REVISED DRAFT REPORT ON COASTAL ZONE MANAGEMENT PLAN OF UNION TERRITORY OF PUDUCHERRY AS PER CRZ NOTIFICATION, 2019

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LIST OF ABBREVIATIONS

CRZ	Coastal Regulation Zone
CVCA	Critically Vulnerable Coastal Area
CZMP	Coastal Zone Management Plan
ESA	Ecologically Sensitive Areas
GIS	Geographic Information System
HTL	High Tide Line
NDZ	No Development Zone
IMP	Integrated Management Plan
PCZMA	Puducherry Coastal Zone Management Authority
LTL	Low Tide Line
MOEF&CC	Ministry of Environment, Forest and Climate Change
NCSCM	National Centre for Sustainable Coastal Management
NCZMA	National Coastal Zone Management Authority
SoI	Survey of India
OSM	Open Series Map published by Survey of India
ESZ	Eco sensitive Zone

EXECUTIVE SUMMARY

The Ministry of Environment, Forest and Climate Change (MoEF&CC), Govt. of India, New Delhi issued Notification No. G.S.R. 37(E) dated 18th January 2019 which is referred to as the Coastal Regulation Zone (CRZ) Notification, 2019 in supersession of CRZ Notification, 2011 with a view to conserve and protect the unique environment of coastal stretches and marine areas, besides livelihood security to the fisher communities and other local communities in the coastal areas and to promote sustainable development based on scientific principles taking into account the dangers of natural hazards, sea level rise due to global warming. The CRZ notification, 2019 declared that the coastal stretches of the country and the water area up to its territorial water limit, excluding the islands of Andaman and Nicobar and Lakshadweep and the marine areas surrounding these islands, as Coastal Regulation Zone (hereinafter referred to as the CRZ).

All coastal States and Union territory administrations were directed to revise or update their respective coastal zone management plan (CZMP) framed under CRZ Notification, 2011 number S.O. 19(E), dated 6th January, 2011. All the project activities attracting the provisions of CRZ notification, 2019 shall be required to be appraised as per the updated CZMP under this notification and until and unless the CZMPs is so revised or updated, provisions of this notification shall not apply and the CZMP as per provisions of CRZ Notification, 2011 shall continue to be followed for appraisal and CRZ clearance to such projects.

As per the provisions of the CRZ Notification, 2019, Department of Science, Technology and Environment, Government of Puducherry have entrusted the responsibility of preparation of the Coastal Zone management Plans in 1:25,000 scale to National Centre for Sustainable Coastal Management (NCSCM), Chennai, who is an authorized agency approved by the Govt. of India, for the said purpose, vide Ministry of Environment & Forests (MOEF&CC) Govt. of India order No. J-17011/8/92-IA-III dated 14th March 2014. The NCSCM, Chennai have completed the job of the preparation of draft CZMP of Puducherry on 1:25000 scale as per the annexure-IV of CRZ Notification, 2019 and guidelines issued by MOEF&CC. The draft Coastal Zone Management Plan (CZMP) of Puducherry indicating HTL, LTL, various regulation lines such as 50m, 200, and 500m, CRZ classification such as CRZ I, CRZ II, CRZ III, CRZ IV and Hazard line etc.
This draft report presents the Coastal Zone Management Plan (CZMP) of Puducherry on 1:25000 scale. A description of the High Tide Line (HTL), Low Tide Line (LTL), demarcation, ecologically sensitive areas, Hazard line, and CRZ categories, etc are given in this report. There are 10 CZMP maps of on 1:25,000 scale in U.T. of Puducherry.

1. INTRODUCTION

The Coastal Regulation Zone (CRZ) Notification was first issued by the Government of India on 19.2.1991 under sub-section (1) of section and clause (V) of subsection (2) of section 3 of the Environment (Protection) Act, 1986 with the aim to provide comprehensive measures for the protection and conservation of India's coastal environment. The notification was reissued in 2011 (published in the Gazette of India, Extraordinary, Part-II, Section 3, Sub-section (ii) dated the 6th January, 2011). The MOEF&CC once again issued CRZ notification, 2019 vide G.S.R. 37(E) dated 18th January, 2019 in supersession of the Coastal Regulation Zone Notification, 2011 vide S.O. 19(E), dated the 6th January, 2011.

By the CRZ notification, 2019, a specified width of the coast is sought to be protected by restricting the setting up and expansion of any industry, operation or process and manufacture or handling or storage or disposal of hazardous substances. The objective of the CRZ Notification, 2019 is to conserve and protect the unique environment of coastal stretches and marine areas, besides livelihood security to the fisher communities and other local communities in the coastal areas and to promote sustainable development based on scientific principles taking into account the dangers of natural hazards, sea level rise due to global warming. The coastal zone, consisting of ecologically sensitive areas and other geomorphological features play a vital role in maintaining the integrity of the coast. These ecological sensitive areas that are extremely vulnerable have to be managed judiciously by maintaining a balance between ecology and development.

The CRZ Notification regulates human activities on the coast with a view to maintaining coastal sustainability. As per the CRZ notification, 2019, CRZ is the land area from High Tide Line (HTL) up to 500 m on the landward side along the sea front and 50 m or width of the creek for the tidal influenced water bodies; the inter-tidal zone and water and the bed area between the LTL to the territorial water limit (12 Nm) in case of sea and the water and the bed area between LTL at the bank to the LTL on the opposite side of the bank, of tidal influenced water bodies.

1.1. CZMP Planning Process

Para 6(i) of the CRZ Notification of 2019 inter-alia provides that the Coastal States/Union Territory shall revise or update their respective coastal zone management plan (CZMP) framed under CRZ Notification, 2011 number S.O. 19(E), dated 6th January, 2011, as per provisions of this notification and submit to the Ministry of Environment, Forest and Climate Change for approval at the earliest.

The coastal States and Union territories shall prepare draft CZMP in 1:25,000 scale map identifying and classifying the CRZ areas within the respective territories in accordance with the guidelines given in Annexure-IV to this notification, which involve public consultation. All developmental activities listed in this notification shall be regulated by the State Government, Union territory administration, the local authority or the concerned Coastal Zone Management

Authority within the framework of such approved CZMP, as the case may be, in accordance with provisions of this notification.

The CZMP may be prepared or updated by the coastal State Government or Union territory by engaging reputed and experienced scientific institution(s) or the agencies including the National Centre for Sustainable Coastal Management (hereinafter referred to as the NCSCM) of Ministry of Environment, Forest and Climate Change and in consultation with the concerned stakeholders.

Para 6(ii) of the said Notification of 2011 further provides that The CZMP may be prepared or updated by the coastal State Government or Union territory by engaging reputed and experienced scientific institution(s) or the agencies including the National Centre for Sustainable Coastal Management (hereinafter referred to as the NCSCM) of Ministry of Environment, Forest and Climate Change and in consultation with the concerned stakeholders.

As per the CRZ Notification, 2019, the draft CZMP shall be submitted by the State Government or Union territory to the concerned Coastal Zone Management Authority for appraisal, including appropriate consultations, and recommendations in accordance with the procedure(s) laid down in the Environment (Protection) Act, 1986 (29 of 1986).

As per para 3(a) the Guidelines issued by MOEF&CC dated 26th June 2019 for updation of Coastal Zone Management Plan (CZMP) prepared as per CRZ notification, 2011 to align it with CRZ notification, 2019, stated that "the CZMP database (shapefiles etc.) prepared as per the CRZ Notification, 2011 which have been scrutinized by the Technical Scrutiny Committee, finalized by the National Centre for Sustainable Coastal Management (NCSCM) and approved by the MoEFCC, shall be used as the base for revision or updation of the CZMP, as per the provisions contained in the CRZ Notification, 2019".

1.2. Development of a coastal database and information system

Coastal Information System refers to Geographic Information System (GIS) applied to the coastal zones for acquiring, storing, organizing, analysing, modelling and managing geospatial data. The approved database as per CRZ notification, 2011 will be utilized for updating the existing CZMPs and it comprises information on the following areas:

a) coastal protection
b) fisheries
c) aquaculture
d) tourism
e) mining
f) ports and harbours
g) coastal resource management
h) infrastructure development and planning, etc

i) coastal land use/land cover including ESAs
j) coastal population

The above databade were enriched based on the requirement as per CRZ notification, 2019 such as population density, Natiolal Highways (NH), State Highway (SH) etc. For the updation/preparation of the CZMPs, the above essential details were inducted in the information system.

1.3. Generation of CZMP maps

High Tide Line (HTL), Low Tide Line (LTL), Ecologically Sensitive Areas (ESAs), and Critically Vulnerable Coastal Areas (CVCAs) demarcated by the National Centre for Sustainable Coastal Management (NCSCM), Chennai, and the 'Hazard line' as demarcated by the Survey of India (SoI), were used in preparation/updation the CZMPs, as required under the provisions of the CRZ Notification, 2019.

Various regulatory lines viz. at a distance of 50 metres, 200 metres and 500 metres from HTL respectively, as applicable in various CRZ categories, and the Hazard line were superimposed in the CZMPs. The CRZ classification such as CRZ I (ESAs, archaeological and heritage sites), CRZ II (Developed area/ municipal areas), CRZ III (undeveloped /rural areas) and CRZ IV (water body) have been incorporated. The CRZ III area has been classified into three categories such as No Development Zone (NDZ), CRZ IIIA and CRZ IIIB. The CRZ IIIA areas are densely populated areas where the population density is more than 2161 per square kilometre as per 2011 census base. In CRZ IIIA, area up to 50 meters from the HTL on the landward side marked as NDZ in case of sea front.
All other CRZ-III areas with population density of less than 2161 per square kilometre, as per 2011 census base, are designated as CRZ-III B and in CRZ-III B, the area up to 200 meters from the HTL on the landward side earmarked NDZ in case of sea front. Land area up to 50 meters from the HTL, or width of the creek whichever is less, along the tidal influenced water bodies in the CRZ III, earmarked as the NDZ.

In case of mangrove areas of greater than 1000 sq.m, a buffer line of 50m has been provided. However, Mangroves in private land will not require a buffer zone. Other buffer lines were drawn wherever necessary, as specified in the CRZ Notification, 2019. With the above information, the draft maps in 1: 25,000 scales were generated as per CRZ Notification, 2019 and has been submitted to the Department of Science, Technology and Environment, Government of Puducherry.

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2. UNION TERRITORY OF PUDUCHERRY

The Union Territory of Puducherry comprises the former French establishments of Puducherry, Karaikal, Mahe and Yanam, which lie scattered in South India. Puducherry, the capital of the Territory was once the original headquarters of the French in India, is situated on the Coromandel Coast of the Bay of Bengal and is about 135 kms. from Chennai Airport. It is bounded on the east by the Bay of Bengal and on the three sides by Tamil Nadu. About 130 kms. south of Puducherry on the East Coast lies Karaikal. Mahe is situated on the Malabar coast on the Western Ghats surrounded by Kerala and is about 70 kms. from Calicut Airport. Yanam is situated adjoining the East Godavari district of Andhra Pradesh and is about 200 kms. from Visakhapatnam Airport. The Union Territory of Puducherry consists of two districts viz., Puducherry District comprising of Puducherry, Mahe and Yanam regions and Karaikal district comprising of Karaikal region (Figure 1). Coast related details of Puducherry is given in Table 1.

Table 1: Overview of Coastal U.T. of Puducherry

1.	**Total Area of State**	**479 sq. km.**
2.	No. of Coastal Districts	TWO i. Puducherry ii. Karaikal
3.	No. of CRZ Covering Taluks	
4.	No. of Municipality/Urban Area	5
5.	No. of villages under CRZ area	49
6.	Length of High Tide Line	280.66

Puducherry region covers a total area of 294 sq. km. bordering the eastern Indian coastline. The region shares its boundary with Tamil nadu on the North, West and South and is bordered by the Bay of Bengal on the East (Figure 1). The Puducherry District comprises Puducherry, Mahe and Yanam regions. Puducherry region, lies on the east-coast, and consists of 12 scattered areas lying in between **11° 42'** and **12° 30' N**, and between **76° 36'** and **79° 53' E**. Semi-arid type of climate, with a mean annual temperature of around 30° C and 70-85 % relative humidity, is prevalent in the Union Territory. While Puducherry region receives rain mostly through North-East monsoon. The region is flat country of average elevation of about 15 meters above sea level, intersected by the deltaic channels of River Gingee and Pennaiyar and other streams forming the two main drainage basins, interspersed with lakes and tanks. The population of Puducherry District (Census, 2011) is 9.50 lakhs. Women and men constitute exactly 50% of the population (4.82 lakh) (https://puducherry-dt.gov.in/about-district/).

Mahe region is situated in the Malabar coast and it covers a total area of 9 sq. km. bordering the western Indian coastline with a coasltal length of ~1 km. The region shares its boundary with Kerala on the North, East and South and is bordered by the Lakshadweep Sea on the West (Figure

1). Mahe district is confined roughly within 11°42'55.552" North and 11°45'38.411" North latitudes to 75°31'37.015" East and 75°33'29.96" East longitudes. This region is situated on the west-coast of India as a humid and tropical climate, with oppressive hot season from March to May. The rainfall is plentiful during the south-west monsoon. The monsoons normally set in by the end of May or early June and withdraws in early November. There is no real cool weather season. December to February however, is a period of relatively dry and cool weather. The average rainfall is 353cm. Most of this, about 80% occurs during June to September and about 10% during October to November. July is the rainiest month which alone accounts for about 3rd of the annual total rainfall. In a year there are about 120 rainy days, ie. days with rainfall about 2.5mm or more. (https://mahe.gov.in/economy/)

Yanam region covers a total area of 30 sq. km. bordering the eastern Indian coastline. The district shares its boundary with Andhra Pradesh on the North, West and South and is bordered by the Godhavari estuary on the East (Figure 1). Yanam region is confined roughly within 16°45'49.446" North and 16°42'7.219" North latitudes to 82°10'56.978" East and 82°18'38.416" East longitudes. Yanam experiences a climate which is characterized by high humidity over 70% in the mornings and over 60% in the evenings throughout the year. It experiences an oppressive summer season and a good rainfall. It enjoys the benefit of both the South-West and North-East monsoon. The average rainfall in a year is about 1226 mm. (https://yanam.gov.in/)

Karaikal District occupies an area of 157 square kilometres (61 sq miles approx.). Karaikal town which is situated 16 km. north of Nagappattinam and 12 km. south of Tharangambadi is the regional headquarters. Karaikal region is made up of the Municipality of Karaikal, and Communies of Neravy, Tirumalairajanpattinam, Thirunallar, Nedungadu and Kottucherry. Karaikal region is about 130 Km. south of Puducherry and is sandwiched by Nagapattinam District of Tamil Nadu. It is located between 10o 49' and 11o 01' N, and 79o 43' and 79o 52' E. Forming part of fertile delta, the Karaikal region is completely covered by the distributaries of Cauvery River. Covered completely by a thick mantle of alluvium of variable thickness, the region is flat having gentle slope towards Bay of Bengal in the east. Karaikal experiences tropical maritime type of climate with small daily range of temperature and moderate rainfall. Karaikal has an annual average rainfall of about 126 cm. 68 percent of which occurs during October to December. The amount of rainfall during the south-west monsoon period is small, being less than 20 per cent of the annual. November is the rainiest month, accounting for about a third of the annual total. The range of variation of annual rainfall is wide. December and January are the coolest months with the maximum of about 280C and the minimum of about 230C (https://karaikal.gov.in/disastermanagement/kddma-profile/).

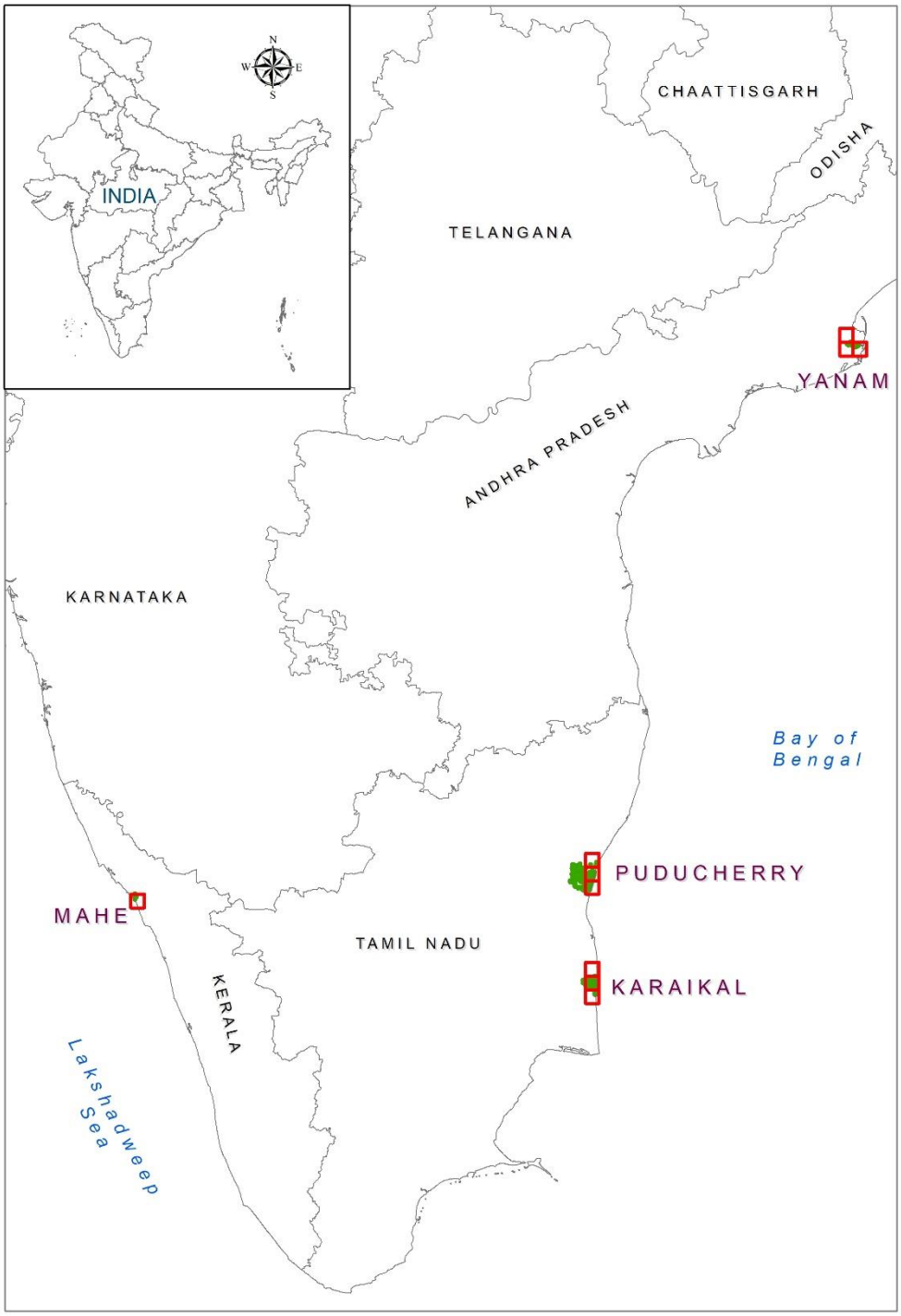

Figure 1: Location map of the study area

1.4. Demography and socio-economic activities

According to the 2011 Census of India, the population of U.T. of Puducherry (includes all four regions) is given in Table 2:

Table 2: District/Region wise population and density

S.No	District	Region	Population in 2011	Population Desnsity	Literates
1	Puducherry	Puducherry	9,50,289	3,232	7,26,649
2		Yanam	55,626	1,854	39,274
3		Mahe	41,816	4,646	36,470
4	Karaikal	Karaikal	2,00,222	1,275	1,54,916

Source: (https://statistics.py.gov.in/population-census-2011)

The population density of all the 4 regions in the above table is higher as against the national figure of 382 per sq km. The population density of Puducherry region is 3232 per sq km, Karaikal district is 1275, Yanam region is 1854 and Mahe region with 4846 as the highest among the rest of the districts. The sex ratio of Puducherry region is 1029 females per 1,000 males, Karaikal district is 1047, Yanam region is 1038 and Mahe region is 1184. The literacy rate of Puducherry region is 85.85 % with 91.26 % for males and 80.67 % for females, Karaikal district is 87.05% with 92.37% for males and 82.02% for females, Yanam region is 79.47% with 82.75% for males and 76.35% for females, and Mahe region is 97.87% with 98.63% for males and 97.25% for females.

Economy

The U.T. of Puducherry has a strong presence in the tourism, agriculture and marine product sectors. It is an attractive tourist destination with beaches and French architecture. Agriculture is one of the most important occupations for the people of Puducherry. About 45% of the total population depends directly or indirectly on farming. The agriculture sector contributes 2% of the Gross State Domestic Product (GSDP) of the Government of Puducherry. The UT is one of the largest producers of bananas, flowers, tapioca, coconut, groundnut and sugarcane in the country. (https://www.ibef.org/states/puducherry-presentation). The total Population of the Government of Puducherry is 12,47,953 and out of this 4,44,968 (35.66%) are classified

as workers. Agriculture Sector of the U.T.of Puducherry had employed 61,370 persons who are either Cultivators or Agricultural Workers. (https://agri.py.gov.in/alstat.html)

Amongst the 95,467 nos of fishermen population 28,966 nos. of fishermen are actively engaged in fishing from 27 nos of marine fishing villages and 23 nos of inland fishing villages/hamlets scattered in and around Union Territory of Puducherry. This Union Territory is also endowed with 1400 Ha of inland water area in the form of Ponds and Tanks suitable for both capture and culture fishery. 800 Ha of Brackish water areas are available for undertaking Brackish water Prawn culture. (https://fisheries.py.gov.in/about-us)

1.5. Coastal Geomorphology and Ecosystem

The Puducherry coast is situated on the Coromandel Coast, the eastern side is bound by Bay of Bengal, Puducherry region is a flat plain with an average elevation of 15m above MSL. The three types of physiographic type. They are Coastal plain, alluvial plain, uplands. The coastal plain parrell to Bay of Bengal, it extends a narrow strch of 4 to 600m on the estern side, the major part of coastal plain is gently sloping, with a chain of sand dune, extending along the coast, other features are, mudflat, creeks, and tidal flats. in karaikal region, the costal stretch, is sandy beaches, and tidal flats.
The alluvial plain, formed between Gingee and Pennaiyar Rivers, with slope ranging from 1 to 3%. In karaikal region vast alluvial plain occur in western side.
Red hills of Puducherry are intersected by a number of gullies and deep ravines giving rise to bed land topography.
Beaches are narrow, and erosion, is occurred in north side. at the same time south side beaches are comparetivily broad and depositional. barrier dunes are seen as, Ariyankuppam, kirumambakkam, Manapattu, and Narimedu ares. Estuarine Mouts are prominent at Ariyankuppam, and north of pooranankuppam, where Gingee and Pennaiyar Rivers join the Bay of Bengal.
(https://dste.py.gov.in/PCZMA/Pdf/Reports/NCSCM%20Shore%20line%20Changes%20Report.pdf/ Coastal Geomorphology)

The Puducherry region in general is a flat peneplain with an average elevation of 15 m above mean sea level. The terrain becomes a little undulating with prominent high grounds varying from 30 to 100m above mean sea level towards northwest and northeastern parts of the region. Three major physiographic units are generally observed, viz., (i) Coastal plain, (ii) Alluvial plain and (iii) Uplands.
The coastal plain extends as a narrow stretch for about 22 km and of four to six hundred meters width on the eastern part of the region along the Bay of Bengal. The major part of the coastal plain comprises gently sloping land with a chain of sand dunes extending all

along the coast. Other physiographic units which are characteristic of the coastal plains such as spit bars, mud flats, lagoons and tidal inlets also occur.
The alluvial plain, formed due to two major rivers namely Gingee and Ponnaiyar, in general is a monotonous plain with slope ranging from 1 to 3 percent. Besides the rivers and major canals, there are depressions acting as storage tanks, which are spread all over the terrain, to serve as surface water reservoirs.
The high grounds are known as Uplands with elevations of about 30 to 100m above mean sea level. These uplands which are popularly known as "Les Montagnes Rouges" or the "Red Hills of Puducherry" are intersected by a number of gullies and deep ravines giving rise to bad land topography. (https://agri.py.gov.in/gwpot.html#:~:text=Geomorphology,northeastern%20parts%20of%20the%20region.)

Karaikal region is a monotonous peneplain with elevation not more than five meters above mean sea level at any point. Aeolian action is evident in the coastal tract in the form of sand dunes and mounds. Being situated on sea coast, coastal geomorphological units like sand dunes, tidal inlet, spit bars, coastal beach with swamps and marshes are common. Sand dunes are found in patches on plains. (https://cgwb.gov.in/District_Profile/Puduchery/KARAIKAL.pdf)

Mahe is a small coastal town situated on the west coast in Kerala, on the Malabar coast of the Arabian Sea located on the mouth of the Mayyazhi River. Mahe is bounded on the southwest by the Arabian sea, on the north by river Ponniyar (Moolakadavu) and on the other sides by a stretch of calcareous hills of medium height, which are linked to the Ghats by a series of wooded hillocks. Mahe is a land that has its soul so connected to Kerala even though it forms a part of the union territory of Puucherry. Mahe has a beautiful landscape surrounded by river and serene beach. (https://cpcb.nic.in/NGTMC/Actionplan_829_1.pdf)

Yanam is a small area of 8 square miles in extent, situated on the left bank of the eastern branch of the Gautami – Godavari River in Andhra Pradesh. It is built in a place where the river Coringa and the Godavari meet and is bounded on the East and South by these rivers. Its located at about nine kilometres from the Bay of Bengal coast. It consists of relatively smooth flood plains, alluvial tracts and fluvial landforms produced by the river. (https://cpcb.nic.in/NGTMC/Actionplan_829_1.pdf)

1.6. Marine Fishery Resources

Puducherry and Karaikal have 25 fishing villages and 24 landing centres of which 15 villages and landing centres are in Puducherry district and the remaining 10 villages and

9 landing centres are in Karaikal. One of the landing centres is a fisheries harbour located at Puducherry.

As per CMFRI 2005 census, there are 7,513 fisher families in Puducherry with a population of 27,047 and 2,858 families in Karaikal with a population of 9,858. There are 5,888 and 2,925 active fishermen in Puducherry and Karaikal respectively and 15,349 and 5,048 engaged in fishery related activities in these two districts respectively. The Status Report of the Puducherry Government states that the fishermen population is 1,50,000 of which 28,750 are active from 27 marine fishing villages including one each located in Yanam (located in Andhra Pradesh state) and Mahe (located in Kerala state).

The U.T. of Puducherry has a total of 4,457 fishing crafts in which 2,957 and 1,199 are spread over Puducherry and Karaikal respectively. There are 86 trawlers, and 68 gillnetters among mechanised vessels and 305 motorised and 1000 nonmotorised vessels. The Karaikal fishermen own 195 trawlers and 86 other crafts among mechanised vessels and 756 motorised and 308 non-motorised crafts and the rest are owned by people other than the fishermen. Total number of gears are estimated to be 20,549 of which 674 are trawlnets, 1,355 drift nets, 16,966 gillnet pieces, 913 hooks & lines, 416 long lines, 6 ring seines, 16 shore seines, 30 scoop nets, 3 troll lines, 14 fixed bag nets, 1 boat seine and the rest 155 are other gears. Karaikal has 15,041 gears comprised of 744 trawlnets, 14,276 gillnet pieces, 13 troll lines, 5 hooks & lines and 3 long lines.

Out of 35 Cooperative Societies functioning in the UT, 10 are in Puducherry, 8 are in Karaikal and the rest 17 are located in Mahe. There are 8 ice factories in the UT of which 2 are in Puducherry and 1 in Karaikal and the balance 5 are in Mahe and there is a cold storage in Puducherry. There is no boat building yard, freezing plant, canning plant, curing yard, peeling shed or fishmeal plant.

(http://eprints.cmfri.org.in/9253/1/35.pdf/ Marine Fish Production in Tamil Nadu & Puducherry/ Overview of the sector in Puducherry)

1.7. Biodiversity of coastal Puducherry

The most important occupation in the Union Territory of Pondicherry is Agriculture, which provides livelihood for about 35% of the rural population. Paddy, Sugarcane, Groundnut, Pulses and Cotton are the major crops in the Union Territory of Pondicherry.

The Botanical Garden situated in the south-west of Pondicherry town, there are mixture of indigenous and exotic trees ranging from deciduous to evergreen species is. And also, a Medicinal Plant Interpretation Center has been established in an area of 5 acre of land at Government Horticulture Farm, Madagadipet.

The flora of Pondicherry has a remarkable diversity which may be attributed to the diverse soil types comprising the hydromorph soil (rich in clay), the halomorphic soils (terrains more or less saltish), the sand dunes and the very dry soils developed on the red sand stones of Kalapet, Dhanvantrinagar (Gorimedu) and Ousteri. The red sand stones are

unknown in Karaikal and Yanam. The flora is listed under six categories, viz., hygrophytes, halophytes, plants of sandstones, avenue trees, hedge plants and ornamental plants.
https://kalpavriksh.org/wp-content/uploads/2019/05/Pondicherry-Final-Feb-2002.pdf
In Puducherry district, the total forest cover is 63%, in Mahe region, 21.5% in Yanam region and only 8.55% in Puducherry region. In Karaikal district the total forest cover is 9.66%.

Mangrove vegetation is seen to some extent in the estuaries and along the sides of Ariyankuppam river in Puducherry region and Gouthami river near Guirempeta in Yanam region.
Some of the important mangrove species are Rhizophora apiculata, Rhizophora mucronata, Avicennia marina, Bruguiera cylindrica, Bruguiera gymnorrhiza (Rhizophoraceae), Acanthus ebracteotus, Acanthus illicifolius (Acanthaceae) etc.

A manmade mangrove forest has been developed and maintained by the Department of Tourism, Forest and Wildlife and Fisheries in the tri junction of River Arasalar, and Beach of Karaikal.
The district administration has initiated establishment of a Biodiversity Park in this Mangrove area. https://dste.py.gov.in/ppcc/pdf/Legal/Action%20Taken/SEP.pdf/ State Environment Plan Union Territory of Puducherry
It is observed that few birds like common Myna, Pied Kingfisher, Little Egret, median Egret, common sand Piper and Red wattled Lapwing are commonly notice in the Avicennia patch Thengaithittu. The wildlife in mangroves include insects, molluscs, fishes, amphibians, reptiles and even microscopic plankton.

There are no reserve forest or scrub jungle, to habitat the wild animals in U.T. of Puducherry. But wetlands are available such as Ousteri and Bahour Tank (fresh water), and marshy area near light house (brackish water) and upto Karaikal, they include mainly ducks, teals, pochards waders, which are coming from various places. and Jackal, Black Napped Hare, Bonnet Macaque, Jungle Cat, Civet Cat, Mongoose, Monitor Lizard, Olive Ridley Turtle and Leather Backed Turtle.

https://kalpavriksh.org/wp-content/uploads/2019/05/Pondicherry-Final-Feb-2002.pdf

1.8. Pollution and waste management issues

Total 5 ULBs (Urban Local Bodies) are responsible for MSW (Municipal Solid Waste) management in the U.T. of Puducherry, out of 5 municipalities, 3 municipalities are coming under below one lakh population category, comprising of 10 Commune Panchayats in the U.T. of Puducherry. Total Solid Waste generation in the U.T. of Puducherry 544.5 TPD. Pondicherry and Oulgarate Municipality are collected, transported and disposed at

Kurumbapet Resource Recovery Park. Wherein recyclable waste is segregated by authorised rag picker. 1 TPD Bio - methanation plant is in operation of pilot scale.

In Karaikal Municipal area, the solid waste collected and transported are made into compost by aerobic windrows. 1MT Bio-gas plant and vermin composting unit are functioning.

In Mahe Municipal area, the non-bio degradable wastes are collected and transported to the existing RRP at Palloor in Pandakkal revenue village. The waste is further segregated into different categories such as plastic, rubber, glass etc. and earning revenue to Mahe Municipality. All the Bio-degradable wastes are used by the households themselves for kitchen garden manure through bio gas plants and pipe composting methods. **Details of Solid Waste Generation in Municipalities is given in Table 3.**

(https://dste.py.gov.in/ppcc/Publication.html /Annual Environment Survey Report - 2019-2020.pdf/ Solid Waste Management)

Details of Solid Waste Generation in Municipalities:

As per 2011 census, the Puducherry Municipality Total Population is 2,44,700, and Total Quantity of Municipal Solid Waste generated - 170 TPD.

As per 2011 census, the Oulgaret Municipality Total Population is 3,00,104, and Total Quantity of Municipal Solid Waste generated - 170 TPD.

As per 2011 census, the Karaikal Municipality Total Population is 86,838, and Total Quantity of Municipal Solid Waste generated - 40 TPD.

As per 2011 census, the Mahe Municipality Total Population is 41,816, and Total Quantity of Municipal Solid Waste generated - 10 TPD.

As per 2011 census, the Yanam Municipality Total Population is 55,628, and Total Quantity of Municipal Solid Waste generated - 61 TPD.

Total Solid Waste Generation in Municipalities – 406 TPD

Details of Solid Waste Generation in Commune Panchayats:

Villianur:
Quantity of Commune Panchayats Solid Waste generated – 29 TPD

Ariyankuppam:
Quantity of Commune Panchayats Solid Waste generated – 26 TPD

Bahour:
Quantity of Commune Panchayats Solid Waste generated – 20 TPD

Nettapakkam:
Quantity of Commune Panchayats Solid Waste generated – 12 TPD

Mannadipet:
Quantity of Commune Panchayats Solid Waste generated – 16 TPD

Kottucherry:
Quantity of Commune Panchayats Solid Waste generated – 08 TPD

Nedungadu:
Quantity of Commune Panchayats Solid Waste generated – 5.5 TPD

Neravy:
Quantity of Commune Panchayats Solid Waste generated – 4.5 TPD

Thirunallar:
Quantity of Commune Panchayats Solid Waste generated – 10 TPD

T.R. Pattinam:
Quantity of Commune Panchayats Solid Waste generated – 7.5 TPD

Details of Solid Waste Generation in Commune Panchayats: 138.5 TPD

Table 3: Details of Solid waste generation in Municipalities of Puducherry U.T.

Sl. No	Name of the Municipality	Total Population as per census 2011	Total Quantity of waste generation in TPD
1	Puducherry	2,44,700	170
2	Oulgaret	3,00,104	170
3	Karaikal	86,838	40
4	Mahe	41,816	10
5	Yanam	55,628	16
	Total	**7,29,086**	**406**

The estimated plastic waste generation is approximately 23 TPD/annum during 2019-20. Complete ban on certain plastic products like

i. Plastic carry bags with or without handle irrespective of size and thickness
ii. Single Use disposable items like cups, plates, straws, spoons etc.
iii. There is no manufacturer of compostable bags in the U.T. of Puducherry.

Plastic Waste generation from Industrial sector are channelized through 15 Authorized Plastic Waste Reprocessors / Recyclers.

5 MT of Plastic waste have been utilized for road construction in M/s Amcor India Pvt. Ltd. and 100 mt. road by utilizing Plastic waste material in Study School, Kalapet.
M/s Hindustan Unilever Ltd., Vadamangalam, has collected the Multilayered plastic (MLP) waste of 272 MT under Extended Producer Responsibility (EPR) through NGOs and sent them for Co-Processing in Dalmia Cements.
(https://dste.py.gov.in/ppcc/Publication.html /Annual Environment Survey Report - 2019-2020.pdf/ Plastic Waste Management)

Department of Science, Technology & Environment / Puducherry Pollution Control Committee has been monitoring Water quality periodically at 31 locations with financial assistance from Central Pollution Control Board under National Water Quality Monitoring Programme (NWMP). Monitoring is carried out on quarterly basis

in surface water bodies in Puducherry and Karaikal regions, annually in Mahe and Yanam regions and during pre and post monsoon in the case of ground water.
The Level of pH in surface water bodies is within the range 6.5-8.5 of primary water quality criteria for bathing water of Class B.
DO is less in Kanagan Lake during December quarter, 2019 and in Arasalar River during January quarter, 2020.
BOD in some of the quarters ranges between 4.0 and 5.0 mg/l at Chunnambar River,
Bahour Lake and Ousteri Lake which is slightly higher than 3 mg/l as per the primary water quality criteria for bathing water of Class B.
In Kanaganeri lake BOD is high during April quarter, 2019 (24mg/l) October quarter, 2019 (13.5mg/l) and in January quarter 2020 (12.0 mg/l). The reason may be due to water stagnation and decomposition of Bio mass.
In Surface water bodies at Yanam and Mahe Region pH, DO and BOD are meeting the primary water quality criteria for bathing water of Class B.
Nitrate concentration in Krishna Nagar borewell and in the borewell of Chevaliar School is higher than the permissible limit. The reason may be due to discharge of sewage and disposal of solid waste.
The other parameters are within the permissible limit.
Pesticides and trace metals viz., Copper mg/L, Nickel mg/L, Cadmium mg/L, Lead mg/L, Total Chromium mg/L, Iron mg/L, Zinc mg/L, Arsenic mg/L, Mercury mg/L are Below Detectable Limit in almost all the locations. Except in Thengaithitu (postmonsoon 1.07mg/l and premonsoon 3.02 mg/l), Bahour borewell (postmonsoon 0.59mg/l) and in Eachangadu (premonsoon 5.1 mg/l) the concentration of iron is higher than the permissible limit.
(https://dste.py.gov.in/ppcc/Publication.html /Annual Environment Survey Report - 2019-2020.pdf/ Status of Water Quality)
U.T. of Puducherry is one of the rapid industrializations in India. Based on the Guidelines of Central Pollution Control Board (CPCB), industries located in the U.T. of Puducherry, have been categorized into four types, such as red, orange, green and white, and are further divided into small, large and medium based on their pollution index.
The total number of red industries in Puducherry is 174, orange is 1681, green is 2778. and White is 71. The total number of industries under these categories in Puducherry 4704. PPCC has issued 121 Consent to Establish during the year 2019-2020.
(https://dste.py.gov.in/ppcc/Publication.html /Annual Environment Survey Report - 2019-2020.pdf/ Industry Scenario of Puducherry)

3. PURPOSE & SCOPE OF CZMPS

The primary purpose of a CZMP is to describe proposed actions to be implemented by administrative or other public authorities and potentially by the private sector to address priority management issues in the coastal zone over a defined implementation period. These issues include:

1. Ensuring livelihood security to the fisher communities and other local communities, living in the coastal areas
2. Conserving and protecting coastal stretches, its unique environment and its marine area and
3. Promoting sustainable development.

The CZMPs should support the goals and objectives of the CRZ Notification 2019 and assist in implementing an integrated coastal zone management plan. The CZMPs has to be prepared in accordance with Annexure - IV of the CRZ Notification 2019 and guidelines issued by MOEF&CC. The CRZ notification, 2019 has made it mandatory for the U.T. to prepare/update the Coastal Zone Management Plan (CZMP) as per the provision of CRZ notification, 2019 and get it approved by the Government of India. Coastal Zone Management Plan for U.T. Puducherry has been prepared accordingly as part of the study and submitted to the Department of Science, Technology and Environment, Government of Puducherry for their review, public consultation and acceptance. The U.T. would subsequently submit the final CZMPs (after revisions if any by NCSCM) to the Ministry of Environment Forest and Climate Change for their approval for implementation.

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4. COASTAL ZONE MANAGEMENT PLAN

The Coastal Zone Management Plans are prepared in 1:25,000 scale with Survey of India toposheets as base maps. The maps are submitted to MoEF&CC, Government of India for approval after stakeholder/public consultations. The local level CZM maps of 1:4000 cadastral scale will be prepared for the use of local bodies and other agencies to facilitate implementation of the CZMPs. The present study and report provide the CZMP maps in 1:25,000 scale.

3.1. Demarcation of High Tide Line (HTL) and Low Tide Line (LTL)

The HTL is defined as "*the line on the land up to which the highest waterline reaches during the spring tide*" which is different from the well-known and widely accepted definition of High Tide Level. The above definition of HTL takes into consideration not only the level of inundation due to maximum tide (spring tide) but also the wave set up (having a seasonal periodicity). The sea level thus formed due to the combined effect of spring tide and wave set up gives the line of maximum reach of water on the land. Unlike the HTL, the Low Tide Line (LTL) has not been defined for CRZ. The HTL required specific definition since the 50, 200 and 500m setback lines are defined with respect to the HTL. The conventional definition of lowest low water level and the resultant low water line during spring tide is taken as the LTL.

As per Para IB.8 of Annexure-I of CRZ notification 2011, the following geomorphological features shall be considered while demarcating in HTL or LTL:

- Landward (monsoonal) berm crest in the case of sandy beaches
- Rocks, Headlands, Cliffs
- Seawalls or revetments or embankments.

Morphological signatures are good indicators of shoreline oscillation and inundation of coastal waters, which could be used for identifying the HTL. The inundation of coastal waters on to the land and seasonal shoreline oscillations are dependent on coastal morphology. Shoreline remains stable and would not retreat significantly along cliffy coasts. The shoreline retreats up to the cliff base along pocket beaches. Artificial morphologies like seawalls confine the oscillation of shoreline along the line of the structure itself. Sandy beaches are prone to seasonal and long-term shoreline oscillation. Long-term stability of the beach and the position of the stable part of the beach would be evident from morphological signatures such as berm and berm crest.

This has been done by using aerial photographs/satellite data. Manual on "Demarcation of High Tide Line and Low Tide line" prepared by NCSCM is referred during the delineation of HTL and LTL.

The following signatures/ geomorphologic/ man-made structures used to demarcate the HTL are explained below using suitable illustrations.

4.1.1. Landward (monsoonal) berm crest for beaches

In all the well-formed wide beaches, one or more berms (which are the nearly horizontal part of the beach formed by the deposition of sand by wave action) are usually observed. The seaward end of the berm, which shows a sudden downward slope, is called the berm crest. When there is only one berm, it normally gets eroded during the monsoon with a berm crest on the landward side. But when there are two berms, the landward berm is the monsoonal berm, which normally does not get eroded. Or else we can say that the erosion reaches only to the second berm crest. Since the tidal waters do not reach the coast beyond this landward berm crest, it is taken as the HTL.

4.1.2. Seawall/revetments/embankments

In highly erosion-prone areas, there are no landward second berms. Such locations will be protected mostly by seawalls. During monsoon season, a majority of these are devoid of beaches. The waves impinge upon the seawall during the monsoon season, especially during high tide. Thus, they are the artificial barriers stopping the waves/tides at the coast. Since the seaward part of the seawall in most cases is defaced due to erosion, the landward toe is taken as the HTL boundary in such locations.

4.1.3. Permanent Vegetation Line

Permanent vegetation develops on the stable part of the beach. The part of the beach landward of monsoon berm crest is mostly stable. Hence, the line of permanent vegetation/perennial plants normally follows the line of monsoon berm crest, which is considered as the HTL.

4.1.4. Coastal sand dune

Coastal sand dunes are ridges or a series of ridges that form at the rear of the beach. Sometimes sand dunes are covered with vegetation. If the vegetation is present then the seaward limit of vegetation boundary is considered as HTL. For eroding dunes, the toe of the foreshore face of dune is considered as HTL.

4.1.5. Mangroves

These are evergreen, tropical coastal plants/ trees occurring in the intertidal zone, bays, estuaries, deltas, lagoons, creeks or any low energy zones of the coast. Landward boundary of mangrove to the extent where tidal water reaches, is considered as the HTL.

4.1.6. Rocks, Headlands, Cliffs

At rock outcrops, headlands and cliffs, the water is quite deep in that there is virtually no spatial displacement in the waterline. Hence, the High Water Line available in the topographical maps (transferred to the base map) can be taken as such.

4.1.7. Other geomorphic/land cover features

Some coasts have a fairly large inter-tidal zone fringed by vegetation or coastal alluvial plain. In such cases, the HTL is demarcated using tonal differentiation between clayey or silty clay region along with salt encrustation upto supra- tidal mudflat and adjoining sandy alluvial plain. Other geomorphic/ land cover features such as marshes, mangroves, fringing corals, saltpans, aquaculture ponds, and seaward side of agricultural/ horticulture land are also used for some of the coastal regions.

4.1.8. Influence of Tidal action

The distance up to which CRZ is applicable upstream of estuaries, creeks, backwaters and lagoons depends on the extent of tidal influence. The distance up to which tidal influence is experienced is dependent on salinity concentration: if it is 5 ppt or more (during the driest month) the water body is considered to be influenced by tidal action (CRZ, 2011). Salinity measurements are carried out during the driest month (usually during March-April) to determine the limit. Tidal barrages/lock and bunds constructed are also taken as the limit of tidal influence.

HTL and LTL were demarcated from aerial photographs. Wherever aerial photograph were not available, high resolution satellite images have been used. Coastal geomorphological signatures as discussed above were used as indicators to demarcate the HTL. The High Water Level (HWL) and Low Water Level (LWL) marked on the Survey of India toposheet on 1:25000/1:50000 scale was extracted/digitized. The coastal geomorphological signatures in the field or satellite imageries or aerial photographs were used for appropriate adjustment in the HWL or LWL for demarcating HTL or LTL in accordance with the CRZ notification, 2011. The delineated HTL and LTL has been corrected with field visits and validated taking respective state governments' suggestions / recommendations before finalisation. The above HTL, LTL has been used in preparation of CZMP of U.T. of Puducherry as per CRZ notification, 2011 and it has been approved by MOEF&CC.

3.2. Demarcation of Ecologically Sensitive Areas

NCSCM was awarded the task of mapping ESAs by MoEF&CC. The task was undertaken in partnership with various expert agencies as provided in Table 4. Mangroves, sand dunes, sea grass, mudflat and salt marsh ecosystems have been mapped by NCSCM using aerial photographs and satellite images.

Table 4: Research Partners / Data Sources for Mapping ESAs

ESA	Source
Mangrove	NCSCM
Sand Dunes	NCSCM
Mudflat, Salt marsh	NCSCM
Archaeological Sites	Archaeological Survey of India
Turtle Nesting Grounds	Indian Institute of Science, Bengaluru

The demarcated ESAs were updated / corrected after rigorous field visits. Further the data has been validated taking respective state governments' suggestions / recommendations before finalisation. The above ESAs has been used in preparation of CZMP of U.T. of Puducherry as per CRZ notification, 2011 and it has been approved by MOEF&CC.

As per para 1 of Annexure-IV of CRZ Notification, 2019 stated that "Demarcation of High Tide Line (HTL) and Low Tide Line (LTL) as carried out by NCSCM for the entire coastline of the country, has been made available to the Coastal States or Union territories and only such demarcation of HTL and LTL shall be applicable for all purposes of this notification". Whereas, as per para 3(a) the Guidelines issued by MOEF&CC dated 26th June 2019 for updation of Coastal Zone Management Plan (CZMP) prepared as per CRZ notification, 2011 to align it with CRZ notification, 2019, stated that "the CZMP database (shapefiles etc.) prepared as per the CRZ Notification, 2011 which have been scrutinized by the Technical Scrutiny Committee, finalized by the National Centre for Sustainable Coastal Management (NCSCM) and approved by the MoEFCC, shall be used as the base for revision or updation of the CZMP, as per the provisions contained in the CRZ Notification, 2019".

In the present work, the above approved database including HTL, LTL, ESAs, CVCA, Hazard line etc. were used as a base database for updation of draft CZMPs prepared as per CRZ notification, 2019.

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5. ECOLOGICALLY SENSITIVE AREAS AND COASTAL LAND USE

Coastal land use is one of the most essential information for assessing the status of natural resources and the coastal environment. It is also a pre-requisite for zonations of the coast as well as for making a sustainable coastal zone management plan. The coastal land use maps on 1:25000 scale was prepared using satellite images during 2018 - 2019 as available with NCSCM and according to the "Manual on Demarcation of High Tide Line and Low Tide Line and Preparation of CZMP of the Coast of India". The landward extent of coastal land use area is the landward limit of CRZ boundary or hazard line whichever is more. For classification of coastal land use, the classification system mentions in the "HTL Manual" was followed (Annexure – I). The coastal land use map also depicted the ESAs, HTL and other details. Cadastral boundary, administrative boundaries, infrastructure details etc. were superimposed on the map and draft map was prepared.

In coastal U.T. of Puducherry, agricultural land, the largest component of land use, occupies 36.96 sq km. The second largest component is habitation/settlement, which occupies 14.13 sq km. Rivers/ Streams/ Canals/ Drains occupies an area of 4.82 sq. km. The total area of Beach/Sand Patch is 2.53 sq. km. Aquaculture Pond occupies an area of 1.90 sq. km. Habitation with vegetation occupies an area of 1.76 sq. km. Road network cover an area of 1.41 sq. km. Sand with vegetation occupies an area of 0.98 sq. km. Open/Vacant land occupies an area of 0.67 sq. km. Tank/Pond/Lake covers an area of 0.56 sq. km. The U.T is covered with Forest which occupies an area of 0.47 sq. km. Saline area occupies an area of 0.13 sq. km. Reclaimed area cover is 0.12 sq. km.

Table 5 provides the details of the coastal land use classes for Puducherry. Extent of ESAs of coastal U.T. of Puducherry is given in Table 5. Districtwise area statistics of ESAs is given in Table 6.

Table 5: Area statistics of coastal land use classes.

Land use classes	Area in (Sq. Km)
Agricultural Land	36.96
Habitation/settlement	14.13
Rivers/ Streams/ Canals/ Drains	4.82
Beach/Sand Patch	2.53
Aquaculture Pond	1.90
Habitation with vegetation	1.76
Road	1.41
Sand with vegetation	0.98
Open/Vacant land	0.67

Land use classes	Area in (Sq. Km)
Tank/Pond/Lake	0.56
Forest	0.47
Saline Area	0.13
Reclaimed Area	0.12
Railways	0.00

Table 6: Extent of ESAs in listed in CRZ 2019 (area in sq km) within CRZ Jurisdiction

ESAs Category	Section in CRZ 2019 notification	Area (Sq.km)
Mangrove	2.1.1 (a)(i)	4.28
Salt Marsh	2.1.1 (a)(vi)	0.15
Turtle Nesting Sites	2.1.1 (a)(vii)	0.54
Sand Dune	2.1.1 (a)(iii)	0.32
Mudflat	2.1.1 (a)(iv)	0.05
Archaeological & Heritage Sites	2.1.1 (a)(xi)	0.07

Table 7: Districtwise area statistics of ESAs

District	Region	ESA Categories (Area in Sq.Km)					
		Mangroves	Mudflat	Salt Marsh	Turtle Nesting Grounds	Sand Dune	Archaeological & Heritage Sites
Puducherry	Puducherry	0.51	0.02	0.10	0.53	0.30	0.07
	Mahe	0.00	0.00	0.00	0.00	0.00	0.00
	Yanam	3.45	0.00	0.00	0.00	0.00	0.00
Karaikal	Karaikal	0.32	0.03	0.05	0.01	0.02	0.00
Total area		**4.28**	**0.05**	**0.15**	**0.54**	**0.32**	**0.07**

3.3. Mangroves

Mangroves are trees of various species of several families, which grows only where they can come into permanent contact with sea water or brackish water. They occur at the edges of the tropical or subtropical seas, bays, lagoons and estuarine regions *(Gerlech, 1973)*. Mangroves occur in quiet depositional coastal environments. Although mangroves grow in a variety of sediments including coral sands, they attain full development on the fine grained, soft organic mud deposited on the sheltered coast. Mangrove roots help accumulation of the silt, which gradually builds up to, form dry land, thus extending the coastline. Mangroves support in maintaining a rich coastal biodiversity.

Mangroves have played an important role in the economics of our coastal population for thousands of years, providing a variety of goods and services, including wood production, support for commercial and subsistence fisheries, aquaculture, salt production and shoreline and coastal erosion control. (https://dste.py.gov.in/PCCC/pdf/Reports/14.pdf)

Total mangroves area of U.T. of Puducherry is 4.28 sq km (Table 8 & Figure 2). Most of the mangroves in Puducherry are of the fringing type or in linear formations along the river or estuarine banks. Mangroves in Puducherry are distributed near the villages - Ariankuppam, Murungapakkam, Veerampattinam and two islets - Thengaithittu and Ashramthittu. In Puducherry, mangroves are found along the sides of Ariankuppam estuary, which opens into the Bay of Bengal on the Coromandal coast. The waterway is a tributary of river Gingee. The channels in the mangroves are lined by a luxuriant vegetation of small salt marsh plants, trees, shrubs and thickets. In Yanam region thick mangrove vegetation is found along in the river islands of Gautanmi Godavari which is a major tourism attraction. Yanam has the maximum mangrove cover among rest of the regions with 3.45 sq. km. (https://dste.py.gov.in/ppcc/pdf/Legal/Action%20Taken/Dec_2019.pdf)

A mangroves area greater than 1000 sq m, a buffer of 50m has been provided as per the CRZ notification, 2019. However, mangroves in private land will not require a buffer.

Table 8: Mangrove distribution of Coastal Puducherry U.T..

District	Region	Mangroves Area (sq. km)
Karaikal	Karaikal	0.32
Puducherry	Puducherry	0.51
	Mahe	0.00
	Yanam	3.45
Total Area		**4.28**

5.4. Coastal Dune/Sand Dunes

Single or multiple ridges or mounds of loose wind-blown material, usually sand on the coast. Coastal sand dune covers small area and is defined as topographical feature of aeolian origin composed of sand grain deposited down wind from a natura source of sand (Fairbridge, 1968). They are developed in any environment in which loose sand size particles are exposed to wind action and are free to migrate and accumulate as unconsolidated masses. The sand dunes function as a buffer for the beach to reduce the impact of coastal erosion.

The coastal zone of Puducherry region comprises newer and older dunes including saline areas of clayey texture. These dunes are well stabilized and the locals claim that they are quite ancient. Though most of the dunes here have Casuarina or coconut plantations, some areas also have mixed vegetation supporting species like Prosopis, Eucalyptus and other shrub species. The sand dunes along the beaches of Puducherry area are slowly vanishing due to human intervention and also due to beach erosion. Many of these dunes have been reported to have been flattened for agriculture, as the swales have a high mineral and clay content, making it a very fertile soil to grow paddy. (https://dste.py.gov.in/ppcc/pdf/Legal/Action%20Taken/Dec_2019.pdf). Total area occupied by the sand dune area along the U.T. of Puducherry coast is about 0.32 sq. km and it is found in Puducherry and Karaikal region.

5.5. Salt marsh

Salt marsh is a community of organisms dominated by plants that are tolerant of wet, saline soils, generally found in low-lying coastal habitats, which are periodically wet and unusually saline to hyper-saline. The term salt marsh summarizes the saline conditions of the habitat as well as the emergent vegetation, which dominates it. Plants, which grow in salt marshes, are thus tolerant of two conditions: saline and wet. They provide essential food, refuge, or nursery habitat for fisheries species, including shrimp, blue crab, and many finfish.

Total salt marsh area of U.T. of Puducherry is 0.15 sq.km and it is observed in the districts of Karaikal with 0.05 sq. km. and Puducherry with 0.1 sq. km.

5.6. The Ancient Monuments and Archaeological Sites

The Ancient Monuments and Archaeological Sites and Remains Act 1956 (or AMASR Act 1956) is an act of parliament of the government of India that provides for the preservation of ancient and historical monuments and archaeological sites and remains of national importance, for the regulation of archaeological excavations and for the protection of sculptures, carvings and other like objects. CRZ Notification, 2019 has been included "Areas or structures of archaeological importance and heritage sites" as CRZ IA.

Total area of archaeological important and heritage sites of U.T. of Puducherry is 0.07 sq. km. and it is foundin Puducherry region alone.

5.7. Mudflats

Mudflats are wide expanse of fine-grained soft mud along the shore. They generally consist of deposits of clay, silt, ooze etc. (King, 1972). Mudflats provide important habitat for bottom-dwelling invertebrates, such as clams and mussels, and thus provide food for predatory fish, birds and invertebrates such as the horseshoe crab, mud-snail and shellfish species. It serves as an important feeding ground for many animals, especially for migratory wading birds which to refuel on their long journeys. The soft mud is also home to a range of burrowing animals.

Total area of mudflats in U.T. of Puducherry is 0.05 sq. km. Karaikal district contributes to about 0.03 sq. km and are observed along the bank of Arasalar River. Puducherry's mudflat area cover is about 0.02 sq. km and is found along Ariyankuppam River.

5.8. Saltpan or Aquaculture:

Salt pans is defined as "An undrained usually small and shallow rectangular, man-made depression or hollow in which saline water accumulates and evaporates leaving a salt deposit" (Margarate et al, 1974). Salt pans are square or rectangular in shape. Whereas, aquaculture is defined as "The breeding and rearing of fresh-water or marine fish in captivity. Fish farming or ranching". The water bodies used for the above are called aquaculture ponds (Encyclopaedic Directory of Environment, 1988).

The Total area of Aquaculture and Saltpan in the U.T. of Puducherry is 1.90 sq. km.

5.9. Turtle Nesting Grounds:

Sea turtles or marine turtles are generally found in waters over continental shelves; females come ashore to sandy beaches where they were born where they dig nests and lay eggs during the nesting season. These beaches are known as turtle nesting grounds/sites. India has five of the seven species of known sea turtles. Mass nesting occurs along sandy beaches on the west and east coast. After hatching, the turtles find their way back to the sea.

All the five species of sea turtles occurring in India, including the Olive Ridley turtles, are legally protected under Schedule I of the Wildlife Protection Act, 1972 and Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES Convention) which prohibits trade in turtle products.

Total Turtle nesting grounds area are about 0.54 sq. km.

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6. METHODOLOGY FOR PREPARATION OF CZMP

The CZMP database (shapefiles) prepared as per the CRZ Notification, 2011 which have been scrutinized by the Technical Scrutiny Committee, finalized by the National Centre for Sustainable Coastal Management (NCSCM) and approved by the MoEFCC, have been used as the base for revision or updation of the CZMP, as per the provisions contained in the CRZ Notification, 2019. The HTL, LTL, ESAs, Hazard line, CVCA & the 'Hazard line' were taken from above database in preparation/updation the CZMPs, as required under the provisions of the CRZ Notification, 2019. Based on the CRZ notification, 2019, various regulatory lines viz. at a distance of 50 metres, 200 metres and 500 metres from HTL respectively, as applicable in various CRZ categories were demarcated. Classification of different CRZ categories were done as per the CRZ notification, 2019 and guidelines isssud by MOEF&CC. In case of mangrove areas of greater than 1000 sq.m, a buffer line of 50m has been provided. However, Mangroves in private land will not require a buffer zone. Other buffer lines were drawn wherever necessary, as specified in the CRZ Notification, 2019. HTL, LTL, CRZ categories, hazard line and infrastructure were superimposed on the cadastral map and a draft CZMPs maps in 1:25,000 scale were prepared with Survey of India toposheets as base maps. Data sources used in the preparation of CZMPs is given in Annexure II.

6.1. Field mapping and map preparation

Geo-referenced cadastral maps in soft copies (shapefile format) for U.T. of Puducherry were provided by PCZMA. The datum used was WGS 84 and the projection was UTM Zone 43N (Mahe region) and 44N for rest of the region of Puducherry. In addition of the above database, fieldwork was carried out all along the coast during 2019-2020 to validate the details and to provide better results in the preparation of coastal land use maps. At the same time, various location and spatial errors that could get magnified in large-scale maps such as cadastral maps were contained through appropriate approaches. Photographs taken during the fieldwork has been given as Annexure-III. Steps involved in the preparation of CZMP maps are shown in Figure 3.

Two sets of maps were prepared in 1:25000 scale namely (i) CZMP map depicting different CRZ categories; and (ii) Coastal land use maps (i.e. land use map used to define CZMP).

With the above information, the draft maps in 1: 25,000 scales were generated as per CRZ Notification, 2019 and has been submitted to the Puducherry Coastal Zone Management Authority, Government of India.

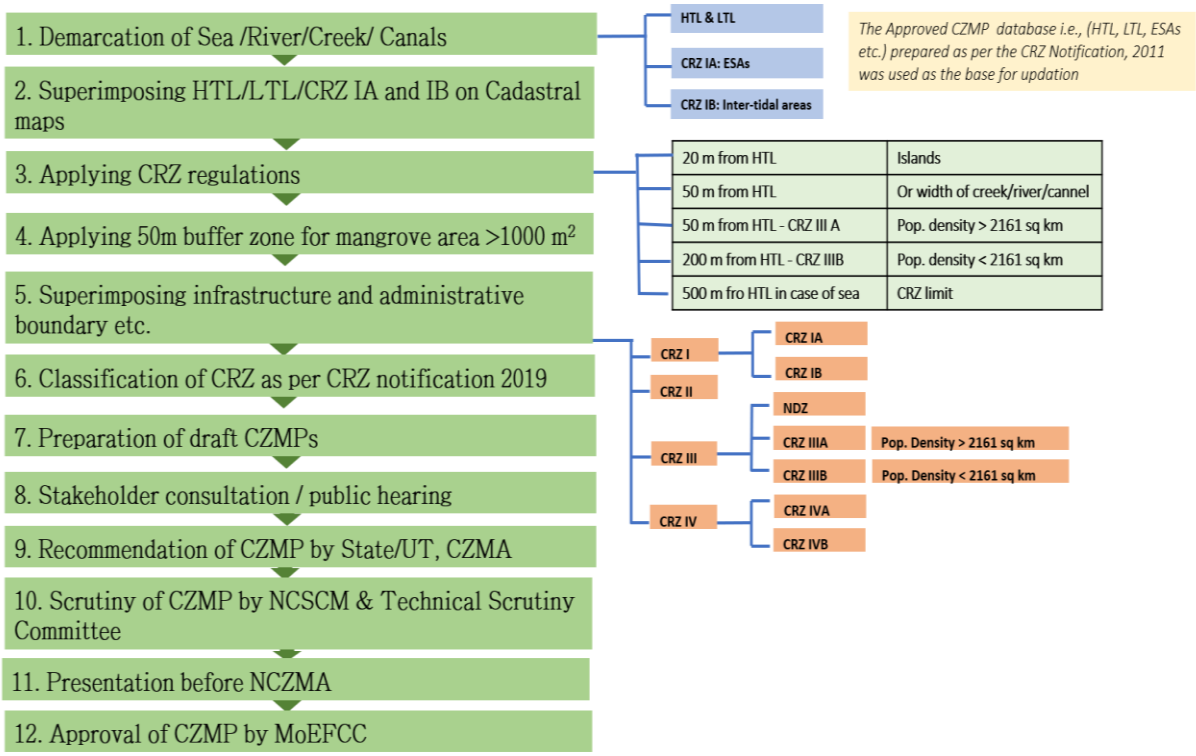

Figure 2: Various steps involved in the preparation of CZMPs

The 33rd Meeting of the National Coastal Zone Management Authority (NCZMA) was held on 24.05.2018 under the chairmanship of Secretary (EF&CC). The relevant portion is given below for ready reference

4. Draft CZMPs presented by the respective States were deliberated upon and the Chairman, NCZMA directed as under:

"All the draft CZMPs shall be routed through NCSCM for a final round of technical scrutiny. Additional inputs, information and clarification etc., if any, envisaged by the States to be incorporated in their CZMPs, may be provided to NCSCM in the intervening period. After the technical scrutiny, a briefing note may be prepared for the guidance of the NCZMA"

Accordingly, NCSCM has constituted a Technical Scrutiny Committee under the Chairmanship of Dr. Shailesh Nayak, former Secretary, Ministry of Earth Sciences, Govt. of India, to scrutinize the Coastal Zone Management Plans (CZMPs) prepared by agencies authorized by MoEF&CC and provide recommendation for NCZMA.

Hence, after the public hearing the modified maps need to be presented before the TSC for scrutiny and recommendation. After that the maps need to be apprised from the U.T.

CZMA. The final draft map neeed to be present before the NCZMA for recommendation and finnaly the MOEF&CC will approve the maps.
Hence, the CZMPs of 1:2500 scale is prepared to clearly identify, demarcate and represent different categories of coastal regulation zone such as CRZ IA, CRZ IB, CRZ II, CRZ NDZ-CRZ III, 50 to 500m – CRZ IIIA, 200 to 500m –CRZ III, CRZ IVA, CRZ IVB in distinguish color. Whereas, in coastal land use map (used to define CZMPs) Ecologically Sensitive Areas (ESAs) such as mangrove, salt marshes, sand dunes, mudflats, Turtle Nesting Grounds, areas of structures of archaeological importance and heritage site etc as required under the CRZ Notification, 2019 are integrated.

The draft published CZMP as per CRZ notification, 2019 were revised by incorporating the stakeholder data such as fishing zone, fish breeding area etc. For more details, refer Annexure – II.

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7. CRZ CLASSIFICATIONS

For the purpose of conserving and protecting the coastal areas and marine waters, the CRZ areas were classified as follows, CRZ I which includes ecologically sensitive areas and the geomorphological features which play a role in maintaining the integrity of the coast (CRZ IA) as well as the inter-tidal zone (CRZ IB) and in case of mangrove areas of greater than 1000 sq.m, a buffer line of 50m has been provided which is considered as CRZ IA; CRZ II - the developed land areas up to or close to the shoreline; CRZ III are land areas that are relatively undisturbed (viz. rural areas, etc.) and those which do not fall under CRZ-I, CRZ-II and CRZ IV (the water and bed) area as per the CRZ Notification 2019 (Figure 4). The CRZ III area has been classified into three categories such as No Development Zone (NDZ), CRZ IIIA and CRZ IIIB. In case of seafront, the CRZ IIIA areas are densely populated areas where the population density is more than 2161 per square kilometre as per 2011 census base. In CRZ IIIA, area up to 50 meters from the HTL on the landward side marked as NDZ.
All other CRZ-III areas (in case of sea front) with population density of less than 2161 per square kilometre, as per 2011 census base, are designated as CRZ-III B and in CRZ-III B, the area up to 200 meters from the HTL on the landward side earmarked NDZ. Land area up to 50 meters from the HTL, or width of the creek whichever is less, along the tidal influenced water bodies in the CRZ III, earmarked as the NDZ.

The schematic diagram showing various CRZ categories is given below (Figure 5).

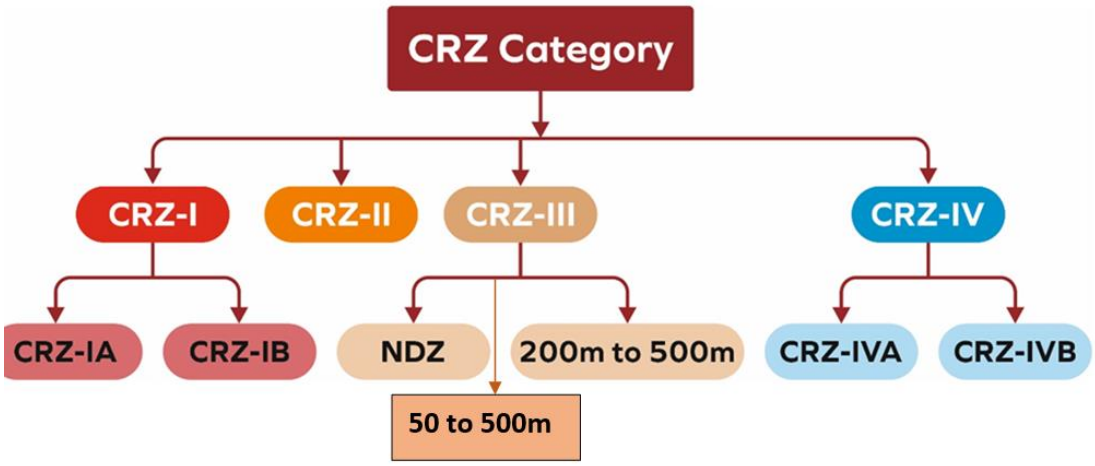

Figure 3: Classification of CRZ area

7.1. CRZ I

As per the CRZ Notification 2019, CRZ I consist of CRZ IA and IB. CRA IA areas are ecologically sensitive and the geomorphological features which play a role in the maintaining the integrity of the coast, include the following:

(i) Mangroves (in case mangrove area is more than 1000 square meters, a buffer of 50 meters along the mangroves shall be provided and such area shall also constitute CRZ–I A);

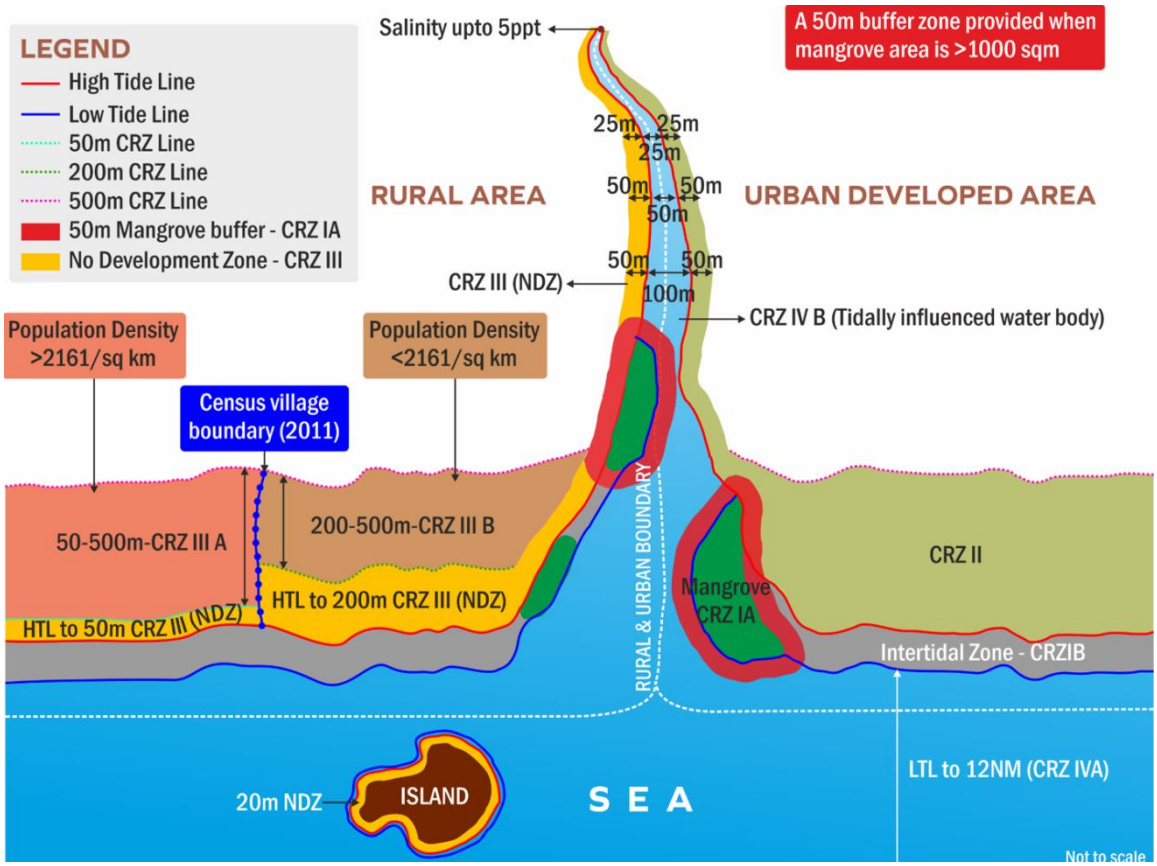

Figure 4: Schematic diagram showing demarcation of different CRZ categories

(ii) Corals and coral reefs;

(iii) Sand dunes;

(iv) Biologically active mudflats;

(v) National parks, marine parks, sanctuaries, reserve forests, wildlife habitats and other protected areas under the provisions of Wild Life (Protection) Act,

1972 (53 of 1972), Forest (Conservation) Act, 1980 (69 of 1980) or Environment (Protection) Act, 1986 (29 0f 1986), including Biosphere Reserves;

(vi) Salt marshes;

(vii) Turtle nesting grounds;

(viii) Horse shoe crabs' habitats;

(ix) Sea grass beds;

(x) Nesting grounds of birds;

(xi) Areas or structures of archaeological importance and heritage sites.

(xii) Eco-Sensitive Zone (ESZ) as per updated guidelines issued my MOEF&CC

The area between Low Tide Line and High Tide Line is the Inter Tidal Zone and categorized as CRZ IB.

7.2. CRZ II

CRZ-II shall constitute the developed land areas up to or close to the shoreline, within the existing municipal limits or in other existing legally designated urban areas, which are substantially built-up with a ratio of built-up plots to that of total plots being more than 50 per cent and have been provided with drainage and approach roads and other infrastructural facilities, such as water supply,sewerage mains, etc.

7.3. CRZ III

Land areas that are relatively undisturbed (viz. rural areas, etc.) and those which do not fall under CRZ-II, shall constitute CRZ–III. CRZ-III area are classified into three categories such as No Development Zone (NDZ), CRZ III A and CRZ IIIB. CRZ-III A areas are densely populated CRZ-III, where the population density is more than 2161 per square kilometre as per 2011 census base, shall be designated as CRZ–III A and in CRZ-III A, area up to 50 meters from the HTL on the landward side shall be earmarked as the 'No Development Zone (NDZ)', provided the CZMP as per this notification, framed with due consultative process, have been approved, failing which, a NDZ of 200 meters shall continue to apply. CRZ-III B areas are all other CRZ-III areas with population density of less than 2161 per square kilometre, as per 2011 census base, shall be designated as CRZ-III B and in CRZ-III B, the area up to 200 meters from the HTL on the landward side shall be earmarked as the 'NDZ' and Land area up to 50 meters from the HTL, or width of the creek whichever

is less, along the tidal influenced water bodies in the CRZ III, shall also be earmarked as the NDZ in CRZ III.

Note: The NDZ shall not be applicable in the areas falling within notified Port limits.

7.4. CRZ IV

The water area comes under CRZ IV and is further classified into IVA and IVB.

i. The water area and the sea bed area between the Low Tide Line up to twelve nautical miles on the seaward side;
ii. CRZ-IV B areas shall include the water area and the bed area between LTL at the bank of the tidal influenced water body to the LTL on the opposite side of the bank, extending from the mouth of the water body at the sea up to the influence of tide, i.e., salinity of five parts per thousand (ppt) during the driest season of the year.

7.5. Regulation lines

The 50, 200 and 500m regulated lines were drawn landward from the HTL. Once the HTL, and bays are well defined and demarcated, the above CRZ lines could be drawn without any ambiguity following planimetric methods. In case of mangrove area >1000 sq. m, a 50 m buffer zone was drawn which is also considered as CRZ IA.

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8. HAZARD LINE

8.1. Demarcation of Hazard Line

The word 'hazard line' denotes the line demarcated by MoEF&CC through the Survey of India (hereinafter referred to as the SoI) taking into account tides, waves, sea level rise and shoreline changes. The hazard line is a composite line of the shoreline changes and sea level rise due to climate change, tides and waves. This initiative of the MoEF&CC forms a critical part of its responsibilities towards the planned management of the country's coastal zone. Mapping of the hazard line for the mainland coast of India has been completed by the SoI, in collaboration with NCSCM. The process involves the following steps:

8.1.1. Tidal data processed by the Survey of India

i. Collection of historical tidal data (Annual highest high tide level) of 21 major / primary ports/tidal stations and 180 minor/secondary ports/tidal stations, covering the Indian coast.
ii. Quality check and cleaning of data.
iii. Determination of Tide level with 100 years Return Period for Primary ports, using the Weibull statistical distribution. A one-hundred-year return period Hazard Line refers to a Hazard event that has a 1% probability of occurring in any given year.
iv. Interpolation/ Extrapolation for determining the tide level with 100 year return period for Secondary ports.
v. Interpolation of tide level with 100-year Return Period for intermediate stations i.e., at transects at every 250 m between secondary ports.
vi. Add the effect of projected sea level rise in 2100.

8.1.2. Generation of Digital Elevation Models (DEM) by the Survey of India

i. Aerial Photography of the entire coastal areas of the country has been completed for about 78,000 sq. km. and very high resolution Digital Aerial Photographs of resolution 9 cm GSD have already been generated.
ii. Photogrammetric surveys and preparation digital elevation model (DEM) for the entire mainland coast have also been completed.
iii. Contour surveys with contours at vertical interval of 0.1m till the Flood line (100 year return period maximum tidal elevations) and 0.5 m for the area beyond have been completed.

8.1.3. Delineation of Flood line by the Survey of India

i. The 100 year return period tidal elevations computed at the intermediate transects at every 250 m along the coast are plotted onto the 0.1 m contour data generated from the high resolution DEM.

   The locus of these points will form the flood line.

8.1.4. Delineation of Erosion line by NCSCM

i. Collection of time series high resolution satellite imagery for the period from 1970 to 2010 and geo-referencing.
ii. Delineation of the periodic shorelines from the satellite imagery for the period from 1970 to 2010 and from the high resolution aerial ortho-image of 2012.
iii. Computation of annual rate of erosion/accretion using the Digital Shoreline Analysis System (DSAS) at transects points at every 300 m along the coast, in terms of annual displacement from a fixed base line.
iv. Extrapolation to compute the 100-year erosion/accretion rates at these transect points, in terms of the distances from the fixed base line.
v. Plotting the above transect points on high resolution satellite image.
vi. The locus of these points will form the Erosion line.

8.1.5. Demarcation of the Hazard Line by the Survey of India

i. Overlaying the Flood line and the Erosion line in a GIS environment.
ii. Marking the segments of the Flood line /Erosion line which are the most landward, to get the Hazard line.
iii. Transferring the hazard line to topographic maps for public dissemination.

8.2. Impact of Hazard Line

As per the Minutes of the 33rdMeeting of the National Coastal Zone Management Authority (NCZMA) held at New Delhi on 24.05.2018, the Hazard line shall be used only for the purpose of planning for Disaster Management. The Hazard line as mapped by Survey of India (SoI), shall, however, be reflected in the respective CZMPs.

As per para 2 of Annexure -IV of CRZ notification, 2019 stated that a 'Hazard line' has been demarcated by the Survey of India (SOI) taking into account the extent of the flooding on the land area due to water level fluctuations, sea level rise and shoreline changes (erosion or accretion) occurring over a period of time.

The hazard line mapped by SOI has been shared with the coastal States or Union territories through NCSCM. The hazard line shall be used as a tool for disaster management plan for the coastal environment, including planning of adaptive and mitigation measures.

With a view to reduce the vulnerability of the coastal communities and ensuring sustainable livelihood, while drawing the CZMP, the land use planning for the area between the Hazard line and HTL shall take into account such impacts of climate change and shoreline changes.

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9. CRZ CATEGORIES OF U.T. of Puducherry

9.1 CRZ categories of coastal U.T. of Puducherry

The CRZ of U.T. of Puducherry consists of CRZ I (CRZ IA & CRZ IB), CRZ II, CRZ III (NDZ, 50 to 500m & 200 to 500 mt. from HTL) and CRZ IV (CRZ IVA & CRZ IVB). Region wise CRZ area statistics is shown in Table 9. Figure 6 displays the Index map showing the numbering of CZMP maps of U.T. of Puducherry.

Table 9: Regionwise area statistics in different CRZ categories

District		CRZ Categories (Area in Sq. Km)						
	Region	CRZ - IA	CRZ - IB	CRZ - II	No Development Zone	50 to 500m from HTL - CRZ IIIA	200 to 500m from HTL - CRZ IIIB	CRZ - IVB
Karaikal	Karaikal	1.18	2.46	4.47	2.52	0.00	2.65	1.25
Puducherry	Puducherry	2.76	1.98	5.35	2.89	1.67	1.38	2.84
	Mahe	0.00	0.16	0.80	0.00	0.00	0.00	0.19
	Yanam	4.43	2.14	1.79	0.00	0.00	0.00	9.08

9.1.1. CRZ I

The CRZ IA are those ecologically sensitive and the geomorphological features which play a role in maintaining the integrity of the coast. These are Mangroves, Salt Marsh, Turtle nesting grounds, Sand Dune, Mudflats and Archeological & Heritage sites are available in U.T. of Puducherry coast. The above mention features/ thematic layer was merged to make CRZ IA. Mangroves area greater than 1000 sq m, a 50m buffer has been provided and the area about 2.21 sq. km.

Total CRZ IA area of the U.T of Puducherry is 6.29 sq. km. The CRZ IB (Intertidal Zone) is the area between HTL and LTL which covers total area of 6.19 sq km.

9.1.2. CRZ II

CRZ-II shall constitute the developed land areas up to or close to the shoreline, within the existing municipal limits or in other existing legally designated urban areas, which are substantially built-up with a ratio of built-up plots to that of total plots being more than 50 per cent and have been provided with drainage and approach roads and other infrastructural facilities, such as water supply,sewerage mains, etc.

The existing Municipality/Town Panchayat/urban area data are taken from Puducherry Coastal Zone Management Authority for demarcation of CRZ II areas (Table 10). The total CRZ II area of the U.T of Puducherry is 11.95 sq.km.

Table 10: List of Municipal Corporation/Urban Area

District	Region	Municipal Corporation/Urban Area
Puducherry	Puducherry	Puducherry Municipality
		Oulgaret Municipality
	Mahe	Mahe Municipality
	Yanam	Yanam Municipality
Karaikal	Karaikal	Karaikal Municipality

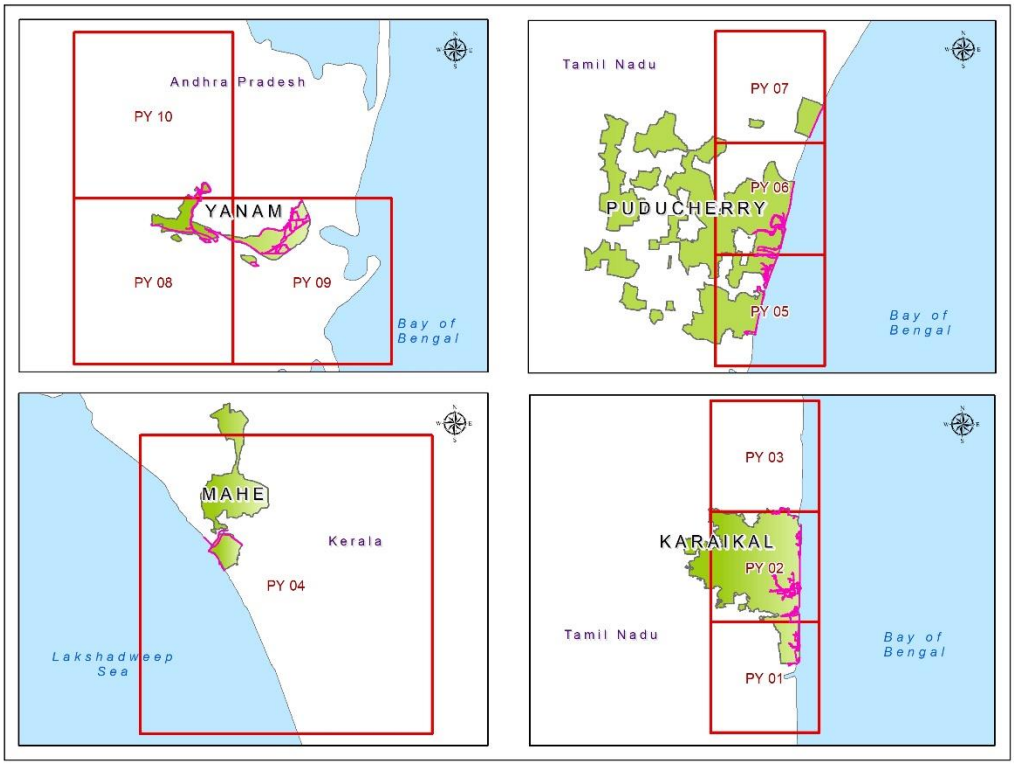

Figure 5: Index Map showing the number of CZMP MAPs in Puducherry U.T

9.1.4. CRZ III

Land areas that are relatively undisturbed (viz. rural areas, etc.) and those which do not fall under CRZ-II, shall constitute CRZ–III. CRZ-III area are classified into three categories such as No Development Zone (NDZ), CRZ III A and CRZ IIIB.

The total CRZ III area of U.T. Puducherry is 10.98 sq km. The calculated area of CRZ III B between 200 to 500 mt. from HTL is 4.03 sq. km and CRZ III A between 50 to 500m from HTL is 1.67 sq.km and No Development Zone (NDZ) along sea side and creek side comprises an area of 5.28 sq. km. There are three seafront revenue villages having population density more than 2161 per square metre in U.T. of Puducherry. These are Kirumampakkam Revenue Village in the Bahour Commune Panchayat, Ariankuppam Commune Panchayat, and Part of Manavely village in Ariyankuppam Commune Panchayat these revenue Villages classified as CRZ – III A the No Development Zone is 50 metres from HTL of Sea and Tidal influenced water body/river/breakwater and like.

9.1.5. CRZ IV

The water area comes under CRZ IV and is further classified into IVA and IVB.

i. CRZ IVA: The water area and the sea bed area between the Low Tide Line up to twelve nautical miles on the seaward side;
ii. CRZ-IV B areas shall include the water area and the bed area between LTL at the bank of the tidal influenced water body to the LTL on the opposite side of the bank, extending from the mouth of the water body at the sea up to the influence of tide, i.e., salinity of five parts per thousand (ppt) during the driest season of the year.

The CRZIVB category covers an area of 13.36 km in the U.T of Puducherry.

9.2 Sheet-wise ESA and CRZ Categories

Sheet wise CRZ categories of Puducherry U.T. are shown Table 11. Details of coastal villages falling under each OSM sheet on 1:25000 scale is shown in Table 12.

Table 11: Sheet-wise area statistics of CRZ Categories (in square km)

Map No	OSM 25K Sheet No	CRZ Categories (Area in Sq. Km)						
		CRZ - IA	CRZ - IB	CRZ - II	No Development Zone	50 to 500m from HTL - CRZ IIIA	200 to 500m from HTL - CRZ IIIB	CRZ - IVB
PY 01	C 44 H 13/SW	0.08	0.78	0.00	1.36	0.00	1.41	0.09
PY 02	C 44 H 13/NW	1.10	1.39	4.29	1.09	0.00	1.24	0.97
PY 03	C 44 B 16/SW	0.00	0.06	0.00	0.09	0.00	0.00	0.06
PY 05	C 44 B 13/SW	0.79	0.84	0.00	2.16	0.82	1.38	1.29
PY 06	C 44 B 13/NW	1.92	0.61	2.95	0.58	0.85	0.00	1.67
PY 07	D 44 T 16/SW	0.05	0.21	2.12	0.00	0.00	0.00	0.00
PY 04	C 43 D 10/NW	0.00	0.16	0.80	0.00	0.00	0.00	0.19
PY 08	E 44 W 2/NE	0.00	1.01	0.71	0.00	0.00	0.00	3.49
PY 09	E 44 W 6/NW	4.43	1.09	0.90	0.00	0.00	0.00	5.54
PY 10	E 44 W 1/SE	0.00	0.04	0.18	0.00	0.00	0.00	0.05

Table 12: Details of coastal villages falling under each OSM sheet

District	OSM 25K Sheet No	Map No	Villages
Karaikal	C 44 H 13/SW	PY 01	Keezhaiyur North, Keezhaiyur South, T.R. Pattinam, Vanjoor

District	OSM 25K Sheet No	Map No	Villages
Karaikal	C 44 H 13/NW	PY 02	Akkaraivattam, Dharapuram, Karaikal, Keezhaiyur North(part), Kizhakasakudy, Keezhavely, Kottuchrery, Kovilpathu, Oduthurai, Poovam, Thalatheru, Thiruvettakudy, T.R. Pattinam, Varichikudy North
Karaikal	C 44 B 16/SW	PY 03	Poovam (part), Varichikudy North
Mahe	C 43 D 10/NW	PY 04	Kallayi, Mahe
Puducherry	C 44 B 13/SW	PY 05	Abishegapakkam, Kirumampakkam, Manapattu, Manavely (part), Pillaiyarkuppam, Pooranankuppam, Thavalakuppam, Uchimedu
Puducherry	C 44 B 13/NW	PY 06	Abishegapakkam, Ariyankuppam, Manavely(part), Murungapakkam, Olandai, Puducherry, Pooranankuppam, Thavalakuppam, Thengaithittu
Puducherry	D 44 T 16/SW	PY 07	Kalapet, Pillaichavady
Yanam	E 44 W 2/NE	PY 08	Adavipalam, Kanakalapet, Francetippa, Mettakur, Isukathippa, Yanam
Yanam	E 44 W 6/NW	PY 09	Adavipalam, Isukathippa

District	OSM 25K Sheet No	Map No	Villages
Yanam	E 44 W 1/SE	PY 10	Mettakur

10. CONCLUSIONS

- High Tide Line (HTL), Low Tide Line (LTL), Ecologically Sensitive Areas (ESAs), and Critically Vulnerable Coastal Areas (CVCAs) demarcated by the National Centre for Sustainable Coastal Management (NCSCM), Chennai, and the 'Hazard line' as demarcated by the Survey of India (SoI), were used in preparation/updation the CZMPs, as required under the provisions of the CRZ Notification, 2019.
- Based on the CRZ notification, 2019, various regulatory lines viz. at a distance of 50 metres, 200 metres and 500 metres from HTL respectively, as applicable in various CRZ categories, were superimposed in the CZMPs
- Survey of India topographical sheet was used as base map.
- HTL, LTL, ESAs etc. were superimposed over the cadastral map. Various administrative boundaries, infrastructure etc. as required in CRZ notification 2019 were overlaid over the above map.
- The Hazard line was overlaid on the CZMP maps based on CRZ 2019 notification.
- The draft CZMP maps were published on the website and asking for suggestion/comment from the public and stakeholders.
- The draft published CZMP as per CRZ notification, 2019 were revised by incorporating the stakeholder data such as fishing zone, fish breeding area etc. For more details, refer Annexure – II.
- Coastal Zone Management Plan (CZMPs) for Puducherry U.T. in 1:25000 scale has been prepared as per the provision of CRZ notification 2019 and guidelines of issued by MOEF&CC
- Coastal land use maps (i.e. land use map used to define CZMP including Ecologically Sensitive Areas) were prepared on 1: 25000 scale

- There are ten maps and ten coastal land use maps for Puducherry U.T. in 1:25000 scale.
- The dominant ESAs are Mangroves, Mudflat, Turtle nesting grounds, Sand Dune, Salt Marsh, and Archeological and Heritage Site etc.
- The calculated area of CRZ I is 13.09 sq km (including CRZ IA and IB), CRZ II is 12.41, CRZ IIIB (200-500 m from HTL) is 4.03, CRZ IIIA (50 to 500m from HTL) – 1.67 sq km and NDZ is 5.41 sq km and CRZ IVB is 13.36 sq. km in Puducherry U.T.
- All developmental activities listed in CRZ notification 2019 shall be regulated by the U.T. of Puducherry Government, the local authority or the concerned CZMA within the framework of the approved CZMPs prepared under CRZ notification, 2019. Until the draft CZMPs are not approved by the MOEF&CC as per CRZ notification, 2019, the approved CZMP (as per CRZ Notification, 2011) is valid for appraisal and CRZ clearance under CRZ Notification 2011.

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ANNEXURES

I. Classification system for coastal land use
II. Data sources used in the preparation of CZMP maps
III. Photographs taken during field work

Annexure – I

CLASSIFICATION SYSTEM FOR COASTAL LAND USE

Level I	Level II	Level III
Agricultural land		
Forest (Non-tidal)	Natural	
	Manmade	
Wetlands	Mud/tidal flat	Sub-tidal
		Inter-tidal
		High tidal (with/without salt encrustations)
		Mud with vegetation
	Sand	Beach/ Sand Patch
		Spit
		Sand Bar/ Barrier Island
		Shoals
		Sand vegetation
	Rocks	Rocky coast
		Rock exposure
	Coral Reef	Reef flat
		Sand Patch /Beach
		Coral Lagoon
		Coralline shelf
	Mangroves	Dense/sparse/degraded
	Marsh vegetation	(Density wise)
	Algae	(Density wise)
	Seagrass	Dense/sparse/degraded
Water bodies	Estuary	
	Creek	
	Lagoon	
	Bay	
Barren land	Mining areas /dumps	
	Rock outcrops/ Gullied land	
Shoreland	Saline area	Vegetated
	Coastal dune	Vegetated
	Reclaimed mudflat	
Built-up land	Habitation/ settlement	With vegetation
	Open/vacant land	
	Transportation	Roads
		Railways
		Port/Harbour/ jetty
		Waterways
		Airport
Other features	Aquaculture pond	
	Reclaimed area	
	Salt pan	
	Seawall / Embankment	
	Tanks/ Ponds/ Lakes	

Level I	Level II	Level III
	Rivers/ streams/ Drains	
	outfalls/effluents/ canals	
HTL		
LTL		
Hazard Line		
Village/ Taluk/ District/ State/ MPA/ Forest boundary		
CRZ boundary	100m/ 200m/ 500m/ 50m buffer zone of mangroves/ width of the creek/	

Annexure – II

DATA SOURCES

Data Source used in the preparation of Draft CZMP maps

Source	Data
Department of Science, Technology and Environment, Govt. of Puducherry/CZMA	• Administrative boundaries • Municipality/urban areas • Cadastral data • Tourism area, Eco-Tourism area • Port limit • Boat Parking/Fish Drying Area/Net Mending Yard • Fishermen Settlement • Port/harbour • School • Hospital/Health Centre, Infrastructure facilities • Ice plant, community hall, • Fish Breeding Area, Fishing Zone, Fish landing centre, etc
Survey of India	• Open Series Maps (OSM) Grid • Toposheets on 1:25,000 scale • Hazard Line
NCSCM	• Lighthouse • High Tide Line • Low Tide Line • Jetty/ Breakwater/Groyne • ESAs and geomorphological features, coastal land use features • CRZ Regulation Line, boundary & categories
Others	• NHO charts • High Resolution Satellite images

Annexure III

PLATES

Plate 1: Sand Dune near Veerampattinam, Puducherry

Plate 2: Sand Dune along the Coast - Puducherry

Plate 3: Fish Landing Centre and Fish Drying Areas at Nalavadu – Puducherry

Plate 4: Fish Landing Centre and Intertidal Zone at Kalapet - Puducherry

Plate 5: Coastal Protection Structures at Pillayarkuppam –Puducherry

Plate 6: Inter Tidal Zone at Puducherry

Plate 7: Coastal Vegetation at Bank of Mahe River

Plate 8: A View of Mahe River

Plate 9: Coastal Vegetation near Mahe River