity each and the outlet water from the filter is stored and pumped to the eight units of horizontal Pressure filter of 300 m^3 capacity each through the intermediate pumping station to remove the suspended solids of particle

- size greater than 5 microns. @1.8 MLD backwash effluent water generate from filter will mix with RO reject water and go to reject disposal tank.
- The three modules of 5 micron cartridge filters are used to remove the remaining suspended solids completely and some of the micro-organisms present in the seawater before it enter into the RO system.

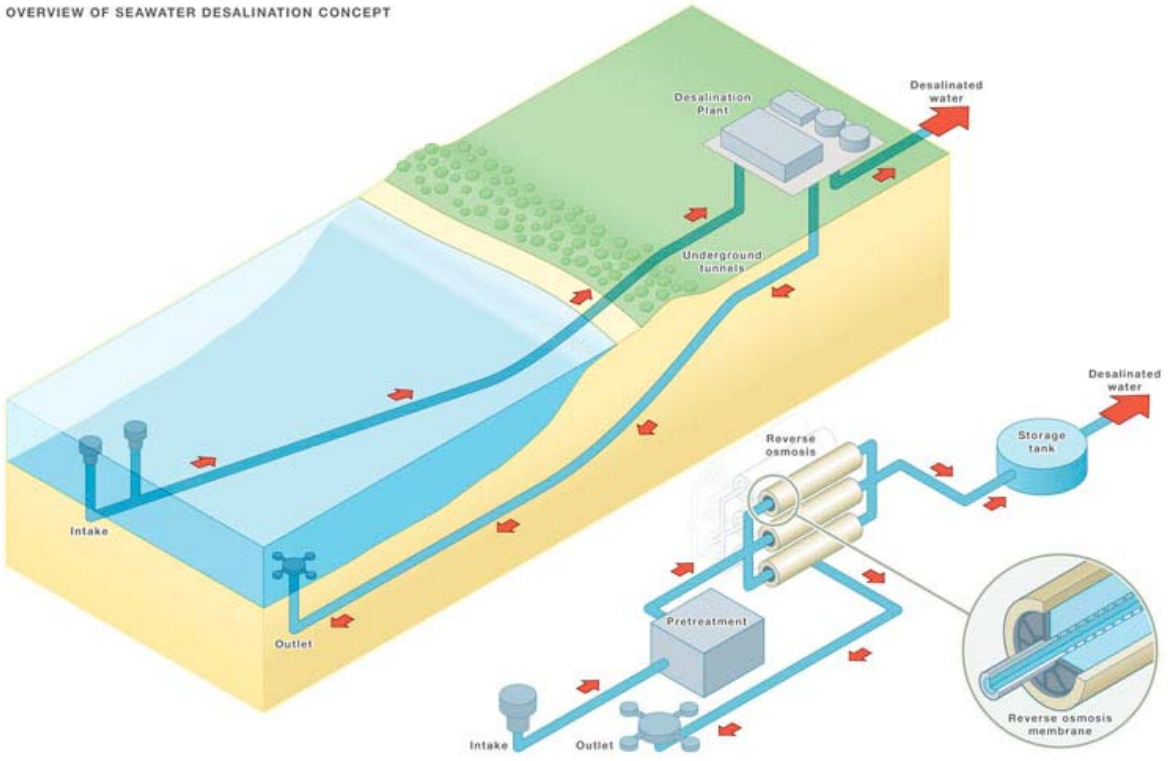
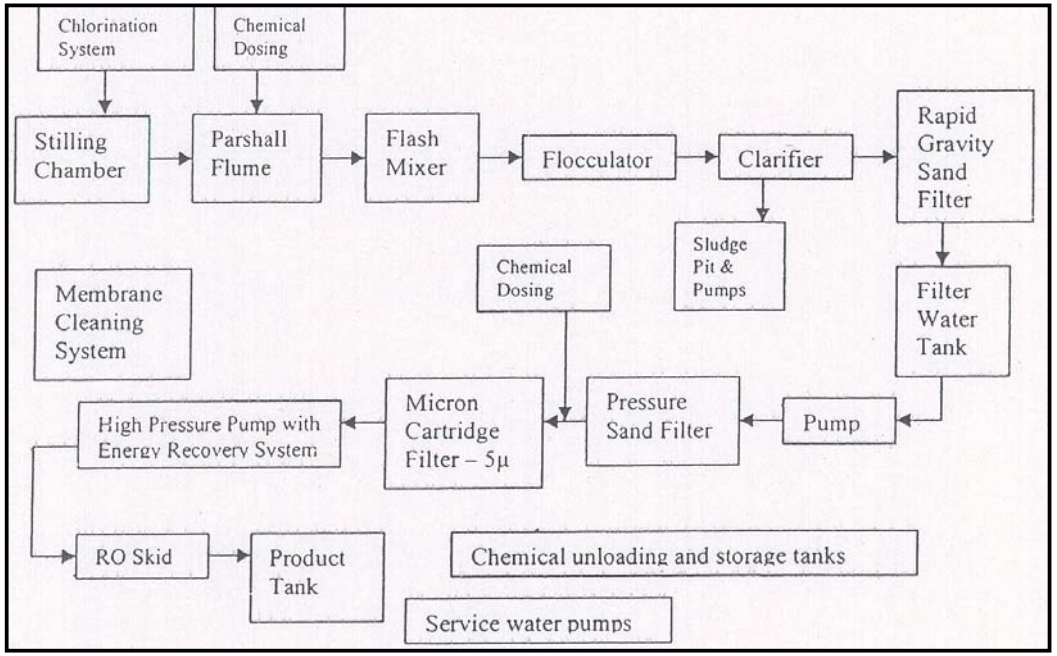


Figure 2-5 Seawater RO System

Parameters	Permissible values	Ambient Values	Discharge Values Calculated	Discharge Value taken for Modelling studies
BOD	100 mg/lit	5mg/lit	14.41mg/lit	20mg/lit
COD	250mg/lit	50mg/lit	94.39mg/lit	100mg/lit
Salinity		37 ppt	57.57ppt	60ppt



Post Treatment

- The 150 MLD product water produced is stored in a tank and again chlorinated to avoid microbial contamination during water distribution.
- The brine is drained to the sea along with the disposal system for the power plant effluent.

Automation

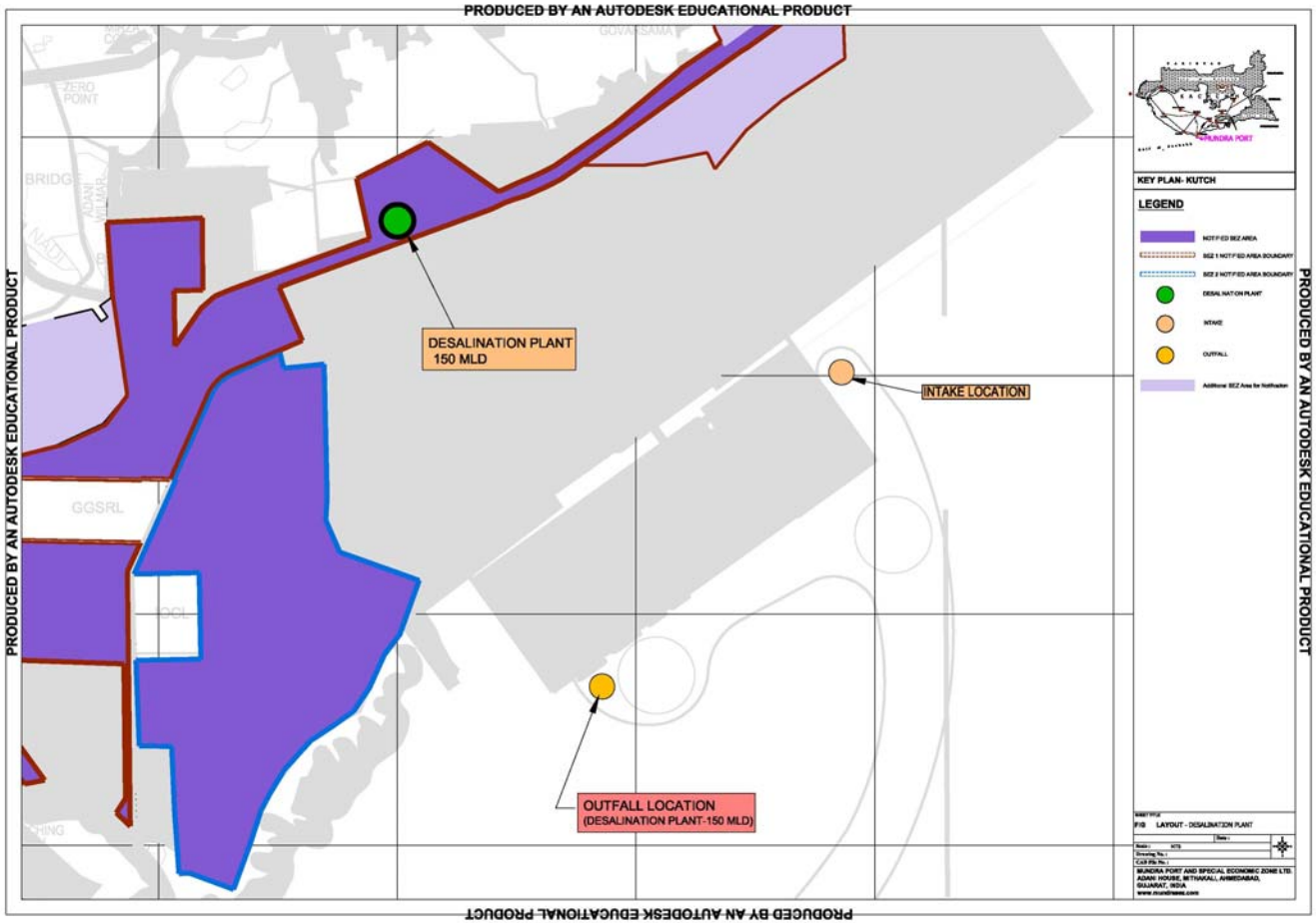
- The 150 MLD desalination plant will be a fully automated plant with multiple PLC's controlled and by SCADA system.

Layout of the Plant

This Desalination Plant will remove the dependence of the Mundra SEZ, and all its ancillary developments on the ground water and fresh water. Since Mundra area is already a 'dark zone' from the ground water perspective, the desalination plant will protect this fragile area for salinity ingress. The fresh water in the rivers and rivulets around Mundra will also be left for the use by the local communities. The Mundra SEZ will thus be completely independent from the point of view of its water requirements.

The RO reject and the CETP treated discharge water after consultation with NIO for carefully proposing the pipeline layout, keeping in mind the marine outfall parameters by GPCB and the results obtained from the mathematical model study, it is proposed to discharge the wastewater through a common outfall point into the sea. Model study for the same has been attached as annexure.

Figure 0-6: Location of Desalination Plant in Mundra SEZ



2.3.2 Electric Power Supply

POWER DEMAND

SEZ comprises of industries, commercial, residential, institutional and sports cum re-creational facilities. Very large load diversity shall be encountered in these various applications. In industrial zones with light to medium power intensive industries, a diversity factor of 40 to 60% over the installed capacity is normally considered adequate for computation of peak demand. However, power diversity is much higher in residential areas.

Electrical loads for 18,000 Ha of developable land for various facilities have been worked out on the area basis as shown below in table 2.10.

Table 0-10 : Estimation of power demand for the First Phase

ITEM NO	TYPE OF AREA	SITE AREA (Ha)	DEMAND (KW/Ha)	TOTAL KW	DIV (%)	Maximum Demand (KW)
1	**Industrial Zone**					
	a) Industries	2500	240	600000	55	330000
	b) Warehousing	192	60	11520	40	4608
2	**Sea Port and Port Backup**	941	20	18820	55	10351
4	**Commercial**	15	160	2400	55	1320
5	**Residential**	180	135	24300	40	9720
6	**Recreation**					
	a) Sports	50	10	NA	NA	NA
	b) Parks and Open Spaces	100	10	NA	NA	NA
7	**Transport**	607	10	NA	NA	NA
8	**Institution**	25	20	500	30	150
9	**Utilities**	146	10	1460	40	584
	TOTAL	**4756**				**356733**

Maximum demand at overall diversity @ 85% = 419686 KW

Or equivalent MVA at 0.8 PF = 525 MVA

Table 0-11 : Estimation of power demand for the Final Phase

ITEM NO	TYPE OF AREA	SITE AREA (Ha)	DEMAND (KW/Ha)	TOTAL KW	DIV (%)	Maximum Demand (KW)
1	**Industrial Zone**					
	a) Industries	6068	240	1456320	55	800976
	b) Warehousing	740	60	44400	40	17760
2	**Sea Port and Port Backup**	2960	20	59200	55	32560
3	**Airport and Cargo Hub**	833	60	49980	40	19992
4	**Commercial**	370	160	59200	55	32560
5	**Residential**	2035	135	274725	40	109890
6	**Recreation**					
	a) Sports	392	10	NA	NA	NA
	b) Parks and Open Spaces	874	10	NA	NA	NA
7	**Transport**	2405	10	NA	NA	NA
8	**Institution**	185	20	3700	30	1110
9	**Utilities**	370	10	3700	40	1480
	TOTAL					**1016328**

Maximum demand at overall diversity @ 85% = 1195680 KW

Or equivalent MVA at 0.8 PF = 1495 MVA

POWER PLANT

To meet the requirement of SEZ, a coal based thermal power generating station shall be installed in different phases. The SEZ will have its own Thermal Power Plant with an ultimate capacity of ~5000 MW. The region in and around would have power plants with an ultimate capacity of ~15000 MW. In the first phase it will generate 2640 MW of power. Power generating station has been planned away from the load centre (to minimize air pollution) at one end of Mundra SEZ periphery.

DISTRIBUTION SYSTEM

Transmission & Distribution (T & D) network for supply of electrical power is a major infrastructure required to be developed as part of the development of the entire

infrastructure. The T & D network is to provide reliable and quality power to all the consumers such as upcoming industries, residential and commercial complexes, social infrastructure areas, and public utilities. The estimated net load requirement for Phase I of the SEZ shall be to the tune of 525 MW. The T&D network is envisaged to be the most ideal and modern with the latest state of the art technologies and employing the latest international and national standards, safety codes and environment friendly with good aesthetic look.

As a part of the T & D Network, at the outset, a 220 / 66 KV Substation will be constructed for receiving the power from 220 KV Switchyard of Phase – I of Adani Power Plant located adjacent to SEZ area by one (1) number 220 KV double circuit transmission line. The Sub Station shall be named as Main Receiving Substation-1 (MRS-1). At MRS-1 voltage shall be stepped down from 220 KV to 66 KV level for further transmission of power at 66 KV level to the load centers where four numbers of 66 KV / 11KV substations will be created. These substations shall be designated as Satellite Substations or Primary Substations (PSS). There will be four numbers of such PSSs, which are designated as PSS -1 PSS – 2, PSS - 3 and PSS –4. These PSSs will be receiving power from the MRS-1 by 66 KV double circuit transmission lines. At the PSS, voltage will be stepped down from 66 KV to 11 KV. Numbers of transformers are decided based on the load to be fed from the respective PSS.

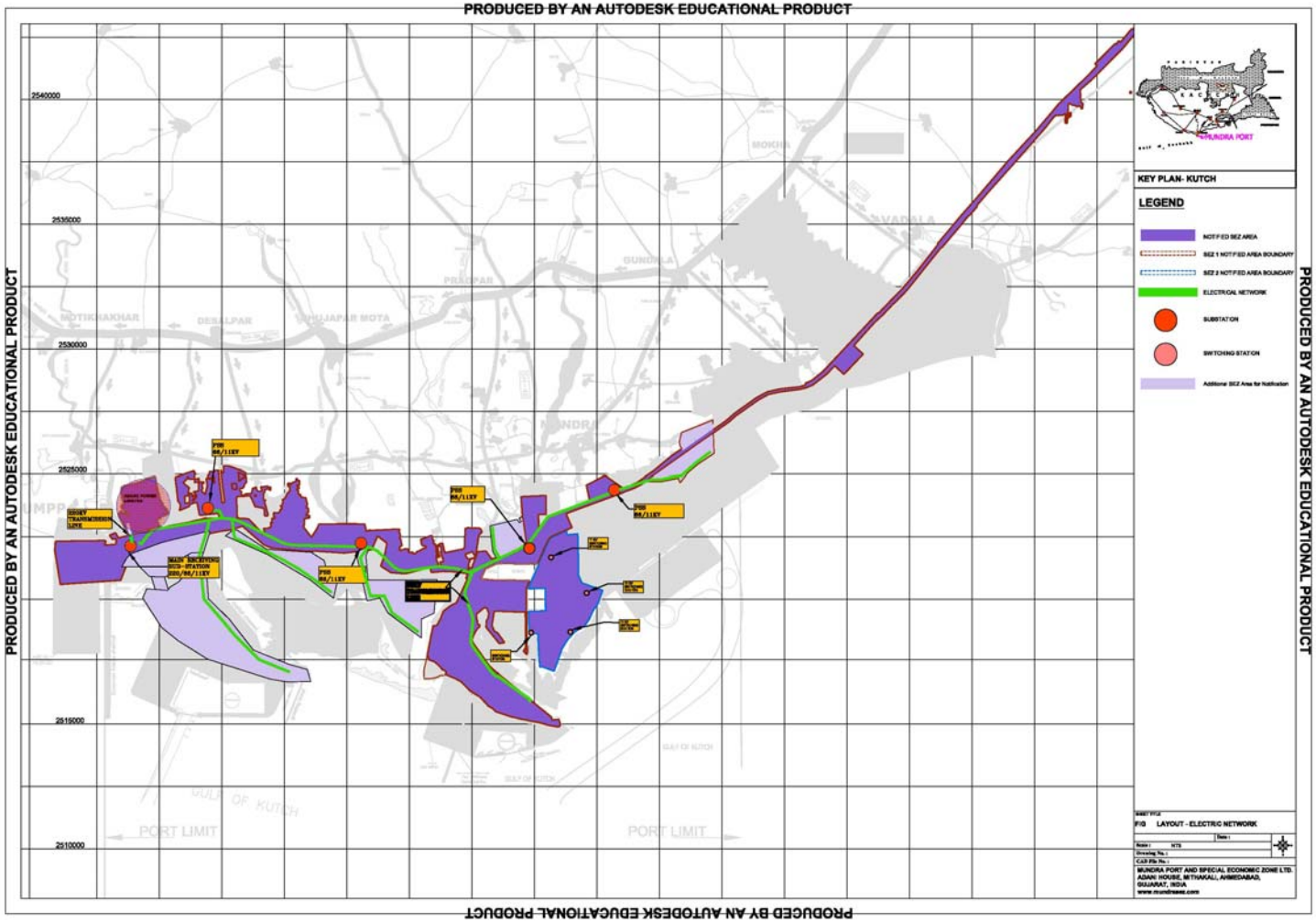
Further the power at 11 KV will be distributed to the entire area of Phase-I though 11 KV distribution network through 11 KV underground cables. 11 KV distribution systems will have a number of 11 KV Switching Stations (SS) to be located at strategic locations.

STREETLIGHTING

Lighting for express highways and arterial roads shall be done by 11/0.415 KV transformers of small ratings, each located at 1.1 to 1.5 km intervals. Double door type watertight feeder pillars shall be provided for receiving 415 volts supply from the above transformers. The cables from feeder pillar to poles shall be laid in 'Kachcha' ground parallel to poles. 11 mt. high double arm and single arm poles with 400 / 250 W HPSV. Lamps shall be used for express highway illumination. 9 mt. and 7 mt. high poles shall be installed for medium and small roads with 150/70W HPSV

lamps. 25 to 30 lux level shall be maintained. The tentative distance of poles at express highways shall be kept between 35 to 40mt.

Figure 0-7 : Electric Supply Network in Mundra SEZ



2.3.3 Telecommunications/IT Network:

The The different activities in Special Economic Zone will have modern telecommunication facilities, by linking communication flow in India and selected destinations throughout the world, particularly in neighboring regions. A telecommunication service network having latest networking features like online, real time and convergence facilities shall be proposed, which shall be capable of transmitting voice, image and data networks.

The following services will be provided:

- Dialup and dedicated Internet access (up to 64 Kbps).
- High bandwidth Internet access (128 Kbps).
    - Integrated Services Digital Network (ISDN).
    - Digital Subscriber Line (DSL).
    - Wireless.
- Website and virtual domain hosting.
- Server co-location.
- Network design, installation, and administration services.
- Web design (Optional and/ or outsourced).

Table 0-12 : Compound Annual Growth Rate, Industrial and SOHO Population

Type	Year	2009	2010	2011	2012	2013
Potential Customers	Growth/ CAGR					
Household Consumers	40%	25000	35000	49000	68600	96040
Industrial	50%	33250	49875	74813	112220	168330
Small Offices/Home Office	10%	39033	42936	47230	51953	57148
Total	**100%**	**97283**	**127811**	**171043**	**232773**	**321518**

The philosophy for the design of the SEZ backbone has been specified in the document - Wireline OSP Access Network. In Mundra SEZ the fibre engineering plan has been worked out with the Main Access Node (MAN) for last mile ring aggregation.

The methodology implemented with the Point of Interconnect (POI) interconnection of the 48 Core Cable as the Mundra Port Backbone is depicted in the following diagram.

The fibre allocation allows for POI ring fibres to be connected onto a twelve fibre cable such that spare fibres are available for growth and jumpered through as well as the additional provision of contingency fibres at the POIs. These contingency fibres are reserved and are available for emergent situations.

Figure 0-8 : Backbone Ring

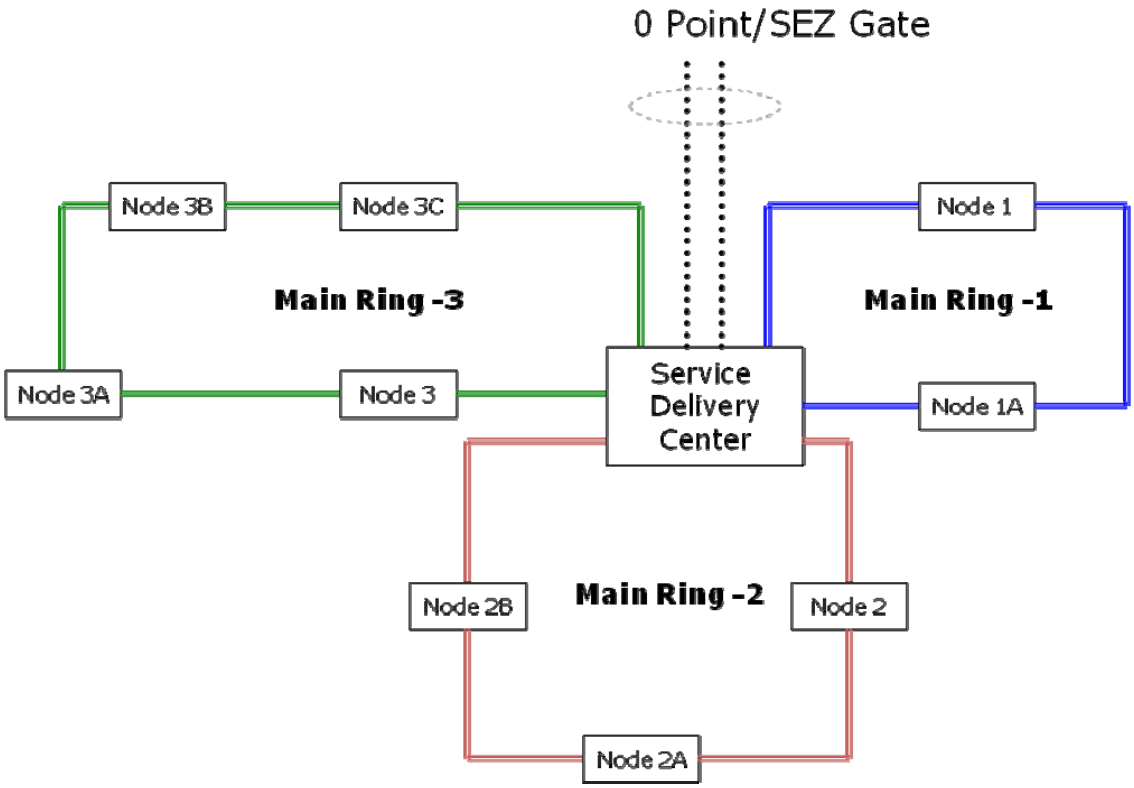


Figure 0-9: Last Mile Ring

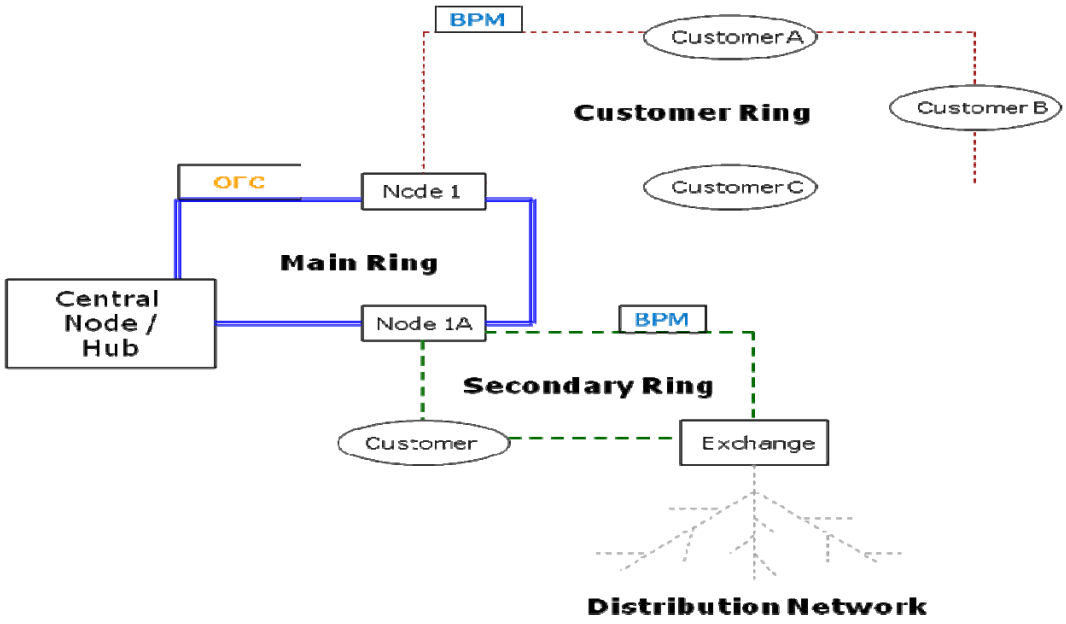
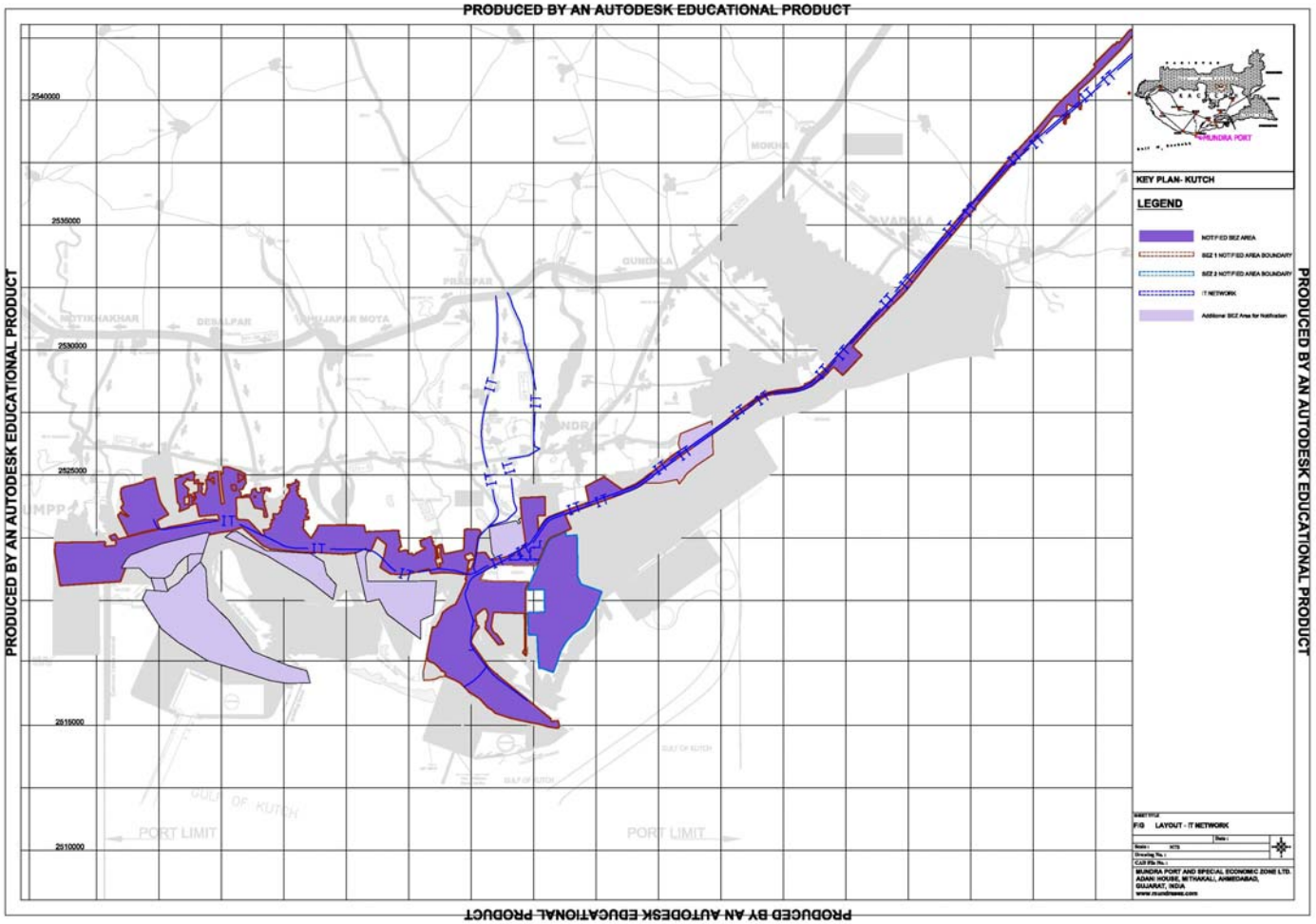


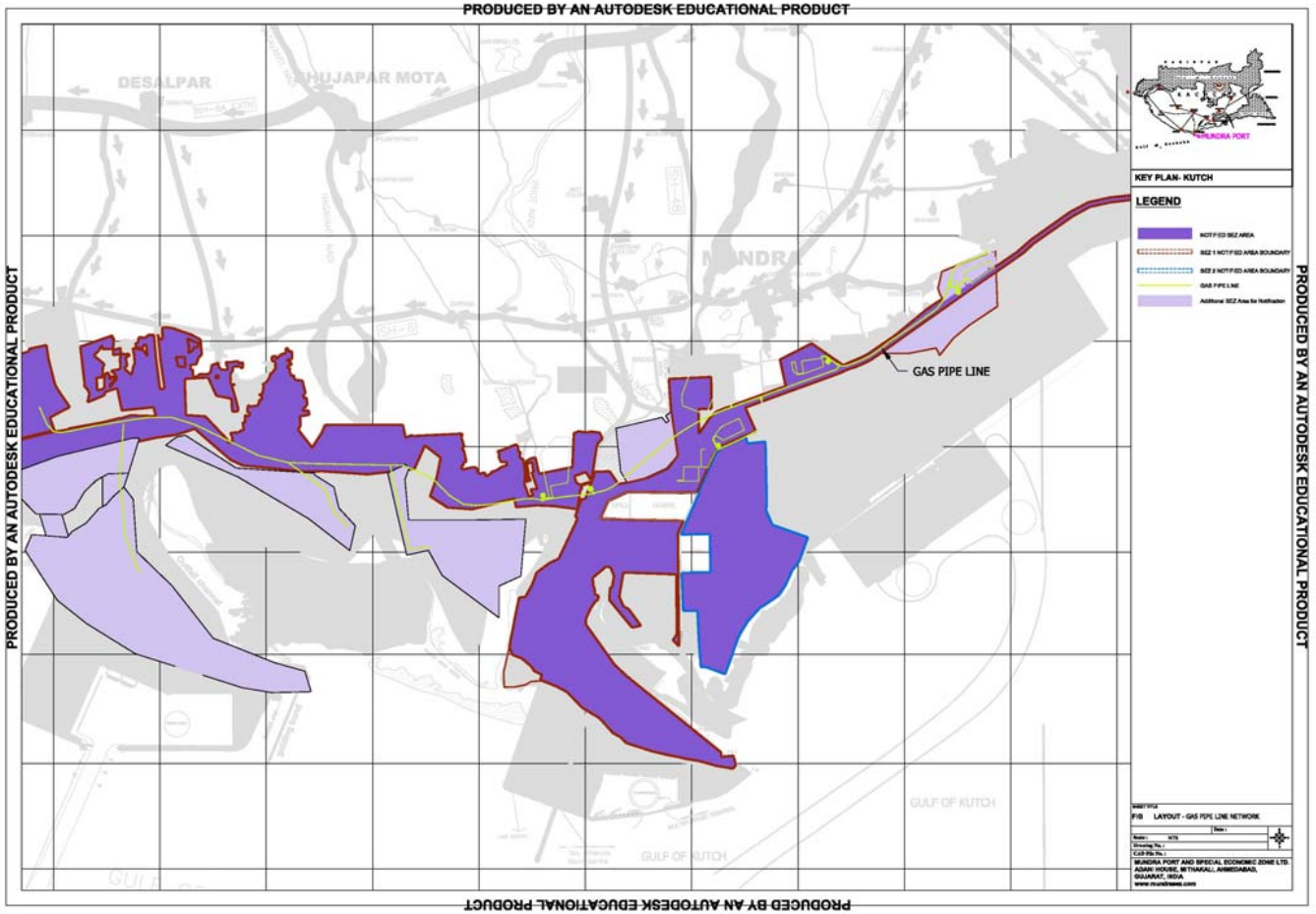
Figure 0-10: IT Network



2.3.4 Gas Distribution Network:

Adani Energy Limited is going to establish CGD Project at SEZ area and Port Area in Mundra. The process involves supply of NG at various pressures. NG is reduced from supply pressure 50 Bar (Max) from transmission grid to 26 bar (Max) in CGD steel network. The pressure is further reduced to 4 Bar for Medium Pressure Network and supplied to Industrial and Commercial customers at required pressure (0.05 bars to 1.5 bars). For domestic customers the pressure is reduced to 110 mbar and at burner tip supply pressure is 21 mbar. For CNG the pressure is increased from 19 bars to 250 bar and vehicle are filled at 210 bar pressure. The gas is however odorized for safety reasons. In our process NG is received and distributed at various pressure levels as per customer requirement. The pressure regime followed in diagrammatically represented. Our whole network will start from City Gate Station (CGS), which will be building on primary basis. Laying of approx 35-40 Km of MS Pipe line with sizing of 6" to 12" is planned. Approx 4 Nos of Distinct Regulating Station (DRS) and 4 Nos of Online CNG station are being connected the said MS pipeline network. Approx 350 Km of Poly Ethylene pipes are being laid, which network will be started at the outlet of DRS. This Poly Ethylene network will cater all Domestic, Commercial and Industrial Customers.

Figure 0-11: Gas Distribution Network



2.4 ENVIRONMENTAL MANAGEMENT SYSTEM

2.4.1 Air Pollution Control Measures

There shall not be any sources of air pollution generation from the proposed infrastructure facilities of the Mundra SEZ, on regular basis. However, 10 no. of DG sets (each of 750 KVA) shall be operated in case of emergency. As per statutory requirement, stacks of adequate height shall be provided. As they shall use LDO/HSD/LSHS as fuel and shall not be operated continuously, no air pollution control measures shall be required.

The only other type of gaseous pollution shall be due to vehicular movement. For this, PUC certification shall be made compulsory for all vehicles moving in and around Mundra SEZ area.

There shall be a vast range of industries in the SEZ, which may release different gases into the atmosphere. Such industries shall provide stacks / vents of adequate height alongwith appropriate air pollution control equipment, which shall be in line with the statutory requirements under the Air Act of State Pollution Control Board.

2.4.2 Sewage Treatment System

Sewerage system comprising of sub-systems; each catering to a self-contained park/hub, shall consist of collection system of pipe network, lifting stations (LS), terminal sewage pumping stations (TSPS), sewage treatment plants (STP) and Common Effluent Treatment Plant (CETP) efore recycling for non-domestic & industrial usages. Planning for the sewerage system for a particular development area shall be such so as to take into account the entire future development in order to avoid re-installation of sewer pipelines for anticipated ultimate flow.

The sewage shall be treated at the STP and treated effluent shall be recycled for non-domestic usages. Effluent from the wastewater shall be treated at the STP and treated effluent shall be discharged in an appropriate manner. The quality of the effluent after treatment shall meet the standards, as prescribed by the Gujarat Pollution Control Board. The exact manner and location of the discharge point for treated effluent shall be identified at the detailed engineering stage.

PLANNING CRITERIA

The following planning criteria shall be adopted for the proposed sewerage system at Mundra SEZ site:

- Sewage Flow: 70% of water supply shall be considered as sewage inflow.
- Peak Factor: Design peak flow shall be two times the average flow.
- Discharge Capacity: The sewers shall be designed for the discharge capacity of Qc to cater adequately for the estimated peak run off using Manning's formula:-

Where,

Qc = 1/n.A.R2/3 S1/2 (m^3/sec)

A = Flow area of sewer (m^2)

R = Hydraulic mean radius (m)

S = Bed gradient

n = roughness coefficient, (assume n=0.015 for reinforced concrete pipes)

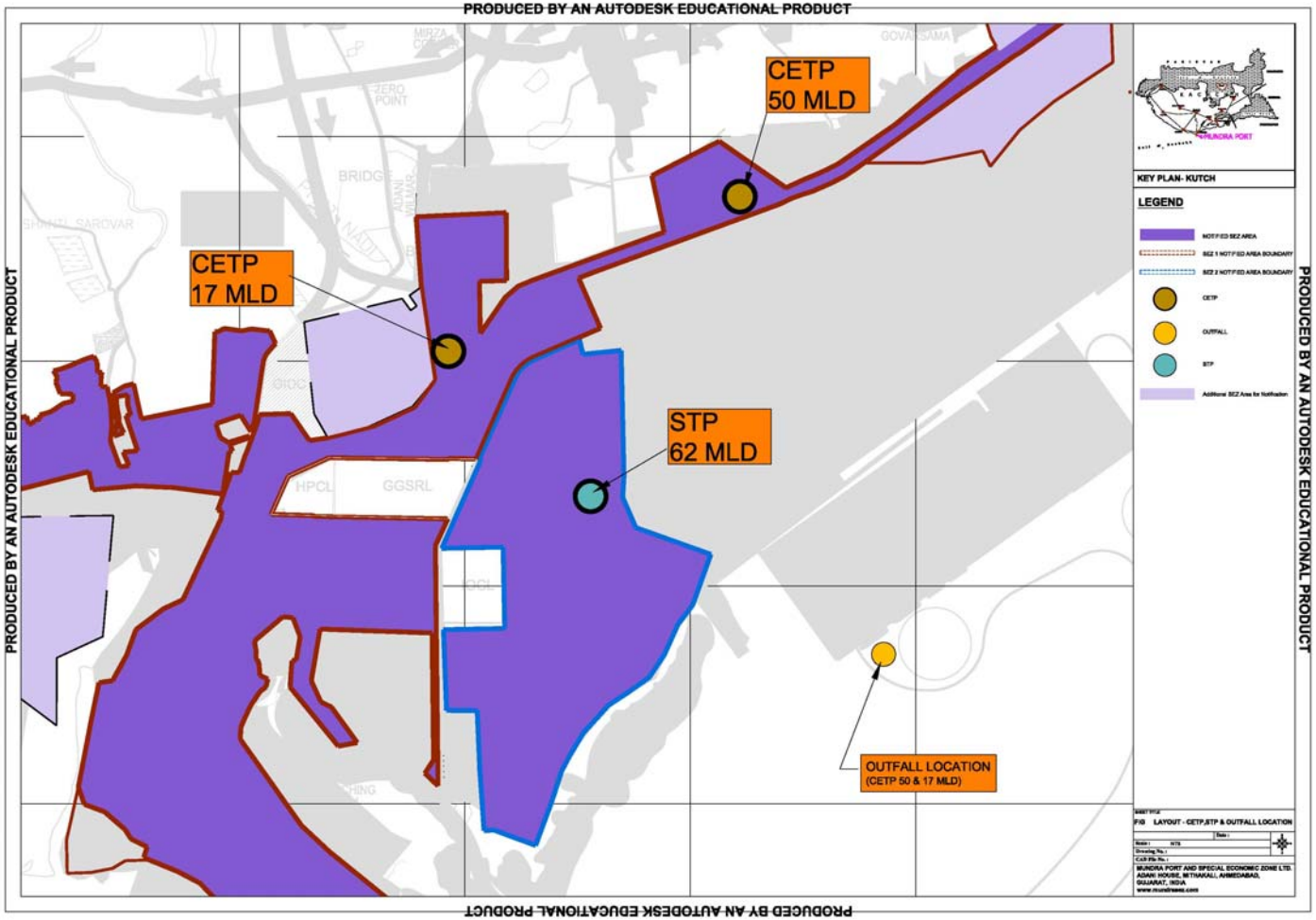
SEWAGE TREATMENT PLANTS

To meet the waste water disposal standards, Mundra SEZ envisages developing 62 MLD Sewage Treatment Plant for Social Infrastructures. The STP will be built in modular and expandable manner. It will be of high efficiency aerobic treatment schemes based on extended aeration system using fine bubble diffused aeration are proposed. These plants are compact, odor free and have an energy efficient process. STP shall generate water of high quality, suitable for use as process water for industries / warehouses / transportation / horticulture etc.

Activated sludge process is an aerobic treatment of sewage in which bacteria require oxygen for their existence, thrive in presence of light and bring about oxidation of the sewage. In this system, certain amount of oxidized or activated sludge is intimately mixed with the sewage, which greatly hastens the process of oxidation of organic matter. Aeration and activation is done through compressed air, which is introduced through diffusers into the sewage as it flows through tanks. Air is supplied through vertical pipes, which run longitudinally along the tank. Waste or excess sludge from the liquid stream is removed in the form of flocculent sludge in

settling tanks. Also, pre-treatment of industrial waste is to be made essential before discharging into the main sewers as these wastes may be of such composition as would damage the sewers or interfere with the treatment process.

Figure 0-12 : Location of STP and CETPs in Mundra SEZ



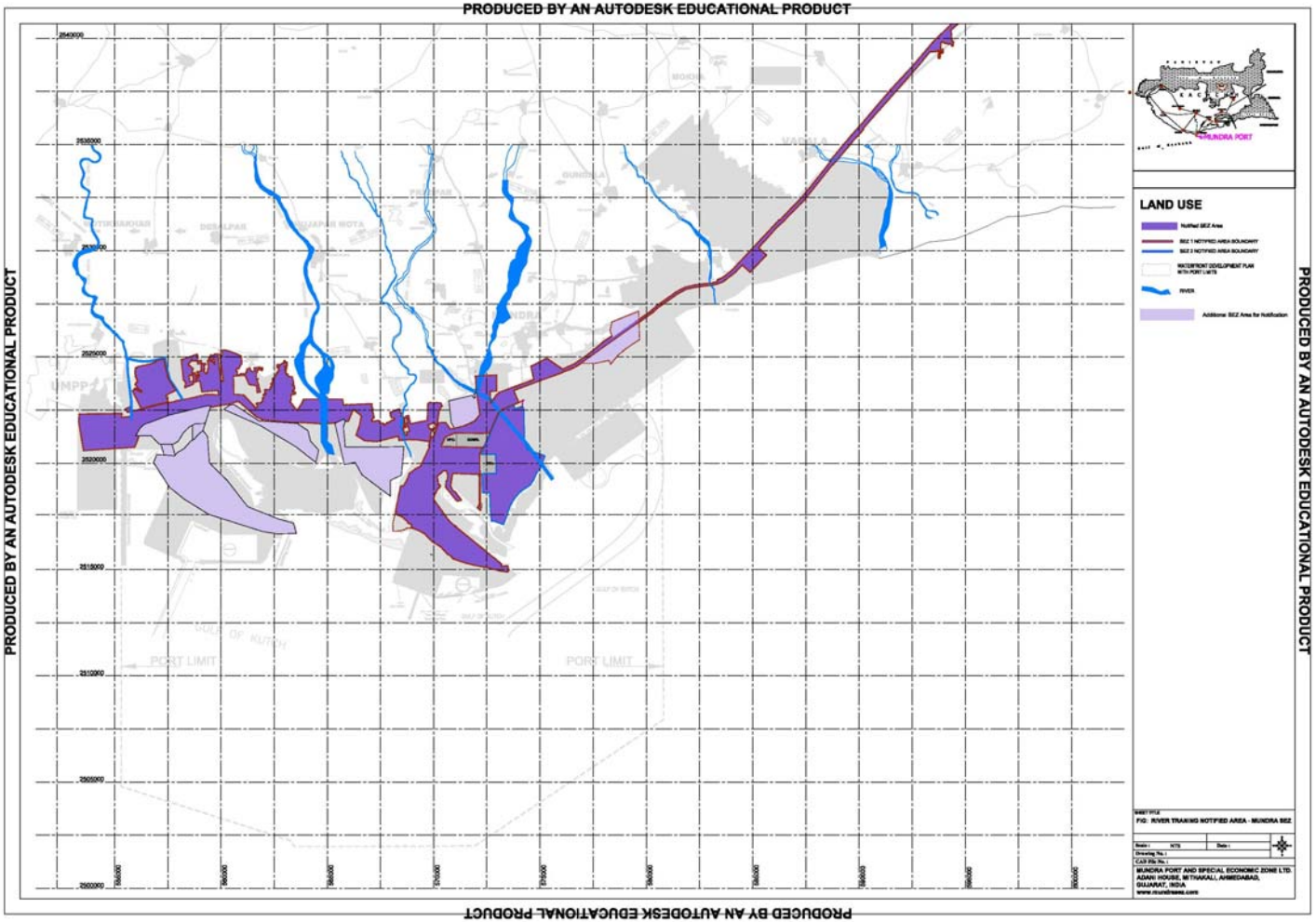
2.4.3 River Training Works

One of main topographical characteristic of the MSEZ site is the presence of numerous Water Bodies, Creeks, Drainage Channels, etc. They forms an integral part of the Development Plan, and proper planning interventions are done for efficient and effective training of identified Water Bodies, Creeks, Drainage Channels, etc and also propose suitable flood diversion measures in order to prevent the run off water from running over the port area of interest and its connecting transportation infrastructure. There may be a possibility of submergence of village's up-stream of port area due to raising of area to + 7.5 m, in case the storm water is not properly diverted/passed to sea. The existing railway line has been maintained +9m. The area in general is being reclaimed to +7.5m.

The composite plan of area, natural drainage channel system passing through the area and corresponding catchment area is analysed. A number of rivers originating from Rann of Kachchh are falling in the Gulf in this area. This indicates that the area receives rainfall during monsoon period. Five main river systems i.e. Phot Nadi, Bhukhi Nadi, Nagmati Nadi, Khari Nadi, Mithi Nadi are passing through the area. These rivers bifurcate in to number of streamlets in the project area located on north side of the existing railway line. In fact, railway line causes obstruction to flow, thereby reducing energy slope, which resulted in to formation of number of stream lets. However, it may be noticed that they are again joining back, before meeting the sea through Mundra creek. NH-8A is located 8 km upstream of project area. The channels on downstream side in the Gulf through tidal flat can be demarcated up to +2.0 m (i.e. MSL). Hence, in-depth survey and study is required to be carried for the zone d/s of NH-8 and bounded by the two-river system.

Further it shows that there exist dams on each river. The design discharges for these dams are very much important for improving the channel. The hydrological study for the catchment area d/s of the dams would be needed to estimate the total run off.

Fig2-9 Layout on River Training



Study of Catchment Areas

- Identification of Catchment Area for area which is the area of interest in Mundra port identified for Development.
- Study the pattern of Run-off from the Catchment Areas to the Creek & Water Body in port area.
- Assess the probability of this Run-off from the Catchment Areas flooding the areas in port.
- Study the existing rivers, natural drainage channels etc. in the Catchment Areas and suggest remedial measures if required for modifications OR training of these rivers, natural drainage and assess the feasibility of construction of artificial ponds or artificial drainage channels within the Catchment Areas.
- Estimation of water depths in the rivers during low flood levels and high flood levels.
- Morphological Studies to assess the behavior of rivers both during 'Monsoon' and during 'Out of Monsoon'.
- Study & analysis of historical data for the following for past 50 years :-
    - Flood discharges and water levels in the rivers and natural drainage channels
    - Rainfall run-off data
    - Maximum Rainfall & Maximum Precipitation
    - Floods for differed return periods
- Estimation of probable maximum floods within the Catchment and it's surrounding areas.
- Through hydrologic and hydraulic analysis, assess flood routing and flood forecasting for the Catchment Areas of port.
- Prepare mathematical model for rainfall run-off studies within the identified Catchment Areas.
- Study on various alternative options for diversion of natural drainage channels OR developing additional discharge channels for draining water from the Catchment Areas through port area into the sea in order to reduce the burden on the identified Water Body and Creek.
- Study and propose various methods for development and construction of various check-dams along the rivers and natural drainage channels thereby

creating artificial barriers and thus reducing the quantum of discharge flowing into the Water Body and Creek identified in the port area or even interlinking of rivers and streams in the project area

- Study the option of building large water storage in the project area which can help in diverting the flood on one hand, and also act as fresh water storage on the other hand to support the water supply system in the project area.

Studies on Water Body and Creek

- Assess the total discharge and carrying capacity of the Water Body & Creek within the project area.
- Carry out Basic Engineering for the following for the Water Body and Creek identified in project area :-
    - Optimum width, depth, gradient and side slopes
    - Determining various Hydraulic Design parameters i.e. velocities, discharge intensity, discharge distribution
    - Slope Stability Analysis
    - Slope Protection Measures
    - Location of Flood Embankments & Guide Bunds
    - Design of appurtenant works i.e. Flood Embankments & Guide Bunds
    - Estimation of Sedimentation Profiles within the Water Body & Creek
    - Estimating life of Water Body
    - Determining availability of dependable flushing discharges
    - Estimating rejuvenation of reservoir live storage capacity by flushing
    - Optimization of flushing discharge and flushing duration and frequency of flushing
    - Suggest gate regulation for effective flushing

Studies on Tidal Regulator / Wier

- Determining layout and orientation of the Tidal Regulator / Wier at the mouth of Creek identified within the project area
- Carry out Basic Engineering for design of Tidal Regulator / Wier
- Estimation of afflux, finalizing crest levels of spillway and under sluices
- Estimation of discharging capacity by determining coefficient of discharge

Approach and Methodology

- Comprehensive Reconnaissance

  A team of experts specialized in similar kind of work shall visit the site to assess the inadequacy of the drainage and assess the need of improvement specially to prevent near by areas from inundation in case of floods.

- Preliminary Studies/Assessment

  Preliminary assessment of system improvement studies will be carried out with the help of Survey of India (SOI) Topo-sheets, rainfall data, Tidal data (from existing Mundra Port), NHO - Hydrographic Chart, NRSA - Satellite Imageries and available topographical details to suggest the prima facie remedial measures to be undertaken in the area within 2 to 3 months time.

- Topographic Survey

  Topographic survey of the land will be carried out to provide the basic input for the system design and mathematical model. This survey shall also cover the details of availability of land on both sides of the streams together with their levels and possible diversion with the Mundra's land.

- Hydrographic Survey

  Hydrographic survey for each of the streams/rivers from inlet to outlet and cross sections at closer interval will be taken to provide the basic input for the system design and mathematical model study. Hydrographic surveys shall determine the tidal reaches of these two streams i.e. the tidal extents during the low tide / high tide (on landward side), desiltation requirements at the outlet (tidal reaches). A naval hydrographic chart of the area shall also be referred.

- Real Time Data Collection

  Real time data will be collected on tidal height level at outlet and rainfall to provide the basic input for calibration of the model. The high flood marks observed during the recent floods could be collected for calibration of model. These fixed marks as available at the Mundra area shall be collected.

- Mathematical Model Studies

  The streams and rivers discharging in the sea through Mundra area shall be modeled. The tidal waters enter these streams and rivers through these creeks to certain extent. The flow of upland discharge during rainy season through these streams will be influenced by the tidal water levels during that period. Therefore, a mathematical model capable of predicting unsteady flows with tide as downstream boundary and flood discharge as upstream boundary will be required to simulate flows in these streams. The software CHARIMA / MIKE-11 or equivalent having these capabilities will be utilized to develop a 1 dimensional mathematical model to simulate the flows in these streams under consideration. The model will cover the channel beyond tidal limit on upstream side and extend up to the mouth of the main creeks in which these rivers are joining. Tidal water levels during spring / neap tide will be given as downstream boundary conditions. The flood hydrographs estimated on the basis of the 24 hour maximum rainfall for different return periods will be used as upstream boundary conditions. Different combinations of these boundary conditions will be studied to predict the worst flood scenario in these streams. Based on the results of these studies and the topographical map of the catchment area, probable flood zones and extent of flooding could be indicated.
- Calibration would be done using the real time data. The tide height during this period corresponding to the time of discharge would also be taken into account during calibration of the model.

Structural Measures

Based on the output of model studies structural measures will be planned, designed and cost estimate will be provided.

Need for Non-Structural Measures

Based on the results of reconnaissance, survey data and model studies the structural measures for accommodating the flood discharge problem due to drainage congestion will be assessed critically. If these measures are not sufficient to cater the need of expectations, we will be suggesting the non-

structural measures for which subsequent studies will have to be undertaken and proposal will be submitted later.

Table 0-13 Time frame of the Study

Phase-I	Reconnaissance by experts, collection of primary data/reports and primary study to submit interim inception report for the improvement of drains in these streams for catering to the flood discharge	Completed
Phase-II	Hydrographic /Topographic Surveys, Geo-technical Investigations, Development of mathematical models, design, cost estimate, submission of final report	7 months time

2.4.4 Industrial Wastewater Management System

To meet the waste water disposal standards, Mundra SEZ envisages developing 67 MLD (50 MLD and 17 MLD) Common Effluent Treatment Plant (CETP) facilities. The CETP will be built in modular and expandable manner. Location of CETP is depicted in Fig. 2-10.

Technology

After review various technology, Mundra SEZ has chosen conventional treatment scheme of Activated Sludge Process to implement this project.

To monitor quality of effluent discharge from the various industries in the Special Economic Zone.

Treatment

At present, both effluent and sewage are proposed will be treated together and are collected in the equalization tanks after passing through screen chamber. The effluent is then pumped to common Effluent treatment plant to bring the effluent to the accepted level for disposal in marine coastal areas or into the sea.

- Description of the Plant
- Effluent Characteristics
- Treatment Scheme
- Technical features of the plant
- Layout of the plant

Effluent Characteristics

It is proposed to combine treatment of the wastewater from the industries of Mundra Special Economic Zone and sewage from social infrastructure. The expected effluent characteristics and those required after the treatment as per the guide lines of Gujarat Pollution Control Board are as follows:

Table 0-14 : Characteristics of Raw Effluent for CETP

Sr. No.	Parameter	Unit	Value
1	PH	mg/lit	6.5-8.5
2	BOD	mg/lit	100
3	COD	mg/lit	250
4	Suspended Soilds	mg/lit	100
5	Oil and Grease	mg/lit	20
6	Cyanide	mg/lit	0.2
7	Phenolic Compound	mg/lit	5
8	Ammonical Nitrogen	mg/lit	50
9	Residual Chlorine	mg/lit	0.5

Treatment Scheme

Following is the list of units involved in the proposed common effluent Treatment Plant.

- Screen Channel with Mechanical Bar Screen.
- Equalization Tanks – 2 Nos.
- Neutralization Tanks – 2 Nos.
- Primary Settling tank with Mechanical sludge scrapper and scum removal.
- Sludge sump cum collection tank with pumps.(Dry well and wet well type)

- Aeration Tank -1, with mechanical surface aerators (1st stage).
- Secondary Settling tank with mechanical Sludge scrapper (1st stage).
- Sludge sump with pumps (1st stage). (Dry well and wet well type)
- Aeration Tank – 2, with mechanical surface aerators (2nd stage).
- Secondary Settling tank with mechanical Sludge scrapper (2nd stage).
- Sludge sump with pumps (2nd stage). (Dry well and wet well type)
- Aeration Tank – 3, with mechanical surface aerators (3rd stage optional).
- Final Settling tank with mechanical sludge scrapper(3rd stage optional)
- Sludge sump with pumps (3rd stage optional). (Dry well and wet well type)
- Sludge drying Platforms.
- Decanters – 2 Nos.
- Intermediate collection Tank.
- Chlorination Plant
- Guard Pond.
- Dried Sludge storage facility.

Table 0-15: Treated Effluent Characteristics of CETP

Sr. No.	Parameter	Permissible Value for disposal into marine coastal areas	Permissible Value for on land irrigation
1	BOD	100 mg/L	100 mg/L
2	COD	250 mg/L	-
3	pH	5.5 – 8.5	5.5 – 9.0
4	SS	100 mg/L	200 mg/L
5	Oil & Grease	20 mg/L	10 mg/L
6	TDS	-	2100 mg/L

2.4.5 Solid Waste Management System

Solid waste can be classified into two main categories, namely municipal solid waste and Industrial waste. Solid waste shall be sorted out for recycling and non-recycling material.

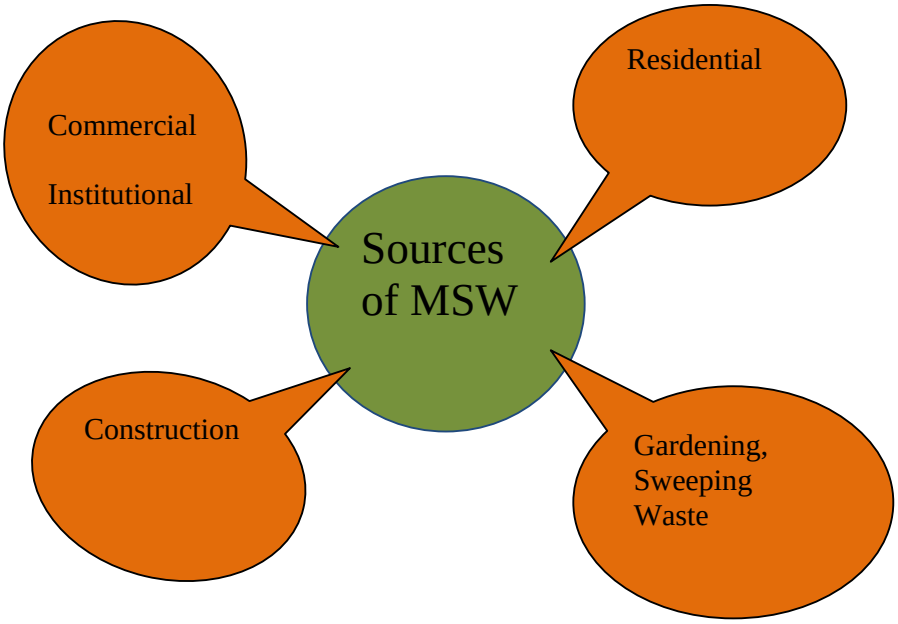
Recycling turns materials that would otherwise become waste into valuable resources. Materials like glass, metal, plastics and paper are collected, separated and sent to facilities that can process these into new material.

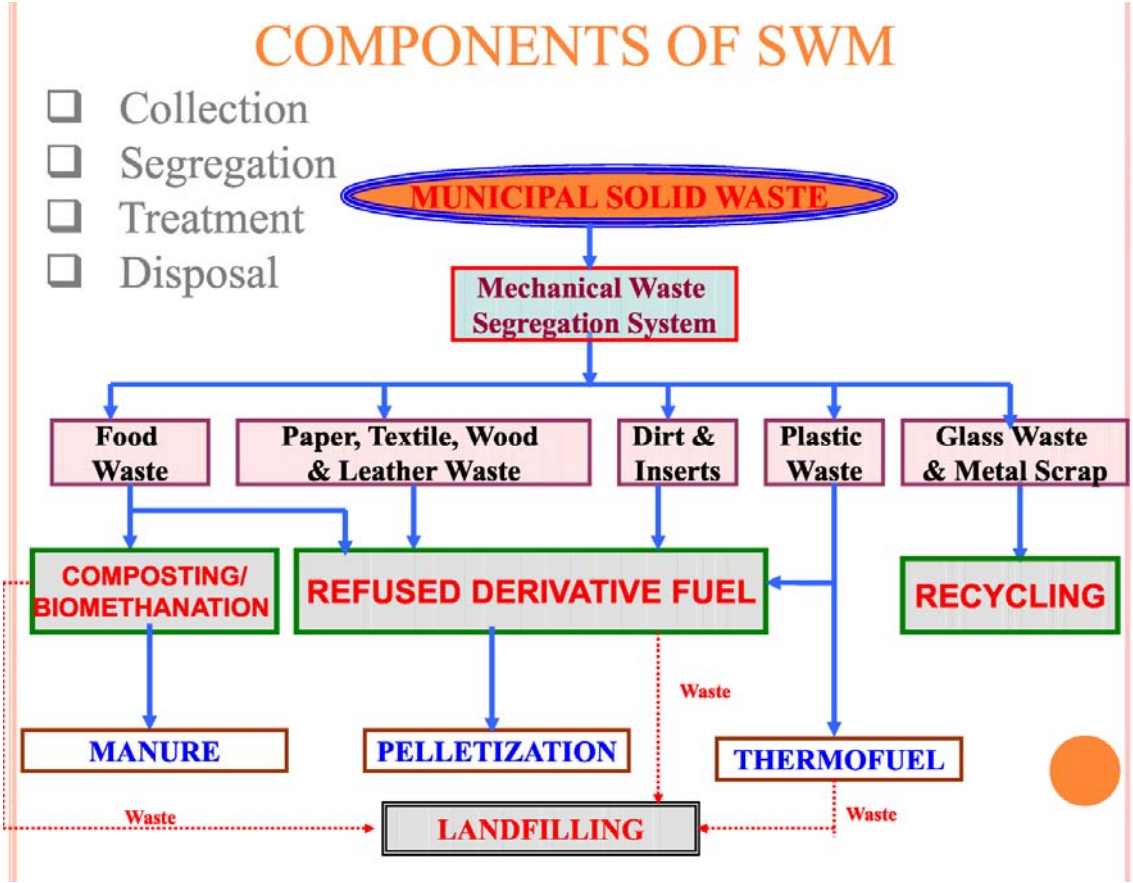
All biodegradable municipal solid waste shall be mixed with sewage sludge to undergo composting to produce saleable fertilizer. Composting is another form of recycling. Composting is the controlled biological decomposition of organic matter into humus. Composting is nature's way of recycling organic waste into new soil, which can be used in vegetable and flower gardens, landscaping and many other applications.

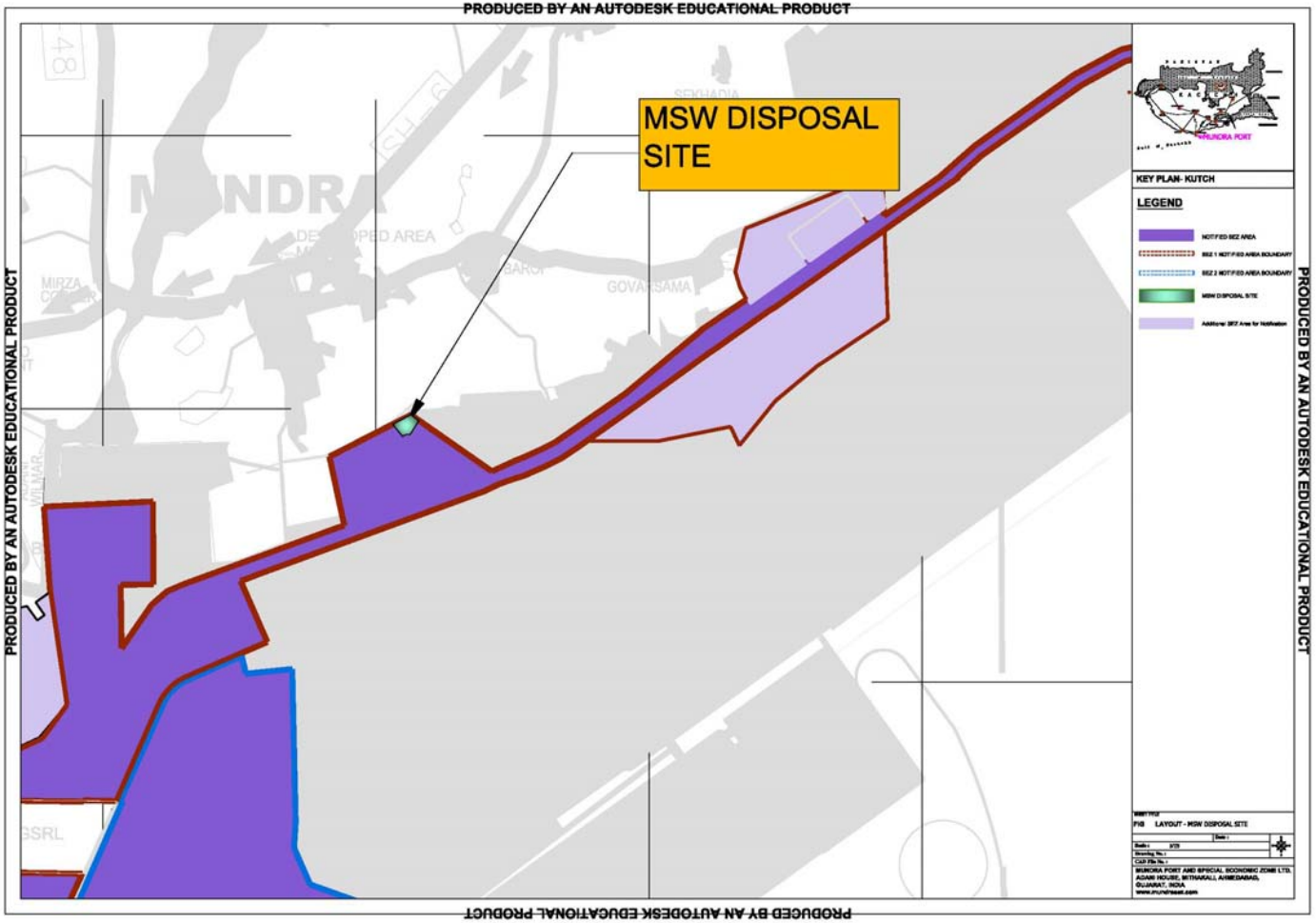
Non-biodegradable waste will be brought together with the industrial waste to the landfill for ultimate disposal. Although source reduction, reused, recycling and composting can divert large portions of municipal solid waste from disposal, non-biodegradable waste shall be collected in landfills. Landfills shall be well engineered facilities that are located, designed, operated, monitored, closed, cared for after closure, cleaned up when necessary to protect human health and the environment.

In a modern landfill, refuse is separated component, compacted layers covered by a layer of clean earth. Pollution of surface water and ground water is minimized by lining and contouring the fill, compacting and planting the upper most cover layer, diverting drainage and selecting proper soil in sites not subject to flooding or high ground water levels. In addition, these new landfills can collect potentially harmful land fill gas emissions and convert the gas into energy.

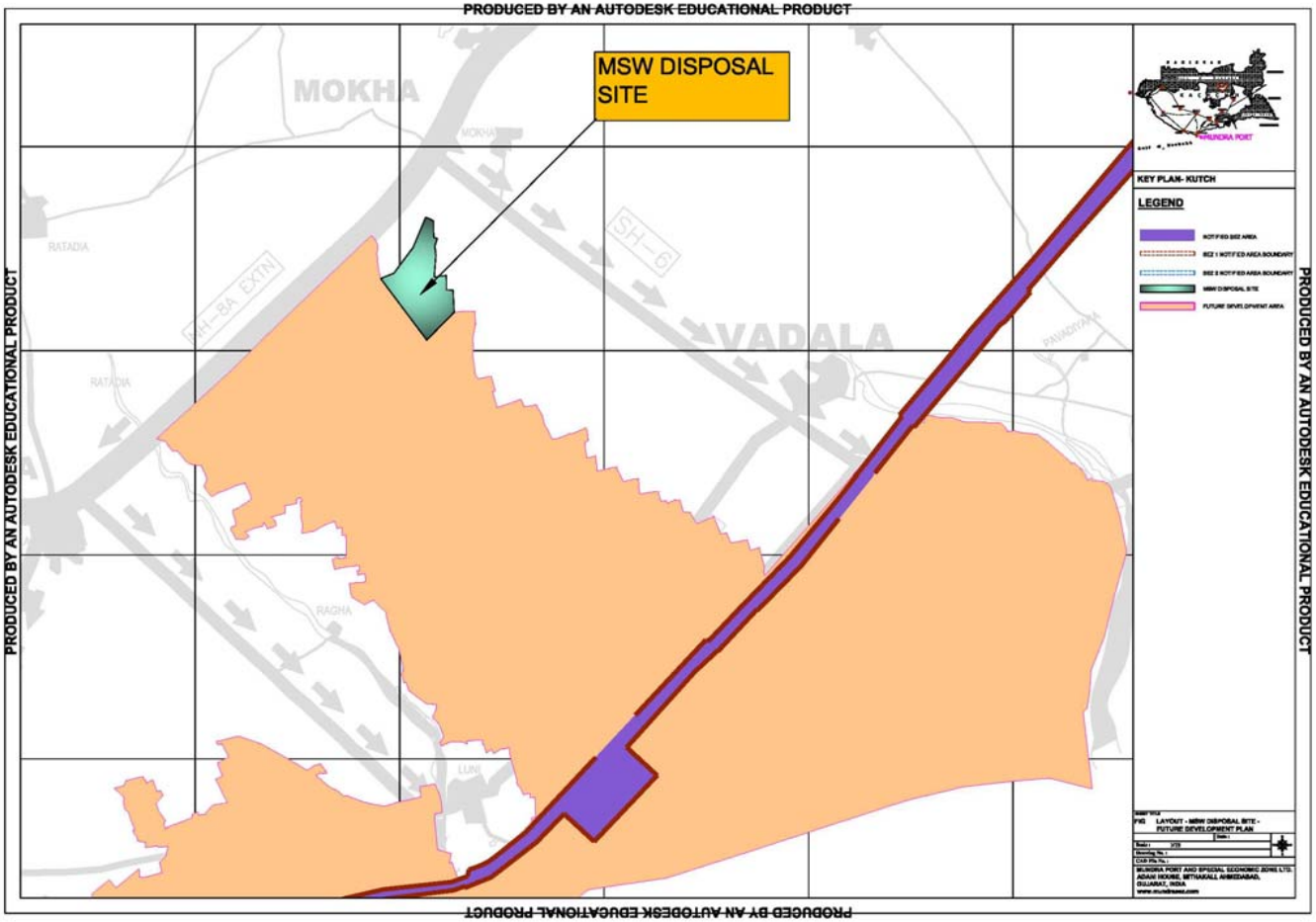
To reduce waste volume, private operators can implement a controlled burning process called combustion or incineration. A variety of pollution control technologies significantly reduce the gases emitted into the air. Among these are scrubbers – devices that use a liquid spray to neutralize acid gases and filters, which remove tiny ash particles.


Residential
Commercial
Institutional
Sources of MSW
Construction
Gardening, Sweeping Waste


COMPONENTS OF SWM
Collection
Segregation
Treatment
Disposal
MUNICIPAL SOLID WASTE
Mechanical Waste Segregation System
Food Waste
Paper, Textile, Wood & Leather Waste
Dirt & Inserts
Plastic Waste
Glass Waste & Metal Scrap
COMPOSTING/ BIOMETHANATION
REFUSED DERIVATIVE FUEL
RECYCLING
Waste
MANURE
PELLETIZATION
THERMOFUEL
Waste
Waste
LANDFILLING


PRODUCED BY AN AUTODESK EDUCATIONAL PRODUCT
MSW DISPOSAL SITE
KEY PLAN- KUTCH
LEGEND
LAYOUT - MSW DISPOSAL SITE
PRODUCED BY AN AUTODESK EDUCATIONAL PRODUCT

The MSW sites for first phase and final phases have been identified & shown:



2.4.5.1 Central Waste Management Facility

Solid waste needs to be put through a number of processing operations before it can be handled for formal disposal or re-use. Emphasis of the processes to is to reduce volume, increase homogenization, reduce moisture and convert most of the material to a usable form so that burden on land filling is reduced.

Site selection of the Central Waste Management Facility has been regulated by the following considerations as specified in the MSW (M&H) Rules, 2000.

- The (landfill) site shall be large enough to last for 20-25 years.
- The (landfill) site shall be away from habitation clusters, forest areas, water bodies, monuments, National Parks, Wetlands and places of important cultural, historical or religious interest.
- A buffer zone of no-development shall be maintained around (landfill) site and shall be incorporated in the Town Planning Department's land-use plans.
- (Landfill) site shall be away from airport including airbase. Necessary approval of airport or airbase authorities prior to the setting up of the landfill site shall be obtained depending upon the site location.

Considering the long term economic viability and gradual future developments with respect to social & commercial establishments along with Industrial Units within the SEZ, the proposed Central Waste Management Facility will be designed for 35 years, at a design waste disposal rate of 40 MT/day. A deciated MSW area is designated for the first and the final phase with a total area of ~62 ha of land.

Few siting options have been worked out basis criteria given in the MSW (M&H) Rules, 2000. The sites have been considered p away from place of activity and per distance criteria from various important places including habitation. All the suggested sites are away from residential areas/town in the region, from natural places such as Forest areas, water bodies, etc.

A buffer zone of 150 m will be created around the Central Waste Management Site, which will be incorporated in the land use plans of MPSEZ Planning Department.

Mundra SEZ has developed an Aerodrome at the South-Eastern boundary of the SEZ. Site options have been made considering norms related to the distance from airport

or airbase. It is proposed to set up the landfill site as far as possible to protect the aircrafts from bird hits.

For solid waste disposal 62 Ha of land is identified in North East Corner of the Mundr a SEZ at Mokha. (Conceptual Design Report Attached)

2.4.6 Noise Management System

Mundra SEZ Ltd. shall provide and operate only infrastructure facilities, which are not noise producing units. However, in case of emergency, DG sets shall be operated. Hence, they shall be installed in acoustic enclosures, to minimize noise pollution.

In case the industries to be set up in Mundra SEZ have any noise generating equipment / machinery, then the industry shall have to provide suitable acoustic hoods / enclosures, such that the noise level in the vicinity shall conform to the national noise quality criteria, stipulated by Govt. of India vide Gazette Notification dated 14.2.2000 are presented in Table 2-16.

Table 0-16 : National Noise Quality Criteria

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

Note : Day time is from 06.00 AM to 10.00 PM and Night time from 10.00 PM to 06.00 AM.

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

2.4.7 Environmental Friendly Measures at Mundra SEZ

RIVER TRAINING WORKS

One of main topographical characteristic of the MSEZ site is the presence of numerous Water Bodies, Creeks, Drainage Channels, etc. They forms an integral part of the Development Plan, and proper planning interventions are done for efficient and effective training of identified Water Bodies, Creeks, Drainage Channels, etc and

also propose suitable flood diversion measures in order to prevent the run off water from running over the port area of interest and its connecting transportation infrastructure.

DEVELOPMENT OF GREEN BELT

Land Zoning & Green Cover:

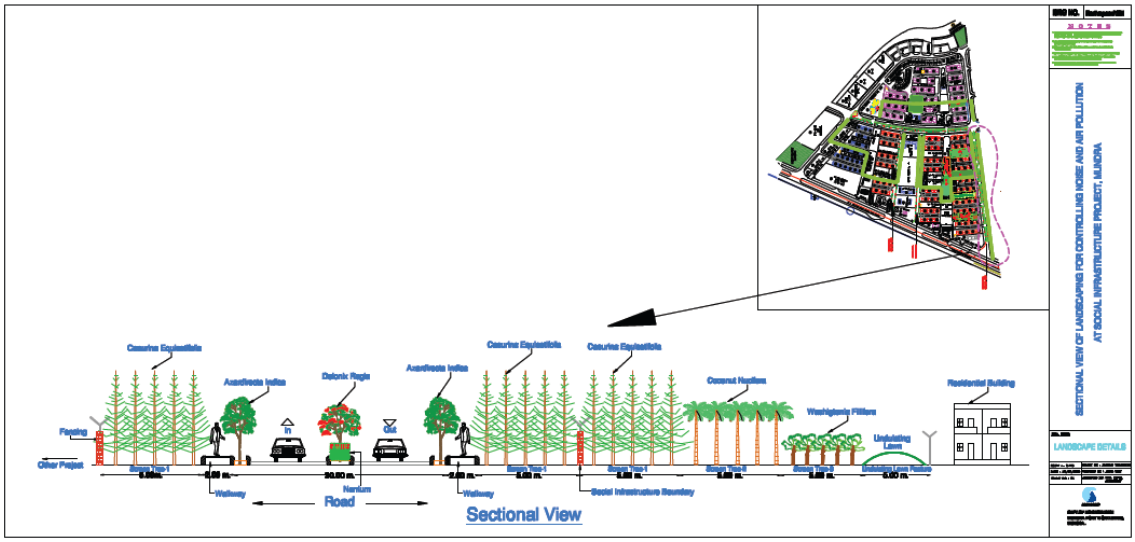
Following from the conceptual framework, the land use plan has been developed in the form of interconnected yet largely independent zones.

The central zone constitutes a large processing and trading hub beginning with CBD and multimodal transport interchange in the north and culminating with the port in the south. Apart from its focal geographical location within the context of the SEZ area, the zone, given its adjacency to the port, attracts attention as the first phase of development. The existing Mundra town and the port are seen as the prime drivers for the start-up.

The western zone constitutes of well-proportioned pockets of port and industrial development planned over the matrix offered by seemingly distinct land parcels, divided by streams and creeks. The western zone, with vast stretches of sprawling mudflats offers unique visual characteristics. A large piece of land is allocated at the western end to the proposed power plant.

The eastern zone is a well-derived unit of all landuses, connected with the port. An Airstrip and Air Cargo Hub has been planned near the rail corridor. Down to the Air Cargo Hub a Sea Port is planned.

The Mundra SEZ throughout will maintain a green cover with an approx. area of 430ha of land. The first phase has a dedicated 13% of area which is distributed as a part of Green Belt Development, Water Bodies & Open Spaces.



Schematic Sectoral View of Green Cover for SI

Plantation \Landscaping for Controlling Noise & Air Pollution at Social Infrastructure, By Dept.of Horticulture, MPSEZL, Mundra

Introduction:

The Kutch region has desert terrain conditions with Saline sandy soil, highly saline water (TDS 35000-45000) and with strong wind conditions. So to improve climatic condition and to change the environment MPSEZ Ltd. has adopted a strategy to develop an eco-friendly port, Social Infrastructure as well as greeneries across the Gujarat coastal area. For that purpose, MP&SEZ Ltd. has developed its own "Dept. of Horticulture "and is taking better measures/steps to improve environment i.e. Implementation of Green belt surrounding project area to absorb air and water pollutants, arrest noise and soil erosion as well as creates favorable climate and aesthetic conditions.

Planning of Landscape\Green zone by Dept. of Horticulture:

Dept.of Horticulture, MPSEZL, Mundra is always consider following criteria While planning of each Landscape \Green zone.

1. To minimize\control the Noise & air pollution by planting of dense Screen tree as per desert principal.
2. To minimize\control the Noise & air pollution by developing sloppy\undulating lawn feature in landscape.

3. To Control Soil Erosion by planting of dense saline resistant Ground cover.
4. To minimize water requirement in irrigation by using Israel Hi-tech mechanized irrigation.
5. To save environment by utilizing treated STP\CETP water in irrigation in green zone development.
6. To develop green zone in 30000-45000 TDS Sea water level by using saline treated plants by Iso-Dutch Technology.
7. To use sloppy landscape for easily use\help in rain water harvesting collection without damage to landscape.

Planning of Landscape at Social Infrastructure for controlling noise & air pollution

1. **First Screen Tree** : Selected Casuarina equisetifolia as a dense Screen tree from ground level to upwards .we has taken 5 row of screen tree with pl. to pl. distance is only 1m along the both side of main traffic road ,in front of social infrastructure.
Also, we has taken again 5 row of screen tree with pl. to pl. distance is only 1m along the inside of all side boundary , means there are taken 10 row of Casuarina equisetifolia as a dense Screen tree from ground level to upwards (10m dense green zone).

2. **Second Screen Tree**: Selected Cocus nucifera as a dense second Screen tree from ground stem to upwards dense leafs .we has taken 5 row of screen tree with pl. to pl. distance is only 3m along the inside all boundary.

3. **Third base Screen Tree**: Selected Washingtonia filifera as a dense third base Screen tree from ground level to till 2m .we has taken 2 row of this screen tree with pl. to pl. distance is only 3m along the inside all boundary.

4. **Fourth base undulating landscape feature** : Selected undulating landscape feature as a fourth base of landscape feature from ground level to till 2m as a undulating lawn for controlling the base noise\air pollution along the inside all boundary

Plantation \Landscaping for Controlling Noise & Air Pollution at CETP, By Dept.of Horticulture, MPSEZL, Mundra

Introduction:

The Kutch region has desert terrain conditions with Saline sandy soil, highly saline water (TDS 35000-45000) and with strong wind conditions. So to improve climatic condition and to change the environment MPSEZ Ltd. has adopted a strategy to develop an eco-friendly port, Social Infrastructure,CETP as well as greeneries across the Gujarat coastal area. For that purpose, MP&SEZ Ltd. has developed its own "Dept. of Horticulture "and is taking better measures/steps to improve environment i.e. Implementation of Green belt surrounding project area to absorb air and water pollutants, arrest noise and soil erosion as well as creates favorable climate and aesthetic conditions.

Planning of Landscape\Green zone by Dept. of Horticulture:

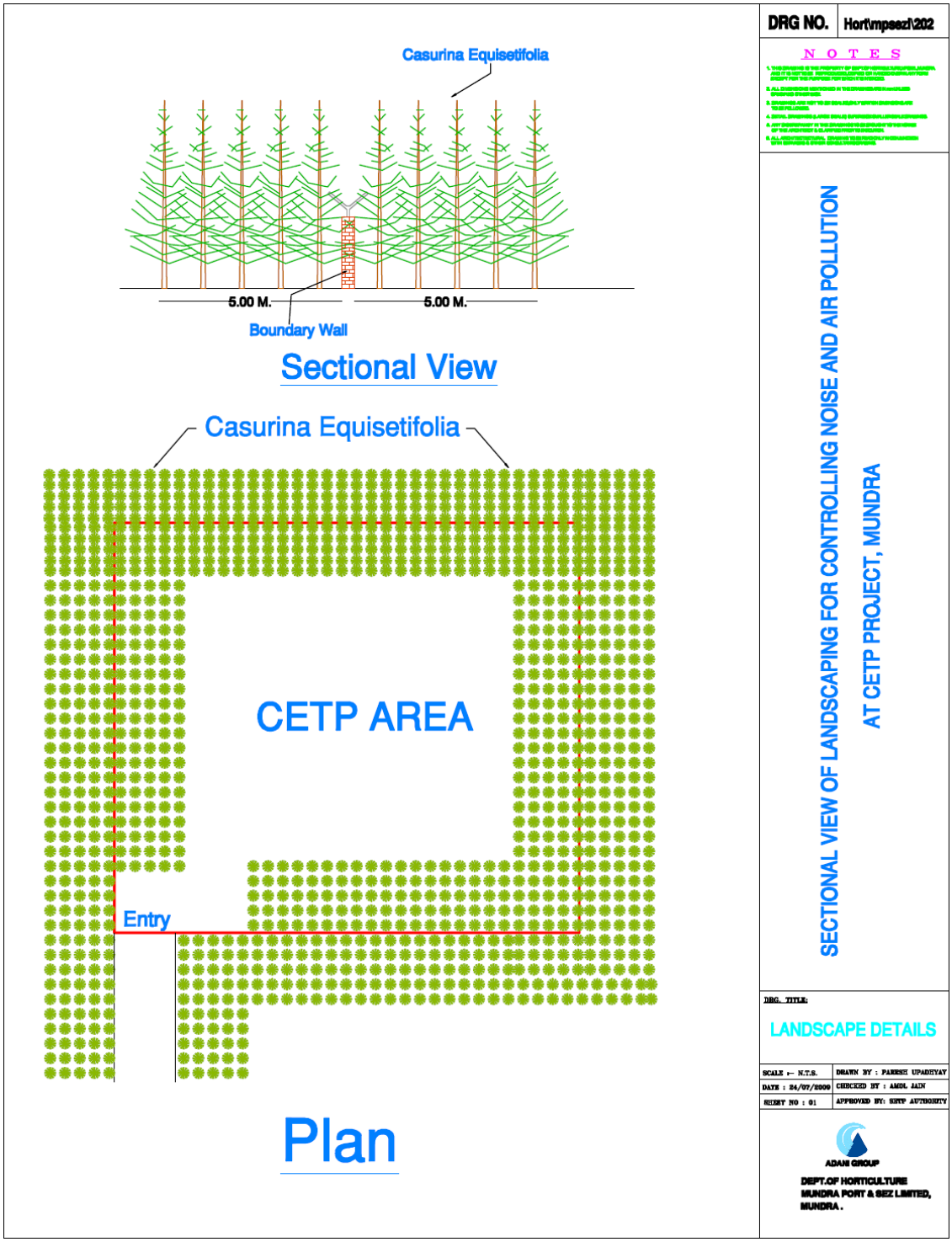
Dept.of Horticulture, MPSEZL, Mundra is always consider following criteria While planning of each Landscape \Green zone.

5. To minimize\control the Noise & air pollution by planting of dense Screen tree as per desert principal.
6. To minimize\control the Noise & air pollution by developing sloppy\undulating lawn feature in landscape.
7. To Control Soil Erosion by planting of dense saline resistant Ground cover.
8. To minimize water requirement in irrigation by using Israel Hi-tech mechanized irrigation.
9. To save environment by utilizing treated STP\CETP water in irrigation in green zone development.
10. To develop green zone in 30000-45000 TDS Sea water level by using saline treated plants by Iso-Dutch Technology.
11. To use sloppy landscape for easily use\help in rain water harvesting collection without damage to landscape.

Planning of Landscape at CETP for controlling noise & air pollution

1. **First Screen Tree** : Selected Casuarina equisetifolia as a dense Screen tree from ground level to upwards .we has taken 5 row of screen tree with pl. to pl. distance is only 1m along the inside of boundary wall as per desert principal.

Also, we has taken again 5 row of screen tree with pl. to pl. distance is only 1m along the inside of all side boundary , means there are taken 10 row of Casuarina equisetifolia as a dense Screen tree from ground level to upwards (10m dense green zone) for controlling noise and air pollution.



Proposed Green Cover -Landscaping for Noise & Air Pollution

DIRECTORATE OF RESEARCH
Sardarkrushinagar Dantiwada Agricultural University
Sardarkrushinagar-385 506

Dr. S.B.S. Tikka
Director of Research & Dean
P.G. Studies

Phone No- 02748-278233
Fax No. 02748-278433
Mobile No. 9824764800
e-mail : dr@sdau.edu.in
sbstikka@yahoo.com

No: SDAU/DR/PSDR / 1720-21/09 Date: 31-03-09

To,
Mundra Port and special Economic Zone Ltd.,
Adani House,
Post Box No.1
Mundra-Kachchh -370421

Sub: Information regarding the soil Structure and texture of Mundra SEZ area & CETP treated water suitability in Green Zone Development (Horticulture Development purpose)

Ref: Your letter No. Nil dated 9th March, 2009

With reference to above, the soil sample submitted by you is analysed in Soil Science Laboratory, C.P.College of Agriculture, S.D.Agricultural University, Sardarkrushinagar.

As per the soil analysis (Detailed report is enclosed), the sample is sandy in nature with less organic matter, poor water holding capacity and high infiltration rate. For raising the vegetation frequent watering, preferably with micro irrigation system is advisable with high dose of fertilizers. Due to poor water holding capacity and high infiltration rate the possibility of water stagnation is very remote.

As per the suggestion and opinion of Horticulturist at Date palm Research Station, Mundra, the sewage water, with the pH, mentioned by you can be utilized for irrigation and the species mentioned by you can be well grown in the soil with the sewage water with proper management. In certain cases the growth may be poor but can be grown with addition of organic manure , bone meal, clay, humus and lime. The soil pH can be improved from 5 to 7 by addition of Gypsum @ of about 2 ton/acre. In addition to the species mentioned by you following species can also be tried.

A.FLOWERING TREE SPECIES:

1.***Callistemon lanceolatus 2.Bauhinia variegate 3.Tamarindus indica 4.Phoenix sylvestris 5.Phoeenis dactylifera 6.Cassia fistula 7.Pongamia pinnata***

B.SHRUBS:

1.Tecoma sp.2.Thevetia nerifolia 3.Lantana,4.Duranta

DIRECTOR OF RESEARCH & DEAN P.G.STUDIES

Cc to: Associate Research Scientist (Hort); Date Palm Res. Station, Mundra

DEPT. OF AGRICULTURAL CHEMISTRY AND SOIL SCIENCE
C. P. COLLEGE OF AGRICULTURE
S D AGRICULTURAL UNIVERSITY
SARDARKRUSHINAGAR -385 506

No: SDAU/CPCA/Ag. Chem./ /2009 Date: 26/03/2009

3206

To,
The Associate Research Scientist (Horticulture),
Date Palm Research Station,
S. D. Agricultural University,
Mundra – Kachchh –370 421

Sub: Analysis report of soil sample...

Ref: Your Office Letter No. SDAU/ARS/DPRS/Tech/298/2009 dated: 12-03-09

In connection to above subject and reference, the analysis report of soil sample sand by you is as under:

Sr. No.	Parameters	Value
1	pH (1 : 2.5 : : soil : water ratio	6.85 (Normal)
2	Electrical Conductivity (dSm^{-1})	0.27 (Normal)
3	Bulk density (g/cc)	1.57
4	Soil structure	Structure less (loose grain structure)
	Sand (%)	89.50
	Silt (%)	5.75
	Clay (%)	4.75
5	Texture	Sandy
6	Organic Carbon (%)	0.056 (Low)
7	Available P_2O_5 (kg/ha)	9.48 (Low)
8	Available K_2O (Kg/ha)	58.8 (Low)

The soil sample has sandy texture, due to higher amount of sand, it has low water and nutrient holding capacity and high infiltration rate (permeability) so it has no chance to get water stagnation in this soil. But for growing crop, it required higher amount of organic manures and chemical fertilizers along with frequent and light irrigation. Micro Irrigation system may be followed if water quality is permitted.

Thanking you.

PROFESSOR AND HEAD

2.4.8 Manpower Requirement

During the construction and for operation of the Mundra SEZ, the estimated man power requirement shall be as follows in Table 2-17

Population Projection and Workforce Distribution

The population density and the work force for MSEZ have been computed on the following basis

- Planning standards adopted by the Bureau of Public Enterprises for development of Industrial townships and similar other areas.
- Workers population has been taken on the basis of the study conducted by the Price Water House Coopers (PWC) for similar developments.
- UDPFI (Urban Development Plan Formulation and Implementation) guidelines for arriving at the workforce, tertiary force, and the Participation Rate (PR) to work out quantum of land for different land-use.

Table 0-17: Manpower Requirement

▪ **Total Industrial Area (Ha)**	6068
▪ **Number of Industrial Worker @ 20-25 workers / Ha.** ▪ **Number of Tertiary Workers @ 1.6 workers/industrial worker** ▪ **Total Workers**	1,21,360 1,94,176 3,15,536 (Say 3,00,000)
▪ **Number of Single Workers @ 20 % of total workforce** ▪ **Married Workers**	60,000 2,40,000
▪ **Population generated based on 40 % Participation Rate** ▪ **Single Workers** ▪ **Total Population**	6,00,000 60,000 **6,60,000**
▪ **Population for which Residential Accommodation is to be provided within the SEZ** ▪ **Population to be accommodated in settlements around the SEZ**	**4,00,000** **2,60,000**

Population projection for Final Development

▪ **Total Industrial Area (Ha)**	2500
▪ **Number of Industrial Worker @ 20-25 workers / Ha.** ▪ **Number of Tertiary Workers @ 1.6 workers/industrial worker** ▪ **Total Workers**	50,000 80,000 1,30,000 (Say 1,00,000)
▪ **Number of Single Workers @ 20 % of total workforce** ▪ **Married Workers**	20,000 80,000
▪ **Population generated based on 40 % Participation Rate** ▪ **Single Workers** ▪ **Total Population**	2,00,000 20,000 **2,20,000**
▪ **Population for which Residential Accommodation is to be provided within the SEZ** ▪ **Population to be accommodated in settlements around the SEZ**	**10,000** **2,10,000**

Population projection for First Phase of Development

3 BASELINE ENVIRONMENTAL STATUS

Preparation of EIA needs a situation datum on which impact prediction and evaluation can be done. It is therefore, necessary to collect data about different environmental attributes that are likely to be affected due to the proposed activity, which in turn defines an existing environmental quality to serve as the baseline datum.

Baseline data are also necessary to identify environmentally significant issues prior to initiation of proposed action as well as to enumerate the critical environmental changes likely to occur due to the implementation of the project.

Here an attempt has been made to collect the information about the existing environment on eight major environmental attributes viz.

- Ambient Air Quality
- Climate and Meteorology
- Water Quality
- Noise Levels
- Soil Quality
- Ecological Status
- Socio-economic Profile
- Aesthetics

3.1 AIR ENVIRONMENT

A methodically designed Air Quality Surveillance Program (AQSP) has formed the basis to determine the impact assessment on air environment that has helped in formulating a sound EMP. The basic considerations for designing such a program included :

i. Representative selection of sampling locations primarily guided by the topography and micrometeorology of the region,
ii. Adequate sampling frequency, and
iii. Inclusion of all the major parameters.

The existing Ambient Air Quality Status (AAQS) within the study area (impact zone) was characterized through in-situ monitoring. The scope of Mundra SEZ Ltd. is limited to

providing infrastructure facilities within the Mundra SEZ and it does not involve creation of any point source of air pollution, except installation of DG sets as standby power source, to be operated intermittently in case of power failure, which shall be operated only in case of emergency. Hence, no significant impact is likely on the air environment due to Mundra SEZ's activity.

3.1.1 Reconnaissance Survey

The prime objective of this AAQ survey within the study area was to establish the existing regional background levels and baseline of air pollution status with present level of emissions from existing sources within the study area.

To assess the existing level of air quality in and around proposed Special Economic Zone (SEZ), 18 Ambient Air Quality Monitoring Stations (AAQMS) were selected primarily on the basis of prevailing meteorological conditions analyzed through past meteorological data available for study area. While selecting the AAQMS, due consideration was given to local topography as well as the other landscape features of entire 10 km radius area from proposed SEZ as per MoEF guideline for the purpose. The location of selected AAQMS is presented in Table 3-1.

Table 3-1 : Locations of Selected AAQMS

AAQMS	Location	AAQMS	Location
1	Baroi	10	Nanakapaya
2	Bhadreshwar	11	Navinal
3	Bhujpur	12	Pragpar
4	Dharub	13	Rangoli Hotel – on the way to Mundra Port
5	Gorsama	14	Siracha
6	Gundala	15	Tunda
7	Luni	16	Vadala
8	Motakapaya	17	Wandh
9	Mundra	18	Adani Wilmar Plant

Ambient Air Quality Status

Four major air pollutants i.e. Suspended Particulate Matter (SPM), Respirable Suspended Particulate Matter (RSPM), Sulphur Dioxide (SO_2) and Oxides of Nitrogen (NO_X) representing the range of emissions from proposed industrial units to be set

up in the SEZ were identified for AAQM. The samples were collected round the clock during study period. Gaseous pollutants i.e. SO_2 and NO_X were collected on 24 hourly basis by drawing air at a flow rate of 0.5 lt/min through the absorbing media, whereas, SPM was collected as 24 hour average by drawing air at a flow rate of 1.0 - 1.5 m^3/min through micro glass fibre filter paper. The standard techniques used for quantification of pollutants are highlighted in Table 3-2.

Table 3-2 : Standard Techniques used for AAQM

S. No.	Parameters	Technique	Minimum Detectable Limit
1.	Suspended Particulate Matter (SPM)	High Volume Sampling	1.0 µg/m^3
2.	Respirable Suspended Particulate Matter (RSPM)	Respirable Suspended Particulate Matter Sampler	1.0 µg/m^3
3.	Sulphur Dioxide (SO_2)	Improved West and Gaeke Method	6.0 µg/m^3
4.	Oxides of Nitrogen (NO_X)	Modified Jacob and Hochheisor Method	3.0 µg/m^3

A total of 12 weekly cycles of air quality monitoring has been undertaken for three months for 18 separate sampling stations. The status of air pollution within the study area in terms of criteria / major air pollutants i.e. SPM, RSPM, SO_2 as well as NO_X recorded during the months of April to June 2006 is presented in Tables 3-3 and 3-4.

SPM concentrations within the study area varied from 146 - 272 µg/m^3, with the highest in Gundala i.e. 272 µg/m^3 and the lowest in Navinal i.e. 146 µg/m^3. The SPM concentration at the proposed SEZ was found to be well within the permissible limits of National Ambient Air Quality Standards (NAAQS) i.e. 500 µg/m^3.

RSPM concentrations within the study area varied from 42.1 - 86.2 µg/m^3, with the highest concentration found at Gundala i.e. 86.2 µg/m^3 and the lowest in Navinal i.e. 42.1 µg/m^3. The RSPM concentration at the proposed SEZ was found to be well within the permissible limit of National Ambient Air Quality Standards (NAAQS) i.e. 150 µg/m^3.

Table 3-3 : Status of Particulate Matter in Core / Impact Zone

S. No.	Name of Sampling Stations	SPM (µg/m^3)			RSPM (µg/m^3)		
		Min	Max	Mean	Min	Max	Mean
1	Baroi	147	249	196	46.3	79.1	64.0
2	Bhadreshwar	192	259	232	62.4	84.7	75.8
3	Bhujpur	166	209	188	51.9	70.7	60.5
4	Dharub	152	203	171	48.7	64.8	54.8
5	Gorsama	152	192	169	47.3	62.5	53.1
6	Gundala	173	272	206	59.4	86.2	67.7
7	Luni	170	226	192	54.6	80.4	63.2
8	Motakapaya	163	243	184	52.3	82.9	60.0
9	Mundra	191	253	215	62.3	85.1	73.2
10	Nanakapaya	152	232	185	47.2	77.3	59.0
11	Navinal	146	184	170	42.1	56.5	51.1
12	Pragpar	152	183	171	42.7	56.2	51.0
13	Rangoli Hotel	182	219	198	59.2	80.9	68.6
14	Siracha	163	229	184	53.4	77.2	60.6
15	Tunda	174	186	180	57.4	61.2	59.3
16	Vadala	156	231	181	47.5	74.8	57.8
17	Wandh	179	179	179	64.2	64.2	64.2
18	Adani Wilmar Plant	156	231	192	49.5	72.1	58.7

SO_2 concentrations within the study area varied from 8.2 - 22.1 µg/m^3 with the highest concentration found in Baroi i.e. 22.1 µg/m^3 and the lowest in Nanakapaya i.e. 8.2 µg/m^3. The concentration of SO_2 in proposed SEZ study area was found to be well within the permissible limit of National Ambient Air Quality Standards (NAAQS) i.e. 120 µg/m^3.

NO_X concentrations within the study area varied from 9.3 - 26.4 µg/m^3 with the highest concentration found at Rangoli Hotel i.e. 26.4 µg/m^3 and lowest at Nanakapaya i.e. 9.3 µg/m^3. The concentration of NO_X in proposed SEZ study area was found to be well within the permissible limit of National Ambient Air Quality Standards (NAAQS) i.e. 120 µg/m^3.

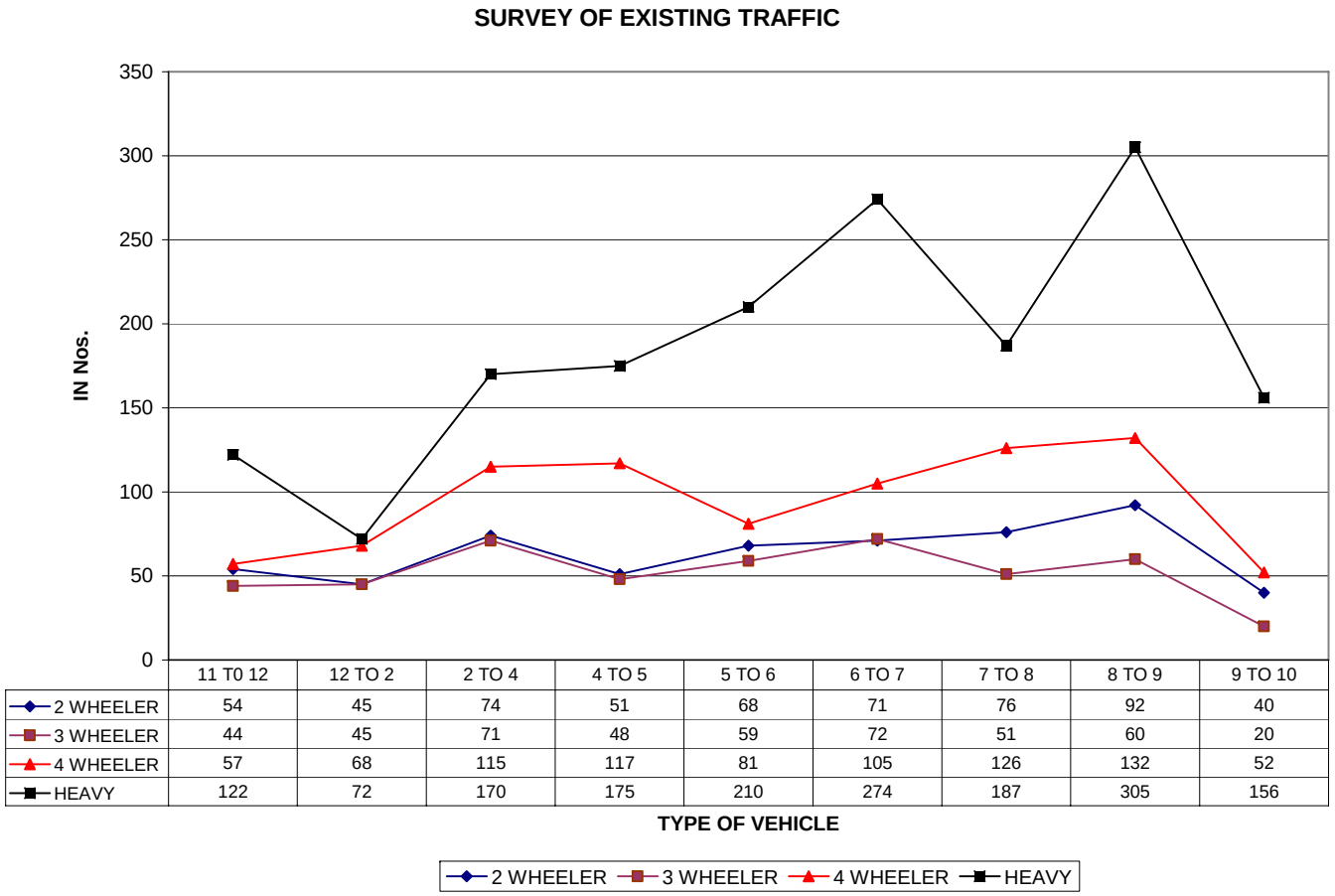
Table 3-4 : Status of Gaseous Pollutants in Core / Impact Zone

S. No.	Name of Sampling Stations	SO_2 (µg/m^3)			NO_X (µg/m^3)		
		Min	Max	Mean	Min	Max	Mean
1	Baroi	9.2	22.1	14.2	12.9	18.1	15.2
2	Bhadreshwar	11.34	16.30	13.39	15.12	20.02	17.15
3	Bhujpur	10.6	16.3	12.9	9.8	15.9	13.3
4	Dharub	10.6	19.3	14.3	11.9	18.7	15.3
5	Gorsama	8.9	15.1	12.1	12.5	16.3	14.2
6	Gundala	14.9	20.6	17.1	18.1	23.9	20.4
7	Luni	10.6	16.1	12.9	10.1	15.6	13.1
8	Motakapaya	12.4	18.1	14.2	12.4	16.3	14.4
9	Mundra	14.8	19.1	17.0	17.3	24.2	20.1
10	Nanakapaya	8.2	12.1	10.4	9.3	15.8	12.3
11	Navinal	9.7	12.4	10.8	11.8	15.1	13.6
12	Pragpar	8.4	10.9	9.5	13.8	16.1	14.6
13	Rangoli Hotel	10.8	16.3	14.0	14.3	26.4	19.5
14	Siracha	8.9	12.9	11.0	12.1	15.2	13.7
15	Tunda	9.6	10.2	9.9	14.3	15.4	14.9
16	Vadala	8.7	14.2	11.6	11.3	15.2	13.6
17	Wandh	12.3	12.3	12.3	16.1	16.1	16.1
18	Adani Wilmar Plant	8.5	14.6	12.1	10.7	15.9	13.7

Thus, the concentration of major gaseous pollutants that is SO_2 and NO_X was found much below the permissible limit of 120 µg/m^3.

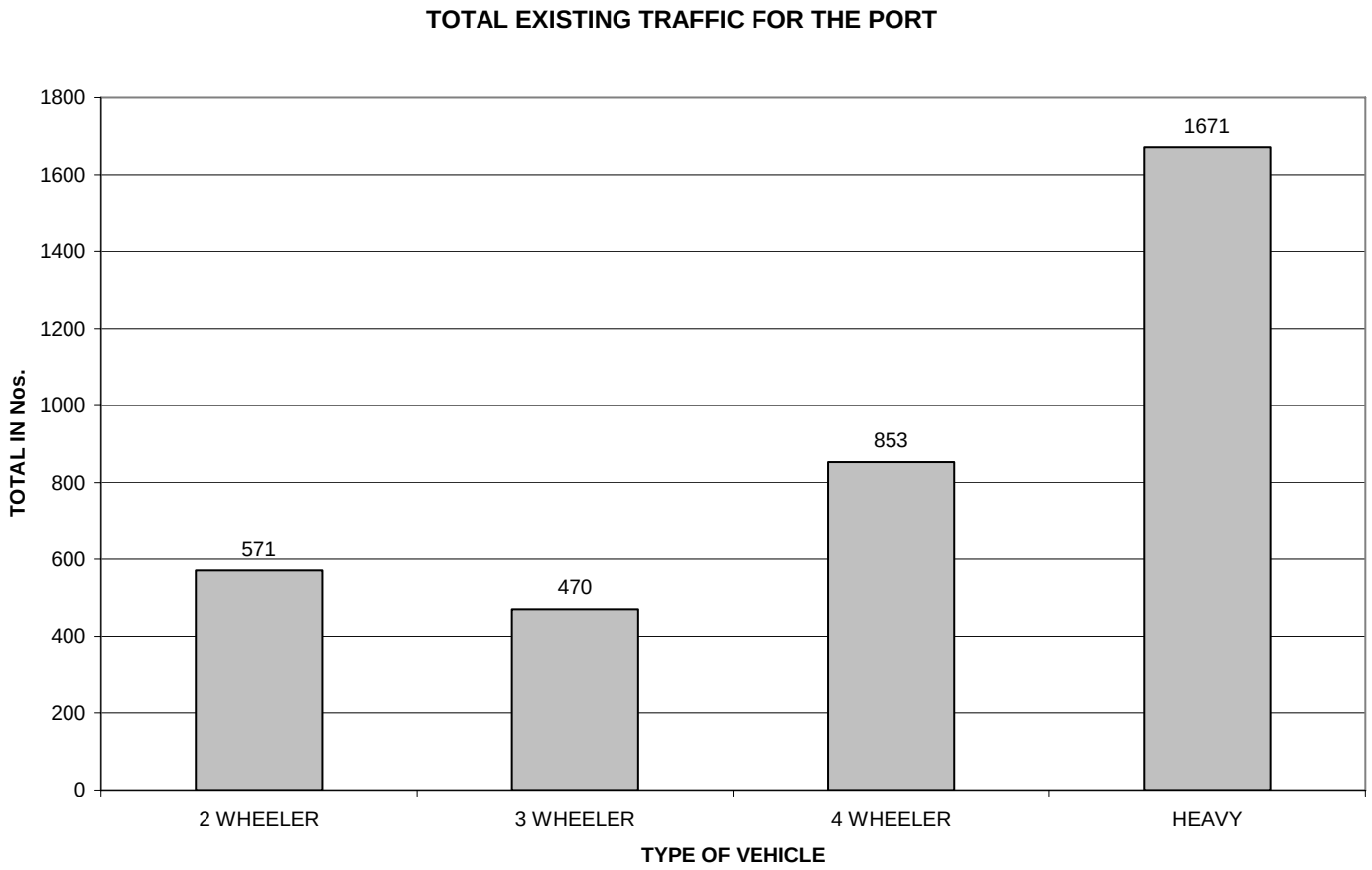
Survey of the existing traffic for the Mundra port was done and graphical representation of the typical number of vehicles on the major road leading to the port is given in Figures 3-1.

Figure 3-1 : Survey of Existing Traffic for Mundra port



	11 T0 12	12 TO 2	2 TO 4	4 TO 5	5 TO 6	6 TO 7	7 TO 8	8 TO 9	9 TO 10
2 WHEELER	54	45	74	51	68	71	76	92	40
3 WHEELER	44	45	71	48	59	72	51	60	20
4 WHEELER	57	68	115	117	81	105	126	132	52
HEAVY	122	72	170	175	210	274	187	305	156

Figure 3-2 : Total Existing Traffic for Mundra port



3.2 MICRO-METEOROLOGICAL STATUS

Transport and diffusion of pollutants in the atmosphere are governed by micro-meteorological factors. Micro-meteorology is defined as the study of minute variation in the atmospheric conditions to an area of few square kilometers and an elevation of 500 - 1000 m. Meteorological data was collected from Indian Meteorological Department (IMD). The current micro-meteorological status like wind speed, wind direction, ambient temperature, relative humidity etc. for the study period have been monitored.

Micro-meteorological features of the study area are given below :

3.2.1 Relative Humidity

Relative humidity remains high throughout the year because of the area's proximity to the sea. However, summer months are characterized by low values ranging from 34 % - 98 % while 80 % - 100 % prevails for the rest of the year. Diurnal variation of minimum and maximum relative humidity during study period was observed.

3.2.2 Temperature

The maximum and minimum temperatures for the study period were observed. It is seen from the same, the maximum temperature observed during the summer (April/June) was 35.2 °C and minimum was 17.7 °C. The long-term monthly variation in temperature in Mundra region is presented in meteorological data (published by IMD). During winter months, temperature inversion condition prevails in the atmosphere. The wind strength is at its lowest during this period making it the most critical period as dispersion of air pollutants shall be the least.

3.2.3 Precipitation

Precipitation at Mundra is mostly brought by the winds of the southwest monsoon. The diurnal variation of rainfall for the study period was also observed. It can be said that rainfall during summer months is scarce.

3.2.4 Winds

The wind pattern varies with different seasons throughout the year. During April to June (summer season), the surface wind speed is very high and about 80 % is from South and South-West directions. For the rest of the year; the surface winds are predominantly Southerly and South-Easterly. The wind-roses for the analysis of wind direction and wind speed pattern for the study period were plotted on the basis of collected data and are shown in Figure 3-3 to 3-6. The calm condition prevailed from 60 - 70 % of the time.

3.2.5 Thunderstorms

In general, no thunderstorms occur during summer months, whereas, in the pre-monsoon months of April and May severe thunderstorms are common in the region. As they appear to come from South direction, exceptionally high wind speeds ranging from 50 - 90 kmph are common. They may begin at any time of the day but the frequency is more during 17.00 - 20.00 hours. The atmosphere becomes cool after a Norwester. Large masses of dust particles get air borne and as a result visibility becomes poor. A second series of thunderstorms occur after the end of monsoon but these are usually milder in intensity than the Norwesters.

Figure 3-3 : Wind Rose for Impact Zone - Summer Season (April to June 06)

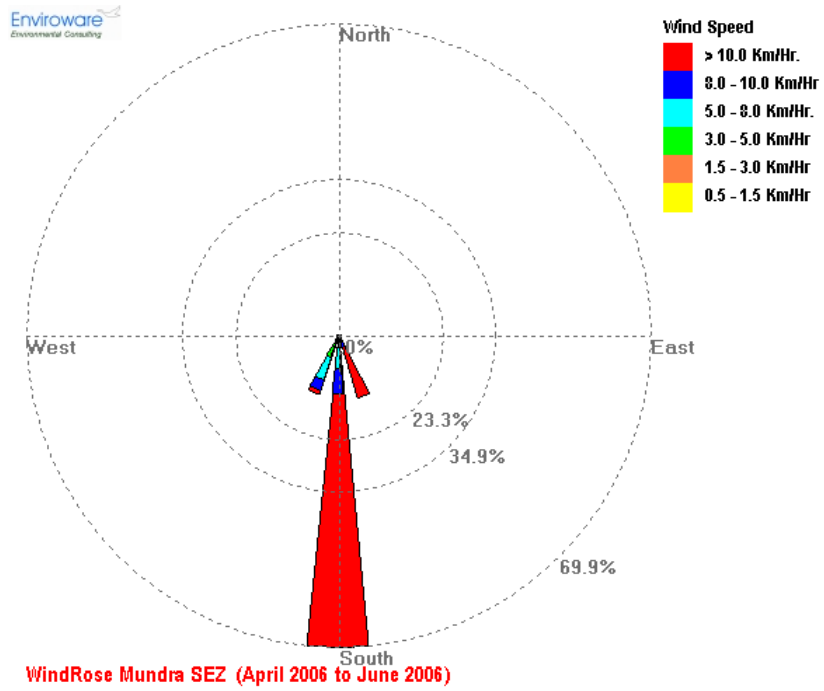


Figure 3-4 : Wind Rose for Impact Zone - April 2006

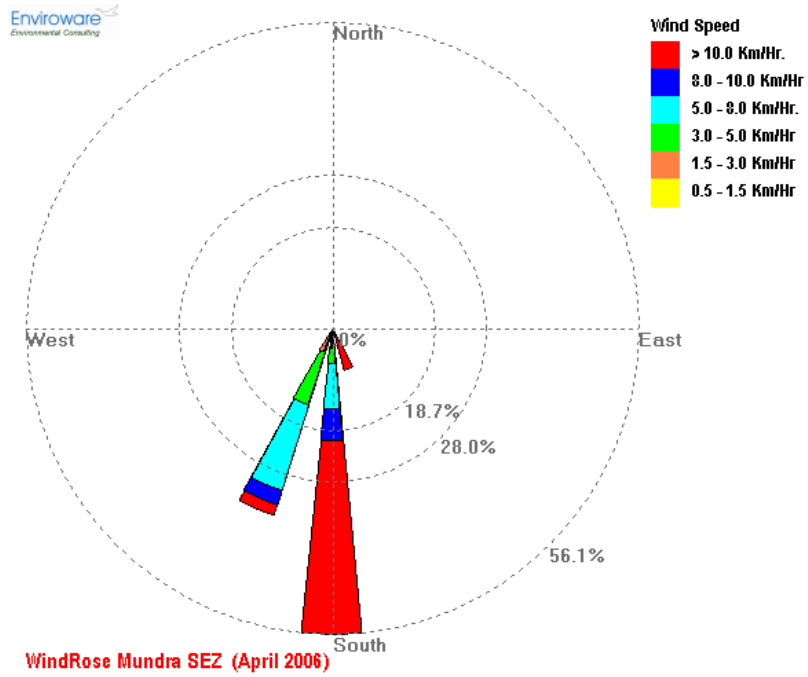


Figure 3-5 : Wind Rose for Impact Zone - May 2006

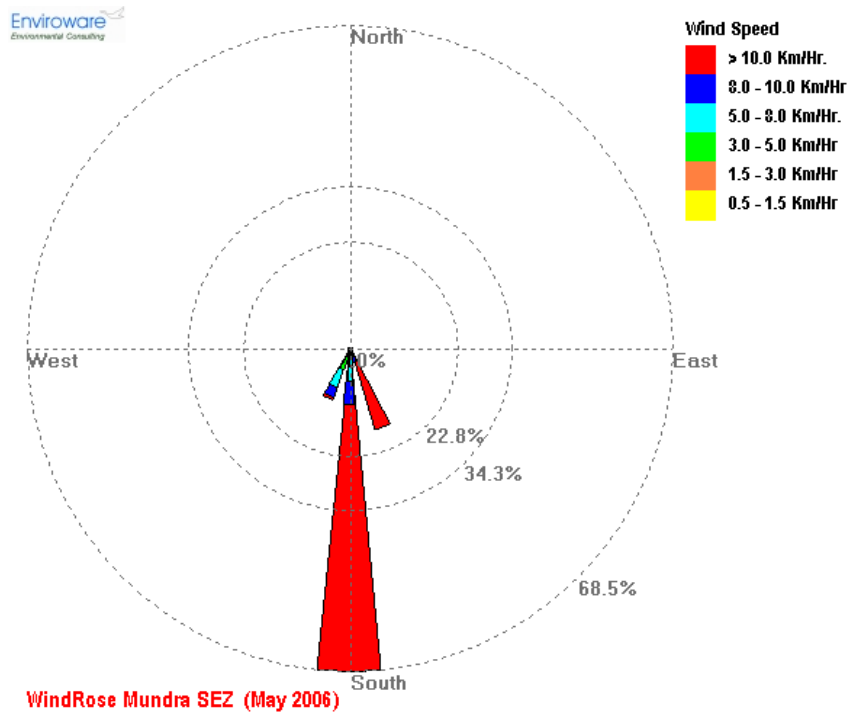
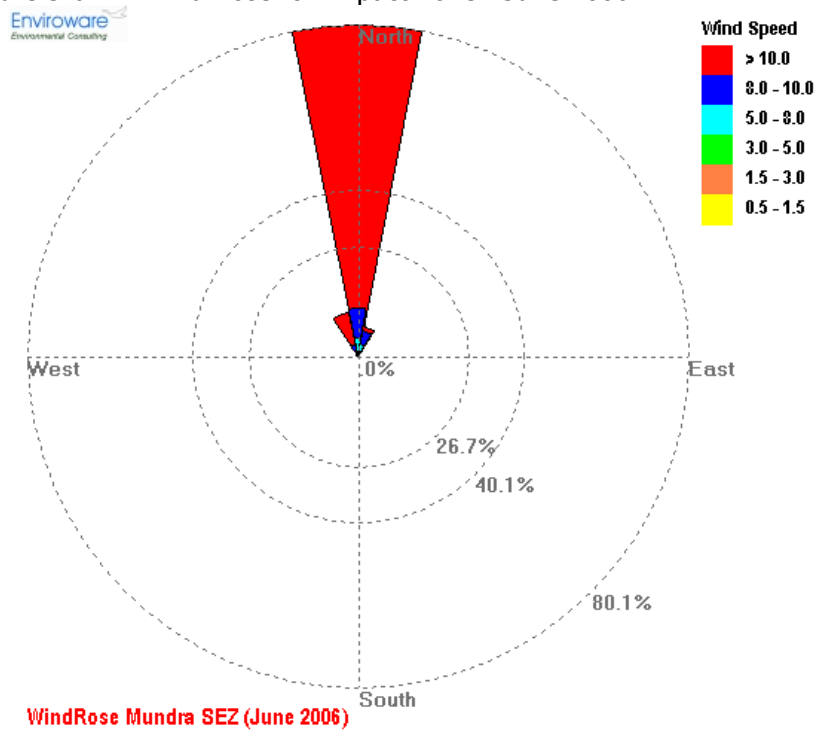


Figure 3-6 : Wind Rose for Impact Zone - June 2006



3.3 WATER ENVIRONMENT

In connection with the assessment of baseline status for water environment, detailed studies have been undertaken for both surface water and ground water in and around proposed SEZ at Mundra.

3.3.1 Reconnaissance Survey

Reconnaissance survey and field investigations were carried out to collect relevant information on the existing water resources (ground/surface) falling within the study area of the proposed SEZ area for their quantitative and qualitative assessment. The water quality of surface as well as ground water sources in the study area was analyzed for physico-chemical parameters of major importance.

Table 3-5 : **Location of selected GWMS**

Sr. No.	Location
1	Baroi
2	Bhadreshwar
3	Bhujpur
4	Dharub
5	Luni
6	Motakapaya
7	Mundra
8	Navinal
9	Pragpar
10	Siracha
11	Tunda
12	Vadala

Surface Water Quality Status

The surface water in the study area mainly includes Gulf of Kutch and rivers which are under its influence. Hence, the water is highly brackish and not conducive for drinking purpose. To obtain a general idea about the quality of surface water, the water quality of the Gulf was determined, which is tabulated in Table 3-6.

Table 3-6 : Quality of Gulf of Kutch Water

Sr. No.	Parameter	Unit	Quality
1	pH	unit	8.01
2	Odour		0
3	TSS	mg/l	0
4	TDS	mg/l	42602
5	Turbidity	NTU	6
6	BOD_3[27]	mg/l	<15
7	COD	mg/l	<65
8	Colour		0
9	Temperature	°C	29
10	Calcium	mg/l	440
11	Magnesium	mg/l	1433
12	Sodium	mg/l	13445.7
13	Potassium	mg/l	510
14	Chlorine	mg/l	21341
15	Sulphate	mg/l	6144
16	Nitrate	mg/l	0
17	Bicarbonates	mg/l	136
18	Alkalinity	mg/l	140
19	Fluoride	mg/l	12.5
20	Boron	mg/l	0
21	Phosphate	mg/l	2.3
22	Total Nitrogen	mg/l	0
23	Cyanide	mg/l	0
24	Free chlorine	mg/l	0
25	Total Chromium (by AAS)	mg/l	0
26	Selenium (by AAS)	mg/l	0

Ground Water Quality Status

Geology controls the occurrence of groundwater in this area. The area is underlain by Quaternary sediments consisting of a succession of clay, silty clay, sand and sand mixed with gravel. The geological set up of the area clearly indicates that groundwater occurs both under unconfined and confined conditions. Groundwater in

the shallow clay, silty clay zone (aquiclude) occurs under the unconfined conditions, while in the deeper granular zones it is under confined conditions. The deeper zone have greater yield compared to shallower aquifer due to their higher hydraulic conductivity. The shallow aquifers in Mundra area contain saline water. The depth of the deep aquifer at Mundra area ranges between 200 m to 350 m. The thickness of aquifer at Mundra is around 30 m.

In order to assess the ground water quality within the study area, water samples were collected through borwell / well / hand pump from 12 representative locations in study area, during the month of April 2006 and analyses were carried out as per the procedure of BIS 1488 and APHA. While selecting the GWMS due consideration was given to depth aquifer i.e. shallow and deep besides the location the entire 10 km radius area from Mundra SEZ as per MoEF guideline for the purpose. Analytical results are given in details in Table 3-7 (a) and (b).

Table 3-7(a) : Ground Water Quality in and around SEZ

No.	Parameters	GW 1	GW 2	GW 3	GW 4	GW 5	GW 6	Des Lim	Perm Lim
	Depth in Feet	400	400	300	140	325	400		
1	Temperature (°C)	32	30	32	31	30	30	-	-
2	Colour (Hazen unit)	<5	<5	<5	<5	<5	<5	5	25
3	Odour	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	-
4	Taste	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	-
5	Turbidity (NTU)	0.4	0.2	0.6	0.3	0.9	0.6	5	10
6	pH	7.81	8.02	7.34	7.41	7.5	7.6	6.5-8.5	NR
7	Conductivity (µmho/cm)	1936	1492	2686	3352	2098	1810	-	-
8	Total Hardness (as $CaCO_3$) in mg/l	325	363	494	496	410	125	300	600
9	Calcium Hardness in mg/l	230	215	280	307	307	105		
10	Magnesium Hardness in mg/l	95	148	214	189	148	21		
11	Alkalinity (as $CaCO_3$) in mg/l	364	340	352	524	392	356	200	600
12	Total Solid in mg/l	1380	1080	1916	2414	1527	1268		
13	Total Dissolved Solid in mg/l	1360	1040	1892	2382	1442	1240	500	2000
14	Total Suspended Solid in mg/l	20	40	24	32	17	28		

15	Chloride (as Cl) in mg/l	438	431	723	931	502	761	250	1000
16	Sulphate (as SO_4) in mg/l	42	49	65	52	43	79	200	400
17	Fluoride (as F) in mg/l	0.54	0.77	0.92	0.65	0.76	0.50	1.0	1.5
18	Sodium (as Na) in mg/l	342	291	412	612	331	331		
19	Potassium (as K) in mg/l	17	32	24	38	27	38		
20	Calcium (as Ca) in mg/l	92	86	112	123	103	42		
21	Magnesium (as Mg) in mg/l	23	36	52	46	31	5	30	100
22	COD in mg/l	24	16	28	36	13	21		
23	Chromium (as Cr) in mg/l	0.03	0.07	0.03	0.05	0.12	0.02	0.05	NR
24	Iron (as Fe) in mg/l	0.34	0.37	0.42	0.49	0.34	0.36	0.3	1.0
25	Lead (as Pb) in mg/l	0.03	0.12	0.06	0.09	0.08	0.03	0.05	NR
26	Manganese (as Mn) in mg/l	0.07	0.09	0.11	0.1	0.17	0.16	0.1	0.3
27	Cobalt in mg/l	0.04	BDL	BDL	BDL	BDL	BDL		
28	Nickel in mg/l	0.09	0.1	0.08	0.05	0.06	0.02		
29	Zinc (as Zn) in mg/l	0.06	0.02	0.07	0.04	0.12	0.13	5.0	15.0

NOTE : GW 1 - Dhrub; GW 2 - Navinal; GW 3 - Siracha; GW 4 - Tunda; 5 - Pragpar; GW 6 - Bhujpur; Des Lim - Desirable Limit; Perm Lim - Permissible Limit; NR - No relaxation; BDL - Below Detectable Limit

Table 3-7(b) : Ground Water Quality in and around SEZ

No.	Parameters	GW 7	GW 8	GW 9	GW 10	GW 11	GW 12	Des Lim	Perm Lim
	Depth in Feet	450	300	210	250	210	200		
1	Temperature (°C)	29	30	28	31	30	27	-	-
2	Colour (Hazen unit)	<5	<5	<5	<5	<5	<5	5	25
3	Odour	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	Unobjectionable	-
4	Taste	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	-
5	Turbidity (NTU)	0.9	1.1	1.6	2.1	3.6	1.8	5	10
6	pH	7.03	7.7	7.3	7.8	7.6	7.1	6.5-8.5	NR
7	Conductivity (µmho/cm)	2652	2498	3672	1894	4172	1857	-	-
8	Total Hardness (as $CaCO_3$) in mg/l	454	455	600	409	642	325	300	600
9	Calcium Hardness in mg/l	240	307	382	240	432	242		
10	Magnesium Hardness in mg/l	95	148	214	189	148	21		
11	Alkalinity (as $CaCO_3$) in mg/l	364	340	352	524	392	356	200	600
12	Total Solid in mg/l	1380	1080	1916	2414	1527	1268		
13	Total Dissolved Solid in mg/l	1360	1040	1892	2382	1442	1240	500	2000
14	Total Suspended Solid in mg/l	20	40	24	32	17	28		
15	Chloride (as Cl) in mg/l	438	431	723	931	502	761	250	1000
16	Sulphate (as SO_4)	42	49	65	52	43	79	200	400

No.	Parameters	GW 7	GW 8	GW 9	GW 10	GW 11	GW 12	Des Lim	Perm Lim
	in mg/l								
17	Fluoride (as F) in mg/l	0.54	0.77	0.92	0.65	0.76	0.50	1.0	1.5
18	Sodium (as Na) in mg/l	342	291	412	612	331	331		
19	Potassium (as K) in mg/l	17	32	24	38	27	38		
20	Calcium (as Ca) in mg/l	92	86	112	123	103	42		
21	Magnesium (as Mg) in mg/l	23	36	52	46	31	5	30	100
22	COD in mg/l	24	16	28	36	13	21		
23	Chromium (as Cr) in mg/l	0.03	0.07	0.03	0.05	0.12	0.02	0.05	NR
24	Iron (as Fe) in mg/l	0.34	0.37	0.42	0.49	0.34	0.36	0.3	1.0
25	Lead (as Pb) in mg/l	0.03	0.12	0.06	0.09	0.08	0.03	0.05	NR
26	Manganese (as Mn) in mg/l	0.07	0.09	0.11	0.1	0.17	0.16	0.1	0.3
27	Cobalt in mg/l	0.04	BDL	BDL	BDL	BDL	BDL		
28	Nickel in mg/l	0.09	0.1	0.08	0.05	0.06	0.02		
29	Zinc (as Zn) in mg/l	0.06	0.02	0.07	0.04	0.12	0.13	5.0	15.0

NOTE : GW 7 - Motakapaya ; GW 8 - Baroi; GW 9 - Luni; GW 10 - Mundra; GW 11 - Bhadreshwar; GW 12 - Vadala; Des Lim - Desirable Limit; Perm Lim - Permissible Limit; NR - No relaxation; BDL - Below Detectable Limit

3.4 NOISE ENVIRONMENT

The basic steps associated with impact assessment on the noise components of the environment involve identification, prediction and evaluation of the present exposure status of the workers (occupational) as well as general population including sensitive receptors viz. school, hospital, post offices, phone etc.

3.4.1 Reconnaissance Survey

Mundra SEZ Ltd. shall set up only infrastructure facilities in the SEZ. Hence, the only source of noise pollution in its scope shall be the DG sets, which shall be installed in acoustic enclosures and operated only in case of emergency.

To assess the existing noise level in and around proposed SEZ, 18 Ambient Noise Level Monitoring Stations (ANLMS) have been selected primarily based on prevailing meteorological conditions. The noise level has been recorded at various strategic locations on highway as well as major sensitive receptors located within the study area viz. hospitals, schools, temples/mosques etc. At each ANLMS, hourly spot noise level has been recorded for 24 hours. The vehicular density in the study area has also been studied.

3.4.2 Baseline Status

Noise survey was conducted around in the study area. Noise levels (A weighted) dB (A) were measured using precision noise level meters (Lutron SL - 4001). The community noise sources including traffic and other activities were also monitored to determine the general noise pollution status. While selecting the ANLMS, due consideration was given to nature of the receptor i.e. commercial, residential and sensitive as well as other landscape features in the study area, as per MoEF guideline for the purpose. The location of selected ANLMS is presented in Table 3-8.

Table 3-8 : Location of selected ANLMS

ANLMS	Location
1	Baroi
2	Bhadreshwar
3	Bhujpur
4	Dharub
5	Gorsama
6	Gundala
7	Luni
8	Motakapaya
9	Mundra
10	Nanakapaya
11	Navinal
12	Pragpar
13	Rangoli
14	Siracha
15	Tunda
16	Vadala
17	Wandh
18	Wilmar

The sampling sites for community exposure survey were selected keeping in view the prevalent micro-meteorological condition at the time of survey. Diurnal variation of Ambient Noise levels for different locations for minimum, maximum and equivalent noise levels in the study area is given in Table 3-9.

Table 3-9 : Status of Ambient Noise Level in Study Area during Study Period

ANLMS	Location	Minimum Noise Level (dB)	Maximum Noise Level (dB)	Equivalent Noise Level (Leq dB)
1	Baroi	49.00	58.00	54.42
2	Bhadreshwar	51.00	59.00	56.39
3	Bhujpur	45.00	53.00	49.04
4	Dharub	50.00	59.00	55.54
5	Gorsama	67.00	79.00	74.43
6	Gundala	51.00	65.00	62.17
7	Luni	41.00	49.00	44.80
8	Motakapaya	54.00	66.00	61.06
9	Mundra	56.00	74.00	70.18
10	Nanakapaya	52.00	58.00	56.94
11	Navinal	58.00	65.00	61.92
12	Pragpar	53.00	57.00	56.60
13	Rangoli	53.00	61.00	57.55
14	Siracha	55.00	61.00	59.04
15	Tunda	54.00	60.00	56.96
16	Vadala	56.00	63.00	58.87
17	Wandh	52.00	62.00	59.02
18	Wilmar	54.00	62.00	58.76

3.4.3 Status of Noise Pollution

About 18 major locations were identified in the study area. Noise levels were measured at these locations (within 1 to 3 m from major noise generation sources) to determine the strength of noise sources and status of noise in the study area.

3.4.4 Community Noise

Community noise includes all types of noise in the outdoor acoustic environment and it is essential to study its variation, magnitude and character at various locations.

The ambient sound pressure level is defined as total noise at a given location due to all sources. The residual noise level is that level below which the ambient noise does not seem to drop during a given time interval and due to distant unidentified sources.

The extent to which an individual is affected by intruding noise is a complex phenomenon. The impact of noise on the individual's strength depends on :

a) Physical dose of noise, viz. Noise level, frequency spectrum, intermittency etc.
b) Human factors, viz. Sex, age, health status, occupation during exposure period, etc.

The intensity of impact however, depends on :

a) Psychological and physiological state of individual and
b) The number of individual exposed.

3.4.5 Day vs. Night Noise Levels

The community noise is determined by recording the day-night noise levels (L_{dn}). L_{dn} is defined as the 24 hrs equivalent sound level except that weighting penalty of 10 db(a) is added to the measured instantaneous noise level for night time period i.e. from 22-00 to 07-00 hrs. This is because the same noise levels during the night time are more annoying than the daytime.

L_{dn} for given location in a community is calculated from an hourly equivalent level (l_{eq}) by the following equation :

$$L_{dn} = 10 \log [1/24 \{15 \times 10^{l_d/10} + 9 \times 10^{(l_n + 10)/10} \}]$$

where l_d = equivalent noise level during day time (06.00 to 22.00 hrs)

l_n = equivalent noise level during night time (22.00 to 06.00 hrs)

Hourly equivalent levels (l_{eq}) for 18 different locations were collected.

Table 3-10 : Day and night noise level in core / impact zone

ANLMS	Location	L_d (dB)	L_n (dB)	L_{dn} (dB)
1	Baroi	49.5346	42.3312	50.6785
2	Bhadreshwar	49.8491	38.4028	49.4184
3	Bhujpur	48.2323	45.4356	52.0657
4	Dharub	49.7301	50.5762	56.4667
5	Gorsama	48.1737	39.7068	48.7470
6	Gundala	47.4552	41.7601	49.4000
7	Luni	49.4516	41.0941	50.0707
8	Motakapaya	45.7882	37.0351	46.2448
9	Mundra	64.6214	59.6952	67.0240
10	Nanakapaya	46.7626	39.5536	47.9037
11	Navinal	46.9425	40.5631	48.5077
12	Pragpar	50.4305	41.4467	50.7963
13	Rangoli	48.2050	40.5398	49.1298
14	Siracha	49.0650	41.8112	50.1843
15	Tunda	89.2889	81.1282	89.9922
16	Vadala	67.4699	52.0445	66.2908
17	Wandh	52.8686	42.8112	49.3293
18	Wilmar	53.7566	42.9157	48.8633

3.5 LAND ENVIRONMENT

The SEZ area is largely occupied by fallow land and agricultural activities. The proposed 8481.2784 ha of SEZ area will be developed comprising of infrastructure services and logistics hub, industrial zone, port, roads and green belt.

3.5.1 Landuse Pattern in study Area

The land use/land cover has been presented in the form of a map prepared by using the IRS-P 6 LISS-III (December 2005), procured from the National Remote Sensing Agency (NRSA), Hyderabad. The satellite data has been processed by EIC using ERDAS Imagine software supported with ground checks and ground truth verification by qualified and experienced professionals. Area and distance calculations have been carried out using GIS software after geo-referencing the interpreted data with the help of SoI topographical maps of 1: 50,000 scale.

Due to proximity of the sea, despite the arid landscape, the temperature does not rise above 40º C or fall to very low level. Scarce rainfall, poor soil conditions do not promote good vegetation, which can act as a significant climate modifier. However, areas where ground water aquifers are present, good growth of vegetation have taken place.

The structure of soil profile also indicates that poor quality of soil is underlain with better quality of soils. Therefore, appropriate adoption of plantation and irrigation techniques may be able to transform this very arid landscape over a period of time. One may draw inspiration from the experience of Delhi, which was also a dry arid landscape when the Colonial Imperial Capital was planned here. This would need integration of water management and landscape development in a planned manner. The standard of open space would be higher than the guidelines, so that full advantage of management of water is realized.

The main area of concern here is the location of the industrial units as per the soil conditions, topography, and adjacent use and wind direction. Another area of concern is the pollution caused by the heavy traffic envisaged in the SEZ area.

3.5.1.1 Details of Land Filling:

.The SEZ land will utilize the already approved dredging quantity of 210Mm3 under the Project Waterfront Development Plan, Mundra. The dredge soil will be used to reclaim near the terminals to create back-up areas for the terminals and SEZ level raising. Port cluster wise details of the back up area which required to be reclaimed is given below. **Thus the Proposed Project does not envisage any Reclamation Activities.**

Location	Reclamation (ha)
West Port (including shipyard)	1138
South Port	700
North Port	224
East Port (including shipyard)	955
Level raising for road/rail/transport/utility corridor embankment	183
Total	**3200**

(Quantity approved under WFDP,Mundra)

The deck top level of all the quays inside the basin is proposed to be kept at + 8.5 m (CD) to avoid inundation even during cyclonic conditions.

The use of dredged materials for reclamation will be as follows:

Location	Quantity (mm3)
Reclamation: port back-up area (3200 ha) at + 8.5 m (CD)	170
Level raising: roads, rail, embankment, other ancillary infrastructure	20
Level raising: other port back-up area /SEZ developable area	20
Total	**210**

(Quantity approved under WFDP,Mundra)

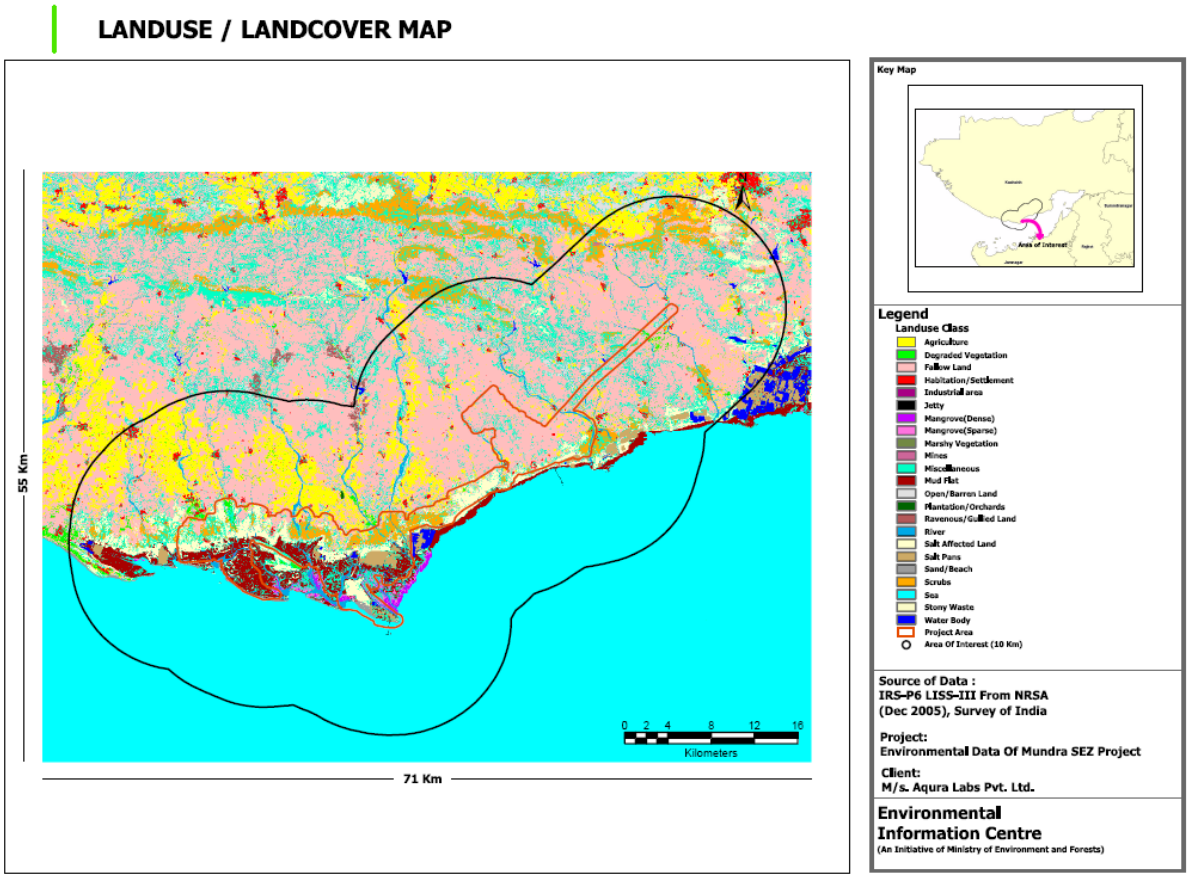
The total area proposed for reclamation is about 3200 ha and total estimated dredge quantity is 210 mm3. The proposed reclamation area of 210 ha is largely intertidal, essential for back-up including various facilities for port operation, maintenance, transport and temporary storages of raw materials and products.

3.5.1.2 General Methedology Followed For Land Filling/Reclamation:

The typical procedure for the large-scale land reclamation, being followed in the development under Mundra SEZ is as follows.

- Based on the dredging area which been identified under WFDP, Mundra shall be used.
- Seabed stabilization is carried out in several ways, such as, excavation of soft material from the seabed; dredging to form a sand-key trench; installation of sand compaction piles or vertical drains to strengthen and consolidate the seabed etc.
- A sand-key is formed from transported sand towed in by hopper barges. In some cases, where conditions are suitable, a sand wall is also constructed along the coast to be reclaimed.
- Reclamation is carried out by direct dumping or hydraulic filling using cutter suction dredgers and pumps or trailer hopper suction dredgers. Where sand is sucked from the stockpile, it is spread into the fill area by a floating spreader. If the depth is too shallow, sand is pumped through overland pipes.
- In submerged and inter-tidal zone, the reclamation fill is naturally compacted through natural hydraulic compaction. However, for the fill portion above high tide level, compaction is carried out by vibratory rollers or any other equivalent means.
- All the side slopes of the reclamation are protected by either breakwater or any other necessary relevant shore protection works. In cases, the entire reclamation site is protected by peripheral breakwater prior to the filling

Figure 3-7 : Landuse in Study Area



The map depicts major land use / land cover classes comprising lands under agriculture, fallow land, open/degraded vegetation; lands falling under water bodies, scrub and lands under inhabitations and is given in Figure 3-7.

3.5.2 Areas under Different Landuse

The land use classification and their respective areas are as follows :

Table 3-11 : Landuse classification and areas in the impact zone

Sl. No.	Class Name	Area (sq.km.)	Percent Area (%)
1	Water Body	43.78	0.82
2	Non Vegetation Area	2695.06	50.77
3	Degraded Vegetation	21.80	0.41
4	Mangrove(Sparse)	9.30	0.19
5	Mangrove(Dense)	4.42	0.08
6	Marshy Vegetation	0.02	0.0004
7	Scrub	144.60	2.72
8	Plantation	0.19	0.003
9	River/Canal	59.67	1.12
10	Sea	2329.11	43.88
11	**Total**	**5307.94**	100

3.5.3 Soil Classification

The soil classification map has been prepared by extracting the areas under different soil categories from the 1:50,000 scale maps prepared by National Bureau of Soil Survey and Land Use Planning (NBSS&LUP). The impact zone, towns and village locations have been added for ease of spatial reference. Locations of towns and villages have been extracted from village maps, SoI topographical maps and confirmed with satellite data.

Map depicting the characteristics of major soil categories in the study area is given in Figure 3-8. The map also marks the study area and project site for reference alongwith village locations.

Figure 3-8 : Soil Characteristics Map in Study Area

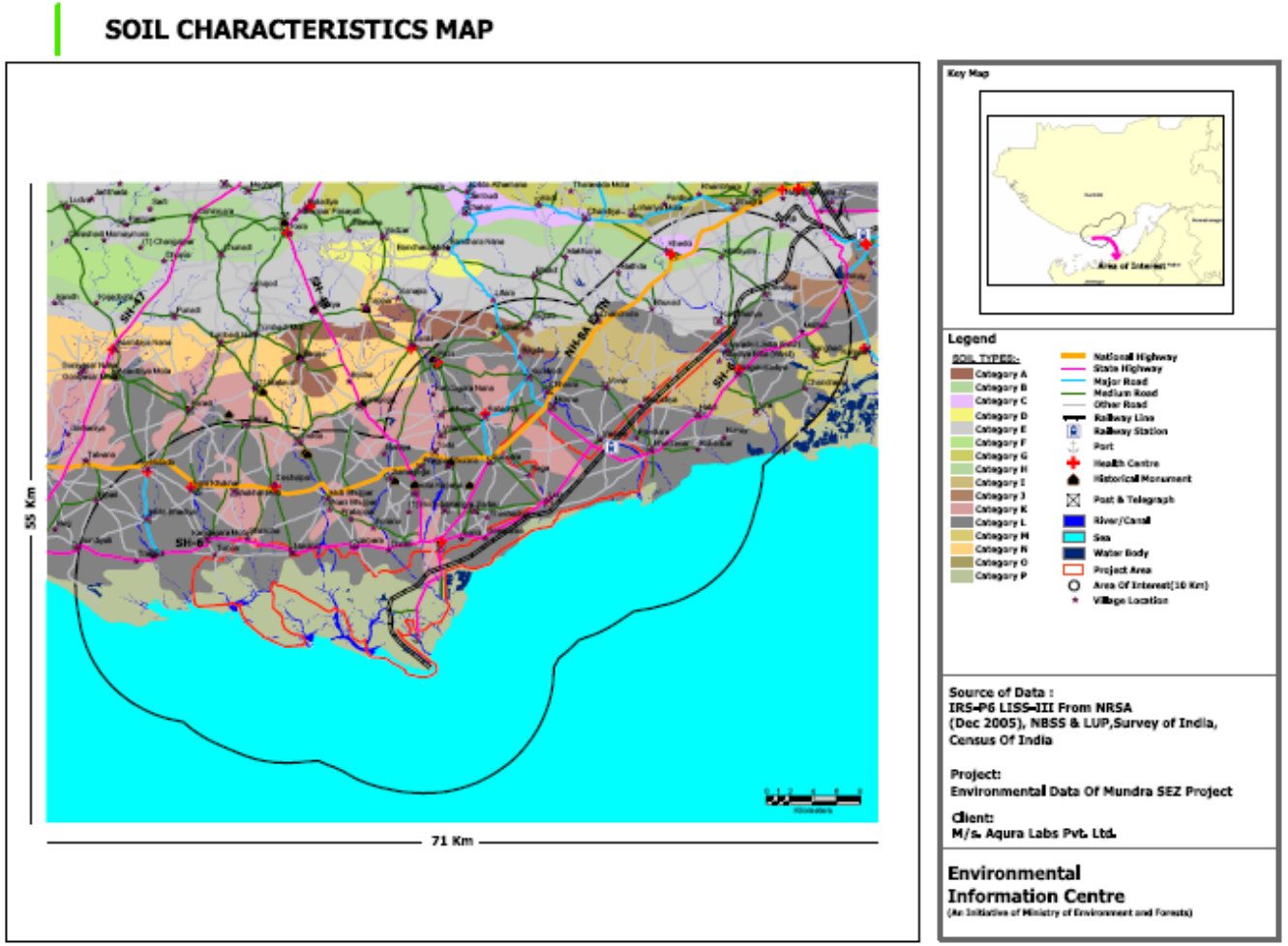


Table 3-12 : Soil Type and Area under Different Soils in the impact zone

Category	Area (sq km)	Description	Taxonomy1	Taxonomy2	Class	Sub Class
Category A	13.44	Moderately shallow, well drained, calcareous fine soils on very gently sloping elongated ridges with moderate erosion; associated with extremely shallow, somewhat excessively drained, calcareous loamy soils on moderately sloping lands with severe erosion	Fine, mixed (calcareous), hyperthermic Ustalfic Haplargids	Loamy, mixed (calcareous), hyperthermic Lithic Torriorthents	Soils of west coast(soils of kachchh peninsula)	Soils of hilly terrain
Category B	19.57	Shallow, well drained, calcareous, loamy soils on very gently sloping elongated ridges with moderate erosion and moderate stoniness; associated with moderately shallow, calcareous, fine loamy soils with moderate erosion	Loamy, mixed (calcareous), hyperthermic Lithic Torriorthents	Fine-loamy, mixed (calcareous), hyperthermic Typic Camborthids	Soils of west coast(soils of kachchh peninsula)	Soils of hilly terrain
Category C	7.70	Moderately deep, somewhat excessively drained, calcareous, coarse loamy soils on very gently sloping pediment with moderate erosion; associated with moderately shallow, somewhat excessively drained, calcareous, fine loamy soils with moderate erosion	Coarse-loamy, mixed (calcareous), hyperthermic Typic Camborthids	Fine-loamy, mixed (calcareous), hyperthermic Typic Calciorthids	Soils of west coast(soils of kachchh peninsula)	Soils of pediments
Category E	118.28	Moderately shallow, well drained, calcareous, fine loamy soils on undulating pediment (with isolated hillocks) with moderate erosion; associated with shallow, well drained, loamy soils with moderate erosion.	Fine-loamy, mixed (calcareous), hyperthermic Typic Camborthids	Loamy, mixed, hyperthermic Lithic Camborthids	Soils of west coast(soils of kachchh peninsula)	Soils of pediments
Category G	0.10	Moderately deep, somewhat excessively drained, calcareous, sandy soils on very gently sloping pediment (with isolated hillocks) with moderate erosion; associated with moderately deep, moderately well drained, calcareous, fine-loamy soils with moderate er	Mixed (calcareous), hyperthermic Typic Torripsamments	Fine-loamy, mixed (calcareous), hyperthermic Typic Calciorthids	Soils of west coast(soils of kachchh peninsula)	Soils of pediments

Category	Area (sq km)	Description	Taxonomy1	Taxonomy2	Class	Sub Class
Category I	89.60	Extremely shallow, somewhat excessively drained, loamy-skeletal soils on undulating pediment (with isolated hillocks) with severe erosion and strong stoniness; associated with very shallow, somewhat excessively drained, calcareous loamy soils with sever	Loamy-skeletal, mixed, hyperthermic Lithic Torriorthents	Loamy, mixed (calcareous), hyperthermic Lithic Torriorthents	Soils of west coast(soils of kachchh peninsula)	Soils of pediments
Category J	12.79	Very shallow, somewhat excessively drained, calcareous, sandy soils on undulating pediment (with isolated hillocks) with severe erosion and moderate stoniness; associated with shallow, well drained, calcareous, loamy soils with moderate erosion and sligh	Loamy, mixed (calcareous), hyperthermic Lithic Torriorthents	Loamy, mixed (calcaeous), hyperthermic Lithic Camborthids	Soils of west coast(soils of kachchh peninsula)	Soils of pediments
Category K	123.87	Very deep, well drained, calcareous coarse-loamy soils on very gently sloping arid plain with slight erosion and moderate salinity; associated with moderately shallow, well drained, calcareous fine loamy soils on very gently sloping lands with moderate e	Coarse-loamy, mixed (calcareous), hyperthermic Typic Calciorthids	Fine-loamy, mixed (calcareous), hyperthermic Typic Camborthids	Soils of west coast(soils of kachchh peninsula)	Soils of arid plains
Category L	653.41					
Category M	23.88	Deep, well drained, calcareous, coarse loamy soils on very gently sloping arid plain with moderate erosion and moderate salinity; associated with moderately shallow well drained, calcareous, coarse loamy soils with severe erosion	Coarse-loamy, mixed (calcareous), hyperthermic Typic Calciorthids	Coarse-loamy, mixed (calcareous), hyperthermic Duric Camborthids	Soils of west coast(soils of kachchh peninsula)	Soils of arid plains
Category N	2.53	Moderately, shallow, well drained, calcareous, fine loamy soils on very gently sloping arid plain (with narrow valleys) with moderate erosion and slight salinity; associated with moderately shallow, well drained, calcareous, fine loamy soils with moderate erosion	Fine-loamy, mixed (calcareous), hyperthermic Typic Calciorthids	Fine-loamy, mixed (calcareous), hyperthermic Typic Torriorthents	Soils of west coast(soils of kachchh peninsula)	Soils of arid plains

Category	Area (sq km)	Description	Taxonomy1	Taxonomy2	Class	Sub Class
Category P	225.05					
Mud	0.03					
Sea	579.75					

3.5.4 Soil Characteristics

To assess the soil quality in and around proposed Mundra Special Economic Zone (SEZ), 12 Soil Quality Monitoring Stations (SQMS) were selected. The location of selected SQMS is presented in Table 3-13. The collected soil samples were analyzed for texture analysis along with other physico-chemical characteristics of soil.

Table 3-13 : Locations of selected SQMS

SQMS	Location
1	Wandh village
2	Navinal Village
3	Sircha Village
4	Motibhujpur Village
5	Motakapaya Village
6	Baroi Village
7	Gorsama Village
8	Dhrub Village
9	Luni Village
10	Vadala Village
11	Bhadreshwar Village
12	Rangoli Hotel Cross Road

The analytical data support, detail further and substantiate the results of remote sensing soil characteristics presented. The description and taxonomy provided for the core zone of port & SEZ will be used in further discussions.

The chemical composition of the soil samples taken from various parts of impact zone establish that there are no sources of heavy metals contamination. The contents of sodium and potassium are, however very high - and the soil is saline which would warrant for adequate treatment.

3.5.5 Salinity

The soil characteristics of project site are mainly Category - L, P and K type of soil. The salinity of soil has prohibited the land area to be used for agriculture and thus, whatever small volume of agriculture is being practices is only in pockets with availability of good ground water quality / canal fed areas. However, it would be necessary to indicate that the agricultural yield of these fields is very low.

Table 3-14 : Physical Characteristics of Soil in Core / Impact Zone

Sl No	Parameters	S 1	S 2	S 3	S 4	S 5	S 6	S 7	S 8	S 9	S 10	S 11	S 12
1	Water Retention Capacity (in %)	33.4	30.9	36.5	34.1	37.8	36.2	34.6	33.9	35.1	36.4	32.8	35.4
2	Bulk Density g/cm3	1.48	1.51	1.48	1.5	1.49	1.52	1.49	1.5	1.53	1.48	1.5	1.53
3	Porosity (in %)	36.5	37.9	34.8	36.1	33.4	39.6	32.8	37.4	38.3	36.2	32.9	35.7
4	Texture Analysis :												
	% of Sand	56.3	51.7	48.9	52.4	48.6	53.8	56.2	54.9	54.3	52.8	53.2	52.7
	% of Silt	15.3	17.9	17.7	13.9	19.3	18.1	16.5	14.9	18.2	17.2	18.3	19.3
	% of Clay	12.4	13.8	14.9	16.4	14.4	13.2	14.1	13.7	15.4	15.8	15.6	15.2
	% of Gravels	16	16.6	18.5	17.3	17.6	14.9	13.2	16.5	17.3	14.2	12.9	12.8

NOTE : S 1 - Wandh Village; S 2 - Navinal; S 3 - Siricha; S 4 - Dhrub; S 5 - Bhujpur; S 6 - Motakapaya; S 7 - Baroi; S 8 - Gorasama; S 9 - Luni; S 10 - Vadala; S 11 - Bhadeswar; S 12 - Rangoli

Table 3-15 : Chemical Characteristics of Soil in and around SEZ

Sl No	Parameters	S 1	S 2	S 3	S 4	S 5	S 6	S 7	S 8	S 9	S 10	S 11	S 12
1	pH (10% Solution)	7.51	7.99	8.05	8.21	7.63	7.65	7.82	7.83	7.52	7.69	7.78	7.76
2	Loss on Ignition	14	10.5	11.2	12.5	13.1	12.3	11.2	11.7	13.4	12.7	9.7	10.1
4	Chloride (as Cl) in mg/kg	0.48	0.49	0.50	0.49	0.5	0.52	0.53	0.48	0.43	0.51	0.56	0.51
5	Calcium g/kg	0.57	0.59	0.55	0.61	0.57	0.52	0.55	0.53	0.49	0.53	0.48	0.53
6	Magnesium g/kg	0.16	0.18	0.21	0.14	0.15	0.15	0.17	0.19	0.18	0.17	0.18	0.14
7	Available Nitrogen g/kg	0.52	0.79	0.83	0.81	0.86	0.57	0.69	0.76	0.92	0.85	0.64	0.62
8	Available Phosphorus g/kg	0.38	0.37	0.23	0.29	0.027	0.019	0.02	0.018	0.019	0.017	0.018	0.017
9	Sodium (as Na) in g/kg	0.72	0.73	0.81	0.75	0.72	0.63	0.81	0.83	0.69	0.70	0.73	0.68
10	Potassium (as K) in g/kg	0.61	0.60	0.58	0.58	0.59	0.59	0.62	0.63	0.60	0.61	0.54	0.59
11	Organic Matter (as C) in %	0.46	0.32	0.29	0.47	0.54	0.29	0.27	0.28	0.32	0.36	0.24	0.26

NOTE : S 1 - Wandh Village; S 2 - Navinal; S 3 - Siricha; S 4 - Dhrub; S 5 - Bhujpur; S 6 - Motakapaya; S 7 - Baroi; S 8 - Gorasama; S 9 - Luni; S 10 - Vadala; S 11 - Bhadeswar; S 12 - Rangoli

Table 3-16 : Status of Heavy Metals in Soil in and around SEZ

Sl No	Parameters	S 1	S 2	S 3	S 4	S 5	S 6	S 7	S 8	S 9	S 10	S 11	S12
1	Lead (Pb) in mg/kg	0.021	0.015	0.009	0.016	0.024	0.016	0.012	0.014	0.013	0.011	0.009	0.008
2	Nickel (as Ni) in mg/kg	0.017	0.011	0.009	0.007	0.012	0.012	0.009	0.012	0.009	0.014	0.014	0.012
3	Chromium (as Ch) in mg/kg	0.016	0.021	0.013	0.029	0.027	0.019	0.02	0.018	0.019	0.017	0.018	0.017
4	SAR	0.22	0.21	0.23	0.22	0.22	0.20	0.24	0.25	0.21	0.21	0.23	0.21
5	Iron (as Fe) in mg/kg	0.23	0.24	0.28	0.19	0.14	0.43	0.34	0.29	0.24	0.26	0.51	0.43
6	Zinc (as Zn) in mg/kg	0.12	0.13	0.16	0.09	0.07	0.16	0.14	0.19	0.14	0.016	0.19	0.16
7	Copper (as Cu) in mg/kg	0.018	0.012	0.019	0.018	0.016	0.009	0.002	0.017	0.016	0.012	0.012	0.018

NOTE : S 1 - Wandh Village; S 2 - Navinal; S 3 - Siricha; S 4 - Dhrub; S 5 - Bhujpur; S 6 - Motakapaya; S 7 - Baroi; S 8 - Gorasama; S 9 - Luni; S 10 - Vadala; S 11 - Bhadeswar; S 12 - Rangoli

3.6 ECOLOGICAL ENVIRONMENT

The study on ecological aspect is important for Environmental Impact Assessment in view of conservation of environmental quality and safety of natural flora and fauna. A biological community being dependent on the condition and resources of its location may change if there is a little change in the ecosystem. Such a community change is a reflection of changes in the plant and animal population that comprises of the community, because of the complex interrelationships of a changing condition of resource that causes one or more of the population to change, may cause many populations to change and be replaced by others. Since the environment of organisms are able to inhabit that location, the inhabitants should be biological induces of environmental changes.

3.6.1 Reconnaissance Survey

The proposed Mundra Special Economic Zone at Mundra is located in Kutch district of Gujarat covering an approximate area of 14,754 ha. The main objective of this survey is to assess the present status of ecological environment in the study area.

In the present study 10 km radius all around the proposed SEZ site was considered for both terrestrial and aquatic ecological analysis. The data has been obtained from Environmental Information Centre (EIC), an initiative of Ministry of Environment and Forests, New Delhi.

3.6.2 Vegetation Cover and Forest Boundaries

The vegetation cover for the area of interest has been prepared by extracting the areas under four different vegetation classification provided by the Forest Survey of India (FSI) based on IRS-P6 LISS III (December 2005) satellite imagery. The boundaries of the Reserved Forests and Protected Forests have been derived from SoI topographical maps. The project site and study area (impact zone) have been added for ease of spatial reference.

The forest cover is classified based on Forest Survey of India into dense, open and scrubs. The vegetation classification criterion used for this study area is given as follows :

- Dense Vegetation is the land with forest cover with canopy density of ≥ 40%

- Medium Vegetation is the forest cover with canopy density of 10 to 40%
- Open Vegetation is the land with forest cover with canopy density < 10%
- Scrubs are the lands generally in and around forest areas, having bushes and / or poor tree growth chiefly of small or stunted trees with a canopy density < 10%.

3.6.3 Area Under Different Vegetation Classification

Following table provides the area falling under vegetation type defined as dense forest, medium dense forest, open forest, scrublands, water bodies and non-forest areas within the region of interest (10 km from the project site).

Table 3-17 : Area Under Different Classification in the Impact Area

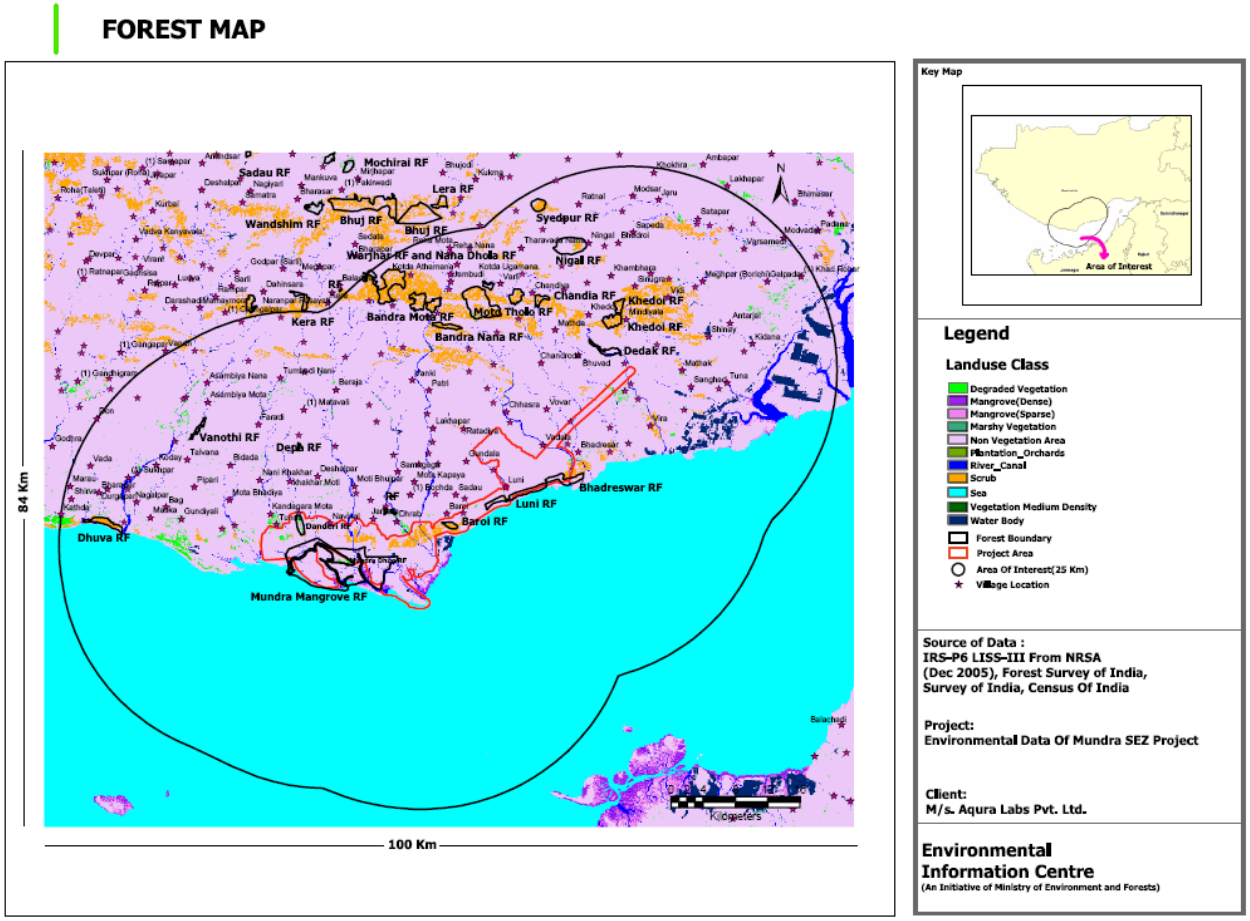
Sl. No.	Vegetation Classification	Area (in sq km)
1	Water Body	47.38
2	Non Vegetation Area	2695.06
3	Degraded Vegetation	21.80
4	Mangrove(Sparse)	9.30
5	Mangrove (Danse)	4.42
6	Marshy Vegetation	0.02
7	Scrub	144.60
8	Plantation	0.19
9	River/Canal	59.67
10	Sea	2329.11
	Total	**5307.94**

3.6.4 Area Under Forests and Sanctuary

The forest patches falling fully or partially in the region of interest i.e. within 25 km radius from project site boundary are depicted in the Forest Map vide Figure 3-9 (procured from EIC). Moreover, the digital map comprises layers of vegetation classification, forest boundaries and town and village locations.

Danderi RF	within SEZ Boundary
Mundra Mangrove RF	within SEZ Boundary
Mundra Dhuo RF	within SEZ Boundary
Baroi RF	within SEZ Boundary
Luni RF	within SEZ Boundary
Bhadreswar RF	within SEZ Boundary

Figure 3-9 : Forest Map in Study Area (Details on diverted Forest Area)



7.70 km	Depa RF in North
1.66 km	Borana Plantation RF in North-East
2.62 km	Bekad RF in North-East
4.95 km	RF in North-East
17.28 km	Dhuva RF in West
14.53 km	Vanothi RF in North-West
1.93 km	Dedak RF in North-West
13.17 km	Bandra Nana RF in North-West
25.42 km	Kera RF in North
5.52 km	Khedoi RF in North-West

3.6.5 Scenarios of Ecological Environment

The term ecological environment would cover the prevalence of all living forms including plants and animals in the study area. The structure and type of vegetation depends on climatic conditions and physiography of an area.

The plant species observed in study area are in the form of scanty natural growth, degraded bushes - typical of a saline soil with hot and humid climate, and isolated agricultural fields and grass lands.

Kutch as recorded in the Bombay Gazetteer, 1880, and Gazetteer of India Kutch, 1971, records that the district has no forests with only few trees. Thakar Jaikrishna Indraji surveyed the vegetation of areas near Bhuj and in the Botanical Garden of Bhuj and recorded in 1926, the flora species in his book "Plants of Cutch and Their Utility". Recently, the plant species of Kutch have been once again enumerated but details about extent, distribution and abundance of various species is not available. Vegetation of Kutch varies with different physiographical regions. Some hills are largely having *Acacia senegal, Euphorbia spp*. community but most of the hills are barren and denuded. The other main associated species include *Acacia leucophloea, Prosopis juliflora, Zizyphus nummularia* etc. General height of the trees varies from 2 m to 6 m. The tree growth occurs only on lower slopes and valleys whereas the upper slopes are almost barren or having only a few Euphorbia bushes. The main grasses of the hill area are *Aristida adscensionnis, Dinhera retroflexa.* The pediment plains of low hillocks support scrub vegetation, constituting *Euphorbia, Zizyphus nummularia, Acacia nilotica* and *Acacia leucophloea* species.

Flat alluvial plains and buried pediment plains with moderate to deep soils support good crops like groundnut, maize, pearl millet and green gram. Field boundaries of cultivated fields are demarcated by trees and shrub species like *Azadirachta indica, Aacia nilotica, Salvadora oleoids and P. juliflora.* Areas near the coastal zone having a good water potential and good soil cover are used for raising horticultural crops like datepalm, coconut, pomegranate, mango, chiku (sapota), guava etc. The muddy creeks and other muddy flats of the coastal area have mangroves consisting mainly of *Avicinnia officinalis*, and *Avicinnia marina*. *Rhizophora mucronata, Salvadora persica* and *Salvadora oleoides* are found on elevated areas but are rare (Saxena, 1994).

Sandy seashores are not congenial for mangrove vegetation. About 456 sq. km. area along the southern coast in Mandvi, Mundra and Naliya (Abdasa) talukas form such an ecosystem. They support halophytic communities with a very low diversity and abundance. The study area of 25 km buffer from project site largely falls in the muddy flats consisting of mangroves and sandy seashores with halophytes.

The site and surroundings have sparse faunal species & mainly domestic animals are observed in this area and the inventory of life forms and biodiversity is typical of an arid coastal climatic zone. However, Kutch district is the famous abode for Flamingo Sanctuary & Wild Ass Sanctuary - but these areas are over 25 km distance from the impact zone. The map showing locations and distances of major sanctuaries in Kutch district is vide Figure 3-10.

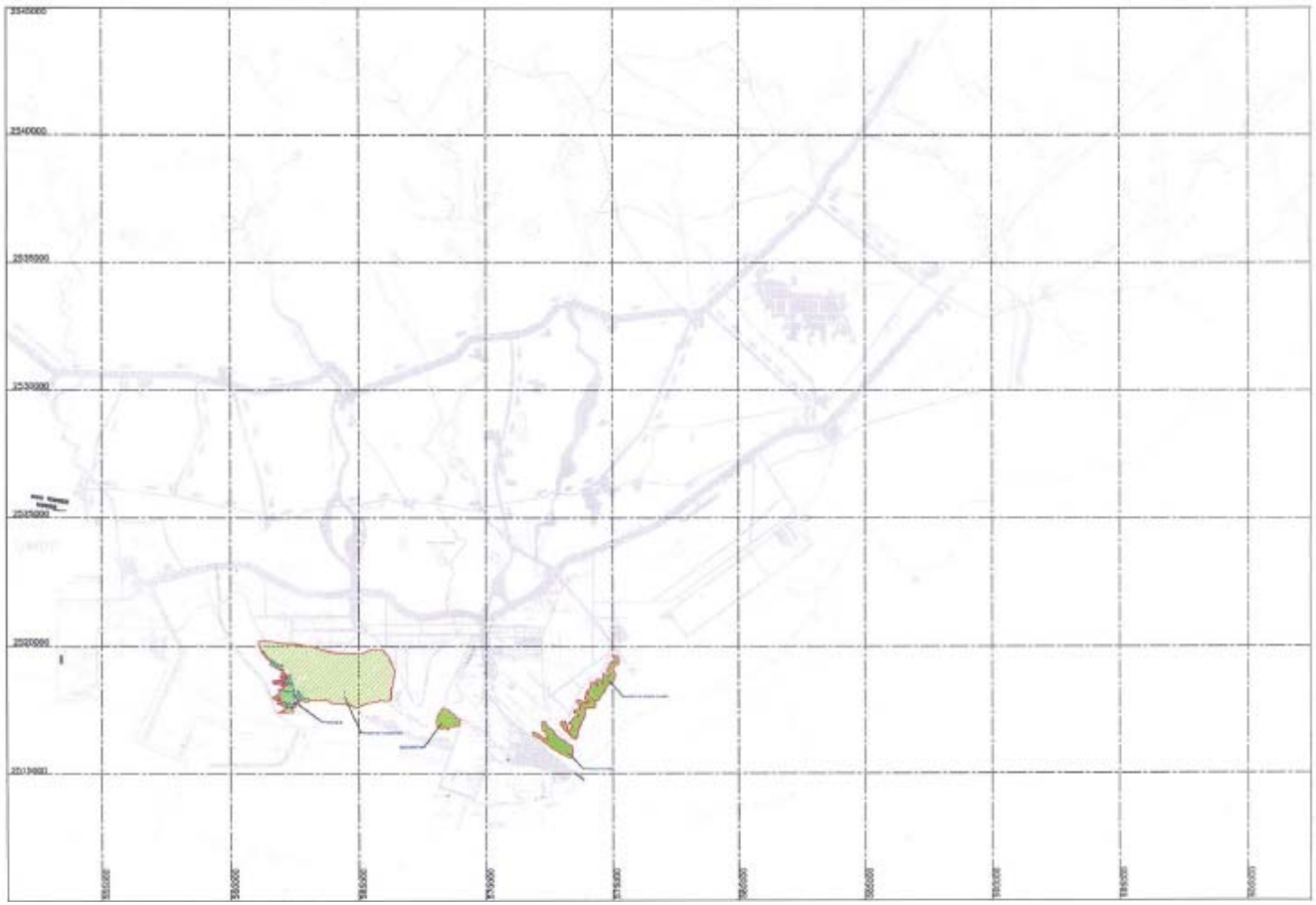
Migratory birds reach this coastal belt and have temporary shelter in the mangroves found in pockets of the coast towards eastern periphery of the study area. These migratory birds are observed to prefer to travel N-NE from coastal mangroves towards the hinterland to finally cross the Himalayas.

Figure 3-10 : Locations and Distances of Major Sanctuaries in Kutch District

Name	Location	Area (Sq. Km)	Wildlife
Kutch Bustard Sanctuary	Near Naliya	500	Great Indian Bustard, Chinkara, Blue Bull Herpetofauna
Banni Grasslands	Chari- Dhand	3847	Waterfowls, Common Cranes, Grey Hypocolius, White-napped Tit, McQueen's Bustard and Dalmatian Pelicans
Narayan Sarovar Sanctuary	Narayana Sarovar	443.23	Chinkara, Caracal, Desert Cat ,Hyena Herpetofauna

Source :District Profile Booklet 2003-2004, Industries Commissionerate Government of Gujarar:2007

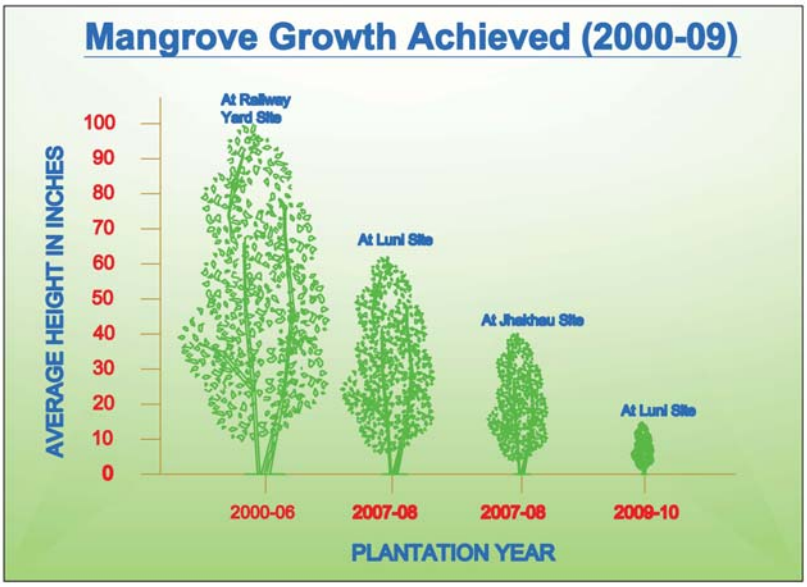
Details of Mangrove Area under Conservation (as approved under WFDP)



Details of Mangrove Conservation along the Cluster of Ports:

Location	Area (ha)
Southern-most stretch of Bocha Island	90
Along the coastline east of Bocha Island upto the openshore south - southeast of oldest Mundra Port	155 85
Kotdi and Baradimata creeks	85
Total	**330**

(as presented & approved under MEIA of WFDP Project)



Status of Mangrove Growth Observed – Horticulture Department, MPSEZL

Table 3-18: List of FLoral Species Found in Study Area

Sr. No.	Local Name	Botanical Name	Family
A.	**Tress and Shrubs**		
1.	Achi	*Tamarix dioica*	Tamaricaceae
2.	Amli	*Tamarindus indica*	Caesalpiniacea
3.	Ankol	*Alangium salvifolium*	Alangiaceae
4.	Aval or Avar	*Cassia auriculate*	Caesalpiniaceae
5.	Baval	*Acacia nilotica*	Mimosaceae
6.	Bordi	*Zizyphus mauritiana*	Rhamnaceae

7.	Cheni bor	*Zizyphus numularia*	Rhamnaceae
8.	Chatri bawal	*Acacia planofrons*	Mimosaceae
9.	Dhraman	*Grewia tiliaefolia*	Tiliaceae
10.	Dumro	*Capparis gradis*	Cappar indaceae
11.	Gongad (Kanjo)	*Xeromphis uliginosa*	Rubiaceae
12.	Gangeti	*Grewia tenax*	Tiliaceae
13.	Gorad	*Acacia Senegal*	Mimosaceae
14.	Gugal	*Commiphora mukul*	Burseraceae
15.	Gundi	*Cordia dichotoma*	Ehret iaceae
16.	Ingoria	*Balanites aegyptia*	Simarubaceae
17.	Kalo Sarsado	*Albizia Tebbeck*	Mimosaceae
18.	Kanthar	*Capparis sepiaria*	Papilionaceae
19.	Kantharo Thar	*Euphorbia nivulia*	Euphorbiaceae
20.	Karamdi	*Carissa carandus*	Apocynaceae
21.	Kasid	*Cassia siamea*	Caesalpiniaceae
22.	Kathgundi	*Cardia monica*	Ehretiaceae
23.	Kerdo	*Capparis aphylla*	Cappar idaceae
24.	Khair	*Acacia catechu*	Mimosaceae
25.	Khakro	*Butea monoperma*	Papilionaceae
26.	Khijdo	*Prosopis cineraria*	Mimosaceae
27.	Khip	*Leptadenia spartium*	Asclepiadaceae
28.	Kundher	*Premna obtusifolia*	Verbenaceae
29.	Luo or Lue	*Grewia villosa*	Tiliaceae
30.	Luno	*Suaeda fruticosa*	Chinopodiaceae
31.	Limdo	*Azadirachta indica*	Meliaceae
32.	Madith	*Dichrostachye cinerea*	Mimosaeae
33.	Mindhol	*Xeromphis spinosa*	Rubiaceae
34.	Moto akdo	*Callotropis gigantia*	Asclepiadaceae
35.	Peepal	*Ficus tseila*	Moraceae
36.	Ron	*Soyamida febrifuga*	Meliaceae
37.	Rohido	*Tecomella undulata*	Bignoniaceae
38.	Sandasado	*Delonix elata*	Caesalpiniaceae
39.	Saruguva	*Moringa oleifera*	Moringaceae
40.	Sarasado	*Albizia oderatissima*	Mimosaceae
41.	Saru	*Casuarina equisitifolia*	Casuarinaceae
42.	Sissoo	*Dalbergia sisoo*	Caesalpiniaceae
43.	Tad	*Borassus flabellifer*	Arecaceae
44.	Tal Bavdi	*Acacia jacquemontii*	Mimosaceae
45.	Umra	*Ficus glomerata*	Moraceae
46.	Vad	*Ficus benghalensia*	Moraceae

47.	Vilayati baval (Gandabawal)	*Prosopis juliflora*	Mimosaceae
48.	Vingo	*Maytenus emerginata*	Celastraceae
	Mangroves		
49.	Cher	*Avicinnia officinalis*	Avicinniaceae
50.	Karod	*Rhizophora mucronata*	Rhizophoraceae
51.	Khari Jar	*Salvadora persica*	Oleaceae
52.	Mithi Jar	*Salvadora oleoides*	Oleaceae
B.	**Climbers**		
1.	Amarvel	*Cuscuta reflexa*	Convolvulaceae
2.	Chanota	*Abrus precatorius*	Fabaceae
3.	Fagvel	*Rivea hypocrateraformis*	Convolvulaceae
4.	Galo	*Tanospora cordifoila*	Menispermaceae
5.	Katambo	*Piliostigma malabaricum*	Caesalpiniacea
6.	Malkankan	*Celastrus paniculata*	Celastraceae
7.	Malvel	*Combratum decandrum*	Combrataceae
8.	Vidari	*Pueraria tuberosa*	Fabaceae
C.	**Grass Species**		
1.	Baru	*Sorgham halepense*	Poaceae
2.	Dab saliu	*Heterophogon contortus*	- do -
3.	Dungri Zenzvo	*Bothriochola ischaemum*	- do -
4.	Darabh	*Desmostachya bipinnata*	- do -
5.	Daro	*Cynodon dactylon*	- do -
6.	Dhramnu	*Cenchrus setigerus*	- do -
7.	Gandharu	*Cymbopogon jwarancusa*	- do -
8.	Jinjvo	*Dichanthium annulathum*	- do -
9.	Kadvano	*Aeloropus lagopoides*	- do -
10.	Kans	*Sacchaum spontaneum*	- do -
11.	Khariu	*Dinebra retrofelxa*	- do -
12.	Khovan (Gandhir)	*Eleusine compressa*	- do -
13.	Lamodu	*Arisida histricula*	- do -
14.	Bhongoru	*Apluda mutica*	- do -
15.	Mosti	*Iseilema prostratum*	- do -
16.	Ratad	*Themeda cymbaria*	- do -
17.	Rois	*Cymbooogon martini*	- do -
18.	Saniar	*Schima sulcatum*	- do -
19.	Saravu	*Bothriochloa intermedia*	- do -

(Source : Working Plan of Kutch - S. K. Sinha, Joshi R. R.)

Arid mainland, saline deserts and the 350 km long coast with shallow creeks and Gulf provide varied habitats to different kinds of wild-life communities. This area also falls along

the migratory routes of birds and during late monsoon and early winter it provides suitable habitat conditions for migratory birds which either spend some time only as visitors or breed during their stay. Dry deserts and Banni also harbour many terrestrial fauna such as Reptiles, Rodents and Mammals. Raptors are also commonly observed in vast grasslands. Spiny tailed lizard, Indian Bustard or Ghorad, Lesser Floricans or Tilor, are a few of the important faunal species found in Kutch and deserve protection. Leopards, wild-boar, wolf, jackal, blue bull (Nilgai) and chinkara (Indian Gazela) are currently struggling for their survival as their habitats have come under severe biotic pressure.

Marine ecosystems of Kutch coast are very rich in species diversity and abundance. This area has a record number of 108 species of algae, coastal mangroves, algae and marine angiosperm. *Halophila ovalis* along with phyto-plankton provide primary production on which rich faunal life sustains. Dugong and Dolphins, two sea mammals, Crabs, Fish, Prawns, Shrimps, etc. are other important marine fauna, which sustain human life. The list of common wild fauna in Kutch is given below

Table 3-19 : Common Fauna of Kutch District

Common Wild Animals

Panther	*Panthera pardus*
Wild Ass	*Equus heminonus*
Chinkara	*Gazella gazella*
Wild boar	*Sus scrofa*
Hyaena	*Hyaena hyaena*
Jackal	*Canis aureus*
Fox	*Vulpes bengalensis*
Wolf	*Canis lupus*
Hare	*Lepus nigricollis*
Wild cut	*Felis chaus*
Porcupine	*Hystrix indica*
Mongoose	*Herpestes edwardsi*
Nilgai	*Boselaphus tragocamelus*

Common Birds

Flamingo	*Phoenicopterus roseus*
Ghorad	The great Indian bustard
Saras Crane	*Grus spp.*
Common Crane	*Grus grus*
Peacock/Peafowl	*Pavo cristatus*
Patridges	*Francolinus spp.*
Jungle fowls	*Gallus spp.*
Sandgrouse	*Petrocks spp.*

Ibis (Glossy)	*Plegadis falcinellus*
Pelicans	*Pelecanus onocrotalus*
Little Egret	*Egretta egretta*
Backdrongo	*Dicruru adsimitis*
Baya	*Plocerus philippinus*
Babbler	*Turdodides caudatus*
Kingfisher	*Alcedo atthis*
Dove	*Streptopelia spp.*

Common Reptiles

Spiny tailed lizard	*Uromastyx hardwickii*
Monitor lizard	*Varanus bengalensis*
Starred tortoise	*Geochelone elegans*
Dhaman	*Ptyas mucosus*
Sand snake	*Psammophis condanorus*
Blind snake	*Typhlina brathina*

3.7 SOCIO-ECONOMIC ENVIRONMENT

There are in all 68 villages in the study area all of which are in Kutch district. 48 of these villages are in Mundra taluka, 16 in Anjar taluka and 4 in Mandvi taluka. The distance and direction of these villages wrt the proposed project site is given as under :

Table 3-20 : Distance and Direction of Villages in Study Area wrt Proposed Project Site

S. No.	Village Name	Distance, km	Direction
	ANJAR TALUKA		
	0.5 - 3 km		
1	Valadiya Bitta (East)	0.7	NE
2	Kumbhariya	0.7	NE
3	Valadiya Bitta (West)	0.8	NE
4	Nagavaladiya	3	ENE
	3 - 7 km		
1	Devaliya	4	NE
2	Bhuvad	5.4	NE
3	Mindiyala	6	NE
4	Mathak	5.8	ENE
5	Vira	6.1	ENE
	7 - 10 km		
1	Chandroda	7.7	NE
2	Khedoi	7.8	NE
3	Mathda	9.6	NE

S. No.	Village Name	Distance, km	Direction
4	Shinay	10	NE
5	Vidi	10	NE
6	Sanghad	7.3	ENE
7	Chandrapar	7.7	ENE
	MUNDRA TALUKA		
	< 0.5 km		
1	Bharudiya	0	NE
2	Raga	0	NE
3	Vadala	0.5	NE
4	Goersama	0	ENE
5	Luni	0	ENE
6	Shiracha	0	W
7	Navinal	0.3	W
8	Tunda	0.5	W
9	Jarpara	0.5	WNW
	0.5 - 3 km		
1	Gundala	1.4	NNE
2	Ratadiya	2.7	NNE
3	Baroi	0.6	NE
4	Shekhadiya	1	NE
5	Mokha	1.6	NE
6	Sadau	1.8	NE
7	Chhasra	2.3	NE
8	Pavdiara	0.8	ENE
9	Bhadresar	2.5	ENE
10	Hatdi	3	ENE
11	Kandagara Mota	1.5	W
12	Dhrab	1.8	WNW
13	Borana	2.7	NW
14	Pratappar	2.8	NW
	3 - 7 km		
1	Mota Kapaya	5	N
2	Viraniya	5.2	N
3	Lakhapar	5.7	N
4	Toda	5.8	N
5	Kundrodi	3.2	NNE
6	Mangra	3.3	NNE

S. No.	Village Name	Distance, km	Direction
7	Bagda	5.1	NNE
8	Bhorara	6.4	NNE
9	Vovar	3.1	NE
10	Kukadsar	5.2	ENE
11	Kuvay	5.9	ENE
12	Nani Bhujpar	3.3	WNW
13	Khakhar Moti	4	WNW
14	Deshalpar	5	WNW
15	Moti Bhujpar	4	NW
16	Bochda	3.5	NNW
17	Samagoga	6.7	NNW
	7 - 10 km		
1	Kandagara Nana	7.2	N
2	Paragpar	7.2	N
3	Patri	8.8	N
4	Fachariya	7.8	NNE
5	Vagura	7.9	NNE
6	Gelda	9	NW
7	Depa	9.5	NW
8	Baraya	8.8	NNW
	MANDVI TALUKA		
	3 - 7 km		
1	Tragadi	5	W
2	Mota Bhadiya	5.9	W
3	Nani Khakhar	6	WNW
	7 - 10 km		
1	Bidada	9	WNW

An integral part of EIA study base line information for the proposed SEZ at Mundra is to define the socio-economic profile of the study area (impact zone). This database is based on Census of India 2001 thus, generated in the process include total population, caste, sex ratio, literacy rate, total main worker, marginal worker and non-worker etc. It is envisaged that this information would serve as baseline while evaluation of likely impact which may occur on socio-economic environment because of proposed SEZ development.

Details of the socio-economic structures of study area like population density, sex ratio, occupational pattern, SC/ST, types of workers, medical facilities available, communication, transport, post office, police station, educational facilities etc. have been collected from different government records, latest published reports relevant information of which are given below.

Table 3-21 : Population Details in Study Area

S.No.	Village Name	No. of Household	Total Population	Total Male	Total Female	Population <06 yrs	Male <06 yrs	Female <06 yrs
1	Vidi	478	2184	1148	1036	420	212	208
2	Mindiyala	324	1631	794	837	222	107	115
3	Mathda	332	1575	782	793	294	155	139
4	Kumbhariya	90	401	196	205	60	33	27
5	Bhuvad	412	1986	997	989	342	166	176
6	Chandroda	446	2024	1022	1002	385	214	171
7	Valadiya Bitta (East)	193	822	401	421	110	61	49
8	Mathak	439	1925	995	930	318	185	133
9	Patri	491	2148	1110	1038	350	188	162
10	Vagura	224	921	466	455	143	74	69
11	Fachariya	78	307	157	150	49	23	26
12	Bagda	159	649	309	340	125	58	67
13	Kundrodi	198	868	428	440	131	63	68
14	Depa	82	378	192	186	69	43	26
15	Ratadiya	250	1250	637	613	169	89	80
16	Lakhapar	230	1093	552	541	200	102	98
17	Gelda	179	918	457	461	153	70	83
18	Kandagara Mota	454	2306	1150	1156	353	174	179
19	Pragpar	141	598	298	300	101	58	43
20	Toda	121	595	312	283	96	52	44
21	Luni	480	2666	1362	1304	501	262	239
22	Mota Kapaya	339	1506	779	727	244	124	120
23	Moti Bhujpar	1188	5952	2942	3010	983	492	491
24	Nani Bhujpar	126	717	370	347	101	60	41
25	Mangra	143	757	389	368	118	51	67
26	Shekhadiya	121	715	362	353	168	93	75
27	Tunda	241	1207	607	600	237	119	118
28	Navinal	241	1146	598	548	238	131	107
29	Borana	63	339	164	175	59	25	34
30	Baroi	590	2741	1396	1345	484	245	239
31	Goersama	137	727	388	339	112	61	51
32	Vadala	405	1751	861	890	282	143	139
33	Pavdiara	30	200	107	93	27	13	14
34	Bhadresar	663	3516	1776	1740	553	284	269
35	Hatdi	139	625	340	285	126	70	56

S.No.	Village Name	No. of Household	Total Population	Total Male	Total Female	Population <06 yrs	Male <06 yrs	Female <06 yrs
36	Vovar	243	1155	580	575	206	103	103
37	Chhasra	257	1176	611	565	174	89	85
38	Bidada	1491	7595	3842	3753	1034	549	485
39	Nana Bhadiya	179	799	394	405	110	56	54
40	Devaliya	176	666	339	327	128	63	65
41	Khedoi	1126	5462	2818	2644	855	462	393
42	Valadiya Bitta (West)	149	577	297	280	102	55	47
43	Nagavaladiya	199	907	472	435	176	98	78
44	Sanghad	631	2801	1393	1408	479	245	234
45	Vira	290	1314	655	659	277	141	136
46	khakhar Moti	324	1596	810	786	265	143	122
47	Deshalpar	424	2013	1045	968	285	161	124
48	Baraya	86	434	229	205	70	39	31
49	Viraniya	141	749	386	363	161	83	78
50	Bhorara	159	823	418	405	134	68	66
51	Gundala	408	1730	882	848	295	151	144
52	Mokha	118	515	267	248	69	43	26
53	Samagoga	352	2021	1019	1002	347	183	164
54	Sadau	310	1345	683	662	244	134	110
55	Shiracha	187	923	456	467	154	69	85
56	Jarpara	1019	5762	2893	2869	1067	564	503
57	Dhrab	356	2007	1089	918	372	192	180
58	(1) Bochda	252	1262	650	612	254	131	123
59	Pratappar	20	62	31	31	7	2	5
60	Kukadsar	137	721	364	357	96	49	47
61	Bharudiya	1	1	1	0	0	0	0
62	Raga	28	130	60	70	27	14	13
63	Nani Khakhar	645	3374	1676	1698	505	253	252
64	Tragadi	143	824	402	422	150	75	75
65	Kandagara Nana	35	190	103	87	30	15	15
66	Kuvay	25	109	47	62	21	8	13
67	Mota Bhadiya	511	2822	1417	1405	547	289	258
68	Chandrapar	1	3	3	0	0	0	0

Table 3-22: SC/ST Population Details in Study Area

S.No.	Village Name	Population Schedule caste	Male Schedule caste	Female Schedule caste	Population Schedule tribe	Male Schedule tribe	Female Schedule tribe
1	Vidi	75	41	34	550	285	265
2	Mindiyala	217	104	113	0	0	0
3	Mathda	132	69	63	9	3	6
4	Kumbhariya	141	68	73	9	4	5
5	Bhuvad	246	126	120	0	0	0
6	Chandroda	107	55	52	84	49	35
7	Valadiya Bitta (East)	75	38	37	0	0	0
8	Mathak	125	67	58	21	13	8
9	Patri	396	223	173	130	56	74
10	Vagura	20	12	8	7	4	3
11	Fachariya	12	7	5	0	0	0
12	Bagda	44	18	26	12	6	6
13	Kundrodi	225	104	121	77	35	42
14	Depa	24	12	12	0	0	0
15	Ratadiya	254	128	126	28	11	17
16	Lakhapar	337	174	163	107	52	55
17	Gelda	155	85	70	29	14	15
18	Kandagara Mota	317	171	146	144	70	74
19	Pragpar	392	211	181	0	0	0
20	Toda	101	50	51	0	0	0
21	Luni	311	155	156	85	41	44
22	Mota Kapaya	701	369	332	29	16	13
23	Moti Bhujpar	895	466	429	498	253	245
24	Nani Bhujpar	252	129	123	0	0	0
25	Mangra	215	108	107	5	3	2
26	Shekhadiya	48	22	26	0	0	0
27	Tunda	68	37	31	0	0	0
28	Navinal	189	99	90	98	57	41
29	Borana	0	0	0	0	0	0
30	Baroi	420	199	221	95	50	45
31	Goersama	137	71	66	148	76	72
32	Vadala	313	167	146	212	107	105
33	Pavdiara	0	0	0	0	0	0
34	Bhadresar	299	155	144	163	87	76
35	Hatdi	0	0	0	114	60	54
36	Vovar	31	17	14	0	0	0
37	Chhasra	76	40	36	373	194	179
38	Bidada	1374	709	665	321	159	162
39	Nana Bhadiya	330	160	170	43	26	17
40	Devaliya	136	68	68	27	19	8
41	Khedoi	407	206	201	524	292	232
42	Valadiya Bitta (West)	62	32	30	0	0	0
43	Nagavaladiya	26	15	11	0	0	0
44	Sanghad	594	290	304	0	0	0

S.No.	Village Name	Population Schedule caste	Male Schedule caste	Female Schedule caste	Population Schedule tribe	Male Schedule tribe	Female Schedule tribe
45	Vira	139	67	72	16	7	9
46	khakhar Moti	335	177	158	60	36	24
47	Deshalpar	366	188	178	125	62	63
48	Baraya	111	58	53	0	0	0
49	Viraniya	250	123	127	4	3	1
50	Bhorara	246	127	119	10	5	5
51	Gundala	519	274	245	91	39	52
52	Mokha	52	25	27	42	20	22
53	Samagoga	301	157	144	0	0	0
54	Sadau	361	182	179	164	86	78
55	Shiracha	463	222	241	59	30	29
56	Jarpara	649	343	306	86	43	43
57	Dhrab	148	78	70	104	49	55
58	(1) Bochda	758	403	355	0	0	0
59	Pratappar	0	0	0	0	0	0
60	Kukadsar	0	0	0	0	0	0
61	Bharudiya	0	0	0	0	0	0
62	Raga	0	0	0	0	0	0
63	Nani Khakhar	534	278	256	248	121	127
64	Tragadi	0	0	0	0	0	0
65	Kandagara Nana	1	0	1	20	12	8
66	Kuvay	0	0	0	109	47	62
67	Mota Bhadiya	380	193	187	15	8	7
68	Chandrapar	0	0	0	0	0	0

Table 3-23 : Literacy Details in Study Area

S. No.	Village Name	Population Literate	Male Literate	Female Literate	Population Illiterate	Male Illiterate	Female Illiterate
1	Vidi	788	505	283	1396	643	753
2	Mindiyala	456	307	149	1175	487	688
3	Mathda	599	382	217	976	400	576
4	Kumbhariya	197	122	75	204	74	130
5	Bhuvad	909	586	323	1077	411	666
6	Chandroda	808	507	301	1216	515	701
7	Valadiya Bitta (East)	379	238	141	443	163	280
8	Mathak	814	549	265	1111	446	665
9	Patri	1134	678	456	1014	432	582
10	Vagura	442	285	157	479	181	298
11	Fachariya	146	86	60	161	71	90
12	Bagda	288	174	114	361	135	226
13	Kundrodi	415	248	167	453	180	273
14	Depa	197	107	90	181	85	96
15	Ratadiya	809	476	333	441	161	280
16	Lakhapar	563	322	241	530	230	300
17	Gelda	399	247	152	519	210	309
18	Kandagara Mota	1397	800	597	909	350	559
19	Pragpar	336	205	131	262	93	169

20	Toda	377	223	154	218	89	129
21	Luni	1055	687	368	1611	675	936
22	Mota Kapaya	860	521	339	646	258	388
23	Moti Bhujpar	3213	1840	1373	2739	1102	1637
24	Nani Bhujpar	423	266	157	294	104	190
25	Mangra	396	225	171	361	164	197
26	Shekhadiya	153	116	37	562	246	316
27	Tunda	558	317	241	649	290	359
28	Navinal	574	352	222	572	246	326
29	Borana	184	106	78	155	58	97
30	Baroi	1481	862	619	1260	534	726
31	Goersama	378	232	146	349	156	193
32	Vadala	787	491	296	964	370	594
33	Pavdiara	138	84	54	62	23	39
34	Bhadresar	1537	917	620	1979	859	1120
35	Hatdi	302	191	111	323	149	174
36	Vovar	549	359	190	606	221	385
37	Chhasra	742	456	286	434	155	279
38	Bidada	5015	2823	2192	2580	1019	1561
39	Nana Bhadiya	486	276	210	313	118	195
40	Devaliya	283	183	100	383	156	227
41	Khedoi	2937	1682	1255	2525	1136	1389
42	Valadiya Bitta (West)	231	153	78	346	144	202
43	Nagavaladiya	403	251	152	504	221	283
44	Sanghad	1089	717	372	1712	676	1036
45	Vira	347	256	91	967	399	568
46	Khakhar Moti	861	515	346	735	295	440
47	Deshalpar	1158	639	519	855	406	449
48	Baraya	224	148	76	210	81	129
49	Viraniya	360	228	132	389	158	231
50	Bhorara	437	267	170	386	151	235
51	Gundala	988	600	388	742	282	460
52	Mokha	312	184	128	203	83	120
53	Samagoga	1182	681	501	839	338	501
54	Sadau	711	423	288	634	260	374
55	Shiracha	479	280	199	444	176	268
56	Jarpara	2517	1616	901	3245	1277	1968
57	Dhrab	1013	668	345	994	421	573
58	(1) Bochda	673	416	257	589	234	355
59	Pratappar	40	23	17	22	8	14
60	Kukadsar	105	64	41	616	300	316
61	Bharudiya	1	1	0	0	0	0
62	Raga	42	28	14	88	32	56
63	Nani Khakhar	2027	1120	907	1347	556	791
64	Tragadi	281	159	122	543	243	300
65	Kandagara Nana	101	61	40	89	42	47
66	Kuvay	49	26	23	60	21	39
67	Mota Bhadiya	1344	855	489	1478	562	916
68	Chandrapar	1	1	0	2	2	0

Table 3-24 : Details of Working Population in Study Area

S. No.	Village Name	Total Worker Population	Main Worker Population	Main Cultivator Population	Main Agriculture Population	Main Household Population	Main Other Population	Marginal Worker Population	Non Worker Population
1	Vidi	646	646	98	223	92	233	0	1538
2	Mindiyala	876	673	8	4	3	658	203	755
3	Mathda	784	761	473	170	23	95	23	791
4	Kumbhariya	192	87	12	48	0	27	105	209
5	Bhuvad	939	870	326	248	34	262	69	1047
6	Chandroda	1062	1030	543	277	2	208	32	962
7	Valadiya Bitta (East)	314	194	96	27	2	69	120	508
8	Mathak	738	560	101	33	18	408	178	1187
9	Patri	814	671	100	229	21	321	143	1334
10	Vagura	501	239	176	36	1	26	262	420
11	Fachariya	177	75	41	19	1	14	102	130
12	Bagda	275	167	121	27	0	19	108	374
13	Kundrodi	230	226	5	144	0	77	4	638
14	Depa	164	149	2	2	0	145	15	214
15	Ratadiya	436	371	37	66	43	225	65	814
16	Lakhapar	306	306	68	170	5	63	0	787
17	Gelda	318	297	59	113	0	125	21	600
18	Kandagara Mota	700	600	154	90	9	347	100	1606
19	Pragpar	283	283	41	61	79	102	0	315
20	Toda	168	164	70	74	0	20	4	427
21	Luni	896	674	94	84	6	490	222	1770
22	Mota Kapaya	415	406	35	300	1	70	9	1091
23	Moti Bhujpar	2286	1810	460	493	74	783	476	3666
24	Nani Bhujpar	355	191	87	71	1	32	164	362
25	Mangra	212	204	54	123	1	26	8	545
26	Shekhadiya	342	227	8	35	7	177	115	373

S. No.	Village Name	Total Worker Population	Main Worker Population	Main Cultivator Population	Main Agriculture Population	Main Household Population	Main Other Population	Marginal Worker Population	Non Worker Population
27	Tunda	605	482	46	66	23	347	123	602
28	Navinal	337	302	85	69	1	147	35	809
29	Borana	92	92	69	14	0	9	0	247
30	Baroi	1029	761	141	77	13	530	268	1712
31	Goersama	332	240	66	53	0	121	92	395
32	Vadala	531	319	15	54	0	250	212	1220
33	Pavdiara	72	72	38	18	0	16	0	128
34	Bhadresar	984	956	74	200	2	680	28	2532
35	Hatdi	156	156	49	2	3	102	0	469
36	Vovar	647	431	182	178	2	69	216	508
37	Chhasra	558	313	123	12	6	172	245	618
38	Bidada	2961	2236	505	866	77	788	725	4634
39	Nana Bhadiya	288	272	0	48	16	208	16	511
40	Devaliya	348	196	48	73	2	73	152	318
41	Khedoi	1783	1588	356	776	49	407	195	3679
42	Valadiya Bitta (West)	216	204	74	103	0	27	12	361
43	Nagavaladiya	267	229	64	30	0	135	38	640
44	Sanghad	897	826	47	57	8	714	71	1904
45	Vira	579	396	124	123	1	148	183	735
46	khakhar Moti	567	517	118	222	1	176	50	1029
47	Deshalpar	822	440	162	75	1	202	382	1191
48	Baraya	163	163	20	75	4	64	0	271
49	Viraniya	285	205	85	75	1	44	80	464
50	Bhorara	435	126	36	66	0	24	309	388
51	Gundala	619	446	17	59	12	358	173	1111
52	Mokha	261	145	42	3	0	100	116	254
53	Samagoga	748	722	233	283	9	197	26	1273
54	Sadau	568	485	63	153	4	265	83	777

S. No.	Village Name	Total Worker Population	Main Worker Population	Main Cultivator Population	Main Agriculture Population	Main Household Population	Main Other Population	Marginal Worker Population	Non Worker Population
55	Shiracha	353	281	78	82	43	78	72	570
56	Jarpara	2471	2002	956	525	2	519	469	3291
57	Dhrab	1146	729	222	167	1	339	417	861
58	(1) Bochda	549	540	154	82	0	304	9	713
59	Pratappar	14	14	2	5	0	7	0	48
60	Kukadsar	331	299	12	6	2	279	32	390
61	Bharudiya	1	1	0	0	0	1	0	0
62	Raga	48	29	17	9	0	3	19	82
63	Nani Khakhar	1370	1051	284	393	40	334	319	2004
64	Tragadi	440	359	46	67	91	155	81	384
65	Kandagara Nana	55	55	28	23	0	4	0	135
66	Kuvay	37	36	5	1	0	30	1	72
67	Mota Bhadiya	1167	981	423	294	12	252	186	1655
68	Chandrapar	1	1	0	1	0	0	0	2

4 IMPACTS IDENTIFICATION, PREDICTION & ASSESSMENT

4.1 IMPACT IDENTIFICATION

The potential impacts on the environment from the development of Mundra SEZ have been identified considering the nature and extent of the activities associated with the project implementation and operation as well as the present scenario of the environmental quality at the project site.

Impact prediction is an important component in Environmental Impact Assessment process. Several techniques and methodologies are in vogue for impact prediction on physical, biological and socio-economic components of environment.

Component wise identification of qualitative and also semi quantitative impacts of the activities proposed in coming 25 years of project have been carried out. A simplex Matrix method has been used to predict impacts of construction and operation phases of the project. Impacts are categorized as positive and negative in nature as also long term and short terms on a time scale.

The impacts are predicted with respect to receptor locations like villages (habitat), ecologically sensitive areas, etc.

The contribution of presently operating port, industries and social (residential & commercial) infrastructures are exhibited in the baseline environmental status presented in earlier chapter. In particular, the results of air quality, water resources, solid waste generation, etc., already have witnessed the impact of past developments.

The earlier pursued development has undergone construction phase which had activities like hauling of earth material & consequent generation of wastes, actual construction phase activities, installation of equipment, transportation of construction materials, material handling etc., creating short term impacts of varying environmental attributes.

Similarly, the earlier pursued development has resulted into operational port and services, besides down the line industries; and all these functioning together present a complex environmental impact. The material handling, storage, movement of cargo and partial value addition (by industries operating in the area) have also been reflected in the baseline environmental quality.

The fact that even at the present level of operations of port and associated utilities, the environmental quality observed is well within the prevailing national standards, is indicative of many things like :

1. The operations are basically less polluting and
2. The Adani group management is vigilant to pursue the earlier proposed EMPs' – that has kept the pollution levels low
3. The socio-economic development that has improved the quality of life of local residents is another receptor based indicator of "Human Interests" aspect of environmental quality

However, the present proposal is for a considerably large scale of development encompassing varied objectives that may trigger activities contributing to localized pollution and waste generation. The preservation of regional ecology and up-holding the quality of life components of socio economic environment may be challenged considerably due to the proposed developments in coming three decades.

It has been considered important therefore, to visualize the dimension of development of operations in forth coming five years that may impact the environmental quality further, as also the plan of activities likely to be pursued in these five years period, which will serve the entire life of the ultimate planed period of 30 years, like transport corridor, railway, water supply and sewerage, storm water drainage, etc. The construction phase impacts would be covering mostly the impacts of infrastructure in the ultimate installed capacities, while the operative phase impacts (for coming five years) would be covering impacts worth considering for the operational phase of Mundra SEZ.

4.2 IMPACT PREDICTION & ASSESSMENT DURING CONSTRUCTION PHASE

The construction phase of proposed Mundra SEZ infrastructure activities shall be done phase-wise over a period of 25 yrs., depending upon the industrial and other development in the SEZ. This phase generally involves activities like erection of civil structures, erection of new equipment and machinery, green belt development etc. The construction phase would bring in immediate but short term changes on various components of environment near the proposed site. The likely changes on starting the constructional activity would be in the following areas :

During this phase the following activities are considered significant.

- Material loading and unloading and storage
- Dust / Particulate Emission
- Equipment Operation
- Gaseous emissions
- Solid Waste Generation
- Employment
- Green Belt Development

4.2.1 Impact on Air Environment

During the construction phase, there would be increase in suspended particulate matter and respirable suspended particulate matter in the ambient air due to construction work like site levelling, earthworks, foundation works etc. and transportation of various materials in trucks. Thus baseline air quality shall be affected in the working area. In order to ameliorate this, the surfaces near the proposed site and transport roads will be sprinkled with water to reduce dust generation.

Levels of SO_2, NO_X, SPM, CO and unburnt hydrocarbon in ambient air are expected to increase due to operation of construction equipments such as generators, bulldozers, loaders, trucks and other vehicles. The impacts occurring due to such exhaust emission are recognized as negligible and short term in nature. However, such an impact can be minimized by restricting entry only to PUC certified vehicles.

4.2.2 Impact on Water Environment

As the construction of the infrastructure facilities shall not involve huge quantities of waste water disposal and the construction shall be restricted to within the SEZ premises, there is little possibility of pollution of surface and / or ground water. Modular sanitation facility shall be provided by contractors for disposal of sanitary sewage generated by the work force. There shall be no disposal of construction waste outside the proposed site.

Hence, the overall impact on water environment during construction phase of the proposed SEZ infrastructure facilities can be considered as short term and insignificant.

4.2.3 Impact on Land and Topography

The area of the proposed SEZ site is more or less flat terrain. It is predominantly covered with fine to medium grained sandy loam as top soil with underlying compacted dense sand. The ground is inclined towards the sea. During the construction phase levelling would be required. There might be a temporary phase of dumping the construction materials and wastes in the SEZ marring the aesthetics of the site. Apart from the localized construction impacts confined to the SEZ site, no significant long term adverse impacts on topography are envisaged.

4.2.4 Impact on Noise Environment

The noise produced during construction phase may not have significant impact on the existing ambient noise levels. The activities like construction of foundation, infrastructure etc. are considered as the main sources of noise emission. The major construction work will be carried out during the daytime. The construction equipment may generate high noise, which can affect the personnel operating the machines. The noise level in the working environment is compared with standards prescribed by OSHA/CPCB/ISO 3746. The acceptable limit for each shift being of 8-hour duration, the equivalent noise level exposure during the shift is 90 dB (A).

The noise level likely to be generated during excavation, loading, transportation of construction materials will be in the range of 90 -100 dB(A). The workers in general are likely to be exposed to an equipment noise level of 80 - 90 dB (A) in an 8 hour

shift for which all statutory precautions as per laws will be taken into consideration. Use of proper personal protective equipments will mitigate any adverse impact of noise on the working population. All noise from the proposed site is expected to be reduced significantly before reaching the nearby habitation.

4.2.5 Impact on Ecological Environment

The contractors will provide cooking fuel to the workforce; this will check cutting & felling of already scanty shrubs, trees available in the nearby areas. The construction work will include the activities like vegetation clearance, cutting, filling and levelling. However, maximum effort shall be made to retain the little vegetation available on site. In addition, there shall be development of green-belt within the premises, which shall improve the existing flora and fauna in the area and have a significant positive impact on the ecological environment.

4.2.6 Impact on Demographic / Socio-economic Environment

The project site is scarcely populated except some clusters of nomadic habitations in the vicinity. A major part of the terrain is non cultivated land. During the construction phase, there will be addition of civic amenities such as road, transport, communication, drinking water, sanitation and other facilities for the work force.

During the construction period, majority of the labour will be deployed from the local area. Skilled and high skilled workers from outside will also get employment. Most of the people will be employed by contractors or subcontractors. The proposed project will provide direct employment to about 8000 persons during construction phase. In addition to this, it is expected that many persons will be indirectly benefited through casual work, transportation, trading etc. This shall cause economic upliftment of the proposed study area.

4.3 IMPACT PREDICTION & ASSESSMENT DURING OPERATIONAL PHASE

This phase of any project is important because it generates long-term impacts, no sooner than the project activities start. The primary impacts causing likely deterioration could be on air, water, land / soil and noise due to the gaseous emissions, vehicular

movement, discharge of liquid effluent, solid waste generation and operation of equipment and machinery.

4.3.1 Impact on Air Environment

Mundra SEZ Ltd. is primarily a service provider. None of the infrastructure facilities to be set up shall generate any air pollution, on regular basis. Only the DG sets, which shall be operated only in case of emergency, shall emit gases, which shall be safely emitted through appropriate stacks. The other source of air pollution shall be from the vehicular traffic. However, such an impact can be minimized by restricting entry only to PUC certified vehicles.

The operational phase activities in the industrial units might have impact on the air quality based on the nature of their process / operation. Wherever required, the units shall provide appropriate stacks / vents and air pollution control equipment for all the gaseous emissions. Greenbelt will also be developed right from commencement of construction activities, which shall act as a major sink.

Thus, impact on air environment due to the proposed Mundra SEZ infrastructure facilities shall negligible.

4.3.2 Impact on Water Environment

Water shall not be used in the infrastructure facilities. For the sewage to be generated from the SEZ, common sewage treatment plants (CSTP) shall be installed and operated by Mundra SEZ Ltd. Treated sewage water shall be recycled and reused within the SEZ premises.

The industrial effluent if generated from the industrial units shall be handled by the units themselves as per the rules and regulations of GPCB, MoEF and any other regulating authority. The units shall treat the effluent in their own effluent treatment plants. Common effluent treatment plants (CETP) may also be setup, based on the type and location of the proposed industrial units. Then, the units shall send their industrial effluent conforming to the CETP inlet norms, to the CETP. Moreover, based on the nature of the industrial effluent to be generated, the units may send their industrial effluent conforming to the CSTP inlet norms, to the CSTPs.

As there shall not be any discharge of treated / untreated liquid / solid waste into existing ground / surface water sources, impact on water environment due to the proposed Mundra SEZ infrastructure facilities shall be minimal.

4.3.3 Impact on Land and Topography

Land / topography of the project site may be altered. However, care shall be taken to avoid any drastic changes, which might have severe repercussions like flooding of upstream areas, etc. If such a situation is unavoidable, then appropriate measures shall be undertaken to lessen such conditions.

All the municipal solid waste to be generated from the proposed Mundra SEZ shall be disposed into scientifically designed secured landfill sites. If the industrial units generate hazardous / non-biodegradable wastes, then they shall have to dispose them at approved TSDF sites, common incinerators etc., as applicable after obtaining the required approvals / permissions from GPCB, MoEF and any other regulating authority.

As there shall not be any discharge of treated / untreated liquid / solid waste on land within or outside SEZ, impact on land environment due to the proposed Mundra SEZ infrastructure facilities shall be minimal.

4.3.4 Impact on Noise Environment

Mundra SEZ Ltd. is only a service provider. Hence, there shall not be any noise pollution on regular basis, except for the DG sets which shall be operated only in case of emergency. These DG sets shall be installed in acoustic enclosures to minimise noise pollution.

The industrial units which shall have noise generating equipment / machinery shall install the same in acoustic enclosures or shall provide acoustic hoods, such that the ambient noise levels shall conform to the prevailing norms.

As green-belt shall also be developed in the SEZ, the impact on noise environment due to the proposed Mundra SEZ infrastructure facilities shall be negligible.

4.3.5 Impact on Ecological Environment

The proposed SEZ shall convert the existing mostly barren land with sparse vegetation into a SEZ with diverse landuses like industrial, commercial, residential, recreational etc. interspersed with green-belt, such that about 30 % of the SEZ shall be covered with green-belt.

Thus, the green-belt development shall give impetus to development of flora and fauna in the SEZ, improving the ecological environment.

4.3.6 Impact on Demographic / Socio-economic Environment

Due to the diverse activities to be set up in the SEZ, skilled as well as unskilled personnel shall obtain direct as well as indirect employment. The SEZ shall bring about a huge upliftment of the study area considering the vast population to use the SEZ. Residential establishments and its linked social infrastructure shall obtain an impetus in this otherwise underdeveloped area, which was further devastated by the 26th January 2001 earthquake. Thus, a significant socio-economic upgradation is predicted in the study area due to the various SEZ activities.

4.4 IMPACTS IDENTIFICATION & PREDICTION MATRICES

The impact identification matrices for the proposed Mundra SEZ infrastructure facilities during construction phase is shown in Table 4-1 and during operation phase is shown in Table 4-2. The various activities which have been identified in the previous sections have been grouped separately and arranged in rows. The environmental factors, which are anticipated to be affected, have been arranged in columns. A preliminary scrutiny has been done and the cells, which fall at the junction of 'Activity' and 'Environmental Factor', that have possible interaction with each other, have been 'Crossed'.

The matrix thus establishes the possible 'cause-effect' relationship and identifies the environmental factors likely to be impacted and activities responsible for the same. The impacts identified may be positive or negative, significant or insignificant. This determination is done in the impact prediction matrices for the proposed Mundra SEZ infrastructure facilities during construction phase is shown in Table 4-3 and during operation phase is shown in Table 4-4.

All such adverse impacts which are predicted shall require mitigation measures, so as to have minimal impact on the environment. Such measures have been represented in the following chapter of Environmental Management Plan.

Table 4-1 : Impact Identification Matrix during Construction Phase

(only under Mundra SEZ Ltd. purview)

Activity / Env. Factor	Raw Materials Storage & Handling	Transportation of Product & Raw Material	Liquid Discharge	Solid Waste Generation	Employment	Infra Structure Development	Green Belt Development
Air	X	X					X
Water			X				X
Noise		X					X
Odour							X
Flora			X	X			X
Fauna			X	X			X
Soil		X	X	X			X
Forest							X
Religious / Historical Places							X
Population					X	X	
Socio - economic					X	X	
Cultural					X		
Health & Safety	X	X					X
Aesthetics			X	X			X

Table 4-2 : Impact Identification Matrix during Operation Phase

(only under Mundra SEZ Ltd. purview)

Activity / Env. Factor	Liquid Discharge	Solid Waste Generation	Employment	Infra Structure Development	Green Belt Development
Air					X
Water	X				X
Noise					X
Odour		X			X
Flora	X	X			X
Fauna	X	X			X
Soil		X			X
Forest					X
Religious / Historical Places					X
Population			X	X	
Socio - economic			X	X	
Cultural			X		
Health & Safety					X
Aesthetics					X

Table 4-3 : Impact Prediction Matrix during Construction Phase

(only under Mundra SEZ Ltd. purview)

Activity / Env. Factor	Raw Materials Storage & Handling	Transportation of Product & Raw Material	Liquid Discharge	Solid Waste Generation	Employment	Infra Structure Development	Green Belt Development
Air	Ng, (-ve)	Ng, (-ve)					S, (+ve)
Water			Ng, (-ve)				S, (+ve)
Noise		Ng, (-ve)					S, (+ve)
Odour							N, (+ve)
Flora			Ng, (-ve)	Ng, (-ve)			S, (+ve)
Fauna			Ng, (-ve)	Ng, (-ve)			S, (+ve)
Soil		Ng, (-ve)	Ng, (-ve)	Ng, (-ve)			N, (+ve)
Forest							S, (+ve)
Religious / Historical Places							N, (+ve)
Population					N, (+ve)	S, (+ve)	
Socio - economic					S, (+ve)	S, (+ve)	
Cultural					S, (+ve)		
Health & Safety	Ng, (-ve)	Ng, (-ve)					S, (+ve)
Aesthetics			Ng, (-ve)	Ng, (-ve)			S, (+ve)

+ve - Positive (beneficial) S - Significant impact

-ve - Negative (adverse) N - Normal impact

Blank - No impact

Ng - Negligible impact

`Table 4-4 : Impact Prediction Matrix during Operation Phase

(only under Mundra SEZ Ltd. purview)

Activity / Env. Factor	Liquid Discharge	Solid Waste Generation	Employment	Infra Structure Development	Green Belt Development
Air					S, (+ve)
Water	Ng, (-ve)				S, (+ve)
Noise					S, (+ve)
Odour		Ng, (-ve)			N, (+ve)
Flora	Ng, (-ve)	Ng, (-ve)			S, (+ve)
Fauna	Ng, (-ve)	Ng, (-ve)			S, (+ve)
Soil		Ng, (-ve)			N, (+ve)
Forest					S, (+ve)
Religious / Historical Places					N, (+ve)
Population			S, (+ve)	S, (+ve)	
Socio - economic			S, (+ve)	S, (+ve)	
Cultural			S, (+ve)		
Health & Safety					S, (+ve)
Aesthetics					S, (+ve)

+ve - Positive (beneficial)
-ve - Negative (adverse)

S - Significant impact
N - Normal impact
Blank - No impact
Ng - Negligible impact

5 ENVIRONMENT MANAGEMENT PLAN

5.1 INTRODUCTION

Any industrial development is associated with certain positive impacts as well as some negative impacts on the environment. However, the negative or adverse impacts cannot possibly rule out scientific development. At the same time adverse impacts cannot be neglected.

An environmental management plan should be formulated for mitigation of the adverse impacts and should be based on the present environmental conditions and environmental impact appraisal. This plan helps in formulation, implementation and monitoring of the environmental parameters.

The Environmental Management Plan describes in brief, the management's plan for keeping a constant check on all the major pollution sources, in the form of regular environment monitoring, proper and adequate implementation of treatment and control systems for air, liquid and solid pollutants and for maintaining the environment. It also includes development of green belt in the industrial premises, noise control and other mitigative measures.

The land identified for the Mundra SEZ is non-agricultural, saline and in-fertile land. This can be better utilized for processing, residential and warehousing uses in the Mundra SEZ. **There are no issues of Resettlement and Rehabilitation on the identified stretch of land.**

5.2 ENVIRONMENT MANAGEMENT POLICY

Although there shall not be any major environmental pollution from the infrastructure facilities provided by Mundra SEZ Ltd., it proposes to make the SEZ highly environment friendly.

The proposed environment polluting industrial units shall also be compelled to abate as much environmental pollution at the source as possible.

There shall be no air pollution from the infrastructure facilities on regular basis. However, DG sets shall be operated only in case of emergency.

Common sewage treatment plants shall be provided to treat the sewage and the treated sewage water shall be recycled and reused within the SEZ premises.

No solid hazardous wastes generation has been envisaged from the Mundra SEZ activities. Based on the nature of solid waste generation from the infrastructure amenities in the SEZ, Mundra SEZ Ltd. shall implement appropriate solid waste management system. For the disposal of solid domestic waste, composting or disposal at approved MSW disposal facility or as per prevailing norms have been planned. The sludge from the CSTPs shall also be composted and used as manure within the SEZ premises. The small quantity of used / spent oil to be generated on the emergency operation of the DG sets shall be sent to MoEF approved recycler for suitable treatment and disposal. For the treatment and disposal of bio-medical waste, a common incinerator shall be installed and operated in the medical college.

There shall be no sources of thermal pollution and noise pollution in the proposed infrastructure facilities, except for the DG sets which shall be installed in acoustic enclosures and thermal insulation shall be done, if required.

Landscaping and green-belt have been planned within the entire SEZ to provide a major sink for any air, thermal and noise pollutions.

5.3 OBJECTIVES OF ENVIRONMENTAL MANAGEMENT PLAN

The main objectives in formulating this environmental management plan are:

- To treat all the pollutants viz. liquid, solid and bio-medical, which contribute to the degradation of the environment, with appropriate technology.
- To comply with all regulations stipulated by the central / state pollution control boards related to liquid effluent, solid / hazardous wastes and bio-medical wastes discharges as per water and environment pollution control laws / rules.
- To handle hazardous wastes as per the Hazardous Waste (Management & Handling) Rules, 1989 of the Environment (Protection) Act, 1986.

- To handle bio-medical wastes as per the Bio-medical Waste (Management and Handling) Rule, 1998 notified on 20th July 1998.
- To encourage support and conduct developmental work for the purpose of achieving environmental standards and to improve the methods of environmental management.
- To create good working conditions (devoid of air and noise pollution) for employees.
- To reduce fire and accident hazards.
- Perspective budgeting and allocation of funds for environment management expenditure.
- Dissemination of technological solutions on commercial basis to interested parties.
- Continuous development and search for innovative technologies for a cleaner and better environment.

5.4 ENVIRONMENTAL MANAGEMENT DURING CONSTRUCTION PHASE

Construction phase usually results in temporary environmental pollution only. Such pollution is mainly due to site preparation, civil works, transportation, storage & handling of different kinds of materials, construction workers' sanitation etc. These are usually short-term impacts as compared to those during operational phase.

Table 5-1 : Recommended Mitigation Measures during Construction Phase of Infrastructure Facilities

No.	Source of Impact	Impact Predicted	Recommendation
A	**AIR ENVIRONMENT**		
1.	Fugitive dust emission from construction areas	a. Increase in SPM and RSPM levels	Water sprinkling in vulnerable areas
2.	Pollution from vehicles and construction equipment	a. Increase in SPM, RSPM and NO_X levels	Enforce proper maintenance of vehicles and construction equipment. Allowing only PUC approved vehicles in the site
3.	Fugitive emission of construction material in dust / powder form	a. Increase in SPM and RSPM levels	Enforce usage of covered trucks for transport of such material
B	**NOISE ENVIRONMENT**		
1.	Vehicles, construction equipment and machinery installation	a. High noise levels possible	Enforce proper maintenance of vehicles and construction equipment. Enforce use of earmuffs / earplugs to workers in

			high noise level areas
C	**WATER ENVIRONMENT**		
1.	Large number of construction workers working within SEZ at a time	a. Unhealthy working conditions	Provide temporary drinking water supply and proper sanitation facilities within the site.
2.	Construction area involving high waste water generation	a. Water logging at such areas	Channelise these waste water to temporary sedimentation tanks for removal of suspended solids
D	**LAND / SOIL ENVIRONMENT**		
1.	Surplus earth and construction debris	a. Unaesthetic	Proper disposal at regular intervals

E	**SOCIO-ECONOMIC ENVIRONMENT**		
1.	Employing large number of workers	a. Induce pressure on existing infrastructure in surrounding areas	It will encourage development of surrounding areas & further generate employment. People from various cultures shall mingle encouraging a more tolerant society
F	**THERMAL ENVIRONMENT**		
1.	Large scale construction	a. Generate heat of hydration	Enforce (i) use of Portland Pozzalano Cement / (ii) use of Portland Slag Cement / (iii) use fly ash as admixture in construction
G	**ENERGY**		
1.	Piping for water distribution, drainage system etc.	a. Pumping b. Piping losses	Wherever possible, piping shall be along the natural topography to permit gravity flow. Else, energy efficient pumps shall be used. Pipe material shall be such as to minimize friction losses
2.	Electrification	a. Large scale electric consumption	Wherever possible, natural light shall be used. Energy efficient electrical fittings and fixtures shall be used.

5.5 ENVIRONMENTAL MANAGEMENT DURING OPERATION PHASE

During operational phase, usually long term impacts are envisaged. The recommended environmental pollution control measures for the various positive and negative, short term and long term impacts identified and predicted are tabulated as under :

Table 5-2 : Recommended Mitigation Measures during Operation Phase of Infrastructure Facilities

No.	Project Activity	Impact Predicted	Recommendation
A	**LAND / SOIL ENVIRONMENT**		
1.	Recycle of treated sewage within premises	a. Leakage from pipeline b. Corrosion of pipelines c. Any damage to pipeline, external / internal	Good quality non-corrosive type pipeline should be used. Regular checking of the pipelines for early detection of any possible leakage and damage. Regular ground water monitoring should be done within the SEZ.
2.	Disposal of solid non-hazardous wastes to existing facility	a. Spillage of waste on road	The waste should be transported in covered trucks. Vermi-composting is highly recommended for treatment and disposal of bio-degradable and kitchen wastes. Other domestic solid waste (garbage) shall be disposed through MSW facility or as per prevailing norms
3.	Disposal of bio-medical wastes to existing facility	a. Spillage of waste on road	The waste should be transported in covered trucks. Transporter should be informed of remedial measures required to be taken in case of spillage of waste
B	**SOCIO-ECONOMIC ENVIRONMENT**		
1.	Employing large number of workers	a. Induce pressure on existing infrastructure in surrounding areas	It will encourage development of surrounding areas & further generate employment. People from various cultures shall mingle encouraging a more tolerant society.

The industrial units shall take adequate measures to control air, water, solid and noise and / or thermal pollution generated, if any.

5.5.1 Wastewater Treatment & Reuse:

Sewerage system comprising of sub-systems; each catering to a self-contained park/hub, shall consist of collection system of pipe network, lifting stations (LS), terminal sewage pumping stations (TSPS), sewage treatment plants (STP) and Common Effluent Treatment Plant (CETP) before recycling for non-domestic & industrial usages. Planning for the sewerage system for a particular development area shall be such so as to take into account the entire future development in order to avoid re-installation of sewer pipelines for anticipated ultimate flow.

The wastewater treated shall be used by the Horticulture Department to develop Green Cover over the Mundra SEZ there by reducing the net fresh water demand and minimize impacts on the competitive users. ***(An enclosed copy of suitability of treated effluent from Agriculture University is referred as on page no. 111-112.)***

The sewage shall be treated at the STP and treated effluent shall be recycled for non-domestic usages. Effluent from the wastewater shall be treated at the STP and treated effluent shall be discharged in an appropriate manner. The quality of the effluent after treatment shall meet the standards, as prescribed by the Gujarat Pollution Control Board. The exact manner and location of the discharge point for treated effluent shall be identified at the detailed engineering stage.

The following planning criteria shall be adopted for the proposed sewerage system at Mundra SEZ site:

- Sewage Flow: 70% of water supply shall be considered as sewage inflow.
- Peak Factor: Design peak flow shall be two times the average flow.
- Discharge Capacity: The sewers shall be designed for the discharge capacity of Q_c to cater adequately for the estimated peak run off using Manning's formula:-

  Where,

  Q_c = 1/n.A.R2/3 S1/2 (m3/sec)

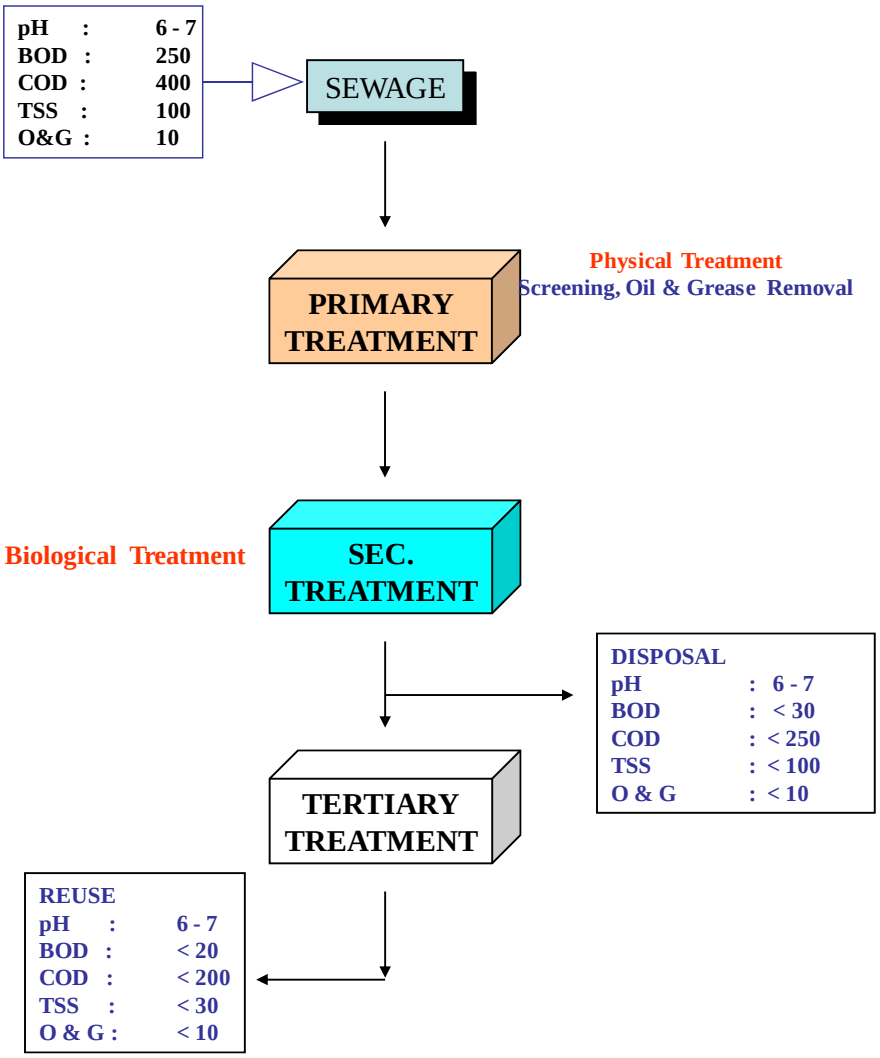
  A = Flow area of sewer (m2)

  R = Hydraulic mean radius (m)

  S = Bed gradient

  n = roughness coefficient, (assume n=0.015 for reinforced concrete pipes)

TREATMENT STAGES



Sewage Treatment Plant

To meet the waste water disposal standards, MSEZ envisages developing 62 MLD Sewage Treatment Plant FOR Social Infrastructures. The STP will be built in modular and expandable manner. It will be of high efficiency aerobic treatment schemes based on extended aeration system using fine bubble diffused aeration are proposed. These plants are compact, odor

free and have an energy efficient process. STP shall generate water of high quality, suitable for use as process water for industries / warehouses / transportation / horticulture etc.

Activated sludge process is an aerobic treatment of sewage in which bacteria require oxygen for their existence, thrive in presence of light and bring about oxidation of the sewage. In this system, certain amount of oxidized or activated sludge is intimately mixed with the sewage, which greatly hastens the process of oxidation of organic matter. Aeration and activation is done through compressed air, which is introduced through diffusers into the sewage as it flows through tanks. Air is supplied through vertical pipes, which run longitudinally along the tank. Waste or excess sludge from the liquid stream is removed in the form of flocculent sludge in settling tanks. Also, pre-treatment of industrial waste is to be made essential before discharging into the main sewers as these wastes may be of such composition as would damage the sewers or interfere with the treatment process.

5.5.2 Common Effluent Treatment Plant (CETP)

The Mundra SEZ will accommodate of processing zones for various kind industries as mentioned in Chapter -2. There for to meet the waste water disposal standards, MSEZ envisages developing 67 MLD (50 MLD and 17 MLD) Common Effluent Treatment Plant (CETP) facilities. The CETP will be built in modular and expandable manner.

Technology

- After review various technology, MSEZ has chosen conventional treatment scheme of Activated Sludge Process to implement this project.
- To monitor quality of effluent discharge from the various industries in the Special Economic Zone.

Treatment

At present, both effluent and sewage are proposed will be treated together and are collected in the equalization tanks after passing through screen chamber. The effluent is then pumped to common Effluent treatment plant to bring the effluent to the accepted level for disposal in marine coastal areas or into the sea.

Description of the Plant

- Effluent Characteristics
- Treatment Scheme
- Technical features of the plant
- Layout of the plant

Effluent Characteristics

It is proposed to combine treatment of the wastewater from the industries of Mundra Special Economic Zone and sewage from social infrastructure. The expected effluent characteristics and those required after the treatment as per the guide lines of Gujarat Pollution Control Board are as follows:-

Table 5-3 : Characteristics of Raw Effluent for CETP

Sr. No.	Parameter	Max Permissible Value of Raw Effluent
1.	pH	6.5-8.5
1.	Temperature	40 °C
2.	Suspended Solids	800 mg/L
3.	Oil & Grease	10 mg/L
4.	Phenolic Compound	1 mg/L
5.	Cyanides	0.2 mg/L
6.	Flourides	2.0 mg/L
7.	Sulphides	2.0 mg/L
8.	Ammonical Nitrogen	50 mg/L
9.	BOD	1000 mg/L
10.	COD	2000 mg/L
11.	Chlorides	600 mg/L
12.	Sulphates	1000 mg/L
13.	TDS	6000 mg/L

Table 5.4 Treated Effluent Characteristics of CETP

Sr. No.	Parameter	Permissible Value for disposal into marine coastal areas	Permissible Value for on land irrigation
1.	BOD	100 mg/L	100 mg/L
2.	COD	250 mg/L	-
3.	pH	5.5 – 9.0	5.5 – 9.0
4.	SS	100 mg/L	200 mg/L
5.	O & G	20 mg/L	10 mg/L

Sr. No.	Parameter	Permissible Value for disposal into marine coastal areas	Permissible Value for on land irrigation
6.	TDS	-	2100 mg/L

Treatment Scheme

Following is the list of units involved in the proposed common effluent Treatment Plant.

- Screen Channel with Mechanical Bar Screen.
- Equalization Tanks – 2 Nos.
- Neutralization Tanks – 2 Nos.
- Primary Settling tank with Mechanical sludge scrapper and scum removal.
- Sludge sump cum collection tank with pumps.(Dry well and wet well type)
- Aeration Tank -1, with mechanical surface aerators (1st stage).
- Secondary Settling tank with mechanical Sludge scrapper (1st stage).
- Sludge sump with pumps (1st stage). (Dry well and wet well type)
- Aeration Tank – 2, with mechanical surface aerators (2nd stage).
- Secondary Settling tank with mechanical Sludge scrapper (2nd stage).
- Sludge sump with pumps (2nd stage). (Dry well and wet well type)
- Aeration Tank – 3, with mechanical surface aerators (3rd stage optional).
- Final Settling tank with mechanical sludge scrapper(3rd stage optional)
- Sludge sump with pumps (3rd stage optional). (Dry well and wet well type)
- Sludge drying Platforms.
- Decanters – 2 Nos.
- Intermediate collection Tank.
- Chlorination Plant
- Guard Pond.
- Dried Sludge storage facility.

Technical features of the plant

The treatment process is based on the biological process of complete mix activated sludge. Two stage, conventional type, activated sludge process is proposed for sea disposal. The Third Stage ASP with chlorination and additional stage of extended aeration is proposed for on-land disposal for irrigation. Primary treatment is consisting of Screening and chemical precipitation. The sludge from primary clarifier tank and excess biological sludge shall be collected in a separate sump and then mixed in sludge collection tank. Decanters are proposed for dewatering of sludge and Sludge Drying Platforms are recommended for the further sun-drying of sludge, which will reduce moisture content further and final disposal of dryed sludge to TSDF site.

- **Screen Channel with Mechanical Bar Screen.**
  A Mechanical Bar Screen of required size is placed in the screen chamber. Flow measurement device (indicator type) is provided to measure the effluent flow. The bar screen will be cleaned manually.

- **Equalization Tanks**
  Two tanks are in parallel with floating aerators to provided proper homogenization of collected effluent and treatment at a consistent flow. With sufficient retention time & floating aerators of suitable capacity, it will give satisfactory homogenous effluent wherein the variations in characteristics of incoming effluent can be controlled.

- **Neutralization Tanks**
  Two tanks are in parallel so that tank contents after chemical reactions (in batch process) can be emptied on to the primary clarifier tank via gravity. Dosing chemicals e.g. Lime solution, Alum solution and Polyelectrolyte dosed as per jar test result.

  The hydraulic mass in the neutralization tanks are getting mixed and aerated by the means of blowers and course bubble aeration technique.

- **Primary Clarifier Tank**
  Primary Clarifier Tank having Oil Skimmer, Trough, Scum Baffle and weir plate and provided with Telescopic Sludge withdrawal. It's have a Mechanical Sludge Scrapper,

rotating bridge and walkway. The sludge will be removed in the sludge sump via gravity.

- **Aeration Tanks**

  The Aeration tank - 1 is constructed in two parallel channels and Aeration Tank – 2 & 3 are in sequence, each of them having suitable size and depth. The tanks have an inlet launder, outlet launder and Aerator Platforms with handrails. The tanks also have a distribution Box at inlet and outlet, going to the Secondary Clarifiers. Isolating gates are provided for maintenance purpose. In aeration tank, the optimum degradation of organic matter will take place.

  Each channel is provided with sufficient numbers of Fixed Mechanical Surface Aerators of suitable capacity.

- **Secondary Clarifiers**

  Secondary Clarifier tanks have, Scum baffle, feed well and weir plate, are provided with recycle sludge sump of dry well and wet well type.

  The tanks are provided with Mechanical Sludge scrapers, rotating bridges and walkway. Each tank has sludge recycle pumps.

- **Sludge Sump and Pump House**

  Sludge sump and pump house of dry well and wet well type, each for Primary and Secondary sludge are constructed. The excess sludge after mixing in sludge collection tank shall be pumped to the Decanters.

- **Guard Pond**

  The treated effluent after two stage of activated sludge process will be collected in the guard pond. After ascertaining the treated effluent quality, the same will be disposed off to the sea disposal pipeline through suitable pump. This guard pond will be a earthen basin with HDPE liner protection.

  The layout of CETP site for phase I is arranged so that the equalization tanks and the guard pond are placed side by side of phase I and phase II.

In future, construction of third stage of activated sludge process the effluent after secondary treatment will get collected into intermediate collection tank. From this tank the effluent will be pumped to online chlorination and finally to guard pond.

- **Decanters**

  The sludge containing 5-8% solid concentration from sludge collection tank shall be passed through decanters for dewatering. It is designed for 12 hours running period.

  The unit is placed under protective shade near to sludge collection tank. The unit can easily accessible from roads for easy transportation of dried sludge. The plain drying beds to dry the dewatered sludge from decanters also be located near to this unit. Tractor trolleys are deployed for collection of dewatered sludge.

- **Chlorination Plant**

  This unit having online chlorination in the outlet pipe shall be used as and when required. Chlorine tonner shall be installed for the purpose of disinfection and removal of colour, if any.

- **Technology -** MSEZ has chosen conventional treatment scheme of Activated Sludge Process to implement this project.

Units involved in CETP

- Screen Channel with Mechanical Bar Screen.
- Equalization Tanks
- Neutralization Tanks
- Primary Clarifier Tank
- Aeration Tanks
- Secondary Clarifiers
- Sludge Sump and Pump House
- Guard Pond
- Decanters
- Chlorination Plant

5.5.3 Solid Waste Disposal

Solid waste can be classified into two main categories, namely municipal solid waste and Industrial waste. Solid waste shall be sorted out for recycling and non-recycling material.

Recycling turns materials that would otherwise become waste into valuable resources. Materials like glass, metal, plastics and paper are collected, separated and sent to facilities that can process these into new material.

All biodegradable municipal solid waste shall be mixed with sewage sludge to undergo composting to produce saleable fertilizer. Composting is another form of recycling. Composting is the controlled biological decomposition of organic matter into humus. Composting is nature's way of recycling organic waste into new soil, which can be used in vegetable and flower gardens, landscaping and many other applications.

Non-biodegradable waste will be brought together with the industrial waste to the landfill for ultimate disposal. Although source reduction, reused, recycling and composting can divert large portions of municipal solid waste from disposal, non-biodegradable waste shall be collected in landfills. Landfills shall be well engineered facilities that are located, designed, operated, monitored, closed, cared for after closure, cleaned up when necessary to protect human health and the environment.

clean earth. Pollution of surface water and ground water is minimized by lining and contouring the fill, compacting and planting the upper most cover layer, diverting drainage and selecting proper soil in sites not subject to flooding or high ground water levels. In addition, these new landfills can collect potentially harmful land fill gas emissions and convert the gas into energy.

To reduce waste volume, private operators can implement a controlled burning process called combustion or incineration. A variety of pollution control technologies significantly reduce the gases emitted into the air. Among these are scrubbers – devices that use a liquid spray to neutralize acid gases and filters, which remove tiny ash particles.

5.5.4 Central Waste Management Facility

Solid waste needs to be put through a number of processing operations before it can be handled for formal disposal or re-use. Emphasis of the processes to is to reduce volume, increase homogenization, reduce moisture and convert most of the material to a usable form so that burden on land filling is reduced.

Site selection of the Central Waste Management Facility has been regulated by the following considerations as specified in the MSW (M&H) Rules, 2000.

- The (landfill) site shall be large enough to last for 20-25 years.
- The (landfill) site shall be away from habitation clusters, forest areas, water bodies, monuments, National Parks, Wetlands and places of important cultural, historical or religious interest.
- A buffer zone of no-development shall be maintained around (landfill) site and shall be incorporated in the Town Planning Department's land-use plans.
- (Landfill) site shall be away from airport including airbase. Necessary approval of airport or airbase authorities prior to the setting up of the landfill site shall be obtained in cases where the site is to be located within 20 km of an airport or airbase..

Considering the long term economic viability and gradual future developments with respect to social & commercial establishments along with Industrial Units within the SEZ, the proposed Central Waste Management Facility will be designed for 35 years, at a design waste disposal rate of 40 MT/day.

Few siting options have been worked out basis criteria given in the MSW (M&H) Rules, 2000. The sites have been considered p away from place of activity and per distance criteria from various important places including habitation. All the suggested sites are away from residential areas/town in the region, from natural places such as Forest areas, water bodies, etc.

A buffer zone of 150 m will be created around the Central Waste Management Site, which will be incorporated in the land use plans of MPSEZ Planning Department.

MSEZ has developed an Aerodrome at the South-Eastern boundary of the SEZ. Site options have been made considering norms related to the distance from airport or airbase. It is proposed to set up the landfill site as far as possible to protect the aircrafts from bird hits.

For solid waste disposal 62 Ha of land is identified in North East Corner of the MSEZ at Mokha.

6 CONCLUSION

After studying long-term impacts on air, water, land / soil and noise due to the gaseous emissions, vehicular movement, discharge of liquid effluent, solid waste generation and operation of equipment and machinery from proposed sez, following conclusion were made and explained in CHAPTER -4.

ANALYSIS OF BASELINE DATA

Impact on Air Environment

Mundra SEZ Ltd. is primarily a service provider. None of the infrastructure facilities to be set up shall generate any air pollution, on regular basis. Only the DG sets, which shall be operated only in case of emergency, shall emit gases, which shall be safely emitted through appropriate stacks. The other source of air pollution shall be from the vehicular traffic. However, such an impact can be minimized by restricting entry only to PUC certified vehicles.

The operational phase activities in the industrial units might have impact on the air quality based on the nature of their process / operation. Wherever required, the units shall provide appropriate stacks / vents and air pollution control equipment for all the gaseous emissions. Greenbelt will also be developed right from commencement of construction activities, which shall act as a major sink.

Thus, impact on air environment due to the proposed Mundra SEZ infrastructure facilities shall be negligible.

Impact on Water Environment

Water shall not be used in the infrastructure facilities. For the sewage to be generated from the SEZ, common sewage treatment plants (CSTP) shall be installed and operated by Mundra SEZ Ltd. Treated sewage water shall be recycled and reused within the SEZ premises.

The industrial effluent if generated from the industrial units shall be handled by the units themselves as per the rules and regulations of GPCB, MoEF and any other regulating authority. The units shall treat the effluent in their own effluent treatment

plants. Common effluent treatment plants (CETP) may also be setup, based on the type and location of the proposed industrial units. Then, the units shall send their industrial effluent conforming to the CETP inlet norms, to the CETP. Moreover, based on the nature of the industrial effluent to be generated, the units may send their industrial effluent conforming to the CETP inlet norms, to the CSTPs.

As there shall not be any discharge of treated / untreated liquid / solid waste into existing ground / surface water sources, impact on water environment due to the proposed Mundra SEZ infrastructure facilities shall be minimal.

Impact on Land and Topography

Land / topography of the project site may be altered. However, care shall be taken to avoid any drastic changes, which might have severe repercussions like flooding of upstream areas, etc. If such a situation is unavoidable, then appropriate measures shall be undertaken to lessen such conditions.

All the municipal solid waste to be generated from the proposed Mundra SEZ shall be disposed into scientifically designed secured landfill sites. If the industrial units generate hazardous / non-biodegradable wastes, then they shall have to dispose them at approved TSDF sites, common incinerators etc., as applicable after obtaining the required approvals / permissions from GPCB, MoEF and any other regulating authority.

As there shall not be any discharge of treated / untreated liquid / solid waste on land within or outside SEZ, impact on land environment due to the proposed Mundra SEZ infrastructure facilities shall be minimal.

Impact on Noise Environment

Mundra SEZ Ltd. is only a service provider. Hence, there shall not be any noise pollution on regular basis, except for the DG sets which shall be operated only in case of emergency. These DG sets shall be installed in acoustic enclosures to minimise noise pollution.

The industrial units which shall have noise generating equipment / machinery shall install the same in acoustic enclosures or shall provide acoustic hoods, such that the

ambient noise levels shall conform to the prevailing norms. As green-belt shall also be developed in the SEZ, the impact on noise environment due to the proposed Mundra SEZ infrastructure facilities shall be negligible.

Impact on Ecological Environment

The proposed SEZ shall convert the existing mostly barren land with sparse vegetation into a SEZ with diverse landuses like industrial, commercial, residential, recreational etc. interspersed with green-belt, such that about 30 % of the SEZ shall be covered with green-belt.Thus, the green-belt development shall give impetus to development of flora and fauna in the SEZ, improving the ecological environment.

Impact on Demographic / Socio-economic Environment

Due to the diverse activities to be set up in the SEZ, skilled as well as unskilled personnel shall obtain direct as well as indirect employment. The SEZ shall bring about a huge upliftment of the study area considering the vast population to use the SEZ. Residential establishments and its linked social infrastructure shall obtain an impetus in this otherwise underdeveloped area, which was further devastated by the 26th January 2001 earthquake. Thus, a significant socio-economic upgradation is predicted in the study area due to the various SEZ activities.

Conclusion

As adequate environmental management system shall be provided, minimal adverse effect is expected from the proposed project. Due to coming up of various types of industries many changes are expected to occur in the socio – economic setup of the region within and surrounding of proposed SEZ. The socioeconomic changes may be beneficial or detrimental. General trend of socio – economic environment due to the proposed SEZ is that it increases the population density within the area and in a few of the surrounding villages. This can be attributed to more job opportunities, direct and indirect, provided by the industry.

Thus, from both the economic as well as environmental point of view, the proposed Mundra SEZ project is justified.