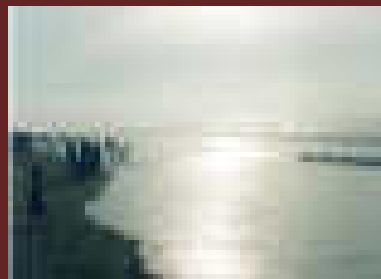
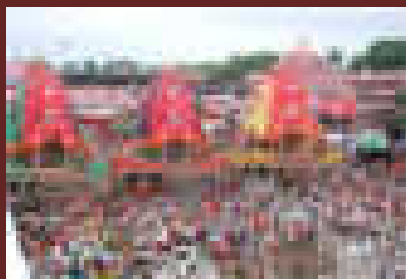


DRAFT COMPREHENSIVE DEVELOPMENT PLAN-2031

Puri Konark Development Authority (PKDA) Area

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Volume I



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LIST OF ABBREVIATIONS

PKDA	Puri Konark Development Authority
CEPT	Center for Environmental Planning & Technology
SIZ-	Special Institutional Zone
CRZ	Coastal Regulatory Zone
RWSSB	Rural Water Supply and Sewerage Supply Board
CDP	Comprehensive Development Plan
ODA	Odisha Development Authorities
DCR	Development Control Regulation
FCDS	Focused Group Discussions
PKRIT	Puri Konark Regional Improvement Trust
IDD	Interim Development plan
TCPO	Town and Country Planning Organisation
SH	State Highway
HH	Household
ORSAC	Odisha Remote Sensing and Space application center
UNESCO	United Nations of
UDPFI	Urban Development Plan Formulation & Implementation
EWS	Economically Weaker section
NSDP	Net State Domestic Product
GSDP	Gross State Domestic Product
OMFRA	Odisha Marine Fishing Regulation Act
MDRs	Major District Roads
ODRs	Other district roads
FSI	Flow space index
NSDP	National Slum Development Programme
VAMBAY	Valmiki Ambedkar Awas Yojana
SJSRY	Swarna Jayanti Shehri Rojgar Yojna
USEP	Urban Self Employment Programme
UWEP	Urban Wage Employment Programme
PHEO	Public health engineering organisation
GSRs	Ground Storage Reservoirs
ESRs	Elevated Storage Reservoirs
PTA-	Property Tax Assessments
HSC	House service connections
CPHEEO	Central Public Health and Environmental Engineering Organisation
SWM	Solid waste management
ULBs	Union local body
TERI	The Energy and Resources Institute
OSDMA	Odisha state disaster management authority
VSCS	Very severe cyclonic storm
SC	Super cyclone



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1. INTRODUCTION

1.1 Introduction

Odisha is an attractive treasure house of cultures and customs, religions and traditions, languages and literature, art and architecture, scenic beauty and wildlife. Endowed with rich cultural heritage and bestowed with bounties of nature, Odisha is a fascinating state with majestic monuments, beautiful beaches, luxuriant forests, enchanting wildlife, etc.

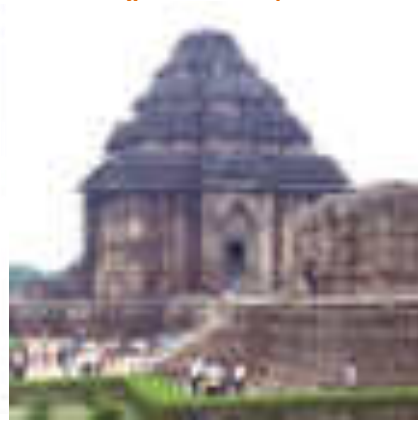
Fig 1.1: Jagannath Temple: Puri



Fig 1.2: Bay of Bengal from Puri



Fig 1.3: Sun Temple: Konark



Wedged between West Bengal and Andhra Pradesh, Odisha lies on the eastern coast of India with the waters of the Bay of Bengal swirling along its eastern and south-eastern boundaries. With an area of about 1,55,707 square kilometres, the state offers diverse habitats from lush green and hilly terrain to coastal plains and rolling river valleys, crisscrossed by the Brahmani, the Mahanadi and the Bansadhara rivers. In its long history spanning several centuries, the region of modern Odisha is today one of the most popular with tourists.

Given the natural setting, the PKDA notified area has the potential to be developed as a peaceful recreational area within easy reach of Odisha. The sanctioned master-plan for Puri and Konark recognizes the tourism potential of this area and designates it as a recreation and tourism development potential zone.

The Housing & Urban Development Department, Government of Odisha, under the Odisha Development Authorities Act - 1982 by Resolution, constituted the Puri Konark Development Authority (PKDA) area. The notified area of the PKDA Region constitutes of 131 revenue villages with an area of 296.33sq.km.

The areas covered under PKDA region include the Puri municipality area, Puri Sadar or Puri master plan area, Konark NAC area, Block A (intervening area between Puri and Konark), Block B (area after Konark) and the special institution zone (SIZ) area. PKDA has initiated the process of preparing the Comprehensive Development Plan for the area with the objective of enhancing the tourism and recreational development potential of the area.

In this context the Puri Konark Development Authority (PKDA) has appointed Centre for Environmental Planning & Technology (CEPT) to prepare the Comprehensive Development Plan of the region with a focus on recreation and tourism and overall physical and economic development of the region to improve the quality of life in the region.



1.2 Planning Issues of PKDA

Behind the serene and picturesque setting of the PKDA notified area lie various development issues which are enumerated as follows:

However, it must be borne in mind that the area attracts local pilgrims and tourist from nearby areas, as well as national and international region. Though the area has tremendous potential as a tourist destination, there are no major efforts made to develop potential sites and provide the required infrastructure to encourage this activity. At this point, the tourism activity is largely local, with the residents / locals providing the required facilities.

1.2.1 Development Pressure on Puri Town

Development pressure that Puri town faces as the worship place of Lord Jagannath and as one of the Char Dhams of the country: Puri town is saturated in terms of land for development and it lacks quality open spaces. It is under continuous pressure for commercial, residential and recreational development. In spite of being a well known tourist destination, it lacks the facilities required to cater to huge floating population through the year.

Fig 1.4: Ratha Yatra



Fig 1.5: Grand Road



1.2.2 Areas under CRZ and No-Development zones

A large part of the PKDA region is under various regulations that restrict development due to its coastal setting and this poses questions to the development activity.

1.2.3 Changing development patterns and need for encouraging Commercial & Recreational activities

With the increasing number of the pilgrims and tourists in this region, there is always a need for encouraging commercial and recreational activities in this region. This calls for a fresh approach in the developments proposed in this region. However, any kind of development strategy would have to take into cognizance the rich environmental characteristics of the area, the socio economic character & rich historic physical fabric of the traditional settlements.

1.2.4 Status of Basic Services

Except Puri town (Municipal limits), PKDA area is lacking in basic infrastructure facilities. The rate of water supply in Puri town is 118 lpcd. Puri town is divided into 10 zones for the supply of water. Other than Puri few of the revenue villages have access to piped water supply provided by Rural Water



Supply and Sewerage Supply Board (RWSSB). The present supply is just adequate for the resident population of the area. Residents store water as the supply is for a few hours. The resorts tap limited amount of water available from the municipal sources and extract ground water.

Fig 1.6: Poor Infrastructure in Puri



In PKDA area there are open / covered drains for sullage and grey water and the sewage is disposed into individual soak pits. Collected sewage by the open drains in Puri town is disposed into the sea. Sewerage network implementation works are still in progress for Puri town and the network is divided into 9 zones within the town. In Puri town, the solid waste is collected by the staff from municipality and dumped at designated areas. The streets are not cleaned on a regular basis. However, the rural areas within the region lack these basic services.

Keeping in view the various development issues faced by the PKDA Notified Area and the need to prepare a plan, PKDA as a Planning Authority is required to develop the area for recreation and tourism and provide the necessary infrastructure & amenities. PKDA has appointed Centre for Environmental Planning & Technology (CEPT) to prepare the Comprehensive Development Plan with a focus on recreation and tourism for Puri Konark Development Authority (PKDA) area and frame development control regulations.

1.3 Need for Comprehensive Development Plan – Changing Context

PKDA region has been an important religious and tourism destination with huge strengths of rich cultural and religious heritages, beach stretches, and cottage & handicrafts industries. But the region lacks in terms of basic services, infrastructure supporting tourism, public transport and a clear land development mechanism.

With the upcoming investment proposals in and around PKDA as well as the core issues related to adequate urban basic service provisions, a comprehensive development plan (CDP) is the need of the hour for this extremely important region in the country. A CDP can play very important role to guide the overall development of PKDA in a sustainable manner in future. The main challenge for CDP is to re-position PKDA with all its internal strengths and linking them to future development potentials such as Business & Leisure Tourism and climate conducive economic activities like IT and education.

Puri – Konark the two points of the “Golden triangle for Tourism” of the State of Odisha fall well within the PKDA area. Due to the growing importance and growth of Tourist visiting Puri and Konark it has become imperative to develop the PKDA area in a methodical and well planned manner taking all the planning parameters into consideration.

Festive season especially at a time of the ‘Rath Yatra’ invites a massive influx of tourist which causes a severe stress on the basic infrastructure facilities, land, resources and amenities of Puri town. Hence, special care should be taken at the time of preparing a new CDP for Puri town.

Apart from this floating population haphazard and unplanned urbanization is the result of increasing population growth and density, trans-migration from rural to urban areas, economic opportunities, agriculture land capture and other social compulsions.

This is resulting in resources constraint due to detrimental land use patterns, diminishing water resources and greenery, increasing demand for land, shelter and infrastructure utilities, traffic congestion, narrow roads, increasing pollution levels, public health hazards, urban disasters along with an overall decrease in the quality of life of people living in urban areas.

These are the reasons that can be attributed for the need of a Comprehensive Development Plan. Thus the Comprehensive Development Plan that will be prepared will take into consideration the existence of both agrarian & tourist economy in this Development plan area and will ameliorate the dwindling economy of the region.

The region will prosper through the process of forward & backward linkages. The existence of persisting unemployment will be minimized to a greater extent. Employment will increase **manifold** through the multiplier effect of the new infused economy. With the directed & infused growth incentives rightly being applied to this region, the region will witness enhanced growth in future decades & so also the social & economic benefits will be optimally distributed.

1.4 The Vision

To develop PKDA region as a vibrant tourist destination by weaving within its scenic fabric , the religious significance, culture and heritage, while augmenting the economic development hence improving the quality of life and sustaining the growth with regional development.

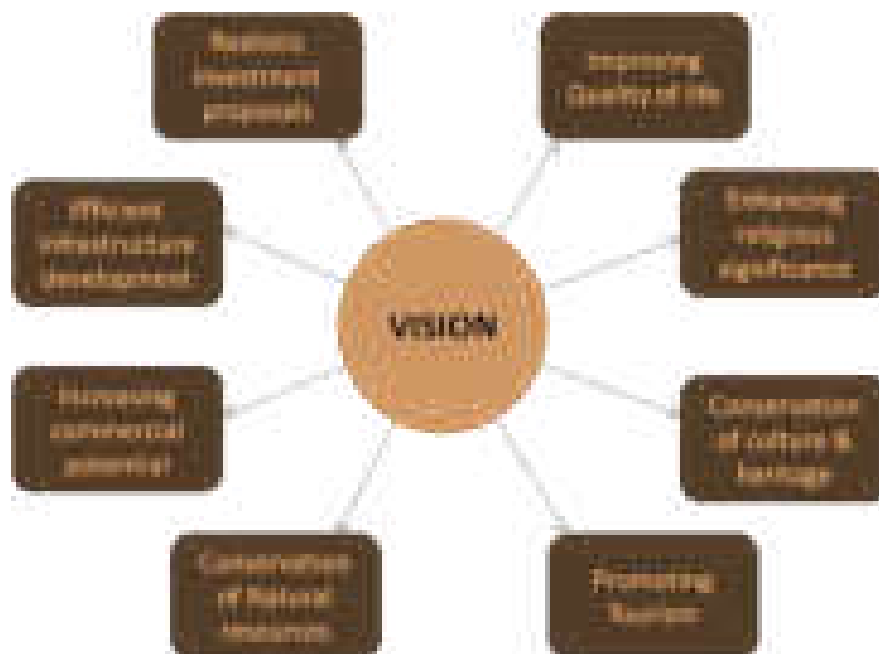


Fig 1.7: Different components of Vision-2031 for PKDA

1.5 Objectives of the CDP, PKDA-2031

The main objectives of the CDP are:

- To generate the up-to-date urban land use map of the area using revenue maps and recent period satellite imageries using GIS technology in 1:2000 scale
- To formulate a meaningful physical development Plan to regulate and guide the urban growth in the region by 2031 A.D. in a planned and healthy manner as per the provisions indicated in ODA Act 1982 and ODA rule 1983.

The Development Plan clearly focuses on:

- The Enhancement of the role of PKDA Notified Area as a recreational and tourism node.
- Ensuring a sustainable pattern of economic development
- Conservation of special features – Forests, water bodies and heritage structures
- Strengthening the traditional economic base
- Enhancement of quality of living environment in the settlements

All plans and proposals will clearly articulate these objectives.

1.6 Structure of CDP

The Comprehensive Development Plan will provide all contents necessary for the integral development of area covered by the Plan. In accordance with the Odisha Development Authority Act 1982, the Comprehensive Development Plan (CDP) has the following roles:

- The CDP shall define the various zones into which the land covered by the Comprehensive Development Plan may be divided for the purpose of development and indicate the manner in which the land in each zone is proposed to be used and the stages by which any such development shall be carried out.
- The CDP shall serve as a basic pattern of frame work within which the Zonal Development Plan of the various zones may be prepared.

The preparation of the Comprehensive Development Plan will start with the assessment of the existing conditions and accounting for the potential resources and constraints. Thereafter, development priorities will be set for the particular urban area taking into consideration the socioeconomic needs.

The formulation of the Comprehensive Development Plan for the development area will start after status analysis and consideration of the prime issues as mentioned below:

- Physical characteristics and natural resources, Location and regional setting, Climate, Existing land use translated over digital revenue plan as per interpretation of satellite imagery and field verification, Environmentally and ecologically sensitive areas, Heritage sites and buildings
- Demography (Existing Population, Household characteristics) & Socio-economic characteristics
- Transportation Network
- Physical & Social Infrastructure Facilities
- Environment
- Development Management (Institutional setup, Legal support, Sectoral integration and coordination).

The CDP as per Odisha Development Authorities Act 1982 shall comprise of:

- Reports on physical and socioeconomic aspects
- Functional plans supported by maps, charts and diagrams on
 - Land use

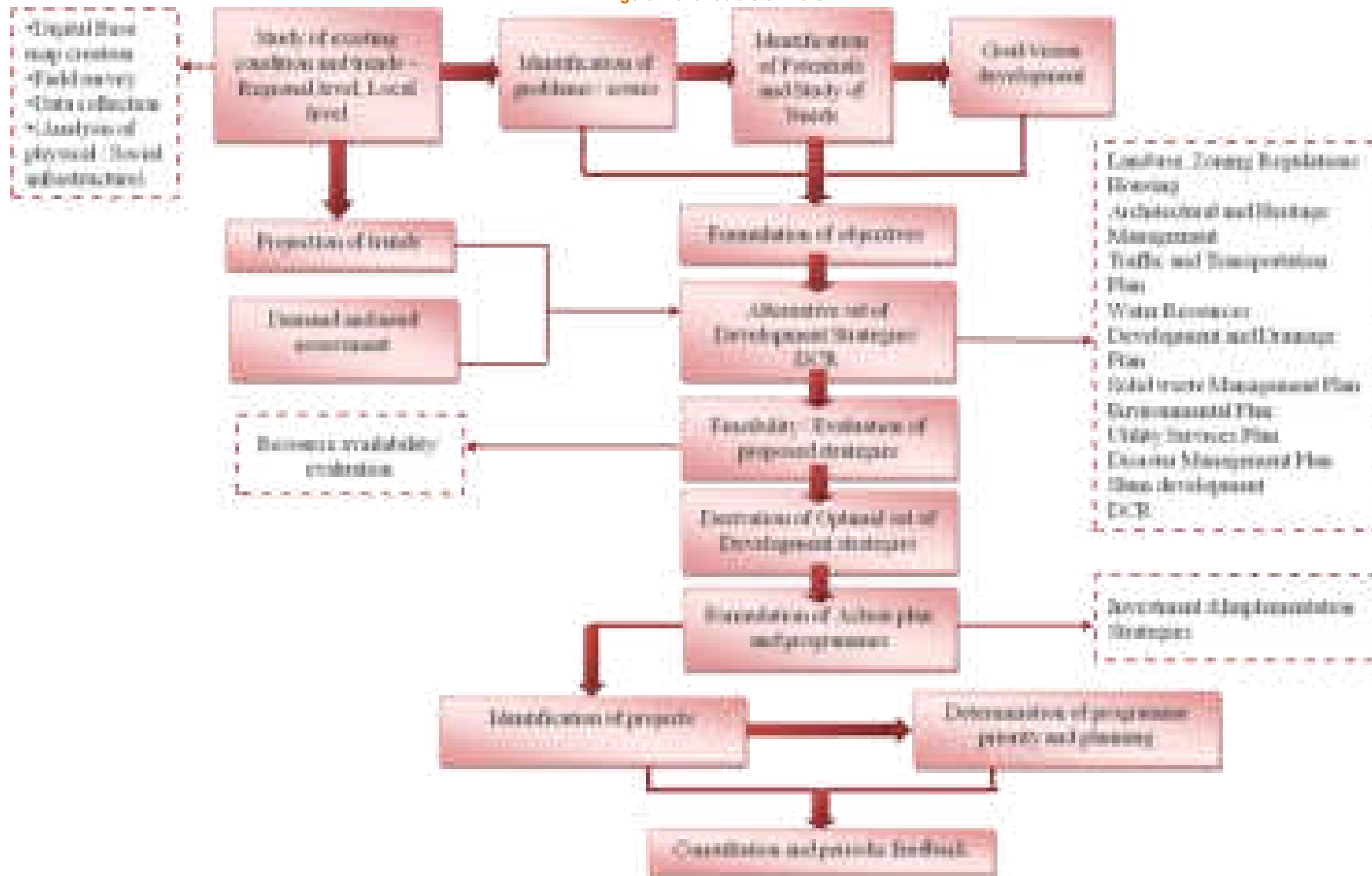


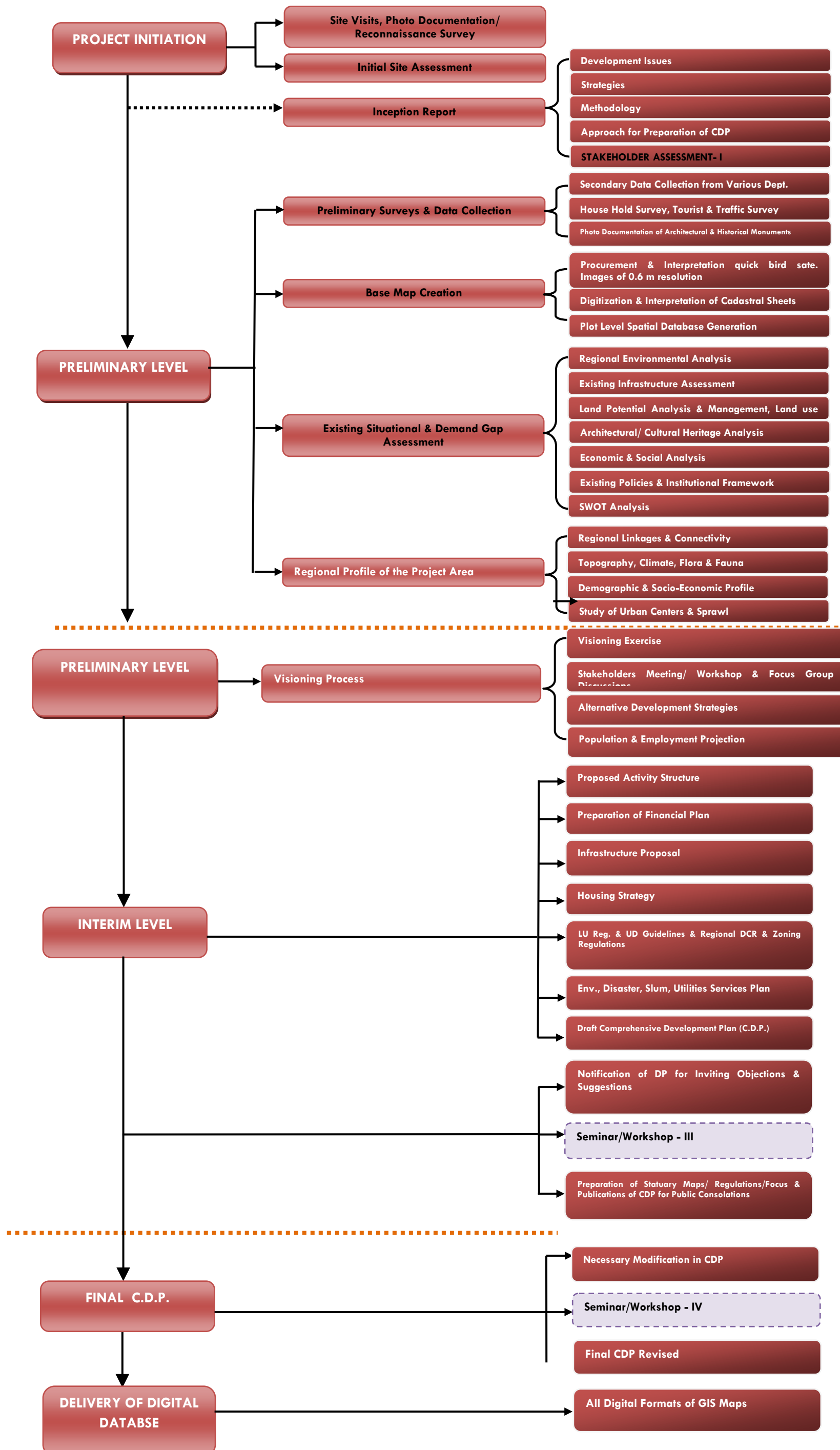
- Traffic and Transportation
 - Housing
 - Public Utilities
 - Environmental Improvement, Education, Research and other community facilities
 - Plantations, city forests etc.
 - Heritage and Tourism
 - Management of water bodies
 - Financial aspects
 - Administrative structures
 - Zoning Regulation with specific emphasis on natural hazard prone zones
- Spatial impact assessment of development proposals
 - Strategies of development and identification of priorities for the city region and phasing
 - Investment Plan and Action Plan
 - Digital proposed land use plan translated over revenue map in GIS format.

The following figure shows the above mentioned structure of the Comprehensive Development Plan:



Figure 1.8: Structure of the CDP





1.7 Approach and Methodology

Task 1 – Project Initiation

- Site visits and photo/video documentation
- Secondary data collection from various agencies (Stage -1)
- Preliminary site analysis based on survey & informal meeting with stakeholders and PKDA.
- Preparation of inception report and meeting/consultation with stakeholder

Task 2 – Preliminary Level

- Preparation of Base Map
- Secondary data collection from various department (stage-2)
- Preliminary surveys which include Household survey, Tourist survey, Traffic survey and Parking survey
- Existing situation and demand gap assessment of PKDA area. It include regional and environmental analysis, existing infrastructure assessment, Land potential analysis & management, Land use analysis, Architectural/Cultural heritage analysis, Economic and Social analysis, Existing policies & institutional framework and SWOT analysis of the PKDA area
- Regional Profile of the area which include Regional linkages & connectivity, topography, climate, flora & fauna, Demographic and socio economic profile, study of urban centers & industrial sprawls Visioning process, which include stakeholder meetings & FGDs alternative development strategy and visioning exercise for projected population and employment.

Task 3 – Interim Level

- Proposed activity structure and infrastructure proposal for PKDA area
- Housing strategy
- Land use regulation and Urban design guideline
- Regional DCR
- Zoning regulation
- Environment plan and Disaster plan
- Slum and utilities services plan
- Preparation of financial plan and model for PKDA area
- Draft Comprehensive Development Plan
- Notification of DP for inviting objection & suggestions of various stakeholders
- Preparation of statutory maps/ regulation/documents & Publications of CDP for consultations

Task 4 – Final CDP Level

- Necessary modification in CDP and Final CDP Revised
- Delivery of Digital Database which includes all digital formats of GIS maps.



1.8 Structure of Report

The Comprehensive Development Plan document for Puri Konark Development Authority Area has been divided into fifteen chapters and structured in a sequence to organize the Plan document. The first volume consists of the following chapters:

Chapters	Contents	Visualization
Chapter 1 – Introduction	Introduction to the preparation of the CDP, main objectives of the CDP, the vision statement guiding the development of the PKDA region along with the purpose of the CDP.	
Chapter 2 – Overview	Gives a broad overview of the study region, with the background introduction of the study region, its administrative boundaries, review of the previous master plans and the legal framework in the region followed by the geographical setting, topography, climate, soil, water resources, flora & fauna, chronological growth of the settlement, economy, regional linkages, housing, physical infrastructure, social infrastructure, culture, recreation, tourism, and the Heritage & conservation.	
Chapter 3 – Heritage & Conservation	This Chapter details the various heritage structures in the region, the cultural heritage & natural heritage, and the proposals for conservation of the same	
Chapter 4 – Existing Land use	Details out the existing land use of the PKDA region with the distribution of each of the land uses in the blocks.	
Chapter 5– Demography and Socio-economic characteristics	Details the demography and the socio-economic characteristics of the region along with the proposed economic zones and activities.	
Chapter 6 – Traffic & Transportation	Details out the regional connectivity of the area, the mobility pattern in the region, the analysis of the bottle necks and congestion areas and the proposals	
Chapter 7 – Housing & Slum	Details the development of the housing sector in the region, along with the analysis of the housing types, ownership pattern etc, analysis of the slum conditions and the proposals in the housing sector	
Chapter 8 – Physical Infrastructure	This chapter details out the current scenario of water supply, drainage & sewerage, solid waste management, the demand assessments and the proposals	
Chapter 9 – Social Infrastructure	Details the social infrastructure facilities in the PKDA Region, the demand assessment and the proposals	
Chapter 10 – Environment & Disaster	Details out the environmental profile of the region and the disasters the region is prone to, along with the proposals to control the pollution levels and improve the environment.	

2. Puri Konark Development Authority Area – An Overview

2.1 Introduction (Background - Description of PKDA area)

The Puri Konark Development Authority (PKDA) region is a naturally picturesque peninsula jutting into the Bay of Bengal and located on the southern part of Bhubaneswar and Cuttack. The area comprises of Puri Municipal limits, Konark NAC area and the adjoining rural areas included in 131 numbers of revenue villages, with a population of about 4.96 lakhs (according to the 2001 census) and stretches over an area of 296.33 sq.km.

The proximity of the PKDA area to two major urban centres - Bhubaneswar and Cuttack makes it an ideal getaway for pilgrims and tourists. Bhubaneswar – Puri – Konark form the ‘golden triangle’ attracting numerous tourists from all over the country and the world. Pilgrims on short visits frequent the area to visit Jagannath temple, Konark temple – a UNESCO world heritage site and the attractive beaches.

Fig 2.1: Ratha Yatra in Puri



Fig 2.2: Sunset at Puri Beach



Fig 8.3: Sun Temple; Konark



2.2 Administrative Jurisdiction

2.2.1 Puri Konark Development Authority (PKDA):

After being carved out from erstwhile Bhubaneswar Regional Improvement Trust, Puri Konark Regional Improvement Trust (P.K.R.I.T.) became a separate entity in September 1982, and started functioning with jurisdiction over the Puri Master Plan area, and the areas in between Puri & Konark, with an objective of enforcement of the Odisha Town Planning and Improvement Trust Act 1956. Subsequently in the year 1997, the Odisha Development Authority Act, via a notification of Govt. in H. & U.D. Department, was re-enforced over the earlier areas supersizing the O.T.P. & I.T. Act of 1956, thus resulting in the formation of the Puri Konark Development Authority on 1.4.1997.

The main objective of the authority is to ensure planned and systematic development of the areas under its jurisdiction, with preparation of development plans, undertaking works pertaining to different Town Planning Schemes and public amenities.

The PKDA area consists of three administrative and planning jurisdictions which are:

- Puri Municipality
- Konark NAC
- Puri Konark Development Authority (PKDA)



Puri Municipality

Puri Municipality was established in the year 1881. After independence, Odisha Municipal Act (1950) was enacted and the city administration was vested with Puri municipality and represented by a chairperson and councilors elected by the people.

Puri municipality has an elected council comprising of elected representatives of each of the 30 wards that fall within the Puri municipality limits. The council is headed by a chairperson who is elected by the councilors.

Konark NAC:

The Konark Notified Area Council has a jurisdiction of 13 NAC wards. It comprises of 7 mouzas with an approximate area of 35.09sq km homing to population of 16979 as per 2001 census information.

2.2.2 Constituents of PKDA

The PKDA area comprises of the Puri Municipal limits, Konark NAC area and 131 number of Revenue villages with adjoining rural areas, have a population of about 4.96 lakhs (according to the 2001 census) and stretches over an area of 296.34 sq.km.

Major development has been found in the Puri development area and Konark NAC and few scattered regions of Proposed SIZ area. The rest of PKDA is basically covered with forests of different types and coastal lowlands. The details of each block in the study area are given in the below table:

Table 2.1 Details of PKDA constituents

Development Area	No. of Mouza	Area (Sqkm)	Population
Puri Area (Puri Town + Puri Sadar)	50	64.10	172717
Konark Area	07	34.93	16979
Block-A	21	100.24	17238
Block-B	14	34.36	6872
Proposed SIZ	39	62.70	75244
Total	131	296.34	289050

Source: Census-2001, CEPT Analysis

2.2.2.1 Puri Development Area:

The Puri development area comprises of 50 mouzas which includes areas under Puri Municipal limits and the Puri Sadar area. It stretches over an area of 64.12 sq km.



Map 2.1: PKDA Region and Its Constituents



2.2.2.2 Konark Development Area:

The Konark development area comprises of 7 mouzas of Gop PS area and stretches over an area of 35.09 sq km. Out of these areas, Konark & Junei villages have exhibited higher growth rates. Konark is a town and a Notified Area Committee, 65km from Bhubaneswar. It is famous for the Sun temple and Golden beach. It is one of the three points of Golden triangle. Junei on the other hand, is in the process of emerging as a small roadside market area. Intervening area of block – A between Puri and Konark:

2.2.2.3 Intervening area of block – A between Puri and Konark:

The intervening area of block – A between Puri Sadar and Konark comprises of 21 mouzas. It includes PS of Gop and Puri Sadar and stretches over an area of 99.27 sq km.

2.2.2.4 SIZ Area and its surroundings:

SIZ area and its surrounding areas comprise of 39 mouzas. It includes Jamarsuan, Baliguali, Gadamrugasira, Chalisibatia, Itibahan, Gopinathpur, Pubasasan, Raigorada, Chandanpur, Balipada, Baliput, Harekrushnapur, Bania sahi, Talajanga, Birabalavadrapur, Dugal, Gadabhingura, Chhaitana, Malatipatapur, Badagaon, Raikhandi, Bantaligan, Saasandamodarpur GP of Puri district. This block stretches over an area of 62.71 sq km.

2.2.2.5 Intervening area of block – B beyond Konark towards Kakatpur:

The area of block – B beyond Konark towards Kakatpur comprises of 14 mouzas of Kakatpur PS. It stretches over an area of 35.15sq km.

2.3 Legal & Institutional Framework, Policy and Plans

This section includes review of Puri master plan, Konark NAC master plan and Puri-Konark SEZ beach development plan which the three major are planning initiatives taken for the regional development.

2.3.1 Review of Master Plans

This section reviews the regional planning context by reviewing the master plans of Puri and Konark area. the earlier efforts for the preparation of the master plan was for the following areas,

- Puri Master Plan
- Konark Master Plan
- DP for Puri – Konark Sea Beach

2.3.1.1 Puri Master Plan

Puri master plan area is basically a planning territory specifically formed for master planning purpose of the expanding and sprawled parts of the Puri town area.

Puri Master Plan area covers an area of 63.57sq.km. The population of Puri Master Plan area was to the tune of 79,328, 109,489 and 1, 36,073 in the year 1971, 1981 and 1991 respectively, thereby indicating a growth rate of 38.02% in 1971-81 and 24.28% in 1981-91.

The gross density worked out was to be 2140 persons per sq.kms in the Master Plan area where as the Puri town witnessed a gross density of 7435 persons in 1991. The scenario would be further aggravated with the increase in the population over the years.



The master plan prepared for Puri in 1967-68 has been shown in the below map along with detailed specific provisions of the plans has been summarised:



Map 2.2 Puri Master Plan

Source: Puri Municipality

2.3.1.2 Statutory provisions made for the Development Plan for Puri

- The Master Plan area consists of Puri Municipality limits and 16 adjoining villages.
- The Odisha Town Planning and Improvement Trust Act, 1956 was extended over Puri Municipal area during the year 1964 vide Notification No. 2346/LSG. Dt. 28.02.64
- Extension of O.T.P. & I.T. Act over 16 other adjoining revenue mouzas was made vide Notification No. 3268/HUD, dt. 21.02.68.
- The draft Master Plan was prepared by Town Planning Unit, Puri under the guidance of the Town Planning Organization and published (Sec.31(1) of the O.T.P & I.T. Act, 1956) by the then S.P.A., Puri vide Notification No. 2266/TP, dt. 01.07.68.
- P.K.R.I.T – Puri Konark Regional Improvement Trust was constituted in the year 1982.
- The Objections & suggestions were received based on which in the year 1983, a short report was prepared by Town Planning Unit, Bhubaneswar for discussion before finalization of the Master Plan.
- On constitution of PKDA, the Master Plan of Puri has been deemed to be interim Development plan (I.D.D) of Puri. The I.D.P. for Puri has been prepared & published in the Odisha Gazette on 13.03.98 inviting objections & suggestions from general public.

2.3.1.3 Master Plan for Konark

The Konark Development plan area comprises of 7 revenue villages which constitutes of 13.55 sq.miles of area & total population of 16,979 (2001 Census). The master plan for Konark along with its plan boundary has been shown in the below image:



Map 2.3: Proposed Konark Masterplan Boundary

Source: Konark NAC

Map 2.4 Detail of Konark Master Plan

Source: Konark NAC

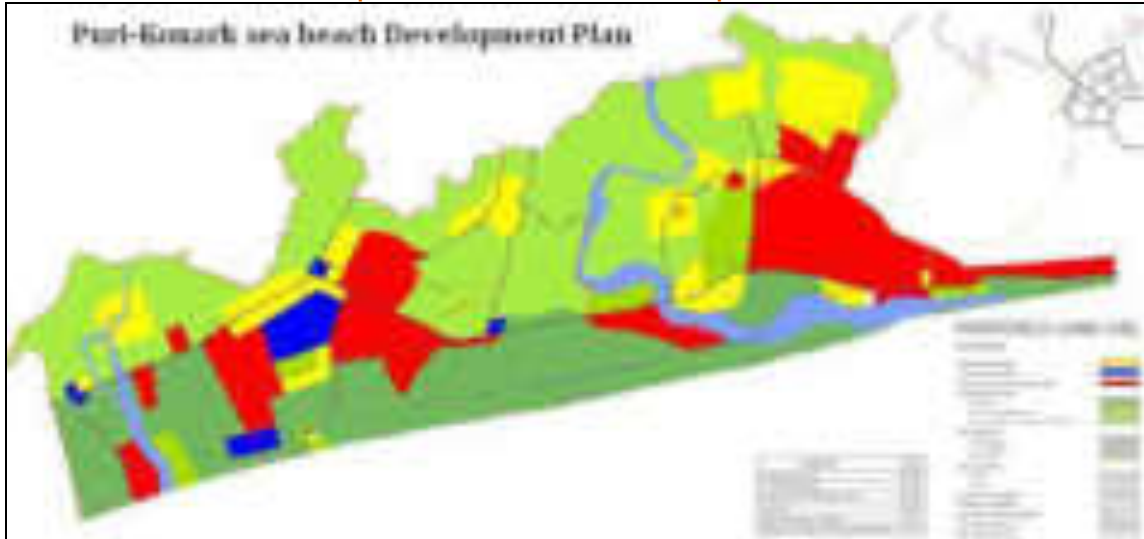
Statutory provisions made are for the development plan of Konark is as follows:

- Extension of O.T.P. & I.T Act is made vide Notification No. 7049/LSG, dt.03.05.65.
- The Master plan was prepared in consultation with T.C.P.O & Directorate of Town Planning, Bhubaneswar.
- Publication of the Master Plan by special Planning Authority under Section 31(1) of the Act, vide Notification No. 1178, dt.05.06.67.
- The Master Plan was finalized & approved by the Govt. U/S 32 of the Act. Vide letter No. 17957/HUD, dt. 17.04.82.
- The IDP for Konark has been published in the Odisha Gazette in September, 1998 inviting objections & suggestions from the general public basing on which the land – use map has been modified.

2.3.1.4 Development Plan for Puri-Konark Sea Beach

The Development plan for the Puri Konark Sea Beach area comprises of 35 revenue villages out of which 21 are within Block-A and 14 villages of Block-B. The total area extend over 32140 acres along the Marine Drive road & Konark – Kakatpur Road, out of which Block A covers an area of Ac 23,448 and Block – B Ac. 8692.

Map 2.5 Puri-Konark sea beach Development Plan



Source: PKDA, Puri

The main components of the development plan for Puri Konark Sea Beach area are:

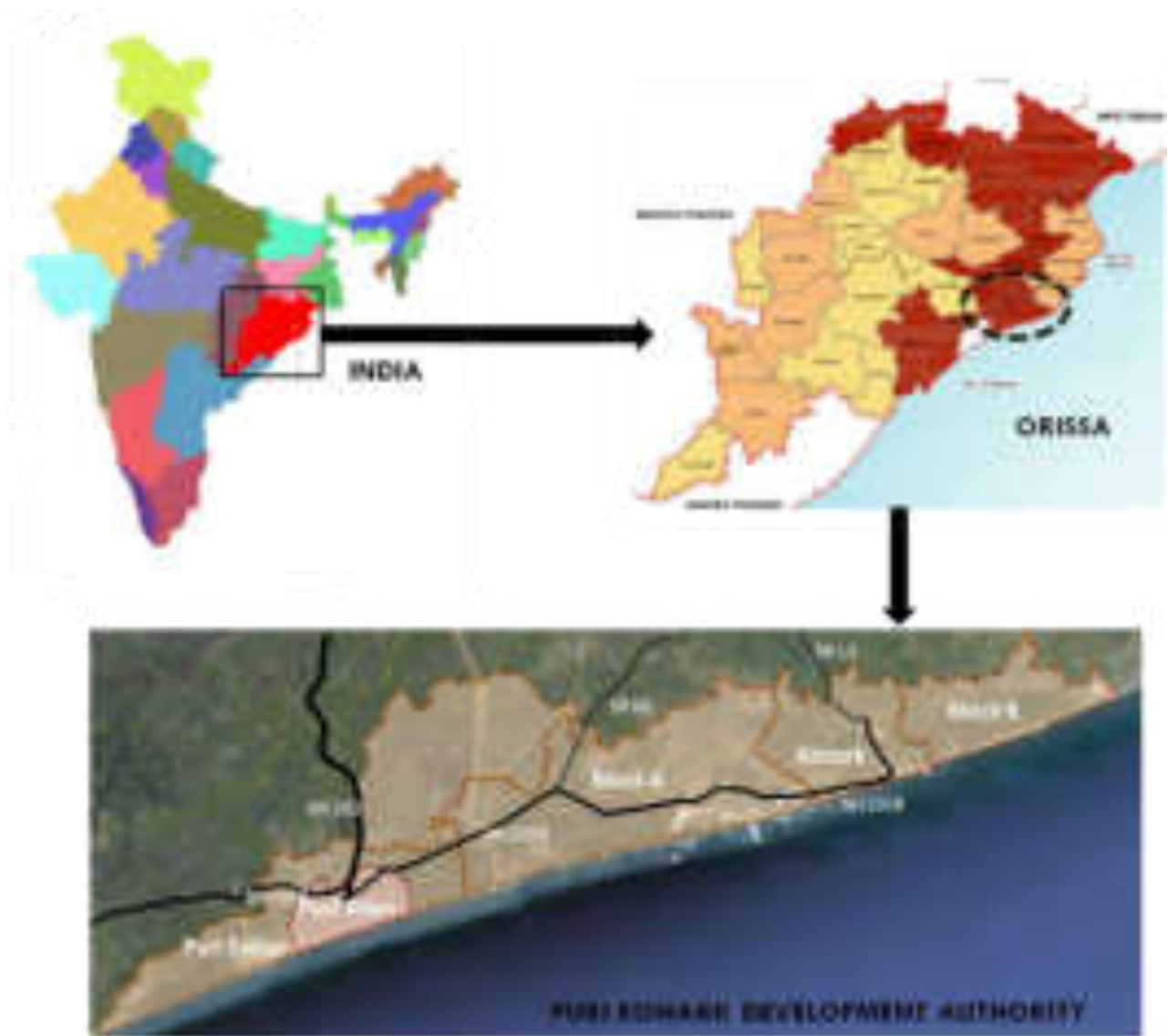
- The total population of this Development plan area was to the tune of 11,864, 13,945, 17,308 and 21,185 during the year 1961, 71, 81 and 1991 registering a growth rate of 17.54%, 24.12% and 22.40% in 1961-71, 71-81 and 1981-91 decades respectively.
- The population of Block-A happened to be 8254, 10253, 12828 And 14861 in the census year of year of 1961, 71, 81 and 1991 having an increase of 24.22%, 25.11% and 15.85% in 1961-71, 1971-81 and 1981-91 decades respectively.
- Block- B was having a population of 3610, 3692, 4480 and 6324 in the aforementioned years and the growth rates of 2.27%, 21.34% and 41.16% respectively in the census decades as stated above.
- The increased growth rate in Block-B may be attributed to creation of new working atmosphere in the sub-region & home-coming of the people when they failed to get long term employment outside and find their luck in their home soil and tourist market of Konark, the nearest town.
- In the year 1991, 6056 persons were the main workers and were gainfully employed, which constitutes 28.59% of the total population. The proportion of gainful employed persons stood at 28.50% in 1971 and 29.46% in 1981 out of the total population of 13945 and 17308 persons respectively.

2.4 Geographical Setting: PKDA

PKDA is situated between $19^{\circ} 21'E$ - $26^{\circ} 29'$ E latitude and $84^{\circ} 29'$ - $86^{\circ} 25'$ E longitude. Puri and Konark are the two nodes of the famous golden triangle with Bhubaneswar and constituting the other nodes in tourism atlas in India. Chilika Lake is also located on the eastern part of the PKDA area. PKDA area consists of Puri, Konark, Puri sadar, Block-A (intervening area between Puri and Konark), Block B (area beyond Konark towards Kakatpur) and area under SIZ (Special Institution Zone). The important tourist places like Konark, Satapada, Sakhigopal, Raghurajpur and Pipli are within the 40-50 kms radius.

Geographically the region is basically a coastal stretch formed of primarily coastal sandy and alluvium, soil with undulating to plain topography. Most importantly the location of the region is on a vulnerable track of cyclone and marine disasters which is a major cause of concern from planning perspective.

Map 2.6 Location map of the study area



2.5 Topography

The strip lies between the alluvial plain and the Bay of Bengal. It assumes the form of a bare belt of sandy ridges which stretches along the entire length of the district varying from 6.5 km to a few hundred meters in width. Accumulation of the windblown sand gives rise to ridges parallel to the coast. It forms the dividing line between Lake Chilika and the ocean.

2.6 Climate

Lying south of the Tropic of Cancer, the region enjoys tropical climate. Hot summers with considerably heavy monsoon downpours and cool pleasant winters mark the climate of the region, with a strong maritime influence.

2.6.1 Temperature

The region experiences hot and humid climate during summers, characterized by temperatures going up as high as above 40°C. Summer starts at the end of March, the effect of which is felt till middle of June when monsoon sets in. The average temperature variation during summers is 27°C - 36°C. The winter season lasts approximately for almost five months starting from October to February. The winter season is not severe in this region, with the winter temperatures ranging between 15°C -25°C. The monsoon sets in July and lasts till October. With the onset of Monsoon the region experiences heavy spells of rain due to its proximity to the Bay of Bengal.

2.6.2 Rainfall

The average rainfall recorded in the region is 135.23 cm. By early June, the Southwest monsoon arrives in the state and departs by middle of October. The month of July receives the heaviest rainfall with the flooding of the local water bodies. The relative humidity is generally high throughout the year, varying from 62% - 85%.

2.6.3 Wind

The wind velocity is moderate throughout the year and it becomes stronger during the south west monsoon. The coastal area is prone to cyclones, these cyclonic storms originate in the Bay of Bengal and crosses the east coast between Paradeep and Chandbali and makes a North-westward journey. A maximum number of cyclones occur during the south west monsoon. The maximum wind speed recorded in the region is 175 kmph in the year 1972.

2.7 Soil

The entire region may be divided into two dissimilar natural divisions.

The littoral tract is the strip which lies between the alluvial lands and the Bay of Bengal, with sandy soil. It assumes the form of a bare but sandy ridge which stretches along the sea- shore for the full length of the District , Varying from 6.5 Km. to a few hundred meters in width . Accumulations of windblown sand give rise to ridges parallel to the coast. It forms the dividing line between the Lake Chilika and the ocean.

Level Alluvial Tract - This level of alluvial region is full of rice fields which is watered by a network of channels, through which the water of distributaries of the most southerly branch of Mahanadi find their way to the sea.

Major problem the region faces is the lack of capacity of the top layer of the soil to hold water.



2.8 Water Resources

The entire PKDA region being situated along the coast of Bay of Bengal has a network of rivers, ponds and lakes, which have an interconnected drainage system. The four main rivers passing through the area are Mangala River near Sipasiruballi, Nuanai River passing through Balukand reserved forest, Kushabadra River near Konark and Kadua Nadi towards Kakatpur. These rivers are the tributaries from River Mahanadi.

Map 2.7: Water bodies Map: PKDA



Source: ORSAC

Due to the proximity to the sea, the ground water in most of the areas is saline; the two sweet water aquifer zones within the Puri municipal limit are the main source of drinking water in the region. These aquifers are located in Baliapanda and Chakratirtha areas. The Major tanks in Puri have great heritage significance as they are associated with the rituals of the Jagannath Temple.

2.9 Flora and Fauna

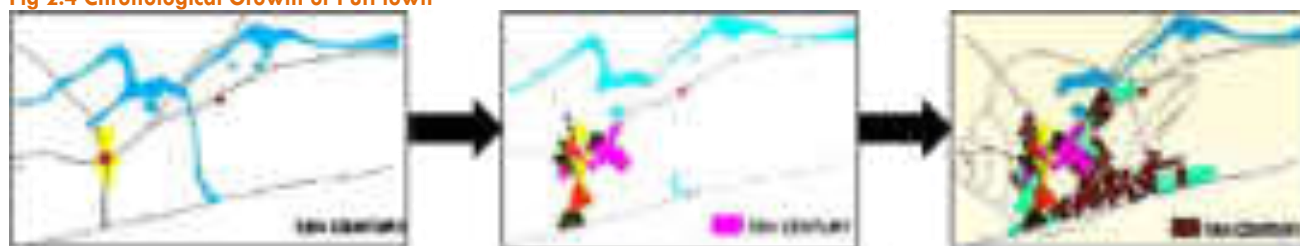
The PKDA region is rich in flora and fauna. The flora in the study region includes casuarinas, anacardium, eucalyptus, neem, tamarind, karanja, etc. The prominent fauna in the region are blackbuck, spotted deer, monkey, squirrel, jungle cat, hyena, jackal, mongoose and variety of birds and reptiles.

2.10 Chronological growth of settlement

The major settlements in the region are in Puri and Konark. This section broadly discusses about the growth of these two towns. Located on the East Coast of India overlooking Bay of Bengal, Puri is located on a 67 km stretch of sandy beach that extends from the Chilika Lake to the south of Puri town. The sun temple of Konark is located on this beach at a distance of 35km north of Puri.

The Puri town was originally built on sandy track which began from north and west towards Cuttack and Ganjam road where the Madhupur or Matia stream is lined with the largest tanks, Narendra, Mitiani, Markandeya and Siva Ganga. As the tributary of the river Matiani draining into the sea dried up, it paved the way for the new direction of development of the town in the southeast.



Fig 2.4 Chronological Growth of Puri town**Table 2.2: Timeline for development of Puri town**

Vedic age to 9th century AD	
Initial settlement of Puri dating back to age of 'Rigveda'	<ul style="list-style-type: none"> An early settlement of Puri town dating back to the age of Rigved itself. According to the records, Puri started with fisherman along the sea & sabars in the forest.
The first temple	<ul style="list-style-type: none"> The original history of Jagannath temple dates back to the times of Mahabharata. According for which the temple was constructed by the king Indradyumna as he found the daru (in the form of Lord Krishna, who was killed by Jara) floating in the eastern shores.
First Nagar (town) 2 nd Century BC	<ul style="list-style-type: none"> King Ashoka invaded Kalinga in 262 AD. With Bhuddism being spread over Odisha.
9th Century AD to 15th Century AD	
Established as one of the "Dhams" (holy destinations)	<ul style="list-style-type: none"> In 9th century AD, Acharya Shankar visited Puri & named the place as one of the four dhams.
The 2 nd temple 10 th Century AD	<ul style="list-style-type: none"> In this period KingYayati Keshari built the 2nd temple of the same place because 1st one was dilapidated.
3 rd and the Present temple 12 th Century AD	<ul style="list-style-type: none"> King Chodaganga deva (1174-1198 AD) built the temple at the time of 1135 AD & his grandson completed the temple. In this time migration took place due to Lord Jagannath temple and the geological nature

Mythologically, the city is believed to have been planned in the shape of conch or 'Sankhakshetra'. This area is about five Koshas (10 miles) in extent of which nearly two koshas are submerged in the sea. In the centre of the khetra lies Jagannath temple on a hillock called Nilagiri with eight Shiva temples guarding the eight quarters radiating from it the hillocks called Nilagiri. Bada Danda connecting to Sri Gundicha Temple forms the Spine of the shankha. The broad end of the Sahnkakshetra lies to the west where the temple of Loknath is located and on the apical end or tail end in the east is located the temple of Nilakantha.

Fig 2.5: Conceptual development of Puri town (Sankhakshetra)

The town consists of the Temple of Lord Jagannath in its centre with eight quarters (Sahis) radiating from it. The town colonies were called 'Sahis'. The population of the town was composed mostly priests and people attached to the various activities of the temple. Besides, there are large numbers of Mathas which chiefly cluster round the temple. As the rituals of the temple and Ratha Yatra became more elaborate, more people started living in Puri.

The Matha Complexes with their system of interconnected open courtyards as well as extensive areas of garden and plantations were

also closely associated with the major temple complexes. These Mathas were located within compact traditional neighborhoods or 'Sahis' with a distinctive built form which emerged in close proximity to the Jagannath temple complex. The sandy tract near Balukhand was not constructed upon, with the exception of the Swargadwara area where certain Mathas and a cremation ground were established, maintaining a distance from the seashore.

Historical records show that Puri was once a seaport. It was open for import and export trade from the middle of September to the middle of March. During the other six months of the year, the coast did not allow the ships to be loaded or unloaded. The vessels that frequented the port consisted chiefly of country barges. They were laid half a mile away from the shore in good weather. The trade consisted mostly of the shipment of rice to Madras coast and occasionally to Mauritius.

2.11 Economy

PKDA region shows a wide range of variations as far as the economic activities are performed. The urban centers in the region namely, Puri town and Konark NAC have major concentration and share in tertiary sector activities and employment generation. This is largely due to the tourism sector which holds the key in employment generation and economic base of these centers as well as the region. On the contrary, the intermediate villages between the urban centers most comprising of agriculture and allied activities in subsistence form. This over the last decade has resulted in population shift from the rural to the urban areas within the region. Major planning interventions are therefore of prime importance in this region.

Table 2.3: Workers distribution: PKDA region

Spatial Unit	Main Workers		Marginal workers		Total workers	
	WFPR% 1991	WFPR% 2001	WFPR% 1991	WFPR% 2001	TWFPR% 1991	TWFPR% 2001
Puri Town (M)	27.19	28.28	0.23	1.71	27.42	29.99
Puri Sadar	24.43	27.41	7.45	2.88	31.88	30.28
Block-A	27.62	25.23	1.04	4.9	28.66	30.14
Konark	26.32	28.69	1.23	4.76	27.55	33.45
Block-B	28.67	25.67	1.62	8.6	30.28	34.27
Proposed SIZ Area	27.62	25.81	1.38	5.2	28.99	31.01
PKDA Total	27.22	27.37	1.03	3.21	28.25	30.59

Source: Census-data, CEPT Analysis

Fig 2.6: Agriculture and HH industry workers

2.12 Regional Linkages

The main road linkages to the region are NH 203 from Bhubaneswar, NH 203A going to Brahmagiri, NH 203 E to Konark. The two state highways passing through the region are SH 60 and SH 13 going to GOP. There is meter gauge railway line running between Puri and Bhubaneswar-Cuttack. The local train services are easily available between Bhubaneswar to Puri.

Ferry service is another important mode of transportation that connects Puri area to Lake Chillika and other parts of Chadrabaga beach. Nearest airport is the Bhubaneswar Domestic Airport, which is 60Km from Puri. There is a helipad located at Konark.



Fig 2.7: Regional Linkage of PKDA region

2.13 Housing

The major concentration of residential clusters is seen in and around the Puri town area, whereas the rest of the region has dispersed type of rural settlements. The major mode of housing production in the region is still individual oriented and lacks major institutional interventions. The condition of housing (type of houses, materials, age etc) in the PKDA region shows a lot of diversity. Major permanent pucca housing type is seen in the Puri town area, whereas in the other parts of the region comprises of kuccha and semi-pucca structures.

The region being vulnerable to cyclones and floods, the traditional housing patterns has emerged as disaster resistant. The design of the housing type is very unique and hence becomes essential to study the same for future development. The major informal settlements/ slum pockets are located in Puri town and Konark NAC. As per the Government of Odisha there are 44 notified slum pockets in the region. Due to the constraints in the developable land, the natural barriers such as the reserved forests, the flood plains, and the haphazard growth of the activities the land and real estate market in the region has been stagnant. Therefore need of policies and interventions for the growth of this sector has been seen as prime necessity.

Table 2.4: Housing Scenario in PKDA

Blocks	Population		No of Households		No of occupied residential houses		HH Size	
	1991	2001	1991	2001	1991	2001	1991	2001
Puri Sadar Area	10874	14880	1792	2819	1689	2709	6.29	5.27
Puri Town	125199	157837	23062	30969	20980	27500	5.43	5.1
Block A	14523	17238	2332	3272	2088	3080	6.55	5.26
Konark	12683	16979	2131	2853	1910	2650	5.95	5.95
Block B	7863	6872	1208	1598	1077	1390	6.46	4.30
Total	171142	213806	30525	41511	27744	37329	5.60	5.15

Source: Census Data, CEPT Analysis



2.14 Physical Infrastructure

The major infrastructure requirement in the region is primarily felt in the urban centers, especially in Puri town are due to the dense concentration of population. The topography of the Puri town is such that the temple is at the highest point with the drains towards the sea coast and towards Atharnala on the other side.

As far as the coverage of water supply is concerned within the 30 wards of Puri municipality, 20 wards have been given the provision of piped water supply. On the other hand Konaark NAC all the wards are under coverage. The water requirements of the rural areas are covered by tube and bore wells.

There are open drains within the Puri town, with solid waste being dumped into these drains, thus clogging the drains. The major problem in the drainage sector is that storm water drainage and sewerage system are combined and have very low coverage over the region, resulting in frequent water logging during the rainy seasons.

As far as solid waste management is concerned there are no systems of door to door collection within the urban centers. The residential zones lack proper coverage both in terms of the provision of bins and solid waste collection. There are no scientific land fill sites available in the region; the current waste dump sites are located on environmentally sensitive areas, thus posing an overall threat to the health of the society.

Table 2.5: Overview of infrastructure scenario in PKDA region

Analysed Parameters		Puri Municipality	Konark NAC
Population	2001	157837	16979
	2010	195600	19900
Total No of wards		30	13
Fully Covered with Piped water supply		20	13
Partly covered		10	0
Rate of Demand (in LPCD)		135	70
Daily Supply in LPCD		123	31
Population covered under piped water supply		82.18%	100%
HP Tube wells		577	232
Storage reservoirs with capacity	Ground Storage Reservoir (GSR)	03 (4.75/L.gln)	01 (0.66/L.gln)
	Elevated Storage Reservoir (ESR)	03 (5.20/L.gln)	01 (0.33/L.gln)
Total pipeline length in km		145	37.664
Treatment Capacity		Nil	Nil
Average daily flow of wastewater in drains (mld)		10	-
% households having septic tank soak pit system		47	-
Minor drains-Coverage (Drain length/Road length)		40%	-
Solid waste Generated, MT/day		60	4
Waste Collection Efficiency, %		70-80	-

Source: Puri Municipality, Konark NAC



2.15 Social Infrastructure

This section deals with availability of social infrastructure focusing mainly on health and education, at settlement level in the study area. The Mouza wise summary of the infrastructure is discussed in detail. Assessment of service level is undertaken based on census 2001 data. The analysis clearly helps in identifying gaps in infrastructure at settlement level and thus provides key inputs for Comprehensive Development Plan preparation. The social infrastructure mainly dealt in this report is as the following:

- Schools
- Hospitals
- Post office, post and telegraph office & phone
- Transport facilities
- Banks & credit societies
- Electricity
- Newspaper and magazines

The existing status of available facilities as per 2001 census has been summarized in table below;

Table 2.6: Overview of social infrastructure facilities- PKDA

Development Area	No. of Villages	Population	Primary schools	Middle schools	Secondary schools	College	Primary Health Centre	Health Centre	Dispensaries	Villages having access to Electricity	Post offices
Puri Sadar	16	14880	4	3	0	0	0	3	0	12	2
Konark (unserved area)	7	1966	3	0	0	0	3	7	0	3	1
Block-A	23	17238	10	6	4	0	0	4	0	12	3
Block-B	14	6872	6	2	1	0	1	2	0	9	1

Source: Census data, CEPT Analysis



2.16 Culture, Recreation and Tourism

It is said that Puri celebrates thirteen important festivals in twelve months. However, in reality Puri has various festivals all across the year. Importantly all these festivals are not only linked with the culture and heritage of Odisha but also of India. These activities are directly and indirectly linked with the employment and economic development potential. It is estimated that around 80% of the income is linked with heritage related activities. This culture and association with the temple activities has given rise to a large number of arts and crafts in the region.

The region being situated in the Golden triangle of the tourism circuit attracts a large number of tourists throughout the year. The major areas of tourist attraction are Puri – Jagannath Temple, the Konark Sun temple, Chilika Lake, the pristine coast line and its beaches.

Map 2.8: Tourist sites in PKDA



2.17 Heritage and Conservation

PKDA area is endowed with varied historical and cultural resources from different historical periods. Puri and Konark both urban areas in the region are important heritage sites. The heritage town of Puri can be divided into six major precincts on the basis of type of structures and activities that take place.

- Temples
- Mathas
- Akhadas
- Jagaghars
- Vernacular and traditional buildings
- Holy tanks (Pokharis)



The famous Jagannath temple was constructed in the year of 1098 A.D. over an area of 10 acres. There are several daily rituals, casual rituals performed in the temple premises during different festivals. Rath Yatra (Car festival), Chandan yatra and Sahi Yatra are among the most attractive and holy festivals organized. Kudichar temple and Loknath temple are among other famous temples in the Puri town area.

There were initially 300 Mathas in the past which is presently close to 70. Large number of Mathas is present in the vicinity of the temple and a few in the peripheries. Many of them have been recently reconstructed. Puri was initially divided into seven Sahis or administrative units. Each Sahi consists of one Akhada and many Jagaghars. They are gymnasiums with some communal and recreational facilities managed by youth organizations.

There are a total of 50 Lodges & Dharmashalas located mostly in Grand road area owned by private owners. Vernacular and traditional residences in the town are mostly located in the areas nearby temple and holy tanks. Many colonial structures are seen in the same locality as well.

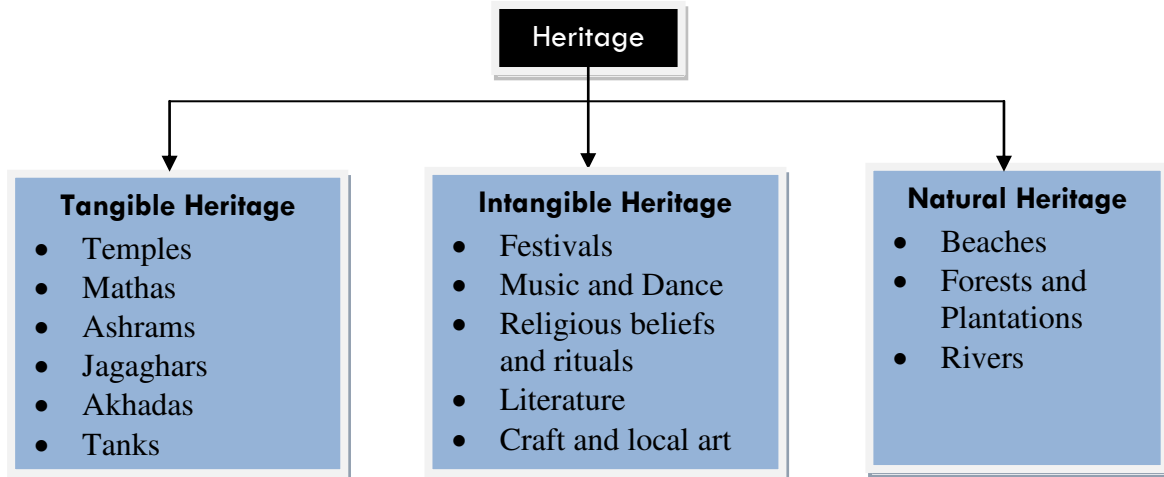
Map 2.9: Broad Elements of Heritage zone in Puri town



3. Heritage and Culture

3.1 Introduction

Heritage is the legacy of physical artifacts and intangible attributes of a group or society that are inherited from past generations, maintained in the present and bestowed for the benefit of future generations. Heritage can be classified as tangible heritage, intangible heritage, and natural heritage. Based on the above definition, the heritage of PKDA region has been categorized as shown below:



3.2 Tangible Heritage

Physical or "tangible heritage" includes buildings and historic places, monuments, books, documents, works of art, machines, clothing, and other artifacts, that are considered worthy of preservation for the future. These include objects significant to the archaeology, architecture, science or technology of a specific culture.

Fig 3.1: Jagannath Temple



Fig 3.2: Akhada in Swargadwar



Fig 3.3: Dharmasala in Puri



The heritage of Puri through numerous eras of ruling mostly revolves around the belief that, Puri is the dwelling place of Lord Jagannath. Puri is thus home to a plethora of temples, Mathas, Jagaghars, numerous sacred tanks and ponds that are under tremendous pressure owing to tourism and continuous urbanization of the town. The main heritage structures in the region comprise of Temples, Holy tanks, Mathas, Akhadas, Jagaghars, & Ashrams.

The following maps show the heritage areas in the PKDA region.

Map 3.1: Heritage Zones: PKDA, Puri, Konark

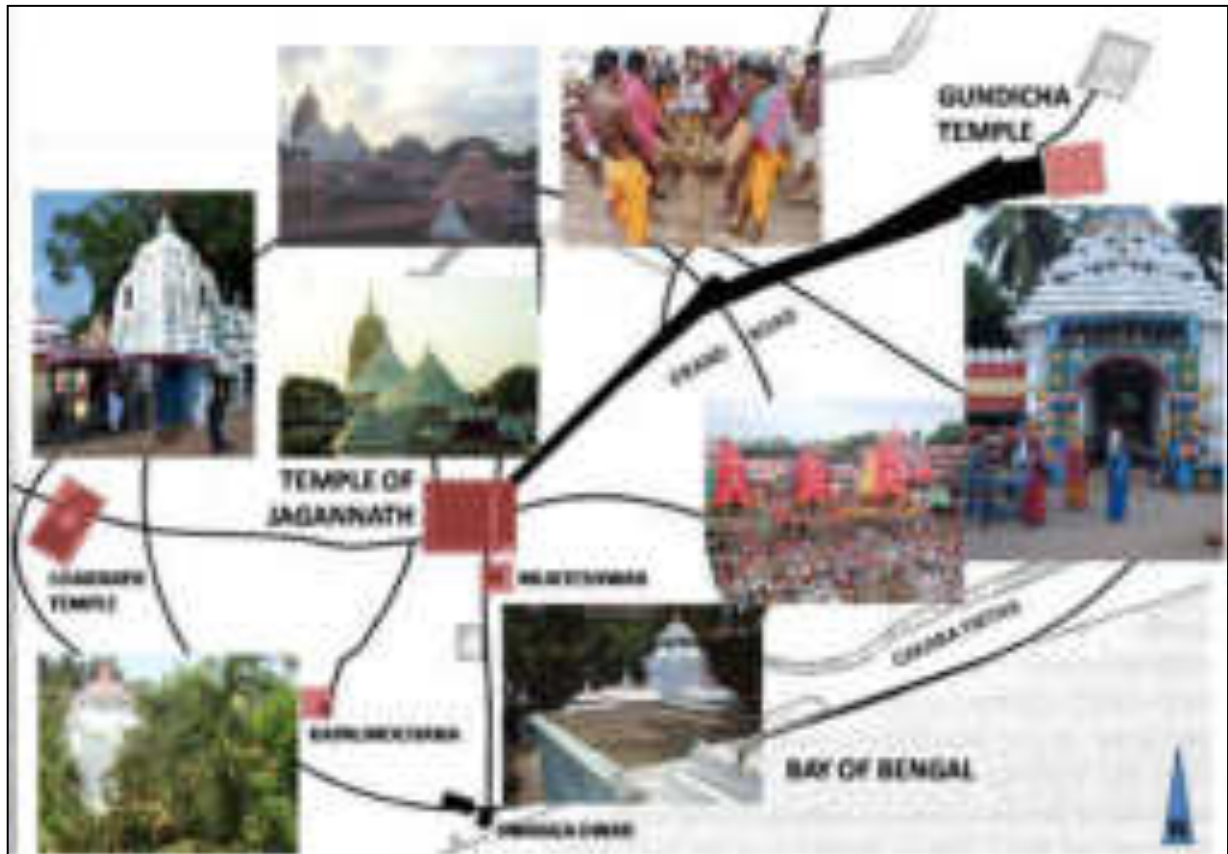


The ASI has identified heritage buildings of National Importance. A comprehensive list of all the other important heritage precincts has been prepared (see annexure). This list is an outcome of surveys conducted on the condition of all heritage structures, and those in a dilapidated state.

3.2.1 Heritage Zones in Puri

The exclusive blend of heritage elements in the form of numerous temples, tanks and many other structures can be categorized into seven zones, as explained below:

Fig 3.4: Heritage elements in Puri town



Zone I

This is the first zone which forms the epicenter of the Kshetra. It houses the idol of lord Jagannatha, Subadhara, and Balabhadra. It lies on the divine platform.

Zone II

The second fold is hexagonal in shape and located in this are four goddesses of power, two tirthas and two sacred trees, garuda, and the top of the hill which is in form of a tortoise shell.

Zone III

The third part is the outer layer of the second fold; it is the central part of the lotus-like structure having 8 petals. Each petal has an idol of Shiva and a goddess.

Zone IV

This area comprises of the area between the inner compound wall and the outer compound wall.



Zone V

The eight incarnations of Siva known as Asta Sambhu, believed to have been guarding the sacred land (Kshetra) and Goddess Chandi or Kali is protecting the holy Kshetra in eight different names.

These are very old shrines and have some ritualistic relationships with the Jagannath Temple. Places for temples of Gods and Goddess who are considered to have been the guarding icons of the presiding deity are also placed carefully with link roads to approach them.

Zone VI

This zone has the sacred tirthas the tanks and the fourth is the ocean or the Mohodadhi. It is said that visiting these holy/ sacred places in Puri is equivalent to visiting the three holy/ sacred places in India Gaya, Kashi and Haridwar.

Zone VII

This is the outermost zone and consists of the sentries of the Sankha Kshetra and two pilgrim centres as mentioned below:

- Nilakantheshwar (governor of Kshetra)
- Narisingh (place where yajna is performed)
- Ardhasosani (guardian of night)
- Bilweshwar (apical region of the Sankha Kshetra)
- Lokeshwar (the basal region of the Sankha Kshetra)
- Kapileshwar (watchmen of the Kshetra)
- Chakaratirtha (pilgrim centre of unique merits)
- Swargadwar the passage to heaven.

Map 3.2: Purshottam Kshetra Plan of Puri town (1840)



3.2.2 Major Precincts of Puri town

The heritage town of Puri can be divided into three major precincts on the basis of location, type of activities which take place and historical importance.

- The Jagannath temple.
- The Grand Road, or bada danda
- The Swargadwar road

3.2.2.1 Jagannath Temple:

The Jagannath temple is the center of the town of Puri. The area around the temple can be perceived as most important zone, and can be divided into two parts,

- The importance of various gates of the temple.
- Importance of the Sahis along each side.
- Various function carried out along periphery of the temple.

- **The Hastridvara or the northern gate:**

The Hastridvara or the northern gate of the temple remains closed after evening. The area around it is known as Markandeswar sahi due to the presence of the Markandeswar Temple and the Markandeswar sacred tank. This tank is one of the five tirthas of the holy city.

The region of the sankha kshetra extends up to Mitiani River on the one side and the Mangala River on the other. These rivers served as an escape routes to carry away the idols to hideouts during invasions and



important water links to Chilika Lake, in the midst of which, hideouts in the shape of rock caves existed. Many important monasteries like utara parsva (ramanuja), bada odia (ati badi), bada santha (ramanuja), trimali (ramanuja) and hamajee (nimbarka) mathas owned by different sects of vaisnavites, are also located in this zone.

Map 3.3: Location and alignment of Sahi's around Jagannath temple



- **To the north-eastern side:**

To the north-eastern side, Narendra Tank is located in which the Chandan jatra of the Lord is held for 21 days during summer. Between the habitation and the Narendra Tank there is a place called, 'Badu Mahapatra Jaga' where there is a stone image of Chodaganga Dev. This locality is known as 'Choudanga Sahi'. (Choudanga may be the abbreviated form of Chodaganga Dev – the King or a twisted form 'Suranga' meaning a, hidden' tunnel – the image used to be taken out of Puri through, it believed' to have set up by Chodaganga Dev himself) near this holy Narendra tank.

A small Ganesh image exists even now which is known as 'Chara Ganesh' which is indicative of the fact that the scaffolding to carry big stone slabs for the constructions of the temple started from that place. This is also true to the Hindu tradition that in the beginning of every auspicious work, 'Ganesa' - who is known as 'Siddhidata' (a deity granting success) has to be worshipped. It appeals to reason that in a sandy tract like Puri where massive stones are a rare building material, they must have been brought by water (either through Mahanadi or Chilika) to Narendra tank from where those were taken to the temple construction site through a scaffold which is called 'Chara' in oriya.

As a scaffold or 'Chara' is usually made of seasoned palm wood and is still used in chariots during Car festival to enable the heavy idols to be raised from the ground to the platform on the chariots.

- **The eastern gate or the Simhadvara**

The eastern gate or the Simhadvara is the most important entrance to the temple. Simha or the Lion is considered the king of the animal kingdom. Apart from this the word Simha has a connotation which indicates the principal or superior. Naturally the Simhadvara of the Temple has some special significance.



It faces towards the locality known as Dola Mandapa Sahi - mostly inhabited by the Suaras, Daitas and Puja Pandas. All these three categories of people have their place of importance in the temple as ritual functionaries. This has its name as the mandapa was originally in Dolamandapa sahi and shifted to the present place in the 18th century A.D.

This area also contains some important Mathas or monasteries, like Emar (Ramanuja), Radhaballav (Nimbarka), Mangu (Nanak-Panth Udasi) and Naval Das (Ramanuja) under the supervision of these sections respectively. It is worth mentioning here that these Mathas have direct and regular ritual connections with the Jagannatha Temple.



Fig 3.5: Heritage elements in Puri town

- **The western gate or the Vyaghradvara**

The western gate or the Vyaghradvara faces Baseli Sahi and in the South Western side Harachandi Sahi. Both these old localities are mostly inhabited by temple functionaries belonging to the categories like singharies, Puspalakas, Supakaras, Maha Supakaras, Madeli, bazanitri maharies besides other. It stretches upto the temple of Loknath, one of the oldest temples of Puri. The presiding deity of this temple Loknath - Siva has a very significant role for the Jagannatha Temple to perform. He is the Bhandara-Raksaka or the guarding deity of the jewelleries contained in the Ratna Bhandar of the temple.

Another sacred tank Pravati Sagar is very much within the temple enclosure. It is said that the presiding deity Lokanath mentioned above, is installed parallel to the water level of the Parvati Sagar for which the image of Siva remains submerged in water throughout the year. He becomes visible only on Pankoddhar Ekadasi - an occasion when soft clay or silt is cleared from the surrounding area of the deity. This is done regularly before the Maha Sivaratri when Thousands of devotees assemble to pay homage to Lokanatha or lord Shiva. Lokanatha is held in high esteem by the local people and believed to have been installed and worshipped by Rama as Lokanatha while going to the Pancabati forest through a Sabar Palli that existed in this area earlier.

- **Other Temples**

Besides the main Lord Jagannath Temple, there are 5 other important shiva temples in Puri. Each one of the mentioned temples perform their own rituals.

Fig 3.6: Jambeswar temple



Fig 3.7: Loknath Temple



Fig 3.8: Kapalmochan Temple**Fig 3.9: Markendaya / Markendeswar Temple****Fig 3.10: Nilkantheswar Temple**

3.2.2.2 Bada Danda or the Grand Road

The main street, from the temple of Jagannatha to Gundicha Temple (his Garden House), is known as Bada Danda or the Grand Road. It is in tune with the central objective of the original lay out of the sacred town and is one of the widest city-streets in India. Three big chariots move on this street annually during the famous Car Festival and to witness it pilgrims in their millions stream in from all parts of India and abroad and assemble on this street.

3.2.2.3 Svargadvvara

Centering round the celebrated temple of the Lord Jagannatha, the cluster of habitations of various Sevakas or ritual functionaries is located. The southern gate or the Asvadvara faces the sea and is interspersed with shady gardens and important shrines of Goddesses Dakshina Kali, Shyama Kali, Mashani Chandi and other temples like, Bata Loknath and Asta Sambhu. Ultimately this zone merges with the sea beach with Golden sand through Swargadvvara or 'Gateway to Heaven'. It is believed that whoever dies in this sacred tract between Kalpabata, the banyan tree granting all wishing inside Jagannath Temple and the sea, obtains salvation.

Within this area, Swethaganga, one of the five sacred tirthas, the palace of the Adya Sevak-the RAJA, Sankarite monasteries like Sankaracharya, Sankarananda Siba Tirtha and Gopal Tirtha, Deula Purohit (The Temple priest) and some other important sevakas were nearer. Subsequently during the British rule, the palace of the Raja was shifted to the grand road, near the east gate of the temple. 'Shyama Kali' and 'Asta Sambhu' are the ancient palace- deities, near the old site of the palace, in the vicinity of Asvadvara in the east. The convention still continues that a new king when succeeding to the throne is required to visit



those shrines and offer obeisance to the Gods and Goddesses there. This is also done by the kings during occasions of religious significance. This area is known as Bali Sahi or the locality in the sandy beach.



Fig 3.11: View of Swargadwara

Map 3.4: Grand Road and Its Heritage Elements



The other temples of heritage importance in PKDA region area as follows:

The eight shivas are

1. Agneshwar
2. Bateswar
3. Khetrapaleswar
4. Chakreshwar
5. Baikuntheshwar
6. Pataleshwar
7. Isaneshwar
8. Lokeshwar

The eight goddesses are

1. Dwarabasini
2. Mahabajreswari
3. Swanabhairabi
4. Bhadrakali
5. Bedhakali
6. Bhubaneshwari
7. Sitala
8. Jagnyeswari

The major problems and issues identified in these three major precincts of the town are as follows:

- Even though this part of the city has majority of heritage structures and historic monuments, the conservation and upgradation of the buildings has not been given priority. Lack of such attempts is leading to decay of inner city areas.
- There are very few attempts at managing the critical nodal junctions of Grand Road and the temple; there are no demarcated lanes for traffic movement, no segregation of pedestrians, no formal parking areas resulting in heavy congestion.
- There is no self awareness of the importance of the rich architectural heritage present in this location, leading to neglect and deterioration of these structures.
- There are no designated parking spaces allotted for tourists leading to poor management of traffic.
- There are no dustbins along this road. The waste is generally dumped on the street from where it is generally collected by the municipality workers on a daily basis; the garbage mainly consists of religious waste and packing material.
- Illegal vending on the roads and important intersections compels pedestrians to walk on the roads leading to traffic havocs.
- The important stretches have no signages, which would guide the visitors about the movement pattern for the temple or even the directions to the local Sahis.
- The street lighting is sparse and there is no provision for toilets or benches on the major tourist circuits portraying the poor status of urban environment in the town.
- Major roads have a heavy concentration of electric overhead cables, which are disturbing and add to the visual chaos, thereby disrupting the image of the town on large.

3.2.3 Tanks in Puri town

The historic urban settlement of Puri had numerous tanks and ponds which were the only source of water for town inhabitants and therefore an integral part of the settlement pattern. Some of these water bodies have been protected and maintained through the ages due to their religious and social significance, most well known being the following four religious tanks:

- Narendra Tank
- Indrayumna Tank
- Markandeswar Tank
- Swetha Ganga tank
- Pravati Sagar Tank



There exists another set of traditional water bodies, smaller in area but an integral part of Puri. There are several tanks in Puri today; most of them still have ponds and tanks attached to their Akhadas and Shrine. These tanks act as water recharge zones in the town. In addition to all the as above mentioned tanks, there are almost 50 Jagagharas in Puri.

Narendra tank is one of the four religious tanks of the city which are also nodes of the major daily religious activities and function. Narendra Tank is one of the most important tanks of the city since Chandan yatra ritual is associated and is performed in this tank.

This largest tank of Puri is 1.5 km N-E of the Jagannath Temple. It is situated on the left side of the Grand Road running from Jagannath Temple to Gundicha Temple. A good approach road is running from Grand Road through 'Dandimala Sahi' to this tank.



This tank stands on the revenue plot No.117 and 199 respectively. On the east of the tank there is Grand Road, Markandeswar Sahi and Temple of Bisoi Thakurani on the west, Brahmagiri Road and Jatia Baba Math on the North and Jagannath Ballabh Math on the south.



- **Religious significance**

The most celebrated, and one of the large tanks of Puri, is the Narendra Tank. Because of its close relationship with Jagannath Temple it is considered a holy tank among the pious Hindus.

The Chandan Mandapa placed in between the tank which is connected with the south bank with a bridge. From which Madanmohana, along with other deities the moving deity of Lord Jagannath, is brought for 21 days during Chandan Yatra.

The surrounding area of this tank gives a picturesque appearance to this place.

- **Historical background**

From the old administrative records of Srimandir it is known that the creation of Narendra tank is due to the seed of pumpkin.

The story is as follows:

"During the reign of King Narendra Dev of the vassal state of Ranpur, he had very good relationship with the Gajapati king of Puri. He was a great devotee of Lord Jagannath. Once he got a pumpkin seed while moving leisurely in the courtyard of his palace. The king in his jolly mood gave the seed to a Sarbarakara (Revenue Collector). He told the Sarbarakara to plant the seed in the name of Lord Jagannath and to offer all the pumpkins produced to the Lord. The Sarbarakara planted the seed in the name of Lord Jagannath with full devotion. Astonishingly the growth of the pumpkin creeper was luxuriant and covered an area of 14 acres. This creeper had a life of 5 years. Lakhs of pumpkins were produced. The sarbarakara sold all the pumpkins worth lakhs of rupees. The Sarbarakara deposited all the money to the king Narendra Dev. King Narendra Dev offered the money to Gajapati King of Puri. Both the kings decided to construct a tank at Srikshestra out of this fund. It is clear that this tank was built during Ganga period. 'Chara Ganesha' is worshipped in a nearby Jaga close to this tank. Tradition says that the scaffolding was done to carry big stone slabs for the construction of the great temple from here."

In 1971, The Govt. of Odisha undertook the renovation of the tank at an estimated cost of Rs.8, 00,000. The work has been completed.

- **Description**

Narendra Tank covers an area of 14.757 acres. It is 834 ft by 873 ft in size. The approximate depth of the tank is 28." The water level of the tank is about 10 feet below the present road level.



Fig 3.14: Religious rituals in Narendra Tank

There are 16 ghats of the tank. Among these ghats 14 are named after the 14 sons of Narendra Deva, one after his queen Kalandi Devi (Kalandiswar ghat) and the main ghata i.e. Narendra Chakada ghat after Narendra Deva, brother of Gajapati Kapilendra Dev. There are 3 ghats in the east, 4 in the west, 3 in the north and 6 in the south (including the chief ghat) respectively. The main ghat contains a flight of steps made of Khondalite stone.

The tank has an island in its centre bearing a small temple of later period called Chandana mandapa (50" x 12"). The tank was previously a fine sheet of water which was kept clean by flushings from the Madhupur river (Mitiani river) during the rains through a channel in the western corner. Over this Madhupur river stands the famous Atharanala Bridge. It is the entrance of Puri town. Presently both the inlet and the outlet of the tank are completely choked up and the system no longer works. The water as a result has turned filthy. On the banks of Narendra tank, Chara Ganesh Matha, Gopinath Ballabha Matha, Brahma Jaga and Jatia Baba Matha are situated.

3.2.3.2 Indrayumna Tank

Indrayumna tank is the one important sacred tank of Puri.

- **Location**

It is Located on the north western part of the Gundicha Ghar.

- **Religious significance**

The Place is famous for its religious importance and its connection to Lord Krishna. A temple of child Krishna stands here. Near the temple is a small Shrine, dedicated to king Indrayumna of Odisha. At this place the 'Ashwamedha Yagnya' arranged by Indrayumna is materialized by Brahma After the end of the yagnya innumerable Brahmins were gifted. Today this 'yagnya kunda' is known as Indrayumna Tank. The statue of Lord Jagannath, Balabhadra and Goddess Subhadra being constructed by Biswakarma is located near this Yanga Kunda at Gundicha Temple. On its bank there are several temples.

- **Historical background**

Previously, it contained big old tortoises, which came to the pilgrims when called for food. Tradition has that the laborers who carried stone for the construction of great temple were because of hard work, turned into tortoises and remained here ever since

- **Description**

It is 396 ft wide and 485ft long and covers an area of 4.5 acres. It has a small shrine of the famous king Indryadyumna believed to be the one who made this grand Jagannatha temple originally. The complex also houses a Balgopal Temple.

3.2.3.3 Markandeswar Tank

It is considered one among the Pancha Tirthas of Puri. This tank is also important as it is connected with a lot of rituals associated with the lord. The temple bears ancient stone inscriptions pertaining to the Gange Dynasty.



Fig 3.15: Markandeswara Tank

- **Location**

The Markandeya tank exists on the north side of the temple at the end of Markandeya road. It is considered one among the Pancha Tirthas of Puri.

- **Religious significance**

God saved Sage Markandeya from a severe danger from Sea. This place is known as Markandeya, the holy place. On that particular spot Markandeya meditated for a long time. He also grasped the spirit of Bhagabat, He also arranged a Yagnya on that spot. At this place a temple was constructed by sage Markandeya.

- **Historical background**

It is said that the sage Markandeya had dug this tank establishing the Shiva temple by its side. It is situated about 1.5 km north the Jagannath temple. The temple bears ancient stone inscriptions pertaining to the Gange Dynasty.

- **Description**

It covers an area of nearly 4 Acres. It is irregular in shape. It has several Ghats around it and largely reported by pilgrims. It is 350ft in North, 508ft in the East, 385ft in the South, and 542 ft in the West. It is lined throughout with stones.

Two temple tanks (Markandeya and Indradyumna) of Puri, India, were studied for monthly variation in their phytoplankton distribution and physico-chemical properties of water during 1992. Altogether 59 algal species were identified in both the tanks. In Markandeya tank Cyanophytes constituted 95.6-98% of the total phytoplankton followed by chlorophytes (1.0-3.8%) and bacillariophytes (0-0.6%) whereas in Indradyumna tank chlorophyta members were dominant (82.4-94.2%) followed by cyanophytes.

3.2.3.4 Swetha Ganga Tank

Swethaganga is a small sacred tank.

Fig 3.16: Swethaganga Tank



- **Location**

Swethaganga a small tank is located to the west of the Jagannath temple.

- **Religious significance**

According to Mahabharat the Swethaganga is created from the nail of Lord Vishnu. The Swethaganga is situated in between Lions gate and Swargadwar. This Ganga is from the bottom of the earth and the water is sacred. Before visiting Lord Jagannath the pilgrims after bathed in Sea again takes a bath on Swethaganga and visits Lord Jagannath. It is believed that there is an internal connection between Swethaganga and the river Ganga. On the bank of this pond are two small temples, dedicated to Swetha Madhava and Matsya Madhava.



- **Historical background**

In 1971, the Govt. of Odisha under took the renovation of the tank at an estimated cost of Rs. 98,280.

- **Description**

There are two small temples on the banks of the tank. One is of Swetha Madhava and the other belongs to Matsya Madhava. They are supposed to be incarnations of Lord Vishnu.

Fig 3.17: Activities at Swethaganga Tank



3.2.3.5 Major Issues in Tanks and adjoining places

- Due to lack of awareness about the importance of the tanks lot of garbage dump can be seen on side of the tanks. People throw their waste in the tank and outlet of open drainage system which pollutes the water and urban environment.
- Due to lack of knowledge most of the sacred beautiful tanks remains unnoticed by the common visitors of Puri resulting in underutilisation of the heritage value of the town.
- Except seasons of festival most of the tanks are used for bathing, washing and other household activities which is resulting in water pollution and there are no regulatory mechanisms for controlling the type of activities in the tanks.
- In many cases open drains from households are draining into the tanks which are totally unscientific and hazardous for health and hygiene of the users.
- There has been no initiative taken to conserve, upgrade and link these tanks so that tourists can be attracted and local culture can be promoted more efficiently.

3.2.4 Mathas / Jagaghars / Akhadas

3.2.4.1 Jainism / Buddhism and the Jagannath culture

Eminent scholars have described the relation of Jagannath culture with Jainism, Buddhism and other cults. In ancient times Jainism spread all over Kalinga. Mahapadma Nanda, the king of Magadha conquered Kalinga and took away "Kalinga Jeena" image to Magadha. Pandit Nilakantha Das argued that this Jeena image is actually that of Sri Jagannath. According to him the word Jagannath is derived from Jeenanath. He also wrote that "Jagannath is primarily a Jaina institution".

The relation between Jainism and Sri Jagannath Culture is quite interesting. Jain philosophers and devotees have also compared Tri Ratna of Jainism with Sri Jagannath, Balabhadra and Subhadra.

Fig 3.18: Gaudiaa Matha



Fig 3.19: Punjabi Matha



A prominent historian, late Kedar Nath Mahapatra, supported this view. Some scholars advocate the theory of the Jaina origin of Jagannath. There is great similarity between the images of Nilamadhava and Jaina Tri Ratna. Jainism was very much popular in Odisha, and archaeological remains and Jaina images recovered from various places of Odisha prove its importance. Hatigumpha inscription of Kharavela highlights the worship of "Adijina" in Kalinga. This worship was done at "Pithunda". According to some scholars Pithunda is identifiable with Puri. Nilakantha Das argued that the Mahaprasad of Jagannath is Kaivalya and this is a derivative of the Kaivalya or the concept of salvation of the Jains. Mahayan Buddhists propagated that the image of Lord Jagannath was really that of the Buddha.

Tri Ratna of Buddhism Buddha is compared with Jagannath, Balabhadra and Subhadra. Scholars like Prof. Wilson, James Fergusson and Gen. Cunningham have referred to the Buddhist origin of Jagannath. Cunningham argues that the figures of Jagannath, Balabhadra and Subhadra are the three devotional representations of the Buddhist symbol of Triratna "Buddha, Dharma and Sangha". Brahma that is placed at the navel of Jagannath is nothing but the Buddhist tooth relic that was brought from Kusi nagar to Kalinga. Buddhists believe in worship of physical relics after death.

The annual bathing ceremony (Snana Jatra) and the car festival (Ratha Jatra) are Buddhist practices. Cunningham also follows the writing of Yuan Chwang. The Chinese pilgrim speaks of Chelitola on the eastern sea board. According to Cunningham Chelitola was "the present town of Puri." Ratha Jatra of Jagannath resembles the procession of the Buddhist image, as has been written by Fa- Hian. Buddhism does not believe in any class or caste distinction. During Ratha Jatra and other festivities, caste distinction is not found in the Jagannath temple. The term Jagannath was applied to Adi Buddha by Raja Indrabhuti of Sambal in his work "Gyana Siddhi". Adi Buddha is even now called Jagannath in Nepalese Buddhism.

Assimilation of Buddhism into Brahminical Hinduism took place after Buddha was taken in as the 9th Hindu Avatara (Incarnation of Lord Vishnu) as shown on the panel of ten incarnations (*Dasavatara*) inside the Jagannath temple at Puri. After the decline of Buddhism Jagannath might have become New Buddha. Jagannath cult did not belong to any particular sect. It is the point of assimilation of all sects and religions. It can be said that the cult of Jagannath is not just a faith, but a way of life that awakens the inner self to attain celestial happiness.

3.2.4.2 Mathas

Along with the main Jagannath Temple there are a large number of Mathas, Akhadas, and Jagaghars belonging to different sects are located here, mainly centering round the Shrine of Jagannath.

As reported in the Puri Gazetteer (1929) the "Mathas are monastic houses originally founded with the object of giving religious instructions to chelas or disciples and generally of encouraging a religious life." The Mathas were originally founded with the purpose of imparting education to Chelas or disciples and give shelter to pilgrims, feeding travelers, ascetics and beggars. Most of the Mathas of Puri are connected with the worship of Jagannath and have various sevas or duties to perform in the temple. In Puri, not only the temple is holy, but the whole of its surroundings is treated as grand and splendid. Many a Matha (Monasteries) grew up gradually in course of time in this holy town. In the past many Saints and Sadhus had come to Puri to have darshan of Lord Jagannath. They came in contact with and influenced the Gajapati Kings through their philosophical doctrines. The saints and sadhus established their monasteries on the lands donated to them by the kings and wealthy persons. The Mathas continued preaching their respective doctrines and also performed certain ritual services in the Jagannath Temple. With endowed properties and lands, the heads of the Maths were able to maintain their institutions. Lands were donated to the Maths for 'Amritmanohi' the proceeds thereof were spent in offering 'Bhoga' to Lord Jagannath and the 'Mahaprasad' thus obtained, were distributed among the pilgrims, pupils, ascetics, and beggars.

Fig 3.20: Matha in Grand road



The functions of the Mathas were:

- Propagation of the essential philosophy of Hinduism and Jagannath Culture.
- Providing shelter to pilgrims coming to Puri.
- Providing accommodation/ financial help to poor and meritorious students.
- Participating in various rituals of the temple of Lord Jagannath.

Fig 3.21: Functions in Matha in Puri



• Historic functions of the Mathas

The western gate or the Vyaghradvara faces Baseli Sahi and in the South Western side Harachandi Sahi. Both these old localities are mostly inhabited by temple functionaries belonging to the categories like singharies, Puspalakas, Supakaras, Maha Supakaras, Madeli, bazanitri maharies besides other.

Various sub-sects have their own mathas in the holy city Puri. The Mathas belonging to different Sampradayas or sub-sects of the cult are numerous at Puri, of which Emar and Dakhinapaswa are supposed to be the richest.

Prominent among the Goudyamathas are Radhakanta and Gangamata whereas the Oriya, Sisu and few other mathas belong to the local sect of Utkaliya Vaisnavas. The Gobaradhana and the

Sankarananda mathas situated near Swargadwar are saiva, and the Kabir chaura matha located in their vicinity belong to the followers of Kabir.

There are two mathas Bauli and Mangu which belong to the followers of Nanak. The Mahantas or the heads of these mathas usually pass on responsibilities to one of the chelas or disciples by way of succession, but there are a few Mathas like Kothabhola, Kalitilaka and Achari, where married Mahantas may hold the office.

The Mahantas are the Gurus or spiritual preceptors of many people. In the past, they received from their wealthy followers liberal gifts of money and endowments in land for the worship of Jagannath and for other charitable purposes.

But now this function is being performed by the Muktimandap. Rathavadas matha, besides other duties, arranges special bhogas in the temple during snana Yatra, Car festival, Chandan Yatra, Kumar Purnima, and along with Gopal Tirtha matha supplies the requirements for the Hatibesa of the deities; The Oriya matha makes arrangement for the pankti bhoga in the Jagamohan during Rakminiharan festival and supplies Kala Sari (black cloth) to goddess Vimala. This matha is also vested with the duty of clearing the Rathnavedi and supplying of canopy and pillows for the Lords.

Fig 3.22: Various elements of Mathas in Puri



The Record of right compiled under the Puri Shri Jagannath Temple (Administration) Act, 1952, mentions in detail the 'nitis' to be performed by certain mathas. Closely connected with the daily 'nitis' and the festivals of Jagannath are the Mathas Jagannathballava, Raghavadas, Sri Ramadas, Emar, Uttarpasva and Oriya.

After their conquest of Odisha in 1803 the British Government took over the management of the temple for some years and made an attempt to assess the properties of Jagannath including the vast landed properties endowed with the mathas for the worship of the Lord. Mr. C. Grome, the Collector of Puri furnished a report in 1805 in which he gave an account of lands under the charge of the Mathadharis for the use of Jagannath.

The lands were endowed to the mathas by the donors with the specific purpose of offering some bhogas or performing certain sevas in the Temple of Jagannath or for performing other acts of charity. But

possessing such huge wealth the Mahantas misutilized these assets. There was much public resentment. Some steps were taken by the British Government to resume endowments of the mathas which were grossly abused, but no tangible result emerged from such half hearted measures as the British Government had committed itself to the policy of non interference in religious matters. After the achievement of Independence the Odisha Hindu Endowments Act, 1951, with its subsequent amendments put some effective control over the management of the religious and charitable trusts. In case of gross mismanagement the commissioner of Endowments was empowered to remove the hereditary system of a matha and appoint one or more persons to discharge his functions till the new trust was appointed in accordance with the Provisions of the (Act 1951, Section-35).

Mathas today (Archeological remains within mathas of puri)

Today Mathas in Puri are store-well of archaeological remains. These representations can be broadly divided into two categories such as images of enshrined deities and deified preceptors and decorative motifs on *matha* temples and residential structures. All these, of course, cannot be dated along with the inception or establishment of the monasteries as stone-works have been added from time to time. Even magnificent works have been undertaken during the last hundred years.

Fig 3.23: Present Condition of Mathas



For example Venkatachari Matha has got its main entrance built recently with high-class scroll works and sculptural representations. Images of Lakshmi and Saraswati with another pair of images of the same goddesses with variations present magnificent artistic look to the door way. Similarly ornamental work at the temple door in the Gangamata Matha is a recent one. Modern masonry materials like glazed tiles and marbles have also been extensively utilized in many Mathas of which Radha Kanta *matha* is a glaring example. Also *mathas* have many old mural paintings, which can be studied before these completely fade away or damaged. The enshrined images both of the deities and deified saints are built in stone, metal and wood. In some cases historical legends are associated with these images indicating their origin and greatness.

There are many stone images of Hanumana enshrined in various mathas belonging to both Ramanandi and non-Ramanandi sects. For example there are three such images in Odiya matha. One of these images is in a tiny temple at the entrance of the matha said to have been installed a century ago. The second one, which is equally magnificent as the first one, is fitted to the wall in the courtyard where stands the matha temple. This one has sculptural variations from the former. The third one, a very small image now almost indistinct under thick coat of vermillion is fitted to the temple wall in its north western corner. There is one Hanumana figure at the entrance of Gangamata Matha. Also, one Hanumana image is kept in a niche, named as Bhutagada Mahavir, at the entrance of Radhakanta Matha. But this image has been placed by one local resident named Babaji Sahu hardly a few years ago. Similarly a



Hanumana image is kept in Kavir Choura by one unknown ascetic who took shelter here in the recent past. Thus Hanumana images though form a special group of sculptural representation and subject of iconographic analysis are of much recent origin in non-Ramanandi mathas.

Fig 3.24: Congested Spaces and Narrow lanes in Puri



A Vishnu image found placed in the Vasudev Ramanuja Matha, situated in front of Venkatachari Matha, was brought here and enshrined in 1935 A.D. by one Maharaja Samarendra of Bhawani Pur, Kolkata who found the image from an old tank in the village Baghawani Pur, and Kolkata who found the image from an old tank in the village Baghawada (Tripura). Similarly one will come across many images in various mathas and temple brought and enshrined by pilgrims who have found those in their native places.

Each Matha has their presiding deities belonging to various cults. There are Nrusimha images in Sankarananda, Mahiprakasa, Dakhina Parsva, Siddhavakila and Narasimhachari Mathas. These images are worshipped as presiding deities. The Nrusimha image in Pandu Ashrama is of rare design where the deity is eight armed. The intestine of the demon Hiranya Kasipu is seen held in two uppermost hands; Hands below these are seen holding disc and conch, the attributes of Vishnu. The next pair of hand is engaged in tearing open the chest of the demon. The lower most hands are holding the legs of the demon tightly and the head firmly. Image of Ugrasena in Bhrgu Ashrama is a rare specimen. The four-armed Gopaldev image in Jagannatha Ballabha Matha is really an image of Krishna- Vishnu.

Wooden Images:

The galaxy of wooden images in various Mathas can be classified as:

- Images of Jagannath cult,
- Images of cultic deities and
- Images of preceptors and saints.

Fig 3.25: Traditionality of Mathas & Akhadas in Puri



Barring a few almost all mathas has enshrined wooden images belonging to Jagannath cult either as single Patitapavana or Trimurty or Chaturdha Murti. In Sankarananda, Gopal Tirtha, Sivatirtha, Mahiprakash, Emara Jiyaraswamy, Narasinghachari, papudia, Chhauni, Chaulia, Nevala Das, Surangi, Radhakanta and Odiya mathas etc. have the wooden Patita Pavana images enshrined as Parsvadevata. Hati Akhada, Mangu and Bauli mathas are some where Patita Pavana is the presiding deity.

In Ramji matha belonging to Nimbarka sect and Jagat Mohini of Goudiya faith Patitapavana Jagannatha, is under worship as the presiding deity along with Radhasagar Gopal and Krushna-Balarama respectively. (By: Dr. Prafulla Kumar Ratha; "Archaeological Remains Within Mathas in Puri")

So, wooden images of holy triad or Chaturdha Murti are enshrined in mathas such as Govardhana, Raghava Dasa, Jagannatha Ballabha, Bada Santha, Bada Chhata, Sana Chhata, Trimili, Kunja Kataki, Haridasa Samadhi, Siddha Vakula and Ayodhya Dasa etc. Vidura matha is an exception in two ways.

First Vidura's stone image is worshipped in this monastery as the presiding deity. Secondly there is one set of triad and one set of Chaturdha Jagannatha images built in wood enshrined within the matha. After the precious metal image stolen, Bhuvaneswari the presiding deity of Gopal Tirtha matha is worshipped through her wooden image is also very significant. Wooden decorative motifs displaying master craftsmanship of local carpenters are in no way insignificant. Though woodcrafts of much antiquity are not available yet these exhibit artistic splendour belonging to last two hundred years. These motifs are largely found on doors and windows of these monasteries. Odiya windows are devoid of railings and shutters. This trend can not be said to have its origin with all definiteness in post 16th century Chaitanya movement or earlier when dominant was the influence of Bhagavata. Artistic representation of Navagunjara and various geometric diagrams are also found nicely carved on windows. Doors of ancient structures are also well ornamented by art works which enhance beauty on one hand and strength of the shutters on the other.

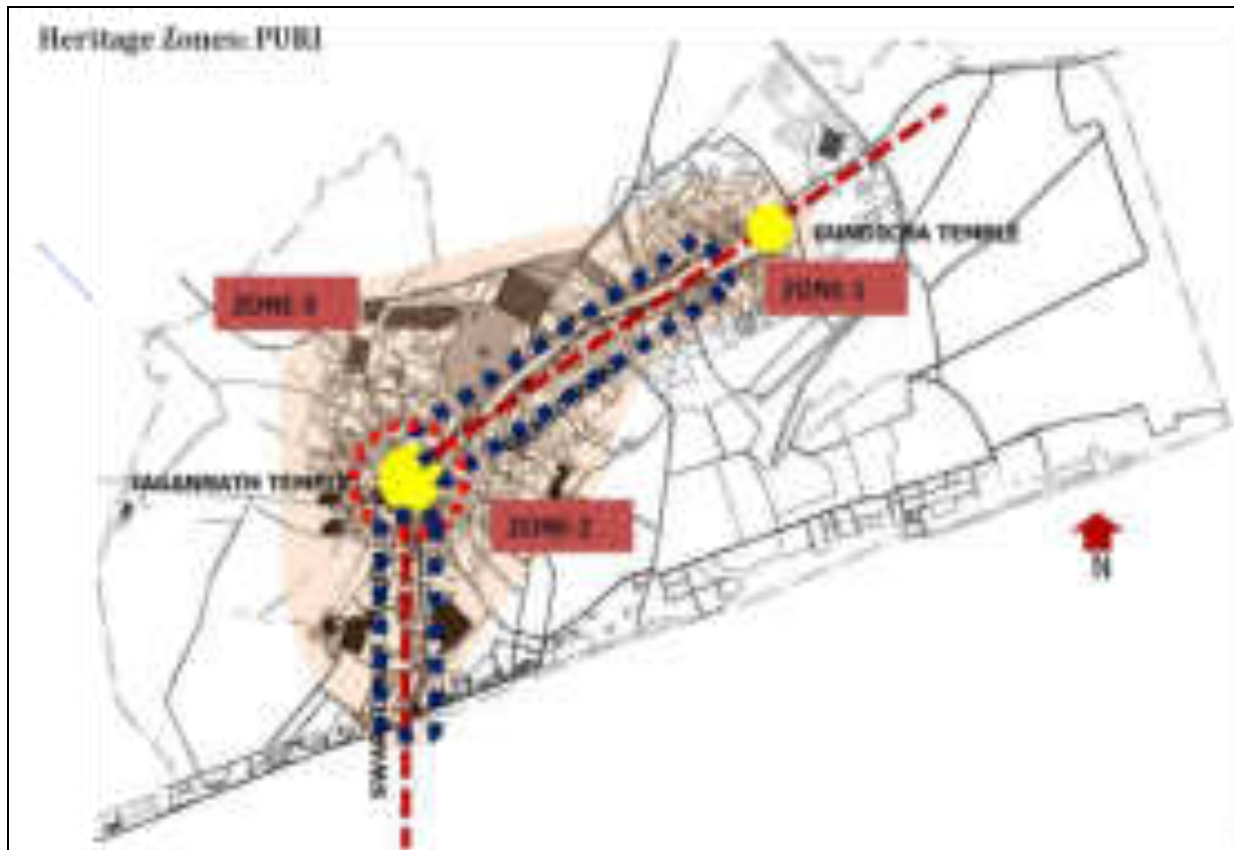
3.2.5 Zoning and assessment of heritage structures through Primary survey:

A primary survey was carried out with a questionnaire prepared for the same. The question ranged from trying to know the land owner, basic function of the Mathas towards the Jagannath Temple, present condition of the building, number of people accommodated in the Mathas and the scenario at the time of the Yatra. The financial status was an important aspect which tried to take into account in order to know the sustainability factor of the Mathas in the present scenario. The Proforma of the same has been attached as annexure.

Based on the primary survey carried out, the heritage zone (consisting of the Mathas, Jagaghars, Akhadas) was demarcated. Accordingly, this heritage zone was divided into three distinct Zones as shown in the map below. Basically the idea of the demarcation of different zones was to find out broad areas having similar characteristics where specific interventions can be made to revive the heritage values of the town.

Basically from reconnaissance survey and primary assessment whole heritage precincts of Puri are divided into three broad zones. Those are: The Bada Danda/Grand road, Swargadwar road and Jagannath temple area. The map below shows each zone along with their unique constituting elements:



Map 3.5: Heritage Zones in Puri Town

Source: ORSAC Data, CEPT Analysis

The map above shows the entire area consisting mainly of Mathas, Jagaghars, Akhadas along with Jagannath Temple and the Gundicha Temple. The tanks, another entity of heritage value also form the part of this demarcated area. As one can see the area around the Jagannath Temple, the stretch of Grand road, and the Swargadwar road form the three major nodes along which majority of the developments have occurred.

Thus, the Swargadwar road and the Grand road form the main spines where majority of the development of heritage value has developed over the years. Hence this whole area and the two roads are termed as the heritage zone and the heritage spines respectively.

3.2.5.1 Zone I: The Grand Road

This zone essentially comprises of the Grand road stretch (Bada Danda) which mainly consists of commercial establishments through the major stretch, except towards the Gundicha Temple.

Map 3.6: Zone I



Altogether thirteen Mathas have been demarcated and surveyed in this stretch. The biggest of all Mathas is the Jagannath Ballav Matha which is situated on this stretch, the Jatia Baba being the other famous Matha on this very stretch.

Jagannath Ballav Matha:

It is so to say the pleasure garden of Lord Jagannath. The "Bije pratimas" (the representative images) of the Lords visit this Matha on different festive occasions like "Basanta Panchami", on the 1st, 4th, 5th and 12th days in the bright fortnight of Falguna. This Matha supplies flower-ornaments like 'tilak' and 'jhumpa' for Baddasinghara besha and supplies 'Kora' (a sweet food) for 'Kaliya dalana' and 'Pralambasura badha' beshas. It also supplies 'dayana' for 'dayana chori' ritual.

This has a trust board under the administrative control of the Endowment Commissioner of the State. It has no Mahanta. The Matha covers an area of almost 44 acres in the heart of the city wherein out of the total land area available only 10% approximately is built-up. The renovation work of the Matha is on as of now as this Matha is one amongst the forty listed by the Odisha State Archaeological Department.

Jatia Baba Matha:

This Matha is situated in the backdrop of the scenic and the biggest tank of Puri, the Narendra tank. This Matha which runs on private funding is one of the most well preserved Mathas of Puri. The Chandan

Yatra, an important festival before Rath Yatra is associated with this Matha. Supplying the Pattadori or the silken rope for the Yatra is the prime function of this Matha.

Overall this stretch has a few Mathas compared to the other two zones as this stretch mainly comprises of the commercial establishments and does not necessarily provide the best setting for such institutions.

Fig 3.26: Jatia Baba Matha in Puri



3.2.5.2 Zone- II: Swargadwar Zone

Zone II essentially comprises the Swargadwar road stretch which starts from the Eastern gate or the Lions gate of the Temple and runs all the way till the Swargadwar square abutting the Puri beach.

This stretch comprises of the maximum number of Mathas of which approximately twenty-five were surveyed and studied. This whole stretch has a varied land use. Towards the temple end, majority of the commercial establishments are seen selling sweets and other items which are offered to the Temple. When one moves towards the interiors the land use suddenly changes into low-density, low-rise residential structures which also comprises of lots of Mathas in this very corridor which are well preserved as compared to the other two zones. While at the Swargadwar end there are lots of garment shops and sweet meat shops. As mentioned earlier the Mathas here are well preserved and some Mathas even today have students learning Vedas, the traditional function of the Mathas

The Ramanuj Kota Matha even today houses about a hundred students to whom the Matha imparts religious teachings. Quite a few Mathas have intricate carvings and paintings which are quite well preserved even today. Most of the Mathas have well preserved ponds and other related ancillary activity areas.

Fig 3.27: Raghavdas (Raghabadasa) Matha in Puri



Even though this stretch isn't as popular as the Grand Road or like the Marine Drive, it is of utmost heritage importance and the fact that this stretch is not as popular as a tourist attraction in fact has been a blessing in disguise for the Mathas here. Proper management plan can really transform this whole stretch into a heritage precinct as a whole.

Map 3.7: Zone 2



3.2.5.3 Zone III: Temple Precinct

This area comprises of the Mathas abutting the Temple Precinct along all the three sides except the western side which is used as the service entry for the Temple.

This whole precinct is bustling with activity and houses some of the biggest Mathas of Puri. The striking feature of the Mathas in this precinct is that most of them don't have clear entrances as the lower floors are used for commercial activities. Hence the character of these Mathas is much different compared to Mathas elsewhere as the façade isn't prominent. The built to un-built ratio is almost 45% to 55% in most of the Mathas and there are large open spaces available right in the center of this bustling Temple town.

The mathas, akhadas and jagaghars form the core of the jagannatha culture in the town. Also there is a great sense of faith among the people that these are elements created for serving the great Lord

Jagannatha. All of these make these heritage places as key to heritage development and revival of value of the past.

Fig 3.28: Siddha Matha



Fig 3.29 Radhakanta Matha Puri



Fig 3.30: Gopaldas Matha



Emar Matha:

It was established by the Saint Ramanuja. This Matha supplies 'Chandrika' and 'Chausara' made of flowers for the Badasinghar besha of the Lords, 'Mala' and 'Chula' for the 'nabanka' ritual. It offers 'Pana bhog' during the Chandan Yatra, 'Chakata bhog' during the 'anasara' period and 'bala bhog' during the month of Kartika. This is one of the biggest Mathas.

Map 3.8: Zone 3



It is situated near the southern gate of the Jagannath temple. This Matha supplies 'tahia' on Snana purnima, Car festival, return Car festival and Niladribije days. It supplies a part of the Hati besha. It supplies 'tuli' for pahandi and a certain quantity of sandal wood for 'Sarbanganeeti' on 'Khalilagi ekadasi'. It also supplies flower garlands for 'Nabanka bedha' and offers 'adhara pana bhog' and 'panti bhog' on certain festive days.

Oriya Matha:

This Matha is responsible for supply of the materials for certain rituals. It supplies 'trimundi chandua' and silk clothes for 'Chaka apasara', repairs 'Kanakamundi'. It also supplies till oil for Phuluri neeti, oil and ghee etc., for 'Deva deepawali', offers 'Chakata bhog' in 'Anasara' and adharpana bhog' and 'Panti bhog' on certain days. On Neeladri bije day, the Mahanta makes 'majana' of ratnavedi. This Matha was set up by Atibadi Jagannath Das, a poet-saint of Odisha in early part of the 16th century.



Fig 3.31: Oriya Matha

Bada Chata Matha:

It is situated in front of the temple. Performs 'Kirtan' at the time of 'mangala alati' and 'pahuda alati' and bala dhupa. Padma besha of the Lords is done and 'Kshiri bhog' offered by this Matha.

Mangu Matha:

It is located by the side of the Emar Matha. It is associated with the memory of Guru Nanak. This Matha supplies a ram for 'bali' (sacrifice) before the Goddess Bimala, each year on Mahanabami night. There is another Matha of Guru Nanak sect, known as Baaul Matha.

The other Maths connected with the affairs of Sri Jagannath temple Radhakanta Matha, (Sri Chaitanya visited Puri in 1510 AD and stayed in this Matha. Some of his personal belongings have been preserved in this Matha). The mahantas of these Matha are entitled to perform 'Upachara Chamara seva, but most of them are not doing the seva. The Mathas are under the control of State Endowment Commissioner. There are two Mathas under the Sri Jagannath Temple Managing Committee. They are Chaulia Matha and Delhi Nablak Ram Das Matha (near Gundicha temple). There is another Matha known as Sata lahadi Matha in the Swargadwar area. It is the burial place of Atibadi Jagannath Das, author of the Bhagabata purana in Oriya. This Matha is being managed by a committee under the Chairmanship of Collector, Puri. Another Matha located in the same area is the Kabir choura Matha, associated with the Kabir sect. It is said that Kabir, the mystic poet stayed here when he visited Puri. There are some other Mathas unconnected with the rituals of the Jagannath temple like Chaitanya Goudiya Matha, Purusottam Goudiya Matha, and Panjabi Matha etc. Many Mathas have stopped performing services in the temple and those who perform now, do so to a limited extent.



Fig 3.32: Mangu Matha

Outside Puri town, there is another Matha in the Kakatpur village area, known as Deuli Matha which is connected with the Nabakalebar ceremony of the temple.

3.2.6 The Ashramas

Connected with certain rituals of the temple of Jagannath, there are four Ashrams (hermitages) in Puri town. These are Angira Ashram, Pandu Ashram, Markandeya Ashram and Bhriugu Ashram.

Fig 3.33: Chaitanya Ashram



Fig 3.34: Gaur Govinda Ashram



On the ninth day of the bright fortnight of Sravana, the Nrusimha deity of the Sri Jagannath temple pays a visit in a ceremonial manner to these four Ashrams. This is called 'Badi Nrusimha bije'. 'Sital bhog' is offered to the Deity in each Ashram. On the full moon day of Margasira, Nrusimha again visits these places. On the full moon day of Sravana, Lord Sudarshan visits all these Ashrams. These Ashrams are being managed by different local committees.

There are some other Ashrams not ritually connected with the Sri Jagannath temple. Some of those Ashrams are Bijaya Krushna Goswami Ashram (near the Narendra tank), Adwait Brahmashram (Girinarbanta), Omkarnath Thakur or Neelachal Ashram (Swargadwar area), Karar Ashram (founded by the great Kriya yogi Sri Yukteswar Giri, (Swargadwar area) Bharat Sevashram (Swargadwar area), Pranabananda Ashram (near Chakratirtha), Satsangha Ashram (Chakratirtha road), Nigamananda Ashram (Lokanath road), Dibyadham Yogashram (Chakratirtha road), Maa Anandayamayi Ashram (near Swargadwar), Abhiram Paramahanshashram (marichikote lane), Bhagabat Ashram (near bus stand), Haridas Ashram (Sarbodaya nagar).

The Jaga Culture

As history says the Temple of Jagannath was completed in the year of 1098 A.D. By the then famous king Sree Anangabhim Dev. The king was the proud possessor of great power, valour and pelf and lavishly spent his wealth for the construction of the Temple with high workmanship. After due consideration the Temple was situated at the centre of Puri with four passages from all four directions leading to the entrance of Puri to approach the Temple.

Fig 3.35: Interior of a Jagaghar



Fig 3.36: Symbolic Paintings



Fig 3.37: Temple and Akhada



At all entrances and strategies there were certain Clubs or Jagas to safeguard the Temple. Hence under the patronage of the king "Jaga Culture" developed. Several "Jagas", Akhadas, Ballavas, Kotas were established which were working as the protective belt to ensure security for the Lord and the people of Puri. Chiefly, Jagas were interested in training youths for wrestling, fighting, body building and war training etc. Every Jaga was bearing gymnastic field to train the youths carefully in the art of wrestling, boxing, sword-fighting, waving of lathis, circling of fire-ropes, throwing of Javelin and lance, Mudgar-fights, rope-climbing, diving and swimming etc.

Akhadas were imparting not only physical education and training but they were the cradle for training dance and music. For the harmonious build-up of a complete man they had their educative values. Good habits, hygienic cares, control over emotion and sex, bravery, valour at the time of danger (Sangfroids) were taught meticulously to the trainees.

Fig 3.38: Jagaghar



Fig 3.39: Internal Spaces in a Jagaghar



In every Akhada there were maestros to teach dance and music both vocal and instrumental. Various types of musical instruments were played on and youths had to choose their favourites. The primary aims of Akhadas were to produce a sound and healthy youth with love for art, culture and tradition. The youths of Akhada or Jagas were ever ready to encounter, any challenge in any field.

Here in this short space may be named few Jagas which are still existent, though some of them are defunct and have lost their past glamour. They are Gandamala, Barabati, Adang Tiadi, Tapanga, Dhvajagada, Nrusingh Ballav, Kadambagada, Gurujanga, Nagakota, Panchuati, Khuntia, Hinjala, Gadajaga, Luhagada, Champagada, Kadambagada, Bajragada, Jadu Tiadi, Narsing gada, Majana, Mali, Khakikota, Brahma, Gopali, Sundara, Satabakhara, panda, Jamai Khuntia, Sankhakota and such many others called "legion".

The Jagas have their vast flower gardens, topes and orchards and they manage their functions with much difficulty from these sources. As yet, Govt. has not come into assistance for all Jagas to revive their culture and preserve the tradition. The enthroned deities of Jagas or Akhadas are chiefly Mahavir or Hanuman and Goddess Durga who are worshipped as the symbol of energy, power and bravery. They also observe some traditional memories; hence set out their youths in the garb of Ravana, Parsuram, Naga, Medha etc. to celebrate the historical victory and fight of the Great Age. The famous historical anecdotes are acted and enacted just to revive in the memory the events and eventualities of past days.

Tremendous development in the technique of modern warfare has completely upset and frustrated the Jaga culture, so also the development in modern musical system and instruments and their patterns. In spite of the impediments the tradition bound Jaga Culture still survives as a token of relic of classical virtue and animation.

Still there is time to upkeep this ancient traditional classical heritage, though lack-lustured now, by way of reviving Jaga Culture once again by the effort of Govt. and people at large. We may think of the past to preserve the lost pride and glory once again.



3.2.7 Major Issues Observed:

Major issues found in the heritage zones identified are:

- Majority of Mathas are poorly maintained and not having adequate infrastructure which needs to be upgraded and redeveloped to revive heritage value.
- The various heritage structures are not linked with each other does not leading to integrated heritage package for tourists.
- There is very little information about many structures available for tourists due to lack of promotional activities.
- Ill defined activities in the heritage sites reducing the cultural values in the sites.
- Many of the open spaces inside the Akhadas and Mathas are now a day used by anti socials during normal season which must be taken care of for safe tourist site development.
- Overall investment and institutional structure must be developed for regeneration of these heritage sites which is currently missing.

3.2.8 Konark Sun Temple

3.2.8.1 Architectural glory of the Sun Temple

The Sun Temple, built in the thirteenth century, was conceived as a gigantic chariot of the Sun God, Surya, with twelve pairs of exquisitely ornamented wheels pulled by seven horses. Majestic in conception, this temple is indeed one of the most sublime monuments of India, famous as much for its imposing dimensions and faultless proportions as for the harmonious integration of architectural grandeur with plastic allegiance. It is admittedly the best in Odisha. Its fine traceries and scrollwork, as well as the beautiful and natural cut of animal and human figures, give it superiority over other temples.

The Sun temple belongs to the Kalinga School of Indian Temples with characteristic curvilinear towers mounted by cupolas. In shape, the temple did not make any major departure from other sikhara temples of Odisha. The main sanctum which is 229 ft. high was constructed along with the audience hall (128 ft. high) having elaborate external projections. The main sanctum which enshrined the presiding deity has fallen off. The Audience Hall survives in its entirety, but only small portions of the Dancing Hall (nata Mandir) and the Dining Hall (Bhoga-Mandap) have survived the vagaries of time. The Temple compound measures 857 ft (261 m) by 540 ft (160 m). The alignment of the Sun Temple is in the east-west direction. The Temple is located in natural surroundings, abounding with casuarina plantations and other types of trees, which grow on sandy soil. Konark is also home to an annual dance festival, held every December, devoted to classical Indian dance forms, including the traditional classical dance of Odisha, Odissi.

Its main attraction lies in its views of the temple. Besides Konark, there is also another sun temple in Odisha called Biranchi khetra (Biranchi Narayan Temple) in Buguda, Ganjam District. The stones at Konark are not joined by any limestone or cement. Instead, they are joined in a unique manner by making the two stone plates so plane like glass plate that just one drop of gum can join the two stones.

3.2.8.2 Incomplete Temple

It is opined by some historians that, due to the early death of the king Langula Narasimha Dev, builder of the Konark temple, its construction could not be completed. As a result of this, the incomplete structure eventually collapsed. But this view is unsupported by historical data. The records of Madala Panji of Puri Jagannath temple, as well as from some copper plates dated 1278 A.D., state that the king Langula



Narasimha. Dev reigned till 1282. Many historians are of the opinion that the construction of the Konark temple was completed between 1253 and 1260 A.D.

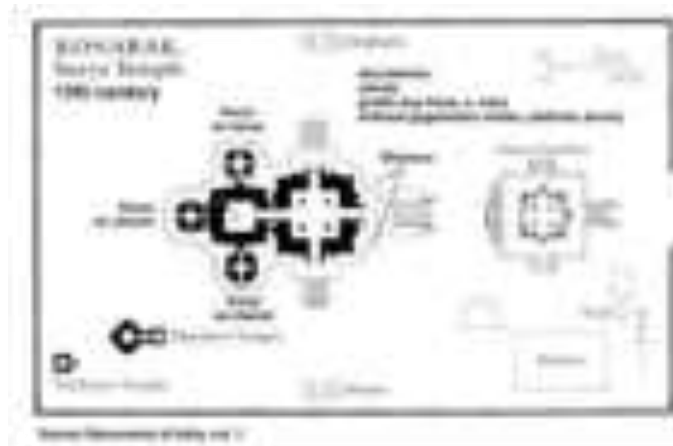


Fig 3.40: Plan of Sun Temple



Fig 3.41: Temple in ancient age

3.2.8.3 Lodestone

Legends describe a lodestone on the top of the Sun temple. Due to its magnetic effects, vessels passing through the Konark Sea were drawn to it, resulting in heavy damage. Other legends state that magnetic effects of the lodestone disturbed ship's compasses so that they did not function correctly. To save their shipping, the Portuguese voyagers took away the lodestone, which was acting as the central stone and keeping all the stones, and the iron columns used to hold them walls together, of the temple wall in balance.



Fig 3.42: Gardens of Konark temple



Fig 3.43: Intricate Stone Carving

3.2.8.4 Kalapahad

The most popular theory about the root of the fall of Konark temple rests with the Kalapahad. According to the history of Odisha, Kalapahad invaded Odisha in 1508. He destroyed Konark temple, as well as a number of Hindu temples in Odisha. The Madala Panji of Puri Jagannath temple describes how Kalapahad attacked Odisha in 1568. Including Konark temple, he broke most of the images in most of the Hindu temples in Odisha. Though it is incomplete, the ASI protected monument attracts tourists from all over the nation and across border which is generating a lot of informal employment generating opportunities for the residents of the region.

3.3 Intangible heritage

"Intangible cultural heritage" consists of non-physical aspects of a particular culture, often maintained by social customs during a specific period in history. These include the ways and means of behaviour in a society, the often formal rules for operating in a particular cultural climate - social values and traditions, customs and practices, aesthetic and spiritual beliefs, artistic expression, language and other aspects of human activity. The significance of physical artifacts can be interpreted against the backdrop of socioeconomic, political, ethnic, religious and philosophical values of a particular group of people. Intangible cultural heritage is more difficult to preserve than physical objects.

3.3.1.1 *Ratha Yatra (Chariot Festival, CAR festival)*

The most splendid of the innumerable festivals celebrated round the year in the holy city of Puri, the Ratha Yatra is the grand culmination of a series of celebrations spread over the summer and the monsoon months.

Akshaya Trutiya tithi marks the beginning of the construction of the Rathas (chariots) for the ceremonial journey and sojourn of Lord Jagannath, Balabhadra and Subhadra at the Gundicha Temple for a week. On the full-moon day of the month of Jyestha (May-June) in the Snana Yatra, the Bathing Festival, when the three deities move in colourful processions to a platform in the outer enclosure of the temple, the Snana Vedi, the bathing platform, where they bath with one hundred and eight pitchers of perfumed water drawn from a temple well once a year. After the ritual bath, the deities assume the special elephant form, recalling the legend of the Lord's affection for a devotee, whom He proved that he was in fact another manifestation of Lord Ganesha.



Fig 3.44: Procession during Ratha Yatra

At the end of the Snana Yatra day, the holy triad, supposedly afflicted with fever, does not return to their pedestal in the sanctum. They stay away from the public view for a period of fifteen days, called Anasara, after which they appear in their Navayauvana Vesha, literally a renewed youth, on the new moon day of the Month of Ashadha. During this fortnight the icons get a fresh coat of paint which gets washed out on the day of the Bathing Festival. During this period the deities eat only fruits other

restricted diet and soft drinks. Cloth paintings representing the deities called Anasara Pati, are displayed beyond the enclosures hiding the deities from the devotees to see and worship.

Then the Ratha Yatra falls on the second day of the bright fortnight of the month of Ashadha, when the three deities come out of the temple in a spectacular procession called Pahandi. The deities, which are colossal wooden statues, adorned with giant floral crowns, called Tahias, are literally pulled, pushed and dragged in rhythmic movement to the accompaniment of the beat of cymbals, drums and chanting of their names in chorus by devotees in frenzied ecstasy. After all the deities are seated in their respective chariots starts the Chhera Pamhara, the ritual of sweeping of the chariots with a golden broom by the Gajapati King of Puri, the foremost servant of God, the Adya sevaka of Lord Jagannath. The King comes from his palace on a richly decorated palanquin. Chhera Pamhara is a symbolic rite which proclaims that the King, like others, is but a humble servant of the real sovereign, Lord Jagannath.

The most exciting part of the Rath yatra is the pulling of chariots by thousands of people who lay their hands on the sturdy ropes and drag the massive structures along the Bada-Danda, the grand road. The chariot of Balabhadra moves first, followed by those of Subhadra and Jagannath. The chariots grind forward slowly until they reach the Gundicha temple and the three deities rest for a night at the entrance on their own chariots. They enter the Gundicha temple on the next day in the usual Pahandi style and stay there for seven days. Goddess Laxmi, who gets angry for being left out at the temple, proceeds to the Gundicha temple to meet her Lord, Jagannath, on the Hera Panchami day, the fifth day of the fortnight. After having a stealthy look at her Lord, she returns to the temple, damaging a part of Jagannath's chariot in anger and disgust.

The deities, after the seven-day stay at Gundicha Temple, their garden house, commence their return journey. It is called Bahuda Yatra held on the tenth day of bright fortnight of Ashadha. The return of the chariots takes place in the same order as in the Rath Yatra. Balabhadra's chariot moves first, followed by those of Subhadra and Jagannath. On his way back, Jagannath stops for a while at Ardhasani temple, popularly called Mausī Ma temple or the temple of Aunt. He accepts from the aunt his favourite rice cake, Poda Pitha. The three chariots pulled by thousands of devotees, reach back the Simhadwara in the late afternoon of the Bahuda day and the deities remain seated on their chariots. On the next day, known as the Bada Ekadasi, the three deities are attired in costumes of glittering gold and are worshipped by thousands of devotees. This form of the deities is known as the famous Suna Vesa. On the Dwadasi day, the three deities go back to their original place, the Ratna Simhasana, literally the jewelled platform, with the usual fanfare and the Pahandi style. Their arrival into the Sanctum sanctorum marks the end of the Ratha Yatra the grand festival of chariots.

3.3.1.2 The Chariots

The three Chariots of Balabhadra, Subhadra and Jagannath are constructed each year with Sal wood, customarily brought from the ex-princely state of Dasapalla, by a specialist team of carpenters who have hereditary rights for this. Lord Jagannath's Chariot is called Nandighosa. It is forty-five square feet at the wheel level. It has sixteen wheels, each of seven feet diameters, and is decked with red and yellow coverings of cloth. The Chariot of Lord Balabhadra, called the Taladhawaja, has fourteen wheels, each of seven feet diameters, and is covered with red and blue cloth. Around each of the Chariots are nine Parsvadevatas, the guardian deities, and four horses.



Fig 3.45: Decorations of Chariots

Each chariot has a Charioteer called Sarathi. Matali, Darruka and Arjuna are the three charioters attached respectively to the three Chariots of Jagannath, Balabhadra and Subhadra.

3.3.1.3 Navakalevara

As a man discarding worn out clothes takes other new ones, so does the embodied soul, casting off worn out bodies enters into others which are new. In the light of this truth of the Bhagavat Geeta, Navakalevar can be interpreted as a ceremony for entering into new bodies, when Lord Jagannath, Balabhadra, Subhadra and Sudarshan cast off their old bodies and take new ones. It is called Navakalevar. The year which has two months of Ashadha is regarded auspicious for Navakalevar ceremony. It usually occurs in 8, 11 or 19 years. The new bodies of the deities are made out of the newly cut Yeem trees. The previous navakalevars were held in 1733, 1744, 1752, 1771, 1790, 1809, 1828, 1836, 1855, 1874, 1893, 1912, 1931, 1950, 1969, 1977 and 1996.

3.3.1.4 Dola Yatra

This is celebrated from the tenth day of the bright fortnight of Falguna up to the full moon day. The representative deities Dologobinda, Bhudevi and Sreedevi are taken in a procession to Dolabedi located outside the outer compound wall of the main Temple and special rites are performed.

3.3.1.5 Chandan Yatra

This Takes place in the month of Vaisaksha and continues for long 42 days. But, generally speaking it is a Festival of first 21 days only. The first period of 21 days is known as "Bahar Chandan" or outer Chandan. During this period, the representative images of Rama, Krushna, Madanmohan, Sridevi and Bhudevi are taken in a procession to Narendra tank. The images of Siva from 5 Siva Temples known as "Pancha Pandavas" also accompany them to the Narendra tank, At Narendra tank the images play in well decorated boats and are worshipped. The second period of 21 days known as "Bhitar Chandana" is celebrated inside the Temple. The rites observed on this period are not popularly enjoyed.



Fig3.46: Chandan Yatra

3.3.1.6 Snana Yatra

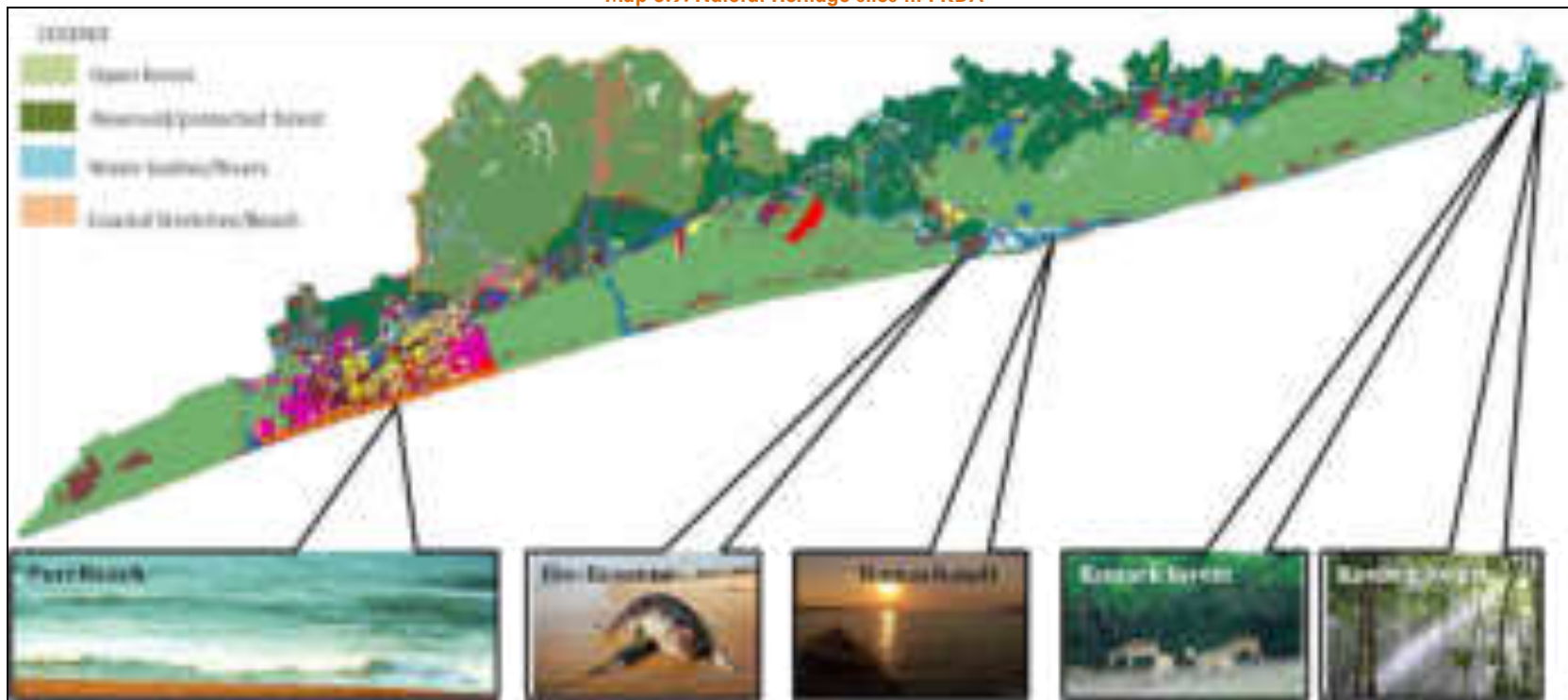
This Festival takes places in the month of Jestha. it is popularly known as the Deba Snana Purnima. This is the first occasion in the course of a year when the deities Jagannath, Balabhadra, Subhadra along with Sudarsan and Madanmohan are brought out from the Temple and taken in procession to Snana Bedi located in the North East corner of the outer compound. The deities are bathed there with 108 pitchers of water drawn from a well near the Northern Gate. Here, Jagannath and Balabhadra are dressed like Lord Ganesh of the Purans with the head of an elephant. The three Chariots of Balabhadra, Subhadra and Jagannath are constructed each year with Sal wood, customarily brought from the ex-princely State of Dasapalla, by a specialist team of carpenters who have hereditary rights for this. Lord Jagannath's Chariot is called Nandighosa. it is forty-five feet square at the wheel level. It has sixteen wheels, each of seven feet diameter, and is decked with red and yellow coverings of cloth.

3.4 Natural heritage

"Natural heritage" is also an important part of a society's heritage, encompassing the countryside and natural environment, including flora and fauna, scientifically known as biodiversity, as well as geological elements (including mineralogical, geo-morphological, paleontological, etc.). These kinds of heritage sites often serve as an important component in a country's tourist industry, attracting many visitors from abroad as well as locally. Heritage can also include cultural landscapes (natural features that may have cultural attributes).

PKDA region is blessed with plenty of natural beauties which include coastal stretches, beaches, and dense protected forests, riverine islands, wildlife sanctuaries and Bio-reserves etc. All of this makes the place an attractive destination for tourists all over the year from different parts of the country and the world. Puri town beach is the most famous natural sites among all. Ramchandi beach is another attractive coastal stretch having a mix of islands and inland water fields making this a suitable place for boating and related activities. Reserved forest and sanctuaries in Konark block and Block-A and B is also elements of rich natural heritage in the region.

Map 3.9: Natural Heritage sites in PKDA



3.5 Summary of Issues identified in the sector

From the above analysis of tangible, intangible and natural heritage details of PKDA region the following issues are identified:

- Illegal encroachment on heritage precincts and activities around the temples makes these stretches highly congested and hence special planning measures are required to revive the heritage value of the areas in Puri town.
- Absence of footpaths in the important stretches like Grand road and Swargadwara road leads to mixing of vehicular and pedestrian traffic and hence resulting in inconvenient mobility in the town areas especially affecting the tourism potential of the region.
- No designated parking spaces allotted in the busy areas of the town leading to crowding of cycle rickshaws, autos, private vehicles.
- Dumping of garbage around temples, on the roads and inadequate provision for dustbins on the prime stretches resulting in poor sanitation scenario and urban environment.
- Lack of space for widening roads in heritage rich areas coupled with unregulated traffic flow impacting the smoother movement of traffic in the congested areas of the town which should be tackled with urban planning and design interventions.
- Inadequate street lighting in major junctions and stretches in the urban areas becomes major cause of discomfort for tourists and affects the urban image at large.
- Washing and bathing in the sacred tanks and lack of management interventions in the areas resulting in water pollution and degrading heritage value in the area.
- Lack of information and knowledge among tourists about the many heritage structures due to lack of awareness creation efforts leaving majority of sites unutilized to their full potential.
- Overhead electricity cables and wares in most of the sites hurting the heritage value of the age old rich heritage monuments.
- Lack of public conveniences like drinking water points, toilets, street furniture, signage's etc fails to provide standard services for the tourists thus becomes a major reason to worry as the economy of the region is mostly dependent on the tourism sector.
- Heritage structures in Puri town are very old and not maintained properly and neither upgraded hence needs to be given priority and should be managed properly to revive the heritage image of Puri town and the region.
- No Surveillance system in the form of control of thefts, terrorist activity etc available in the urban centers of the region which must be taken care off to ensure safe movement of the tourists in the area.

4. Land Use

4.1 Introduction

Land use planning is the systematic assessment of physical, social and economic factors in such a way as to encourage and assist land users in selecting options that increase their productivity, are sustainable and meet the needs of society. It provides the prerequisites for achieving a sustainable form of land use which is acceptable as far as the social and environmental contexts are concerned and is desired by the society while making sound economic sense.

The study of the existing land use pattern helps in assessing the structure of the region, its trends in growth characteristics, which are prime guiding factors for the initiation of any future planning activities. This chapter gives the details of the existing land use pattern in the study region. This chapter deals with the following components:

- Land use /land cover of PKDA area
- Block-wise land use pattern
- Residential developments in urban centres
- Commercial development areas
- Agricultural zones
- Public/semi public and religious area
- Natural features in the region
- Summary of issues regarding land use in the region

4.2 Existing Land use Distribution

The existing land use was prepared by the interpretation of the Quick Bird satellite imagery (obtained in the year 2009) with ground verification. The land use thus obtained was to be matched with the revenue plots. The revenue sheets obtained were edge matched to form the revenues villages, which were mosaiced to form the development plan area.

The process of preparation of the land use plan was done by ORSAC; the land use classification is as per ORSAC standard.

4.3 Land use/ Land cover of PKDA area

The overall land use of the PKDA area has been divided into four major categories. They are as follows:

- Built up Land – Urban
- Built up Land Rural
- Vacant Land
- Non Built up Land

The total land area of the PKDA Region is 296.33 Sq. Km. The distribution of the land uses over the PKDA area, in the above mentioned categories along with different traditional land use categories of land use both in terms of percentages and square kilometers is shown in the table below which gives a clear pattern of development and disparities in the study region:



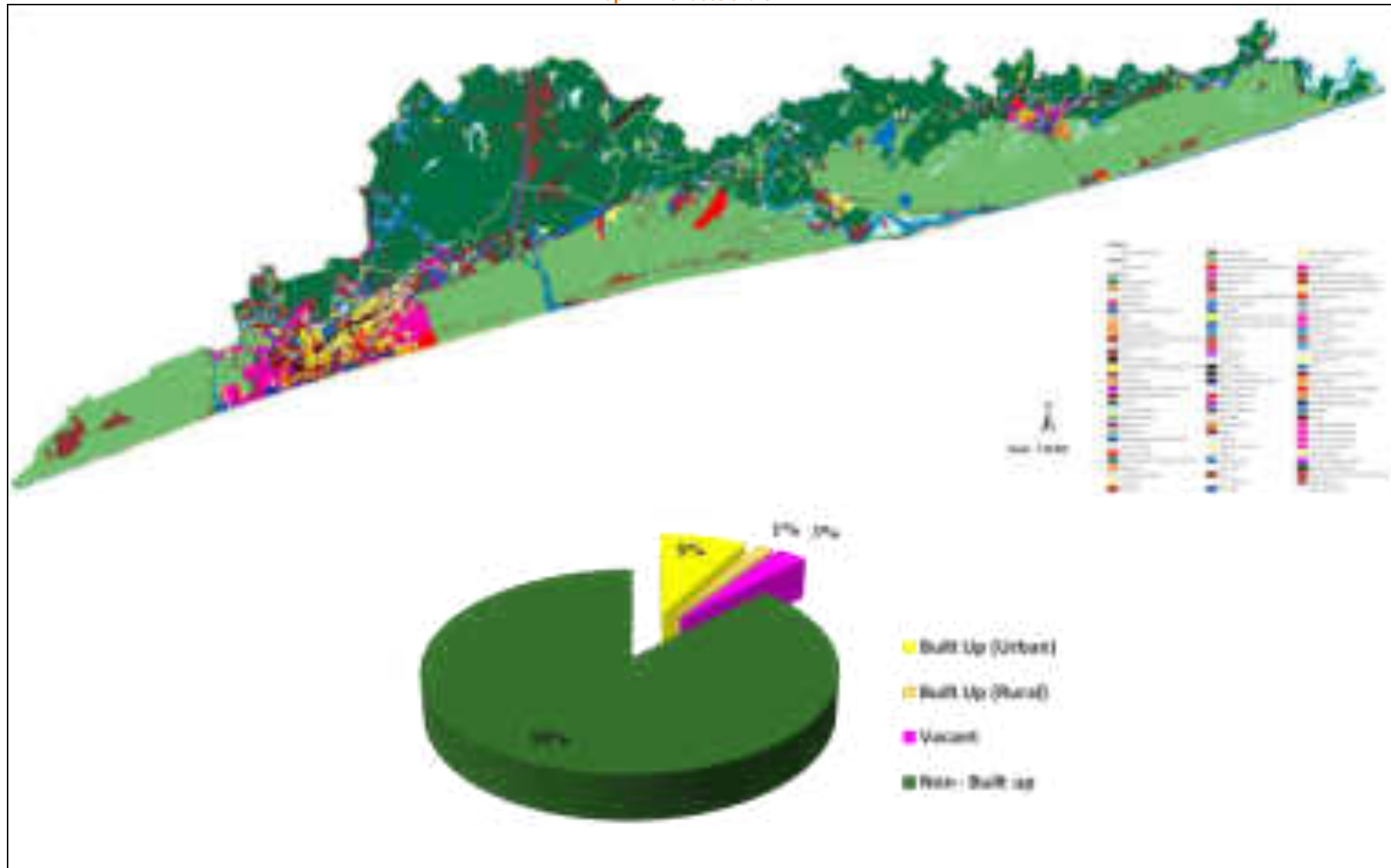
Table 4.1: Land use break-up - PKDA region

Location	Area	Residential (Urban)	Commercial	Industrial	Recreational	Transport	Public/Semi-Public	Public	Religious Center	Other Urban	Residential (Rural)	Vacant	Agriculture	Vegetation / Forest	Waste Land	Wet Land	Water body	Other	Total
Puri Town	sq.km	4.66	0.91	0.03	0.60	1.51	1.41	0.28	1.81	0.21	0.00	2.75	1.10	0.03	0.40	0.13	0.44	0.01	16.28
	%	28.60	5.56	0.19	3.68	9.26	8.65	1.73	11.10	1.28	0.01	16.90	6.76	0.20	2.48	0.81	2.70	0.08	100.00
Konark NAC	sq.km	1.25	0.21	0.01	0.37	0.65	0.30	0.12	0.05	0.40	0.04	0.99	11.41	16.94	0.72	0.88	0.59	0.02	34.95
	%	3.57	0.61	0.02	1.05	1.85	0.85	0.34	0.15	1.14	0.11	2.83	32.65	48.51	2.06	2.53	1.68	0.06	100.00
Block A	sq.km	0.03	0.08	0.01	0.40	0.80	1.06	0.02	0.35	0.47	1.91	0.60	31.82	48.21	7.16	2.11	5.20	0.00	100.24
	%	0.03	0.08	0.01	0.40	0.80	1.06	0.02	0.35	0.47	1.91	0.60	31.75	48.09	7.14	2.10	5.18	0.00	100.00
Block B	sq.km	0.01	0.00	0.00	0.70	0.21	0.03	0.11	0.01	0.01	0.74	0.04	8.01	19.10	1.97	1.54	1.87	0.01	34.36
	%	0.04	0.00	0.01	2.03	0.62	0.08	0.31	0.04	0.04	2.15	0.12	23.31	55.58	5.73	4.47	5.44	0.03	100.00
Puri Sadar	sq.km	0.93	0.25	0.03	0.51	0.51	0.04	0.11	0.17	0.21	0.59	2.98	7.23	26.76	6.34	0.21	0.94	0.00	47.82
	%	1.94	0.52	0.07	1.07	1.06	0.09	0.24	0.35	0.44	1.23	6.22	15.12	55.96	13.26	0.43	1.97	0.00	100.00
SIZ	sq.km	0.09	0.01	0.01	0.01	0.75	0.05	0.05	0.02	0.67	1.35	1.09	49.49	0.02	5.92	0.99	2.17	0.01	62.70
	%	0.15	0.01	0.02	0.02	1.19	0.08	0.08	0.03	1.07	2.16	1.73	78.94	0.02	9.44	1.59	3.46	0.01	100.00
PKDA	sq.km	6.98	1.46	0.09	2.59	4.42	2.88	0.69	2.41	1.98	4.63	8.44	109.0	111.0	22.51	5.86	11.20	0.05	296.34
	%	2.35	0.49	0.03	0.87	1.49	0.97	0.23	0.81	0.67	1.56	2.85	36.8	37.48	7.60	1.98	3.78	0.02	100.00

Source: ORSAC data, CEPT Analysis



Map 4.1: Landuse share in PKDA



From the above table and the figure it is clear that a major portion of the land area is covered under the non built up category (Agriculture/crop land area, Forest land), constituting to 87.64% of the PKDA area.

The area under forests is the highest accounting to 111.05sq.km (37.48%) of the total land area. Under the forests the area occupied by the Protected Reserved Forests (P.R.F) is 66.19sq.km. The forest cover is found in Block A (between the Puri municipality area and the UNESCO protected Konark temple area), and in Block B (the area beyond Konark).

The urbanized area under the PKDA region is comparatively less, amounting to 7.93% (23.51sq.km). Puri urban area accounts to 16.29sq.km; the remaining urban land area (7.22sq.km) is distributed within the PKDA region. The other major concentration of the urbanized land area is found in and around Konark. The various land uses other than residential are recreational, religious centers, and other land uses such as embankments, helipad etc.

Apart from the non-built up and the urbanized area, vacant land has the third major share in the PKDA region occupying 8.43sq.km (2.85%) of area within the region.

The area occupied by the rural households/built up is the least – 4.63sq.km (1.56%) of the PKDA region.

4.4 Block wise/ Zone wise Ownership Pattern

This section gives the detailed land use of the six blocks (the administrative blocks) of the region. Puri town and Konark NAC area are the two main blocks which are also the main urban centres in the region. These urban areas are discussed followed by the other blocks.

4.4.1 Existing land use of Puri Town

Puri the major urban centre in the region is more than thousand years old and is a religious town. The town is based on Vaastu Purusha Mandala with many meta-physical aspects interwoven in the planning of the town. The area occupied by the Puri municipality area is 16.29sq.km; Puri municipality area has been divided into 30 wards for the administration purpose. Puri town stretches along the sea shore measuring about 5km. the following table gives the land use break up within the Puri town/municipal area.

The specific **facture** of land use development in Puri town is as mentioned below:

- Majority of urban land in Puri town belongs to residential use accounting for 29% of the total land in the urban centre.
- Second highest share of land is vacant (17% of the total land) which is primarily constituted of water fields at the periphery of the city.
- Being a religious town more than 10% of land is allocated for religious use in the town. Most of them are placed in the central areas of the town around the Jagannath temple.
- Different public and semi public utilities cover 11% of the urban land which is higher than average standards as prescribed by UDPFI.
- Transportation use is confined within 7% of the land in the urban centre which is far lower than average standards.
- Because of demand of commercial facilities due to higher tourist arrival rates commercial use has grabbed 6% of the urban use which is higher than average standards.
- Recreational and open space is found in the 4% of the urban land which is lesser than the demand found in the neighbourhoods of the town
- Overall the standards of land distribution in the town are found to be average and needs planned intervention for equitable distribution of land commodity.



Map 4.2: Existing Landuse: Puri town

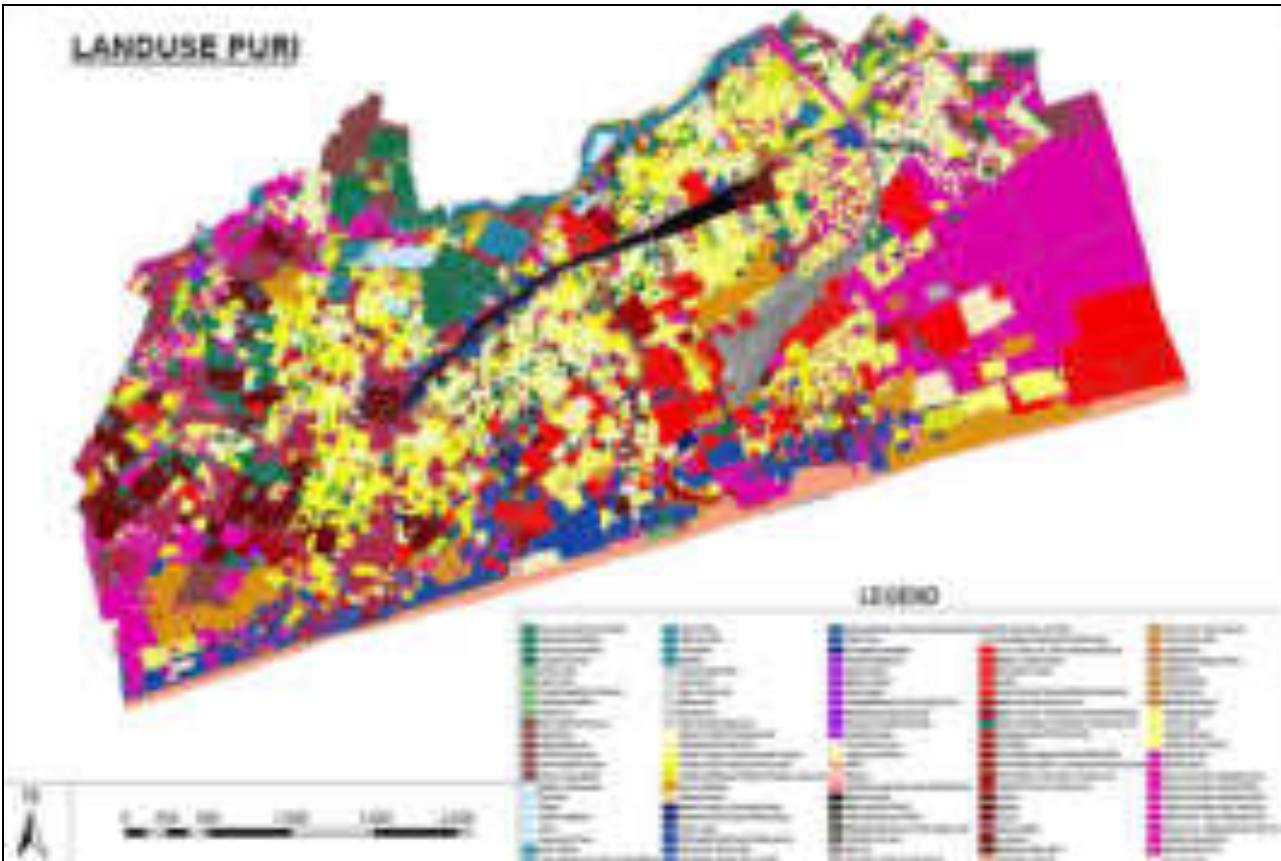
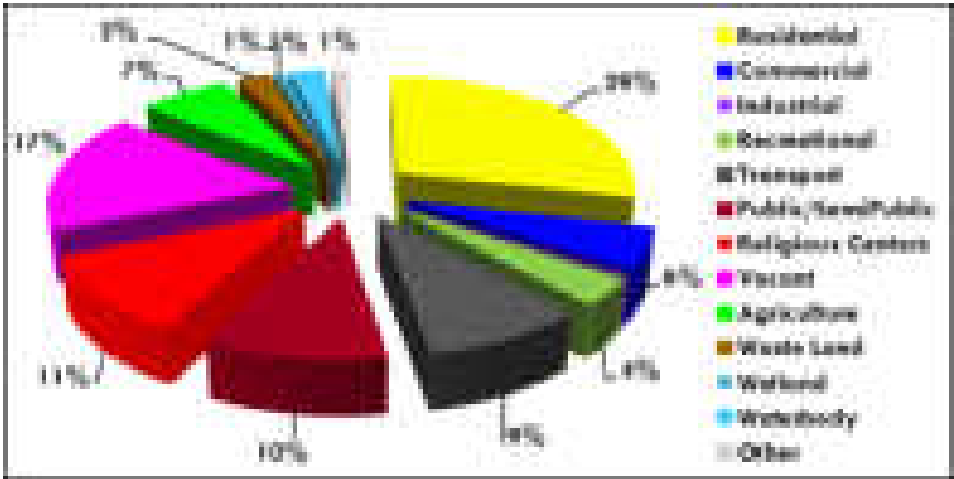


Fig 4.1: Existing Landuse: share in Puri town



4.4.2 Existing Land use of Puri Sadar / Puri Master Plan area

The area around Puri town has been declared as the Puri Master plan area known as Puri Sadar. Major growth has been witnessed in this block over the recent years. It is expected that this area would show a faster rate of growth owing to the limited land area within Puri town/municipality area.

The area covered by Puri sadar is 47.82 sq km with 16 mouzas. The major land uses within the block are Coastal plantations and the forest area under Balukand sanctuary. The following section gives the detail picture of the land use distribution in the region.

Map 4.3: Existing Landuse: Puri Sadar

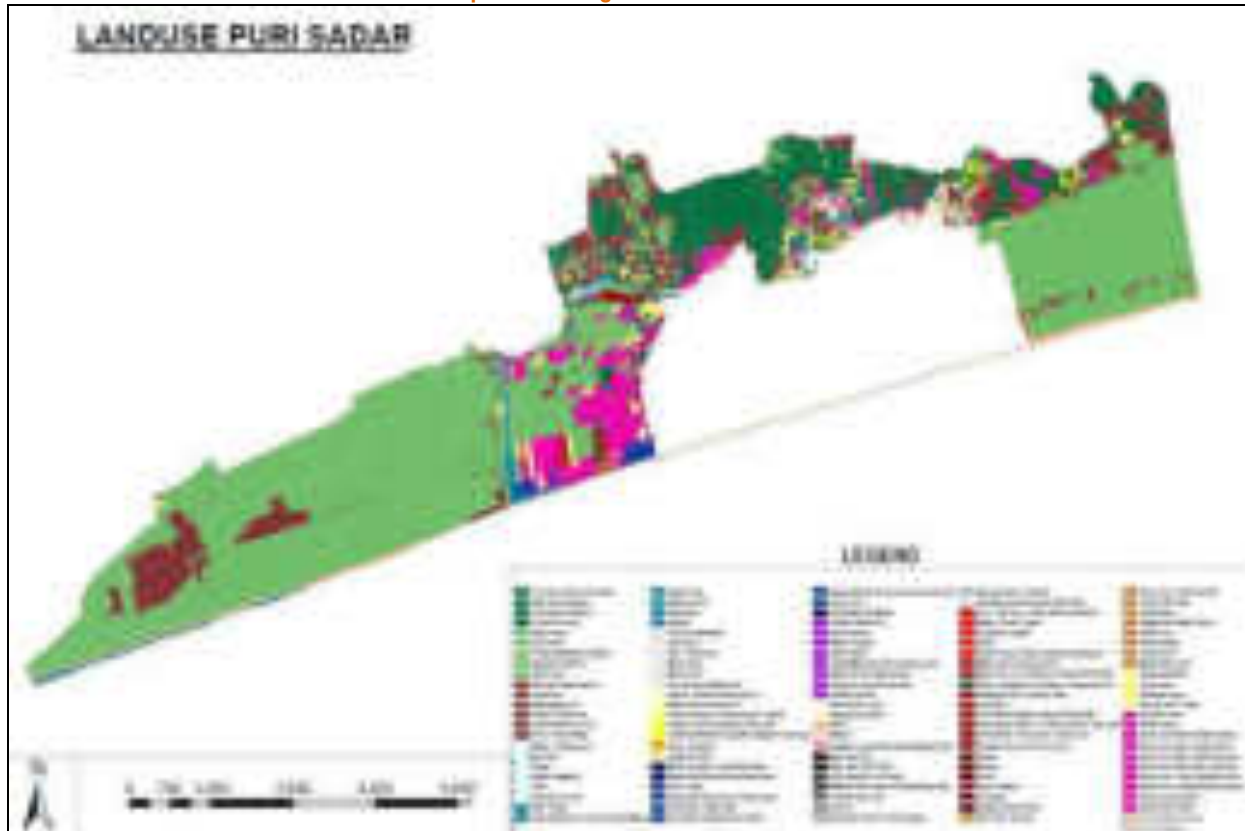
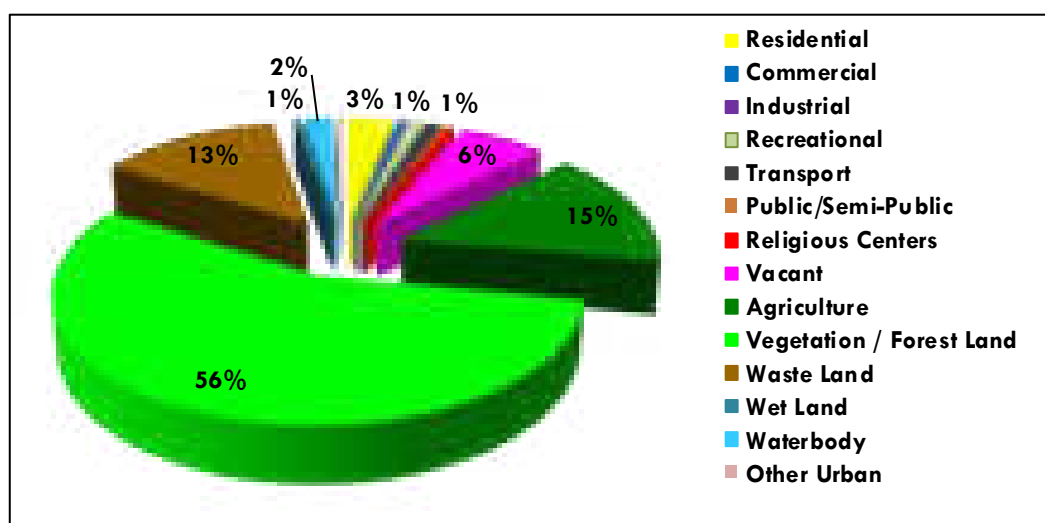


Fig 4.2: Existing Landuse: share in Puri Sadar



4.4.3 Existing Land use of Konark NAC

Konark, the seat of World famous Sun Temple, is the second important urban centre in the region. The Sun Temple chariot of the Sun God on the golden sands of Bay of Bengal is a 13th Century architectural marvel. To-day Konark is not merely a symbol of Odisha's great architectural craftsmanship; it is also the most sought after centre of attraction for tourists from all over the World.

"Konarka", the place bears a name composed of two World elements: Kona meaning corner and ARKA meaning the Sun. In 'Brahma Purana' the Sun God in Ark-kshetra has been described as Konaditya. Hence, the place where the Kona aditya (or Kona-arka, the Sun god) was worshipped and was popularly called Konark. Purusottam Mahatmya gives a mention of Konark being named as Padma Kshetra.

The Konark NAC area mostly comprises of forest area and agricultural zones as shown in the map below:

Map 4.4: Existing Landuse: Konark

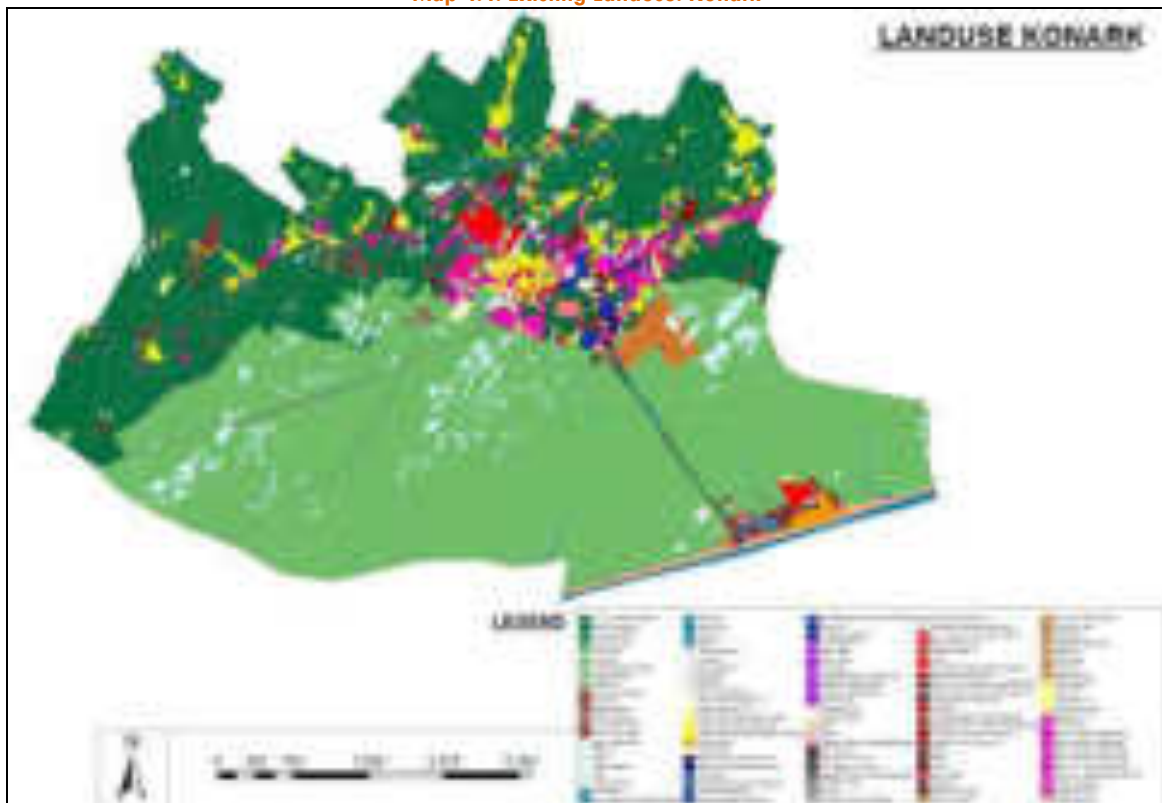
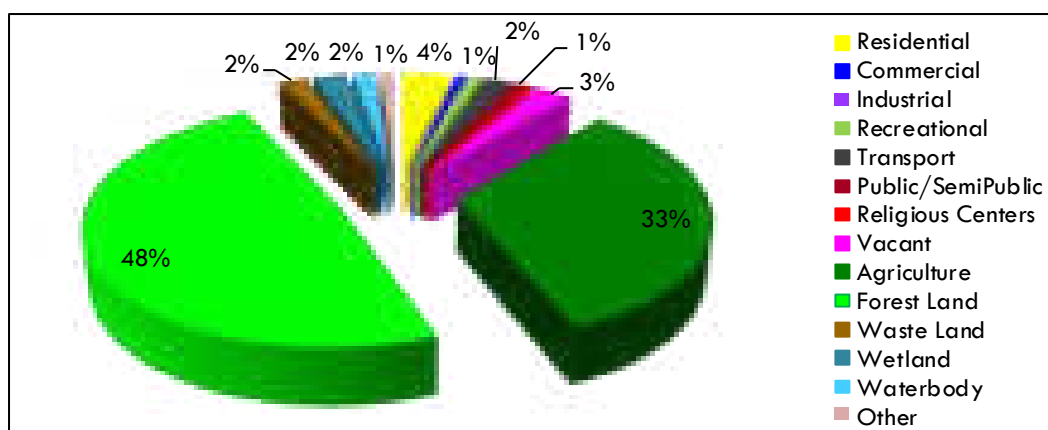


Fig 4.3: Existing Landuse: share in Puri Sadar



4.4.4 Existing Land use Block A

The largest block in the region - Block A covers 100.24 sq km of the PKDA region. Block A consists of 21 mouzas covering the areas between Puri town and Konark. Most of the land area falls under the forest area. The main forest ranges within this block are the Balukhand reserved forest and Balighai protected forest. This section gives details of the existing land use of the block.

The map below and figure showing the Existing land use of Block A and the distribution of different uses:

Map 4.5: Existing Land use: Block-A

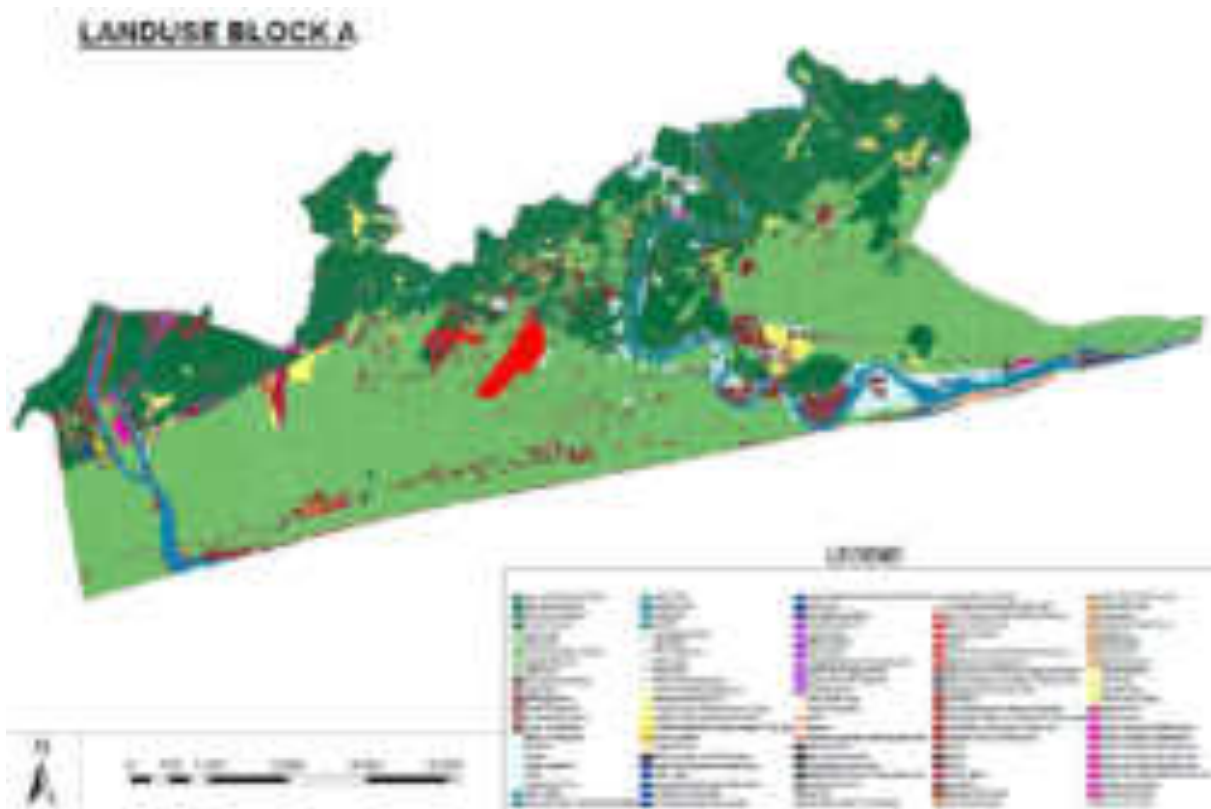
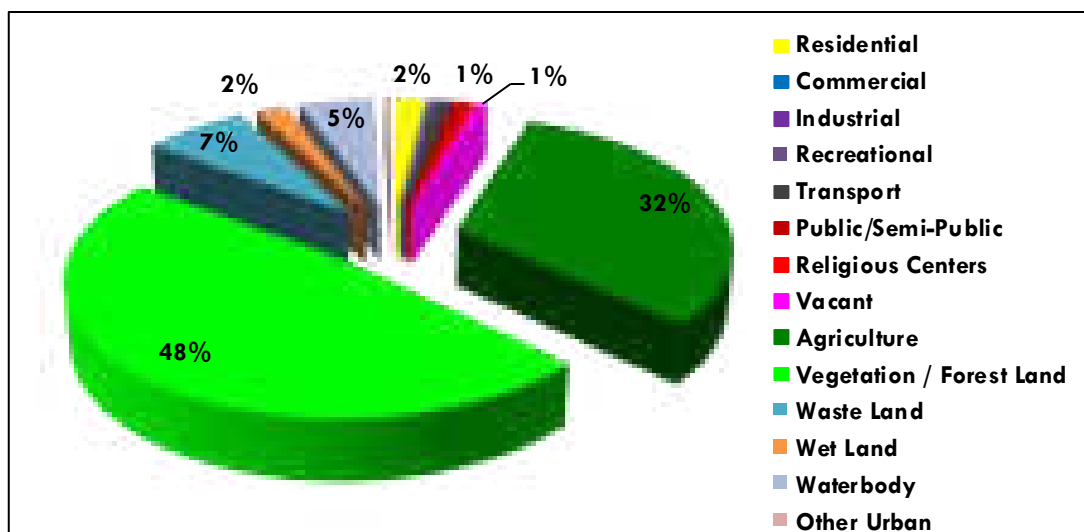


Fig 4.4: Land use share: Block-A



4.4.5 Existing Land use of Block B

The area covered by block B sums up to 34.36 sq km it includes 14 mouzas within the block. The main urban centre near this block is Konark and Kakatpur, which falls outside the study area. The main land uses within this block are agriculture and forests.

The map below showing the Existing land use of Block B which is primarily consists of forest areas and agricultural zones along with a few scattered village settlements in between them.

Map 4.6: Existing Land use: Block-B

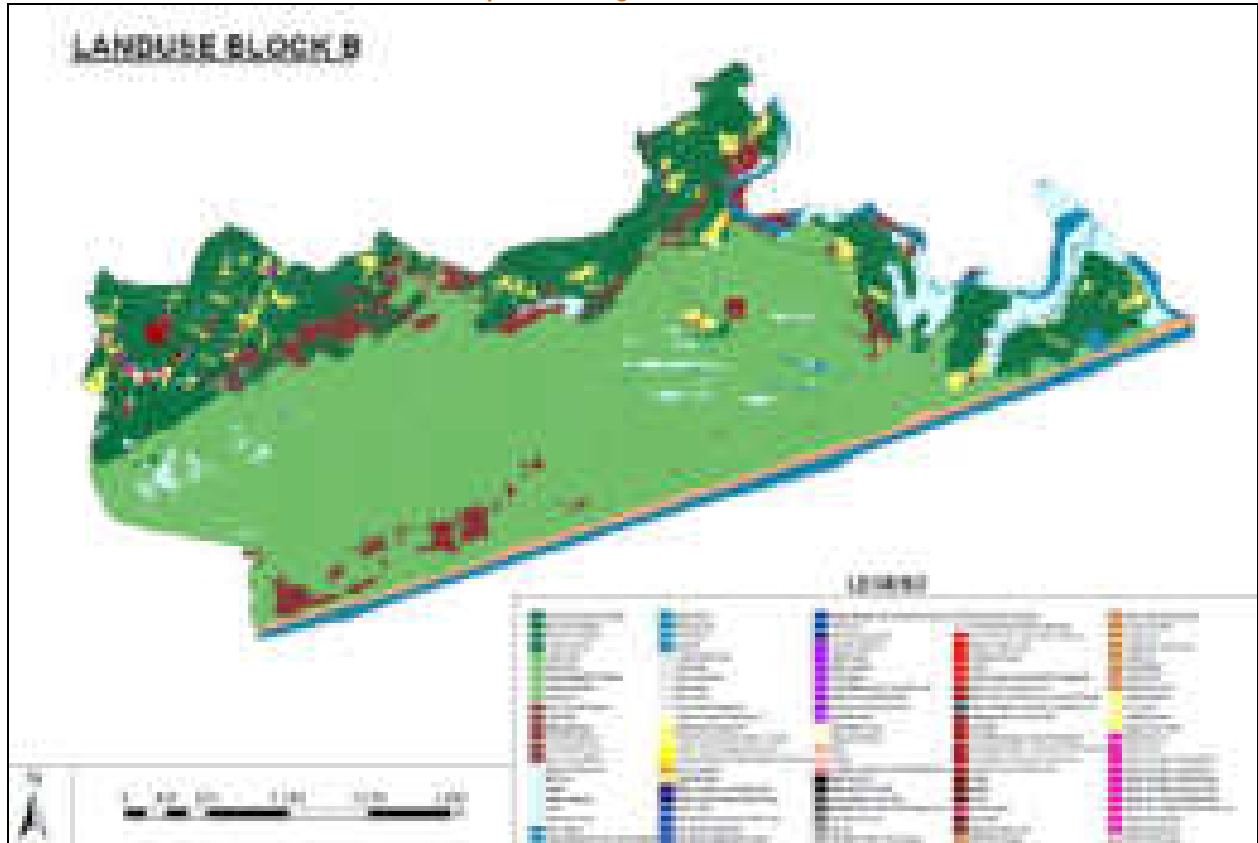
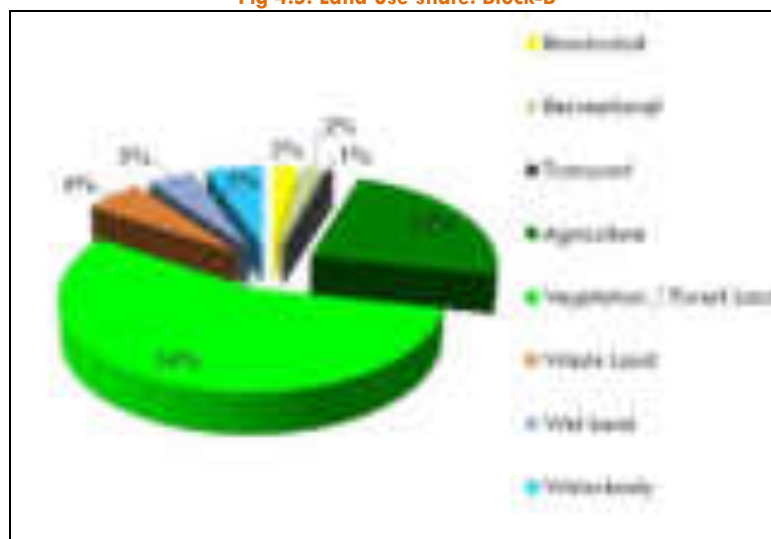


Fig 4.5: Land use share: Block-B



4.4.6 Existing Land use of the SIZ area

This block is situated in the middle of the study region, comprising 39 villages covering an area of 62.70 sq. km. The major land use in this region is agriculture, with a less percent of built up areas.

The map below is showing the Existing land uses of SIZ where it can be seen that rural settlements are scattered in the block are the main developed areas of the zone. Also the standard of transportation facilities and public utilities are lesser than required in the block.

Map 4.7: Existing Land use: SIZ Area

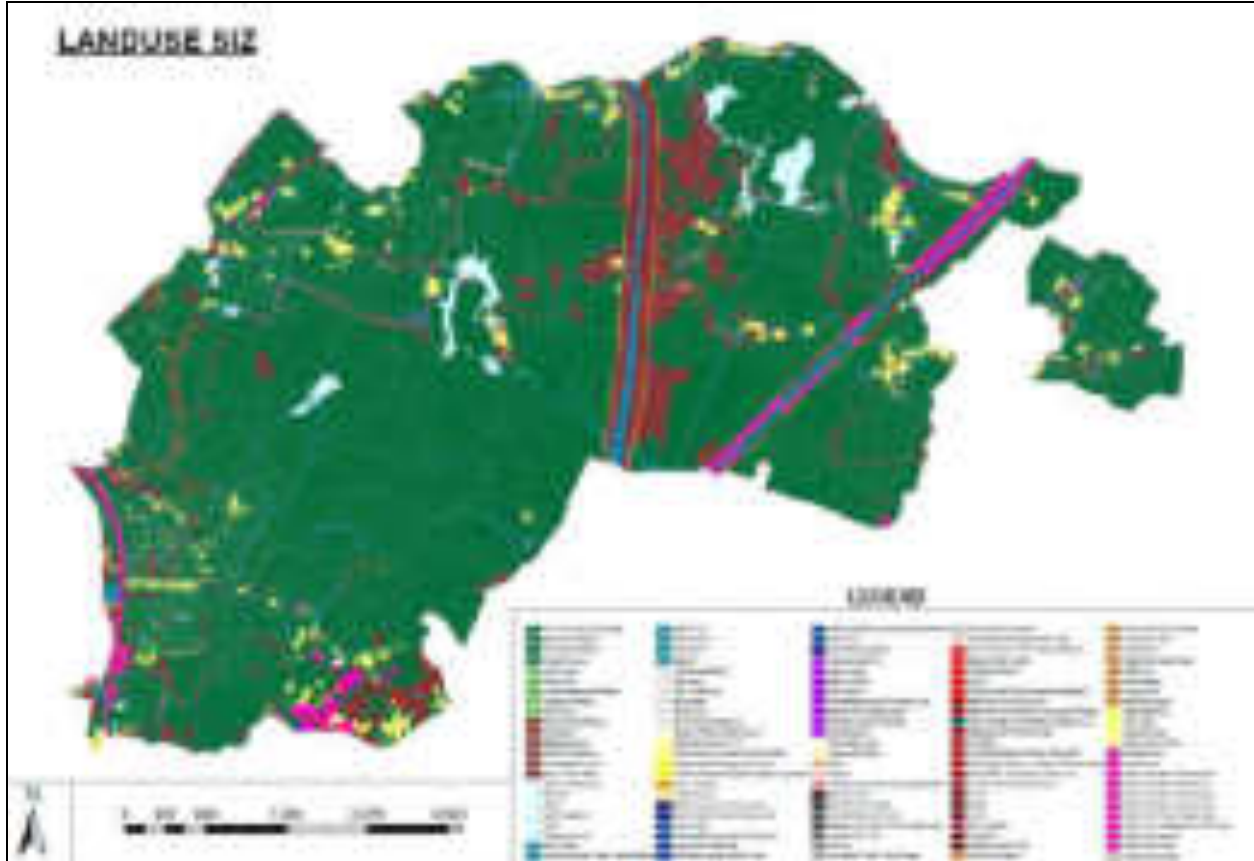
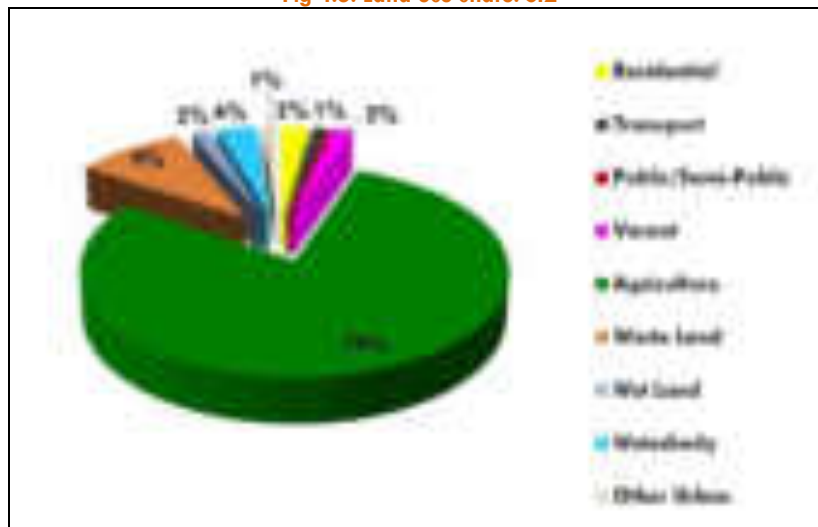


Fig 4.6: Land use share: SIZ



4.5 Detailed analysis of the Land uses for the main urban centers

The individual land uses and their details are analyzed in this section for the entire PKDA Region, and the two main urban centres – Puri Town and Konark NAC.

4.5.1 Residential Development

The total existing residential development in the PKDA area covers 6.91 Sq.km of the total area. The development is concentrated in the Puri urban area. The growth is radial outwards from the Jagannath Temple. There are small hamlets showing low density residential development along NH -230 and other major roads. Around the UNESCO protected Konark temple there are clusters of residential development are found.

The existing Residential Land Use comprises of

- Planned / plotted houses
- Multi Storied Housing
- Project housing / housing schemes / quarters
- Irregular layout / varying plot size houses
- Clustered settlement / engulfed villages in urban areas
- Slums / Squatters
- Scattered Houses

The map below shows the detailed extent of residential development in the PKDA Region, Puri Urban Area and Konark NAC area. Within the Puri town, large cluster of residential development is near Swargadwara area, south of Jagannath Temple. Other large hamlet of the same kind is towards north near Atharnala Bridge.

The residential development along the Swargadwara area and around the Jagannath Temple, primarily comprise of irregular layout/varying plot sizes (24.65% of the total residences in Puri Urban area). Towards the Gundicha temple and towards the Atharnala Bridge the residential development is comprised of Quarters/Project housing/Housing scheme which sums up to 26.36% of the total residential area in the urban areas of Puri. Thus it is evident that the households initially developed during the growth of Puri were around the Jagannath temple, comprised of houses with irregular layouts and varying plot sizes.

The area has considerably less area under slums. Most of the houses of the fishermen community by the sea shore are found to be “kutchra” and in dilapidated condition (constituting to 16.43%) with some of the slums are also concentrated on both the sides of the railway station. Apart from the above mentioned categories of residential development, planned/plotted houses have a major share (24.04%); they are located along the Grand road and towards the Atharnala Bridge.

Fig 4.7: Existing Development along Marine Drive



The multi-storied houses constitute a very less number compared to the other categories of residences and are found scattered along the Grand Road within the irregular layout category and the planned/plotted houses (only 2.06% of houses among all the types of residences in the urban area).

Majority of the residential development falls under the categories of clustered settlement and irregular layout. Photographs illustrate the typical residential cluster in the Puri Urban area. Houses of Puri are normally laid adjoining to each other having roadside front yards or porches. Residential development in most parts of the city does not exceed three floors above ground level. Majority of the houses in Puri and surrounding areas are constructed by conventional construction practices and are of brick masonry and concrete. Typical house form of Puri has narrow frontals and generally is quite deep having a small light shaft or courtyard in the centre.

The above map shows the concentration of the residential areas around Konark. Most of the residential agglomeration is found towards the north of the Sun Temple of Konark, away from the sea coast. Clustered settlement or engulfed villages are found to occupy a larger percentage of the residential growth. Apart from the clustered settlements, irregular/varying plot size houses are found in large number.

Fig 4.8: Residential Development in the region



4.5.2 Commercial Development

The total existing commercial development in the PKDA area covers 1.42 Sq.km of the total area. The growth is found to be along the Grand Road outwards from the Jagannath Temple and along the sea shore towards the south of Jagannath temple. The other major concentration of commercial activity can be found around the UNESCO protected Konark temple. The commercial activity in Konark mainly comprises of small shops which display artifacts to attract tourists.

The commercial development is concentrated in the Puri urban area. The commercial activities have witnessed a linear pattern of growth, along the sea shore and along the Grand road. Out of the total urban area in Puri the commercial development accounts to 5.4%. The commercial activities mainly comprise of hotels/lodges, Dharmasalas/holiday resort, street vendors etc, attracting tourists.

Fig 4.9: Hotels on Marine Drive



Hotels/lodges constitute a larger percentage among the various commercial activities, constituting 48.89% of the commercial area, followed by Dharmasala/Rest house/Holiday resorts leading to 28% of the commercial

area. The other commercial activity which occupies a prominent area is by the Street/Roadside shops/vending zones which amounts to 11.35%

The existing Commercial Land Use comprises of

- Market complex/Commercial Centre
- Street/Roadside shops/vending zones
- Hotel/Lodge
- Dharmasala/Rest house/Holiday resorts
- Cinema hall/Theatre halls
- Auto works/Garage/Service centre
- Kalyan mandap/Community centre/Auditorium
- Petrol pump
- Daily/weekly hat/market
- Informal stalls in Beach and Grand road

Fig 4.10: Various Markets in Puri and Konark

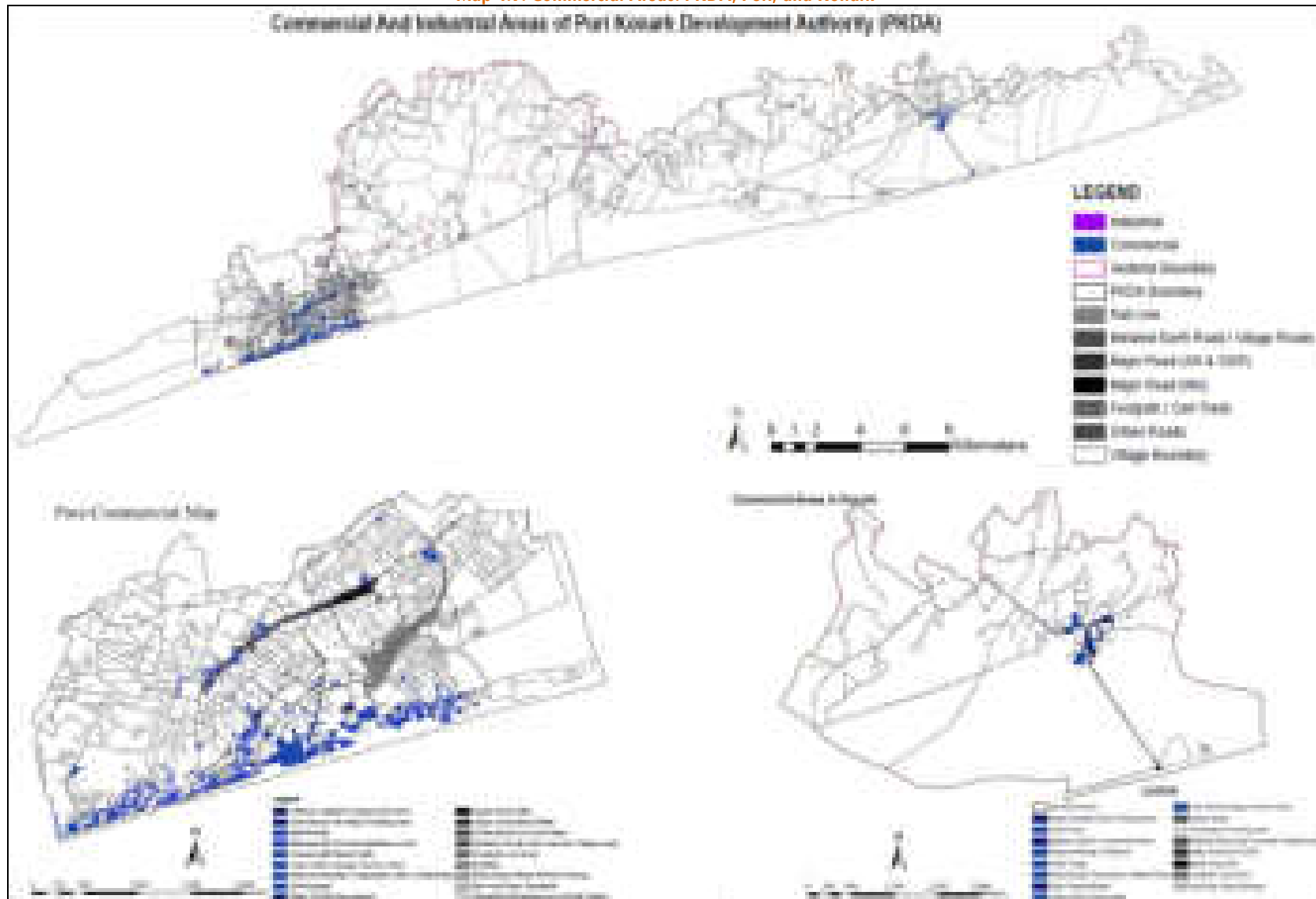


The stalls and various types' vendors are shown in the pictures; these stalls are along the sea shore, south of the Swargadwara area. These vendors form a major tourist attraction along the beach areas.

Commercial activities are very less in the Konark region. The commercial activities are concentrated around the Konark Temple. These commercial activities include Hotels, Dharmasala, community centres etc. apart from these there are vendors or the market complex. There is a small concentration of hotels near the beach area. Apart from the commercial activities, there are also a few go-downs/storage places, found near the sea coast.

There are various issues found for commercial development in the study area especially at Puri which are summarized below:

- Rapid development of commercial establishments like hotels, guest house, Restaurants etc are putting enormous threat to coastal ecosystem in the Puri town coastal area and some part of Konark NAC.
- Growing informal activities in the beach at Puri town leading to decay of urban environment and fabric of the marine ecosystem.
- Uncontrolled expansion of informal stalls in Grand road and surrounding areas of Jagannath temple is resulting in decay of heritage values in the town.
- Most of the hotels and commercial establishments generates greater amount of waste water and solid waste which are mostly disposed untreated into the sea which is polluting the marine ecology in the region.

Map 4.9: Commercial Areas: PKDA, Puri, and Konark

4.5.3 Agricultural Development

The total area under cultivation within the PKDA area constitutes about 109.13 Sq. km area, which accounts to around 32.82% of the total area. It can also be noticed that most of the area under cultivation falls within the SIZ area.

The area under cultivation can be broadly divided into the following categories,

- Agricultural Plantation
- Crop Land
- Horticulture Plantation
- Orchard/Grooves

The agricultural plantation is found to be mainly around the UNESCO protected Konark temple area. It constitutes to 8.71% of the total area under cultivation. Crop land accounts to a major share within the cultivated area, which accounts to 78.31%. Most of the crop land falls within the SIZ area villages on the either side of the River Nuanai. Orchards/ Grooves constitute 7.41% of the area under cultivation. These orchards are mainly found within the Puri urban area and around the UNESCO declared Konark temple area. The orchards are found to be present in a scattered pattern within the Puri urban area. There is also a small fraction of horticulture plantation amounting to 5.56% which is found within the crop land.

Fig 4.11: Agriculture, Coconut Plantation and Horticulture in PKDA region



Agricultural land is found towards the northern region of Konark. Crop lands and agricultural plantations are found to have a major share. Around the temple area, Horticulture plantations are found. Agricultural land area occupies 11.68 sq.km of area.

As far as area under agriculture and production is concerned, GOP tehsil area shows leading trend where as Puri and Kakatpur has lower production rates and area designate for agriculture use.

Table 4.2: Agriculture production and area: PKDA

Area	Total		
	Area	Yield rate (qnt/HA)	Production (MT.)
Puri	13157	23.01	302786
Gop	17839	28.79	513508
Kakatpur	11526	25.99	29956

Source: Puri collectorate, CEPT Analysis



CEPT, Ahmedabad



4.5.4 Public, Semi Public, Religious Utilities and Development

The total area under public and semi public & religious utilities in the PKDA area sums up to 5.99 Sq.km of the total area. The development as seen earlier is concentrated within the Puri town area. Apart from the Puri urban area, there are small clusters of public and semi-public areas around the UNESCO protected Konark temple area.

The maps below show the location of the religious, public and semi public utilities in the PKDA Region, Puri urban area and Konark NAC area. These utilities account to about 21.55% of the total urban land area of Puri.

The public/semi public utilities amount to 40.27% of the area under Public, Semi Public, and Religious Utilities. These can be found concentrated around the railway station area and also towards the south- eastern side of the urban area. They are also found to be scattered among the religious centres. The public utilities amount to a very small percentage (7.6%) of the land area under Public, Semi Public, and Religious Utilities.

There are a very few public and semi public utilities at Konark. They have a scattered pattern of arrangement, around the existing residential areas. There are two major educational institutions situated on the highway connecting Konark and Pipli.

Puri being a pilgrimage destination, the share of religious spaces is found to be higher accounting to 53.03% of the area under Public, Semi Public, and Religious Utilities. This area comprises of Temples, Mosques, Gurudwara, Ashram/Matha and Church as given in the table. It can be found that the concentration of religious spaces is more towards the western side of the city, and towards the Swargadwara area.

Table 4.3: Details of religious centres in Puri town

Religious Centres	Number
Ashram/Matha	207
Church	6
Gurudwara	1
Mosque	2
Temple	287
others	89

Source: Puri Municipality, ORSAC Land Use survey

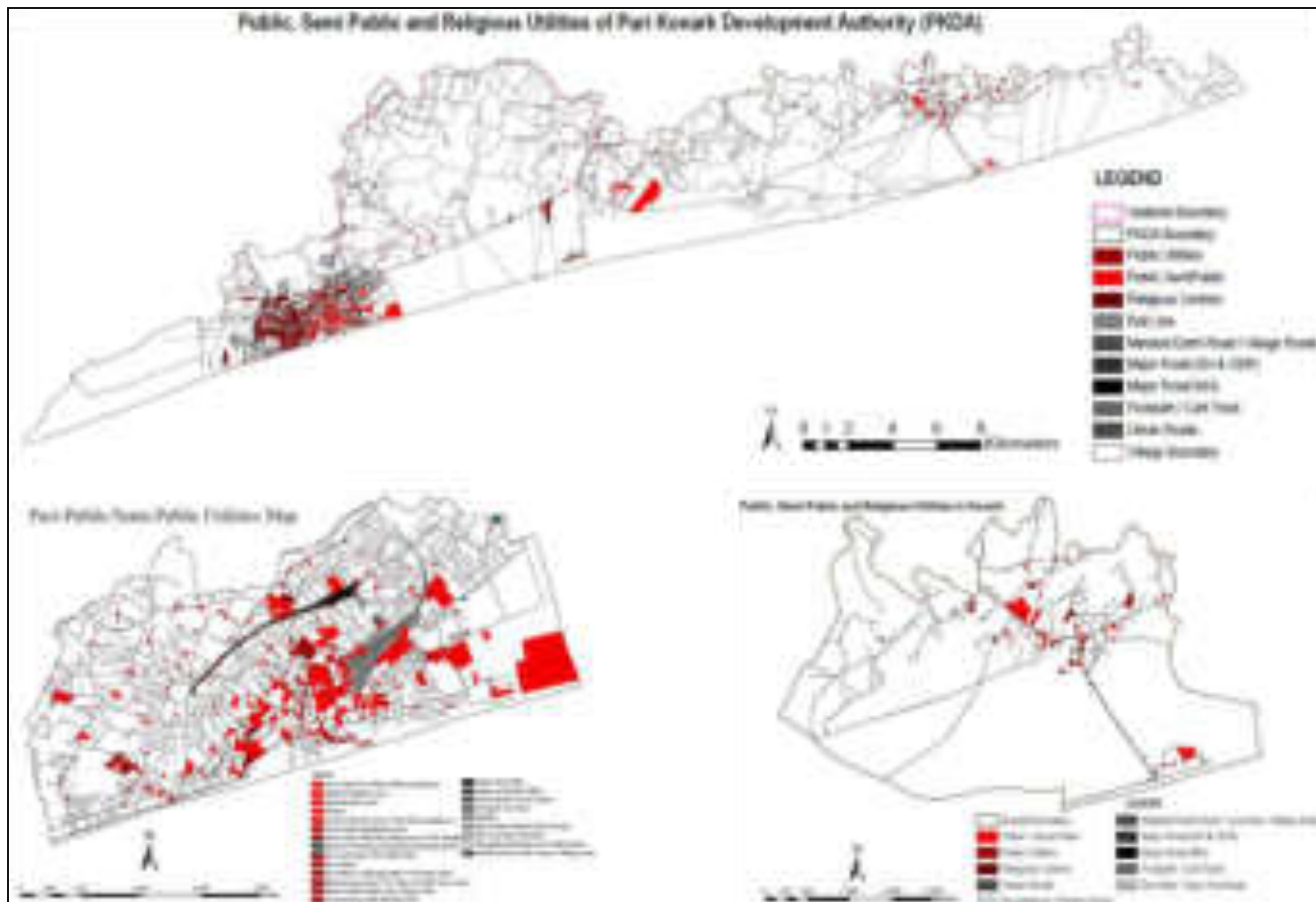
Fig 4.12: School in Puri



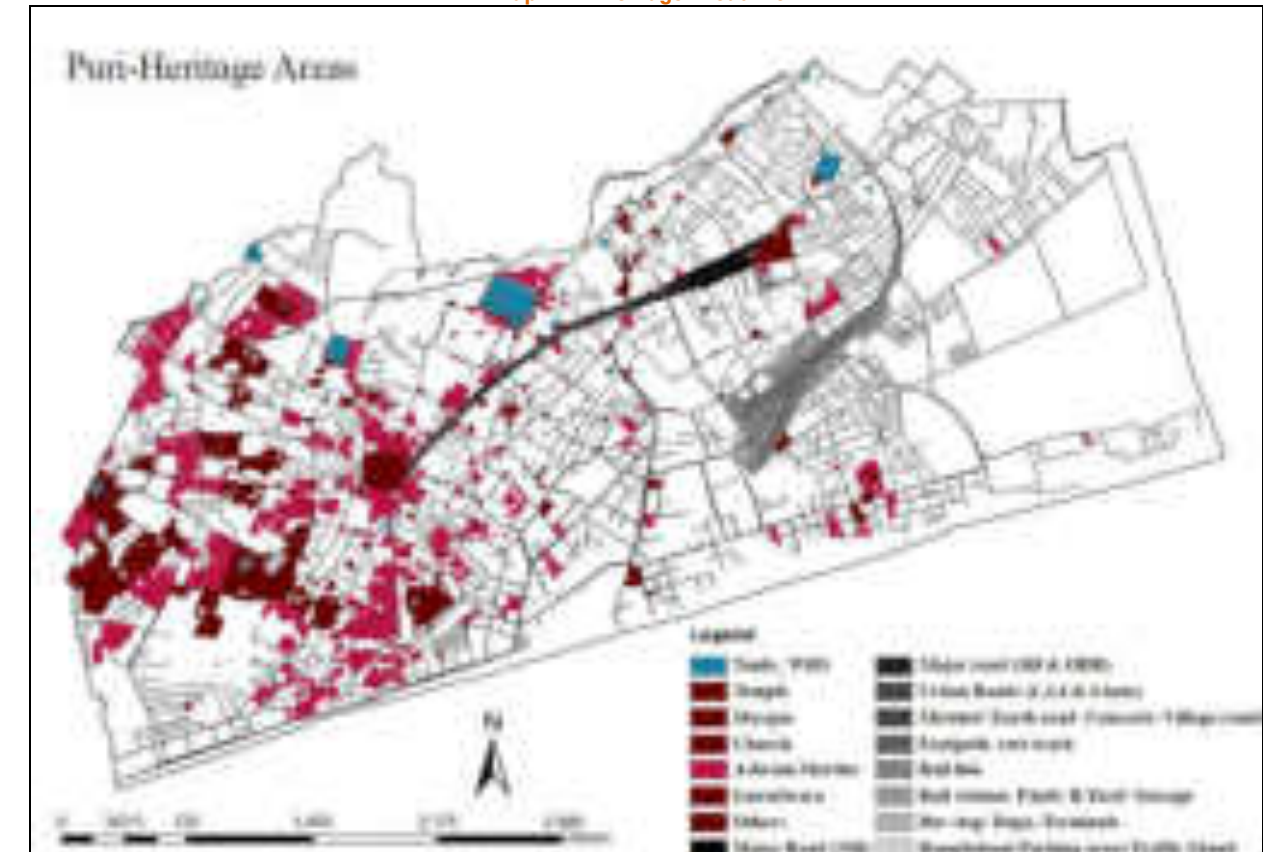
Fig 4.13: Matha in Puri



Map 4.11: Public, Semi Public and Religious Areas: PKDA, Puri, and Konark



Map 4.12: Heritage Areas: Puri



4.5.5 Natural Features – Water Bodies, Forests

PKDA region has a high percentage of ecologically sensitive areas. Reserved forests, Aquifers, Water bodies, River Bed Areas and waste lands are some of the natural features which need to be conserved.

Forests:

The map given below shows the major Forest areas in Puri Konark Development Authority area. The forest cover in this area are mainly divided into the following types

- Dense Forests
- Forest/Coastal/Strip plantation
- Degraded plantation

These forests are located towards the southern part of the region. Forest/Coastal/Strip plantation come up to 87% of the forest area, and degraded plantations constitute 12% of the forest area, with a minimal area of the dense plantations.

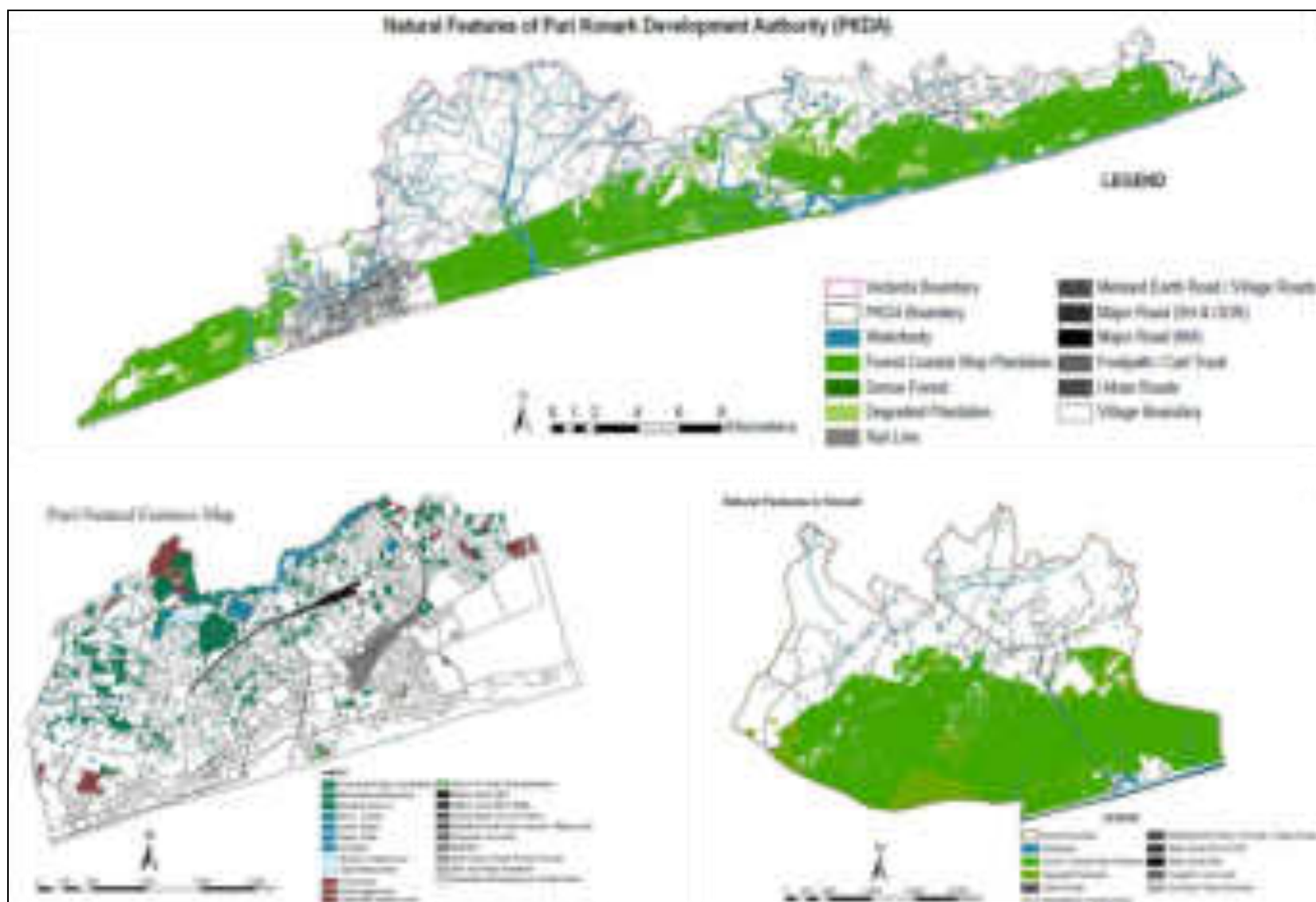
Water Bodies:

There are four major rivers in the PKDA region which are Mangala, Nuanai, Kushavadra and Kadua River. Mangala and Kushavadra River is the major water sources in the region for municipal use and agricultural purpose. The rest of water bodies are ponds, small lakes, coastal submerges urban water reserves, tanks etc. As far as urban water features is concerned Puri town has four major tanks which are seen as sacred places having cultural values for the residents.

Overall the region has plenty of natural features although proper management measures are still lacking.



Map 4.13: Natural Features: PKDA, Puri, Konark



Observations and Summary of Issues identified

From the above analysis the following issues can be identified and summarized:

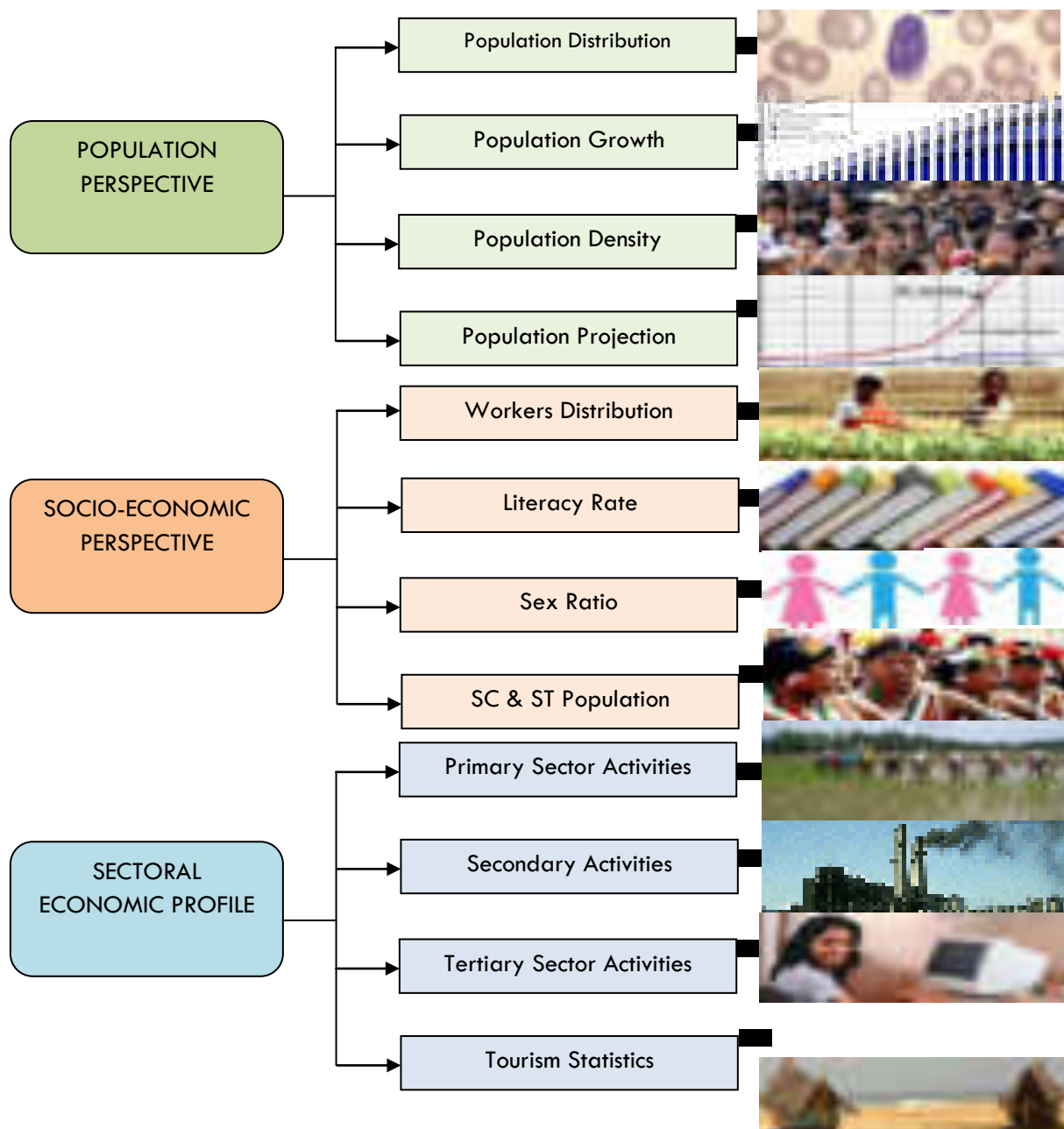
- Land use distribution in the PKDA region has wide disparity resulting in dissimilar opportunities in the various parts of the region. This is effecting widespread migration from rural to urban areas which should be well answered in the land use plan formulation strategies in the CDP.
- The most important economy generating sector in the region is tourism and on the other hand major proportion of urban land is designated for religious and heritage use. Major interventions are required to conserve the heritage zone in the urban precincts which will promote more economy generation opportunities in the region.
- Due to incoming of large tourist population the beach area has been intensively used for commercial development which needs to be controlled through effective Development control regulations which will improve the coastal environment and reduce the chances of disasters.
- The transportation facilities provided in the region consists of only a total of 1.49% of PKDA region and 9% of Puri town area which is far below from standards. This scenario must be improved through providing an effecting mobility plan for the region which will focus on internal mobility of urban centres as well as intra regional connectivity.
- Puri town area has very little designated open space within the municipal arena which does not make it an environmental friendly liveable urban space. Hence adequate neighbourhood level, sectoral and town level provision of open spaces should be designed in the CDP to enhance the quality of life in the town area.
- The region has rich natural forests and bio reserve zones which should be conserved and managed to attract tourists and increase tourism potential of the region.
- Urban agriculture in the town is on a decreasing trend which should be planned and promoted along with necessary technical interventions. This will help in improving urban environment and increase employment opportunities.
- As far as residential development is concerned there is very limited provision for EWS section of residents in Puri town. In this CDP adequate strategies and land use zoning should be prepared to internalise this section of population.
- There are some valuable large water bodies existing in Puri town. These carry a lot of faith and heritage values for the town and hence should be conserved with required intervention in the CDP.
- Informal activity is at the core of the fabric of the urban centres especially Puri town. But these are growing in an unplanned fashion degrading the heritage value and potential of the town. Therefore planning interventions and strategies for informal activity is highly essential.

5. Demographic & Economic Perspective

The Existing trends of demography and economic scenario helps to analyze and understand how the region is growing and where it will lead to. Therefore this study will lead to logical conclusion of what are the current trends and how the mosaic is going to be change in due time span. The chapter basically analyses the demographic, social and economic fabric of the region as well as projected scenario will also be visualized.

Census Data for the years 1971, 1981, 1991 and 2001 is analyzed for the preparation of charts and thematic maps from which inferences about the condition of the study area are drawn. The unit of analysis is the “Village”. The present PKDA area consists of 131 revenue villages that fall within – Puri Development Area, Konark Development area, Block A and Block B.

This chapter includes the analysis of the following components of different sectors:



5.1 The Population Perspective

The section here will include the population distribution, growth pattern, density mapping, and literacy and caste distribution analysis. This will give an overview about the study region and emerging issues will be underlined from the same:

5.1.1 Population Distribution:

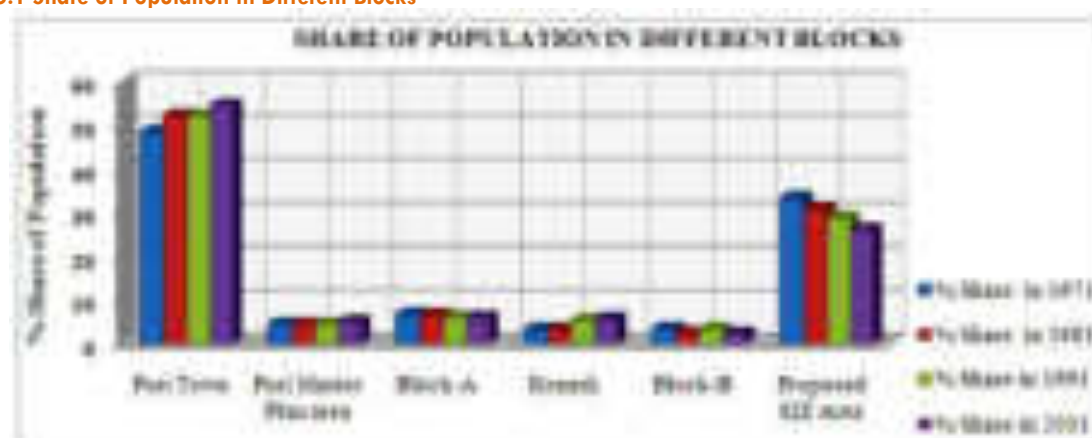
The table below shows the block wise distribution of population and its comparison with the district and state level status. Basically majority of population in the area is concentrated in Puri Town Area (54.6%) due to various opportunities the town provides; whereas the rest of the region is basically large village tracts having dispersed population. Except for Puri, Konark NAC is having moderate population accumulation. The maps below the table indicates the same scenario as mentioned.

Table 5.1 Population Distribution in Different Blocks

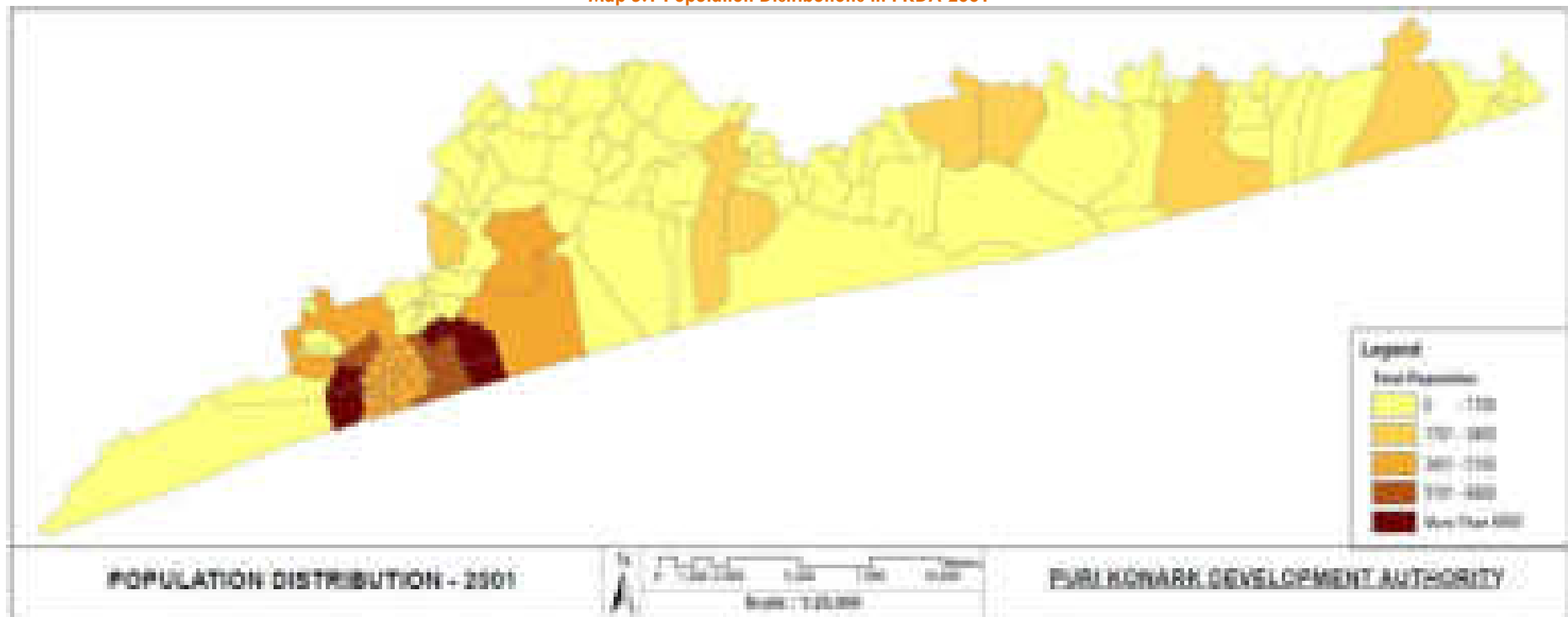
Sr. No	Spatial unit	Population 1971	% of PKD A Total	Population 1981	% of PKD A Total	Population 1991	% of PKD A Total	Population 2001	% of PKD A Total
1	Puri Town (M)	72674	48.5	100942	52.2	125199	52.1	157837	54.6
2	Puri Sadar Area	6654	4.5	8547	4.4	10874	4.5	14880	5.1
3	Block A	10253	6.8	12828	6.6	14523	6.0	17238	6.0
4	Konark Master Plan area	4960	3.3	6436	3.3	12683	5.3	16979	5.8
5	Block B	5324	3.5	4892	2.5	7863	3.3	6872	2.4
6	Proposed SIZ area	49959	33.4	59789	31.0	69055	28.8	75244	26.1
PKDA Total		149824	100	193434	100	240197	100	289050	100
Puri District		2,340,859	-	2,921,045	-	3,570,000	-	1,502,682	-
Odisha		21,944,615	-	26,370,271	-	31,659,736	-	36,804,660	-

Source: Census data, CEPT Analysis

Fig 5.1 Share of Population in Different Blocks



Map 5.1 Population Distributions in PKDA 2001



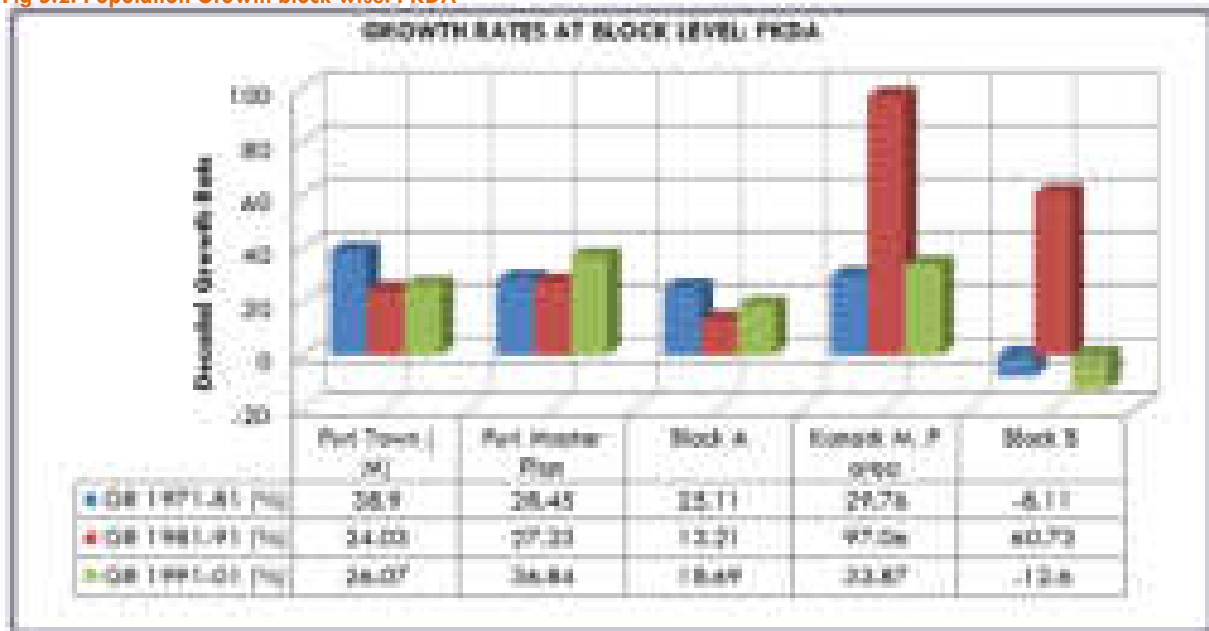
Source: ORSAC data, CEPT Analysis

5.1.2 Population Growth

Trends of growth in different territories go to show how the region is evolving and competing with various inter-regional forces. The growth pattern in the study area clearly points out that the growth rates in the towns is on a decreasing mode whereas the same is growing in the surrounding areas to towns as we see Puri Master Plan area trends. The reason is basically the spillover and congestion in the core city areas pushing people out of the core city areas and also attracting newly migrating population.

The large village tracts in the area shows a gradual decreasing trend of growth with a little fluctuation at some places can be seen in Block B area. On the other hand Konark has faced a very high increase in Population between 1981-'91 mostly due to its NAC status and planned interventions coming into practice. The trend in the last decade anyway has stabilized.

Fig 5.2: Population Growth block wise: PKDA



Source: Census of India

5.1.3 Population Density

Except Puri Town which has a density of 9395 persons/sq. km (2001) rest of the blocks in the study area is showing very low density as seen in table below. Consonance with population distribution the density has also has not increased much in last decade in most of the blocks.

The density in Puri Town has increased considerable in the last decade resulted in compaction and sprawl in the town. Core wards around the Jagannath Temple have very high density in the town compared to other parts of it.

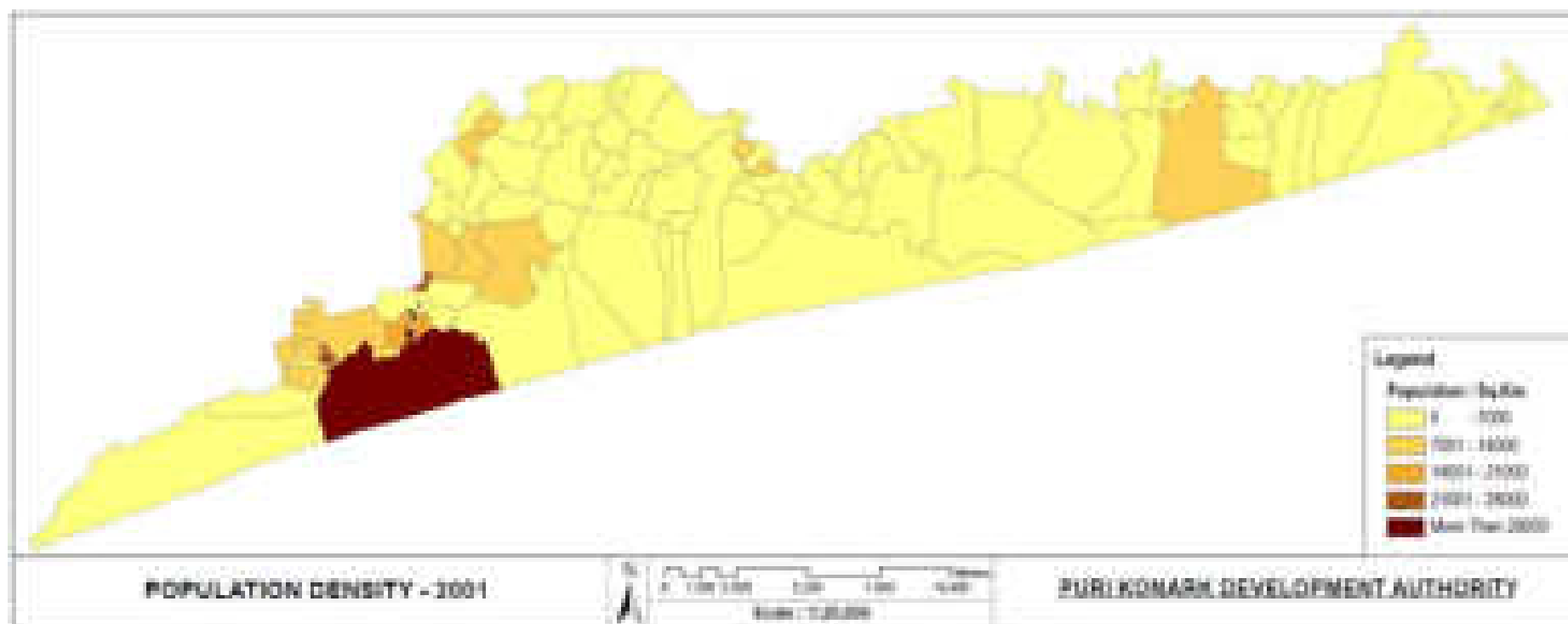
Table 5.2: Population density in different blocks: PKDA

Sr.No.	Spatial unit	Population 1991	Density/sq. km, 1991	Population 2001	Density/sq. km, 2001
1	Puri Town (M)	125199	7452.32	157837	9395.06
2	Puri Master Plan	10874	2.06	14880	2.89
3	Block A	14523	1.53	17238	1.74
4	Konark Master Plan area	12683	5.95	16979	9.38
5	Block B	7863	1.73	6872	1.97

Source: Census data, CEPT Analysis



Map 5.2 Population Density in PKDA 2001



5.2 Population Projections

Forecasting of population for 2031 has been analyzed in this section which will give us an idea of how much population we need to accommodate in the study region and within its different blocks. This will further help us in forecasting the future housing needs and infrastructure requirements in the region and urban centers in the area.

Major four methods have been applied to calculate the future populations which are:

- Arithmetic method of Population increase
- Geometric method of population increase
- Incremental method of increase and
- Decrease method of population increase

The final outcome of the population forecast is as per *Geometric Increase Method* on basis of the observation that the Growth rate of the region has a constant over the decades and in line with the present development trend.

During this exercise different blocks has been analyzed and forecasted as shown in the below table the forecasting methods and the outputs applied in Puri town and Puri Sadar area. After doing this consequent calculations final output has been formulated which is shown in the chart below and maps in the next page.

The summary of emerging issues which should be considered is:

- Puri town will be the major hub of growth in the area in future.
- Within the town peripheral wards will face rapid growth.
- Puri Sadar area will see steady growth due to spill over effect of Puri town.
- Areas within Konark NAC will face moderate compaction.
- The rural tract requires some planned interventions to grow and flourish.

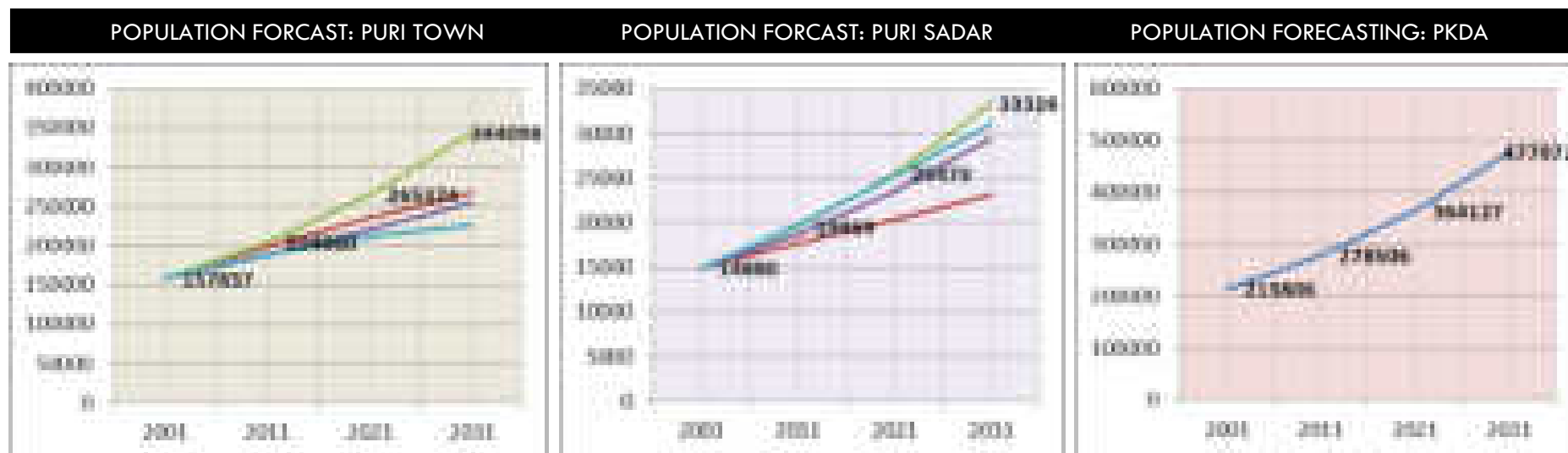
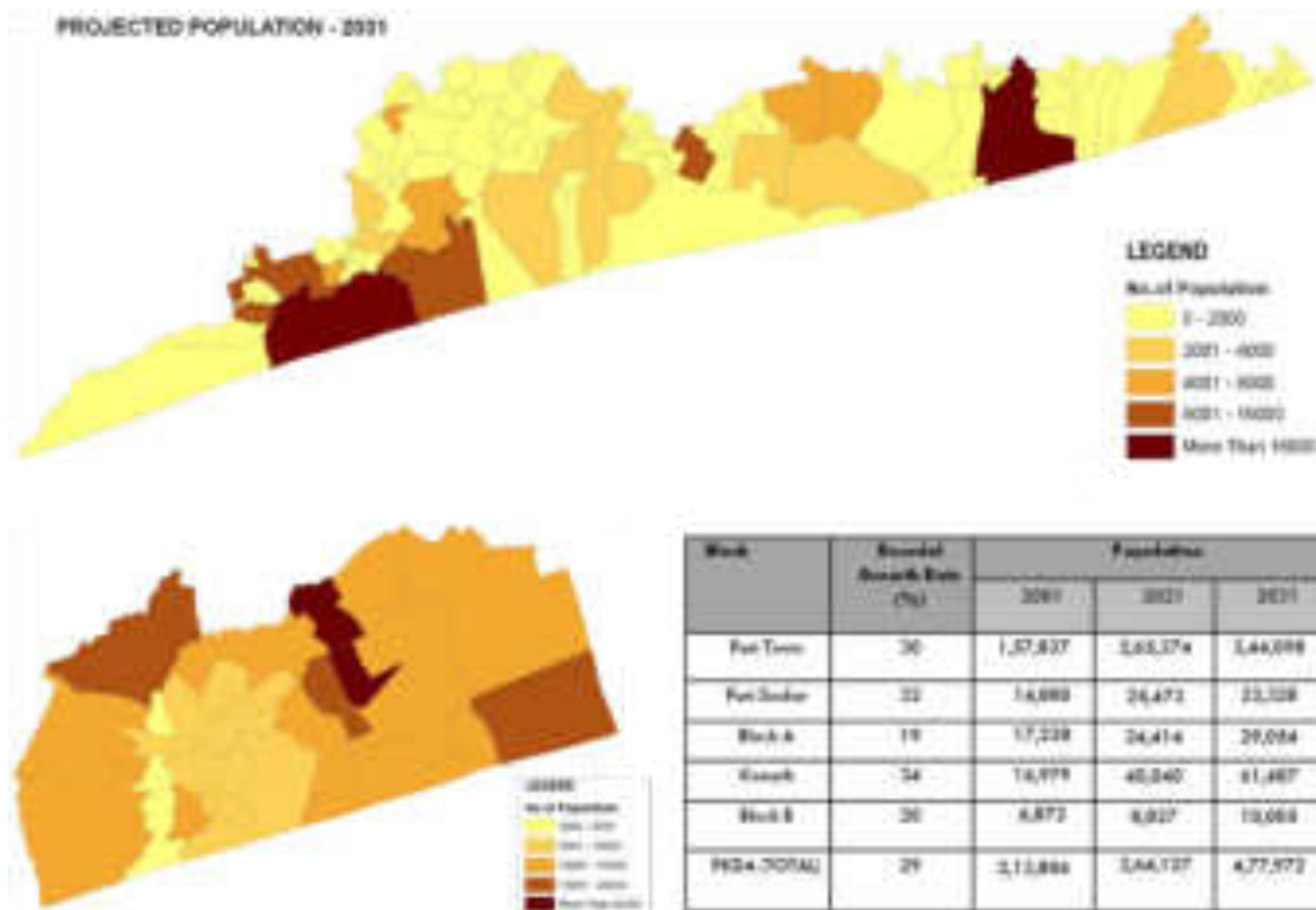


Table 5.3: Projection Alternatives for Puri and Puri Sadar

Method	2011		2021		2031	
	Puri	Puri Sadar	Puri	Puri Sadar	Puri	Puri Sadar
Arithmetic Method	1,98,798	17,622	2,36,279	20,364	2,68,044	23,106
Geometric Increase	2,04,660	19,469	2,65,374	25,473	3,44,098	33,328
Incremental Increase	1,87,994	18,679	2,20,449	23,534	2,54,975	29,445
Decreased Growth	1,88,159	19,692	2,12,391	25,175	225,928	31,050

Source: Census data, CEPT Analysis

Map 5.3 Projected Populations in PKDA 2031



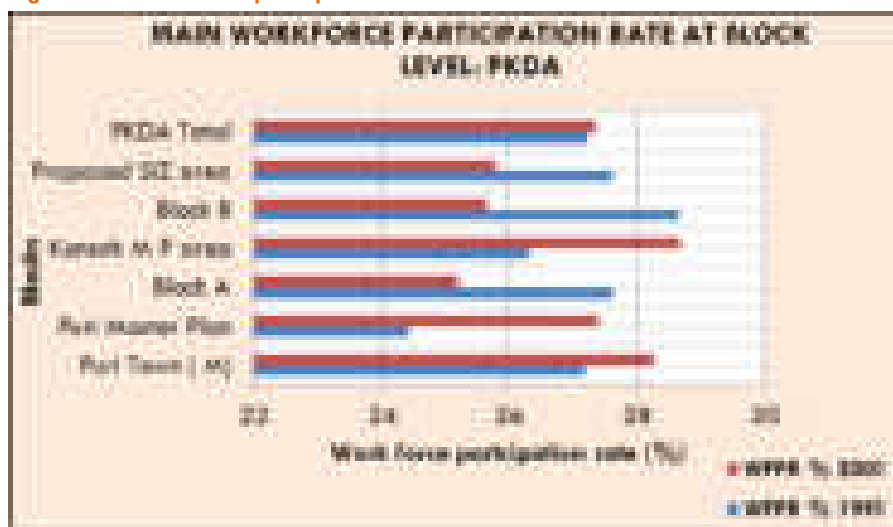
5.3 Socio-Economic Perspective

This section will try to explore the existing socio-economic fabric of the region in the form of sex ratio, workforce participation, literacy status, backward caste status etc. Basically through charts, tabulation and mapping existing socio economic scenario and trends has been understood to plan efficiently and accordingly.

5.3.1 Work force participation:

The workforce participation has been analyzed in the heads of main workers distribution, marginal workers distribution and total workers distribution. The analysis has been done at the block level in the whole region.

Fig 5.3: Main workforce participation: PKDA



Let us first look at the main workers distribution in the study area. The analysis in the chart below clearly indicates that main workers share is maximum in the town area where as it is less the rural tracts as most of the people there involved in agriculture and allied activities. The growth pattern also shows that % of main

workers in the city area has increased in the last decade where as it has decreased in most of the rural parts of the study region.

Table 5.4: Main workers Distribution: PKDA

Sr. No.	Spatial unit	Population 1991	Main workers 1991	Population 2001	Main worker 2001	WFPR % 1991	WFPR % 2001
1	Puri Town (M)	125199	34043	157837	44636	27.19	28.28
2	Puri Master Plan	10874	2657	14880	4078	24.43	27.41
3	Block A	14523	4011	17238	4350	27.62	25.23
4	Konark	12683	3338	16979	4871	26.32	28.69
5	Block B	7863	2254	6872	1764	28.67	25.67
6	Proposed SIZ area	69055	19071	75244	19420	27.62	25.81
PKDA Total		240197	65374	289050	79119	27.22	27.37

Source: Census data, CEPT Analysis

As far as the marginal workers distribution is concerned except the Puri Master Plan area everywhere the share has increased. As shown in the below table the villages are showing a steady increase in this category indicating that there may be a tendency of people shifting and sticking to traditional activities in the region.

The analysis indicates that rural to urban migration may be occurring in the region which is resulting in lowering of main workers in the villages and opposite phenomenon in the urban centers of Puri and Konark. Planning intervention is therefore of prime necessity.

Therefore measures should be adopted to incorporate the agrarian sector in the overall development scenario of the region and not exclude the same. May be rural based manufacturing sector can be strengthened to improve the diversity of activities in the rural areas to increase the economic base of majority of rural population.

Table 5.5: Marginal workers Distribution: PKDA

Sr. No.	Spatial unit	Population 1991	Marginal Workers 1991	Population 2001	Marginal Workers 2001	WFPR % 1991	WFPR % 2001
1	Puri Town (M)	125199	289	157837	2703	0.23	1.71
2	Puri Sadar	10874	810	14880	428	7.45	2.88
3	Block A	14523	151	17238	845	1.04	4.90
4	Konark	12683	156	16979	809	1.23	4.76
5	Block B	7863	127	6872	591	1.62	8.60
6	Proposed SIZ area	69055	951	75244	3916	1.38	5.20
PKDA Total		240197	2484	289050	9292	1.03	3.21

Source: Census data, CEPT Analysis

The table below shows the holistic distribution of workers in the study area. It is obvious from the analysis that overall increase in the workers share has not been much and in fact very low compared to other similar type region. This goes to show that, economy generating opportunities are very limited in the region and not expanding that much. Planned interventions are required to explore and invent job generating opportunities through expansion and introduction of different economic sectors.

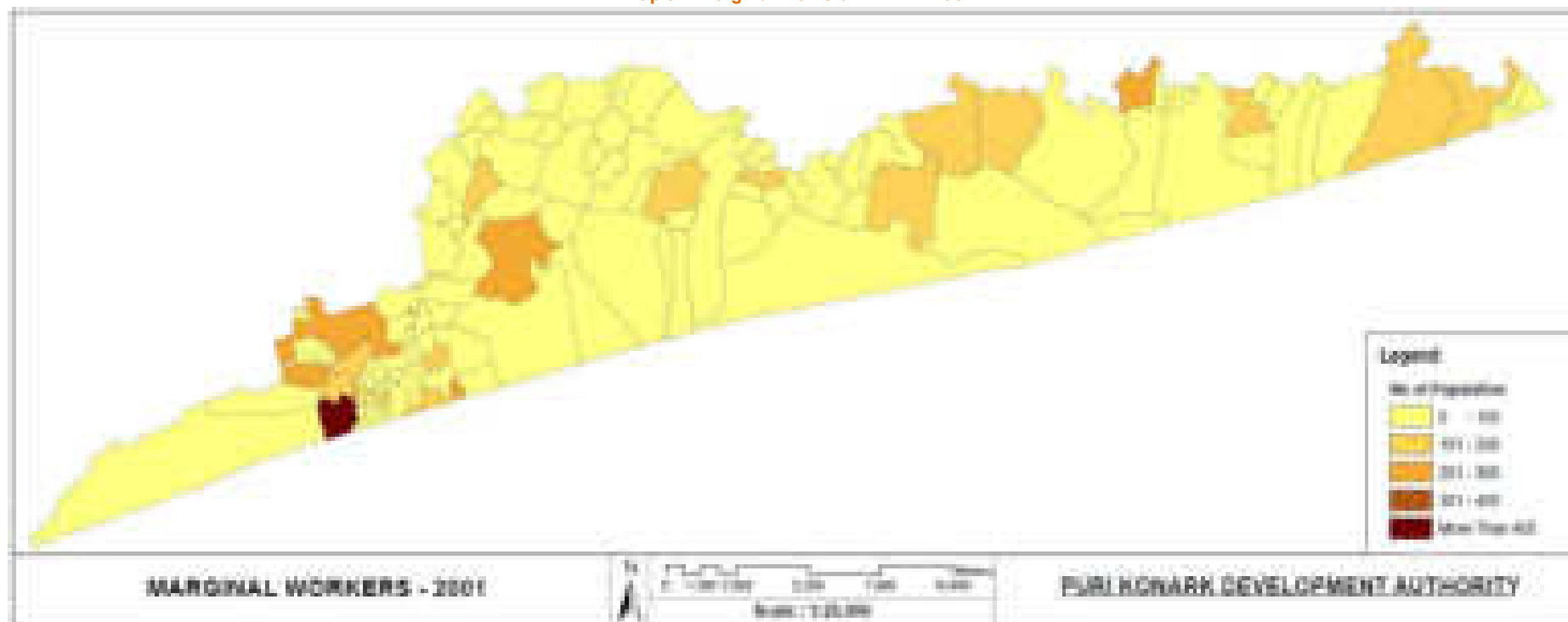
Table 5.6: Total workers Distribution: PKDA

Sr. No.	Spatial unit	Population 1991	Total Workers 1991	Population 2001	Total Workers 2001	TWFPR % 1991	TWFPR % 2001
1	Puri Town (M)	125199	34332	157837	47339	27.42	29.99
2	Puri Sadar	10874	3467	14880	4506	31.88	30.28
3	Block A	14523	4162	17238	5195	28.66	30.14
4	Konark	12683	3494	16979	5680	27.55	33.45
5	Block B	7863	2381	6872	2355	30.28	34.27
6	Proposed SIZ area	69055	20022	75244	23336	28.99	31.01
PKDA Total		240197	67858	289050	88411	28.25	30.59

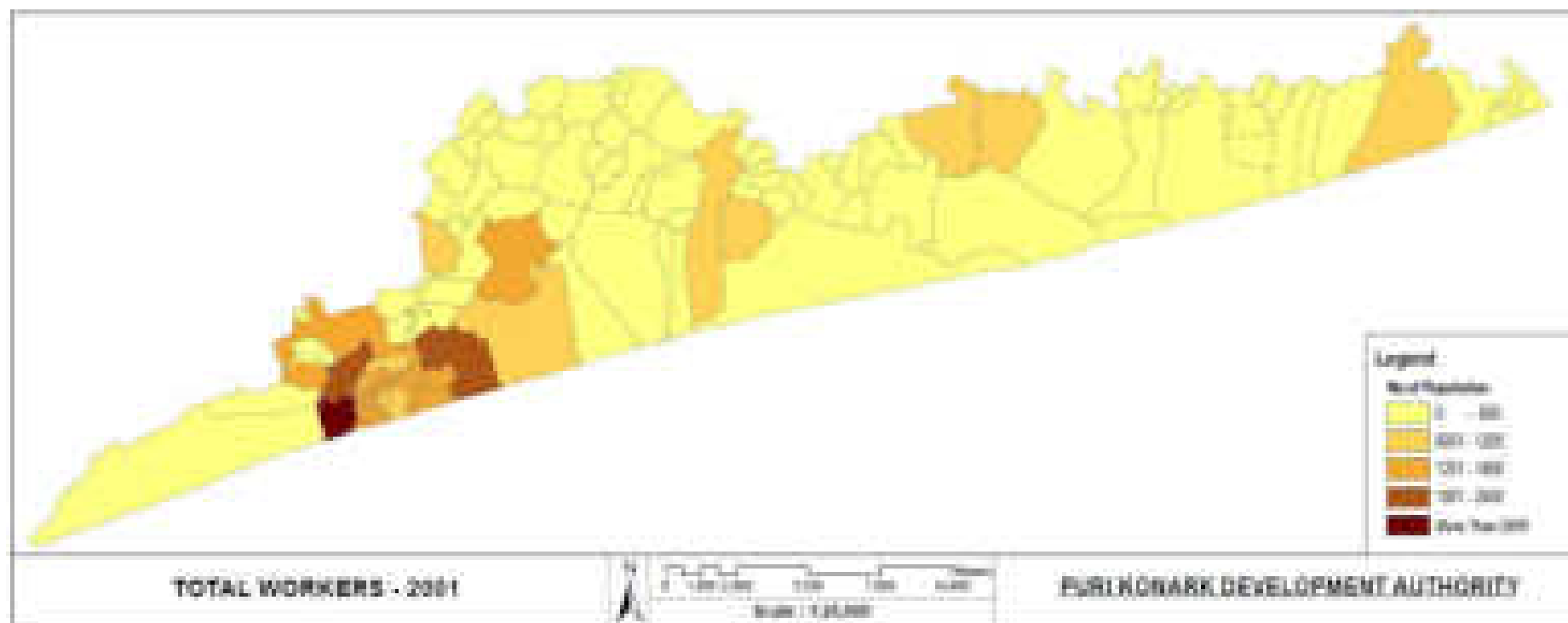
Source: Census Data, CEPT Analysis



Map 5.4 Marginal Workers in PKDA 2001



Map 5.5 Total Workers in PKDA 2001



5.3.2 Literacy Rates

Literacy rates in the region have shown a steady increase over the last decade giving a positive sign to the overall socio-economic development of the region. The below graph clearly indicates that compared to the year-1991 the year of 2001 is showing improved literacy rates.

Fig 5.4: Growing Literacy rate: PKDA

Female literacy rates as shown in the below tables are seen to be very low, although the same has increased in the last decade considerably.

The maps in the next page show that the literacy rate in the last decades have improved in the rural areas which is most commendable and positives coming out.



Source: Census Data, CEPT Analysis

Table 5.7: Literacy Rate-1991, PKDA

Sr.No	Spatial unit	Population 1991			Literate Population 1991			% of Literacy		
		Total	Male	Female	Total	Male	Female	Total	Male	Female
1	Puri Town (M)	125199	66508	58691	83077	48034	35043	66.36	72.22	59.71
2	Puri Sadar	10874	5636	5238	4962	3319	1643	45.63	58.89	31.37
3	Block A	14523	7332	7191	7149	4442	2707	49.23	60.58	37.64
4	Konark	12683	6594	6089	5419	3377	2042	42.73	51.21	33.54
5	Block B	7863	3985	3878	3851	2448	1403	48.98	61.43	36.18
6	Proposed SIZ area	69055	35403	33652	34329	21775	12554	49.71	61.51	37.31
PKDA Total		240197	125458	114739	138787	83395	55392	57.78	66.47	48.28

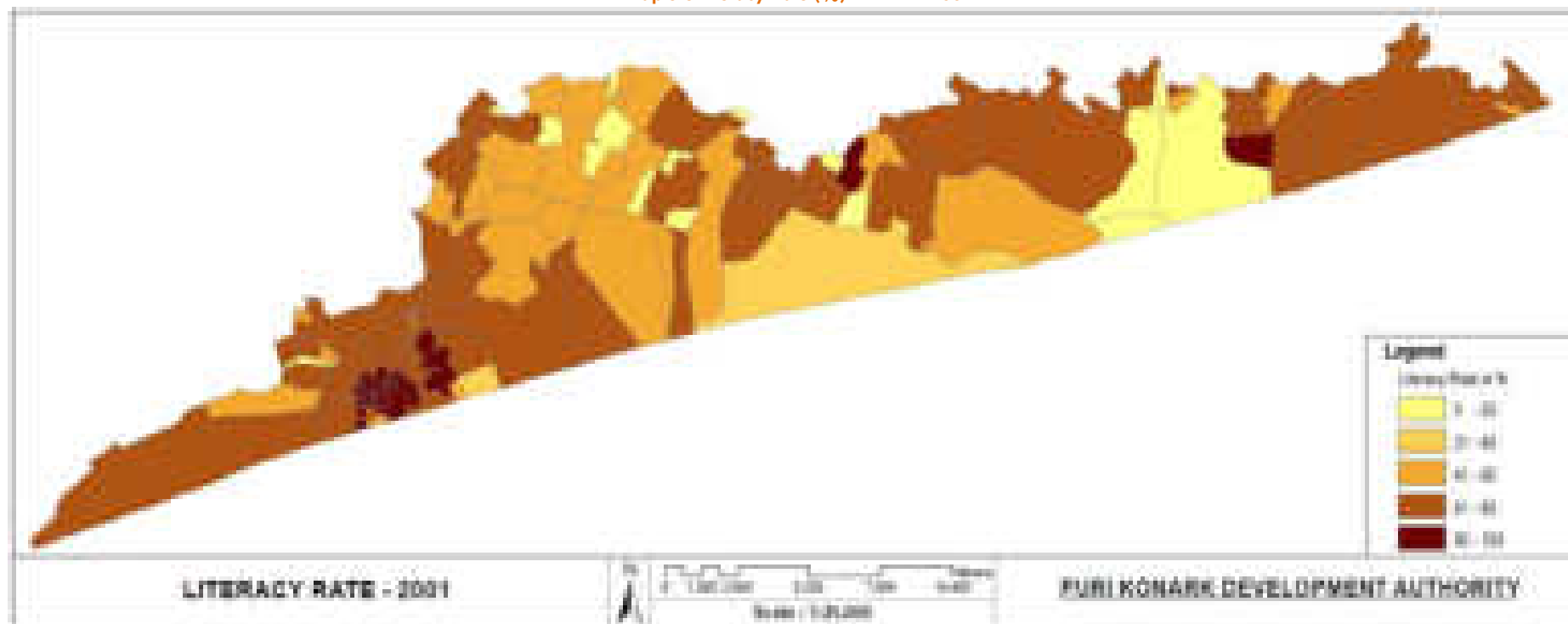
Source: Census Data, CEPT Analysis

Table 5.8: Literacy Rate-2001, PKDA

Sr.No.	Spatial unit	Population 2001			Literate Population 2001			% of Literacy		
		Total	Male	Female	Total	Male	Female	Total	Male	Female
1	Puri Town (M)	157837	82269	75568	116731	64617	52114	73.96	78.54	68.96
2	Puri Sadar	14880	7619	7261	9547	5575	3999	64.16	73.17	55.08
3	Block A	17238	8648	8590	11041	6286	4755	64.05	72.69	55.36
4	Konark	16979	8824	8155	9864	5773	4091	58.10	65.42	50.17
5	Block B	6872	3470	3402	4569	2612	1957	66.49	75.27	57.52
6	Proposed SIZ area	75244	38098	37146	49381	28747	20634	65.63	75.46	55.55
PKDA Total		289050	148928	140122	201160	113610	87550	69.59	76.29	62.48

Source: Census Data, CEPT Analysis

Map 5.6 Literacy Rate (%) in PKDA 2001



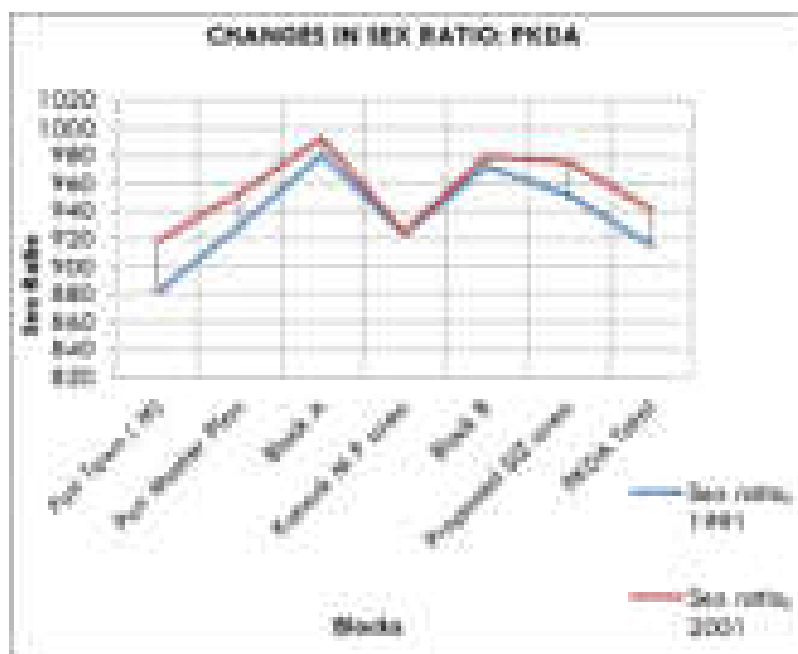
5.3.3 Sex Ratio:

Scenarios regarding sex ratio is also on a positive note as one can clearly see from the below diagram that in the last decade the sex ratio in all the parts of the region has increase at a steady rate. This probably due to rising education levels people are more aware now and away from devil thoughts.

Compared to urban centers rural areas have high sex ratio as seen in the table below which is primarily due to migration of working males into urban centers from rural places. This scenario is not different from the rest of the country but still should be tackled in an efficient manner.

As the trends shows that share of women in population is increasing along with literacy levels economic and social planning measures should be adopted in the strategic planning part in the CDP to provide adequate schooling and higher education facilities in the region as per demand.

Fig 5.5: Increasing sex ratio: PKDA



Source: Census Data, CEPT Analysis

Table 5.9: Sex Ratio-1991, PKDA

Sl.No	Spatial Unit	Population 1991			Sex ratio 1991
		Total	Male	Female	
1	Puri Town (M)	125199	66508	58691	882
2	Puri sadar	10874	5636	5238	929
3	Block A	14523	7332	7191	981
4	Konark	12683	6594	6089	923
5	Block B	7863	3985	3878	973
6	Proposed SIZ area	69055	35403	33652	951
TOTAL		240197	125458	114739	915

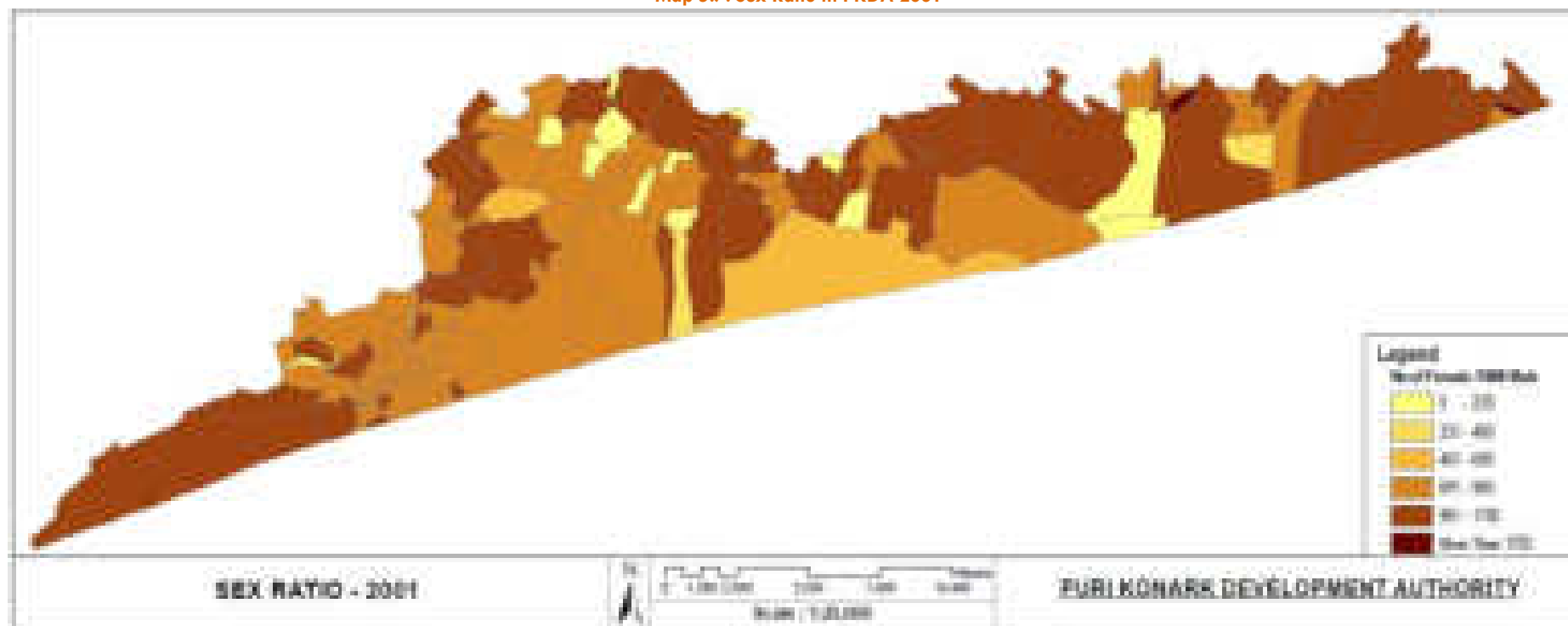
Source: Census Data, CEPT Analysis

Table 5.10: Sex Ratio-2001, PKDA

Sl.No	Spatial Unit	Population 2001			Sex ratio 2001
		Total	Male	Female	
1	Puri Town (M)	157837	82269	75568	919
2	Puri Sadar	14880	7619	7261	953
3	Block A	17238	8648	8590	993
4	Konark	16979	8824	8155	924
5	Block B	6872	3470	3402	980
6	Proposed SIZ area	75244	38098	37146	975
TOTAL		289050	148928	140122	941

Source: Census Data, CEPT Analysis

Map 5.7: Sex Ratio in PKDA 2001



5.3.4 SC and ST Population

Analysis of proportion and regional alignment of population of backward categories is a most important component of regional planning as it helps in reducing the regional disparity among classes with understanding and planning interventions for the classes.

The table below analyses the concentration and distribution of SC and ST population in Different blocks. It is quite clear from the study that urban areas has very low share of backward caste population where the same is high in interior rural PKDA.

One simple inference can be drawn from the analysis is that overall share of SC and ST population has decreased in the last decade considerably in the overall PKDA area although the share is quite high compared to normal.

Comparing between the two categories SC is the more dominating one in the region while ST population is only concentrated in interior rural regions mostly covered with forests.

The tables below show the distribution and % share of SC and ST population for 1991 and 2001 for different blocks in PKDA:

Table 5.11: SC & ST population-1991, PKDA

Sr. No	Spatial unit	Population 1991	SC_1991	ST_1991	Total SC + ST	% of SC & ST P	% SC to total SC & ST	% ST to total SC & ST
1	Puri Town	125199	12640	516	13156	10.51	96.08	3.92
2	Puri Sadar	10874	2395	42	2437	22.41	98.28	1.72
3	Block A	14523	2940	9	2949	20.31	99.69	0.31
4	Konark	12683	2902	18	2920	23.02	99.38	0.62
5	Block B	7863	2449	0	2449	31.15	100.00	0.00
6	Proposed SIZ area	69055	24088	848	24936	36.11	96.60	3.40
PKDA Total		240197	47414	1433	48847	20.34	97.07	2.93

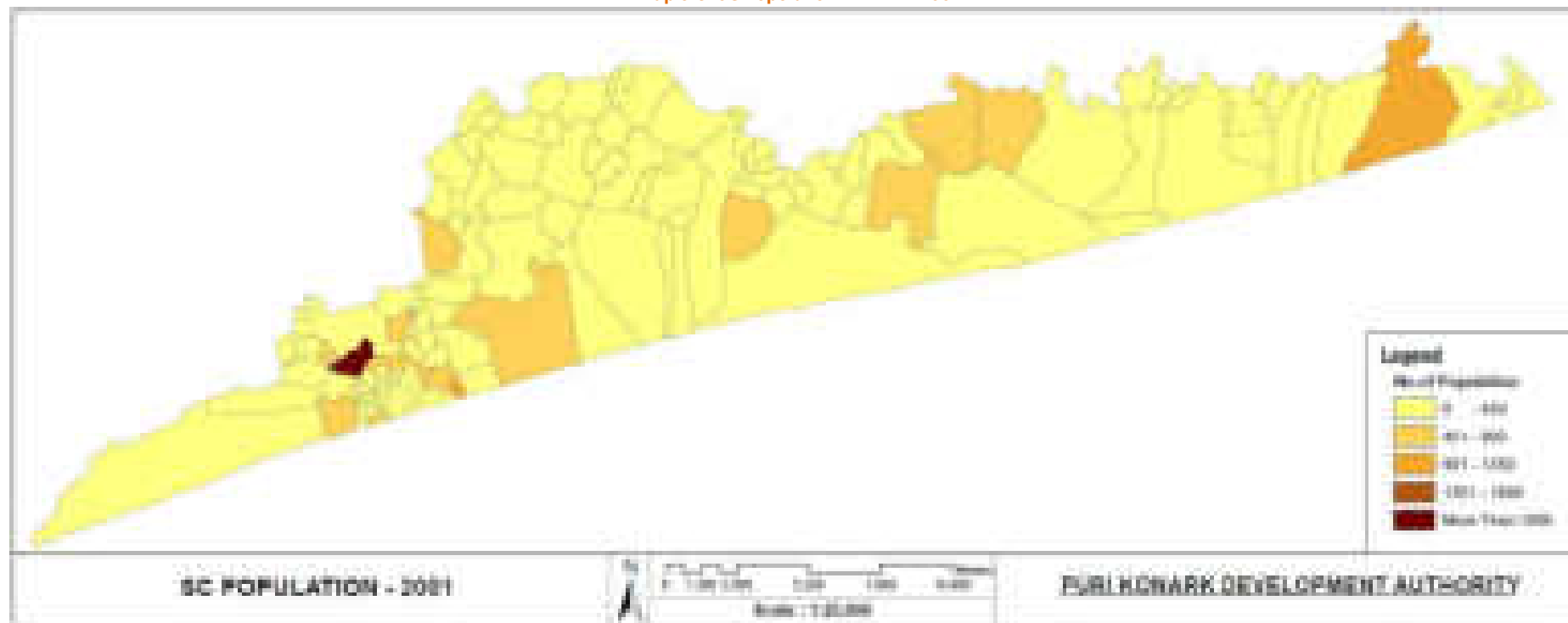
Source: Census data, CEPT Analysis

Table 5.12: SC & ST population-2001, PKDA

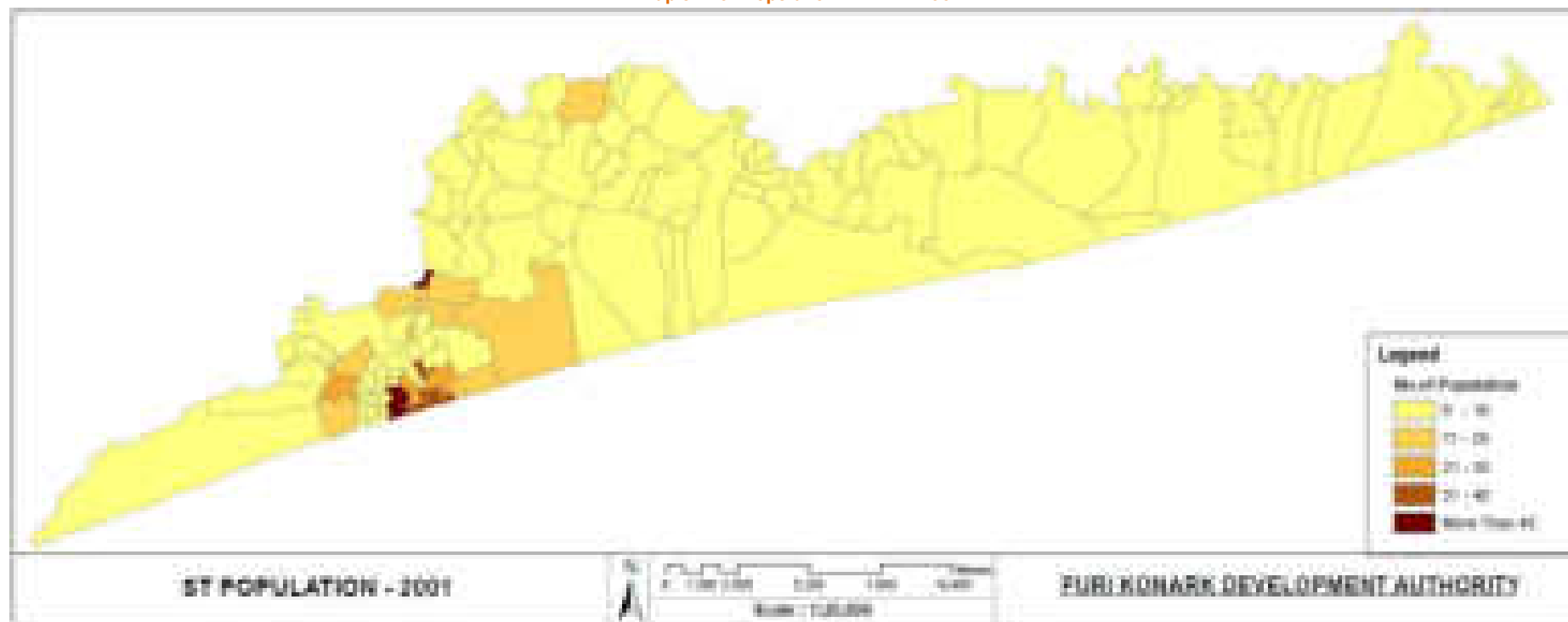
Sr. No	Spatial unit	Population 2001	SC_2001	ST_2001	Total SC + ST	% of SC & ST	% SC to total SC & ST	% ST to total SC & ST
1	Puri Town	157837	10550	337	10887	6.90	96.90	3.10
2	Puri Sadar	14880	3714	52	3766	25.31	98.62	1.38
3	Block A	17238	3485	0	3485	20.22	100.0	0.00
4	Konark	16979	3375	31	3406	20.06	99.09	0.91
5	Block B	6872	2264	0	2264	32.95	100.0	0.00
6	Proposed SIZ area	75244	14925	486	15411	20.48	96.85	3.15
PKDA Total		289050	38313	906	39219	13.57	97.69	2.31

Source: Census data, CEPT Analysis

Map 5.8: SC Population in PKDA 2001



Map 5.9: ST Population in PKDA 2001



5.4 Existing Sectoral Profile of Local Economy

To understand the study region and its economic diversity this section deals with profile and details of various sector activities and potentials for future will also be assessed. Basically broad sectors: namely primary, secondary and tertiary have been undertaken for detailed study for the purpose.

Puri, though a small temple town, attracts large number of people from different parts of India, many of who wished to settle down here for its status as the ultimate place of salvation. Normally, Puri locals comprise the original inhabitants of Puri, mostly consisting of the priestly order, artisans and others connected with the great temple. Flow of pilgrims from different parts of India in almost all seasons helps the locals earn their livelihood.

The general occupational structure and the socio-economic condition determine the lifestyle of the people of a particular locality. Puri being a cosmopolitan culture entertains various classes of people. The traditional class of persons of Puri consists of Temple Sevayats, Supakars and others as stated earlier. The most significant are the artisans, which consist of carpentars (Badhei), Painters(Chitrakaras), Potters (Kumbhakarars), Stone - carvers (Pathurias), Applique workers and other artisans engaged in manufacturing of different handicrafts like Patta Paintings, Palm-leaf carving, Seashell production etc.

Till the late 50s of the 20th century, Puri reigned as a pilgrim centre. The increase in flow of tourists from India and abroad have gradually introduced other functions to promote its economic activities. This section examines the different aspects of economic activities of the PKDA region.

The table shows the status and decadal shift of different tier activities in Puri Town. Being the prime population concentration and economy providing territory this data is of key significance.

Table 5.13: Sector wise workers distribution: PKDA

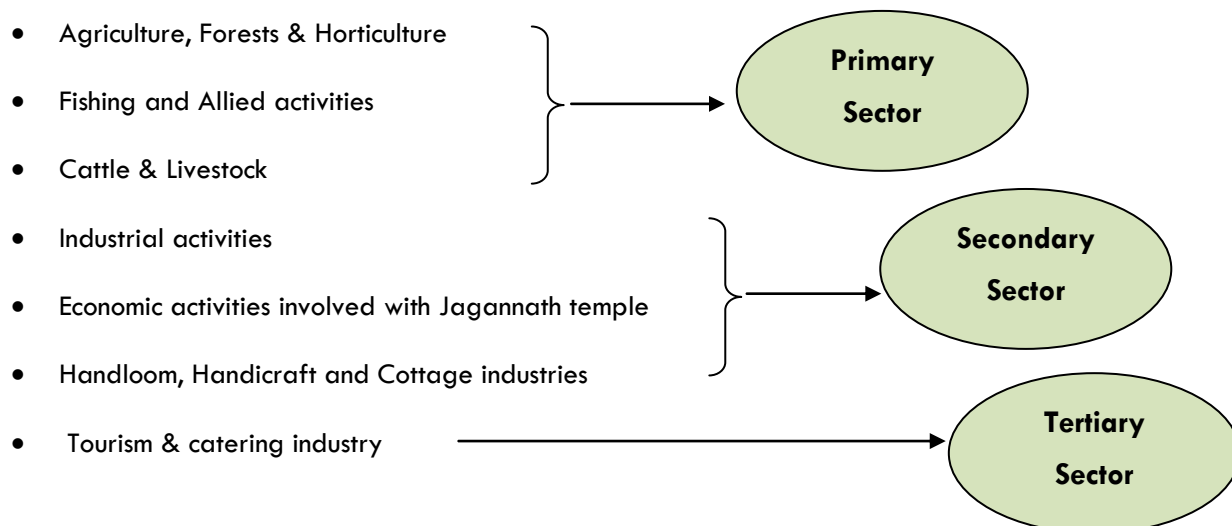
Puri Sadar						
	Primary	Secondary	Tertiary	Total Population	Workers	WPR
1981	2384	45	1234	8547	3663	0.428571
1991	1933	129	444	10874	2506	0.230458
2001	1361	200	2517	14880	4078	0.274059
Puri						
1981	629	1029	26799	100942	28457	0.281914
1991	706	1015	13326	125199	15047	0.120185
2001	219	1075	43342	157837	44636	0.282798
Block A						
1981	3372	22	377	12828	3771	0.293966
1991	3442	50	250	14523	3742	0.25766
2001	3264	91	995	17238	4350	0.252349
Konark						
1981	996	26	461	6436	1483	0.230423
1991	637	11	34	1784	682	0.382287
2001	1075	125	3158	15013	4358	0.290282
Block B						
1981	1219	12	187	4892	1418	0.289861
1991	1382	2	105	7863	1489	0.189368
2001	1451	51	487	6872	1989	0.289435

Source: Census data, CEPT Analysis



One is very clear from the table above is that there is a constant shift of population in the town from agriculture base to industry based and service based activities in the area. Although the rate of change has not been fast enough to grab attention and hence more economic planning intervention is highly essential to fasten the shift of activities to improve economic base of the region.

Listed below are the main economy drivers identified in the PKDA region:



5.4.1 Primary sector activities

5.4.1.1 Agriculture, Forests and Horticulture:

The State of Odisha is an agrarian state with Agriculture and Animal Husbandry Sector contributing more than 22.46 % to the Net State Domestic Product (NSDP) in 2006-07 at 1999-2000 prices and providing employment, directly or indirectly to 65 % of the total work force. The share of Gross State Domestic Product (GSDP) from Agriculture during 2004-05 at constant price (1993-94) and at current price (2004-05) is 21.4% & 26.4% respectively.

The agricultural activities largely involve growing of paddy, other cereals and pulses. The district is partly irrigated by the river delta system. Supply of water through canals tapers towards the tail, thereby creating two distinct zones i.e. head end with relatively abundant water availability and the tail end, with substantial water stress. The latter is a deprived zone reducing agriculture to subsistence level.

The below table shows the land use characteristics in various Agrarian blocks in Puri district studied:

Table 5.14: Land use characteristics: PKDA

District	Forest area	Misc trees and grooves	Permanent pastures	Cultivable waste	Non-agriculture land	Barren & uncultivable land	Current fallow	Other fallow	Net area sown
Puri	1586	4495	747	427	3092	7	3098	380	11910
Gop	3016	3176	1672	765	5438	472	1353	861	17605
Kakatpur	1886	596	1074	218	2781	458	156	349	8865

Source: Puri district collectorate, CEPT Analysis

Map 3: Share of uncultivable land: PKDA

Source: Puri district collectorate

The image above presents the share and percentage of uncultivable land within the study region. The PKDA region has very less area under agriculture. Puri sadar area has a high percentage of Agriculture land. The other areas like GOP and Kakatpur have high uncultivable land. Puri sadar area has good cultivable land and approximately 6-10% of uncultivable land.

The horticulture practices are largely coconut, mango, cashew nut, banana and betel leaves.

From the analysis it is prominent that the agriculture base is weakest in Block A, Block B and Konark areas in PKDA region and hence recommended that immediate interventions is required to improve agricultural activities in the same areas.

Irrigation:

The main crops are Kharif and Rabi. Both the crops are irrigated on minor and major irrigation projects. Another main crop grown in the region is paddy. Other than these, crops grown in the region are cereals (Rice), Pulses (Mung, Biri, Kulthi), Oil seeds (Ground Nut, sesamum, Mustard, Line seed), vegetable & cash crops (potato, onion & sugar-cane). Lift irrigation is practiced very less in the area as compared to the other types of irrigation.

The table below shows the area irrigated with different types of irrigation system in the blocks. The “S” shows the summer crop. The yield and production of paddy is found highest in summer. There is no paddy grown in Puri region in autumn. Puri, GOP and Kakatpur all the 3 regions has the highest yield rate in summer. But the production is seen to be highest in winter for all the three regions as the net area cultivated is high in winter. A very less tract of land is cultivated in autumn.

Then blocks comprising the study area are further analyzed to get a view of the area under irrigation and the yield rate in different season in those areas. It is seen from the below table that winter season is the time when maximum utilization of irrigation water has been done to increase area coverage and subsequently yield rates in the region.

Table 5.15: Irrigation Facilities: PKDA

	Major & Minor irrigation project		Minor (flow) irrigation project		Minor (lift) Irrigation project	
	kharif	Rabi	Kharif	Rabi	Kharif	Rabi
Puri	4232	3261	NA	NA	1065	575
GOP	8096	4729	NA	NA	1025	1344
Kakatpur	6046	2036	NA	NA	1785	2010

Source: Puri district collectorate



4'000 Ha is under cultivation for oil seeds in Puri. 146'000 Ha is under cultivation for Cereals. About 161'000 Ha is under cultivation for Food grains. A very less area of 15'000 is under cultivation for Pulses and 16'000 ha for Vegetables and Cash crops.

Table 5.16: Crop production in different seasons in PKDA

Area	Autumn			Winter			Summer		
	Area (hac)	Yield rate (Qtls/Ha)	Producn(MT.)	Area (hac)	Yield rate (Qtls/Ha)	Producn. (MT.)	Area (hac)	Yield rate (Qtls/Ha)	Producn (MT.)
Puri	NA	NA	NA	9584	20.7	199155	3573	29	103631
Gop	71	18.35	1303	13522	27.8	376773	4246	31.9	135432
Kaktpur	493	14	6904	8626	25.76	222199	2407	29.29	70493

Source: Puri district collectorate, CEPT Analysis

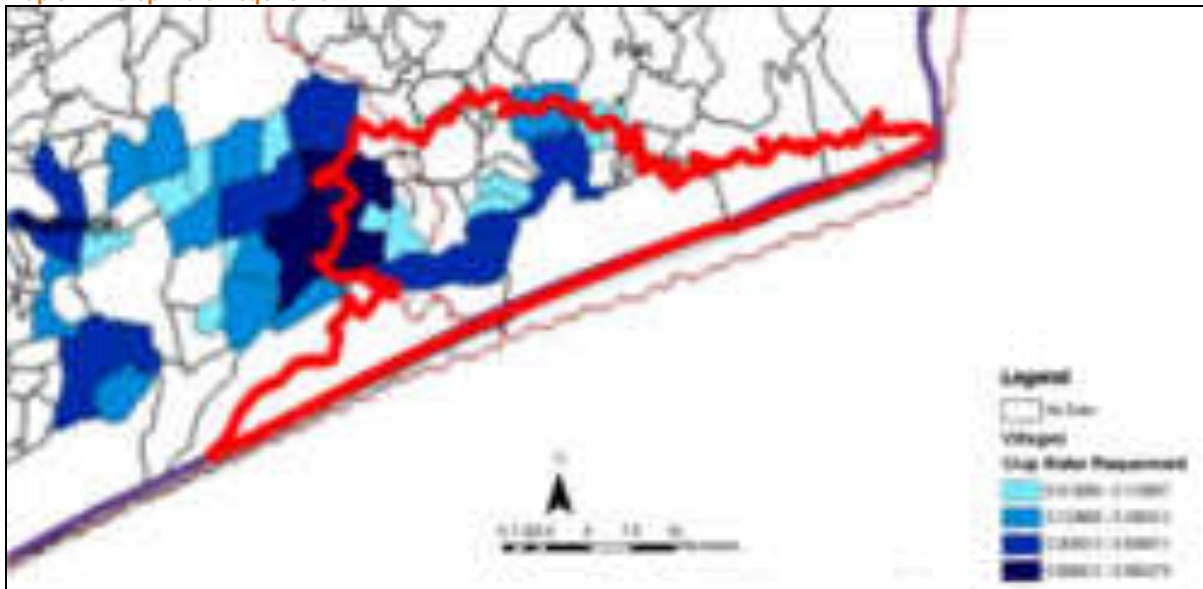
Table 5.17: Production of various crops: PKDA

Category	Crop	Area ('000 Ha)
Cereals		146
Pulses	Mung	4
	Biri	9
	Kulthi	2
	Total	15
Food grains	Total	161
Oil seeds	Ground nut	2
	Sesamum	1
	Line seed	1
	Total	4
Vegetables, cash crops	Total	16

Source: Puri district collectorate, CEPT Analysis

As most of the agricultural land is located in the Proposed SIZ area and a few scattered places of Block- A area majority of crop water requirement is felt at those places as shown in the map below:

Map 5.11: Crop water requirement: PKDA



Source: Puri district collectorate, CEPT Analysis

Fertilizers:

About 19 thousand metric tonnes of fertilizers were used in the district in 2005-06. Since the fertilizers and pesticides used for enhancing agricultural activity is low, the pollution threat to ground water and surface water from NO₃ and PO₄ in the district is minimal. Total amount of fertilizers used is high in GOP with high agricultural activities. Rain water management technique area also an effective means to dilute sub surface water to keep pollution within safe levels. From statistics it can be said that rate of use of fertilizers is lower than standards seen in developed agricultural districts. This is due to dependence on traditional form of agricultural practices in the region.

Table 5.18: Use of fertilizers in PKDA region

	Nitrogenous	Phosphatic	Potassic	Total
Puri	0.78	0.2	0.3	1.3
Gop	1.01	0.31	0.44	1.76
Kakatpur	0.29	0.14	0.18	0.61

Source: Puri district collectorate, CEPT Analysis

Production of different crops:

The below tables show the average yield rate and production of different crops in the Puri District under study. Yield rate for cereals is about 128'000 MT. Subsequently Pulses on 15 '000 Ha 4'000 MT is produced. 131'000 MT of Food grains, 3'000 MT of Oil seeds and 369'000 MT of Vegetables and Cash crops is produced on 161'000 Ha, 4'000 Ha and 16'000 Ha subsequently. The vegetables and cash crops seem to be profitable in compare to the other crop cultivated. The Average yield/Ha is also high for vegetables and Cash crops. So the total production of the Vegetables and cash crops is high. The average yield for Cereals is 9 Qtls/Ha, Pulses 8 Qtl/ha, Oil seeds 6 Qtls/Ha.

Table 5.19: Yield rate for different crops: PKDA

Category	Crop	Average yield (Qtls/Ha)
Cereals		9
Pulses	Mung	2
	Biri	3
	Kulthi	3
	Total	8
Oil seeds	Ground nut	2
	Sesamum	1
	Line seed	3
	Total	6
Vegetable and cash crops	Potato	121
	Chillies	9
	Ginger	20
	Turmeric	18
	Onion	65

Source: Puri district collectorate, CEPT Analysis

The data available here does not provide a detail understanding about region wise yield rate and production of different crops. In fact there is a wide range of variation we have seen from perception study. Major areas of Konark and Block B due to saline soil and water is still mostly unutilized which seems to be major area of concern.



Table 5.20: Production of different crops: PKDA

Category	Crop	Production ('000 MT)
Cereals		128
Pulses	Mung	1
	Biri	2
	Kulthi	1
	Total	4
Food grains	Total	131
Oil seeds	Ground nut	2
	Sesamum	-
	Line seed	1
	Total	3
Vegetables and cash crops	Total	369

Source: Puri district collectorate, CEPT Analysis

5.4.1.2 Fishing and allied activities:

The fishermen population of the state of Odisha is 10.84 lakh persons. Among 80% of the state population are fish eaters. So fishing is one of the major economic activities. The economic status of the fishermen is below poverty line. Odisha has mainly 3 types of aquaculture; fresh water fish, Marine water fish and brackish water fish. The fresh water fishery is carried out in privately owned ponds, rivers, streams, lakes or community water bodies. The marine water fishery, prawn culture, salt and sweet water fisheries are subjected to OMFRA (Odisha Marine Fishing Regulation Act).

Table 5.21: Fish production in PKDA region

	Fresh water (MT)	Brackish water (MT)	Marine water (MT)	Total (MT)
Puri	1117.9	-	16611	17728.9
Gop	841.68	-	99.23	940.91
Kakatpur	369.99	79.49	-	449.48
Konark	-	-	3196.89	3196.89
Odisha	6733	2009	27504	36046

Source: Puri district collectorate, CEPT Analysis

The table above reflects that Puri is the biggest producer of fish in the PKDA Area. The main fishing area of the region is Pentakota, an area of migrants from Andhra Pradesh. This area is classified as a slum area. This signifies that the economical status of these fishermen is below poverty line. Some of the important aspects of Fisheries in the PKDA region are:

- In the inland sector, production of quality fish seed continues to be one of the most important activities.
- The Highest fish catch is found in Puri (>60.1 MT/Year).
- Lowest fish catch is found in Kakatpur and Gop (2-15 MT/Year)
- There is no brackish water fishery in Puri and Gop
- There is no Marine water fish catch in Kakatpur region
- There is no fresh water and brackish water fish catch in Konark (NAC) region.
- Majority of slum dwellers in Puri town and Konark NAC are employed in Fish catching activities.
- Economy of the Villages in the coastal PKDA area is mostly dependent on this sector

**Fig 5.6: Fishing Activities in PKDA**

5.4.1.3 Cattle and Livestock:

The activities under cattle & live stock include:

- Dairy activities (stall fed animals, animal grazing on private pasture, animals grazed randomly or in nearby forest land)
- Goat & Sheep rearing (stall fed animals, animal grazing on private pasture, animals grazed randomly or in nearby forest land)
- Meat processing
- Poultry

Livestock in Odisha is high livelihood intensive and 80% of its rural households own livestock of one species or the other and earn supplementary incomes from them. The sector contributes 7.25 % the state's net domestic product and, therefore, development of the livestock sector is the total livestock in Odisha as per 2001 census is about 24 million excluding dogs.

Table 5.22: Details of Cattle & Livestock in PKDA region

	Male	Female	Total
Cattle			
Cross Breed	17301	68116	85417
Exotic	5	22	27
Indigenous	171717	204858	376575
Total	189023	272996	462019
Buffalo			
Indigenous	5160	11352	16512
Improved	43	94	137
Total	5203	11446	16649
Total (Cattle+ Buffalo)	194226	284442	478668
Sheep			
Cross Breed	80	227	307
Indigenous	26333	48401	74734
Total	26413	48628	75041
Goat			
Cross Breed	12	12	24
Indigenous	39583	80521	120104
Total	39595	80533	120128
Pig			
Cross Breed	2	2	4
Indigenous	790	1265	2055
Total	792	1267	2059
Fowl			
Desi			140376
Improved			125698
Total			266074

Source: Puri district collectorate, CEPT Analysis

Out of the total livestock population, cattle population account for about 59% (about 14 million), Buffaloes account for about 6 % (more than 1million), Goats and Sheep account for about 33 % (about 8 million) and Pigs account for about 3% (about 1million). Besides, the percentage of genetically cross breed animals in Odisha account for about 6 % for cattle, about 2 % for Buffaloes and less than 1% and Goats and Sheep. The concentration of the livestock is the maximum in the coastal districts. The production of milk in 2002-2003 was about 1million tones with per capita availability of about 70 grams per day only. The amount of production of milk, meat, egg and per capita availability is given in table –13. The production of meat, milk and eggs are very low in comparison to other States of the country.



There are about 463019 cattle in Odisha in 2007. The poultry and duck population in Odisha are about 18 million. The State has 9 poultry and duck breeding farms. In 2002-2003, about 1100 million eggs were produced and this amounts to about 30 eggs per person per annum, one of the lowest in the country. There are about 71 poultry producer's cooperative societies. It is found that the total cattle population is much lesser compared to other states in India. To improve the socio-economic standard of the general public, different Animal Husbandry and Dairy development programs are being implemented through fisheries and ARD department. To provide nutritional food, the department aims at increasing the milk, egg & meat production of the state through scientific breeding, feeding and management practices. Overall it can be stated that cattle and livestock related activities form the base of the local economy in PKDA region and special proposals should be formulated for mainstreaming the activities.

5.4.2 Secondary sector Activities:

Odisha is rich in mineral resources. There are no major industries in the region. But there are few small scale industries. There are several small and medium scale industries in Puri that play a phenomenal role in shaping the town's economy. Tourism, handicrafts and cottage industries are an important segment of the economy. The coastal location of Puri facilitates the burgeoning of fishing and its allied industries. Agro based industries, forestry units, marine based industries, units manufacturing leather and leather products as well as tourism have mushroomed in the town.

Table 5.23: Details of Industries in PKDA

	Industries Activities- 1	Industrial Activities-2	Industrial Activities- 3
Alasana	Rice Milling		
Alikia	Rice Milling		
Balipada	Printing		
Baliput	Rice Milling		
Barana	Rice Milling		
Birabalabhadrapur	Readymade Garment		
Biragobindapur	Rice Milling		
Birapratappur	Ready Made Garment		
Chandanpur	Rice Milling	Rapeseed oil	Printing
Harekrushnapur	Bricks		
Jagannathapur	Processed Spices		
Kaliakera	Rice Milling		
Maltipatpur	Bricks		
Naiguan	Rice Milling		
Talajanga	Cement Concrete	Cement Slabs	
Atharanala	Prawns frozen		
Atharanala alias Jitkar Muduli patana	Synthetic resins		
Gopinathpur alias Routrapur	Bricks		
Kharipada	Rice Milling	Polythene bags	Wooden product

Source: Puri district collectorate

Tourism industry shares major portion of the economic map of Puri. The handicraft industry and cottage industries have also flourished widely in Puri.

The handicraft and cottage industry also include silver filigree work, stone carving, bone work, horn work, appliqué work, patta painting, and bamboo sticks, artifacts made of sea shell, bell metal ware, coir and furniture making. The classification of industrial activities within the Villages of PKDA area and presented in the table beside.



Basically rice milling and Brick works and garment industry are the major activities carried out in the PKDA region under study.

Fig 5.7: Rice Mill in Puri



Fig 5.8: Brick making industry



Although the region has considerable proportion of secondary sector activities as seen the table still there is no formal structured method for industrial development in the region which should be promoted through economic planning interventions in the CDP.

5.4.2.1 Small scale Activities:

Ample natural resources and intensive human labour force has always been the backbone of success to large base of small scale secondary activities in Puri district. The district and the study area within it show a lot of diversity in terms of number of secondary activities carried out in the region and most importantly the quality of materials produced.

In Puri, Small Scale Industries are consumer oriented and encompasses fisheries, handicrafts and rice milling. The total number of registered small scale industrial units in Puri is 949, though there are many other units involved unofficially in the production process.

The small scale industries in Puri are classified into the following types:

- Agro-based
- Marine based
- Leather manufacturing
- Forest based
- **The small scale industrial units of Puri include agro- based industries includes:**
 - Snacks, molasses, coir, cashew processing, sauce, ice cream, squash, pickles, jams and jellies and the like.
- **Marine based small scale industries are :**
 - Processing of prawn pickles, shrimps and dry fish. (The Nulias of Puri are principal social groups involved in fishing industries.)
- **Other small scale units are:**
 - Manufacture leather based products, such as shoes, bags and belts.
- **Forest based industries of Puri includes:**
 - Bee keeping and manufacture of wooden furniture, beedi, ethyle, sisal rope, Sal seed oil and bamboo sticks.
- **Food production related:**
 - Rice milling and extraction of edible oils from rice are also preferred small scale industries in Puri.



Fig 5.9: Products of Handicraft Industry: Puri

5.4.2.2 Economic activities associated with Jagannath Temple:

The Brahmins play an important role in rendering different religious service to the pilgrims like Sradhha, Sankalpa, and Jagya etc. The Brahmins of nearby Sasan village around Puri use to sit on Mukti Mandap and offer prescription (Byabastha) containing Puri factory advice (prayaschita Bidhi) for different social sins. The gifts and donations of the pilgrims constitute their livelihood.

Fig 5.10: various Economic Activities associated with Jagannath Temple

However the most significant are the artisans, consisting of carpenters (Badhei), Painters (Chitrakaras), Potters (Kumbhakaras), Stone – carvers (Pathurias), Appliqué workers and other artisans engaged in different handicrafts like Patta Paintings, Palm-leaf carving, Seashell production etc. All such artisans have linkage with the Jagannath Temple and the products have tourist's attraction. Their economic activities are more oriented and influenced by the lifestyle of Sevayats.

Around 175 carpenters including helping assistants and specialized team carpenters who have hereditary rights to build the chariots is another major livelihood and economic activity. These carpenters (Badheis) of Puri are engaged in the construction of the

massive chariots (Rath Yatra) every year.

Similarly the Tailors (Dargi) stitch the cloth of the chariots (Raths) and flag (pataka) for the temple, the jewellers (Bania) are associated with the preparation and repair of ornaments of the temple Lords, the carriers (Bojhia) of Mahaprasad all entertain a sense of pride being associated with service (Seva) to Lord Jagannath temple.



The Golden beach offers tourists the rare opportunity of witnessing the colorful sunrise and sunset on the same beach where they can bathe and laze for hours on the golden sands. One can also see and enjoy traditional fishermen playing their catamarans or sail boats and drawing into their nets rich catches of prawn, pomfret and other fish on this long and wide beach extending for miles.

Fig 5.12: Various attractions in Puri: Jagannath Temple, Puri beach



The other attraction of Puri is its ancient villages where one can find the oriyana value and culture. Raghurajpur the artesian village is a living museum itself. Every household here has a painter and can show the age old traditional paintings painted lavishly on canvas, silk and other varieties. Pipili is a craft village famous for appliqué work. One can find series of shops decorated with many appliqué works with bright colors. The varieties are like umbrellas, lamp shades, wall cloths, table covers, sofa covers, children clothes, bed covers and many more.

Sakhigopal known otherwise as Satyabadi is famous for the shrine of Lord Krishna. Although the temple was built during the 19th century, the legend is very strong. Sakhigopal is surrounded by full of coconut trees. One can visit villages in Sakhigopal. Visits to the villages become more enjoyable during the festive seasons.

The important monuments of the town are:

- Jagannath Temple, Puri
- Gundicha Temple, Puri
- Shyamakali Temple, Puri
- Siddha Mahavir Temple, Puri
- Swethaganga Tank, Puri
- Lokonath Temple, Puri
- Jambeswar temple, Puri
- Karar Ashram, Kriyayoga Teaching & Meditation Centre, Puri

Chilika Lake:

It is the largest inland lake in the country spreading over 1100 square kilometers. The Chilika is a paragon of Nature's beauty. The hills inside the lake namely Deepamundia, Kalijugeswar, Ghantasalia, Soleri, Bhaleri and Jatiya create beautiful scenery during sunrise and sunset. Dotted with many emerald green islands with colorful names such as Honeymoon Island and Breakfast Island, Chilika is the home to a rich variety of aquatic fauna. It is also the sanctuary and winter resort for migratory birds, some coming from as far as Siberia.

Fig 5.13: Chilika and Islands in it



Fig 5.14: Sunset from Chilika Lake



Fig 5.15: Wildlife at Chilika



The lake is a natural aquarium of about 160 varieties of fish. Chilika is home to about 150 species of birds. One third of which are permanent residents and the remaining two third are migratory birds such as Siberian cranes, Flamingoes that come from the Persian Gulf and Pelicans from the north which make the lake their home during the winter season.

One can persuade the local fisher folk to take a person on one of their native wooden boats. Satapada is another retreat in the bosom of the nature of Chilika Lake. The thrilling sight of dolphins round the year and abundance of migratory and resident birds in winter make Satapada a preferred place for a tryst with nature.

Most important factor that needs to be counted is that the tourists come to visit the places passes through Bhubaneswar and Puri corridor and visits places in-between possess tourism opportunities.

Konark:

Konark (35 km from Puri), known the world over for the magnificent Sun Temple, is just an hour's drive from Puri. The Sun Temple, now a UNESCO World Heritage Site, is widely considered as one of the most stunning monuments of religious architecture in the world. At Konark, immortalized in stone, by the sea, is a 13th century paean of victory transformed forever into the famous sun Temple of Konark.

Fig 5.16: Konark Sun Temple



The great building work at Konark is the inspiration of King Narashima of the Ganga dynasty, today, is partly in ruins because of its close proximity to sea and the softness of the ground. The construction of sun temple took 1200 masons and sculptors for twelve years and cost the state exchequer of twelve years of revenue. Many poets of India have celebrated the beauty and grandeur of Konark temple in their verses. So it is little difficult to describe the architectural achievements of the temple.

The porch alone rivals the great temple at Bhubaneswar in height and is superior in art to anything else built in Odisha or may be anywhere else. Some of the gigantic statues like the war elephants or the famous horses show the artists' power of expression and carpenters' skill in handling such massive materials. And yet the scenes of love and war, of dance and music have been furnished with superb attention to details. The lady with the suggestion of an enigmatic smile on her lips, the amorous coupé for whom the rest of world is irrelevant or the horse, brimming with power in every limb is the product of the hands and minds of masters.

Fig 5.17: Dance Festival at Konark Sun Temple



The focal points of the whole complex are the images of Sun God that represent the morning, midday and sunset. The images are bursting with power and grace. The whole temple was conceived with intricately carved out gigantic wheels at the basement. This revolutionized architectural conceptions. The images of the sun God standing or mounted, wearing knee length riding boots, alluding power and majesty are majestic & mesmerizing. Museum of the

Archaeological Survey of India preserve the rare collection of sculpture from the ruins of the Sun Temple. Konark Beach ebbed by sand dunes, off the Bay of Bengal, is an ideal beach for sunbathing. It also provides a glimpse of traditional fishing life. An early morning view of the sunrise here is memorable. Balighai Beach is an isolated silver arc, lapped by the sea, girdled by casuarina forests.

Heritage and traditional values mingling with natural gifts makes this one of the most attractive destinations for the tourists from across the country and the world. Although there are plenty of positives exist about this place there are problems of lack of infrastructure and accommodation facilities in the NAC region which is the major areas of concern and needs to be developed properly to protect the image of the site and the region.

Bhubaneswar:

Lingaraj Temple dating back to the beginning of the 11th century, dedicated to Lord Shiva, serves as a pinnacle of Odisha architecture. The 54 meter spire of the temple dominates the Bhubaneswar landscape. Set in a walled compound, the Lingaraj is surrounded by smaller votive shrines and neighbours Bindusagar and Ananta Vasudeva. The Lingaraj compound has another outstanding temple, dedicated to Parvati. Open only to Hindus, the Lingaraj temple is the site of major Shivaratri festival in Feb-March, when the night preceding the new moon thousands of pilgrim light lamps in a nightlong ceremony of devotion.

11th century Raja Rani temple is aesthetically endearing, sculpted with graceful feminine figures. Another such ancient temple, Parasurameswara, a 7th century Shiva temple, classical in style is situated in Bhubaneswar. Khandagiri and Udaygiri caves, twin hills honey combed with Jain caves that reveal the sculptural art of the 2nd century BC make an interesting study of the life and times of Jain ascetics. Dhauli is the site of the Kalinga battle where Asoka's edicts (3rd century BC) are inscribed on rock. The illustrious Shanti stupa or peace Pagoda commemorates the event. Nandan Kanan, The garden of the gods, is a sprawling wildlife and botanical garden with a pellucid lake. It is also a home of the rare white tiger, lion and crocodile.

Fig 5.18: Tourism Destinations in Bhubaneswar



5.4.4 Attractive tourist spots within Study Area

The study region being culturally rich has a variety of attractions for tourist mainly visiting for holy and recreational purposes. The major places of attractions in the study area are shown in the map below are: Puri temple and Puri beach located in Puri Town area, Konark temple in Konark NAC, Ramchandi temple and Chandrabhagha area situated in-between the Puri and Konark areas. Through necessary planning interventions heritage conservation and development of such places is perquisite.

Map 5.12: Important spots within PKDA

Source: CEPT Analysis

5.4.4.1 Fairs & Festivals:

Odisha being a land of ancient and sacred temples, where three religions flourished, is thronged by pilgrims throughout the year.

Festivals in Odisha are mesmerizing in their raw energy, religious favour and a splash of colours juxtaposed with rhythms that vary from district to district and tribe to tribe. The religious undercurrent in events of all origin and purpose unite the festivals and fair in a harmony of dances, music and Yatras.

Enamoured with temples across its landscape, Odisha hosts a number of temple festivals especially related to Lord Jagannath at Puri including the world famous Rath Yatra or the Car Festival.

Fig 5.19: Ratha Yatra in Puri

Odisha constitutes many tribal communities especially in its south-western districts, the festivals in Odisha also include tribal festivals and fairs that are sometimes intriguing, sometimes bewildering but always entertaining. Some of the tribal festivals include Chaita Parva and Bali Yatra.

Festivals in Odisha are not restricted to temples and tribal festivals but are also concerned with celebrating the cycle of life with all its joys and sorrows. To showcase the varied folk tradition and cultural heritage of Odisha, there are several special festivals being organized in Odisha such as the Puri Beach Festival, Konark Festival and Kalinga Festival.

Fig 5.20: Chandan Yatra

Table 5.24: Details of major festivals in PKDA region

Sl No.	Major Festivals	Month	Days
1	Devasnan Purnima	June	1
2	Shree Gundicha(car festival)	June- July	1
3	Shree Gundicha(Return car festival)	July	8
4	Bahuda	July	1
5	Suna Vesa	July	1
6	Dakshinayan Yatra	July-August	1
7	Parsva Parivartan Yatra	August	1
8	Debothapan Yatra	October	1
9	Odhan Yatra	November	1
10	Pusyabhisekh	December	1
11	Uttarayan	January	1
12	Dolo Yatra	March	5
13	Damanak Yatra	April	1
14	Chandan Yatra	May	21

Source: Puri Municipality, CEPT Analysis

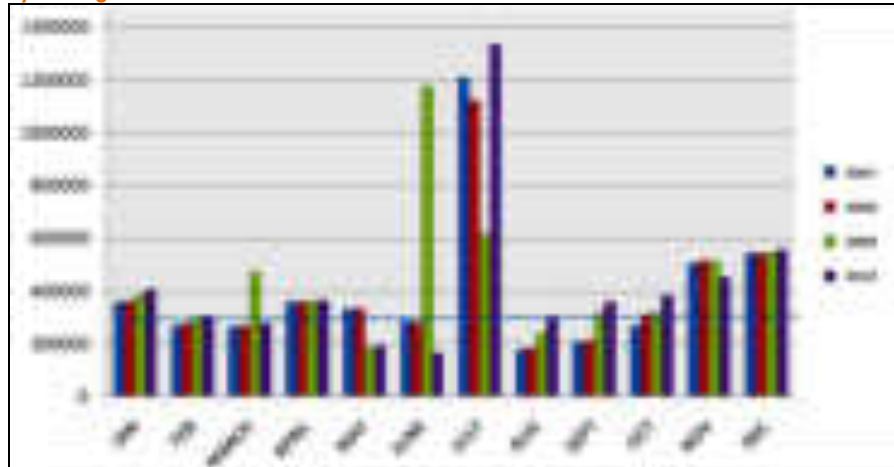
5.4.5 Tourist Population:

Puri is endowed with rich natural resource, visual feast of color variety picturesque tourist potential and a cultural journey to one of the oldest civilization in the world. It has scope for tremendous tourist potential owing to great monuments resulting in abundant tourist flow in to the region as shown in below table for last four years of tourist flow to Puri town. The rich tourism potential of the place can be used as an effective medium to promote overall growth and generate employment in the region.

Table 5.25: Tourist Inflow in PKDA region

Tourist centre	2006			2007			2008		
	Domestic	Foreign	Total	Domestic	Foreign	Total	Domestic	foreign	Total
Puri (Hotel Occupancy)	17,59,626	14,627	17,74,253	19,93,454	7,675	20,11,129	22,12,466	17,025	22,29,491
Puri (Day visitors)	51,56,758	14,763	1,71,521	51,81,810	7,700	51,99,510	48,80,375	7,629	48,98,004
Konark (Day visitors)	20,77,360	8,573	0,85,933	20,90,400	0,050	21,00,450	20,55,600	9,110	20,64,710
Konark (A.S.I.entry ticket)	11,96,500	7,883	12,04,383	13,47,483	9,917	13,57,400	14,71,082	9,067	4,80,149
Ramachandi	1,64,390	3,218	1,67,608	1,70,611	3,250	1,73,861	1,80,700	1,127	1,81,827
Beleswar	50,370	12	50,382	54,785	22	54,807	56,820	27	56,847
Kakatpur	1,85,770	-	1,85,770	1,95,410	-	1,95,410	1,99,313	-	1,99,313

Source: Puri Municipality, CEPT Analysis

Fig 5.24: Monthly average tourist inflow at Puri

Source: Puri Municipality, CEPT Analysis

The major tourist circulation routes in Puri town during normal season and peak season are mapped below:

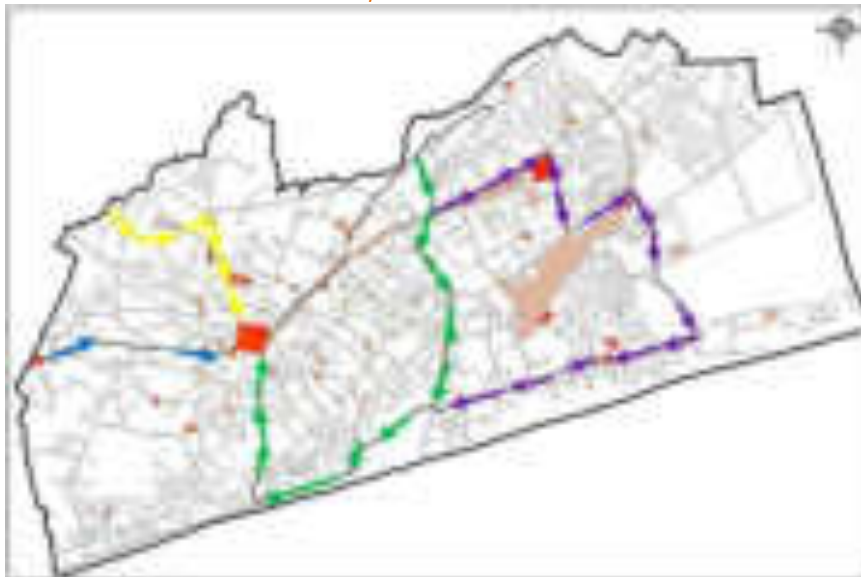
Map 5.13: Direction of Tourist flow in Normal season, Puri**Map 5.14: Direction of tourist flow in peak season, Puri**

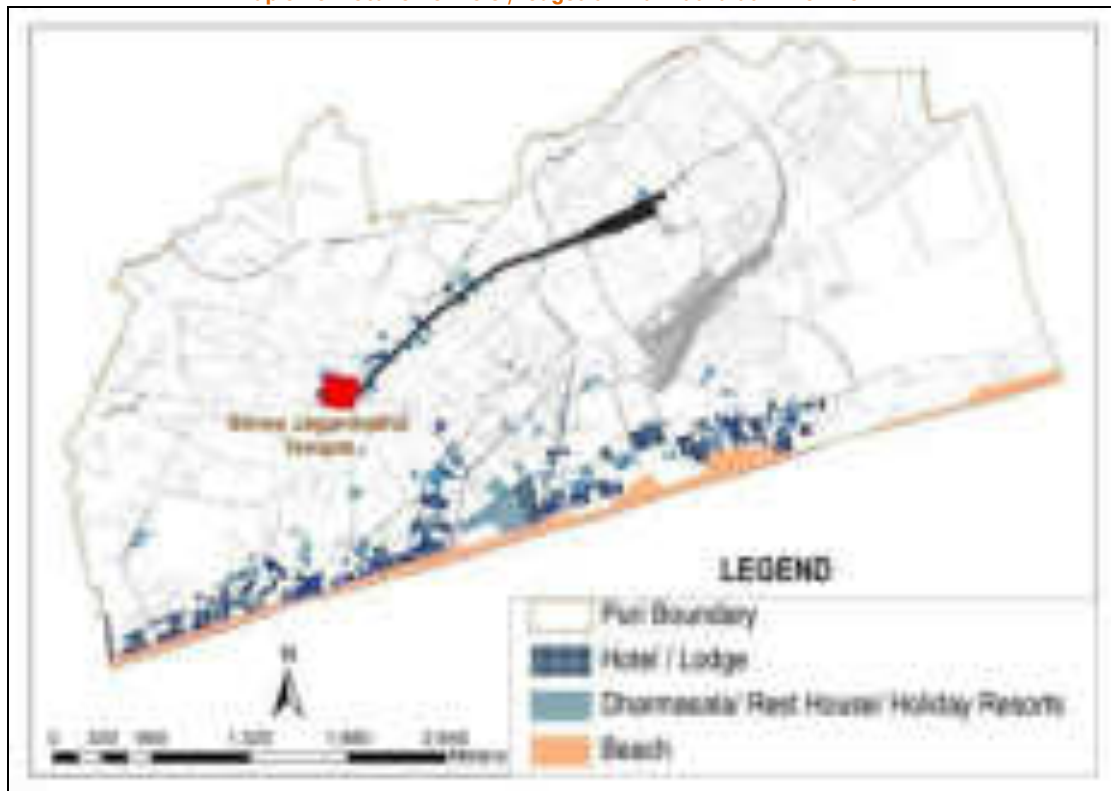
Fig 5.25: Festive time activities at Puri

Various accommodation facilities are provided in both urban centres of Puri and Konark for tourists and floating population coming in different season. The below table and maps provide an outline of them:

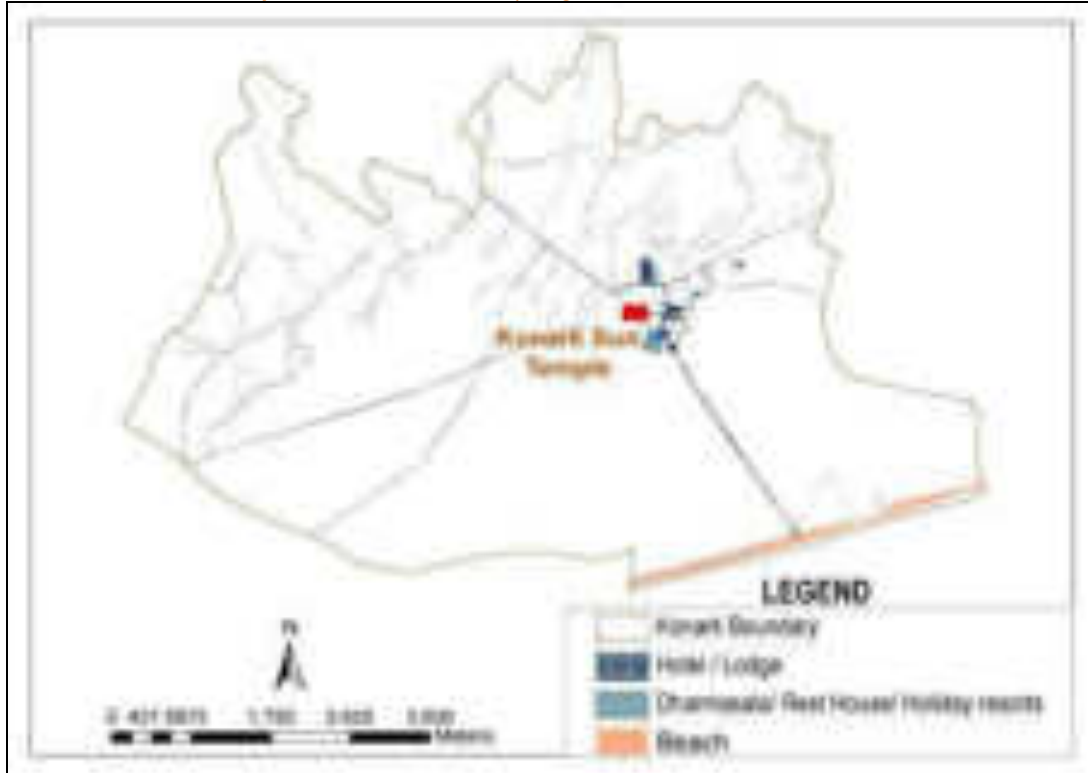
Table 5.2: Accommodation facilities in PKDA region

Classification	No. of hotels	No. of rooms	No. of beds
High Spending Group	57	1928	4119
Medium Spending group	65	1768	3965
Low Spending group	218	3286	6862
Total	340	6982	14,946
Dharmasala	6	267	1150
Holiday Home	15	300	

Source: Puri Municipality, CEPT Analysis

Map 5.15: Location of hotel/Lodges & Dharmashalas in Puri Town

Source: Puri Municipality, CEPT Analysis

Map 5.16: Location of Hotels/Lodges & Dharmashalas in Konark

Source: Puri Municipality, CEPT Analysis

Although Puri Town and Konark has lot of heritage importance and tourism potential still not much attention has been paid for planned development and management of the spaces in the areas. The town area during tourist season faces enormous challenges which are not been answered and tackled with. Some of the major issues related to tourism are as follows:

- Lack of liveable units during peak season to accommodate huge inflow of tourists visiting especially during Rath Yatra
- Road and traffic infrastructure is inadequate and hence Congestion and traffic problems during the peak season are a routine scenario.
- Lack of parking facilities during peak season results into on-street parking.
- Street vending in major tourist routes is creating congestion due to narrowing of roads and gatherings on the same.

Therefore the need of the hour is to regulate, plan and manage this sector which is the major economy and employment generation option for the whole region of PKDA.

5.5 Summary and Conclusion

The summary of issues identified through the above analysis of demographic and economic sector which should be incorporated for proposals in the CDP are as following:

- The pattern in share of population in the region show that Puri town and Konark are getting crowded by increasing share over the decades where as the rural belts is losing the overall population share.
- The decadal growth trend indicates that peripheral zones of the Puri town which constitutes of Puri Sadar area is showing higher growth rate than other areas in the region.
- The above two statistics clearly points towards effective rural to urban migration taking place in the region. Therefore measures should be taken to create employment opportunities and

strengthening agricultural base in the rural part of the region. Adequate infrastructure and housing provisions should also be taken care off in the urban centres which can prevent spreading of slums and degradation of urban environment.

- From the workers distribution analysis it can be clearly stated that working population share especially main workers share is highly concentrated in the Puri town and surrounding area where as the population in the rest of the region lacks adequate opportunities and engaged in marginal sector. This should be tackled by promoting specialized secondary and tertiary based activities suitable to local fabric in the rural belt of PKDA.
- Literacy status in the region has increased considerably in the last decade. The rate in Puri town has increased from 66% to 73% between 1991-2001 where as the in the same time line the regional literacy rate has increased from 57% to 69%. This will lead to increasing demand for higher educational institutions and schooling provisions which should be well incorporated in the provisions for social infrastructure in the CDP.
- The overall sex ratio in the PKDA region has increase from 882 to 919 persons/000 males in the last decade. The same increasing trend has been seen in all the blocks constituting the region. This can be taken as a positive phenomenon and provisions and activities as well as awareness should be promoted to provide equal opportunities for women in the region.
- The concentration of backward castes in the Puri town and surrounding area has increased in the last decade. People have migrated from interior areas for working opportunities are living in informal settlements in the town. Special attention should be given to the minorities through formal schooling, job opportunities for equitable growth.
- Primary sector activities in the form of agriculture, fishing and forest based activities are still employing a considerable share of population in the region. The sector should be further strengthened by promoting household based activities, manufacturing and use of modern technologies in the activities.
- Handicrafts and handloom products of the region is of high class and very attractive to the consumers. Use of technology for greater outputs and Marketing of the products is the need of the hour to promote and strengthen the sector.
- Tourism is the backbone of local economy in the towns and overall region. Various attractions in and around the region attracts tourists in plenty. There are still a lot of opportunities to be explored through specific area planning, beach development, sanctuary development etc in the sector to improve the tertiary sector in the region.
- Accommodation facilities for tourists in the region especially in the town are far below than the demand. Therefore adequate accommodation facilities should be developed through private partnerships to meet the demand.
- Increasing trend of floating population during peak seasons leading to more infrastructure demand in the region especially in Puri town. Adequate proposals should be given for special tourism infrastructure development in the area.

6. Housing & Slum

6.1 Introduction

Housing is one of the basic requirements of the population and key to overall development of a region. Sometimes people tend to perceive wrong about housing by defining the arena of the sector to only residential units. But in real sense and practicality it is a process of developing an area, and offering a space to reside, recreate and some time work also. Therefore it is not only residential units but also the interlinked space and infrastructure which define the housing terminology and compound of the same. This chapter will try to explore the various issues related to the same:

6.2 PKDA: Overview of Housing Scenario

Here is an overview of the Housing sector in the study region analyzed for different blocks. Basic data on population, number of households, occupied houses and household size has been clubbed together to link and compare between blocks. Major housing concentration is seen in Puri Town where as the rest of the Zones have very less population and housing concentration. Therefore for detailed study we will concentrate on Puri town area and Konark NAC where major requirements are availing for planned housing interventions.

From the statistics presented in the below table it is quite apparent that the growth of households in the urban areas and the peripheries has been rapid in compare to the rural areas in the region. Also the household size in the urban areas have decreased slightly over last few decades whereas the same has decreased abruptly in the rural area namely Block-B etc. this is primarily due to migration of working and young population to urban areas seeking employment opportunities.

Table 6.1: Overview of housing condition in PKDA

Blocks	Year	Puri Sadar	Puri Town	Block A	Konark	Block B
Population	1971	6654	72674	10794	4960	5324
	1981	8547	100942	13474	6440	4888
	1991	10874	125199	15290	12683	7802
	2001	14880	157837	17238	16979	6872
No of Households	1971	1277	14519	1627	862	881
	1981	1510	18867	2024	1083	793
	1991	1792	23062	2332	2131	1208
	2001	2819	30969	3272	2853	1598
No of Occupied residential Houses	1971	1123	12764	1463	700	734
	1981	1365	16447	1731	850	591
	1991	1689	20980	2088	1910	1077
	2001	2709	27500	3080	2650	1390
Household Size	1971	5.48	5	6.63	5.75	6.04
	1981	5.82	5.35	6.66	5.95	6.16
	1991	6.29	5.43	6.55	5.95	6.46
	2001	5.52	5.1	5.54	5.95	4.25

Source: Census data, CEPT analysis



6.3 Ground Checking of Existing Housing Situation

6.91 Sq. km of the total area is developed as residential in the PKDA area. The development is concentrated in the Puri urban area growing radically outwards from the Jagannath Temple. There are small hamlets showing low density residential development along NH -8 and other major state roads. Around the UNESCO protected Konark temple there are clusters of residential development growing towards the sea area towards the south and fertile agricultural areas at the other side.

6.3.1 Puri Town

The existing Residential Land Use development in the town area comprises of

- Planned / plotted houses
- Multi Storied Housing
- Project housing / housing schemes / quarters
- Irregular layout / varying plot size houses
- Clustered settlement / engulfed villages in urban areas
- Slums / Squatters
- Scattered Houses
- Dilapidated Houses

Table 6.2: Overview of housing condition: Puri town

Ward No	Total Pop	No. of HH	% of Total	HH Size	Sex Ratio
Ward 1	6146	1157	3.74	5.31	979
Ward 2	3535	644	2.08	5.49	954
Ward 3	4536	822	2.65	5.52	924
Ward 4	3641	649	2.10	5.61	899
Ward 5	7392	1487	4.80	4.97	956
Ward 6	8847	1863	6.01	4.75	965
Ward 7	4047	740	2.39	5.47	885
Ward 8	4411	824	2.66	5.35	895
Ward 9	4570	820	2.65	5.57	948
Ward 10	4570	824	2.66	5.55	999
Ward 11	4315	789	2.55	5.47	901
Ward 12	3534	663	2.14	5.33	1002
Ward 13	4353	840	2.71	5.18	846
Ward 14	4341	811	2.62	5.35	871
Ward 15	4779	841	2.72	5.68	955
Ward 16	4086	800	2.58	5.11	857
Ward 17	4152	823	2.67	5.05	940
Ward 18	4681	916	2.96	5.11	909
Ward 19	4026	817	2.64	4.93	929
Ward 20	4555	687	2.22	4.27	753
Ward 21	5201	1029	3.32	5.05	916
Ward 22	5787	1260	4.07	4.59	925
Ward 23	4925	1070	3.45	4.6	908
Ward 24	5566	1199	3.87	4.64	913
Ward 25	6683	1416	4.57	4.72	985
Ward 26	6226	1348	4.35	4.62	919
Ward 27	6650	1444	4.66	4.6	903
Ward 28	6822	1357	4.38	5.03	906

Source: Puri Municipality



The major planned and plotted development has come in the last decade due to change in demand pattern rising in the present context where as the irregular and unplanned housing developments and dilapidated housing conditions is seen in the older part of the city areas except Grand road which although located on the older core of the city still having planned structures with a bit variations in-between. This is primarily due to location of high income households in the part of the town area.

Fig 6.1: Planed Development in Atharnala road



Large cluster of residential development is near Swargadwara area, south of Jagannath Temple. Other large hamlet of the same kind is towards north near Atharnala Bridge.

The residential development along the Swargadwara area and around the Jagannath Temple, primarily comprise of irregular layout/varying plot sizes (24.65% of the total residences in Puri Urban area). Towards the Gundicha temple and towards the Atharnala Bridge the residential development is comprised of Quarters/Project housing/Housing scheme which sums up to 26.36% of the total residential area in the urban areas of Puri. Thus it is evident that the households initially developed during the growth of Puri were around the Jagannath temple, comprised of houses with irregular layouts and varying plot sizes.

Fig 6.2: Mixed use development in PKDA



The area has reasonably less slum. Most of the houses of the fishermen community by the sea shore are found to be “kutchra” and in dilapidated condition (constituting to 16.43%) with some of the slums are also concentrated on both the sides of the railway station. Apart from the above mentioned categories of residential development, planned/plotted houses have a major share (24.04%); they are located along the Grand road and towards the Atharnala Bridge.

Fig 6.3: Housing in Poor Condition



The multi-storied houses constitute a very less number compared to the other categories of residences and are found scattered along the Grand road within the irregular layout category and the planned/plotted houses (only 2.06% of houses among all the types of residences in the urban area).

Majority of the residential development falls under the categories of clustered settlement and irregular layout. Photographs illustrate the typical residential cluster in the Puri Urban area. Houses of Puri are normally laid adjoining to each other having roadside front yards or porches. Residential development in most parts of the city does not exceed 3 floors above ground level.

Majority of the houses in Puri and surrounding areas are constructed by conventional construction practices and are of brick masonry and concrete. Typical house form of Puri has narrow frontals and generally is quite deep having a small light shaft or courtyard in the centre.

Overall the existing housing scenario in the town is moderate which should be upgraded with planning interventions along with new housing augmentation through development of housing schemes.

6.3.2 Konark NAC

Fig 6.4: Development along Roads



Konark NAC has grown rapidly between 1981-'91 due to its local government status and associated facilities provided in urban centre. In the last decade the growth although normalized due to location of reserved forests and seashore around the centre.

Most of the residential development in the NAC is towards the north of the Konark temple where there is flat land available for urban expansion.

Fig 6.5: Traditional Housing: Konark



Prime residential developments have occurred along the roads in the area as seen in the picture. Also major commercial centres and administrative offices are located in the same areas. The development in the areas is not at all planned and more in haphazard fashion. Infrastructure shortage is a major area of concern in the centre.

Fig 6.6: Traditional Bungalow in Konark



Clustered houses, village settlements are located in other directions of Konark temple rather than north of it.

Some of the visible house types are captured and presented side by side to get an idea about the type of residential developments in the areas.

Large number of irregular/varying plot size houses makes it difficult to manage and market of land and real estate thereby has not been able to get any ground in the urban centre.

Planning intervention in the form of TP Scheme or land pooling etc mechanism should be adopted to improve the land market.

6.3.3 Intervening Villages

The intervening areas between Puri and Konark have monotype typical rural agrarian house type. Most of the houses are mud built with either thatch made or tile made roof. The houses are very scattered except the Proposed SIZ area where some large cluster village settlements are found. The houses in the village are well decorated by paintings on the wall as can be seen in the below image depicts the cultural identity of the place

Major areas adjoining to Puri town is sprawling and growing in haphazard fashion which is the major cause of worry. In future it can be more complex and therefore planned Housing development in the peripheral regions/villages to urban centers is the need of the hour.

Fig 6.7: Different types of rural houses in PKDA region



6.4 Existing Scenario and Trends

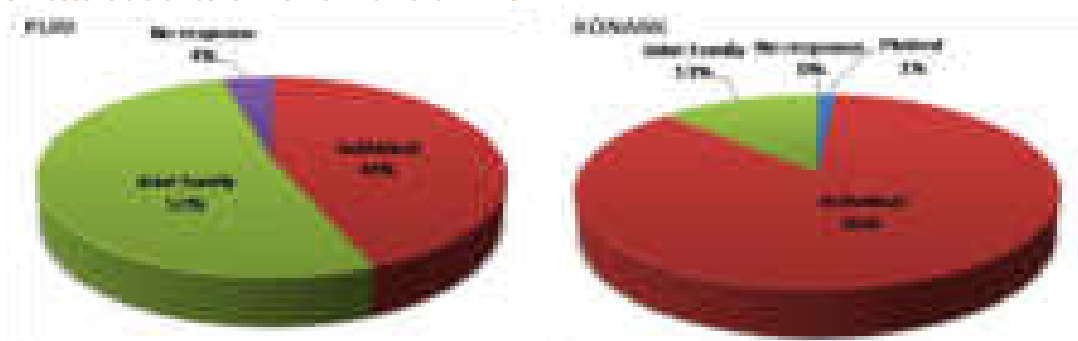
For detailed understanding of the housing scenario in the region socio-economic survey has been conducted in both Puri Town and Konark NAC where major housing clusters are located. The analysis is done for the following set of parameters:

- Household Distribution
- Ownership Pattern
- Type of dwelling units
- Floor area/Person Ratio and
- Nature of dwelling units (Number of Floors, age of House)

6.4.1 Household Distribution

Distribution of household gives an idea about the socio cultural process through which communities are evolving. From the chart below it is apparent that people of Puri is still continuing with Joint family structure where as in Konark NAC it is individual oriented? This is basically due to fresh migration of few members to Konark areas where as Puri is mostly constituting of old population.

Fig 6.8: Household distribution: Puri town & Konark NAC



Source: CEPT survey & Analysis



6.4.2 Ownership Pattern

The charts below show the housing ownership status for both Puri and Konark areas. In Puri due to tourist inflow and temporary housing demand rental accommodation share is more than Konark. Largely the ownership is individual type in both the areas where as informal and unclear land ownership status found in core of Puri due to location of slums in the town.

Fig 6.9: Ownership pattern: Puri town

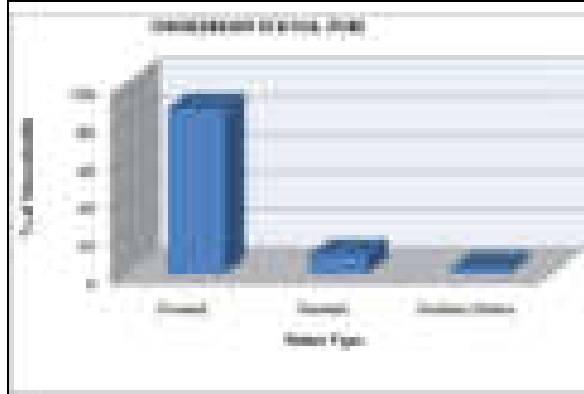
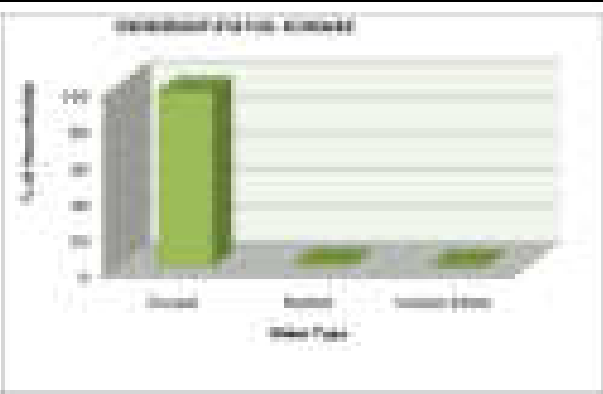


Fig 6.10: Ownership pattern: Konark



Source: CEPT survey & Analysis

6.4.3 Distribution of Household by type of Dwelling Unit:

As far as type of dwelling unit is concerned condition of Puri town is far better than Konark NAC. From the graph beside it is apparent that 68% of the surveyed buildings were pucca where as the share is only 36% Konark NAC. This is due to inclusion of rural areas in Konark territory.

Share of Temporary and Kutcha houses again in Konark is larger than of Puri due to the same reason. Except the slum areas the house condition in Puri is moderate. But Konark housing condition has to be ranked as poor and needing immediate interventions.

Fig 6.11: Type of housing units: Puri

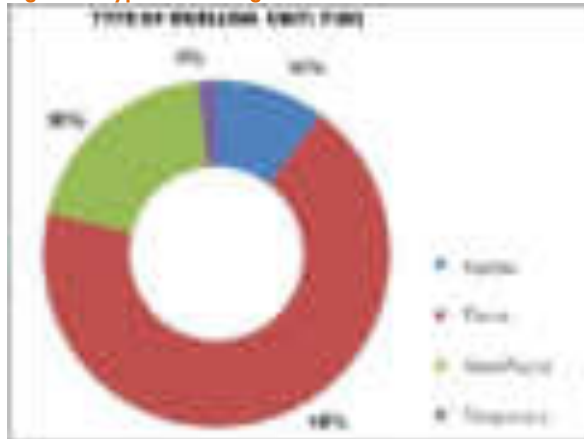


Fig 6.12: Type of housing units: Konark



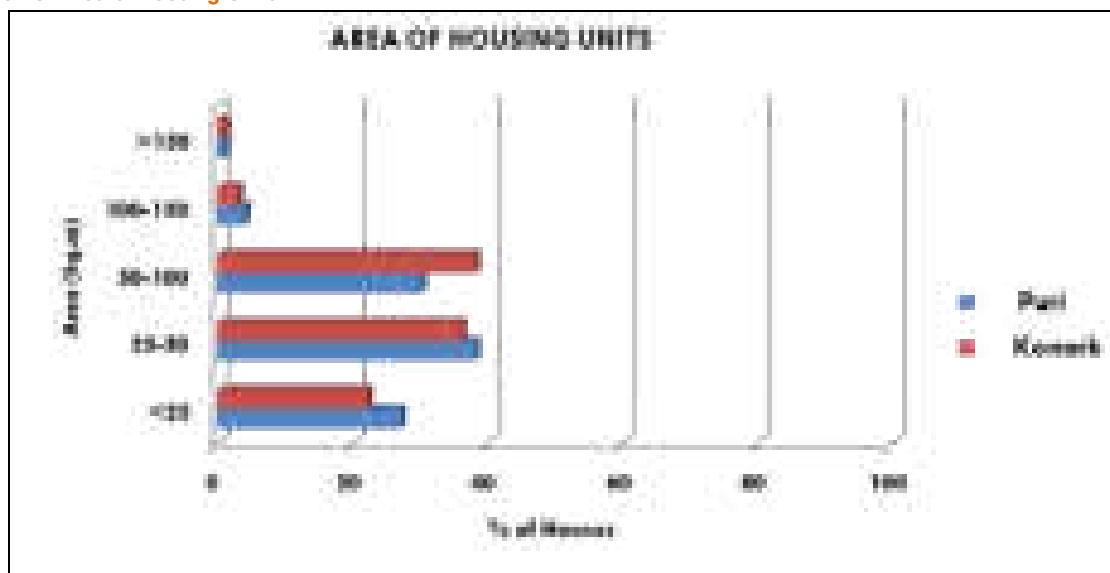
Source: CEPT survey & Analysis

Different government schemes should be applied in Puri for improving the housing condition in slums where as Private Investments in infrastructure and housing holds the key in coming times to improve the condition in Konark NAC. Although the present housing condition in Puri is not worse but in upcoming years the demand will increase as we have seen in the population projection and therefore planned interventions becomes a real necessity.

6.4.4 Floor Area per Household/Person

The average range of floor area/ person is between 45-60 sq.m. in the region, although the region shows a wide range of variation especially between the rural and urban centers. In urban areas the average unit size is less where the same is more in rural areas due to scarcity of urban land. Still there average rate in the region and especially in urban field is higher than medium & large cities in India

Fig 6.13: Area of housing Units



Source: CEPT survey & Analysis

6.4.5 Nature of Dwelling Units

Both the urban centers of Puri town and Konark NAC has very high share of ground structures which means that there is very low intensity of use in urban land. In fact within samples surveyed Konark NAC area has no residential units having a height of more than G+1. In Puri most of the G+1 and above structures are located in the Grand Road and VIP Road and associated areas.

Fig 6.14: Nature of Dwelling Units: Puri

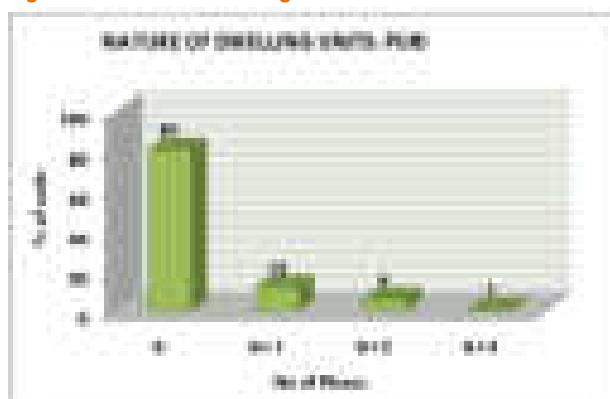
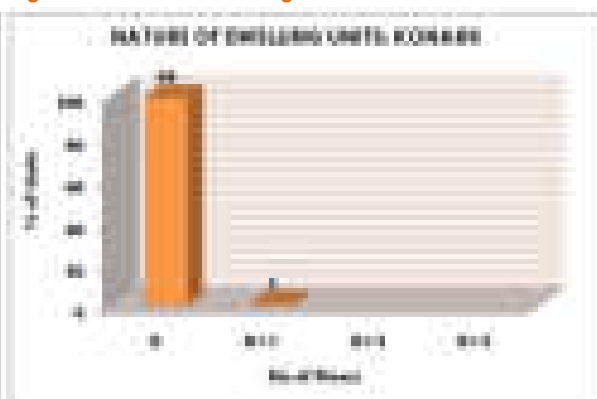


Fig 6.15: Nature of Dwelling Units: Konark



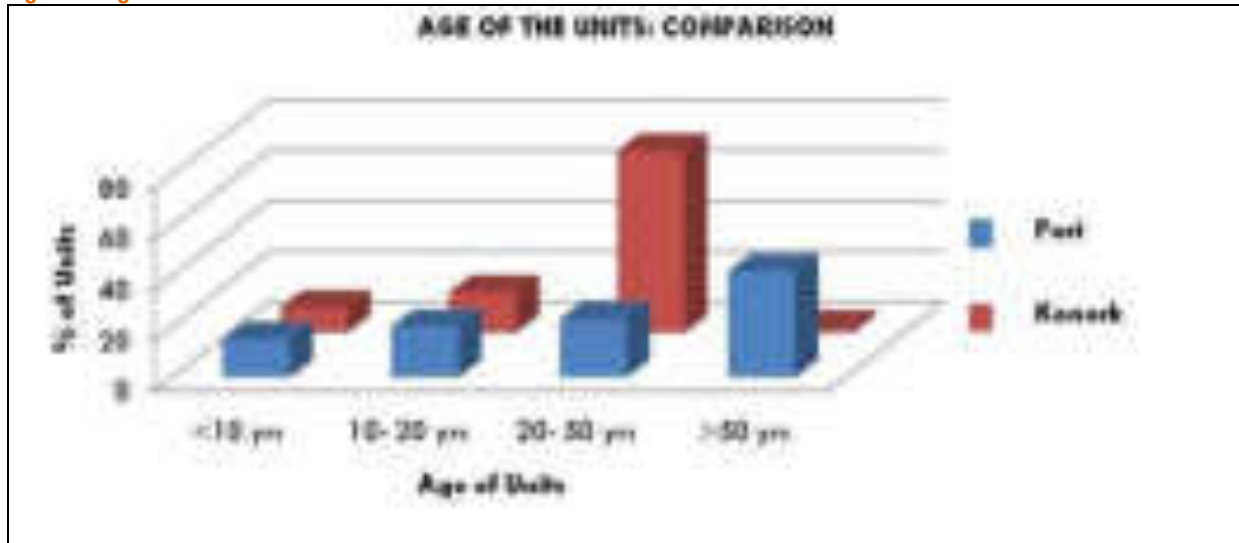
Source: CEPT survey & Analysis

The major development in the urban centers in the region took between 1981-'90 as discussed earlier. Therefore the average age of the residential buildings is between 25-50 years as per analysis in the below chart. Development in Puri is older than that of Konark as can be seen that close to 35% of houses in Puri town is older than 50 years. The important inference coming out from this study is that major housing stock of the urban centers is age old and may be needs be replaced/upgraded soon through interventions.



Fig 6.16: Different types of Structures in PKDA

Source: CEPT survey & Analysis

Fig 6.17: Age of Units Puri & Konark

Source: CEPT survey & Analysis

6.5 Major Housing Providers

The major providers in the regions are categorized into three namely: individual self built housing supply, Supply through private developers and public housing supply. The status for each source has been illustrated below:

6.5.1 Individual Supply

Majority share of houses in the region is self built individual mode of supply. The town of Puri and Konark NAC is having a negligible share of private housing development which has come up very recently. The individual mode of supply has 100% share in the rural PKDA as there is no other choice for the residents in those areas. The houses constructed in this mode are mostly using locally available materials like mud, bricks, sand, bamboo etc. The town areas is having majority of pucca houses constructed through self mode and self financing.

**Fig 6.18: Self-built Kutcha Houses**

6.5.2 Private Developers

Fig 6.19: Private Apartments



Very recently due to larger demand large numbers of private realty developers are building housing in Puri town. The major one being Arya construction Pvt. Ltd. Neelachal Build-tech & Resorts (P) Ltd is another large building house in the town where as Maruti Estate India working as development professional in the town. In the upcoming years as more demand will rise more players are expected to enter the real estate market in the town for housing & infrastructure development.

6.5.3 Institutional Supply

The Odisha State Housing Board the only public housing institution of the state came in to existence in the year 1968 by an Act of State Legislature, with prime objective of providing affordable shelters both in urban and rural areas, to cater to the acute shortage of housing in the State especially for economically weaker section of the society.

But the Board has not ventured yet in Puri town one of the prime pilgrimage centre of the regional and the state. Only one small commercial plotted development has been carried out by them in Baliapada. The public housing scenario is therefore very poor in the study region and needs to be given priority.

6.6 Housing Trends in PKDA Region

The housing trends in the region especially in the urban centers can be understood according to different time span and developments occurred during the time. Previous to 1980s the housing developments were basically traditional individual oriented supply of ground structures in the core city areas. Whereas between the years of 1980-2000 major developments took place in the form pucca structure of G and G+1 structures in the town. But still the mode was self supply oriented. In the last decade due to grown demand private developers build housing schemes took place and the housing pattern also shifted to multistoried project housing, apartment etc. the rural areas has not been that much affected though through these time period except peripheries of the urban centers

6.7 Future New Housing Requirement in PKDA Region/Area, 2031

The future housing requirements for the PKDA area has been calculated in the below table. Population projection has been done with applying Geometric method of population increase. The assumption that has been used to calculate the household is that the household size will remain same for 2031 as was on 2001.

Basically at the first step total dwelling units has been calculated for each blocks. The submission of the same identifies the total housing requirement for the year 2031. The existing housing shortage has been calculated by deducting the number of households and occupied houses in 2001. The next stage is to determine the number of dilapidated houses needs to be reconstructed at 2031. It was assumed to be 5% of the existing stock on 2001. The final requirement has been calculated by adding three components namely fresh demand in 2031, existing shortage and the dilapidated stock as shown below:

Table 6.3: Housing demand assessment for PKDA- 2031

Block	Area	Decadal Growth Rate (%)	Population 2001	Projected Population 2031	No of HH	HH Size	Total No of DU required
			2001	2031	2001	2001	2031
Puri Town	5253	30	1,57,837	3,44,098	30969	5.1	67470
Puri Sadar	1684	32	14,880	33,328	2819	5.27	6037
Block A	9883	19	17,238	29,054	3272	5.26	5244
Konark	3510	34	16,979	61,487	2853	5.95	10333
Block B	3486	20	6,872	10,005	1598	4.30	2354
PKDA (TOTAL)	23816	29	2,13,806	4,77,972	41511.00	5.15	93469.00
Existing Total occupied Houses: PKDA							37329
Total new Housing demand							56140
Existing Housing Shortage (41511- 37329)							4182
Existing No. of Dilapidated Houses (Assuming 5% of the total stock)							1866
Total Demand for 2031 (Total new demand+ Shortage + Dilapidated stock)							62188

Source: CEPT survey & Analysis

6.8 Slums

As per the 2001 Census of India, “a slum is a compact area of at least 300 persons population or about 60-70 households of poorly built congested tenements, in an unhygienic environment usually with inadequate infrastructure and lacking in proper sanitary and drinking water facilities”.

The Government of Odisha defines Slums as follows:

“Slum area” means any predominantly residential area, where the dwellings which by reasons of dilapidation, overcrowding faulty arrangements or designs, lack of ventilation, light or sanitary facilities or any combination of these factors, are detrimental to safety and health of the inhabitants or others and which is defined by development plan as a slum area.

6.8.1 Existing slums in PKDA Region/Area

Urbanization in any city is accompanied with the growth of slums. The city of Puri is no exception to slum development and proliferation. In fact, the slum proliferation and informal sector has been growing since evolution modern Puri. The growth of informal sector in slums and squatters is due to huge migration from the rural hinterland and borders states of Andhra Pradesh in search of employment particularly in tourism and fishing sector. The slum settlements in the city can be classified into slum colonies belonging to fishing communities, common slums, population squatting on the land belonging to Indian railways and other government agencies. The growth of slums, squatters and informal settlements has become more acute after super cyclone, which has aggregated the problem. Most of the slums of the city are located on unutilized Government land/ Railway land. These Government land remained temporarily vacant where development could not be done immediately. This provides favorable opportunities to the lower economic groups specially belonging to the labor classes who came to the city in quest of new opportunities and employment. A significant portion of the slum dwellers in Puri are migrants in search of employment, primarily in the unorganized sector. Basic characteristics of these slums are dilapidated housing structures with poor ventilation, overcrowding,



inadequate lighting, lack of potable water, absence of sanitation facilities, faulty alignment of streets/lanes, inundation during monsoon season, lack of access for fire-fighting and control measures and other basic physical and social services.

As per the 2001 Census, there were 33768 slum populations in the city, which constituted about 21.39 percent of the city's population. Lack of civic services, unhygienic living conditions coupled with increase in housing stock deficit gave raise to slum dwellings and its population.

Table 6.4: Basic details about slum in Puri town

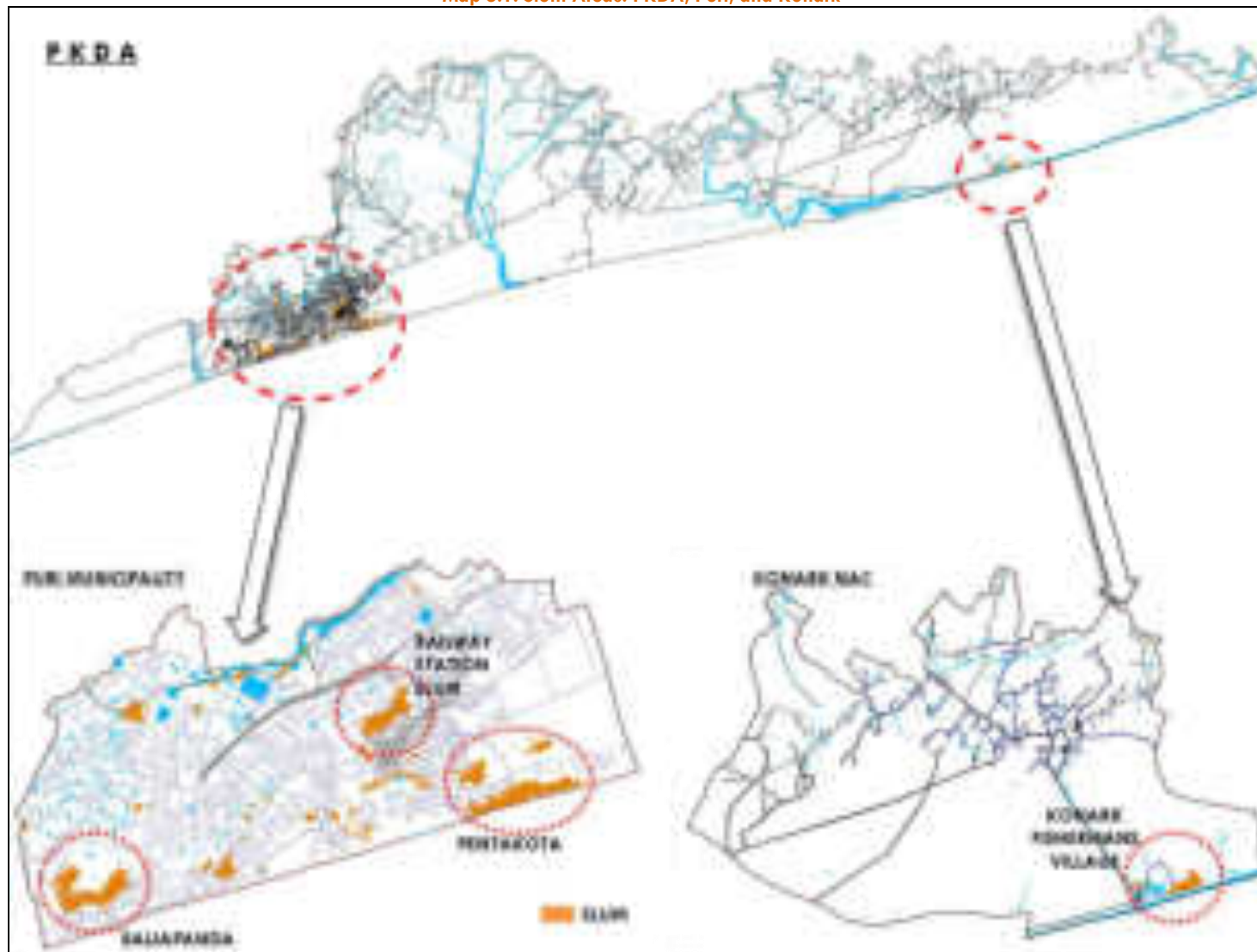
Index	Town	Slum
Population	157837	33768
Average Household Size	5.1	5
Sex Ratio	919	902
Proportion of SC Population in Slums	6.68	10.47
Proportion of ST Population in Slums	0.21	0.17
Literacy Rate	74	51.89
Workers Participation Ratio	29.99	30.53
Proportion of Main Workers to Total Workers	28.28	92.17

Source: CEPT survey & Analysis

Fig 6.20: Poor Living Conditions in Slums



Map 6.1: Slum Areas: PKDA, Puri, and Konark



Source: ORSAC, CEPT Analysis

Puri Municipality in the year 2004 identified 44 slums based on Government of Odisha and census criteria. The list of slums along with their location ward and population details are given in the below table:

Table 6.5: List of Notified Slums in PKDA

Sr. No.	Name of Slums	Ward No.	Population of Slum Area
1	Matitota	1	442
2	Gokha Sahi	1	1309
3	Mangala Ghat	1	661
4	Khuntia Bagischa Bhoi Basti	1	226
5	Jagannath Basti	1	421
6	Markendeswar Sahi Harijan Basti	1	773
7	Trivedi Nagar	5	1109
8	Leprosy Colony	5	526
9	Hati Sala Bhoi Basti	6	209
10	Bijay Nagar (Balisa Panda)	6	1346
11	Para Nolia Sahi	6	536
12	Gauda Bada Nolia Sahi	6	1450
13	Akshya Dham Basti	6	311
14	Tiadi Sahi Harijan Basti	7	158
15	Bali Harijan Sahi	8	738
16	Bali Mochi Basti	9	472
17	Bali Noila Sahi	10	4455
18	Gadi Khana(Mochi) Basti	12	308
19	Mochi Sahi	12	748
20	Indira Marga Colony	13	122
21	Old Sadar Thana Bhoi Basti	13	108
22	Jagannath Ballav Matha Bhoi Basti	15	179
23	V.I.P Road Banki Muhana Basti	18	728
24	Banki Muhana Nala Basti	18	107
26	Kumbharapara	20	1584
27	Narendra Kona Harijina Basti	20	741
28	Mangala Sahi (N.S.Depot)	20	1134
29	Gopabandu Colony Harijan Basti	20	323
30	Ramchandi Balikuda	22	2140
31	Ghoda Bazar	23	3550
32	Gora Kabar	24	389
33	Dhoba Sahi	24	979
34	Youth Hostel Backside Basti	24	305

35	Jali Sahi Telgu Basti (A)	24	605
36	Chakratirtha Noila Basti	25	2076
37	Penthakata (A)	25	8897
38	Jali Sahi (B)	26	698
	Railway Adibasi Basti	26	227
40	Matiapara	27	868
41	Tikarapara	28	624
42	Chasa Sahi	29	202
43	Chamara Sahi	29	232
44	Binabha Nagar	29	294
45	Kumuti Patana	29	1006
46	Penthakata	30	2936
	Total		47530

Source: Puri Municipality

Fig 6.21: Open Defecation in Puri Slum



Fig 6.22: Poor Living Conditions in Puri Slum



6.8.2 Socio-Economic Characteristics

Analyzing socio-economic characteristics in case of slums becomes an interesting exercise due to the fact that quality of life in the informal settlements depicts the social wellbeing of an urban centre. General scenario in Indian cities is that there is an abrupt difference the quality of life between the people living in slums and in formal settlements. Let us see the same is replicated in case of the urban areas of PKDA region or the real scenario is something else.

According to the information available on 2001 census various socio economic characteristics (in the form of backward caste composition, workers distribution etc.) of the identified slums analyzed and compared with the District and state level shown in the below table:

Table 6.6: Socio-economic status of population in slums in Puri town (2001 census data)

Item	Puri Town			Puri Slum			Odisha		
Total HH	30969			6759			1119518		
	Total	Male	Female	Total	Male	Female	Total	Male	Female
Total Population	157837	82269	75568	33768	17758	16010	5517238	2911600	2605638
Population 0-6 Age	17109	8884	8225	4847	2578	2269	662452	342620	319832
SC Population	10550	5386	5164	3535	1838	1697	703275	360866	342409
ST Population	337	213	124	58	34	24	446723	229373	217350
Literates	116731	64617	52114	17522	10355	7167	3924451	2258801	1665650
Total Workers	47339	40809	6530	10308	8344	1964	1689519	1428311	261208
Main Workers	44636	39393	5243	9501	8012	1489	1517270	1327323	189947
Cultivators	134	108	26	11	9	2	42855	38799	4056
Agricultural Labourers	85	77	8	8	8	0	40966	31581	9385
Household Industry Workers	1075	830	245	64	47	17	44109	33771	10338
Other Workers	43342	38378	4964	9418	7948	1470	1389340	1223172	166168
Marginal Workers	2073	1416	657	807	332	475	172249	100988	71261
Cultivators	16	8	8	1		1	6894	4217	2677
Agricultural Labourers	11	8	3	2	1	1	36213	16243	19970
Household Industry Workers	368	82	286	36	2	34	14807	4935	9872
Other Workers	2308	1318	990	768	329	439	114335	75593	38742
Non Workers	110498	41460	69038	23460	9414	14046	3827719	1483289	2344430

Source: Census data, CEPT Analysis



The major observation from the table given above can be summarized as:

- The average slum household size was 5.00, which is lower than that of the city (5.10) average. The reason for this may be migration of working age of population in to urban centres.
- The sex ratio of the slum population (902) was also lower than that of the Municipality ratio (919) which is well ahead of both the country & state average of 901 & 895 respectively. Inflow of working males living in slums seems to be the reason for the same.
- The literacy rate of the slum dwellers (51.89%) found much lower than that of the city population (74%).
- The workers participation rate was higher than that of the city. About 92.17% of the total workers were main workers in the slums which is quite a positive aspect for the centre.

The prevailing socio-economic characteristics slum population indicates an immense potential for bringing them into socio and economical main stream of the city.

6.8.3 Current Status of Services in Slums

About 33768 persons forming part of about 6700 households were living in these slums. Factual information on the type and number of dwelling units was not available. However, based on the discussion, it is estimated that about 7000 dwelling units are there in the notified slums and out of which, only about 5 percent may be pucca in nature. About 10 percent may be semi-pucca structures and remaining 85 percent may be kutchra in nature, indicating huge capital investment for up gradation of existing dwelling units.

The water supply requirements in these slums were met with tube wells; public stand posts and wells altogether. Few of the slum dwellers in the notified slums were having individual latrine while others were relying on community latrines or open defecation. Some of the notified slums were provided with temporary waste storage points/dustbins for the storage/collection of the solid waste generated. All slums were provided with these dustbins and the Puri Municipality has been providing the collection and transportation services. Most of the notified slums were provided with streetlights. There were community centers in the slums. The Puri Municipality has provided training to the slum dwellers of the notified slums in various areas under different employment generation schemes.

Table 6.7: House types in slums: Puri town

Year	Kucha	Pucca	Semi Pucca
1998/99	11206 (100%)	0	0
2004	10719 (83.60%)	0	2103 (16.40)

Source: Census data, CEPT analysis

The table below represents the status of basic services in slums in Puri town. It can be clearly observed that individual water supply facility is almost unavailable in the slum areas where people mostly depend on community water supply or other informal arrangements. Same trend follows for sanitation.

Table 6.8: Status of basic services in Puri slum

Year	No. of Slum Dwellers	Percentage of Slum Dwellers having access to Services					
		Water Supply		Sanitation			Waste Service Collection
		Own	Other	Own	Community	Open	
1998	11206	0.21	99.79	4.82	89.51	5.67	Yes
2004	12822	16.7	83.3	78.77	24.55	3.32	Yes

Source: Census data, CEPT analysis



The major issues identified from the understanding on availability of services to the slum dwellers are as mentioned below:

- Housing stock in slum areas is of very poor quality where as at the same time lack public housing supply is major area o concern.
- Lack of tenure security in the informal settlements resulting in very less investment in housing up gradation by residents.
- Lack of adequate infrastructure in the slums links to development of sub-standard living environment.
- Inter-linkage of housing and livelihood generation makes it difficult for relocation of the residents as in most of the cases it has been observed that people use spaces within slum for income generating opportunities.

6.8.4 Slum Upgrading/ Development Approaches

The traditional approach of slum relocation and provision of new housing to slum dwellers in Indian cities due to various reasons has not been able to cover much ground. The reason being primarily the economic and livelihood of slum population is mostly dependent on the same space. Therefore in-situ slum up gradation approach now a days is much more popular and acceptable exercise. A multi focused approach is therefore necessary to answer the problem and improving the life in slums.

6.8.4.1 Settlement Reconstruction

If the existing location of the slums is compatible with the surrounding and proposed land use and zoning regulations, settlement reconstruction approach can be considered. Pentakota slums and Baliapanda area etc can be taken for redevelopment in this model.

There should be adequate FSI available and the minimum affordability of households for a 150- 200 sq. ft. tenement with two storied structure on an average.

Fig 6.23: Settlement reconstruction methods



6.8.4.2 Slum Relocation

Slums located in the railway land and Konark area can be relocated to suitable sites closer to the same locality. The relocated site should be close enough to the working spaces of the existing population living in the slum. The relocated site has to be well connected by affordable transport mediums so that these residents can travel at an affordable cost.

The government and Local Governments can create a land bank for this purpose. Also there should be minimum affordability of households for serviced plots 200 sq.ft in area on an average.

6.8.4.3 Slum Networking

In lines of the successful networking approaches found in Ahmadabad and Indore this approach can also be suitably adopted. This requires a detail study of the existing slums, especially those along the main submerged areas along with the contours of the area. This will not only improve the slums but integrate this approach with the overall physical infrastructure and social development of the area. The process is safer and quite effective than relocation and the cost of development is very less in this method and hence effective. The transformations brought by Indore and Ahmadabad are shown for example in the images below:

Fig 6.24: Effects of SNP in Ahmedabad (case study)



6.8.4.4 VAMBAY

This successful model of VAMBAY in a 50:50 cost sharing between centre and state is proposed for rehabilitating slum pockets in Konark Fisherman's village, Pentakota etc slums. The effort will be to achieve slum less cities. By this including NGOs and Civil Society into mainstream planning process can be achieved which is still missing from urban planning paradigm. The successful case studies of Hyderabad and Perupalem has been illustrated in the below diagram.

Fig 6.25: Housing in VAMBAY projects: Hyderabad & Mumbai



6.8.5 Ongoing Slum Improvement Projects

This section reviews past and current programs including ongoing schemes that address service delivery to the poor in Puri. Given the complexity of the social, economic and physical environment in which a growing number of urban poor eke out their livelihoods, it is clear that the formulation of anti-poverty measures and the design of slum improvement programs is a difficult issue. A review of slum improvement programmers indicate that by improving basic infrastructure and access to municipal services, there is a significant impact on the quality of life of slum residents, both poor and non-poor. To alleviate the problems of slum dwellers and to reduce urban poverty, a number of programs are initiated and being implemented by the Puri Municipality with assistance from the GoO and the Gol. Some of the major slum improvement programs being implemented in Puri are in the adjacent box while the components of these schemes, beneficiaries, and other details are given below.

6.8.5.1 BSUP under JnNURM Scheme:

Under Basic services for Urban Poor component of JnNURM Puri Municipality has undertaken slum redevelopment program for seven identified slum pockets. The comprehensive cost structure for house construction as well as infrastructure develop has been summarized in the below table. Major share of development has been given for Matitota slum where new house construction has been given priority.

Table 6.9: BSUP project undertaken by Puri Municipality

Sr No	Project Name	Project Cost	Component	
			Housing	Infrastructure
1	Tikarapada	127.67	78.2	49.47
2	Kumutipatna	111.22	44.2	67.02
3	Mangala Sahi	94.96	68	26.96
4	Narendra Kona	75.18	39.1	36.08
5	Matitota	87.28	35.7	51.58
6	Gokha Sahi	258.5	188.7	69.8
7	Chamara Sahi	88.64	47.6	41.04
Total		843.45	501.5	341.95

Source: Census data, CEPT analysis

6.8.5.2 National Slum Development Programme (NSDP)

Under this scheme, roads, drains, street lighting, community toilet/bath for the slum people can be constructed. The allotment under the scheme involves 70 percent as loan and 30 percent as grant. The loan portion carries a grace period of 5 years for repayment with 10 percent interest per annum, with 15 (fifteen) equated installments per annum and with a penal interest of 2.75 percent if not paid in time. Special Priority is given to the following:

- Improvement of drinking water supply system
- Laying/relaying of roads
- Provision of street lights
- Drainage facilities
- Improvement and new public conveniences with water supply
- Welfare (education, etc.); and
- Shelter up gradation (individual water connections)

The Puri Municipality has availed financial assistance from the Gol and constructed/provided drains, roads, streetlights, community latrines/baths, community centers.



Table 6.10: Details of NSDP undertaken by Puri Municipality

Year	Funds released	U/C submitted
2002/03	2132000	2132000
2003/04	500000	500000
2004/05	0	0
2005/06	0	0
Total	2632000	2632000

Source: Census data, CEPT analysis

6.8.5.3 Valmiki Ambedkar Awas Yojana (VAMBAY)

Valmiki Ambedkar Awas Yojana (VAMBAY) was introduced in the year 2001. The primary objective of this scheme is to provide shelter or upgrade the existing shelter of people living below the poverty line in the urban slums. The upper financial limit for construction of VAMBAY units under normal circumstances will be maximum of Rs. 40,000/- including provision for sanitary latrine for an area of not less than 15 (fifteen) sq. m with a subsidy of 50 percent i.e. Rs. 20,000/- by HUDCO.

Under this program, the Puri Municipality has identified 222 beneficiaries and the construction of dwelling units are under progress. The unit cost of each dwelling unit was Rs 40,000/-. The Puri Municipality has transferred entire subsidy of Rs. 20,000/- received from the Gol to the beneficiaries and also provided loan assistance to beneficiaries to an extent of Rs. 20,000/- per dwelling unit to meet the gap.

6.8.5.4 Swarna Jayanti Shehri Rojgar Yojna (SJSRY)

Swarna Jayanti Shehri Rojgar Yojna (SJSRY) consists of two special schemes, viz. Urban Self Employment Programme (USEP) and Urban Wage Employment Programme (UWEP). It is funded in a ratio of 75:25 between the Centre and the State. Under UWEP of SJSRY, socially and economically useful public assets i.e. roads, drains, culverts, community centers, community latrines are constructed in slum areas, providing wage employment to the urban poor. Under the USEP, the Puri Municipality has provided loan and subsidy for income generation activities to the beneficiaries. The beneficiaries have been trained on health, sanitation, child care, leprosy, AIDS, different social welfare schemes, etc. Under the UWEP activities, roads, drains, culverts, community centers, community latrines, etc. have been constructed in many slum areas. In addition, Anganwadi workers are functioning under ICDS Programme and Balwadie are functioning under the SJSRY Scheme.

Table 6.11 SJSRY scheme details of Puri Municipality

Year	Funds Released	U/C Submitted	USEP (S) (Persons)	USEP (T) (Persons)	Man days Generated	DWCUA Group	T & CS (Groups)
2002/03	1631080	1311450	43	0	623	0	6
2003/04	181000	180000	46	344	0	47	23
2004/05	151364	0	23	0	0	0	0
2005/06	2249800	0	6	0	560	0	0
Total	4213244	1491450	-	-	-	-	-

Source: Census data, CEPT analysis

6.8.5.5 Development of Women and Children in Urban Areas (DWCUA)

This scheme is distinguished by the special incentive extended to urban poor women who decide to set up self employment ventures as a group as opposed to individual effort. Groups of poor women shall take up an economic activity suited to their skill, training, aptitude and local conditions. Besides generations of income, their group shall strive to empower the urban poor women by making them independent as also providing a facilitation atmosphere for self employment.



The DWCUA group sets itself up as a Thrift and Credit Society, in addition to its other entrepreneurial activity. The group is entitled to a lump-sum grant of Rs. 25,000 as revolving fund at a maximum rate of Rs. 1000 per individual. 11 Thrift and Credit Society (self-help groups) having women members assisted with revolving fund. They are engaged in income generation activities i.e. household articles, food items, etc.

7. Traffic & Transportation

7.1 Introduction

Puri, the holy land of Lord Jagannath is one of the oldest cities in the eastern part of the country. The city is an important nerve centre for all religious activities in the state of Odisha. Famous for its Rath Yatra, this place holds a significant position in every Indians heart. Thousands of tourists flock the city every day. This number rises to many folds especially during the festive season of the famous Rath Yatra.

Puri is an important urban node in this region, with Bhubaneswar, Puri and Konark forming the famous triangle. The road from Puri to Konark goes through picturesque fields and abuts the serene beaches nearing Konark. The very importance of this city, not only in the regional but national context explains the need for a good traffic and transportation plan both at the city level as well as at the regional level connecting it to Bhubaneswar, Konark and Brahmagiri.

Insufficient carrying capacity of the intercity routes and the national highways, poor planning in urban infrastructure development, absence of proper linkage of various forms of transportation and insufficient parking areas especially during the festive season have resulted in an inadequate transportation system within the city. As a part of the comprehensive development of the city an efficient traffic and transportation plan needs to be formulated.

Map 4: Regional Connectivity of PKDA



This section describes the status of the traffic and transportation network in the study area. A study of the regional connectivity in the area has been carried out. This is followed by a brief discussion of the existing transit and terminal facilities. The network characteristics have been analyzed, to assess the sufficiency of the system in the tourist and non tourist season. Through the course of studies parking has been found to be one of the major issues, especially in the urban areas. Solutions for the same have been examined. It has been observed that from the transportation point of view the urban area of Puri, is the major stress area. Hence the transport proposals concentrate on the betterment of the inner-city mobility of Puri and address the concerns of insufficient network widths, lack of parking facilities and better traffic management in the city. The high rates of vehicles especially the two wheelers in the

area and the trip patterns of the city have been discussed in detail to identify the hotspots and ways and means to resolve the same.

Ongoing and proposed projects have been studied to get a picture of the future transportation scenario in the region. A set of actions and recommendations, along with proposals have been identified to improve the existing transport conditions and to address the future mobility requirements.

7.2 Regional Connectivity

7.2.1 Road

PKDA region stretches over 296.33 sq.km of area. The regional road network comprises of National Highways and State Highways connecting the urban areas to other parts of the PKDA region.

Table 7.1: National Highways in PKDA

Road	Alignment	Origin	Destination	Distance	Jurisdiction
NH 203 & NH203 Extension	E-W	Bhubaneswar	Konark	97	Puri R&B Division
NH 203 A	N-S	Brahmagiri	Satapada	48	Puri R&B Division

Source: OSRP (NHAI)

7.2.1.1 National Highway

There are three National Highways passing through the region, namely NH-203 (running from Bhubaneswar up to Puri), NH-203Extn (From Puri to Konark) and NH-203A (passing from Puri via Brahmagiri to Satapada). This Highway passes through the heart of Puri town. The table below gives details of the mentioned National highways.

a. National Highway 203, 203 Extn.

National Highway 203 is one of the main arteries of Puri town and is the main access to other urban centres such as Bhubaneswar and Konark. The National Highway 203 after passing through Puri is termed as NH 203Extn up to Konark. The National Highway 203 & NH 203Extn stretches to about 97 km starting from Bhubaneswar passing through Puri city and exits at Konark.

b. National Highway 203A

The National Highway-203A stretches to about 49 km starting from Brahmagiri and terminates at Satapada with a junction with NH-203 at Puri. This National Highway is well-connected to state highways at various intersections and provides linkages to other parts of the study area.

Map 7.2: National Highways alignment in PKDA region



7.2.1.2 State Highway

The two state highways passing through the PKDA region are SH-13 and SH-60. The main towns through which the SH-13 passes are Khurda-Jatni-Pipili-Nimapara-Gop. The distance covered by SH-13 within the Puri division is Puri-36 km.

The State Highway 60 connects to GOP. The main towns covered by SH-60 are Phulnakhara-Niali-Charichhak-Gop-Konark-Puri. Within the Puri division, the SH-60 covers a distance of 18 km.

7.2.1.3 Major district roads (MDR) & ODRs

The distance covered by the Major District Roads (MDRs) within the Puri R&B division is 75.30km and the distance covered by the other district roads (ODRs) within the Puri R&B division sums up to 314.36km.

7.2.1.4 Connectivity

The proximity or access to the truck roads have been identified as the major determinants of urbanization. To understand the propensity to urbanize CEPT has analyzed the

The NH passes through 72 villages, thus, covering almost 55% of villages in the PKDA region. The SH passes through 30 villages in the region. The attached map spatially identifies the villages covered by the NH and SH. The attached table gives a breakup of the various types of roads in the region. It can be inferred that most of the region has access to all weather roads.

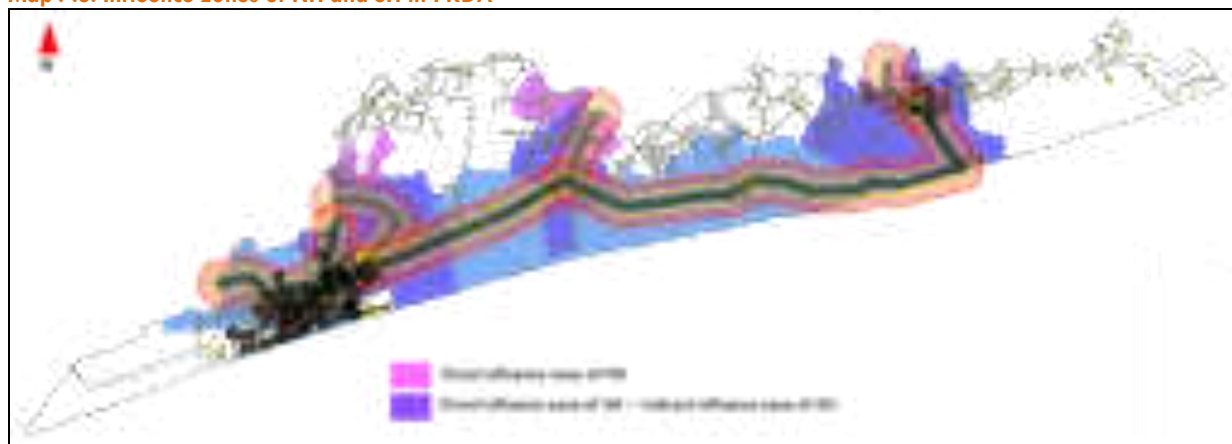
Table 7.2: Distribution of roads according to types in PKDA

Roads	Length (in Km)		
	PKDA	Puri Town	Konark NAC
Major Roads - NH	44.79	7.64	5.72
Major Roads - SH & ODR	9	NA	2.54
Urban Roads	252.65	185.41	35.04
Metalled/ earth Village Roads	260.15	NA	11.76
Railway	8.19	3.09	NA

Source: ORSAC data, CEPT Analysis

The attached map shows the location of the villages which are at close proximity to the NH and SH. The villages have been identified by buffering the roads at a distance of 100m and 500 m respectively.

Map 7.3: Influence zones of NH and SH in PKDA



Source: ORSAC Data, CEPT Analysis

Map 7.4: Existing mobility scenario: PKDA



Source: ORSAC Data, CEPT Analysis

Table 7.3: Area and % distribution of different categories of roads: PKDA

Classification of Roads	LU Code	Area (Sq.Km)	Area (sq.m)	% To Total LU	% To Total Roads
Major_Road_NH	1151	0.49	485.30	0.16	10.98
Major_Road_SH_ODR	1152	0.09	87.42	0.03	1.98
Urban_Roads	1153	1.32	1319.79	0.45	29.86
Metaled_Earth_Road_Concrete_Village_Roads	1154	1.48	1475.19	0.50	33.38
Footpath_Cart_Track	1155	0.69	687.95	0.23	15.56
Rail_Line	1156	0.17	174.24	0.06	3.94
Rail_Station_R_Yard_Storage	1157	0.14	138.59	0.05	3.14
Bus_Stop_Depo_Terminals	1158	0.04	36.00	0.01	0.81
Roundabout_Parking_Areas	1159	0.02	20.41	0.01	0.46
Total		4.42	4420.00	1.49	100.00

Source: ORSAC data, CEPT Analysis

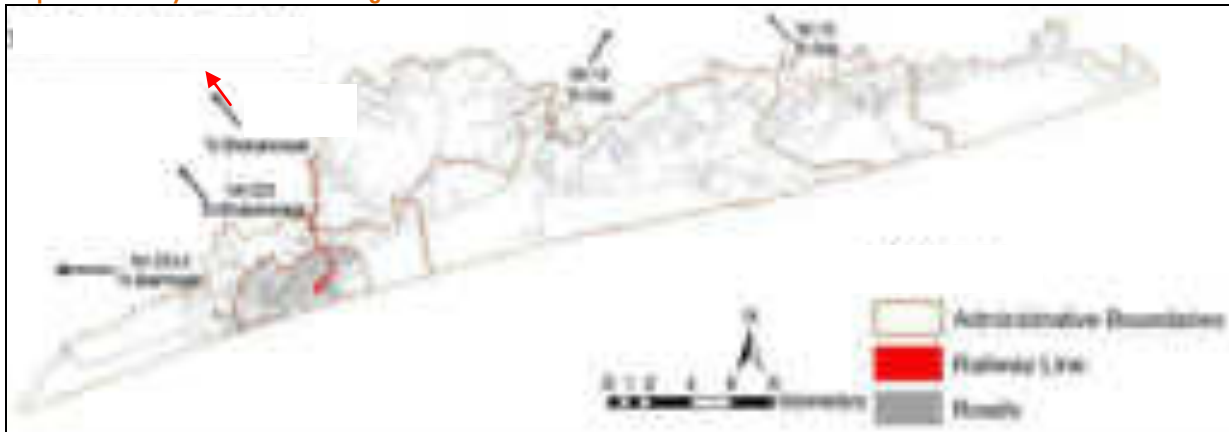
7.2.1.5 Roads under R&B:

The roads other than the NH fall under the purview of the R&B department in the Puri division. The total length of roads under R & B is 314.88km 299.35 km) (with a total of 37 roads (includes SH, MDR, ODRs). The length of the Major district roads is about 75.30 km. The list of the roads under R&B has been attached in annexure. The length of the other district road is about 314.36 km longest of these is New Jagannath sadak/Nua Jagannath sadak with 29.6km.

7.2.2 Rail Connectivity

The East coast railway extends its services to the States of Odisha. Puri is well connected with other major urban centres in Odisha as well as to other urban centres in the country. There are two main rail corridors traversing the town namely, North-South and East- West which connects with Puri. One of the branch lines of the Indian network of railways called the South Eastern network links up Puri with the states of the southern parts of India. The attached map shows the location of the railway lines passing through the town of Puri.

Map 7.5: Railway network: PKDA region



Source: ORSAC Data, CEPT Analysis

7.2.3 Air Connectivity

Puri does not have direct air connectivity. It is a tourism destination to attract domestic as well as foreign tourist. It takes almost 2 hours to reach Puri from Bhubaneswar airport. The distance between the same is 57 km. Buses and IPTs ply between Bhubaneswar and Puri on a regular basis.

7.2.4 Issues of Regional Connectivity

Having understood the various aspects of the regional connectivity of the PKDA region, the network coverage and the strengths, CEPT has identified the major areas of concern for the region with respect to the mobility.

The connectivity between Puri and Konark passes through the coastal areas as it nears Konark. This road has been a victim of coastal erosion and also it has been noticed that in the peak tourist season there is congestion along this spine. The attached images give an idea of the status of the road, also popularly known as the marine drive road.



Fig 7.1: Coastal erosion in Puri



This corridor needs to be strengthened and alternate alignments to the same needs to be identified. The marine drive road passes through the forest areas in the region. This is unsafe to travel at night and it has been noticed that the people generally avoid taking that route post sunset.

Also the need for better public transport in the region has been felt. Alternate modes of transit between Puri and Konark through waterways can be examined. This is not only a joyful experience, especially for the tourists but also helps in easing some of the traffic load of the already stressed Puri Konark link.

It is also suggested that there should be better disaster preparedness since the area is vulnerable to floods. Alternate links to the NH should be strengthened such that evacuation and help during disasters can permeate the region.

It has been noticed during the course of the surveys and the visits to the region that the transportation issues in the urban area are immense and require immediate attention. The town of Puri has to accommodate a tourist population that is way more than its residential population. This creates problems like congestion, road encroachments etc. The subsequent sections detail the transport problems in the town of Puri and the ways and means to address the same.

7.3 Travel Scenario in Urban Centres of PKDA

The transport scenario of Puri has been explained in the following sections. The network components, the carrying capacity, the performance, the stress areas and the parking aspects have been identified and studied. Puri being a town which has a considerable percentage of the tourist population the variation of the travel demand in the festive times requires special attention.

7.3.1 Existing mobility scenario in Puri town

The two important nodes and junctions within Puri town are Market Chowk and Hospital Chowk. These two nodes or junctions have several traffic issues. The map given below shows these two squares. The intersection of two roads of different widths at these squares creates a bottle neck situation.

The roads marked in green, cater to two-way traffic and are of lesser width creating congestion. The road indicated in yellow suffers the same problem. This road connects the Jagannath Temple and Marine drive. The flow of the traffic demands higher road surface. The condition of the road is also not good with multiple pot holes and also high extent of encroachments from the activities along the road. This needs immediate rectification. This road requires special measures such as provision of dividers for the sake of traffic regulation.

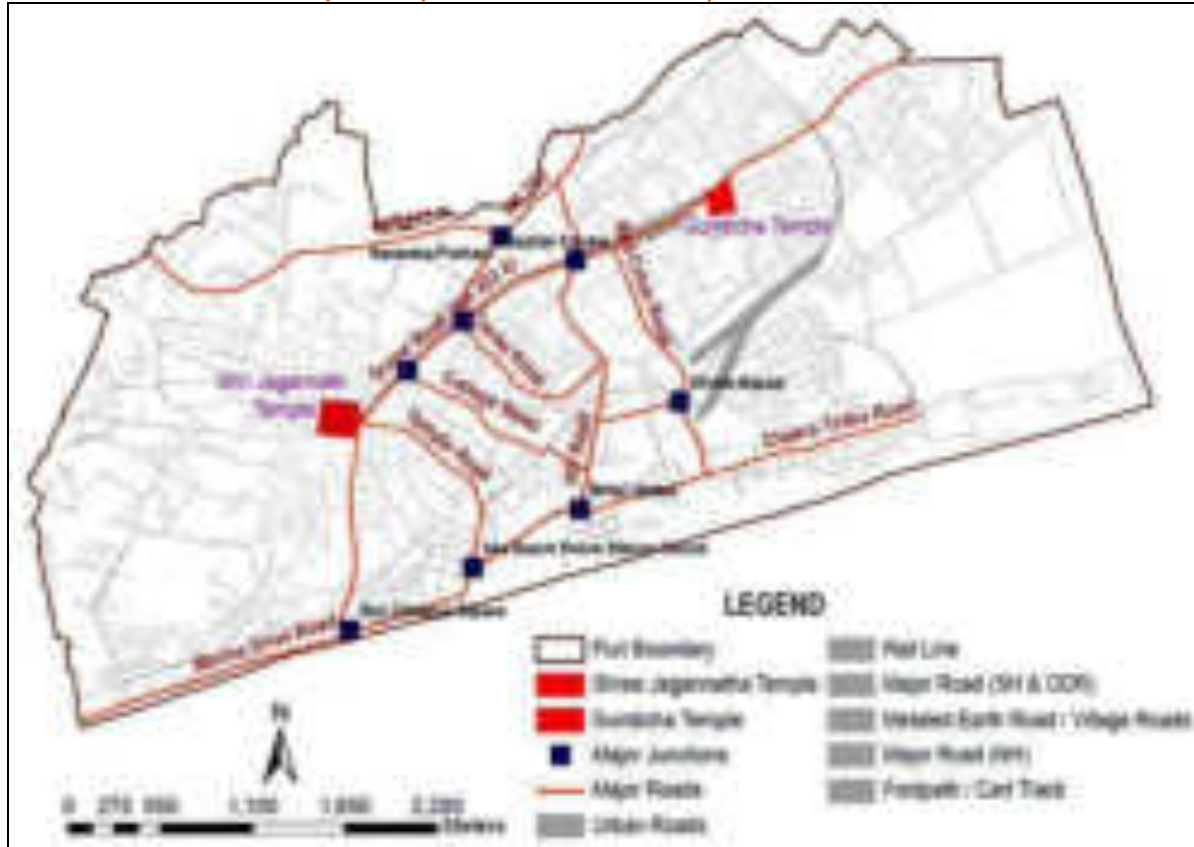
Table 7.4: Area and % distribution of roads in Puri town

Sub Classes	Area (Sq.Km)	Area (sq.m)	% To Total LU	% To Total Roads
Major_Road_NH	0.19	187.78	1.15	12.44
Major_Road_SH_ODR	0.00	0.03	0.00	0.00
Urban_Roads	0.97	965.51	5.93	63.94
Metaled_Earth_Road_Concrete_Village_Roads	0.01	10.81	0.07	0.72
Footpath_Cart_Track	0.02	21.52	0.13	1.43
Rail_Line	0.14	144.73	0.89	9.58
Rail_Station_R_Yard_Storage	0.14	138.59	0.85	9.18



Bus_Stop_Depo_Terminals	0.02	20.34	0.12	1.35
Roundabout_Parking_Areas	0.02	18.40	0.11	1.22
Total	1.51	1510.00	9.26	100.00

Source: ORSAC data, CEPT Analysis

Map 7.6: Major roads and Nodes of transportation in Puri town

Source: ORSAC data, CEPT Analysis

7.3.2 Existing mobility scenario in Konark NAC

Konark NAC area has four major arterial roads. NH-203E is the major arterial road runs from Konark Sun Temple towards south of the region. Whereas the second important road SH-13 runs from Temple to Nimapara NAC. The other two major roads are the ring road around sun temple and Konark-Kakatpur road.

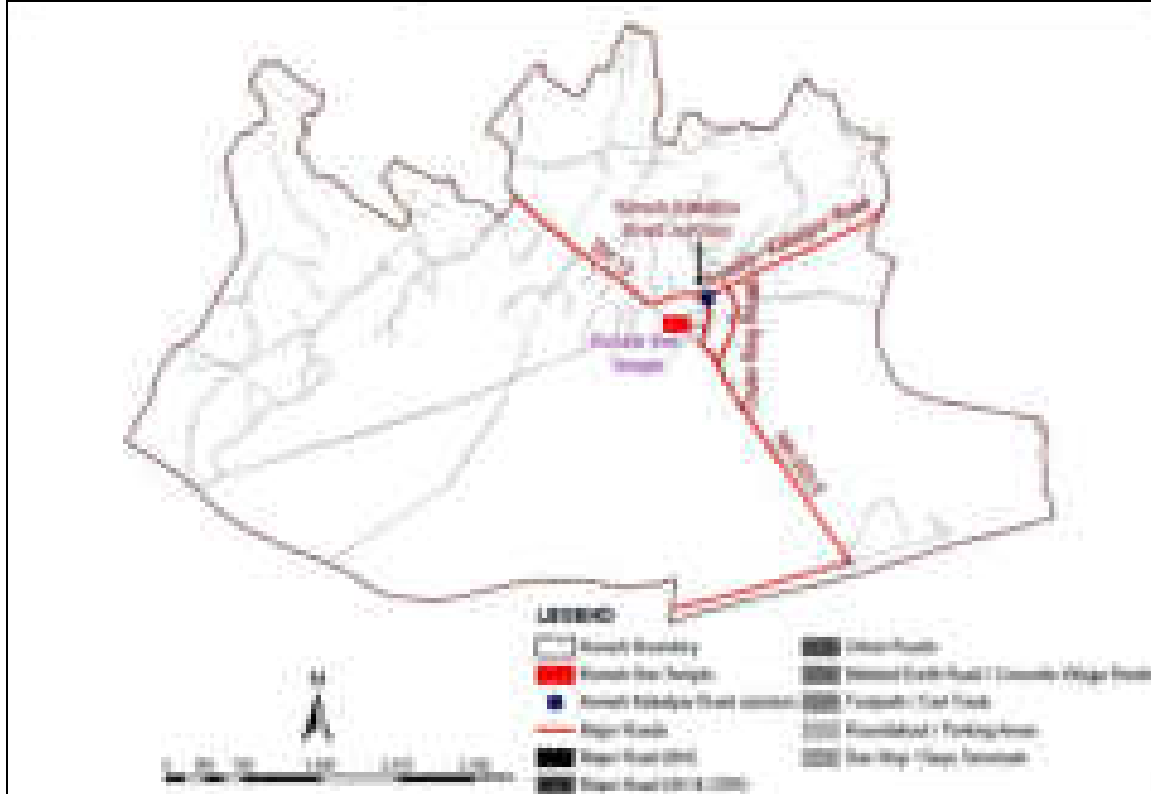
Transportation facilities cover only 0.65 sq km. of the NAC area which is less than 2% of the total area which is far below standards for urban areas. The CDP hence should identify new links in the NAC area as well as strengthen the regional connectivity.

Table 7.5: Area and % distribution of roads in Konark NAC

Sub Classes	Area (Sq.Km)	Area (Sq.m)	% To Total LU	% To Total Roads
Major_Road_NH	0.08	82.12	0.24	12.63
Major_Road_SH_ODR	0.03	32.34	0.09	4.98
Urban_Roads	0.19	191.15	0.55	29.41
Metaled_Earth_Road_Concrete_Village	0.11	112.07	0.32	17.24
Footpath_Cart_Track	0.21	211.92	0.61	32.60
Rail_Line	NA	0.00	0.00	NA

Rail_Station_R_Yard_Storage	NA	0.00	0.00	NA
Bus_Stop_Depo_Terminals	0.02	15.37	0.04	2.36
Roundabout_Parking_Areas	0.00	0.66	0.00	0.10
Total	0.65	650.00	1.85	100.00

Source: ORSAC data, CEPT Analysis

Map 7.7: Major roads and nodes of transportation in Konark NAC

Source: ORSAC data, CEPT Analysis

7.3.3 Traffic volume measurement in Puri town

The objective of traffic surveys was to establish the existing travel demand & pattern of the study area and forecasting for the future travel demand.

The following surveys were undertaken to develop the traffic and transportation data for the study:

- Traffic volume count
- Intersection and Turning Movement Survey
- Pedestrian count survey
- On street parking survey
- Off street parking survey
- House Hold Travel Survey [By Random Sampling]

7.3.3.1 Criteria for selection of survey points:

The criteria for selection of traffic survey points were based upon the following factors:

- **Entry and Exit of the PKDA region:** Three points were selected to directly study the traffic entering and exiting the PKDA project area through these points and their peak hours.

- **Intersection of Major Roads (NH & SH):** These intersections were the major sources of diversion of traffic to various parts of the PKDA region. Multi direction traffic can be studied at these points.
- **Main spine of Puri Town:** All major roads carrying traffic were identified and conducted traffic survey to know a traffic density on road.

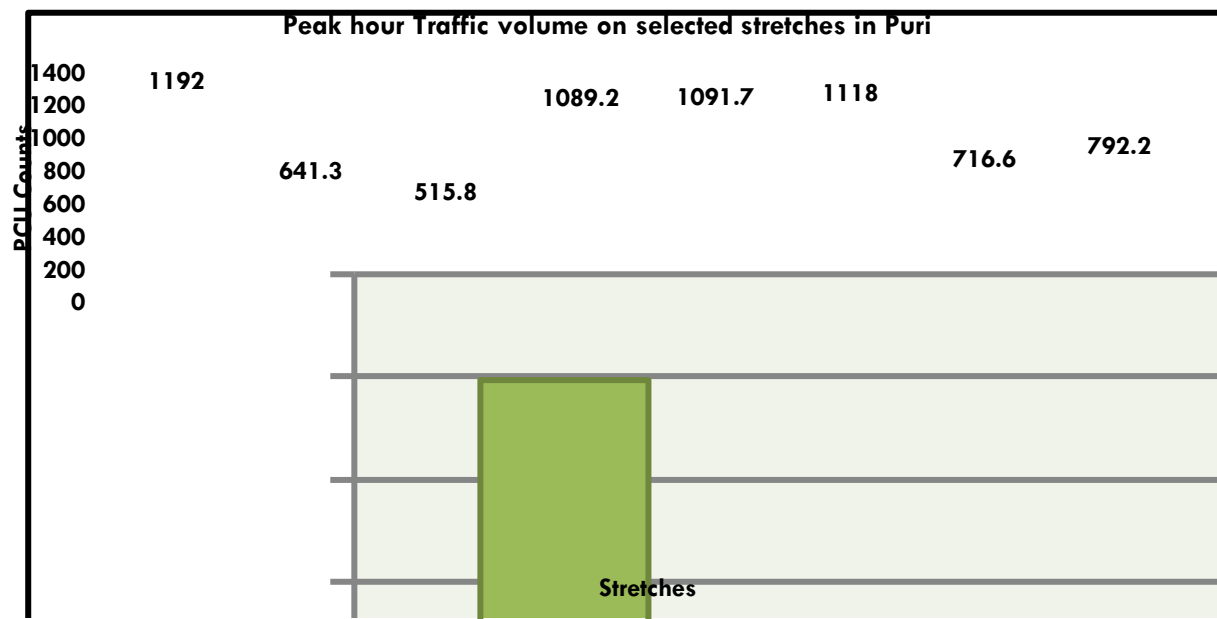
Map 7.8: Screen and cordon survey locations



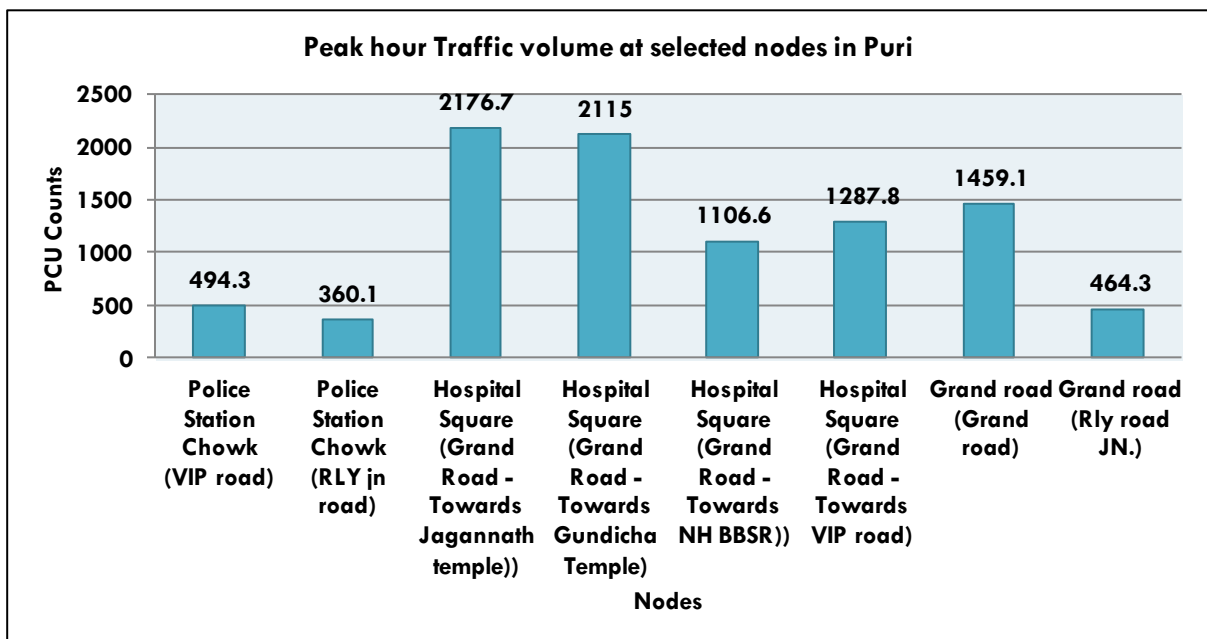
Source: ORSAC data, CEPT Analysis

Traffic counts at each survey stretch were taken and the traffic counts were converted into PCU for analysis. The traffic survey results can be found in the annexure. The traffic volumes at each survey points are mentioned in the attached chart.

The chart below presents the traffic volume data as observed in selected stretches in Puri town especially at important location which are used for entering or exit for Puri town. It can be seen that NH-203 which is the major connector between Puri and BBSR near Atharnala Bridge shows maximum volume followed by Marine drive which is a major tourist circuit and Railway station road. From the analysis it can be inferred that the highest traffic counts have been observed in the areas of the Jagannath temple, on the grand road. Ironically this is one of the widest roads in the area. The issues of the grand road are that there is severe on road parking and high levels of encroachments which reduce the effective width of the roads. The attached images give an idea of the same.

Fig 7.2: View of congested stretches in Puri town**Fig 7.3: Peak hour Traffic volume in selected stretches in Puri**

Source: CEPT survey & Analysis

Fig 7.4: Peak hour Traffic volume in selected nodes in Puri town

Source: CEPT survey & Analysis

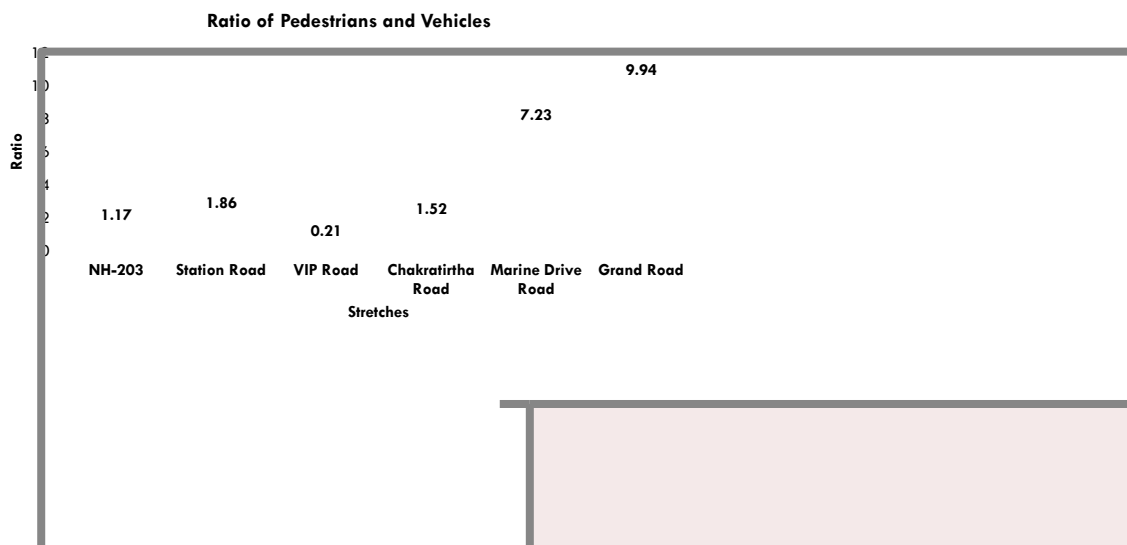
Observations made from the above analysis are summarized below:

- NH-203 which is the major connector between Puri and Bhubaneswar has the maximum traffic volume as tourists come through this route entering Puri. Also tourists travelling towards Brahmagiri take the same route. Hence major intervention required for increasing the carrying capacity of the road from Atharnala Bridge to aligned stretch in the town.
- Marine drive road and Railway station road are the other two stretches which show major pressure of vehicles in it. Therefore adequate planning methods should be applied for improving mobility in the areas.
- Within important junctions Hospital square on Grand road seems to be the major cause worry as far as traffic situation is concerned in Puri town. Major proposal should be identified for improving mobility and traffic situation in the whole stretch of grand road and interlinked junctions.

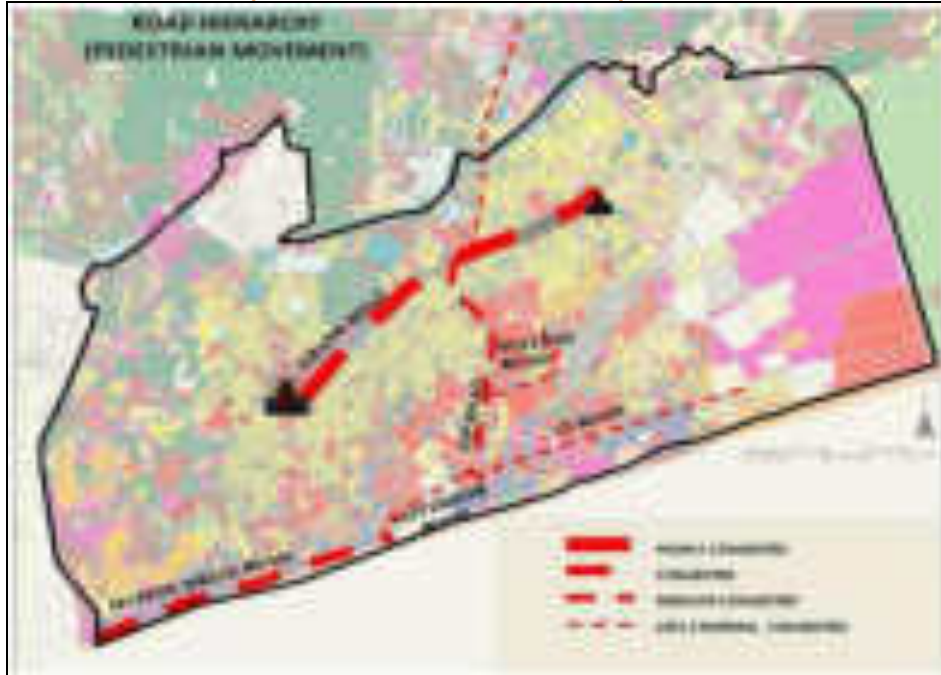
7.3.3.2 Pedestrian Count

The survey was conducted at a number of locations within the city along the major roads. The roads selected for the mid-block survey were also selected for pedestrian surveys. The attached chart illustrates the pedestrian movement in the Puri Town. The formulae used for analysis was $PV^2 > 2 \times 10^8$, where P stands for the number of pedestrians and V is the volume of Vehicles.

Fig 7.5: Pedestrians and vehicle ratio in selected stretches in Puri town



Source: CEPT survey & Analysis

Map 7.9: Pedestrian movement hierarchy: Puri town

Source: CEPT survey & Analysis

It can be attributed that the maximum concentration of pedestrians can be found at the grand road followed by the marine drive road. Correlating it with the V/C ratio of the same it can be attributed that the congestion levels are rather high. Also the presence of pedestrian infrastructure in the form of dedicated footpaths is conspicuously absent. It should also be understood at this point that the possibility of grade differences in the grand road is not possible since it hosts the Rath Yatra when thousands of pilgrims gather along this corridor.

7.3.3.3 Observations

Puri is accessible to the tourists both by rail and by road (buses and private vehicles) and considering tourist movement the Grand Road; it makes the Grand Road the most congested, which is followed by NH203 and Station Road within the city limits. Residential movement pattern is also found to be the maximum on The Grand Road and the Station Road.

Being a temple town, the city has large volume of pedestrian traffic and therefore a proper pedestrian walkway system needs to be put in place. The main spine and the most affected is the Grand road with a width of 50m on an average which goes up to 100m near Gundicha temple and reduces to 45m near Jagannath temple.

Puri town lacks a rigid traffic control system. Traffic management and control at main intersections is marginal. The varied composition of the traffic from bullock carts to fast moving cars adds to the congestion and chaos of the roads within the city.

Presently there exists no proper co-ordination between different local authorities for smooth and efficient management of traffic. Although, during festive seasons, co-ordination committees are set up for providing one way traffic routes, parking places and other requirements.

7.3.4 Terminal and Parking Facilities in Puri

7.3.4.1 Bus terminal

The existing bus terminal is located on the Grand Road near the Gundicha temple, where the major outstation buses (from Bhubaneswar & Konark) get parked. The other area where the intra-state buses get parked within Puri is in Talabania (the sweet water zone).

7.3.4.2 Railway station/terminal

Served by the East Coast Railways, the Puri railway station is the terminal point of the South Eastern Railways. Located at a reasonable distance from the city center of Puri, the Puri railway station is easily accessible and regular autos and taxis run between the city and the station. The railway station is located next to the Hospital road which is connected by station road.

7.3.4.3 Parking facilities

There are two major parking areas in Puri town. For the intercity buses which ply between Puri and regional cities like Bhubaneswar, Cuttack and Konark, there is bus stand in ward no 29 at Talabania (Map 6). There is a parking space available in ward no 20 near to the Grand road for other vehicles). Apart from these, there are no parking spaces available to cater to the huge floating population. The attached map shows the location of the parking facilities in the city.

Parking requirement of the city during Rath Yatra, New Year, Kartik Purnima and other festivals for which very little facilities are available, is significantly high.

The surveyed locations have been mentioned as below:

I. On-Street Parking

- a. Grand Road
- b. Marine Drive Road
- c. Railway Station Road
- d. Chakratirtha Road

II. Off-Street Parking

- a. Jagannath Temple Administrative Parking
- b. Talabania Parking in S/W Zone
- c. Railway Station Parking
- d. Marine Drive Road Parking
- e. Konark Parking – At BBSR-Konark-Puri Junction
- f. Konark Parking – Near Bus Stand

Fig 7.6: On street parking at Grand road



Fig 7.7: On street parking in Swargadwar



The attached map shows the location of these parking areas. The attached image shows the status of the on road parking. These are rather ad hoc and add to the woes of congestion in the city.

Observations:

- It is observed from the parking survey that the parking space available for local residents and tourists is adequate during non-festive days at the city level.
- Major issue concluded is that Grand road and Marine drive road has on-street parking throughout the length creating congestion. Automobile repair garages are also found on the Grand Road near the Gundicha temple. Since Chakratirtha road is a commercial area and a narrow street, the on street parking creates congestion on the road.
- During tourist season the parking facility in the town clearly collapses due to nature of demand arises during the time which results in to traffic chaos. Provision of adequate parking should be therefore a top priority for transportation plan in this CDP.

Map 7.10: Parking facilities in Puri town

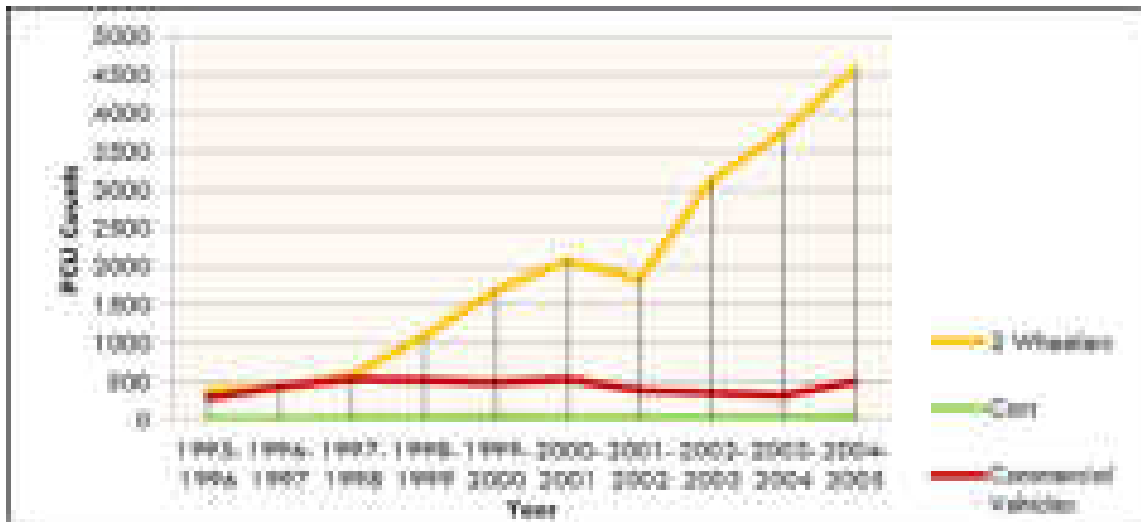


Source: CEPT survey & Analysis

7.3.5 Travel Characteristics in Puri

7.3.5.1 Vehicle Ownership Pattern

The growth of the vehicles from the year 2006 to 2008 shows that each year, especially from 2006 to 2007, there seems to be a huge growth in the number of vehicles registered. The growth of vehicles category has been explained in the attached chart. It can be understood that the growth in the two wheelers has been the highest in the span of the three years. This can be attributed to the lack of public infrastructure in the city. When the number of the two wheelers, cars and commercial vehicles are compared it can be noted that the commercial vehicles over shoot the private cars. This is a typical trend of a city which relies heavily on tourism.

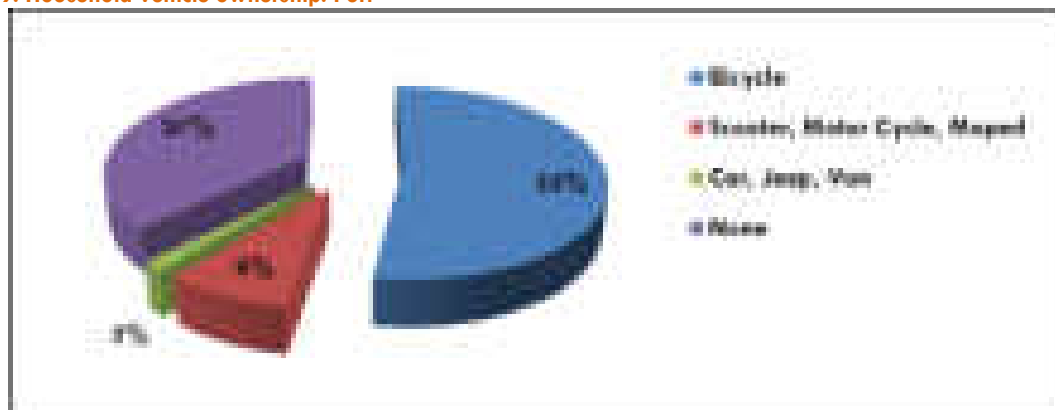
Fig 7.8: Changing composition of vehicle ownership

Source: Puri Municipality

Thus it can be concluded that there is a huge growth in vehicles over the past two years, but the facilities available to accommodate these have not been improved.

Vehicular Census Data has been compiled in the below graph to plot the composition of vehicle ownership in Puri town over last two decades.

From the household survey conducted it was understood that 53% of the households owned bicycles, followed by a major chunk 37% of households, who do not own any vehicle. A small percentage of households - 8% own two-wheelers, with a marginal number of households owning cars/four wheelers. This indicates that the trip lengths in the city are short and there is a great scope for the introduction of better public transport systems in the city. Also since there is a considerable percentage of the population that relies on Bicycle as a preferred mode of transport, it should be attempted to introduce dedicated bicycle tracts in the city. This will not only reduce the traffic problem but also will help in improving the urban environment at large.

Fig 7.9: Household vehicle ownership: Puri

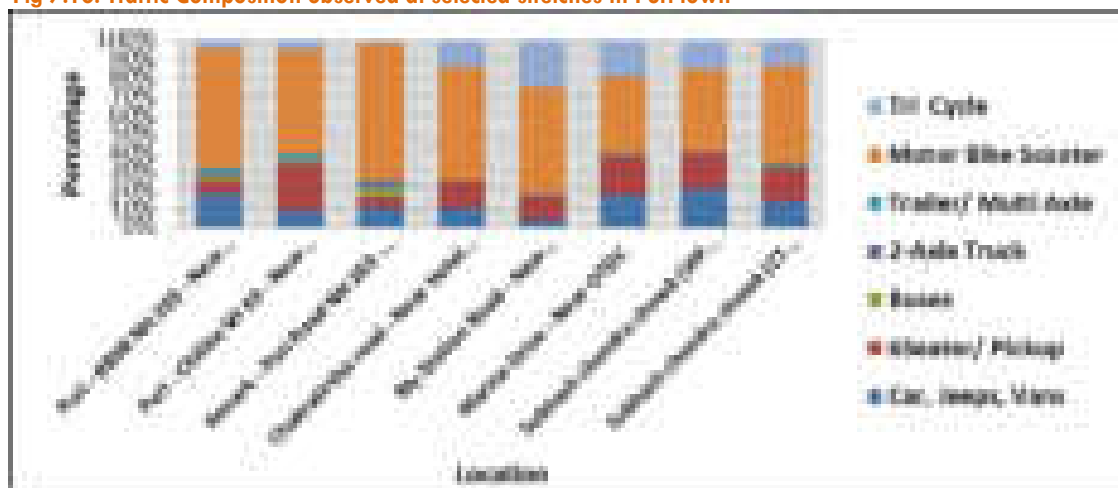
Source: Puri Municipality

7.3.5.2 Traffic Composition

Primary survey has been conducted by CEPT to understand the composition of vehicular flow and modal split of vehicles in Puri town where majority of traffic is generated. Survey has been done at same locations as mentioned above based on the same criteria's.

The attached chart below shows the composition of the traffic at the surveyed locations which comprises major stretches and nodes of Puri town. The output of the analysis is given in the below chart:

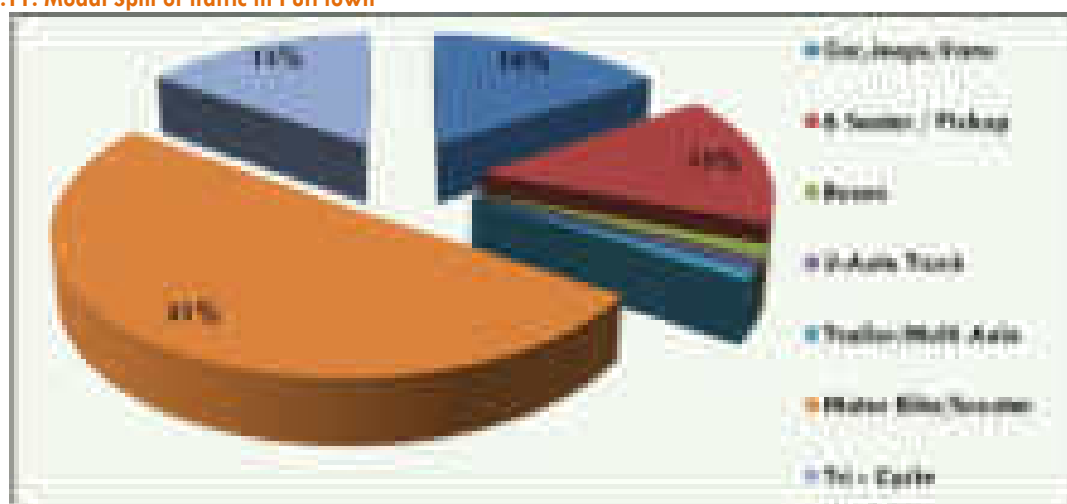
Fig 7.10: Traffic Composition observed at selected stretches in Puri town



Source: CEPT survey & Analysis

From the survey conducted it is clear that the major modal share is by the two-wheelers (51%), followed by cycle rickshaws (tri-cycle), cars, jeeps and pickup vehicles. From the survey it is also clear that the mass transport modes available are of negligible percentages when compared to the private vehicles or modes of transport. The attached chart shows the average modal share of the survey locations on a gross level to given an understanding.

Fig 7.11: Modal Split of traffic in Puri town

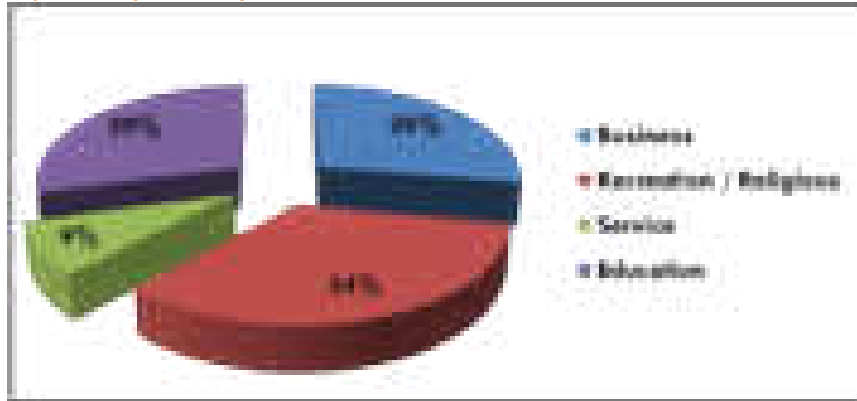


Source: CEPT survey & Analysis

7.3.5.3 Trip Purpose

The following figure shows the analysis on the purpose of the trips made by the tourists and outsiders entering the PKDA region

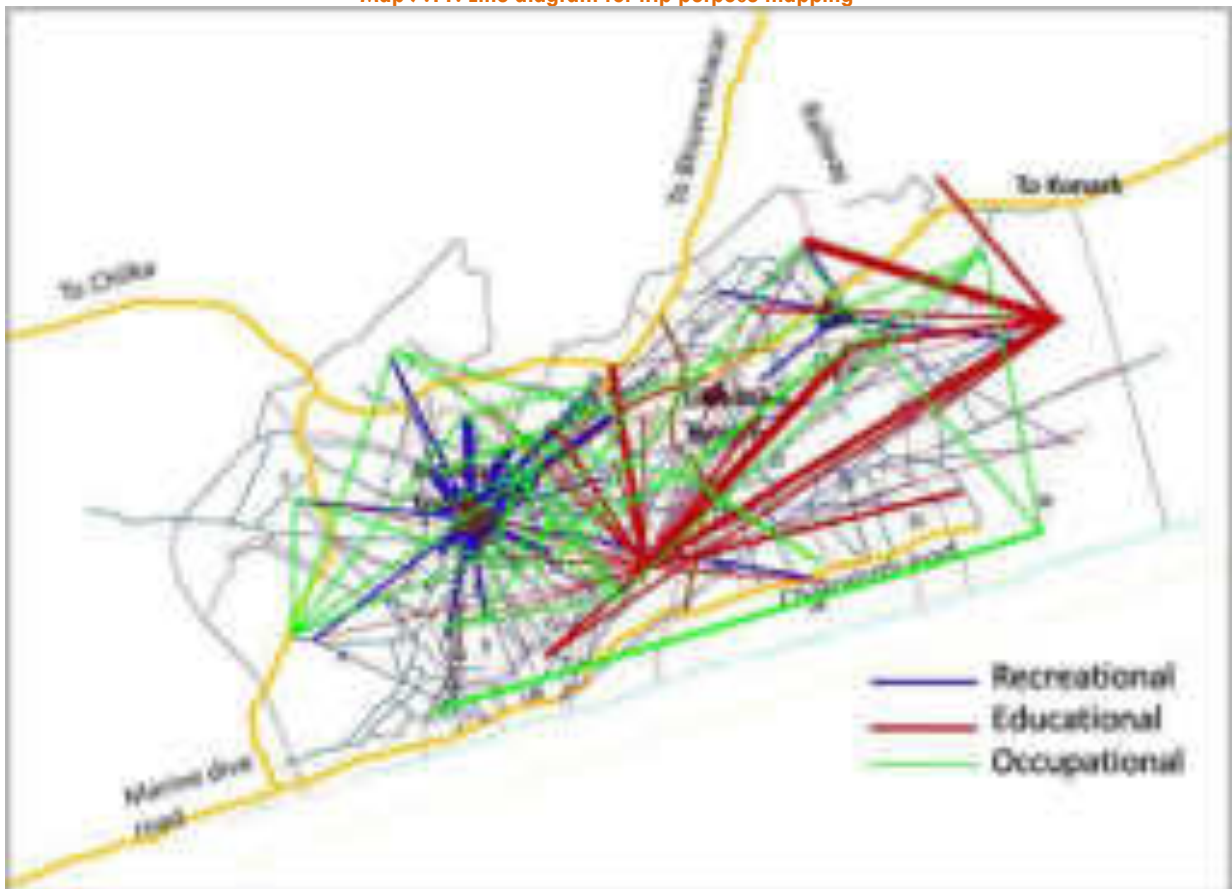


Fig 7.12: Purpose of trips made by Tourists

Source: CEPT survey & Analysis

It is evident that a major share of visitors coming are for religious or recreational purposes to the Jagannath Temple, Konark sun temple, route to Chilika Lake and the beaches. The other purposes of travel include business, education and service. Majority of travel source are originating from Peripheral areas of the town to the central parts includes Jagannath Temple and major commercial areas located nearby beach in the town. Due to the reason major vehicular flow has been observed in the analysis above in the same areas.

The attached map below explains the location of the tourist areas and the commercial and institutional areas and the pattern of flow of travelers according to purpose of visits:

Map 7.11: Line diagram for trip purpose mapping

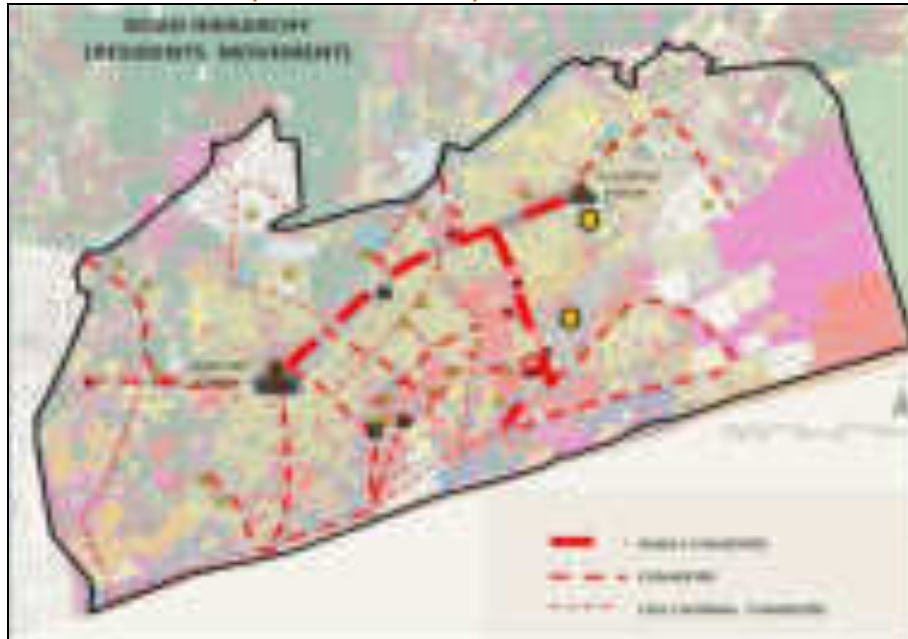
Source: CEPT survey & Analysis

From the map above it becomes clear that among the local residents of the Puri Town, the major trips or purposes for travel are for education and business. The modes of transport for the same are found to be primarily bicycles, followed by auto rickshaws. It is also clear that the percentage of public transport is very less when compared to the private modes of transport, emphasizing the improvement of public transport in the region and within the town.

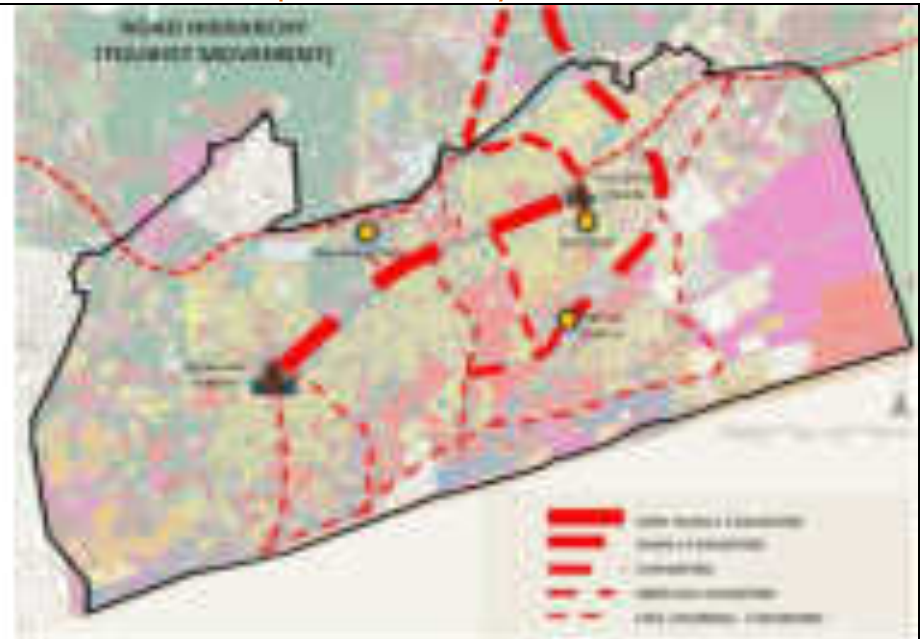
7.3.5.4 Traffic Flow Scenario

This section describes the movement of vehicles (residents and tourists), and pedestrian traffic flow. The vehicular composition of the vehicles in the morning and evening comprises maximum percentage of slow moving vehicles, that varies from 65% to 75% and the fast moving vehicles account for 25%. The surveys conducted reveal the most congested roads, and the major bottlenecks within Puri city. The maps below depict the same:

Map 7.12: Road Hierarchy: Residents Movement



Map 7.13: Road Hierarchy: Tourist Movement



Source: CEPT survey & Analysis

Source: CEPT survey & Analysis

Fig 7.13: Traffic Scenarios in Puri



7.3.6 Road Accident and Safety

The current traffic scenario and the transit pattern indicate that a major amount of traffic within the region is primarily reliant on the private transit modes, when compared to the public transit modes. The public transit modes are more often used for long distance travel, than within the town.

A major amount of traffic is been witnessed on the National Highways (NH 203, NH 203A, NH 203E) entering Puri, and going to Brahmagiri and Konark. It is also noted that the tourist entering the town contribute to the major amount of traffic passing through these routes. It is noted that in the year 2009, there were 138 cases which were registered for accidents on the NH 203

7.3.7 Identification of Hotspots

From the analysis the following areas have been identified as areas of congestion, where immediate action has to be taken in order to improve the traffic within Puri town.

- Atharnala Bridge
- Hospital Square
- College Road
- Station Road
- Marine Drive Road
- NH 203(a)

The following figure shows the areas of congestion within the Puri town. The major reasons for congestion are due to on-street parking which is done in a haphazard manner, especially on the marine drive road and the Grand road. Near Atharnala Bridge – the entry point to Puri, the congestion is due to diversion of heavy vehicles entering Puri, going to Konark, Chilika & Brahmagiri. Along the Grand Road and near the Gundicha temple, the congestion is more due to the large number of vehicles entering the town, the missed activities on the Grand Road (such as garages, other commercial activities, road side vendors, etc.,) and a large proportion of pedestrian traffic.

Map 7.14: Identification of major hotspots in Puri town



Source: CEPT survey & Analysis

7.4 Summary of Issues identified in the sector:

From the analysis of the existing ground situation of the transportation sector the following issues has been identified:

- Overall regional linkage in PKDA is very weak as most of the facilities is concentrated in Puri town and not been diversified. Therefore existing disparity is apparent from the analysis done. Hence improvement of regional linkage and mobility should be emphasised in the mobility plan in CDP for PKDA-2031.
- The distance between Puri and Konark is approximately 35-40 km. but the means of connectivity between the two is primarily NH-203E. There is an increasing need to connect the two urban centres in the region through faster public transport medium.
- The major problem that is currently Puri town is facing is due to primarily mixing of domestic traffic and tourist traffic as there is no line of separation between the two. Hence there is a need to create an alternative route for tourist traffic entry into the town especially for tourists visiting for recreation in beach of Puri.
- The PKDA area on a gross level designates only 1.49% of its total area for transportation facilities use. Whereas Puri town being the prime urban centre in the region gives out 9% of its total land for the same use. Both of the shares are far below standards as prescribed by UDPFI guidelines. Therefore the CDP should plan accordingly for increasing the share for providing efficient mobility in the region.
- Major traffic in Puri town is generated in the NH-203 which is main link between Puri and Bhubaneswar. But the width of the same road is less than 20 m on an average which is clearly inefficient to carry the current and growing traffic volume. Expansion and proper design interventions in the road are therefore the prime necessity felt for the case.
- Major traffic within Puri city is generated in the Grand road, Marine drive road and Station road areas where specific interventions must be proposed in the CDP to enhance mobility the town.
- Existing traffic management system in the urban areas of the region is very weak and inappropriate. Major junctions should be identified and managed in scientific and technically sound manner so as to increase the standards of transportation facility.
- The major traffic problem in Puri town is created by on street parking in busy roads where there is no regulation for the same. Stretched should be identified in different part of the city for designated on street parking to reduce the gravity of the problem.
- Spaces for off street parking in both Puri town and Konark NAC are very less according to demand especially in the tourist season. The CDP should therefore identify appropriate spaces for off-street parking especially in Puri town.
- The existing condition of terminals, bus stops and other facilities is highly inadequate and ill managed. Within growing population and traffic scenario specific plans should be formulated for identifying terminal spaces and well designed and managed stops in the region and most importantly in the urban areas.
- Most of the traffic congestion in urban areas are created due to informal vending and illegal encroachments which should be kept to check through necessary interventions in the CDP.

8. Physical Infrastructure

Provision of physical infrastructure is the key to provide healthy, safe and standard living environment to the urban residents. Providing infrastructure means attracting investments which leads to employment generation and economic development of a region. Basic problem the Indian cities face is the infrastructure provision is done in a fire fighting mode and not in a pre planned manner. This makes it difficult to grow at par with population increase and standard of infrastructure supply. Hence it is required to plan the infrastructure for future by assessing the demand and plan infrastructure accordingly.

This chapter deals with Existing scenario assessment, demand calculation, gap analysis and proposal for suitable solutions in the following sectors:

- Water Supply
- Sewerage
- Drainage
- Solid waste management

8.1 Water Supply

Water supply is one of the basic necessity of population and a mandatory responsibility of local government to supply the infrastructure. Due to the location of the PKDA area nearing the coastline most of the ground water zones are saline in nature and hence pose serious challenges for the local authority to extract and supply pure and safe drinking water to the residents.

The lack of piped water supply connections clubbed with extensive use of ground water in Puri reflects an inadequate water system. The existing situation of the water supply system in the PKDA area is described in this section.

8.1.1 Water supply in Puri:

8.1.1.1 Drinking water Sources

• Ground water resources

The city meets its drinking water needs from the ground water through tube wells fitted with motorized pumps and hand pumps. Since the city is situated near the sea, the ground water near the sea beach is saline. There two major sweet water zones at about 2 to 3 km away from the seashore, which are the main sources of drinking water to the city: one at Chakratirtha towards the east of the city and the other at Baliapanda towards the west of the city. The Chakratirtha well field extends over an area of 497.68 acres, while the Baliapanda one extends over 207.52 acres. Several production wells have been sunk in these two areas for extraction of water from these well fields and supply to the community. Besides there are also production wells sunk in other areas of the city to supplement the supply to the community as well as to various institutions and government residential offices/quarters/houses.

The ground water level in the town area is higher towards the seashore where as it is lower at the opposite direction. This trend effect quality of ground water as the same is salty towards the sea. Also the quality of water is not of good standard as the contents of iron and sodium is generally high in the area.

The ground water source hence is limited as well as confined and along with the rising population and growing urban area the water supply scarcity poses serious concern for local authority.



• Surface waters Sources

River Bhargabi has tributaries like River Kanchi and River Dhaudia. But no water is available in these tributaries during the summer months. The nearest surface water source to be tapped for drinking purposes is river Mahanadi at Naraj which is at a distance of 90 km. The major problem for surface water is that due to its nearness to sea most of the flowing rivers face inflow of tidal waves and hence is saline in nature. Therefore it is difficult to meet the demand of water supply from the surface water sources and possible other sources have to be augmented.

Water supplied by Puri municipality extracted from different sources is listed in the below table:

Table 8.1: Water supply sources: Puri Municipality

Sl. No.	Water supplied from different sources	Quantity supplied/ Nos.
1	Ground water through Production Wells:	
	Ground water through production wells for Public w/s system	18.6 MLD
	Ground water through production wells for Institutional w/s system	1.20 MLD
	Ground water through production wells for Residential w/s system	0.22 MLD
2	Hand Pump Tube Wells:	
a	Total number of HP tube wells for public use in running condition	549 nos.
	Deep hand pump tube wells	432 nos.
	Shallow hand pump tube wells	117 nos.
b	Total number of HP tube wells for institutions in running condition	93 nos.
	Deep hand pump tube wells	26 nos.
	Shallow hand pump tube wells	67 nos.
c	Total number of HP tube wells for Govt. Residential use in running condition	105 nos.
	Deep hand pump tube wells	1 no.
	Shallow hand pump tube wells	104 nos.

Source: Puri Municipality

The 83 wells in the Chakratirtha and Baliapanda areas are equipped with 83 pumps that provide the city with drinking water throughout the year. The Chakratirtha well field has 15 production wells with 13 pump houses whereas the Baliapanda well field has 13 production wells, each provided with a pump house. The location of the two water fields and details of their existing capacity of supply has been shown in the map in the next page.

Besides these, there are 27 other isolated production wells sunk at various places in the city, mostly inside Government offices and institutions. These production wells are at a distance of 350m and 680m respectively from the shoreline.

Details of the quantity supplied are given in the below table and locations are shown in the map below:

Table 8.2: Details of various water fields in Puri Municipality

Features	Baliapanda Water Field	Chakratirtha Water Field	Total
No. of Pump Chambers	14	22	36
Present Pumping Rate (MLD)	7.95	12.49	20.44
Safe Pumping Rate (MLD) against salt water intrusion	11.67	25	36.67

Source: Puri Municipality



There are five different sources of water supply serves the water supply system in Puri Municipality. Water supply network have been designed in the town in consonance to location and population concentration and resultant demand. The major two supply points are from Baliapanda to Gopinath supply system which supplies 8 MLD of water and second one is from Chakra tirtha to Markandeswara Tank which supplies 7 MLD of water. The detail of supply system in the municipality is shown in the below table:

Table 8.3: Sector wise pumps and their capacity: Puri Municipality

No	Sector wise pump installed	Capacity
1	From Chakratirtha well field – Markandeswara tank supply system	13.20 mld
2	From Baliapanda well field to Gopinath supply system	11.25 mld
3	From isolated wells	09.48 mld
4	Total water pumped	33.93 mld

Source: Puri Municipality

Table 8.4: Quantity of water supplied from different system lines

No	Supply System	Quantity
1	From Baliapanda to Gopinath Sully System	8 MLD
2	From Chakra Tirtha to Markandeswara tank	7MLD
3	From Godha bazar supply system	5MLD
4	Individual industrial sources	2.5MLD
5	Hand Pumps (504 no's)	3.5MLD
	Total	26MLD

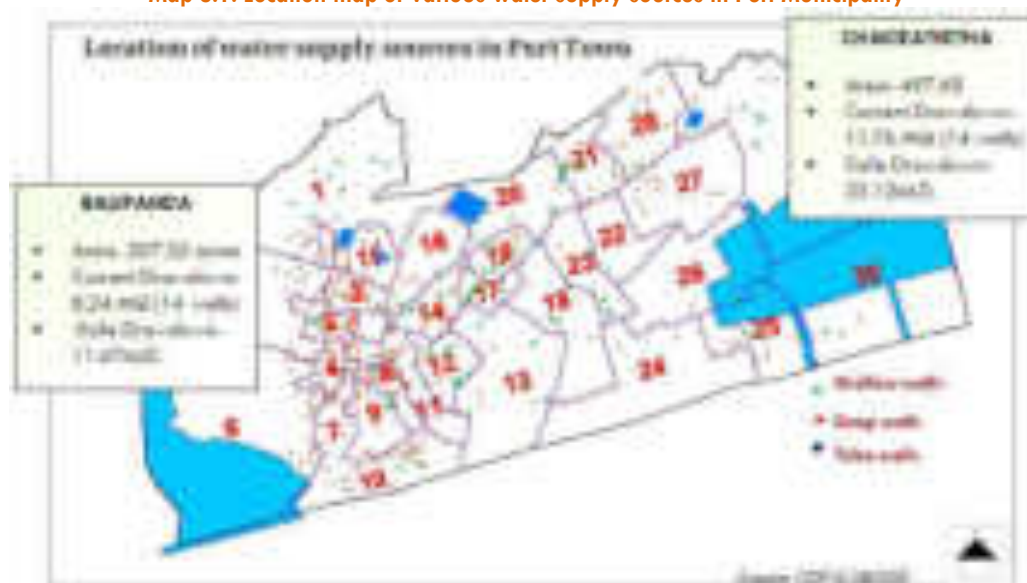
Source: Puri Municipality

Table 8.5: Water Supplied to Various Sources

No	Sources supplied	Amount
1	Community supply	18.60 mld
2	Institutional supply	01.20 mld
3	Government residential supply	00.22 mld
4	Total water supplied	20.02 mld

Source: Puri Municipality

Map 8.1: Location map of various water supply sources in Puri Municipality



Source: Puri Municipality

The PHEO has installed the pumps with a view to pumping only about 70 percent of the capacity of pumps on an average. But in absence of any rational measurement, the actual quantity is not known. Therefore the data presented in the above table although shows the system is installed for pumping in ground the capacity far lesser than installed.

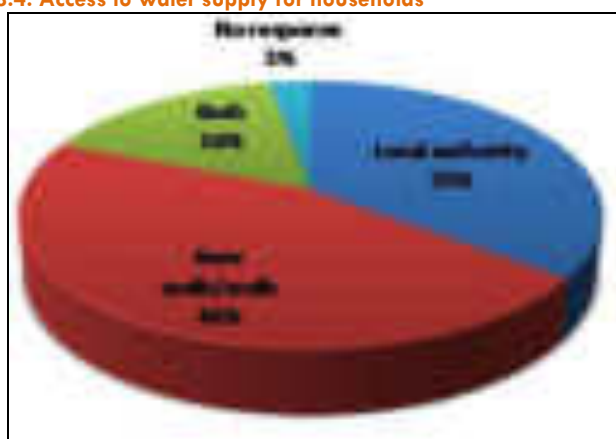
As far as the supply to various sources by Municipality is concerned more than 90% of the share is supplied to community supply where as very less proportion is supplied to institutions and other categories of use. The industrial supply is very less in the town due to less no of heavy industries in the area. The pattern of supply though changes in the peak season due to need of more water for institutions and small industries in the urban region.

From the primary survey conducted by CEPT it has been analyzed that 35% of the household have access to Municipal water supply where as majority of population (46%) uses bore wells/wells for the supply. The rest of the residents access the water from diversified sources like ponds, river water etc. this clearly depicts the poor status of water supply in the town. Immediate interventions in the sector are therefore the need of the hour.

Fig 8.1: Pumping Station at Baliapanda Fig 8.2: Community Tap in Puri town Fig 8.3: Individual Tubewell in Pentakota



Fig 8.4: Access to water supply for households



Source: OWSSB

8.1.1.2 Transmission:

Water from the production wells is transmitted through transmission mains to 3 major storage reservoirs located at Ghodabazar, Markanda tank and Totagopinath. The transmission mains, varying in sizes from 250 to 400 mm in diameter, are about 15 km long.

8.1.1.3 Storage:

There are three major storage reservoir complexes, consisting of Ground Storage Reservoirs (GSRs) and Elevated Storage Reservoirs (ESRs) in the city at Ghodabazar, Markanda and Totagopinath. Besides, there are 3 other institutional service storage reservoirs in the city. The detailed storage capacities of the reservoirs are as given in Table below. The



Fig 8.5: Water Reservoir in Puri town

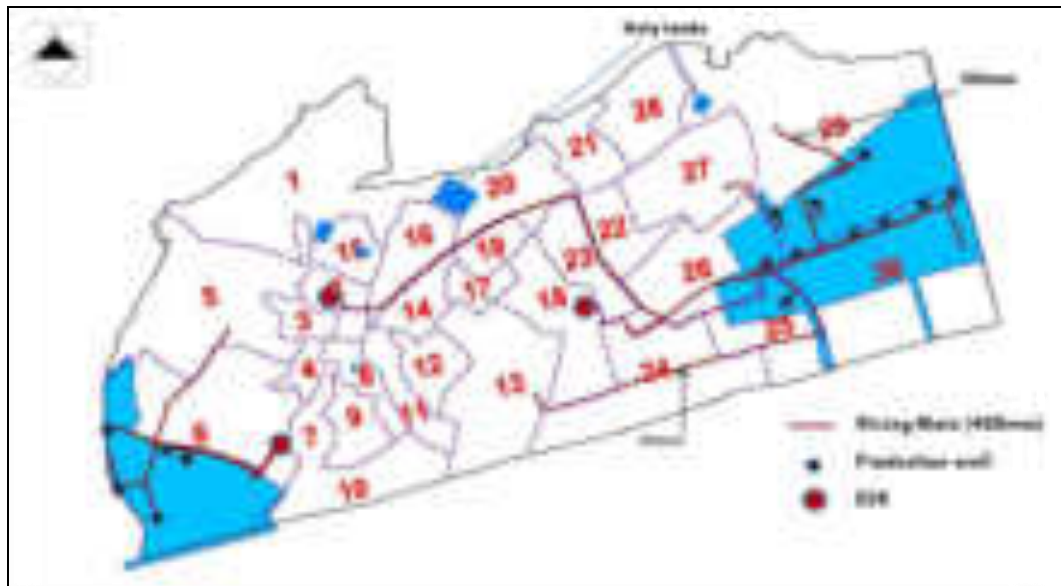
Markanda ESR constructed of brick masonry in the year 1935, has a capacity of 2, 20,000 gallons, diameter 18.10m and height 4.56m over a staging height of 22m. The height of the dome is 7m. The thickness of the staging wall is 1.2m at the bottom and 1m at the top. The wall thickness of the tank portion is 0.8m.

The Totagopinath ESR was constructed in the year 1969 and has a capacity of 1, 00,000 gallons, diameter 10m and height 3.6m over a staging height of 30m. The staging comprises of a polygonal structure of circular columns in five stages.

The Ghodabazar ESR, constructed in the year 1975, has a capacity of 2, 00,000 gallons, diameter 11m and height 8.5 m over a staging height of 29.5 m. The staging comprises of a polygonal structure of circular columns in five stages with acicular ladder attached to the superstructure.

As of now the total storage capacity of the service reservoirs at Puri including the institutional reservoirs is about 6.61 MLD.

Map 8.2: Water storage facilities in Puri Municipality



Source: ORWSSB

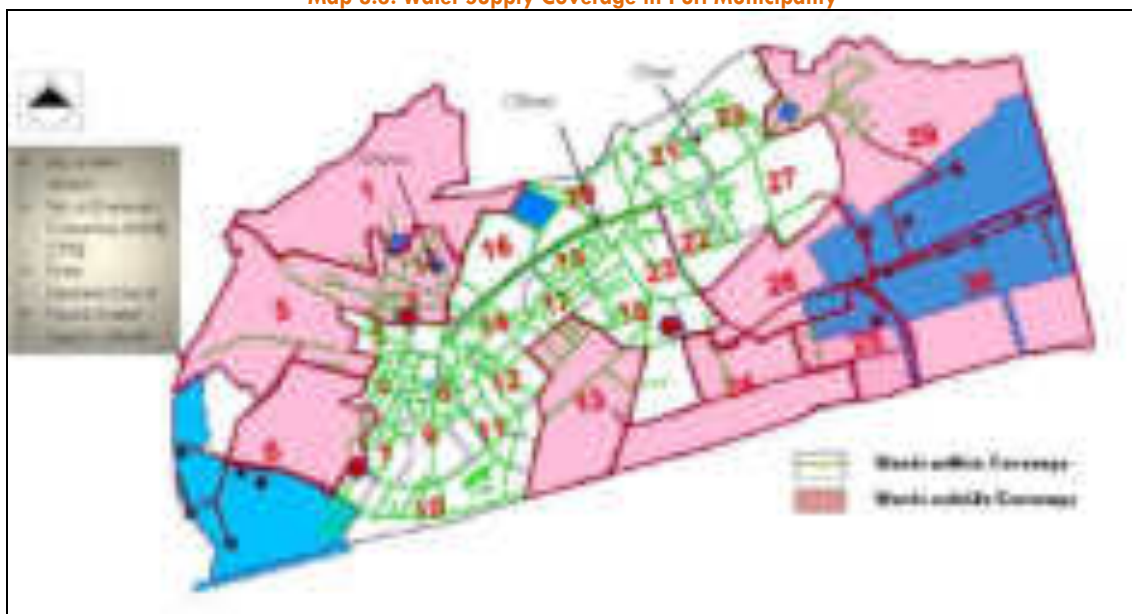
Table 8.6: Details of storage facilities: Puri Municipality

SL No	Location	Capacity				Total capacity Gallons	Total capacity Liters
		GSR		ESR			
		Gallons	Liters	Gallons	Liters		
Community Reservoirs Existing							
1	Ghodabazar	75000	340957	200000	909218	275000	1250175
2	Markanda Tank			220000	1000140	275000	1000140
3	Totagopinath	400000	1818436	100000	454609	500000	2273045
	Total	475000	2159313	520000	2363967	995000	4523360
Community Reservoirs under construction							
1	Chakratirtha	200000	909218			200000	909218
	Total	200000	909218			200000	909218
2	Chakratirtha	400000	1818436			400000	1818436
Institutional Reservoirs Existing							
1	Ayurvedic College			20000	909920	20000	90920
2	Kamaladevi Hospital			20000	909920	20000	90920
3	IDH			20000	909920	20000	90920
	Total			60000	272760	60000	272760
	Grand Total	875000	3977829	580000	2636727	1455000	6614556

Source: Puri Municipality

8.1.1.4 Transmission and Distribution:

Supply of water to the city is made through a distribution network as shown in Drawing 1. The network comprises of the following lengths of pipes as per PHEO. The higher sizes include a portion of the transmission mains also. It may be noted that about 54 percent of the pipes are of 100 mm dia, while about 15 percent are 150 mm dia, about 10 percent 200 mm dia and 8 percent 80 mm diameter. The total length of transmission and distribution mains together is 145.01 km laid along a total road length of about 692 km in the city, which is about 21 per cent.

Map 8.3: Water Supply Coverage in Puri Municipality

Source: ORWSSB

8.1.1.5 Duration of Supply:

Puri consumers get on an average 6 hours of water supply per day, 4 hours in the morning and 2 hours in the evening. The normal supply hours from the system are as below:

Table 8.7: Duration of water supply: Puri Municipality

SL. No	From Head works at	Hours of supply				Total HRS of supply
		Morning		Evening		
		From	To	From	To	
1	Ghoda Bazar	5	9	4	6	6
2	Markanda	5	9	4	6	6
3	Totagopinath	5	9	4	6	6
4	Didhamahabir	5	9	4	6	6

Source: Puri Municipality

Fig 8.6: Duration of water supply in Puri town



Source: CEPT analysis

From the analysis of primary data it is clear that there is some mismatch between the municipal figures and actual ground situations. It can be seen from the chart that more than 20% of the consumers have reported to avail water supply for <2 hrs/day. This indicates that there is a wide range of variation in duration of supply in different zones of the town. Also there is data gap between the information provided by Municipality and survey analysis outputs conducted by CEPT. Permanent sources of water supply needs to be tapped for increasing water supply coverage and duration of supply in the town.

8.1.1.6 Water Charges:

The water charges for different consumers priced by Puri Municipality has been analysed in the following table:

Table 8.8: Water charges of Puri Municipality

Name of ULB	Type of consumer	Water tariff target for 2007-08		Water tariff collection for 2007-08		Water tariff target for 2008-09	
		Current	Arrear	Current	Arrear	Current	Arrear
Puri	Domestic	5067246	4588241	2383135	1821660	5260875	14182884
	Institutional	2058191	725248	1283284	672286	2108005	2422422
	Commercial	52856	114242	21490	23958	58647	350549
	Industrial	--	--	--	--	--	--
	Stand post	672502	1835900	--	--	708849	5998147
Konark	Domestic	2503	3547	--	--	4164	6050
	Institutional	76246	168459	--	--	83155	244705
	Commercial	206796	76914	60000	--	232835	223710
	Industrial	--	--	--	--	--	--
	Stand post	37758	166192	--	--	97063	203950

Source: Puri Municipality, Konark NAC

8.1.1.7 Water Quality:

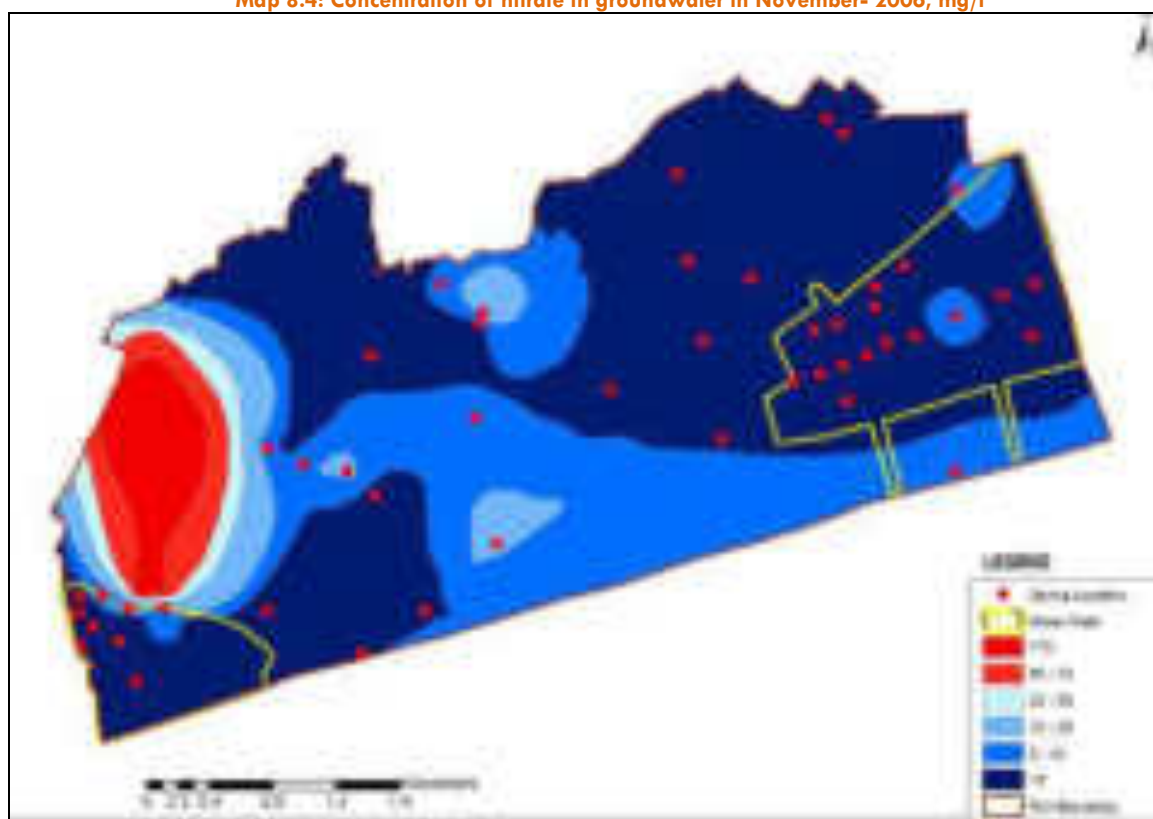
Due to the location of the region nearer to the sea water quality is always a matter of concern and must be looked at carefully. Water quality in the town has been measured in different seasons by PHEO department, Govt. of Odisha. The results in post monsoon season shown in below table & map:

Table 8.9: Water Quality Measurement, Nov-2006

Parameter	Chakratirtha Waterworks			Baliapanda Waterworks			Town Hand Pump Tube wells			Accepted limit	
	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.
pH	6.67	8.64	7.4	6.83	8.08	7.49	6.69	8.27	7.29	6.5	8.5
TDS (mg/l)	87	370.2	227.12	84	619.2	250.15	87	1572	611.57	500	2000
Hardness as CaCO ₃ (Mg/l)	76	263.2	167.05	12	200	100.92	52	480	221.98	300	600
Alkalinity (mg/l)	40	148	74.75	42	200	117.82	48	432	181.33	200	600
Na (mg/l)	2.8	48.2	28.51	5.8	27	18.65	6.8	167.8	34.65	-	-
K (mg/l)	3.5	26	7.13	2.7	26	10.25	3.4	121	39.73	-	-
Ca (mg/l)	0	63.52	27.15	9.6	48	24.36	6.4	76.8	34.51	75	200
CO ₃ (mg/l)	24	88.8	43.05	16.8	60	39.68	28.8	129.6	65.77	-	-
NO ₃ (mg/l)	0.35	9.71	2.05	0.19	102	10.64	0.23	155	11.33	45	45
Cl (mg/l)	14	56	38.07	22	110	58.18	16	464	138.29	250	1000
F (mg/l)	0.04	1.84	0.26	0.04	0.85	0.18	0.04	1.75	0.51	1	1.5
Fe (mg/l)	0.15	0.32	0.25	0.17	0.98	0.54	0.8	1.1	0.95	0.3	1

Source: ORWSSB

Map 8.4: Concentration of nitrate in groundwater in November- 2006, mg/l



Source: ORWSSB

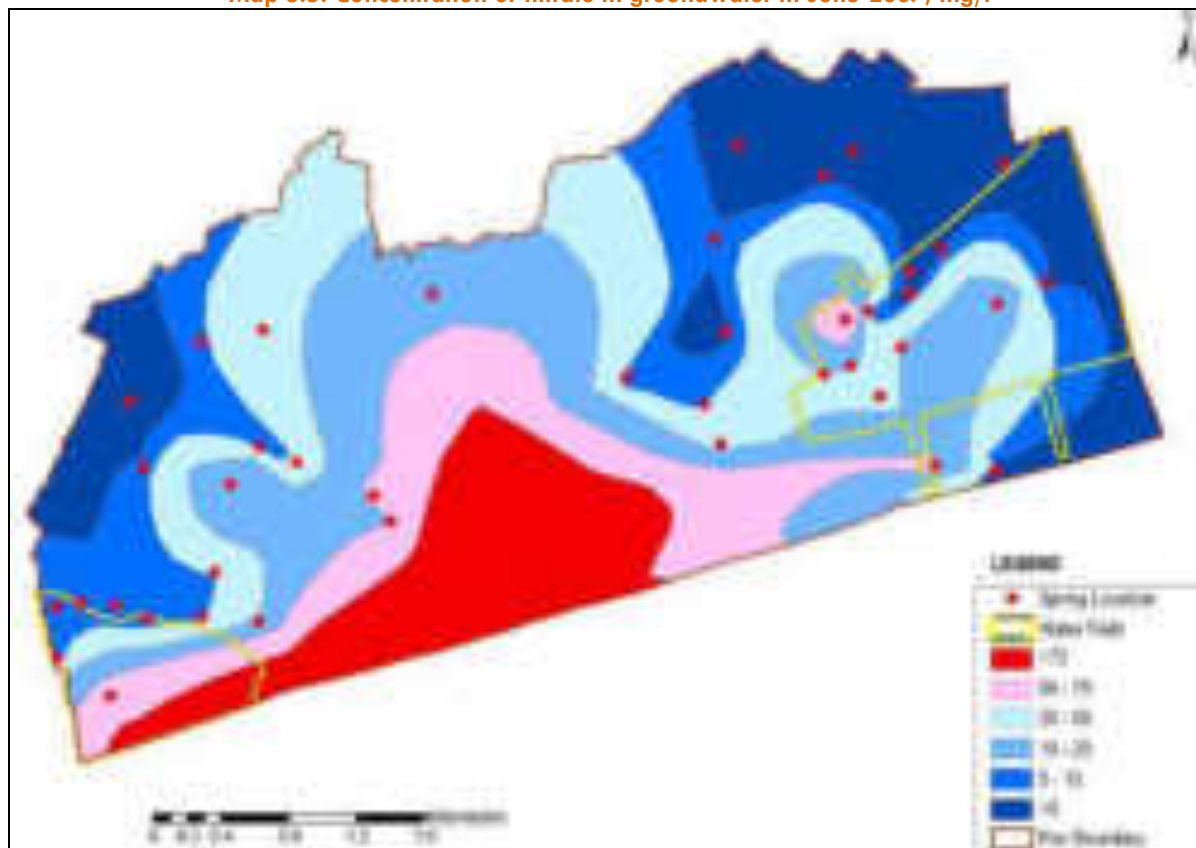
The results for the water quality assessment done in summer season (June, 2007) shown in below table and map:

Table 8.10 Water Quality Measurement, June-2007

Parameter	Chakratirtha Waterworks			Baliapanda Waterworks			Town Hand Pump Tube wells			Accepted limit	
	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.
pH	7.44	7.88	7.60	6.71	7.44	7.06	6.85	8.17	7.56	6.5	8.5
TDS (mg/l)	55.2	345.6	215.04	78.6	372	198.1	93.0	2208	504.8	500	2000
Hardness as CaCO ₃ (Mg/l)	52.0	164.0	114.4	40.0	180.0	101.3	24.0	520.0	162.0	300	600
Alkalinity (mg/l)	12.0	148.0	90.0	20.0	200.0	93.33	52.0	288.0	151.1	200	600
Na (mg/l)	0.1	865.0	111.47	6.3	43.7	29.0	25.6	1145.0	217.3	-	-
K (mg/l)	2.0	11.1	5.9	2.8	11.5	6.2	3.2	335.0	68.08	-	-
Ca (mg/l)	9.6	22.4	15.52	6.4	27.2	16.27	6.4	54.4	14.76	75	200
CO ₃ (mg/l)	7.2	88.8	54.0	12.0	120.0	56.0	31.2	172.8	90.67	-	-
NO ₃ (mg/l)	0.91	49.28	15.76	1.38	61.11	14.36	1.99	147.85	30.53	45	45
Cl (mg/l)	27.5	82.5	51.5	37.5	60.0	48.75	22.5	1122.5	147.5	250	1000
F (mg/l)	0.06	0.138	0.09	0.086	0.305	0.16	0.046	2.04	0.43	1.0	1.5
Fe (mg/l)	0.18	1.69	0.79	0.12	1.21	0.62	0.04	3.47	1.52	0.3	1.0

Source: ORWSSB

Map 8.5: Concentration of nitrate in groundwater in June-2007, mg/l

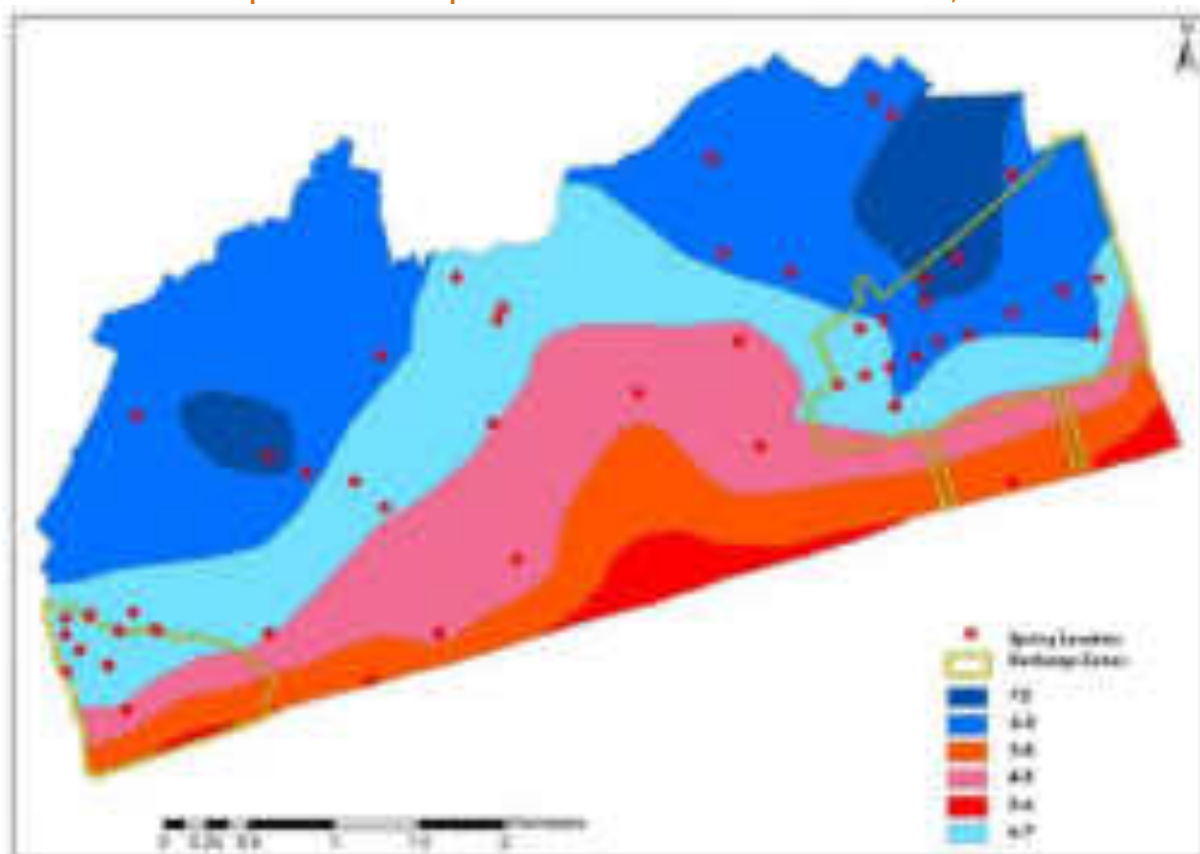


Source: ORWSSB

From tables, it is observed that nitrate concentration is high in two waterworks where groundwater production well field are concentrated. Nitrate concentration is also high in hand pump tube wells located inside the town which are used by people to supplement water needs due to intermittent water supply. The spatial distribution of nitrate in groundwater of Puri town in November 2006 and June 2007 sampling becomes clear in shown maps.

It is seen that nitrate concentration in groundwater in many areas exceeds 45 mg/l, permissible limit as per Bureau of Indian Standard for potable water (50 mg/l, as per WHO Standard). The spatial distribution in post rainy season (November 2006) is different from summer season (June 2007, before the onset of monsoon rain). The source of nitrate plume traveling towards Baliapanda water field in November 2006 sampling could be attributable to presence of an old unsanitary solid waste dump site nearby. Leachate from the dump site infiltrates with rain occurring during July to October. The plume travels with groundwater flow in the direction of sea.

Map 8.6: Contour map of water table observed in November-2006, mt



Source: ORWSSB

The June 2007 result shows that nitrate plume has flown across Baliapanda well field. But, at the same time high nitrate concentration is found along sea beach area and inland area. These places are highly dense with compact residential buildings, hotels and restaurants.

8.1.2 Water supply scenario in Konark NAC:

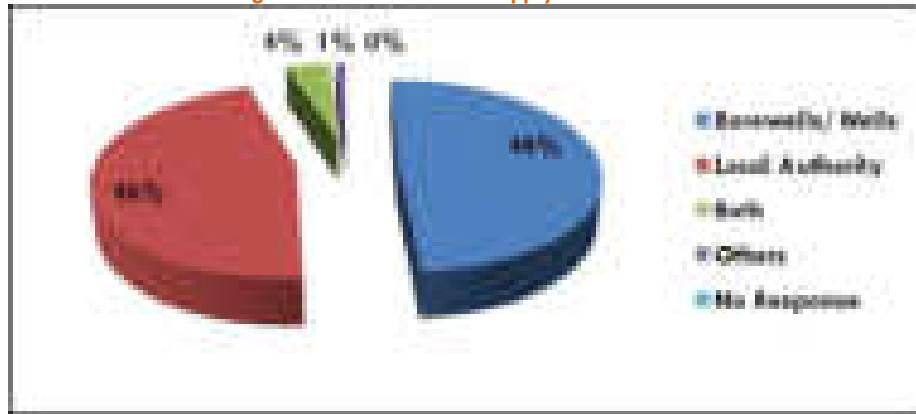
Konark has a population of 19900 (2010) which is distributed in 13 wards. The water supply network in the NAC is 37.6 Km long covering all the wards under water supply network. More than 99% of the population has been served by community stand post where as only less than 1% has household tap connection. The rate of demand for water in the area 70 LPCD where as the rate of supply is only 31 LPCD. 5 PWs AND 232HP tube wells has been provided by local authority for supplying water to the residents. There is no effort made for treating water in the area and hence the quality of supply can be questioned. Overall the standard of service can be rated as moderate to low.

The two waterworks are sensitive to simulation for sea water intrusion. The interface of salt water and fresh water moves faster towards the well fields due to pumping of groundwater. The present withdrawal quantity is found safe against salt water intrusion.



The safe quantity of groundwater withdrawal against sea water intrusion is 25.12 MLD for Chakratirtha waterworks and 11.67MLD for Baliapanda waterworks. In the simulation model, the interface shifted inland in summer by 140 m towards Chakratirtha well field and by 173m towards Baliapanda well field. The interface restored to original position in monsoon season due to high recharge.

Fig 8.7: Sources of water supply to households



Source: CEPT survey & analysis

Fig 8.8: Duration of water supply to households



Source: CEPT survey & analysis

Fig 8.9: Issues with water supply infrastructure



Source: CEPT survey & analysis

From the household survey conducted we have analysed different parameters in this section to get an overview of the actual ground situation. One can see from the chart beside that among the household surveyed more than 45% have access to local authority supply where as nearing 50% of them use wells for accessing drinking water. This proves that although database collected from authority show 100% coverage of population people in ground actually not much benefited from the supply.

11% of the households in the region have access to water supply <2 hrs/day, whereas 31 have answered to access it more than 2 hrs. But majority of the household surveyed have not answered due to the reason they do not access the water supply of the authority. Some of them access irregularly as well. This is a very generic picture in the smaller urban centres where the water supply standard is low and people have very little faith and dependence on the authority to access the same.

Table 8.11: Service level and standards a comparison

Urban Centres		Puri Municipality	Konark NAC
Population	2001	157610	15015
	2010	195600	19900
Total No of wards		30	13
Fully Covered with Piped water supply		20	13
Partly covered		10	0
Rate of Demand (in LPCD)		135	70
Demand (MLD)		26.4	1.39
Daily Supply in LPCD		123	31
Daily Supply in MLD		24	0.651
Population covered under piped water supply		82.18%	100%
Through House connection		43%	0.60%
Through stand post		46.56%	99.47%
Sources of water supply (No of PWs)		61	5
HP Tube wells		577	232
Storage reservoirs with capacity	GSR	03 (4.75/L.gln)	01 (0.66/L.gln)
	ESR	03 (5.20/L.gln)	01 (0.33/L.gln)
Total pipeline length in km		145	37.664
Treatment Capacity		Nil	Nil

Source: OWSSB

The chart beside shows the perception of the households on the water supply by authority. Here unreliability, poor quality of supply has been seen as prime concern. This is largely due to limited water resource augmentation, poor coverage of house connection and no available treatment system in the area.

The basic need therefore emerging from the analysis is that there is a strong need to plan water supply network which should focus on augmenting new sources, create a strong network of supply and treatment of supplied water. This will help in providing adequate provision of basic services to residents.

From the above understanding of the details provided for water supply status Puri town and Konark NAC we can compare the standards which will give an idea of the difference in supply mode and standards. Different parameters that have been compared are as shown in the below table:

The major highlights have been summarized below:

- Although Konark has lesser water supply network the coverage is larger than Puri town. Konark has water supply network covering all the wards where as in Puri 10 wards has been left uncovered/partially covered.



- The demand and supply of water both for Puri town is lot higher than Konark NAC due to difference living standards and requirements of the residents.
- Both the urban areas do not have any treatment facility has been the major area of concern.
- Water supply coverage in slum areas has not been given priority in both the urban centres due to lack of tenure status.
- Augmentation of new water sources will be the most important aspect for the centres in future.

8.1.3 Water Supply facility in rural PKDA:

Water supply facility in the rural areas of the region is very poor and below standards. Except few villages adjoining to Puri town which is constituted of Puri Sadar there is no provision for piped water supply in any part in the region. The source of water supply in villages in the area is primarily wells and hand pumps. The details of existing water supply facilities in rural PKDA are summarized below:

Table 8.12: Water supply sources in rural area: PKDA

Development Area	No. of Villages	Population	Wells (Existing)	Tanks (Existing)	Hand Pumps (Existing)
Puri Sadar	16	171880	11	9	12
SIZ	95	75244	72	76	81
Konark	7	1966	5	4	5
Block-A	21	17238	6	12	16
Block-B	14	6872	12	3	14

Source: PKDA, Puri – population as per PKDA analysis

8.1.4 Water supply infrastructure during Tourist Season:

During festive season in Puri town different departments namely: Puri Municipality, PHE department, Puri police line etc comes in collaboration with each other to provide extra facilities in the town for tourists. The details of facilities provided by different departments are summarized in this section. The PHE Department provided 30 water tankers in Puri during the car festivals. This map shows the deployment of area wise water tanker in Puri town at the time of car festival. According to the gathering of large no. of pilgrims it has kept in different area. Some areas it is kept in 3 no., in most of the area 2 nos. also 1 no. Stand by tankers are there for refilling purposes.

Map 8.7: Location of water tankers in Tourist season

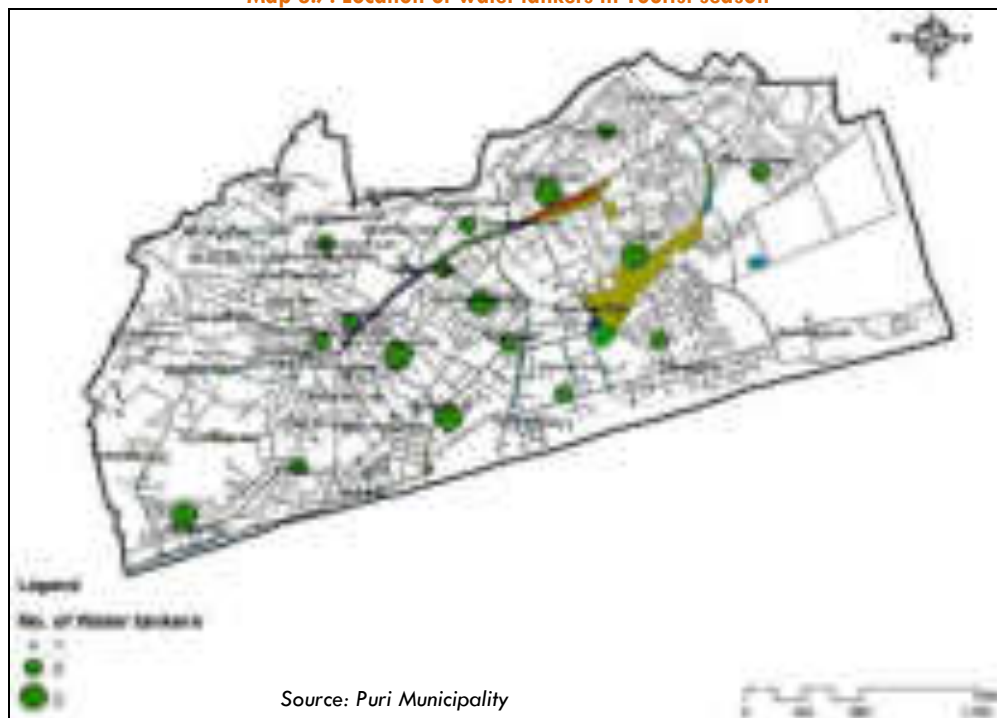


Table 8.13: Location of temporary water supply points in Puri during Ratha yatra

SL. NO.	LOCATION	NOS.
1	Puri zilla school	5
2	Govt Girls High School	5
3	Podakothi Barrack	2
4	Police line high school	2
5	Reserved Police line	2
6	Biswamber vidya pitha	4
7	Municipal high school	3
8	Badasankha girls high school	3
9	Fire station	2
10	Police line M.E. School	1
11	Near bus stand	2
12	Indoor stadium(chkaratirtha)	4
13	Sanskrit University	2
14	Balagandi High school	2
15	Gadadhara high school	3
16	Police abakash	1
17	S.C.S College	4
18	Bholanath Vidya pitha	2
19	Gopabandhu ayurvedic hospital	3
20	Talabania	1
21	Railway station	1
22	Central school	4
23	Near conference hall	1
24	Temporary camps	6
25	Inside the gundicha temple	4
26	Saradha bali	4
27	Diff. water scarcity area	9
28	Sea beach area,digabareni to swargadwar	5
29	Reserve police line	2
30	Additional police camps	13

Source: Puri Municipality

The department installed 100 temporary water supply points at different locations during 2010- Car Festival as described below:

Although there is different facility provided by the Municipality and different authorities but still there is huge shortfall between the kinds of demand arises during festive season and the amount of supply extended. The quality of infrastructure provided is also becomes an important issue.

Therefore the water supply system should be designed in way which can not only satisfy the demand for residing population but also meet the requirements of the floating population. This will be the prime challenge for the town in coming years. This CDP should also keep provisions for the same demand.

8.1.5 Underlining the Issues:

From the above understanding on various aspects the issues on water supply in PKDA region has been summarized below which will lead us to formulate strategies and plans to improve the standard and quality of the infrastructure provision.

The table below shows the comparison of water supply indicators between standards and actual status of supply in Puri town:



Table 8.14: Comparison between existing service level and standards: Puri Municipality

Indicators	Actual value	Desired value
Average daily per capita supply (liter/person/day)	108	150
Quantity of groundwater withdrawal for supply (mld)	20.02	Assess environmentally safe groundwater withdrawal quantity for the aquifer
Access to drinking water supply	20 full and 10 wards partial coverage	100% coverage of town area
% number of connections metered	0	100
Number of domestic connections without meter	7466	0
Number commercial connections without meter	73	0
Hours and frequency of supply	4 hours/day intermittent supply, twice/day	24, continuous
Number of public stand posts	1047	338
Number of hand pump tube wells	530	Alternative water supply
wells		source may not be necessary if existing supply quantity and quality is reliable
Water Loss	15%	< 5%
Energy consumption for groundwater abstraction etc.	2,456,757	Explore energy efficiency

Source: Puri Municipality, CEPT analysis

The major drawbacks of the water supply infrastructure have been underlined below:

8.1.5.1 Quantity and quality:

- The existing quantities of water supplied in the urban centres are far below the demand and standards.
- The Chakratirtha and Baliapanda areas face contamination of the ground water owing to its usage as a parking area and encroachment by slums and housing colonies.
- The vast distribution network in Puri and Konark lacks a water treatment system that would keep check on the quality of the water supplied.

8.1.5.2 Inadequacy of different facilities:

- Considering the geographical conditions of the urban areas, it is required to provide additional UGR and ESR for facilitating adequate drinking water for problematic and elevated zones.
- Since, the holy city of Puri carries paramount importance for its cultural heritage & festivals throughout the year; the department requires additional water tankers for mitigating demand during such festivals and congregation of pilgrims and during breakdown of water supply system.
- The unplanned urban centres comprises of narrow lanes on account of which it also requires to provide three wheelers vehicle mounted water tankers. The dept also requires at least 1 no of compressor for cleaning of choked small dia pipe lines that have been laid since pre independence.

8.1.5.3 Coverage:

- There still exist some uncovered areas in Puri Town. Improper or no hydraulic assessment prior to extension of pipelines has resulted in inequitable distribution of water. The growing areas in peripheries, large villages can be included within coverage.



- Low level of service coverage in terms of ratio of House service connections (HSC) to Property Tax Assessments (PTA).
- The distribution network in Puri of 145Kms covers approximately 35 percent of the population, whereas a fully developed water supply system for a city like Puri should have a minimum coverage of 70 to 80 percent of the PTA. The rest of the 65% population is dependent on public stand posts, hand pumps, tanks, etc.

8.1.5.4 Losses in the system:

- The distribution pipes lines in the urban areas are too old. Water pressure is reduced. Therefore it needs replacement with suitable diameter of pipes.
- Significant volume of water loss takes place especially in Konark from the stand posts and other leakages.

8.1.5.5 Water supply usage:

- Water drawdown has doubled from 13.6MLD to 26MLD over the last two decades. Illegal tapping on distribution mains is a persistent issue.
- Non-metering of water supply results in indiscriminate usage of ground water.
- Lack of control on tapping of ground water can cause imbalance of sweet water reservoir leading to intrusion of saline water.

8.1.5.6 Revenue losses:

- Non revenue water entailed by the system results in revenue losses.
- The total revenue in Puri from the connections and monthly charges meets only 60% of the total cost of O & M.

8.1.6 Demand Assessment for water supply: PKDA-2031

This section deals with demand assessment, gap identification for water supply in 2031 and will try to suggest possible measures to plan and improve service delivery to the citizens in the region. The assessment is done primarily on the basis of projections carried out by CEPT using suitable methods of projections. We have also incorporated assessment done in the detailed project report prepared by TCI for Puri water supply project. We have also incorporated the proposals identified as they are going to be implemented shortly. The decision has been taken after series of discussions with major department heads and stakeholder meetings.

8.1.6.1 Water supply scenario in PKDA -2031

Before projecting the scenario let us look at the existing gap between the demand and supply going to arise in 2011. This has been generated by using current figures and assuming that current supply will be constant in due time.

The demand for water supply for Puri town in 2010 is 70 MLD which has been projected to rise to 74 MLD in 2011. Similarly the existing supply and demand datasets has been compared to find out the gaps in existing supply. The villages in the region have no provision for tapped water supply and hence the supply side is shown as zero.

It is quite apparent that maximum difference will be generated in Puri town due to large concentration of population and accumulating increase. The growing population in the town if needed to be served, the only option left is to create new sources of water supply and develop existing network. The rest of rural tracts can be taken for pilots. Especially community led water supply system development can be seen as an option



The demand assessment for 2031 has been analyzed for different blocks in the region. We have used standards for demand as per CPHEO Manual as shown in table. For calculating demand we have added 20% floating population in case of Puri town. For fire demand we have used standards only for Puri and Konark. Institutional demand has been taken as 10% where we have added 15% demand for incorporating water losses.

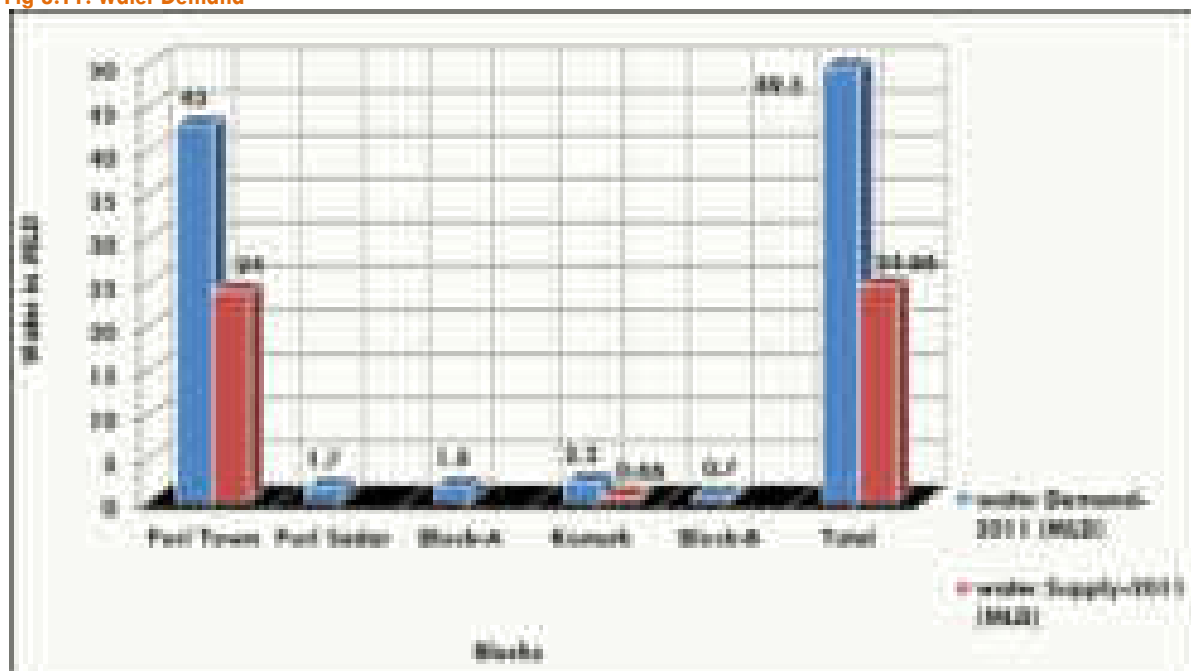
From the chart below it is quite clear that major shortfall in water supply is felt in Puri town where demand is also highest. The demand for the town is almost double that what the existing level of supply is. Konark also faces same problem where water demand is far higher than supplied.



Water demand for Puri town in 2021 according to the analysis will be 64.2 MLD where as it will grow up to 83.4 MLD in 2031. The demand for water supply in Konark NAC will be doubled in 2031. The rest of the villages will face relatively lower growth in demand due to less population increase than the urban centres. Overall the demand for water supply in the PKDA region in 2021 will be 126 MLD where as it will be 162 MLD BY 2031. The below chart shows the detail forecasting in the region for water supply:

The detailed project report prepared by TCS for Puri Municipality also includes the demand assessment for the Puri Town area. The gross demand for 2031 in the report is lesser than our projected demand. This is due to use of application of different method/standards used for calculation. The projected assessment in the DPR is shown in the following table:

Fig 8.11: Water Demand



Source: Puri Municipality, CEPT analysis

Table 8.15: Demand Assessment for water supply: PKDA-2031

Block	Existing 2001		Standards	Projected Estimation					
	Popln.	Piped Supply (MLD)		Population			Water Demand (MLD)		
			Domestic Demand (lpcd)	2011	2021	2031	2011	2021	2031
Puri Town	157837	20.05	135	204660	265374	344098	43.0	55.4	71.6
Puri Sadar	14880	0	70	19469	25473	33328	1.7	2.3	3.0
Block A	17238	0	70	20515	24414	29054	1.8	2.2	2.6
Konark	16979	0.55	70	26074	40040	61487	2.3	3.5	5.4
Block B	6872	0	70	7789	8827	10005	0.7	0.8	0.9
PKDA (TOTAL)	213806	20.60	-	278507	364128	477972	49.5	64.2	83.4

Source: Puri Municipality, CEPT analysis

From the demand pattern one aspect is quite clear that major interventions must be made for augmenting new water supply sources and raising the standards of supply to meet the same. Large scale investments and co-ordination between various public institutions and private support also will play a major role in paving the way for infrastructure development in the town.

Table 8.16: Demand assessment as per DPR for Puri

Summary of water demand for Puri town (DPR for Water Supply, Puri)					
Year	Total Population	Domestic Demand (MLD) considering 15% losses	Institutional Demand (MLD)	Lord Jagannath Temple Demand (MLD)	Gross Water demand(MLD)
1961	62426	9.91	-	-	-
1971	74607	11.85	-	-	-
1981	103520	16.44	-	-	-
1991	128421	20.4	-	-	-
2001	163353	25.94	1.94	1.74	29.62
2011	202734	32.2	2.3	1.84	36.33
2021	247286	39.27	2.84	1.98	44.09
2026	271485	43.12	3.42	2.11	48.65
2031	296478	47.09	4.12	2.25	53.46

Source: Puri Municipality

8.1.6.2 Water availability in 2031

Furthermore the DPR for water supply in PURI has tried to assess expected water sources from where water can be extracted for supply. As ground water level is low and saline hence increasing extraction can be environmentally disastrous and hence the rate of collection must be kept same. The major collection can be done from surface water sources especially rivers which are not practiced currently. If all the surface water sources water used skillfully still the amount will be lower than demand generate. This scenario poses serious question on sustainability of water supply infrastructure in the study region. The table below shows expected water generation in Puri Municipality:

Table 8.17: Water availability in Puri as calculated in the DPR for water supply: Puri

Water availability from surface and ground water source				
Year	Total Population	Gross Water demand (MLD)	Ground Water Source (MLD)	Surface Water Source (MLD)
2001	163353	29.62		
2011	202734	36.33	15.3	21.03
2021	247286	44.09	15.3	28.79
2026	271485	48.65	15.3	33.35
2031	296478	53.46	15.3	38.16
2041	364350	65.39	15.3	50.09

Source: Puri Municipality



8.1.7 Overview of Existing Proposals

8.1.7.1 Background

Proposals identified for implementation has been stratified on the basis of identified issues and already formulated proposals that have been undertaken by local authority for implementation. For sustainable development of the water supply infrastructure in the town we will suggest some strategies as well as incorporate the 24*7 water supply proposal identified by Puri Municipality.

8.1.7.2 24*7 water supply project for Puri city:

The project has been formulated by Odisha Water supply and sewerage board for implementation in Puri Municipality. This is to augment new water sources as well as improve the network and strengthening other components in the system.

The major component that has been proposed within the framework of the project is as mentioned below:

- Intake structure
- Raw Water Pump House
- Raw water rising main from Intake to WTP
- Water Treatment Plant - Conventional
- Clear Water Sump & Pump House
- Clear Water Rising main to Various ESR in the Puri Town.
- Clear Water Rising main to UGR at SBP.
- Elevated Service Reservoirs
- Distribution network for entire Puri Town
- Consumer Metering
- Miscellaneous works such as site development, Pipeline bridge etc.

Map 8.8: Proposed Network design for water supply proposal in Puri town



Source: Puri Municipality

The proposal identifies several zones for water supply infrastructure development in the town. Puri is divided into eleven zones based on following criteria:

- Based on contour survey map of Puri Town.
- Difference in the elevation is not more than 15m is a zone.
- As per CPHEEO maximum zonal population is limited to 50,000.
- As Puri town is located along sea shore and relatively flat topography, all the zones will be filled by pumping directly to ESR in each zone. Staging height required for ESR is 25 m at two locations and 20m at other 9 locations.
- Existing ESR at Ghodabazar and Tota Gopinath area are utilized and additional ESR capacity is proposed in that zone for projected year.
- Existing ESR at Markandeswar tank is not utilized as it is not a RCC structure and is constructed in 1935. This issue is discussed and approved by PHEO
- If there is an average elevation difference of more than 15m between zones, then each zone should be served by a separate system. The neighbouring zones may be interconnected to provide emergency supplies. The valves between the zones, however, should normally be kept completely closed. The layout should be such that the difference in pressure between different areas of the same zone or same system does not exceed 12 to 15m.
- Based on the source of supply, road layout, elevation and the density of population etc., it is proposed to divide the town water supply service into 11 different zones. Each zone will have a storage complex with underground and/or elevated service reservoir(s).

Map 8.9: Zoning and Detailed plan for water supply network as per DPR



Source: Puri Municipality

The technical details of the given proposal are as following:

- Entire town is divided in to 11 water distribution zones. 8 zones will be served form surface water source and 3 zones will be served from ground water source.
- Distribution network is proposed with Cast Iron pipe (LA Class) for 100 mm diameter and Ductile Iron Pipe (K-9) pipes for 150mm and above sized diameter.
- Total distribution network length analyzed is about 162 Km.
- Existing distribution network length utilized after hydraulic analysis is 51 Km.
- Net length proposed for the distribution network is about 111 Km.
- Diameter for distribution network varies from 100 mm dia to 400mm dia.
- Water supply to Sri Jagannath Temple will have dedicated distribution mains from ESR near Jagannath Vallabha Math, Parking Place area.
- The total cost of the project is based on the Schedule of rate, Govt. of Odisha, Fair Market Rate and TCE's Cost data bank for similar projects in resent past.
- Use of 100 mm dia cast iron pipe over ductile iron pipes saves about Rs. 1. 38 Crores as cast iron pipes are locally available i.e. from Kalinga Works in Odisha.

8.2 Sewerage System

8.2.1 Existing System of Sewerage in Puri Municipality

The entire region of the PKDA does not have a fully functioning and organized public sewerage system. Storm water drains carry both rain water as well as waste water in many parts of the town. Poor hygienic practices such as open defecation along the drains further aggravate the situation. There is also a need for increased number of public toilets for the huge floating population. Currently, sanitation facilities for the public are limited to around 180 seats in the bus stand and main areas of tourist attraction. This is minimal considering the demands of the tourist and floating population. This results in open defecation and related environmental degradation. This section thus gives a picture of the existing sewerage and drainage system highlighting the deficits and areas needing improvement.

8.2.1.1 Waste water generation

To some extent Puri has some drainage system where the drain finally merges into the sea. General elevation of Puri is approximately 6m above mean sea level and the overall topography is more or less flat with a mild gradient from North West to south east.

To the south of the Grand Road (towards the beach) the storm water drains towards the Bankimuhin River, carrying all the sewage from here to the River and finally to the sea. Sewage from the Chakratirtha area is also carried to Bankimuhan through open channels to the north of Grand road. It is also carried to Bankimuhan through open channels. To the north of the Grand Road the drainage network slopes towards the Musa River. Subsidiary drains carry storm water from the catchment area to the main drain. The area around the Markandeshwar tank drains first into the Mitiani Jheel, which is a eutrophied water body and finally into the Musa River. The Narendra Tank area also drains into the Musa River. The Musa River is dry as its mouth is blocked off by the shifting sands of the seashore; it is now a stagnant and eutrophied water body.

The network is presently maintained by Puri municipality. The total length of storm water drain is approximately 70.965 km. The drains are mostly of brick/laterite masonry structure. Some drains are lined cast concrete construction. During the year of 2001-2002 an amount of Rs 25.89 lakhs had been spent under Flood Damaged Restoration worked for de-sludging of Pond No-III, repair of embankment of Pond No-III, replacement of M.S screens etc, with provision for installation of 2 no. 2m x 2m size M.S sluice gate followed by trapezoidal masonry escape channel to allow quick release of storm water generated at Bankimuhan waste water plant during heavy rains.

Fig 8.12 Open waste water disposal at Marine drive



Fig 8.13: Waste water flowing through open channel at Puri town



The waste water generated in the town is collected through 3 trunk sewers:

- Badadanda-Dhoba sahi drain of 6.60 km length carrying sewage from Grand Road
- Ganamala Sahi Drain which starts from Ganmala Sahi drain & covers a length of 1.85 km
- Sea beach sewer 1.8 km long close conduit which basically collects water from hotels and holidays homes located along the sea beach

The existing treatment plant at BankiMuhan presently treats the waste water conveyed through the drains and recently laid sewer line from the nearby hotels, via collection in a catchment basin through screen and grit chamber. The waste water generated in the sea beach closed conduit sewer is collected in a screen chamber where floating debris and solid particles are allowed to settle down, arrested and separated. The waste water from both the chambers is drained into three facultative ponds in series where the organic materials are biologically degraded with the assistance of blue-green algae culture through oxidation. The finally treated effluent from the maturation pond is pumped to the 'High rate Transpiration system' consisting of 11 hectares of land at Bankimuhan besides the facultative ponds, and 50 hectares of land at Balukhanda Reserve forest with specially adopted species of Cassurina, Gravellia, Acacia, etc. (based on technology evolved by NEERI, Nagpur).

The treatment plant at BankiMuhan has a capacity of 5MLD whereas the sewage generated is about 18MLD. This reflects that the existing treatment plant needs augmentation in order to be able to treat the generated sewage.

8.2.1.2 Sanitation Status

Sanitation is one of the key parameters which is used to rate the environmental status of urban areas. PKDA region is located on the coastal region of the state of Odisha having the gift of a good scenic natural environment. But the built/cultural environment in the area is not well managed through provision of adequate sanitation facilities and hence does not qualify as one of the better sanitized town. In fact Puri town and Konark the urban centres in the region has very poor quality of sanitation facility in the areas.

Unplanned sewerage facilities and open drainage network is very much inefficient to carry the waste water safely to dispose areas. This is resulting in water logging and overflowing in places making waste water run through the roads and infecting the urban environment at large. Lack of private and community toilets in the town is the other major cause of worry. In the below images broad issues are shown to provide a picture of the current practices in the town.

Fig 8.14: Open defecation at Puri beach



Fig 8.15: Household discharge in streets



Fig 8.16: Sewer flow at Pentakota



Most of the urban areas are not covered under community latrine facilities. The facility is not of satisfactory level in the tourism related areas. Household toilets are the major modes of sanitation facilities in the region. There is more than 10% urban residents do not have access to any sanitation and toilet facility and practices open defecation in most of the cases.

Only 47% of the households in Purim town having soak pit system and the rest of them has no connection to safe disposal system. The situation is even worse in case of Konark NAC. Both the urban centres do not have any underground sewerage system which is the major cause of worry. Overall the sanitation status is very poor as far as we see from the comparing standards.

The location and details of community toilet facilities provided by Puri Municipality has been shown in the below table:

Table 8.18: Commnity Toilet details of Puri Municipality

Name of the toilet	Total	Seats	No. of Seats	Maintained by
Bus Stand	20	13	7	Sulabh International
Swargadwar	24	14	10	Sulabh International
Dist. Hospital. Headquarters	10	7	3	Sulabh International
Narendra Tank	15	10	5	Sulabh International
Matitota	10	7	3	Sulabh International
Indradyumna Tank	10	7	3	Sulabh International
Markanda	10	6	4	Sulabh International
Police line premises	10	6	4	Sulabh International
Balinolia Sahi	10	5	5	Sulabh International
Near Flag staff	15	10	5	Sulabh International
Singhadwara	15	10	5	Puri Municipality
Daitapada Sahi Municipality Market	10	7	3	Puri Municipality
Urban hat (Near DAG Office)	20	11	9	Under Construction

Source: Puri Municipality

Infrastructure development and management are both important for sustainable provision of infrastructure facility for residents. Puri Municipality although have developed some communal toilet facilities but they have failed to manage those and hence most of these latrine systems are not working currently. This is where the local authority has failed to provide sustainable means of infrastructure provision.

Recently government of India has conducted a sanitation rating (2009-'10) where Puri has been ranked in 90th position. This simple statistics proves the inefficiency in the sanitation system in the town.

Although there is provision of temporary mobile latrine facilities during the tourist season the facility falls far too short than the demand. The list of temporary latrine facilities for car festival installed has been listed in the below table:



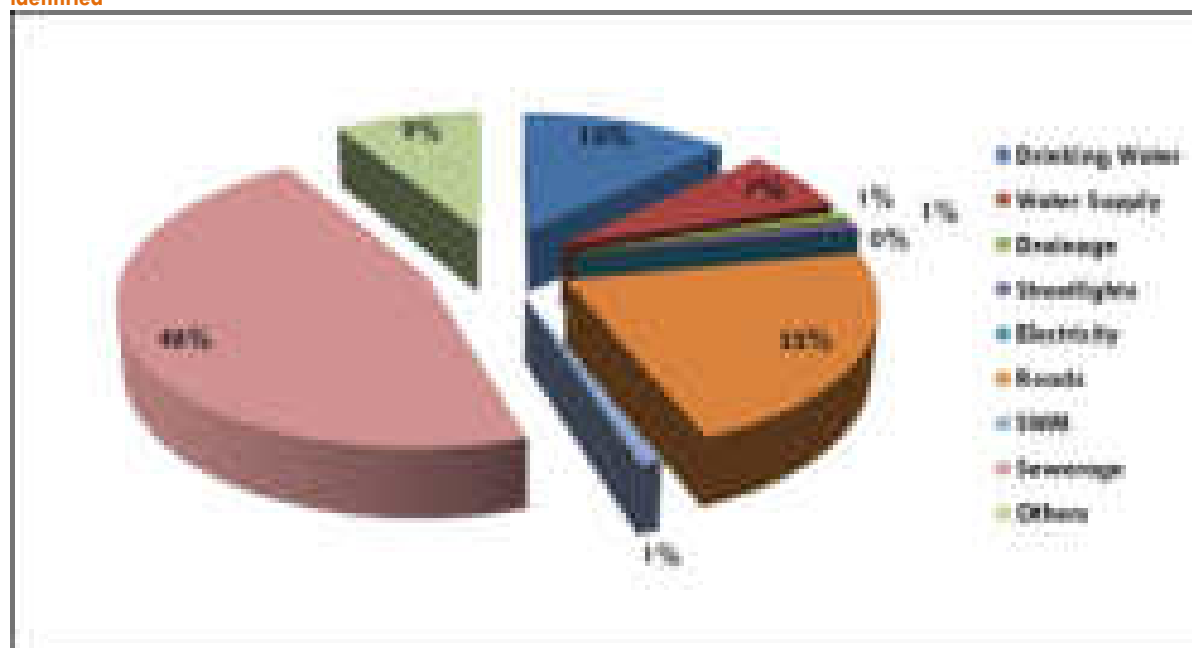
Table 8.19: Temporary Laterine facilities by Puri Municipality

SI No.	Location	Quantity	SI No.	Location	Quantity
1	Near Gadadhar high school	15	15	Police line U.P school	5
2	Markandeswar sahi high school	6	16	Govt womens college	10
3	Trilochan U.P school	6	17	Cyclone shelter	5
4	Madhuban high school	6	18	I.T.I Puri	10
5	Balagandi high school	6	19	Indoor stadium	15
6	Sukhalata high school	10	20	Central school	4
7	Municipal high school	10	21	Town P.S., Puri	5
8	Secondary training school	5	22	Baseli sahi P.S	5
9	Government girls high school	15	23	Police line Barreck	5
10	Zilla school	25	24	Ladu patra building at baliapanda	20
11	Biswamber vidya Pitha	15	25	Talabania Parking place	50
12	S.C.S college	3	26	Near Municipality bus stand	30
13	Badasankha high school	3	27	Near Puri railway station	30
14	Police high school	10	28	Sea beach area	30

Source: Puri Municipality

8.2.1.3 Underlining the Issues:

The Municipality has overall responsibility for sanitation. It is the beginning of journey in sanitation ladder. The indicator for households lacking access to sanitation shows that only 6.3% households lack access to any kind of facility. These households are in slum. Pit latrine is also considered an improved sanitation facility. Slum area with community toilet facility is considered having access to improved sanitation. About 31.4% of urban non-slum households have such system in their premises. It must be realized that wastewater from pit latrines, soak pits and open channel drains infiltrate in sandy soil. Ground water pollution due to wastewater infiltration cannot be ruled out as groundwater table is high in many areas of the town.

Fig 8.17: Most critical infrastructure sector identified

Source: CEPT survey & analysis

According to the household survey conducted by CEPT it has been analyzed 45% of the household surveyed has rated the sewerage problem as the prime concern they face. This alone shows the gravity of the problem this sector has in the region and needs for improvement.

From the data gathered through Puri Municipality sources various parameters has been analyzed for understanding sanitation issues in the town has been shown in the below table:

Table 8.20: Existing service level VS standards for Puri Municipality

Indicators	Actual value	Desired value
Average daily flow of wastewater in drains (mld)	10	16 (80% of water supplied)
% households having septic tank soak pit system	47	0
Number of public toilets	17	>100
Type of treatment of wastewater and efficiency	Secondary treatment in stabilization ponds, efficiency of	Treatment up to tertiary level
Reuse of treated effluent and nutrients	Effluent used in plantation, but suspended for technical reason	100
Treatment of sludge	Nil	100
% of households lacking access to improved sanitation	6.3	0
% households connected to public sewer	0 (an underground sewerage system is under construction)	100

Source: CEPT survey & analysis

The issues indentified from the above existing situation analysis has been summarized below:

- Lack of underground sewerage system in the urban areas leading to overflow of sewerage during the rainy season and effecting degradation of urban environment.
- Dumping of household garbage and solid wastes into drain are among the major problems faced in the system due to lack of awareness of the residents.
- Water logging in rainy season causes malfunctioning of soak pits and unsanitary condition.
- Infiltration of wastewater from septic tanks and soak pits may contaminate groundwater which can in large effect the health and hygiene of the population.
- Poor hygienic practice by slum population and lack of access to sanitation are a concern as they defecate in open and inside drains.
- Existing public amenities for pilgrims and tourists are inadequate and inaccessible which create ample problem during festive season.
- Deterioration in water quality of ponds and holy tanks used for bathing, recreation and religious ritual is also one of the major area of concern identified..
- Lack of public toilets for tourists in the peak season leads to open defecation and degradation of urban environment in the town.

8.2.2 Wastewater Demand assessment for PKDA2031

This section deals with demand and gap assessment of sewerage generation in different blocks of PKDA region in 2031. The assessment is done on the basis of population projection and standard of sewerage generation as per guidelines. This will give us an overview of scenarios in 2031 and will help consequently in strategy formulation for future.

8.2.2.1 Expected Sewage Generation in PKDA, 2031

The population projection has been calculated on the basis of geometric rate of population increase. The decadal growth and population calculated for different years have been shown in the below table:

Table 8.21: Population Forecasting for PKDA-2031

Block	Decadal Growth Rate (%)	Population		
		2001	2021	2031
Puri Town	30	1,57,837	2,65,374	3,44,098
Puri Sadar Block	32	14,880	25,473	33,328
Block A	19	17,238	24,414	29,054
Konark Block	34	16,979	40,040	61,487
Block B	20	6,872	8,827	10,005
PKDA (TOTAL)	29	2,13,806	3,64,127	4,77,972

Source: Census data, CEPT analysis

Sewage Generation is estimated based on 80% of water Supplied to the households as per standard of CPHEO Manuals. It can be seen from the chart below that major sewerage generation will be in Puri town area due to huge concentration of population growth in the area. As there is no underground facility available it can be summarized as the entire demand is the gap identified for the region.

This assessment clearly indicates that lot of developmental activities and investments needs to be undertaken for holistic development of sewerage and sanitation infrastructure in PKDA region.

Table 8.22: Demand assessment for sewerage generation: PKDA-2031

Block	Water Demand (MLD)			Sewage Generation (MLD) (@80%)		
	2011	2021	2031	2011	2021	2031
Puri Town	43	55.4	71.6	34.4	44.3	57.3
Puri Sadar Block	1.7	2.3	3.0	1.4	1.8	2.4
Block A	1.8	2.2	2.6	1.4	1.7	2.1
Konark Block	2.3	3.5	5.4	1.8	2.8	4.4
Block B	0.7	0.8	0.9	0.6	0.6	0.7
PKDA (TOTAL)	49.5	64.2	83.4	39.6	51.3	66.7

Source: Census data, CEPT analysis

Fig 8.18: Sewerage and Sanitation issues in Puri



8.2.3 Proposals undertaken for Implementation

8.2.3.1 The Background

Proposals identified for implementation has been stratified on the basis of identified issues and already formulated proposals that have been undertaken by local authority for implementation. For sustainable development of the sewerage network in the town we will suggest some strategies as well as incorporate the plans and proposals already prepared by PHEO.

8.2.3.2 Proposed sewerage system

Puri city does not have an integrated sewage collection system. As a result, the underground water sources are getting contaminated. A comprehensive integrated sewerage system comprising trunk sewer, branch sewer, man holes, pumping stations, sewage treatment plant and related appurtenances is now being implemented by the Public Health Department and is likely to be completed. On completion of the project the house hold sewage will get conveyed and treated thus reducing the threat to ground water contamination & pollution of sea.

The treatment plant is being constructed at Mangalaghat which is an aerated lagoon. It has a capacity of treating 15 million litres sewage per day. The project includes the treatment of the waste water and effluents, finally disposing it to the Mangala River after chlorination. The plant is constructed for a population of about 233414 (Residential-175301, floating – 58113) and sewage flow of 28 MLD by 2021.

Table 8.23: Sewerage Infrastructure Targets vs Progress

Physical targets set are as follows:	Physical progress (March 2007)
▪ Street sewer-134291 m	▪ Street sewer-77217 m
▪ House sewer-72320 m	▪ House sewer-38751 m
▪ Manholes-7635 nos	▪ Manholes-5169 nos
▪ Pumping mains-11812 m	▪ Pumping mains-8519 m
▪ Pumping stations-10 nos	▪ Pumping stations- 5 in progress
▪ Sewage treatment plant-15 Mld capacity	

Source: Puri Municipality

Fig 8.19: View of constructed STP in Mangalghat



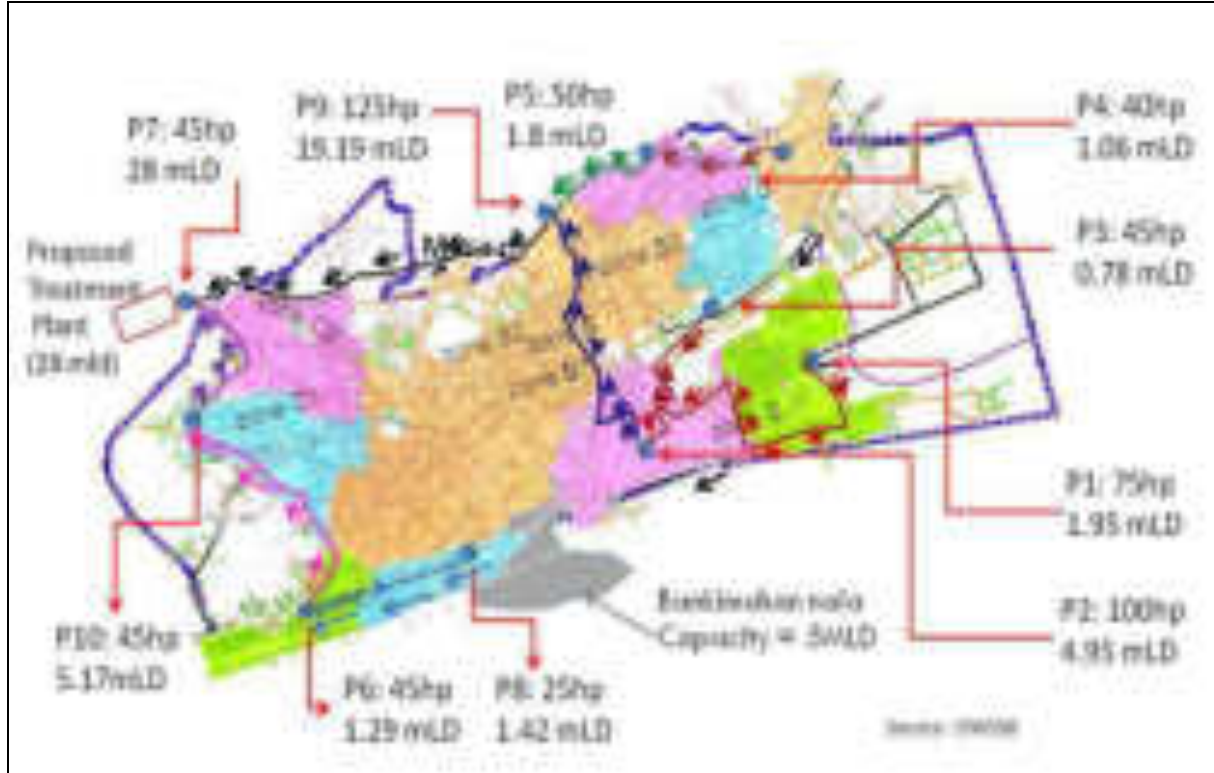
Fig 8.20: Laying of sewer line at VIP road



For Vision 2031 of JNNURM Scheme, the provision has been made for sewerage system of the extended area like Sipasarubali, towards Gopalpur, towards Balighat etc. Provision has been made for laying of sewer network of 72 KM with man-holes, pumping station and STP. This extended project

will help to overcome the dangers of the high tourist and floating population of Puri town during festive occasions.

Map 8.10: Proposed Master plan for sewerage: Puri Municipality



Source: OWSSB

The different components of the proposed system and the cost details as per master plan for sewerage have been summarized in the below table:

Table 8.24: Details of cost for sewerage development as per DPR for Puri Municipality

Sl.No.	Components	Original DPR Estimated Cost	Revised Cost approved by Gol
1	Gravity sewage collection system	2714.72	4796.73
2	Pumping Stations	469.98	920.94
3	Pumping Mains	253.07	579.39
4	Sewage Treatment Plant	931.72	1039.11
5	Miscellaneous works	84.49	94.69
6	Centages	356.32	594.47
7	Land Cost	19.53	19.53

Source: OWSSB

8.3 Drainage

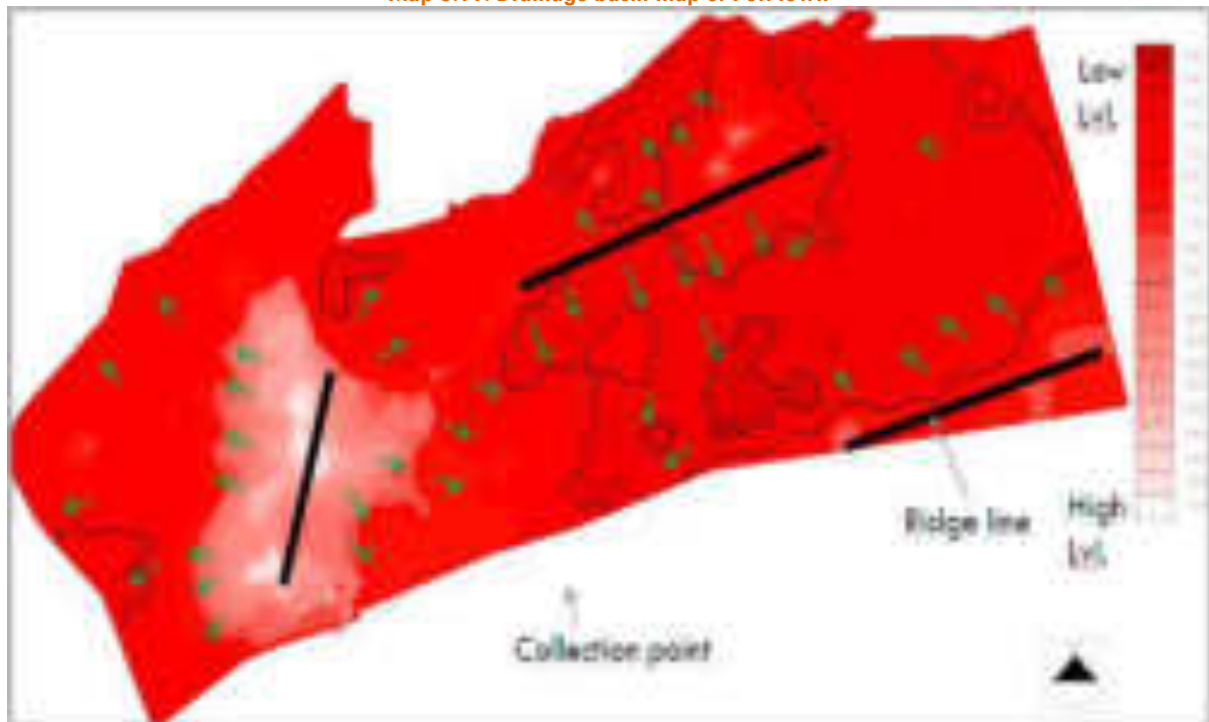
Along with sewerage, drainage system is one of the key components of urban infrastructure affect the urban environment at large. The location of the study region is on a strong monsoon route which results in heavy downpour during rainy season and hence the component gets added priority in the context. Planned drainage infrastructure development therefore is a must for the region.

8.3.1 The drain system: Puri Municipality

To some extent Puri has some drainage system where the drain finally merges into the sea. General elevation of Puri is approximately 6mt. Above mean sea level and the overall topography is more or less flat with a mild gradient from North West to south east.

To the south of the Grand Road (towards the beach) the storm water drains towards the Bankimuhin River, carrying all the sewage from here to the River and finally to the sea. Sewage from the Chakratirtha area is also carried to Bankimuhan through open channels to the north of Grand road. It is also carried to Bankimuhan through open channels. To the north of the Grand Road the drainage network slopes towards the Musa River. Subsidiary drains carry storm water from the catchment area to the main drain. The area around the Markandeswar tank drains first into the Mitiani Jheel, which is a eutrophied water body and finally into the Musa River. The Narendra Tank area also drains into the Musa River. The Musa River is dead, its mouth is blocked off by the shifting sands of the seashore, and it is now a stagnant and eutrophied water body.

Map 8.11: Drainage basin map of Puri town



Source: OWSSB

The network is presently maintained by Puri municipality. The total length of storm water drain is approximately 70.965 km. The drains are mostly of brick/laterite masonry structure. Some drains are lined cast in site concrete construction. During the year of 2001-2002 an amount of Rs 25.89 lakhs had been spent under Flood Damaged Restoration worked for De-sludging of Pond No-III, repair of embankment of Pond No-III, replacement of M.S screens etc, with provision for installation of two 2m x

2m size M.S sluice gates followed by trapezoidal masonry escape channel to allow quick release of storm water generated at Bankimuhan waste water plant during heavy rains.

Map 8.12: Open Drain Network & Disposal Route: Puri Municipality Area



Source: OWSSB

The table below shows the performance indicators of the drainage system in Puri. The service level for major drains/catchment area, coverage in the town etc as shown is far below the standards. Hence, there is a need for development of strong drainage system which will not only increase the service levels but also provide ample opportunities for future residents.

Table 8.25: Comparison of Service level and standards for Puri Municipality

Sl. No	Parameter/component	Service level	Benchmark	Remark
1	Major drains-catchment area	30%	100%	Inadequate
2	Minor drains-Coverage (Drain length/Road length)	40%	90%	Inadequate
3	Hydraulic conveying capacity of major drains	Data not available.	100-year return flood, 2-hrs rainfall, 4-hrs flow	Inundation prone

Fig 8.21: Open drain: Puri Fig 8.22: Drain in Swargadwar Fig 8.23: Wet spaces in streets Fig 8.24: Narrow drains: Puri



8.3.1.1 Underlining the Issues:

The following issues are emerging from the above understanding about the system:

- Storm water drains in the city function as a conveyance channel for untreated sewage from the partially laid/incomplete interceptor sewer network.
- Drains located within the Puri Municipality limits are choked by indiscriminate dumping of solid waste, building materials and related refuse.
- Drains are also significantly silted and collapsed in some sections reducing the effective cross-section and resulting in inundation problems during the monsoon periods which were not prevalent during earlier times owing to the prevalent natural gradient and nature of sub-soil.
- Lack of separate developed Master Plan for storm water drainage system.
- Limited awareness at the city level among people effecting excess waste generation.

8.3.1.2 Proposals for Implementation:

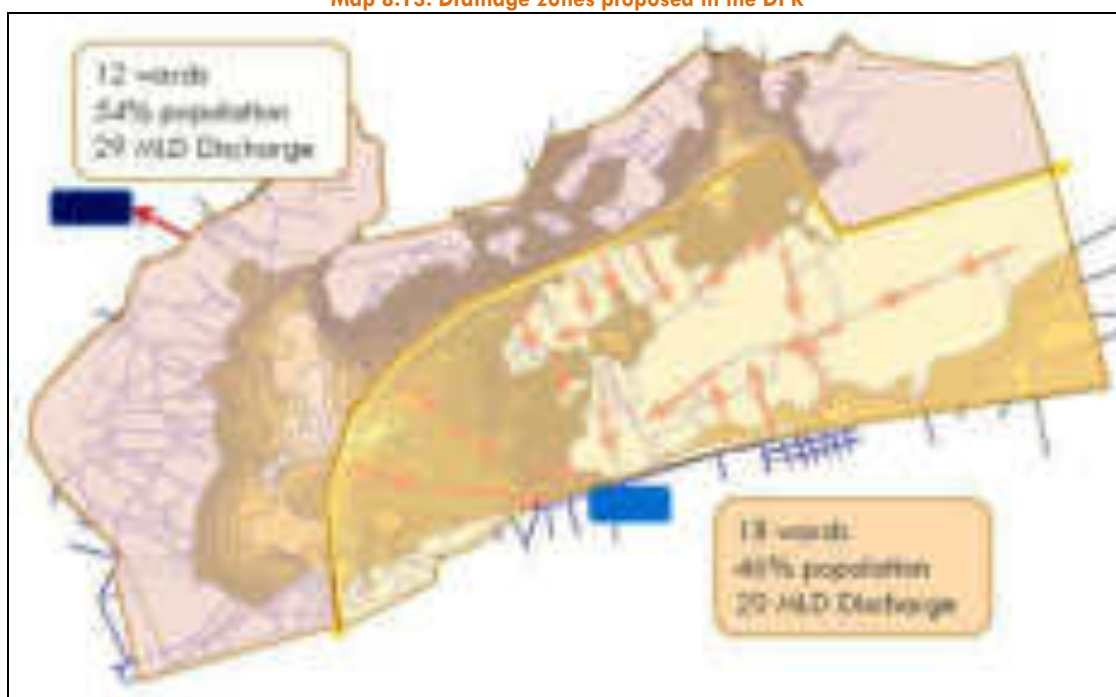
Background:

Proposals identified for implementation has been stratified on the basis of identified issues and already formulated proposals that have been undertaken by local authority for implementation. For sustainable development of the drainage network in the town we will suggest some strategies as well as incorporate the master plan already prepared nu PMC.

Proposed Drainage Master Plan

It is proposed that the master plan prepared by Puri Municipality for drainage development in the town has to be incorporated with the CDP and should be implemented. According to the plan the town has been divided in to two broad drainage zones according to the contours as shown in map below:

Map 8.13: Drainage zones proposed in the DPR



Source: OWSSB

Map 8.14: Proposed drainage master plan for Puri Municipality



Source: OWSSB

The basic concept that has been applied in the plan is that the natural slope has been used for discharge and lying of drainage lines. Major two discharge points have been proposed one is towards north east of the town towards Mangalaghat River and the second is at southwestern slope towards the sea. For lying of networks the town has been divided into five zones according to population, area coverage, storm water generation rate etc.

Eco city Project

Under Eco city project for drainage development Puri Municipality has identified three pilot projects at different location of the town. 22 crores have been estimated to be the cost for development of drainage networks at the sites. The details of location, length and cost of development have been summarized in below table:

Table 8.26: Particulars of Eco city project: Puri Municipality

S.No.	Particulars	Amount (Rs.)
1	Reconstruction of drain from Surya lodge to head post office at mochi sahi (0.75kms) @ Rs 8,00,000/- per km.	6,00,000.00
2	Reconstruction of drain at Duttatota and bye lanes (1.00 km) @ Rs 8,00,000/- per km.	8,00,000
3	Construction of drain at Srikhetra colony and Water Works Road (1.00 Km) @ Rs. 8,00,000/- per km.	8,00,000
	TOTAL	22,00,000

Source: Puri Municipality

8.3.2 Drainage System: Konark NAC

Konark NAC area is currently having no underground drainage system for discharge the water to nearby sea. The area is having flat terrain with mild undulation in-between. Location of the area in heavy precipitation belt results in heavy downpour in monsoon season results in water logging in the area frequently. Poor outfall condition and inadequacy of drainage system is the main reason for the same. So encroachment in some places on the network sites and drains makes it difficult to discharge water efficiently. A serious problem of water logging has been to discharge rain water from sun temple causing inconvenience to the tourists and inhabitants.

8.3.2.1 Issues Identified

The major issues found in the system are summarized below:

- **Lack of field drains** : lack of field drains to the drainage system of Konark NAC causes insufficient discharge of surplus flood water from the catchment area
- **Encroachment** : Drainage path is obstructed due to encroachment of drainage area by inhabitants
- **Non provision of drainage network**: Non provision of suitable drainage network for discharging surplus rain water.
- **Insufficient vent size** : The vent size provided in the NH is not adequate to discharge the surplus rain water



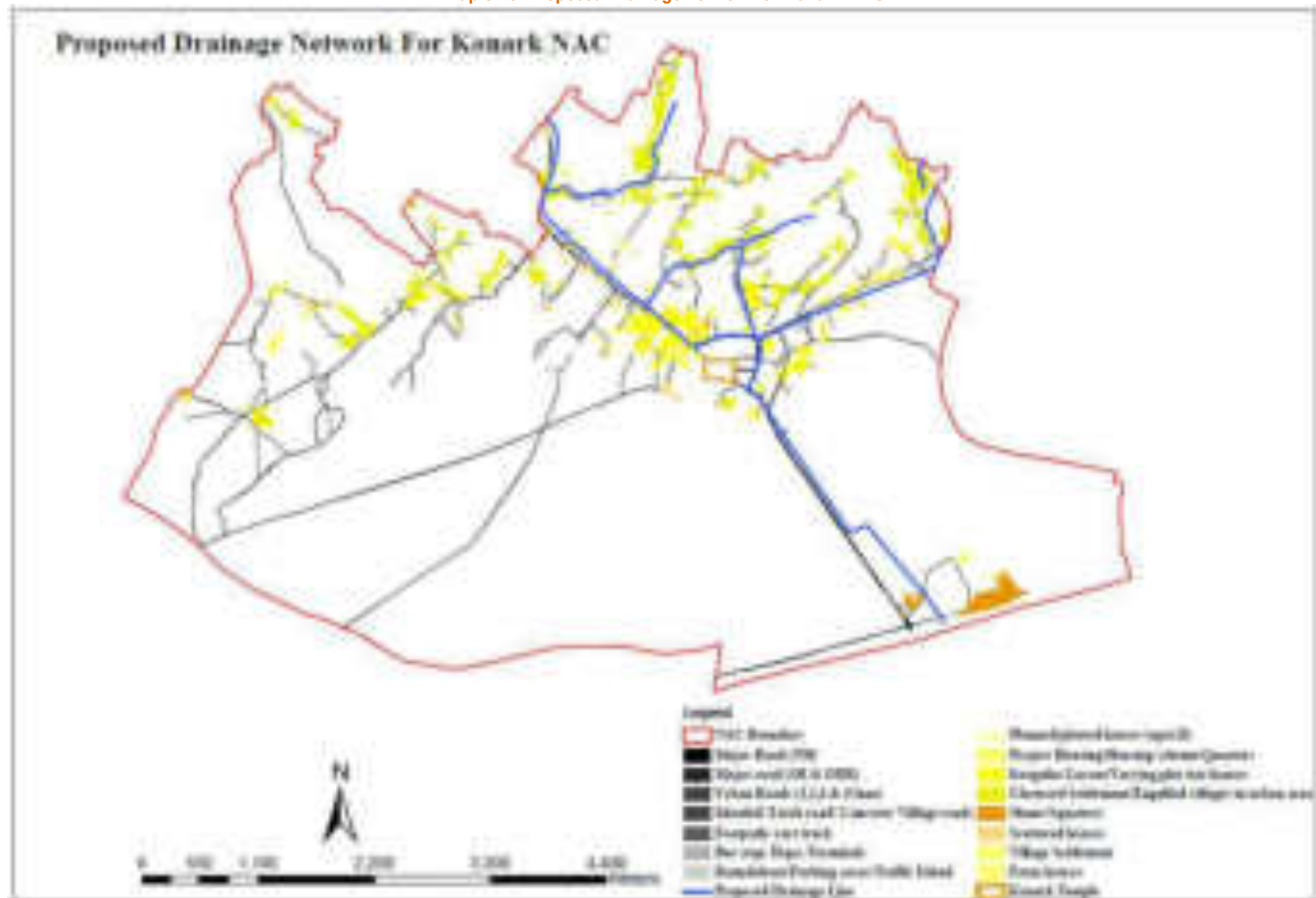
Fig 8.25: Encroachment on river channels**Fig 8.26: Outfalls**

8.3.2.2 *Proposals identified*

The major proposal identified by the PHEO for improvement of drainage facilities in the area are as mentioned below:

- Excavation of primary drains
 - Konark P.S. To Patharbuha nalla
 - Konark P.S. To Karmanga road to Patharbuha nalla
 - Konark Medical Chowk to Raulpatna to Kadua nalla
 - Konark Urban Bank Hat to Chandrabhagha
- Construction of drainage siphon / cross drainage work at Medical Chowk.
- In order to overcome the drainage problem of Konark NAC area the 4 nos. link drain to be constructed along with 35 Nos. of culvert across Road Crossing
- One bridge to be provided across Pipli – Puri NH in front of Konark Temple

Map 8.15: Proposed Drainage network for Konark NAC



8.4 Solid Waste Management

The production of the solid waste in an area is a function of the socio-economic profile of the population and activities in the area. Inadequate solid waste management in most of the urban areas leads to a scenario where garbage is spread on the road sides or open spaces further resulting in unhygienic living conditions. The garbage is removed by the municipal authority and dumped at the sanitary land fill or in some cases it is converted to compost, especially in small towns.

8.4.1 Solid Waste Management Scenario of PKDA

The present system adopted by Puri Municipality for solid waste treatment and its disposal is rudimentary in nature and unscientific. The other areas of the PKDA region also do not have any solid waste management system.

This results in significant environmental degradation and health hazards. Puri being a city thriving primarily on tourism, solid waste management and its scientific disposal plays a major role in attracting tourist flow into the city. A clean city will not only attract more tourists, but will also provide healthy living condition to its locals.

The Health Department of Municipal Corporation is responsible for collection and transportation of solid waste generated in Puri Municipal area. For operational purposes the entire area is divided into 30 wards or 7 zones each headed by a sanitary inspector (source: CDP). Under each inspector, there are 24 Jamadars and 464 sweepers.

Present Activities of the Municipality for solid waste management includes the following:

- Road Cleaning
- Drain Cleaning
- Public latrines
- Garbage loading and unloading
- Spraying of Batex, malarial Oil, abeta for control of mosquitoes population

1	Collection of Municipal Solid Waste	Existing Situation for Puri	Existing Situation for Konark
1.1	Organizing Door to door collection	No system of primary collection from the source of waste generation.	No system of primary collection from the source of waste generation.
1.2	Devising collection including hotels, restaurants, office complexes and commercial areas;	No separate collection system for Commercial and Institutional areas and areas like restaurants, offices, hotels.	No separate collection system for Commercial and Institutional areas and areas like restaurants, offices, hotels.
1.3	Separate collection of the biodegradable waste. (slaughter houses, meat and fish markets, fruits and vegetable markets)	No separate collection system for the waste generated from slaughter house, meat and fish market.	No separate collection system for the waste generated from slaughter house, meat and fish market.
1.4	No mixture of Bio-medical wastes and industrial wastes with municipal solid wastes.	No separate collection system of Biomedical waste from hospitals and dispensaries.	No separate collection system of Biomedical waste from hospitals and dispensaries.



1.5	Hand driven carts to be used for residential areas.	At present hand driven carts are used for waste collection only from commercial areas.	-
1.6	Separate collection and Disposal of Horticultural and construction or demolition wastes or debris.	Construction and demolition waste/ Debris dumped on open sites at the outskirts of the town in various locations.	Construction and demolition waste/ Debris dumped on open sites at the outskirts of the town in various locations.
1.7	Waste (garbage, dry leaves) shall not be burnt;	Waste burning was observed for dry leaves etc.	-
1.8	Prohibit stray animals moving around the city.	No action is being taken for stray animals.	No action is being taken for stray animals.
2	Segregation of Municipal Solid Waste	Existing Situation for Puri	Existing Situation for Konark
2.1	Municipal authority to organise awareness programmes for segregation, recycling or reuse of materials.	No segregation of waste into Recyclable, Organic and Nonorganic waste is not done.	No segregation of waste into Recyclable, Organic and Nonorganic waste is not done.
2.2	The municipal authority shall undertake phased program to promote community participation in waste segregation.	No such programs are being undertaken.	No such programs are being undertaken.
3	Storage of Municipal Solid Waste	Existing Situation for Puri	Existing Situation for Konark
3.1	A storage facility shall be so placed that it is accessible to users;	At present waste is stored in containers located at 1000m.	Waste Containers were observed for waste storage.
3.2	Storage facilities so designed that wastes stored are not exposed to open atmosphere and shall be aesthetically acceptable and user-friendly;	No practice of storing segregated waste in the town at present.	No practice of storing segregated waste in the town at present.
3.3	Bins for storage of bio-degradable wastes shall be printed green, recyclable wastes to be printed white and storage of other wastes shall be printed black;	No separate bins for recyclable, organic and inorganic waste.	No separate bins for recyclable, organic and inorganic waste.
3.4	Manual handling of waste shall be prohibited.	Manual interface in solid waste collection is prominent.	Manual interface in solid waste collection is prominent.
4	Transportation of Municipal Solid Waste	Existing Situation for Puri	Existing Situation for Konark
4.1	The bins or containers have to be daily attended for clearing of wastes.	Since waste is not collected daily, the bins overflow.	Daily emptying of bins was not observed.
4.2	Transportation vehicles shall be so designed that multiple handling of wastes, prior to final disposal, is avoided.	Transportation of waste is done through mini lorries and trucks. The chances of spillage in such a system are high	Transportation of waste is done through mini lorries and trucks. The chances of spillage in such a system are high
5	Processing of Municipal Solid Waste	Existing Situation for Puri	Existing Situation for Konark

5.1	Waste to be Processed by composting, vermicomposting, anaerobic digestion or any other appropriate biological processing for stabilization of wastes.	Compost Plant of 100TPD is in Place	No facility available.
5.2	Incineration with or without energy recovery including pelletisation.	There is no waste utilization technology as incineration, pelletization being used.	There is no waste utilization technology as incineration, pelletization being used.
6	Disposal of Municipal Solid Waste	Existing Situation for Puri	Existing Situation for Konark
6.1	Well planned landfill site with proper documentation.	No Scientific Landfill exists	No Scientific Landfill exists
6.2	The landfill sites shall be selected to make use of nearby wastes processing facility.	No Scientific Landfill exists	No Scientific Landfill exists
6.3	Biomedical and Hazardous wastes shall be disposed off in accordance with the Bio-medical Wastes (Management and Handling) Rules, 1998.	-	-
6.4	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.	No Scientific Landfill exists	No Scientific Landfill exists
6.5	Landfill site shall be fenced or hedged and provided with proper gate.	No Scientific Landfill exists	No Scientific Landfill exists
6.6	Wastes shall be compacted in thin layers using landfill compactors to achieve high density of the wastes.	No Scientific Landfill exists	No Scientific Landfill exists
6.7	Diversion of storm water drains to minimize leachate generation and prevent pollution of surface water	No Scientific Landfill exists	No Scientific Landfill exists

8.4.1.1 Solid Waste Generation

Solid waste generation depends on a number of factors for various urban centres and village settlements. Primarily characteristics of population, economic and household activities, commercial establishments, different institutions all can affect the amount and type of solid waste generated.

Solid waste generation in Puri Municipality area is close to 60 MT/day which is higher than average generation rate of similar size class cities. On the other hand the collection rate is less than 50% of the waste generated every day. This simple statistics exposes the dark side of the system existing:

Table 5: Solid waste generation rate

Description	Puri Municipality Area	Konark NAC
Solid waste Generated, MT/day	60	4
Solid waste collection, MT/day	23-27	NA
Collection Efficiency, %	70-80	-
Per capita Generation, gm/day	0.20	-

Source: Puri Municipality, Konark NAC



8.4.1.2 Physical Composition of generated solid waste

The total waste generated in the municipal area as per the assessment done by the local authorities is around 50 tons/day. Organic matter and fine earth with soil and ash are the major constituents. Organic matter accounts for 35.60% of the waste while 58.50% comprises of inert matter. Paper and plastics constitutes of about 2.80% and 2.00% respectively. The table below presents the current (2010) sources and quantity of solid waste generated in Puri Town.

Table 8.28: Waste generation from various sources: Puri town

S.No	Waste Generation	Unit (%)	Value	MT/day
1	Waste generated by Households	MT/Month	299.5	10
2	Waste generated by street sweeping	MT/Month	300	10
3	Waste generated by hotels and restaurants	MT/Month	490	16
4	Waste generated by markets	MT/Month	300	10
5	Waste generated by comm. Establishments	MT/Month	280	9
6	Waste generated by other sources (horticulture, etc)	MT/Month	130.5	5
7	Total Waste Generated	MT/Month	1800	60

Source: Puri Municipality

8.4.1.3 SWM during festive seasons:

The solid waste generated during festive seasons is estimated to be 80 tones / day (Puri CDP, 2006) which is far higher than normal season poses serious challenge for the system. Hotels and restaurants dispose off their waste into the bins provided by the municipality in Puri town in different places. Most of the waste generated from the commercial establishments is bio-degradable in nature. The amount of waste generated by the hotels and other guest houses depends on number of rooms and occupancy rates in the places.

The details of these hotels in the form of number of rooms, average occupancies etc in Puri municipality area are given below.

Table 8.29: Tourist stiaistics staying at Puri

Classification	No.	No. of rooms per hotel	Avg. Persons per hotel during normal season	Avg Persons per hotel during peak season	Population residing in hotels in normal seasons	Population residing in hotels during peak seasons
3 star hotels	2	50	50	300	100	600
1 st class hotels	107	40	50	200	5350	21,400
Other small hotels	136	30	30	150	4080	20,400
Boarding and lodging houses	117	25	20	150	2340	17,550
TOTAL	362	-			11870	59,950

Source: Puri Municipality

Considering the waste generation to be 0.3 t / occupant / day, the waste generated in Puri has been calculated below:

Normal season – 3600kg/day (12,000 people) & Peak season – 18,000 kg/day (60,000 people)

Hence, out of 80 t / day, only 18,000 kg / day is generated from hotels and other lodging houses. The rest is generated at the temples in lieu of the various temple activities and activities performed by devotees.



8.4.1.4 Collection and Storage

Activities such as collection of waste from open dumps, street sweeping, and drain cleaning, placing of waste at open collection points constitute the primary collection system in Puri municipality Area. The details of existing collection and storage system have been shown the table beside. It is apparent that the system falls short of meeting the required CPHEEO standards as the primary and secondary systems of collection are not clearly structured. Hence the needs are to redesign and develop the method by using modern technologies etc to improve the condition.

Table 8.30: waste storage facilities in PMC

Sl.No.	Component	PM Area
1	Dust Bins	60
2	Open collection points	7
3	Push carts/wheel barrows	480
4	Conservancy staff	477
5	Barrow wheel	480
6	Excavators	1

Source: Puri Municipality

The different source of waste generation and collection method for each has been summarized in the below table:

Table 8.31: Waste collection method in PMC

Components	1991	2001	2011
Population in lakhs	1.25	1.58	1.97
Total solid waste/ day (leaving the recycling)	62 MT	79 MT	98 MT
Approx. volume @ 450 kg/cum	138 cum	176 cum	218 cum
Total organic content @ 20% of volume	28 cum	35 cum	44 cum
Compostable materials @ 35% of volume	48 cum	62 cum	76 cum
Approx. community bins required @ 1Bin/100	1250	1580	1970
Solid waste generated/ 100 population	100 kg	100 kg	100 kg
With alternate day cleaning			
Capacity of each community bins Considering 50% extra volume	300 ltr	300 ltr	300 ltr
Growth in solid waste generated with respect to usage and demand for packed products	300 ltr	300 ltr	300 ltr

Source: Puri Municipality

There are 10-11 organized recyclers operating within the town who pick up waste of commercial value such as plastic items, broken glasses, scrap steels, liquor bottles etc. The details of system requirements and existing standard have been calculated by Puri Municipality has been summarized below:

Table 8.32: Details of generation & collection of waste: Puri Municipality

Source	Primary collection method
Domestic, market and Institutional waste	Collection in hand wheel barrows from 7 dumping designated dumping areas, narrow lanes, over 60 waste bins, heaps on the roadside
Hotel and restaurant waste	Collection from waste bins and roadside heaps
Slaughterhouse waste	Collected by wheel barrow and stored outside the compound wall for transportation to the compost plant
Hospital and nursing home waste	No facility for bio-medical solid waste management. Deep burial is done for infectious waste for and at District HQ hospital in a cement concrete well of 1.5m dia and 3.5m depth. Other wastes are dumped along with municipal solid waste. The total waste generation is about 119.5 kg/day for total number of 467 beds in various hospitals in the Municipality area
Street sweeping	With a total road length of 293.39km, waste collected by sweeping forms a major component of solid waste.

Source: Puri Municipality



8.4.1.5 Transportation of Waste:

After collection and storage of solid waste it is transported to different locations of the town for disposal of the same. Different transport facilities have been put in place by Puri Municipal health department for moving waste from collection points to disposal sites. The details of the system are as shown in below table:

Table 8.33: Waste transportation facility: Puri Municipality

S.No	Quantity of waste	Number	Capacity
1	Number of mini lorries / trucks	10 Mini lorries, 2 trucks	Mini lorry: 2MT, Truck capacity: 5 MT
2	Total number of trips made b mini lorries / trucks to disposal site	24 Trips per day	
3	Total quantity of waste collected	1800 MT/Month	
4	Number of Dumper places	7	15 MT
5	Total trips made by dumper placers	1 trip per day	
6	Total quantity of waste collected by dumper placers	3150 MT/Month	
7	Total quantity of waste collected by mini lorries/trucks	1200 Mt/Month	
8	Total number of tractor trailers	13 numbers	2 MT
9	Trips per day made by tractor trailers	20 trips per day	
10	Total quantity of waste collected by tractor trailers	1200 Mt/Month	
11	Total number of Tipper trucks	2 Numbers	5 MT

Source: Puri Municipality

Staffing pattern and transportation facilities in the two urban areas of the region has been compared in the table given below along with waste generation rate:

Table 8.34: Staffing details for transportation of waste: PMC

Name of the ULB	Garbage generated per day	No. of conservancy staff	No. of sanitary vehicles and equipments for sanitary work
Puri Municipality	50.00 MT (out of which 45 MT collected)	464	Mini truck-1 Tractor with Trailor-8 Tractor-4 Tricycle-4 Hydraulic Truck-1 Auto Tipper-7
Konark N.A.C	4.00 MT	9	Tractor with Trailor-2 Tricycle-11 Wheel Barrow-25

Source: Puri Municipality

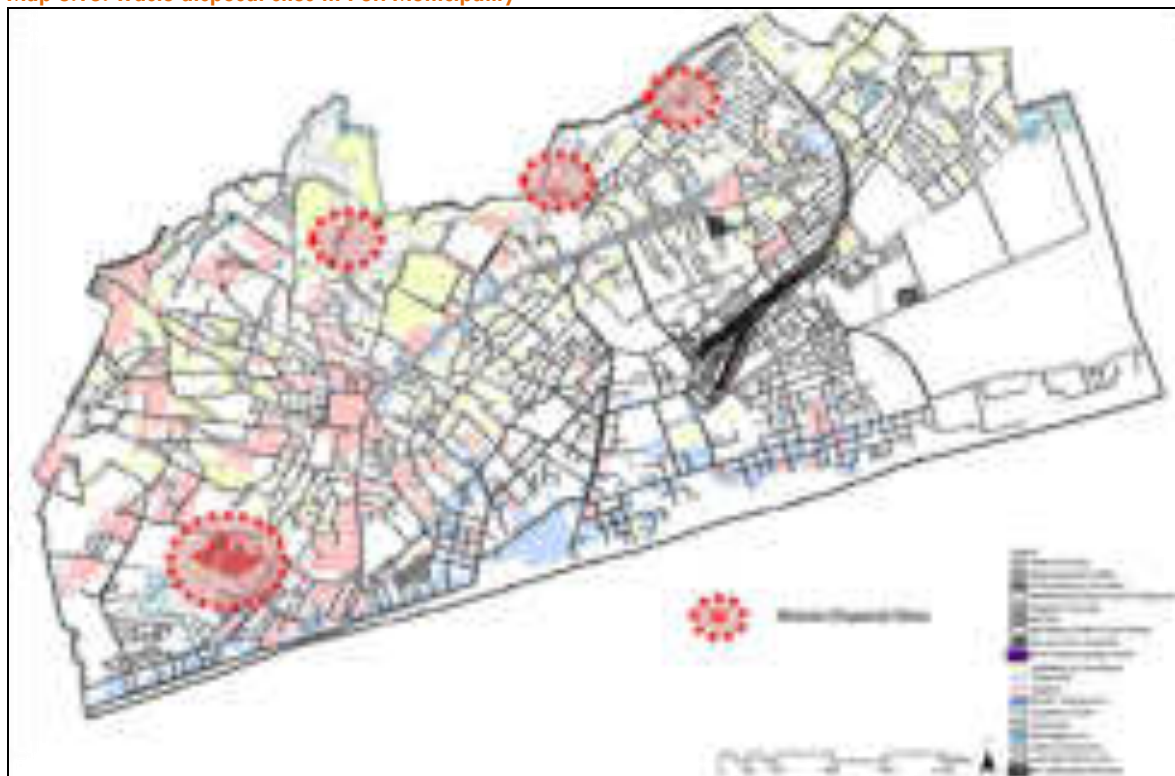
8.4.1.6 Disposal of Solid Waste

The total waste collected is transferred to the aerobic solid waste treatment plant established in 1998. There is no sanitary land fill site dedicated for the disposal of non-treatable wastes and this is disposed off by the trolley drivers near the compost plant gate. Presently the residues from the compost plant are stored within the premises. During special occasions like the world famous Rath



Yatra, extra tractors with trolleys and sweepers are engaged for cleaning different roads, drain, etc. for a fortnight. The map below shows the disposal sites located in different parts of the town area:

Map 8.16: Waste disposal sites in Puri Municipality



Source: Puri Municipality

Bio-medical waste:

There is no facility for treatment of bio-medical waste in the region. As per the assessment done by the Puri Municipality the total waste generated in the town per day is about 500 kg per day considering 1 kg/day. The bio-medical waste per day is 100 kg, and the domestic waste is currently 400kg per day. The waste is calculated considering the hospital details (Govt. Hospital -6, Public sector-1, and Nursing home-3). The generation is going to increase in the town due to increase in population and health facilities in the area. Therefore treatment and compost facility development is a requirement which is felt with greater importance.

8.4.1.7 Details of Existing compost plant in Puri town:

Under Odisha Environment Programme one compost plant has been developed in Puri town in a total area over 2hactre with a capacity to treat 100 MT. The system is expected to generate revenue at 5% of sales. The project involves windrow dumping of the garbage which is biologically treated with bacterial powder. This treated garbage after different levels of screening is converted to organic manure. The conversion ratio of garbage to manure is 20%. The basic detail of the system is stated in the below table:

Table 8.35: Details of existing treatment plant

Capacity of treatment plant	100 MT
Available land	2 Ha
Cost of the project	1.5 crores (Excl land)
Funding agency	Odisha Environment programme a project of Indo-Norwegian Development corporation under administrative control of govt. of Odisha, forest & Environmental department
Date of commissioning	15.10.1998
Monthly solid waste treated	1500 MT Avg



Monthly Manure Production	250 MT Avg
Process by product	Organic manure
Detail of process	Aerobic decomposition of solid waste for manufacturing organic manure
Revenue collected	@ 5% of sales
Total Man power	14 Nos
Sources of water	Bore well
Quantity of water used	7000 Ltr per day
Chemical use	Biological inoculums 4 tons per month

Source: PKDA, Puri

On an average Puri Municipality spends around Rs 15, 00,000 every year towards solid waste management. A private firm manages the plant. The project is an example of feasibility of Public Private Partnership in the development of infrastructure for the city. The plant is managed by a private agency that saves municipality's expenditure on operation and maintenance of the plant. The annual lease of Rs 5 lakh and royalty (5%) on the amount of compost sold would recover initial cost incurred in construction of plant. There has been an increase in demand for compost by urban residents and agricultural units particularly in Horticulture and tea gardens. Puri Municipality may take steps to institutionalize the door to door waste collection. This will move the city towards more sustainability in SWM process.

At present the plant is not running efficiently and treatment system is stopped, due to poor management system and low revenue generated by the system. Modernization and system enhancement is hence required which can be promoted by Private – public partnerships which will help in better management through use of modern technologies. Revenue generation will also hike in the process.

Table 8.36: Production & value system of treatment plant

Year	Collection (MT)	Production (MT)	Leased Value (Rs.)	Royalty (Rs.)
2007-2008	6252	1130	65000	92667
2006-2007	6582	1038	65000	104109
2005-2006	6309	1399	65000	11238
2004-2005	8111	752	65000	67250

Source: Puri Municipality

8.4.1.8 Analysing the benchmarks and service standards existing

The comparison between the service level of the existing solid waste management system and the Benchmark (based on performance indicators and standards as per CPHEEO guidelines) is tabulated below:

Table 8.37: Comparison of existing service and standards: Puri Municipality

S No	Parameter/component	Service level	Benchmark	Remark
1	Per capita generation	200 gms	250 gms	Moderate
2	Collection performance	70%	100%	Needs Improvement
3	Spacing of collection bins	1000 m	500 m	In adequate
4	No. of sanitary workers per 1,000 population	2.7	1.80	Almost inadequate
5	Sanitary workers per supervisor	65	25	Grossly inadequate

Source: Puri Municipality

The comparative study shows that the existing solid waste management system in PKDA is inadequate and would prove to be fateful to the environment and to the image of Puri and Konark as a prime



religious and tourist destination. Local authority and concerned state level departments should be engaged in better solid waste management practice than what is currently practised.

Efficient solid waste management plan preparation and implementation as well as waste management therefore becomes a key challenge for the local authority.

8.4.1.9 Summary of issues:

From the above analysis the following issues have been identified in the region:

- The system of door-to-door collection in Puri was found unscientific and the sanitary workers were restricting themselves to sweeping of streets and cleaning of drains.
- It was observed that all the streets, except for certain important roads and markets are not cleaned on a daily basis in both Puri and Konark.
- Also there was no definite yardstick prescribed for each sanitary worker in the urban centres.
- Significant portion of collection infrastructure is reportedly damaged and not been managed in Puri for last few years.
- Waste is also indiscriminately dumped along major drains and water bodies posing a severe health hazard and rendering the Puri town un-aesthetic.
- Door-door-collection and source segregation of waste has not been implemented.
- No of staffs in the health department is not found adequate to carry out the function efficiently in the town which is increasing every day.
- Containerization of collection and transportation of municipal waste also a critical factor to avoid double and man handling of wastes.
- Specific treatment of bio-hazardous waste generated from slaughterhouses, hospitals and other institutions is absent resulting in high risk to public safety and environmental health.
- Use of polythene disposable packing products and other recyclable waste material without planned disposal creates unhealthy environment.
- Efficiency of compost plant not being utilized as only 40T per day is sent for compost whereas the capacity of the plant is 100T/day.
- Capacity building of ULB's needs to be carried out in order to effectively manage the solid waste management programme.
- Public awareness is at minimum level adding further to the problem.

Fig 8.27: Burning of waste Fig 8.28: Waste dumping at VIP road Fig 8.29: Disposal site of Temple waste



8.4.2 Demand assessment for solid waste generation: PKDA-2031

8.4.2.1 Background

The section deals with demand assessment for waste generation for 2031 which will give an idea of current gaps as well. Finally recommendations will be given to improve the SWM condition in urban centres in the region.

8.4.2.2 Assessment of Solid Waste generation

For this assessment 0.358kg per capita generation is considered for Puri Town and 0.240kg per capita per day for PKDA which has been coupled with population increase to get an overview of the demand pattern for the projected year. Tourist population is also included for demand projections for Puri and Konark due to the considerable share of the same in the centers.

Table 8.38: Population projection: PKDA-2031

Block	Decadal Growth Rate (%)	Population (2001)	Block	Decadal Growth Rate (%)
Puri Town	30	1,57,837	Puri Town	30
Puri Sadar Block	32	14,880	Puri Sadar Block	32
Block A	19	17,238	Block A	19
Konark Block	34	16,979	Konark Block	34
Block B	20	6,872	Block B	20
PKDA (TOTAL)	29	2,13,806	PKDA (TOTAL)	29

Source: Census data, CEPT analysis

From the assessment it is apparent that maximum generation of waste will be coming from Puri town which is the largest concentration of population in the region. The figures are huge in terms of instruments required to manage the solid waste in the region. The existing practice must be improved to manage the scenario which is arising in future to provide safe and healthy environment in the region. For rural areas specific decentralised system can be formulated for waste management in the areas. This will lead to regional environmental improvement as a whole.

Table 8.39: Waste generation projection: PKDA-2031

Block	Solid Waste Generation (kg/capita/day)			Solid Waste Generation (Tones/Day)		
	2011	2021	2031	2011	2021	2031
Puri Town	0.35	0.41	0.45	72	108	154
Puri Sadar	0.24	0.27	0.30	5	7	10
Block A	0.24	0.27	0.30	5	7	9
Konark	0.24	0.27	0.30	6	11	18
Block B	0.24	0.27	0.30	2	2	3
PKDA	-	-	-	90	134	194

Source: Census data, CEPT analysis

8.5 Power and street Lighting:

The area of the PKDA region is characterized by 3 types of electricity facilities; domestic, agriculture and other type. The below section describes the access to electricity availability in each of the sub-region of the PKDA region.

The table below shows the availability of electric supply facility for different needs at the village level in different blocks. It is apparent from the data that large number of villages in every block is still not covered under complete electricity supply which may be due to very less number of people living in those areas or inhabited. The electric supply status for agriculture sector is very poor and must be improved for agricultural and industrial development in the region.

Table 8.40: Rural electricity details of PKDA

Development Area	No. of villages	Population	Access to Electricity (Domestic)	Access to Electricity (Agriculture)	Access to Electricity (other)
Puri sadar	16	171880	12	1	0
Proposed SIZ area	95	75244	64	1	1
Konark	7	1966	3	0	0
Block-A	21	17238	12	0	0
Block-B	14	6872	9	0	0

Source: PKDA, Puri

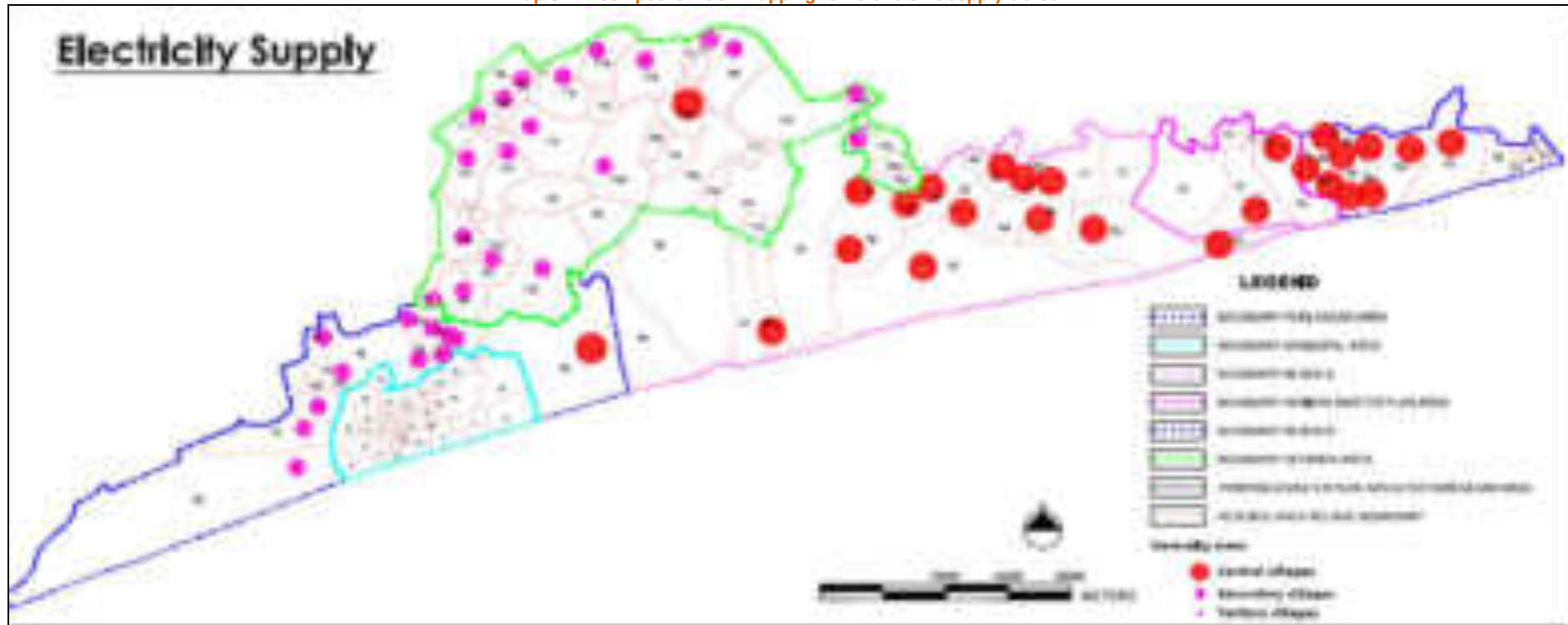
Puri town has been categorized into 4 sub-divisions for covering electricity supply by PHED. Those are: Sub division-I, Sub division-II, Sub division-III, and Sakthigopal-I. The categorisation is done on the basis of number of households and area of the zones. The number of consumers, revenue generation and efficiency of bill collection in each of the sub-divisions has been summarized in the below table which shows that Sub division-II has maximum numbers of live consumers although the collection efficiency in the same zone is far lower than other zones whereas Sub-division-III shows maximum collection efficiency among all the zones.

Table 8.41: Details of electric supply: Puri town

Name of Section	Total Consumers	Live Consumer	Bills generated through SBMS (%)	Issued money receipts to domestic consumers (%)	Issued money receipts to non domestic consumers (%)	Billing Efficiency in %	Collection Efficiency in %
Sub-division-I	19659	16464	93	72	67	42	70
Sub-division-II	24072	21959	76	60	51	38	63
Sub-division-III	18346	16191	89	70	61	59	80
Sakthigopal	21730	19354	91	57	60	32	64
Total	83807	73968	87	64	61	42	72

Source: Odisha Elect. Board

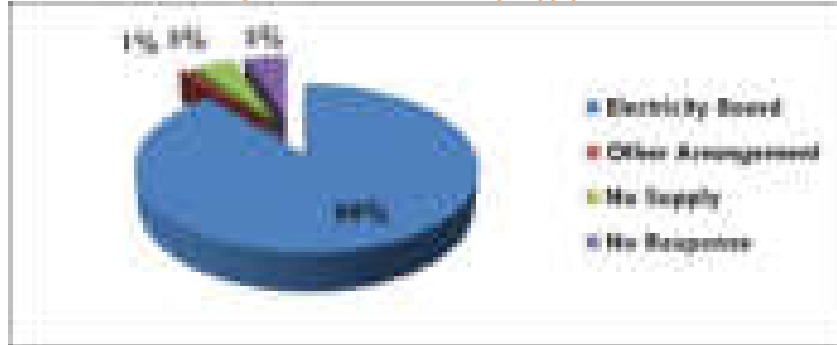
Map 8.17: Composite Index mapping for rural electric supply status



The above map shows the centrality index for electricity supply in the rural areas in different blocks. Maximum weightage is given for electricity access to agriculture in villages where as next level importance has been given for domestic supply. It is quite clear from the map that Puri Sadar and Proposed SIZ areas the blocks which has poor electricity supply where as Block-A and Block-B shows maximum values due to supply of electricity in the agriculture sector. Hence priority should be given for improvement of electricity supply facility in area where urbanization is taking place at faster rate and demand is getting increased subsequently in the Puri Sadar and Proposed SIZ area in the region.

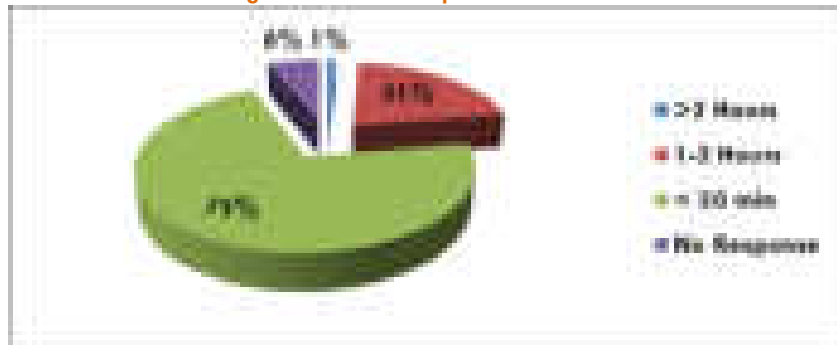
From the household survey conducted by CEPT it is apparent that majority of household depends on electricity board for supply in Puri whereas most of them depends on various other sources in Konark area due to heavy power cuts as shown in the diagram below. Duration of power cut is low in Puri due to its importance as a tourist destination. This signifies that except Puri the power supply trend in the region is below standard and not favorable for future investments and development and hence proposal should be made for improving the power supply standards in the region.

Fig 8.30: Source of electricity supply: Puri



Source: CEPT survey & analysis

Fig 8.31: Duration of power cut off: Puri



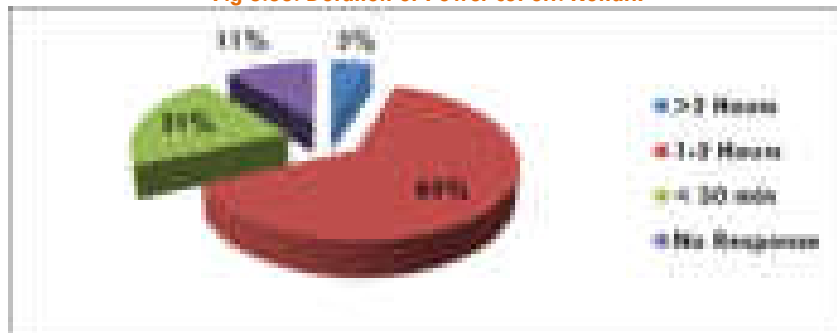
Source: CEPT survey & analysis

Fig 8.32: Source of electricity supply: Konark



Source: CEPT survey & analysis

Fig 8.33: Duration of Power cut off: Konark



Source: CEPT survey & analysis

Street lighting in the two urban centers in the region is far below standard in quality and coverage. Puri town area is not fully covered with street lightening facility. It is available in only few important roads and not anyway in the interiors of the urban growth areas. Also the quality of lights and distance between them is highly inadequate and in some cases unscientific.

Konark NAC has the facility available in the main road (NH-203E) which is the main spine of the centre covering most of the tourist and commercial areas of the urban spread. The village areas in the NAC are not provided with the facility. The details of system design available in Puri town are shown in the table beside.

The present service levels and benchmarks have been compared for Puri town to have understandings of the service standards in the area. It can be seen that service provision is far below benchmarks and standards as spacing between lamp posts and Proportion tube light of florescent etc are showing far below numbers than required.

Perception of households have been analyzed in the below chart which shows that more than 30% of households in Konark and 15% households in Puri stated that the facility provided is not sufficient.

Table 8.42: Street lighting facilities: Puri town

Types	In No
Ordinary bulb	1007
Tube light	1957
70 watt S.V Light	412
250 watt S.V Light	556
400 watt S.V. fitting	247
22 watt C.F. fitting	120
400 x 2 watt fitting	38
High mast	9
Mini high mast	1

Source: Puri Municipality

Table 8.43: Existing service levels and standards for street lighting: Puri town

Sl. No	Parameter / Component	Service Level	Benchmark	Commitment/ Remarks
1	Spacing posts between Lamps	80 m	<30 M	Very High spacing
2	Proportion Tube Lights of Florescent	20 %	70-80 %	Less
3	Proportion Vapor Lamps of Sodium	5 %	20-30 %	Less

Source: Odisha Elect. Board

Fig 8.34: Perception about street lighting: Puri town



Source: CEPT survey & analysis

Fig 8.35: Perception about street lighting: Konark town



Source: CEPT survey & analysis

The issues identified and strategies proposed in Power and street lighting sector has been summarized below:

- Adequate amount of power supply should be generated in the Konark NAC area where the demand is fast increasing.
- Electricity coverage should be increased in the Proposed SIZ area and Puri Sadar area where many villages are still out of supply coverage.
- Power cuts should be eliminated in the region to attract investments in the tourism and industrial sector.
- Short fall of resources for augmenting street lighting within the city should be tackled efficiently through promoting PPP models.
- Adequate management of power consumption by street lights should be adopted efficiently.
- Power consumption measurement and saving equipments such as trip censor solar coupled lights can be promoted for low electricity consumption and lesser expenditure.
- Equitable distribution of street lights within different areas is an important necessity.

9. Social Infrastructure

9.1 Introduction

Social infrastructure and amenities fall under the social welfare objectives of the urban development programme, as distinct from economic development objectives and especially in context of the rapidly liberalized and competitive economic scenario.

The provision of these amenities in any town/city shall consider the regional bearings as small town cater to the requirements of surrounding villages, medium size towns cater to small towns and villages and so on in the hierarchy of settlements in the region for the higher level facilities.

As per UDPFI Guidelines, social infrastructure comprises education, health, socio-cultural facilities, distributive services, miscellaneous facilities like bus stops, cremation grounds, and other facilities including communication, postal services, security forces and fire protection services, commercial facilities and recreational facilities. UDPFI guidelines are used as benchmarks to ascertain where particular services are adequately available and there are gaps.

Adequate social infrastructure like schools and hospitals are the basic needs of the human life which would allow for the improve the standard of the living and affordability levels of the people in the region

This chapter deals with the availability of social infrastructure facilities, focusing on health and education, at settlement level in the study area. Available of financial services at the settlement level is also dealt with. The Mouza wise summary of the infrastructure availability is presented herewith in this chapter, while the settlement level details are given in the Annexure. Assessment of service levels is undertaken based on the Census 2001 data. The analysis helps clearly identify gaps in infrastructure at settlement level and thus provides key inputs for Comprehensive development plan preparation.

Fig 9.1: Anganwadi School



Fig 9.2: Primary health centre: Puri



Fig 9.3: Street lights



9.2 Education

9.2.1 Existing Educational Facilities in PKDA

Education is the backbone for development of any community and region as a whole as it enhances the potential human resources available. Providing education facility is the basic responsibility of the state and the ULB. This section will assess the existing education facility available at different levels, identify the gap existing and will propose the future requirement according to UDPFI guidelines. Major strategies and interventions in the land use plan will be discussed in Volume-2 of the CDP.

The status of different level education facilities have been listed and analyzed in the below tables:



Table 9.1: Status of Primary Schools: PKDA

Development Area	No. of Villages	Population	Primary schools (Existing)	Primary School Norms (UDPFI Guidelines)	Status
Puri Sadar	16	14880	4	6	-2
SIZ area	39	75244	57	31	26
Konark	7	1966	3	3	0
Block-A	21	17238	10	7	3
Block-B	14	6872	6	3	3

Source: Census data, CEPT analysis

Table 9.2: Status of Middle Schools: PKDA

Development Area	No. of Villages	Population	Middle schools (Existing)	Middle School Norms (UDPFI Guidelines)	Status
Puri Sadar	16	14880	3	4	-1
SIZ area	39	75244	18	21	-3
Konark	7	1966	0	0	0
Block-A	21	17238	6	5	1
Block-B	14	6872	2	2	0

Source: Census data, CEPT analysis

Table 9.3: Status of Secondary Schools: PKDA

Development Area	No. of Villages	Population	Secondary schools (Existing)	Secondary School Norms (UDPFI Guidelines)	Status
Puri Sadar	16	14880	0	2	-2
SIZ area	39	75244	13	10	3
Konark	7	1966	0	0	0
Block-A	21	17238	4	2	2
Block-B	14	6872	1	0	1

Source: Census data, CEPT analysis

Table 9.4: Status of Colleges: PKDA

Development Area	No. of Villages	Population	College (Existing)	College Norms (UDPFI Guidelines)	Status
Puri Sadar	16	14880	0	0	0
SIZ area	39	75244	1	1	0
Konark	7	1966	0	0	0
Block-A	21	17238	0	0	0
Block-B	14	6872	0	0	0

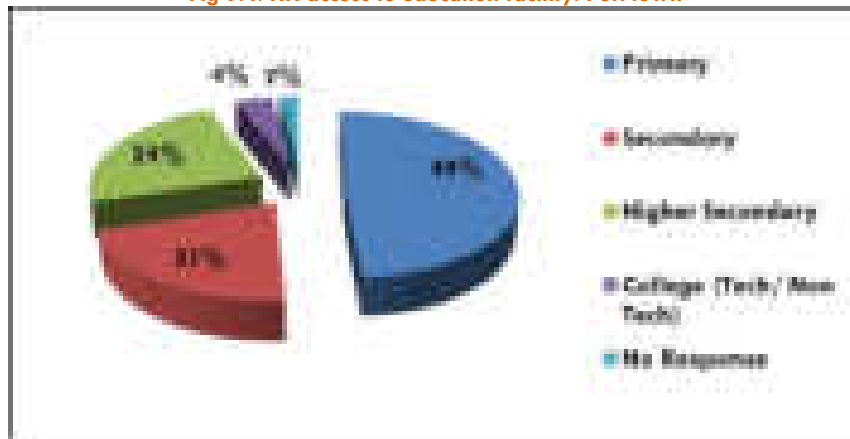
Source: Census data, CEPT analysis

The chart below shows the analysis of the household information surveyed to assess the status of schooling access for residents in Puri and Konark areas.

About 81% of the respondents in Konark and 49% in Puri state the requirement of primary schools is less as compared to the population and hence a demand for Primary educational facilities. A very less percentage of about 15% in Konark and 21% suggested for provision of Secondary school facilities.

Equal numbers of people, about 2% in Konark require higher secondary school which signifies that there are very less number of higher educational facilities in the area compared with the population.

Fig 9.4: HH access to education facility: Puri town



Source: Census data, CEPT analysis

Fig 9.5: HH access to education facility: Konark



Source: Census data, CEPT analysis

The summary of the facilities from the above analysis can be stated as following:

- Puri sadar has 4 primary schools, and 3 middle schools and no higher secondary school or college reducing the scope for higher education for residents.
- SIZ area has adequate 57 primary schools. 21 middle schools, 13 secondary schools, and 1 college
- Konark has only 5 primary schools. Seems to be adequate for existing population.
- Block-A has 10 primary schools, 6 middle schools, 4 secondary schools
- Block-B has 6 primary schools, 2 middle schools and requires more facilities.
- Puri Sadar area has a requirement of primary, middle and secondary school facilities.
- On a whole the educational facilities are found to be satisfactory except in Puri Sadar and Block-B area.
- There are no colleges in any areas except SIZ area delimiting the scope for higher education.

9.2.2 Assessment of Future Requirements for Education

Demand assessment for future requirements has been formulated on the basis of UDPFI guidelines for specified size class cities and settlements. The major issues identified are as follows:

- Although number of primary school is currently sufficient except Konark availability of Secondary and higher secondary schooling facilities is very limited in the region.
- There is a need for college education in the region especially technical education institution to promote higher education in the region.
- In future demand of schooling for physically challenged and adult literacy centre will be felt which should be provided to promote equitable education access to all the residents.

Table 9.5: Demand and gap for Education facilities, 2011: PKDA

Block	Primary School		Middle School		Higher Secondary School		Technical College		School for physically challenged		Adult Literacy Centre	
	Demand	Gap	Demand	Gap	Demand	Gap	Demand	Gap	Demand	Gap	Demand	Gap
Puri Sadar	6	0	10	7	2	2	0	0	1	1	2	2
Block A	8	0	12	5	3	0	0	0	1	1	2	2
Konark	7	4	11	7	2	2	0	0	1	1	2	2
Block B	3	0	4	2	1	0	0	0	1	1	1	1

Source: Census data, CEPT analysis

Table 9.6: Demand for Education facilities, 2021: PKDA

Block	Primary School	Middle School	Higher Secondary School	Technical College	School for physically challenged	Adult Literacy Centre
Puri Sadar	35	25	12	1	2	9
Block A	10	7	3	1	1	2
Konark	16	11	5	0	1	4
Block B	4	3	2	0	0	1

Source: Census data, CEPT analysis

Table 9.7: Demand for Education facilities, 2031: PKDA

Block	Primary School	Middle School	Higher Secondary School	Technical College	School for physically challenged	Adult Literacy Centre
Puri Sadar	70	49	24	1	4	15
Block A	12	8	4	1	1	3
Konark	25	17	8	0	1	6
Block B	4	3	2	0	1	1

Source: Census data, CEPT analysis



9.2.3 Suggested Policies and Strategies for Education

Institutional Arrangements:

- The Government should work very closely with the private and public sector to form an advisory committee comprising representatives from all concerned parties and form up-to date courses only to ensure that its education and training system would meet the tertiary needs, now and in the future.
- Close collaboration with international reputed institutions in the development of various training courses could form part of the Government's HRD policy. The Government, along with National Productivity Council, Technical Education Board and other appropriate organizations should also develop extensive programs to upgrade the skills of the existing workforce under the overall guidance of experienced and well qualified national and overseas personnel. Only then could we identify their best practices and suitably modify them for developing the present education and training system.
- The Government could promote the adoption of the city's municipal schools by NGO's and communities to reduce dropout rates

Fig 9.6: Primary school in Konark



Fig 9.7: Mid may mill in school



Fig 9.8: School in SIZ area



Improving Quality of Education:

Introduce Institutions of Technical, Medical and Management and Vocational Training Education. The supply of skilled man power is the key factor in the process of managing the future urban development. It is important to develop new initiatives in management training outside the formal education and training system to provide the adequate skill required for running operation and maintenance of various old and new industrial institutions.

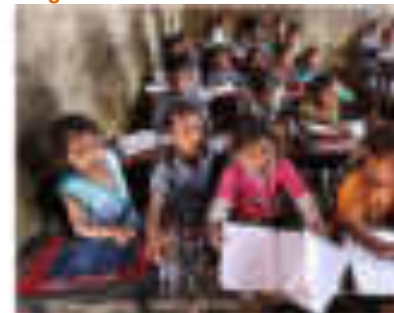
Fig 9.9: Women empowerment



Fig 9.10: Awareness for Education



Fig 9.11: Education for All



Capacity Building:

- Release of land for setting up of high quality day schools in the model of DPS in different villages.
- Formation of teachers' training institute for improvement in the qualification and experience of the teachers at all levels, especially the secondary and higher secondary level.



- Augmentation of infrastructural support such as text books, furniture, storage in classrooms, playgrounds, libraries, laboratories etc; with a stress on extra-curricular and recreational activities especially in the primary sections. Introduction of mid-day meal would enhance the effort in this direction.

9.3 Health Care

One of the basic requirements of the society is health facilities available in the area. It is again one of the prime responsibilities of the state and local bodies to provide the facilities to the residents. This section deals with the availability and status of the health facilities in the PKDA region. Each area of the region is dealt separately and existing status, current gaps and future demand has been calculated for each of them.

9.3.1 Existing Health care Facilities in PKDA

The PKDA region is characterized by the presence of 7 levels of health facilities. Existing status of different level health facilities has been stated and compared with UDPFI guidelines in the below tables:

Table 9.8: Status of Primary Health Centre: PKDA

Development Area	No. of Villages	Population	Primary Health Centre (Existing)	Primary Health Centre (UDPFI Guidelines)	Status
Puri Sadar	16	14880	0	2	-2
SIZ area	39	75244	2	-	-
Konark	7	1966	3	3	0
Block-A	21	17238	0	2	-2
Block-B	14	6872	1	1	0

Source: Census data, CEPT analysis

Table 9.9: Status of Health Centre: PKDA

Development Area	No. of Villages	Population	Health Centre (Existing)	Health Centre (UDPFI Guidelines)	Status
Puri Sadar	16	14880	3	10	-7
SIZ area	39	75244	-	-	-
Konark	7	1966	7	12	-5
Block-A	21	17238	4	11	-7
Block-B	14	6872	2	4	-2

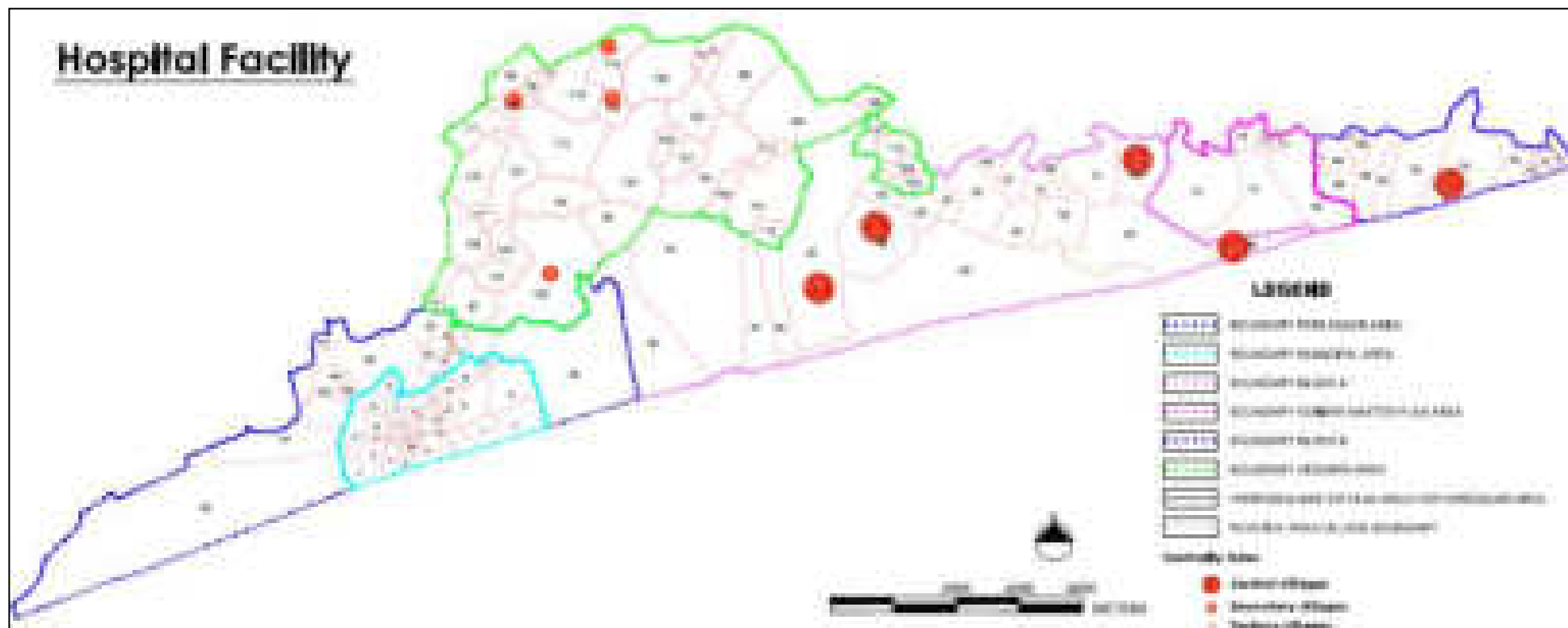
Source: Census data, CEPT analysis

Table 9.10: Status of Dispensaries: PKDA

Development Area	No. of Villages	Population	Dispensaries (Existing)	Dispensaries (UDPFI Guidelines)	Status
Puri Sadar	16	14880	0	2	-2
SIZ area	39	75244	2	-	-
Konark	7	1966	0	2	-2
Block-A	21	17238	0	2	-2
Block-B	14	6872	0	1	-1

Source: Census data, CEPT analysis

Map 9.2: Health facilities in PKDA region



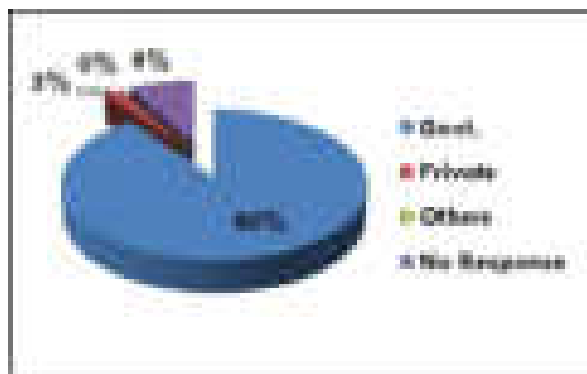
Source: ORSAC data, CEPT analysis

The above map shows the centrality index for health facilities in the rural areas in different blocks. Higher weightage has been given for higher level health institutions in this method. The weightage for different level institutions have been given same weightage for every block. But the regional weightage has been taken at varying scales at block level due to changing demand pattern in the concerned villages. It is clear from the map that Puri sadar block has very poor health facilities while Block-A, Proposed SIJ area and Konark has moderate level facilities in the region.

From the Socio-economy survey it is observed access to health facilities is mostly through Govt. Hospitals about 96% of the population in Konark and 90% in Puri town respond towards Govt. hospitals. This signifies that the area has no private hospitals.

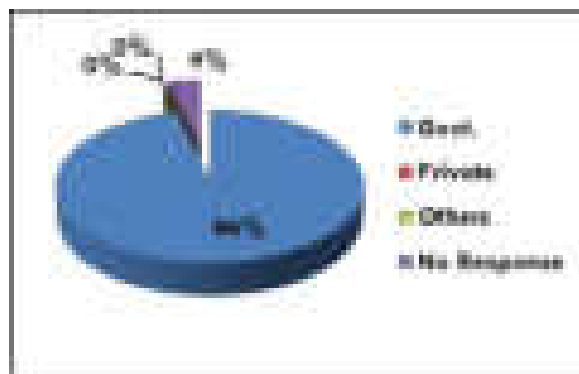
Even if private hospitals are provided the people are reluctant to go there due to the low economy standards. This is the typical scenario of rural India. The below charts have been presented to show the access to health facilities in Konark and Puri:

Fig 9.12: Access to health facilities: Puri town



Source: Census data, CEPT analysis

Fig 9.13: Access to health facilities: Konark



Source: Census data, CEPT analysis

The summary of existing health facilities in the region can be summarized as following:

- Puri Sadar has substandard health facilities in the overall regional context and standards.
- SIZ area has 9 Primary Health Sub centers, 1 ayurveda dispensary, 1 homeopathy dispensary, 1 maternity and child welfare centre, 2 child welfare centers, 2 primary health centers and 1 family centre accounting to majority of health facilities in the rural PKDA.
- Konark has only 2 primary health sub centers and people in this part are over dependent on government supply of the facility.
- Block-A has 3 primary health sub centers which can be rated as moderate standard of service.
- Block-B has only 1 primary health sub centre and needs improvement in the sector.

On a whole the health facilities are found to be moderately satisfactory needing interventions in a few blocks for achieving overall balanced development in the region.

9.3.2 Assessment of Future requirements and proposals

Demand assessment for future requirements has been formulated on the basis of UDPFI guidelines for specified size class cities and settlements. The major issues identified are as follows:

- Puri Sadar and Konark block are among the blocks which has largest gap existing in no of health centers and other facilities as per standards,
- There is no general hospital in the region except one in Puri town. The number should be more in the context of the needs arising.
- Polyclinic, Mother & Child care and dispensaries should be provided as per adequate standards the need of which will emerge in the coming future

Table 9.11: Demand and gap for Health facilities, 2011: PKDA

Block	General Hospital		Health Centre		Primary Health Centre		Poly Clinic		Mother and Child Care		Dispensary	
	Demand	Gap	Demand	Gap	Demand	Gap	Demand	Gap	Demand	Gap	Demand	Gap
Puri Sadar	0	0	10	7	2	2	0	0	1	1	2	2
Block A	0	0	12	5	3	0	0	0	1	1	2	2
Konark	0	0	11	7	2	2	0	0	1	1	2	2
Block B	0	0	4	2	1	0	0	0	1	1	1	1

Source: Census data, CEPT analysis

Table 9.12: Demand and gap for Health facilities, 2021: PKDA

Block	General Hospital	Health Centre	Primary Health Centre	Poly Clinic	Mother and Child Care	Dispensary
Puri Sadar	0	1	1	1	2	6
Block A	0	0	0	0	1	2
Konark	0	0	0	0	1	3
Block B	0	0	0	0	0	1

Source: Census data, CEPT analysis

Table 9.13: Demand and gap for Health facilities, 2031: PKDA

Block	General Hospital	Health Centre	Primary Health Centre	Poly Clinic	Mother and Child Care	Dispensary
Puri Sadar	1	2	2	2	4	12
Block A	0	0	0	0	1	2
Konark	0	1	1	1	1	4
Block B	0	0	0	0	0	1

Source: Census data, CEPT analysis

9.3.3 Suggested Policies and strategies for health facilities

The various strategies proposed for improving the standard of health facilities in the region are as following:

Raising the level of medical services:

The existing standard of health facility should be upgraded in compatible with new trends of health care services such as tele-medicine, setting up of health intranet, patient information centre through internet, and related computerization should be actively encouraged in the PKDA region. Specific focus should be given to development rural health facility development in the region.

Community based approach

- The motto for tomorrow's health care should be "help at the doorstep". Preventive practices coupled with medical help provided by community health officers will ensure that the number of patients with critical diseases will decrease. All categories of citizens including government workers are to be brought under the medical insurance coverage to avail the facilities in the major hospitals.
- The strategy for community based approach will be to increase the participation of the people, especially womenfolk in semi-urban, industrial and rural areas. A system of health card has to be introduced to each individual by the NGO's and CBO's.
- Introduce a system of appropriate user fees in all the state-run hospitals without withdrawing the sanctioned fund.

Public Private Partnership:

- Encourage public–private partnership in the creation of new kinds of hospitals for ensuring specialized kinds of medical facilities for the people at large.
- The private sector in healthcare should cater to the referral hospital like that of VMC, Tata memorial etc. while improving the medical equipment and laboratories. However some form of cross subsidy may be worked out so that the private sector could provide services to people at more affordable prices.

Capacity Building:

- There is an immediate need to increase the number of qualified doctors as well as the para-medical staff in hospitals.
- There is an immediate need for upgrading all basic and diagnostic equipments in all primary health centers and sub-centers mainly in the rural areas which lack these facilities.

Fig 9.14: Health Centre at Puri



Fig 9.15 Health Awareness



Fig 9.16: Medical College



9.4 Other Social Infrastructural facilities

9.4.1 Communication Facilities:

The area of the PKDA region is characterized by 3 types of communication; Post office, Post & Telegraph office and Telephone. The below section describes the access to Communication available in each of the sub-region of the PKDA region.

Puri town being the prime settlement in the region is the hub for communication facilities in the area. But the facilities in the villages are far below standards and demand available. The below table shows the status of communication facilities in the PKDA region:

Table 9.14: Communication facilities in rural PKDA

Development Area	No. of Villages	Population	Post offices (Existing)	Post & Telegraph	Telephone
Puri Sadar	16	171880	2	9	9
Proposed SIZ area	39	75244	13	5	25
Konark	7	1966	1		2
Block-A	21	17238	3		5
Block-B	14	6872	1		1

Source: Census data, CEPT analysis

The following aspects can be summarized from the table:

- The overall access to communication facilities is not found to be satisfactory as much of the region have no access to any one of the Communication facilities described above.
- In Puri Sadar area only 2 villages have post office, 9 villages have Post & Telegraph and 9 villages have telephone facilities and 4 has no facility
- In SIZ area out Of the 39 villages, 13 have Post office facility, 5 villages have Post & Telegraph facilities and 25 villages have Telephone facilities.
- Facilities in Konark area comprises of Post office in 1 village and Telephone facilities in 2 villages.
- Out of the 21 villages in Block-A, 3 villages have Post offices, 5 villages have Telephone facilities.
- Out of the 14 villages IN Block-B, 1 village has post office and 1 village has Telephone facility.
- Overall the standard of communication can be rated as poor in the region.

Fig 9.17: Post office: Puri



Fig 9.18: Post carrier van: Konark



Fig 9.19: Head post office: Puri town



The issues identified and consequent strategies proposed for development of communication facilities are as follows:

- Means of communication in the region should be decentralized and planned accordingly which will result in flow of information into interior of the region.
- Modern postal and communication facilities should be provided in the town areas for increased potential of the region.
- Deployment of adequate staffs and capacity enhancement of them should be well taken care off for efficient service delivery for the residents.

9.4.2 News Paper and Magazines:

Availability of news papers and magazines is an important indicator for identifying development state of a region. Information access is highly dependent on availability of news papers in the rural areas and plays a key role in social transformation.

The below table represents access to news paper and magazines in the rural PKDA:

Table 9.15: Availability of news papers and magazines in rural PKDA

Development Area	No. of Villages	Population	News paper	Magazines
Puri Sadar	16	171880	12	11
Proposed SIZ area	39	75244	72	54
Konark	7	1966	4	1
Block-A	21	17238	15	13
Block-B	14	6872	9	9

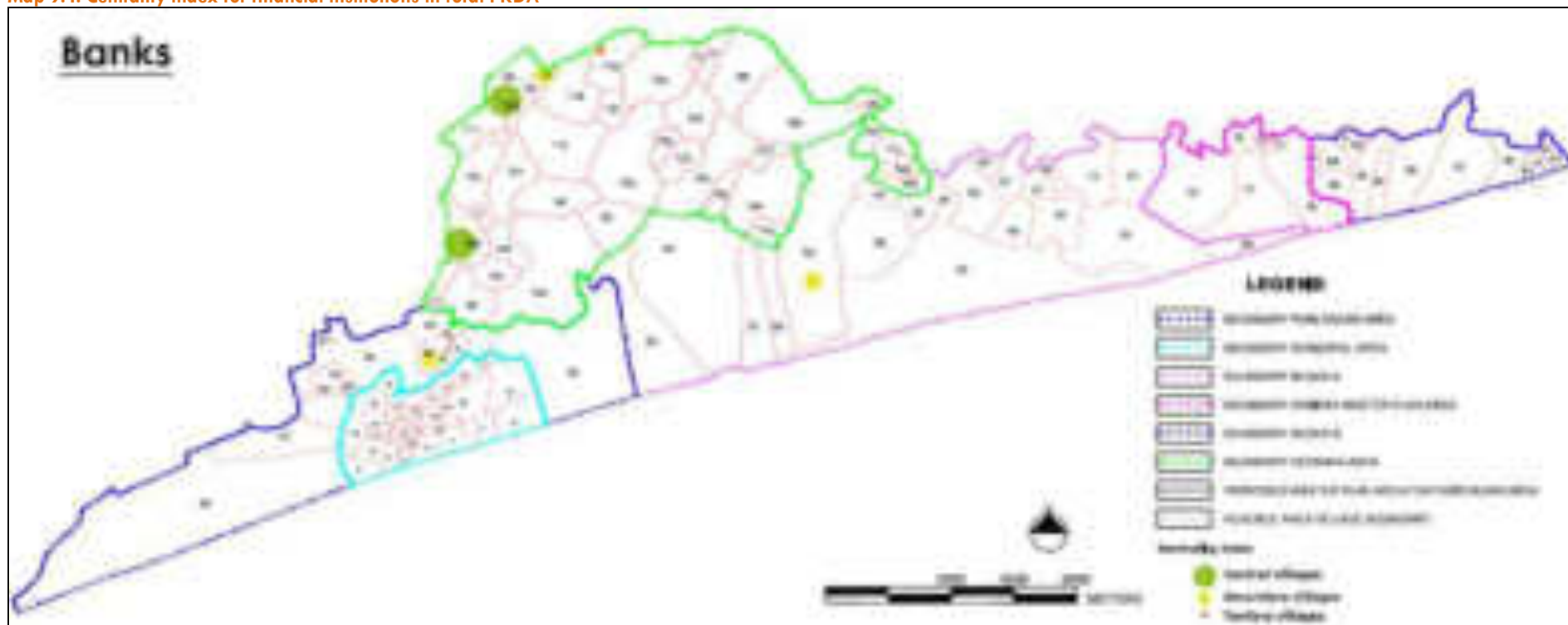
Source: Census data, CEPT Analysis

The strategies required to be adopted in this regard are as follows;

- Transportation facilities should be improved in the rural belts to increase access to the facility for the residents in the interior PKDA region.
- Coverage for circulation of the facility can be further enhanced with innovative strategies.

9.4.3 Financial Institutions:

Financial institutions play a key role in economic development of a region, PKDA is no exception. In fact being a tourism destination this sector plays a key role in the context. As far as availability of Banks is concerned most of them are concentrated in Puri town area to some extent Konark NAC. Rather than this Puri Sadar area which is mostly constitutes of outgrowth of Puri town is having some facilities available. Rather than this the region have limited to no facility of banks or similar institutions.

Map 9.4: Centrality index for financial institutions in rural PKDA

Source: ORSAC data, CEPT analysis

The above map shows the centrality index for banking facilities in the rural areas in different blocks. For mapping highest weightage has been given for government banks where as lowest has been given co-operatives. It is quite clear from spatial arrangements in the map that except few large villages of Proposed SIZ area rest of the rural tracts of the region is having no facilities for banking mostly dependent on facilities available at Puri town. Hence decentralization of the banking facilities in the region is proposed so that it can cater for achieving the goal overall regional development.

10. Environment and Disaster Profile

Environment and ecology form the core of human habitat. Development and environment are interlinked and improvement of one impacts the other and vice versa. Due to its location, PKDA area has rich environmental resources as well high vulnerability to natural disasters. Hence, study of the environmental status and disaster scenario always helps in better physical planning of the region. This chapter analyses various sectors of environment as well list various hazards and their effects over the region in the past.

10.1 Environmental Profile

10.1.1 Air Quality

The quality of human life is associated with the quality of air we breathe. The rising levels of various pollutants in the atmosphere have drastically reduced the quality of life.

The climate of the study region is affected by the maritime influence due to its close proximity to Bay of Bengal. The characteristics include hot humid summers and high humidity during the monsoons. Summer spans from March to June, winters from October to February, and monsoons are from June to October. The maximum temperature goes up to 38°C – 40°C. The average rainfall of the region is about 1352 mm and the humidity varies between 62% - 85%. The maximum wind speed recorded in this region is 175kmph.

The atmosphere is composed of gaseous mixture, water vapors and particulate matter. This gaseous mixture consists of gases whose concentrations remain constant. Any change in the natural composition of gases in air or addition of new gases or particulate matter affects air adversely. Pollutants in the atmospheric that are emitted from various natural and anthropogenic sources have diverse impacts on all the living creatures. In addition to the natural activities like smoke from wildfires, dust in desert areas, biological decay, volcanoes, human-induced activities such as traffic, change in land use, industries etc. are the main agents causing pollution in the air.

The following section gives a brief of the air quality in the main urban centre (Puri) of the study region. The other parts of the study region are on a rural front with less or negligible human influence, and hence this section refers to Puri – the main urban town.

10.1.1.1 Pollution Levels

The ambient air quality of Puri town was analyzed for the year 2002 both during the pre-monsoon and post-monsoons and also during the Rath Yatra. The air quality standards have been determined from the following five locations within the town. These five locations have been selected by the pollution control board owing to the various activities in these regions.

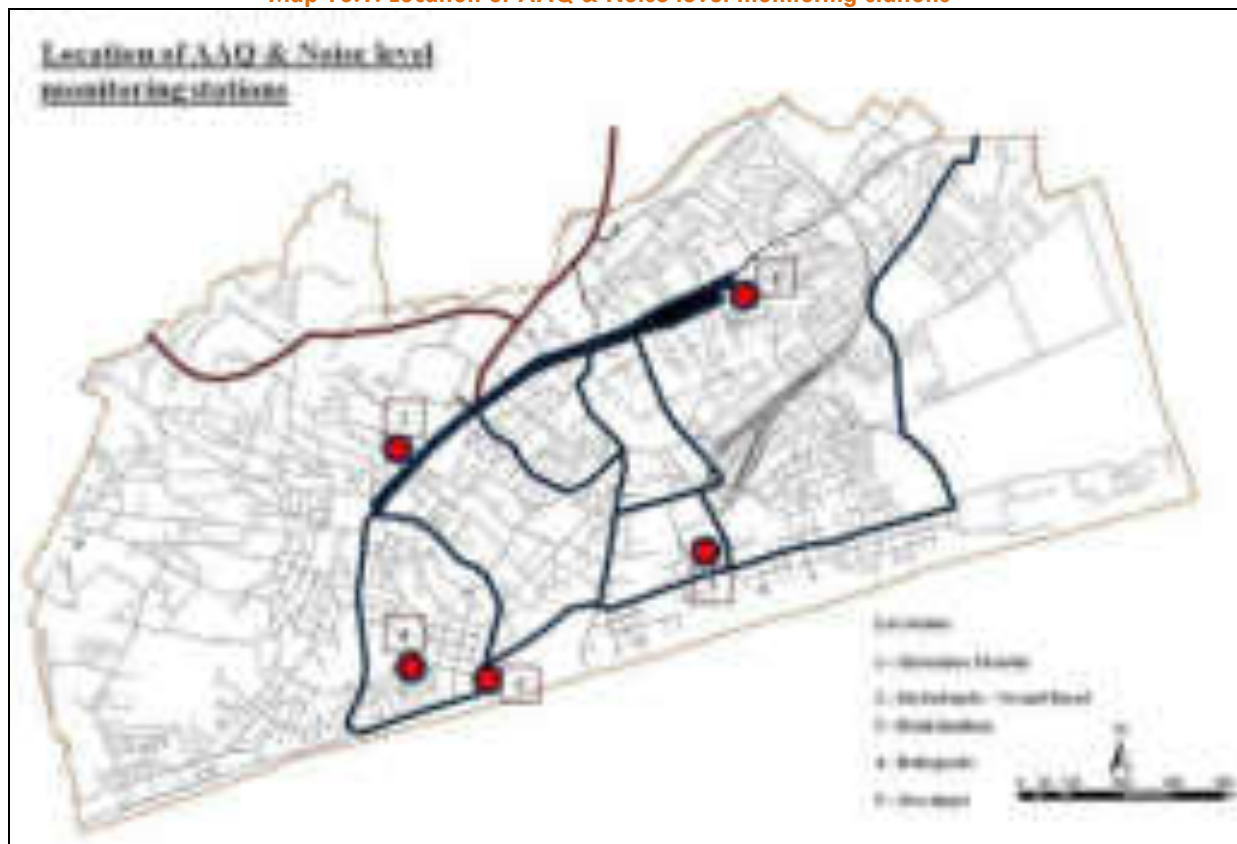
- Mausima Mandir
- Badadanda
- Sea shore
- Baliapanda
- Bankimuhan

The point source of air pollution is absent within the Puri town. However, diffuse sources like household fuels, hotel industry, vehicular movement and burning of solid waste are main sources of the air pollution. Increasing vehicular traffic and the huge amount of tourist population visiting the town are



two main factors which insist on regular monitoring of the air quality in this region. The following figure shows the locations of the monitoring stations within the Puri town.

Map 10.1: Location of AAQ & Noise level monitoring stations



Source: ORSAC data, CEPT analysis

Table 10.1: Ambient air quality in Puri town during Rathyatra, 2002

$\mu\text{g}/\text{m}^3$	Mausima Mandir			Badadanda			Sea shore			Baliapanda			Bankimuhan			Standard (Residential) 24hrs Avg.
	Pre	Dur	Post	Pre	Dur	Post	Pre	Dur	Post	Pre	Dur	Post	Pre	Dur	Post	
SO₂	32	38.5	7.5	4	7	2	ND	ND	ND	12	14.3	ND	7.2	10	ND	80
NO_X	42	46.9	11.9	28	33.4	9.71	ND	ND	ND	8	8	ND	8	12	6.72	80
SPM	202	557.7	113	167	371	133	95	98	68	100	120	56	120	140.5	64.4	200

Source: Odisha State Pollution Control Board (OSPCB)

It is observed that the levels of sulphur dioxide (SO₂) and Nitrogen Oxide (NO_X) levels within the Puri town are low and very much within the permissible limits. In case of Suspended Particulate Matter (SPM) the levels are high. The monitoring stations where the levels are higher than the permissible limits are Mausima Mandir and Badadanda. The level of SPM goes up to 557.7g/m³, when the permissible limits within the residential areas are 200g/m³. The main reason for the higher levels of SPM in these two monitoring stations is the heavy traffic flow on the NH 203, and the congestion occurring in these regions (on the Badadanda – Grand Road, Atharnala – entry point to Puri) and due to the saw dust generation during the Rath Yatra.

There is a great deal of difference seen in air quality in the normal season in compared to tourist season in Puri town. Major degradation of environment is found in the peak season.

10.1.2 Noise Levels

Noise is defined as the unwanted sound that is loud or unpleasant or unexpected. It has adverse impacts on the daily activities of human beings and animals. The adverse impacts of noise on human and animals also depend on time, season and quality of sound. Birds and many other animals are quite sensitive to noise and greatly affect their feeding, breeding and resting behavior/stage.

The noise levels are also monitored at five stations within Puri town. These are the same as the air quality monitoring stations. The following table shows the ambient noise levels of Puri in three different intervals in the year 2002. The noise levels are monitored during pre Rath Yatra season, post Rath Yatra and during the Rath Yatra. It is found that the noise levels are higher than the permissible limits in almost all the monitoring stations other than Baliapanda monitoring station. At the Baliapanda monitoring station, the ambient noise levels are closer to the permissible limits.

Table 10.2: Ambient noise level in Puri town during Rathyatra, 2002

Sl.No.	Location	Ambient Noise Level, db (A) Leq Day Time (6.00am to 10.00am)			Ambient Noise Standard for Commercial area, db(A) Leq Day time (6.00am – 10.00pm)
		Pre	During	Post	
1	Mausima Mandir	80.6	89.9	78.6	65
2	Badadanda	67.4	85.2	65.5	
3	Sea shore	62.4	66	62.8	
4	Baliapanda	56.2	58	56	
5	Bankimuhan	60	64	58	

Source: Odisha State Pollution Control Board (OSPCB)

It is observed that the highest noise levels are reported at Mausima Mandir monitoring station, located on the Grand Road near Gundicha Temple. It can be noted that this area houses the local bus stand and garages for the repair of automobiles. It is evident that noise levels in most of the monitoring stations vary from 60db – 89.9db, whereas the permissible standards for these commercial areas are 65db.

From the above analysis and data it can be said that noise pollution is still not at an alarming stage but with growing population and car ownership, the condition can change rapidly as seen in most of the growing Indian cities. On the other hand, during Ratha Yatra and other festivals, the pollution level does go beyond the safe limit and hence necessary measures should be taken for providing the residents and tourists a safe living environment.

Fig 10.1: Substandard vehicles and pollution



Fig 10.2: Overcrowding in tourist season



10.1.3 Water Quality

The quality of water plays a vital role in the environment as a whole. It plays a main part in contributing to the health of the society and also on the flora and fauna of the region. The entire PKDA region being situated along the coast of Bay of Bengal has a network of rivers, ponds and lakes, which have an interconnected drainage system. The three main rivers passing through the area are Mangala River near Sipasiruballi, Nuanai River passing through Balukand reserved forest, Kushabadra River near Konark and Kadua Nadi towards Kakatpur. These rivers are the tributaries from River Mahanadi.

Due to the proximity to the sea, the ground water in most of the areas is saline; the two sweet water aquifer zones within the Puri municipal limit are the main source of drinking water in the region. These aquifers are located in Baliapanda and Chakratirtha areas. The Major tanks in Puri have great heritage significance as they are associated with the rituals of the Jagannath Temple.

The main parameters considered for the assessment of water quality are COD, BOD, pH, turbidity, hardness, iron, chlorine, manganese, lead etc.

Water quality in Puri is monitored in five places which are as follows:

- Indrayamuna Tank
- Narendra Tank
- Markandeswar Tank
- In front of Swargadwar
- Swethaganga Tank

The map below shows the location of these five water quality monitoring stations in Puri town area:

Map 10.2: Ambient water quality monitoring stations in Puri town



Source: ORSAC data, CEPT analysis

Puri is one of the Char Dhams (four holy destinations) in India and hence the pressure on water resources is high, owing to high floating population throughout the year. The water quality has been monitored at five main tanks, shallow tube wells and deep tube wells within Puri town. There are about 23 parameters of water which have been monitored for the above mentioned sources of water.

The water quality has been monitored at five sacred tanks namely -

- Narendra Tank
- Indradyumna tank
- Markanda Tank
- Swethaganga Tank
- Parvati Sagar Tank

The water quality of the shallow tube wells have been monitored at following five stations, namely -

- Mausima Mandir
- Bada Akhada Matha
- Seba medical hall
- Hotel Jhadeswari
- Near Pantha Nivas
- Outside the MSW treatment plant, Baliapanda

The water qualities of deep water tube wells in Puri town were monitored at following four monitoring stations, and 26 parameters of water were monitored.

- Near Sulabh International
- Infront of Singhadwara
- In front of Senapati & Senapati shop
- Om Gayatri Lubricant shop

Major issues identified from the information's gathered are as follows:

- PH level for water in the tanks is found to be higher than normal at majority of the monitoring stations. The rate increases during the festive season and is the major reason to worry.
- Turbidity of the water is also found to be higher than permissible. This is largely due to inappropriate use of tanks like for bathing, washing of cloths etc. and the rate rapidly increases during festive season due to extensive use by floating population.
- Sodium content is again found to be higher than the standards for safe water in all the tanks.
- The shallow water tubewells shows more iron content than permissible standards in most of the monitoring stations.
- Other categories do not seem to be much of concern in the studied places.

This clearly depicts the fact that the water quality in the town areas and probably in the region is below safer limit. Also as discussed earlier in the water supply infrastructure section, ground water quality is far below safe limits and most importantly water fields (main recharge zones) are also polluted. Hence immediate action must be taken for conserving surface water resources and de-infect the ground water in the town.



Table 10.3: Water quality of tanks of Puri town during Rathayatra (2002)

Sl.No.	Parameter	Narendra			Indradyumna			Markandeya			Swethaganga			Parvati Sagar		
		Pre	During	Post	Pre	During	Post	Pre	During	Post	Pre	During	Post	Pre	During	Post
1	pH	8.2	8.1	7.86	8.32	8.28	8.32	8.06	8.42	8.12	8.35	8.22	7.94	7.5	7.97	7.76
2	Turbidity, NTU	18	11.6	9	14	25.2	13	12	15.9	12.8	12	17.8	16.2	22	24.9	21.6
3	TSS, mg/l	18	20	20	13	21	18	22	26	29	17	17	16	18	19	18
4	DO, mg/l	9.4	8.9	9.5	7.1	6.5	6.7	9.6	8.05	8.7	8	7.8	7.8	9.1	8.8	8.4
5	BOD, mg/l	9	9.8	9	7	7.6	7.2	7	7.7	7	6.5	7.5	7	8	8.2	8
6	COD, mg/l	51.1	68.1	58.1	32.4	38.3	33.4	43.9	46.8	45	13.6	24.3	22.9	50.7	52.6	51.4
7	ml	1700	1900	1400	1700	1700	1100	1400	1700	1700	2700	8000	1700	13000	17000	9000
8	ml	700	800	700	1300	1300	800	700	200	200	1700	5000	800	8000	11000	5000
9	Cl-, mg/l	148	152	94	157	166	154	71	89	74	89	96	90	92	97	94
10	SO42-, mg/l	36.8	42.8	36.6	59.4	60.6	69.5	38.3	45.4	36.8	22.6	25.3	25.8	24.1	24.4	28.3
11	PO43-,mg/l	0.13	0.183	0.16	0.12	0.22	0.16	0.15	0.48	0.31	0.06	0.098	0.07	0.125	0.121	0.1
12	NO3-,mg/l	65.5	85.1	83.2	46.1	65.5	38.9	79.7	111.6	100.3	61.9	91.7	71.6	55.8	80.6	74.8
13	Total hardness,mg/l	246	280	240	245	250	240	140	170	156	70	78	68	300	304	296
14	Ca, mg/l	54.4	59.2	51.2	35.2	43.2	40	52.8	54	51.2	12.8	12.8	11.2	99.2	100.8	97.6
15	Mg, mg/l	26.8	32.2	27.3	27.5	28.1	27.3	12.6	15.1	13.6	9.26	11.2	9.75	12.6	15.1	12.6
16	F-, mg/l	0.19	0.23	0.18	0.13	0.16	0.18	0.12	0.14	0.12	0.19	0.23	0.23	0.18	0.21	0.19
17	CN-, mg/l	0.02	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
18	Phenolic comp.	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
19	Fe, mg/l	0.1	0.183	0.117	0.161	0.161	0.151	0.088	0.096	0.039	0.115	0.115	0.119	0.094	0.056	0.151
20	Mn, mg/l	ND	ND	ND	0.05	0.05	0.05	0.075	0.1	0.075	ND	ND	ND	ND	ND	ND
21	Cu, mg/l	0.003	0.003	0.003	0.002	0.002	0.002	0.002	0.003	0.003	0.004	0.004	0.004	0.002	0.002	0.002
22	Co, mg/l	0.015	0.015	0.015	0.012	0.016	0.012	0.008	0.009	0.009	0.012	0.016	0.012	0.007	0.009	0.007
23	Zn, mg/l	0.008	0.009	0.009	0.01	0.015	0.016	0.012	0.015	0.015	0.01	0.01	0.01	0.012	0.014	0.012
24	Pb, mg/l	0.016	0.018	0.018	0.023	0.026	0.026	0.025	0.032	0.028	0.005	0.009	0.009	0.008	0.012	0.012
25	Cd, mg/l	0.003	0.005	0.005	0.004	0.006	0.005	0.003	0.005	0.004	0.003	0.003	0.004	0.003	0.005	0.005
26	Ni, mg/l	0.002	0.002	0.003	0.032	0.037	0.032	0.025	0.023	0.024	0.006	0.008	0.008	0.008	0.009	0.009

Source: Odisha State Pollution Control Board (OSPCB)



Table 10.4: Water quality of shallow tube wells in Puri town during Rathyatra, 2002

Sr.No.	Parameter	Near Sulabh International			In front of Singhadwara			In front of Senapati & Senapati shop			Om Gayati Lubricant Shop		
		Pre	During	Post	Pre	During	Post	Pre	During	Post	Pre	During	Post
1	pH	7.92	7.56	8.22	8.16	8.26	8.34	8.15	8.36	8.31	8.46	8.43	8.34
2	Turbidity, NTU	1.2	1.1	1	0.9	0.9	0.4	1.7	0.9	0.9	1	0.9	1.1
3	TSS, mg/l	1	3	2	1	3	2	2	2	2	2	2	2
4	BOD, mg/l	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.5	0.2	0.2	0.2	0.2
5	COD, mg/l	7	8.56	7.04	3.9	3.9	4	6.51	8.8	8	8	9.5	9.3
6	TC, MPN/100ml	< 2	23	23	<2	<2	<2	<2	<2	<2	<2	<2	<2
7	FC, MPN/100ml	< 2	8	8	<2	<2	<2	<2	<2	<2	<2	<2	<2
8	Cl-, mg/l	43.6	52.8	48	124	124	126	154	158	154	174	182	182
9	SO42-, mg/l	16.9	17.5	19	34.6	35.5	33.4	56	64.8	56.2	22.4	24.4	25
10	PO43-, mg/l	0.02	0.07	0.05	0.12	0.36	0.4	0.014	0.015	0.041	0.04	0.04	0.072
11	NO3-, mg/l	51.3	53.3	53.5	34.5	354	35.4	28.3	29.1	27.2	46.1	46.5	46.4
12	Total Hardness, mg/l	232	236	252	172	176	180	208	230	216	230	278	240
13	Ca, mg/l	17.6	17.6	19.2	36	32	33.6	36	40	39.2	80	96	88
14	Mg, mg/l	48.2	46.8	49.4	19.9	23.4	23.4	28.7	31.7	28.7	7.31	9.26	4.87
15	F-, mg/l	0.716	0.181	0.179	0.136	0.139	0.142	0.155	0.155	0.16	0.154	0.156	0.165
16	CN-, mg/l	0.0036	0.0038	0.0035	0.0015	0.0019	0.002	0.0046	0.0047	0.0046	0.0066	0.0061	0.0072
17	Phenolic Compounds	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
18	Fe, mg/l	0.28	0.18	0.2	0.129	0.129	0.129	0.612	0.598	0.599	0.589	0.552	0.524
19	Mn, mg/l	0.025	0.025	0.025	ND	ND	ND	0.2	0.2	0.2	0.675	0.675	0.6
20	Cu, mg/l	0.001	0.002	0.002	0.007	0.007	0.009	0.003	0.003	0.003	ND	ND	0.002
21	Co, mg/l	0.009	0.061	0.085	0.14	0.16	0.151	0.16	0.6	0.58	0.025	0.026	0.026
22	Zn, mg/l	0.07	0.061	0.085	0.14	0.16	0.151	0.16	0.6	0.58	0.025	0.026	0.026
23	Pb, mg/l	0.002	0.003	0.004	0.003	0.004	0.004	0.008	0.009	0.003	0.01	0.009	0.009
24	Cd, mg/l	0.003	0.003	0.004	0.006	0.007	0.005	0.005	0.006	0.002	0.004	0.005	0.005
25	Ni, mg/l	0.025	0.029	0.025	0.031	0.035	0.031	0.012	0.013	0.01	0.024	0.023	0.026

Source: Odisha State Pollution Control Board (OSPCB)



10.2 Vulnerability to Disasters

10.2.1 Introduction

Natural Hazard: A natural hazard is an unexpected or uncontrollable natural event of unusual magnitude that threatens the activities of people or people themselves.

Natural Disaster: A natural disaster is a natural hazard that actually results in widespread destruction of property or caused in and/or death.

Odisha is broadly divided into four geographical regions, i.e. Northern Plateau, Central River Basins, Eastern Hills and Coastal Plains. It has a 480 km coastline. The average density of population comes to 236 per sq km. with significantly higher density in the coastal areas compared to the interior parts. The PKDA area falls under the Coastal Plains and has 58.29km long coastal line.

10.2.2 Case of PKDA area

Urban local bodies offer most urban environmental services but lack the capacity, as well as the resources, to effectively provide the minimum basic services in the cities. Therefore, in Puri, environmental risks as well as disaster related vulnerabilities grow hand-in-hand with chaotic physical development. This further underscores the need to develop Puri as a city with appropriate risk reduction strategies engraved into it.

A growing body of literature over the past decade has examined India's vulnerability to natural hazards, including climate-change, and confirms that Odisha is among the most vulnerable states of the country (TERI 2001). The vulnerability Atlas prepared by an Indian government agency considered the multiple hazards faced by different regions and gave an account of various natural hazards the area is prone to. The following figure shows the level of hazard exposure of various districts of Odisha including Puri according to which PKDA area is one among the most vulnerable areas of the state.

Map 10.3: Multi hazard map of Odisha State



Source: OSDMA

Odisha, due to its geographical location, is prone to various types of natural hazards such as cyclones, floods, earthquakes (Risk zone II & III), and tsunamis. Being situated on the Bay of Bengal makes Odisha one of the most vulnerable regions to violent tropical cyclones in the world (Thomalla and Schmuck 2004).

Its densely populated coastal plains are the alluvial deposits of its river systems. The rivers in these areas with heavy load of silt have very little carrying capacity, resulting in frequent floods, only to be compounded by breached embankments. Besides these natural hazards, human-induced disasters such as accidents, stampede, fire, etc, vector borne disasters such as epidemics, animal diseases and pest attacks and industrial / chemical disasters add to human suffering.

“The socio-economic vulnerability of the people turns these natural hazards into disasters. With nearly 90% of the population living in disaster-prone areas and about 66% below poverty line, the coping mechanism of the state and its people are continuously under severe strain. Several initiatives have been taken to prepare the community to meet the challenges posed by natural disasters, but there is hardly any time left to complete the process” (RDMD 2006).

An analysis for vulnerability to climate-change using data on the frequency of occurrence of extreme events in the Eastern coastal districts of India suggests that districts in the state of Odisha are highly vulnerable compared to other states (Patnaik and Narayanan, 2005). Furthermore, the latter study compares the district-wise distribution of the frequency of depression, storm and severe storm from 1877 to 1990 in the 14 most vulnerable districts of two coastal states; the study finally ranked the district of Puri at the top of the list of most vulnerable districts, with maximum numbers (total 84) of cyclones (of different types) experienced over the 100-year period.

In October 1999, Odisha experienced a severe cyclonic storm (commonly known as a super-cyclone), with wind speed of 350 km/hr, enough to devastate most of the coastal area including Puri. The District Disaster Management Plan-2005 prepared by the office of the District collector (DC 2005) identified the disasters listed in the following table in Puri district.

Table 10.5: Different type of disasters in context to Odisha

Common Natural Disasters	Man-made Disasters
Flood	Fire accident (House fire or Industrial fire)
Cyclone	Communal riot
Heavy rain (sometimes leading to landslide)	Road/rail accident
Drought (also scarcity of drinking water in towns)	Rasta Roko (road block/protests, sometimes destroys roads and vehicles)
Heat waves/ sun stroke (urban heat island effect)	Building collapse (due to heavy rain)
Cloud burst (casualties due to lightning)	Stampede (real or due to false rumours during mass congregations)
Earthquake (zone III, moderate damage risk zone)	Vector-borne diseases (epidemics – especially during festivals, animal disease) and pet attacks.

Source: CEPT analysis

Interestingly, tsunami was not recognized as a possible disaster in India despite its 7,500 km long coastline. However, the Indian Ocean Tsunami in 2004 dispelled this myth. Now, the Odisha State Disaster Management Authority (OSDMA 2007a) has recognized 165 places in Odisha those are vulnerable to tsunami. Six coastal blocks in Puri district, including Puri city, are also vulnerable to tsunami (OSDMA 2007b).

10.2.3 Flood

A flood is an overflow of an expanse of water that submerges land, a deluge. It is usually due to the volume of water within a body of water, such as a river or lake, exceeding the total capacity of the body, and as a result some of the water flows or sits outside of the normal perimeter of the body.

The 482 km long of coastline of Odisha exposes the State to flood, cyclones and storm surges. Heavy rainfall during monsoon causes floods in the rivers. Flow of water from neighbouring States of Jharkhand and Chattisgarh also contributes to flooding. The flat coastal belts with poor drainage, high degree of siltation from the rivers, high soil erosion, breaching of the embankments, are the main causes of floods in the river basin and delta areas. In Odisha, rivers such as the Mahanadi, Subarnarekha, Brahmani, Baitarani, Rushikulya, Vansadhara and their many tributaries and branches flowing through the State expose vast areas to floods.

Map 10.4: Flood Zones of Odisha State



Source: OSDMA

In Odisha, damages are caused due to floods mainly in the Mahanadi, the Brahmani, and the Baitarani. These rivers have a common delta where flood waters intermingle, and when in spate simultaneously, wreak considerable havoc. This problem becomes even more acute when floods coincide with high tide. The water level rises due to deposits of silt on the river-bed. Rivers often overflow their banks or water rushes through new channels causing heavy damages.

The map above prepared by OSDMA shows that the major flood prone area in the state is the coastal parts of Puri and Jagatsinghpur district. Major proportion of PKDA area comes under the same flood prone zones. This is primarily due to high level of sea water intrusion during rainy season along with river overflow resulting in widespread waterlogging in the area.

PKDA area has been affected by the floods of 1999, 2001, 2003, 2006, 2008 and 2009. The detailed effects of each event have been summarised in the below tables:

Table 10.6: Brief of 2006 Flood in PKDA

No. of District Affected	27
No. of Blocks Affected	245
No. of GP Affected	3574
No. of villages Affected	18912
No. of ULB Affected	73
Crop Area affected (in lakh hectare)	4.65
Population affected (in lakh)	67.39
Human live lost	105
Livestock lost	1656
No. of houses damaged	130460

Source: Puri district collectorate

Table 10.7: Brief of 2001 Flood in PKDA

No. of Districts affected	19
Blocks affected	145
GPs affected	1880
Villages affected	8026
ULBs affected	29
Population affected (In lakh)	45.23
Human lives lost	96
Houses damaged	212965

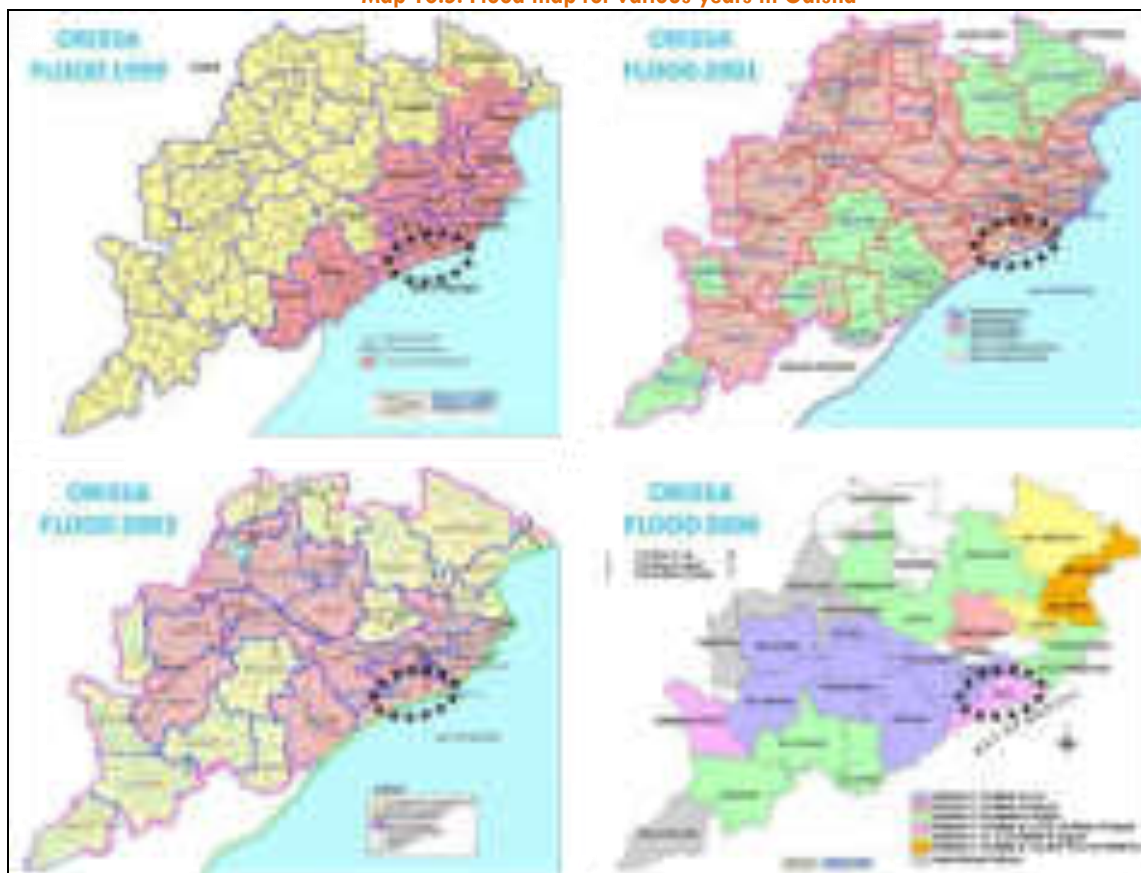
Source: Puri district collectorate

Table 10.8: Brief of 2009 Flood in PKDA

No. and name of the districts affected	15 Districts (Balasore, Bhadrak, Cuttack, Ganjam, Jaipur, Kalahandi, Kandhamal, Kendrapada, Keonjhar, Khurda, Koraput, Nayagarh, Puri, Subarnapur & Sundergarh)
No. of villages affected	1451
Population affected	3.94 lakh
No. of human lives lost	56
Crop Area affected	1.29 lakh hectare
No. of houses damaged	12547 (Fully – 870, partially – 11677)
No. of persons evacuated	62200
No. of boats deployed for evacuation	90
No. of relief camps opened	80

Source: Puri district collectorate

Map 10.5: Flood map for various years in Odisha



Source: OSDMA

The flood in September 2008 was due to heavy rainfall in the upper as well as in lower catchments of the Mahanadi River System resulting out of the effect of a deep depression in the Bay of Bengal from 16th to 21st September 2008. The magnitude and severity of the flood in this system has even surpassed the ferocities of 1982 and 2001 floods which were known to be greatest floods in the system. During September, 19 districts namely, Angul, Bargarh, Bhadrak, Bolangir, Boudh, Cuttack, Gajapati, Jagatsinghpur, Jajpur, Kalahandi, Kendrapara, Keonjhar, Khurda, Nayagarh, Puri, Rayagada, Sambalpur, Nuapara and Subarnapur had been seriously affected. The severity of September flood was considered to be at par with the floods 1982.

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From the above analysis the following issues can be identified:

- Majority of floods in Odisha over different years have been occurring over the study region which is highlighted in the maps.

- The floods in each year have resulted in widespread impacts on human lives and house and infrastructure in the region
- Relief facilities provided during different events was clearly inadequate.

10.2.4 Cyclone

A cyclone is an area of low atmospheric pressure characterized by inward spiralling winds. An atmospheric system characterized by the rapid inward circulation of air masses about a low-pressure centre, usually accompanied by stormy, often destructive weather. Cyclones circulate counter clockwise in the Northern Hemisphere and clockwise in the Southern Hemisphere.

Map 10.6: Wind & Cyclone zones of Odisha



Source: OSDMA

Map 10.7: Combined surge & wave set up



Source: OSDMA

PKDA occupies a position in Very High Damage Risk Zone-B (50m/s) on Wind and Cyclonic Hazard Map. About 100% of the area is vulnerable to cyclone with a wind velocity of 50-55m/s. 8-11 October, 1967 a very Severe Cyclonic Storm Crossed Odisha Coast between Puri and Paradeep resulted in very high damage.

The following table shows the IMD classification by sustained wind speed

Table 10.9: IMD classification by sustained wind speed

Storm category	Abb.	Wind speed (knots)	Wind speed (kmph)
Super cyclone	SC	>120	>221
Very severe cyclonic storm	VSCS	64 – 119	119 – 221
Severe cyclonic storm	SCS	48 – 63	88 – 118
Cyclonic storm	CS	34 – 47	63 – 87
Cyclonic depression	CDP	33 or less	62 or less
Cyclonic disturbance during monsoon	CD	Not specified	Not Specified

Source: IMD, Govt. of India

Table 10.10: Damage caused by the Super Cyclone Oct 29-31, 1999:

Affected area	46 municipalities and 17,993 villages in 14 districts	
Affected population	19 million	
Killed	8,479	
Homeless	8.26 million	
Houses damaged	2.06 million	
Crop damaged	2.1 million Ha (mainly Paddy/Rice) worth INR 18 billion (USD 391 million)	
Livestock killed	2.479 million heads	
Total Damage	INR 62.2759 billion	USD 1.3538 billion

Source: Puri District Collectorate



10.2.4.1 Return period calculations:

The Indian state of Odisha on the Bay of Bengal coast has been hit by many tropical cyclones in the past 200yrs. It was also calculated that the 1999 super cyclone had a return period of approximately 50yrs. Cyclones in 1831, 1885, 1895 were also possible super cyclones.

The following figures show the return period/the cyclone tracks impacting the coast of Odisha from the year 1971 to 2000. The 2nd figure shows the six synthesized cyclone tracks along the coastal districts of Odisha so as to provide more complete geographical coverage of the coastal area. Figures showing the cyclone tracks along the coast of Odisha

Fig 10.3: Mapping of cyclone tracks of different events

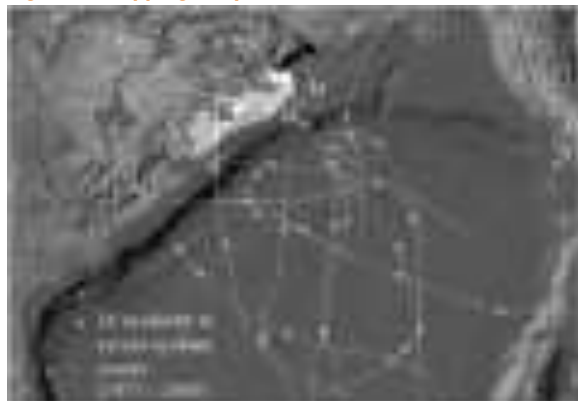


Fig 10.4: Return period calculation



10.2.5 Earthquakes

An earthquake is the result from the sudden release of stored energy in the Earth's crust that creates seismic waves. PKDA area lies in moderate damage risk zone (MSK VII) on the Earthquake Hazard Map. Out of 9 class-I towns, 5 namely Bhubaneswar, Cuttack, Puri, Sambalpur & Balasore are located in zone-III. In this region there is a possibility of an earthquake of 3.0-3.9 on Richter scale. As the technology stands today though earthquake prone areas are identified yet earthquakes still remain unpredictable.

Possible Damage

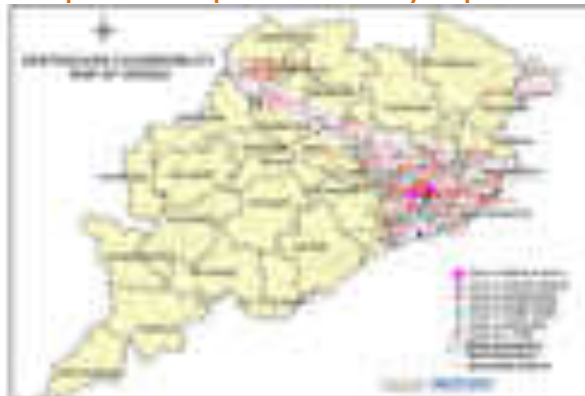
Felt only by a few persons at rest, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motorcars may rock slightly. Vibrations are similar to that of a passing truck. Figures below are showing the earthquake vulnerability zones of Odisha.

Map 10.8: Earthquake Zones of Odisha



Source: OSDMA

Map 10.9: Earthquake vulnerability map



Source: OSDMA

10.2.6 Tsunami

A tsunami is a series of waves most commonly caused by violent movement of the sea floor. The movement at the sea floor leading to tsunami can be produced by earthquakes, landslides and volcanic eruptions.

The State of Odisha falls in the peninsular shield region of India. Studies show that the margins of the shield are generally seismogenic where earthquakes are likely to occur. The earthquakes experienced occasionally along the eastern margins of the Deccan shield are attributed to uplifting of earth's crust in those areas. This uplifting is however, considered to be slower than its counterpart in the Western margin.

Fig 10.5: Conceptual diagram of Tsunami formation



Source: OSDMA

Recent studies have also given an indication that the Mahanadi river valley is faulted and could be a potential earthquake source. Besides this, the Sumatra fault zone and tectonic plate setting along the Andaman & Nicobar Islands and Burma Micro plate boundaries remaining in the eastern part of the Bay of Bengal pose potential threats of tsunami for the coast of Odisha. As per the assessment made, 266 villages of different districts are vulnerable to Tsunami. 88 nos. of revenue village of six blocks of Puri, including Puri municipality and Konark NAC area are vulnerable to Tsunami.

The table shows the areas vulnerable to tsunami where it is apparent that Puri and Konark both the urban centres of the study region are vulnerable to tsunami. Infact 88 villages of Puri district most of which is under study are tsunami prone.

Table 10.11: Tsunami prone districts in Odisha

District	Coastal Blocks	GP	No. Of Villages	ULBs
Balasore	5	29	63	
Bhadrak	2	13	41	Chandbali
Kendrapada	2	13	64	--
Jagatsinghpur	3	10	28	Paradeep
Puri	6	35	88	Puri, Konark
Ganjam	4	15	44	Gopalpur
Total	22	115	328	

Source: Puri district collectorate

10.2.7 Heat wave

Heat wave can be defined as a condition of atmospheric temperature that leads to physiological stress, which sometimes can claim human life. Quantitatively heat wave can be defined as: Any increase from the above normal temperature is called heat wave.

- + 5° or 6° C – Moderate heat wave
- 7° C or more – Severe heat wave

If the maximum temperature of any place continues to be 45° C. consecutively for two days, it is called a heat wave condition. During the summer months (April to June), the natural calamity control rooms at the State and also at the district levels need to be vigilant and watchful about heat wave warning from analyzing the daily reports of IMD.

Table showing maximum temperature during 2000 – 2006:

Table 10.12: Temperature variation in Puri: 2000-'06

Puri	2000	2001	2002	2003	2004	2005	2006
Temperature	35.3	37.4	35.6	35.4	36.5	36.5	35.7
Date	(14.05.00)	(27.05.01)	(20.06.02)	(12.05.03)	(11.06.05)	(18.06.05)	(07.10.06)

Source: IMD, Govt. of India

Immediately upon receipt of such a warning, the state and district control rooms should make necessary arrangement for flashing the warning through all forms of media. Simultaneously, departments like Health, PHED & other related departments need to remain alert and put necessary emergency measures in place.

Drinking water supply arrangements, rescheduling of timing in educational institutions, working hours, especially of those doing physical labour, veterinary measures, bus timings, etc. are to be modified, once heat wave warnings are issued.

10.2.8 Fire Hazard in context of PKDA

A fire hazard is any situation in which there is a greater than normal risk of harm to people or property due to fire. Fire hazards can take the form of ways that fires can easily start, such as a blocked cooling vent, or overloaded electrical system, ways fires can spread rapidly, such as an insufficiently protected fuel store or areas with high oxygen concentrations, or things which, in a fire, pose a hazard to people.

Puri municipality is the most compact, densely populated and multiple activity areas in the study region and hence highly susceptible to this type of hazard. Being an old settlement it has very narrow lanes and roads through clusters of house which makes it more vulnerable to fire hazard.

Possible Damage:

The fire hazard probability in the old city /gramtal is high as most of the houses are constructed with good amount of wood/timber. Majority of the streets have commercial use on the ground floor and residential use on the upper floors. There are many grain market, cloth markets and timber go downs which are highly vulnerable to fire. In case of a fire it is difficult to get fire brigade into these narrow streets. There is no other facility or source of water nearby for extinguishing fire within core area.



10.3 Existing Disaster mitigation instruments

Emergency shelters are places for people to live temporarily when they can't live in their previous residence. Emergency shelter typically specializes in people fleeing a specific type of situation, such as natural or man-made disasters, domestic violence, etc. Emergency shelters facilitate support groups, and/or provide meals.

The PKDA region often experiences natural disasters in terms of floods, cyclone, etc, and it falls in the highly vulnerable zone for disasters such as earthquake, tsunami. It was felt that number of deaths were more in the affected areas during the Super Cyclone due to non-availability of safe shelter buildings in the coastal villages, which could have withstood the intensity of the cyclone and the storm surge.

The following figure shows the location of the emergency shelters in the PKDA Region. Following are the location of the emergency shelters, which are also located in the Map below

- Pentakota within Puri Municipality, village – Balukhanda
- Beldal in Block A
- Badagan within Block A
- Madhipur in Konark
- Singharpal in block B
- Katakana within Block B

These emergency shelters can withstand wind speed up to 300kmph and mild earthquakes. Its plinth is above High Flood line (HFL) and standing on a stilted floor, it can remain unaffected in storm surge up to the 1st floor level.

The table below shows the blocks where the emergency shelters are located and the capacity of these emergency shelters.

Table 10.13: Location of Emergency shelters in Puri district

Sl. No.	District Name	Block Name	GP Name	Location/Village	Capacity
1	Puri	Puri Sadar	Baliput	Siara	2000
2	Puri	Puri Sadar	Baliguli	Beladala	3000
3	Puri	Puri Municipality	Puri Municipality	Pentakota	3000
4	Puri	Kakatpur	Abadan	Singarpal	3000

Source: Puri district collectorate

Map 10.10: Location of Emergency shelters in PKDA region



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