

**BEFORE THE NATIONAL GREEN TRIBUNAL
SOUTHERN ZONE, CHENNAI**

Original Application No. 131 of 2022 (SZ)

IN THE MATTER OF:

P. Mahendran,

Chennai

...Applicant(s)

Versus

The State of Tamil Nadu,

Reps. by its Secretary,

Chennai and Others

...Respondent(s)

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Through

Dr. D. Shanmuganathan

National Green Tribunal,

Southern Zone

Additional Report on Original Application No: 131 of 2022 :

The Ministry of Environment, Forest & Climate Change (MoEF & CC) in its letter No. J-17011/18/1996-IA.III dated 11th April 2014, constituted a committee under the Chairmanship of Dr. Shailesh Nayak, Secretary, MoES with seven authorized agencies as members and Director, National Center for Sustainable Coastal Management (NCSCM) as Member Convener, to standardize the methodology for demarcation of HTL/LTL so as to make the demarcation procedure uniform.

The formation of the Committee was based on the decision taken at the National Coastal Zone Management Authority meeting held on 25th June 2013. The Committee recommended NCSCM to undertake the demarcation of HTL and LTL to achieve uniformity in mapping and to achieve required accuracy.

It was decided that the tidal data, orthophotos and Digital Elevation Model (DEM) available with Survey of India (Sol) will be utilized by NCSCM to undertake the demarcation within a limited period. In areas where orthophotos are unavailable (gap areas), the Committee recommended the use of the high resolution remote sensing data from Indian satellites of the same period.

Methodology to demarcate the HTL and LTL (As per the 'Manual on Demarcation of High Tide Line and Low Tide Line & Preparation of CZMP of the Coasts of India' approved by Govt. of India):

a) Satellite data :

In areas wherever there are gaps in aerial photographs or if aerial photos are not of good quality; high resolution remote sensing data from Indian satellites of the same period will be utilized for this purpose. Primarily, the Indian Remote Sensing (IRS P6) satellite, Resources at 1&2 LISS-IV and Cartosat (1&2) digital data of 2011 are to be used for demarcation of HTL and LTL.

The HTL/ LTL coordinates shall be provided to the authorized agencies/ State Governments by NCSCM at a cost that would be decided by MoEF&CC. However, the coordinates can also be read from the shapefiles, at required intervals, by the agencies.

b) Measurement of Salinity :

It is recommended not to use salinity measurements for delineation of HTL.

c) Identifying geo-morphological features:

- i) All natural salt pans should be taken as Inter-tidal zone, except artificially pumped salt pans, such as those in Tuticorin District, Tamil Nadu
- ii) Bunds constructed across tidally influenced water bodies such as rivers, creeks etc., before the year 1991 should be taken as the HTL and bunds constructed after 1991 should not be taken as the HTL. HTL as in the years 1991 and 2011 should be surveyed and changes in HTL with respect to 1991 and 2011, if any, should be indicated with justifications.
- iii) Width of rivers and water bodies should be taken from HTL to HTL (and not LTL to LTL which refers to CRZ in water bodies).

d) Accuracy Assessment:

The Committee decided on the following accuracy thresholds:

S. No.	Map scale	Planimetric / Positional Accuracy	Thematic/Classification Accuracy
1	1: 25,000	<ul style="list-style-type: none"> • Accuracy for HTL and LTL demarcation: 1m and 2m respectively. • Accuracy for CZMP using Satellite imagery: 5m 	90 % classification accuracy at 90 % confidence interval
2	1: 4000		90 % classification accuracy at 90 % confidence interval
3	1: 1000		NA

A detailed methodology for delineation of HTL and LTL has been given separately in the “Manual on Demarcation of High Tide Line and Low Tide Line and preparation of CZMP of the Coast of India”.

Validation of the HTL and LTL:

As per the Official memorandum of the Govt. of India, No. 11-64/2011-SICOM (Vol-II) dated 7.10.2014, NCSCM shall demarcate the HTL for the entire country from the ortho images. Based on the HTL demarcated from the ortho corrected images, NCSCM shall validate the HTL to be made available by the concerned State/UT Governments in their CZMP. The HTL validated by NCSCM shall be taken up for preparation of the final CZMPs as required under the CRZ Notification, 2011.

It is noted that, (i) if HTL of 1996 is taken into account, in some places, the HTL is seen inside the sea when compared to HTL of 2018. (ii) The HTL and LTL was revalidated by NCSCM as per the Government of India guidelines for coastal states in India. The same has been taken into account by the states of Odisha and Maharashtra in preparation of the CZMP under CRZ notification 2019 and the same was implemented in their states.

Preparation of CZMP based on CRZ Notification 2011:

- Based on the above guideline / Office Memorandum dated 7.10.2014, the HTL demarcation was carried out by NCSCM for the State of Tamil Nadu and was validated in the year 2016. Based on the validated HTL, the CZMP as per CRZ Notification, 2011 was prepared.
- The CZMP map as per CRZ Notification, 2011 (notified in the year 2018) was prepared based on extensive field survey, satellite based methods, flotsam method etc.,
- The draft CZMP as per CRZ Notification, 2011 was published in the website on 19/2/2018 for public consultation. Then, the public hearing was conducted in the 13 coastal districts from 12/4/2018 to 30/4/2018 after 45 days of time interval.
- As a part of post public hearing, a joint field verification was carried out by Department of Environment and Climate Change and NCSCM including that in the Ennore creek area on 26/7/2018.
- After the field verification, the NCSCM prepared the draft map as per the guidelines in the CRZ notification 2011 and the maps contain all ecological sensitive areas which are present on the ground and verified by ground trothing.
- The draft final CZMP was prepared after incorporating all valid suggestions from public hearing and ground trothing. The draft final maps were examined by the Technical Scrutiny Committee headed by Dr. Shailesh Nayak in September 2018.
- Based on the recommendations/ corrections/ amendments to the draft CZMPs after examination by the Committee and based on the objections/ suggestions obtained during public consultation, the corrections were carried out by the State Government. The draft CZMP was then placed before the National Coastal Zone Management Authority (NCZMA) for approval.
- The NCZMA recommended the CZMP of Tamil Nadu to Ministry of Environment, Forest and Climate Change in the 35th meeting held on 24/09/2018.
- Based on the recommendations of NCZMA, the Ministry of Environment, Forest and Climate Change approved the CZMP of Tamil Nadu vide Lr.No: F.No.12-8/2018-IA-III dated: 24/10/2018.

- Thus it is seen that the CZMP map of 2018 (as per CRZ Notification, 2011) prepared by NCSCM is far more comprehensive and extensive than the CZMP 1996.
- As per Para 1 of Annexure- IV of CRZ Notification, 2019 stipulates 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 the purposes of this notification”.

Validity of CZMP 1996 prepared as per CRZ 1991

- As per para 5(XII) of CRZ Notification 2011, “The CZMPs approved under CRZ notification 1991 shall be valid for a period of 24 months unless the aforesaid period is extended by MoEF by a specified notification subject to such terms and conditions as may be specified therein”.
- However, the validity was further extended vide amendment to dated 31/03/2015 issued vide S.O 938 (E). As per the amendment, “The CZMPs already approved by MoEF shall be valid upto the 31.01.2016, **or till such time as the approval is given by that Ministry to the fresh CZMPs made under the said notification, whichever is earlier**”.
- Accordingly, the CZMPs approved under CRZ notification, 1991 (CZMP-1996) are not valid after 23/10/2018, for the reason that the CZMPs prepared as per the CRZ notification, 2011 have already been approved by Govt. of India.

Provisions of CRZ Notification 2019 regarding demarcation of HTL

- Para 1 of Annexure- IV of CRZ Notification 2019 stipulates that “Demarcation of HTL and 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**”.
- Accordingly, the HTL demarcated by NCSCM only has to be used for preparation of CZMP as per the CRZ notification, 2019. Thus, it is evident that the CZMP-1996 prepared as per CRZ notification, 1991 are invalid and untenable as on date.
- As per amendments dated 01.05.2020 to CRZ Notification 2011, **the HTL has to be restricted up to the line along the bund/ sluice constructed in the past** prior to the date of notification issued vide S.O 114 (E) dated 19.02.1991. In such a case, area under mangroves arising due to saline water ingress beyond the bund or sluice gate shall be classified as CRZ-IA irrespective of the extent of the area beyond the bund/sluice gate. Such mangrove areas shall be protected and shall not be diverted for any developmental activities”.

- The same amendment regarding demarcation of HTL along bunds/sluice gates has also been notified under CRZ Notification 2019 vide amendment S.O 4886 (E) dated 26.11.2021 to CRZ Notification 2019.
- Thus it is submitted that the CZMP of the Ennore Area (Map Nos. TN-110 and TN-111) and other areas prepared as per the provisions of CRZ Notification 2011 and approved by MoEFCC needs to be revisited and updated as per the provisions contained in the amendment dated 01.05.2020 to CRZ Notification 2011.

Prayer before the Hon'ble Tribunal :

Based on the averments made in the above paragraphs, the following points are put forth before the Hon'ble Tribunal for kind consideration,

- The CZMP 1996 prepared under CRZ Notification 1991 used already existed maps of Chief Hydrographer. CRZ Notification 1991 was superseded by CRZ Notification 2011 dated 06.01.2011, wherein MoEFCC, Govt. of India issued guidelines for demarcation of HTL and LTL based on scientific methods so as to maintain uniformity in the method of demarcation throughout the country.
- The Hon'ble Tribunal may be pleased to consider the approved CZMP prepared as per CRZ Notification, 2011 as the baseline datum for Ennore Area (Map No. TN-110 and TN-111) and other areas as already approved in 2018, since the above maps have been prepared based on the guidelines and methodology stipulated by Govt. of India and by following extensive field study, visits and ground trothing as is followed in rest of the coastal States.
- Further, the Hon'ble Tribunal may consider that facts that the maps have been prepared based on the guidelines for preparation of CZMP as mentioned under CRZ Notification 2011 and 2019, Guidelines for Demarcation of HTL, amendment dated 01.05.2020 under CRZ Notification 2011 and amendment dated 26.11.2021 under CRZ Notification 2019,
- As due process based on the rules and regulations were followed from time to time in the preparation of CZMP, it is prayed that this Tribunal shall take into account all the procedures followed in demarcation of HTL as mentioned above and upon which the entire exercise of preparation of CZMP relies on.
- It is submitted before the Hon'ble Tribunal that, preparation of the CZMP using the baseline of 1996 especially the HTL would lead to non-accounting the changes occurred in the coastal geo-morphology in the intervening period while drawing the latest CZMPs. Because of which, the Guidelines of Govt. of India to update the HTL and its validation for preparation of the CZMP 2011 was issued.

- It is submitted before the Hon'ble Tribunal that, going back to CZMP 1996 will make the entire exercise futile, as the preparation of latest CZMPs based on the 2011 and 2019 CRZ Notifications are based on more scientific / technical information.
- Hence such scientifically demarcated HTL by NCSCM completed in 2016 shall be taken as reference in the preparation of CZMP as per CRZ Notification 2019 as it was done during preparation of CZMP in 2018 as per CRZ Notification 2011.
- It is submitted that, as directed by the Hon'ble Tribunal, all the valid suggestions and corrections that would arise and reported during the public consultations will be taken into consideration before the finalization of the CZMPs as per the 2019 CRZ Notification.

L. S.
26/05/2023
ASSISTANT CONSERVATOR OF FORESTS
GREEN SQUAD,
O/o. DIRECTOR OF ENVIRONMENT
PANAGAL MALIGAI,
SAIDAPET, CHENNAI-600 015.

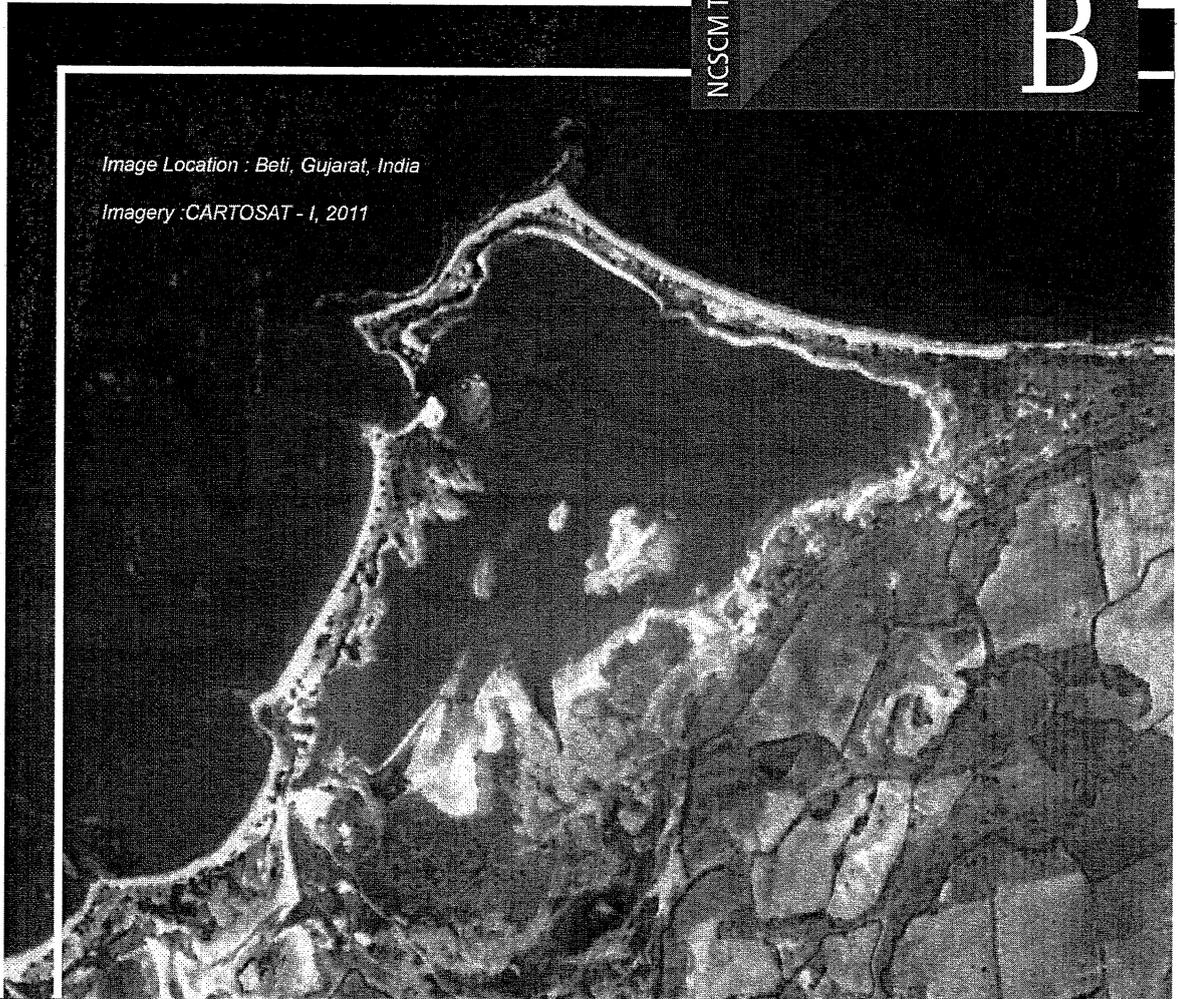
nak
26/05/2023
MEMBER SECRETARY,
TAMIL NADU STATE COASTAL ZONE
MANAGEMENT AUTHORITY,
CHENNAI - 600 015.

NCSCM TECHNICAL REPORT SERIES

23
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Image Location : Beti, Gujarat, India

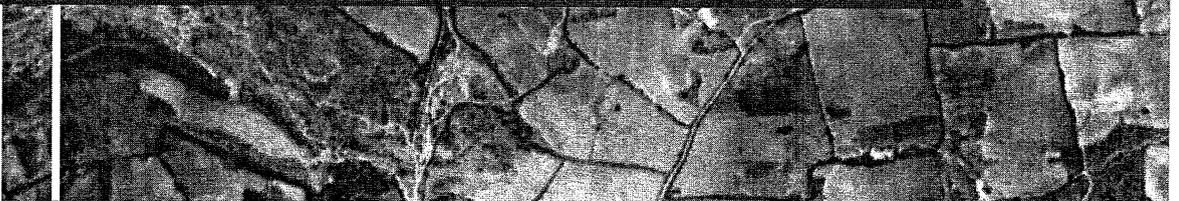
Imagery : CARTOSAT - I, 2011



MANUAL ON DEMARCATION OF

High Tide Line and Low Tide Line and preparation of CZMP of the Coast of India

2015



Ministry of Environment,
Forest and Climate Change



National Centre for Sustainable
Coastal Management

Manual on Demarcation of High Tide Line and Low Tide Line

and

Preparation of CZMP of the Coast of India

Prepared by

The Committee on Standardization of the Methodology for Demarcation
of HTL/LTL

1. Chairman, Earth System Science Organization & Secretary, MoES
2. Space Applications Centre, Ahmedabad
3. National Centre for Earth Science Studies, Trivandrum
4. Institute of Remote Sensing, Anna University, Chennai
5. Institute of Environmental Studies and Wetland Management,
Kolkata
6. Naval Hydrographic Office, Dehradun
7. National Institute of Oceanography, Goa
8. National Institute of Ocean Technology, Chennai
9. National Centre for Sustainable Coastal Management, Chennai

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Preface

The Ministry of Environment, Forests & Climate Change (MoEF&CC), Government of India has taken several policy initiatives and enacted environmental and pollution control legislations towards sustainable management of natural resources. One such initiative is the Coastal Regulation Zone (CRZ) Notification issued on 06.01.2011 under the provisions of Environment (Protection) Act, 1986. The Notification declares the coastal stretches of India 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 up to its territorial limit), as Coastal Regulation Zone. This Notification regulates establishment and expansion of any industry, operations or processes and manufacture or handling or storage or disposal of hazardous substances in the CRZ, with a view to ensuring livelihood security to the fisher communities and other local communities living in the coastal areas, as well as to conserve and protect coastal stretches and its unique environment. It promotes development through sustainable manner based on scientific principles taking into account the likely impact of natural hazards in the coastal areas and sea level rise due to global warming.

The CRZ Notification 2011 is defined with reference to two coastal baselines: i) the landward baseline or the High Tide Line and ii) the seaward baseline or the Low Tide Line. These lines have been drawn by authorized agencies of the MoEF&CC. However, these agencies have used diverse methods, which resulted in variations in demarcation of these lines. Hence it became imperative to ensure uniformity in the precise demarcation of HTL/LTL and achieve desired accuracy levels.

This Manual is now being brought out by MoEF&CC, Government of India as part of the continued efforts of the Ministry to ensure standardization and uniformity in methodology and procedures for delineation of HTL and LTL. The Manual has been designed to cover the whole range of issues such as standardization of the methodology for demarcating HTL, LTL, mapping of CZMPs, standardize the classification system and definitions for tidal wetlands and coastal landforms and use of aerial photographs and satellite imagery for mapping and development of a coastal database. It is hoped that the authorized agencies, project proponents, consultants, regulatory authorities and the coastal community in general will find this Manual useful.

I wish to thank the Ministry of Environment, Forests and Climate Change, Government of India for this initiative to harmonize the methodology for the delineation of baselines. I am grateful to all Committee Members for their support and useful interaction.

Dr. Shailesh Nayak

Chairman, Earth System Science Organization & Secretary, MoES
Government of India

**Manual on Demarcation of High Tide Line and Low Tide Line and
Preparation of CZMP of the Coast of India**

Acknowledgement

On behalf of the Committee for Standardization of the Methodology for Demarcation of HTL/LTL, the following members of the Committee, experts and invitees whose names are listed below, are acknowledged for their technical expertise and contributing to the proceedings of the Committee and for reviewing the draft HTL Manual.

Members / Representatives of Authorized Agencies:

1. Dr. A.S. Rajawat, Head, Geosciences Division, SAC, Ahmedabad
2. Dr. K.V. Thomas, Head Marine Sciences Division, NCESS Trivandrum
3. Dr. S.S. Ramakrishnan, Director IRS, Anna University, Chennai
4. Dr. Debajyoti Bhowmik, IESWM, Kolkata
5. Cdr. Anirban Banerjee, NHO, New Delhi
6. Dr. A.K. Chaubey, Chief Scientist and Scientist-in-Charge, NIO-RC, Mumbai
7. Dr. M.A. Atmanand, Director, NIOT, Chennai
8. Dr. R. Ramesh, Director, NCSCM, Chennai

Invitees:

1. Dr. M. Baba, Former Director, NCESS, Thiruvananthapuram
2. Dr. Anjali Bahuguna, Environment Consultant, Ahmedabad
3. Dr. A. Senthil Vel, Additional Project Director, SICOM, MoEF&CC, New Delhi
4. Dr. Purvaja Ramachandran, Scientist-G, NCSCM, MoEF&CC, Chennai
5. Mr. M. Dharma Raj, Senior Consultant, NCSCM, Chennai
6. Dr. Badarees K.O. Scientist-D, NCSCM, MOEF&CC, Chennai
7. Mr. S. K. Sinha, Director, Survey of India
8. Mr. G. Varun Kumar, Survey of India

We are also thankful to Dr. M. Baba, Dr. A S Rajawat and Dr. Anjali Bahuguna in particular for agreeing to our request to provide their expert inputs in the preparation of the HTL Manual and for attending many additional meetings in NCSCM, Chennai, at short notices, for reviewing the draft manual.

Sincere thanks are due to the Director SAC, Ahmadabad and Dr. A S Rajawat Head, Geosciences Division, SAC, Ahmedabad, for providing their primary data along with detailed reports of National Wetland Atlas and Coastal Zone Information System (CZIS) to NCSCM, Chennai to carry forward the work on HTL, LTL, ESA and mapping of CRZ, under the ICZM project.

Dr. R. Ramesh
Member Convener

Dr. Shailesh R. Nayak
Chairman



List of key abbreviations

CRZ	Coastal Regulation Zone
CVCA	Critically Vulnerable Coastal Areas
CZM	Coastal Zone Management
CZMP	Coastal Zone Management Plan
DEM	Digital Elevation Model
DTM	Digital Terrain Model
ESA	Ecologically Sensitive Areas
GIS	Global Positioning System
GIS	Geographic Information System
HTL	High Tide Line
ICRZ	Island Coastal Regulation Zone
ICZMP	Integrated Coastal Zone Management Plan
IMD	India Meteorological Department
IMP	Integrated Management Plan
IMSL	Indian Mean Sea Level
IOM	Institute for Ocean Management
IRS	Indian Remote Sensing
IRS	Institute of Remote Sensing
IESWM	Institute of Environmental Studies and Wetland Management
LISS	Linear Imaging Self-Scanning Sensor
LTL	Low Tide Line
LWL	Low Water Line
MoEF&CC	Ministry of Environment, Forests & Climate Change
NCESS	National Centre for Earth Science Studies
NCSCM	National Centre for Sustainable Coastal Management
NHO	National Hydrographic Office
NIO	National Institute of Oceanography
NIOT	National Institute of Ocean Technology
NRSC	National Remote Sensing Centre
OSM	Open Series Map
RMSE	Root Mean Square Error
SAC	Space Applications Centre
SoI	Survey of India
UT	Union Territory
UTM	Universal Transverse Mercator
WGS	World Geodetic System

Executive Summary

The National Coastal Zone Management Authority (NCZMA) in its meeting held on 25th June 2013 constituted a committee under the Chairmanship of Dr. Shailesh Nayak, Secretary, Ministry of Earth Sciences (MoES), Government of India, with seven authorized agencies as members and Director, National Centre for Sustainable Coastal Management (NCSCM) as Member Convener, to standardize the methodology for demarcation of HTL/LTL. Accordingly, the Ministry of Environment, Forests & Climate Change (MoEF&CC), Government of India, constituted the said Committee, on 11 April 2014.

The following were the Terms of Reference (ToR) of the Committee.

- i. To review/ evolve uniform guidelines/ methodology for demarcation of HTL/LTL.
- ii. To suggest the format of the report on HTL/LTL demarcation, including map of 1:4000 scale with coordinates, land features, etc.
- iii. To prescribe the time schedule for demarcation of HTL/LTL.
- iv. To prescribe cost for demarcation of HTL/LTL.

The Committee discussed the ToRs in detail during several sittings and recommended concrete methods for mapping of the HTL and LTL. Since the MoEF&CC has already acquired high resolution aerial photographs of the entire coastline during 2011-12 as part of the ICZM Project through the Survey of India (Sol), the Committee felt it prudent to utilize this information for the demarcation of HTL and LTL. Hence the Committee recommended NCSCM to undertake the demarcation of HTL and LTL to achieve uniformity in mapping and to achieve required accuracy. It was decided that the tidal data, orthophotos and Digital Elevation Model (DEM) available with Sol will be utilised by NCSCM to undertake the demarcation within a limited period. In areas where orthophotos are unavailable (gap areas), the Committee recommended the use of the high resolution remote sensing data from Indian satellites of the same period.

The Committee recommended that the digital data of HTL and LTL, along with base maps covering the entire coastline of mainland India will be provided by NCSCM to the authorized agencies for the preparation of the CZMPs. This manual provides the methodology for demarcation of the HTL and LTL by NCSCM and preparation of CZMPs by the authorized agencies.

Accordingly, the Committee held two meetings in New Delhi and Chennai to finalise the manual on Demarcation of High Tide Line and Low Tide Line & Preparation of CZMP of the Coast of India.

The Committee, based their deliberations on the fact that the Coastal Regulation Zone (CRZ) Notification 2011 is defined with reference to the coastal baselines - the landward baseline or the High Tide Line (HTL) and the seaward baseline or the Low Tide Line (LTL). Such baselines represent the intersection of the coastal surface with a particular tidal datum plane/ elevation. Delineation of these boundaries is challenging due to complexities of the coast, various uncertainties such as unavailability of accurate tidal data or the use of improper survey methods making the precise marking of the physical boundary line along the coast a complex task. Nevertheless, it is a fundamental requirement to have an accurate coastal baseline for the implementation of CRZ 2011 and the various setbacks prescribed therein. Delineation of these coastal baselines is also vital for effective coastal zone management.

In order to effectively address the issues more specifically in the ToR, the Committee has designed specific sub-tasks for ToRs **i** and **ii** as follows:

- i. Review/ evolve uniform guidelines/ methodology for demarcation of HTL/LTL
 - a. Standardize the methodology for demarcating HTL, LTL and mapping of CZMPs;
 - b. Standardize the classification system and definitions for inventorying the different features such as tidal wetlands and coastal landforms;
 - c. Use of aerial photographs and satellite imagery (2011) for mapping
 - d. Development of a coastal database
- ii. Suggest the format of the report on HTL/LTL demarcation including map of 1:4000 scale with coordinates, land features
 - a. Achieve uniformity in output with respect to the content, format, legend, colour scheme in the maps;
 - b. Suggest the format of the 'report on HTL/LTL demarcation' with coordinates, land features, and so on;
- iii. Prescribe the time schedule for demarcation of HTL/LTL
- iv. Prescribe the cost for demarcation of HTL/LTL

The Manual contains detailed guideline/ methodology for each of the above tasks, which have been given as separate chapters/ sections, to serve as a guide to the authorized agencies in the preparation of CZM Plans. The manual also contains definitions of specific terms related to the contents of the manual in the main text, a general glossary (Annex 1) of all associated terms, image interpretation and coastal land use / land cover classification systems and positional & classification accuracy specifications.



1. Introduction

The Coastal Regulation Zone (CRZ) Notification 2011 is defined with reference to the coastal baselines - the landward baseline or the High Tide Line (HTL) and the seaward baseline or the Low Tide Line (LTL). Such baselines represent the intersection of the coastal surface with a particular tidal datum plane/ elevation. The precise delineation of these boundaries is a challenging task due to complexities of the coast, various uncertainties such as unavailability of accurate tidal data or the use of improper survey methods. Nevertheless, it is a fundamental requirement to have an accurate coastal baseline for the implementation of CRZ and the various setbacks prescribed therein. The delineation of these coastal baselines is vital also for effective coastal zone management.

Hence, the purpose of this manual is two-fold:

- i. To provide recommendations for an acceptable clarity to the HTL and LTL, based on which the boundaries of the CRZ 2011 Notification are determined and
- ii. To provide the baselines and guidelines to coastal managers on the methods of applying this for the preparation of Coastal Zone Management Plans (CZMPs).

1.1 Requirements of CRZ 2011 Notification

For the implementation of CRZ 2011 Notification the HTL/LTL need to be demarcated in the CZMP. These baselines are also required for the following purposes:

- Mapping of Ecologically Sensitive Areas (ESAs) including preparation of Integrated Management Plans (IMPs)
- Delineation of CRZ-I, CRZ-II, CRZ-III and CRZ-IV for CZMP
- Demarcation of hazard line along the entire coast of India taking into account erosion and flooding of the coast.
- Preparation of Island Coastal Regulation Zone (ICRZ) and Integrated Island Management Plans (IIMP) as per the Island Protection Zone 2011 Notification.

1.2 Demarcation of HTL and LTL

As per the CRZ 2011 Notification, demarcation of HTL and LTL will be undertaken by one of the agencies authorized by MoEF&CC and marked on the Coastal Zone Management (CZM) Maps of 1:25,000 scale and cadastral scale, the latter for local level regulations. Local level CZM Maps on cadastral scale are for the use of local bodies and other agencies to facilitate implementation of the CRZ. The eight agencies authorized by MoEF&CC who are mapping HTL/LTL are adopting different methods resulting in some variations in the accuracy levels. Hence it is necessary to establish uniformity and accuracy levels required in the mapping of

HTL/LTL.

1.3 Objectives of the Manual

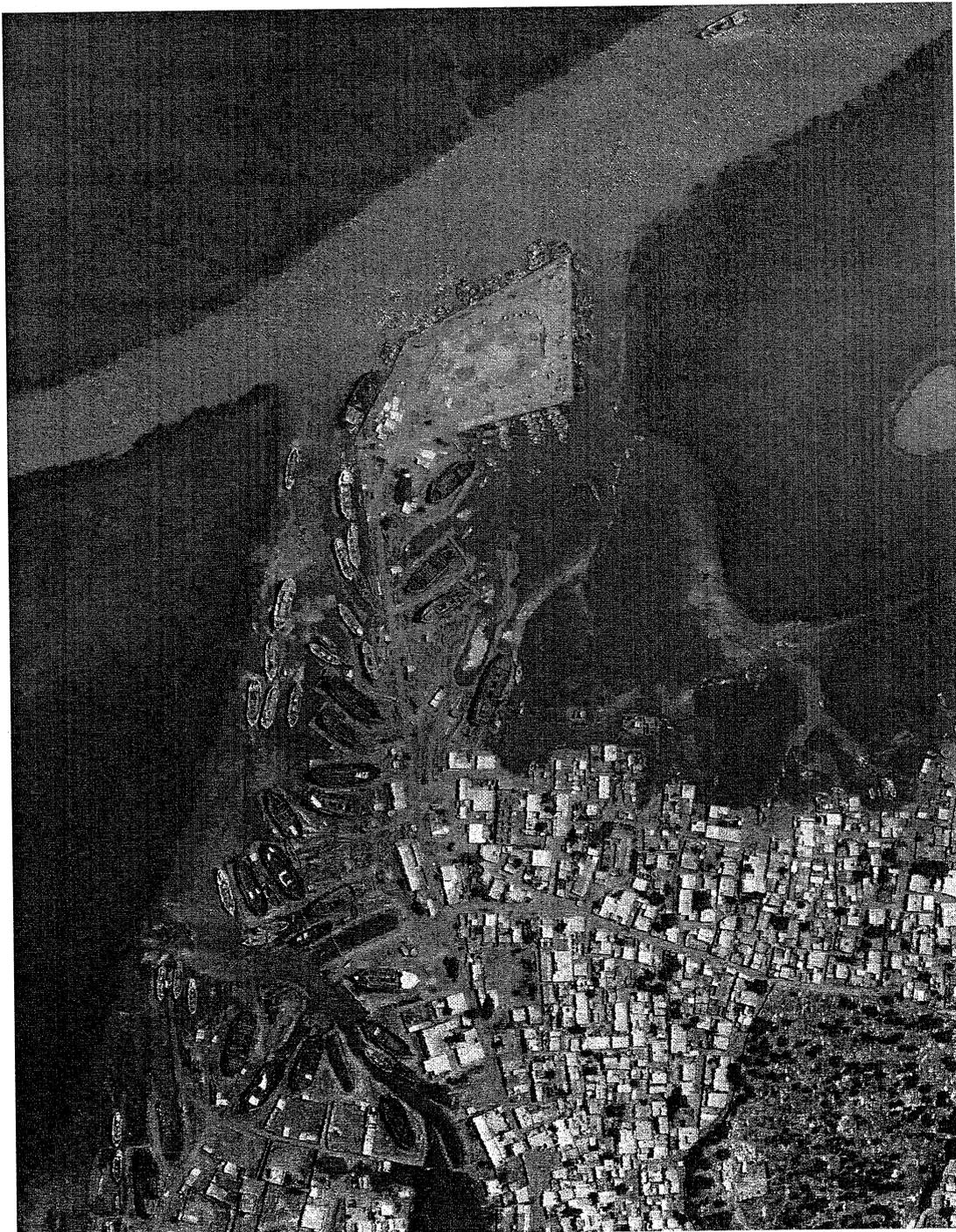
In order to effectively address the issues more specifically in the ToR, the Committee has designed specific sub-tasks for ToRs 1 and 2 as follows:

- i. **Review/ evolve uniform guidelines/ methodology for demarcation of HTL/LTL**
 - a. Standardize the methodology for demarcating HTL, LTL and mapping of CZMPs;
 - b. Standardize the classification system and definitions for inventorying the different features such as tidal wetlands and coastal landforms;
 - c. Use of aerial photographs and satellite imagery (2011) for mapping and
 - d. Development of a coastal database
- ii. **Suggest the format of the report on HTL/LTL demarcation including map of 1:4000 scale with coordinates, land features**
 - a. Achieve uniformity in output with respect to the content, format, legend, colour scheme in the maps;
 - b. Suggest the format of the 'report on HTL/LTL demarcation' with coordinates, land features, and so on;
- iii. **Prescribe the time schedule for demarcation of HTL/LTL**
- iv. **Prescribe the cost for demarcation of HTL/LTL**

1.4 Approach

The Ministry of Environment, Forests & Climate Change (MoEF&CC), Government of India had constituted a committee for the preparation of this manual / guidelines. The committee discussed the objectives in detail and came out with concrete suggestions for the mapping of HTL and LTL. Since the MoEF&CC has already acquired high resolution aerial photography of the entire coastline during 2011-12 as part of the World Bank ICZM Project through the Survey of India (SoI) it will be expeditious to utilise this information for the demarcation of HTL and LTL. Hence the committee recommended that the demarcation of HTL and LTL may be carried out by the National centre for Sustainable Coastal Management (NCSCM) for achieving uniformity and for maintaining accuracy. It was decided that the tidal data, orthophotos and Digital Elevation Model (DEM) available with SoI will be utilised by NCSCM to undertake the demarcation within a limited period. Wherever there are gaps in aerial photographs or if aerial photos are not of good quality; high resolution remote sensing data from Indian satellites

of the same period will be utilised for this purpose. The digital data of HTL and LTL along with base maps covering the whole coast line will be provided by NCSCM to the authorized agencies for the preparation of the CZMPs. Since there should be uniformity in the CZMPs prepared by the authorized agencies the committee recommended that guidelines need to be provided to them for the same along with the HTL and LTL information. Thus this manual provides the methodology for demarcation of the HTL and LTL and preparation of CZMPs by the authorized agencies. A glossary of terms relevant to the preparation of CZMPs is given in Annex - 1.



2. Guidelines/ Methodology for Demarcation of HTL/LTL

2.1. Background

The Coastal Regulation Zone (CRZ) Notification 2011 defines the **High Tide Line** (HTL) as '*the line on the land up to which the highest water line reaches during the spring tide*'. It is pertinent to note that in this definition the HTL depends on 'the spring tide' and the '*highest water line*'. Since high water levels during the spring tides vary over a period of 18.6 years, which is known as a Tidal Epoch, the HTL can be derived from the long-term data. However, it is known that the tides leave their distinct signatures in the form geomorphic formations on the coast and they can be easily recognized in aerial photographs or high-resolution satellite images.

The **Low Tide Line** (LTL) is the lowest water line during the spring tides. However, unlike in the case of HTL the signatures left by the low tides are not easily discernable in aerial photograph and satellite images, it would be expedient to utilize the available long-term tidal data and the DEM generated for the demarcation of LTL.

The CRZ 2011 Notification requires the HTL and LTL to be demarcated in the tidal influenced water bodies like estuaries, creeks, rivers, backwaters, etc. For the upper limit of tidal influence in these water bodies the committee recommended aerial photos/ satellite images to be used along with the approved CZMPs.

The following accuracies (Table 1) shall be achieved for HTL/LTL and for the spatial information in the CZMPs:

Table 1: Accuracies for HTL/LTL and for the spatial information in the CZMPs

S.No.	Map Scale	Planimetric / Positional Accuracy	Thematic / Classification accuracy
1.	1: 25,000	Accuracy for HTL and LTL demarcation: 1m and 2m respectively	90 % classification accuracy at 90 % confidence interval
2.	1: 4,000		90 % classification accuracy at 90 % confidence interval
3.	1: 1,000		NA

Accuracy for CZMP using satellite imagery: 5m

2.2. Demarcation of HTL Using Aerial Photograph

A Memorandum of Understanding was signed in May, 2010 between the Ministry of Environment and Forests (MoEF) and Survey of India (Department of Science and Technology), for mapping, delineation and demarcation of the hazard line along India's coast. The process involves, among others, Digital Aerial Photography at 9cm GSD and photogrammetric surveys for preparation digital terrain model at 0.5m elevation contour map on 1:10,000 scale as base map to delineate the Hazard Line for the entire mainland coast of India up to the maximum width of 7 km from shore line on the landward side. Generation of Ortho photographs have been made at 10 / 30 cm ground spatial distance, for the entire mainland coast. The mainland coast of India is divided into 8 (eight) blocks. The objective is to delineate, map and benchmark the coastal hazard line all along the mainland coast of India under the "Integrated Coastal Zone Management" (ICZM) project.

For the purpose of delineation of High Tide Line these high-resolution aerial photographs (stereo/ ortho images) render themselves highly suitable for direct visual/ on-screen interpretation. For this purpose ortho photos, stereo images and DEMs are already archived in Hyderabad and Bangalore centers of Sol. The following are the steps by which the deliverables of digital photogrammetry such as DEM, ortho image, stereo/ 3D feature datasets, contours and so on are derived from a set of stereo aerial photographs covering a project area:

- a. establishing block control by field GPS surveys and levelling;
- b. aerial triangulation and block adjustment;
- c. DEM collection and processing and contour generation and
- d. ortho image production.

2.2.1 Image Interpretation

The ortho photos shall be used for interpretation of HTL line considering the various geomorphic units and photographic interpretation elements. The basic elements which aid in identifying such objects on aerial photographs are tone, size, shape, texture, pattern, shadow, site and association (Jensen, 2000). The various geomorphic units such as berm crest, cliff, head land, line of permanent vegetation are to be considered while demarcating the HTL line on the shore.

2.3. Demarcation of HTL Using Satellite Imagery

Though the HTL would be demarcated using aerial photographs. However, in areas wherever there are gaps in aerial photographs or if aerial photos are not of good quality; high resolution remote sensing data from Indian satellites of the same period will be utilised for this purpose. Primarily, the Indian Remote Sensing (IRS P6) satellite, Resourcesat 1&2 LISS-IV and Cartosat (1&2) digital data of 2011 are to be used. Salient characteristics are given in Table 2.

Table 2: Salient characteristics of Resourcesat LISS-IV 1&2 and Cartosat 1&2

S. No	Satellite	Sensor	Spectral bands (μm)	Spatial resolution (m)	Swath	Radiometry	Repeat cycle (days)
1	Resourcesat - 1/2	LISS IV (multispectral)	0.52-0.59	5.8	23.9 km MX and 70.3 km in mono mode	Res-1: 7 bits Res-2: 10 bits	5 days sampler
			0.62-0.68				
			0.77-0.86				
2	Cartosat-1	Panchromatic (Fore +26°, Aft -5°)	0.50-0.85	2.5	30 km	10 bits	5 days
3	Cartosat-2	Panchromatic	0.50-0.85	0.8	9.6 km	10 bits	3 days

The LISS IV sensor with multispectral capability in visible and IR bands and ground resolution of 5.8 m gives us spectral and spatial capabilities to interpret the coastal land use/ land cover classes considerably up to Level III and Cartosat 1&2 Panchromatic data with ground resolution up to 2.5 and 0.8 m give details on coastal land use/land cover classes. LISS-IV and PAN merged digital precision products provide required digital enhancement for improved interpretation.

Cloud free satellite data during low tide conditions should be selected so that demarcation of HTL/LTL can be easily carried out. The selection can be done using tide tables available from the Sol. These tide tables enlist predicted time and height at low and high water periods and are published for the entire Indian coast every year. The tide tables, in conjunction with the satellite calendar, can help in selecting the imagery of low-tide conditions, if required tidal conditions for the secondary ports can be calculated.

The reproductive cycle of the vegetation present in the wetland areas should be taken into account for the selection of data. Mangroves are evergreen (perennial) plants, but algal growth on rocks, reefs, and so on is seasonal (occurs from October to February under favourable conditions, and senescence takes place in April). Owing to this, the images of the period from October - March (2010-12) should be selected (Nayak et al., 1991; Joseph, 2003)

Satellite data pre-processing involves georeferencing, ortho-rectification, image fusion and seamless mosaic generation. Georeferencing and image rectification involves removal of random and systematic errors in the image and transforming image to UTM projection system and WGS-84 datum. About 4-5 well-distributed GCPs for each image are used for georeferencing. The image is rectified using GCPs in first-order polynomial transformation with RMSE xy accuracy better than 1 pixel at each checkpoint. The relief distortions are rectified by ortho-rectification of the image using standard procedures available in the image-processing software.

The removal of relief distortion is followed by image fusion, which is used to combine different images with complimentary information into one single composite. The image fusion is required to obtain both high-spatial and high-spectral resolution. Standard PAN-sharpening techniques available in the image-processing software packages are used to merge the co-registered high-resolution panchromatic data with the multispectral image. In case, the coastal region is covered in more than single image, a single seamless mosaic is generated and image interpretations are carried out.

2.3.1 Image Interpretation

Interpretation of satellite image for demarcating HTL and LTL should be carried out using the following steps:

- a. preparation of Image interpretation key;
- b. preliminary interpretation;
- c. modifications and
- d. final interpretation.

Image interpretation is carried out using basic elements of visual interpretation such as tone/colour, size, shape, texture, pattern and association. Using these elements, various wetland/ land use features have to be identified and interpreted based on the image interpretation key (Annex 2). Image interpretation key helps to organize the information present in the image form and guides in arriving at correct identification of unknown objects. The image interpretation key originally developed for mapping coastal wetland coastal land use inventory was suitably modified to include additional coastal features (Nayak et al., 1991, 1992).

2.4. Identification of HTL using geomorphological features in aerial photographs and satellite images

Typical geomorphologic features which are discernible in aerial photographs and satellite images can be used for HTL demarcation; e.g. berms, cliffs, sand dunes, headlands, etc. Other features like line of permanent terrestrial vegetation, upper limit of mangroves and flotsam are indicators of the reach of tide into land. Coastal protection structures such as seawall, embankment, bunds and revetments also limit the intrusion of tide and can be easily detected in images. Such features are time tested to withstand the onslaught of the highest of the high spring tides. Hence, HTL (line of maximum reach of tide into the land during spring tide) can be demarcated with respect to these features and tied to the reference points, as detailed below.

The following signatures/ geomorphologic/ man-made structures (Figs. 1 to 9) used to demarcate the HTL are explained below through suitable illustrations.

Berm Crest: Berm is the nearly-horizontal deposition of materials by wave action at the time of high tide. Some beaches have no berms, others have one or several. HTL will be the most landward crest of the berm (monsoonal) in the case of wide sandy beaches. Since the tidal waters do not reach the coast beyond this landward berm crest, it may be demarcated as the HTL (Fig. 1).

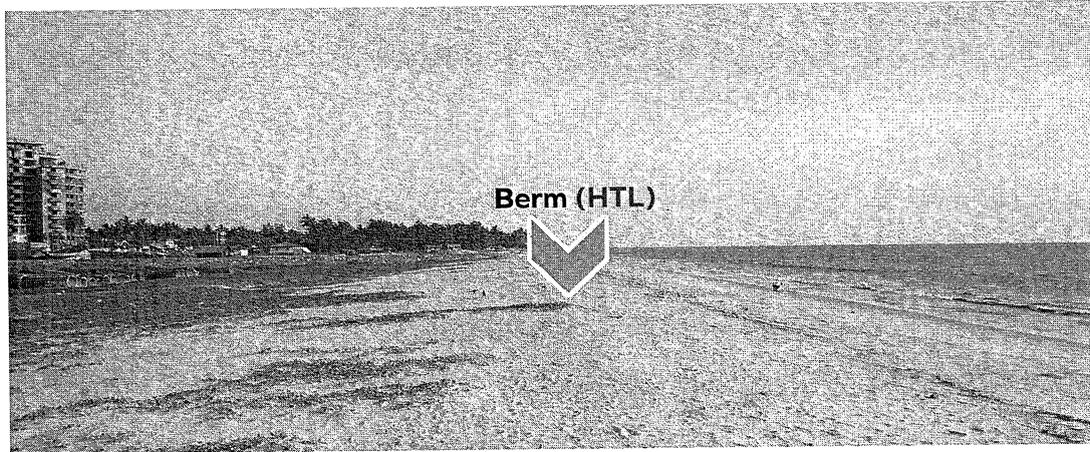


Fig 1: HTL - Landward monsoonal berm crest.

Permanent terrestrial vegetation: There are several locations which do not have any berm or have only one berm, and the beaches undergo severe erosion during the monsoon. In such cases, permanent vegetation, particularly well-grown coconut trees, casuarina plantation or terrestrial shrubs, which are the main vegetation prevalent along the Indian coast, can be used as an indicator. Permanent vegetation is distinctly seen on images and is easy to interpret and its boundary towards sea shall be used as HTL (Fig 2).

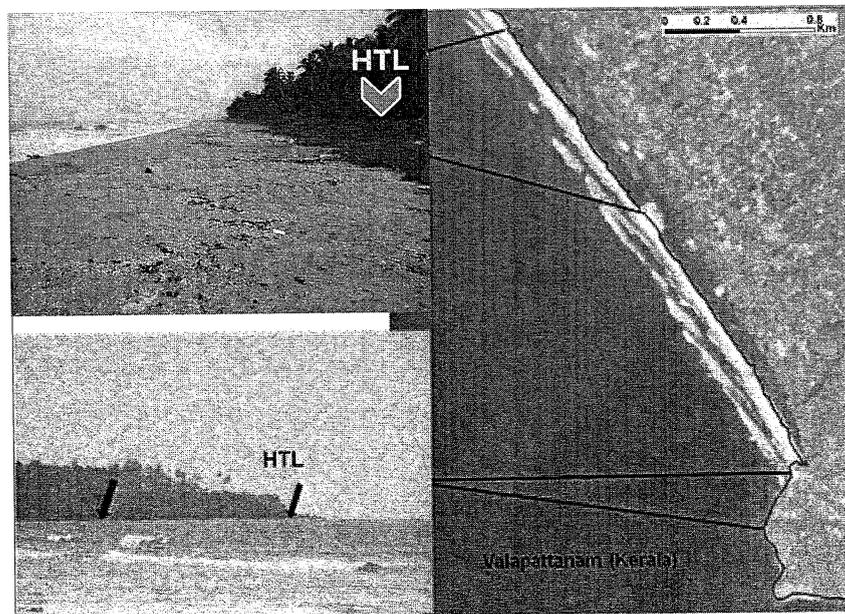


Fig 2: IRS LISS IV image showing parts of the Kerala coast and its field photo. HTL demarcation of rocky cliff at promontory and permanent vegetation along sandy beach

Coastal sand dune / paleo-aeolian 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 (Fig. 3).



Fig. 3: Toe of the dune as HTL

Cliff / Rocky Headlands: At the rock outcrops, headlands, cliffs or other elevated coastal stretches, the sea face is steep and the water is quite deep, so virtually there is no spatial displacement in the water line. This land-water boundary is easy to identify on images. However, at the eroding cliff, the latest position of the toe shall be used (Fig. 4).

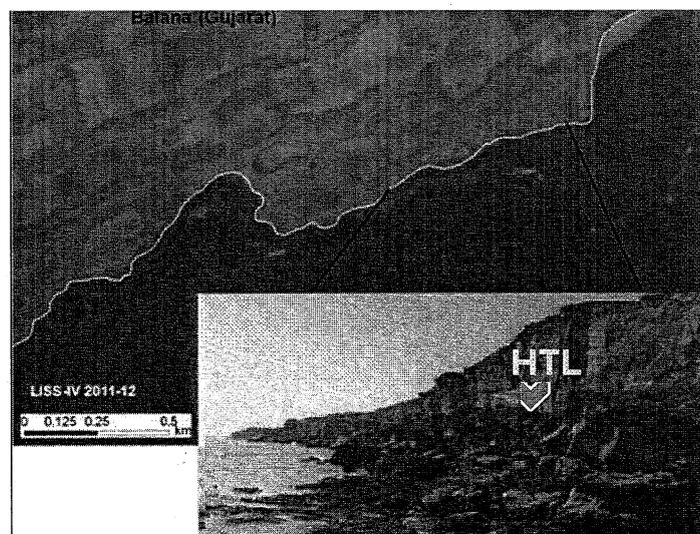


Fig 4: IRS LISS IV image showing parts of the Saurashtra coast with field photo.
Toe of rocky cliff as HTL.

Seawall/ Embankment: In highly erosion-prone areas, generally seawalls/ revetments/ embankments/ bunds are constructed to protect the coast. During the monsoon season, a majority of these areas are devoid of beaches. The waves impinge upon the seawall during the monsoon season, especially during the high tide. Thus, they are 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 side should be considered as the HTL. At places there may be two or three lines of seawalls, in such cases, the landward-most seawall should be considered; however, care should be taken to select a seawall up to which the highest high-tide water reaches. Landward limit of seawall/ embankment is considered as the HTL (Fig. 5).

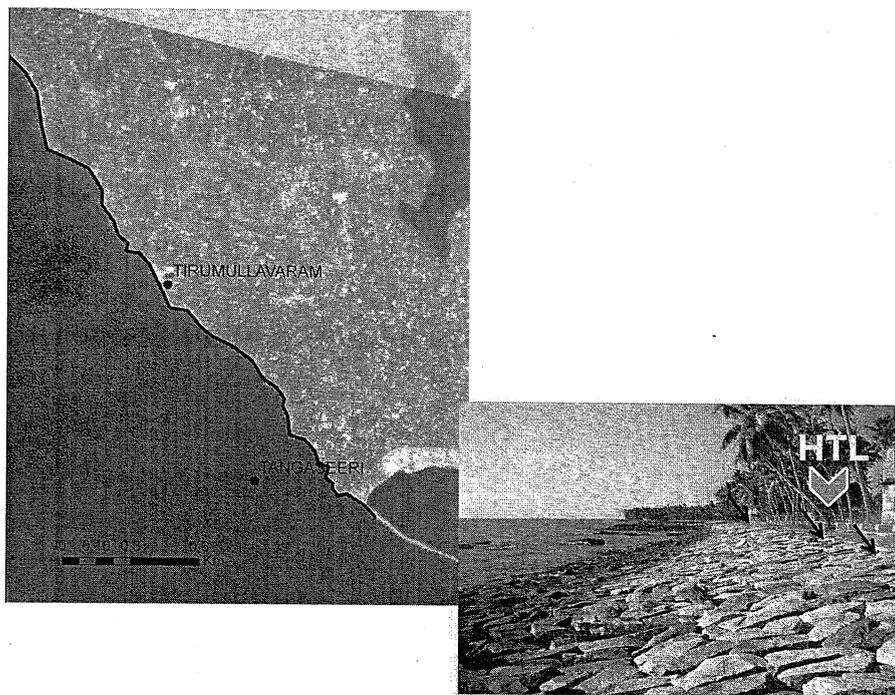


Fig 5: IRSLISS IV image showing parts of the Kerala coast and field photo. HTL depicted landward boundary of seawall.



Flotsam: Floating materials on the sea surface are deposited on the beach forming one or several lines, depending on the seasonal variations of the wave climate and tidal positions. HTL is demarcated by more or less continuous landward deposit of flotsam on the coast (Fig. 6).

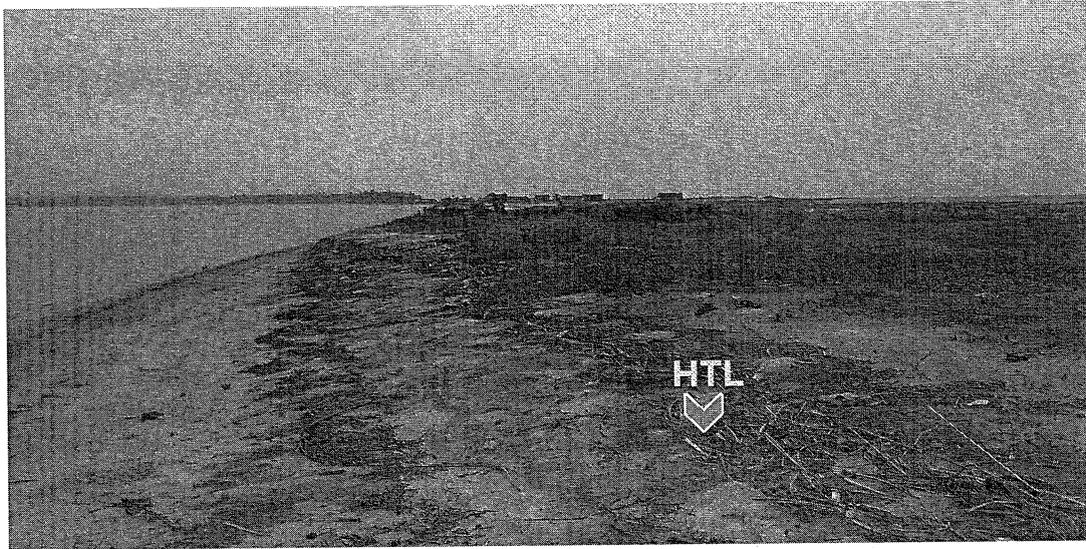


Fig 6: Location of HTL between monsoonal debris and landward of daily debris deposits

Mangroves: These are evergreen, tropical coastal tidal 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 (Fig. 7).



Fig 7: Landward boundary of mangrove as HTL.

Mudflat/ tidal flat: Mudflats/ tidal flats are formed by fine-grained silt and clay in a medium to- large tidal environment. They have a fairly large intertidal zone, fringed by euryhaline vegetation and may or may not be interlaced with individual mangroves or creeklets. In such cases, HTL can be demarcated as the line of permanent stenohaline terrestrial vegetation/ bund/ road/ embankment (Fig. 8).

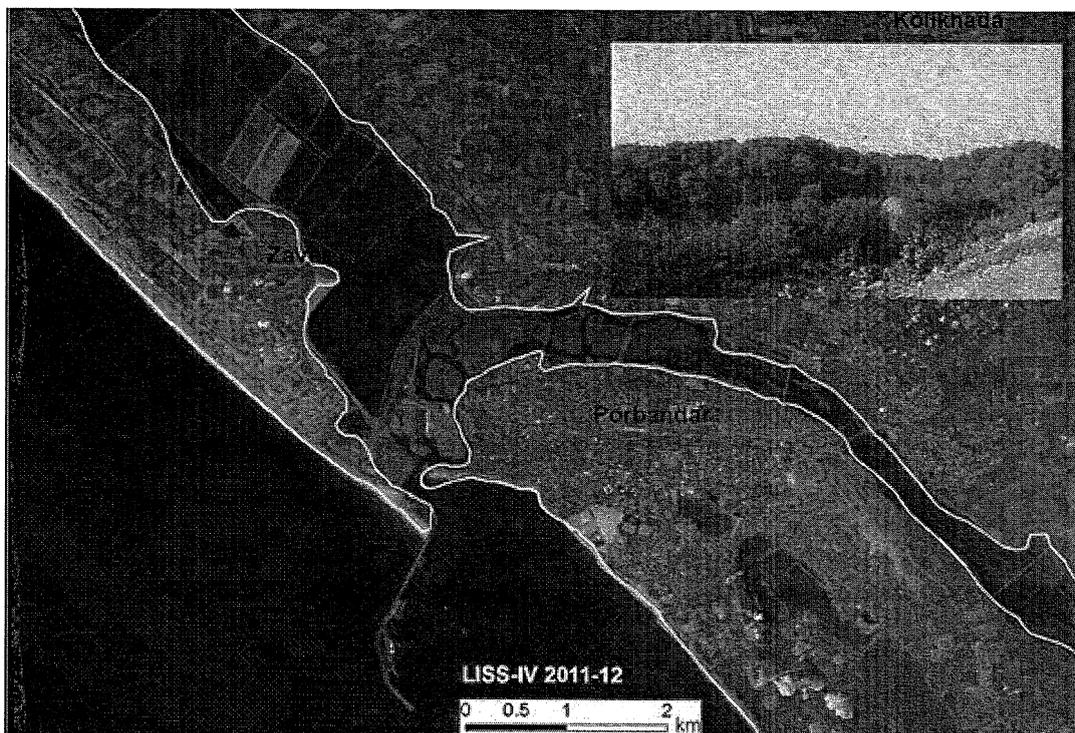


Fig 8: IRS LISS IV image showing parts of the Saurashtra coast, Gujarat and its field photo. HTL demarcation is on the basis of tonal discontinuity, natural salt pans, landward side of mangroves, land-water boundary and boundary of urban built up area towards creek/sea.

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 up to supratidal mudflat and adjoining sandy alluvial plain. Other geomorphic/ land cover features such as marshes, mangroves, fringing corals, saltpans, aquaculture ponds, seaward side of agricultural/ horticulture land and so on are also used for some of the coastal regions.

2.5. Demarcation of LTL using Tide Data and DEM

There are two components involved in demarcating the low tide line:

- The tidal datum, i.e., Low Tide Level and
- The intersection of the tidal datum with the topography of the coast.

India, with a coastline more than 7500 km (including the islands), tidal variations

are not uniform. Hence it is necessary to take these variations into account while demarcating LTL. The tidal datum will be related to topography of the coast using the most recent survey data provided by the Sol in a GIS environment as a Digital Terrain Model (DTM). The topography used in the DTM will be related to the Indian Mean Sea Level (IMSL) by the Sol and thus will coincide with the datum referred to by the tidal data. Intersection of the horizontal plane representing the tidal datum with the DTM can be carried out in a GIS environment to demarcate LTL.

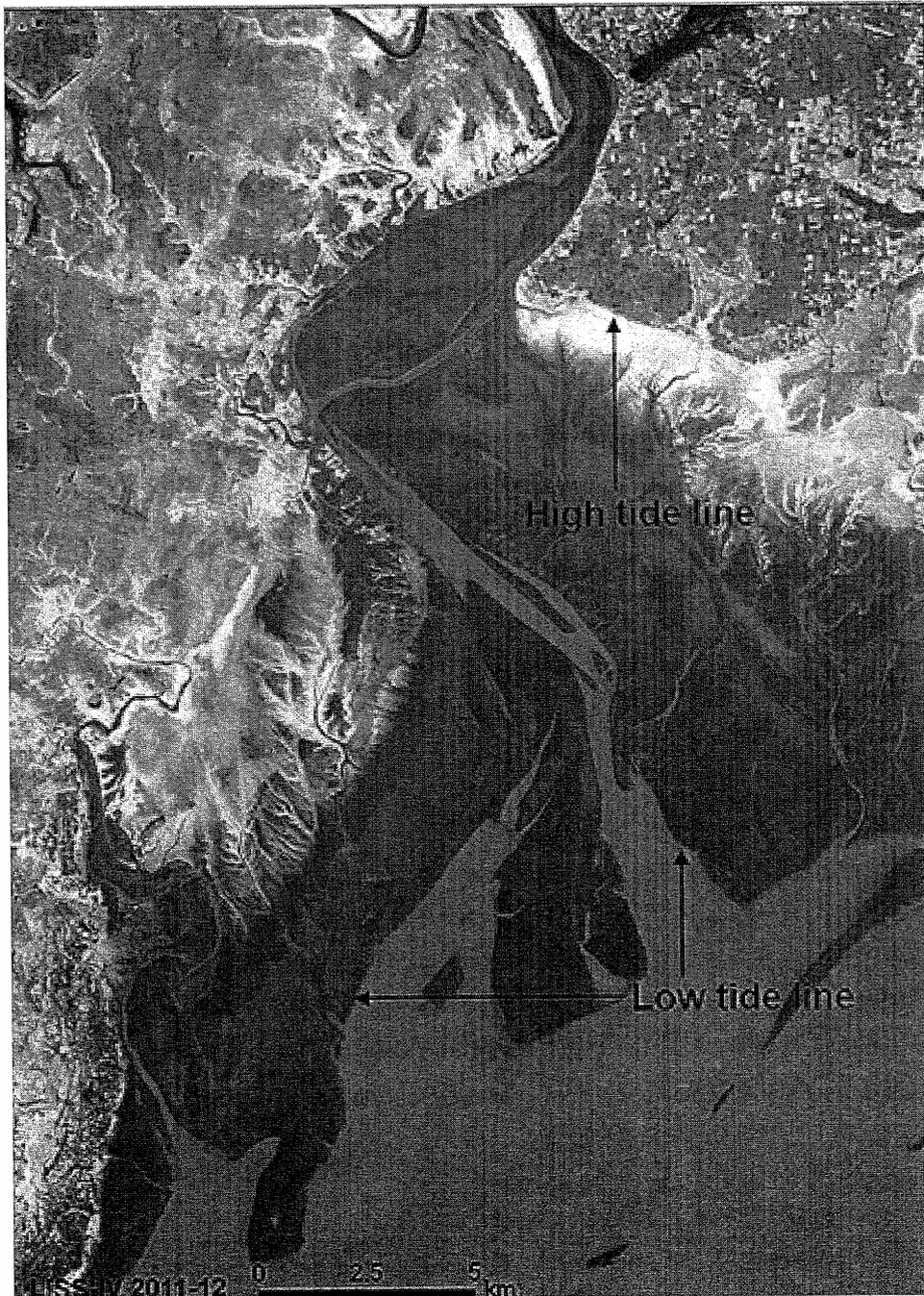


Fig. 9: Low Tide Line (LTL) near Rahtalav, Ahmedabad, Gujarat

The Survey of India has analyzed tidal data for the entire set of 21 primary ports (where tide gauge data for more than 10 years is available are named primary ports) and 131 secondary ports (where tidal data of less than one year is available). Wherever data gaps are there the LTL can be demarcated using high resolution satellite images as illustrated in Fig. 9. In such cases the Low Water Line (LWL) available in the topographical maps is transferred to the base map as such. This could be corrected from the satellite imagery by identifying the shoreline position during fair weather when the beaches have maximum width. The imagery could be selected for a spring tide low. The land (beach)-sea boundary being one of the most distinguishable lines in the imagery, corrections can be done without much difficulty. Inlets (openings of river to the sea) being dynamic features do not conform to their base map positions. All the changes in their position, as obtained from the satellite imagery are to be incorporated. The information obtained during any coastal survey can also be made use of.

2.5.1 Methodology for Calculating Low Tide Level and Demarcation of Low Tide Line (LTL)

Low Tide Levels at transect points at 250 m intervals along the coast will be interpolated using the data from nearest primary/secondary ports on both sides by direct linear interpolation method. Low Tide Level can then be delineated by plotting these levels at the various transect points taken at the above intervals on the high resolution DEM. Tidal data are obtained at centimetre level accuracies. The optimum resolution recommended for the DEM on which the tide levels would be plotted is 0.1 m contour interval. The horizontal accuracy of demarcated LTL should be ± 2 m.

2.6. HTL/LTL provided by NCSCM

A shapefile containing HTL and LTL along with their coordinates will be provided by NCSCM to the authorized agencies for the preparation of CZMPs. As explained above, the data on the position of HTL and LTL at 1 m interval with its coordinates are generated. The shapefiles of HTL and LTL with essential control points will be generated based on Sol 1:25000 OSM (WGS84 datum and UTM projection) toposheets. The authorized agencies will be provided with the following:

- a. HTL and LTL as features
- b. HTL and LTL as coordinates
- c. Uniformly distributed essential image control points with ground photos, description of the control points, latitude / longitude and ellipsoidal height.
- d. Uniformly distributed essential map control points

3. Guidelines/Methodology for the preparation of CZMP / ICRZ / IIMP

3.1. Introduction

CZMPs in 1:25,000 scale have to be prepared by the concerned coastal states/UTs on the base map provided by NCSCM with the information on HTL and LTL for the approval of the MoEF&CC as per the CRZ 2011 Notification. For the local level application CZMPs are to be prepared at the cadastral level. There are occasions where for the project approval detailed project level CZMPs superimposing the project details are also required. These are to be prepared by the agencies authorized by the MoEF&CC. For this purpose the committee recommended that each agency will prepare coastal information system for the state or UT on GIS platform. The above CZMPs will be generated from this information system as and when required.

3.2. Development of a coastal database and information System

Coastal Information System refers to GIS applied to the coastal zone for acquiring, storing, organizing, analysing, modelling and managing geospatial data of the coastal zone. This data will be utilised for the purpose of CZMPs / ICRZ / IIMPs and also may be useful for various other applications related to Integrated Coastal Zone Management (ICZM), particularly in the area of

- i. hazard management
- ii. coastal protection
- iii. fisheries
- iv. aquaculture
- v. tourism
- vi. mining
- vii. ports and harbour

For the preparation of the CZMPs / ICRZ / IIMPs the following essential details are to be inducted in the information system:

- i. NCSCM base layer based on Sol OSM Grid
- ii. HTL/ LTL and CRZ categories
- iii. Coastal land use and land cover and infrastructures (satellite/aerial)
- iv. Administrative Boundaries

- v. Cadastral information
- vi. Ecologically Sensitive Areas (ESA), Geomorphologically Important Zones and Archeologically Important and Heritage Sites and Critically Vulnerable Coastal Areas (CVCA) (satellite/ aerial)
- vii. Hazard Line

In this base layer, which is based on Sol OSM Grid, HTL/LTL details and control points are provided by NCSCM as explained above. The authorized agencies have to create spatial information on coastal land use / land cover and infrastructure from the high-resolution satellite images of 2010-12. The detailed methodology for this is given in the following sections. Additional infrastructure details can also be supplemented from local sources. The information on the administrative boundaries such as district, taluk, village, panchayat, ward, municipality, corporation and such others may be created. The cadastral information such as survey numbers and boundaries, road network, rivers/canal boundary and other infrastructure available has to be generated. The basic approach to be followed for integrating the cadastral information is also explained in this chapter. The information on ESAs, Geomorphologically Important Zones and Archeologically Important and Heritage Sites and CVCA shall be provided by NCSCM and integrated to the system. The hazard line is being mapped by Sol for the whole country and as required in the CRZ Notification has to be obtained from MoEF&CC.

Subsequently in connection with the preparation of ICZMPs whenever required the data on sediment cells, shoreline change and socio-economic data can also be included in the information system. Some activities related to generation of this information are already in progress in NCSCM.

3.3. Definition of Terms

The definitions of the basic terminologies contained in the land use / land cover classification system described in Section 3.4 of this Manual, which is used to generate the coastal information system for CZMPs / ICRZ / IIMPs are given below. Additional terminologies related to coast and in particular CRZ notification are given as glossary in Annex - 1.

Algae: A large and diverse group of autotrophic organisms that range in size from unicellular to gigantic multicellular forms. They contain different types of chlorophyll and obtain food via photosynthetic activities. Unlike plants, they don't have root, stem or leaves. They can move freely or spend life attached to the rocks or sea bottom. Morphologically, they can be classified in couple of level of organisation: colonial, capsoid, coccoid, palmelloid, filamentous and parenchymatous types. Algae can reproduce asexually, via simple cellular division, or sexually, via complex

forms of reproduction. The most complex forms of marine algae are called seaweeds. (<http://thesciencedictionary.org/algae/>)

They are photosynthetic, almost exclusively aquatic plants belonging to thallophytes, including seaweeds. They normally prefer hard substrate (Campbell, 1972)

Algae refer to the exclusively aquatic, photosynthetic plants of Thallophytic division, which grow on hard substrate (like rock, coral reefs, etc.) by means of a holdfast. They lack proper vascular and root systems (Gerlech, 1973). They are non-flowering and their plant body (thaloid) is not differentiated into root, stem and leaves They colonize the reef flat. They are broadly classified into marine and freshwater type.

Bars or Sand Bars: Bars are submerged ridges of detrital sediments which are larger and less regularly spaced than ripple marks (Fairbridge, 1968, p. 55). They are formed typically in shallow epicontinental or shelf waters by waves and currents. They are found singly or together and internally laminated. Bars are named by their positions/offshore bar, bay bar. Bars are generally submerged during high tides. They are generally parallel to the shore. The waves generated by onshore winds blowing from the direction transverse to the shore, when they approach the shore, where the water is relatively shallow on the continental shelf are likely to erode sediments from the sub marine floor. These sediments are built up into ridges or offshore bars above the sea level.

In many cases, probably the bars have been pushed into inland, so that they are merged with the shore zone or beach zone of sand dunes near the shoreline or converted into spits by their appendage at one or the other end to some headland. It may be mentioned here that what have been marked in the maps are mostly sub aqueous ones, while some of them could be sub-aerial also.

Bay: A bay is a well-marked indentation whose penetration is in such proportion to the width of its mouth as to contain land locked waters and constitute more than a mere curvature of the coast. The foregoing provision does not apply to so called "historic" bays. (United Nations Convention on the Law of the Sea, 1982).

Beach: The shore-parallel linear deposition of sand, shingle or gravel by the waves is commonly known as beach. Beach also known as shore is a gently sloping zone of unconsolidated material, typically with a concave profile, that extends landward from the low water line (LWL) to the place where there is a definite change in material or physiographic form or the line of permanent vegetation. Most often beach material is of sand grade (2-1/16 mm size). But sand may be replaced by cobbles, shingles or mud in certain areas (Fairbridge, 1968). The

material of the beach is supplied from the erosion of the headlands and cliffs, the sediments brought by rivers, floods and slope wash of land surface and from the pre-existing beaches and offshore marine floor. Beach material is transported along the shore by longshore drift for long distances. The extent and height of the beach is variable. It varies from a width of a few metres to several kilometres. Beach is the primary protector of the coast that absorbs the impacts of waves and currents.

Bund/embankment: A term used mainly in India and southeast Asia for an artificial embankment, usually of earth or gravel, built along the coastline or the banks of a river or estuary (Glossary – Encyclopaedia of Coastal Science¹).

Coastal 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 downwind from a natural 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.

Coral reef: Corals are exclusively polypoid, marine organisms (which belong to Class: Anthozoa of Phylum: Coelenterata/ Cnidaria), capable of secreting a massive calcareous skeleton. Hermotypic or reef building corals, colonize suitable sea floor substrates in tropical and sub-tropical shallow waters with appropriate ecological conditions (summer maximum mean temperature is 28°C and winter minimum mean temperature generally is above 18°C, colonizing mainly photic depths, salinity 35±2 psu etc (SAC, 2012). Coral reef is defined as 'a complex organogenic framework of calcium carbonate (primarily of corals), which forms a rocky eminence on the sea floor and customarily grows upwards to the tide limit' (Fairbridge, 1968).

Creek: Creek is a small tidal channel of the sea generally perpendicular to the coast through tidal swarms. Sometimes small streams of fresh water drain into the creek in their upstream region.

Estuary: A semi-enclosed body of water which has free connection with the open sea and within which sea water is measurably diluted with freshwater derived from land drainage.

Hazard line: The hazard line for the CRZ purposes is being demarcated by the MoEF&CC through the Sol taking into account tides, waves (water level

fluctuations), sea level rise and shoreline changes as the most landward boundary of the reach of the above-mentioned parameters (CRZ, 2011).

HTL: It is the line on the land up to which the highest water line reaches during the **spring tide** (CRZ, 2011). The highs related to the spring tides vary every time, and there is a cycle which is estimated to be repeating every 18.6 years. Hence, in hydrography and sea surveying, the usually defined high sea level connected with tides is the MHWS which is the average of all spring tides over a period of 18.6 years.

Jetty: On open seacoast, a structure extending into a body of water, and designed to prevent shoaling of a channel by littoral materials and to direct a confines the stream or tidal flow jetties are built at the mouth of a river or tidal inlet to help deeper and stabilize a channel. (Glossary of Geology, AGI).

Lagoon: A lagoon is an elongated body of water lying parallel to the coastline and separated from the open sea by barrier islands or by a narrow strip of land or a sand bank (Fairbridge, 1968). Usually, it lies across from side to side of mouth of streams (estuaries). Lagoons are most common along coasts bordering

lowlands. The entrance of a lagoon is restricted by the narrow tidal inlets through the barrier islands and complex of sand bars which form on both the lagoon side and sea ward side of the inlet.

LTL: It is the line on the land up to which the lowest water line reaches during the spring tide. The lows related to the spring tides vary every time and there is a cycle which is estimated to be repeating every 18.6 years. Hence, in hydrography and sea surveying, the usually defined low sea level connected with tides is the mean low water springs which is the average of all spring tides over a period of 18.6 years.

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.

Mudflat, Tidal: They are wide expanse of fine grained soft mud along the shore. They generally consist of deposits of clay, silt, ooze etc. (King, 1972).

The tidal mudflats are further classified on the basis of tidal influence into three types (Davies, 1972) i.e., i) high tidal mudflats; ii) intertidal mudflats, and iii) sub-tidal mudflats.

High-tide mudflats are more or less flat and near high waterline. Deposition here is caused by material brought during the very highest tides. Intertidal slope areas which are unstable are affected by daily tides. The sub-tidal zone is normally exposed during very low tides.

Reef flat: The nearly flat surface that gets exposed as the summit level of the reef at low tide is known as reef flat. Under low tide condition, water depth on reef flat is extremely shallow, at the most a few meters. Reef flat is commonly composed of loosely cemented coralline sand or coarser reef debris and may consist of shallow pools, irregular gullies, low islands or cays of sand or rubble, vegetated and widely scattered colonies of hardy species of coral.

River: A general term for a natural, freshwater surface stream of considerable volume and generally with a permanent base flow, moving in a defined channel toward a larger river, lake or sea. (NRCS, USDA²).

Rock: Any formation of natural origin that constitutes an integral part of the lithosphere. The naturally occurring material that forms firm, hard, and solid masses." (c-coast glossary - NOAA).

Rock outcrop: It includes residual hills, hillocks and rocky knobs which are exposed in the coastal zone.

Salt pan: An undrained, usually small and shallow, rectangular, man-made depression or hollow normally in the mudflats in which saline water is allowed to accumulate and evaporate leaving a salt deposit is called salt pan.

Sand: The deposition of sand results in various features like beach, coastal dunes, spits and bars. A sediment consisting of rock particles with a diameter between 0.125 and 2.0 mm. Subdivisions are very coarse sand (1-2 mm), coarse sand ($1/2$ or 0.5^{-1} mm), medium sand ($1/4$ or $0.25^{-1/2}$ or 0.5 mm), fine sand ($1/8$ or $0.125^{-1/4}$ or 0.25 mm) and very fine sand ($1/16$ or $0.0625^{-1/8}$ or 0.125 mm). Glossary - Encyclopedia of Coastal Science.

Sea grass /Sea grass bed: Seagrasses are marine flowering plants forming extensive beds or meadows, which can be either monospecific (made up of a single species) or in mixed beds where more than one species coexist. They occur in the infratidal and midtidal zones of shallow and sheltered localities of sea, gulf, bays, backwaters and lagoons. Seagrasses are often found in association with coral reef areas, especially in the Palk Bay (Tamil Nadu) and off the coast of

Maharashtra (Malvan). They form a habitat for rare and endangered animals such as marine turtles and dugongs, apart from economically important species of fish and shellfish.

Advanced flowering plants complete with both vascular and root systems (Gerlech, 1973). The root rhizome system anchors sea grasses on to soft sediments of low energy environment. (Fine sand mixed with silt and shell debris below which lies fine black sediments/sands rich in decomposing organic matter).

Seawall: It is an embankment or wall built parallel to the shore for the protection of the coast against waves or tidal action along a shore or water front.

Shoals: shoals are either submerged ridge, bank or bar producing a shoal, consisting of or covered by sand, mud, gravel or other unconsolidated material (AGI Glossary, 1972, p. 653). These can be within rivers, lakes, lagoons and offshore, and in all cases, beneath water and most often recognizable in aerial photographs and satellite images essentially because of their occurrence at shallow depths.

Shoreland: This covers the area from the tidal flat inland upto the nearest foothill with some features on the coast as well. Categories like delta, paleomudflat, coastal dunes, relict alluvium, paleochannel, terrace, ox-bow lake, reclaimed mudflat and strandline etc. are classified in this category.

Shoreland include coastal watershed and flood-prone areas. Coastal watersheds are those lands that drain directly into coastal water of 0.5 ppt water salinity (Clark, 1977). The term flood-prone area means the lowland and relatively flat area adjoining wetland. The area is subject to a 1% or greater chance of flooding in any given year.

Spit: Spit is a small point or low tongue or narrow embankment of land commonly consisting of sand or gravel deposited by longshore drifting and having one end attached to the mainland and other protruding into open water, usually the sea, across the entrance of a bay or an estuary, a finger like extension of the beach (AGI, Glossary, 1972, 682 p). Spits have been found to lengthen as well as shorten during the course of years. This may be due to the changes in currents. Spits are likely to come into existence when the currents are tangential to a headland and do not pursue the irregularities of the shore (Thornbury, 1969). The spits are curved at the distal ends which probably indicate changes of current directions or dominant monsoonal drift. Several factors influence the curvature of the spit landward resulting in curved/hooked spits.

Tanks: These are artificial impoundments of water used for irrigation.

Water bodies: The areas that are persistently water covered like estuaries, lagoons, back waters, lakes and creeks are included in this category.

Wetland: Wetlands are land transitional between terrestrial and aquatic system where the water table is usually at or near the surface of land is covered by shallow water. The land areas that are periodically (at least once a year) exposed and flooded by salt or brackish water through tides and normal storm action and having mangrove swamps and marshes, they are referred to as "Coastal wetlands" (Cowardin et. al. 1979).

Wetland Non-vegetated: They are normally barren areas of rock or having a cover of mud and sand. They are with or without swamps and without any dominant vegetation types and may have sparse cover of vegetation. Non vegetated wetlands can be sub divided into various types on the basis of nature of material, nature of tidal influence and location.

Wetland Vegetated: Vegetated wetlands are dominated by vegetation. They include mangroves swamps, marsh, algae etc. They can be detected and mapped by seasonal (Winter/Summer) imagery.

3.4. Classification System

The classification system has been designed in order to generate information on CZMPs / ICRZ related to coastal features at the national level. In this classification system, attention has been given to the first and second level of categorization. Level III classes are introduced for detailed mapping. The classification system was developed by SAC (Nayak *et al.*, 1991) and fine-tuned by the committee. The classification system for coastal zone maps is based on the following criteria (Nayak, 2002, 2009):

- i. **Accuracy:** The minimum level of accuracy in identification of wetland categories (at the minimum) should be of the order of 90% at 90% confidence level. At the same time, the level of accuracy for various wetland categories should be more or less same.
- ii. **Repeatability:** Repeatable or repetitive results should be obtainable from one interpreter to another and from one time mapping to another.
- iii. **Applicability:** The classification system should be applicable to extensive areas, i.e. throughout the nation's coastline.
- iv. **Suitability:** The classification system should be suitable for use with different remote sensor data obtained at different times of the year.
- v. **Flexibility:** Effective use of sub-categories that can be obtained from ground surveys or from use of aerial photographs should be possible.

The classification system is given in Table 3.



Table 3: Classification system for coastal land use / land cover database

Level I	Level II	Level III
Agricultural land		
Forest (Nontidal)	Natural	
	Manmade	
Wetlands	Mud/tidal flat	Sub-tidal
		Inter-tidal
		High tidal (with/without salt encrustations)
	Sand	Mud with vegetation
		Beach/ Sand Patch
		Spit
		Sand Bar/ Barrier Island
	Rocks	Shoals
		Sand vegetation
	Coral Reef	Rocky coast
Rock exposure		
Reef flat		
Mangroves	Sand Patch /Beach	
	Coral Lagoon	
	Coralline shelf	
	Dense/sparse/degraded	
Marsh vegetation	(Density wise)	
	(Density wise)	
	(Density wise)	
	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	
	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/	

3.5. Selection of satellite data, processing, image analysis and interpretation

The Indian Remote Sensing (IRS P6) satellite, Resourcesat1&2 LISS-IV and Cartosat (1&2) digital data of 2011 are to be used. Salient characteristics of these images and pre-processing required are given in Section 2.3. Interpretation of satellite image for identifying coastal wetlands/landforms/land use/land cover should be carried out using the following steps:

- a. preparation of Image interpretation key;
- b. preliminary interpretation;
- c. ground truth collection;
- d. modifications and final interpretation;
- e. accuracy estimation

Image interpretation is carried out using basic elements of visual interpretation such as tone/colour, size, shape, texture, pattern and association. Using these elements, various wetland/land use features are to be identified and interpreted based on the image interpretation key given in Annex 2 (modified after Nayak, et al., 1991). Geometrically corrected IRS LISS IV image is to be interpreted using the classification and interpretation key explained above. All doubtful areas are to be identified and listed for ground truth verification. Ground truth data for those doubtful areas, which are accessible in the field, are to be collected. GPS can be used for locating on the ground during fieldwork. The corrected information on the landuse/landcover categories shall be utilised in the information system after verifying classification accuracy explained in the Annex 3 (Nayak, et al., 1991)

3.6. Cadastral data generation and integration

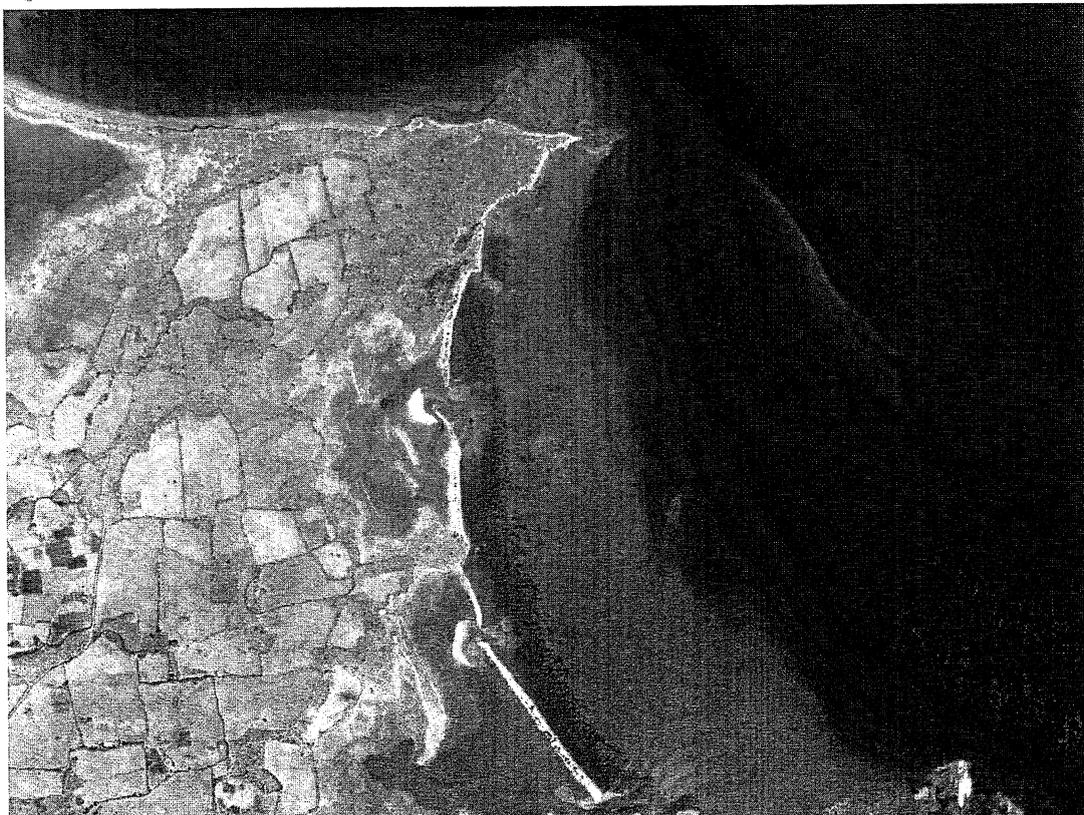
For the preparation of the CZMP at the cadastral level the village cadastres available need to be integrated to the information system. The cadastral maps available in the country are in 1:3960 / 1:7820 or 1: 5000 / 1:10000. The cadastral maps contain survey boundaries and survey numbers of individual plots, the basic infrastructure such as roads, institutions including religious and the like, rivers / canals / ponds and survey stone locations. These maps are prepared in planar coordinate system. These maps are generally not available in digital form and hence the primary task is to digitise the information contain in them.

One of the challenges faced while digitising and integrating cadastral information with the existing normal projection system is related to geo-referencing. In geo-referencing the first step is to transfer the control points from the base map (rectified high resolution imagery) to the cadastre. While transferring the control

points care must be taken for the selection of control points and if required uniformly distributed GCPs can be collected from the field using DGPS. After this the cadastral information can be digitised and brought to the information system.

3.7. CZMP/ ICRZ / IIMP map generation in required scales

Once the information system is equipped with the necessary details enumerated above it can be utilised for the generation of the CZMP / ICRZ / IIMP maps in the required scales. Before doing this, with the available information on HTL the 500m CRZ line on the sea coast and the 100m or width of the water body line for the tidal influenced water bodies can be drawn using GIS. The boundary lines of CRZ I (ESAs, geo-morphologically important zones, archaeological and heritage sites), CRZ II (municipal areas) and CRZ III (rural areas) have to be incorporated. In the case of CRZ III there is a requirement of 200 m line to be drawn on the maps. In the case of mangrove areas of more than 1000 sqm a buffer line of 50m has to be provided around those areas. Other buffer lines may also be drawn on these maps wherever necessary, as specified in the Notification. In the case of A & N islands and Lakshadweep islands wherever IIMP is applicable the development setback line identified by the islands / authorized agencies based on the criteria for the same prescribed in the Notification also need to be demarcated. With this information the final maps in 1:25000, 1:4000 and project scale can be generated. Standard symbols, colours and patterns to be used for mapping are given in Annex 4.



4. Time Schedule, Prescribed Cost and Format of CZMP Report

4.1. Background

As there is a time limit for the demarcation of HTL/LTL and preparation of CZMPs the work on the above activities has to be scheduled as required. Similarly there is a cost involved in the preparation of CZMP by the authorized agencies. It is found by the committee that the different agencies are costing the CZMP preparation differently and hence the committee recommended that there should be uniformity in the costing. Whenever CZMPs are prepared for project level approval a report is also prepared by the agencies and at present it does not have a uniform pattern. Hence the committee suggested that there should be a uniform pattern for the report.

4.2. Prescribed cost for preparation of 1:25000 and 1:4000 scale CZMP maps

The cost is based on the various tasks / components that are involved in preparation of 1: 25,000 / 1: 4000 CZMP maps and are only indicative. Cost of HTL/LTL mapping should be based on the layout/size of the maps. The cost estimate for preparing 1:25000 or 1:4000 scale maps have been worked out and an approximate cost as given below plus actual travel cost and taxes as applicable has been recommended (Table 4). This cost is based on the broad guidelines given below and will be subject to revision depending on wages/tax structure and other factors to be considered from time to time.

Table 4: Prescribed cost for preparation of CZMP maps

S.No.	Tasks involved in producing one 1: 25,000 scale (7 ½' x 7 ½' - 196 sq. km) / 1: 4,000 scale (1 ½' x 1 ½' - 2.7 km X 2.7 km or 7 sq. km approx.) CZMP map	No. of scenes/ sheets/ mandays	Unit cost [per manday/ sheet/scene]
1	Cost of HR satellite image	1 scene	12000
2	Image pre-processing, GCP collection from base map, geo-referencing & image rectification.	1 manday	4000
3	Merging of Cartosat and LISS IV and mosaicing [PAN-sharpening & mosaic generation]	1 manday	4000

S.No.	Tasks involved in producing one 1: 25,000 scale (7 1/2' x 7 1/2' - 196 sq. km) / 1: 4,000 scale (1 1/2' x 1 1/2' - 2.7 km X 2.7 km or 7 sq. km approx.) CZMP map	No. of scenes/ sheets/ mandays	Unit cost [per manday/ sheet/scene]
4	Image interpretation and preparation of coastal GIS / database	10 mandays	4000
5	Geo-referencing cadastral maps, base map preparation, digitization & transfer of village boundaries, survey numbers etc., from the cadastral base map.	2 mandays	4,000
6	Ground truth collection (random points) excluding travel costs	5 mandays	10000
7	Overheads	@10%	
8	Institutional cost	@10%	
9	Service Tax	@12.36 %	
10	Travel expenses	actuals	

4.3. Format of project level CZMP report

The following format is recommended for the preparation of the project level reports:

- i. Introduction
- ii. Geomorphology & topography of the area
- iii. Land use
- iv. Data used
- v. Methodology
- vi. Details of CZMP of the project area
- vii. Summary & conclusions
- viii. Appendix, figures and maps



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ANNEXES

Annex 1: Glossary

Algal ridge: Algal ridge is a prominent, wave resistant, slightly elevated seaward (outer) margin of the reef flat, which rises from the reef edge and culminates into the steep sea-facing side of the reef crest or the reef front zone. This ridge is mainly composed of the calcium carbonate secretions of actively growing calcareous algae. The algal pavement of encrusting coralline algae provides a hard, resistant surface which bears the main force of the breaking waves and reduces their destructive power before they sweep into reef flat behind the rim (Maxwell, 1968). Very little fine sediments are retained on the algal ridge because of their exposure to the breaking waves.

Anthropogenic Feature: An artificial feature on the earth's surface (including those in shallow water), having a characteristic shape and range in composition, composed of unconsolidated earthy, organic materials, artificial materials, or rock, that is the direct result of human manipulation or activities; can be either constructional (e.g., artificial levee) or destructional (e.g., quarry). (NRCS, USDA).

Aquifer: A saturated, permeable geologic unit of sediment or rock that can transmit significant quantities of water under hydraulic gradients (NRCS, USDA).

Atoll: Reef forming islands with a central lagoon. If the lagoon is deep and large, is called oceanic atoll. Atoll with a shallow lagoon is known as shelf atoll. Very small atoll is known as faros atoll.

An atoll is a basic type of coral reef formation, which appears annular or ring-shaped (roughly circular or elliptical or horse-shoe shaped) in its plan view. An atoll is often topped by low sand island(s), enclosing a body of water (i.e. the lagoon) and is surrounded by deep water of the open sea, either oceanic or of continental shelf.

Backshore: The upper or inner, usually dry, zone of the shore or beach, lying between the high-water line of mean spring tides and the upper limit of shore-zone processes; it is acted upon by waves or covered by water only during exceptionally severe storms or unusually high tides. It is essentially horizontal or slopes gently landward, and is divided from the foreshore by the crest of the most seaward berm. (NRCS, USDA).

Backswamp: These are swampy or marshy, depressed areas developed on a flood plain with poor drainage, behind the natural levees of the river. Swamps which are developed on Channel Islands are also considered as backswamp.

Backwater: The water that is retarded, backed up or turned back in the coast from the land towards the sea by the movement of the tide, e.g. the water obtained at high tide to be discharged at low tide. This is always behind (on the landward side) the coast, with varying spread on either side of tidal creeks, depending upon the gradient of the adjoining land.

Backwater Island: Islands found in the backwaters are called backwater islands (CRZ, 2011).

Barrier Beach: A narrow, elongate, coarse-textured, intertidal, sloping landform that is generally parallel with the beach ridge component of a barrier island or spit and adjacent to the ocean (NRCS, USDA)

Barrier reef: reef separated from the coast by a deep channel.

Bathymetry: Science of measuring water depths (usually in the ocean) in order to determine bottom topography. (Ellis 1978) NOAA Shoreline Website Glossary (<http://shoreline.noaa.gov/glossary.html#partg>).

Beach ridge: Beach ridge is a low essentially continuous mound of beach or beach and dune material (sand, gravel, shingle) heaped up by the action of waves and currents on the backshore of a beach beyond the present limit of storm waves or the reach of ordinary tides and occurring singly as one of a series of approximately parallel deposits. The ridges are roughly parallel to the shoreline and represent successive position of an advancing shoreline.

Beach Scarp: An almost vertical slope along the beach caused by wave-induced beach erosion. It may vary in height from a few centimeters to few meters depending on wave action and nature and composition of the beach.

Berm: A nearly horizontal part of the beach or backshore formed by the deposition of material by wave action. Some beaches have no berms, while others have one or several depending on the seasonal variations of the wave climate and tidal positions.

Berm crest: The crest of the berm is berm crest. This is used as a geomorphological feature indicating the HTL in CRZ mapping.

Bioshield: A vegetation belt along the coast that protects from wave and tide action, especially during storms. Coastal bioshields include mangroves, casuarina plantations etc.

Biosphere reserve: Designated resource area featuring multiple use management systems whereby nature protection and uses for farming, forestry, fisheries, etc. are accommodated (note: an international system of such reserves is endorsed and guided by UNESCO). (IOM Glossary)

Brackish water: A dilution of fresh water by the sea; brackish water may be defined as containing between 5 and 30 parts per thousand (ppt) of dissolved solids. (IOM Glossary)

Breakwater: An artificial structure built into the sea, often curved, and designed to impede wave action so as to shelter a harbor or protect a stretch of coastline. The terms jetty and pier are sometimes used as synonyms. Glossary - Encyclopedia of Coastal Science.

Buffer area: A protective, often transitional, area of controlled use-in coastal management, a peripheral zone separating a developed area from a protected natural area.

Cadastral map: Village level survey maps depicting the individual land holdings and the plot boundaries for revenue purposes are available throughout the country. They are generally in 1:3960, 1:5000 or 1:7920 or 1:10,000 or other near scales.

Cliff: Any high, very steep to perpendicular or overhanging face of rock or earth rising above the shore of the sea (Campbell, 1972).

Coast / Coastal Zone: The term coastal zone means the coastal waters, wetlands and adjacent shorelands, strongly influenced by marine water or vice versa. Thus coastal zone includes the nearshore marine waters, islands, beaches, intertidal areas, wetlands and inland area to the limits of the coastal watersheds and flood-prone areas in which natural and man-made activities can affect the coastal waters.

Coastline: It is the water's edge, moving to and fro as the tides rise and fall, so that there is a low-tide shoreline, a mid-tide shoreline, and a high-tide shoreline. The term has been used as a synonym for Shoreline (q.v.), but it is useful to maintain a distinction between the two terms, taking coastline as equivalent to the high-tide shoreline. Where the tidal range is large and the shore profile is gently sloping, there is much variation in the position of the various shorelines.

Coastal Plain: A low, generally broad plain that has as its margin an oceanic shore and its strata horizontal or gently sloping toward the water, and generally represents a strip of recently prograded or emerged sea floor; (NRCS, USDA)

Coastal protection: Works or management operations intended to control coastal erosion. (IOM Glossary).

Coastal 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 downwind from a natural 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.

Coastal watershed: Coastal watersheds are those lands that drain directly into coastal water of 0.5 ppt water salinity (Clark, 1977). The term flood-prone area means the lowland and relatively flat area adjoining wetland. The area is subject to a 1% or greater chance of flooding in any given year

Coastal Zone Management: A governmental process for achieving sustainable use of resources of the coastal zone whereby participation by all affected economic sectors, governmental agencies and non-government organizations is involved; unified or integrated coastal zone management when the management actions of the various stakeholders are formally unified and community participation is emphasized. (IOM Glossary).

Contour Map: a topographic map on which the shape of the land surface is shown by contour lines, the relative spacing of the lines indicating the relative slope of the surface.

Coral: Corals are marine invertebrates in class Anthozoa of phylum Cnidaria (formerly Coelenterata) typically living in compact colonies of many identical individual «polyps». The group includes the important reef builders that inhabit tropical oceans and secrete calcium carbonate to form a hard skeleton. (Wikipedia).

Coral Head: Coral head refers to the massive, rounded/knobby or mushroom shaped protuberance of corals usually formed on the submerged part of a reef.

Coral Knoll: An isolated, rounded, massive, often knobby or mushroom shaped protuberance or growth/structure of coral colonies, which develop locally and upward rather than outward or laterally is commonly termed as coral knolls (Darwin, 1842). These isolated mounds are commonly associated with lagoons of the atoll reefs. The term was first used by Tiddeman (1890) for a reef feature that originated as a knoll. The term was used by Emery in 1948 to differentiate a coral head from a coral pinnacle. The size of knolls may vary from very small (<10 feet across and 3feet high) to several hundred feet or more than a mile but are characterized by the gentle slope (Ladd, 1977).

Coral Pinnacles: Very small, reef forming islands without central lagoon.

Coral reef - Barrier reef: Reef separated from the coast by a deep channel.

Coral reef - Fringing reef: Reef adjacent to the coast or separated by a shallow channel.

Coral reef - Platform reef: Large reef forming islands without central lagoon.

Coral reef - Patch reef: Small, reef forming islands central lagoon.

Coral reef - Coral pinnacles: Very small, reef forming islands without central lagoon.

Coral reef - Atoll: reef forming islands with a central lagoon. If the lagoon is deep and large, is called oceanic atoll. Atoll with a shallow lagoon is known as shelf atoll. Very small atoll is known as faros atoll.

Critically Vulnerable Coastal Areas (CVCA): Critical Vulnerable Coastal Areas (CVCA) are ecological sensitive areas which shall be managed with the involvement of the local coastal communities including the fisher folk (CRZ 2011).

CRZ map: Map depicting the HTL, LTL and the CRZ boundaries.

Cyclone: A warm-core, non-frontal synoptic-scale cyclone, originating over tropical or subtropical waters, with organized deep convection and closed surface wind circulation about a well-defined centre.

(WMO <http://severe.worldweather.wmo.int/tc/cnp/acronyms.html#c>)

A tropical cyclone is a rotational low pressure system in tropics when the central pressure falls by 5 to 6 hPa from the surrounding and maximum sustained wind speed reaches 34 knots (about 62 kmph). It is a vast violent whirl of 150 to 800 km, spiraling around a centre and progressing along the surface of the sea at a rate of 300 to 500 km a day. (IMD: <http://www.imd.gov.in/section/nhac/dynamic/faq/FAQP.htm#q1>)

CZM Plan/ Map: CZM plan/map depicting the HTL, LTL, the CRZ boundaries and all other details required for identifying and classifying the CRZ areas within the respective territories in accordance with the guidelines given in Annexure-I of the CRZ 2011 Notification and for regulating the activities prohibited / permitted in the CRZ Notification.

Datum: For marine applications, a base elevation used as a reference from which to reckon heights or depths. It is called a tidal datum when defined in terms of tidal phenomena and is based on a 19-year tide cycle (in the USA)- the datum is referenced to a fixed point typically known as a bench mark. (IOM Glossary).

Delta: Delta is a product of rapid deposition of stream-borne sediments into relatively still standing bodies of water. The river supplies and deposits sand, silt and other detrital material more rapidly than they can be removed by currents (Fairbridge, 1968). Delta is essentially a land surface through a part of it may be subaqueous. The subaqueous part will be beneath a bay of lagoon or open sea.

Developed area: Developed area refers to areas within the existing municipal limits or in other existing legally designated urban areas which are substantially built-up and have been provided with drainage and approach roads and other infrastructural facilities, such as water supply and sewerage mains. (CRZ 2011).

Dredging: The excavation of sediments and other material from aquatic areas for the purpose of maintaining adequate depths in navigation channels and berthing areas, as well as for other purposes (IOM Glossary).

Ecotourism: Tourist activity attracted to environmental resources and based, usually, on a conservation theme. (IOM Glossary).

EIA: Environmental Impact Assessment: Detailed prediction of the impact of a development project on environment and natural resources with recommendations as to acceptability of the project, need for minimizing/eliminating/offsetting adverse effects, and a management plan to accomplish these countermeasures; a generic term for all types of impact assessment is Environmental Assessment (EA). (IOM Glossary).

Erosion: Transportation of weathered (decomposed) rock material or soil by natural forces. NOAA Shoreline Website Glossary (<http://shoreline.noaa.gov/glossary.html#partg>).

Erosion control Measure: Methods to control coastal erosion such as the use of seawalls, groynes (hard control measures) or beach nourishment, bioshields (soft control measures).

ESA: The areas that are ecologically sensitive and the geomorphological features which play a role in the maintaining the integrity of the coast as listed in the CRZ 2011 Notification. These include mangroves, coral reefs, sand dunes, mudflats, national parks [marine parks, sanctuaries, reserve forests, wildlife habitats and their protected areas under the provisions of Wildlife Protection Act 1972, the Forest (Conservation) Act 1980 or Environment (Protection) Act 1986 including biosphere reserves], salt marshes, turtle nesting grounds, horse-shoe crab habitats, sea grass beds and nesting grounds of birds, Areas or structures of archaeological importance and heritage sites are also grouped under this category for regulatory purposes in the CRZ 2011 Notification.

Eutrophication: The process of enrichment of water which leads to excessive growth of algae and other aquatic plants from the introduction of an oversupply of nutrients such as nitrates or phosphates. (IOM Glossary).

Faros Atoll: Faros atoll is a miniature atoll with a lagoon either forming part of the rim or found in the central lagoon of a much larger atoll reef system.

Flotsam: Floating materials on the sea surface which get deposited on the beach forming one or several lines depending on the seasonal variations of the wave climate and tidal positions are known as flotsam. It is used to identify a line of deposit indicating HTL in coastal mapping (*considered as a coarse method*).

Flood plain: Flood plains represent the surface being constructed by the river. They run parallel to the river, and are subject to periodic overflow of river water.

Foredune: A coastal dune or dune ridge oriented parallel to the shoreline, occurring at the landward margin of the beach, along the shoreward face of a beach ridge, or at the landward limit of the highest tide, and more or less stabilized by vegetation (NRCS, USDA).

Foreshore: The intertidal part of a beach or the part of the shorefront lying between the beach head (for upper limit of wave wash at high tide) and the ordinary low water mark that is ordinarily traversed by the uprush and backrush of the waves as the tides rise and fall. (IOM Glossary).

Foreshore Facilities: The expression "foreshore facilities" means those activities permissible under the CRZ 2011 notification and they require waterfront for their operations such as ports and harbours, jetties, quays, wharves, erosion control measures, breakwaters, pipelines, lighthouses; navigational safety facilities, coastal police stations and the like.

Fracture / fault: The term 'Fracture' as herein used is any linear break or cut in the rocks. It may be joint or a fracture or a fault or a trace or any of these (Rumsey, 1971). Displacement and abrupt truncations of rocks, variations in the foliation trend, long and straight and right-angled off setting stream courses and linear sharp tonal variations are the main criteria for the recognition of the fracture/faults in the imagery.

Fringing reef: Fringing reef is one of the basic types of reef formation, which is adjacent to the continental or island coastline separated by a shallow channel from the mainland. These reefs are generally characterized by rough, table like surfaces exposed at low tide and their seaward edges are marked by sharp steep slopes down to the sea floor. These surfaces may extend over a width of a kilometer or more and show ecological zonation parallel to the shore. They are further classified into Platform, Patch and Pinnacles on the basis of their relative size.

Groundwater: Groundwater is the water located beneath the earth's surface in soil pore spaces and in the fractures of rock formations. A unit of rock or an unconsolidated deposit is called an aquifer when it can yield a usable quantity of water (Wikipedia).

Groyne: A wall built out at right angles from the coastline, intended to intercept drifting beach material. American spelling: groin. Glossary - Encyclopedia of Coastal Science.

Gulf: A relatively large part of an ocean or sea extending far into the land, partly enclosed by an extensive sweep of the coast, and opened to the sea through a strait; the largest of various forms of inlets of the sea. It is usually larger, more enclosed, and more deeply indented than a bay. (NRCS, USDA).

Headland: A high protrusion of the land into the sea, usually cliffed. Glossary - Encyclopedia of Coastal Science / An irregularity of land, especially of considerable height with a steep cliff face, jutting out from the coast into a large body of water (usually the sea or a lake); a bold promontory or a high cape / The high ground flanking a body of water, such as a cove / The steep crag or cliff face of a promontory. (NRCS, USDA).

High Water Mark: A line or mark left upon tide flats, beach, or along shore objects indicating the elevation of the intrusion of high water. The mark may be a line of oil or scum on along shore objects, or a more or less continuous deposit of fine shell or debris on the fore shore or berm. This mark is physical evidence of the general height reached by wave run up at recent high waters. It should not be confused with the mean high water line or mean higher high water line. NOAA Shoreline Website Glossary (<http://shoreline.noaa.gov/glossary.html#partg>).

Hill: A generic term for an elevated area of the land surface, rising at least 30 m (100 ft.) to as much as 300 meters (approx. 1000 ft.) above surrounding lowlands, usually with a nominal summit area relative to bounding slopes, a well-defined, rounded outline and slopes that generally exceed 15 percent. A hill can occur as a single, isolated mass or in a group. A hill can be further specified based on the magnitude of local relief: low hill (30 – 90 m) or high hill (90 – 300 m). Informal distinctions between a hill and a mountain are often arbitrary and dependent on local convention (NRCS, USDA).

Horseshoe crab habitat: Horseshoe crabs (family Limulidae, order Xiphosura or Xiphosurida) are arthropods that live primarily in and around shallow ocean waters on soft sandy or muddy bottoms. They are found only on the eastern coasts of the world. *Tachypleus gigas* (Muller) and *Carcinoscorpius rotundicauda* (Latreille) are found within Indian limits, the former in north-east coast of Odisha (especially Balramgari) and the latter in the Sunderbans area of West Bengal; also reported in some parts of north coastal Andhra Pradesh coast.

ICZM: Integrated coastal zone management (ICZM) is a dynamic, multidisciplinary and iterative process to promote sustainable management of coastal zones. It covers the full cycle of information collection, planning (in its broadest sense), decision making, management and monitoring of implementation. ICZM uses the informed participation and cooperation of all stakeholders to assess the societal goals in a given coastal area, and to take actions towards meeting these objectives. ICZM seeks, over the long-term, to balance environmental, economic, social, cultural and recreational objectives, all within the limits set by natural dynamics. 'Integrated' in ICZM refers to the integration of objectives and also to the integration of the many instruments needed to meet these objectives. It means integration of all relevant policy areas, sectors, and levels of administration. It means integration of the terrestrial and marine components of the target territory, in both time and space. See also: Coastal Zone Management. (IOM Glossary).

IMP: Integrated Management Plan prepared for CVCA keeping in view the conservation and management of mangroves, needs of local communities such as, dispensaries, schools, public rain shelter, community toilets, bridges, roads, jetties, water supply, drainage, sewerage and the impact of sea level rise and other natural disasters (CRZ 2011). The IMPs are prepared in line with the other guidelines for preparation of Coastal Zone Management Plans.

Integrated Coastal Zone Management Plan: See ICZM

Integrated Management Plan: See IMP

Intertidal Zone: land area between HTL and Low Tide Line (hereinafter referred to as the LTL) (CRZ 2011).

Island: An island may be defined as a relatively small body of land surrounded entirely by waters. Islands include backwater islands, channel islands, bay mouth islands (barrier islands) and lake islands.

Khar land: Khar land refers to tidal land which is made cultivable or otherwise beneficial in any matter whatsoever by protecting it, by means of an embankment, from the sea or tidal river, and includes all such land in whatever manner described, whether as khar (in Maharashtra), khazan (in Goa), pokkali (in Kerala), kharepat, gazni or otherwise.

Khazan Land: In Goa: ecosensitive low lying areas influenced by tidal action seasonally used for paddy cultivation.

Land Reclamation: See 'reclaimed land'

Landward monsoon berm: In the case of beaches with multiple berms, the landward berm represents the berm generated due to the monsoonal waves. The crest of it is the landward monsoonal berm crest and is prescribed as one of the geomorphological feature in delineating HTL.

Littoral Drift: The movement of sand and other material by littoral (long shore) currents in a direction parallel to the beach along the shore; usually wind driven. The sedimentary material moved in the littoral zone under the influence of waves and currents. (IOM Glossary).

Littoral Transport: The movement of littoral drift in the littoral zone by waves and currents, including movement parallel to the shore (long-shore transport) and movement perpendicular to the shore (onshore-offshore transport). (IOM Glossary).

Marsh: marshes are grassy wetland areas in standing or slow moving water, usually treeless vegetation, composed of grass and low shrubs (Sedge sods), frequently interspersed with channels or pools of open water (Kennet, 1982). Maritime salt marsh as distinct from inland salt marsh, is essentially confined to the temperate regions of the world (Chapman, 1977).

Muddy Reef Flat: The part or portions of the reef flat where either thin or thick veneer of silt and mud gets deposited on the reef is the muddy reef flat.

Mudflat Paleo: Paleo mudflats are defined as mudflats lying above high tide flats and are formed by marine deposition of the past sea level (Nayak and Sahai, 1984, 1985). These mudflats are related to the phenomenon of regression of the sea. They represent the sites of older mudflats when the sea level was several meters higher than the present.

Mudflat, reclaimed: It is a mudflat which is reclaimed by the construction of bunds across creeks. The bunds stop the inflow of sea water.

Nearshore Zone: A subaqueous marine or lacustrine landform area that generally parallels the shore and extends seaward or lakeward from the low water line to beyond the breaker zone including longshore bars. In the nearshore zone, waves steepen, break, and reform during passage to the beach. Sediment transport occurs both along and perpendicular to the shore via wave and current action (NRCS, USDA).

Non-vegetated wetland: See Wetland, Non-vegetated.

Other Features: Other features include cliffs, high and low waterlines and salt pans.

Other Vegetation: Any vegetation growth which could not be identified under any of the permanent vegetation classes is kept in this category.

Oxbow Lake: The cut-off portion of the meander of a river.

Photogrammetry: Photogrammetry is the "art, science and technology of obtaining reliable information about physical objects and the environment through the process of recording, measuring and interpreting photographic images and patterns of electromagnetic radiant imagery and other phenomena" (American Society of Photogrammetry, 1980). Digital photogrammetry is photogrammetry as applied to digital images that are stored and processed on a computer.

Paleochannel: A paleochannel is an abandoned course of a river. It represents the former levels of the river bed.

Paleomudflat: paleomudflats are defined as mudflats lying above high tide flats and are formed by marine deposition of the past sea level (Nayak and Sahai, 1984, 1985). These mudflats are related to the phenomenon of regression of the sea. They represent the sites of older mudflats when the sea level was several meters higher than the present.

Patch reef: small, reef forming islands central lagoon.

Patch reef is less extensive than a platform reef (generally less than a kilometer) and also without a lagoon. They frequently form a larger reef complex. These mound-like, flat-topped reefs are also known as 'shelf', 'bank', 'table' and 'hummock' reefs.

Pediments: A broad, flat or gently sloping, rock floored erosion surface or plain of low relief, typically developed by sub-aerial agents (including running water) in an arid or semiarid region at the base of an abrupt and receding mountain front, and underlain by bedrock (occasionally by older alluvial deposits) that may be bare but more often partly mantled with a thin and discontinuous veneer of alluvium derived from the upland masses and in transit across the surface (AGI Glossary, 1972, P. 522).

Permanent vegetation: Vegetation on the non-eroding or accreted portion of the coast firmly attached to the substratum and unaffected by the erosional and tidal cycles. Well-grown coconut trees, palms, cashew trees, desert scrubs such as persopis,

and so on found along the Indian coast create a firm seaward vegetative boundary line often used to demarcate the HTL.

Plantations on Sand: These plantations include cassuarina, cashew, eucalyptus commercially grown by the government as well as private organizations all along the coast on beach sands and dunes. The plantations specially on the sandy coast are developed extensively for the protection of the coast from high tide surge.

Platform reef: large reef forming islands without central lagoon.

Platform reef is an extensive/large reef without lagoon having a rounded or ovoid shape in plane, with a flat upper surface, sometimes forming an island with shallow pools. They are found in waters of moderate depth (generally 20-40m) on the continental shelves, sometimes dotted in random manner, but more often in recognizable belts, suggesting an evolution from former (drowned) shorelines. Probably they grew on upward as the sea level continued to rise (Fairbridge, 1968).

Pond: (a) A natural body of standing fresh water occupying a small surface depression, usually smaller than a lake and larger than a pool. (b) A small artificial body of water, used as a source of water. (NRCS, USDA).

Reclaimed land: (a) A land area composed of earthy fill material that has been placed and shaped to approximate natural contours, commonly part of land-reclamation efforts after mining operations. (b) A land area, commonly submerged in its native state, that has been protected by artificial structures (e.g., dikes) and drained for agricultural or other purposes (NRCS, USDA).

Reclaimed mudflat: It is a mudflat which is reclaimed by the construction of bunds across creeks. The bunds stop the inflow of sea water.

Relict alluvium: Relict alluvium comprises patches of high grounds of alluvium, surrounded by mudflats, unaffected by the action of sea-level changes.

Revetment: Sloping structures placed on banks or cliffs in such a way as to absorb the energy of incoming water. (Wikipedia).

Ribbon reef: Ribbon reef is a linear chain of reefs, emergent at low tide, commonly having inwardly curved extremities, and form a festoon along the precipitous edge of the continental shelf.

Rip-rap: A layer of broken rock, cobbles, boulders, or fragments of sufficient size to resist the erosive forces of flowing water and wave action (c-coast glossary - NOAA).

Rolling Plain: A plain with low to gentle undulation with varying altitude of about 25 to 30 m forms this unit: the material composition is almost the same as colluim, with variations in the percentage of gravel and sand, far away from the hills, as this unit enters the 'level plain'. This comparatively finer materials, like sand and silt, are deposited by stream in the lower parts.

Salinity: Salinity is a measure of the concentration of dissolved salts in water. A common way to define salinity values is parts per thousand (ppt). The average salinity of the ocean typically varies from 32 to 37 psu. By definition it is 'the weight in grams (in vacuo) of solids that can be obtained from 1 kg of seawater (also

measured in vacuo), when all of the carbonate has been converted to oxide, the bromine and iodine replaced by chloride, all organic matter oxidized, and the residue dried at 480°C to constant weight'.

Salinity Ingress: Also seawater intrusion. Mainly in the case of groundwater, the intrusion of seawater due to excess withdrawal of groundwater as compared to its recharge from coastal aquifers resulting in increased salinity of groundwater.

Salt marsh: «a flat or gently sloping vegetated wetland in the upper intertidal zone on sheltered parts of the coast (estuaries, inlets, lagoon shores). Often in the form of a depositional terrace, periodically submerged, with halophytic grasses, herbs, and shrubs; dissected by tidal creeks, and may contain enclosed Salt Pans»
Glossary - Encyclopedia of Coastal Science

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.

Sandy reef flat: The lee side/inward part/portions of the reef flat where fine coralline sand and broken molluscan shells get deposited are known as the sanded reef flat. However, the deposition may be migratory in nature and may have a seasonal cover of algae or sea grass. The sand is mainly coralline in nature, consisting of fine sand and broken molluscan shells (Fairbridge, 1968).

Satellite Imagery: Visual representation of energy recorded by remote sensing instruments. These imageries are taken by satellites using various sensors that record electromagnetic energy associated with an environmental phenomenon or feature (IOM glossary).

Scrub: Scrub are low growth or stunted vegetation, growing on poor soil or in semi-arid region.

Sea front: The land area exposed to the sea is the sea front.

Sea level: The level at which the sea stands against the coast, conventionally taken as mean sea level, the arithmetic mean of the calm sea surface (excluding waves and oscillations related to winds and atmospheric pressure variations) measured at hourly intervals over at least 18.6 years. Glossary - Encyclopedia of Coastal Science.

Sea level rise: The long-term rise in the sea level due to global warming is called the sea level rise.

Shallow sandy lagoon: Shallow lagoon with less than 2m depth having carbonate sands white in colour and well aerated (Nayak et. al. 1989).

Shoreline: The water's edge which moves to and fro as the tides rise and fall forms a low tide shoreline, a mid-tide shoreline, and a high tide shoreline. The term has been used as a synonym for coastline (q.v.), but it is useful to maintain a distinction between the two terms, taking coastline as equivalent to the high-tide shoreline.

Where the tidal range is large and the shore profile is gently sloping there is much variation in the position of the various shorelines (C-COAST Glossary - NOAA).

Shoreline change: Change over time of the shoreline due to processes of accretion and erosion. These can be analyzed in a geographic information system (GIS) by measuring differences in past and present shoreline locations. (<http://shoreline.noaa.gov/apps/>).

Silt: A sediment consisting of particles with a diameter between 1/256 (about 0.004) and 1/16 (0.0625) mm. Glossary - Encyclopedia of Coastal Science.

Spring Tide and Neap Tide: The spring tide occurs at or near the time of the new or full moon and rises the highest and falls lowest from the mean sea level. It is an augmented tide range when the sun and the moon are in alignment with the earth, so that their gravitational effects are combined (Glossary - Encyclopedia of Coastal Science). Approximately twice a month, the tidal force due to the sun reinforces that due to the moon. The tide's range is then at its maximum: this is called the spring tide, or just springs. Neap tide occurs when the difference between high and low tide is least; the lowest level of high tide. Neap tide comes twice a month, in the first and third quarters of the moon.

Storm surge: The difference between the actual water level under the influence of a meteorological disturbance (storm tide) and the level which would have been attained in the absence of the meteorological disturbance (i.e. astronomical tide). (WMO <http://severe.worldweather.wmo.int/tc/cnp/acronyms.html#c>)

A rising of the sea as a result of wind and atmospheric pressure changes associated with a storm. Usually associated with cyclones, storm surge can travel long distances inland especially in areas of flat topography such as deltas and low elevation coastal zones.

Strandline: The term strandline is generally preserved for ancient shorelines i.e. shoreline out of reach of present wave action. As an ancient shoreline, strandline refers collectively to the assemblage of various features characteristics of the former coastal area (Fairbridge, 1968).

Substrata material: Refers to the underlying layer or materials or substances, in particular a layer of rock or soil or minerals beneath the surface of the ground.

Subtidal: Continuous submergence of substrate in an estuarine or marine ecosystem; these areas are below the mean low tide. (NRCS, USDA).

Sustainable Development: "Development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987).

Swale: The swale is a long, narrow generally shallow trough like depression between two beach ridges and aligned roughly parallel to the coastline.

Swash Zone: The sloping part of the beach that is alternately covered and uncovered by the uprush of waves, and where longshore movement of water occurs in a zigzag (upslope-downslope) manner. Compare - shoreline (NRCS, USDA).

Terrace: Terrace is an abandoned flood plain and thus represents former levels of the flood plain. They demarcate episodic formation of valley landscapes. They work on previous levels of valley fill and stream plantation. Climatic hydrologic, eustatic and tectonic changes are involved in the interpretation of terraces.

Territorial limit: As defined by the 1982 United Nations Convention on the Law of the Sea, territorial sea is a belt of coastal waters extending at most 12 nautical miles (22.2 km; 13.8 mi) from the baseline (usually the mean low-water mark) of a coastal state. The territorial limit is taken as 12 nautical miles.

Tidal-influenced water bodies: These are the water bodies influenced by tidal effects from sea, in the bays, estuaries, creeks, backwaters, lagoons, connected to the sea or creeks and the like.

Tidal inlet: Any inlet through which water alternately floods landward with the rising tide and ebbs seaward with the falling tide (NRCS, USDA)

Tidal range: The tidal range is the vertical difference between the high tide and the succeeding low tide. Tidal data for coastal areas is published by the national hydrographic service of the country concerned. Tidal data is based on astronomical phenomena and is predictable. Storm force winds blowing from a steady direction for a prolonged time interval combined with low barometric pressure can increase the tidal range, particularly in narrow bays. (Wikipedia) Tidal surge: See 'Storm surge'.

Tide: Tide is the periodic (few hours) rising and falling of the sea surface resulting from gravitational attraction of the moon and sun and other astronomical bodies acting upon the rotating earth as opposed to the wind-generated waves. A tide with one high water and one low water every day is the diurnal tide and the tide with two high and two low waters every day is the semi-diurnal tide.

Tsunami: Long seismic sea waves, generated by a major disturbance within an ocean basin (mainly due to earthquakes, but sometimes explosive volcanic eruptions or submarine landslides). They are of subdued form in deep water, but on entering shallow nearshore areas their height increases greatly, and can exceed 30 m when they break over the coastline. Glossary - Encyclopedia of Coastal Science.

Turtle nesting Grounds: Sea turtles or marine turtles are generally found in waters over continental shelves; females come ashore to sandy beaches 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. Female turtles come ashore on sandy beaches where they were born, dig a nest and bury their eggs in it. After hatching the turtles find their way back to the sea.

Vegetated wetland: See Wetland, vegetated.

Waterfront: With reference to CRZ 2011 Notification, activities that require waterfront for their operations include ports and harbours, jetties, quays,

wharves, erosion control measures, breakwaters, pipelines, lighthouses, navigational safety facilities, coastal police stations and the like.

Wave: The term wave indicates the short-period (few seconds) undulations observed on the sea surface due to the action of wind. Wind-generated wave at the generating area is called 'sea' and that have travelled outside their generating area is called 'swell'.

Undulations produced on the sea surface by disturbance, generally the frictional drag of wind action, but see Giant Waves (q.v.). Wave height is the vertical distance between adjacent crests and troughs, wave length the horizontal distance between successive wave crests, wave period the time taken by successive crests to pass a fixed point, wave steepness the ratio of wave height to wave length, and wave velocity the speed at which a wave crest moves forward. Wave energy is taken as length multiplied by the square root of the height. Glossary - Encyclopedia of Coastal Science.

Wave built terrace: A gently sloping coastal feature at the seaward or lakeward edge of a wave-cut platform, constructed by sediment brought by rivers or drifted along the shore or across the platform and deposited in the deeper water beyond (NRCS, USDA).

Wave-cut platform: A gently sloping surface produced by wave erosion, extending into the sea or lake from the base of the wave-cut cliff. This feature represents both the wave-cut bench and the abrasion platform. (NRCS, USDA).

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Annex 2: Image Interpretation key for CZMP mapping (modified after Nayak, et al., 1991)

Category	Tone	Shape	Texture	Location	Association	Remarks
Agricultural Land	Red	Regular	Smooth	-	Plains	Rectangular pattern of fields are seen in some cases.
Forest						
Natural	Red	Irregular	Rough	-	Hilly terrain	-
Manmade	Dark brownish red/ dark brown	Linear	Smooth	Adjacent to beach, on dunes	Sandy area/dunes	-
Wetlands						
Mudflat						
Sub-tidal Mudflat	Brown/ Black	Irregular	Smooth	Along lowest water line	Low energy coasts	Usually clayey and silty. Vegetation may be present.
Inter tidal Mudflat	Persian green	Irregular	Smooth	In inter-tidal areas	Low energy coasts and quite depositional Areas, where tidal Influence is not too strong.	Made up of fine grained soft mud in inter-tidal zone. Acts as a suitable habitat for mangroves/marsh vegetation & a variety of flora and fauna
High tidal Mudflat	Bluish green	Irregular	Smooth	Near high tide line	-	Does not get inundated by daily tides. Inundated only during monsoon and highest of high tide.
High tidal Mudflat (With Salt Encrustation)	Pale blue to white	Irregular	Rough to smooth	Near high tide line	-	Have crenulated boundary

Category	Tone	Shape	Texture	Location	Association	Remarks
Mudflat with Vegetation	Bluish green / Brown with red tinge/ spots	Irregular	Rough	-	-	-
Sand						
Beach/Sand Patch	White	Linear/ Crescent	Smooth	Adjacent to coast on land-water boundary	Open coast	Made up of fine sand particles; broken mollusca shell, etc.
Spit	White	Linear may be curved at end	Smooth	Part of beach extending in sea	Open coast	Narrow embankment of land consisting of sand/gravel having one end attached to the mainland and other terminating in open water
Sand Bar/ Barrier Island	Whitish	Linear and Narrow	Smooth	Running Parallel to the beach	In shallow epicontinental or shelf water. Found singly or together and internally terminated.	Linear deposite of sand/gravel
Shoal	Brown	Irregular	Smooth	Near the coast or offshore within estuary, delta, gulf, etc.	-	Either submerged ridge, bank or bar producing shoal. Consisting of sand, mud, gravel etc.
Rocks						
Rocky coast	Dark Brown	Narrow strip	Rough	Adjacent to coast	Pocket beach and cliffs	Beach, mudflats are normally absent
Rock exposure	Dark Brown	Irregular	Rough			
Coral Reef						
Coral reef	Greenish, Greenish Blue		Smooth	Near Low Water line	Lagoon in some cases	Can be fringing, atoll, platform or patch reefs

Category	Tone	Shape	Texture	Location	Association	Remarks
Reef Flat	Green, Bluish Green, Reddish Green	Irregular	Smooth	Inward to Algal Ridge	Occurrence of live coral colonies	Exposed during low tides, scattered coral colonies, may be covered with a layer of mud or sand
Sandy Patch / Beach	White, Light Pink if vegetated	Irregular	Smooth	On Reef Flat	Reef flat	Sand depositions
Coral Lagoon	Cyan/ bright blue/ deep blue depending on the depth and substrate	Irregular but mostly circular or elliptical	Smooth	Landward from the reef flat or algal ridge and seaward from the beach	Atoll	A coral reef lagoon is an enclosed body surrounded by reef and island and may have one or more openings into the sea
Coralline Shelf	Blue	Irregular	Smooth	Surrounding Windward Reef Front/ extending southwards or connecting two reefs	Coral Reef	Coralline shelf is the shelf area discernible from satellite data when the waters are clear. It may be 50 m or more in depth and may be with corals
Mangrove	Bright red, if dense, pale red if sparse	Irregular	Rough to Smooth	In the inter-tidal area	Low energy coasts or quiet depositional area. Warm waters.	Grows on substrate of mud/ mudsand composition where the percentage of mud is more. Evergreen.
Marsh vegetation	Dark brown if dense, brown if sparse	Irregular	Smooth	In the inter-tidal/ supra tidal area	Low energy coasts or quite depositional area. Cold waters	Usually occur in temperate countries. Certain salt-tolerant species occur within mangroves or after the mangrove belt. Evergreen.

Category	Tone	Shape	Texture	Location	Association	Remarks
Algae	Pink if dense	Irregular	Smooth	Inter-tidal/ Supra-tidal area	On reefs, rocks and mudflat	Distinct on reef edge, reef flats & rocky coast
Seagrass	Dark Green, Blackish Green, Bluish Green	Irregular	Smooth	In lagoonal waters shore-ward/reef-flat	Sand/sandy mud in low energy environment	They occur as beds/meadows in the lagoonal areas or may inhabit shallow pools in the reef flat.
Water Bodies						
Estuary	Dark blue	Funnel	Smooth	Connection with Sea and land	Rivers draining into Sea	Semienclosed body. Part of the lower river course that is affected by mixing of salt-water and fresh water
Creek	Blue	Meandering	Smooth	Inter-tidal/ Supra-tidal area near high-tide mark	Mudflat	Intricate network of narrow inlets of sea water in tidal flats
Lagoon	Deep blue	Varying Oval, linear etc	Smooth	Offshore / near / Parallel to coast	In between coral reefs lying parallel to coast and separated from open sea by bar/barrier island/Spits, in some area	Lagoons situated in between reef have sandy beach on one end. Opening of the lagoon into sea may be more than one.
Bay	Dark blue	Semicircular	Smooth	On the coast	-	-
Barren Land						
Mining area/ dumps	Light to dark green	Irregular	Rough	Bad land	Ponds	Iron ore, stone quarries

Category	Tone	Shape	Texture	Location	Association	Remarks
Rock outcrops / gullied land	Green blue yellow brownish	Irregular	Very coarse to coarse & medium	Steep hillrocks; hill slope/crest plateau and eroded plains	Barren and exposed rock, stony waste, lateritic out crops, mined areas, and quarried sites	These are exposures of different rock types which occur as massive boulders etc. in hill forest, plateau, plains etc. These are barren and devoid of soil cover and vegetation.
Shoreland						
Saline Area						
Coastal Dune	Red/ white	Linear	Smooth	Behind the beach on land ward side,	Develops in any environment in which loose particles of sand are exposed to sand action. Plantation in some cases.	Detected easily when vegetation is present on it, otherwise the signature of dune gets mixed up with beach. Casuarina plantations may be present.
Reclaimed mudflat	Bluish white	Irregular	Rough	Above High Water Line	Presence of Earthen Bund	Crops are grown on it.
Built Up Land						
Habitation	Dark bluish green in the core & bluish on the periphery	Irregular	Coarse &	Plains, plateaus on hill slopes	Network of road and rail etc.	Built up land can be big or small size settlement industrial structures bldg. or any other artifact physical spread or sprawl along with density of transport network are useful surrogates to classify it as urban or rural land transformation can be noticed around built up land.

Category	Tone	Shape	Texture	Location	Association	Remarks
Habitation with veg.	Dark bluish green in the core & bluish on the periphery and reddish spots	Irregular	Coarse & Mottled	Plains, Plateau, Hill slopes	Same as above	Under regulative order.
Open vacant land	Yellowish greyish	Rectangular	Smooth		Within built up area	-
Transportation						
Roads	Dark grey	Straight with bends	Smooth		Interspersed with pink tone	It has a linear pattern.
Railways	Light grey	Straight	Smooth	-	-	-
Harbour	Light cyan	Irregular	-	On the coast	Breakwater, Berths, Quays etc.	-
Waterways	Dark	Linear	-	-	Reservoirs and Large Water bodies	-
Airport	Light blue	Long straight strips	-	Outskirts of city	Runways	
Other Features						
Aquaculture ponds	Dark black	Rectangular/ square	Smooth	Near high tide limit	Mudflat, Creek	-

Category	Tone	Shape	Texture	Location	Association	Remarks
Reclaimed area	Dark bluish green in the core and bluish on the periphery	Irregular	Coarse & mottled	-	Bunds, embankments	Reclaimed for agriculture, industrial, residential use
Salt Pan	Dark Blue/ light blue/ white	Rectangular/ square	Smooth	Near high tide limit	On the land, Tidal influx is not daily.	Dry salt pan appears white. Shallow depressions in which water collects and evaporates leaving salt deposit.
Embankment		Linear			Across the creeks, near HTL	Constructed to stop salinity ingress, reclamation, etc.
Ponds/lakes	Light blue to dark blue	Regular to irregular	Smooth to mottled	Tanks and lake in lowlands/plains, reservoirs, etc	Amidst cultivated lowlands	These are impounded water bodies on low lands, plains across river/streams
Rivers/streams	Blue/ White	Irregular sinuous	Smooth to medium	Natural rivers /streams (perennial & ephemeral)	Drainage pattern on hill slopes, floodplains, uplandsetc	These are water courses in the channels of different dimensions and lengths.
High water line	White	Linear	Smooth	Located up to the highest sea water influx on land during high tide	Supratidal area	Total discontinuity between wetland and terrestrial system
Low water line	Blue	Linear	Smooth	Located up to level to which water recedes during low tide	Subtidal area	Total discontinuity between wetland and marine waters.

Annex 3: Classification accuracy estimation (modified after Nayak, et al., 1988)

The geographical location of points to be sampled on the ground is commonly determined by any of the following three ways: (i) random sampling, (ii) stratified random sampling and (iii) stratified systematic unaligned sampling. We have followed the random sampling method. In random sampling, the location of the sample point on the ground is chosen using a random number table to select random coordinates for sampling. These coordinates may be geographic (latitude and longitude) or any arbitrary coordinate system, so long as all the areas on ground have an equal probability of being selected.

The classification accuracy is tested on a sample basis assuming a binomial distribution for the probability of success/failure of sample tests. Sample size is decided using look-up tables prepared (Tables 5, 6 and 7), using a binomial probability distribution model (Arnoff, 1982). Each segment was chosen of size 50 x 50 m (2 x 2 mm on 1:25,000 scale). This ensures that there is only one predominant class in each segment to satisfy binomial condition. This segment should be large enough to be easily locatable the ground.

Initially, 300 points are to be selected by pseudo-random sampling and plotted on the final wetland map (the points falling in the sea as well as far inland are to be rejected). The selected points are to be transferred on 1:25,000 scale topographical maps to evaluate approachability of these sites/locations. To reach these areas, approach the nearest village. Cultural features, tomb, water well, and so on are to be used to confirm the position. Wherever no such cultural features are available the topographic/geomorphic information such as creeks, rock outcrops and islands are to be used to reach the sample sites. Before visiting the area, the tidal conditions are to be checked, as the points falling in the intertidal area can be approached only during low tide.

Confusion matrix is then drawn and the accuracy is estimated (Table 5). The confusion matrix scores each observation according to the class in which it has been mapped and the true class as observed on the ground. A sample result for the Maharashtra coast is given in Tables 6 and Table 7

Table 5: Confusion error matrix of coastal wetland/land use mapping (Maharashtra coast)

S. No	Category in Map	Verified on ground										Total omission/Commission	Error	
		1	2	3	4	5	6	7	8	9	10			
1	Mudflat	6											6	
2	Beach		4										4	
3	Mangrove			6	1								7	1
4	Other vegetation				3								3	
5	Dune					3							3	
6	Mining area/ Dumps						2						2	
7	Habitation							4					4	
8	Habitation with vegetation								3				3	
9	Reclaimed mudflat									2			2	
10	Salt pans										2		2	
Total		6	4	6	4	3	2	4	3	2	2	36		1

No. of points checked = 36

No. of failures = 1

Classification accuracy = 89 % at 90 % confidence level.

Table 6: Classification accuracy levels for the confidence level of 90%

Sample	No. of allowed Failures										
Size	0	1	2	3	4	5	6	7	8	9	10
15	85	76	68	61	54	47	40	34	28	23	17
20	89	82	76	70	64	59	53	48	43	38	34
25	91	85	80	75	71	66	62	57	53	49	45
30	93	88	83	79	75	71	68	64	60	57	53
35	94	89	86	82	78	75	72	69	66	62	59
40	94	91	87	84	81	78	75	72	70	67	64
45	95	92	89	86	83	80	78	75	73	70	68
50	95	92	90	87	85	82	80	78	75	73	71

Table 7: Confidence levels for classification accuracy of 85%

Sample	No. of allowed Failures										
Size	0	1	2	3	4	5	6	7	8	9	10
15	91	68	40	18	6	2					
20	96	82	60	35	17	7	2	1			
25	98	91	75	53	32	14	7	3	1		
30	99	95	85	68	48	29	15	30	1		
35	100	98	91	79	62	43	27	14	7	3	1
40	100	99	95	87	74	57	39	24	14	7	3
45	100	99	97	92	83	69	52	36	23	13	7
50	100	100	99	95	89	78	64	48	33	21	12

N = Sample size

X = No. of allowed failures

Annex 4: Standard symbols, colours and patterns to be used for mapping

Sr. No.	Class type	Symbol	Layer 1										Layer 2									
			Type	Color	Red	Green	Blue	Angle	Scale	Type	Color	R	G	B	Width/size	Angle	Scale	Symbol	Width/size	Color		
1	Sub-tidal mudflat		Simple Fill Symbol	Gray 60%	104	104	104	104	0	0	104	104	104	0	0	0	0	18	0	0	12	
2	Inter-tidal mudflat		Simple Fill Symbol	Gray 50%	130	130	130	130	0	0	130	130	130	0	0	0	0	18	0	0	12	
3	High tidal mud flat		Simple Fill Symbol	Gray 60%	104	104	104	104	0	0	104	104	104	0	0	0	0	18	0	0	12	
4	High tidal mud flat with salt encrustation		Simple Fill Symbol	Gray 60%	104	104	104	104	0	0	104	104	104	0	0	0	0	18	0	0	12	
5	Beach/Patch		ESRI Picture Fill Symbol	Foreground: Polka Dotted, Background: Topaz Sand	230	235	235	175	0	0	230	235	235	175	0	0	0	18	0	0	12	
6	Spit		ESRI Picture Fill Symbol	Foreground: Gray 50%, Background: Yucca Yellow	130	130	130	130	0	0	130	130	130	0	0	0	0	18	0	0	12	
7	Barrier/island		Simple Fill Symbol	Topaz Sand	235	235	235	175	0	0	235	235	235	175	0	0	0	18	0	0	12	
8	Shoals		Simple Fill Symbol	Topaz Sand	235	235	235	175	0	0	235	235	235	175	0	0	0	18	0	0	12	
9	Beach ridge		Simple Fill Symbol	Teacote Dust	215	194	158	0	0	0	215	194	158	0	0	0	0	18	0	0	12	
10	Savile		Simple Fill Symbol	Teacote Dust 50%	215	194	158	0	0	0	215	194	158	0	0	0	0	18	0	0	12	
11	Rocky coast		ESRI Picture Fill Symbol	Background: Bunt Umber	156	76	0	0	0	0	156	76	0	0	0	0	0	18	0	0	12	
12	Rock exposure		ESRI Picture Fill Symbol	Foreground: Gray 30%, Background: Bunt Umber	178	178	178	0	0	0	178	178	178	0	0	0	0	18	0	0	12	
13	Mangrove Dense		Simple Fill Symbol	Fir Green	38	115	0	0	0	0	38	115	0	0	0	0	0	18	0	0	12	
14	Mangrove Sparse		Simple Fill Symbol	Medium Apple	85	255	0	0	0	0	85	255	0	0	0	0	0	18	0	0	12	
15	Mangrove degraded		Simple Fill Symbol	Fir Green	38	115	0	0	0	0	38	115	0	0	0	0	0	18	0	0	12	
16	Marsh Vegetation Dense		Simple Fill Symbol	Fir Green	140	137	70	0	0	0	140	137	70	0	0	0	0	18	0	0	12	
17	Marsh Vegetation Sparse		Simple Fill Symbol	Fir Green	140	137	70	0	0	0	140	137	70	0	0	0	0	18	0	0	12	
18	Algae Dense		Simple Fill Symbol	Fir Green	255	223	255	0	0	0	255	223	255	0	0	0	0	22	0	0	10	

Annex 5: Standardization of Methodology for Demarcation of HTL/LTL - Minutes of the Meeting 1 & 2.

Minutes of the 1st Meeting on
Standardization of Methodology for Demarcation of HTL/LTL
held at Ministry of Earth Sciences, New Delhi on 1st July 2014

1. Introduction: In its 27th meeting held in the Ministry of Environment, Forests and Climate Change, New Delhi, on 25.06.2013, the National Coastal Zone Management Authority (NCZMA) constituted a committee under the chairmanship of Dr. Shailesh R Nayak, Secretary, MoES with seven authorized agencies as members and Director, NCSCM as Member Convener to standardize the methodology for demarcation of HTL/LTL so as to make the demarcation procedure uniform. The following is the ToR for the Committee.

- i. Review / Evolve uniform guidelines / methodology for demarcation of HTL/LTL.
- ii. Suggest the format of the report on HTL / LTL demarcation including map of 1: 4,000 scale with Co-ordinates, land features etc.
- iii. Prescribe the Time schedule for demarcation of HTL/LTL.
- iv. Prescribe cost for demarcation of HTL/LTL.

Accordingly, the first meeting of the Committee was held at Prithvi Bhawan, Ministry of Earth Sciences, New Delhi on 01/07/2014, under the Chairmanship of Dr. Shailesh R Nayak, Secretary, MoES. Representatives of the following authorized agencies for demarcation of HTL/LTL attended the meeting.

- i. Space Application Centre (SAC), Ahmedabad
- ii. National Centre for Earth Science Studies (NCESS), Thiruvananthapuram
- iii. Institute for Remote Sensing (IRS), Anna University, Chennai
- iv. Institute of Environmental Studies and Wetland Management (IESWM) Kolkata
- v. National Hydrographic Office (NHO), Dehradun
- vi. National Institute of Oceanography (NIO), Panjim, Goa
- vii. National Institute of Ocean Technology (NIOT), Chennai
- viii. National Centre for Sustainable Coastal Management (NCSCM), MoEF, Chennai

The List of members and invitee who attended the meeting is given in Annex A.

2. Opening Remarks by Chairman: Dr. Shailesh R Nayak, Secretary, MoES Chairman in his opening remarks stated that the methodology for demarcation of HTL/LTL and for preparation of regional level and local level CRZ maps should be based on scientific principles and should be repeatable and verifiable. He emphasized that all the records used and generated in various projects should be maintained for future verification by independent agencies and that the accuracy of the results should invariably be specified in the final reports. He also said that the definition of each parameter should

be understood and agreed upon by all agencies involved and that the period of input data such as Satellite imageries etc, chosen for the work should be in synchronization with the task. He stressed the need for discussions in order to arrive at unanimity and standardization of definitions and classification systems used for landuse, geomorphology and various other parameters.

3. Remarks by Member Convenor: In his remarks, Prof. R. Ramesh, Director NCSCM and Member Convenor of the Committee welcomed Chairman and proposed to the Chair to guide the Committee through the process of standardization of methodologies. He mentioned that NCSCM is also now authorized by MoEF&CC, Government of India for demarcation of HTL/ LTL. NCSCM would coordinate between the various agencies and the MoEFC in developing a comprehensive standardized Manual for demarcation of HTL/ LTL. This manual would be used by the current authorized agencies and various other agencies who will be involved in future for demarcation of HTL/ LTL. Prof. R. Ramesh also explained in detail the various aspects of the ToR of the Committee.

4. Group Discussions: The presentations made by the various agencies are given in Annex B. The members brought out the following points for discussions during their presentation.

4.1. Issues related to CRZ mapping:

a) Definitions and Classification system:

- Definition, location and distribution of sand dunes and mud flats have to be provided by appropriate authorities.
- Defining and identifying 'biologically active mudflats'.
- Distinction between Khar land, Filtration pond & paddy fields.

b) Satellite data – Multi-Resolution, Different time period etc:

- Inaccessible areas like Andaman & Nicobar, Reserved Forest, Defense areas and endangered areas cannot be done by the present methodology.
- In some cases of densely populated built-up areas even 1: 4000 scale map is not interpretable accurately, to suit individual site needs.

c) Ecologically important areas such as mangroves etc:

- Some of the ecologically sensitive areas such as turtle nesting sites have to be provided by the authorized agencies.
- Categorization for any mangrove plantation/ sapling areas.
- Information on 'Turtle nesting grounds' and Horse shoe crab habitats, biologically active mud flats & salt marshes is necessary.

d) Boundaries of CRZ with respect to features – Classification of CRZ I, II, III, IV & V:

- There are no guidelines available for fixing the mouth of the Creek / Bay / backwaters and it leads to confusion.
- In case of Kerala and Maharashtra, it is observed that low lying areas

are protected by bunds constructed prior to 1991. However, due to damage of bunds, salt water intrusion occurs in low lying areas causing mangroves to grow. In the same way Holding ponds meant for storm water management also suffer incursion of sea water because of damage to the bunds.

- Change of shoreline by natural and manmade sources has to be critically addressed.
 - Within a legally designated urban body, there can be patches of dense built-up area, vacant plots/area, sparse or undeveloped area. Will such different land use plots be marked as different CRZ categories such as CRZ-II or CRZ -III? What will be the threshold of "Substantially built up" quantitatively? Dichotomy in interpreting ratio of built up to that of total plots > 50% = CRZ- II due to scale factor.
 - In case different CRZ categories may be delineated, what may be the minimum area acceptable for a separate CRZ categories within an urban body or if there are other basis for classification??
 - For a built-up unit lying partly within a designated urban body what will be the basis of CRZ zonation?
 - Boundary between the sea and creek, estuary, backwater, bay, river.
 - Salt pans : any distinction between those with natural tidal flow & artificially pumped ?
- e) Tidal levels and their transfer, width of water bodies:**
- Tide levels are currently available only for major / selected minor ports. Because of this the high and low tide levels are interpolated which affect the accuracy.
 - Guideline does not stipulate the frequency of HTL / LTL sampling during field verification.
 - Storm surges during extreme events are not considered as HTL.
 - Width of the water body: whether it is the distance between the HTL at the bank to the HTL on the opposite bank or the width between the LTL at the bank to the LTL on the opposite side.
- f) Period related issues - 1991 or 2011 etc:**
- Guideline does not stipulate the conditions for mangrove mapping. Whether mangrove map will be as on 1991 or 2011 or present day?
 - 50 m buffers for mangroves on the landward side which has got road as in 1991 to be drawn or not to be drawn?
- g) Geo-referencing, Benchmark, etc:**
- Geo-referencing of village maps is done using Satellite imagery/GCP due to non-availability of village bi-junction / tri-junction pillars.
 - The resolution of previous data (1:25,000) and present data (1:4000, 1:25,000) are different, making it difficult to superimpose and compare.
 - Non-availability of Bench marks along the coast and inland creeks causes hardship in transferring high tide levels. Hence geomorphology and ground evidences are only used to mark HTL.

h) Measurement of Salinity:

- Salinity level is dynamic even across the day due to changing rainfall conditions and mixing of domestic and industrial waste disposal. Salinity sampling for all the creeks at the same time is not possible.
- In Kerala fresh water dilutes the Salinity level which makes it difficult to estimate the Tidal influence.
- Treating / lining structural changes in the storm water drainage channels draining into the creeks bring about serious changes in Salinity levels.

5. Standardization of Methodology:

- **Definitions & Classification system:** Standard definitions of all important parameters/ terms (e.g. Bay, estuary, creeks etc) will have to be provided as definitions and as Glossary in the Manual, for the benefit of all authorised agencies.
- **Coastal Information System:**
 - » Database should be prepared first, irrespective of scale and checked for accuracy and final maps should be prepared in the required scales.
 - » Satellite images should also be a part of the database in all projects and images from Bhuvan is also recommended for use.
- **Field Surveys - Determining Upper Limit of Tidal Influenced Water Bodies:** Standardized methodology will be provided in the Manual for measurement of salinity, from sampling to Analysis, in order to maintain methodological consistencies among all authorised agencies.
- **CRZ Survey Report Format:** The Manual prepared by SAC / International symbols and legends available in IHO publication may be used for consistency.
- **Accuracy Assessment:**
 - » For estimation of Total horizontal and vertical uncertainties, Special Publication #44, 5th edition of the IHO Publication may be referred.
 - » Quality check of all output should be done and accuracy numbers should invariably be mentioned as part of final reports.
- **Identifying geo-morphological features:**
 - » All natural salt pans should be taken as Inter-tidal zone, except artificially pumped salt pans, such as those in Tuticorin District, Tamil Nadu.
 - » Bunds constructed across tidally influenced water bodies such as rivers, creeks etc before the year 1991 should be taken as the HTL and bunds constructed after 1991 should not be taken as the HTL. HTL as in the years 1991 and 2011 should be surveyed and changes in HTL with respect to 1991 and 2011, if any, should be indicated with justifications.
 - » Ecological sites / turtle breeding sites, sand dunes and mud flats, etc are being mapped by NCSCM under the ICZM project and will be provided to the authorised agencies.
 - » Width of rivers and water bodies should be taken from HTL to HTL (and not LTL to LTL which refers to CRZ in water bodies).

- **Cost factors for preparing 1:25,000 & 1:4000 scale HTL/ LTL maps:**
Cost of HTL/ LTL mapping should be based on the layout/ size of maps. Follow the standardised pattern of Sol for charging for various maps (e.g. 7 ½' x 7 ½' for 1: 25,000 maps). Exact costs need to be worked out collectively.

6. Decisions taken:

- i. The next meeting will be tentatively either on 1st of August 2014 or around 11th of August 2014.
- ii. A Sub- Committee consisting of Dr. M. Baba, Dr. Anjali Bhuguna, Dr. A.S. Rajawat, SAC, along with a team from NCSCM will prepare the first draft of the Manual by 15th July 2014 and submit to the Chairman.
- iii. Member Convenor can also request the representatives from authorized agencies to contribute to the manual as deemed necessary for specific aspects.
- iv. This draft Manual will be finalized in the next meeting of the full Committee in August 2014.

7. The meeting ended thanking the Chairman.

Annex A

List of Members & Invitees who attended the first meeting on Standardization of Methodology for Demarcation of HTL/LTL held on 1st July 2014 at 11:00 am in the Conference room 114, Prithvi Bhawan, MoES, New Delhi

Chairman: Dr. Shailesh R Nayak, Secretary, Ministry of Earth Sciences, New Delhi.

Member Convener: Prof. R. Ramesh, Director National Centre for Sustainable Coastal Management, MoEF&CC, Government of India, Anna University Campus, Chennai.

Members / Representatives of Authorized Agencies:

- i. Dr. A S Rajawat Head, Geosciences Division, SAC, Ahmedabad.
- ii. Dr. K V Thomas, Head Marine Sciences Division, NCESS Trivandrum.
- iii. Dr. S S Ramakrishnan, Director IRS, Anna University, Chennai.
- iv. Dr. M A Atmanand, Director, NIOT, Chennai.
- v. Dr. Debajyoti Bhowmik IESWM, Kolkata.
- vi. Dr. A K Chaubey, NIO, Goa.
- vii. Cdr Anirban Banerjee, NHO, , New Delhi

Invitees:

- i. Dr. M. Baba, Former Director, NCESS, Thiruvananthapuram.
- ii. Dr. Anjali Bhaguna, Environment Consultant, Ahmedabad.
- iii. Dr. A.B. Harapanahalli, National Project Director, SICOM, MoEFC, New Delhi.
- iv. Dr. A. Senthil Vel, Additional Project Director, SICOM, MoEFC, New Delhi.
- v. Dr. Purvaja Ramachandran, Scientist-G, NCSCM, MoEFC, Chennai.
- vi. Mr. M. Dharma Raj, Senior Consultant, NCSCM, Chennai.
- vii. Dr. R. Vidhya, Professor, IRS, Chennai.
- viii. Dr. K. Srinivasaraju, Professor, IRS, Chennai.
- ix. Dr. Alak Haldar, IESWM, Kolkata.

Annex B

Presentation by Authorized agencies:

1. **Presentation by SAC Ahmedabad:** In his presentation, Dr. A S Rajawat Head, Geosciences Division, SAC, Ahmedabad highlighted the following aspects concerning the methodology being followed by SAC.
 - SAC had undertaken Pilot studies to determine the methodology for mapping the hazard Line, which is the union / most landward of flood and erosion lines
 - Satellite imagery selected at Low tide time (using Tide tables) is used for demarcation of LTL
 - Season of satellite data is from December to February
 - LISS IV merged with Cartosat data is used
 - IKONOS data is used for 1: 4000 scale mapping in grids of 2' 30" X 2' 30"
 - Band 4 of LISS IV in which land-water boundary is distinct is used, especially for LTL
 - SAC LULC classification which is specific to the coastal areas is used
 - On-screen interpretation is done using interpretation keys
2. **Presentation by National Centre for Earth Science Studies (NCESS), Thiruvananthapuram:** Dr. K V Thomas, Head, Marine Sciences Division, NCESS Thiruvananthapuram, detailed the following points regarding the methodology being followed by NCESS.
 - i. HTL is normally defined as the water level at which the highest tide intersects with the vertical plane. But according to the functional definition given by MoEF, HTL is *"the line on the land up to which the highest waterline reaches during the spring tide"*, which gives the combined effect of spring tide, wave set up and seasonal shoreline oscillations. LTL may be defined as the conventional LLWL.
 - ii. Different approaches to demarcate HTL:
 - a. Tide level Projection;
 - b. Using Morphological Signatures
 - Field method; b. Satellite data.
 - iii. NCESS follows the method which uses Morphological signatures. The HTL is identified using morphological indicators such as landward (monsoonal) berm crest, seawalls/ revetments/ embankments, permanent vegetation line, tidal flats, mudflats, rocks, headlands and cliffs. Position of HTL is fixed with respect to identified reference points (GCPs) on the land, at intervals of about 1 km alongshore which is dependent on coastal morphology. In the cases of estuaries, creeks, backwaters, etc, the upstream limit of tidal influence is determined based on whether salinity is 5 ppt or more. Salinity measurements and indicators like tidal barrages, presence of mangroves, tidal flats and reversal of flow are also used to identify the limit of tidal influence.
 - iv. Cadastral/ Revenue maps are geo-referenced with WGS 84 datum and UTM projection using GPS measured GCPs' at identified plot junctions, survey stones and other ground features identifiable both on the map

and ground. Signature of the nearest HTL is identified and observed using GPS with reference to GCP and transferred to the map in GIS platform. Information from Satellite images are used to verify the data collected and also to supplement the data wherever the area is not approachable. With the availability of precision GPS and high resolution Satellite data like Quick bird, IKONOS, Cartosat and Resource Sat (P6) it is now possible to get an accuracy of less than 1 m for the demarcation of HTL / LTL.

- v. LTL Delineation: Information on LTL from Hydrographic charts and Satellite imagery is used. Seaward limit of beach / tidal flat during fair weather season when the beaches / intertidal zone will have the maximum width is identified from imagery.
- vi. CRZ Map in 1: 25,000 scale: For policy decisions, CRZ maps in 1: 25,000 scale are sufficient. These are prepared with Sol Toposheet as base map. HTL and other morphological features are extracted from imageries supported with maximum ground truthing. In areas having canopy cover like coconut, field mapping is more relied upon for 1:25000 CRZ map.

3. Presentation by NIOT, Chennai: In his presentation, Dr. M.A. Atmanand, Director, NIOT, Chennai discussed the following points on the methodology followed at NIOT.

- i. Steps involved:
 - a. Tracing the contour corresponding to the High Tide Level on the ground.
 - b. Integrating the contour of HTL onto the chart containing cadastral data and project details.
- ii. Tracing the contour of HTL on the ground:
 - Nearest Sol/other Bench mark (MSL) is identified.
 - Using this BM another TBM is established at the site close to the beach.
 - The tidal characteristics at the site are ascertained from the largest scale NHO charts.
 - MSL ~ CD indicates the amplitude of the tide at the site (e.g. Chennai 1.2 m).
 - Taking TBM as the reference, beach profiling is done at 50 m interval, from lowest possible level to HTL + 2 m, using RTK GPS.
 - A contour chart is prepared for the coverage area in which contours corresponding to HTL / LTL are marked.
- iii. Integrating the HTL contours and the Cadastral details:
 - Cadastral map is geo-coded using prominent features such as road junctions or known structures as control points.
 - HTL contour is superimposed on the map.
 - From NHO chart 0 depth contour is digitized and added in the Cadastral map.

4. Presentation by Institute for Remote Sensing (IRS), Anna University, Chennai: In his presentation, Dr. S S Ramakrishnan, Director IRS brought out the following points regarding the methodology being followed by IRS.

i. Methodology:

- Collection of Cadastral & ward maps, Geo-referencing & Digitization.
- Extraction of HHT and LLT from Sol Tide tables for ports and interpolation for places between the ports.
- Mapping Coastal Geomorphology from Satellite Imagery.
- Transfer of levels from the Sol GTS bench marks to the base point network.
- Simulation of HHTL and LLTL on the ground using DGPS at 250 m intervals.
- This has helped to identify the distance along the coastal zone and creeks, rivers and canals up to which the Tidal waters would have inundated during HHT.
- Validation of HTL & LTL with the help of indicators like permanent vegetation, geomorphic features like dunes, berms, cliffs available on the ground as well as in the Satellite data.
- Processing of surveyed information in ArcGIS.
- Quality assessment.

5. Presentation by Institute of Environmental Studies and Wetland Management (IESWM), Kolkata: Tide line(HTL / LTL) Mapping Approach Methodology - IESWM, Kolkata: In his presentation, Dr. Debajyoti Bhowmik explained the following regarding the methodology being followed by IESWM.

For tide line mapping, the approach of IESWM involves preparing digital data base in GIS platform and preparing pre-field map based on satellite image interpretation. Necessary Ground Truth Verification and validation are conducted during field work and accordingly updation is carried out as post-processing in the RS&GIS laboratory for analysis, cartographic layout and report generation.

Delineation of Tide lines during field normally involve assessment of combination of indicators including but not limited to soils, vegetation, hydrology and other physical indicators.

- **Step 1:** Collection of Data (Cadastral Map, Topographic map, Satellite Image, other relevant information).
- **Step 2:** Geo rectification of Cadastral Maps and Satellite imagery (WGS-84 & UTM projection), Digital Image Processing (DIP)
- **Step 3:** Preparation of field map based on Image Interpretation and existing data.
- **Step 4:** Field Survey and random LU/LC ground verification around the 7km radius from the AOI.
- **Step 5:** Delineation of High Tide Line using GPS and ground verified indicators (scum line, wrack line, soil, vegetation, etc).

- **Step 6:** Low Tide Line is primarily delineated based on satellite image interpretation based on digital image processing where land-water boundary is extracted. Cloud free satellite data of low tide time based on tide table are indented for procurement if available.
- **Step 7:** Mapping of ecologically sensitive areas if present such as mangroves, sand dunes; and turtle breeding sites, archaeological sites, marsh/salt flats and other features are delineated or validated using GPS and pre-field map during filed work.
- **Step 8:** Superimposition of HTL, LTL, ecologically sensitive areas if any, buffer lines (50m, 100m, 200m, 500m etc.) along the coast and tidal influenced water bodies are transferred onto cadastral maps at 1:4000.
- **Step 9:** Classification of CRZ as per Notification using colour codes and symbols developed by the institute for CRZ Mapping.
- **Step 10:** Generation of CRZ Maps including LULC at 1:25000 Scale incorporating 7 km radius from the AOI. HTL and LTL at this scale are solely based on satellite image interpretation.

6. Presentation by National Hydrographic Office (NHO), New Delhi: 6. National Hydrographic Office (NHO), Dehradun: In his presentation, Cdr Anirban Banerjee, NHO, Dehradun brought out the following points regarding the methodology being followed by NHO.

1. HTL is delineated by following methods
 - i. Walking over
 - ii. Flotsam and debris – considered indicative of HTL
 - iii. Delineation by helicopter where walking over is not feasible
 - iv. Remote sensing data (satellite imageries) is utilised in inaccessible areas and planning purposes only.
2. LTL is Delineated by following methods
 - i. Soundings using shallow draft boat
 - ii. Spot soundings using sounding poles from shore to seaward.
3. The entire length of the coastline and foreshore is to be walked, mapped and graphically depicted. The accuracy/confidence levels are to be described in accordance with International Hydrographic Organisation (IHO) Special Publication, SP-44.
4. The whole foreshore is to be walked at low water as far as possible during spring tides in order to demarcate the HTL as well as detect inter tidal features not otherwise detected whilst sounding.
5. The standardisation of all symbols globally being utilised for the depiction of features are accepted in accordance with United Kingdom Hydrographic Office (UKHO) publication INT 5020.

7. Presentation by National Institute of Oceanography (NIO), Goa: In his presentation, Dr. A. K. Chaubey brought out the following points regarding the methodology being followed by NIO.

1. Demarcation of HTL:

- Survey is carried out using DGPS & Total Station
- Base and reference stations are established by DGPS observations
- Criteria indicated by MoEF (2011) for demarcation of HTL are followed
- Total Station observations are made to obtain geographical position of identified HTL and extent of morphological feature

2. Demarcation of LTL:

- Bathymetry survey following standard procedure.
- Spot sounding by Levelling staff and DGPS / Total Station.
- Carrying out measurements during lowest low tide on particular day of Survey using Total station.
- Beach profiling at an appropriate interval.

Minutes of the 2nd Meeting on
Standardization of Methodology for Demarcation of HTL/LTL held
at National Centre for Sustainable Coastal Management (NCSCM),
Chennai on 9th October 2014

The Second Meeting of the Committee on Standardization of the methodology for demarcation of HTL/LTL was held at NCSCM, MoEF&CC, Chennai on 9th October 2014 under the Chairmanship of Dr. Shailesh R Nayak, Secretary, MoES, Government of India, New Delhi. This meeting is in continuation of the 1st meeting held at Prithvi Bhawan, MoES, Government of India, New Delhi on 1st July 2014 and subsequent three meetings of the expert Sub-Committee held in NCSCM, Chennai. Representatives of the following authorized agencies for demarcation of HTL/LTL attended the meeting.

- i. Space Application Centre (SAC), Ahmedabad
- ii. Institute for Remote Sensing (IRS), Anna University, Chennai
- iii. Institute of Environmental Studies and Wetland Management (IESWM) Kolkata
- iv. National Hydrographic Office (NHO), Dehradun
- v. National Centre for Sustainable Coastal Management (NCSCM), MOEF&CC, Chennai

NCESS had sent its comments for the consideration of the Committee. Dr. A. Senthil Vel, Additional Project Director, SICOM, MoEF&CC, New Delhi; Dr. M. Baba and Dr. Anjali Bahuguna attended the meeting as special invitee experts. The list of members and invitees who attended the meeting is given in Annex C.

- 2. Introduction by the Member Convenor:** In his opening remarks, Prof. R. Ramesh, Director NCSCM and Member Convenor of the Committee welcomed the Chairman, other members and invitees and highlighted the significant suggestions made by MoEF&CC in the meeting held in New Delhi on 29/9/2014 and subsequently during the sub-committee meeting under the Chairmanship of Dr. Shailesh Nayak on 8th October 2014 at NCSCM, Chennai.
- 3. Remarks by Chairman:** Dr. Shailesh R Nayak, Secretary, MoES and Chairman in his remarks stated that there should be uniformity in the demarcation of HTL and in the methods followed by different agencies in preparing the CZMPs. The Chairman indicated that HTL will be mapped by NCSCM while CZMP maps will be prepared by the authorized agencies using 2011 satellite data using the classification system and other details provided in the HTL manual being finalized.
- 4. Presentation by the Member Convenor:** Prof. R. Ramesh then made a presentation to the Committee on the following decisions taken in the expert Sub-Committee meeting held in NCSCM Chennai on 8/10/2014 Chaired by Dr. Shailesh R Nayak, Secretary, MoES, Government of India, New Delhi.

4.1 Objectives: The main objectives as specified in the ToRs for the Committee and the various sub-tasks under each ToR as given below were explained by Prof. R. Ramesh.

ii. Review/ evolve uniform guidelines/ methodology for demarcation of HTL/LTL

- a. Standardize the methodology for demarcating HTL, LTL and mapping of CRZs;
- b. Standardize the classification system and definitions for inventorying the different features such as tidal wetlands and coastal landforms;
- c. Use of satellite imagery (2011) for 1:25,000 and 1:4,000 Scale
- d. Development of coastal database with
 - i. Information derived from aerial photographs
 - ii. Satellite imagery
 - iii. HTL/ LTL and CRZ categories as in 1991 Notification and 2011 Notification
 - iv. CZM Plans
 - v. ICRZ and IIMP
 - vi. Hazard line
 - vii. Cadastral information
 - viii. Ecologically Sensitive Areas (ESA) and Critically Vulnerable Coastal Areas (CVCA)
 - ix. Administrative Boundaries

iii. Suggest the format of the report on HTL/LTL demarcation including map of 1:4000 scale with coordinates, land features

- a. Achieve uniformity in output with respect to their content, format, legend, colour scheme, etc.
- b. Suggest the format of the 'Report on HTL/LTL Demarcation' including map of 1:4000 scale with co-ordinates, land features, etc.

iv. Prescribe the time schedule for demarcation of HTL/LTL

v. Prescribe the cost for demarcation of HTL/LTL

4.2 Procedure of delineation of HTL / LTL using Aerial Photographs / ortho images of Sol: Prof. R. Ramesh explained the availability of 2011-2012 aerial photography data covering the entire mainland coast from Gujarat to West Bengal, organised into eight blocks at Survey of India campus funded by MoEF&CC under the ICZM project. He explained the method that would be adopted in delineating the HTL using the Sol orthoimages and LTL using the LAT data and High resolution DEM.

4.3 Cost: Prof. R. Ramesh explained the cost table showing the cost worked out for 1: 25,000 or 1: 4,000 scale CZMP maps, as given below. The cost is based on the various tasks / components that are involved in preparation of 1: 25,000 or 1: 4000 CZMP maps and are only indicative.

S. No	Tasks involved in producing one 1: 25,000 scale (7 ½' x 7 ½' - 196 sq. km) / 1: 4,000 scale (1 ½' x 1 ½' - 2.7 km X 2.7 km or 7 sq. km approx.) CZMP maps	No. of Scenes/ Sheets/ Mandays etc.	Unit cost [permanday/ sheet/scene etc.] (₹)
1	Cost of HR Satellite Image	1 Scene	12000
2	Image pre-processing, GCP collection from base map, Geo-referencing & image rectification.	1 manday	4000
3	Merging of Cartosat and LISS IV and mosaicing [PAN-sharpening & mosaic generation]	1 manday	4000
4	Image interpretation and preparation of Coastal GIS / Database	10 mandays	4000
5	Geo-referencing cadastral maps, Base map preparation, Digitization & transfer of village boundaries, survey numbers etc., from the cadastral base map.	2 Mandays	4,000
6	Ground Truth Collection (Random points) excluding travel costs	5 mandays	10000
7	Total		
8	Overheads	@10%	
9	Institutional cost	@10%	
10	Total cost		
11	Service Tax	@12.36 %	
Fees to be charged on state Government for production of one 1: 25,000 scale (7 ½' x 7 ½' - 196 sq. km) or 1:4,000 scale (1 ½' x 1 ½' - 2.7 km X 2.7 km or 7 sq. km approx.) CZMP maps		Total cost + 12.36 % Service Tax	

Decisions

5.1. HTL Demarcation will be carried out by NCSCM using aerial photographs at Sol. Wherever there are gaps in aerial photographs or if aerial photos are not of good quality; high resolution remote sensing data from Indian satellites of the same period will be utilized for this purpose. NCSCM will provide the data with 'HTL coordinates'. The curvilinear and spacing would be at 1m interval along the entire coast of India. For tidally influenced water bodies the upper limit will be as demarcated in the CZMPs approved based on the 1991 Notification/ Sol Toposheet. The HTL line already demarcated by the States through the authorized agencies may be validated based on the above.

5.2. Issues related to CZMP mapping:

a. **Definitions and classification system:** It was agreed that in addition to glossary, definition of terms appearing in the main text will be included in the main section of the manual. The classification system for uniformity in

geomorphological features was discussed and it was agreed to provide details in the CZMP up to Level III.

- b. **CZMP preparation:** CZMP will continue to be prepared by the state Government through the authorized agencies. The HTL / LTL from 2011 ortho-photos delineated by NCSCM will be provided to the States/ authorized agencies as X-Y coordinates with curvilinearity and spacing of 1m. A shapefile containing HTL and LTL along with their coordinates will be provided by NCSCM to the authorized agencies for the preparation of CZMPs at a cost to be decided by MoEF&CC.
- c. The HTL/ LTL coordinates shall be provided to the authorized agencies/ State Governments at a cost that would be decided by MoEF&CC.
- d. The authorized agencies will follow the HTL/ CZMP manual being finalized by the Committee.

5.3. Satellite Data:

- a. Cartosat & LISS IV data of 2011 will be used to prepare the coastal database from which the CZMP on 1: 25,000 and 1: 4,000 scales will be produced by the authorized agencies.
- b. In areas where there are gaps in the 2011 ortho-images of Sol (e.g. Vishakhapatnam, Lakshadweep, Andaman & Nicobar Islands) satellite images of 2011 will be used by NCSCM to delineate the HTL.

5.4. Ecologically Sensitive Areas:

It was decided that as part of the ESA mapping, locations of turtle nesting sites will be provided to NCSCM by the concerned coastal State Governments

5.5. Geo-referencing, Benchmarks etc:

- a. In addition to HTL, NCSCM will also provide shape files with certain important features such as road junctions, bund junctions etc, mapped from the Sol ortho-images, uniformly distributed in each 1:25,000 HTL map to the authorized agencies, so as to enable uniform geo-referencing of their satellite images and cadastral maps.

5.6. Measurement of Salinity:

- a. NCSCM will use ortho-images /satellite images to fix the upper limit of HTL in tidal influenced water bodies or use the upper limit already fixed using salinity measurements or other suitable methods from the existing approved CZMPs/ Sol Toposheets

- 5.7. Information on fishing hamlets / ice factories / fishing harbour etc., required as per CZMP would be depicted as attributes by the authorized agencies.

5. Standardization of methodology:

a. Definitions/classification system and glossary: Standard definitions of all important parameters/ terms (e.g. bay, estuary, creeks etc.) will be provided in the Manual.

b. Coastal Information System:

- Database will be prepared first, irrespective of scale and checked for accuracy. Final maps will be prepared in the required scales using this database.
- Satellite images should also be a part of the database in all projects and images from Bhuvan are also recommended for use.
- Any relevant information pertaining to CZMP should be added to the data base, e.g. Hazard line as and when it is completed by Sol.

c. Accuracy Assessment: The following will be the accuracy thresholds:

S.No.	Map Scale	Planimetric/ Positional Accuracy	Thematic/ Classification accuracy
1.	1: 25,000	• Accuracy for HTL and LTL demarcation: 1m and 2m respectively	90 % classification accuracy at 90 % confidence interval
2.	1: 4,000		90 % classification accuracy at 90 % confidence interval
3.	1: 1,000		NA

Accuracy for CZMP using satellite imagery: 5m

d. Identifying geo-morphological features:

- Bunds constructed across tidally influenced water bodies such as estuaries, creeks, backwaters etc. before the year 1991 should be taken as the tidal limit of HTL and bunds constructed after 1991 should not be taken as the tidal limit of HTL. Changes in HTL with respect to 1991 and 2011, if any, should be indicated with justifications.
- ESAs, geo-morphologically important zones, archaeological and heritage sites are being mapped by NCSCM and will be provided to the authorized agencies as part of CZMP mapping at a cost to be decided by MoEF&CC

e. Cost factors for preparing 1:25,000 or 1:4000 scale CZMPs: Cost of HTL/ LTL mapping should be based on the layout/size of maps. The cost estimate for preparing 1: 25,000 or 1: 4,000 scale maps have been worked out and an approximate cost as provided in Section 4.3 plus actual travel costs and taxes as applicable has been recommended. This cost is only indicative and is based on the broad guidelines given in para 4.3 above and will be subject to revision depending on the wage/ tax structure and other factors to be considered from time to time.

6. The draft Manual will be finalized and submitted to the Chairman by 29/10/2014 for final submission to MoEF & CC by end of December 2014.

7. The meeting ended thanking the Chair.

Annex C

List of Members & Invitees who attended the second meeting on Standardization of Methodology for Demarcation of HTL/LTL held on 9th October 2014 at 10:30 am, Koodal Hall, NCSCM, Chennai

Chairman: Dr. Shailesh R Nayak, Secretary, Ministry of Earth Sciences, New Delhi.

Member Convenor: Prof. R. Ramesh, Director National Centre for Sustainable Coastal Management, MOEF&CC, Government of India, Anna University Campus, Chennai.

Members / Representatives of Authorized Agencies other than NCSCM:

1. Dr. A S Rajawat Head, Geosciences Division, SAC, Ahmedabad
2. Dr. S S Ramakrishnan, Director IRS, Anna University, Chennai
3. Dr. Debajyoti Bhowmik IESWM, Kolkata
4. Cdr Prachit Mangrulkar, NHO, Dehradun

Invitees:

1. Dr. M. Baba, Former Director, NCESS, Thiruvananthapuram
2. Dr. Anjali Bhaguna, Environment Consultant, Ahmedabad
3. Dr. A. Senthil Vel, Additional Project Director, SICOM, MOEF&CC, New Delhi
4. Dr. Purvaja Ramachandran, Division Chair & Scientist-G, NCSCM, MoEF&CC, Chennai
5. Dr. B R Subramanian, Senior Consultant, NCSCM, Chennai
6. Mr. M. Dharma Raj, Senior Consultant, NCSCM, Chennai
7. Dr. D. Thirumalaivasan, Professor, IRS, Chennai
8. Dr. R. Vidhya, Professor, IRS, Chennai
9. Dr. K. Srinivasaraju, Professor, IRS, Chennai
10. Dr. Alak Haldar, IESWM, Kolkata
11. Dr. Ramachandra Bhatta, Division Chair & Scientist 'G', NCSCM, MoEF&CC, Chennai
12. Dr. P. Krishnan, Scientist NCSCM, MOEF&CC, Chennai
13. Dr. Badarees K O Scientist NCSCM, MOEF&CC, Chennai
14. Mr. S. K. Sinha, Director, Survey of India, Chennai

Composition of the Committee

It is informed by the Ministry in its letter No. J-17011/18/1996-IA.III dated 11th April 2014 that the National Coastal Zone Management Authority in its meeting held on 25th June 2013 decided to constitute a committee under the Chairmanship of Dr. Shailesh Nayak, Secretary, MoES with seven authorized agencies as members and Director, NCSCM as Member Convener to standardize the methodology for demarcation of HTL/LTL so as to make the demarcation procedure uniform.

Terms of Reference of the Committee

- i. Review/evolve uniform guidelines/methodology for demarcation of HTL/LTL
- ii. Suggest the format of the report on HTL/LTL demarcation, including map of 1:4000 scale with coordinates, land features etc.
- iii. Prescribe the time schedule for demarcation of HTL/LTL
- iv. Prescribe cost for demarcation of HTL/LTL

Sittings of the Committee

The committee in accordance with the ToR had the following meetings:

- 1st July 2014 at MoES, New Delhi- meeting of the committee to examine the issues presented by various authorized agencies
- 9th October 2014 at NCSCM, Chennai - meeting of the committee to draft the report
- A series of discussions were held through emails and personal communications with the members/ experts, at various times during the course of preparation of this manual
- The Minutes of the meeting is given in the Annex 5
- The report will be submitted in the second week of February, 2015

COASTAL REGULATION ZONE NOTIFICATION
MINISTRY OF ENVIRONMENT AND FORESTS
(Department of Environment, Forests and Wildlife)

Annexure : U

95

New Delhi, the 6th January 2011 (As amended upto 22.03.2016)

S.O.19(E).- WHEREAS a draft notification under sub-section (1) of section and clause (V) of sub-section (2) of section 3 of the Environment (Protection) Act, 1986 was issued inviting objections and suggestions for the declaration of coastal stretches as Coastal Regulation Zone and imposing restrictions on industries, operations and processes in the CRZ was published vide S.O.No.2291 (E), dated 15th September, 2010.;

AND WHEREAS, copies of the said Gazette were made available to the public on 15th September, 2010.;

AND WHEREAS, the suggestions and objections received from the public have been considered by the Central Government.;

Now, therefore, in exercise of the powers conferred by sub-section (1) and clause (v) of sub-section (2) of section 3 of the Environment (Protection) Act, 1986 (29 of 1986), the Central Government, with a view to ensure livelihood security to the fisher communities and other local communities, living in the coastal areas, to conserve and protect coastal stretches, its unique environment and its marine area and to promote development through sustainable manner based on scientific principles taking into account the dangers of natural hazards in the coastal areas, sea level rise due to global warming, does hereby, declare the coastal stretches of the country and the water area upto its territorial water limit, excluding the islands of Andaman and Nicobar and Lakshadweep and the marine areas surrounding these islands upto its territorial limit, as Coastal Regulation Zone (hereinafter referred to as the CRZ) and restricts the setting up and expansion of any industry, operations or processes and manufacture or handling or storage or disposal of hazardous substances as specified in the Hazardous Substances (Handling, Management and Transboundary Movement) Rules, 2009 in the aforesaid CRZ.; and

In exercise of powers also conferred by clause (d) and sub rule (3) of rule 5 of Environment (Protection) Act, 1986 and in supersession of the notification of the Government of India in the Ministry of Environment and Forests, number S.O.114(E), dated the 19th February, 1991 except as respects things done or omitted to be done before such supersession, the Central Government hereby declares the following areas as CRZ and imposes with effect from the date of the notification the following restrictions on the setting up and expansion of industries, operations or processes and the like in the CRZ,-

- (i) the land area from High Tide Line (hereinafter referred to as the HTL) to 500mts on the landward side along the sea front.
- (ii) CRZ shall apply to the land area between HTL to 100 mts or width of the creek whichever is less on the landward side along the tidal influenced water bodies that are connected to the sea and the distance upto which development along such tidal influenced water bodies is to be regulated shall be governed by the distance upto which the tidal effects are experienced which shall be determined based on salinity concentration of 5 parts per thousand (ppt) measured during the driest period of the year and distance upto which tidal effects are experienced shall be clearly identified and demarcated accordingly in the Coastal Zone Management Plans (hereinafter referred to as the CZMPs).

Explanation.- For the purposes of this sub-paragraph the expression tidal influenced water bodies means the water bodies influenced by tidal effects from sea, in the bays, estuaries, rivers, creeks, backwaters, lagoons, ponds connected to the sea or creeks and the like.

- (iii) the land area falling between the hazard line and 500mts from HTL on the landward side, in case of seafront and between the hazard line and 100mts line in case of tidal influenced water body the word 'hazard line' denotes the line demarcated by Ministry of Environment and Forests (hereinafter referred to as the MoEF) through the Survey of India (hereinafter referred to as the SoI) taking into account tides, waves, sea level rise and shoreline changes.
- (iv) land area between HTL and Low Tide Line (hereinafter referred to as the LTL) which will be termed as the intertidal zone.
- (v) the 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.

2. For the purposes of this notification, the HTL means the line on the land upto which the highest water line reaches during the spring tide and shall be demarcated uniformly in all parts of the country by the demarcating authority(s) so authorized by the MoEF in accordance with the general guidelines issued at Annexure-I. HTL shall be demarcated within one year from the date of issue of this notification.

3. Prohibited activities within CRZ,- The following are declared as prohibited activities within the CRZ,-

- (i) Setting up of new industries and expansion of existing industries except,-
 - (a) those directly related to waterfront or directly needing foreshore facilities;

Explanation: The expression "foreshore facilities" means those activities permissible under this notification and they require waterfront for their operations such as ports and harbours, jetties, quays, wharves, erosion control measures, breakwaters, pipelines, lighthouses, navigational safety facilities, coastal police stations and the like.;

(b) projects of Department of Atomic Energy;

(c) facilities for generating power by non-conventional energy sources and setting up of desalination plants in the areas not classified as CRZ-I(i) based on an impact assessment study including social impacts.;

(d) development of green field Airport already permitted only at Navi Mumbai;

(e) reconstruction, repair works of dwelling units of local communities [**especially**]^{*1} [**fisher folk**]^{*2} in accordance with local town and country planning regulations.

(ii) manufacture or handling oil storage or disposal of hazardous substance as specified in the notification of Ministry of Environment and Forests, No. S.O.594 (E), dated the 28th July 1989, S.O.No.966(E), dated the 27th November, 1989 and GSR 1037 (E), dated the 5th

*1 and *2 - Substituted vide Corrigendum S.O.651(E) dated 29.03.2011.

December, 1989 except,-

- (a) transfer of hazardous substances from ships to ports, terminals and refineries and vice versa;
- (b) facilities for receipt and storage of petroleum products and liquefied natural gas as specified in Annexure-II appended to this notification and facilities for regasification of Liquefied Natural Gas (hereinafter referred to as the LNG) in the areas not classified as [CRZ- I (A)]*³ subject to implementation of safety regulations including guidelines issued by the Oil Industry Safety Directorate in the Ministry of Petroleum and Natural Gas and guidelines issued by MoEF and subject to further terms and conditions for implementation of ameliorative and restorative measures in relation to environment as may be stipulated by in MoEF.

Provided that facilities for receipt and storage of fertilizers and raw materials required for manufacture of fertilizers like ammonia, phosphoric acid, sulphur, sulphuric acid, nitric acid and the like, shall be permitted within the said zone in the areas not classified as [CRZ-I (A)]*⁴.

- (iii) Setting up and expansion of fish processing units including warehousing except hatchery and natural fish drying in permitted areas:
- (iv) Land reclamation, bunding or disturbing the natural course of seawater except those,-
 - (a) required for setting up, construction or modernisation or expansion of foreshore facilities like ports, harbours, jetties, wharves, quays, slipways, bridges, sealink, road on stilts, and such as meant for defence and security purpose and for other facilities that are essential for activities permissible under the notification;
 - (b) measures for control of erosion, based on scientific including Environmental Impact Assessment (hereinafter referred to as the EIA) studies
 - (c) maintenance or clearing of waterways, channels and ports, based on EIA studies;
 - (d) measures to prevent sand bars, installation of tidal regulators, laying of storm water drains or for structures for prevention of salinity ingress and freshwater recharge based on carried out by any agency to be specified by MoEF.
- (v) Setting up and expansion of units or mechanism for disposal of wastes and effluents except facilities required for,-
 - (a) discharging treated effluents into the water course with approval under the Water (Prevention and Control of Pollution) Act, 1974 (6 of 1974);
 - (b) storm water drains and ancillary structures for pumping;
 - (c) treatment of waste and effluents arising from hotels, beach resorts and human settlements located in CRZ areas other than CRZ-I and disposal of treated wastes and effluents;
- (vi) Discharge of untreated waste and effluents from industries, cities or towns and other human settlements. The concerned authorities shall implement schemes for phasing out existing discharge of this nature, if any, within a time period not exceeding two years from the date of issue of this notification.
- (vii) Dumping of city or town wastes including construction debris, industrial solid wastes, fly

*3 and *4 - Substituted vide Corrigendum S.O.651(E) dated 29.03.2011.

ash for the purpose of land filling and the like and the concerned authority shall implement schemes for phasing out any existing practice, [within a period of one year]*⁵ from date of commencement of this notification.

Note:-The MoEF will issue a separate instruction to the State Governments and Union territory Administration in respect of preparation of Action Plans and their implementation as also monitoring including the time schedule thereof, in respect of paras (v), (vi) and (vii).

(viii) Port and harbour projects in high eroding stretches of the coast, except those projects classified as strategic and defence related in terms of EIA notification, 2006 identified by MoEF based on scientific studies and in consultation with the State Government or the Union territory Administration.

(ix) Reclamation for commercial purposes such as shopping and housing complexes, hotels and entertainment activities [except for construction of memorials/ monuments and allied facilities, only in CRZ-IV (A) areas in exceptional cases, by the concerned State Government, on case to case basis;]*⁴¹

(x) Mining of sand, rocks and other sub-strata materials except,-

(a) those (rare)*⁶ deleted minerals not available outside the CRZ area [and collection of dead shells by the traditional communities for poultry and animal feed supplements]*⁷.

(b) exploration and exploitation of Oil and Natural Gas.

(xi) Drawl of groundwater and construction related thereto, within 200mts of HTL; except the following:-

(a) in the areas which are inhabited by the local communities and only for their use.

(b) In the area between 200mts-500mts zone the drawl of groundwater shall be permitted only when done manually through ordinary wells for drinking, horticulture, agriculture and fisheries and where no other source of water is available.

Note:-Restrictions for such drawl may be imposed by the Authority designated by the State Government and Union territory Administration in the areas affected by sea water intrusion.

(xii) Construction activities in CRZ-I except those specified in para 8 of this notification.

(xiii) Dressing or altering the sand dunes, hills, natural features including landscape changes for beautification, recreation and other such purpose [except utilizing the rocks / hills/ natural features, only in CRZ-IV (A) areas, for development of memorials / monuments and allied facilities, by the concerned State Government]*⁴²

(xiv) [Except]*⁸ Facilities required for patrolling and vigilance activities of marine/coastal police stations. ;

4. Regulation of permissible activities in CRZ area.- The following activities shall be regulated except those prohibited in para 3 above,-

(i)(a) clearance shall be given for any activity within the CRZ only if it requires waterfront and foreshore facilities;

(b) for those projects which are listed under this notification and also attract EIA notification, 2006 (S.O.1533 (E), dated the 14th September, 2006), for such projects clearance under EIA notification only shall be required subject to being recommended by the concerned State or Union territory Coastal Zone Management Authority (hereinafter referred to as the CZMA).

(c) Housing schemes in CRZ as specified in paragraph 8 of this notification;

*5 and *7 - Substituted vide Corrigendum S.O.651(E) dated 29.03.2011.

*6 - deleted vide Corrigendum S.O.651(E) dated 29.03.2011.

*8 - inserted vide Corrigendum S.O.651(E) dated 29.03.2011.

*41, *42 - inserted vide notification S.O. 556 (E) dated 17.02.2015.

- (d) Construction involving more than 20,000sq mts built-up area in CRZ-II shall be considered **[for approval]***³⁵ in accordance with EIA notification, 2006 **[however, for]***⁹ projects less than 20,000sq mts built-up area shall be approved by the concerned State or Union territory Planning authorities in accordance with this notification after obtaining recommendations from the concerned CZMA and prior recommendations of the concern CZMA shall be essential for considering the grant of environmental clearance under EIA notification, 2006 or grant of approval by the relevant planning authority.
- (e) MoEF may under a specific or general order specify projects which require prior public hearing of project affected people.
- (f) construction and operation for ports and harbours, jetties, wharves, quays, slipways, ship construction yards, breakwaters, groynes, erosion control measures **[and salt works]***³⁶;
- (ii) the following activities shall require clearance from MoEF, **[after being recommended by the concerned CZMA]***³⁷ namely:-
- (a) **[those activities listed under category 'A' in the EIA notification, 2006 and permissible under the notification:]***³⁸
- (b) construction activities relating to projects of Department of Atomic Energy or Defence requirements for which foreshore facilities are essential such as, slipways, jetties, wharves, quays; except for classified operational component of defence projects. Residential buildings, office buildings, hospital complexes, workshops of strategic and defence projects in terms of EIA notification, 2006.;
- (c) construction, operation of lighthouses;
- (d) laying of pipelines, conveying systems, transmission line;
- (e) exploration and extraction of oil and natural gas and all associated activities and facilities thereto;
- (f) Foreshore requiring facilities for transport of raw materials, facilities for intake of cooling water and outfall for discharge of treated wastewater or cooling water from thermal power plants. MoEF may specify for category of projects such as at (f), (g) and (h) of para 4;
- (g) Mining of rare minerals as listed by the Department of Atomic Energy;
- (h) Facilities for generating power by non-conventional energy resources, desalination plants and weather radars;
- (i) Demolition and reconstruction of (a) buildings of archaeological and historical importance, **[(b)]***¹⁰ heritage buildings; and buildings under public use which means buildings such as for the purposes of worship, education, medical care and cultural activities;

*9 and *10 - Substituted vide Corrigendum S.O.651(E) dated 29.03.2011.

*35, *36 and *37 - inserted vide notification S.O. 3085 (E) dated 28th November, 2014.

*38 - substituted vide notification S.O. 3085 (E) dated 28th November, 2014.

(j) [construction of memorials/ monuments and allied facilities by the concerned State Government in CRZ-IV (A) areas in exceptional cases, with adequate environmental safeguards, subject to the following, namely:-

- (A) The concerned State Government shall submit justification for locating the project in CRZ area along with details of alternate sites considered and weightage matrix on various parameters including environmental parameters to State CZMA who will examine the project and make recommendation to the Central Government (MoEF) for grant of Terms of Reference (ToRs) for preparation of an environmental impact assessment report by the State Government;
- (B) on grant of ToRs by the Central Government, the concerned State Government shall submit the draft Environmental Impact Assessment report (EIA) with Environmental Management Plan (EMP), draft Risk Assessment Report with Disaster Management Plan (DMP) including on-site and off-site emergency plan and evacuation plan during emergency, to the State Pollution Board for conduct of public hearing for the proposed project in accordance with the procedure laid down under the Environment Impact Assessment notification;
- (C) The concerned State Government shall submit final EIA, EMP, Risk Assessment and DMP after addressing the relevant issues raised by the public during the public hearing, to State CZMA for their examination and recommendation to MoEF.

Note: Construction of memorials / monuments would generally discouraged in CRZ-IV areas and the same would be allowed only in exceptional cases with adequate environmental safeguards.]*⁴³

4.2 Procedure for clearance of permissible activities.- All projects attracting this notification shall be considered for CRZ clearance as per the following procedure, namely:-

- (i) The project proponents shall apply with the following documents seeking prior clearance under CRZ notification to the concerned State or the Union territory Coastal Zone Management Authority,-
- (a) Form-1 (Annexure-IV of the notification);
- (b) Rapid EIA Report including marine and terrestrial component except for construction projects listed under 4(c) and (d)
- (c) Comprehensive EIA with cumulative studies for projects in the stretches classified as low and medium eroding by MoEF based on scientific studies and in consultation with the State Governments and Union territory Administration;
- (d) Disaster Management Report, Risk Assessment Report and Management Plan;
- (e) CRZ map indicating HTL and LTL demarcated by one of the authorized agency (as indicated in para 2) in 1:4000 scale;
- (f) Project layout superimposed on the above map indicated at (e) above;

*43 – inserted vide notification S.O. 556 (E) dated 17.02.2015.

- (g) The CRZ map normally covering 7km radius around the project site.
- (h) The CRZ map indicating the CRZ-I, II, III and IV areas including other notified ecologically sensitive areas;
- (i) No Objection Certificate from the concerned State Pollution Control Boards or Union territory Pollution Control Committees for the projects involving discharge of effluents, solid wastes, sewage and the like.;
- (ii) The concerned CZMA shall examine the above documents in accordance with the approved CZMP and in compliance with CRZ notification and make recommendations within a period of sixty days from date of receipt of complete application,-
- (a) MoEF or State Environmental Impact Assessment Authority (hereinafter referred to as the SEIAA) as the case may be for the project attracting EIA notification, 2006;
- (b) MoEF for the projects not covered in the EIA notification, 2006 but attracting para 4(ii) of the CRZ notification;
- [(c) SEIAA, for the projects specified under paragraph 4 (i) (except with respect to item (d) thereof relating to building projects with less than 20,000 sq.mts of built up area) and for the projects not attracting EIA Notification 2006]*³⁹**
- (iii) MoEF or SEIAA shall consider such projects for clearance based on the recommendations of the concerned CZMA within a period of sixty days.
- [(iv)]*¹¹** The clearance accorded to the projects under the CRZ notification shall be valid for the period of five years from the date of issue of the clearance for commencement of construction and operation.
- (v) For Post clearance monitoring – (a) it shall be mandatory for the project proponent to submit half-yearly compliance reports in respect of the stipulated terms and conditions of the environmental clearance in hard and soft copies to the regulatory authority(s) concerned, on 1st June and 31st December of each calendar year and all such compliance reports submitted by the project proponent shall be published in public domain and its copies shall be given to any person on application to the concerned CZMA.
- (b) the compliance report shall also be displayed on the website of the concerned regulatory authority.
- (vi) To maintain transparency in the working of the CZMAs it shall be the responsibility of the CZMA to create a dedicated website and post the agenda, minutes, decisions taken, clearance letters, violations, action taken on the violations and court matters including the Orders of the Hon'ble Court as also the approved CZMPs of the respective State Government or Union territory.

5. Preparation of Coastal Zone Management Plans.

- (i) The MoEF may obtain the CZMPs prepared through the respective State Government or Union territory;
- (ii) The CZMPs may be prepared 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 MoEF and in consultation with the concerned stakeholders;
- (iii) The hazard line shall be mapped by MoEF through SoI all along the coastline of the country and the hazard line shall be demarcated taking into account, tide, waves, sea level

*11 - Substituted vide Corrigendum S.O.651(E) dated 29.03.2011.

*39 - substituted vide notification S.O. 3085 (E) dated 28th November, 2014.

rise and shoreline changes;

- (iv) For the purpose of depicting the flooding due to tides, waves and sea level rise in the next fifty and hundred years, the contour mapping of the coastline shall be carried out at 0.5m interval normally upto 7km from HTL on the landward side, and the shoreline changes shall be demarcated based on historical data by comparing the previous satellite imageries with the recent satellite imageries;
- (v) Mapping of the hazard line shall be carried out in 1:25,000 scale for macro level planning and 1:10,000 scale or cadastral scale for micro level mapping and the hazard line shall be taken into consideration while preparing the land use plan of the coastal areas;
- (vi) The coastal States and Union Territory will prepare within a period of twenty four months from the date of issue this notification, draft CZMPs in 1:25,000 scale map identifying and classifying the CRZ areas within the respective territories in accordance with the guidelines given in Annexure-I of the notification, which involve public consultation;
- (vii) The draft CZMPs shall be submitted by the State Government or Union territory to the concerned CZMA for appraisal, including appropriate consultations, and recommendations in accordance with the procedure(s) laid down in the Environment (Protection) Act, 1986;
- (viii) **[The Coastal Zone Management Authority of a State or of a Union Territory shall submit the draft Coastal Zone Management Plan along with its recommendations to the Ministry of Environment, Forest and Climate Change, after incorporating the suggestions and objections received from the stakeholders] *44**
- (ix) MoEF shall thereafter consider and approve the CZMPs within a period of four months from the date of receipt of the CZMPs complete in all respects;
- (x) All developmental activities listed in this notification shall be regulated by the State Government, Union Territory Administration, the local authority or the concerned CZMA within the framework of such approved CZMPs as the case may be in accordance with provisions of this notification;
- (xi) The CZMPs shall not normally be revised before a period of five years after which, the concerned State Government or the Union territory may consider undertaking revision of the maps following the above procedures;
- (xii) **[The Coastal Zone Management Plans as already approved by the Ministry of Environment and Forests shall be valid up to the 31st day of January, 2017 or till such time as the approval is given by that Ministry to the fresh Coastal Zone Management Plans made under the said notification, whichever is earlier.] *45**

6. Enforcement of the CRZ, notification, 2011-

- (a) For the purpose of implementation and enforcement of the provisions [of]*12 this notification and compliance with conditions stipulated thereunder, the powers either original or delegated are available under Environment (Protection) Act, 1986 with the MoEF, State Government[s]*13 or the Union territory Administration[s]*14 NCZMA and SCZMA s;
- (b) The composition, tenure and mandate of NCZMA and State Government or the Union territory CZMA s have already been notified by MoEF in terms of Orders of Hon'ble

*12, *13 and *14 - Inserted vide Corrigendum S.O.651(E) dated 29.03.2011.

*44 and *45*46 - Substituted vide Corrigendum S.O. 938(E) dated 31.03.2015 & 1212 (E) dated 22.03.2016.

Supreme Court in Writ Petition 664 of 1993;

- (c) the State Government or the Union territory CZMAs shall primarily be responsible for enforcing and monitoring of this notification and to assist in this task, the State Government and the Union territory shall constitute district level Committees under the Chairmanship of the District Magistrate concerned containing atleast three representatives of local traditional coastal communities [**especially**]*¹⁵ from fisherfolk;
- (d) The dwelling units of the traditional coastal communities [**especially**]*¹⁶ fisherfolk, tribals as were permissible under the provisions of the CRZ notification, 1991, but which have not obtained formal approval from concerned authorities under the aforesaid notification shall be considered by the respective Union territory CZMAs and the dwelling units shall be regularized subject to the following condition, namely-
- (i) these are not used for any commercial activity
 - (ii) these are not sold or transferred to non-traditional coastal community.

7. Classification of the CRZ – For the purpose of conserving and protecting the coastal areas and marine waters, the CRZ area shall be classified as follows, namely:-

(i) CRZ-I,-

A. The areas that are ecologically sensitive and the geomorphological features which play a role in the maintaining the integrity of the coast,-

- (a) Mangroves, in case mangrove area is more than 1000 sq mts, a buffer of 50meters along the mangroves shall be provided;
- (b) Corals and coral reefs and associated biodiversity;
- (c) Sand Dunes;
- (d) Mudflats which are biologically active;
- (e) 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), the Forest (Conservation) Act, 1980 (69 of 1980) or Environment (Protection) Act, 1986 (29 of 1986); including Biosphere Reserve [**as enumerated in para V(4)(b)**]*¹⁷
- (f) Salt Marshes;
- (g) Turtle nesting grounds;
- (h) Horse shoe crabs habitats;
- (i) Sea grass beds;
- (j) Nesting grounds of birds;
- (k) Areas or structures of archaeological importance and heritage sites.

B. The area between Low Tide Line and High Tide Line;

(ii) CRZ-II,-

The areas that have been developed upto or close to the shoreline.

Explanation.- [**For the purposes of the**]*¹⁸ ~~deleted~~ expression “developed area” is referred to as that area within the existing municipal limits or in other existing legally designated urban areas which are substantially built-up and has been provided with drainage and approach roads and other infrastructural facilities, such as water supply and sewerage mains;

*15 and *16 - substituted vide Corrigendum S.O.651(E) dated 29.03.2011.

*17 - Inserted vide Corrigendum S.O.651(E) dated 29.03.2011.

*18 - deleted vide Corrigendum S.O.651(E) dated 29.03.2011.

(iii) CRZ-III,-

Areas that are relatively undisturbed and those do not belong to either CRZ-I or II which include coastal zone in the rural areas (developed and undeveloped) and also areas within municipal limits or in other legally designated urban areas, which are not substantially built up.

(iv.) CRZ-IV,-

- A. the water area from the Low Tide Line to twelve nautical miles on the seaward side;
- B. shall include the water area of the tidal influenced water body from the mouth of the water body at the sea upto the influence of tide which is measured as five parts per thousand during the driest season of the year.

(v) Areas requiring special consideration for the purpose of protecting the critical coastal environment and difficulties faced by local communities,-

- A. (i) CRZ area falling within municipal limits of Greater Mumbai;
- (ii) the CRZ areas of Kerala including the backwaters and backwater islands;
- (iii) CRZ areas of Goa.
- B. Critically Vulnerable Coastal Areas (CVCA) such as Sunderbans region of West Bengal and other ecologically sensitive areas identified as under Environment (Protection) Act, 1986 and managed with the involvement of coastal communities including fisherfolk.

8. Norms for regulation of activities permissible under this notification,-

- (i) The development or construction activities in different categories of CRZ shall be regulated by the concerned CZMA in accordance with the following norms, namely:-

Note:- {The word [existing, used]*¹⁹ hereinafter in relation to existence of various features or existence of regularisation or norms shall mean existence of these features or regularisation or norms as on 19.2.1991 [when the CRZ notification, 1991]*²⁰ was notified.}*⁴⁶ ~~{deleted}~~}

I. CRZ-I,-

- (i) no new construction shall be permitted in CRZ-I except,-
 - (a) projects relating to Department of Atomic Energy;
 - (b) pipelines, conveying systems including transmission lines;
 - (c) facilities that are essential for activities permissible under CRZ-I;
 - (d) installation of weather radar for monitoring of cyclones movement and prediction by Indian Meteorological Department;
 - (e) construction of trans harbour sea link and without affecting the tidal flow of water, between LTL and HTL.
 - (f) development of green field airport already approved at only Navi Mumbai;
- (ii) Areas between LTL and HTL which are not ecologically sensitive, necessary safety measures will be incorporated while permitting the following, namely:-

*19 and *20 – substituted vide Corrigendum S.O.651(E) dated 29.03.2011.

*46 – deleted vide notification S.O. 1599 (E) dated 16th June 2015.

- (a) exploration and extraction of natural gas;
- (b) construction of dispensaries, schools, public rainshelter, community toilets, bridges, roads, jetties, [erosion control measures]*⁴⁰ water supply, drainage, sewerage which are required for traditional inhabitants living within the biosphere reserves after obtaining approval from concerned CZMA.
- (c) necessary safety measure shall be incorporated while permitting such developmental activities in the area falling in the hazard zone;
- (d) salt harvesting by solar evaporation of seawater; (e) desalination plants;
- (f) storage of non-hazardous cargo such as edible oil, fertilizers and food grain within notified ports;
- (g) construction of trans harbour sea links, roads on stilts or pillars without affecting the tidal flow of water.

II. CRZ-II,-

- (i) buildings shall be permitted only on the landward side of the existing road, or on the landward side of existing authorized structures;
- (ii) **[buildings permitted on the landward side of the existing and proposed roads or existing authorised structures shall be subject to the existing local town and country planning regulations as modified from time to time, except the Floor Space Index or Floor Area Ratio, which shall be as per 1991 level :
Provided that no permission for construction of buildings shall be given on landward side of any new roads which are constructed on the seaward side of an existing road :
Provided further that the construction in CRZ-II area of Goa, Kerala and Mumbai shall be governed by the provisions of Clause V of paragraph 8.]***⁴⁷
- (iii) reconstruction of authorized building to be permitted subject with the existing Floor Space Index or Floor Area Ratio Norms and without change in present use;
- (iv) facilities for receipt and storage of petroleum products and liquefied natural gas as specified in Annexure-II appended to this notification and facilities for regasification of Liquefied Natural Gas subject to the conditions as mentioned in sub-paragraph (ii) of paragraph 3;
- (v) desalination plants and associated facilities;
- (vi) storage of non-hazardous cargo, such as edible oil, fertilizers and food grain in notified ports;
- (vii) facilities for generating power by non-conventional power sources and associated facilities;

III. CRZ-III,-

A. Area upto 200mts from HTL on the landward side in case of seafront and 100mts along tidal influenced water bodies or width of the creek whichever is less is to be earmarked as "No Development Zone (NDZ)",-

- (i) the NDZ shall not be applicable in such area falling within any notified port limits;
- (ii) No construction shall be permitted within NDZ except for repairs or reconstruction of existing authorized structure not exceeding existing Floor, Space Index, existing plinth area and existing density and for permissible activities under the notification **[especially]***²¹ facilities essential for activities; Construction/reconstruction of dwelling units of traditional coastal communities including fisherfolk may be permitted between 100 and 200 metres from the HTL along the seafront in accordance with a comprehensive plan prepared by the State Government or the Union territory in consultation with the traditional coastal communities **[especially]***²² fisherfolk and

*21 and *22 – substituted vide Corrigendum S.O.651(E) dated 29.03.2011.

*40 – inserted vide notification S.O. 3085 (E) dated 28th November, 2014.

*47 – substituted vide notification S.O. 1599 (E) dated 16th June 2015.

incorporating the necessary disaster management provision, sanitation and recommended by the concerned State or the Union territory CZMA to NCZMA for approval by MoEF;

(iii) however, the following activities may be permitted in NDZ –

- (a) agriculture, horticulture, gardens, pasture, parks, play field, and forestry;
- (b) projects relating to Department of Atomic Energy;
- (c) mining of rare minerals;
- (d) salt manufacture from seawater;
- (e) facilities for receipt and storage of petroleum products and liquefied natural gas as specified in Annexure-II;
- (f) facilities for regasification of liquefied natural gas subject to conditions as mentioned in subparagraph (ii) of paragraph 3;
- (g) facilities for generating power by non conventional energy sources;
- (h) Foreshore facilities for desalination plants and associated facilities;
- (i) weather radars;
- (j) construction of dispensaries, schools, public rain shelter, community toilets, bridges, roads, provision of facilities for water supply, drainage, sewerage, crematoria, cemeteries and electric sub-station which are required for the local inhabitants may be permitted on a case to case basis by CZMA;
- (k) construction of units or auxiliary thereto for domestic sewage, treatment and disposal with the prior approval of the concerned Pollution Control Board or Committee;
- (l) facilities required for local fishing communities such as fish drying yards, auction halls, net mending yards, traditional boat building yards, ice plant, ice crushing units, fish curing facilities and the like;
- (m) development of green field airport already permitted only at Navi Mumbai.

B. Area between 200mts to 500mts,-

The following activities shall be permissible in the above areas;

- (i) development of vacant plot in designated areas for construction of hotels or beach resorts for tourists or visitors subject to the conditions as specified in the guidelines at Annexure-III ;
- (ii) facilities for receipt and storage of petroleum products and liquefied natural gas as specified in Annexure-II;
- (iii) facilities for regasification of liquefied natural gas subject to conditions as mentioned in sub-paragraph (ii) of paragraph 3;
- (iv) storage of non-hazardous cargo such as, edible oil, fertilizers, food grain in notified ports;
- (v) foreshore facilities for desalination plants and associated facilities;
- (vi) facilities for generating power by non-conventional energy sources;
- (vii) construction or reconstruction of dwelling units so long it is within the ambit of traditional rights and customary uses such as existing fishing villages and goathans. Building permission for such construction or reconstruction will be subject to local town and country planning rules with overall height of construction not exceeding 9mts with two floors (ground + one floor);
- (viii) Construction of public rain shelters, community toilets, water supply drainage, sewerage, roads and bridges by CZMA who may also permit construction of

schools and dispensaries for local inhabitants of the area for those panchayats, the major part of which falls within CRZ if no other area is available for construction of such facilities;

- (ix) reconstruction or alteration of existing authorised building subject to sub-paragraph (vii), (viii);
- (x) development of green field airport already permitted only at Navi Mumbai.

(IV) In CRZ-IV areas,-

The activities [**impinging**]*²³ on the sea and tidal influenced water bodies will be regulated except for traditional fishing and related activities undertaken by local communities as follows:-

- (a) No untreated sewage, effluents, ballast water, ship washes, fly ash or solid waste from all activities including from aquaculture operations shall be let off or dumped. A comprehensive plan for treatment of sewage generating from the coastal towns and cities shall be formulated within a period of one year in consultation with stakeholders including traditional coastal communities, traditional fisherfolk and implemented;
- (b) Pollution from oil and gas exploration and drilling, mining, boat house and shipping;
- (c) There shall be no restriction on the traditional fishing and allied activities undertaken by local communities.

V. Areas requiring special consideration,-

1. CRZ areas falling within municipal limits of the Greater Mumbai.

- (i) Developmental activities in the CRZ area of the Greater Mumbai because of the environmental issues, relating to degradation of mangroves, pollution of creeks and coastal waters, due to discharge of untreated effluents and disposal of solid waste, the need to provide decent housing to the poor section of society and lack of suitable alternatives in the inter connected islands of Greater Mumbai shall be regulated as follows, namely:-

- A. Construction of roads - In CRZ-I areas indicated at sub-paragraph (i) of paragraph 7 of the notification the following activities only can be taken up:-
 - (a) Construction of roads, approach roads and missing link roads approved in the Developmental Plan of Greater Mumbai on stilts ensuring that the free flow of tidal water is not affected, without any benefit of CRZ-II accruing on the landward side of such constructed roads or approach roads subject to the following conditions:-
 - (i) All mangrove areas shall be mapped and notified as protected forest and necessary protection and conservation measures for the identified mangrove areas shall be initiated.
 - (ii) Five times the number of mangroves destroyed/cut during the construction process shall be replanted.
- B. Solid waste disposal sites shall be identified outside the CRZ area and thereafter within two years the existing conventional solid waste sites shall be relocated outside the CRZ area.

[(ii)]*²⁴ In CRZ-II areas-

- (a) The development or redevelopment shall continue to be undertaken in accordance with the norms laid down in the Town and Country Planning Regulations as they existed on the date of issue of the notification dated the 19th February, 1991, unless specified

*23 and *24 – substituted vide Corrigendum S.O.651(E) dated 29.03.2011.

otherwise in this notification.

(b) SLUM REHABILITATION SCHEMES,-

1. In the Greater Mumbai area there are large slum clusters with lakhs of families residing therein and the living conditions in these slums are deplorable and the civic agencies are not able to provide basic infrastructure such as drinking water, electricity, roads, drainage and the like because the slums come up in an unplanned and congested manner and the slums in the coastal area are at great risk in the event of cyclones, storm surges or tsunamis, in view of the difficulties in providing rescue, relief and evacuation.
2. To provide a safe and decent dwelling to the slum dwellers, the State Government may implement slum redevelopment schemes as identified as on the date of issue of this notification directly or through its parastatal agencies like Maharashtra Housing and Area Development Authority (MHADA), Shivshahi Punarvasan Prakalp Limited (SPPL), Mumbai Metropolitan Region Development Authority (MMRDA) and the like.:

Provided that,-

- (i) such redevelopment schemes shall be undertaken directly or through joint ventures or through public private partnerships or other similar models ensuring that the stake of the State Government or its parastatal entities shall be not less than 51%;
- (ii) the Floor Space Index or Floor Area Ratio for such redevelopment schemes shall be in accordance with the Town and Country Planning Regulations prevailing as on [6th January, 2011]*²⁵
- (iii) it shall be the duty of the project proponent undertaking the redevelopment through conditions (i) (2) above along with the State Government to ensure that all legally regularized tenants are provided houses in situ or as per norms laid down by the State Government in this regard.

(c) REDEVELOPMENT OF DILAPIDATED, CESSSED AND UNSAFE BUILDINGS:

1. In the Greater Mumbai, there are, also a large number of old and dilapidated, cessed and unsafe buildings in the CRZ areas and due to their age these structures are extremely vulnerable and disaster prone and therefore there is an urgent need for the redevelopment or reconstruction of these identified buildings.

2. These projects shall be taken up subject to the following conditions and safeguards:

- (i) such redevelopment or reconstruction projects as identified on the date of issue of this notification shall be allowed to be taken up involving the owners of these buildings either above or with private developers in accordance with the prevailing Regulation, directly or through joint ventures or through other similar models.
- (ii) the Floor Space Index or Floor Area Ratio for such redevelopment schemes shall be in accordance with the Town and Country Planning Regulations prevailing as on [6th January, 2011]*²⁶
- (iii) suitable accommodation to the original tenants of the specified buildings shall be

*25 and *26 – substituted vide Corrigendum S.O.651(E) dated 29.03.2011.

ensured during the course of redevelopment or reconstruction of the buildings by the project proponents, undertaking the redevelopment through condition 2(i) above.

- (d) Notwithstanding anything contained in this notification, the developmental activities for slums and for dilapidated, cessed and unsafe buildings as specified at paras (b) and (c) above shall be carried out in an accountable and transparent manner by the project proponents mentioned therein which shall include the following pre-condition measures, wherever applicable;-
1. (i) applicability of the Right to Information Act, 2005 to all redevelopment or reconstruction projects granted clearance by the Competent Authorities;
 - (ii) MoEF shall issue an order constituting the CPIO and the first Appellate Authority of appropriate ranks in consultation with Government of Maharashtra;
 - (iii) details of the Slum Rehabilitation Scheme, including the complete proposal and the names of the eligible slum dwellers will be declared suo-moto as a requirement of Section 4 of compliance of the Right to Information Act, 2005 by the appropriate authority in the Government of Maharashtra in one month before approving it;
 - (iv) the implementing or executing agency at the State Government with regard to projects indicated at sub-item (b) and (c) of item (iii) of sub-paragraph V shall display on a large notice boards at the site and at the office of the implementing or executing agency the names of the eligible builders, total number of tenements being made, names of eligible slum dwellers who are to be provided the dwelling units and the extra area available for free sale.
 - (v) Projects being developed under sub-items (b) and (c) of item (iii) of sub-paragraph V shall be given permission only if the project proponent agree to be covered under the Right to Information Act, 2005.
2. MoEF may appoint statutory auditors, who are empanelled by the Comptroller and auditor General (hereinafter referred to as the C&AG) to undertake performance and fiscal audit in respect of the projects relating to redevelopment of dilapidated, cessed and unsafe buildings and the projects relating to Slum Rehabilitation Scheme shall be audited by C&AG.
 3. A High Level Oversight Committee may be set up by the Government of Maharashtra for periodic review of implementation of V(iii)(b) and (c) which shall include eminent representatives of various Stakeholders, like Architects, Urban Planner, Engineers, and Civil Society, besides the local urban bodies, the State Government and the Central Government.
 4. The individual projects under V(iii)(b) and (c) shall be undertaken only after public consultation in which views of only the legally entitled slum dweller or the legally entitled tenent of the dilapidated or cessed buildings shall be obtained in accordance with the procedures laid down in EIA notification, 2006.
- (e) In order to protect and preserve the 'green lung' of the Greater Mumbai area, all open spaces, parks, gardens, playgrounds indicated in development plans within CRZ-II shall be categorized as CRZ-III, that is, 'no development zone'.
- (f) the Floor Space Index upto 15% shall be allowed only for construction of civic amenities, stadium and gymnasium meant for recreational or sports related activities and the residential or commercial use of such open spaces shall not be permissible.

- (g) Koliwada namely, fishing settlement areas as identified in the Development Plan of 1981 or relevant records of the Government of Maharashtra, shall be mapped and declared as CRZ-III so that any development, including construction and reconstruction of dwelling units within these settlements shall be undertaken in accordance with applicable as per local Town and Country Planning Regulations.
- (h) Reconstruction and repair works of the dwelling units, belonging to fisher communities and other local communities identified by the State Government, shall be considered and granted permission by the Competent Authorities on a priority basis, in accordance with the applicable Town and Country Planning Regulations.

2. CRZ for Kerala

In view of the unique coastal systems of backwater and backwater islands alongwith space limitation present in the coastal stretches of the State of Kerala, the following activities in CRZ shall be regulated as follows, namely:-

- (i) all the islands in the backwaters of Kerala shall be covered under the CRZ notification;
- (ii) the islands within the backwaters shall have 50mts width from the High Tide Line on the landward side as the CRZ area;
- (iii) within 50mts from the HTL of these backwater islands existing dwelling units of local communities may be repaired or reconstructed [, however,]*²⁷ no new construction shall be permitted;
- (iv) beyond 50mts from the HTL on the landward side of backwater islands, dwelling units of local communities may be constructed with the prior permission of the Gram panchayat;
- (v) foreshore facilities such as fishing jetty, fish drying yards, net mending yard, fishing processing by traditional methods, boat building yards, ice plant, boat repairs and the like, may be taken up within 50mts width from HTL of these backwater islands.

3. CRZ of Goa.-

In view of the peculiar circumstances of the State Goa including past history and other developments, the specific activities shall be regulated and various measures shall be undertaken as follows:-

- (i) the Government of Goa shall notify the fishing villages wherein all foreshore facilities required for fishing and fishery allied activities such as traditional fish processing yards, boat building or repair yards, net mending yards, ice plants, ice storage, auction hall, jetties may be permitted by [**Gram Panchayat**]*²⁸ in the CRZ area;
- (ii) reconstruction, repair works of the structures of local communities including fishermen community shall be permissible in CRZ;
- (iii) purely temporary and seasonal structures customarily put up between the months of September to May;
- (iv) the eco sensitive low lying areas which are influenced by tidal action known as khazan lands shall be mapped;
- (v) the mangroves along such as khazan land shall be protected and a management plan for the khazan land prepared and no developmental activities shall be permitted in the khazan land;
- (vi) sand dunes, beach stretches along the bays and creeks shall be surveyed and mapped. No activity shall be permitted on such sand dune areas;
- (vii) the beaches such as Mandrem, Morjim, Galgiba and Agonda [**have**]*²⁹ been

*27, *28 and *29 – substituted vide Corrigendum S.O.651(E) dated 29.03.2011.

designated as turtle nesting sites and protected under the Wildlife Protection Act, 1972 and these areas shall be surveyed and management plan prepared for protection of these turtle nesting sites;

(viii) no developmental activities shall be permitted in the turtle breeding areas referred to in sub-paragraph (vii).

4. (a) Critical Vulnerable Coastal Areas (CVCA) which includes Sunderbans and other identified ecological sensitive areas **[which]**^{*30} shall be managed with the involvement of the local coastal communities including the fisher folk;-
- (b) the entire Sunderbans mangrove area and other identified ecologically important areas such as Gulf of Khambat and Gulf of Kutchchh in Gujarat, Malvan, **[Achra in Ratnagiri]**^{*31} in Maharashtra, Karwar and Coondapur in Karnataka, Vembanad in Kerala, Gulf of Mannar in Tamil Nadu, Bhaitarkanika in Orissa, Coringa, East Godavari and Krishna in Andhra Pradesh shall be declared as Critical Vulnerable Coastal Areas (CVCA) through a process of consultation with local **[fisher folk]**^{*32} and other communities inhabiting the area and depend on its resources for their livelihood with the objective of promoting conservation and sustainable use of coastal resources and habitats;
- (c) the process of identifying planning, notifying and implementing CVCA shall be detailed in the guideline which will be developed and notified by MoEF in consultations with the stakeholders like the State Government, local coastal communities and fisherfolk and the like inhabiting the area;
- (d) the Integrated Management Plans (IMPs) prepared for such CVCA shall interalia keep in view the conservation and management of mangroves, needs of local communities such as, dispensaries, schools, public rain shelter, community toilets, bridges, roads, jetties, water supply, drainage, sewerage and the impact of sea level rise and other natural disasters and the IMPs will be prepared in line with the para 5 above for preparation of Coastal Zone Management Plans;
- (e) till such time the IMPs are approved and notified, construction of dispensaries, schools, public rain shelters, community toilets, bridges, roads, jetties, water supply, drainage, sewerage which are required for traditional inhabitants shall be permitted on a case to case basis, by the CZMA with due regards to the views of coastal communities including fisherfolk.

[F.No.11-83/2005-IA-III]
J. M. MAUSKAR, Addl. Secy.

*30, *31 and *32 – substituted vide Corrigendum S.O.651(E) dated 29.03.2011.

MINISTRY OF ENVIRONMENT, FOREST AND CLIMATE CHANGE**NOTIFICATION**

New Delhi, the 18th January, 2019

G.S.R. 37(E).—Whereas by notification of the Government of India in the erstwhile Ministry of Environment and Forests number S.O.19 (E), dated the 6th January, 2011 (hereinafter referred to as the Coastal Regulation Zone Notification, 2011), the Central Government declared certain coastal stretches as Coastal Regulation Zone (hereinafter referred to as the CRZ) under section 3 of Environment (Protection) Act, 1986 (29 Of 1986);

And Whereas, the Ministry of Environment, Forest and Climate Change has received representations from various coastal States and Union territories, besides other stakeholders, regarding certain provisions in the Coastal Regulation Zone Notification, 2011 related to management and conservation of marine and coastal ecosystems, development in coastal areas, eco-tourism, livelihood options and sustainable development of coastal communities etc.;

And Whereas, various State Governments and Union territory administrations and stakeholders have requested the Ministry of Environment, Forest and Climate Change to address the concerns related to coastal environment and sustainable development with respect to the Coastal Regulation Zone Notification, 2011;

And Whereas, the Ministry of Environment, Forest and Climate Change had constituted a Committee under the Chairmanship of Dr. Shailesh Nayak to examine various issues and concerns of coastal States and Union territories and various stakeholders, relating to the Coastal Regulation Zone Notification 2011 and to recommend appropriate changes in the said Notification;

And Whereas, the report submitted by Dr. Shailesh Nayak Committee has been examined in the Ministry and consultations have been held with various stakeholders in this regard;

And Whereas, a draft Coastal Regulation Zone Notification, 2018 was issued and hosted in the website of the Ministry of Environment, Forest and Climate Change on the 18th April, 2018 seeking comments and suggestions from all concerned;

And Whereas, objections and suggestions received in response to the above mentioned draft Coastal Regulation Zone Notification, 2018 have been duly considered by the Central Government;

Now, therefore in exercise of the powers conferred by sub-section (1) and clause (v) of sub-section (2) of section 3 of the Environment (Protection) Act, 1986 (29 of 1986) and in supersession of the Coastal Regulation Zone Notification 2011, number S.O. 19(E), dated the 6th January, 2011, except as respects things done or omitted to be done before such supersession, the Central Government, 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, do hereby, declares 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 as under:-

- (i) The land area from High Tide Line (hereinafter referred to as the HTL) to 500 meters on the landward side along the sea front.

Explanation. - For the purposes of this notification, the HTL means the line on the land upto which the highest water line reaches during the spring tide, as demarcated by the National Centre for Sustainable Coastal Management (NCSCM) in accordance with the laid down procedures and made available to various coastal States and Union territories.

- (ii) CRZ shall apply to the land area between HTL to 50 meters or width of the creek, whichever is less on the landward side along the tidal influenced water bodies that are connected to the sea and the distance upto which development along such tidal influenced water bodies is to be regulated shall be governed by the distance upto which the tidal effects are experienced which shall be determined based on salinity concentration of five parts per thousand (ppt)

measured during the driest period of the year and distance up to which tidal effects are experienced shall be clearly identified and demarcated accordingly in the Coastal Zone Management Plan (hereinafter referred to as the CZMP):

Provided that the CRZ limit of 50 meters or width of the creek whichever is less, shall be subject to revision and final approval of the respective CZMPs as per this notification, framed with due consultative process, public hearing etc. and environmental safeguards enlisted therein, and till such time the CZMP to this notification is approved, the limit of 100 meters or width of the creek whichever is less, shall continue to apply.

Explanation.- For the purposes of this sub-paragraph the expression "tidal influenced water bodies" means the water bodies influenced by tidal effects from sea in the bays, estuaries, rivers, creeks, backwaters, lagoons, ponds that are connected to the sea.

- (iii) The "intertidal zone" means land area between the HTL and the Low Tide Line (hereinafter referred to as the LTL).
- (iv) The 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.

2.0 Classification of CRZ. – For the purpose of conserving and protecting the coastal areas and marine waters, the CRZ area shall be classified as follows, namely: -

2.1 CRZ-I areas are environmentally most critical and are further classified as under:

2.1.1 CRZ-I A:

- (a) CRZ-I A shall constitute the following ecologically sensitive areas (ESAs) and the geomorphological features which play a role in maintaining the integrity of the coast viz.:
 - (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);
 - (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 of 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.
- (b) A detailed environment management plan shall be formulated by the states and Union territories for such ecologically sensitive areas in respective territories, as mapped out by the National Centre for Sustainable Coastal Management (NCSCM), Chennai based on guidelines as contained in **Annexure-I** to this notification and integrated with the CZMP.

2.1.2 CRZ-I B:

The intertidal zone i.e. the area between Low Tide Line and High Tide Line shall constitute the CRZ-I B.

2.2 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.

2.3 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, and CRZ-III shall be further classified into following categories: -

2.3.1 CRZ-III A:

Such densely populated CRZ-III areas, 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.

2.3.2 CRZ-III B:

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 'No Development Zone (NDZ)'.

2.3.3:

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.

2.4 CRZ- IV:

The CRZ- IV shall constitute the water area and shall be further classified as under:-

2.4.1 CRZ- IVA:

The water area and the sea bed area between the Low Tide Line up to twelve nautical miles on the seaward side shall constitute CRZ-IV A.

2.4.2 CRZ- IVB:

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.

3.0 Areas requiring special consideration in the CRZ.- Following coastal areas shall be accorded special consideration for the purpose of protecting the critical coastal environment and difficulties faced by local communities: -

3.1 Critically Vulnerable Coastal Areas (CVCA):

Sundarban region of West Bengal and other ecologically sensitive areas identified as under Environment (Protection) Act, 1986 such as Gulf of Khambat and Gulf of Kutchh in Gujarat, Malvan, Achra-Ratnagiri in Maharashtra, Karwar and Coondapur in Karnataka, Vembanad in Kerala, Gulf of Mannar in Tamil Nadu, Bhitarkanika in Odisha, Coringa, East Godavari and Krishna in Andhra Pradesh shall be treated as Critical Vulnerable Coastal Areas (CVCA) and managed with the involvement of coastal communities including fisher folk who depend on coastal resources for their sustainable livelihood.

3.2 CRZ for inland Backwater islands and islands along the mainland coast.

3.3 CRZ falling within municipal limits of Greater Mumbai.

4. Prohibited activities within CRZ.- The following activities shall be prohibited, in general, within the entire CRZ and exceptions to these and other permissible and regulated activities in specific CRZ categories viz. CRZ-I, II, III and IV, shall be governed by the provisions of paragraph 5:-

- (i) Setting up of new industries and expansion of existing industries, operations or processes.
- (ii) Manufacture or handling of oil, storage or disposal of hazardous substances as specified in the notification of the Ministry of Environment, Forest and Climate Change number G.S.R.395 (E), dated the 4th April, 2016.
- (iii) Setting up of new fish processing units.
- (iv) Land reclamation, bunding or disturbing the natural course of seawater except for the activities permissible under this notification and executed with prior permission from the competent authority.
- (v) Discharge of untreated waste and effluents from industries, cities or towns and other human settlements.
- (vi) Dumping of city or town wastes including construction debris, industrial solid wastes, fly ash for the purpose of land filling.
- (vii) Port and harbour projects in high eroding stretches of the coast.
- (viii) Mining of sand, rocks and other sub-strata materials.
- (ix) Dressing or altering of active sand dunes.
- (x) In order to safeguard the aquatic system and marine life, disposal of plastic into the coastal waters shall be prohibited and adequate measures for management and disposal of plastic materials shall be undertaken in the CRZ.
- (xi) Drawal of ground water.

5. Regulation of permissible activities in CRZ:

5.1 CRZ-I:

5.1.1. CRZ-IA:

These areas are ecologically most sensitive and generally no activities shall be permitted to be carried out in the CRZ-I A area, with following exceptions:-

- (i) Eco-tourism activities such as mangrove walks, tree huts, nature trails, etc., in identified stretches areas subject to such eco-tourism plan featuring in the approved CZMP as per this notification, framed with due consultative process, public hearing, etc. and further subject to environmental safeguards and precautions related to the Ecologically Sensitive Areas, as enlisted in the CZMP.
- (ii) In the mangrove buffer, only such activities shall be permitted like laying of pipelines, transmission lines, conveyance systems or mechanisms and construction of road on stilts, etc. that are required for public utilities.
- (iii) Construction of roads and roads on stilts, by way of reclamation in CRZ-I areas, shall be permitted only in exceptional cases for defence, strategic purposes and public utilities, subject to a detailed marine or terrestrial or both environment impact assessment, to be recommended by the Coastal Zone Management Authority and approved by the Ministry of Environment, Forest and Climate Change; and in case construction of such roads passes through mangrove areas or is likely to damage the mangroves, a minimum three times the mangrove area affected or destroyed or cut during the construction process shall be taken up for compensatory plantation of mangroves.

5.1.2 CRZ-I B - The inter tidal areas:

Activities shall be regulated or permissible in the CRZ-I B areas as under:-

- (i) Land reclamation, bunding, etc. shall be permitted only for activities such as,-

- (a) foreshore facilities like ports, harbours, Jetties, wharves, quays, slipway, bridges, hover ports for coast guard, sea links, etc;
 - (b) projects for defence, strategic and security purposes;
 - (c) road on stilts, provided that such roads shall not be authorised for permitting development on the landward side of such roads, till the existing High Tide Line:
 Provided that the use of reclaimed land may be permitted only for public utilities such as mass rapid or multimodal transit system, construction and installation of all necessary associated public utilities and infrastructure to operate such transit or transport system including those for electrical or electronic signaling system, transit stopover of permitted designs; except for any industrial operation, repair or maintenance;
 - (d) measures for control of erosion;
 - (e) maintenance and clearing of waterways, channels, ports and hover ports for coast guard;
 - (f) measures to prevent sand bars, installation of tidal regulators, laying of storm water drains or for structure for prevention of salinity ingress and freshwater recharge.
- (ii) Activities related to waterfront or directly needing foreshore facilities such as ports and harbours, jetties, quays, wharves, erosion control measures, breakwaters, pipelines, lighthouses, navigational safety facilities, coastal police stations, Indian coast guard stations and the like.
 - (iii) Power by non-conventional energy sources and associated facilities.
 - (iv) Transfer of hazardous substances from ships to Ports, terminals and refineries and vice versa.
 - (v) Facilities for receipt and storage of petroleum products and liquefied natural gas as specified in Annexure-II to this notification, subject to implementation of safety regulations including guidelines issued by the Oil Industry Safety Directorate in the Ministry of Petroleum and Natural Gas and guidelines issued by the Ministry of Environment, Forest and Climate Change, provided that such facilities are for receipt and storage of fertilizers and raw materials required for fertilizers, like ammonia, phosphoric acid, sulphur, sulphuric acid, nitric acid, etc.
 - (vi) Storage of non-hazardous cargo i.e. edible oil, fertilizers and food grains in notified Ports.
 - (vii) Hatchery and natural fish drying.
 - (viii) Existing fish processing units may utilise 25% additional plinth area for modernisation purposes (only for additional equipment and pollution control measures) subject to the following:-
 - (a) Floor Space Index of such reconstruction not exceeding the permissible Floor Space Index as per prevalent town and country planning regulations;
 - (b) additional plinth area is constructed only to the landward side.
 - (c) approval of the concerned State Pollution Control Board or Pollution Control Committee.
 - (ix) Treatment facilities for waste and effluents and conveyance of treated effluents.
 - (x) Storm water drains.
 - (xi) Projects classified as strategic, defence related projects and projects of the Department of Atomic Energy, Government of India.
 - (xii) Manual mining of atomic mineral(s) notified under Part-B of the First Schedule to the Mining and Minerals (Development and Regulation) Act, 1957(67 of 1957) occurring as such or in association with one or other minerals in the intertidal zone by such agencies as authorised by the Department of Atomic Energy, Government of India as per mining plan approved by the Atomic Mineral Directorate for Exploration and Research:

Provided that the manual mining operations shall be carried out only by deploying persons using baskets and hand spades for collection of ore or mineral within the intertidal zone and as per approved mining plan, without deploying or using drilling and blasting or Heavy Earth Moving Machinery in the intertidal zone.

- (xiii) Exploration and extraction of oil and natural gas and all associated activities and facilities thereto;
- (xiv) Foreshore requiring facilities for transport of raw materials, facilities for intake of cooling water, intake water for desalination plants, etc, and outfall for discharge of treated wastewater or cooling water from thermal power plants in conformity with the environmental standards notified by Ministry of Environment, Forest and Climate Change and relevant directions of Central Pollution Control Board (CPCB) or State Pollution Control Board (SPCB) or Pollution Control Committee (PCC), as the case may be.
- (xv) Pipelines, conveying systems including transmission lines.
- (xvi) Weather radar for monitoring of cyclones prediction, ocean observation platforms, movement and associated activities.
- (xvii) Salt harvesting and associated facilities.
- (xviii) Desalination plants and associated facilities.

5.2 CRZ-II:

- (i) Activities as permitted in CRZ-I B, shall also be permissible in CRZ-II, in so far as applicable.
- (ii) Construction of buildings for residential purposes, schools, hospitals, institutions, offices, public places, etc. shall be permitted only on the landward side of the existing road, or on the landward side of existing authorised fixed structures:

Provided that no permission for construction of buildings shall be given on landward side of any new roads which are constructed on the seaward side of an existing road.

- (iii) Buildings permitted as in (ii) above, shall be subject to the local town and country planning regulations as applicable from time to time, and the norms for the Floor Space Index (FSI) or Floor Area Ratio (FAR) prevailing as on the date of this Notification, and in the event that there is a need for amendment of the FSI after the date of publication of this notification in the official Gazette, the Urban Local Body or State Government or Union territory Administration shall approach the Ministry of Environment, Forest and Climate Change through the concerned State Coastal Zone Management Authority (SCZMA) or Union Territory Coastal Zone Management Authority, as the case may be and the SCZMA shall forward the proposal to the National Coastal Zone Management Authority (NCZMA) with its views in the matter, and the NCZMA shall thereafter examine various aspects like availability of public amenities, environmental protection measures, etc., and take a suitable decision on the proposal and it shall be the responsibility of the concerned Town Planning Authority to ensure that the Solid Wastes are handled as per respective Solid Waste Management Rules and no untreated sewage is discharged on to the coast or coastal waters.
- (iv) Reconstruction of authorised buildings shall be permitted, without change in present land use, subject to the local town and country planning regulations as applicable from time to time, and the norms for the Floor Space Index or Floor Area Ratio, prevailing as on the date of publication of this notification in the official Gazette and in the event that there is a need for amendment of the FSI after the said date of this notification, the Urban Local Body or State Government or Union territory Administration shall approach the Ministry of Environment, Forest and Climate Change through the concerned State Coastal Zone Management Authority (SCZMA) or Union Territory Coastal Zone Management Authority, as the case may be and the CZMA shall forward the proposal to the National Coastal Zone Management Authority (NCZMA) with its views in the matter, and the NCZMA shall thereafter examine various aspects like availability of public amenities, environmental protection measures etc., and take a suitable decision on the proposal and it shall be the responsibility of the concerned Town Planning Authority to ensure that the Solid Wastes are

handled as per respective Solid Waste Management Rules and no untreated sewage is discharged on to the coast or coastal waters.

- (v) Development of vacant plots in designated areas for construction of beach resorts or hotels or tourism development projects subject to the conditions or guidelines at **Annexure-III** to this notification.
- (vi) Temporary tourism facilities shall be permissible in the beaches which shall only include shacks, toilets or washrooms, change rooms, shower panels; walk ways constructed using interlocking paver blocks, etc, drinking water facilities, seating arrangements, etc. and such facilities shall however be permitted only subject to the tourism plan featuring in the approved CZMP as per this notification, framed with due consultative process or public hearing, etc. and further subject to environmental safeguards enlisted in the CZMP, however, a minimum distance of 10 meter from HTL shall be maintained for setting up of such facilities.

5.3 CRZ-III:

- (i) Activities as permitted in CRZ-I B, shall also be permissible in CRZ-III, in so far as applicable.

- (ii) **Regulation of activities in NDZ:**

Following shall be permissible and regulated in the NDZ:-

- (a) No construction shall be permitted within NDZ in CRZ III, except for repairs or reconstruction of existing authorised structure not exceeding existing Floor Space Index, existing plinth area and existing density and for permissible activities under this notification including facilities essential for activities and construction or reconstruction of dwelling units of traditional coastal communities including fisher folk, incorporating necessary disaster management provisions and proper sanitation arrangements.
- (b) Agriculture, horticulture, gardens, pastures, parks, playfields and forestry.
- (c) Construction of dispensaries, schools, public rain shelter, community toilets, bridges, roads, provision of facilities for water supply, drainage, sewerage, crematoria, cemeteries and electric sub-station which are required for the local inhabitants may be permitted on a case to case basis by Coastal Zone Management Authority (CZMA).
- (d) Construction of units or auxiliary thereto for domestic sewage, treatment and disposal with the prior approval of the concerned Pollution Control Board or Committee.
- (e) Facilities required for local fishing communities such as fish drying yards, auction halls, net mending yards, traditional boat building yards, ice plant, ice crushing units, fish curing facilities and the like.
- (f) Wherever there is a national or State highway passing through the NDZ of CRZ-III areas, temporary tourism facilities such as toilets, change rooms, drinking water facility and temporary shacks can be taken up on the seaward side of the road.

On landward side of such roads in the NDZ, resorts or hotels and associated tourism facilities shall be permitted and such facilities shall, however, be permitted only subject to the incorporation of tourism plan in the approved CZMP as per this notification and the conditions or guidelines at Annexure-III, to this notification as applicable.

- (g) Temporary tourism facilities shall be permissible in the NDZ and beaches in the CRZ-III areas and such temporary facilities shall only include shacks, toilets or washrooms, change rooms, shower panels, walk ways constructed using interlocking paver blocks, etc, drinking water facilities, seating arrangements etc., and such facilities shall, however, be permitted only subject to the tourism plan featuring in the approved CZMP as per this notification subject to maintaining a minimum distance of 10 meters from HTL for setting up of such facilities.
- (h) Mining of atomic minerals notified under Part-B of the First Schedule to Mining and

Minerals (Development and Regulation) Act, 1957 (67 of 1957) occurring as such or in association with one or other minerals by such agencies as authorised by the Department of Atomic Energy, Government of India, as per mining plan by the Atomic Mineral Directorate for Exploration and Research.

(iii) **Regulation of activities for CRZ-III areas beyond NDZ:**

- (a) Development of vacant plots in designated areas for construction of beach resorts or hotels or tourism development projects subject to the conditions or guidelines at Annexure-III to this notification.
- (b) Construction or reconstruction of dwelling units, so long it is within the ambit of traditional rights and customary uses such as existing fishing villages, etc. and building permission for such construction or reconstruction will be subject to local town and country planning rules, with an overall height of construction not exceeding 9 meters and with only two floors (ground + one floor).
- (c) The local communities including fishermen may be permitted to facilitate tourism through 'home stay' without changing the plinth area or design or facade of the existing houses.
- (d) Construction of public rain shelters, community toilets, water supply drainage, sewerage, roads, bridges, etc.
- (e) Limestone mining:
Selective mining of limestone minerals may be permitted in specific identified areas under the mining plans, which are adequately above the height of HTL, based on the recommendations of reputed National Institutes in the mining field such as Council of Scientific and Industrial Research (CSIR), Central Mining Research Institute etc., provided that the extraction of minerals shall be carried out not below a height of 1 meter above the HTL and an adequate barrier shall be created so as to safeguard against saline water incursion and subject to appropriate safeguards related to pollution of coastal waters and prevention of coastal erosion.
- (f) Mining of atomic minerals notified under Part-B of the First Schedule of Mining and Minerals (Development and Regulation) Act, 1957 (67 of 1957) occurring as such or in association with one or other minerals by such agencies as authorised by Department of Atomic Energy, Government of India, as per mining plan by the Atomic Mineral Directorate for Exploration and Research.

- (iv) Drawing of groundwater and construction related thereto shall be prohibited within 200 meters of HTL except for the use of local communities in areas inhabited by them and in the areas between 200 to 500 meters of the HTL, groundwater withdrawal may be permitted only through manual means from ordinary wells for drinking, horticulture, agriculture and fisheries, etc. where no other source of water is available and restrictions for such drawal may be imposed by the designated Authority by State Government or Union territory Administration in the areas affected by sea water intrusion, however, for horticulture and agriculture purpose, micro irrigation promoted by Government welfare schemes shall be permitted.
- (v) Development of airports in wastelands and non-arable lands in CRZ-III areas with adequate environmental safeguards.

5.4 CRZ-IV:

Activities shall be permitted and regulated in the CRZ IV areas as under:-

- (i) Traditional fishing and allied activities undertaken by local communities.
- (ii) Land reclamation, bunding, etc to be permitted only for activities such as.-
 - (a) foreshore facilities like ports, harbours, Jetties, wharves, quays, slipway, bridges, sea links and hover ports for coast guard ,etc;
 - (b) projects for defence, strategic and security purpose including coast guard;

- (c) measures for control of erosion;
- (d) maintenance and clearing of waterways, channels and ports;
- (e) measures to prevent sand bars, installation of tidal regulators, laying of storm water drains or for structure for prevention of salinity ingress and freshwater recharge.
- (iii) Activities related to waterfront or directly needing foreshore facilities, such as ports and harbours, jetties, quays, wharves, erosion control measures, breakwaters, pipelines, navigational safety facilities and the like.
- (iv) Power by non-conventional energy sources and associated facilities such as offshore wind, wave energy, ocean thermal energy conversion, etc.
- (v) Transfer of hazardous substances from ships to Ports.
- (vi) Storage of non-hazardous cargo like edible oil, fertilizers and food grains in notified Ports.
- (vii) Facilities for discharging treated effluents into the water course.
- (viii) Projects classified as strategic and defence related projects including coast guard coastal security network.
- (ix) Projects of department of Atomic Energy.
- (x) Exploration and extraction of oil and natural gas and all associated activities and facilities thereto.
- (xi) Exploration and mining of atomic minerals notified under Part-B of the First Schedule of the Mining and Minerals (Development and Regulation) Act, 1957 (67 of 1957), occurring as such or in association with other mineral(s) and of such associated mineral(s).
- (xii) Foreshore requiring facilities for transport of raw materials, facilities for intake of cooling water and outfall for discharge of treated wastewater or cooling water from thermal power plants, and foreshore requiring facilities for transport of raw materials, facilities for intake of cooling water and outfall for discharge of treated wastewater or cooling water from thermal power plants, in conformity with the environmental standards notified by Ministry of Environment, Forest and Climate Change and relevant directions of the Central Pollution Control Board or State Pollution Control Board or Pollution Control Committee.
- (xiii) Pipelines, conveying systems including transmission lines.
- (xiv) Weather radar for monitoring of cyclone prediction, ocean observation platforms, movement and associated activities.
- (xv) Construction of memorials or monuments and allied facilities by the concerned State Government in CRZ-IV (A) areas, in exceptional cases, with adequate environmental safeguards, subject to the following, namely: -
 - (a) the concerned State Government shall submit justification for locating the project in CRZ-IVA area along with details of alternate sites considered and weightage matrix on various parameters including environmental parameters, to State Coastal Zone Management Authority who will examine the project and make recommendation to the Central Government (Ministry of Environment, Forest and Climate Change) for grant of Terms of Reference (ToRs) for preparation of an environmental impact assessment report by the State Government;
 - (b) On grant of ToRs by the Central Government, the concerned State Government shall submit the draft Environmental Impact Assessment report (EIA) with Environmental Management Plan (EMP), draft Risk Assessment Report with Disaster Management Plan (DMP) including on-site and off-site emergency plan and evacuation plan during emergency, to the State Pollution Control Board for conduct of public hearing for the proposed project in accordance with the procedure laid down under the Environment Impact Assessment (EIA) notification number S.O. 1533(E), dated the 14th September, 2006;

- (c) The concerned State Government shall, after addressing the relevant issues raised by the public during the public hearing referred to in sub-item (b), submit the final EIA, EMP, Risk Assessment and DMP, to the State CZMA for their examination and recommendation to MoEF&CC;
- (d) The Central Government may, if it considers necessary so to do, dispense with the requirement of public hearing referred to in sub-clause (b), if it is satisfied that the project will not involve rehabilitation and resettlement of the public or the project site is located away from human habitation.

5.5 Requirement for Clearance from Department of Atomic Energy installations:

Prior to undertaking any developmental activity including construction of new structures, falling in the boundary limits specified by Atomic Energy Regulatory Board (AERB) guidelines, prior clearance shall be obtained from Department of Atomic Energy installations.

6. Coastal Zone Management Plan (CZMP)

- (i) All coastal States and Union territory administrations 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 and all the project activities attracting the provisions of this notification shall be required to be appraised as per the updated CZMP under this notification and until and unless the CZMP 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.
- (ii) 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.
- (iii) 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.
- (iv) 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).
- (v) The Ministry of Environment, Forest and Climate Change shall thereafter consider and approve the respective CZMP of concerned State Governments or Union territory administrations.
- (vi) The CZMP shall not normally be revised before a period of five years after which, the concerned State Government or the Union territory may consider undertaking a revision.

7. CRZ clearance for permissible and regulated activities- Delegation:

- (i) All permitted or regulated project activities attracting the provisions of this notification shall be required to obtain CRZ clearance prior to their commencement.
- (ii) All development activities or projects in CRZ-I and CRZ-IV areas, which are regulated or permissible as per this notification, shall be dealt with by Ministry of Environment, Forest and Climate Change for CRZ clearance, based on the recommendation of the concerned Coastal Zone Management Authority.

- (iii) For all other permissible and regulated activities as per this notification, which fall purely in CRZ-II and CRZ-III areas, the CRZ clearance shall be considered by the concerned Coastal Zone Management Authority and such projects in CRZ -II and III, which also happen to be traversing through CRZ-I or CRZ-IV areas or both, CRZ clearance shall, however be considered only by the Ministry of Environment, Forest and Climate Change, based on recommendations of the concerned Coastal Zone Management Authority.
- (iv) Projects or activities which attract the provisions of this notification as also the provisions of EIA notification, 2006 number S.O. 1533(E), dated the 14th September, 2006, shall be dealt with for a composite Environmental and CRZ clearance under EIA Notification, 2006 by the concerned approving Authority, based on recommendations of the concerned Coastal Zone Management Authority, as per delegations i.e., State Environmental Impact Assessment Authority (hereinafter referred to as the SEIAA) or the Ministry of Environment, Forest and Climate Change for category 'B' and category 'A' projects respectively.
- (v) In case of building or construction projects with built-up area less than the threshold limit stipulated for attracting the provisions of the EIA Notification, 2006 these shall be approved by the concerned local State or Union territory Planning Authorities in accordance with this notification, after obtaining recommendations of the concerned Coastal Zone Management Authority.
- (vi) Only for self-dwelling units up to a total built up area of 300 square meters, approval shall be accorded by the concerned local Authority, without the requirement of recommendations of concerned Coastal Zone Management Authority and such authorities shall, however, examine the proposal from the perspective of the Coastal Regulation Zone notification before according approval.

8. Procedure for CRZ clearance for permissible and regulated activities:

- (i) The project proponents shall apply with the following documents to the concerned State or the Union territory Coastal Zone Management Authority for seeking prior clearance under this notification:-
 - (a) Project summary details as per Annexure-V to this notification.
 - (b) Rapid Environment Impact Assessment (EIA) Report including marine and terrestrial component, as applicable, except for building construction projects or housing schemes.
 - (c) Comprehensive EIA with cumulative studies for projects, (except for building construction projects or housing schemes with built-up area less than the threshold limit stipulated for attracting the provisions of the EIA Notification, 2006 number S.O 1533(E), dated 14th September, 2006) if located in low and medium eroding stretches, as per the CZMP to this notification.
 - (d) Risk Assessment Report and Disaster Management Plan, except for building construction projects or housing schemes with built-up area less than the threshold limit stipulated for attracting the provisions of the EIA Notification, 2006 number S.O 1533(E), dated 14th September, 2006).
 - (e) CRZ map in 1:4000 scale, drawn up by any of the agencies identified by the Ministry of Environment, Forest and Climate Change vide its Office Order number J-17011/8/92-IA-III, dated the 14th March, 2014 using the demarcation of the HTL or LTL, as carried out by NCSCM.
 - (f) Project layout superimposed on the CRZ map duly indicating the project boundaries and the CRZ category of the project location as per the approved Coastal Zone Management Plan under this notification.
 - (g) The CRZ map normally covering 7 kilometre radius around the project site also indicating the CRZ-I, II, III and IV areas including other notified ecologically sensitive areas.
 - (h) "Consent to establish" or No Objection Certificate from the concerned State Pollution Control Board or Union territory Pollution Control Committee for the projects involving treated discharge of industrial effluents and sewage, and in case prior consent of

Pollution Control Board or Pollution Control Committee is not obtained, the same shall be ensured by the proponent before the start of the construction activity of the project, following the clearance under this notification.

- (ii) The concerned Coastal Zone Management Authority shall examine the documents in clause (i) above, in accordance with the approved Coastal Zone Management Plan and in compliance with this notification and make recommendations within a period of sixty days from date of receipt of complete application as under: -
- (a) For the projects or activities also attracting the EIA Notification, 2006 number S.O. 1533(E), dated 14th September, 2006, the Coastal Zone Management Authority shall forward its recommendations to Ministry of Environment, Forest and Climate Change or SEIAA for category 'A' and category 'B' projects respectively, to enable a composite clearance under the EIA Notification, 2006 number S.O. 1533(E), dated 14th September, 2006, however, even for such Category 'B' projects located in CRZ-I or CRZ-IV areas, final recommendation for CRZ clearance shall be made only by the Ministry of Environment, Forest and Climate Change to the concerned SEIAA to enable it to accord a composite Environmental Clearance and CRZ clearance to the proposal.
 - (b) Coastal Zone Management Authority shall forward its recommendations to the Ministry of Environment, Forest and Climate Change for the projects or activities not covered in the EIA notification, 2006, but attracting this notification and located in CRZ-I or CRZ-IV areas.
 - (c) Projects or activities not covered in the aforesaid EIA Notification, 2006, but attracting this notification and located in CRZ-II or CRZ-III areas shall be considered for clearance by the concerned Coastal Zone Management Authority within sixty days of the receipt of the complete proposal from the proponent.
 - (d) In case of construction projects attracting this notification but with built-up area less than the threshold limit stipulated for attracting the provisions of the aforesaid EIA Notification 2006, Coastal Zone Management Authority shall forward their recommendations to the concerned State or Union territory planning authorities, to facilitate granting approval by such authorities.
- (iii) The Ministry of Environment, Forest and Climate Change shall consider complete project proposals for clearance under this notification, based on the recommendations of the Coastal Zone Management Authority, within a period of sixty days.
- (iv) In case the Coastal Zone Management Authorities are not in operation due to their reconstitution or any other reasons, then it shall be responsibility of the Department of Environment in the State Government or Union territory Administration, who are the custodian of the CZMP of respective States or Union territories, to provide comments and recommend the proposals in terms of the provisions of the said notification.
- (v) The clearance accorded to the projects under this notification shall be valid for a period of seven years, provided that the construction activities are completed and the operations commence within seven years from the date of issue of such clearance.
- The validity may be further extended for a maximum period of three years, provided an application is made to the concerned authority by the applicant within the validity period, along with recommendation for extension of validity of the clearance by the concerned State or Union territory Coastal Zone Management Authority.
- (vi) Post clearance monitoring:
- (a) It shall be mandatory for the project proponent to submit half-yearly compliance reports in respect of the stipulated terms and conditions of the environmental clearance in hard and soft copies to the regulatory authority(s) concerned, on the 1st June and 31st December of each calendar year and all such compliance reports submitted by the project proponent shall be published in public domain and its copies shall be given to any person on application to the concerned Coastal Zone Management Authority.

- (b) The compliance report shall also be displayed on the website of the concerned regulatory authority.
- (vii) To maintain transparency in the working of the Coastal Zone Management Authority, it shall be the responsibility of the Coastal Zone Management Authority to create a dedicated website and post the agenda, minutes, decisions taken, clearance letters, violations, action taken on the violations and court matters including the Orders of the Hon'ble Court as also the approved CZMP of the respective State Government or Union territory.

9. Enforcement of this notification:

- (i) For the purposes of implementation and enforcement of the provisions of this notification and compliance with conditions stipulated thereunder, the powers either original or delegated are available under Environment (Protection) Act, 1986 (29 of 1986) with the Ministry of Environment, Forest and Climate Change, State Government or the Union territory Administration, National Coastal Zone Management Authority and the State or Union territory Coastal Zone Management Authority;
- (ii) The composition, tenure and mandate of National Coastal Zone Management Authority and State Government or the Union territory Coastal Zone Management Authority have already been notified by the Ministry of Environment, Forest and Climate Change in terms of Orders of Hon'ble Supreme Court in Writ Petition 664 of 1993;
- (iii) The State Government or the Union territory Coastal Zone Management Authority shall primarily be responsible for enforcing and monitoring of this notification and to assist in this task, the State Government and the Union territory shall constitute district level Committees under the Chairmanship of the District Magistrate concerned comprising at least three representatives of local traditional coastal communities including from fishermen, and the State Government may consider the enforcement of this notification to the level of respective District Magistrates.
- (iv) The dwelling units of the traditional coastal communities including fishermen, tribals as were permissible under the provisions of the Coastal Regulation Zone notification, 2011 number S.O. 19(E), dated the 6th January, 2011, but which have not obtained formal approval from concerned authorities under the said Notification shall be considered by the respective Coastal Zone Management Authority and the dwelling units shall be regularised subject to the following condition, namely: -
- (a) these are not used for any commercial activity;
- (b) these are not sold or transferred to non-traditional coastal community.

10. Areas requiring special consideration:

10.1 Critically Vulnerable Coastal Areas (CVCAs):

- (i) For all the CVCAs mentioned in sub-paragraph 3.1, Integrated Management Plans (IMPs) shall be prepared, which shall, inter alia, keep in view the conservation and management of mangroves, needs of local communities, such as dispensaries, schools, public rain shelter, community toilets, bridges, roads, jetties, water supply, drainage, sewerage and the impact of sea level rise and other natural disasters and the IMPs will be prepared in line with the guidelines for preparation of Coastal Zone Management Plan.
- (ii) Till such time the IMPs are approved and notified, construction of dispensaries, schools, public rain/cyclone shelters, community toilets, bridges, roads, jetties, water supply, drainage, sewerage which are required for traditional inhabitants shall be permitted on a case to case basis, by the Coastal Zone Management Authority with due regards to the views of coastal communities including fisher folk.

10.2 CRZ for inland backwater islands and islands along mainland coast:

- (i) All the inland islands in the coastal backwaters and islands along the mainland coast shall also be covered under this notification.

- (ii) In view of the unique coastal systems of backwater islands and islands along the mainland coast, along with space limitations in such coastal stretches, CRZ of 20 meters from the HTL on the landward side shall uniformly apply to such islands and activities shall be regulated as under:-
- (a) existing dwelling units of local communities may be repaired or reconstructed within 20 meters from the HTL of these islands, however, no new construction shall be permitted in this zone.
- (b) foreshore facilities, such as fishing jetty, fish drying yards, net mending yard, fishing processing by traditional methods, boat building yards, ice plant, boat repairs and the like, may be taken up in CRZ limits subject to due environmental safeguards.
- (iii) Integrated Island Management Plans (IIMPs), as applicable to smaller islands in Lakshadweep and Andaman & Nicobar, as per Island Protection Zone Notification, 2011 number S.O. 20(E), dated the 6th January, 2011, shall be formulated by respective States or Union territory for all such islands and submitted to Ministry of Environment, Forest and Climate Change and till the IIMPs are framed, provisions of this notification shall not apply and the CZMP as per provisions of CRZ Notification 2011 number S.O. 19(E), dated the 6th January, 2011, shall continue to apply.

10.3 CRZ areas falling within municipal limits of Greater Mumbai:

- (i) In order to protect and preserve the 'green lung' of the Greater Mumbai area, all open spaces, parks, gardens, playgrounds indicated in development plans within CRZ-II shall be categorised as No Development Zone and a Floor Space Index up to 15% shall be allowed only for construction of civic amenities, stadium and gymnasium meant for recreational or sports related activities and the residential or commercial use of such open spaces shall not be permissible.
- (ii) Construction of sewage treatment plants in CRZ-I area for the purpose of treating the sewage from the municipal area shall be taken only by the municipal authorities in exceptional circumstances, where no alternate site is available to set up such facilities, subject to recommendations of the Coastal Zone Management Authority and approval by the Central Government and in case the construction of such plant is inevitable in a mangrove area, a minimum three times the mangrove area affected or destroyed or cut during the construction process shall be taken up for compensatory plantation of mangroves.

[F. No. 19-112/2013-IA-III]

RITESH KUMAR SINGH, Jt. Secy.

Annexure-I

CONSERVATION, PROTECTION AND MANAGEMENT FRAMEWORK FOR ECOLOGICALLY SENSITIVE AREAS

The coastal and marine Ecologically Sensitive Areas (ESAs) and the geo-morphological features play a vital role in maintaining the functions of the coast. Mangroves, beaches, coral reefs, etc., aid in controlling coastal erosion, shoreline change, saltwater intrusion and also serve as natural defence against coastal hazards such as storm surges, cyclones and tsunamis. The ESAs maintain the biological integrity of the coast by providing direct and indirect ecosystem services to the coastal livelihood. In addition, several invaluable archaeological and heritage sites are also located along the coast. Hence conservation and protection of the above areas, features and sites become necessary.

1. General measures

- (i) All ESAs shall be identified and boundary delineated by NCSCM using satellite data.
- (ii) The State Governments or Union territory Administrations through the authorised agencies shall prepare CZMP as per the guidelines contained in this notification highlighting the conservation and protection of the ESAs.
- (iii) Those activities permissible under this notification shall be included in the CZMP.

Specific conditions shall be adopted for the conservation, protection and management of each of the ESAs as under: -

1.1 Mangroves:

- (i) Mangroves declared as forest under the Forest (Conservation) Act, 1980 (69 of 1980).

Notwithstanding anything contained in this notification, such mangroves declared by the concerned State Governments or Union territory Administrations or Central Government as forest land under the Forest (Conservation) Act, 1980 (69 of 1980) shall attract the provisions of the said Act.

- (ii) Mangroves not declared under Forest (Conservation) Act, 1980:

(a) Mangroves in Government land shall be protected based on a detailed plan to be prepared by the concerned State Governments or Union territory administrations, and in case the mangrove area is more than 1000 square meters, a buffer of 50 metre along the periphery of mangrove area shall be provided. This buffer zone of 50 metre may be utilised for public facilities for developing parks, research facilities related to mangrove biodiversity, facilities for conservation and the like.

(b) Mangroves in private land will not require a buffer zone.

1.2 Corals and coral reefs and associated biodiversity:

- (i) Destruction of coral and coral reefs and the surroundings is a prohibited activity.
- (ii) All coral and coral reefs shall be protected except for those small quantities required for research purposes.
- (iii) Coral and coral reefs transplantation activities shall be through recognised research institutions wherever required for regeneration after obtaining necessary approvals under Wildlife (Protection) Act 1972 (53 of 1972).
- (iv) The dead or destroyed or both coral areas shall be taken up for rejuvenation and rehabilitation. The conservation and protection of corals and coral reefs shall be taken up as follows:-
- (a) active and live coral and coral reefs identified and delineated shall be declared and notified as ESA under Environment (Protection) Act 1986 (29 of 1986);
- (b) it shall be ensured that no activities that are detrimental to the health of corals, coral reefs and its associated biodiversity, such as mining, effluent and sewage discharge, dredging, ballast water discharge, ship washings, fishing other than traditional non-destructive fisheries, construction activities and the like are taken up in and around the coral areas.

1.3 The National Parks, marine parks, Sanctuaries, reserve forests, wildlife habitats and other protected areas declared under the provisions of Wild Life (Protection) Act, 1972 (53 of 1972), the Forest (Conservation) Act 1980 (69 of 1980) or Environment (Protection) Act 1986 (29 of 1986); including Biosphere Reserves shall be conserved and protected as follows:-

- (i) Conservation and protection of the above mentioned areas shall be as per the provisions of the respective Acts, notifications or guidelines as the case may be.
- (ii) Efforts shall be made to increase the forest area in the coastal region in order to prevent loss of life and property from increased storms, tides and floods.
- (iii) The concerned State Governments or Union territory administrations shall provide for adequate funds for such measures to undertake shelter belt plantation or bio-shields with planting material suitable to the location.

1.4. Salt marshes:

The conservation and protection of salt marshes shall be as follows:-

- (i) The salt marsh areas shall be conserved and protected and efforts shall be made to promote the endemic biodiversity in the salt marshes.
- (ii) Only those activities required for overhead conveying or transmission of cables and underground laying of transmission line cables and so on, shall be permissible.
- (iii) Traditional fishing shall be permissible in salt marshes.
- (iv) Temporary tourism facilities around the salt marsh areas may be considered subject to adhering to norms laid down in the guidelines.
- (v) Certain salt marshes which have less biodiversity, identified by NCSCM and demarcated in Coastal Zone Management Plan can be considered for salt pan activities.

1.5 Turtle nesting grounds shall be protected and conserved as follows:-

- (i) Turtle nesting grounds identified by the concerned State Governments or Union territory administrations shall be protected as per Wildlife (Protection) Act of 1972.
- (ii) No activities shall be permitted in and around the turtle nesting ground including those causing light and sound pollution except for those required for conservation and protection of these sites.
- (iii) Strict management plans for protecting the turtle nesting grounds shall be undertaken and implemented by the concerned State or Union territory Authorities.

1.6 Horse shoe crabs habitats shall be protected and conserved as follows:-

- (i) The habitat identified shall be taken up for conservation and protection.
- (ii) No activities shall be taken up in and around these habitats which affect the horse shoe crab ecosystem.

1.7 Sea grass beds shall be protected and conserved as follows:-

- (i) Identified sea grass beds shall be conserved and protected.
- (ii) No developmental activities that have adverse effect on the sea grass bed shall be undertaken.
- (iii) Efforts shall be made to propagate sea grass beds along the coastal waters where ever possible by States or Union territories as it acts as a carbon sink.

1.8 Nesting grounds of birds shall be protected and conserved as follows:-

- (i) The nesting ground of birds including their local migratory route shall be protected. No developmental activities which have adverse impact on the nesting grounds and the migratory routes shall be undertaken including construction of wind mills, transmission lines and the like in the locality.
- (ii) Efforts shall be made to increase the forest cover and mangrove cover including enriching the biodiversity of salt marsh and other coastal water bodies so as to provide for suitable habitat for the avifauna.

1.9 Geo-morphologically Important Zones shall be protected and managed as follows:

- (i) **Sand dunes** identified shall be conserved and protected as follows:
 - (a) sand dunes identified shall be notified under Environment (Protection) Act 1986;
 - (b) no developmental activities shall be permissible except for providing eco-friendly temporary tourism facilities on stilts such as walkways, tents and the like;
 - (c) mining of sand from sand dunes shall be prohibited activity except for the removal of atomic minerals with proper replenishment using the tailings or other suitable sand;
 - (d) no activities on the sand dunes shall be taken up that would lead to erosion/destruction of sand dunes;
 - (e) afforestation, if any, on the sand dunes shall be done only with native flora;

(f) the States or Union territory shall prepare management plans for the demarcated sand dunes.

(iii) **Sandy beaches:**

(a) Mining of beach sand is prohibited except for manual mining of atomic minerals with proper replenishment using the tailings or other suitable sand.

(b) When the permissible developmental activities are taken up on the beaches if loss of beach in the neighbourhood is predicted, necessary beach nourishment to compensate for the losses shall be undertaken by the project authorities and its long term maintenance shall be ensured by them.

(c) The States or Union Territory shall prepare management plans for the demarcated beaches.

(iv) **Biologically active mudflats:**

(a) Biologically active mudflats shall be identified by NCSCM in association with State Governments or Union territory administrations.

(b) The States or Union territories shall prepare management plans for such demarcated biologically active mudflats.

1.10 Areas or structures of archaeological importance and heritage value sites:

(i) State Archaeological agencies shall be responsible for conservation and protection of all archaeological structures and heritage sites identified by the Archaeological Survey of India, as per the provisions of the respective Acts, notifications or guidelines.

(ii) No activities that are detrimental to the identified areas or structures of archaeological and heritage value shall be permitted.

(iii) It shall be ensured that these structures or areas are preserved and activities undertaken without changing the façade/plinth of such structures. Such structures could be considered for use in accordance with the relevant norms after undertaking careful designing of the interiors without changing the exterior architectural design of the structure.

Annexure-II

LIST OF PETROLEUM AND CHEMICAL PRODUCTS PERMITTED FOR STORAGE IN CRZ, EXCEPT CRZ-I A

- (i) Crude oil;
- (ii) Liquefied Petroleum Gas;
- (iii) Motor spirit;
- (iv) Kerosene;
- (v) Aviation fuel;
- (vi) High speed diesel;
- (vii) Lubricating oil;
- (viii) Butane;
- (ix) Propane;
- (x) Compressed Natural Gas;
- (xi) Naphtha;
- (xii) Furnace oil;
- (xiii) Low Sulphur Heavy Stock;

- (xiv) Liquefied Natural Gas;
- (xv) Fertilizers and raw materials for manufacture of fertilizers;
- (xvi) Acetic acid;
- (xvii) Mono ethylene glycol;
- (xviii) Paraxylene;
- (xix) Ethane;
- (xx) Butadine;
- (xxi) Methanol;
- (xxii) Caustic;
- (xxiii) Bitumen.

Annexure-III**GUIDELINES FOR DEVELOPMENT OF BEACH RESORTS, HOTELS AND TOURISM DEVELOPMENT PROJECTS IN THE DESIGNATED CRZ AREAS****1. CRZ-II**

Construction of beach resorts or hotels in designated areas of CRZ-II for occupation of tourist or visitors shall be subject to the following conditions, namely: -

- (i) construction shall be permitted only to the landward side of an existing road or existing authorized fixed structures;
- (ii) live fencing and barbed wire fencing with vegetative cover may be allowed around private properties subject to the condition that such fencing shall in no way hamper public access to the beach;
- (iii) no flattening of sand dunes shall be carried out;
- (iv) no permanent structures for sports facilities shall be permitted except construction of goal posts, net posts and lamp posts;
- (v) construction of basement may be allowed subject to the condition that no objection certification is obtained from the State Ground Water Authority to the effect that such construction will not adversely affect the flow of groundwater in that area;
- (vi) the State Ground Water Authority shall take into consideration the guidelines issued by the Central Government before granting such no objection certificate;
- (vii) the quality of treated effluents, solid wastes, emissions and noise levels and the like, from the project area must conform to the standards laid down by the competent authorities including the Central or State Pollution Control Board and under the Environment (Protection) Act, 1986 (29 of 1986);
- (viii) necessary arrangements for the treatment of the effluents and solid wastes must be made and it must be ensured that the untreated effluents and solid wastes are not discharged into the water or on the beach; and no effluent or solid waste shall be discharged on the beach;
- (ix) if the project involves diversion of forest land for non-forest purposes, clearance as required under the Forest (Conservation) Act, 1980 (69 of 1980) shall be obtained and the requirements of other Central and State laws as applicable to the project shall be met with and approval of the State or Union territory Tourism Department shall be obtained.

2. CRZ-III

Construction of beach resorts and hotels in designated areas of CRZ- III for occupation of tourists or visitors shall be subject to the following conditions, namely: -

- (i) live fencing and barbed wire fencing with vegetative cover may be allowed around private properties subject to the condition that such fencing shall in no way hamper public access to the beach;
- (ii) no flattening of sand dunes shall be carried out;
- (iii) no permanent structures for sports facilities shall be permitted except construction of goal posts, net posts and lamp posts;
- (iv) construction of basement may be allowed subject to the condition that no objection certification is obtained from the State Ground Water Authority to the effect that such construction will not adversely affect the flow of groundwater in that area;
- (v) the State Ground Water Authority shall take into consideration the guidelines issued by the Central Government before granting such no objection certificate;
- (vi) though no construction is allowed in the no development zone for the purposes of calculation of Floor Space Index, the area of entire plot including the portion which falls within the no development zone shall be taken into account;
- (vii) the total covered area on all floors shall not exceed 33 per cent of the plot size i.e., the Floor Space Index shall not exceed 0.33 and the open area shall be suitably landscaped with appropriate vegetal cover;
- (viii) the construction shall be consistent with the surrounding landscape and local architectural style;
- (ix) the overall height of construction up to the highest ridge of the roof, shall not exceed 9 metres and the construction shall not be more than two floors (ground floor plus one upper floor);
- (x) groundwater shall not be tapped within 200 metre of the High Tide Line; and within the 200 to 500 metre zone it can be tapped only with the concurrence of the Central or State Ground Water Board;
- (xi) extraction of sand, leveling or digging of sandy stretches, except for structural foundation of building or swimming pool, shall not be permitted within 500 metres of the High Tide Line;
- (xii) the quality of treated effluents, solid wastes, emissions and noise levels and the like, from the project area must conform to the standards laid down by the competent authorities including the Central or State Pollution Control Board and under the Environment (Protection) Act, 1986 (29 of 1986);
- (xiii) necessary arrangements for the treatment of the effluents and solid wastes must be made and it must be ensured that the untreated effluents and solid wastes are not discharged into the water or on the beach; and no effluent or solid waste shall be discharged on the beach;
- (xiv) to allow public access to the beach, at least a gap of 20 metres width shall be provided between any two hotels or beach resorts; and in no case shall gaps be less than 500 metres apart; and
- (xv) If the project involves diversion of forestland for non-forest purposes, clearance as required under the Forest (Conservation) Act, 1980 (69 of 1980) shall be obtained and the requirements of other Central and State laws as applicable to the project shall be met with; and approval of the State or Union territory Tourism Department shall be obtained.

Note: Construction of beach resorts or hotels shall not be permitted in Ecologically sensitive areas (such as marine parks, mangroves, coral reefs, breeding and spawning grounds of fish, wildlife habitats and such other area as may be notified by the Central Government or State Government or Union territory administrations).

ANNEXURE -IV**GUIDELINES FOR PREPARATION OF COASTAL ZONE MANAGEMENT PLANS****1. Demarcation of High Tide Line and Low Tide Line:**

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.

2. Hazard Line:

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.

3. Preparation of CZM Maps:

- (i) Base Maps of 1:25,000 scale shall be acquired from the Survey of India (SOI) and wherever 1: 25,000 maps are not available, 1: 50,000 maps shall be enlarged to 1: 25,000 for the purpose of base map preparation and these maps will be of the standard specification given below:-

Unit : 7.5 minutes X 7.5 minutes

Numbering : Survey of India Sheet Numbering System

Horizontal Datum : Everest or WGS 84

Vertical Datum : Mean Sea Level (MSL)

Topography : Topography in the SOI maps will be updated using latest satellite imageries or aerial photographs

- (ii) Coastal Zone Management (CZM) Maps of scale 1:25,000 shall be got prepared by any of the agencies identified by the Ministry of Environment, Forest and Climate Change vide its Office Order number J-17011/8/92-IA-III dated the 14th March, 2014 using the demarcation of the High Tide Line or LTL, as carried out by NCSCM.
- (iii) Various regulatory lines viz. at a distance of 20 metres, 50 metres, 200 metres and 500 metres from HTL respectively, as applicable in various CRZ categories, and the Hazard line shall be demarcated and transferred to the CZM maps.
- (iv) HTL, LTL and CRZ boundaries, as applicable, shall also be demarcated in the CZM maps along the banks of tidal influenced inland water bodies.
- (v) Classification of different coastal zones shall be done as per the CRZ notification and Standard national or international colour codes shall be used.

4. Local level CZM Maps:

- (i) Local level CZM Maps are for the use of local bodies and other agencies to facilitate implementation of the Coastal Zone Management Plans.
- (ii) Cadastral (village) maps in 1:3960 or the nearest scale, as available with revenue authorities shall be used as the base maps.
- (iii) HTL, LTL, other CRZ regulatory lines and the Hazard line shall be demarcated in the cadastral maps and classifications shall be transferred into local level CZM maps.

5. Classification of CRZ areas:

- (i) The CZM Maps shall clearly demarcate the land use plan of the area and map out the Ecologically Sensitive Areas (ESAs) or the CRZ-IA areas as per mapping made available by NCSCM to coastal State or Union territories. All such ESAs shall be appropriately demarcated with colour codes.
- (ii) Buffer zone along mangrove areas of more than 1000 square metres shall be stipulated with a different colour distinguishing from the mangrove area. The buffer zone shall also be classified as CRZ-I area.
- (iii) In the CRZ areas, the fishing villages, common properties of the fishermen communities, fishing jetties, ice plants, fish drying platforms or areas infrastructure facilities of fishing and local communities such as dispensaries, roads, schools, and the like, shall be indicated on the cadastral scale maps. States and Union territories shall prepare detailed plans for long term housing needs of coastal fisher communities in view of expansion and other needs, provisions of basic services including sanitation, safety, and disaster preparedness.
- (iv) The water areas of CRZ-IV shall be demarcated and clearly demarcated if the water body is sea, lagoon, backwater, creek, bay, and estuary and for such classification of the water bodies the terminology used by Naval Hydrographic Office shall be relied upon.
- (v) The fishing Zones in the water bodies and the fish breeding areas shall be clearly marked.
- (vi) In CVCAs, the land use maps shall be superimposed on the Coastal Zone Management Plan clearly demarcating the CRZ-I, II, III, IV.
- (vii) The existing authorised developments on the seaward side shall be clearly demarcated.
- (viii) The features like cyclone shelters, rain shelters, helipads and other infrastructure including road network may be clearly indicated on the CZM Maps for the purpose of rescue and relief operations during cyclones, storms, tsunami and the like.
- (ix) Construction of buildings or other activities shall be permitted under the CZMP provided adequate arrangements are made for proper management and disposal of solid and liquid wastes in accordance with the environmental standards, rules and statutes, and under no circumstances, untreated effluents shall be disposed off in the coastal waters.

6. Public consultations on CZMP:

- (i) The draft CZMP prepared shall be given wide publicity and suggestions and objections received in accordance with the Environment (Protection) Act, 1986. Public hearing on the draft CZMP shall be held at district level by the concerned CZMA.
- (ii) Based on the suggestions and objections received the CZMPs shall be revised and approval of Ministry of Environment, Forest and Climate Change shall be obtained.
- (iii) The approved CZMP shall be put up on the website of Ministry of Environment, Forest and Climate Change, concerned website of the State or Union Territory Coastal Zone Management Authority and hard copy made available in the Panchayat Office and District Collector Office.

7. Revision of Coastal Zone Management Plans:

- (i) Whenever there is a doubt, the concerned State or Union territory Coastal Zone Management Authority shall refer the matter to the National Centre for Sustainable Coastal Management who shall verify the CZMP based on latest satellite imagery and ground truthing.
- (ii) If required, the rectified map shall be submitted to Ministry of Environment, Forest and Climate Change for consideration.



भारत का राजपत्र

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असाधारण

EXTRAORDINARY

भाग II—खण्ड 3—उप-खण्ड (ii)

PART II—Section 3—Sub-section (ii)

प्राधिकार से प्रकाशित

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पर्यावरण, वन और जलवायु परिवर्तन मंत्रालय

अधिसूचना

नई दिल्ली, 1 मई, 2020

का.आ. 1422(अ).— भारत सरकार के पर्यावरण और वन मंत्रालय की अधिसूचना संख्या का.आ. 19(अ.), तारीख 6 जनवरी, 2011 (जिसे इसमें इसके पश्चात् तटीय विनियमन क्षेत्र अधिसूचना, 2011 कहा गया है) द्वारा केंद्रीय सरकार ने कतिपय तटीय विस्तारों को तटीय विनियमन क्षेत्र के रूप में घोषित किया था और उक्त क्षेत्र में उद्योगों को स्थापित करने और विस्तार करने, प्रचालन और प्रसंस्करण पर निर्बंधन अधिरोपित किये गए थे ;

और, केंद्रीय सरकार ने विभिन्न पणधारियों, जिनके अंतर्गत राज्य सरकारें भी हैं, से उक्त अधिसूचना के उपबंधों के अधीन खजान भूमि से बंड/ गीली भूमि तक एच टी एल के चिन्हांकन, और सुंदरबन जैव आरक्षित में एच टी एल और सी आर जेड प्रवर्गों की रूपरेखा हेतु अभ्यावेदन प्राप्त हुए हैं ;

और, 13 जनवरी, 2020 को हुई अपनी 39 वीं बैठक में राष्ट्रीय तटीय क्षेत्र प्रबंध प्राधिकरण ने भी यह विनिश्चित किया था कि ऊपर वर्णित मुद्दों पर विचार करने की आवश्यकता है ;

और, केंद्रीय सरकार की, पर्यावरण (संरक्षण) नियम, 1986 के नियम 5 के उपनियम (4) के उपबंधों को ध्यान में रखते हुए यह राय है कि उक्त तटीय विनियमन क्षेत्र अधिसूचना, 2011 के संशोधन के लिए उक्त नियमों के नियम 5 के उपनियम (3) के खंड (क) के अधीन नोटिस की अपेक्षा को समाप्त करना लोक हित में होगा,

अतः, अब केंद्रीय सरकार, पर्यावरण (संरक्षण) नियम, 1986 के नियम 5 के उपनियम (3) के खंड (घ) के साथ पठित पर्यावरण (संरक्षण) अधिनियम, 1986 (1986 का 29) की धारा 3 की उपधारा (1) और उपधारा (2) के खंड (v) द्वारा प्रदत्त शक्तियों का प्रयोग करते हुए, तटीय विनियमन क्षेत्र अधिसूचना, 2011 में निम्नलिखित और संशोधन करती है, अर्थात:-

1. पैरा 2 में निम्नलिखित परन्तुक अंतः स्थापित किया जाएगा अर्थात्:-

"परंतु का. आ.114(अ), तारीख 19 फरवरी, 1991 द्वारा अधिसूचना जारी करने की तारीख के पूर्व, बंद विद्यमान होने या गीली भूमि द्वार का सन्निर्माण होने के मामले में, एच टी एल का निर्बंधन बंद या गीली भूमि द्वार रेखा तक होगा और ऐसे मामले में बंद या गीली भूमि द्वार से आगे खारे पानी के कारण उद्भूत कच्छ वनस्पति के अधीन क्षेत्र, बंद या गीली भूमि द्वारा से आगे क्षेत्र का विस्तार होते हुए भी सी आर जेड-14 के रूप में वर्गीकृत किए जाएंगे। कच्छ वनस्पति के अधीन ऐसे क्षेत्र संरक्षित किए जाएंगे और उनका किन्हीं विकास संबंधी क्रियाकलापों के लिए परिवर्तन नहीं किया जाएगा।"

2. पैरा 7 के उप पैरा (i) के खंड अ के उपखंड (ड) में "जैव आरक्षित" शब्दों के पश्चात् निम्नलिखित अंतः स्थापित किया जाएगा, अर्थात् :-

"सुन्दर बन जैव आरक्षित के मामले के सिवाय, जिसमें सी आर जेड का प्रवर्गीकरण और एच टी एल तथा सी आर जेड सीमाओं की रूपरेखा सी आर जेड अधिसूचना, 2011 के उपबंधों के अनुरूप की जाएगी।

टिप्पण : सुंदरबन जैव आरक्षित के भीतर रेखांकित सी वी सी ए ,राज्य सरकार द्वारा तैयार और केंद्रीय सरकार द्वारा अनुमोदित एकीकृत प्रबंधन योजना द्वारा प्रबंधित किया जायेगा।"

3. विशेष ध्यान की अपेक्षा वाले क्षेत्रों से संबंधित पैरा 8.V के अधीन, खंड(3) में, उपखंड(iv)के स्थान पर, निम्नलिखित उपखंड रखा जाएगा, अर्थात् :-

"(iv) पारिस्थितिक संवेदनशील निम्नस्थ क्षेत्र जो ज्वार भाटा द्वारा प्रभावित होते हैं और खजान भूमि के नाम से ज्ञात हैं, उनका नक्शा तैयार किया जाएगा और का. आ.114(अ),तारीख 19 फरवरी,1991 द्वारा अधिसूचना जारी करने की तारीख के पूर्व, बंद विद्यमान होने या गीली भूमि द्वार का सन्निर्माण होने के मामले में,एच टी एल का निर्बंधन बंद या गीली भूमि द्वार रेखा तक होगा और ऐसे मामले में बंद या गीली भूमि द्वार से आगे खारे पानी के कारण उद्भूत कच्छ वनस्पति के अधीन क्षेत्र, बंद या गीली भूमि द्वार से आगे क्षेत्र का विस्तार होते हुए भी सी आर जेड-14 के रूप में वर्गीकृत किए जाएंगे। कच्छ वनस्पति के अधीन ऐसे क्षेत्र संरक्षित किए जाएंगे और उनका किन्हीं विकास संबंधी क्रियाकलापों के लिए परिवर्तन नहीं किया जाएगा।"

[फा. सं. 19-27/2015 आई ए III (भाग)]

अरविंद कुमार नौटियाल, संयुक्त सचिव

टिप्पण: मूल अधिसूचना, भारत के राजपत्र, असाधारण, भाग II, खंड 3, उप-खंड (ii) में संख्या का.आ. 19 (अ), तारीख 6 जनवरी, 2011 द्वारा प्रकाशित की गई थी और उसमें अंतिम संशोधन का.आ. 1002(अ), तारीख 6 मार्च, 2018 द्वारा किया गया।

MINISTRY OF ENVIRONMENT, FOREST AND CLIMATE CHANGE

NOTIFICATION

New Delhi, the 1st May, 2020

S.O. 1422(E).— WHEREAS by notification of the Government of India in the Ministry of Environment and Forests number S.O. 19(E), dated the 6th January, 2011 (hereinafter referred to as the Coastal Regulation Zone Notification, 2011), the Central Government declared certain coastal stretches as Coastal Regulation Zone and restrictions were imposed on the setting up and expansion of industries, operations and processes in the said zone;

AND WHEREAS, the Central Government have received representations from various stakeholder including the State Governments regarding need for restricting demarcation of HTL in Khazan Land to the bund/sluice gate, and delineation of HTL and CRZ categories in the Sundarbans Biosphere Reserve under the provisions of the said notification;

AND WHEREAS, the National Coastal Zone Management Authority in its 39th meeting held on 13th January, 2020 had also decided that the above-mentioned issues need consideration;

AND WHEREAS, the Central Government, having regard to the provision of sub-rule (4) of rule 5 of the Environment (Protection) Rules, 1986, is of the opinion that it is in public interest to dispense with the requirement of notice under clause (a) of sub-rule (3) of rule 5 of the said rules for amending the said Coastal Regulation Zone Notification, 2011.

NOW THEREFORE, in exercise of the powers conferred by sub-section (1) and clause (v) of sub-section (2) of section 3 of the Environment (Protection) Act, 1986 (29 of 1986) read with clause (d) of sub-rule (3) of rule 5 of the Environment (Protection) Rules, 1986, the Central Government hereby makes the following further amendments in the Coastal Regulation Zone Notification, 2011, namely: -

1. In paragraph 2, the following proviso shall be inserted, namely: -

“Provided that in case there exists a bund or a sluice gate constructed in the past, prior to the date of notification issued vide S.O. 114(E) dated 19th February, 1991, the HTL shall be restricted up to the line long along the bund or the sluice gate and in such a case, area under mangroves arising due to saline water ingress beyond the bund or sluice gate shall be classified as CRZ-IA irrespective of the extent of the area beyond the bund or sluice gate. Such areas under mangroves shall be protected and shall not be diverted for any developmental activities.”

2. In paragraph 7, in sub-paragraph (i), in clause A, in sub-clause (e), after the words “Biosphere Reserves”, the following shall be inserted, namely: -

“except in the case of the Sundarbans Biosphere Reserve, wherein, the categorization of CRZ and delineation of the HTL and CRZ boundaries shall be done in consonance with the provisions of the CRZ Notification, 2011

Note: The CVCA delineated within the Sundarbans Biosphere Reserve shall be managed by the Integrated Management Plan prepared by the State Government and approved by the Central Government”.

3. Under paragraph 8.V relating to Areas requiring special consideration, in clause 3, for sub-clause (iv), the following sub-clause shall be substituted, namely: -

“(iv) the eco sensitive low lying areas which are influenced by tidal action known as khazan lands shall be mapped and in case there exists a bund or a sluice gate constructed in the past, prior to the date of notification issued vide S.O. 114(E) dated 19th February, 1991, the HTL shall be restricted up to the line long along the bund or the sluice gate and in such a case, area under mangroves arising due to saline water ingress beyond the bund or sluice gate shall be classified as CRZ-IA irrespective of the extent of the area beyond the bund or sluice gate. Such areas under mangroves shall be protected and shall not be diverted for any developmental activities”.

[F. No. 19-27/2015-IA III (pt)]

ARVIND KUMAR NAUTIYAL, Jt. Secy.

Note: The principal notification was published in the Gazette of India, Extraordinary, Part II, Section 3, Sub-section (ii), vide number S.O. 19 (E), dated the 6th January, 2011 and was last amended vide number S.O. 1002(E), dated 6th March, 2018.

MINISTRY OF ENVIRONMENT, FOREST AND CLIMATE CHANGE

NOTIFICATION

New Delhi, the 26th November, 2021

S.O. 4886(E).—WHEREAS by notification of the Government of India in the Ministry of Environment, Forest and Climate Change, number G.S.R. 37(E), dated the 18th January, 2019 (hereinafter referred to as the Coastal Regulation Zone Notification, 2019), the Central Government declared certain coastal stretches as Coastal Regulation Zone (CRZ) and restrictions were imposed on the setting up and expansion of industries, operations and processes in the said zone;

AND WHEREAS, the Central Government have received representations from the State Governments for inclusion of those provisions in CRZ Notification 2019, which were already available in the CRZ Notification, 2011 but have been missed out in the CRZ Notification 2019, with regard to restricting demarcation of High Tide Line (HTL) in Khazan Land to the bund / sluice gate, collection of dead shells by traditional communities in CRZ areas and delineation of HTL and CRZ categories in the Sundarbans Biosphere Reserve;

AND WHEREAS, the provisions related to demarcation of High Tide Line (HTL) in Khazan Land to the bund / sluice gate and delineation of HTL and CRZ categories in the Sundarbans Biosphere Reserve were incorporated in the CRZ Notification 2011, through amendment *vide* notification number S.O. 1422 (E), dated the 1st May 2020, however, these provisions could not be incorporated in CRZ Notification 2019, as it was notified on 18th January, 2019 i.e. before the above-said amendment dated the 1st May 2020;

AND WHEREAS, the provisions related to collection of dead shells by traditional communities in CRZ areas was included in the CRZ Notification 2011 through notification number S.O. 19(E), dated the 6th January 2019, however, the same was erroneously left out in the subsequent amendment *vide* number G.S.R. 1227(E), dated the 6th October 2017, and as such, the same could not be incorporated in the CRZ Notification 2019;

AND WHEREAS, the National Coastal Zone Management Authority (NCZMA) in its 42nd meeting held on the 23rd March, 2021 has recommended that the above-said provisions which were already available in the CRZ Notification, 2011 and had been inadvertently or erroneously missed out in the CRZ Notification, 2019, shall be included in the CRZ Notification, 2019;

AND WHEREAS, in view of the fact that the provisions already applicable *vide* CRZ Notification, 2011, are proposed to be included in the CRZ Notification, 2019, and as there is no fresh restriction or prohibition being imposed *vide* proposed amendment notification, therefore, the requirement of notice under clause (a) of sub-rule (3) of rule 5 of the Environment (Protection) Rules, 1986 is hereby dispensed with in public interest;

NOW THEREFORE, in exercise of the powers conferred by sub-section (1) and clause (v) of sub-section (2) of section 3 of the Environment (Protection) Act, 1986 (29 of 1986) read with sub-rule (4) of rule 5 of the Environment (Protection) Rules, 1986, the Central Government hereby makes the following amendments in the Coastal Regulation Zone Notification, 2019, namely: -

1. In the said notification, -

(i) in paragraph 1, in clause (i), for the Explanation, the following Explanation shall be substituted, namely, -

"Explanation. - For the purposes of this notification,-

(a) *the HTL means the line on the land upto which the highest water line reaches during the spring tide as demarcated by the National Centre for Sustainable Coastal Management (NCSCM) in accordance with the laid down procedures and made available to various coastal States and Union territories;*

(b) *in case there exists a bund or a sluice gate constructed prior to the date of notification issued vide S.O. 114(E) dated 19th February, 1991, the HTL shall be restricted up to the line long along the bund or the sluice gate, however, in such a case, area under mangroves arising due to saline water ingress beyond the bund or sluice gate shall be classified as CRZ-IA irrespective of the extent of the area beyond the bund or sluice gate and such areas under mangroves shall be protected and shall not be diverted for any developmental activities."*

2. In paragraph 2, in sub-para 2.1.1, in clause (a), in sub-clause (v), the following sub-clause shall be inserted after the words 'Biosphere Reserves', namely: -

“(v) ..except in the case of the Sundarbans Biosphere Reserve, wherein, the categorization of CRZ and delineation of the HTL and CRZ boundaries shall be done in consonance with the provisions of this Notification”.

Note: *The CVCA delineated within the Sundarbans Biosphere Reserve shall be managed through the Integrated Management Plan prepared by the State Government and approved by the Central Government.”*

3. In paragraph 5, in sub-para 5.1.2, after sub-clause (xviii), the following sub-clause shall be inserted, namely: -

“(xix) Collection of dead shells by traditional communities for poultry and animal feed supplements and shall not require prior CRZ clearance;”

[F.No.19-112/2013 -IA III (pt)]

Dr. SUJIT KUMAR BAJPAYEE, Jt. Secy.

Note: The principal notification was published in the Gazette of India, Extraordinary, Part II, Section 3, Sub-section (ii), vide number G.S.R. 37(E), dated the 18th January, 2019.