# SHORE LINE CHANGE ATLAS OF THE INDIAN COAST

**(Volume – 2)**

## Maharashtra and Goa




**Space Applications Centre (ISRO)**
**Ahmedabad 380015**
**and**
**Coastal Erosion Directorate, Central Water Commission,**
**Ministry of Water Resources,**
**Govt. of India, New Delhi 110606**

**May, 2014**

# DOCUMENT CONTROL AND DATA SHEET

| | |
|---|---|
| Report No. and Date | SAC/EPSA/GSAG/GSD/A/01/14, May, 2014 |
| Title | Shoreline Change Atlas of India<br>(Volume – 2 Maharashtra and Goa) |
| Type of Report | Atlas |
| No. of Pages, Tables, Figures, Plates | 209, 14, 2, 62 |
| No. of References | 3 |
| Author (s) | Project Team (As per attached list) |
| Originating Unit | GSD/GSAG/EPSA/SAC |
| Abstract | This Atlas comprises of shoreline change maps prepared using satellite data of 1989-91 and 2004-06 time-frame on 1:25,000 scales for the entire country (Volume – 2 show maps of Maharashtra and Goa). The maps show eroding, stable and accreting coast. Data used, methodology, results, area under erosion and accretion and status of coastal protection measures are briefly described. |
| Keywords | Shoreline change map, erosion, accretion, stable coast, coastal protection measures. |
| Security Classification | General |
| Distribution | Among concerned only |

# SHORE LINE CHANGE ATLAS OF THE INDIAN COAST

**(Volume – 2)**

## Maharashtra and Goa

**Space Applications Centre (ISRO)**
**Ahmedabad 380015**
**and**
**Coastal Erosion Directorate, Central Water Commission,**
**Ministry of Water Resources,**
**Govt. of India, New Delhi 110606**

**May, 2014**

## PROJECT TEAM

**Team Leader:** Dr. Ajai

**SAC, Ahmedabad**

Dr. A.S. Rajawat
Dr. H.B. Chauhan
Ms. Sneha Rode
Shri Ratheesh Ramakrishnan
Shri Manik Mahapatra
Shri R.J. Bhanderi

**CWC, New Delhi**

Shri K.N. Keshri
Shri C.P. Singh
Shri R. Shimray
Shri D.P. Mathuria
Shri M.S. Dhillon
Shri Rajesh Yadav
Shri Shiv Sunder Singh

**CWC, Kochi**

Shri S.P. Abraham
Shri T.K. Sivarajan
Shri Sunil Jain

देवेंदर शर्मा
सदस्य ( नदी प्रबंध )

Devender Sharma
Member(River Management)

केन्द्रीय जल आयोग
CENTRAL WATER COMMISSION
कक्ष संख्या 212 (द0), सेवा भवन,
राम कृष्ण पुरम, नई दिल्ली 110606
Room No.212 (S), Sewa Bhawan,
R.K. Puram, New Delhi-110606

## PREFACE

Coastal erosion is one of the most significant coastal hazards leading to loss of valuable land and property along the coastal zone. It is serious problem for the Indian coast, especially during monsoon and cyclonic storms and storm surge events. Developmental activities along the coast as well in the catchment areas of rivers draining into the sea cause changes in the equilibrium of sediment transport along the coast and induce coastal erosion. Climate Change and consequent threat due to predicted sea level rise is expected to further accelerate coastal erosion. Measures have been undertaken for protecting the coast by maritime States and Union Territories of the country at several places. It is required that a proper inventory of current status of coastal erosion and protection measures undertaken so far be made, so that effective planning for protecting the coast can be carried out.

Due to dynamic nature of the coast, baseline data at National level on current status of coastal erosion as well measures taken by maritime States and UTs is lacking and it is in this context and based on recommendations of Coastal Protection and Development Advisory Committee (CPDAC), present work of preparation of Shoreline Change Atlas of India has been undertaken by the Space Applications Centre (ISRO), Ahmedabad and Coastal Erosion Directorate of Central Water Commission (CWC), Ministry of Water Resources, New Delhi. The shoreline change maps depict changes mapped on 1:25, 000 scale using satellite images of 1989-91 and 2004-06 time frame and status of coastal protection measures taken up by maritime states and Union Territories. The entire database is digitized and put under GIS platform. The Atlas is brought out in Six Volumes and highlights type of satellite data used, methodology adopted and salient observations.

This Atlas provides a baseline data for initiating appropriate action for protecting the Indian coast by concerned maritime States and Union Territories besides use by the scientific community as well decision makers of the country. I appreciate efforts put by all those who have made contributions to this significant task.

**(Devender Sharma)**
Member (RM), CWC &
Chairman (CPDAC)

**Telephone:** 011-26103221 **Fax:** 011-26101749 **Email:** mrm@nic.in

भारत सरकार
अन्तरीक्ष विभाग
अन्तरिक्ष उपयोग केन्द्र
आंबावाडी विस्तार डाक घर,
अहमदाबाद-380015. (भारत)
दुरभाष: +91-79-6912000, 6915000
फैक्स :

Government of India
Department of Space
SPACE APPLICATIONS CENTRE
Ambawadi Vistar P.O.
Ahmedabad-380 015. (India)
Telephone : +91-79-6912000, 6915000
Fax :

A.S. Kiran Kumar
Director

## *Foreword*

Coastal Zone is one of the most fragile and dynamic ecosystem having the interface of sea and land. Interactions between various natural processes and human activities are important factors in the coastal areas. About 40% of the world's population lives within 100 km of the coastline and this proportion is increasing. There has been increasing anthropogenic pressure on the coastal ecosystem. In addition, the coastal ecosystems are vulnerable to natural phenomenon such as waves, tides, storm surges, erosion etc.

India has a long coastline of 7516 km including that of its Island territories. Coastal Zone in India, assumes its importance because of high population pressure, development of various industries and spurt in recreational activities, exploitation of renewable and non renewable natural resources, discharge of waste effluents and municipal sewage etc. Periodic storms and cyclones as well as erosion further adds to the problems in the coastal areas. In view of the dynamic nature of the coast, it needs to be monitored regularly.

Taking appropriate coastal protection measures require spatial information on the status of the shoreline and its dynamic behavior including the areas undergoing erosion and accretion. The spatial information on the change in shoreline over a period of time and the associated processes active along the Indian coast are not available. Thus, Space Applications Centre, at the behest of Central Water Commission, Ministry of Water Resources, Government of India has taken up the task of preparation of shoreline change inventory of Indian coast based on maps prepared using satellite data of 1989-91 and 2004-06 on 1:25,000 scale. These maps depict areas under erosion, accretion as well as stable coast. In addition, the status of coastal protection measures taken by states are also depicted. This is for the first time a spatial inventory on shoreline changes using satellite data has been created for the entire country.

I am sure, the present atlas will be useful to the scientific community and decision makers in investigating the coastal changes as well as in taking appropriate action for protecting the Indian coast and thus will go a long way in conserving the coastal environment of the country. I would like to place on record my deep appreciation to all those who have made contributions for the success of this project.

(A.S. Kiran Kumar)

भारत सरकार
अन्तरीक्ष विभाग
अन्तरिक्ष उपयोग केन्द्र
आंबावाडी विस्तार डाक घर,
अहमदाबाद-380015. (भारत)
दुरभाष: +91-79-6912000, 6915000
फैक्स :

Government of India
Department of Space
SPACE APPLICATIONS CENTRE
Ambawadi Vistar P.O.
Ahmedabad-380 015. (India)
Telephone : +91-79-6912000, 6915000
Fax :

# *ACKNOWLEDGEMENTS*

We would like to place on record our deep sense of gratitude to Dr. R.R. Navalgund, former Director, Space Applications Centre, Ahmedabad and Shri A.S. Kiran Kumar, Director, Space Applications Centre, Ahmedabad for their keen interest, guidance and constant encouragement during the entire course of this project. We are grateful to Dr. Shailesh Nayak, Secretary, Ministry of Earth Sciences (MoES), Government of India, New Delhi for initiating this project when he was at Space Applications Centre, Ahmedabad and providing guidance and encouragement. We would like to place on record our appreciation for the guidance and support provided by Dr. J.S. Parihar, Deputy Director, EPSA, Space Applications Centre, Ahmedabad.

The baseline data on coastal landuse including delineation of HTL and LTL on 1:25, 000 scale has been prepared for 1989-1991 and 2004-2006 time frames using satellite data under two separate projects funded by Ministry of Environment and Forests (MoEF), Government of India, New Delhi. We gratefully acknowledge the funding support provided by MoEF and to all the participating agencies who have contributed in these projects.

The project on preparation of shoreline change for the Indian coast has been carried out jointly by Space Applications Centre and Central Water Commission, Ministry of Water Resources (MWR), Government of India. Ministry of Water Resources (MWR), Government of India is thankfully acknowledged for providing funds for preparing A-3 size Shoreline change Atlas of India using the available baseline data. We are thankful to Chairman CWC for his guidance and support. Our special thanks are due to Chairman and Members of Coastal Protection and Development Advisory Committee (CPDAC) for necessary support. Sub-Committee members of the Coastal Atlas are acknowledged for their useful suggestions and time to time guidance. Special thanks are to Director, Coastal Erosion Directorate, Central Water Commission, Ministry of Water Resources for his constant support and organizing collection of coastal protection measures data from all the maritime States and U.T. of India.

Thanks are due to Shri N.S. Mehta, Manager, RACF/EPSA and his team for providing necessary facilities to complete this work at SAC.

Dr. Ajai
Group Director
Marine, Geo and Planetary Sciences Group
Space, Applications Centre (ISRO), Ahmedabad

# CONTENTS

# LIST OF TABLES

## LIST OF FIGURES

# LIST OF PLATES

# INTRODUCTION

Coastal zone is the area of interaction between land and sea. It includes both terrestrial as well as marine resources, which are renewable as well as non-renewable. In addition, interactions between various natural processes and human activities are important factors in the coastal area. India has a long shoreline of about 7500 km including its island territories. Coastal zone in India assumes its importance because of high productivity of its ecosystems, concentration of population, exploitation of natural resources, discharge of waste effluent and municipal sewage, development of various industries, increasing load on harbors, spurt in recreational activities and above all petroleum exploration activities.

The destruction and loss of land due to sea erosion is a severe problem, particularly for a country like India facing explosive population growth. Shoreline is a dynamic geomorphological entity, which responds to the external forces exerted by waves, tides, nearshore currents and the resultant sediment transport. When the resultant sediment transport entering a particular area is greater than the sediment going out from the area, accretion or beach development takes place. On the other hand, when there is a deficit of the incoming sediment supply into a particular area with reference to the sediment going out of the same area, beach erosion takes place. Beaches act as constant absorbers of the wave energy of water and though subject to small disturbances, remain in equilibrium. However, sometimes this equilibrium gets disturbed due to either natural phenomena or human intervention. When shore structures are constructed, it is quite likely that equilibrium condition is altered. Since this can cause considerable damage and reduce the effectiveness of such structures, it is necessary to study the equilibrium condition of shores before constructing such structures. Therefore, it is of utmost importance to get information on accreting, eroding and stable coasts so that effective measures to combat sea erosion may be taken.

Major concern of coastal zone management is to ensure a rational development of area and judicious use of its resources, which is consistent with the surrounding natural systems and environment. Environmentally effective policy decisions pertaining to coastal zone management depends upon accurate and comprehensive scientific data. A basic problem confronting our country is limited availability of geographic data on coastal zone. Accurate and updated scientific data is required on coastal wetlands/landform/land use, shoreline changes, sediment transport and water quality of near shore waters.

Satellite data have proved to be extremely useful in creating baseline inventory of the entire Indian shoreline at 1:250,000, 1:50,000 and 1:25,000 scale (Nayak et al. 1991, SAC, 2012). The prepared landuse/wetland maps show

wetland features between high and low water lines and land use features of the adjoining shore (up to 1.5 km from high waterline).

Coastal Protection and Development Advisory Committee (CPDAC) constituted by Ministry of Water Resources, Govt. of India in April, 1995 is the apex body responsible for formulating policies/ programmes, providing technical guidelines, monitoring, reviewing and co-ordinating coastal zone protection and developmental activities executed by different Central and State Departments along the Indian coastline. The committee recommended the need for preparation of Coastal Atlas showing information related to coastal erosion derived from satellite data and protection measures undertaken by all maritime states of India. A subcommittee was constituted for the purpose. The subcommittee met several times, discussed and finalised the contents of the Atlas. It was decided that shoreline change atlas of the entire Indian coast would be prepared based on Highest High Tide Line depicted on coastal landuse/landcover maps of 1989-91 and 2004-06 time-frame on 1:25,000 scale The baseline data has been generated under two projects funded by Ministry of Environment and Forests (MoEF) with Space Applications Centre, Ahmedabad as a nodal agency with active participation of several related Central & State Government Departments and Academic Institutes.

The entire database of coastal thematic maps prepared using satellite data for the period 1989-91 and 2004-06 time-frames has been digitised and put as part of Coastal Zone Information System (CZIS) in GIS environment developed at Space Applications Centre (ISRO), Ahmedabad. Coastal Zone Information System for entire India (CZIS-India) is developed to include and update all the coastal information viz. landuse, wetland, shoreline, coral reef etc. for all maritime states including Union Territories in ARC/INFO environment. The information is catalogued as per Survey of India topographical map indexing. This data has been used as a baseline data for preparing the shoreline change atlas of India.

The major task involved preparation of a digital shoreline change atlas in GIS environment using existing databases of coastal landuse/landcover maps prepared on 1:25,000 scale (1989-91 and 2004-06 time-frame), depict and quantify shoreline changes as eroding/accreting/stable, show status of shoreline protection measures taken by respective States and generate A3 size State-wise Coastal Atlas of all the maritime states of India.

The detailed tasks taken up are:

i. Quantify and classify the shoreline as shoreline under erosion, stable and accretion for all the maritime states by integrating shoreline using existing database of 1989-91 and 2004-06 period.

ii. Integrate the field information on coastal erosion and shoreline protection measures of all the maritime states of India in GIS environment.

iii. Analyse satellite data of 2011-12 period for selected hotspot areas (areas showing large shoreline changes) and understand coastal processes responsible for such changes.

iv. Generate Six Volumes of A-3 size coloured digital as well as hard copy Coastal Atlas of India (Volume 1 covering Gujarat, Daman & Diu, Volume 2 covering Maharashtra & Goa, Volume 3 covering Karnataka & Kerala, Volume 4 covering Tamilnadu, Puducherry & Andhra Pradesh, Volume 5 covering Odisha & West Bengal and Volume 6 covering Lakshadweep & Andaman & Nicobar islands).

## DATA USED

Primarily, landuse/landcover maps on 1:25,000 prepared using IRS-P6 LISS-IV data of 2004-06 period and SPOT-1 & 2 Multispectral and IRS-1A & IRS-1B LISS-II data of 1989-91 period available at Space Applications Centre, Ahmedabad have been utilized. In few cases where suitable data were not available, the data of nearest time frame were used. These maps depict shoreline as Highest High Tide Line (HTL) and Low Tide Line (LTL). Shoreline changes with respect to Highest High Tide Line have been taken up for the present work. The entire database has been put in GIS environment as part of Coastal Zone Information System (CZIS) developed at Space Applications Centre (ISRO), Ahmedabad. Landsat TM, ETM and Resourcesat-1 AWiFS data of corresponding time frames was used for rechecking and confirming the continuity of HTL in adjoining map sheets. Status of coastal protection measures taken up by respective maritime states and UT were prepared in spatial format and were put in the GIS database.

List of the satellite data used is summarised in the Annexure-III (Tables 3-6).

The status of coastal protection measures taken up by maritime states and UTs was provided by them through Central Water Commission (CWC), New Delhi. These were prepared in spatial format and were put in the GIS database. Details are provided in Annexure-III (Tables 7-14).

## METHODOLOGY

Following steps were undertaken:

i. The existing Coastal Zone Information System (CZIS) developed at Space Applications Centre (ISRO), Ahmedabad has been primarily used. Coastal landuse maps for the entire Indian coast prepared on 1:25,000 scale for 1989-91 and 2004-06 time-frame available in CZIS have been used for shoreline change mapping.

ii. National Spatial framework from NRDB has been used for organizing and creating the database. The basic framework of CZIS-India is prepared for all maritime states and Union territories of India on 1:25,000 scale. One degree consists of 8X8 rectangular grids or cells. Each rectangular grid or cell represents one SOI topographic area on 1:25,000 scale (M.C Gupta et al., 2000).

iii. Spatial layer of Line (LN25) of 1989-91 time-frame (containing High Water Line, rail, road, drainage) has been taken from the CZIS database.

iv. Spatial layer of Line (LN25N) of 2004-06 (containing High Water Line, rail, road, drainage) has been taken from CZIS database.

v. Spatial layer of Point of habitation has been taken from CZIS database.

vi. Registration of two time-frame data sets considering rail, road and HTL of 1989-91 as base has been done.

vii. Output spatial layer showing shoreline changes using overlay of rectified coverage and base coverage is created.

viii. Maps were rechecked using Landsat TM, ETM, AWiFS and LISS-IV data to make it seamless in database.

ix. Polygons for areas under erosion and accretion were created.

x. Areas under erosion and accretion were measured for the main shoreline (excluding creeks, river mouths, estuaries). Shore length under erosion, accretion and stable categories were measured for the main shoreline (excluding creeks, river mouths, estuaries).

xi. A table containing all the above statistics has been generated for each maritime state and U.T.

xii. Status of shoreline protection measures have been depicted as per the information provided by the maritime State/UT agencies through Central Water Commission.

xiii. A standard map composition and layout were finalised and have been used for final map composition of each map.

xiv. Field checks were carried out and based on field observations, corrections were incorporated while finalizing the map. Field photographs were also taken during the field visits.

Accuracy Assessment: Classification as well as planimetric accuracy of the maps was assessed while carrying out the field work. Overall the classification accuracy of these maps range from 90-95% at 90% confidence level. The Planimetric Accuracy of these maps is 6.25 m as per Survey of India (SOI) standard.

xv. Hotspots were identified based on the magnitude of shoreline dynamics. Recent satellite images (2011-12) were acquired and analysed.

xvi. Finalised maps depicting shoreline changes were utilized for preparing shore line change Atlas of the Indian coast (Six Volumes). Volume 1 covers Gujarat, Daman & Diu, Volume 2 covers Maharashtra & Goa, Volume 3 covers Karnataka & Kerala, Volume 4 covers Tamil Nadu, Puducherry & Andhra Pradesh, Volume 5 covers Odisha & West Bengal and Volume 6 covers Lakshadweep & Andaman & Nicobar islands. Digital Atlas in form of CD was prepared.

# RESULTS

## Maharashtra

The Maharashtra coast, popularly known as Konkan coast, lies between $15^0$ 45' - $20^0$ 00' N latitudes and $68^0$ 00' - $73^0$ 30' E longitudes. It is a narrow zone between the Western Ghats to the east and the Arabian Sea to the west trending NNW-SSE in general. The Sahyadris Western Ghats run parallel to the coast. The Dudh, the Vaitarna, the Ulhas, the Amba, the Kundalika, the Vashishthi, the Savitri are major coastal rivers draining into the Arabian Sea in the west. The coastal region is hilly, narrow, dissected with transverse ridges of the Western Ghats, extending as promontories at many places. It is characterized by pocket beaches flanked by rocky cliffs of Deccan basalt, estuaries and patches of the mangroves along it. Beaches of the Maharashtra coast are small, crescent shaped and flanked by promontories. They are termed as pocket beaches as they are pocketed between headlands. They are observed southwest of Dahanu, Andheri, north of Alibag, Vadamirya and Rajapur creek. Long and linear beaches are observed near Guhaghar and Malvan. Mudflats are observed mainly along the estuaries and bay. They are broad at the mouth and gradually taper down. They are observed near Thane creek, Panvel creek, Vasai creek, on the bank of the Kundalika River and along the Rajapur creek. Mangroves are mainly observed along the intertidal region of estuaries and creeks. Large patches of mangroves occur along the Panvel creek, the Vasai creek, the Thane creek and the Dharamtar creek, along estuaries of the Vasishtha, the Savitri and the Kundalika rivers. Coastal dunes are found with Casuarina plantation near Malvan and Devgarh.

The shoreline of Maharashtra is 742.26 km (It does not include length of mouth of estuary, rivers, creeks and their inner parts). It is observed that 449.50 km length of the Maharashtra coast has eroded, 244.47 km has accreted and 48.29 km has been stable during the time frame 1989-91 and 2004-06 (Table-1, Fig. 1). The total area eroded is 7.83 sq km and area accreted is 5.08 sq km (Table-1). Details for each individual map sheet are provided in Table-1. The erosion is been observed for around 60% of the total Maharashtra coastline whereas around 33% of the coast has accreted and around 6% of the coast is observed to have stable coast.

The coastal length of Maharashtra is classified into three sectors based on coastal configuration, geological and geomorphological characteristics. The northern sector comprises of coastal region from Thane upto Raygad. The Central Sector covers coast along the Ratnagiri and the southern sector covers coast along Sindhudurg upto Goa.

The coast along Thane district, Mumbai Suburban and Mumbai City comprises of tidal mudflats dissected by a number of creeks. Mangroves are observed along these creeks. The northernmost coast in this sector, south of Umbergaon in Gujarat upto Mur river near Kelve in Thane district is eroding coast in general. Eroding coast is observed around Bordi, Gholvad, Chikhle (Map Sheet no. 46D12SE, Plates 12-17), Dahanu, Varur, Chinchani (Map Sheet no. 47A09NE, Plates 18-20), Tarapur, Ghivoli, Navapur, Vadvalpada (Map Sheet no. 47A09SE), Shivgaon, Jambalpada (Map Sheet no. 47A10NE) and around Kevle, north of Mur river (Map Sheet no. 47A10SE). The area is identified as one of the hot spot areas due to the severity and magnitude of erosion. Plates 12-20 depict field photographs of this coastal segment. Accretion due to construction activities are observed near Ghivoli (Map Sheet no. 47A09SE). South of the Mur river, around Vedvan, Kova (Map Sheet no. 47A10SE) upto Nallasopara (Map Sheet no. 47A15NW), the coast is eroding to stable in nature. Plates 21-22 show field photographs of coastal segment near Nallasopara. Beach erosion as evident at present from uprooting of Casuarina trees is observed here. Accretion is observed along small segments either due to constructional activities or due to bar formations at river/creek opening. Significant depositional bars are found near Nallasopara (Map Sheet no. 47A15NW) and around small creeks north to the Vasai creek (Map Sheet no. 47A15SW) in Thane District. This coastal segment is protected by a number of sea walls to check erosion.

The Mumbai suburban segment north of the Manori creek shows eroding nature (Map Sheet no. 47A16NW). South of the Manori creek upto the Malad creek and furthur south upto the Mahim Bay in Mumbai City (Map Sheet No. 47A16SW) shows almost stable nature. The sector around Mumbai Suburbs and Mumbai City is more or less stable (Map Sheet no. 47B13NW), with no indications of major coastal dynamics, unless altered by land reclamations for development activities. Plate 1 shows reclamation of land for the constructional activities at Mahim Bay (Map Sheet no. 47A16SW). The tetra pods along the coast of Mumbai City (Map Sheet no. 47B13NW) are shown in Plate 23.

South of Mumbai, the coastal segment mainly in Raygad district comprises of the stretch between Sasvane (Map Sheet no. 47B13SW) to the coast north of the Savitri River (Map Sheet no. 47G01NW). The Kundalika and the Amba rivers are major rivers getting discharged into the Arabian Sea and the Dharamtar and the Rajapuri form major creeks in this segment. In this coastal stretch, both erosion and accretion are observed in segments, primarily near the creek/river mouths. Coast around Dharamtar creek shows eroding nature (Map Sheet no. 47B13SE). Around Sasvane and Avas, accreting to stable nature is observed (Map Sheet no. 47B13SW). The accretion at southern part of the inlet mouth near Akshi (Map Sheet no. 47B14NE) is shown in Plate 2. Field investigations at Akshi also confirmed the accretion activities. Plate 24

shows the accreting coast at the southern side of the creek inlet at Akshi. Northern region of the Kundalika River mouth (Map Sheet no. 47B14SE) also show significant accretion activities. Plate 3 shows the accretion of land along the northern region of the Kundalika River. The stretch around Kamoth, Thai (Map Sheet no. 47B14NW), Nagaon, Palepala upto Kundalika River shows accreting to stable nature (Map Sheet no. 47B14SE). Plate 25 shows the stable coast near Revdanda. South of the Kundalika River upto Nandgaon the coast shows stable to eroding nature (Map Sheet no. 47B15NE). The coast around Vihur, Rajapuri, Sarve, Adgaon, Vilaskhud, Karle, Shekadi is almost stable in nature (Map Sheet no. 47B15SE, 47B16SE). South of Vadi and Aravi, small segments of erosion are observed (Map Sheet no. 47B16SE). The segment around Shrivardhan is eroding to stable in nature (Plates 26-27). South of Shrivardhan upto Hareshwar, the coast is eroding (Map Sheet no. 47F04SW).

The Central coastal segment of Maharashtra, south of the Raygad, is the Ratnagiri coastal sector from south of the Savitri River (Map Sheet no. 47G01NW) to north of the Vijayadurg creek (Map Sheet no. 47H06SW). Along this sector the Savitri, the Jog, the Vashishti, the Shastri, the Kajvi and the Machkandi rivers get discharged into the Arabian Sea. Rocky coasts form a larger portion of this coastal region and a considerable length of the coast is stable. Mangroves are observed along the Savitri River, north of Velas, shown in Plate 28. Plate 29 shows the coastal segment north of Velas (Map Sheet no. 47G01NW). South of Velas upto Sakhari the coast is almost stable in nature. South of Sakhari, Padale (Map Sheet no. 47G01NW), Panchgaon, south of Jog River upto Palandwadi and Murud, the coast is eroding to stable in nature. Plates 30-32 show the coast around Murud. Some small segments of erosion are observed around Bhandariwadi (Map Sheet no. 47G02NE). The segment from Kolthare to Bhiv Bandar, the coast is almost stable in nature (Map Sheet no. 47G02NE, 47G02SE). Erosion is observed north of Vashishti River mouth (Map Sheet no. 47G02SE), where a significant portion of coastal region has undergone erosion. Plate 4 shows the severity of erosion at the northern bank of the Vashishti River mouth. Field checks have been conducted along this region. Plates 33-34 show the protection measures at the site to resist the erosion. South of the Vashishti River, along coastal segment of Kalhal Wadi, Palshet, Budhelwadi (Map Sheet no. 47G03NE), Sakhri Agar, Narvan, Sankdol (Map Sheet no. 47G03SE), Bhandarwadi (Map Sheet no. 47G04NE), Kumbharwadi, Malgund (Map Sheet no. 47G08NW), Kajarwadi, Vada Mirya (Map Sheet no. 47G08SW, Plate 35-37 ), Ratnagiri, Kasop (Map Sheet no. 47H05NW), Bandheri, Purangad (Map Sheet no. 47H05SW), Bokarwadi (Map Sheet no. 47H06NW), south of Rajapur creek (Map Sheet no. 47H06SW) almost stable nature of coast is observed, except small segments of erosion around Guhagar and north of Velneshwar (Map Sheet no. 47G03NE), north of Bhandarpule (Map Sheet no. 47G08NW). Some accretion is observed north of Bhatya creek (Map Sheet no. 47H05NW), south of Wadavetye (Map Sheet no.

47H06NW). Plate 5 shows the stable rocky coast south of the Rajapur creek (Map Sheet no. 47H06SW) in the Ratnagiri district.

The southern coastal segment along the Maharashtra coast covers the Sindhudurg region and comprises of the coastal stretch between Gharwadi (Map Sheet no. 47H06SW) to Redi (Map Sheet no. 48E10NE). The Vagothan and the Karli form the major river discharges along this coastal region. This segment also comprises of rocky coastal region almost stable in nature. The pocket beaches that lie between the rocky out crops are subjected to coastal dynamics. Notably, the accretions are mainly at the river mouths, where the spits are observed to grow towards southern directions. The region south of Vijaydurg creek, along Gharwadi (Map Sheet no. 47H06SW), Girya Kathar (Map Sheet no. 47H07NW), Advawadi, Tand Vali (Map Sheet no. 47H08NE), Malvan (Map Sheet no. 47H08SE), Bhogvewadi, Medhavadi, Nivitiwadi (Map Sheet no. 48E09NW), Dabos (Map Sheet no. 48E09SE) are almost stable in nature, except few small straight segments of erosion around Shelgulwadi, Tembaldegwadi (Map Sheet no. 47H07SE), Pirawadi (Map Sheet no. 47H08NE, Plates 38-39), Kolamb (Map Sheet no. 47H08SE), Tarkarli (Map Sheet no. 47H08SE, Plates 41-42), Ubhadanda, Valagar, (Map Sheet no. 48E09SE, Plates 43-44), Redi (Map Sheet no. 48E10NE). Accretion is observed along the Kalavali creek mouth (Map Sheet no. 47H08SE) and the Karli River mouth (Map Sheet no. 48E08NW). This confirms the southern growth of the spits at the river/creek mouths. Plate 6 shows the extensive southern growth of the spit at Kalavali creek mouth. Plate 40 shows the field photograph of the spit at the river mouth.

Table 1: Map sheet wise results of shoreline changes for 1989-91 and 2004-06 time frame for Maharashtra coast

| Serial No. | MAP no | Erosion Area (in Sq Km) | Erosion Length (Km) | Accretion Area (in Sq Km) | Accretion Length (Km) | Stable Length (Km) |
|---|---|---|---|---|---|---|
| 1 | 46D12SE | 0.53 | 14.4 | 0.04 | 0.94 | 0 |
| 2 | 47A09NE | 0.57 | 16.3 | 0.02 | 1.61 | 0 |
| 3 | 47A09SE | 0.49 | 14.6 | 0.1 | 2.44 | 0 |
| 4 | 47A10NE | 0.39 | 12.9 | 0.05 | 2.44 | 0 |
| 5 | 47A10SE | 0.22 | 14.2 | 0.02 | 2.54 | 0 |
| 6 | 47A11NE | 0.06 | 2.28 | 0 | 0.04 | 0 |
| 7 | 47A14SW | 0.01 | 0.7 | 0.02 | 1.59 | 0 |
| 8 | 47A15NW | 0.16 | 8.4 | 0.37 | 4.34 | 0 |
| 9 | 47A15SW | 0.26 | 14.5 | 0.24 | 4.33 | 0 |
| 10 | 47A16NW | 0.16 | 12.6 | 0.12 | 12.6 | 0 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 11 | 47A16SW | 0.04 | 6.18 | 0.58 | 14.1 | 0 |
| 12 | 47B13NE | 0.13 | 3.51 | 0.01 | 0.87 | 0 |
| 13 | 47B13NW | 0 | 0 | 0 | 0 | 20.2 |
| 14 | 47B13SE | 0.3 | 10.8 | 0.05 | 2.74 | 0 |
| 15 | 47B13SW | 0.01 | 0.92 | 0.16 | 5.87 | 0 |
| 16 | 47B14NE | 0 | 0.53 | 0.12 | 1.5 | 0 |
| 17 | 47B14NW | 0.09 | 6.42 | 0.19 | 8.05 | 0 |
| 18 | 47B14SE | 0.14 | 9.23 | 0.24 | 9.93 | 0 |
| 19 | 47B15NE | 0.18 | 12.5 | 0.07 | 6.36 | 0 |
| 20 | 47B15SE | 0.18 | 17.1 | 0.12 | 10.8 | 0 |
| 21 | 47B16NE | 0.22 | 16.3 | 0.06 | 5.06 | 0 |
| 22 | 47B16SE | 0.17 | 9.09 | 0.01 | 1.08 | 0 |
| 23 | 47F04SW | 0.15 | 7.15 | 0.02 | 1.97 | 0 |
| 24 | 47G01NW | 0.22 | 11.2 | 0.09 | 5.22 | 0 |
| 25 | 47G01SE | 0 | 0.06 | 0 | 0 | 0 |
| 26 | 47G01SW | 0.23 | 12.1 | 0.05 | 4.43 | 0 |
| 27 | 47G02NE | 0.13 | 9.01 | 0.02 | 2.86 | 0 |
| 28 | 47G02NW | 0.04 | 4.09 | 0.01 | 1.58 | 0 |
| 29 | 47G02SE | 0.42 | 16.2 | 0.03 | 5.01 | 0 |
| 30 | 47G03NE | 0.25 | 18.5 | 0.05 | 5.88 | 0 |
| 31 | 47G03SE | 0.27 | 21.7 | 0.13 | 10.2 | 0 |
| 32 | 47G04NE | 0.08 | 7.19 | 0.12 | 5.37 | 0 |
| 33 | 47G08NW | 0.07 | 4.19 | 0.06 | 3.52 | 0 |
| 34 | 47G08SW | 0.12 | 13.3 | 0.21 | 11 | 7.64 |
| 35 | 47H05NW | 0.1 | 11.6 | 0.23 | 9.6 | 0 |
| 36 | 47H05SW | 0.1 | 11.2 | 0.06 | 7.33 | 8.95 |
| 37 | 47H06NW | 0.1 | 13.1 | 0.15 | 7.95 | 4.1 |
| 38 | 47H06SW | 0.13 | 17.1 | 0.13 | 12.9 | 6.08 |
| 39 | 47H07NW | 0.07 | 7.99 | 0.12 | 7.8 | 0 |
| 40 | 47H07SE | 0.11 | 9.41 | 0.1 | 6.3 | 0 |
| 41 | 47H07SW | 0.03 | 2.18 | 0.01 | 0.83 | 0 |
| 42 | 47H08NE | 0.23 | 10.8 | 0.08 | 4.7 | 0 |
| 43 | 47H08SE | 0.16 | 8.68 | 0.5 | 11.7 | 0 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 44 | 48E05NE | 0 | 0 | 0.11 | 3.37 | 0 |
| 45 | 48E09NW | 0.09 | 10 | 0.15 | 10.2 | 0 |
| 46 | 48E09SE | 0.24 | 11.7 | 0.01 | 1.72 | 0 |
| 47 | 48E09SW | 0.05 | 2.98 | 0.03 | 1.45 | 1.35 |
| 48 | 48E10NE | 0.13 | 4.66 | 0.02 | 2.3 | 0 |
| | Total | 7.83 | 449.5 | 5.08 | 244.47 | 48.29 |

Figure 1 shows the accreting length, eroding length and stable shoreline of Maharashtra coast.

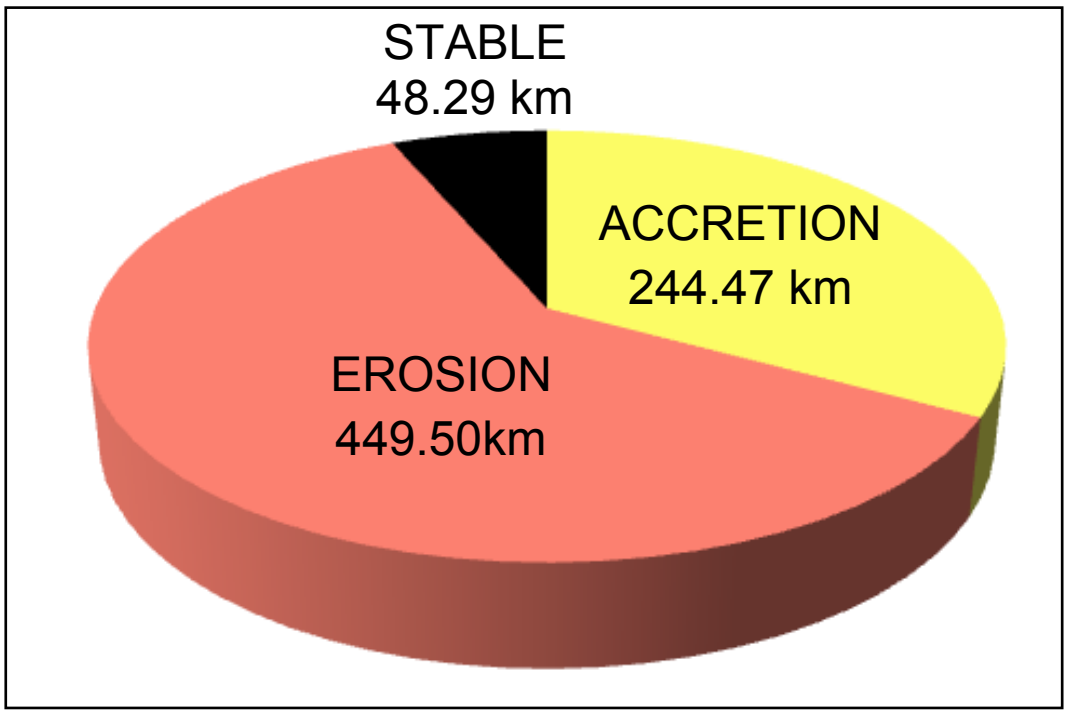



Figure 1: Status of coastal erosion, accretion and stable nature of Maharashtra coast (Total coastal length of 742.26 km does not include length of mouth of estuary, rivers, creeks and their inner parts).

## Goa

The smallest state of India—Goa, is located between 15°44’30” and 14°53’30” N latitude, and 73°45’ and 74°26’E longitude, along the Central West Coast of India. It has a shoreline about 155 km long. Goa is divided into North Goa and South Goa districts. The coastal plains of Goa consist of sandy beaches, sea cliffs, promontories, estuaries, spits, sand dunes, wave cut platforms, wooded or bare hill slopes which are dissected by rivers such as the Terekhol, the Chapora, the Mandovi and the Zuari. Goa has long, linear and wide beaches in the north and rocky cliffs along the southern coast. Beaches occur along Harmal, near Mandre, Morji, Chapora, Kalangute in the north and Bogmalo, Agonda, Palolen, Talpona in the south. The Mandovi river drains into the Aguada Bay, while the Zuari into the Marmagao Bay.

Goa hosts variety of natural coastal ecosystems that are fragile and rich in biodiversity like mangroves and estuaries. The Goa territory has seven estuaries. Mainly twelve species of mangroves occur in these zones of Goa. Some of the mangrove species found in intertidal environment include *Rhizophora mucronata, R. apiculata, Avicennia officinalis, A. marina, A. alba, Sonneratia alba, S. caseolaris, Exoecaria agallocha* etc. They occur along estuaries of rivers Terekhol, Chapora, Mapusa, Mandvi, Zuari (North bank) in North Goa district and Sal, Talpona, Galgibag and Zuari (south bank) in South Goa district. Chorao Island in Mandovi River is one of the best mangrove forests and houses most of the mangrove species found in Goa.

The shoreline of Goa is 155.39 (It does not include length of mouth of estuary, rivers, creeks and their inner parts). It is observed that 27.03 km length of the Goa coast has eroded, 46.98 km has accreted and 81.38 km has been stable during the time frame 1989-91 and 2004-06 (Table-2, Fig. 2). The total area eroded is 0.77 sq km and area accreted is 1.53 sq km (Table-2). Details for each individual map sheet are provided in Table-2.

Entire coastal length of Goa is classified into three sectors based on coastal configuration, geological and geomorphological characteristics. Coastal sector of North Goa comprises of regions south of Terekhol River upto Shinken. The Central coastal segment comprises region around the bay areas mainly the Aguada Bay and the Marmagao Bay. The South Goa coastal sector comprises of regions south of Bobdan around Vasco to Loliem near Karnataka border.

The North Goa sector is a linear coastal segment comprising of wide beaches, rocky cliffs, and mangroves. The Terekhol and the Chapora are major rivers of this coastal sector. Protection measures, mainly sea walls are constructed at several locations. In North Goa, the shoreline shows segments of erosion, accretion as well as stable nature. Severe erosion is seen at Keri (Map Sheet no. 48E10NE, Plate 7). Tetrapods have been used here recently along with sea wall to check erosion. This is one of the hot spot regions identified. Plates 45-49 show the eroding Keri coast and the protection measures. The sea wall

has been partially destroyed due to the wave action. Steep cut beach berm and uprooting of Casuarina plantation is observed here. The coastal stretch extending from Harmal, Mandre, upto Morji shows accretion to stable trend (Map Sheet no. 48E10NE, Plate 50-51). Chapora, Vagator in the north show eroding to stable nature (Map Sheet no. 48E10SE, Plate 52). Other regions showing stable nature of coast are south of Anjuna (Map Sheet no. 48E10SE), Candolim, Sinquerim between Kalangut and Nerul (Map Sheet no. 48E14SW, Plates 53-54) and Shinken (48E15NW). Few pockets of erosion are observed north of the Chapora River (Map Sheet no. 48E10SE), around Arpora, south of Kalangut (Map Sheet No. 48E14SW, Plate 8). Various anti sea erosion measures are taken along North Goa coast, mostly as sea walls near Keri, Anjuna, Bardez and Tiswadi.

The Central coastal segment of Goa comprises of regions around the Aguada and Marmagao Bay. The Mandovi and Zuari rivers discharge into these respectively. This region is between south of Shinken upto Vasco. This coastal stretch is majorly stable in nature (Map Sheet no. 48E14NW), except few small segments of erosion. Coco beach, south of Shinken (Map Sheet no. 48E15NW) is a pocket beach showing local erosion. Protection measures are implemented here shown in Plate 55. Eroding segment is also observed near Dona Paola. The famous Miramar beach is located in this segment near Karanjnalen. Sea walls have been constructed at several locations around Miramar, Dona Paola, Cabo Hill, Campal to protect the coast and remedial measures have been taken for stabilizing unstable slopes of Cabo Hill.

In South Goa sector, long linear beaches, rocky cliffs, headlands are observed. Pocket beaches are formed between rocky headlands. Segments of erosion, accretion as well as stable nature occur in the South Goa sector. The coastal stretch along Bobdan, south of Vasco (Map Sheet no. 48E15NW), Kimsavlin, Arosin, Sernabalim (Map Sheet no. 48E15SE), near Kavllesi (Map Sheet no. 48E16NE) and south of Talpona upto Mahi (48J01NW) shows accretion. Plate 61 shows the spit near Mahi. Erosion is observed around Betalbatim, between Kolva and Majorda. Uprooting of Casuarina plantation due to coastal erosion and protection measures taken near Betalbatim (Map Sheet no. 48E15SE) are depicted in Plate 57-59. Erosion is also observed along South of Betul, upto Kanagini and between Parven to Agonda (Map Sheet no. 48E16SE). Small segments of stable coast occur along Dabolim, Arosin, south of Sernabalim (Map sheet no. 48E15SE), Bogmoha, Chukolna (Map Sheet no. 48E15SW, Plate 56). A long stretch of stable beaches is observed from Fatrade almost upto Betal (Map Sheet no. 48E16NE, Plate 9-10). Stable coast at Karmona, north of Kavlessi is shown in Plate 60. Beautiful sandy beaches (Benaulim, Varca, Betul) occur along this segment. The rocky cliffs in the southern region, from Cape Rama to Loliem near Karnataka border constitute the stable coastal stretch (Map Sheet no. 48E16SE, 48I04SW, 48J01NW, Plate 11, 62).

Table-2: Map sheet wise results of shoreline changes for 1989-91 and 2004-06 time-frame for Goa coast.

| Sr. No | Map Sheet no. | Erosion Area (sq. km) | Erosion length (km) | Accretion area (sq. km) | Accretion length (km) | Stable (km) |
|---|---|---|---|---|---|---|
| 1 | 48E10NE | 0.04 | 2.23 | 0.22 | 8.57 | 2.99 |
| 2 | 48E10SE | 0.15 | 5.98 | 0.04 | 2.43 | 0.56 |
| 3 | 48E14SW | 0.1 | 2.57 | 0.1 | 3.86 | 0.52 |
| 4 | 48E15NW | 0.01 | 1.12 | 0.23 | 5.53 | 32.79 |
| 5 | 48E15SE | 0.05 | 2.06 | 0.39 | 9.68 | 2.06 |
| 6 | 48E15SW | 0.003 | 0.18 | 0.08 | 2.08 | 6.46 |
| 7 | 48E16NE | 0.12 | 3.59 | 0.06 | 2.12 | 10 |
| 8 | 48E16SE | 0.29 | 8.79 | 0.17 | 6.56 | 18.52 |
| 9 | 48I04SW | 0 | 0 | 0.16 | 3.64 | 2.18 |
| 10 | 48J01NW | 0.008 | 0.51 | 0.08 | 2.51 | 5.3 |
|  | TOTAL: | 0.771 | 27.03 | 1.53 | 46.98 | 81.38 |

Figure 2 shows the accreting length, eroding length and stable shoreline of Goa coast.

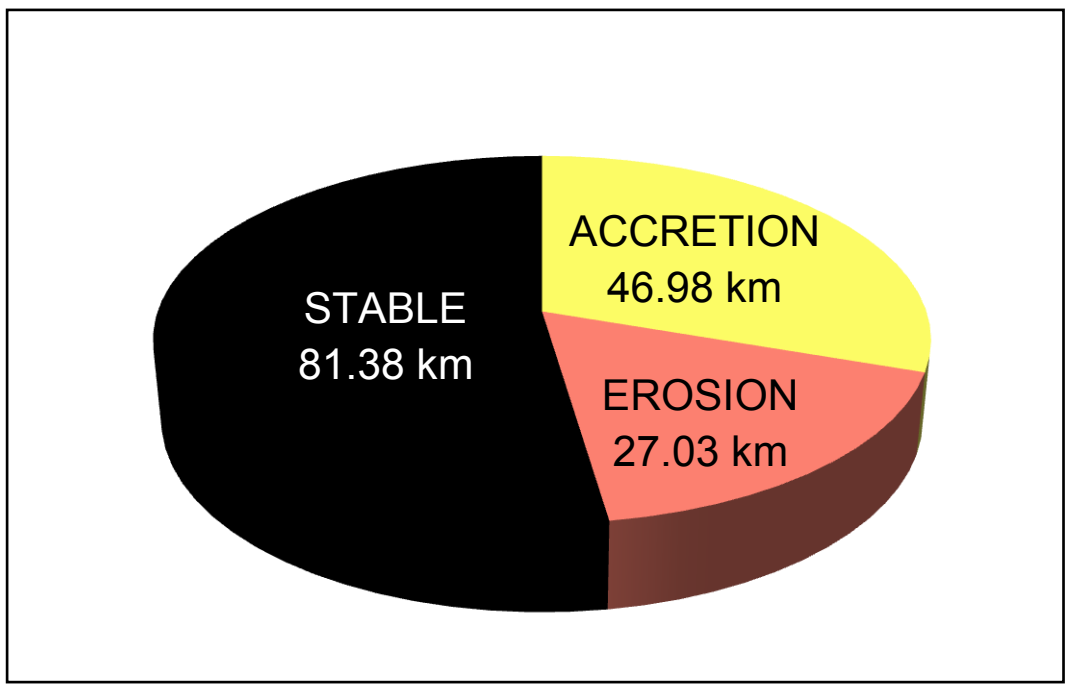



Figure 2: Status of coastal erosion, accretion and stable nature of Goa coast (Total coastal length of 155.39 km does not include length of mouth of estuary, rivers, creeks and their inner parts).

# END USE

The Atlas can be used as a reference material for obtaining information on status of shoreline changes during 1989-91 and 2004-06 time-frames along entire Indian coastline. Areas under coastal erosion and status of coastal protection measures taken up by respective maritime State and Union Territory are depicted and can be used for planning coastal protection measures.

The Atlas is extremely useful to Coastal Erosion Directorate, Central Water Commission for providing guidance towards coastal protection works in maritime states of India.

All the State Public Works Departments, Ports and Harbour Authorities, Coastal Regulation Zone Authorities shall be able to have better management of the shorelines in respective states.

# REFERENCES


Gupta M.C. et. al., 2000, Coastal Zone Management Information System for Gujarat, Technical Report, SAC/MWRD/TR/04/2000.

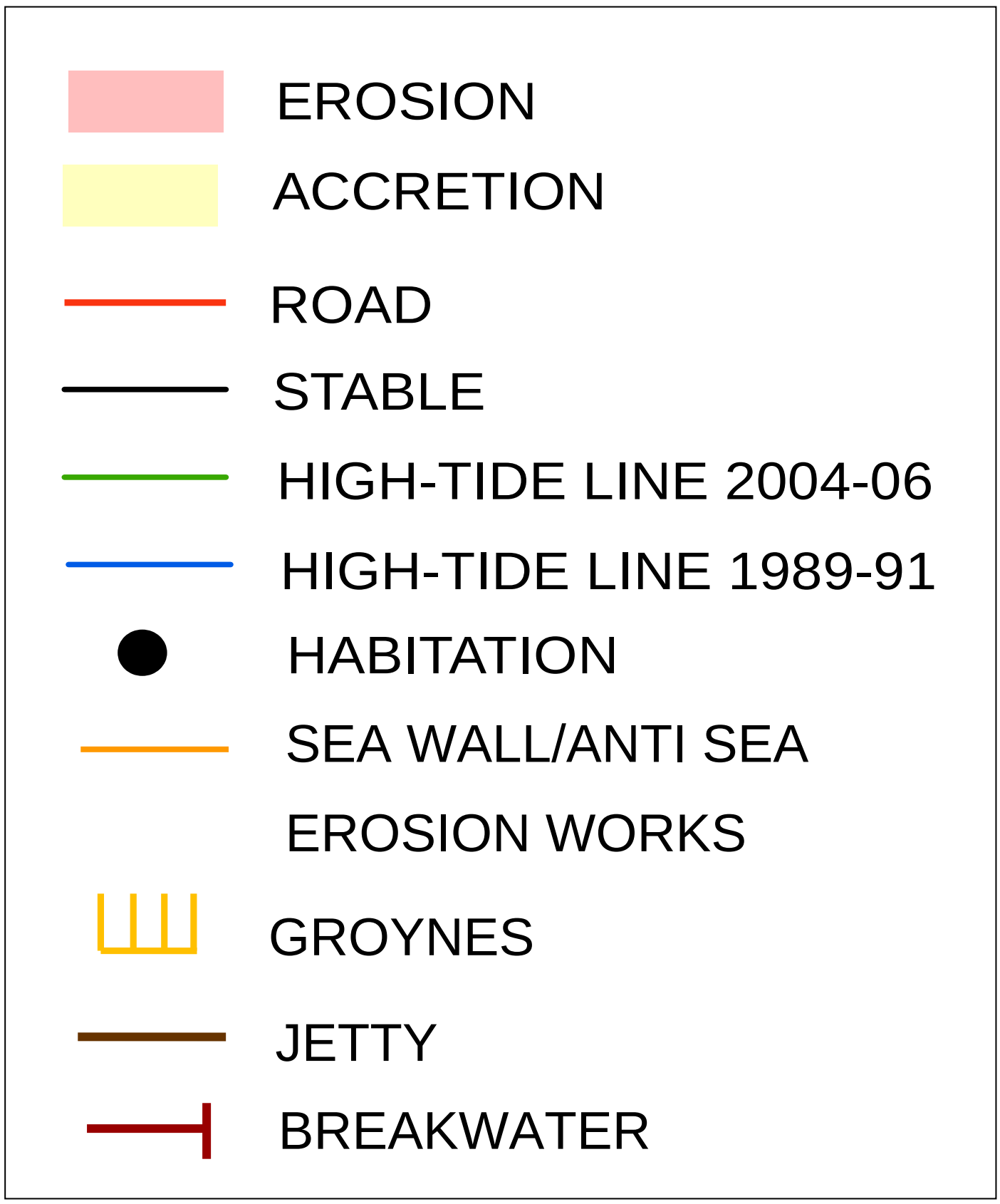
Nayak, S. R., Bahuguna, A., Shaikh, M., Rao, R. S., Trivedi, C. R., Prasad, K. N., Kadri, S. A., Vaidya, P. H., Patel, V. B., Oza, S. H., Patel, S. S., Rao, T. A., Shereiff, A. N. and Suresh, P. V., 1991, *Manual for mapping of coastal wetlands/landforms and shoreline changes using satellite data*: Technical Note, IRS-UP/SAC/MCE/TN/32/91 (Space Applications Centre, Ahmedabad), 63 p.

SAC, 2012, *Coastal Zones of India*, Space Applications Centre (ISRO), 2012, 597 p. ISBN: 978-81-909978-9-8.

# Annexure-I

(Shoreline Change Maps)

# COMPLETE LEGEND TO SHORELINE CHANGE MAPS



# SHORELINE CHANGE MAPS

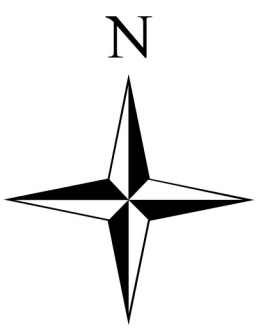
# MAHARASHTRA

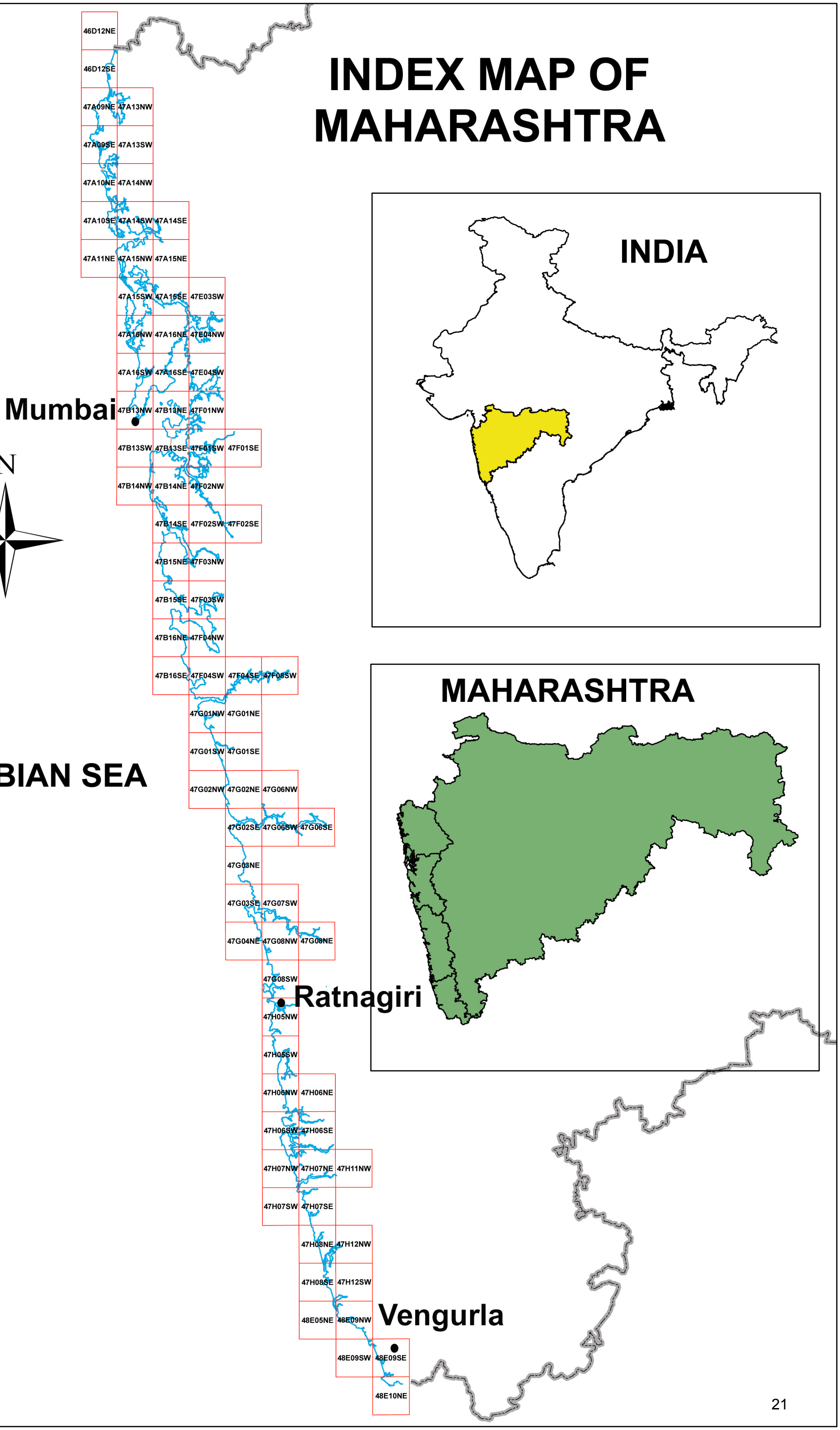
# INDEX MAP OF MAHARASHTRA









# SHORELINE CHANGES OF MAHARASHTRA



DAHANU

MUMBAI

ARABIAN SEA

RATNAGIRI

REDI

N

LEGEND

EROSION LENGTH

ACCRETION LENGTH

STABLE LENGTH

HTL 2004-2006

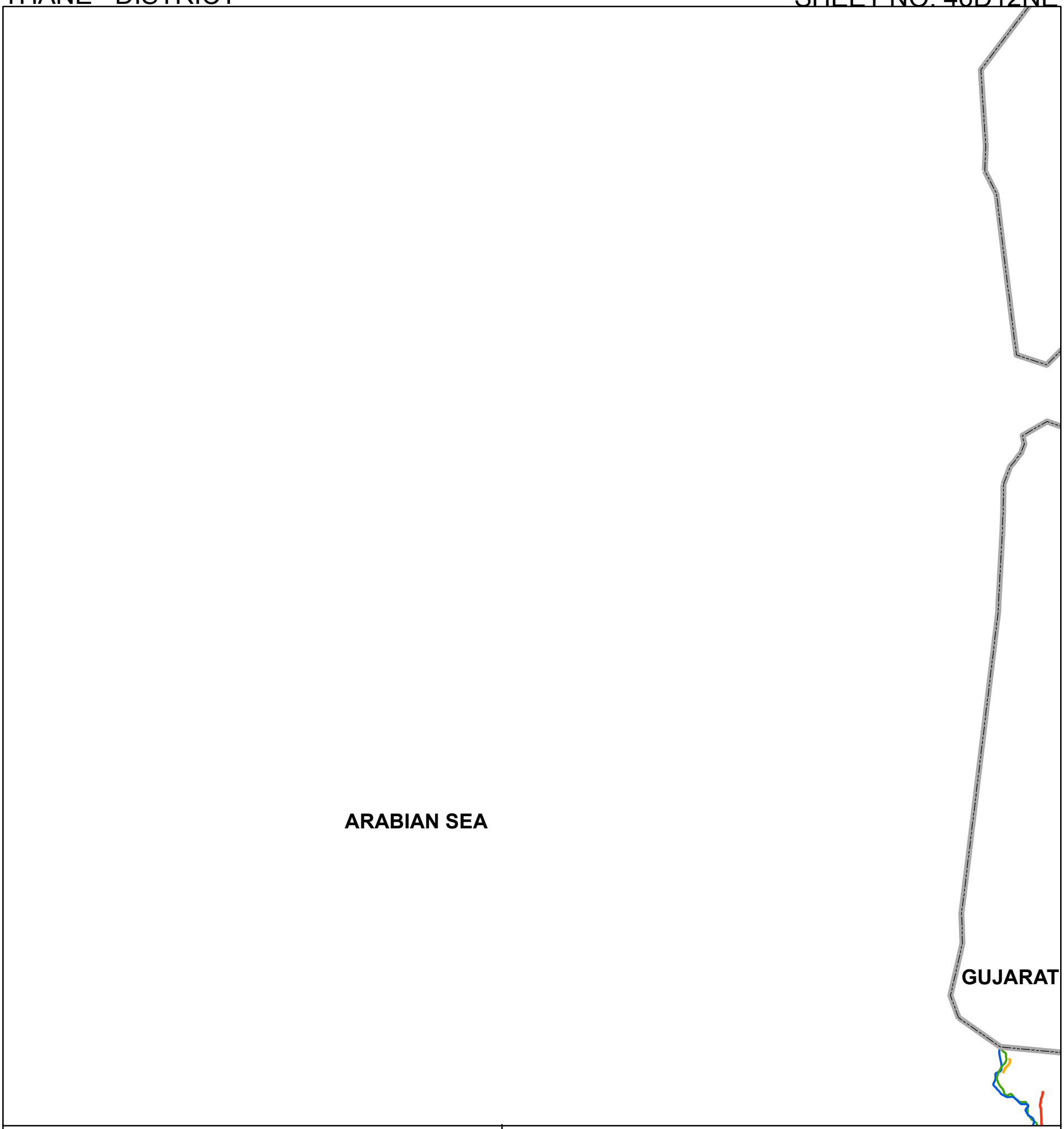
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

THANE DISTRICT

SHEET NO. 46D12NE




### Legend

- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- STATE BOUNDARY
- SEA WALL

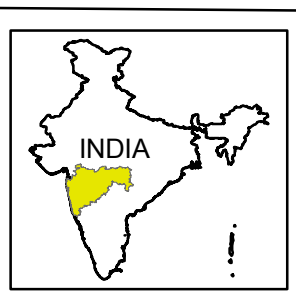
N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| SEA | SEA | 46D15SW |
| SEA | | 46D16NW |
| SEA | 46D12SE | 46D16SW |





DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

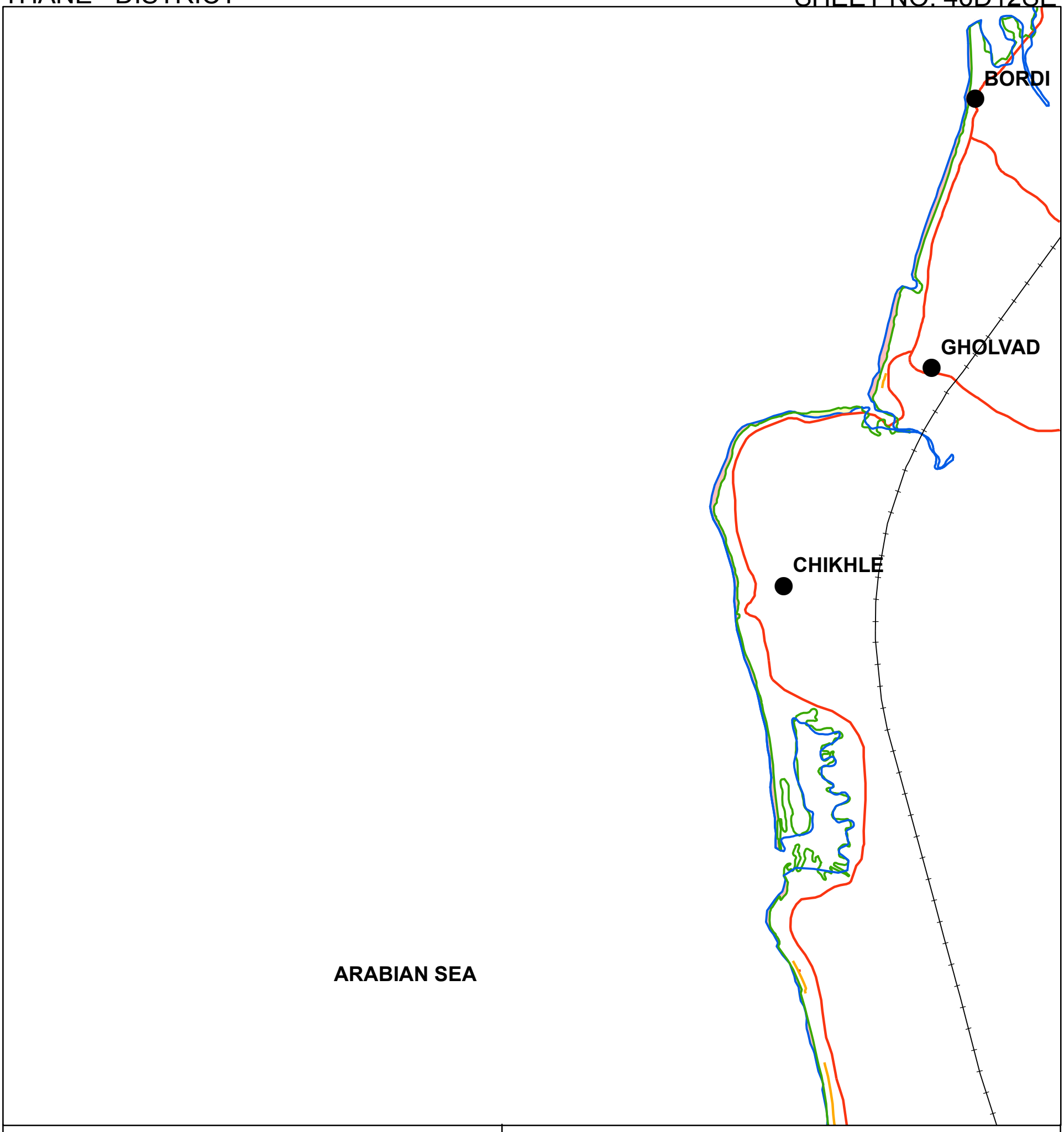
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

THANE DISTRICT

SHEET NO. 46D12SE




## Legend

- EROSION
- ACCRETION
- ROAD
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION
- SEA WALL

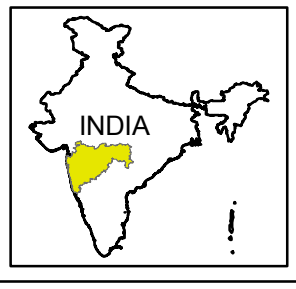
N
W E
S

0 2

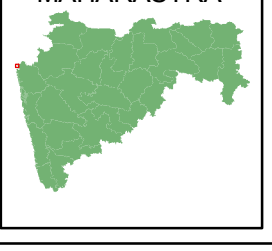
Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| SEA | 46D12NE | 46D16NW |
| SEA | | 46D16SW |
| SEA | 47A09NE | 47A13NW |




MAHARASTRA



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

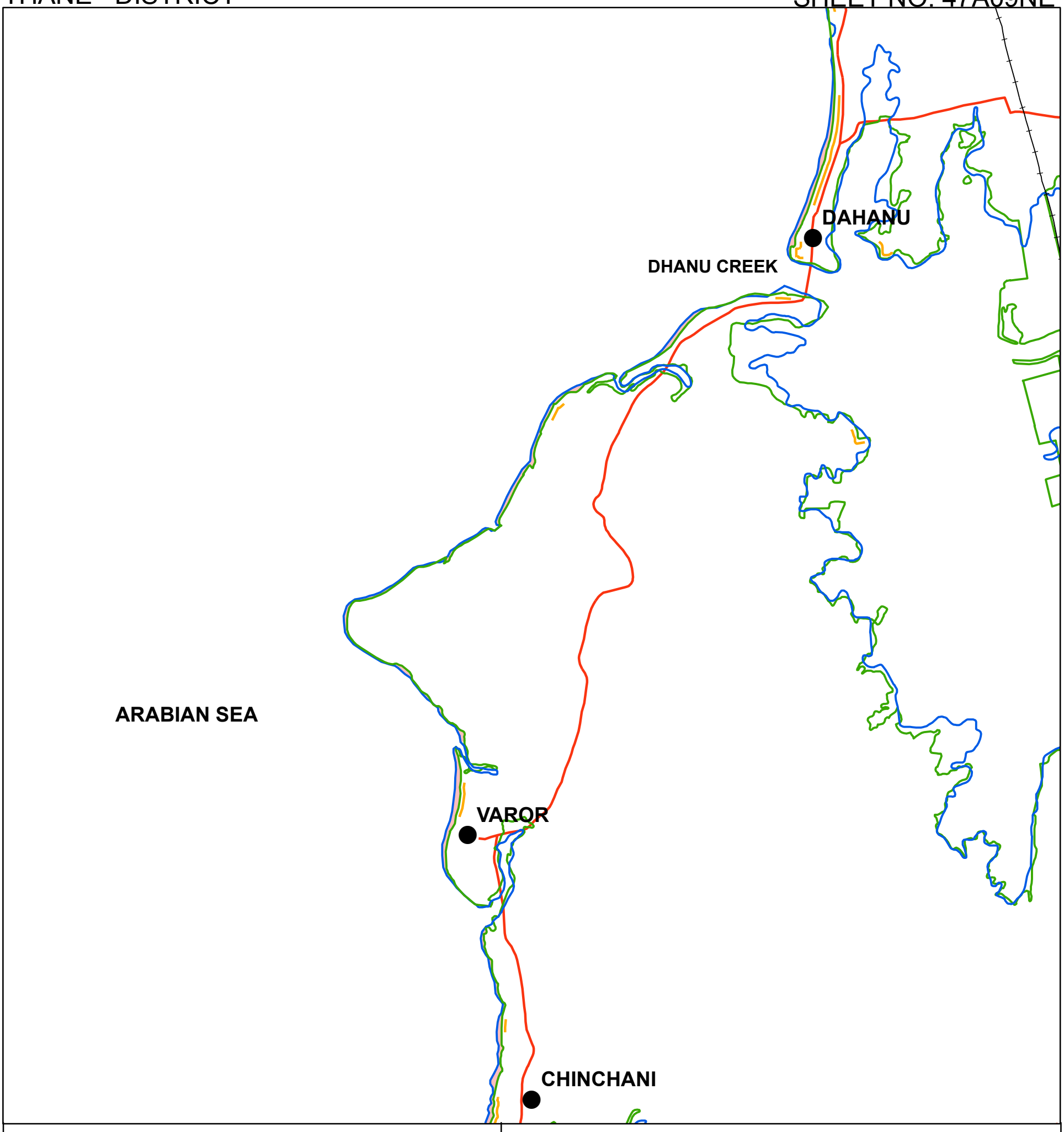
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

THANE DISTRICT

SHEET NO. 47A09NE




### Legend

- EROSION
- ACCRETION
- ROAD
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION
- SEA WALL

N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| SEA | 46D12SE | 46D16SW |
| SEA | | 47A13NW |
| SEA | 47A09SE | 47A13SW |



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

THANE DISTRICT

SHEET NO. 47A09SE

CHINCHANI TARAPUR CREEK

TARAPUR

GHIVOLI CREEK

GHIVOLI

UCHELI CREEK

NAVAPUR

ARABIAN SEA

VADVALPADA

### Legend

- EROSION
- ACCRETION
- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION
- SEA WALL

N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| SEA | 47A09NE | 47A13NW |
| SEA | | 47A13SW |
| SEA | 47A10NE | 47A14NW |

INDIA

MAHARASTRA

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

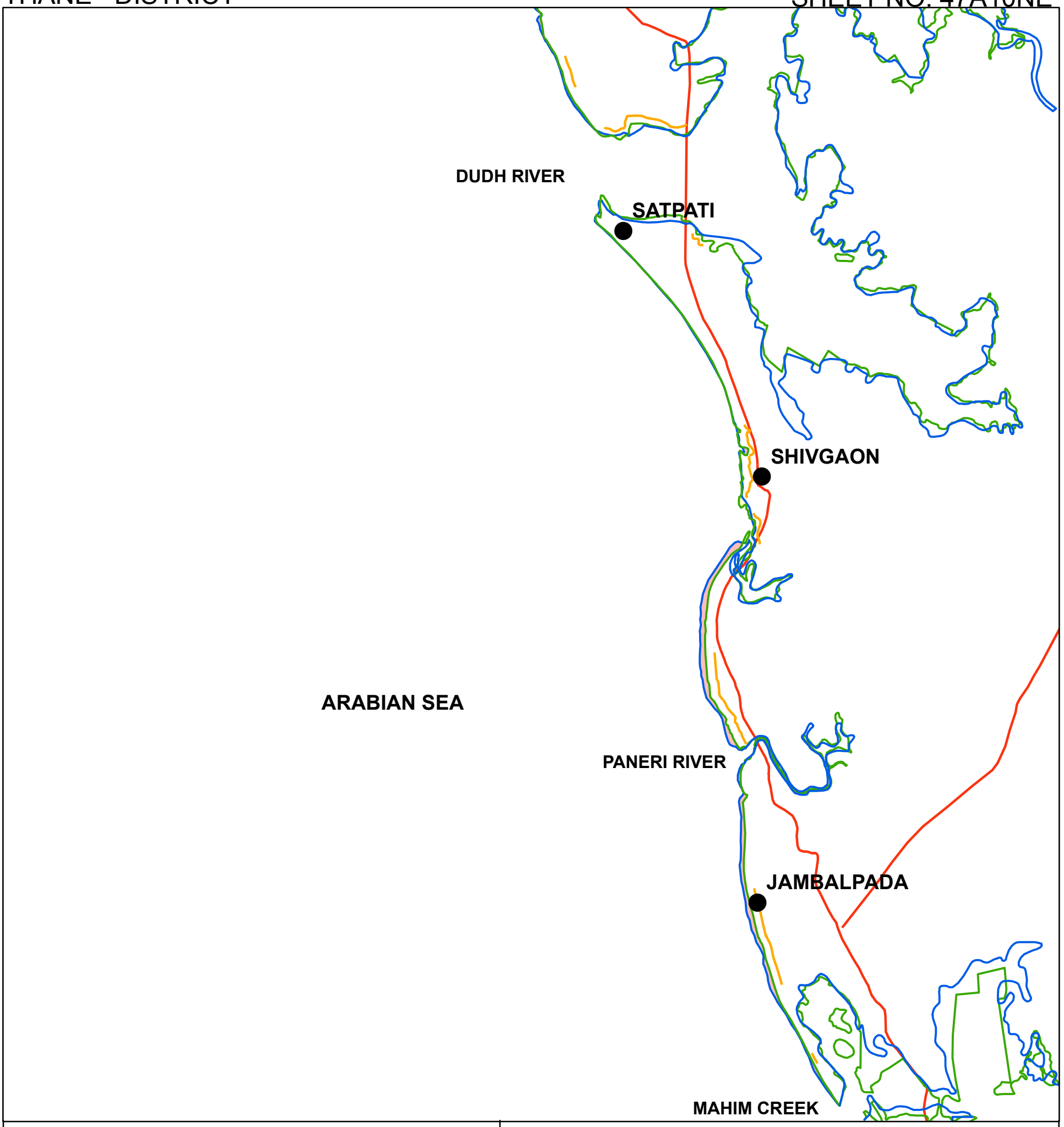
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

THANE DISTRICT

SHEET NO. 47A10NE




### Legend

- EROSION
- ACCRETION
- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION
- SEA WALL

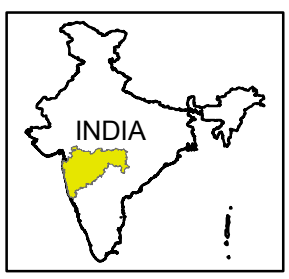
N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| SEA | 47A09SE | 47A13SW |
| SEA | | 47A14NW |
| SEA | 47A10SE | 47A14SW |




MAHARASTRA

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

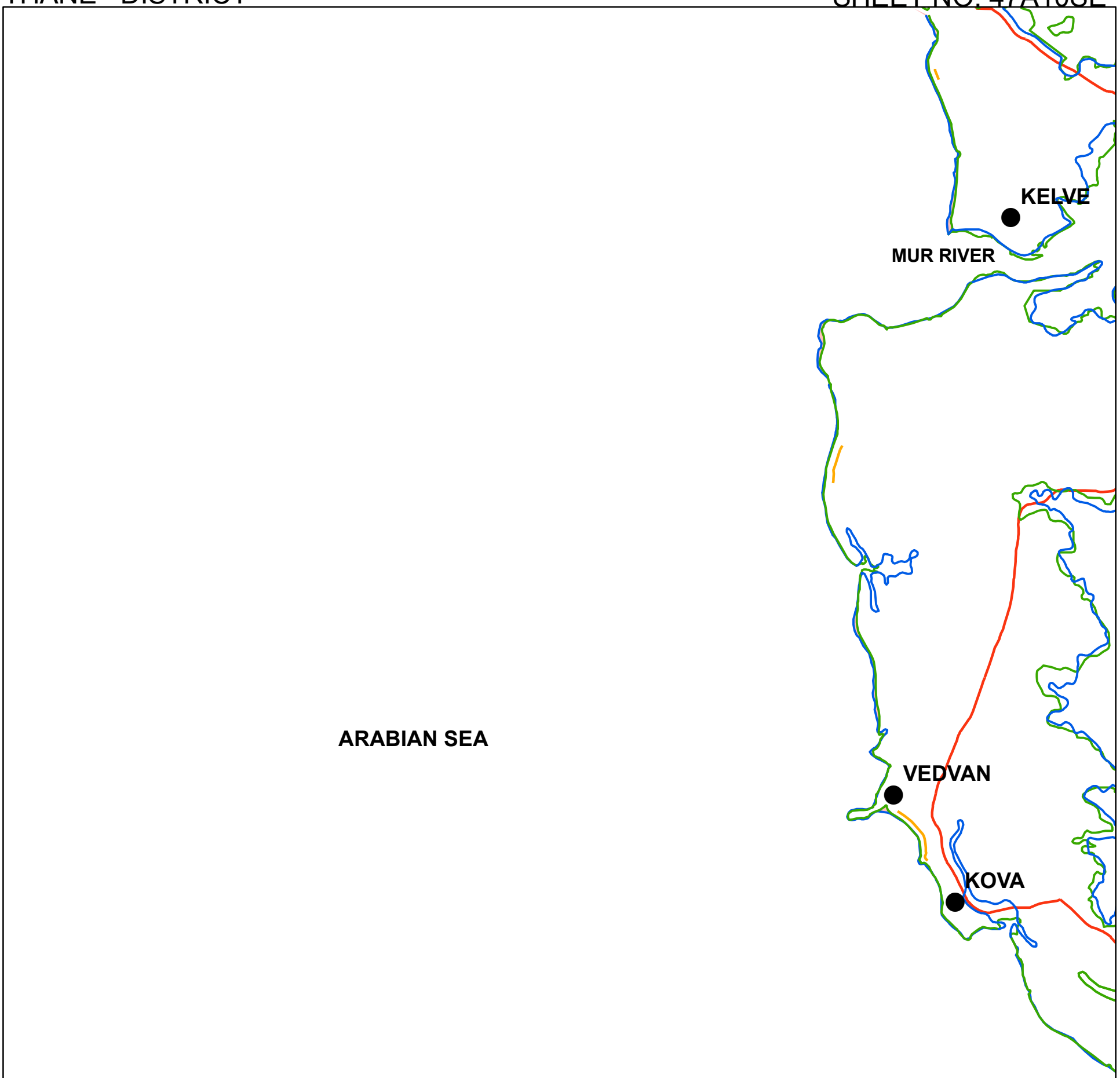
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

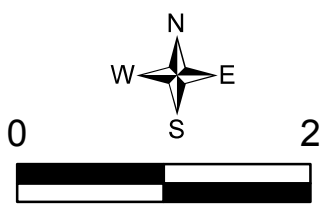
THANE DISTRICT

SHEET NO. 47A10SE




### Legend

- EROSION
- ACCRETION
- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION
- SEA WALL




Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| SEA | 47A10NE | 47A14NW |
| SEA | | 47A14SW |
| SEA | 47A11NE | 47A15NW |



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

THANE DISTRICT

SHEET NO. 47A11NE

**ARABIAN SEA**

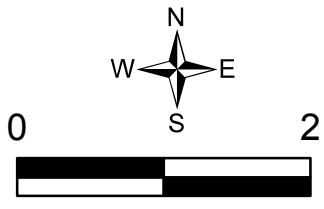
## Legend

EROSION

HIGH-TIDE LINE 2004-06

HIGH-TIDE LINE 1989-91

SEA WALL




Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| SEA | 47A10SE | 47A14SW |
| SEA | | 47A15NW |
| SEA | SEA | 47A15SW |



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

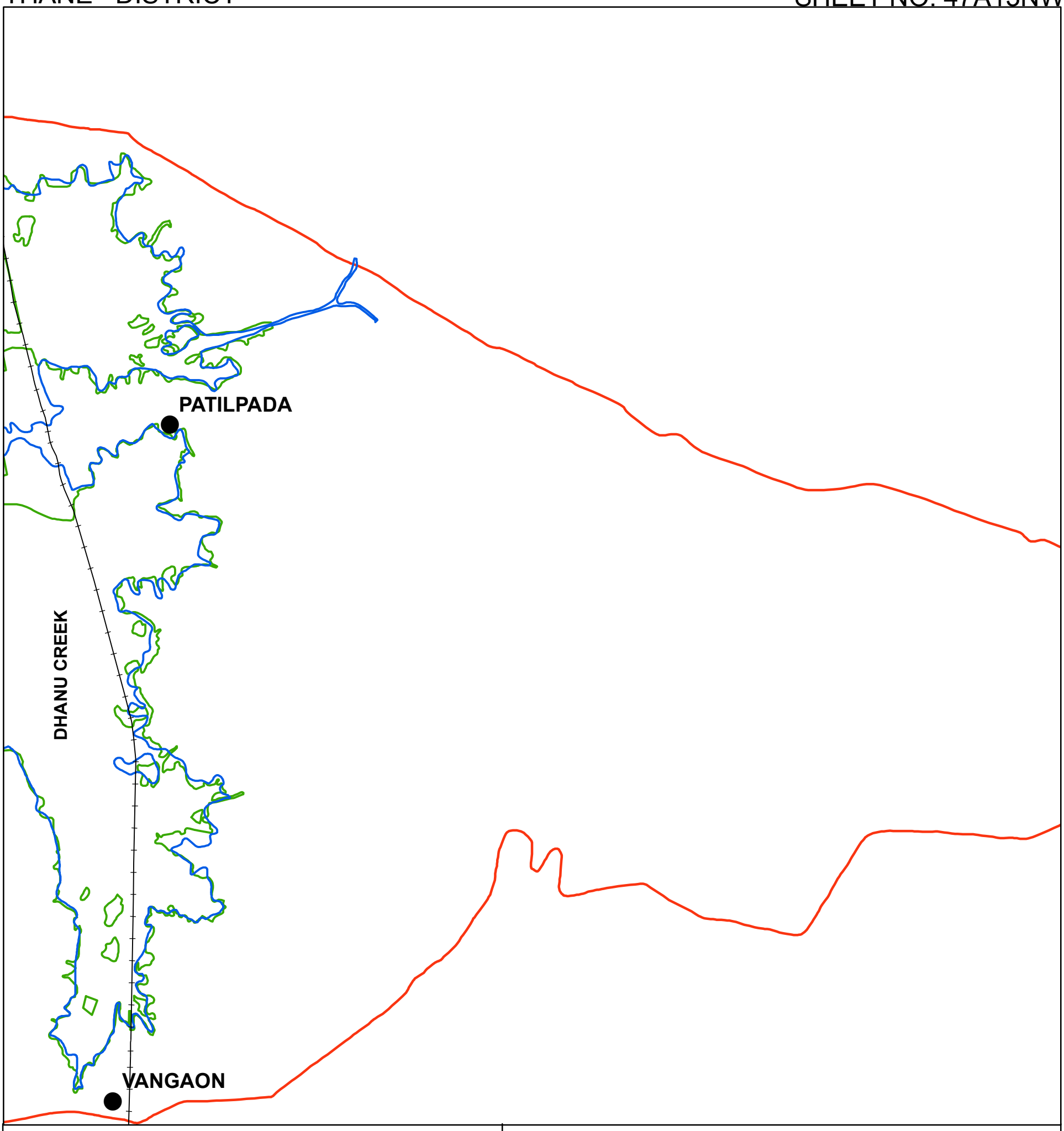
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

THANE DISTRICT

SHEET NO. 47A13NW




### Legend

- ROAD
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 46D12SE | 46D16SW | 46D16SE |
| 47A09NE | | 47A13NE |
| 47A09SE | 47A13SW | 47A13SE |



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

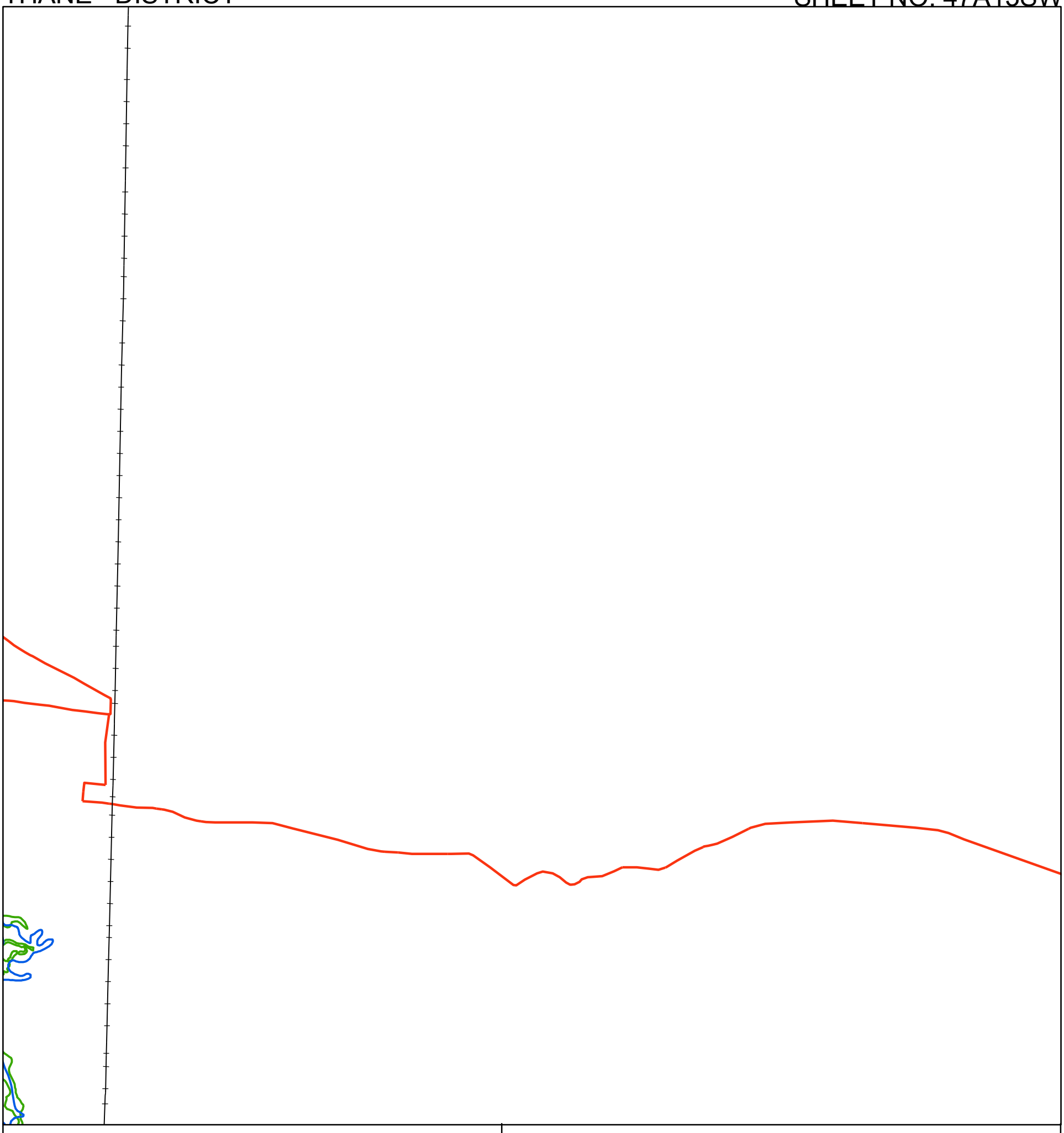
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

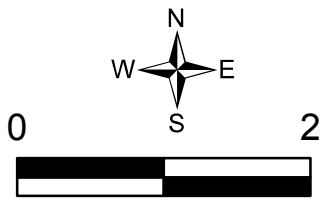
THANE DISTRICT

SHEET NO. 47A13SW



### Legend

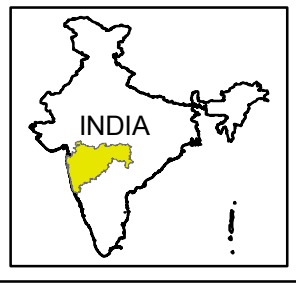
- ROAD
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91

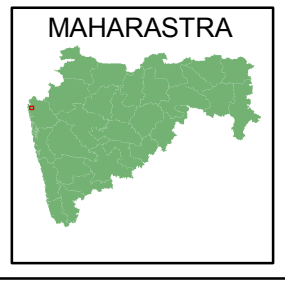



Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 47A09NE | 47A13NW | 47A13NE |
| 47A09SE | | 47A13SE |
| 47A10NE | 47A14NW | 47A14NE |




DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

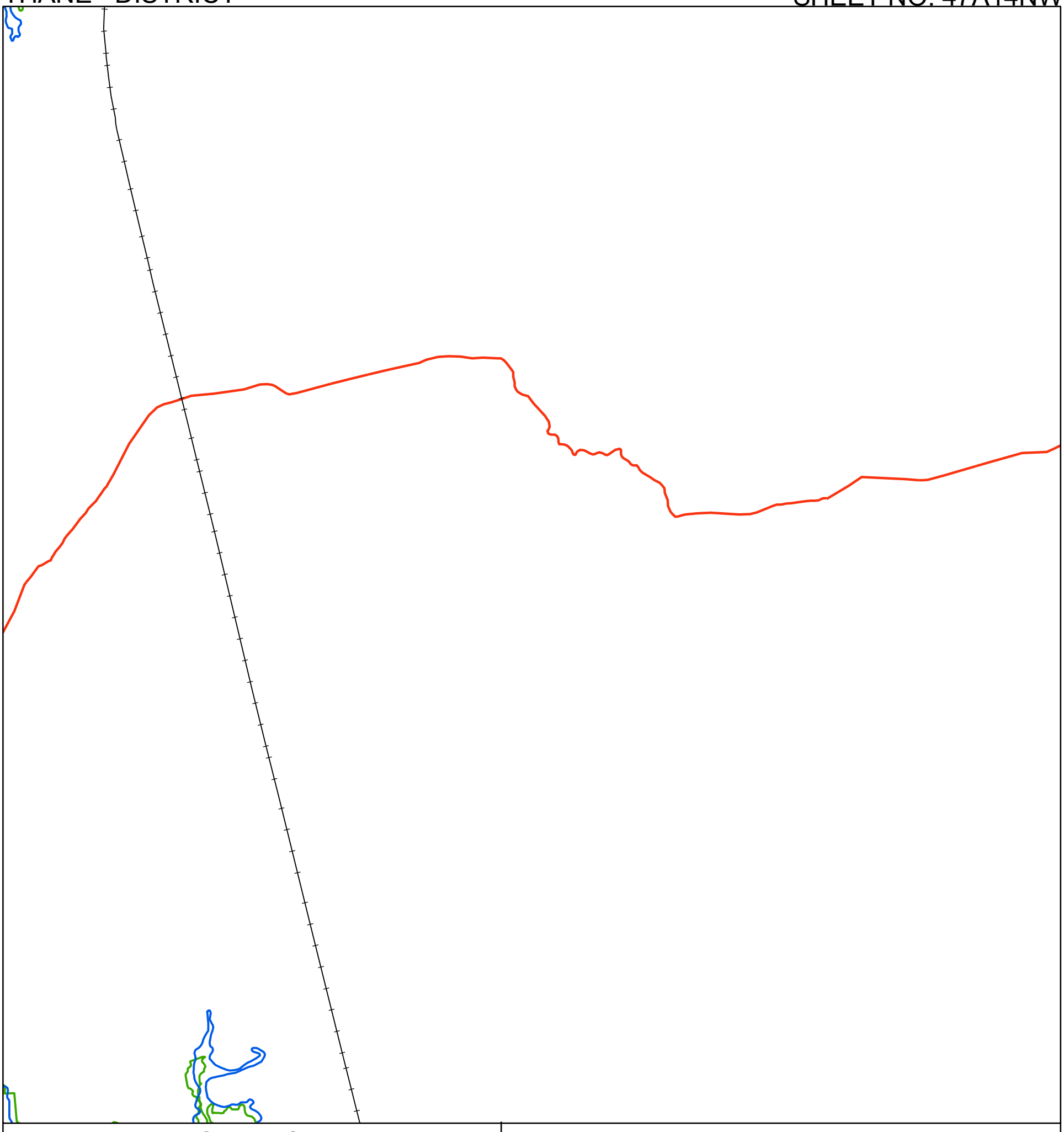
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

THANE DISTRICT

SHEET NO. 47A14NW



## Legend

- ROAD
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91

N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 47A09SE | 47A13SW | 47A13SE |
| 47A10NE | | 47A14NE |
| 47A10SE | 47A14SW | 47A14SE |



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

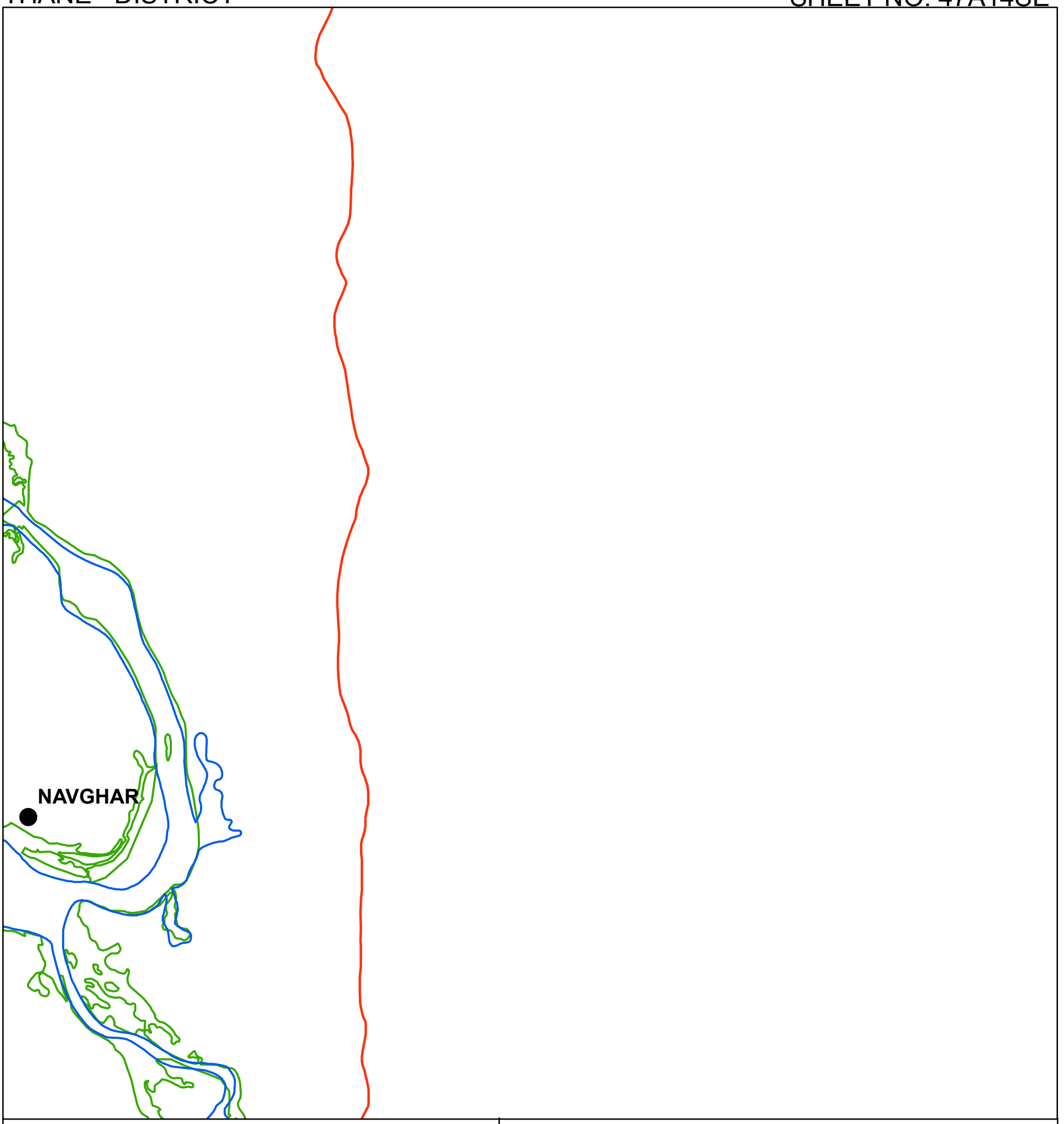
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

THANE DISTRICT

SHEET NO. 47A14SE




### Legend

- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 47A14NW | 47A14NE | 47E02NW |
| 47A14SW | | 47E02SW |
| 47A15NW | 47A15NE | 47E03NW |



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

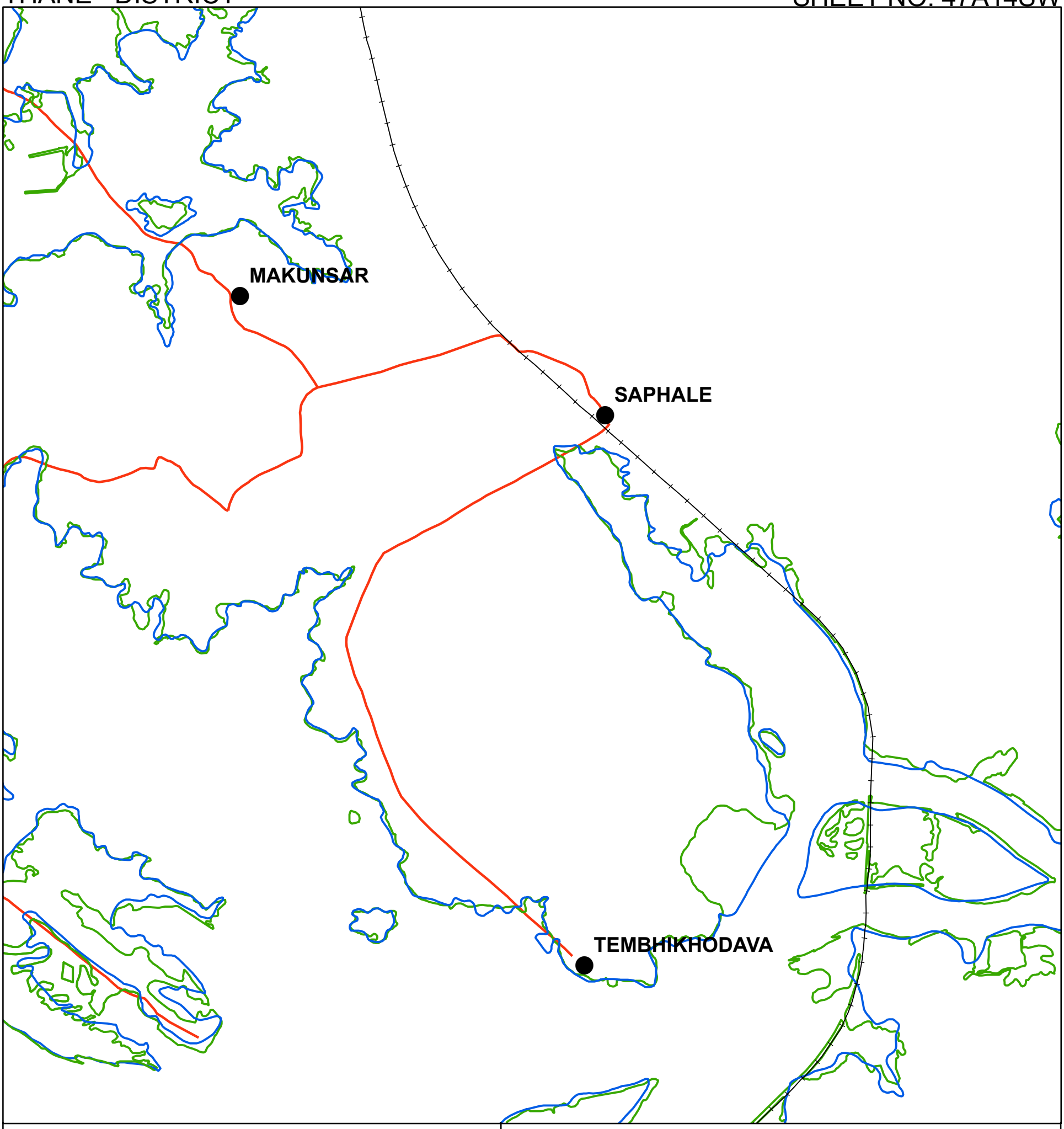
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

THANE DISTRICT

SHEET NO. 47A14SW




### Legend

- ROAD
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 47A10NE | 47A14NW | 47A14NE |
| 47A10SE | | 47A14SE |
| 47A11NE | 47A15NW | 47A15NE |


MAHARASTRA

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

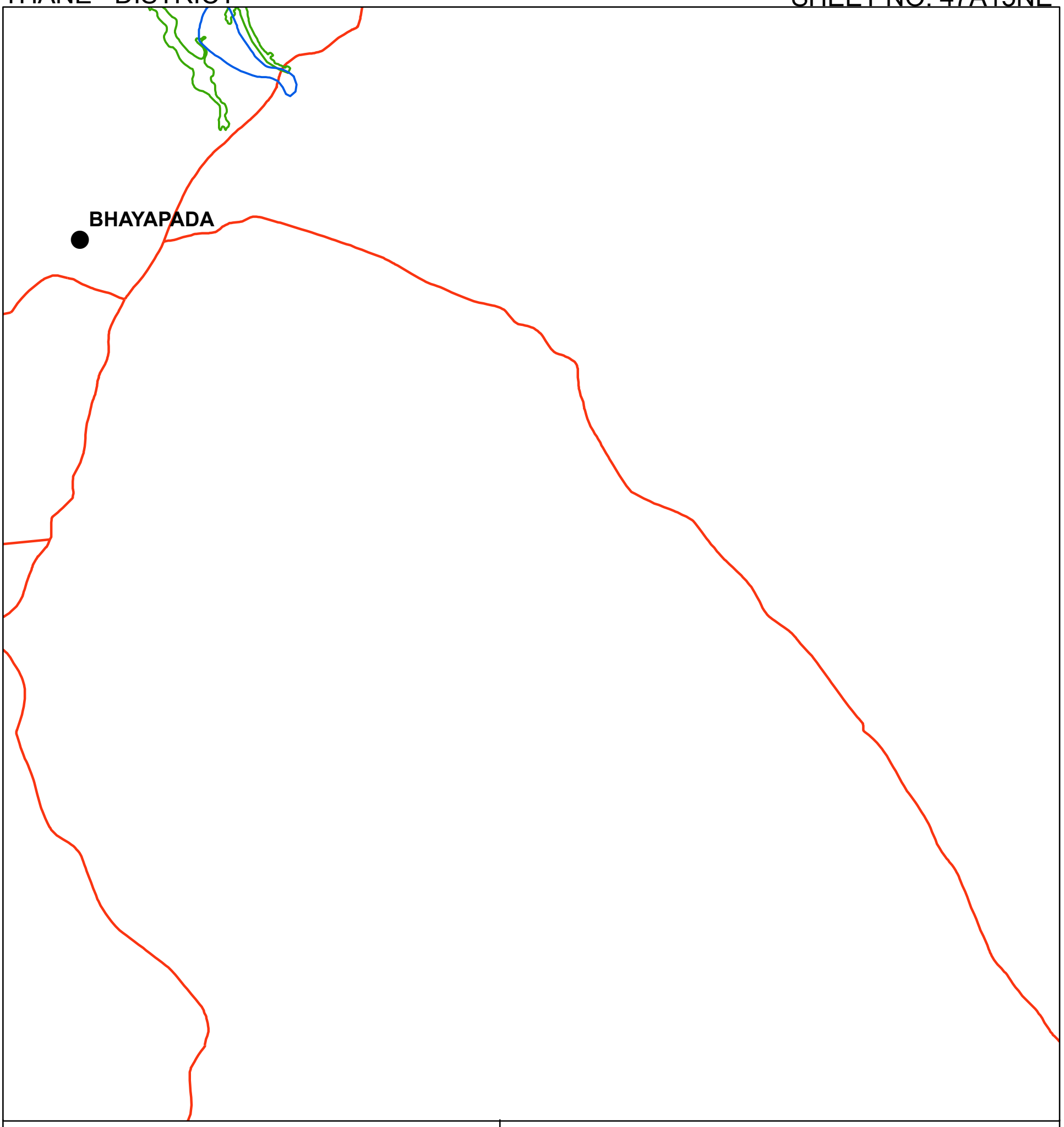
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

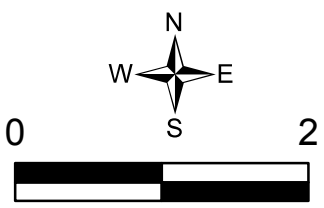
THANE DISTRICT

SHEET NO. 47A15NE




### Legend

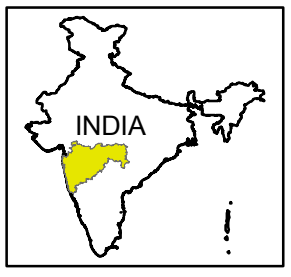
- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION




Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 47A14SW | 47A14SE | 47E02SW |
| 47A15NW | | 47E03NW |
| 47A15SW | 47A15SE | 47E03SW |





DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

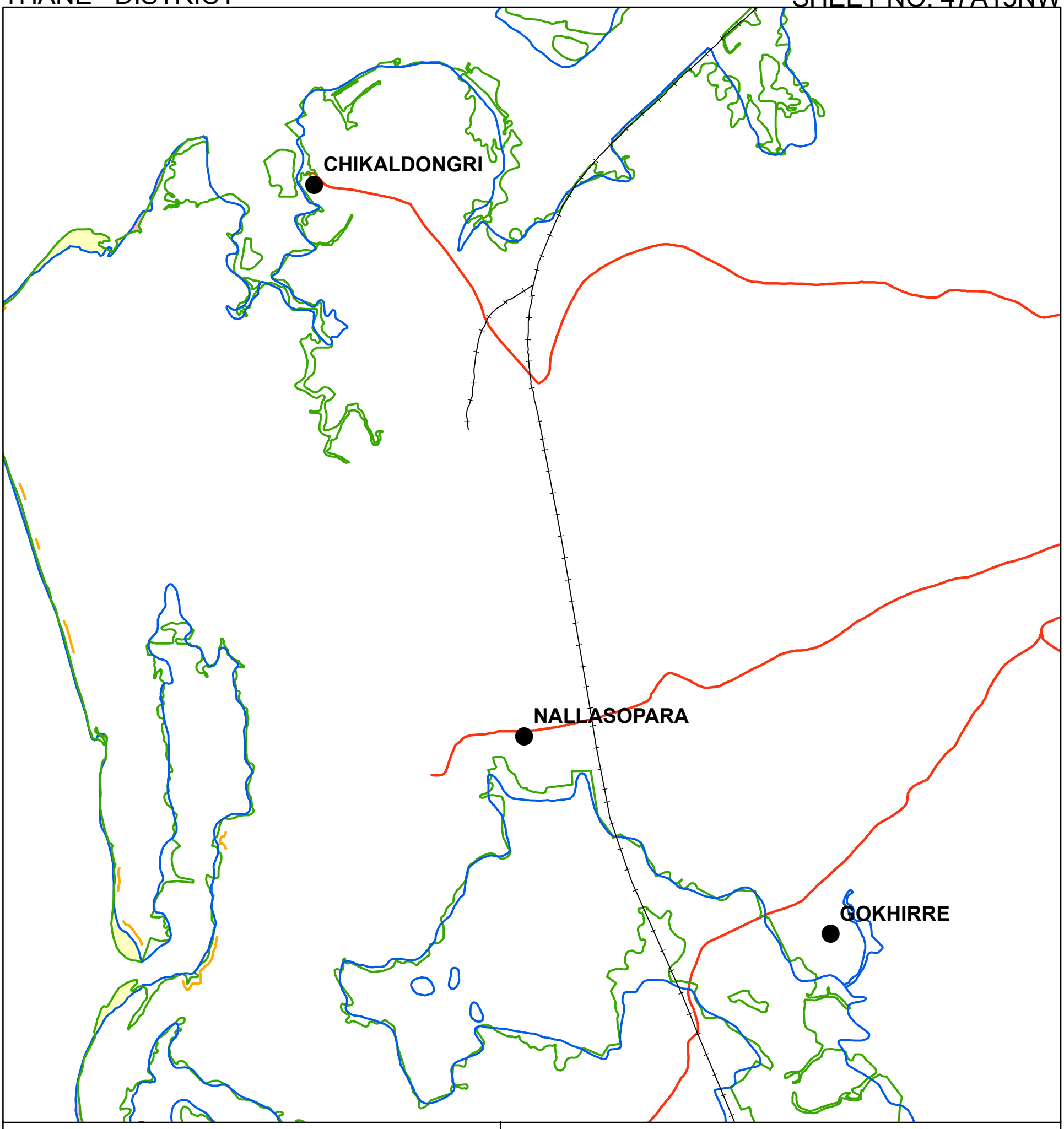
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

THANE DISTRICT

SHEET NO. 47A15NW




### Legend

- EROSION
- ACCRETION
- ROAD
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION
- SEA WALL

N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 47A10SE | 47A14SW | 47A14SE |
| 47A11NE | | 47A15NE |
| SEA | 47A15SW | 47A15SE |


MAHARASTRA

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

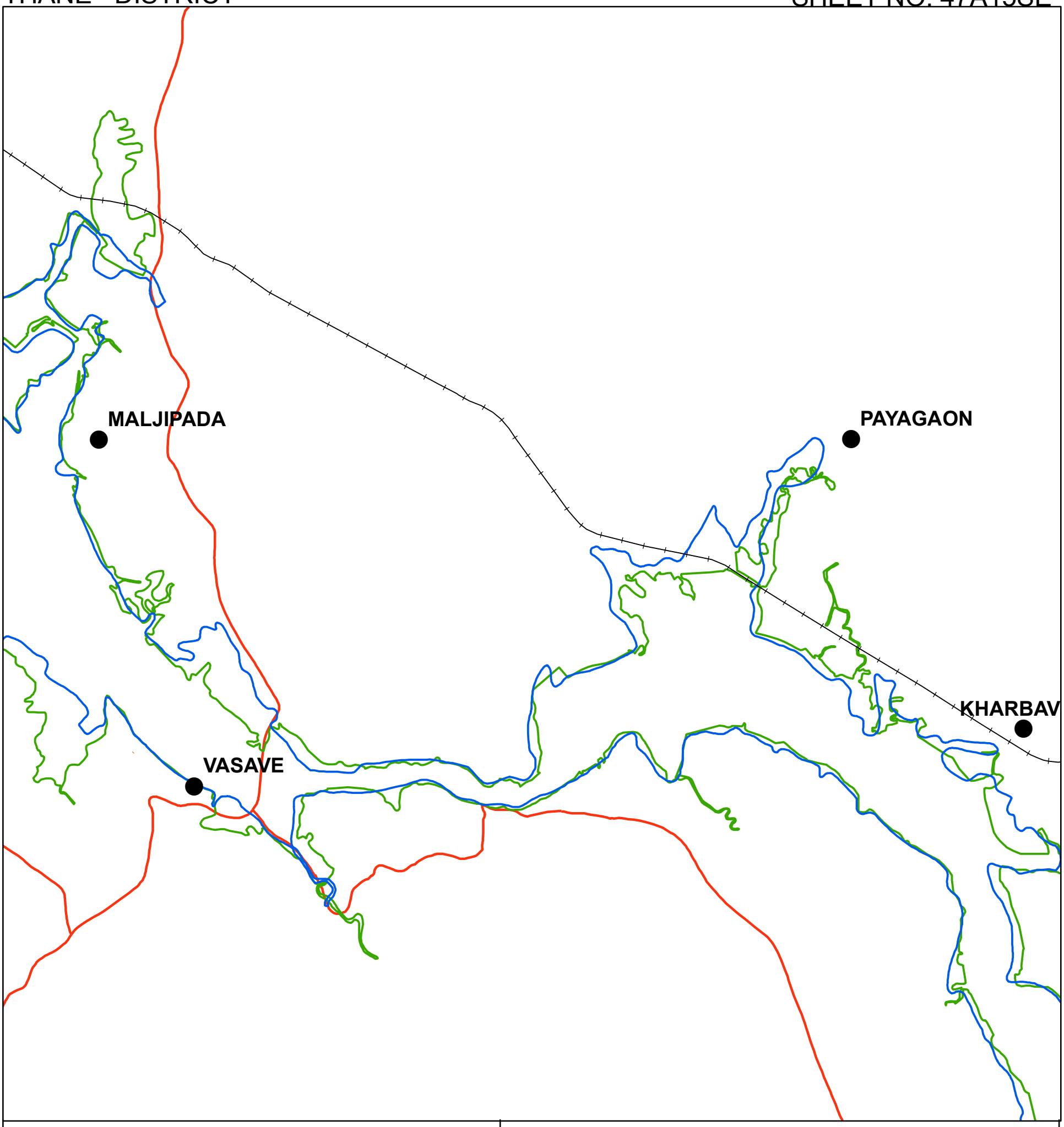
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

THANE DISTRICT

SHEET NO. 47A15SE



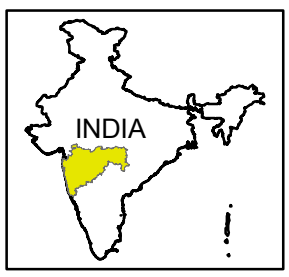

### Legend

- ROAD
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N
W E
S
0 2
Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 47A15NW | 47A15NE | 47E03NW |
| 47A15SW | | 47E03SW |
| 47A16NW | 47A16NE | 47E04NW |





DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

THANE DISTRICT

SHEET NO. 47A15SW

RANGAON

UMELE

VASAI CREEK

ARABIAN SEA

DAISAR

### Legend

- EROSION
- ACCRETION
- ROAD
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION
- SEA WALL

N

W E

S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 47A11NE | 47A15NW | 47A15NE |
| SEA | | 47A15SE |
| SEA | 47A16NW | 47A16NE |


MAHARASTRA

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

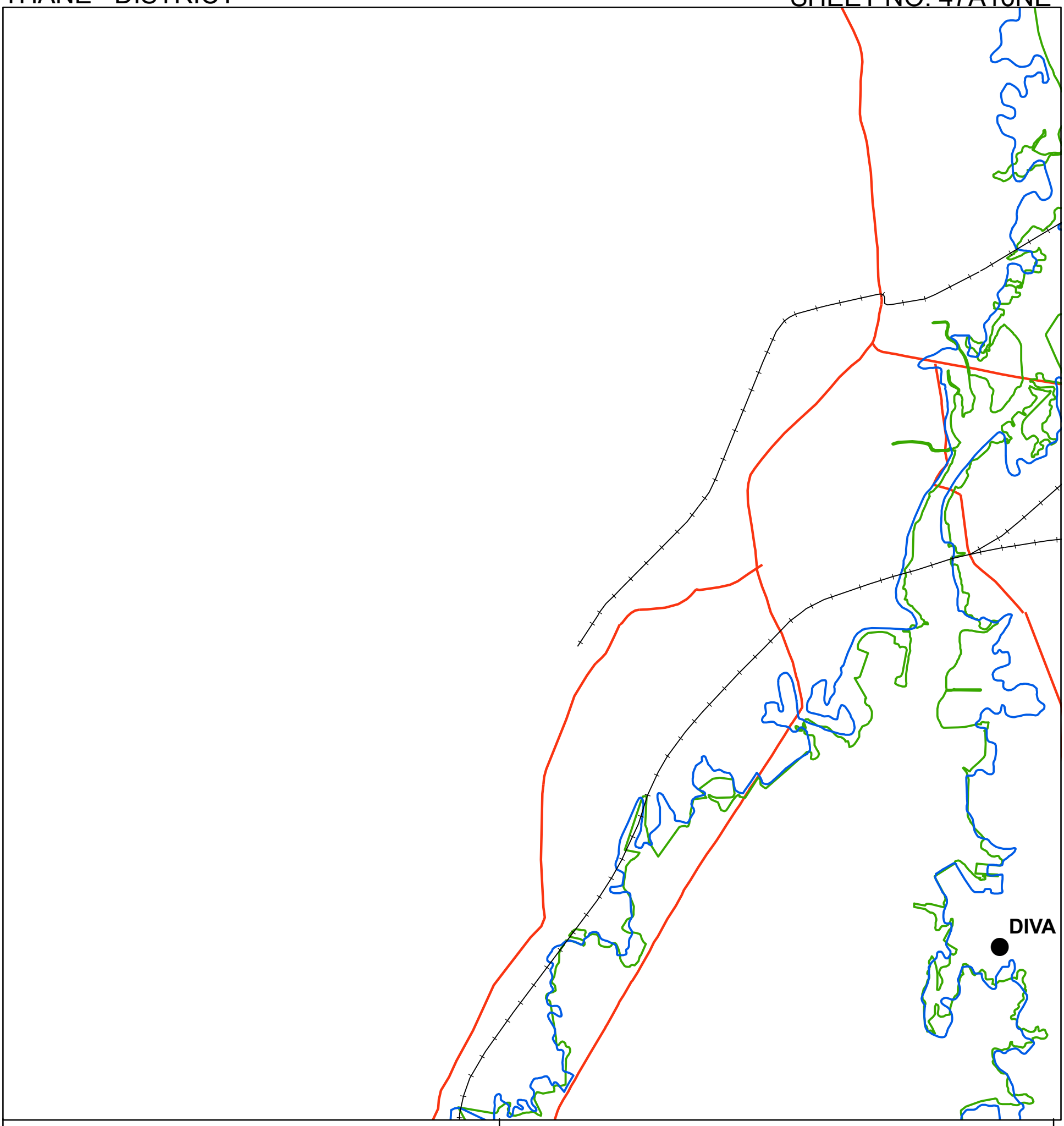
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

THANE DISTRICT

SHEET NO. 47A16NE




### Legend

- ROAD
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

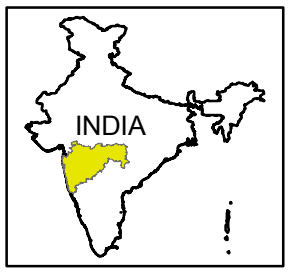
N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 47A15SW | 47A15SE | 47E03SW |
| 47A16NW | | 47E04NW |
| 47A16SW | 47A16SE | 47E04SW |





DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

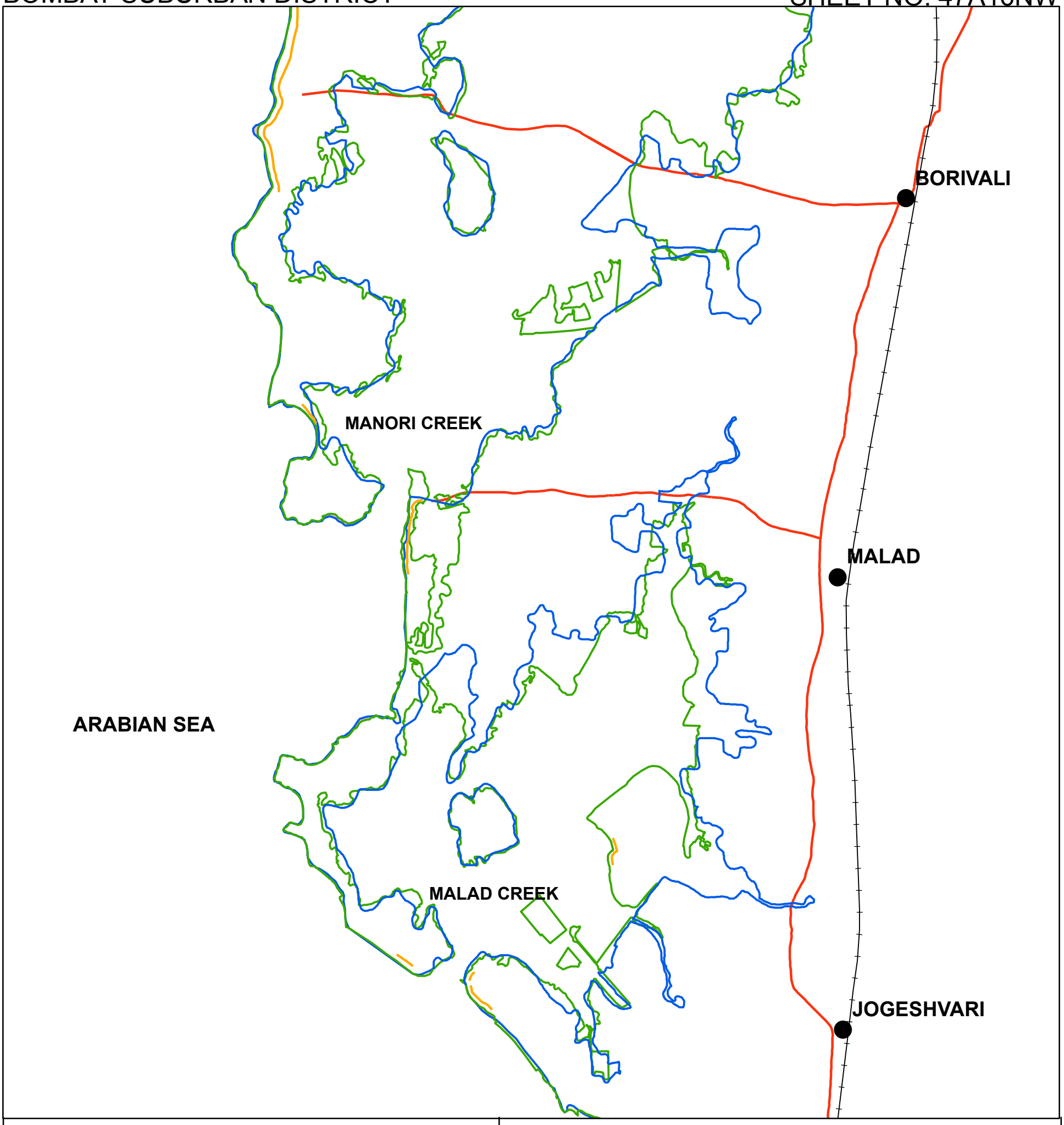
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

BOMBAY SUBURBAN DISTRICT

SHEET NO. 47A16NW




### Legend

- EROSION
- ACCRETION
- ROAD
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION
- SEA WALL

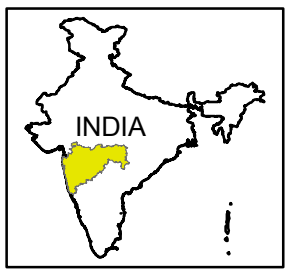
N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| SEA | 47A15SW | 47A15SE |
| SEA | | 47A16NE |
| SEA | 47A16SW | 47A16SE |




MAHARASTRA

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

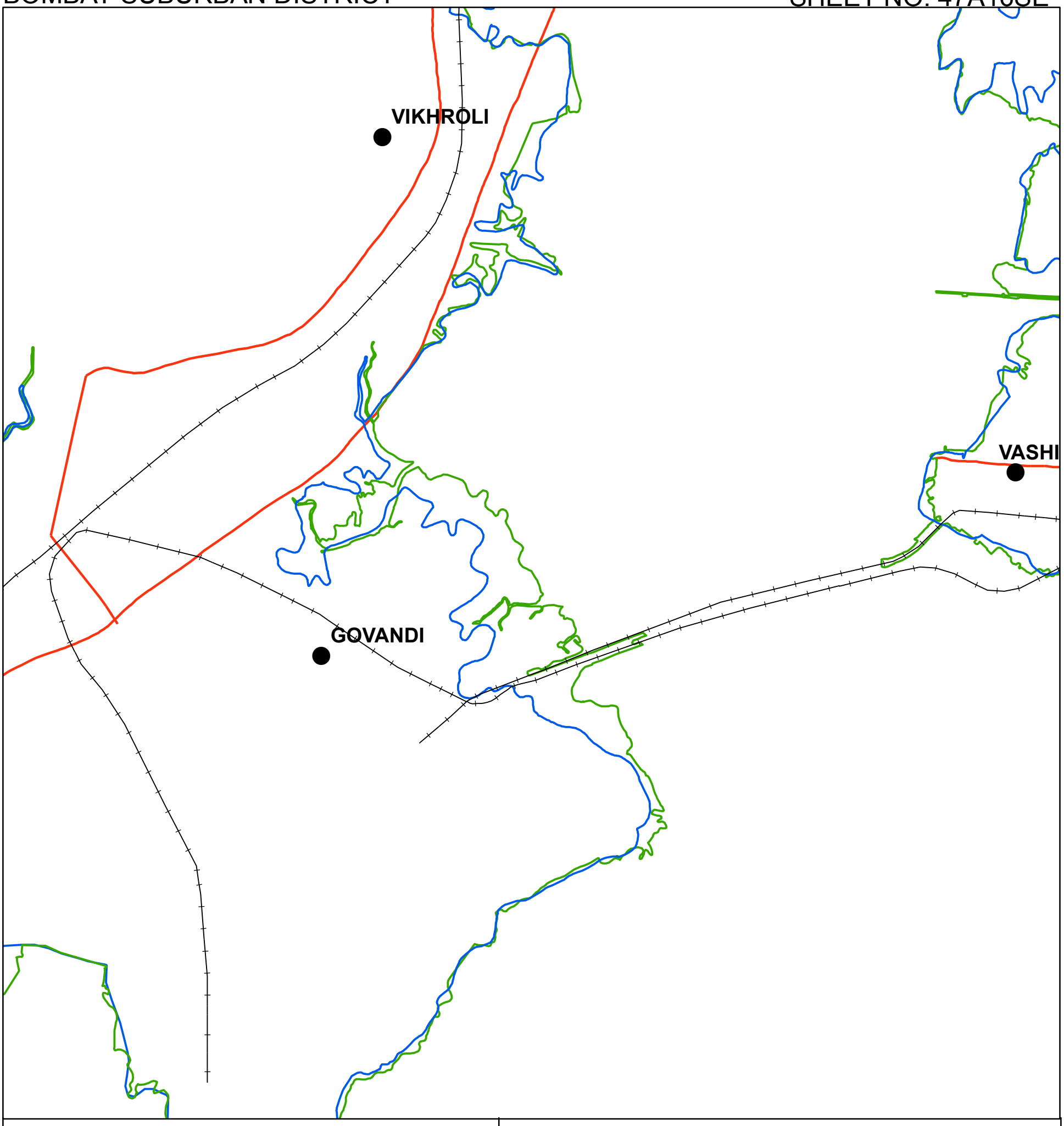
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

BOMBAY SUBURBAN DISTRICT

SHEET NO. 47A16SE




### Legend

- ROAD
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

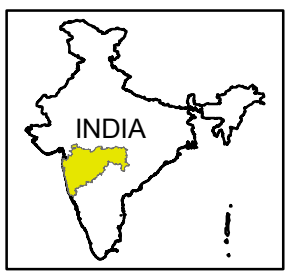
N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 47A16NW | 47A16NE | 47E04NW |
| 47A16SW | | 47E04SW |
| 47B13NW | 47B13NE | 47F01NW |




MAHARASTRA

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

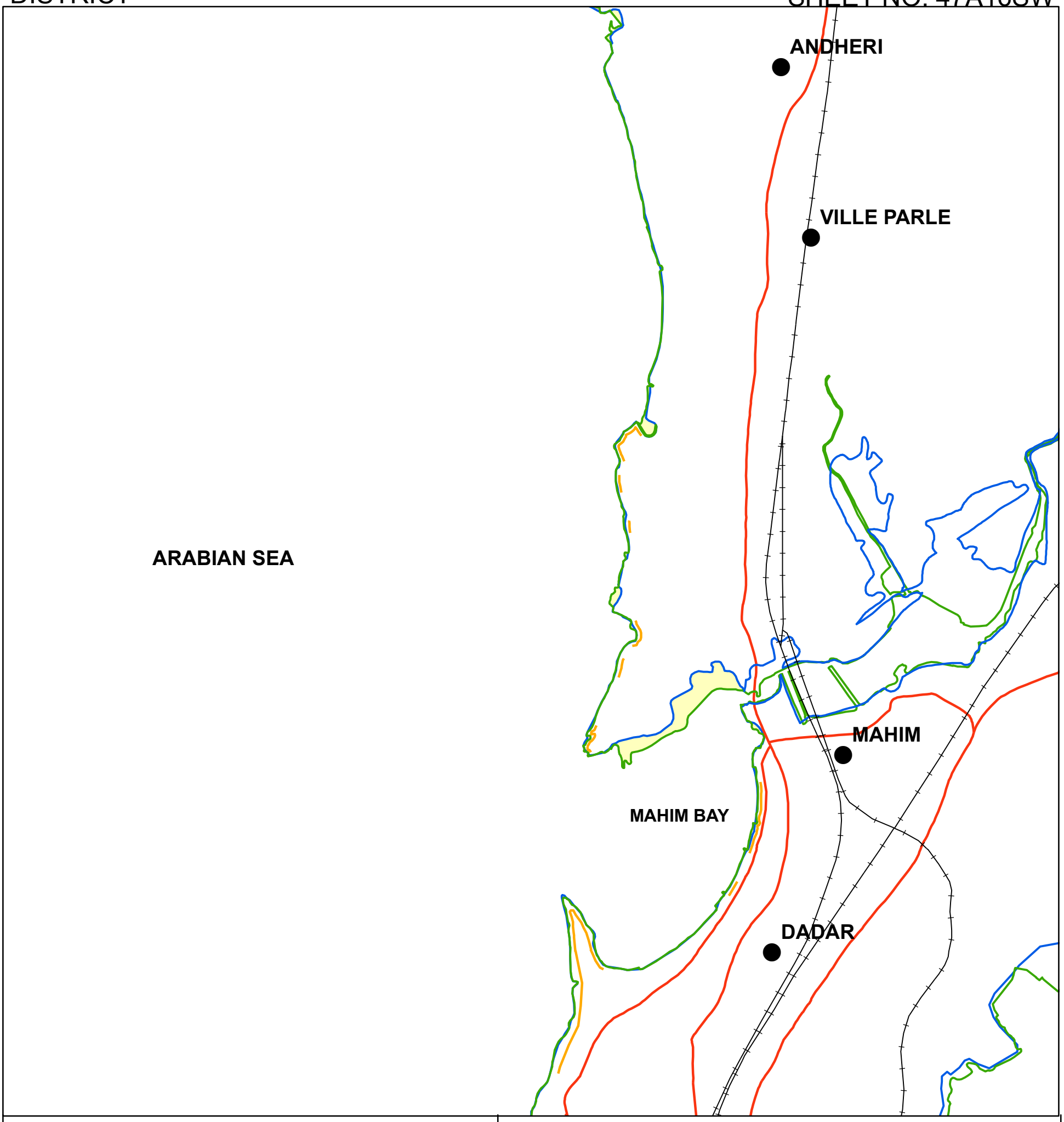
# SHORELINE CHANGE MAP

BOMBAY SUBURBAN/BOMBAY CITY DISTRICT

## MAHARASTRA

FOR OFFICIAL USE ONLY

SHEET NO. 47A16SW




### Legend

- EROSION
- ACCRETION
- ROAD
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION
- SEA WALL

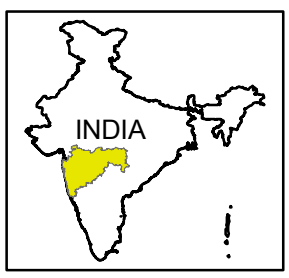
N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| SEA | 47A16NW | 47A16NE |
| SEA | | 47A16SE |
| SEA | 47B13NW | 47B13NE |




MAHARASTRA

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

RAYGAD DISTRICT

SHEET NO. 47B13NE

ARABIAN SEA

## Legend

- EROSION
- ACCRETION
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- SEA WALL
- ROAD

N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 47A16SW | 47A16SE | 47E04SW |
| 47B13NW | | 47F01NW |
| 47B13SW | 47B13SE | 47F01SW |



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

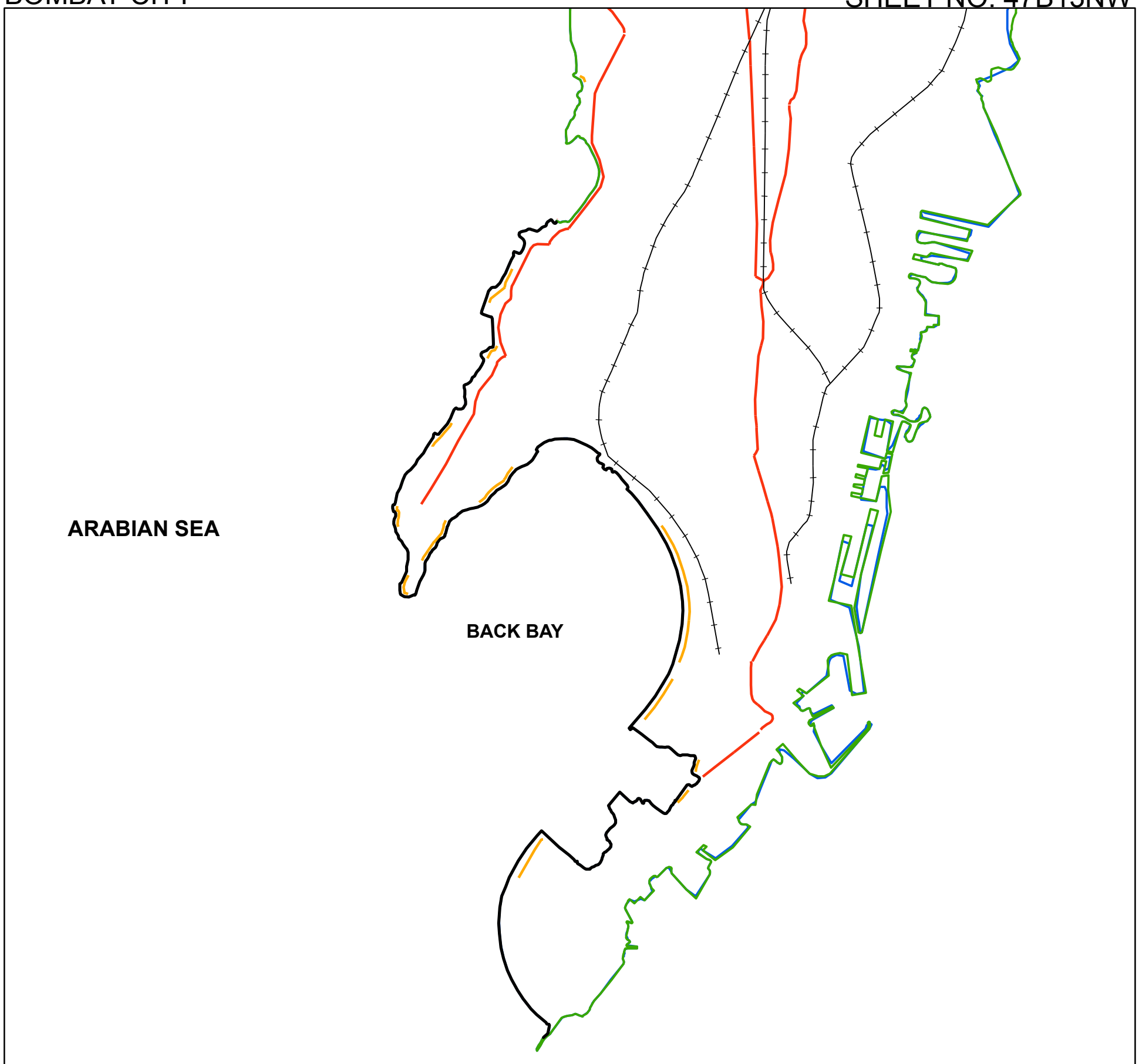
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

BOMBAY CITY

SHEET NO. 47B13NW



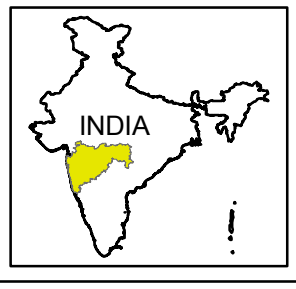

### Legend

- EROSION
- ACCRETION
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- STABLE LINE
- SEA WALL
- ROAD

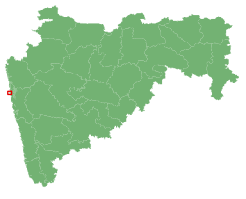
N
W E
S
0 2
Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| SEA | 47A16SW | 47A16SE |
| SEA | | 47B13NE |
| SEA | 47B13SW | 47B13SE |




MAHARASTRA



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

RAYGAD DISTRICT

SHEET NO. 47B13SE

KARANJA CREEK

DHARAMTAR CREEK

MANDVE

AMBA RIVER

### Legend

- EROSION
- ACCRETION
- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION
- SEA WALL

N

W E

S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 47B13NW | 47B13NE | 47F01NW |
| 47B13SW | | 47F01SW |
| 47B14NW | 47B14NE | 47F02NW |



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

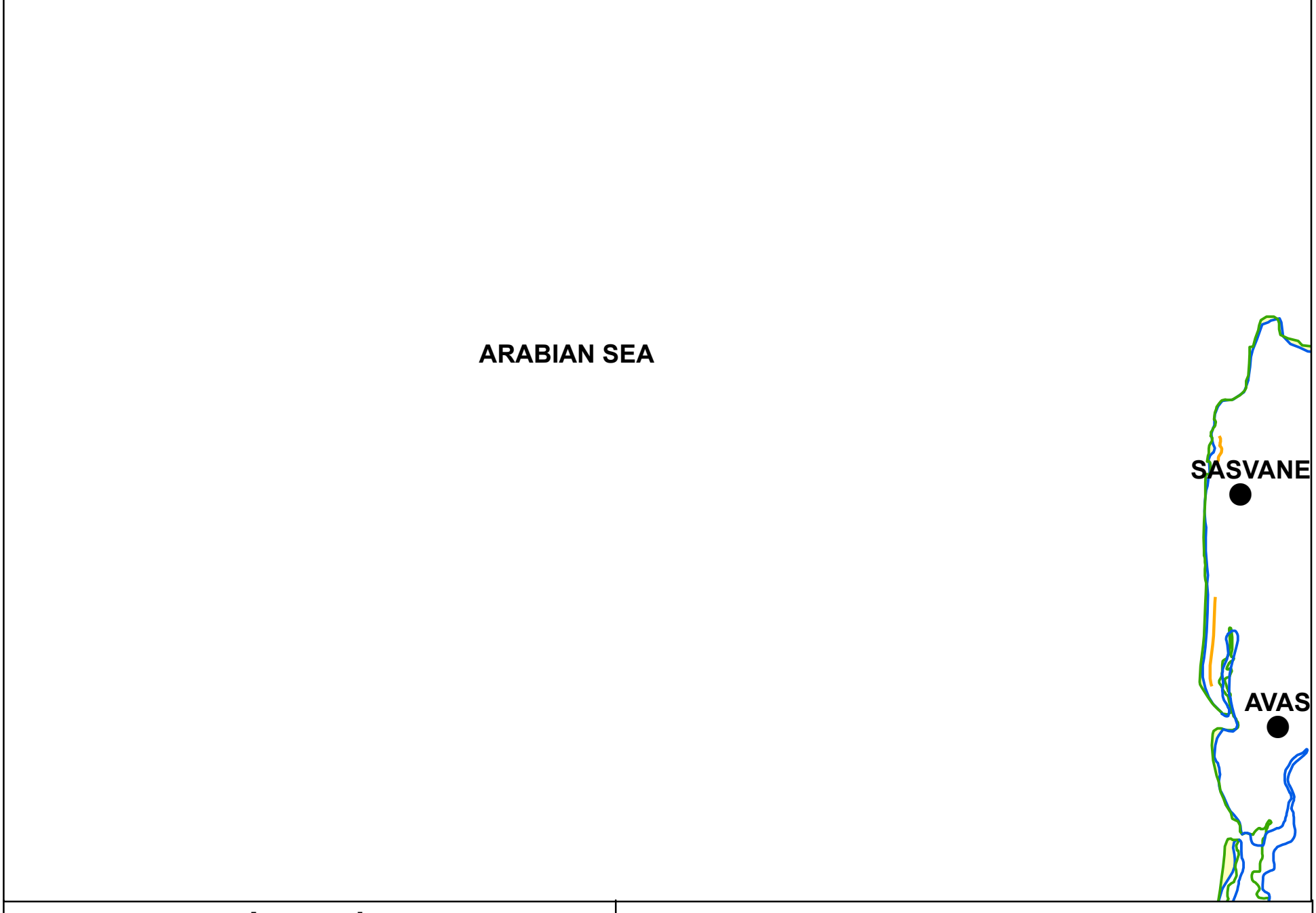
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

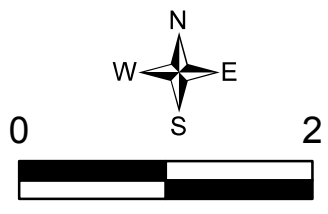
RAYGAD DISTRICT

SHEET NO. 47B13SW




## Legend

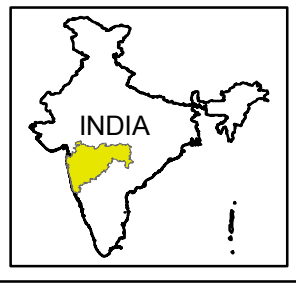
- EROSION
- ACCRETION
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION
- SEA WALL




Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| SEA | 47B13NW | 47B13NE |
| SEA | | 47B13SE |
| SEA | 47B14NW | 47B14NE |





DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

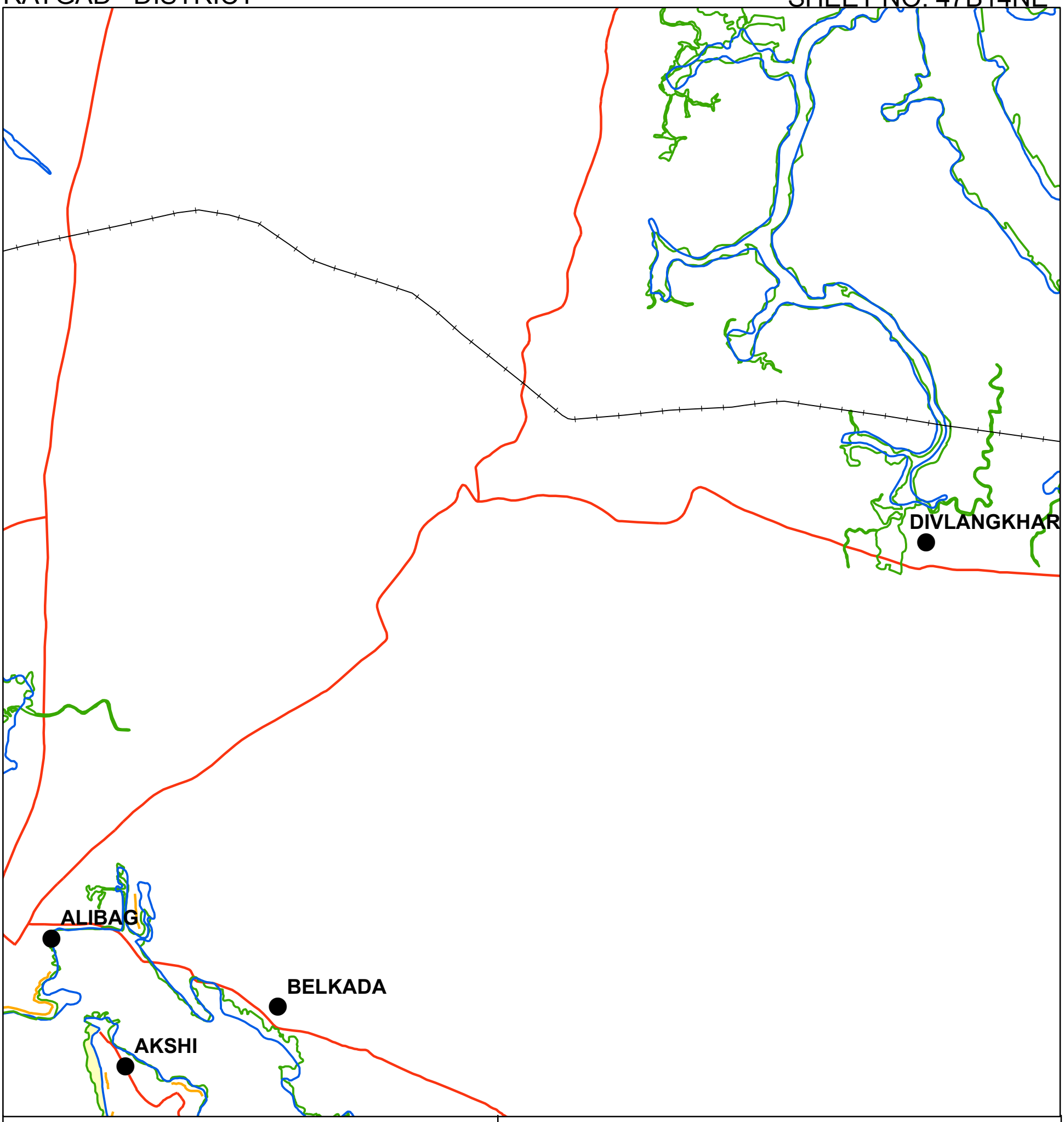
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

RAYGAD DISTRICT

SHEET NO. 47B14NE




### Legend

- EROSION
- ACCRETION
- ROAD
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION
- SEA WALL

N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 47B13SW | 47B13SE | 47F01SW |
| 47B14NW | | 47F02NW |
| SEA | 47B14SE | 47F02SW |


MAHARASTRA

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

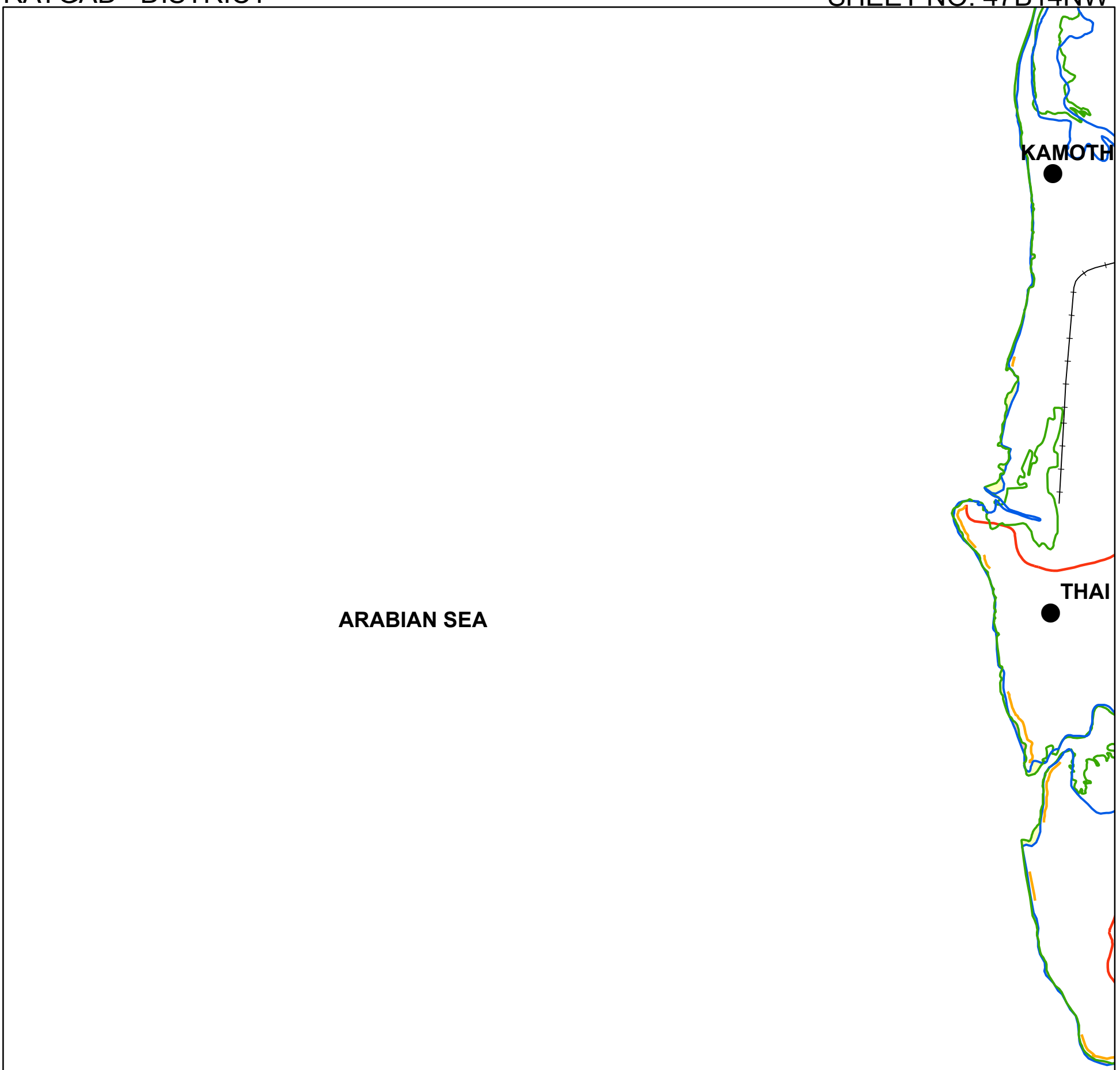
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

RAYGAD DISTRICT

SHEET NO. 47B14NW




### Legend

- EROSION
- ACCRETION
- ROAD
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION
- SEA WALL

N
W E
S
0 2
Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| SEA | 47B13SW | 47B13SE |
| SEA | | 47B14NE |
| SEA | SEA | 47B14SE |



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

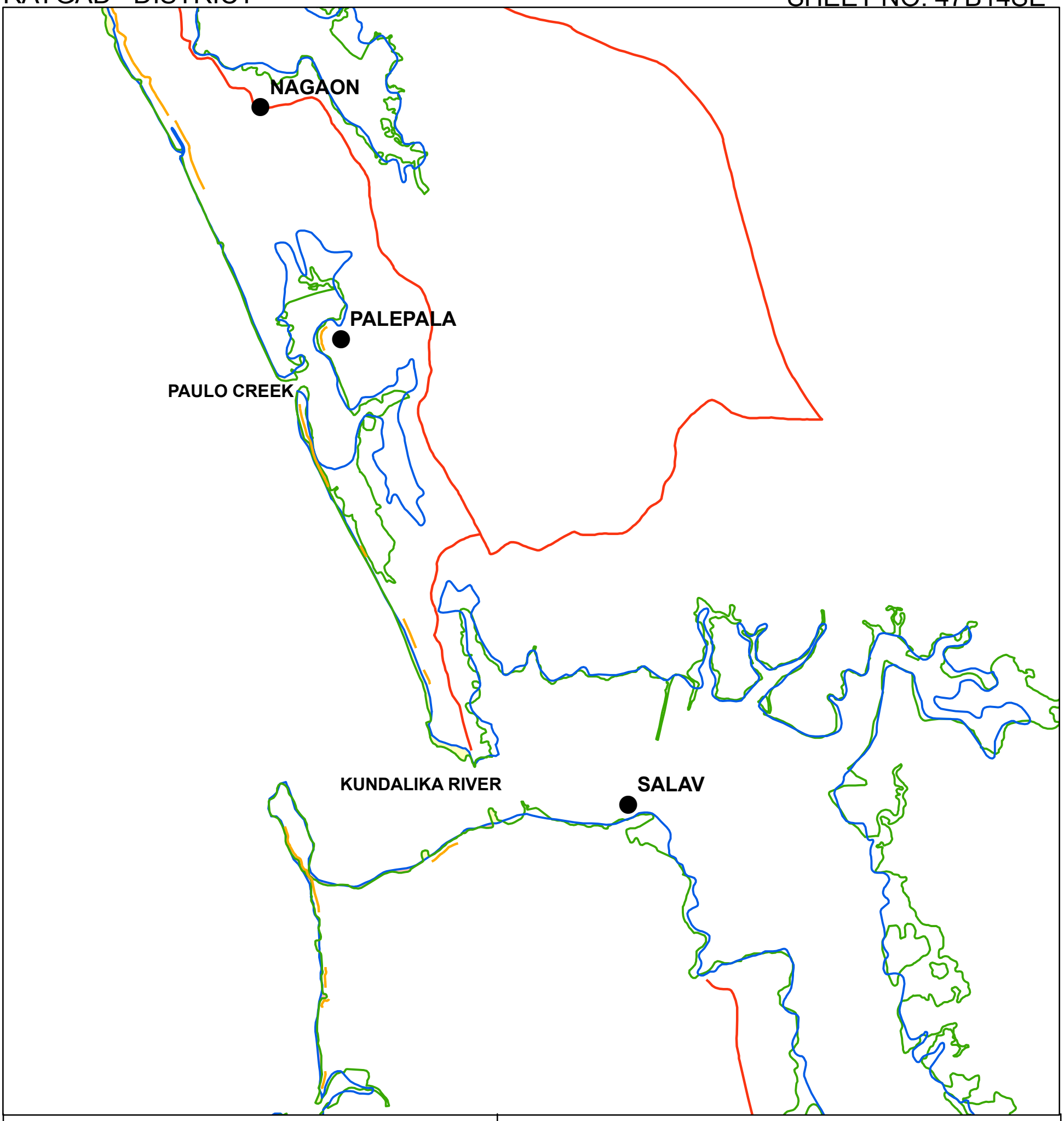
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

RAYGAD DISTRICT

SHEET NO. 47B14SE




### Legend

- EROSION
- ACCRETION
- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION
- SEA WALL

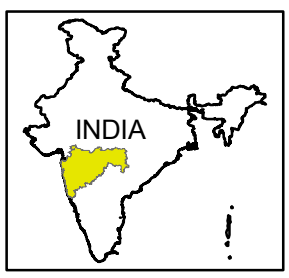
N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 47B14NW | 47B14NE | 47F02NW |
| SEA | | 47F02SW |
| SEA | 47B15NE | 47F03NW |





DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

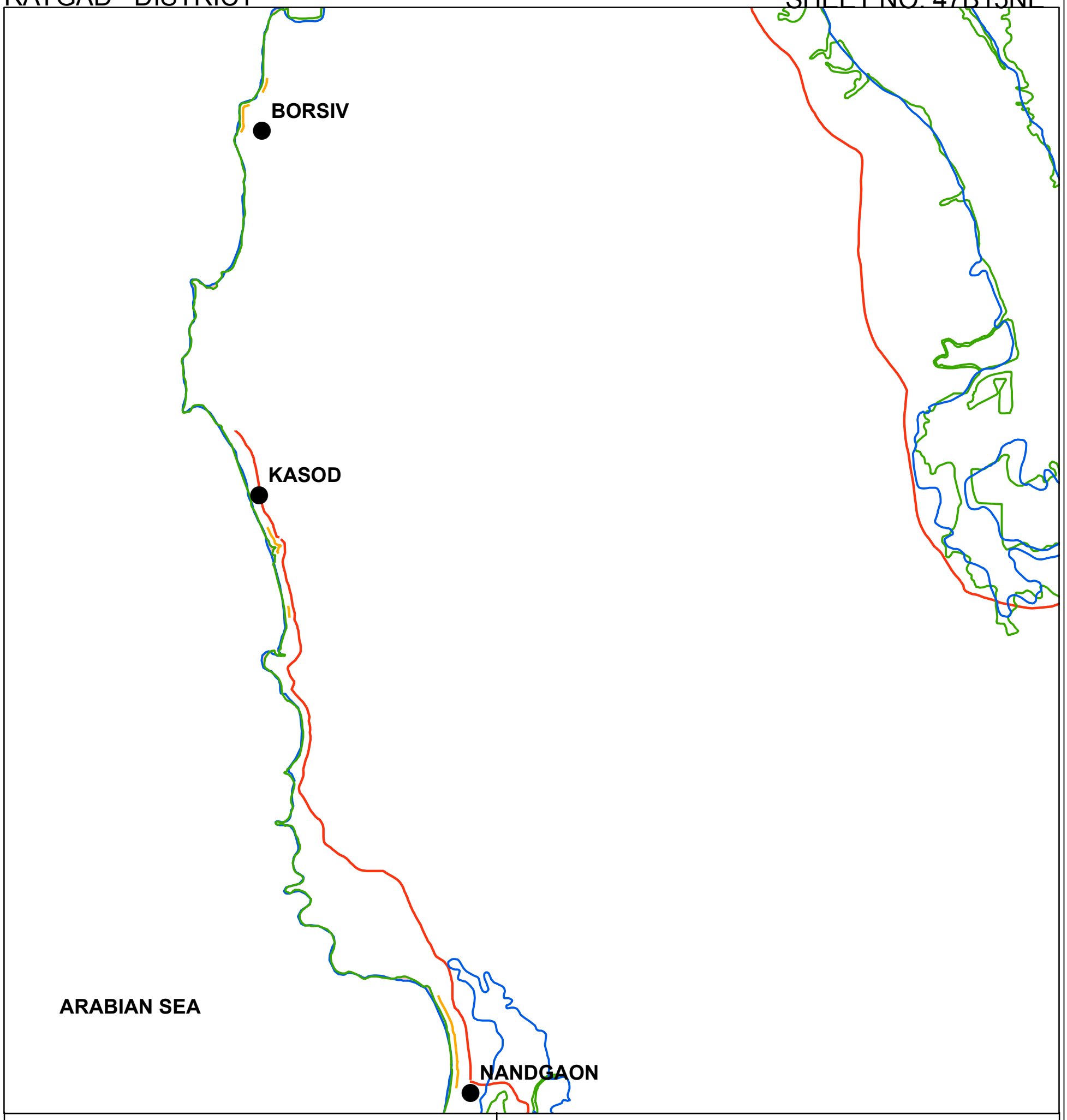
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

RAYGAD DISTRICT

SHEET NO. 47B15NE




### Legend

- EROSION
- ACCRETION
- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION
- SEA WALL

N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| SEA | 47B14SE | 47F02SW |
| SEA | | 47F03NW |
| SEA | 47B15SE | 47F03SW |



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

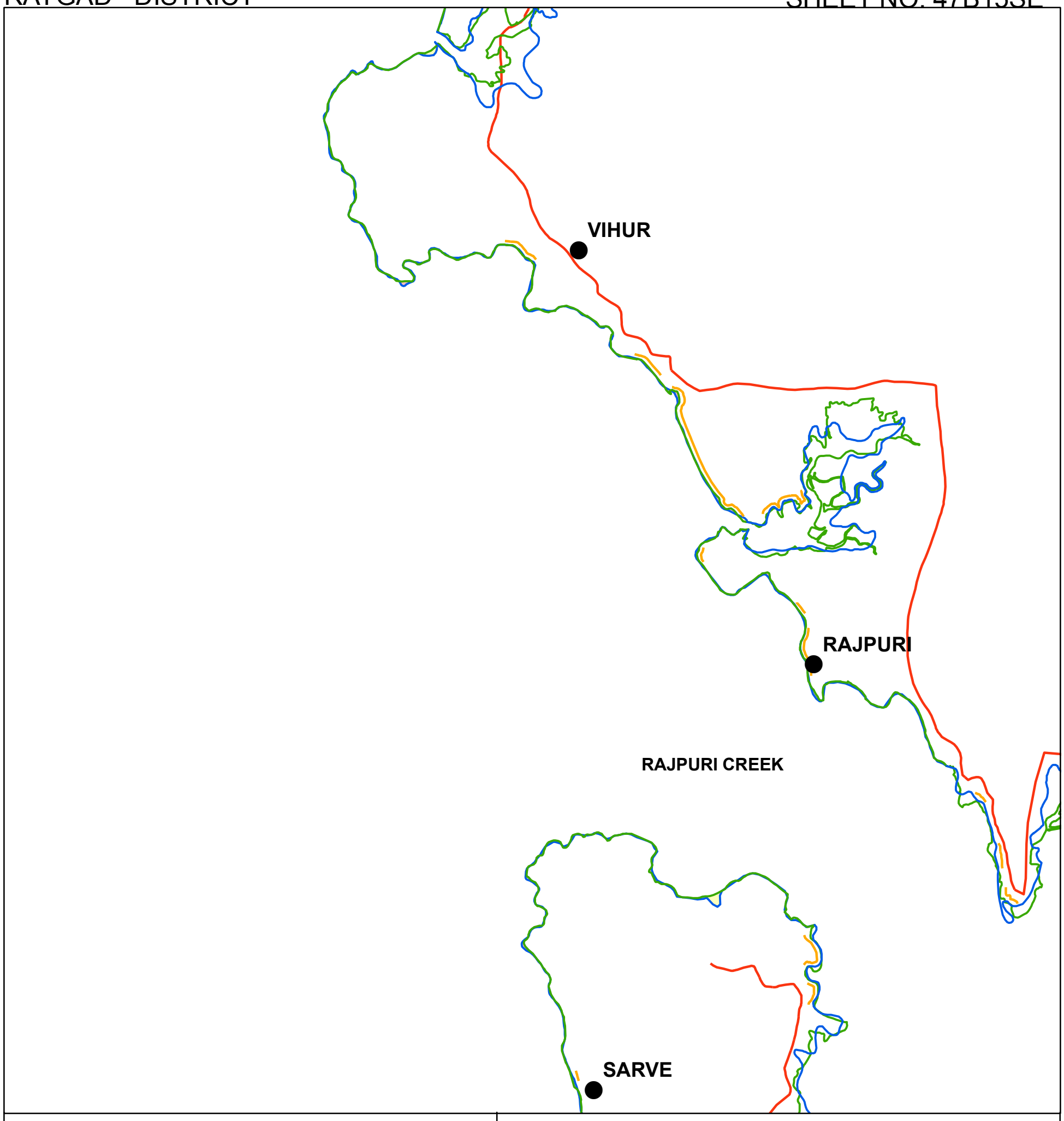
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

RAYGAD DISTRICT

SHEET NO. 47B15SE



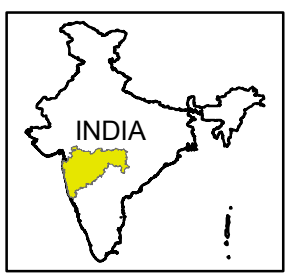

### Legend

- EROSION
- ACCRETION
- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION
- sea wall

N
W E
S
0 2
Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| SEA | 47B15NE | 47F03NW |
| SEA | | 47F03SW |
| SEA | 47B16NE | 47F04NW |





DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

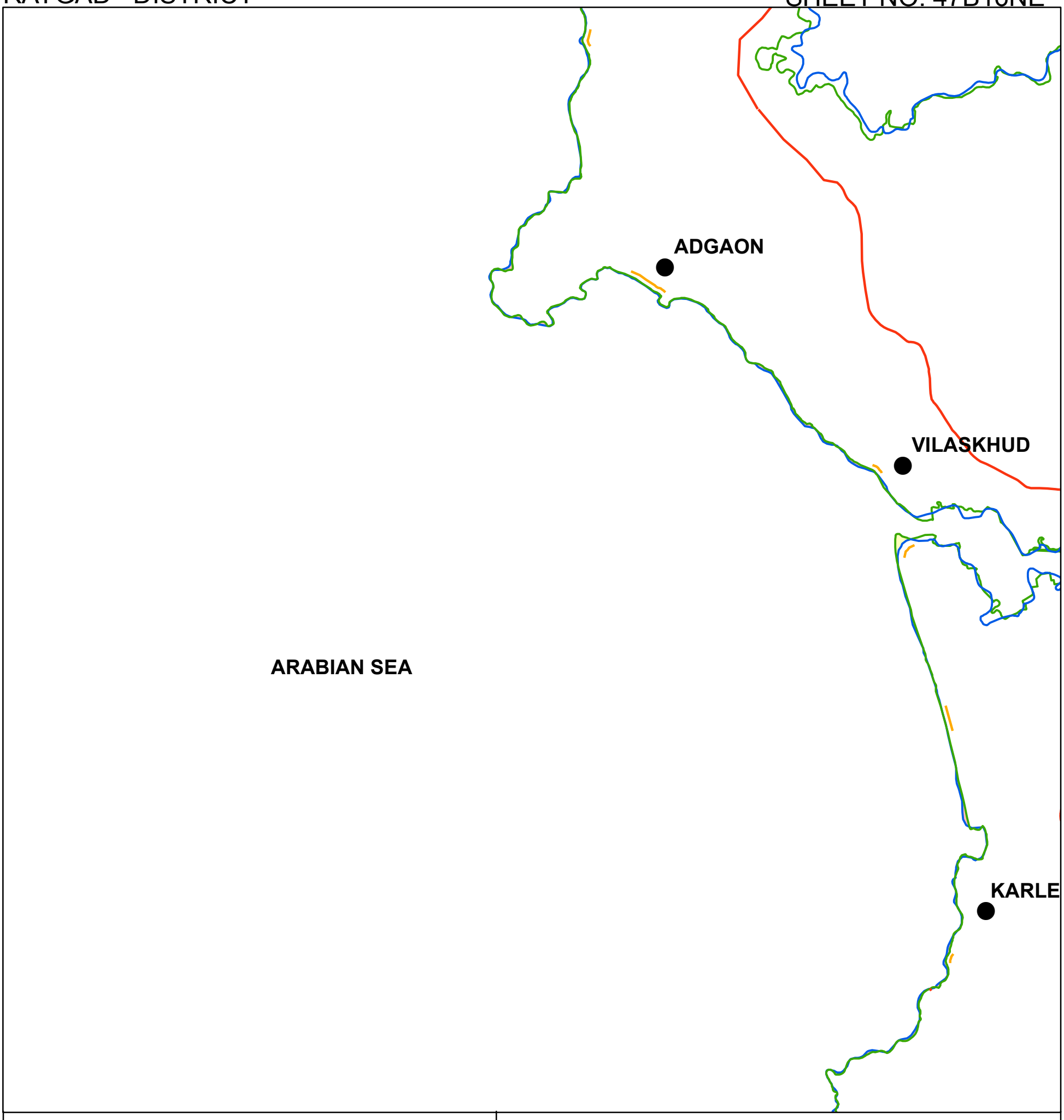
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

RAYGAD DISTRICT

SHEET NO. 47B16NE




### Legend

- EROSION
- ACCRETION
- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION
- SEA WALL

N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| SEA | 47B15SE | 47F03SW |
| SEA | | 47F04NW |
| SEA | 47B16SE | 47F04SW |



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

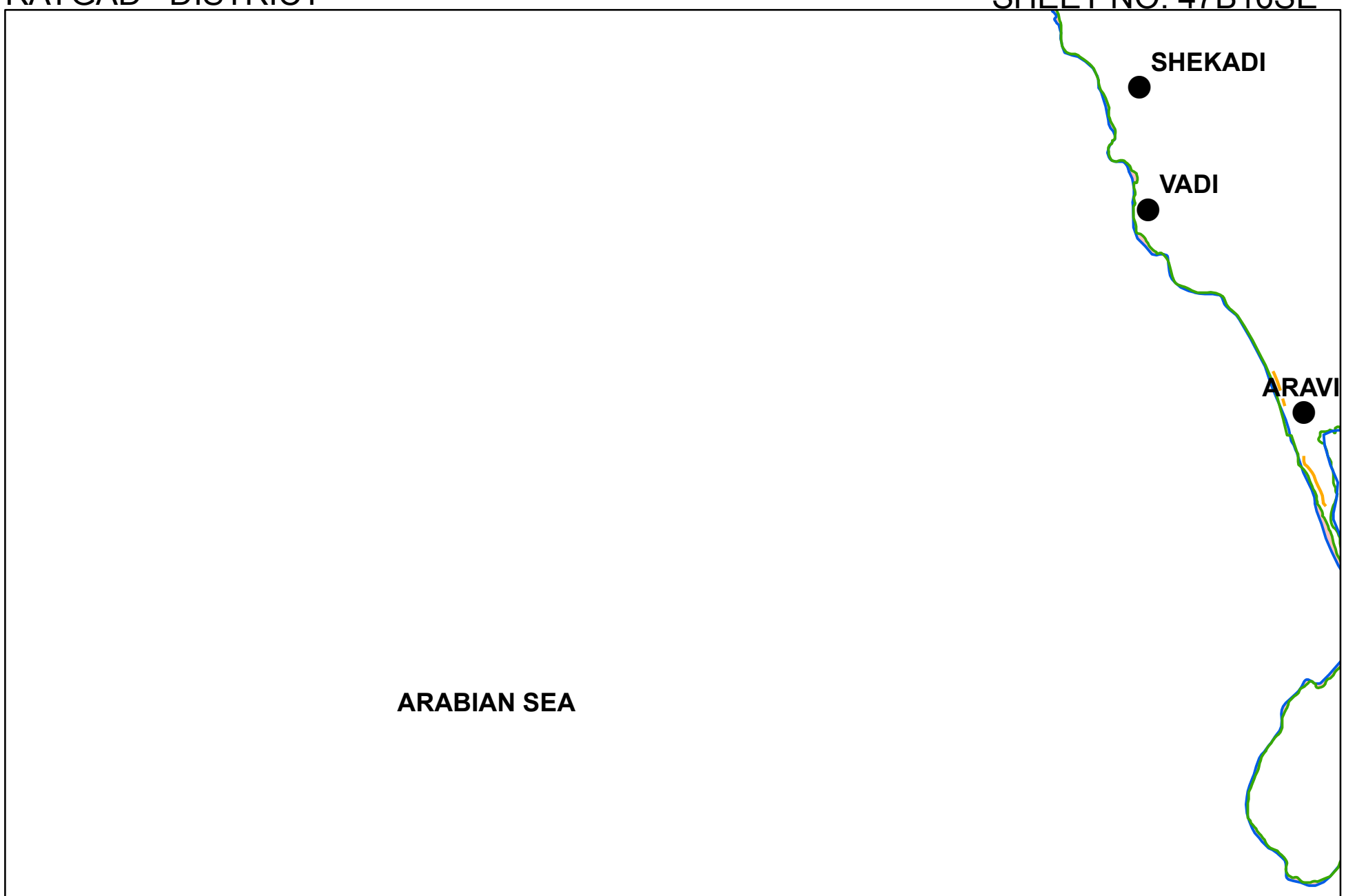
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

RAYGAD DISTRICT

SHEET NO. 47B16SE




## Legend

- EROSION
- ACCRETION
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION
- SEA WALL

N
W E
S
0 2
Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| SEA | 47B16NE | 47F04NW |
| SEA | | 47F04SW |
| SEA | SEA | 47G01NW |



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

THANE DISTRICT

SHEET NO. 47E03SW

BHIWANDI

### Legend

- ROAD
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

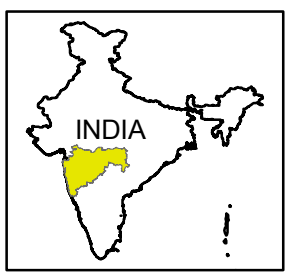
N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 47A15NE | 47E03NW | 47E03NE |
| 47A15SE | | 47E03SE |
| 47A16NE | 47E04NW | 47E04NE |





DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

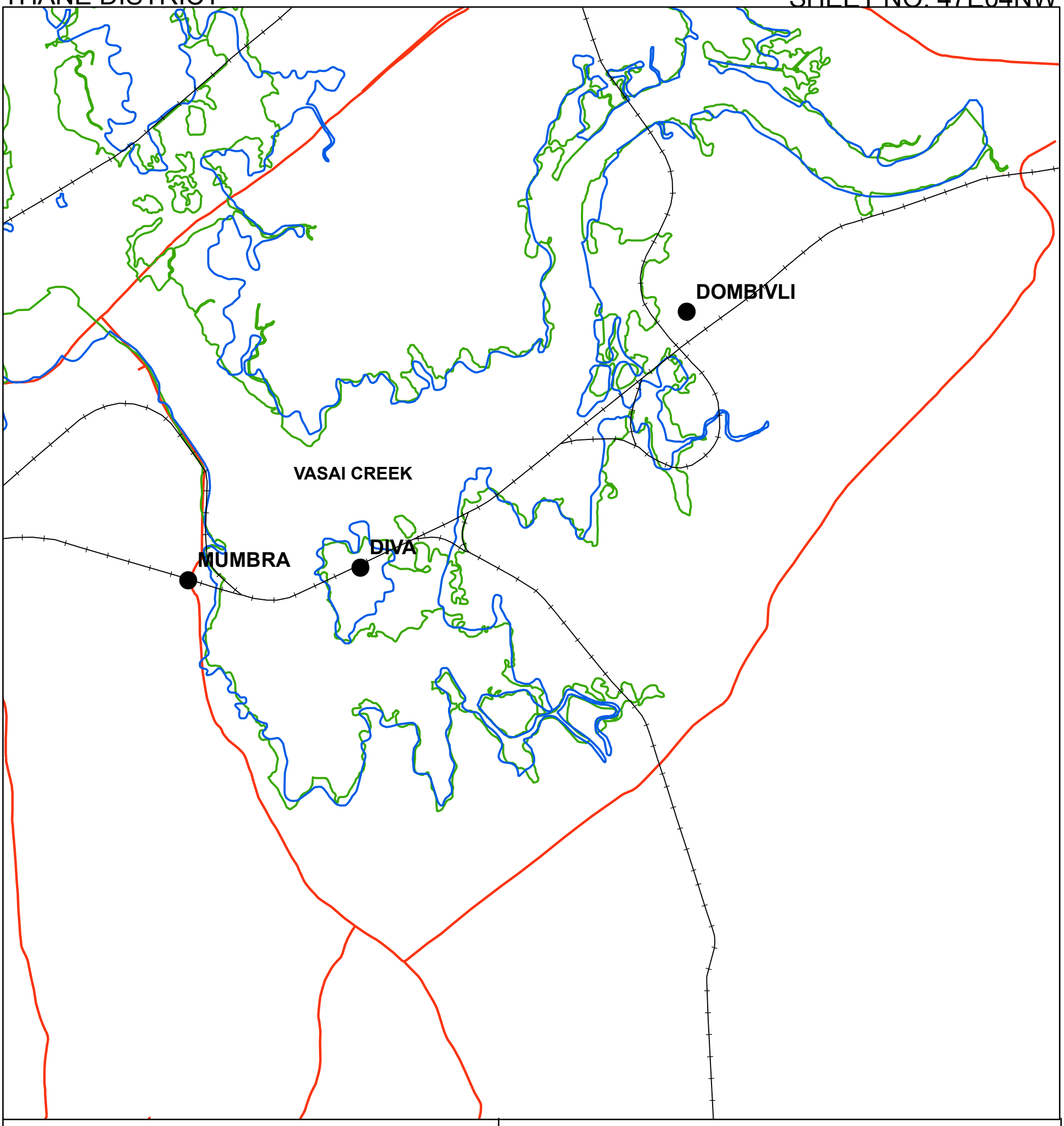
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

THANE DISTRICT

SHEET NO. 47E04NW




### Legend

- ROAD
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 47A15SE | 47E03SW | 47E03SE |
| 47A16NE | | 47E04NE |
| 47A16SE | 47E04SW | 47E04SE |


MAHARASTRA

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

THANE/RAYGAD DISTRICTS

SHEET NO. 47E04SW

DARAVE

BELAPUR

### Legend

- ROAD
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 47A16NE | 47E04NW | 47E04NE |
| 47A16SE | | 47E04SE |
| 47B13NE | 47F01NW | 47F01NE |

INDIA

MAHARASTRA

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

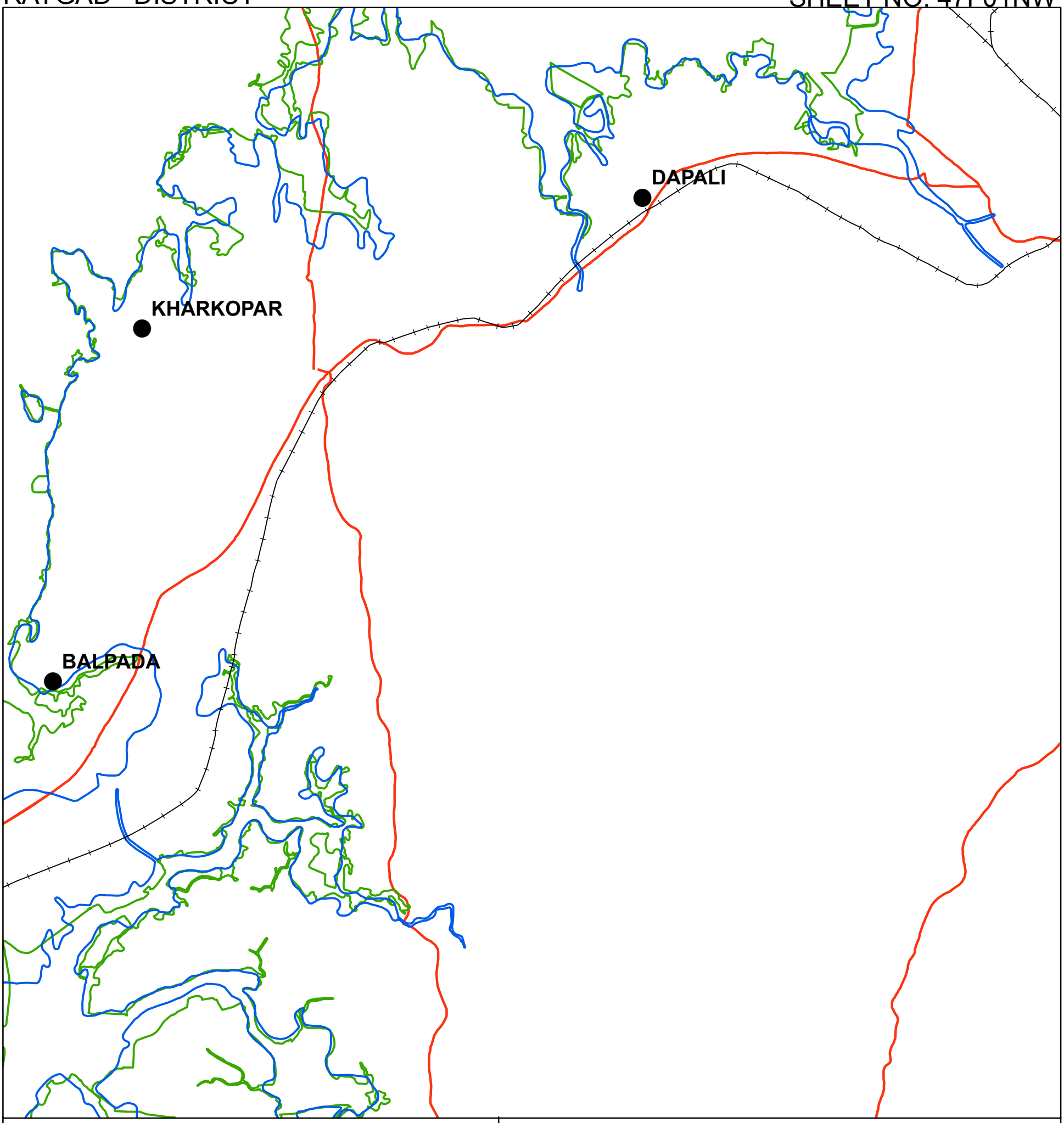
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

RAYGAD DISTRICT

SHEET NO. 47F01NW




### Legend

- ROAD
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N
W E
S
0 2
Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 47A16SE | 47E04SW | 47E04SE |
| 47B13NE | | 47F01NE |
| 47B13SE | 47F01SW | 47F01SE |



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

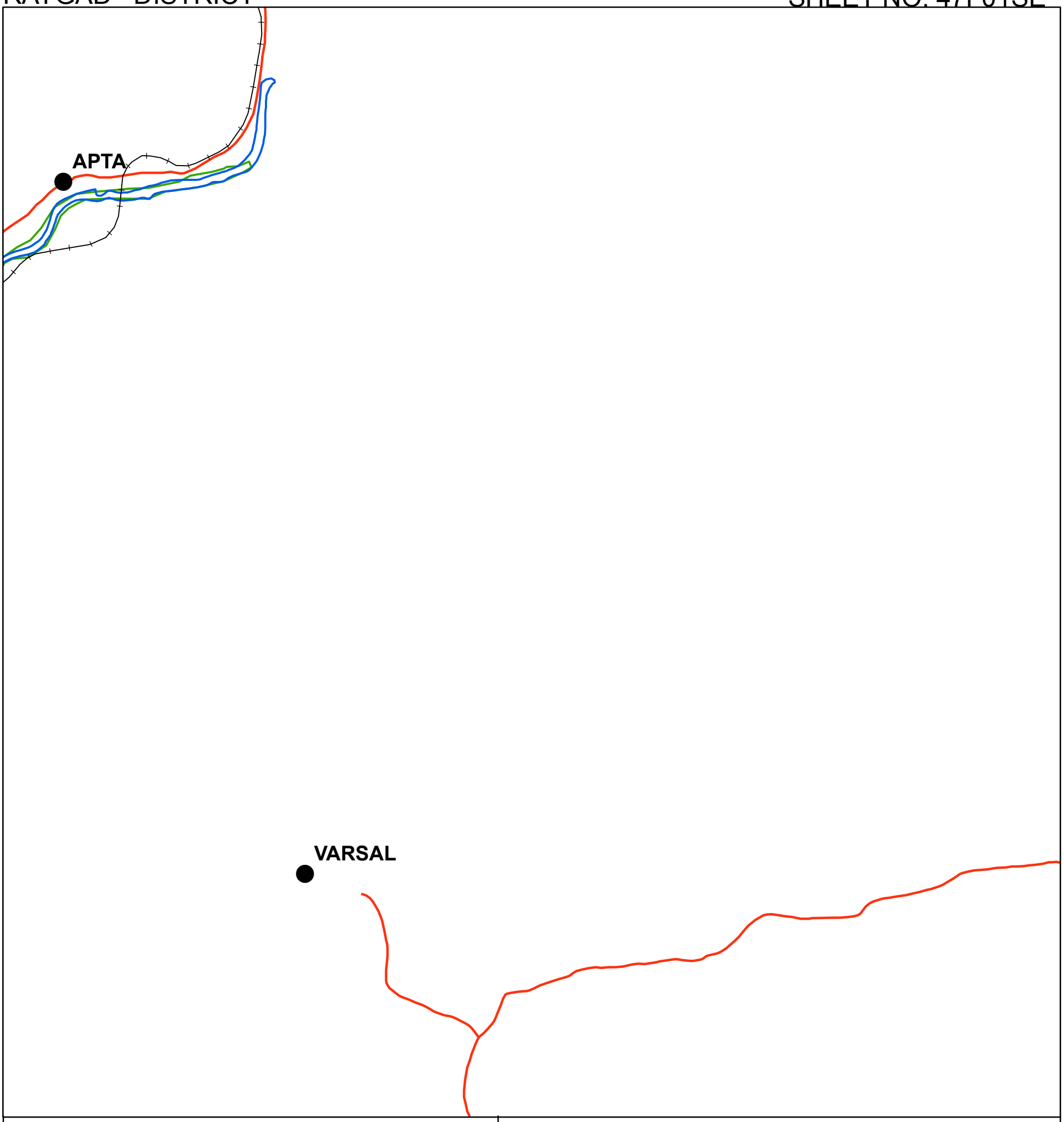
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

RAYGAD DISTRICT

SHEET NO. 47F01SE




### Legend

- ROAD
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N
W E
S
0 2
Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 47F01NW | 47F01NE | 47F05NW |
| 47F01SW | | 47F05SW |
| 47F02NW | 47F02NE | 47F06NW |



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

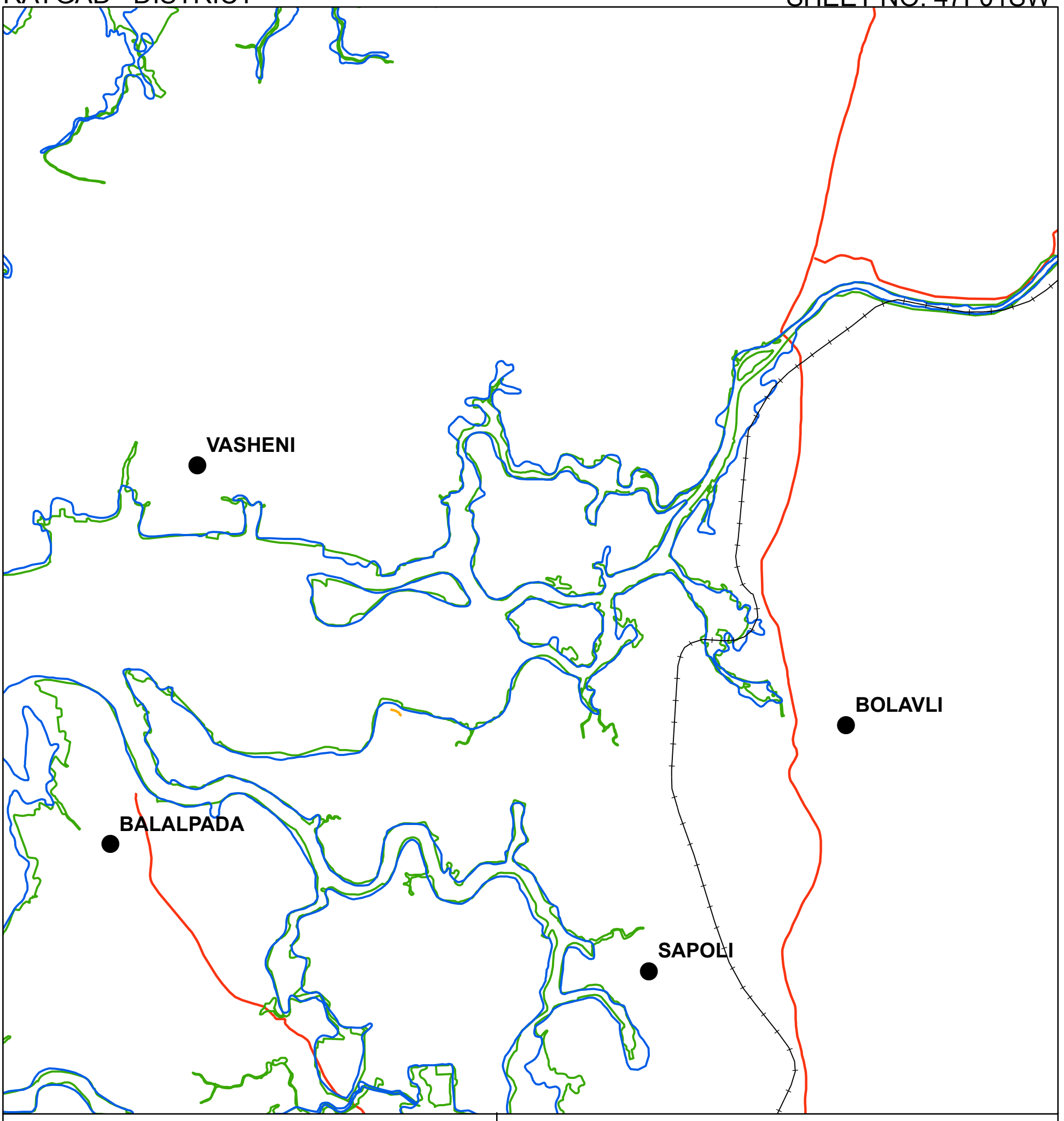
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

RAYGAD DISTRICT

SHEET NO. 47F01SW




### Legend

- ROAD
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION
- SEA WALL

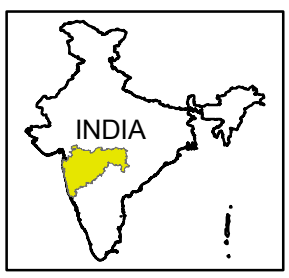
N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 47B13NE | 47F01NW | 47F01NE |
| 47B13SE | | 47F01SE |
| 47B14NE | 47F02NW | 47F02NE |





DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

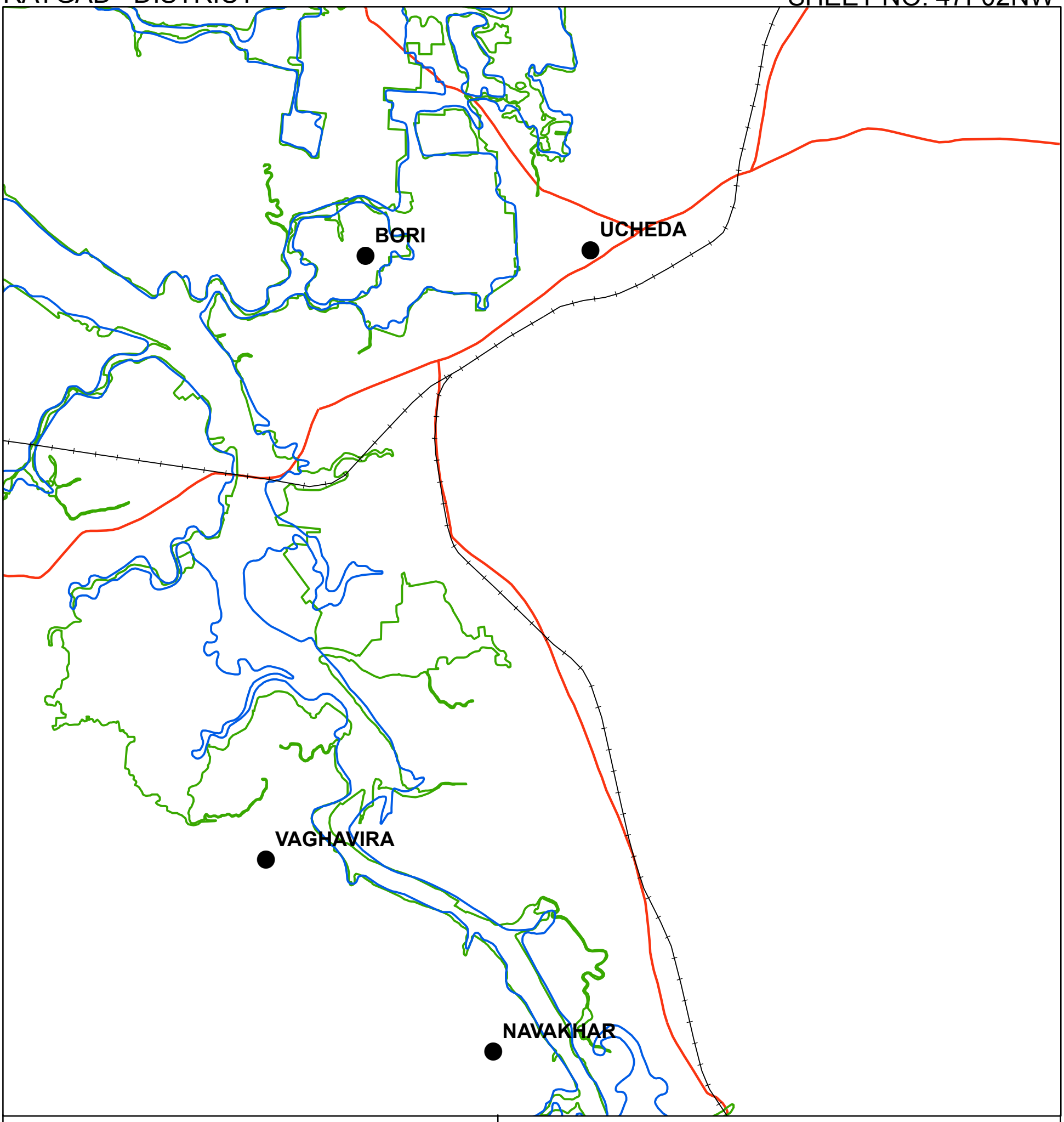
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

RAYGAD DISTRICT

SHEET NO. 47F02NW




### Legend

- ROAD
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 47B13SE | 47F01SW | 47F01SE |
| 47B14NE | | 47F02NE |
| 47B14SE | 47F02SW | 47F02SE |



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

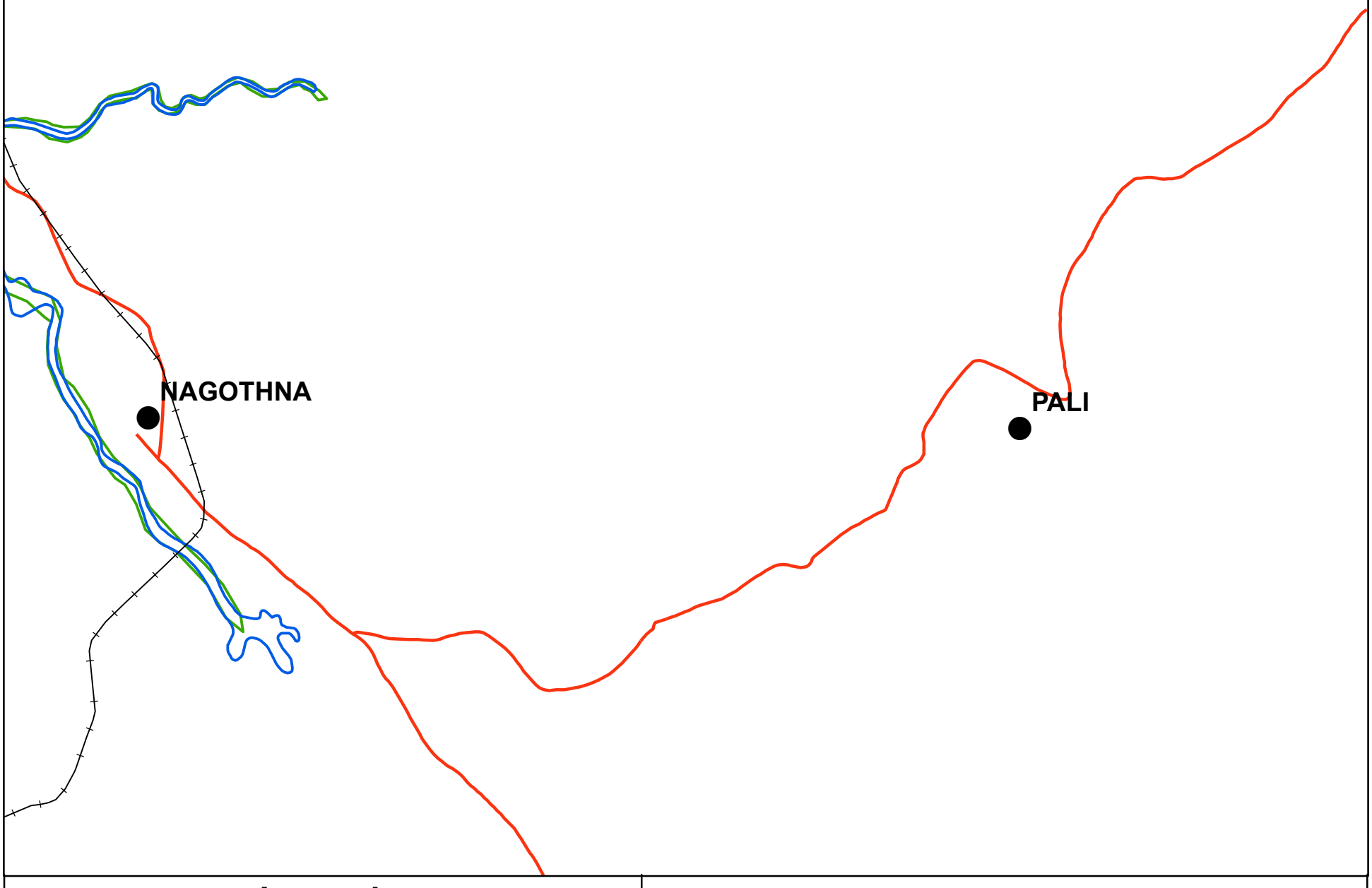
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

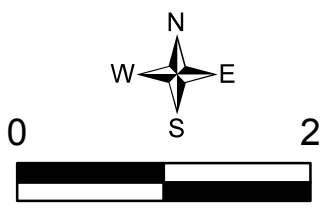
RAYGAD DISTRICT

SHEET NO. 47F02SE



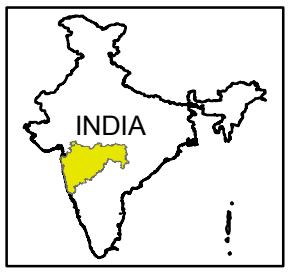

### Legend

- ROAD
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION




INDEX TO SHEETS

| | | |
|---|---|---|
| 47F02NW | 47F02NE | 47F06NW |
| 47F02SW | | 47F06SW |
| 47F03NW | 47F03NE | 47F07NW |





DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

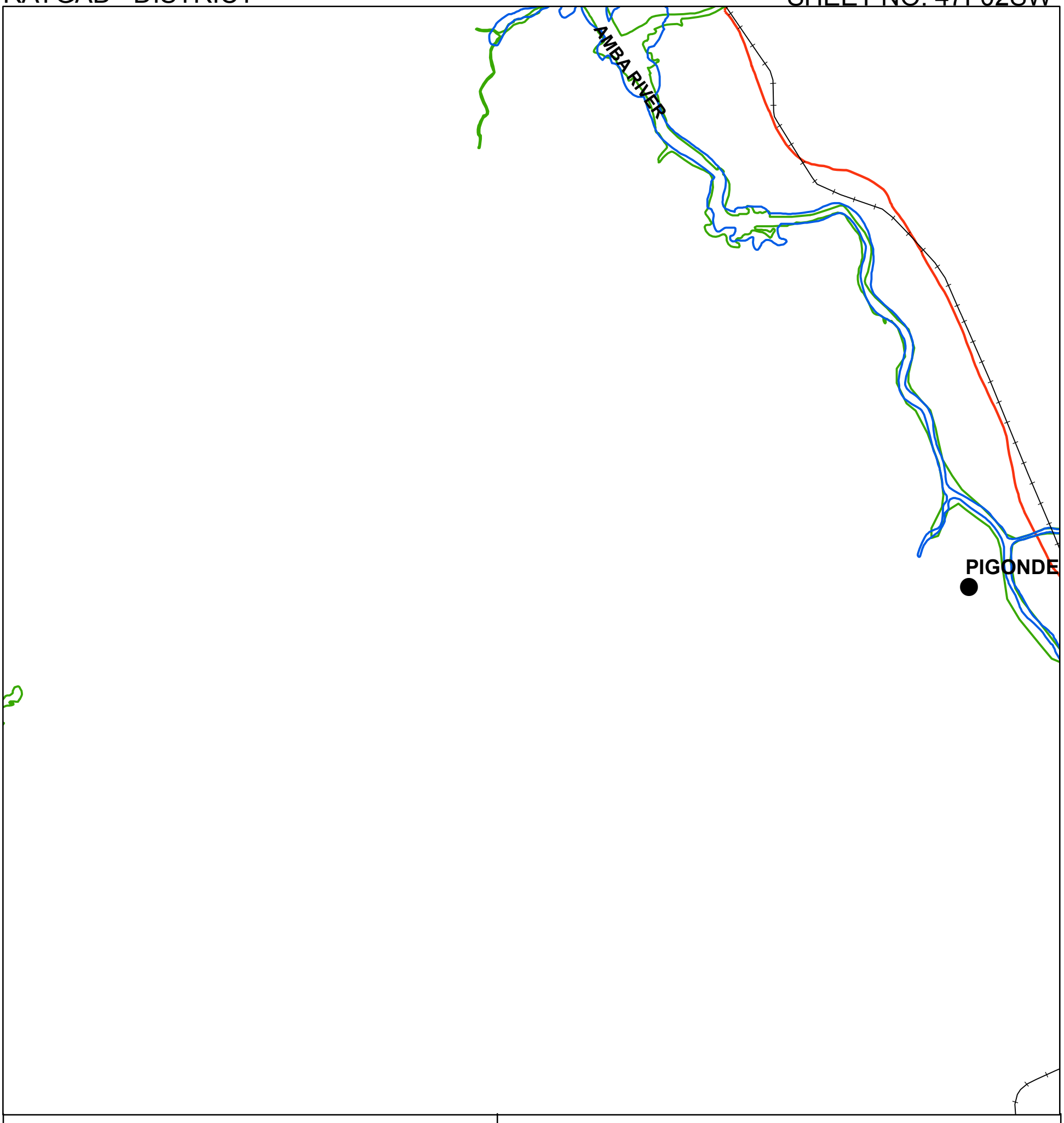
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

RAYGAD DISTRICT

SHEET NO. 47F02SW




### Legend

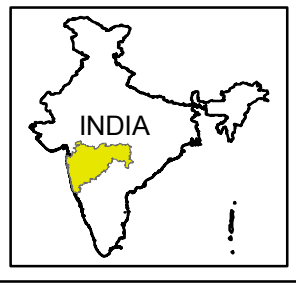
- ROAD
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N
W E
S
0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 47B14NE | 47F02NW | 47F02NE |
| 47B14SE | | 47F02SE |
| 47B15NE | 47F03NW | 47F03NE |





DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

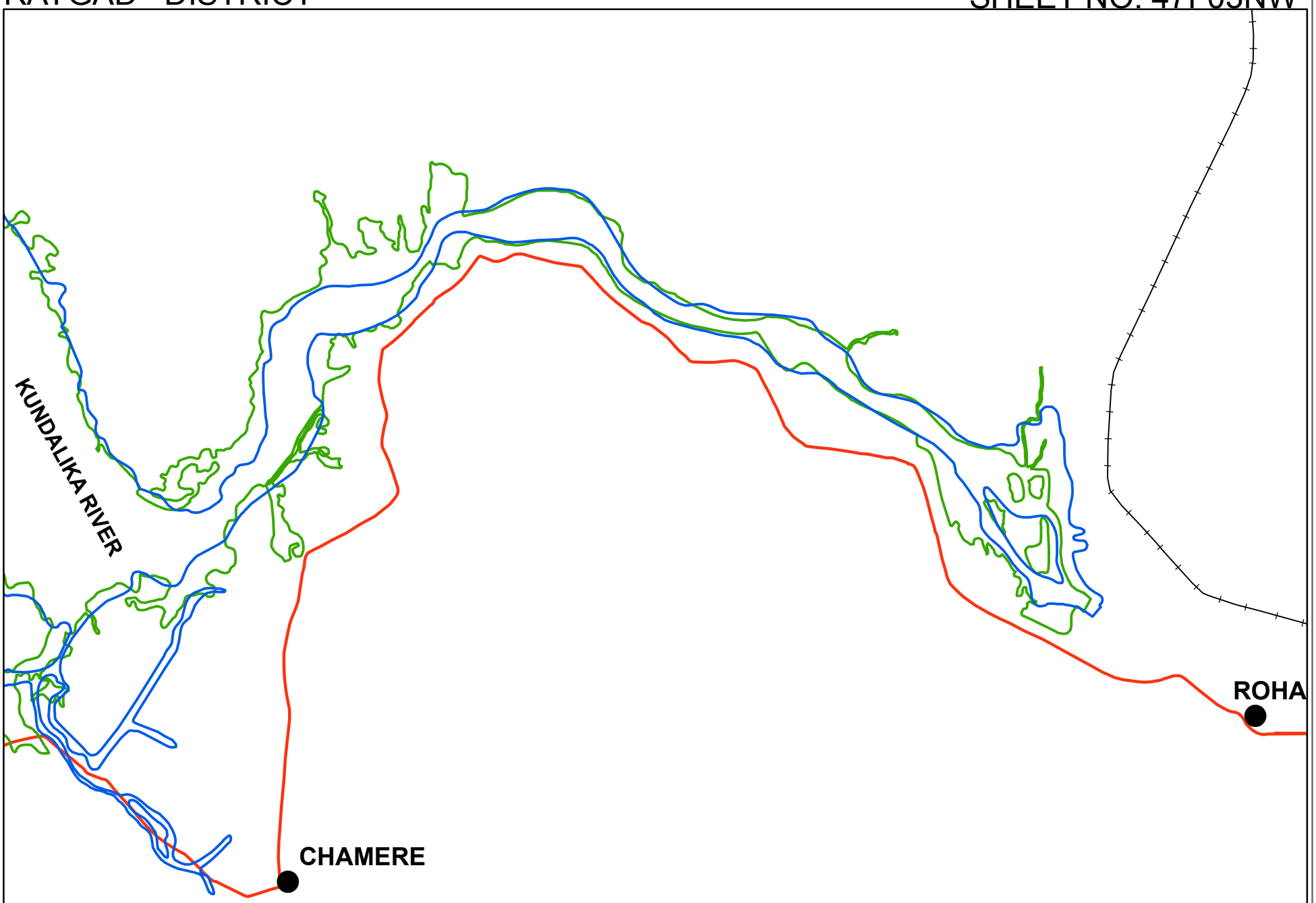
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

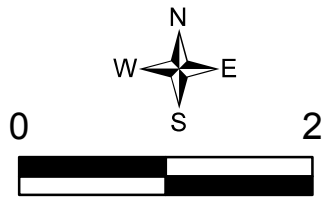
RAYGAD DISTRICT

SHEET NO. 47F03NW




### Legend

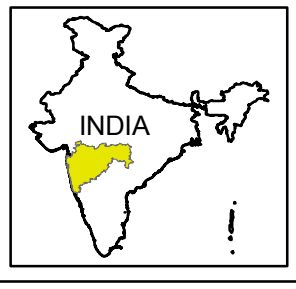
- ROAD
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION




Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 47B14SE | 47F02SW | 47F02SE |
| 47B15NE | | 47F03NE |
| 47B15SE | 47F03SW | 47F03SE |





DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

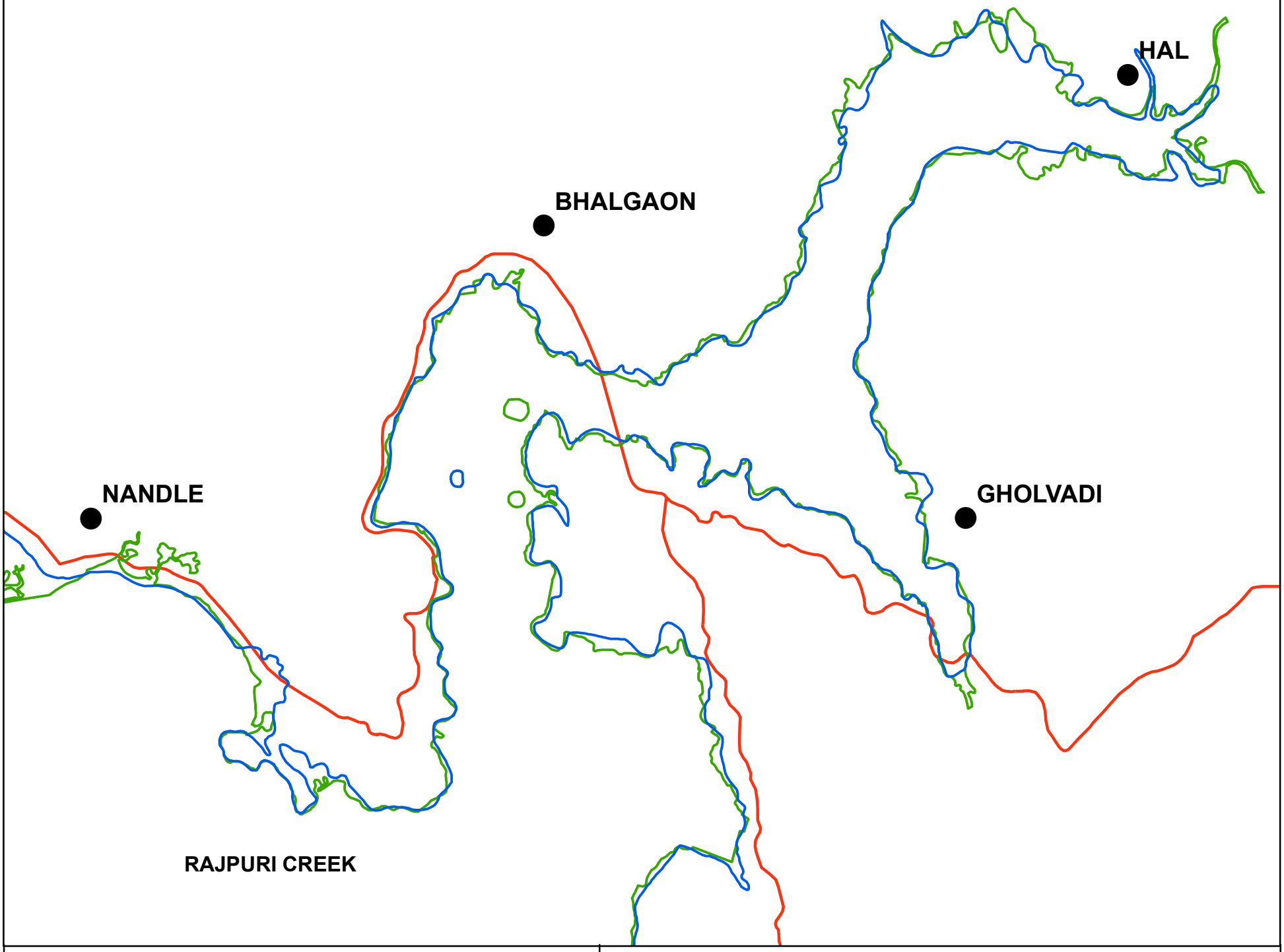
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

RAYGAD DISTRICT

SHEET NO. 47F03SW




## Legend

- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

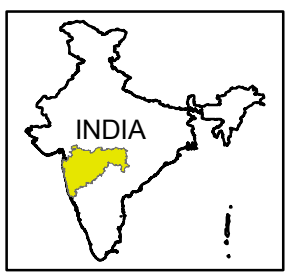
N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 47B15NE | 47F03NW | 47F03NE |
| 47B15SE | | 47F03SE |
| 47B16NE | 47F04NW | 47F04NE |





DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

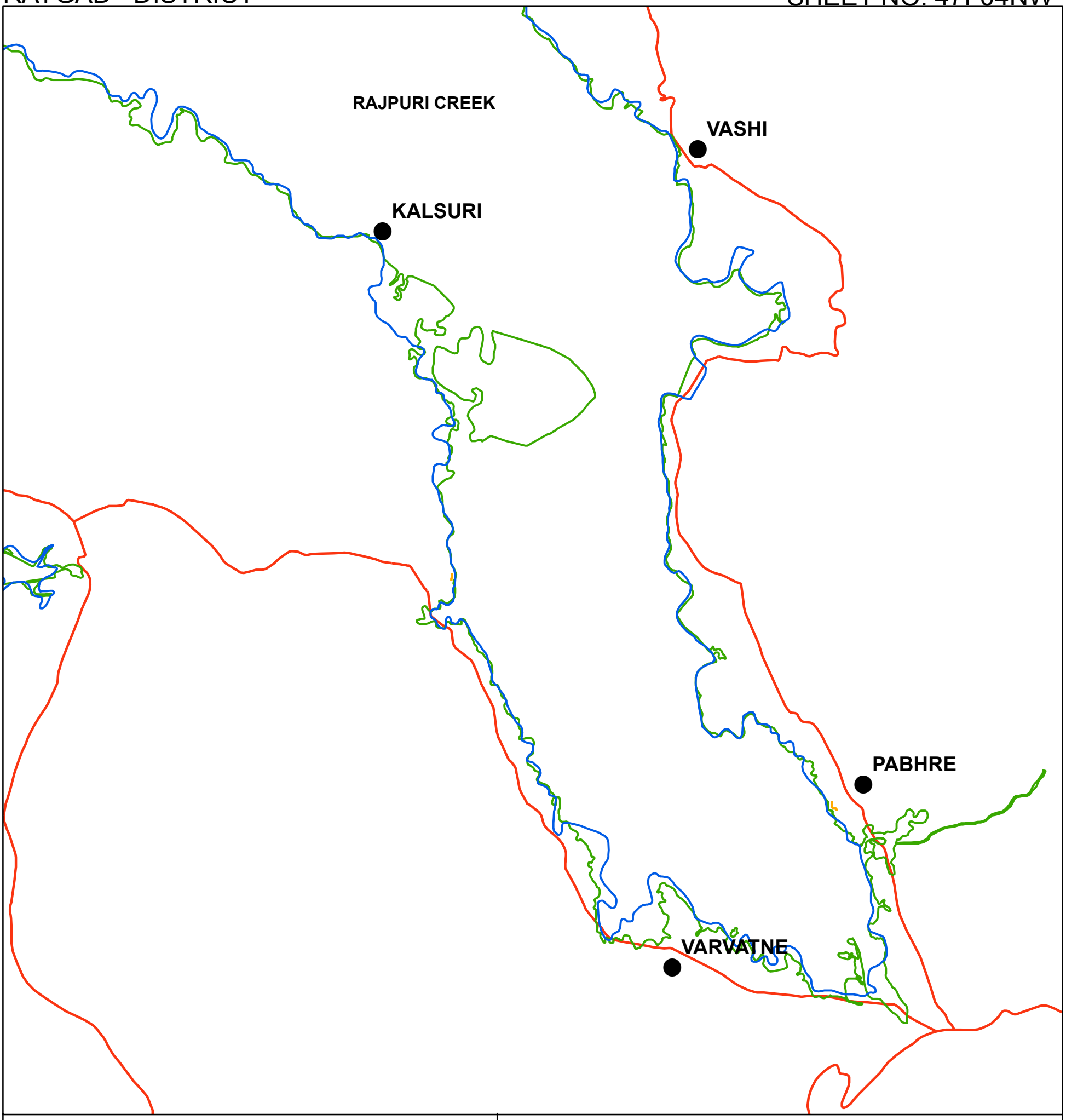
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

RAYGAD DISTRICT

SHEET NO. 47F04NW




### Legend

- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION
- SEA WALL

N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 47B15SE | 47F03SW | 47F03SE |
| 47B16NE | | 47F04NE |
| 47B16SE | 47F04SW | 47F04SE |



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

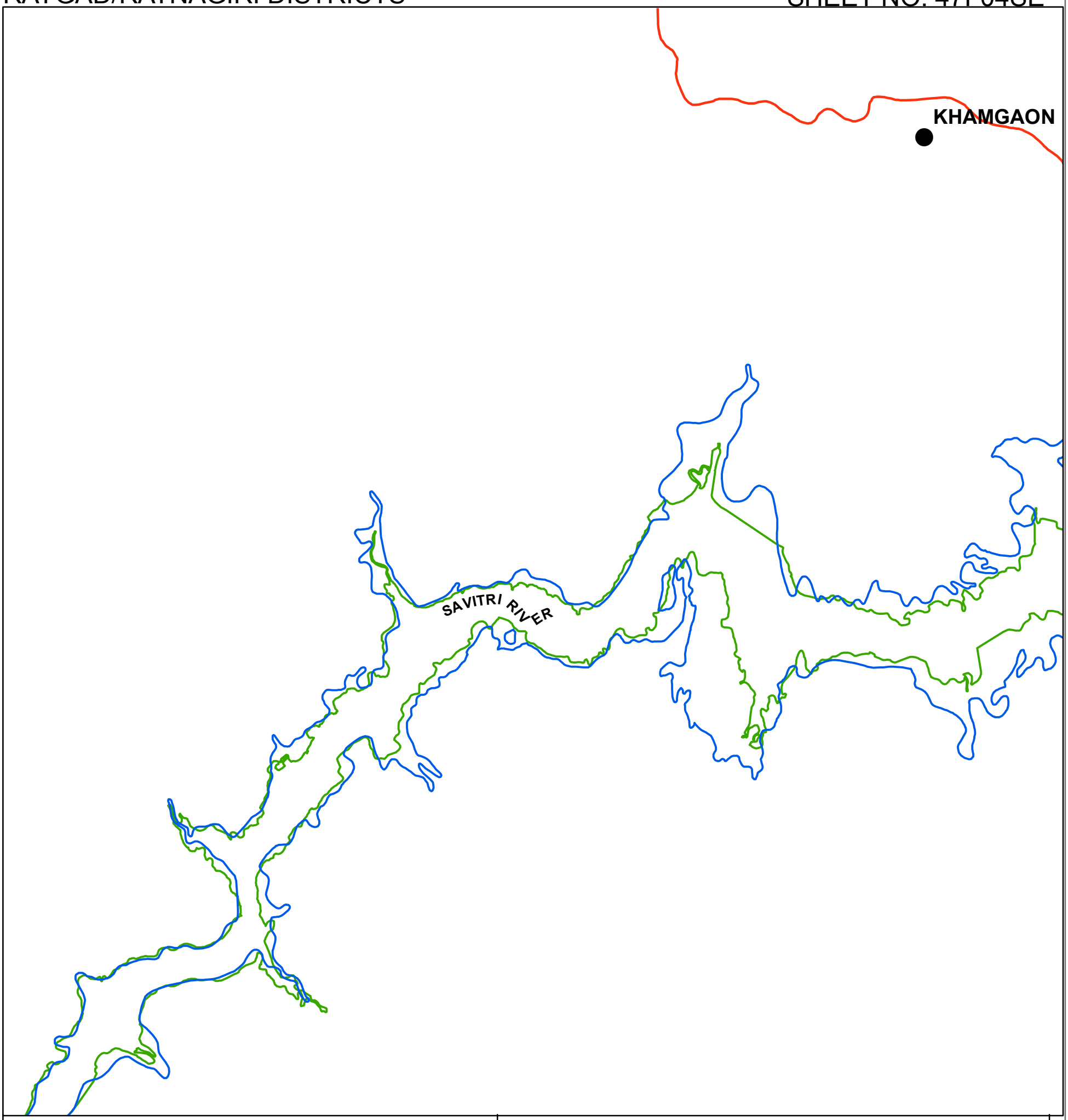
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

RAYGAD/RATNAGIRI DISTRICTS

SHEET NO. 47F04SE




### Legend

- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 47F04NW | 47F04NE | 47F08NW |
| 47F04SW | | 47F08SW |
| 47G01NW | 47G01NE | 47G05NW |



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

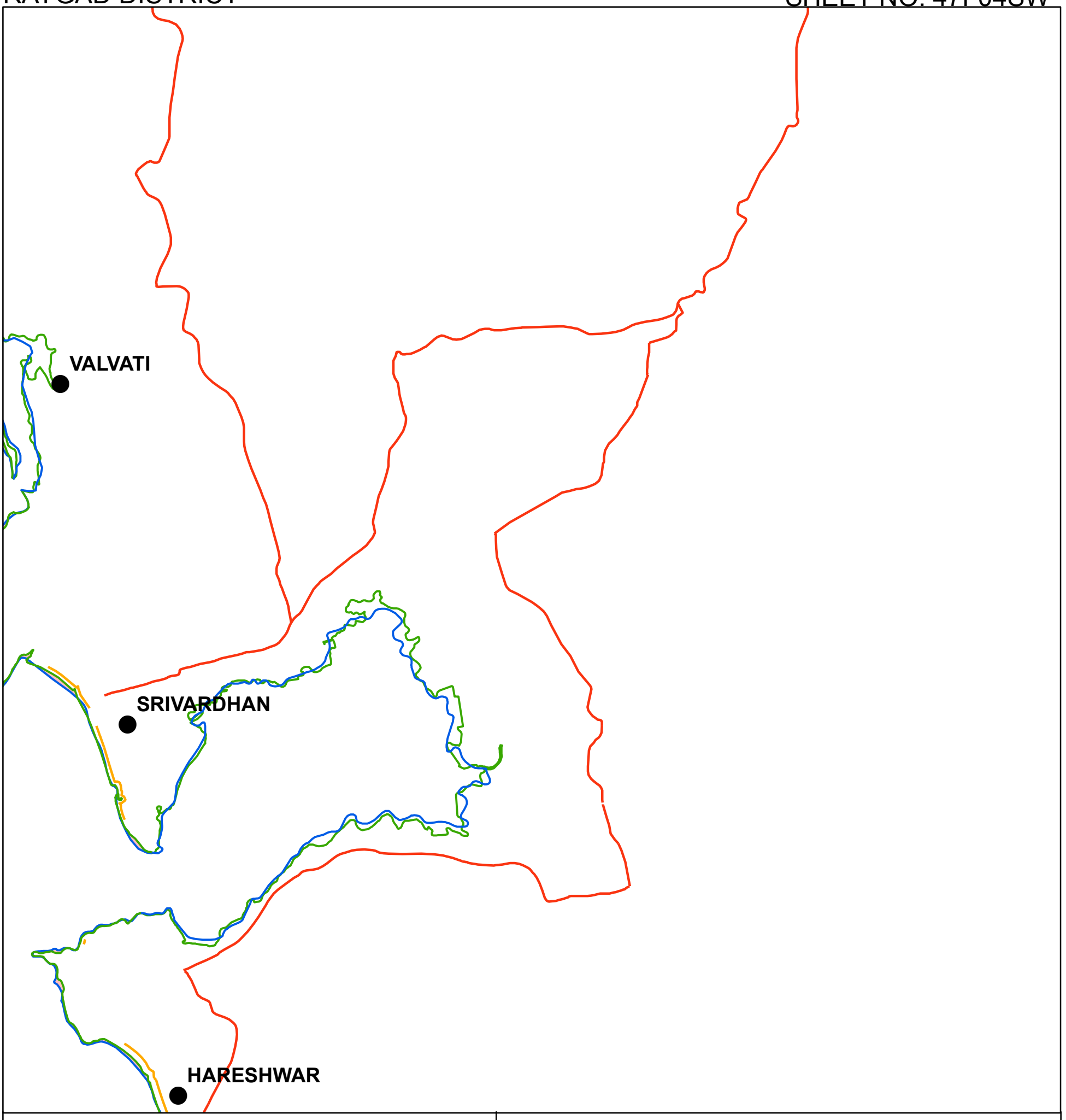
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

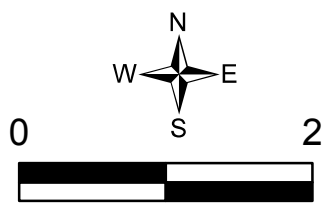
RAYGAD DISTRICT

SHEET NO. 47F04SW




### Legend

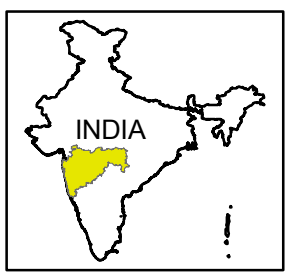
- EROSION
- ACCRETION
- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION
- SEA WALL




Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 47B16NE | 47F04NW | 47F04NE |
| 47B16SE | | 47F04SE |
| SEA | 47G01NW | 47G01NE |





DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

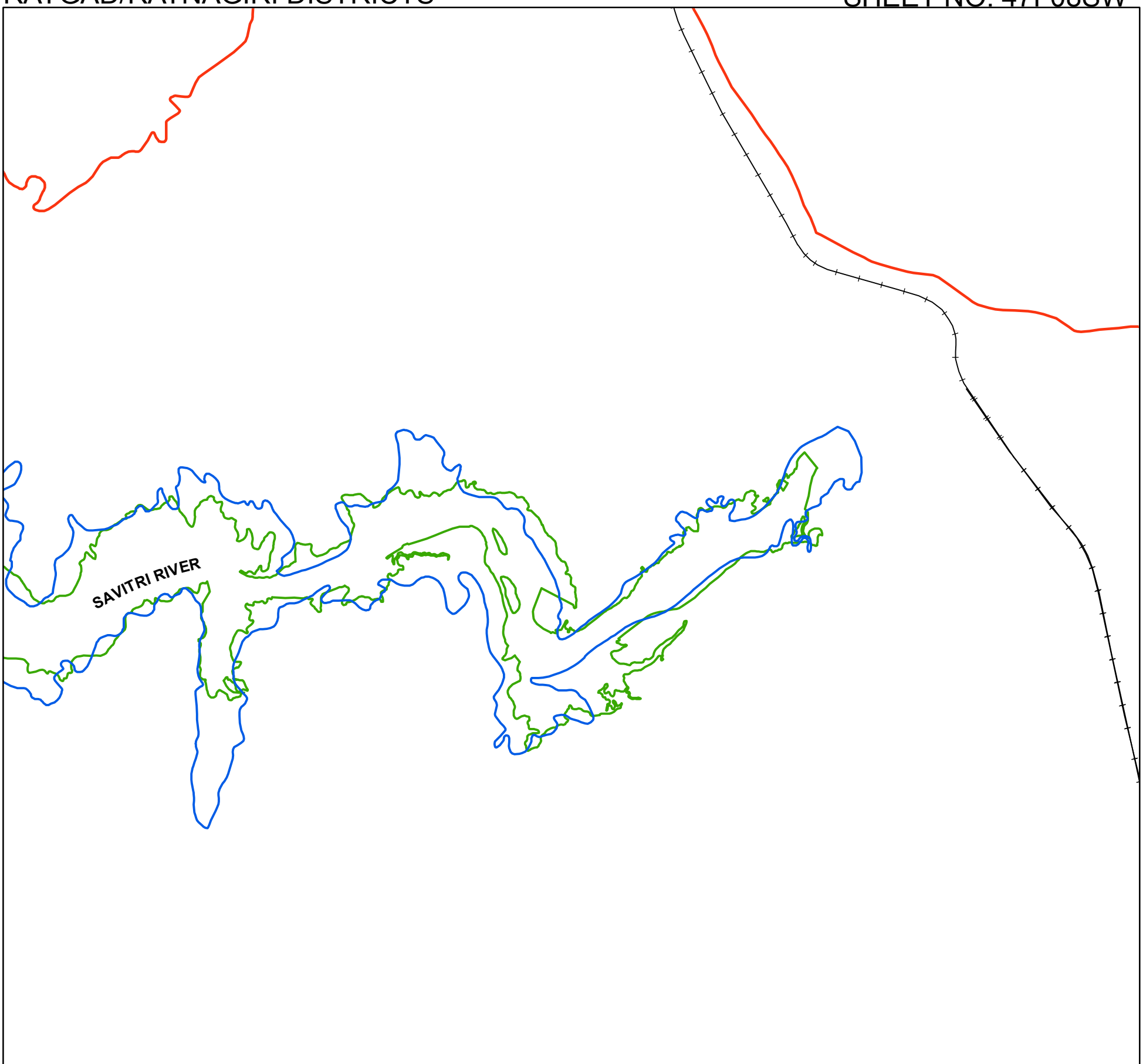
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

RAYGAD/RATNAGIRI DISTRICTS

SHEET NO. 47F08SW




## Legend

- ROAD
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91

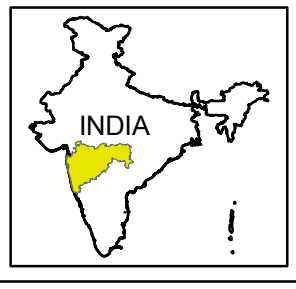
N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 47F04NE | 47F08NW | 47F08NE |
| 47F04SE | | 47F08SE |
| 47G01NE | 47G05NW | 47G05NE |





DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

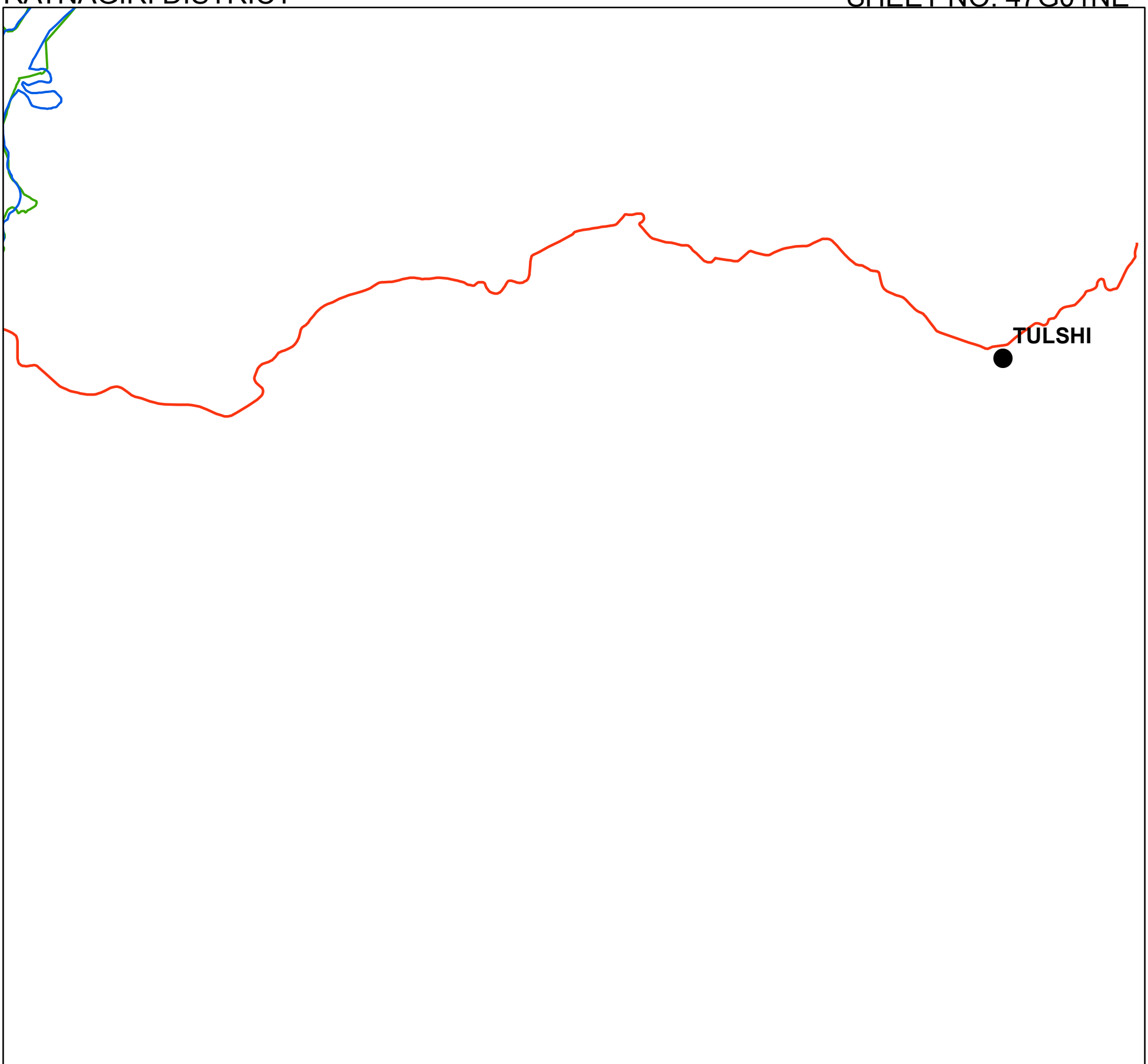
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

RATNAGIRI DISTRICT

SHEET NO. 47G01NE



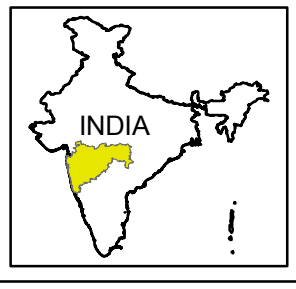

### Legend

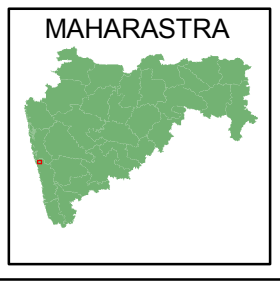
- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N
W E
S
0 2
Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 47F04SW | 47F04SE | 47F08SW |
| 47G01NW | | 47G05NW |
| 47G01SW | 47G01SE | 47G05SW |




DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

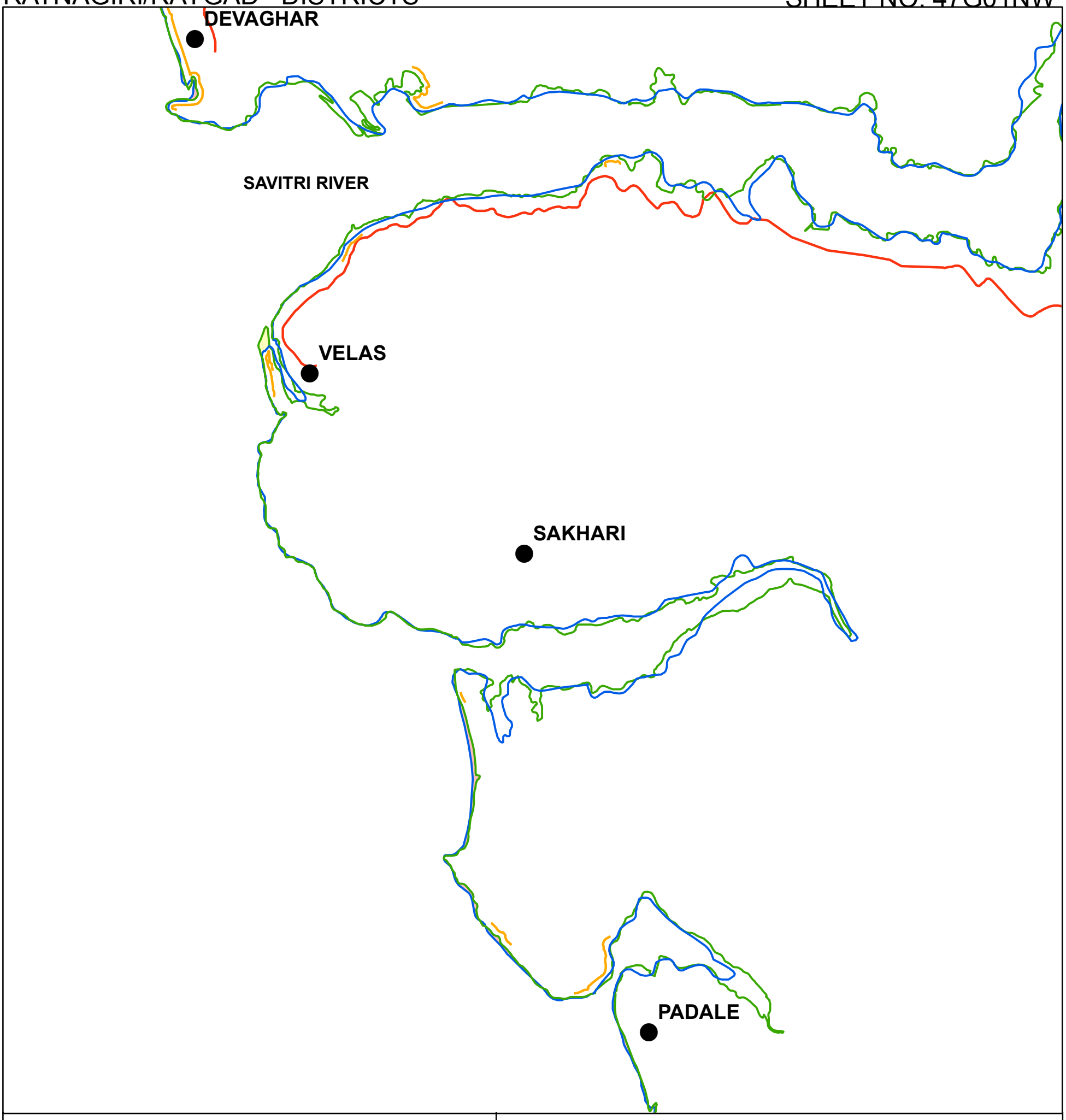
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

RATNAGIRI/RAYGAD DISTRICTS

SHEET NO. 47G01NW




### Legend

- EROSION
- ACCRETION
- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION
- SEA WALL

N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 47B16SE | 47F04SW | 47F04SE |
| SEA | | 47G01NE |
| SEA | 47G01SW | 47G01SE |



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

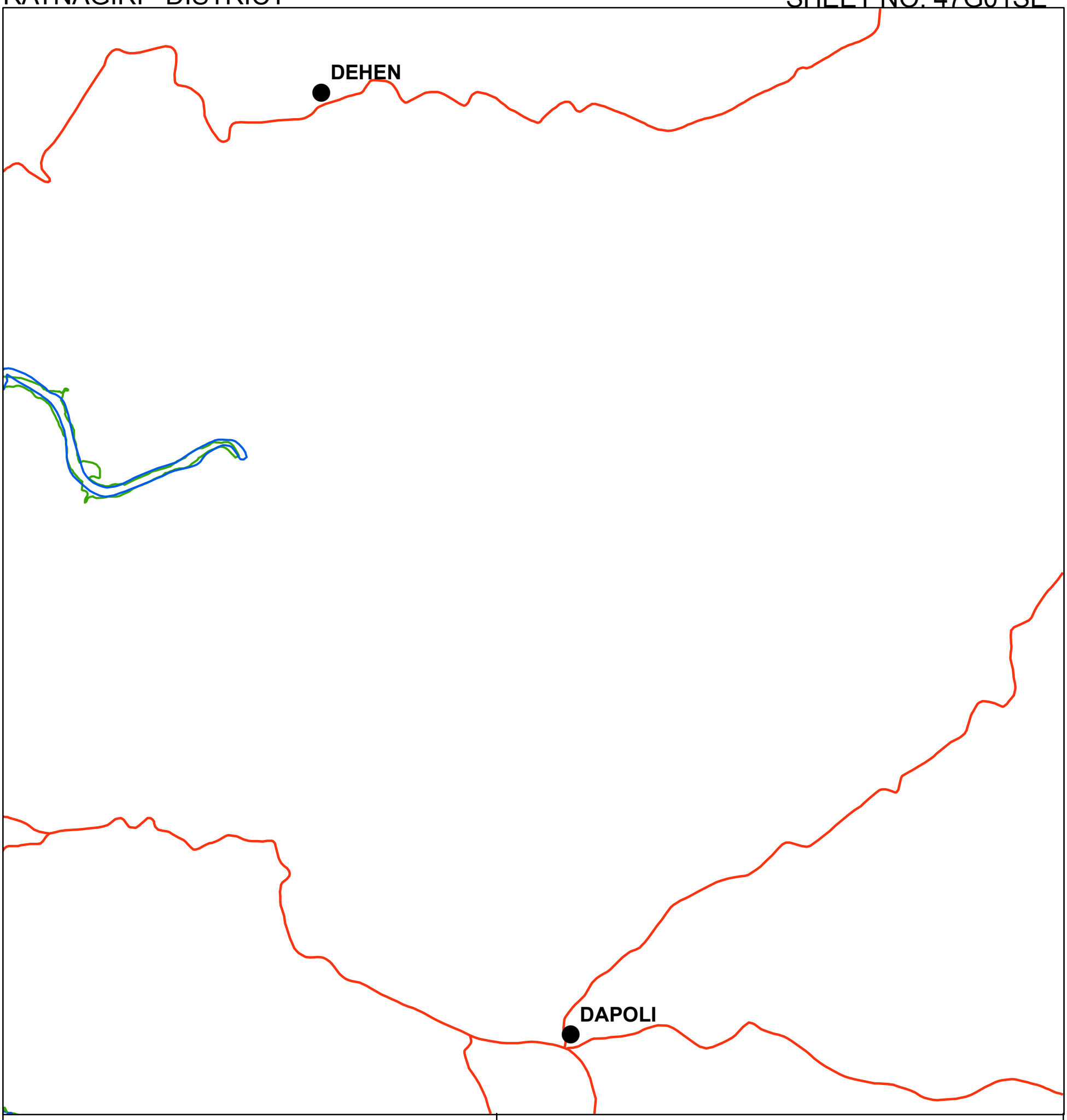
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

RATNAGIRI DISTRICT

SHEET NO. 47G01SE




### Legend

- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

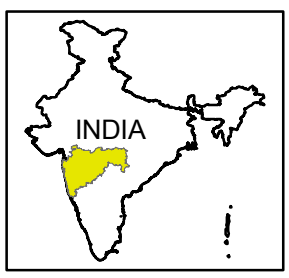
N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 47G01NW | 47G01NE | 47G05NW |
| 47G01SW | | 47G05SW |
| 47G02NW | 47G02NE | 47G06NW |





DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

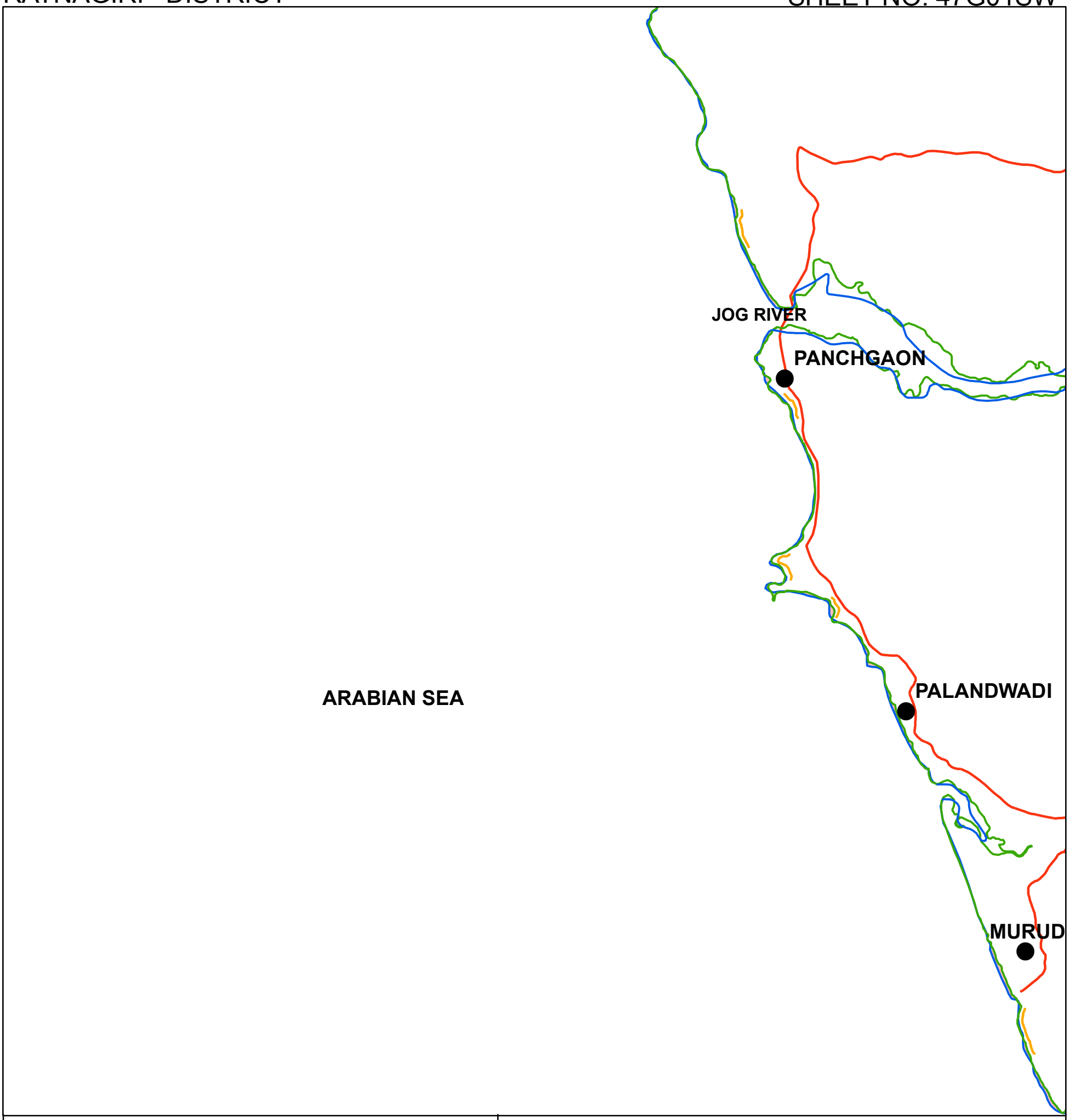
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

RATNAGIRI DISTRICT

SHEET NO. 47G01SW




### Legend

- EROSION
- ACCRETION
- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION
- SEA WALL

N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| SEA | 47G01NW | 47G01NE |
| SEA | | 47G01SE |
| SEA | 47G02NW | 47G02NE |


MAHARASTRA

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

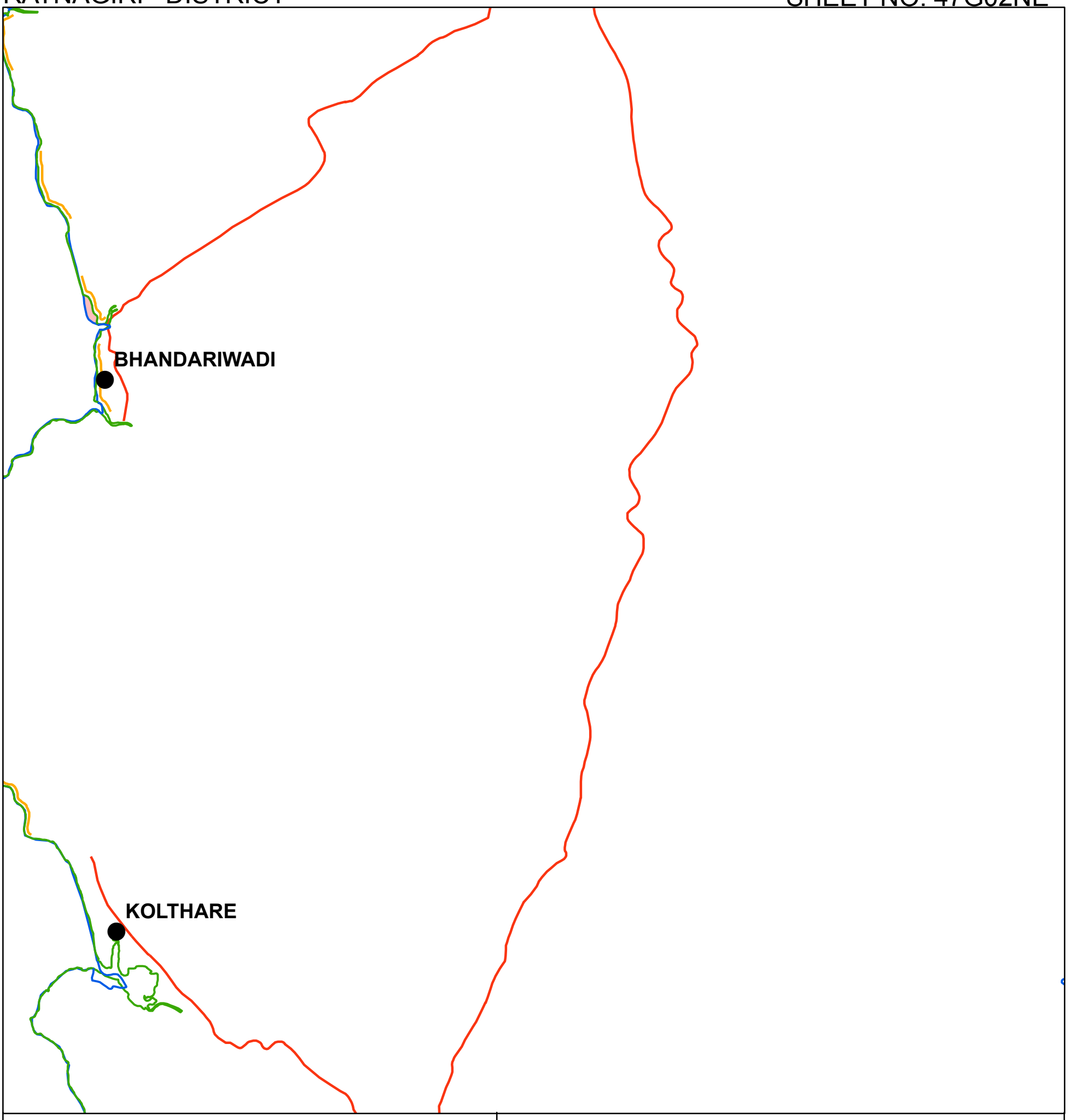
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

RATNAGIRI DISTRICT

SHEET NO. 47G02NE




### Legend

- EROSION
- ACCRETION
- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION
- SEA WALL

N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 47G01SW | 47G01SE | 47G05SW |
| 47G02NW | | 47G06NW |
| SEA | 47G02SE | 47G06SW |



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

RATNAGIRI DISTRICT

SHEET NO. 47G02NW

**ARABIAN SEA**

## Legend

- EROSION
- ACCRETION
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- SEA WALL

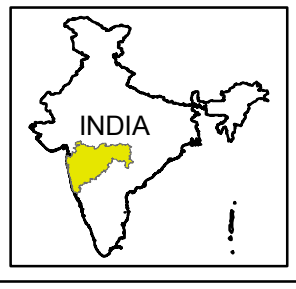
N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| SEA | 47G01SW | 47G01SE |
| SEA | | 47G02NE |
| SEA | SEA | 47G02SE |





DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

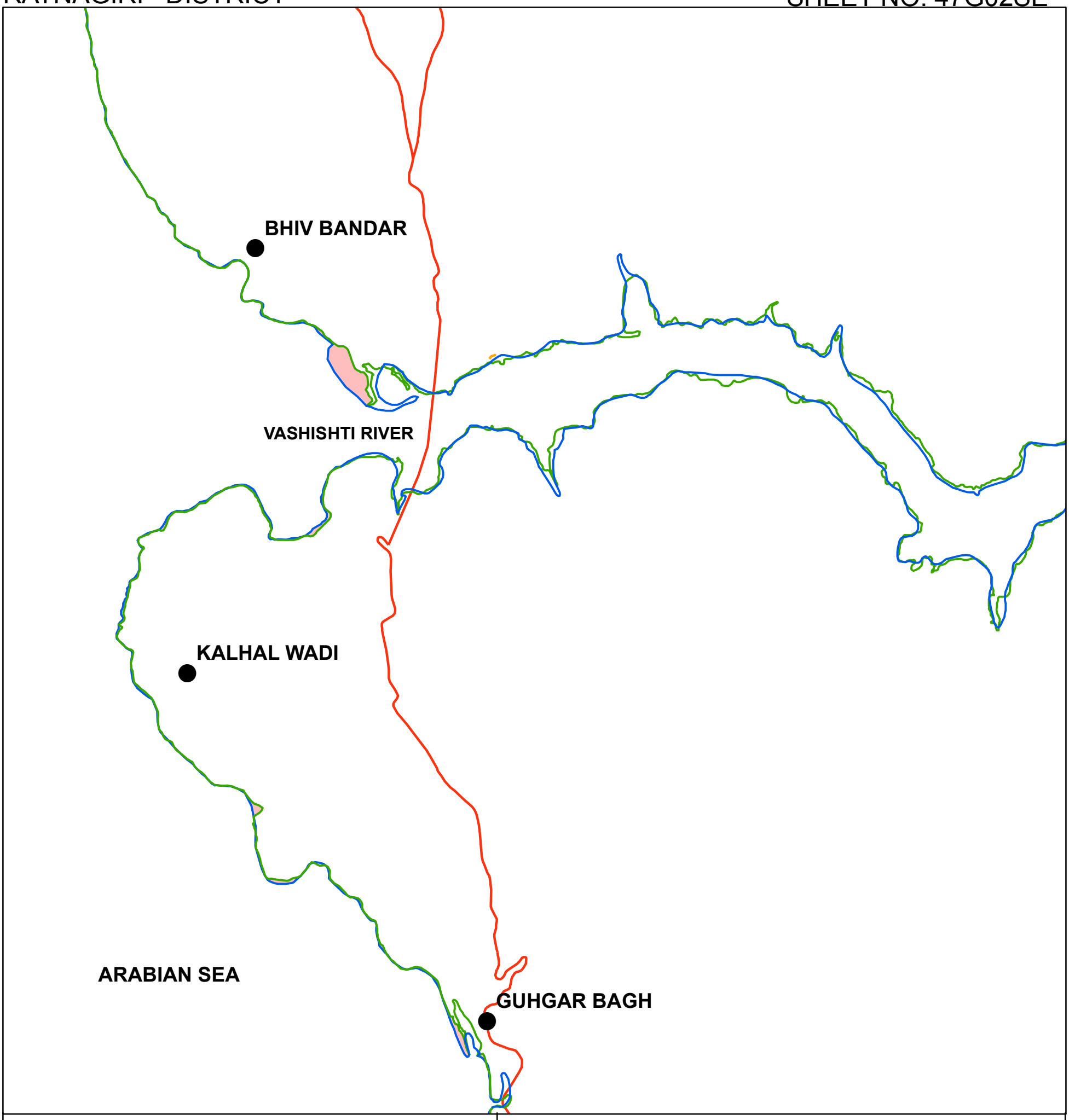
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

RATNAGIRI DISTRICT

SHEET NO. 47G02SE




## Legend

- EROSION
- ACCRETION
- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION
- SEA WALL

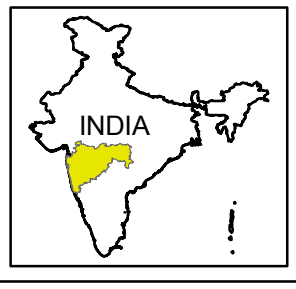
N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 47G02NW | 47G02NE | 47G06NW |
| SEA | | 47G06SW |
| SEA | 47G03NE | 47G07NW |





DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

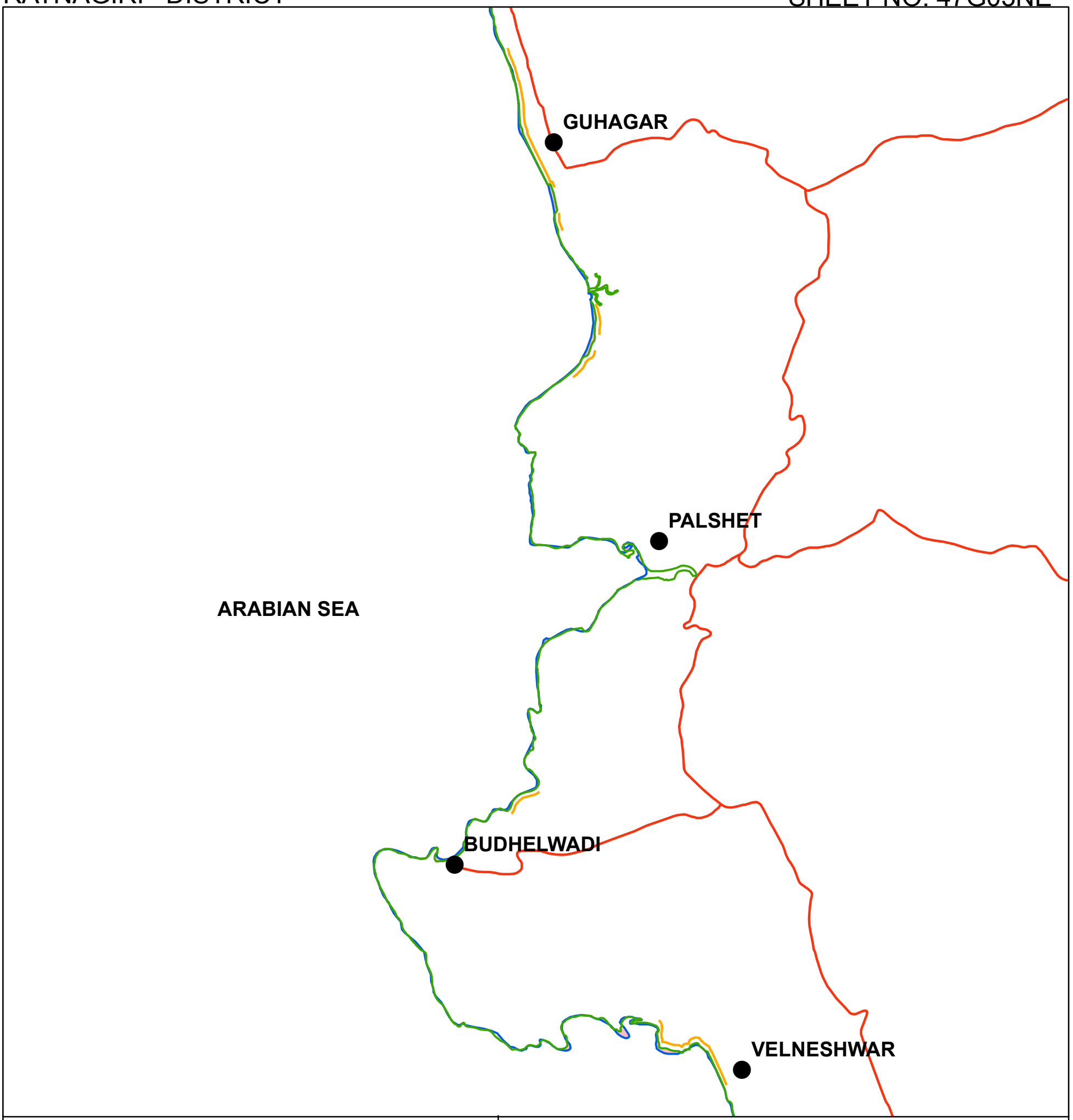
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

RATNAGIRI DISTRICT

SHEET NO. 47G03NE




### Legend

- EROSION
- ACCRETION
- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION
- SEA WALL

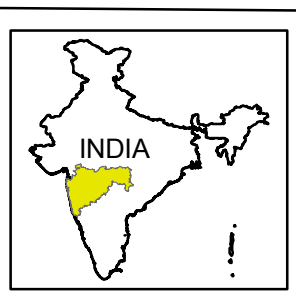
N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| SEA | 47G02SE | 47G06SW |
| SEA | | 47G07NW |
| SEA | 47G03SE | 47G07SW |





DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

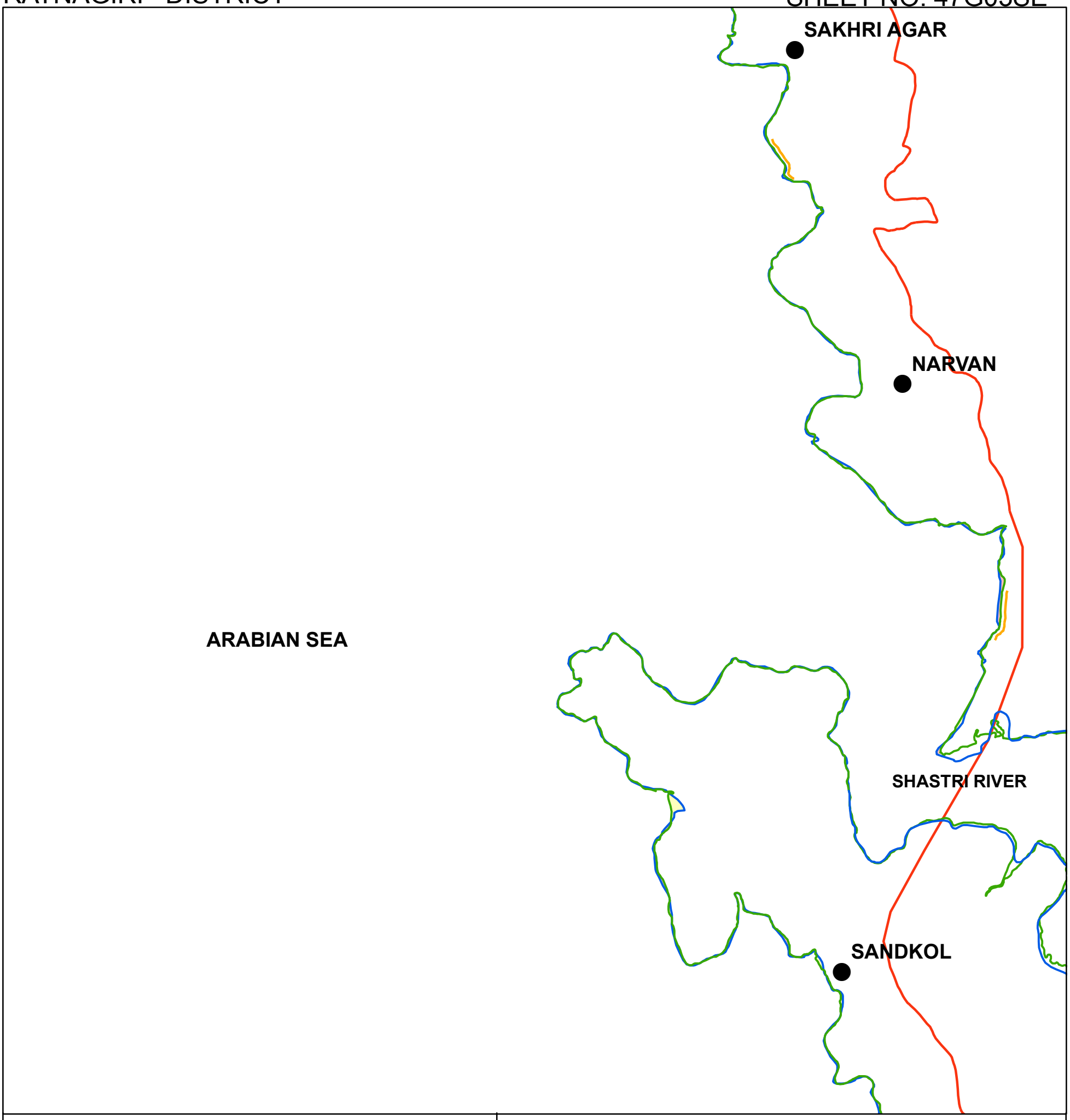
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

RATNAGIRI DISTRICT

SHEET NO. 47G03SE



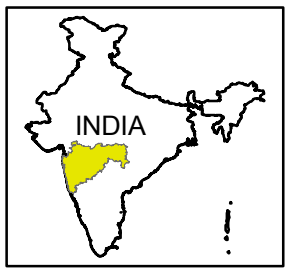

### Legend

- EROSION
- ACCRETION
- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION
- SEA WALL

N
W E
S
0 2
Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| SEA | 47G03NE | 47G07NW |
| SEA | | 47G07SW |
| SEA | 47G04NE | 47G08NW |





DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

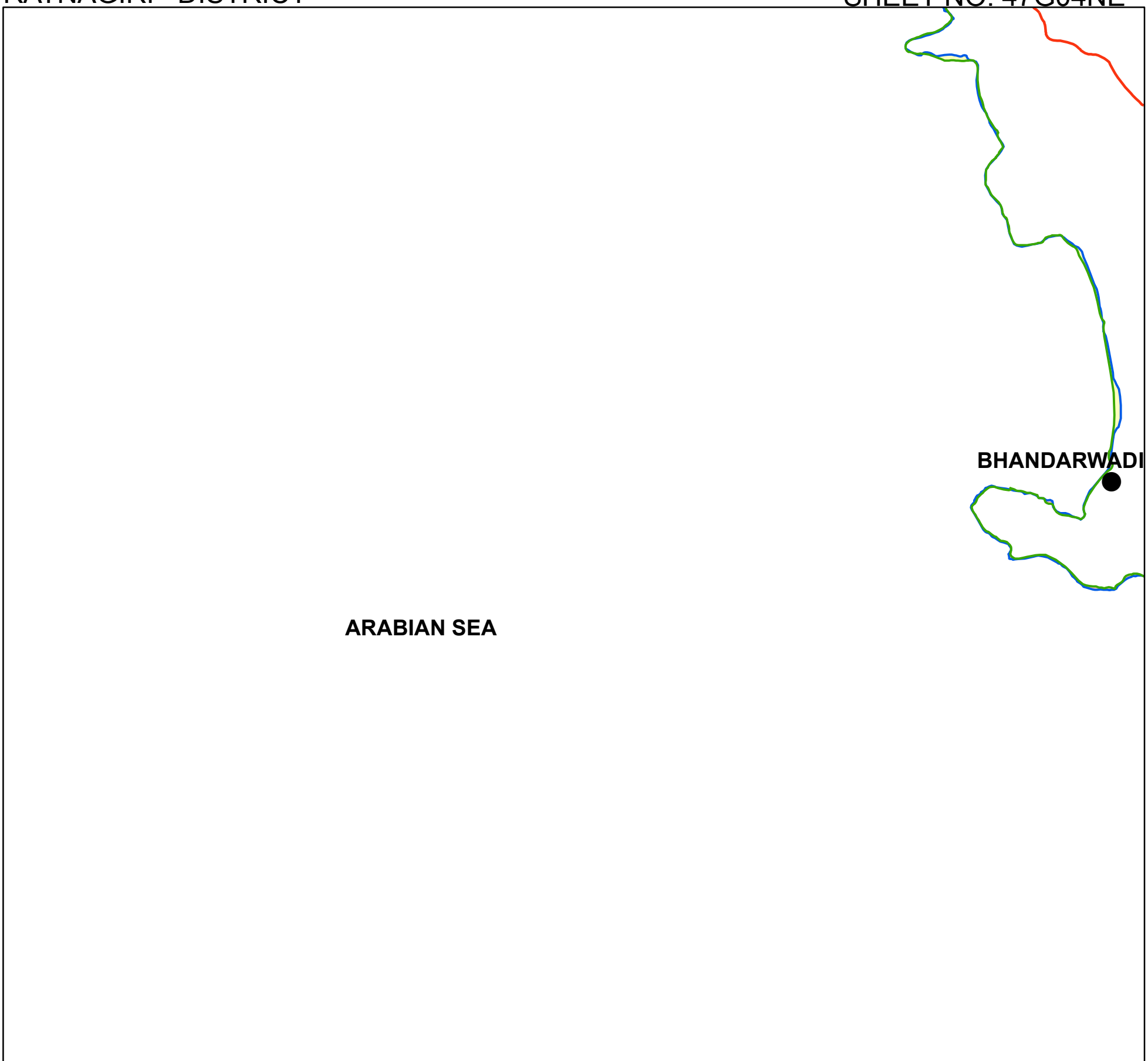
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

RATNAGIRI DISTRICT

SHEET NO. 47G04NE




### Legend

- EROSION
- ACCRETION
- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N
W E
S
0 2
Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| SEA | 47G03SE | 47G07SW |
| SEA | | 47G08NW |
| SEA | SEA | 47G08SW |



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

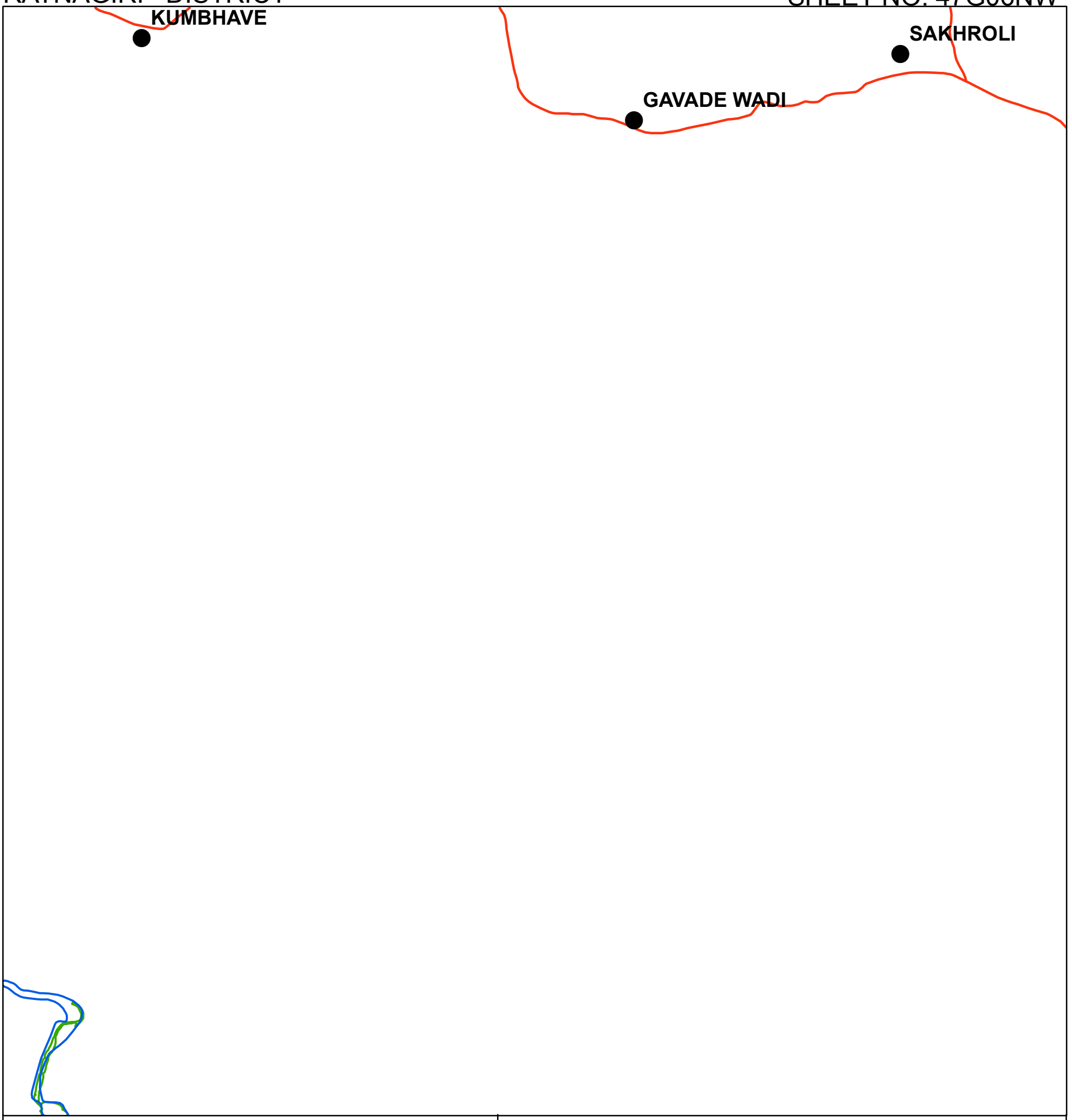
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

RATNAGIRI DISTRICT

SHEET NO. 47G06NW




### Legend

- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- ROAD
- HABITATION

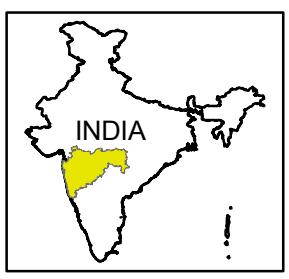
N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 47G01SE | 47G05SW | 47G05SE |
| 47G02NE | | 47G06NE |
| 47G02SE | 47G06SW | 47G06SE |





DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

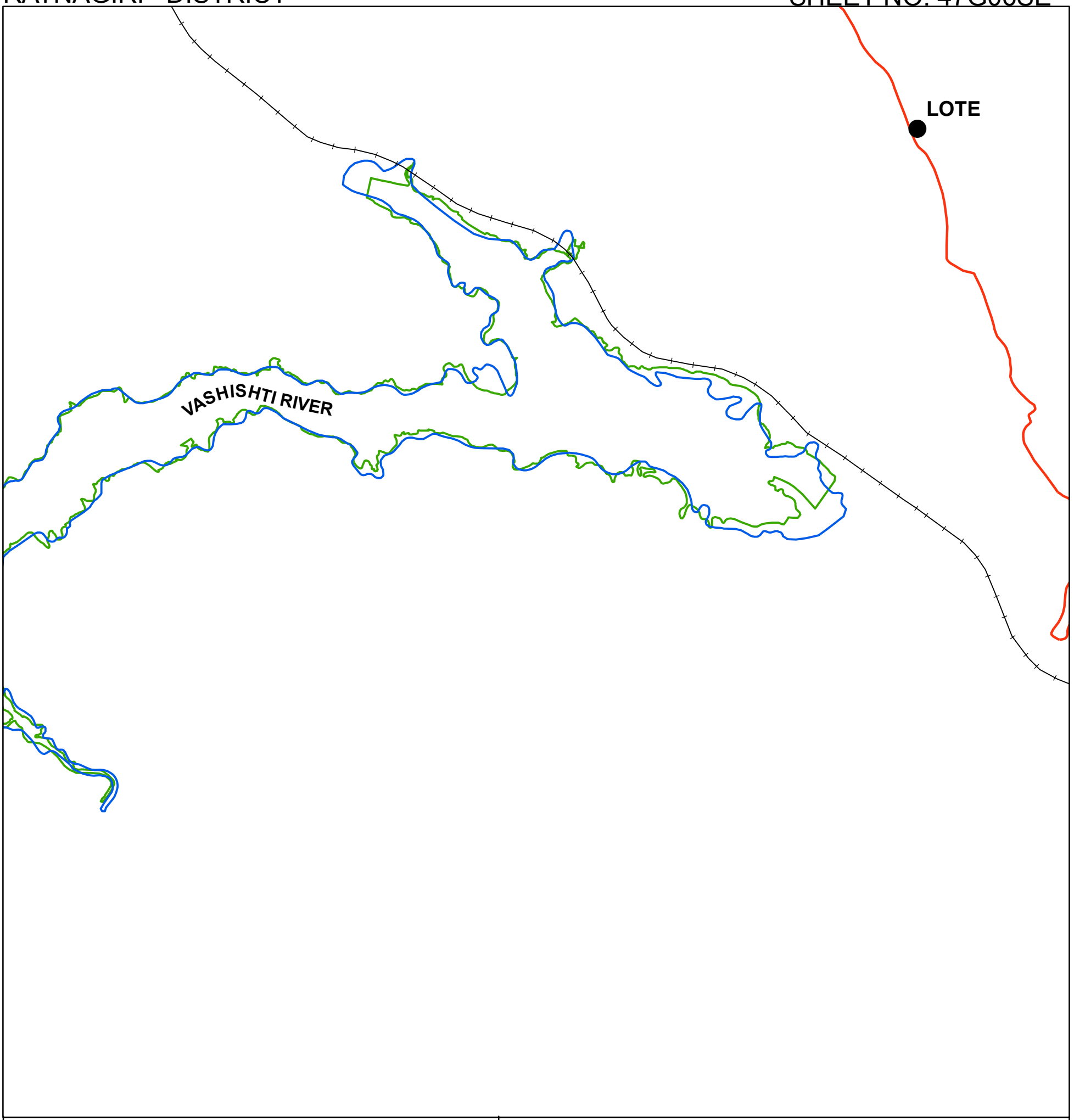
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

RATNAGIRI DISTRICT

SHEET NO. 47G06SE




### Legend

- ROAD
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 47G06NW | 47G06NE | 47G10NW |
| 47G06SW | | 47G10SW |
| 47G07NW | 47G07NE | 47G11NW |



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

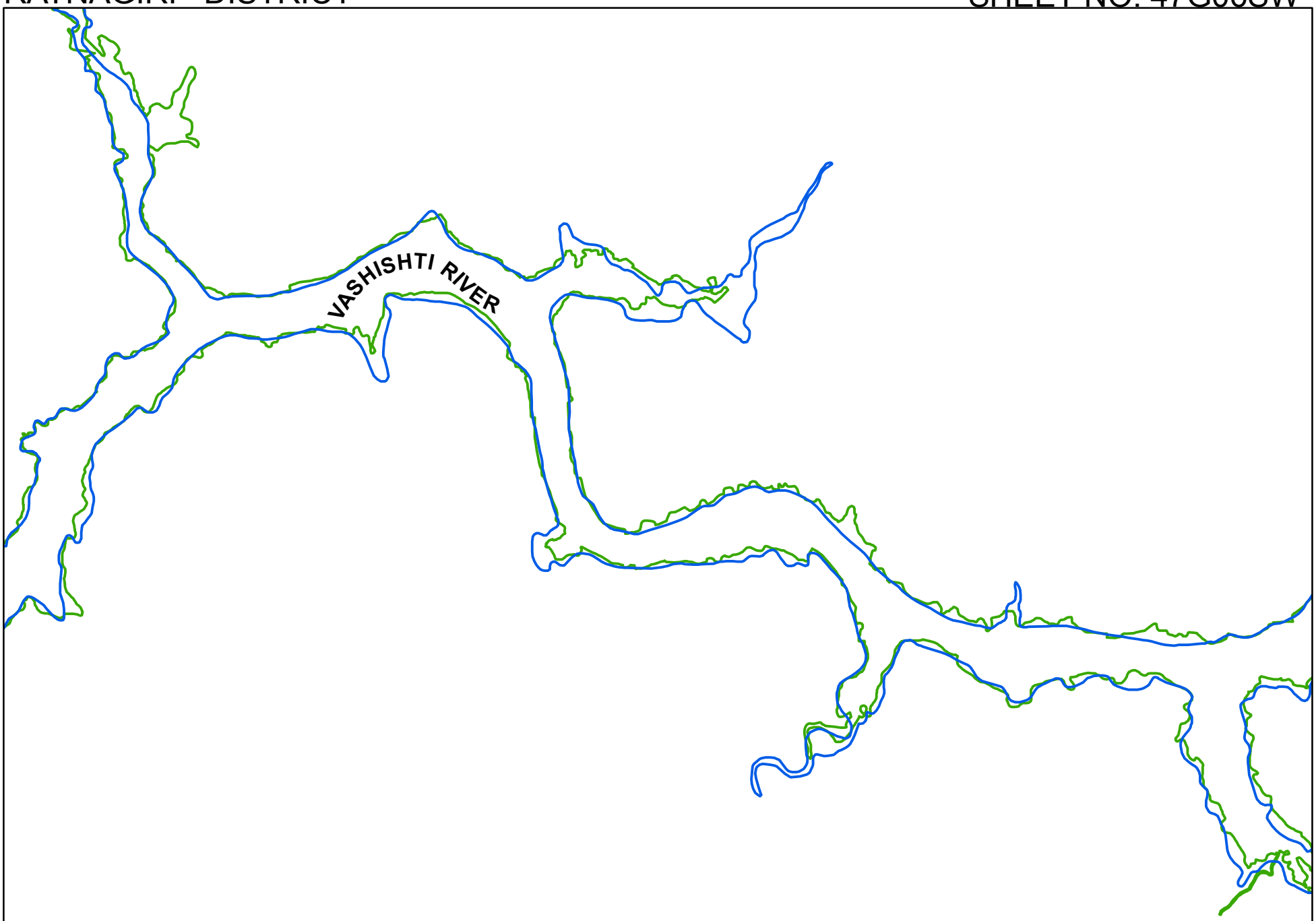
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

RATNAGIRI DISTRICT

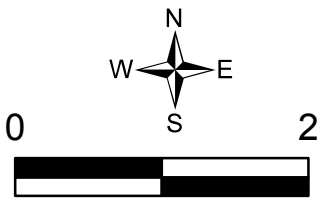
SHEET NO. 47G06SW




### Legend

HIGH-TIDE LINE 2004-06

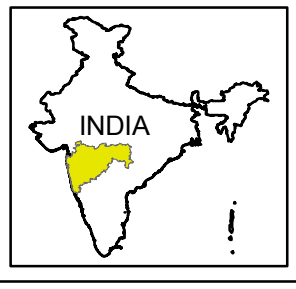
HIGH-TIDE LINE 1989-91




Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 47G02NE | 47G06NW | 47G06NE |
| 47G02SE | | 47G06SE |
| 47G03NE | 47G07NW | 47G07NE |





DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

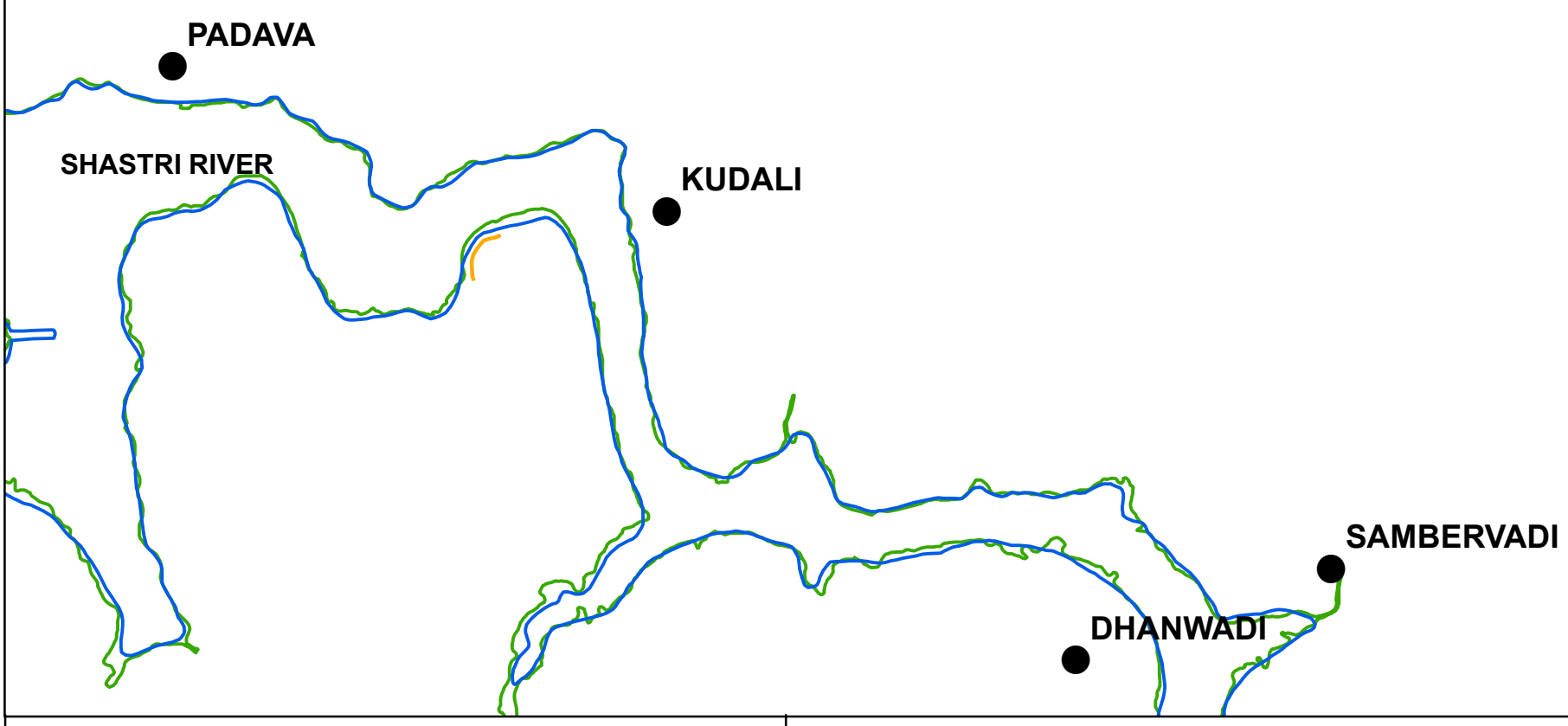
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

RATNAGIRI DISTRICT

SHEET NO. 47G07SW




### Legend

- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION
- SEA WALL

N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 47G03NE | 47G07NW | 47G07NE |
| 47G03SE | | 47G07SE |
| 47G04NE | 47G08NW | 47G08NE |


MAHARASTRA

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

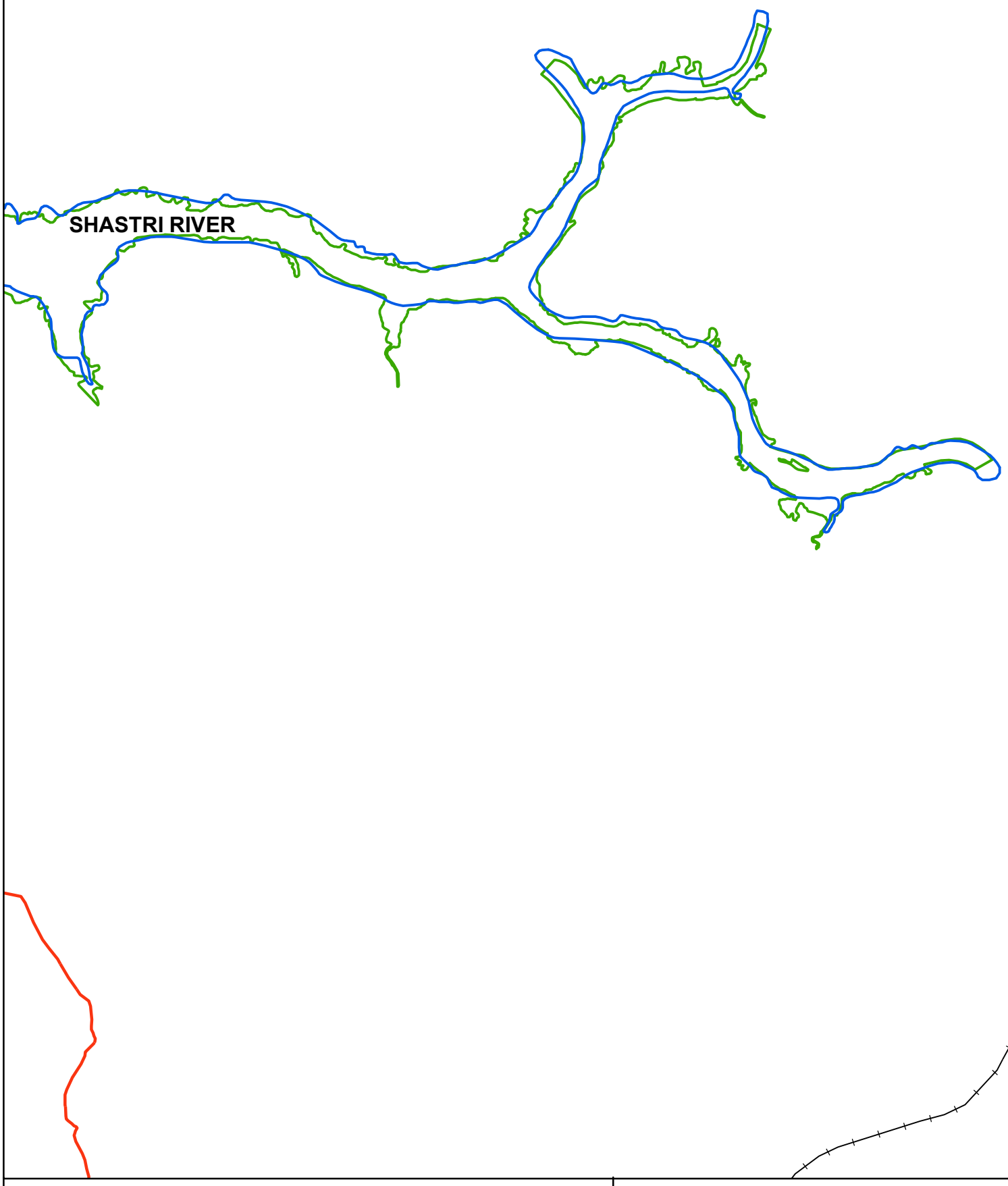
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

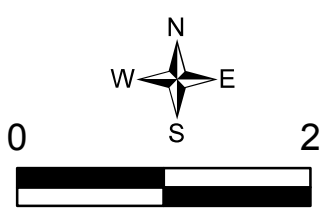
RATNAGIRI DISTRICT

SHEET NO. 47G08NE




## Legend

- ROAD
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91




Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 47G07SW | 47G07SE | 47G11SW |
| 47G08NW | | 47G12NW |
| 47G08SW | 47G08SE | 47G12SW |



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

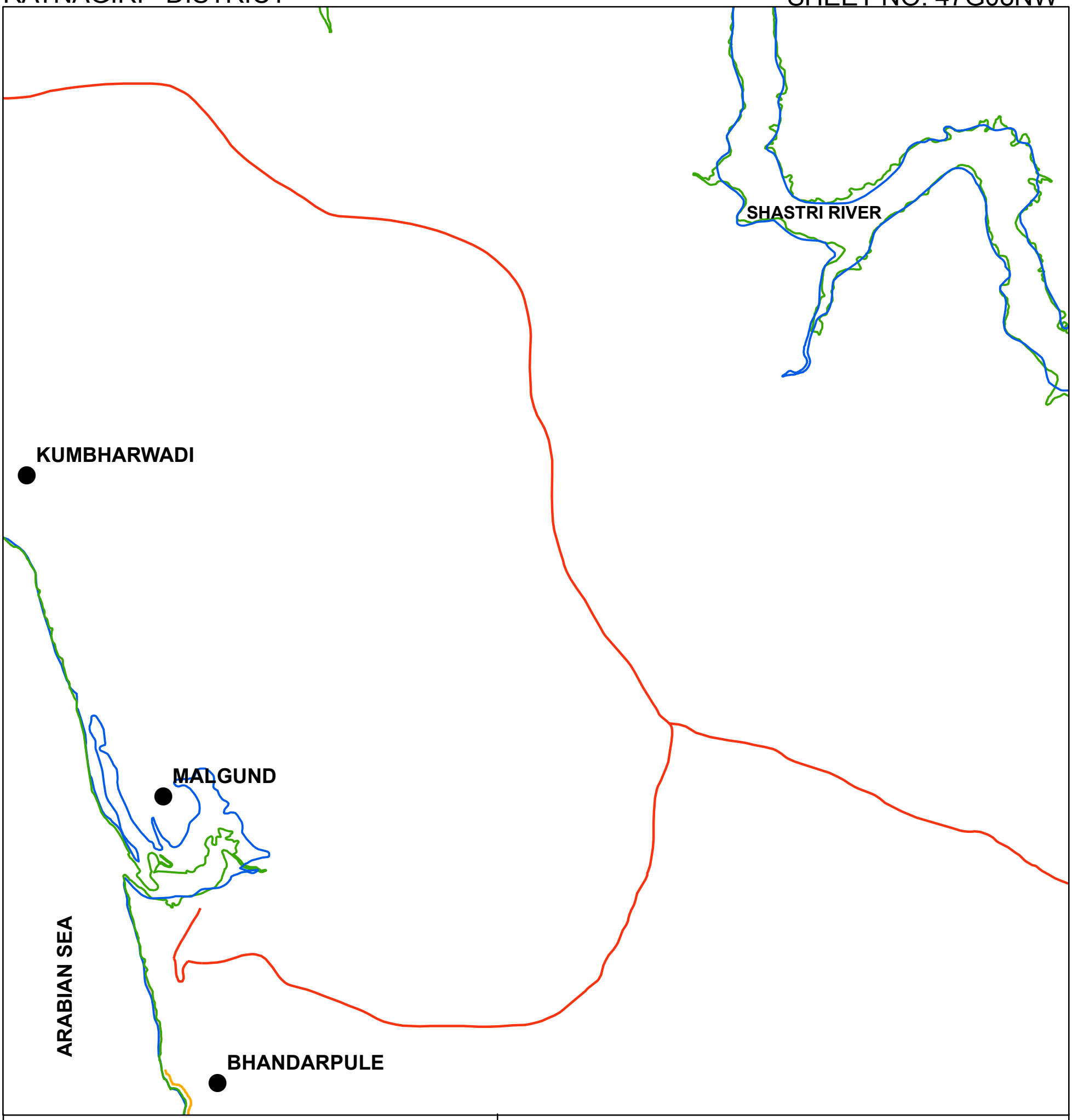
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

RATNAGIRI DISTRICT

SHEET NO. 47G08NW




### Legend

- EROSION
- ACCRETION
- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION
- SEA WALL

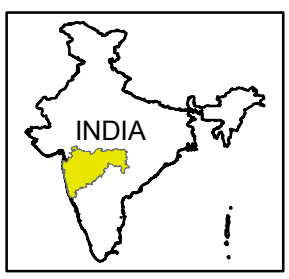
N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 47G03SE | 47G07SW | 47G07SE |
| 47G04NE | | 47G08NE |
| SEA | 47G08SW | 47G08SE |





DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

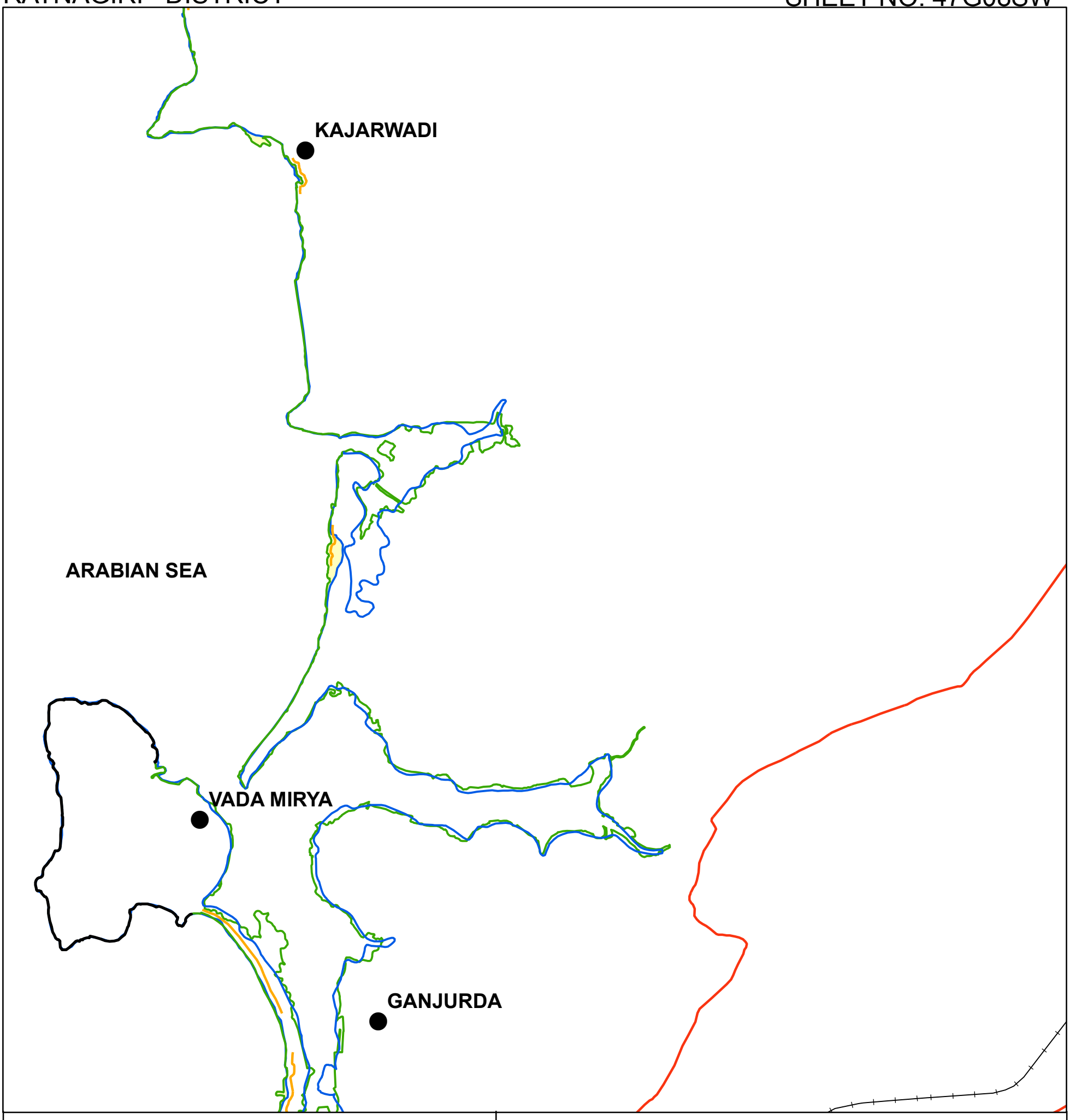
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

RATNAGIRI DISTRICT

SHEET NO. 47G08SW




### Legend

- EROSION
- ACCRETION
- ROAD
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION
- STABLE LINE
- SEA WALL

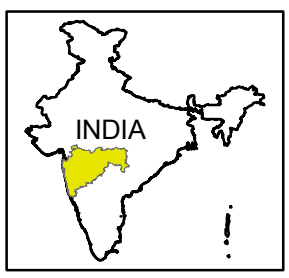
N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 47G04NE | 47G08NW | 47G08NE |
| SEA | | 47G08SE |
| SEA | 47H05NW | 47H05NE |




MAHARASTRA

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

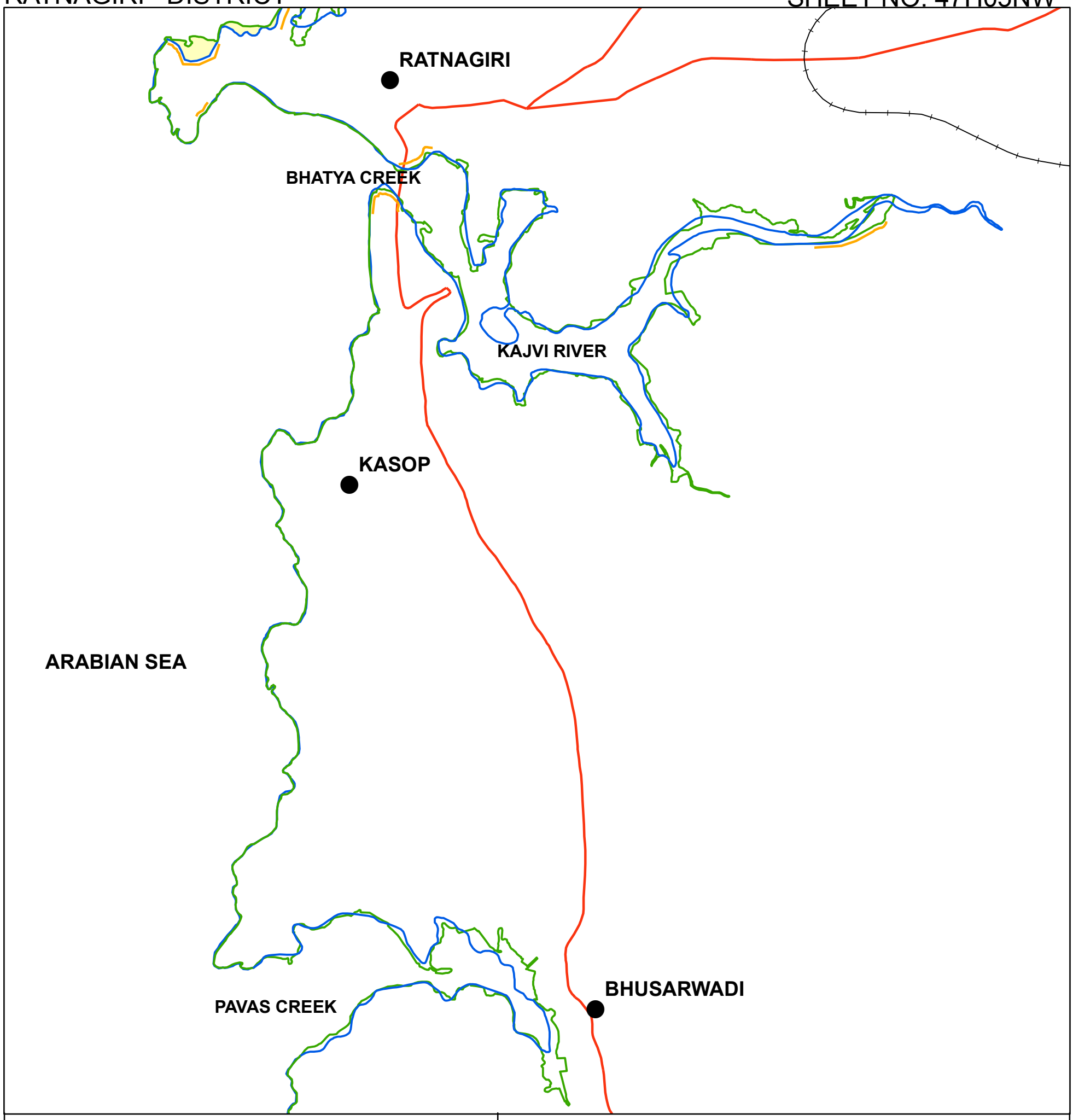
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

RATNAGIRI DISTRICT

SHEET NO. 47H05NW




### Legend

- EROSION
- ACCRETION
- ROAD
- RAIL
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION
- SEA WALL

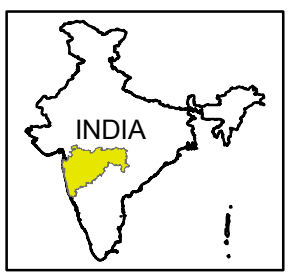
N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| SEA | 47G08SW | 47G08SE |
| SEA | | 47H05NE |
| SEA | 47H05SW | 47H05SE |





DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

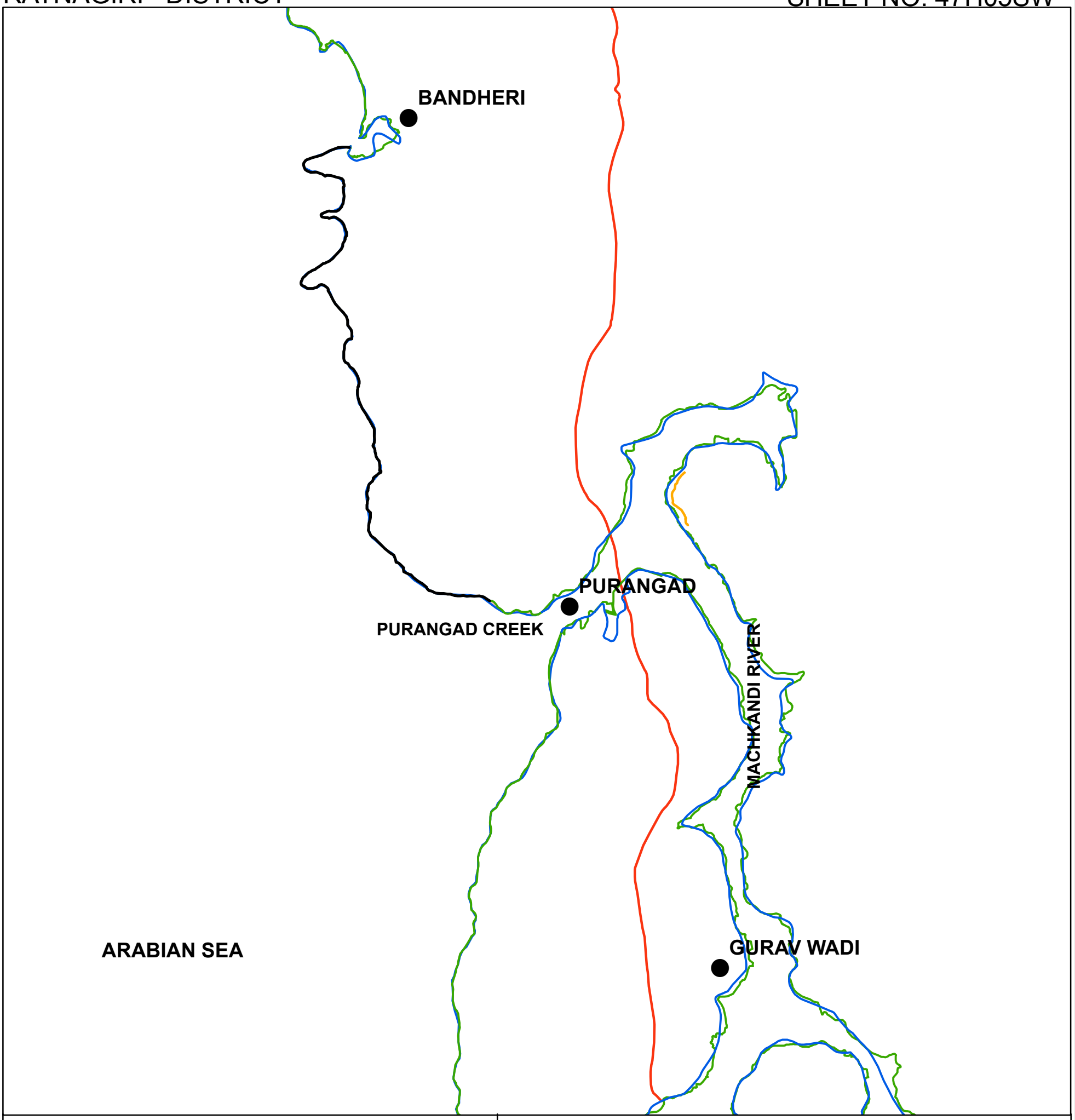
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

RATNAGIRI DISTRICT

SHEET NO. 47H05SW




## Legend

- EROSION
- ACCRETION
- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION
- STABLE LINE
- SEA WALL

N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| SEA | 47H05NW | 47H05NE |
| SEA | | 47H05SE |
| SEA | 47H06NW | 47H06NE |



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

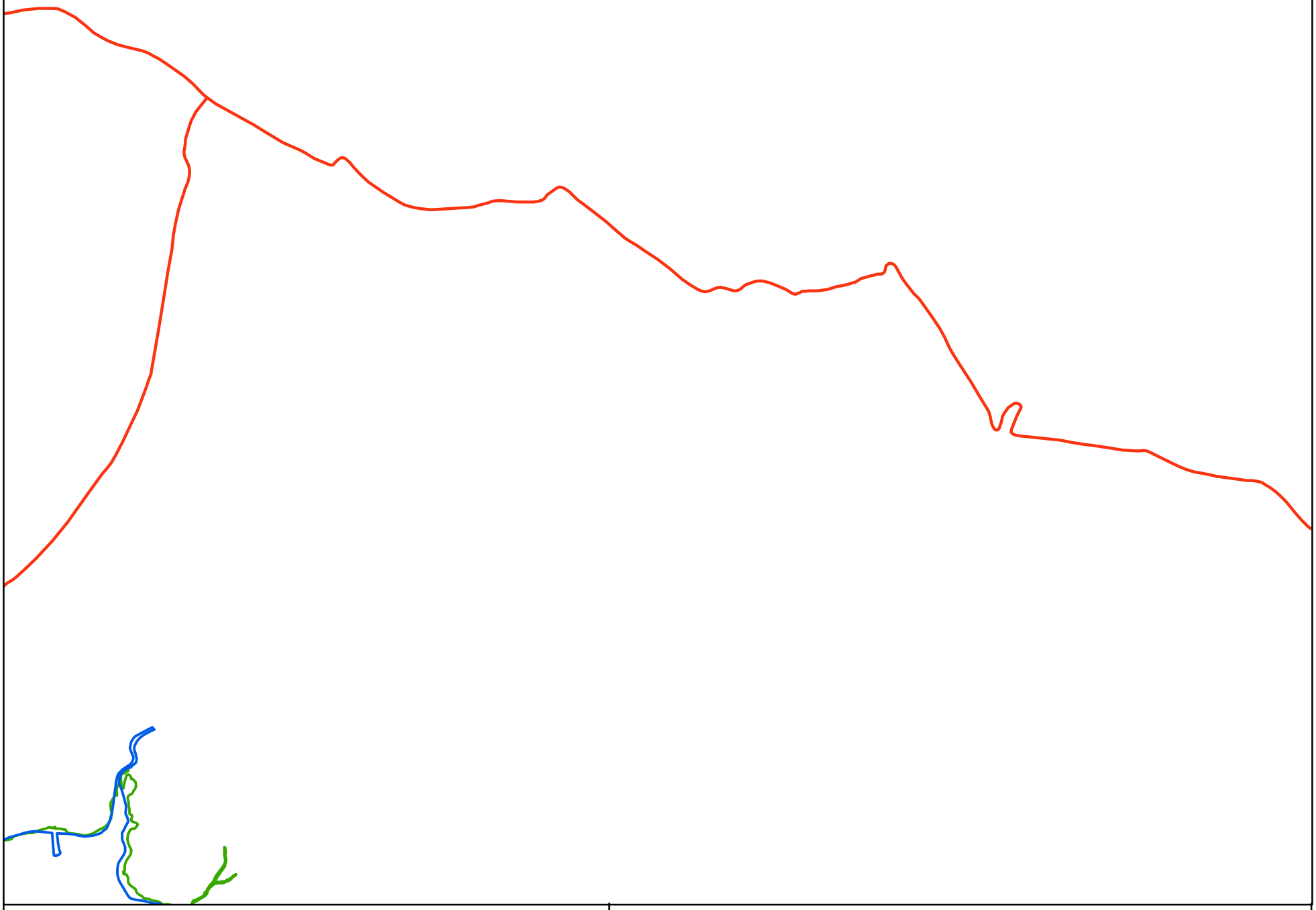
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

RATNAGIRI DISTRICT

SHEET NO. 47H06NE

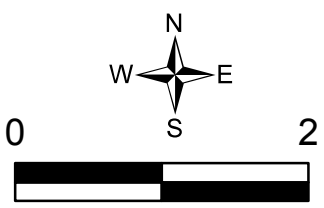


## Legend

ROAD

HIGH-TIDE LINE 2004-06

HIGH-TIDE LINE 1989-91




Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 47H05SW | 47H05SE | 47H09SW |
| 47H06NW | | 47H10NW |
| 47H06SW | 47H06SE | 47H10SW |



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

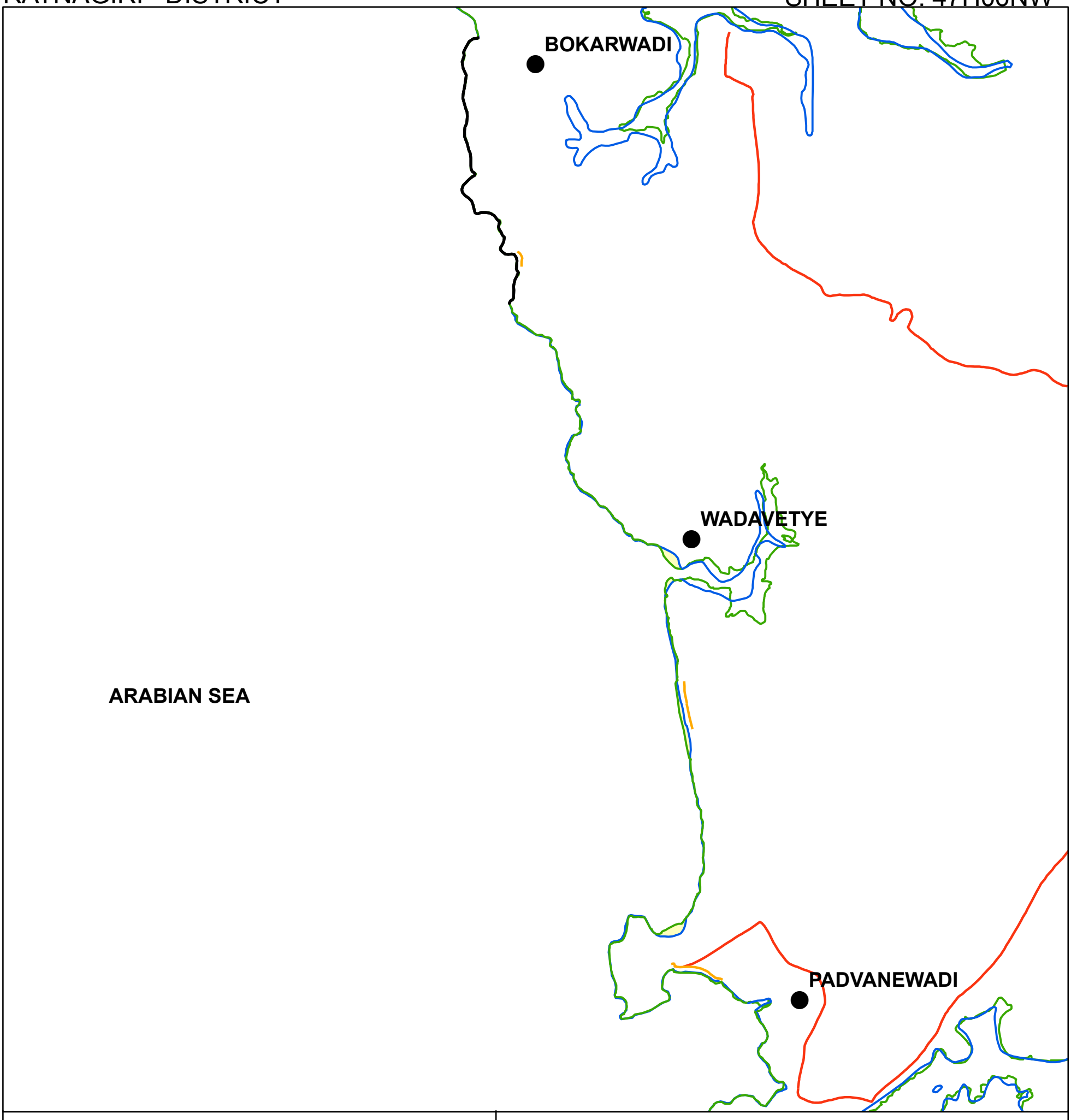
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

RATNAGIRI DISTRICT

SHEET NO. 47H06NW




## Legend

- EROSION
- ACCRETION
- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- STABLE LINE
- SEA WALL
- HABITATION

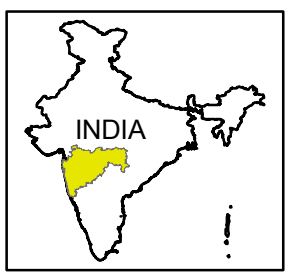
N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| SEA | 47H05SW | 47H05SE |
| SEA | | 47H06NE |
| SEA | 47H06SW | 47H06SE |




MAHARASTRA

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

RATNAGIRI DISTRICT

SHEET NO. 47H06SE

MARVELWADI

SOGAMWADI

RAJAPUR RIVER

KAREL

VAGHOTAN RIVER

PAKARWAD

### Legend

- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 47H06NW | 47H06NE | 47H10NW |
| 47H06SW | | 47H10SW |
| 47H07NW | 47H07NE | 47H11NW |

INDIA

MAHARASTRA

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

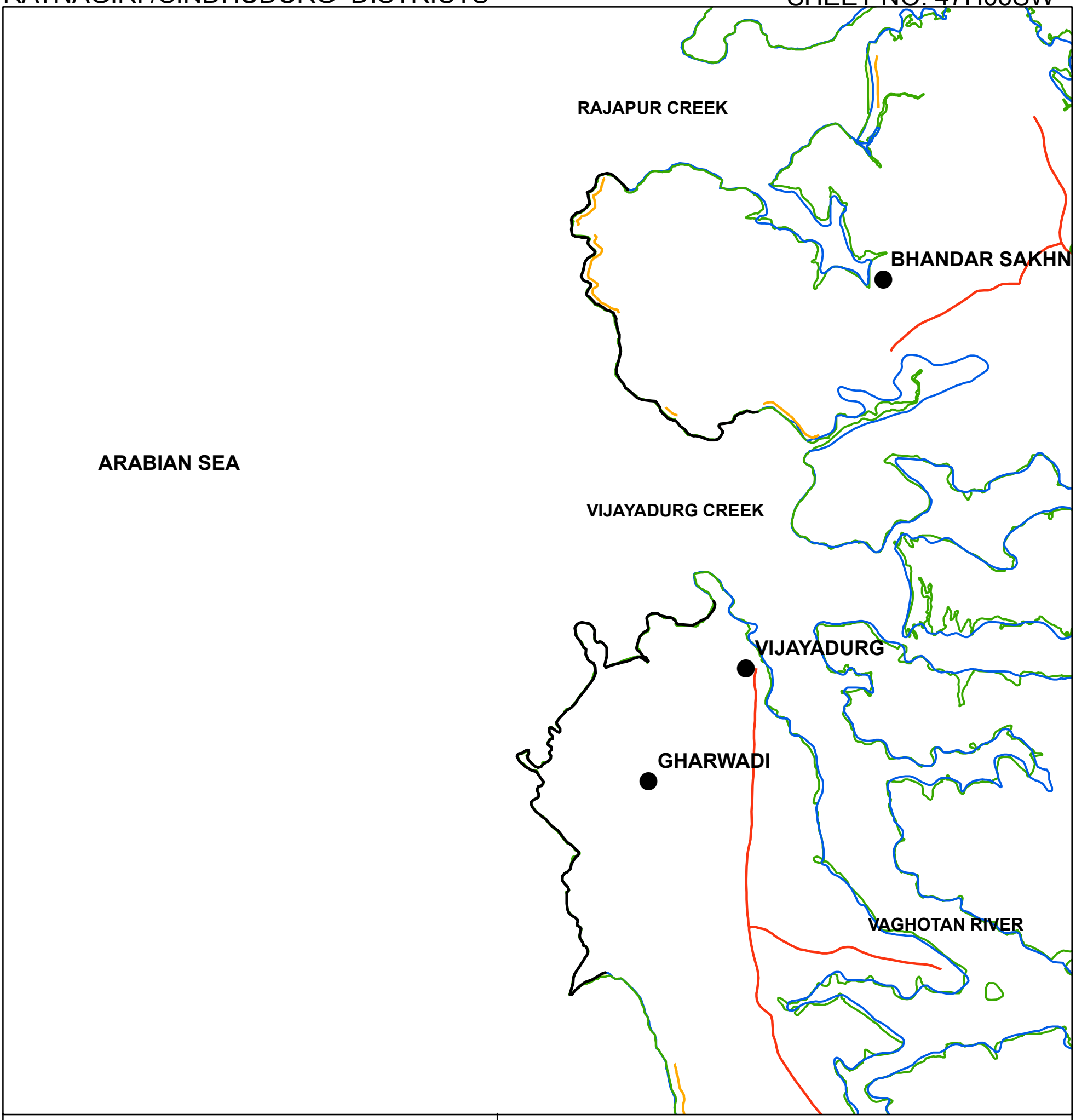
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

RATNAGIRI /SINDHUDURG DISTRICTS

SHEET NO. 47H06SW




### Legend

- EROSION
- ACCRETION
- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION
- STABLE LINE
- SEA WALL

N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| SEA | 47H06NW | 47H06NE |
| SEA | | 47H06SE |
| SEA | 47H07NW | 47H07NE |



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

SINDHUDURG DISTRICT

SHEET NO. 47H07NE

VAGHOTAN

KHAYALWADI

ANANDWADI

DABHOL

### Legend

- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION
- SEA WALL

N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 47H06SW | 47H06SE | 47H10SW |
| 47H07NW | | 47H11NW |
| 47H07SW | 47H07SE | 47H11SW |

INDIA

MAHARASTRA

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

इसरो isro

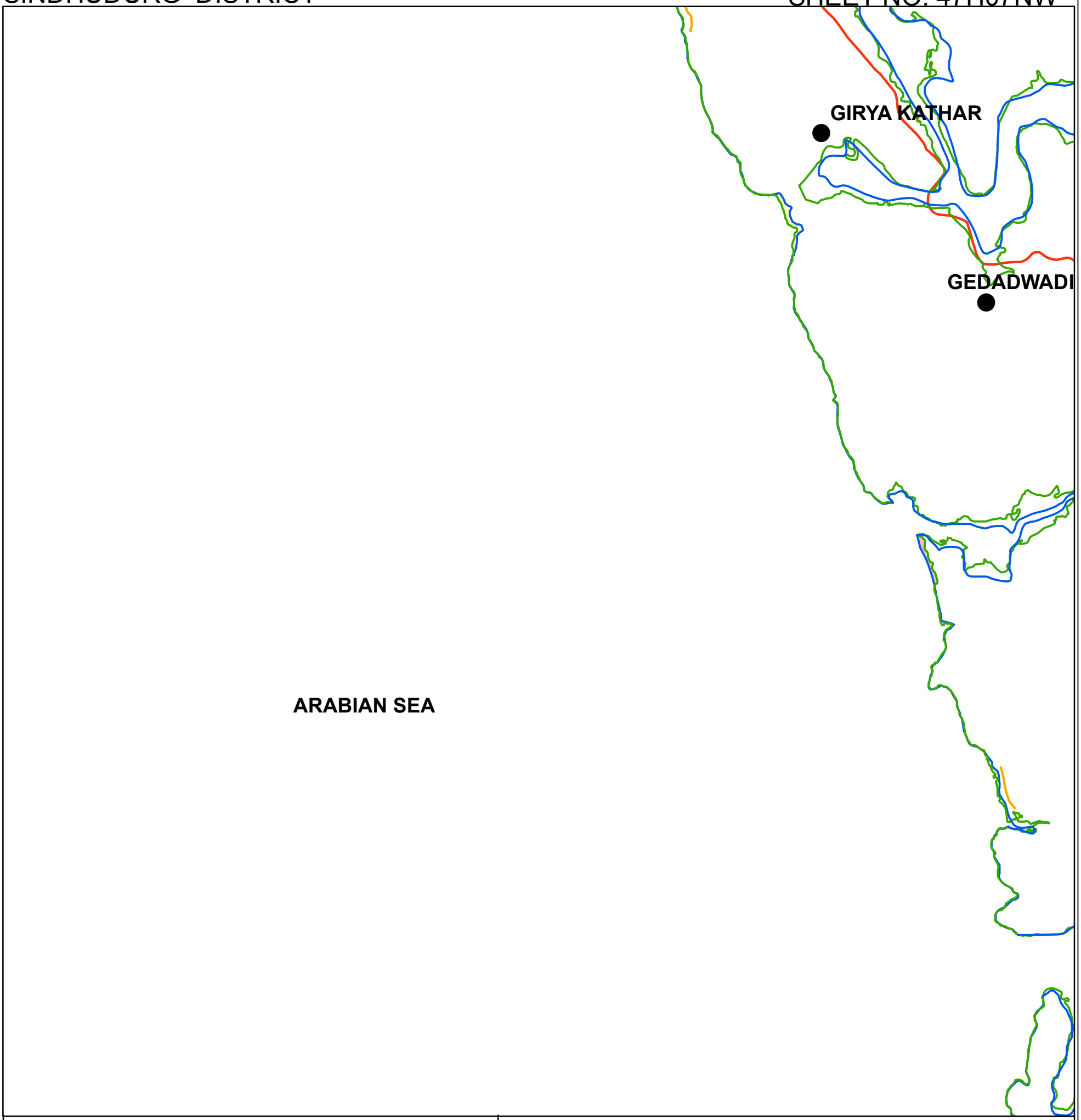
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

SINDHUDURG DISTRICT

SHEET NO. 47H07NW




## Legend

- EROSION
- ACCRETION
- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION
- SEA WALL

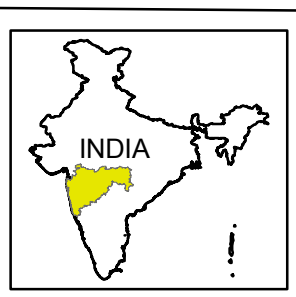
N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| SEA | 47H06SW | 47H06SE |
| SEA | | 47H07NE |
| SEA | 47H07SW | 47H07SE |




MAHARASTRA

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

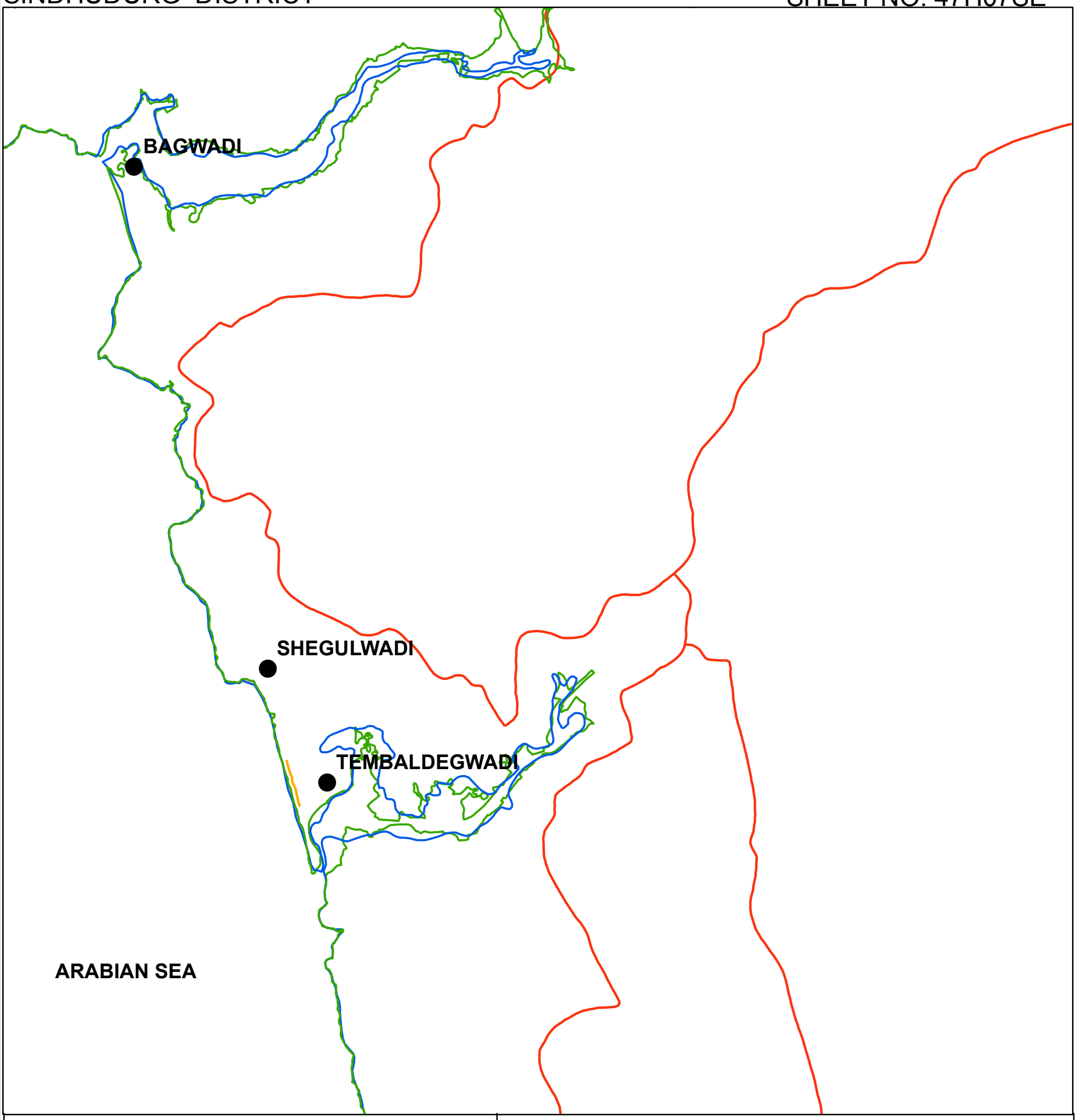
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

SINDHUDURG DISTRICT

SHEET NO. 47H07SE




### Legend

- EROSION
- ACCRETION
- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION
- SEA WALL

N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 47H07NW | 47H07NE | 47H11NW |
| 47H07SW | | 47H11SW |
| SEA | 47H08NE | 47H12NW |

INDIA

MAHARASTRA

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

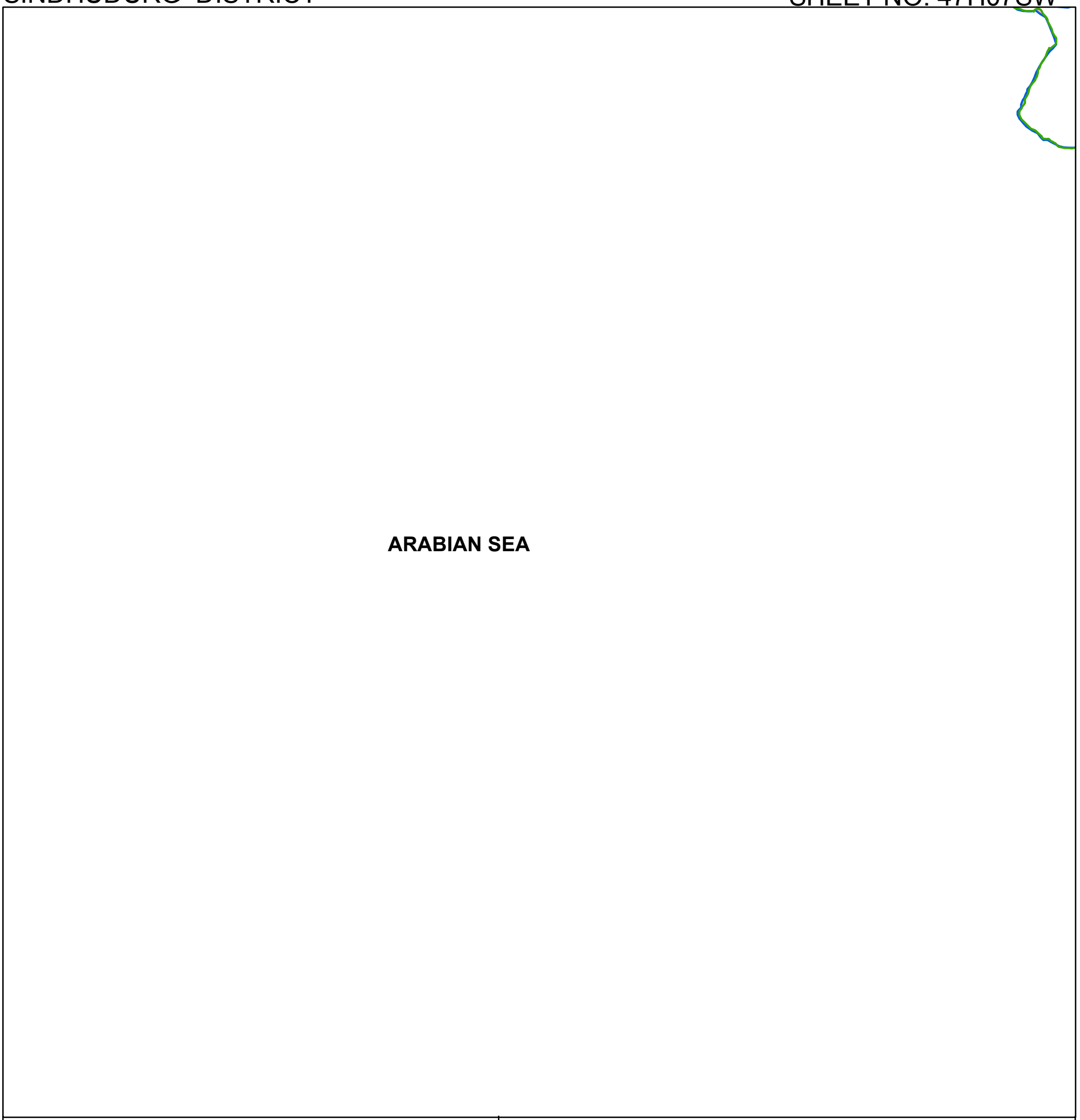
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

SINDHUDURG DISTRICT

SHEET NO. 47H07SW




## Legend

EROSION

ACCRETION

HIGH-TIDE LINE 2004-06

HIGH-TIDE LINE 1989-91

N

W E

S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| SEA | 47H07NW | 47H07NE |
| SEA | | 47H07SE |
| SEA | SEA | 47H08NE |



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

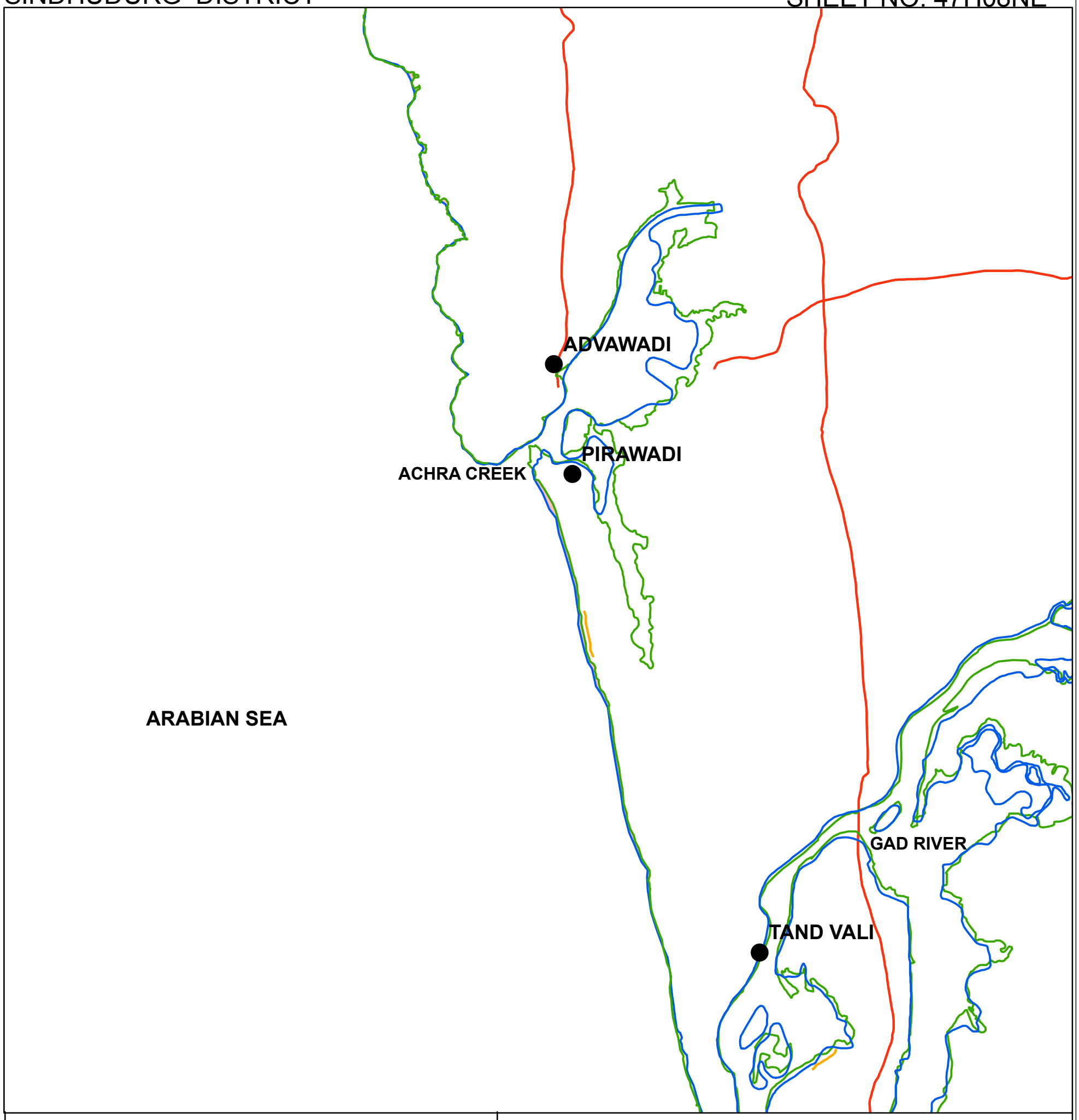
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

SINDHUDURG DISTRICT

SHEET NO. 47H08NE




### Legend

- EROSION
- ACCRETION
- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION
- SEA WALL

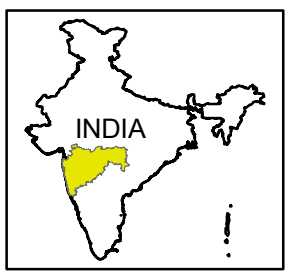
N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 47H07SW | 47H07SE | 47H11SW |
| SEA | | 47H12NW |
| SEA | 47H08SE | 47H12SW |





DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

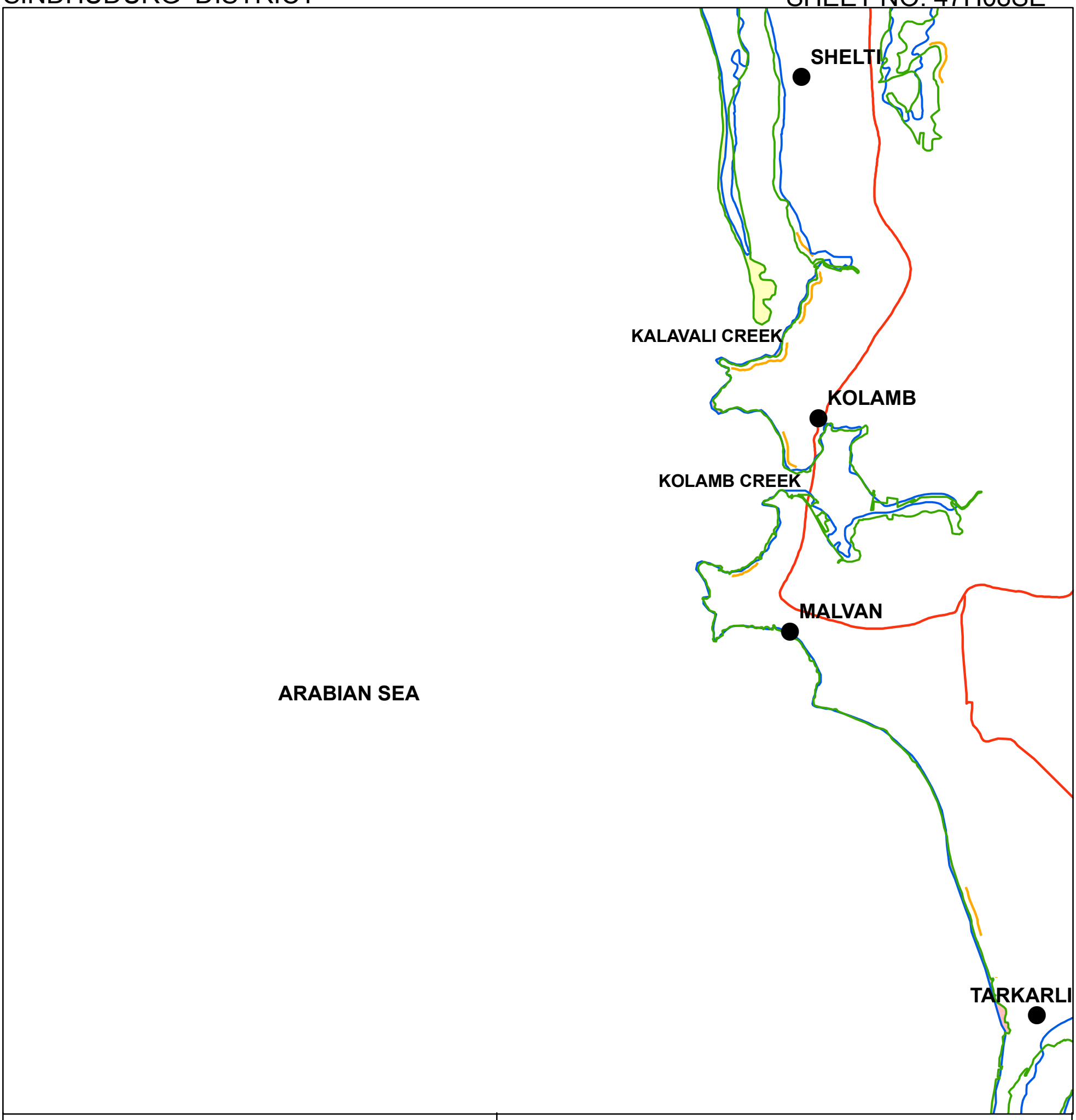
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

SINDHUDURG DISTRICT

SHEET NO. 47H08SE




### Legend

- EROSION
- ACCRETION
- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION
- SEA WALL

N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| SEA | 47H08NE | 47H12NW |
| SEA | | 47H12SW |
| SEA | 48E05NE | 48E09NW |



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

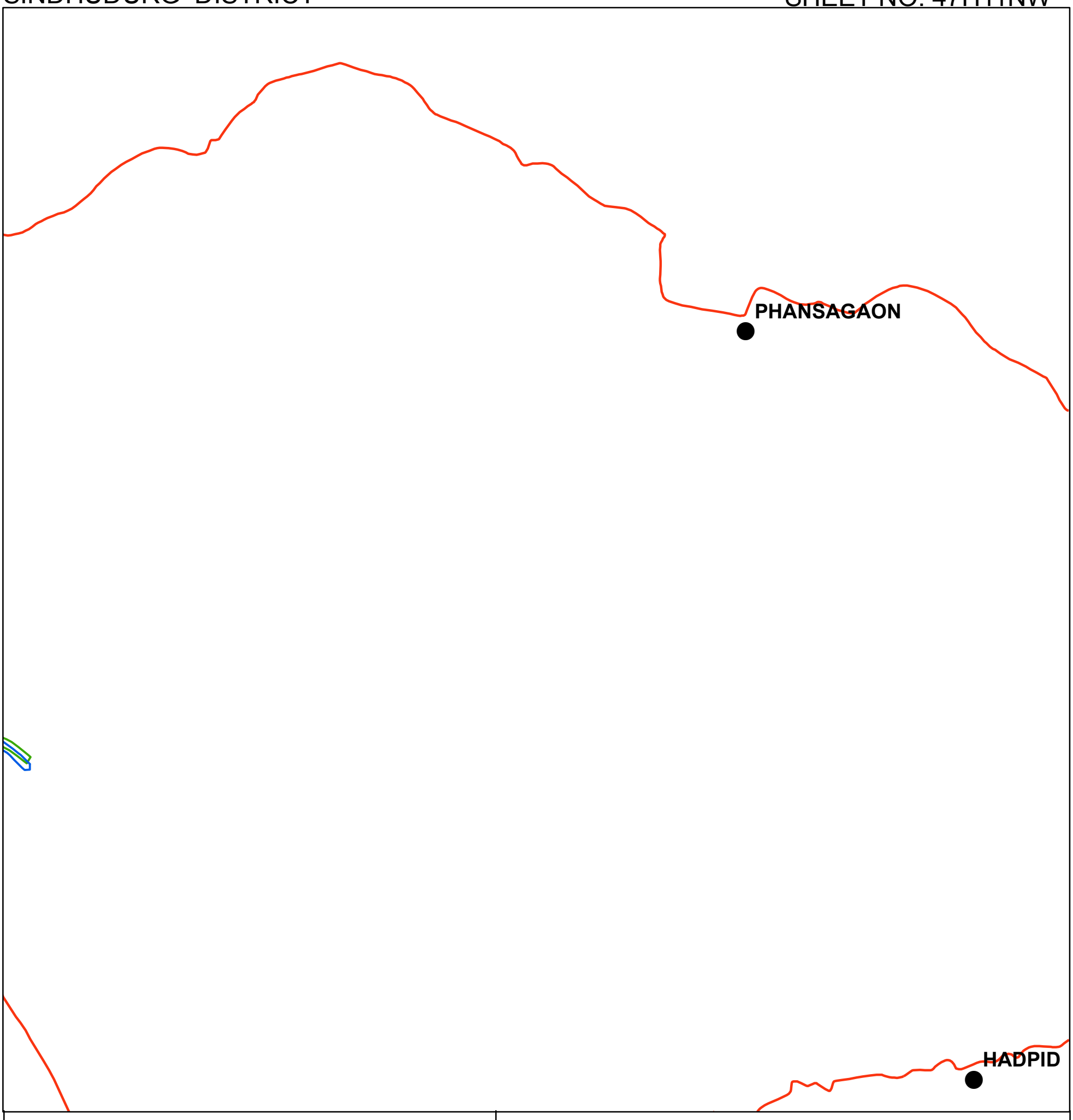
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

SINDHUDURG DISTRICT

SHEET NO. 47H11NW



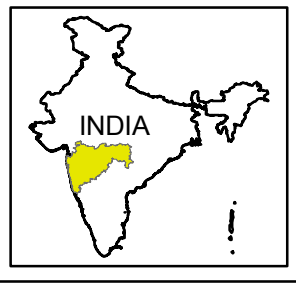

### Legend

- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N
W E
S
0 2
Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 47H06SE | 47H10SW | 47H10SE |
| 47H07NE | | 47H11NE |
| 47H07SE | 47H11SW | 47H11SE |





DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

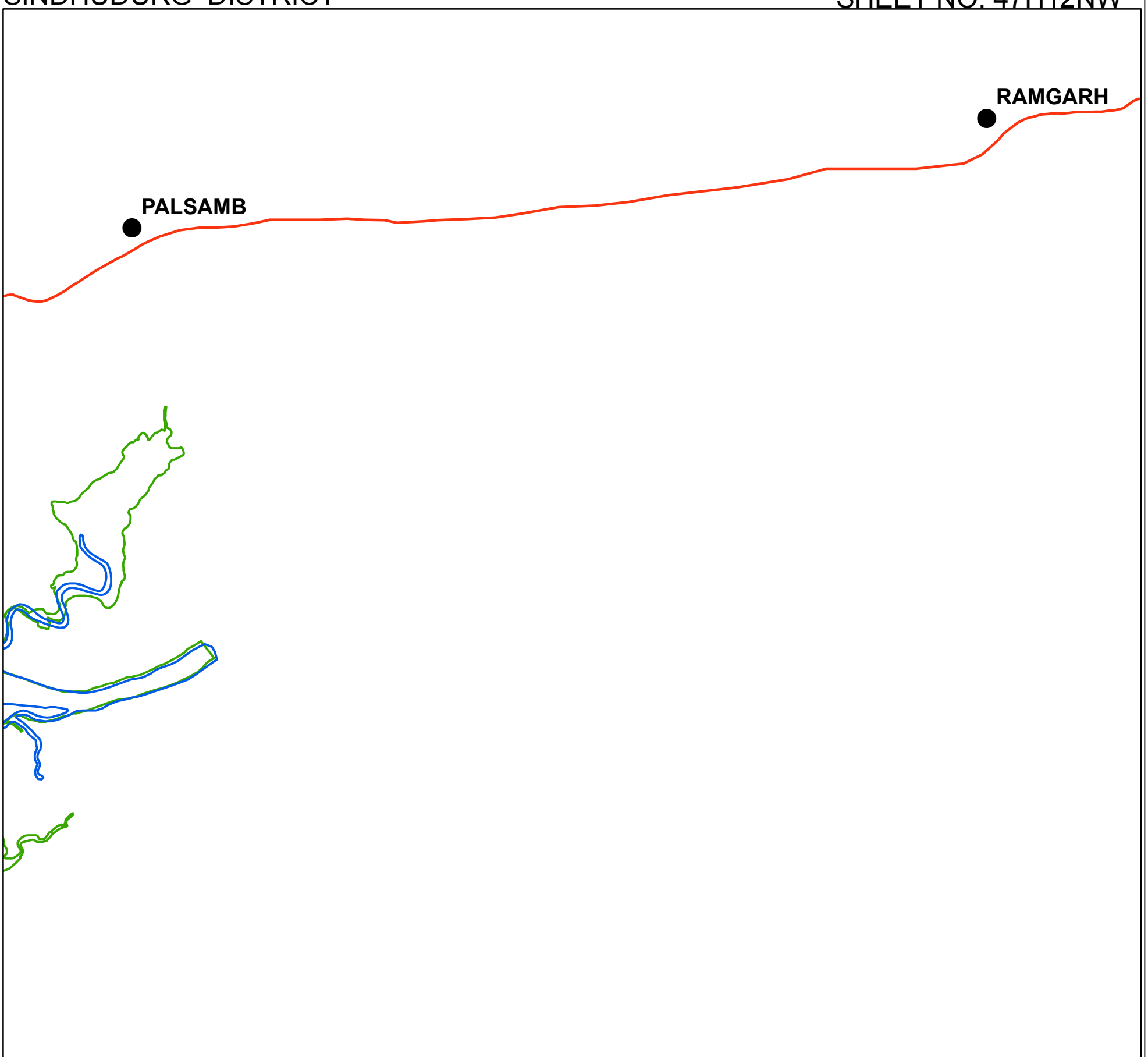
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

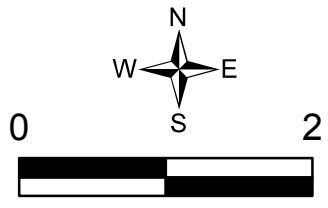
SINDHUDURG DISTRICT

SHEET NO. 47H12NW




### Legend

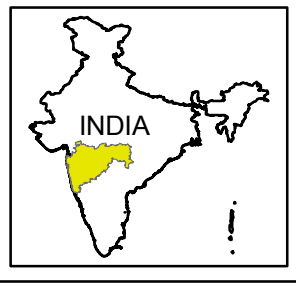
- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

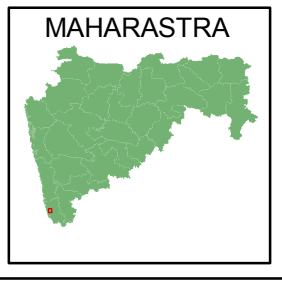



Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 47H07SE | 47H11SW | 47H11SE |
| 47H08NE | | 47H12NE |
| 47H08SE | 47H12SW | 47H12SE |




DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

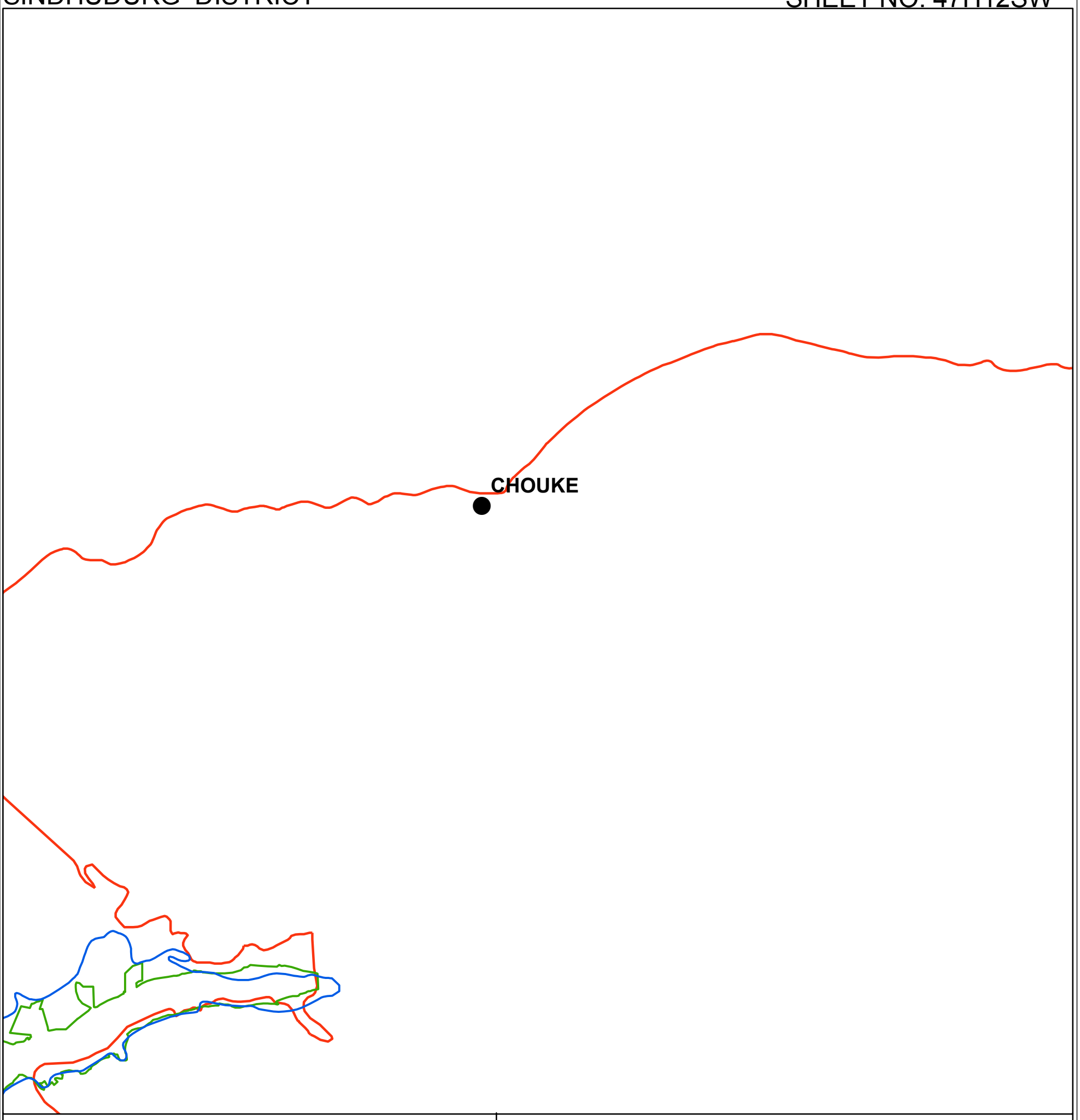
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

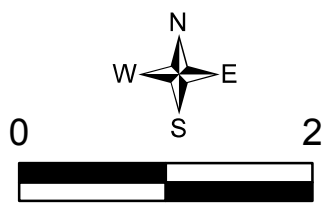
SINDHUDURG DISTRICT

SHEET NO. 47H12SW




## Legend

- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION




INDEX TO SHEETS

| | | |
|---|---|---|
| 47H08NE | 47H12NW | 47H12NE |
| 47H08SE | | 47H12SE |
| 48E05NE | 48E09NW | 48E09NE |



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

SINDHUDURG DISTRICT

SHEET NO. 48E05NE

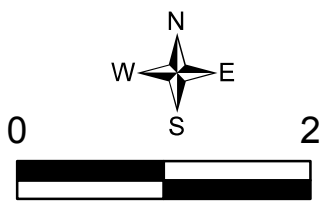
**ARABIAN SEA**

## Legend

ACCRETION

HIGH-TIDE LINE 2004-06

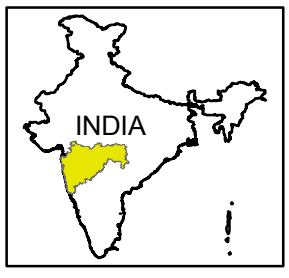
HIGH-TIDE LINE 1989-91




Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| SEA | 47H08SE | 47H12SW |
| SEA | | 48E09NW |
| SEA | SEA | 48E09SW |





DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

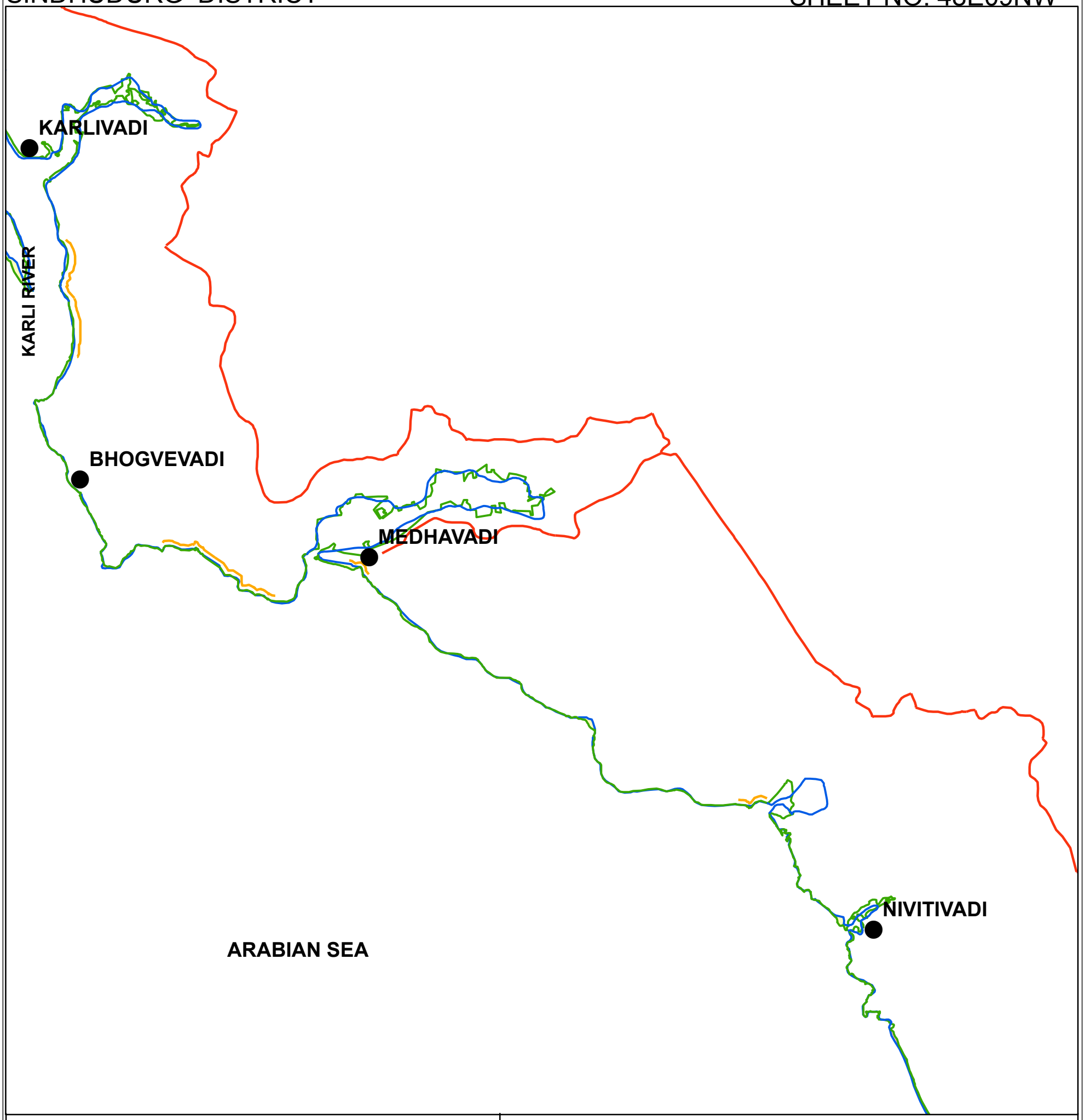
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

SINDHUDURG DISTRICT

SHEET NO. 48E09NW




### Legend

- EROSION
- ACCRETION
- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION
- SEA WALL

N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 47H08SE | 47H12SW | 47H12SE |
| 48E05NE | | 48E09NE |
| SEA | 48E09SW | 48E09SE |



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

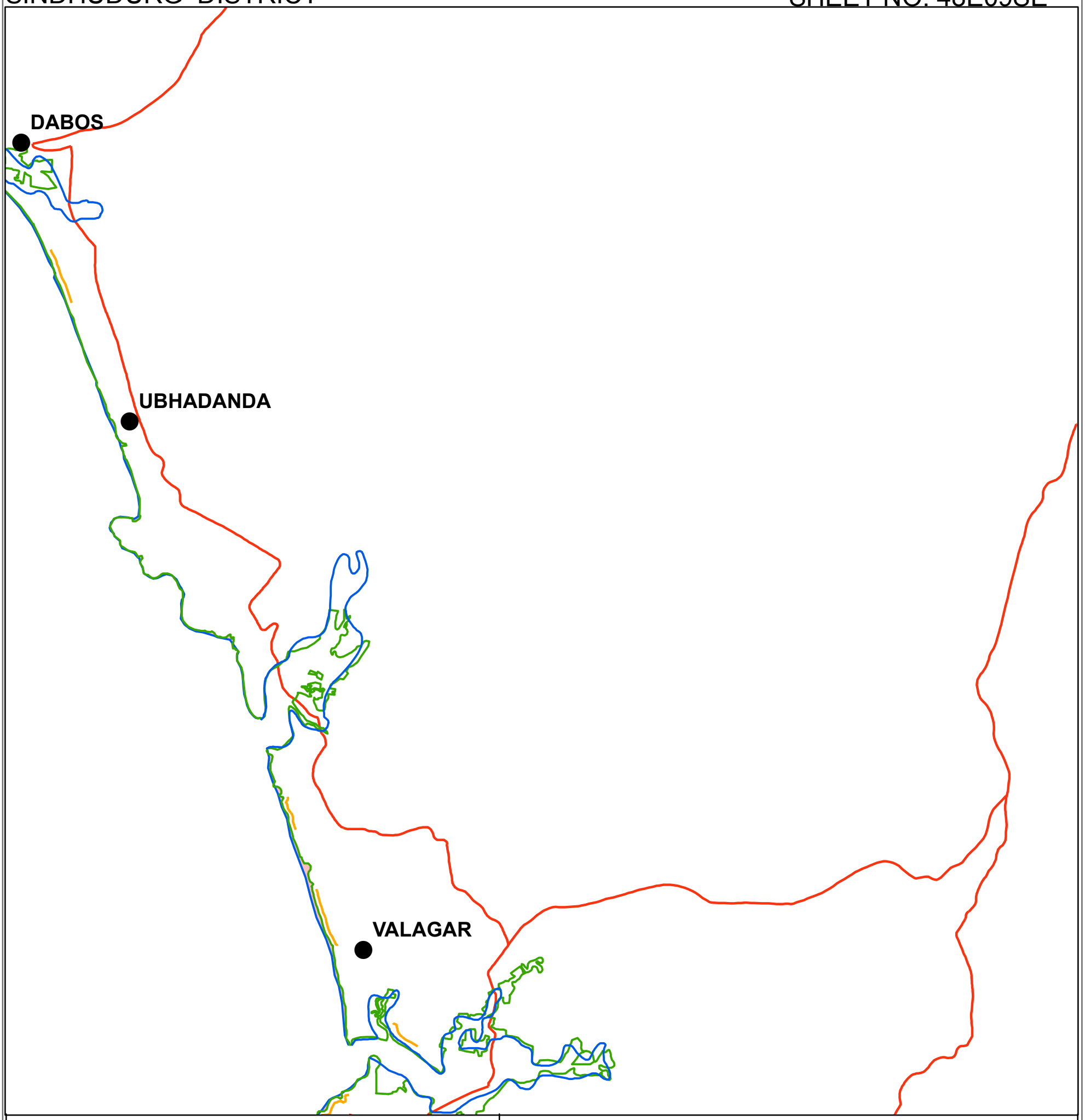
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

SINDHUDURG DISTRICT

SHEET NO. 48E09SE




### Legend

- EROSION
- ACCRETION
- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION
- SEA WALL

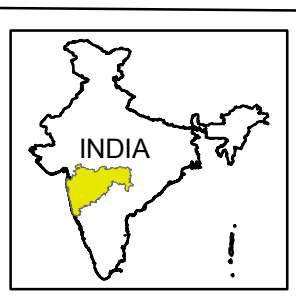
N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 48E09NW | 48E09NE | 48E13NW |
| 48E09SW | | 48E13SW |
| SEA | 48E10NE | SEA |





DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

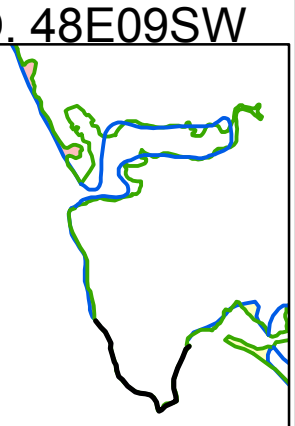
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

SINDHUDURG DISTRICT

SHEET NO. 48E09SW



**ARABIAN SEA**

## Legend

- EROSION
- ACCRETION
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- STABLE LINE

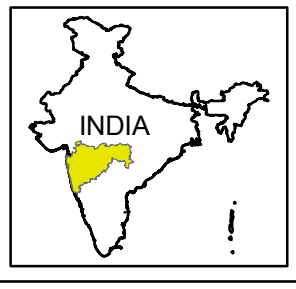
N
W E
S

0 2

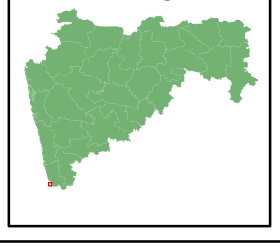
Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 48E05NE | 48E09NW | 48E09NE |
| SEA | | 48E09SE |
| SEA | SEA | 48E10NE |




MAHARASTRA



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

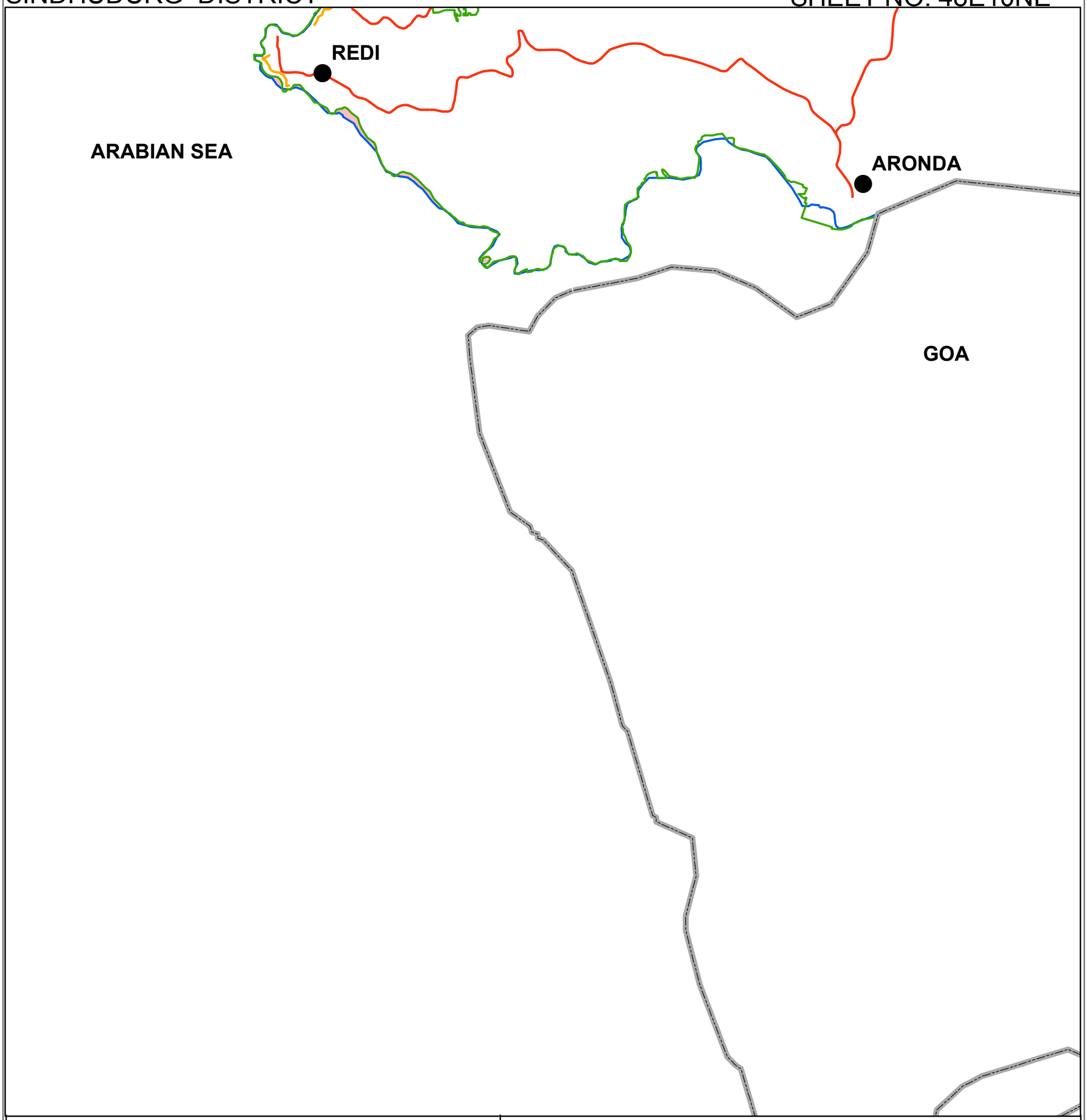
# SHORELINE CHANGE MAP

## MAHARASTRA

FOR OFFICIAL USE ONLY

SINDHUDURG DISTRICT

SHEET NO. 48E10NE




### Legend

- EROSION
- ACCRETION
- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION
- STATE BOUNDARY
- SEA WALL

N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 48E09SW | 48E09SE | 48E13SW |
| SEA | | SEA |
| SEA | SEA | SEA |



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

# SHORELINE CHANGE MAPS

# GOA

# INDEX MAP
# GOA

N
W E
S

48E10NE 48E14NW 48E14NE

CHAPORA

48E10SE 48E14SW 48E14SE 48I02SW

PANAJI

48E15NW 48E15NE 48I03NW

DABOLIM

ARABIAN SEA

48E15SW 48E15SE 48I03SW 48I03SE

MADGAON

48E16NE 48I04NW 48I04NE

48E16SE 48I04SW

48J01NW

INDIA

GOA

MAHARASHTRA

GOA

ARABIAN SEA

KARNATAKA

107

# SHORELINE CHANGES OF GOA

N

CHAPORA

Mandovi River

PANAJI

Zuari River

DABOLIM

ARABIAN SEA

MADGAON

INDIA

GOA

LEGEND

ERODING COAST

ACCRETING COAST

STABLE COAST

HTL 2004-2006

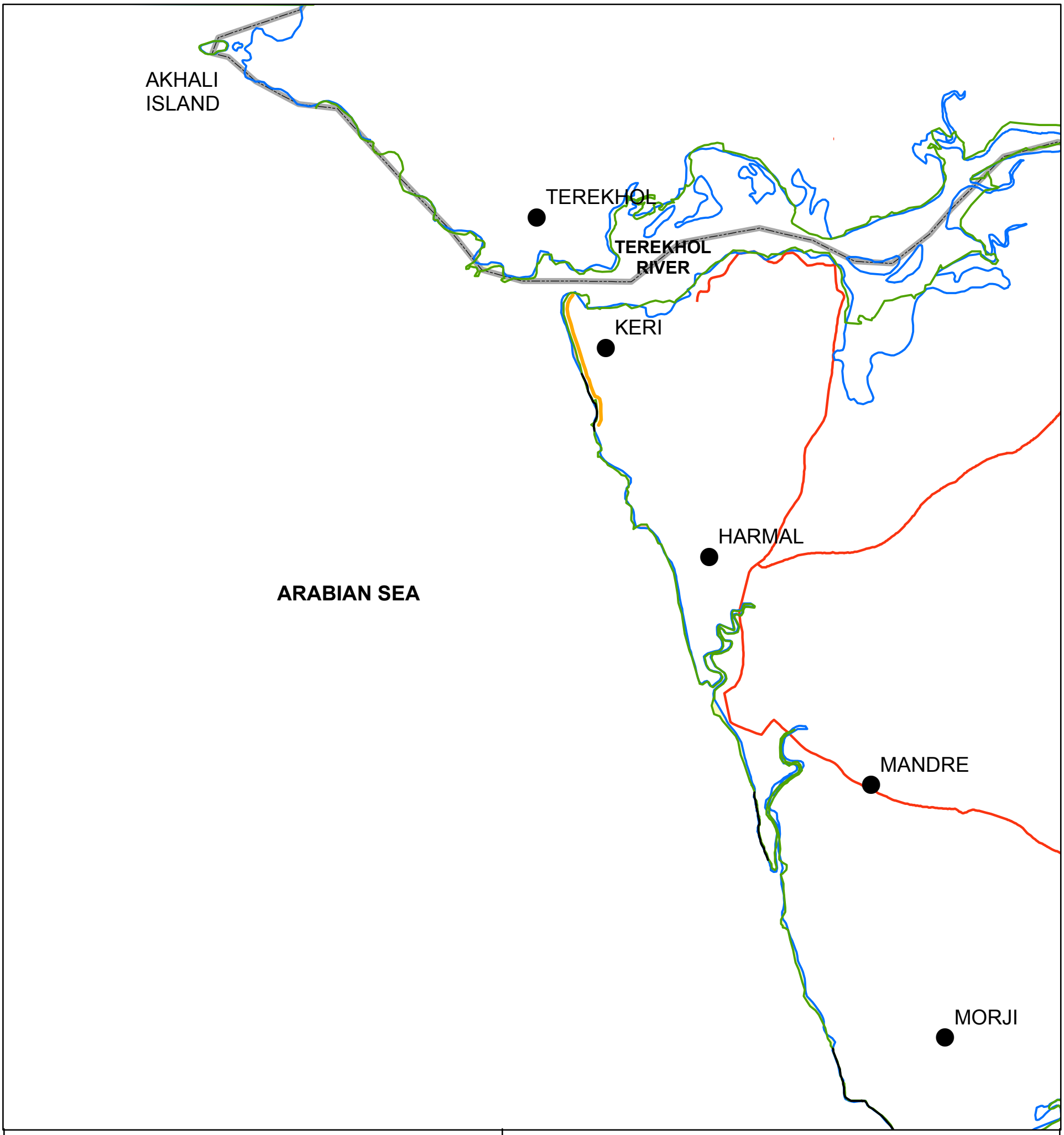
# SHORELINE CHANGE MAP

## GOA

FOR OFFICIAL USE ONLY

NORTH GOA DISTRICT

SHEET NO. 48E10NE




### Legend

- EROSION
- ACCRETION
- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- STABLE
- SEAWALL
- STATE BOUNDARY
- HABITATION

N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| SEA | 48E09 SE | 48E13 SW |
| SEA | | 48E14 NW |
| SEA | 48E10 SE | 48E14 SW |



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

# SHORELINE CHANGE MAP

## GOA

FOR OFFICIAL USE ONLY

NORTH GOA DISTRICT

SHEET NO. 48E14NW

SATARDA

DEUS

KAUTHANA

PERNEM

**CHAPORA RIVER**

CHIKLI

KAMURTI

PROPDA

### Legend

- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N

W E

S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 48E09 SE | 48E13 SW | 48E13 SE |
| 48E10 NE | | 48E14 NE |
| 48E10 SE | 48E14 SW | 48E14 SE |

INDIA

GOA

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

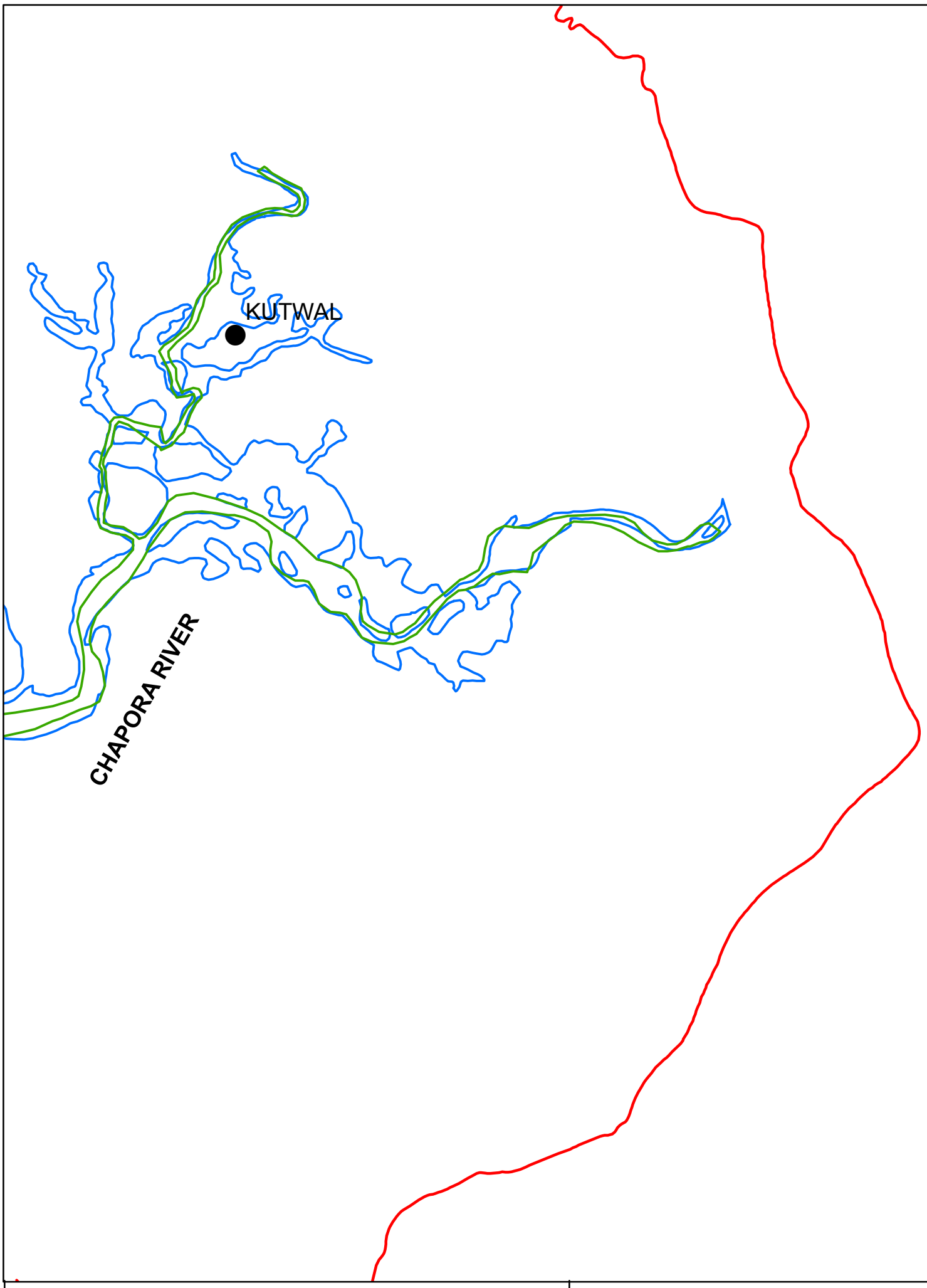
# SHORELINE CHANGE MAP

## GOA

FOR OFFICIAL USE ONLY

NORTH GOA DISTRICT

SHEET NO. 48E14NE



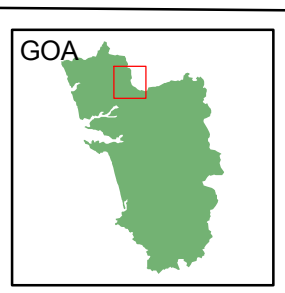

### Legend

- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N
W E
S
0 2
Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 48E13 SW | 48E13 SE | 48I01 SW |
| 48E14 NW | | 48I02 NW |
| 48E14 SW | 48E14 SE | 48I02 SW |


DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

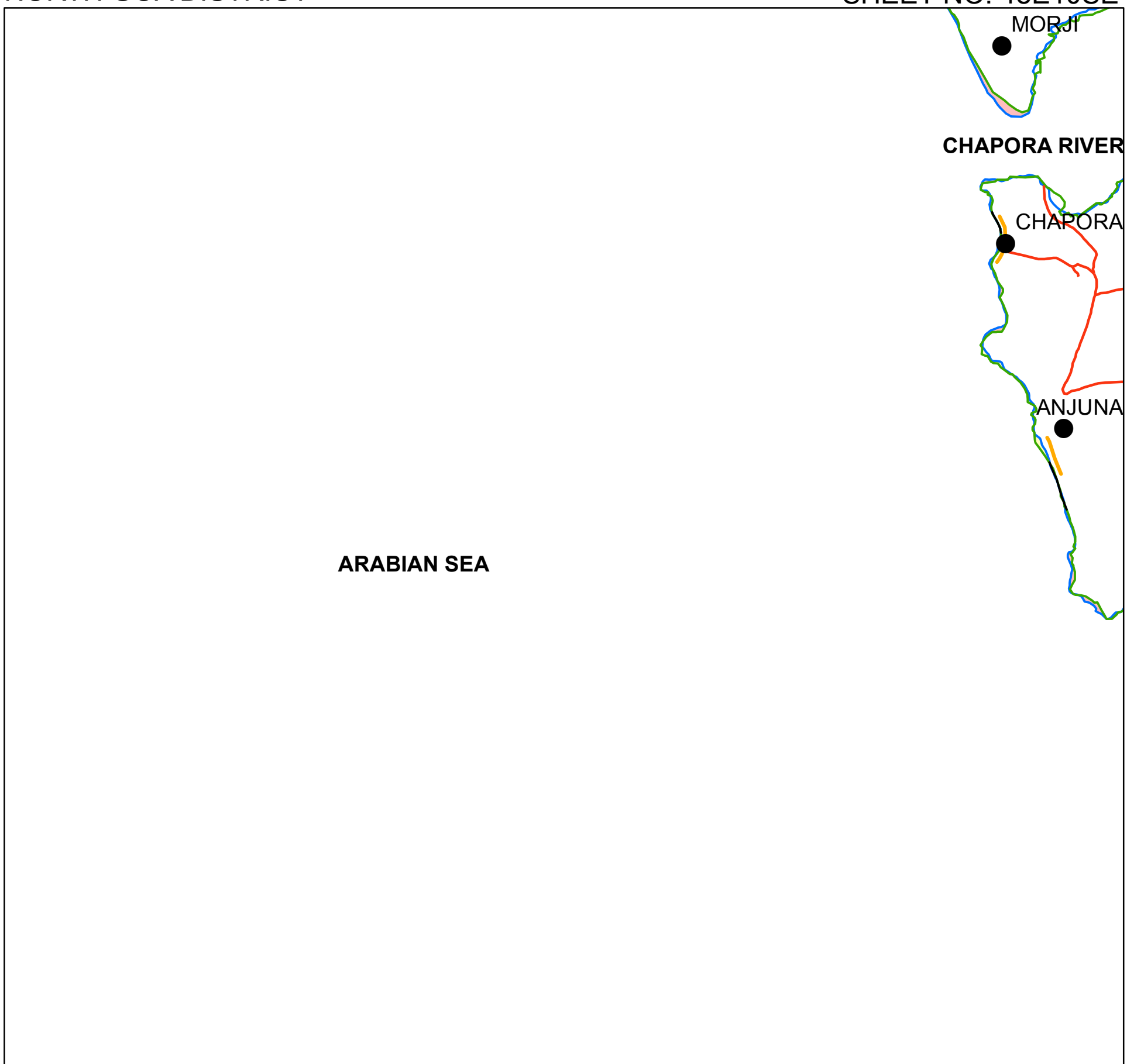
# SHORELINE CHANGE MAP

## GOA

FOR OFFICIAL USE ONLY

NORTH GOA DISTRICT

SHEET NO. 48E10SE




### Legend

- EROSION
- ACCRETION
- STABLE
- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- SEAWALL
- HABITATION

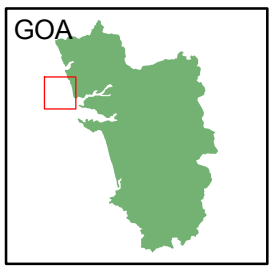
N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| SEA | 48E10 NE | 48E14 NW |
| SEA | | 48E14 SW |
| SEA | SEA | 48E15 NW |


DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

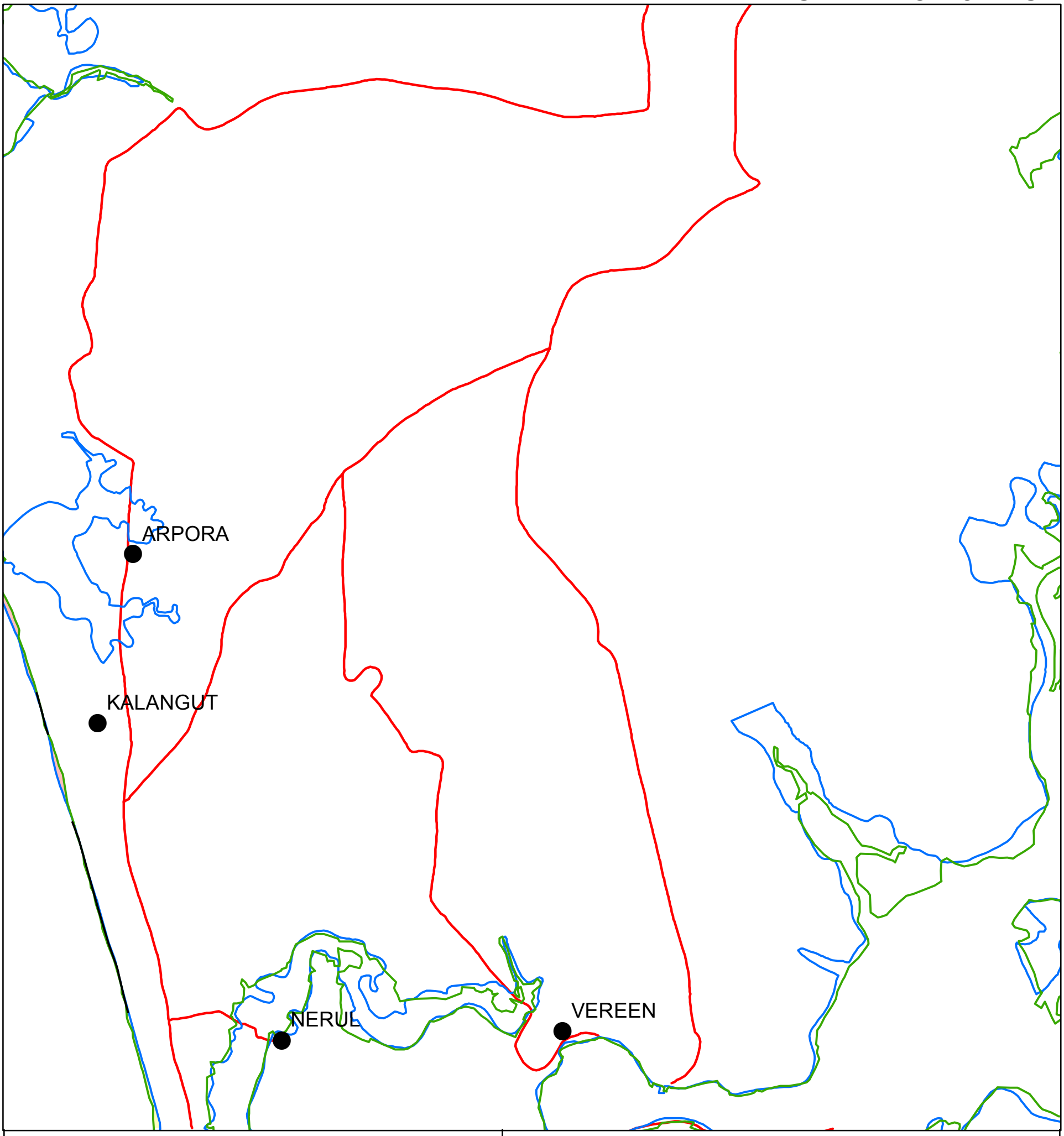
# SHORELINE CHANGE MAP

## GOA

FOR OFFICIAL USE ONLY

NORTH GOA DISTRICT

SHEET NO. 48E14SW




### Legend

- EROSION
- ACCRETION
- ROAD
- STABLE
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N
W E
S
0 2
Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 48E10 NE | 48E14 NW | 48E14 NE |
| 48E10 SE | | 48E14 SE |
| SEA | 48E15 NW | 48E15 NE |



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

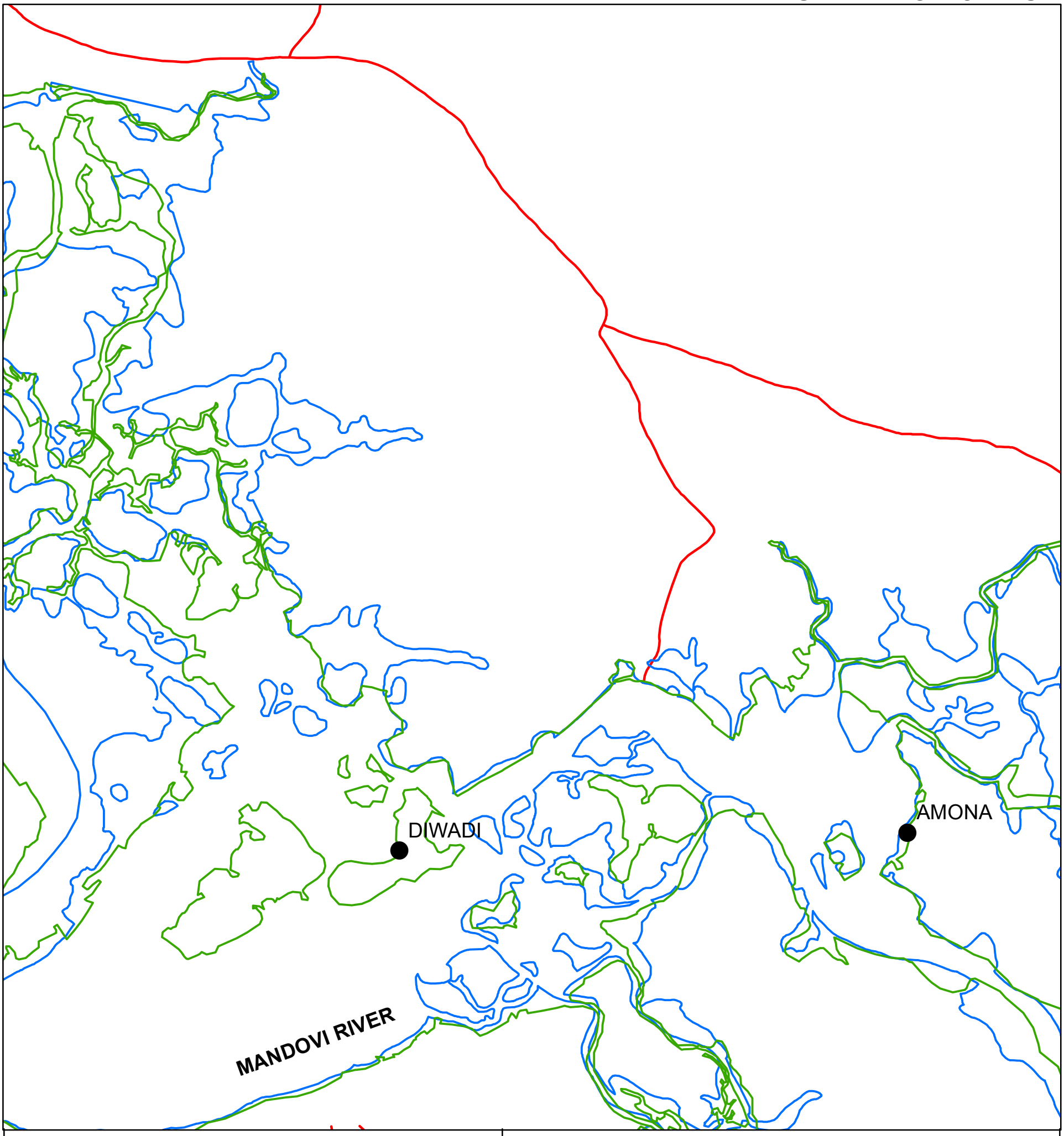
# SHORELINE CHANGE MAP

## GOA

FOR OFFICIAL USE ONLY

NORTH GOA DISTRICT

SHEET NO. 48E14SE




### Legend

- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N
W E
S
0 2
Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 48E14 NW | 48E14 NE | 48I02 NW |
| 48E14 SW | | 48I02 SW |
| 48E15 NW | 48E15 NE | 48I03 NW |



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

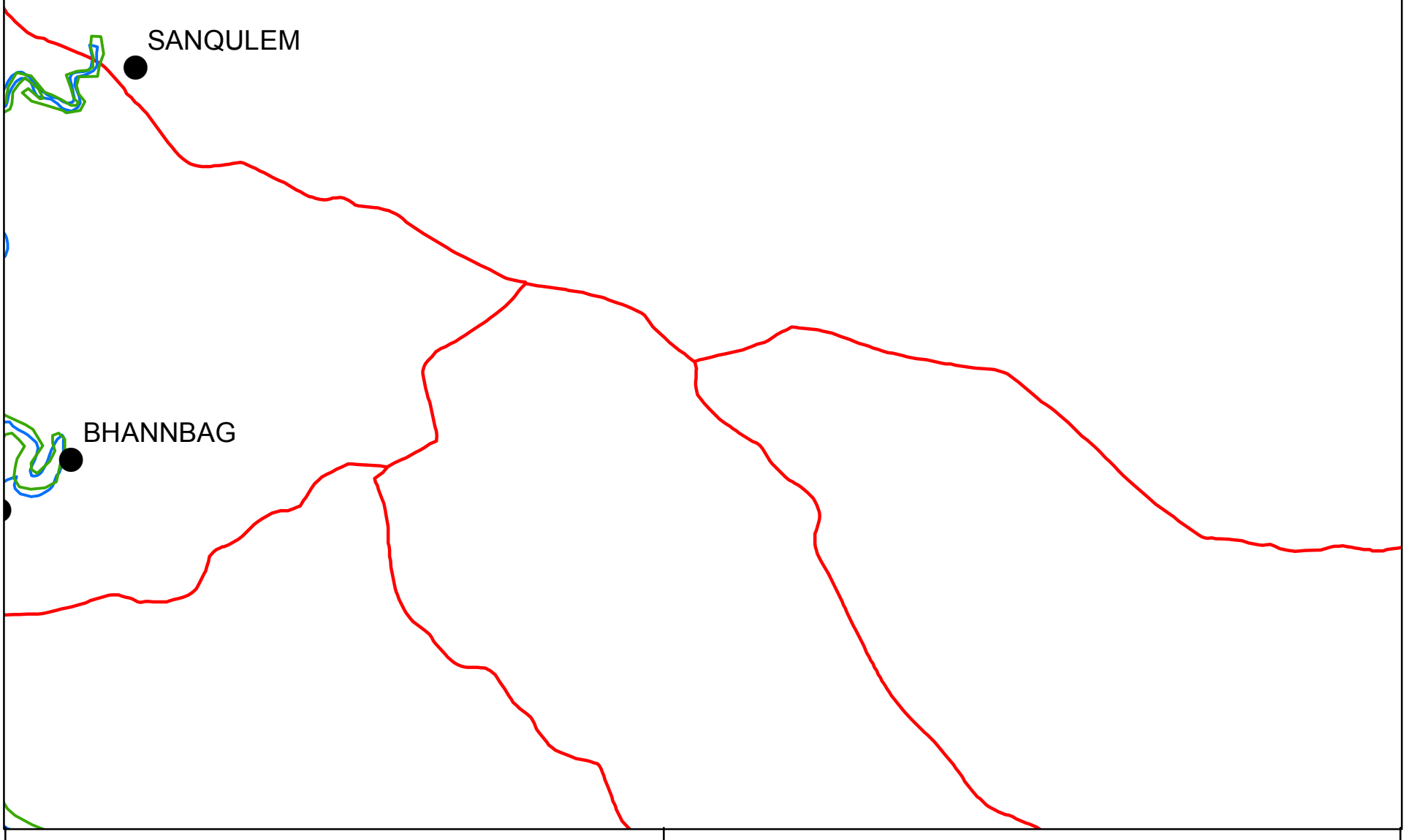
# SHORELINE CHANGE MAP

## GOA

FOR OFFICIAL USE ONLY

NORTH GOA DISTRICT

SHEET NO. 48I02SW




### Legend

- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 48E14 NE | 48I02 NW | 48I02 NE |
| 48E14 SE | | 48I02 SE |
| 48E15 NE | 48I03 NW | 48I03 NE |

INDIA

GOA

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

# SHORELINE CHANGE MAP

## GOA

FOR OFFICIAL USE ONLY

NORTH GOA DISTRICT

SHEET NO. 48E15NW

SHINIKEN

MANDOVI RIVER

PANAJI

AGUADA BAY

KARANJNALEN

DON PAOL

MORGADU

MARMAGAO BAY

CHIKALIN

JASIARU ISLAND

KAMBARIAN IS.

VASCO DA GAMA

BOBDAN

DABOLIN

DABOLIMRS

PIKENE IS.

DABOLIM AERODROME

### Legend

- EROSION
- ACCRETION
- ROAD
- RAILWAY
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- JETTY
- SEAWALL
- HABITATION

N

W E

S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 48E10 SE | 48E14 SW | 48E14 SE |
| SEA | | 48E15 NE |
| SEA | 48E15 SW | 48E15 SE |

INDIA

GOA

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

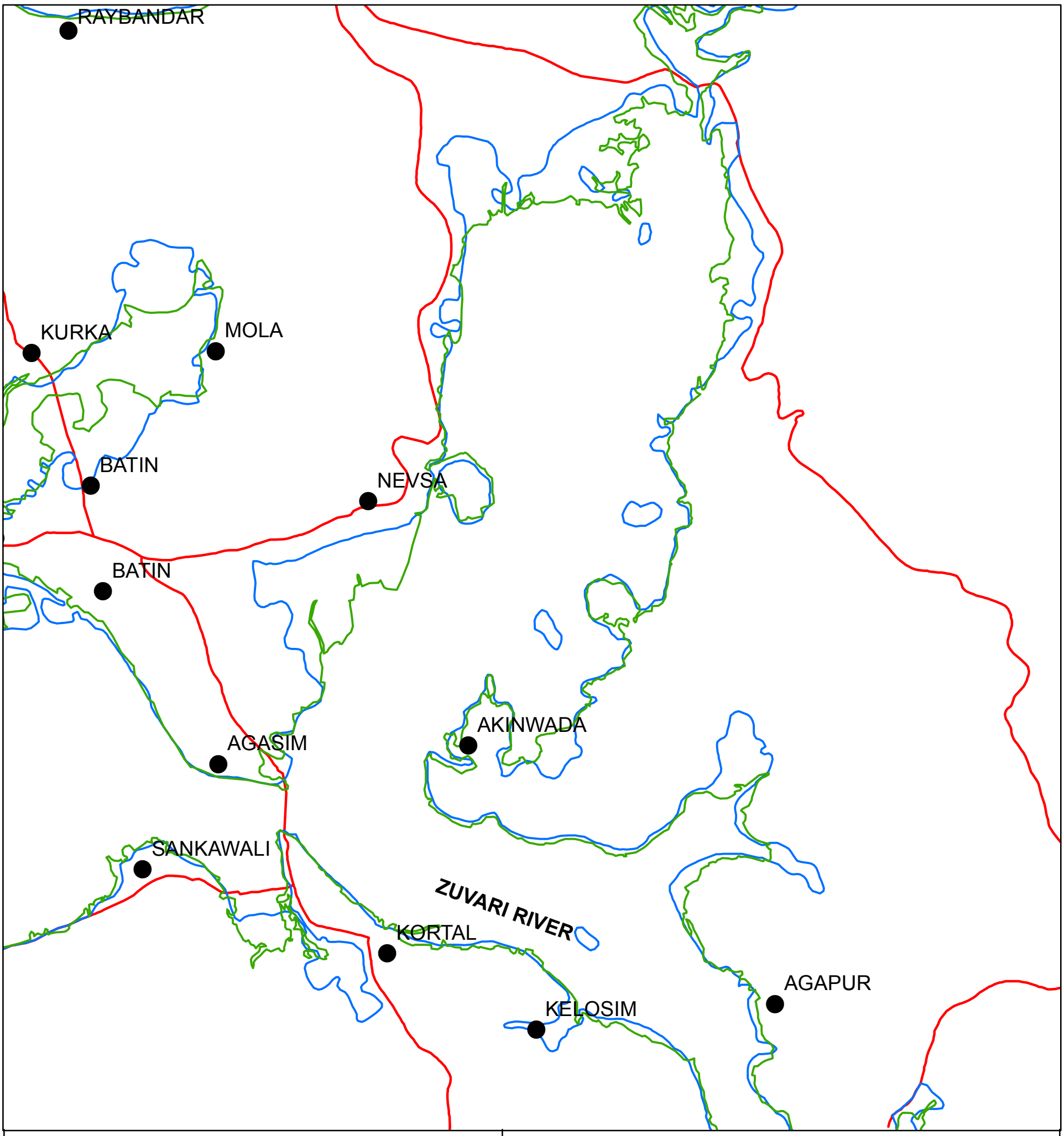
# SHORELINE CHANGE MAP

## GOA

NORTH GOA DISTRICT

FOR OFFICIAL USE ONLY

SHEET NO. 48E15NE




## Legend

- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 48E14 SW | 48E14 SE | 48I02 SW |
| 48E15 NW | | 48I03 NW |
| 48E15 SW | 48E15 SE | 48I03 SW |



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

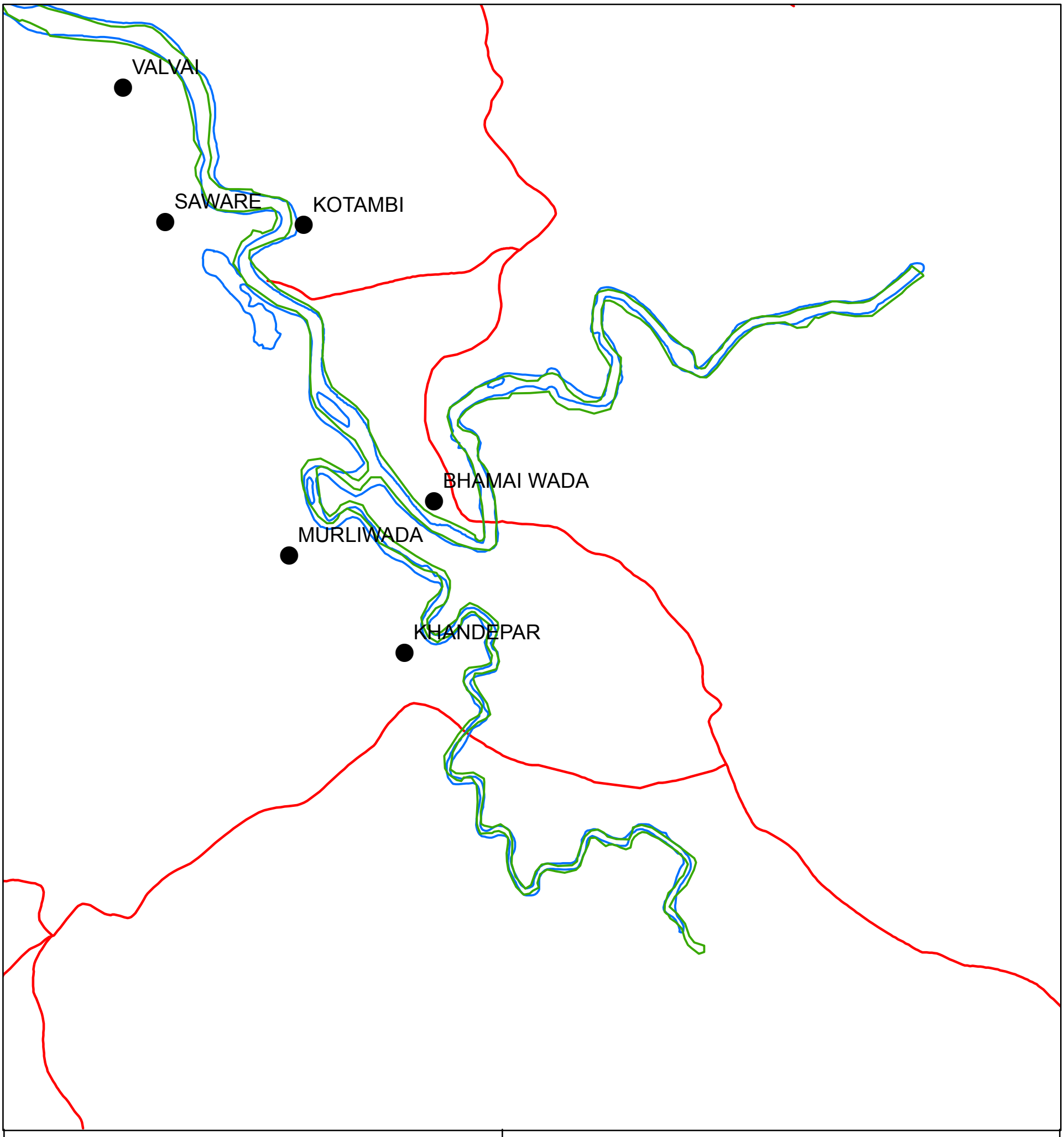
# SHORELINE CHANGE MAP

## GOA

FOR OFFICIAL USE ONLY

NORTH GOA DISTRICT

SHEET NO. 48I03NW




### Legend

- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 48E14 SE | 48I02 SW | 48I02 SE |
| 48E15 NE | | 48I03 NE |
| 48E15 SE | 48I03 SW | 48I03 SE |



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

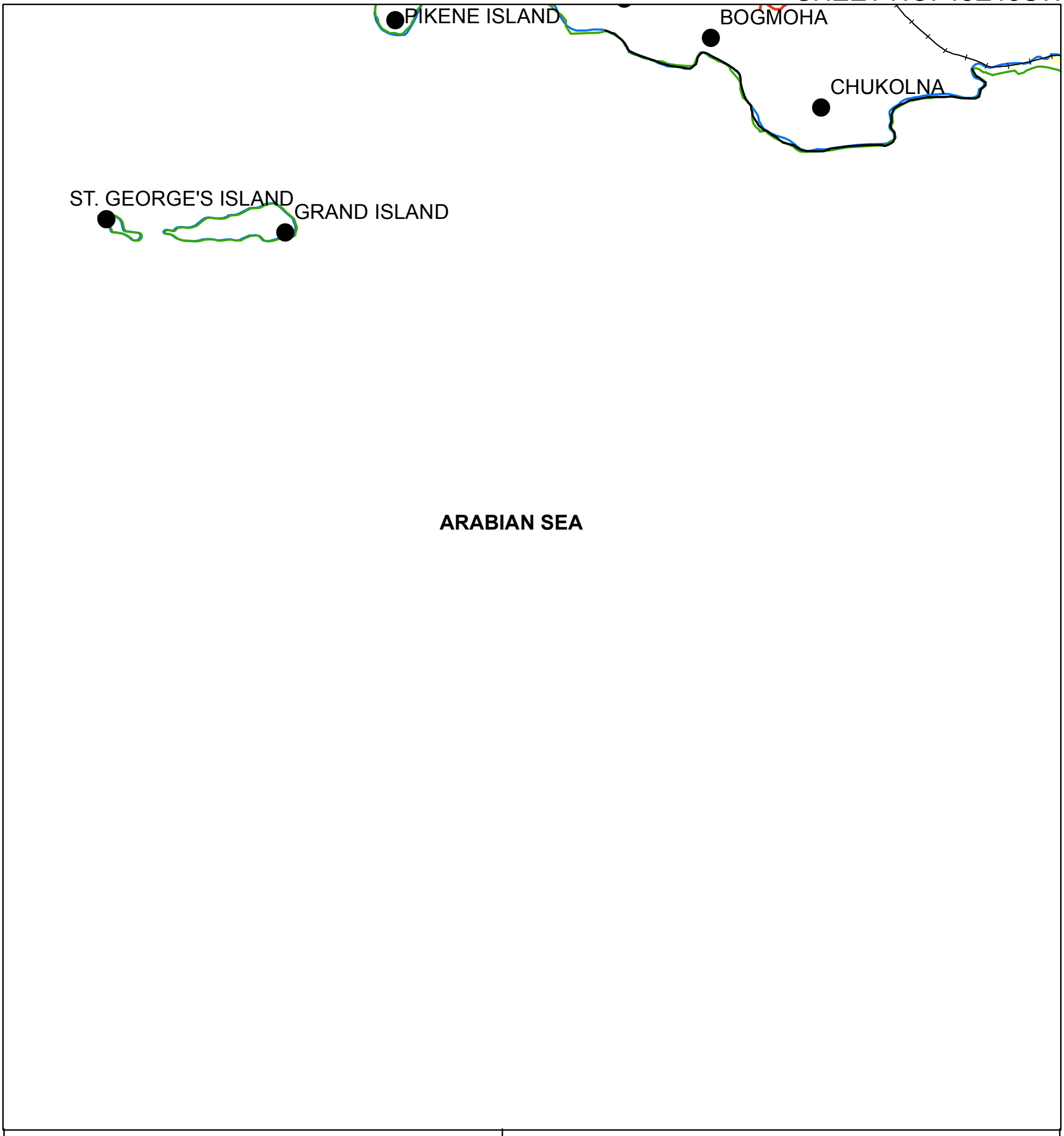
# SHORELINE CHANGE MAP

## GOA

FOR OFFICIAL USE ONLY

NORTH GOA DISTRICT

SHEET NO. 48E15SW




**ARABIAN SEA**

## Legend

- EROSION
- ACCRETION
- RAILWAY
- ROAD
- STABLE
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

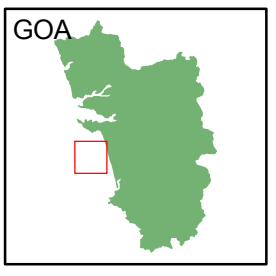
N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| SEA | 48E15 NW | 48E15 NE |
| SEA | | 48E15 SE |
| SEA | SEA | 48E16 NE |


DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

# SHORELINE CHANGE MAP

## GOA

FOR OFFICIAL USE ONLY

SOUTH GOA DISTRICT

SHEET NO. 48E15SE

ADPAL

BORI

KARVHOL

KIMSAVLIM RS.

AROSIN

MAJORDA

ARABIAN SEA

KOLVA

SERNABALIM

MADGAON

### Legend

- EROSION
- ACCRETION
- ROAD
- RAILWAY
- STABLE
- HABITATION
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91

* ANTI SEA EROSION WORKS:
BETALBATIM-SALCETE (800 m),
MAJORDA-SALCETE (700 m).

N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 48E15 NW | 48E15 NE | 48I03 NW |
| 48E15 SW | | 48I03 SW |
| SEA | 48E16 NE | 48I04 NW |

INDIA

GOA

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

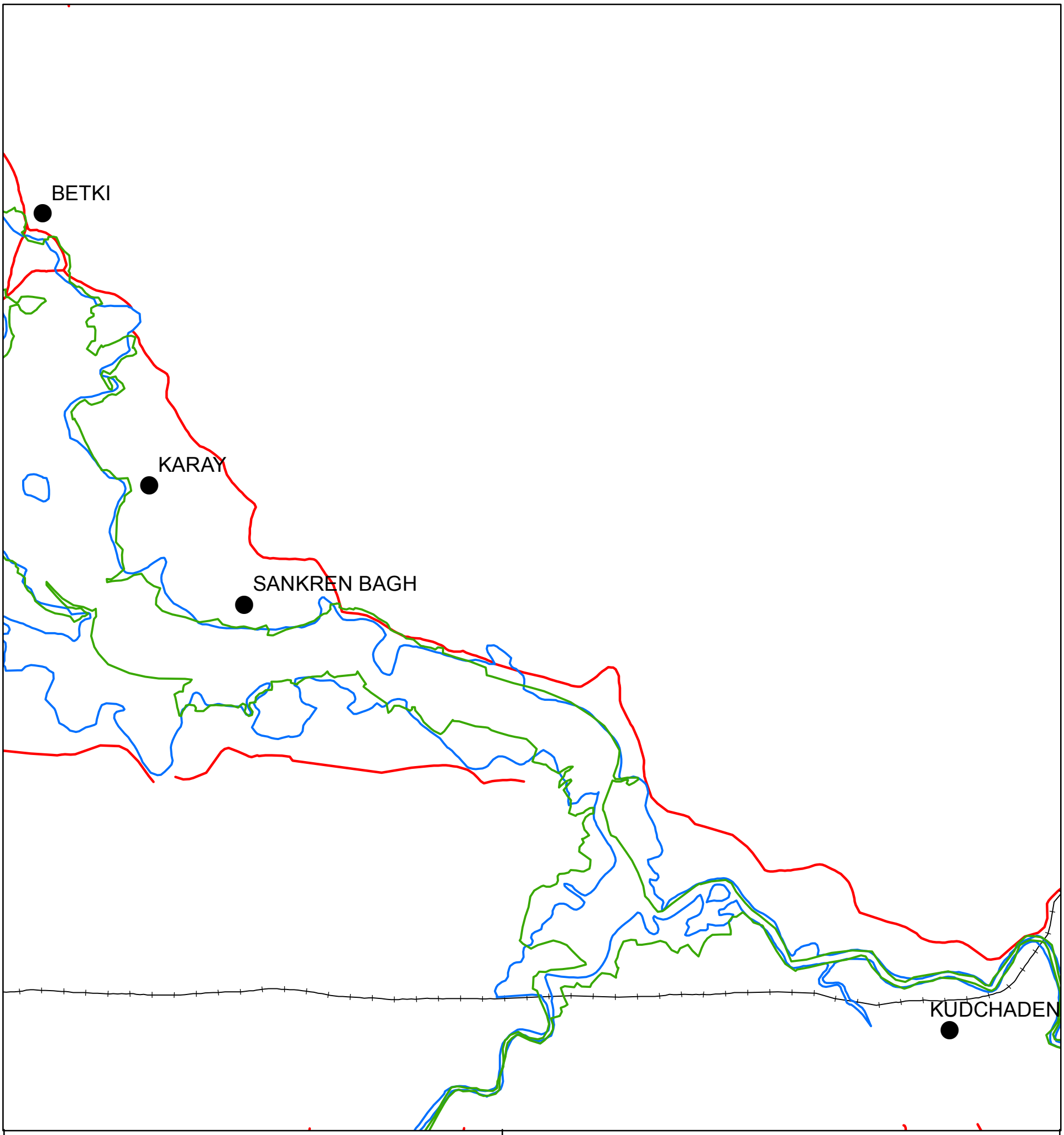
# SHORELINE CHANGE MAP

## GOA

FOR OFFICIAL USE ONLY

NORTH GOA DISTRICT

SHEET NO. 48I03SW




### Legend

- RAILWAY
- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

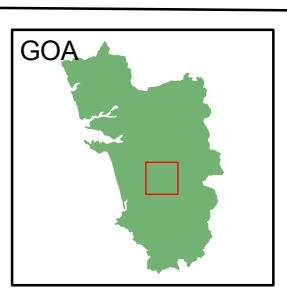
N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 48E15 NE | 48I03 NW | 48I03 NE |
| 48E15 SE | | 48I03 SE |
| 48E16 NE | 48I04 NW | 48I04 NE |


DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

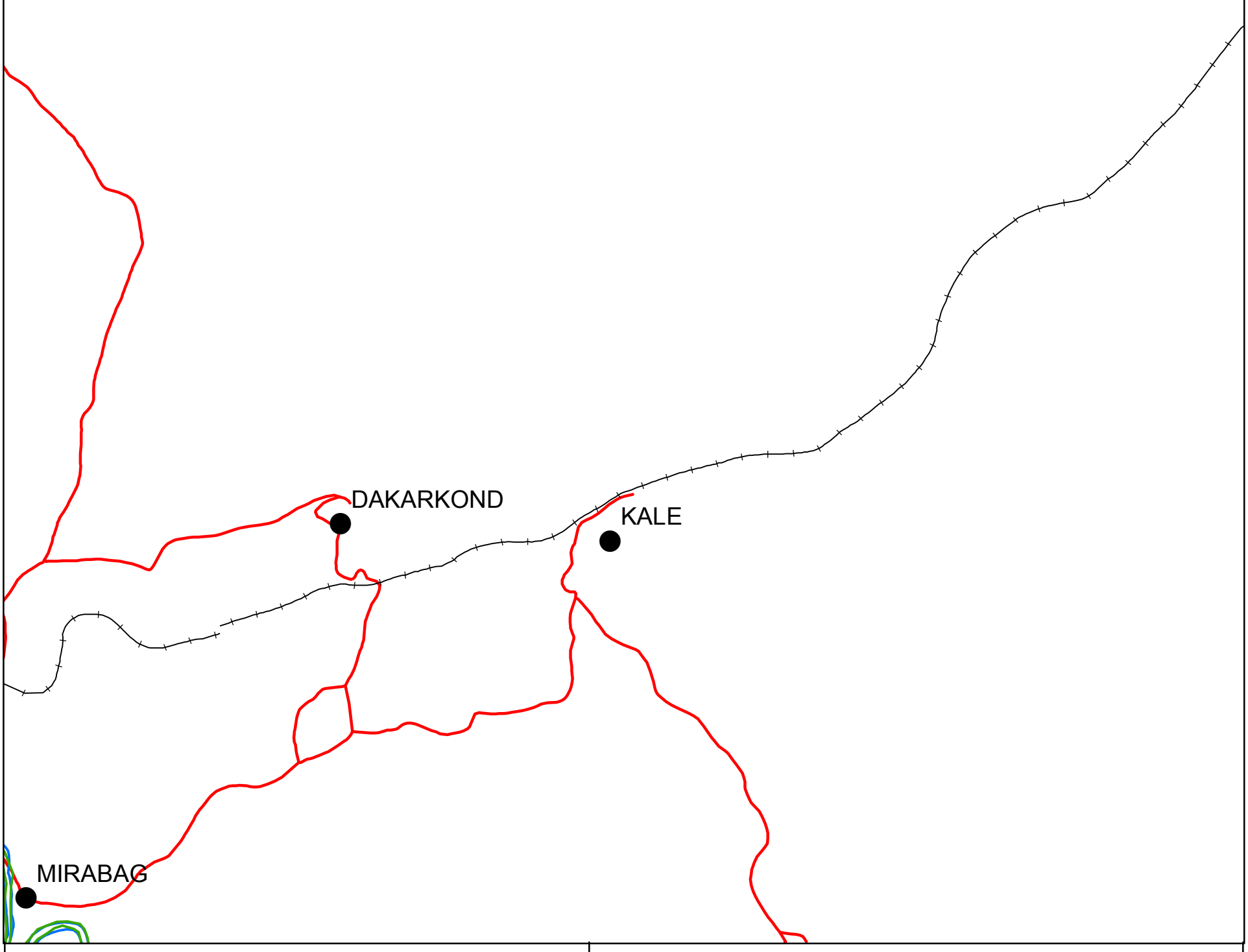
# SHORELINE CHANGE MAP

## GOA

FOR OFFICIAL USE ONLY

NORTH GOA DISTRICT

SHEET NO. 48I03SE




### Legend

- RAILWAY
- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N
W E
S
0 2
Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 48I03 NW | 48I03 NE | 48I07 NW |
| 48I03 SW | | 48I07 SW |
| 48I04 NW | 48I04 NE | 48I08 NW |



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

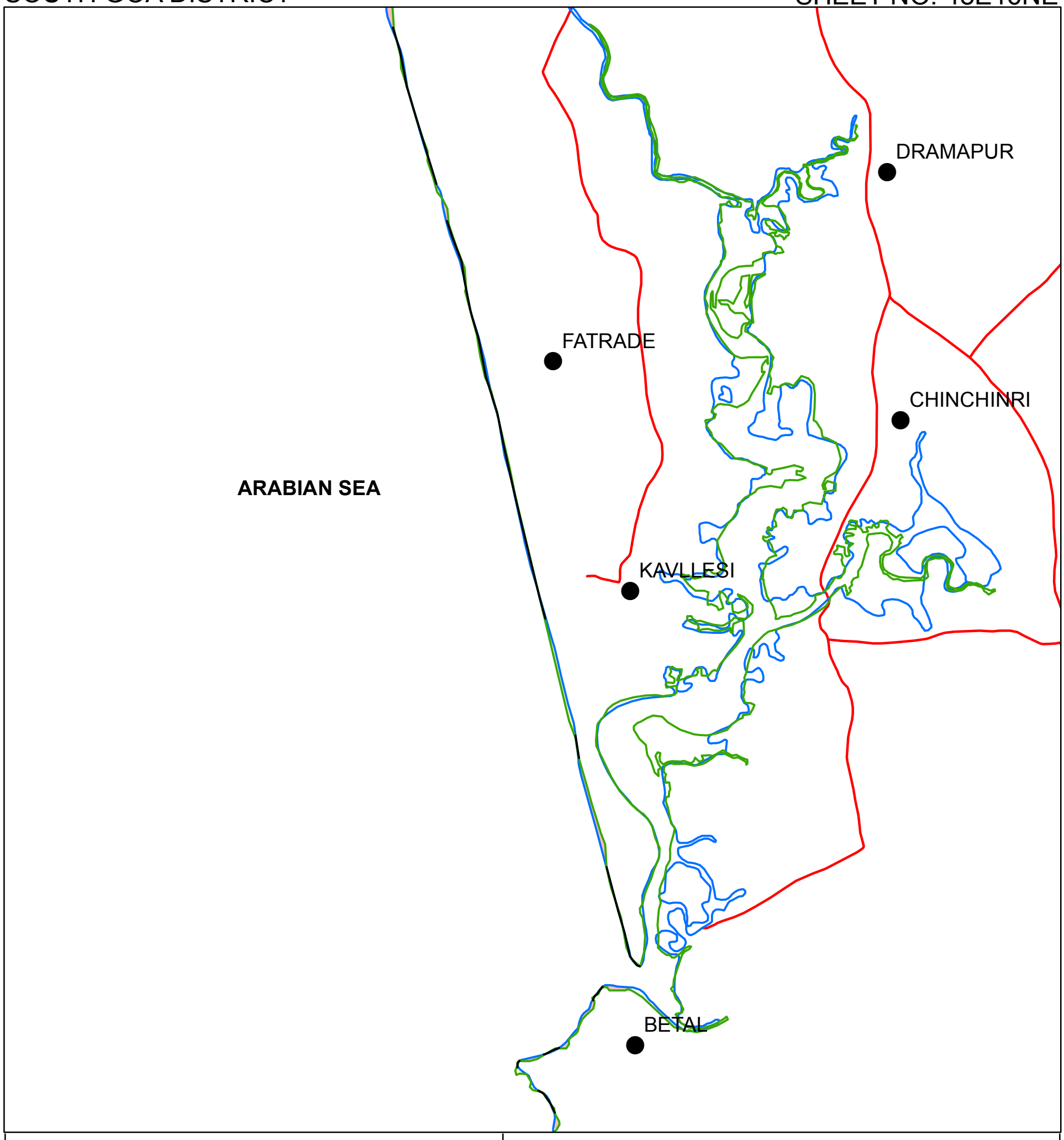
# SHORELINE CHANGE MAP

## GOA

FOR OFFICIAL USE ONLY

SOUTH GOA DISTRICT

SHEET NO. 48E16NE




## Legend

- EROSION
- ACCRETION
- ROAD
- STABLE
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 48E15 SW | 48E15 SE | 48I03 SW |
| SEA | | 48I04 NW |
| SEA | 48E16 SE | 48I04 SW |



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

इसरो isro

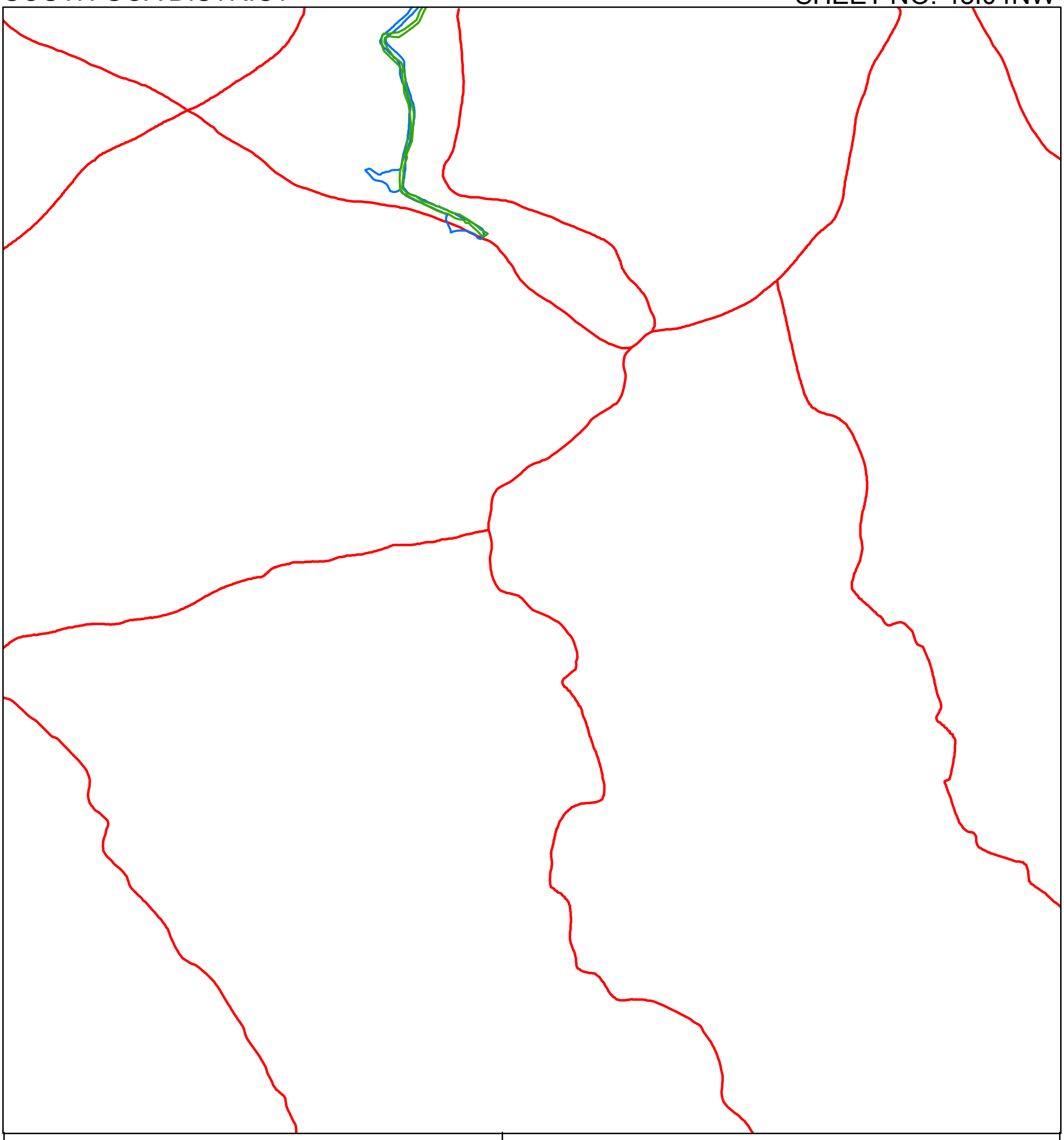
# SHORELINE CHANGE MAP

## GOA

FOR OFFICIAL USE ONLY

SOUTH GOA DISTRICT

SHEET NO. 48I04NW



## Legend

- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 48E15 SE | 48I03 SW | 48I03 SE |
| 48E16 NE | | 48I04 NE |
| 48E16 SE | 48I04 SW | 48I04 SE |

INDIA

GOA

DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

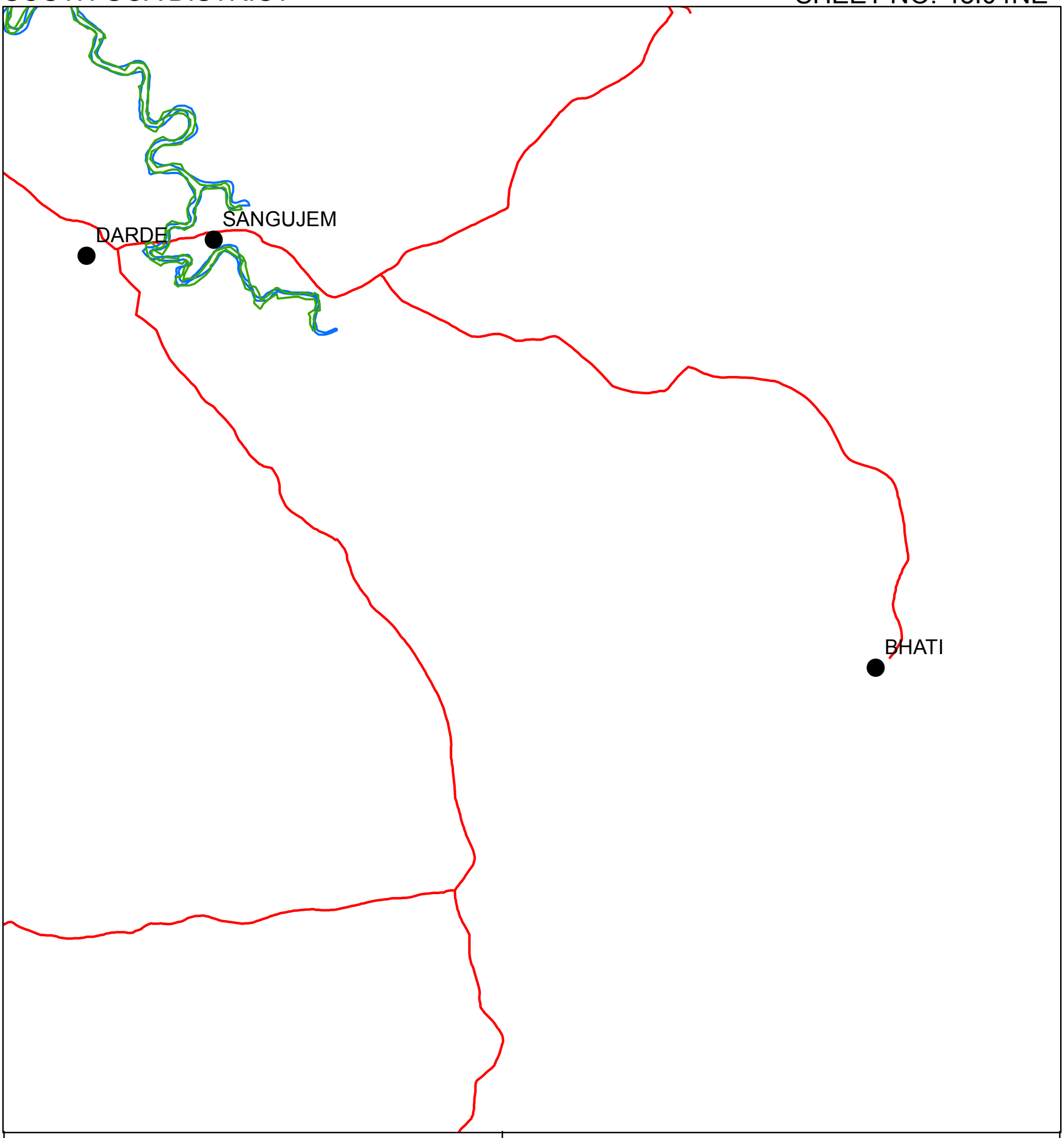
# SHORELINE CHANGE MAP

## GOA

FOR OFFICIAL USE ONLY

SOUTH GOA DISTRICT

SHEET NO. 48I04NE




### Legend

- ROAD
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

N
W E
S
0 2
Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 48I03 SW | 48I03 SE | 48I07 SW |
| 48I04 NW | | 48I08 NW |
| 48I04 SW | 48I04 SE | 48I08 SW |



DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

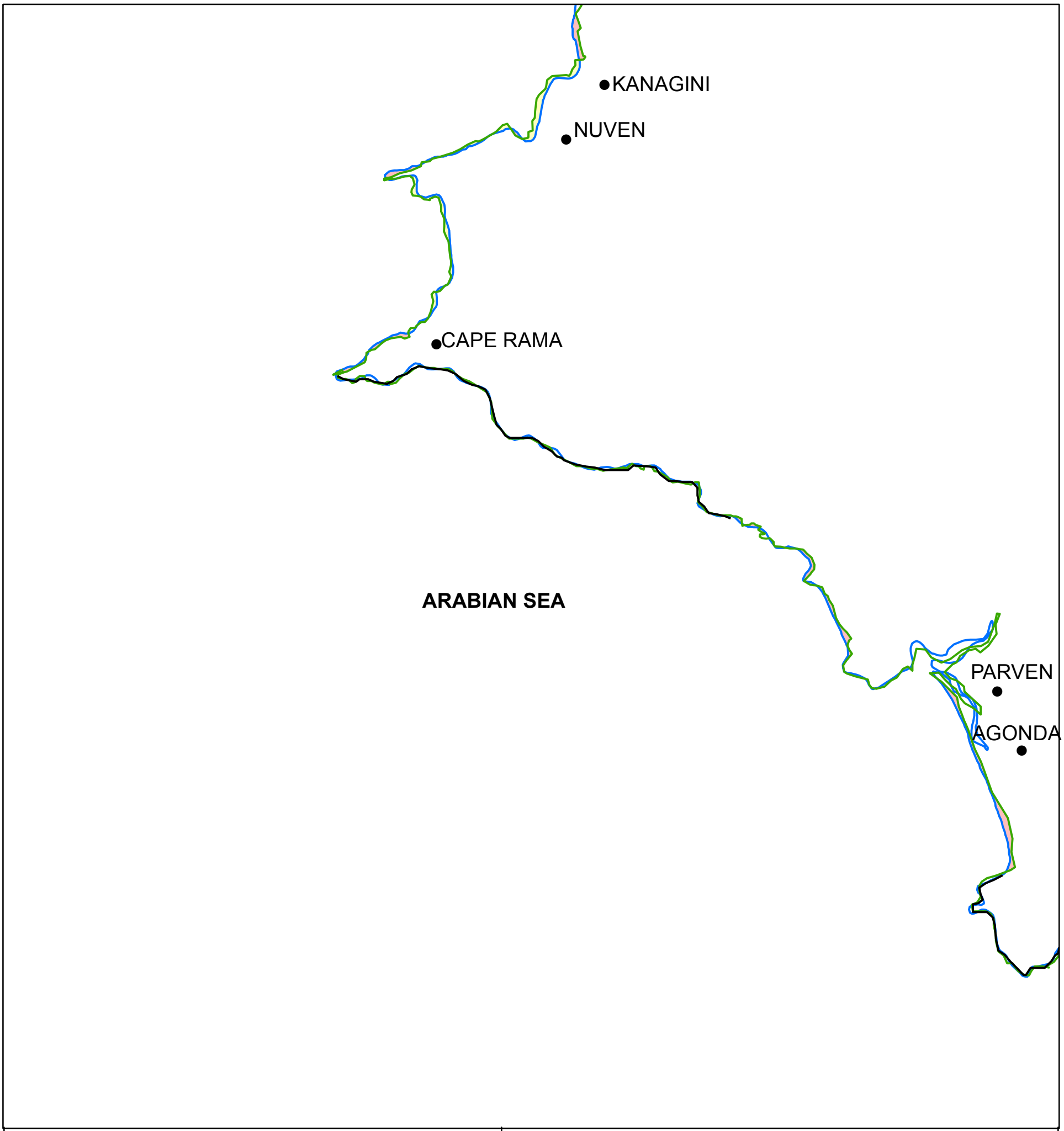
# SHORELINE CHANGE MAP

## GOA

FOR OFFICIAL USE ONLY

SOUTH GOA DISTRICT

SHEET NO. 48E16SE




### Legend

- EROSION
- ACCRETION
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

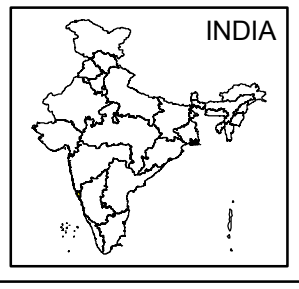
N
W E
S

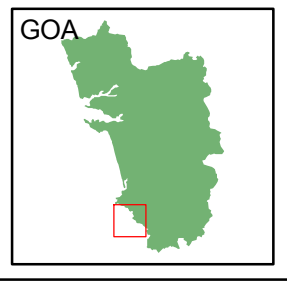
0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| SEA | 48E16 NE | 48I04 NW |
| SEA | | 48I04 SW |
| SEA | SEA | 48J01 NW |




DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

126

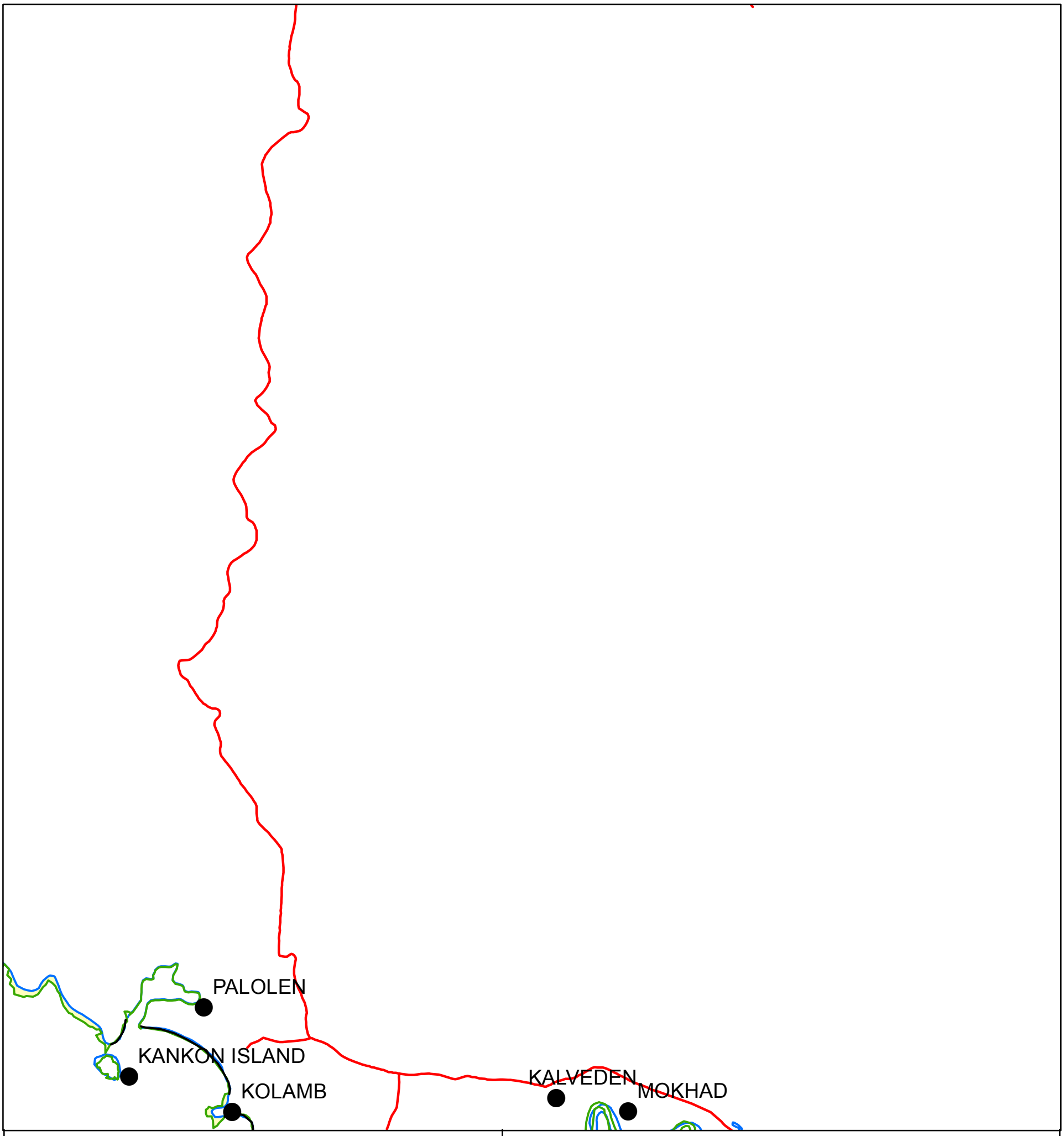
# SHORELINE CHANGE MAP

## GOA

FOR OFFICIAL USE ONLY

SOUTH GOA DISTRICT

SHEET NO. 48I04SW




## Legend

- ACCRETION
- ROAD
- STABLE
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- HABITATION

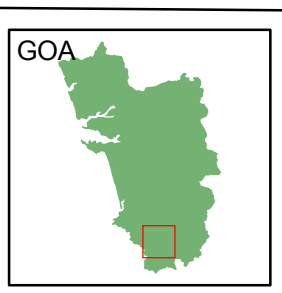
N
W E
S

0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 48E16 NE | 48I04 NW | 48I04 NE |
| 48E16 SE | | 48I04 SE |
| SEA | 48J01 NW | 48J01 SE |


DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

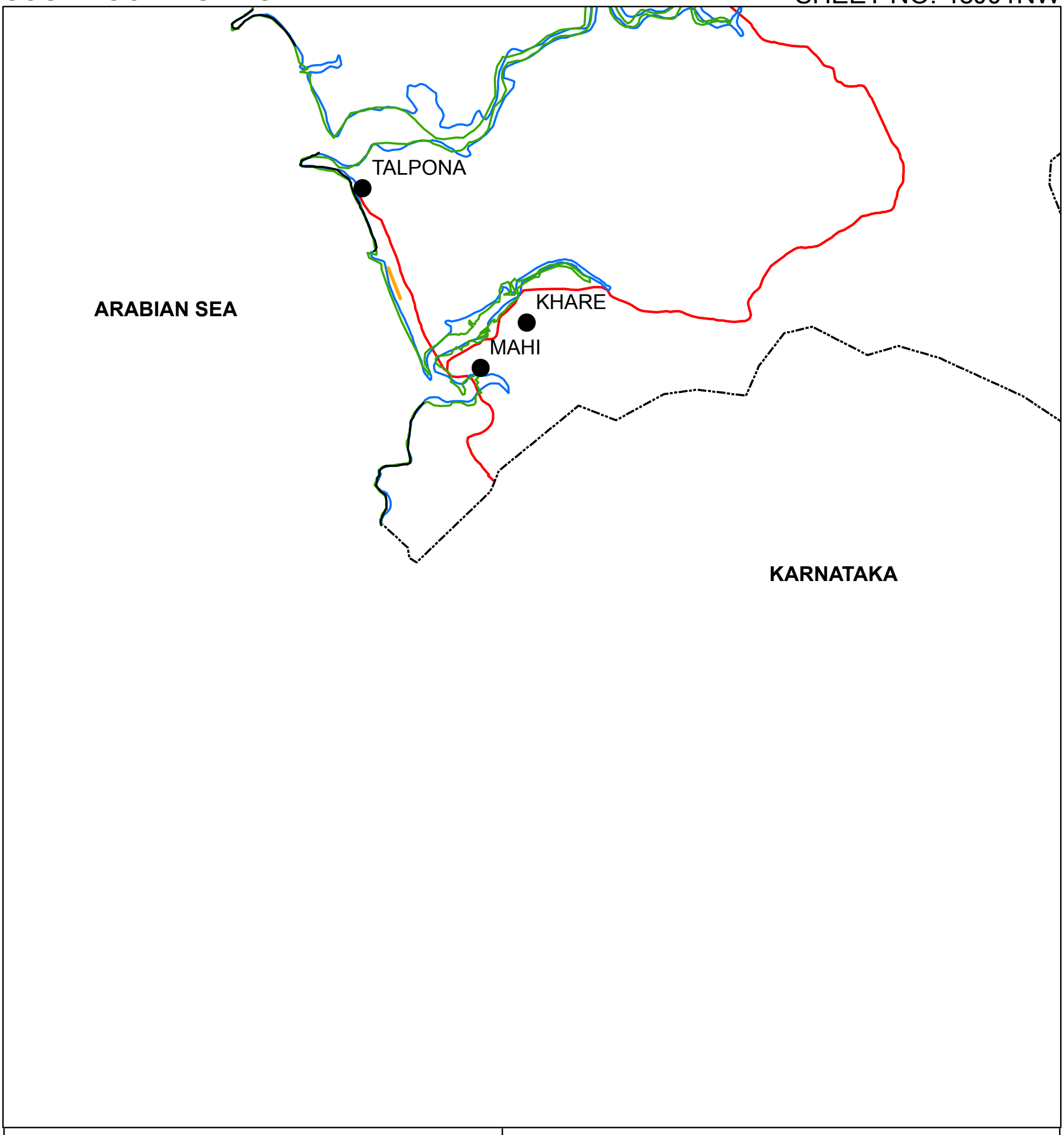
# SHORELINE CHANGE MAP

## GOA

FOR OFFICIAL USE ONLY

SOUTH GOA DISTRICT

SHEET NO. 48J01NW




### Legend

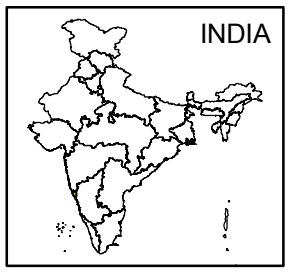
- EROSION
- ACCRETION
- ROAD
- STABLE
- HIGH-TIDE LINE 2004-06
- HIGH-TIDE LINE 1989-91
- STATE BOUNDARY
- SEAWALL
- HABITATION

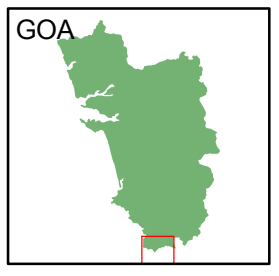
N
W E
S
0 2

Scale in Km

INDEX TO SHEETS

| | | |
|---|---|---|
| 48E16 SE | 48I04 SW | 48I04 SE |
| SEA | | 48J01 NE |
| SEA | 48J01 SW | 48J01 SE |




DATA SOURCE:
SATELLITE IMAGES OF 1989-91 & 2004-06

PREPARED BY:
SPACE APPLICATIONS CENTRE, AHMEDABAD
AND CENTRAL WATER COMMISSION, NEW DELHI

# Annexure-II

(Plates)

# MAHARASHTRA


Plate 1: 2011-12 LISS IV image overlaid with high tide line of 2004-06 and 1989-91, showing reclamation of land for constructional activities near Mahim Bay in Mumbai (47A16SW).

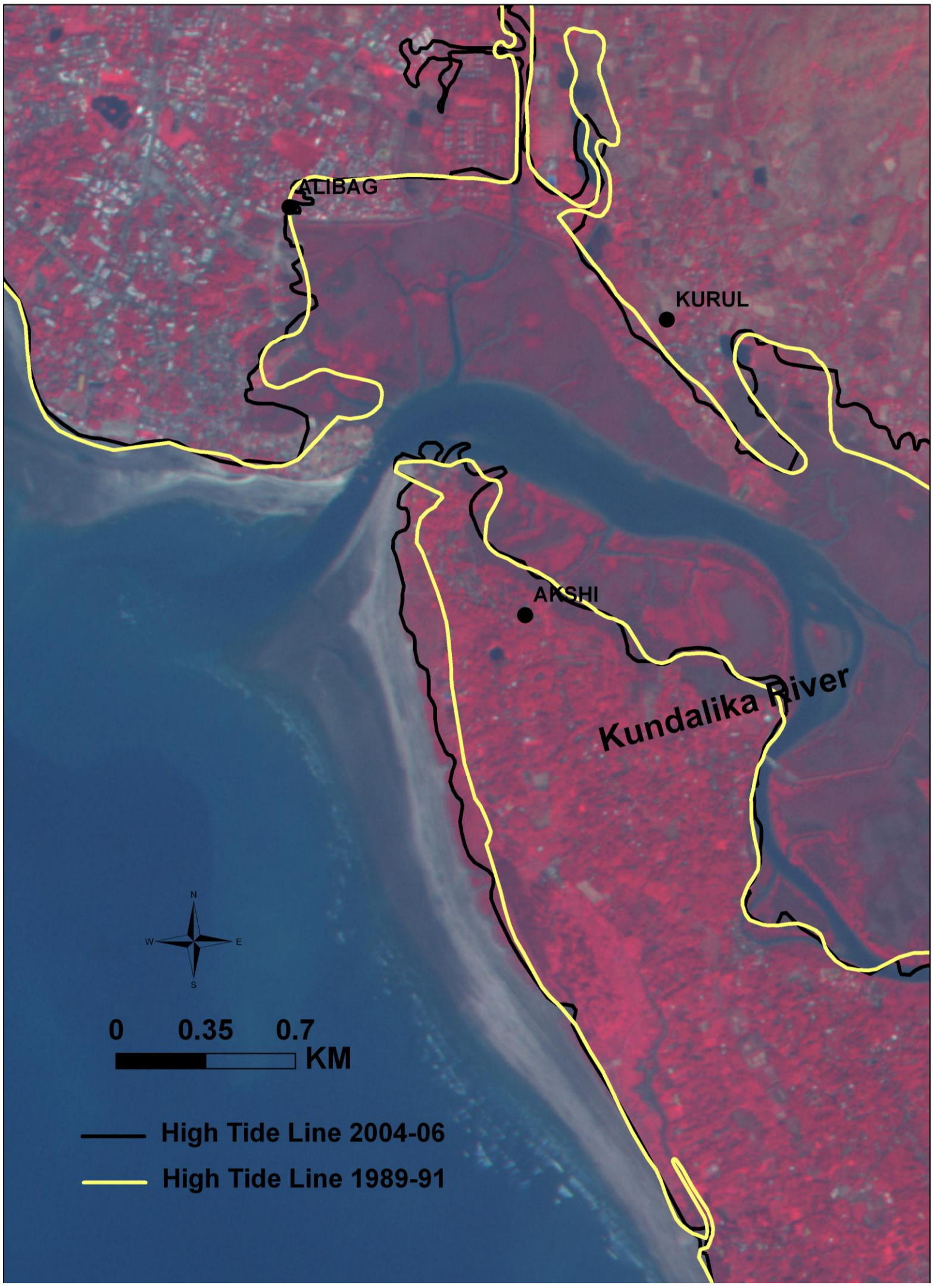



Plate 2: 2011-12 LISS IV image overlaid with high tide line of 2004-06 and 1989-91, showing accretion at Akshi in Raygad District (47B14NE).

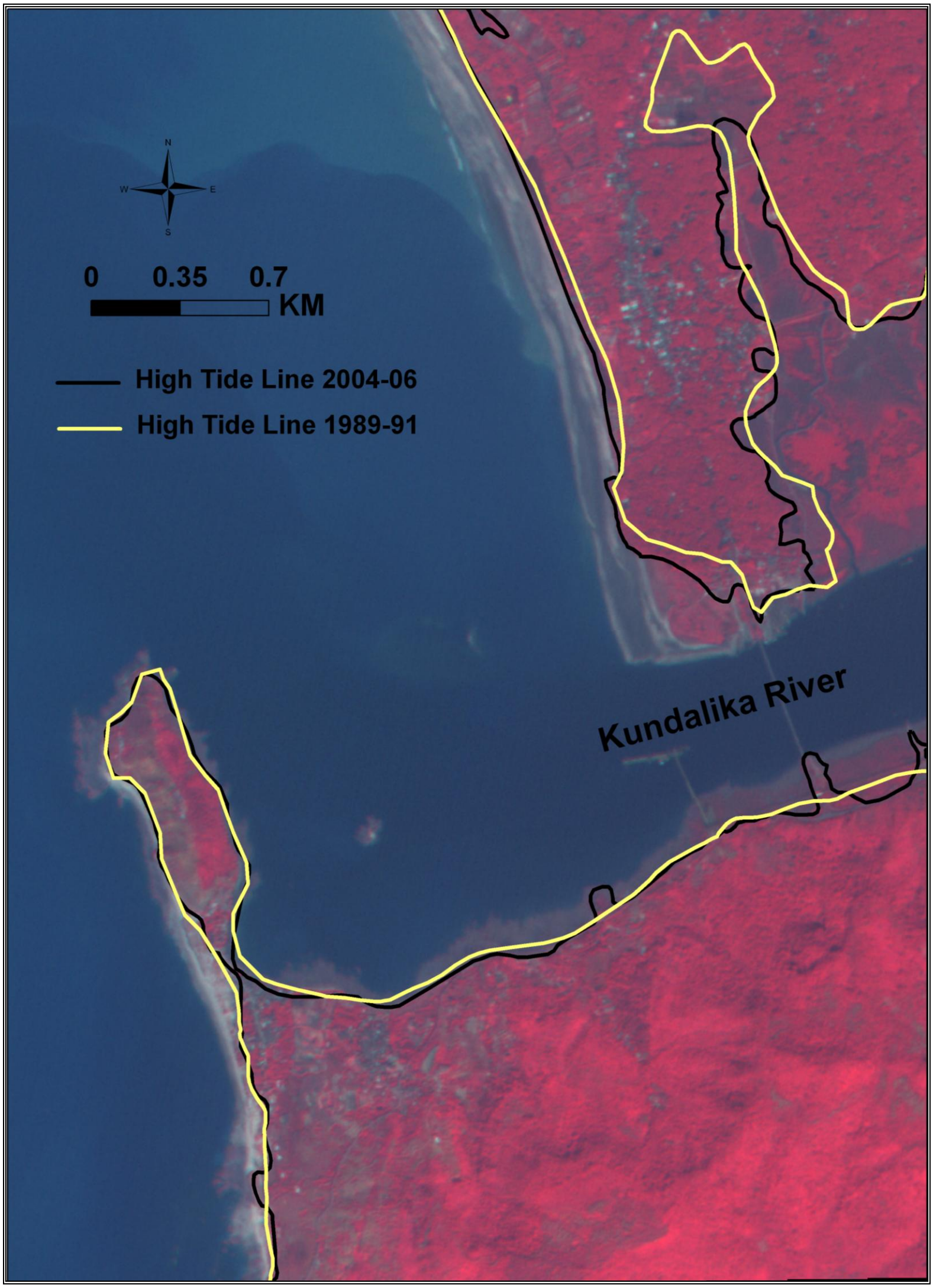



Plate 3: 2011-12 LISS IV image overlaid with high tide line of 2004-06 and 1989-91, showing accretion at northern region of Kundalika River mouth (47B14SE).

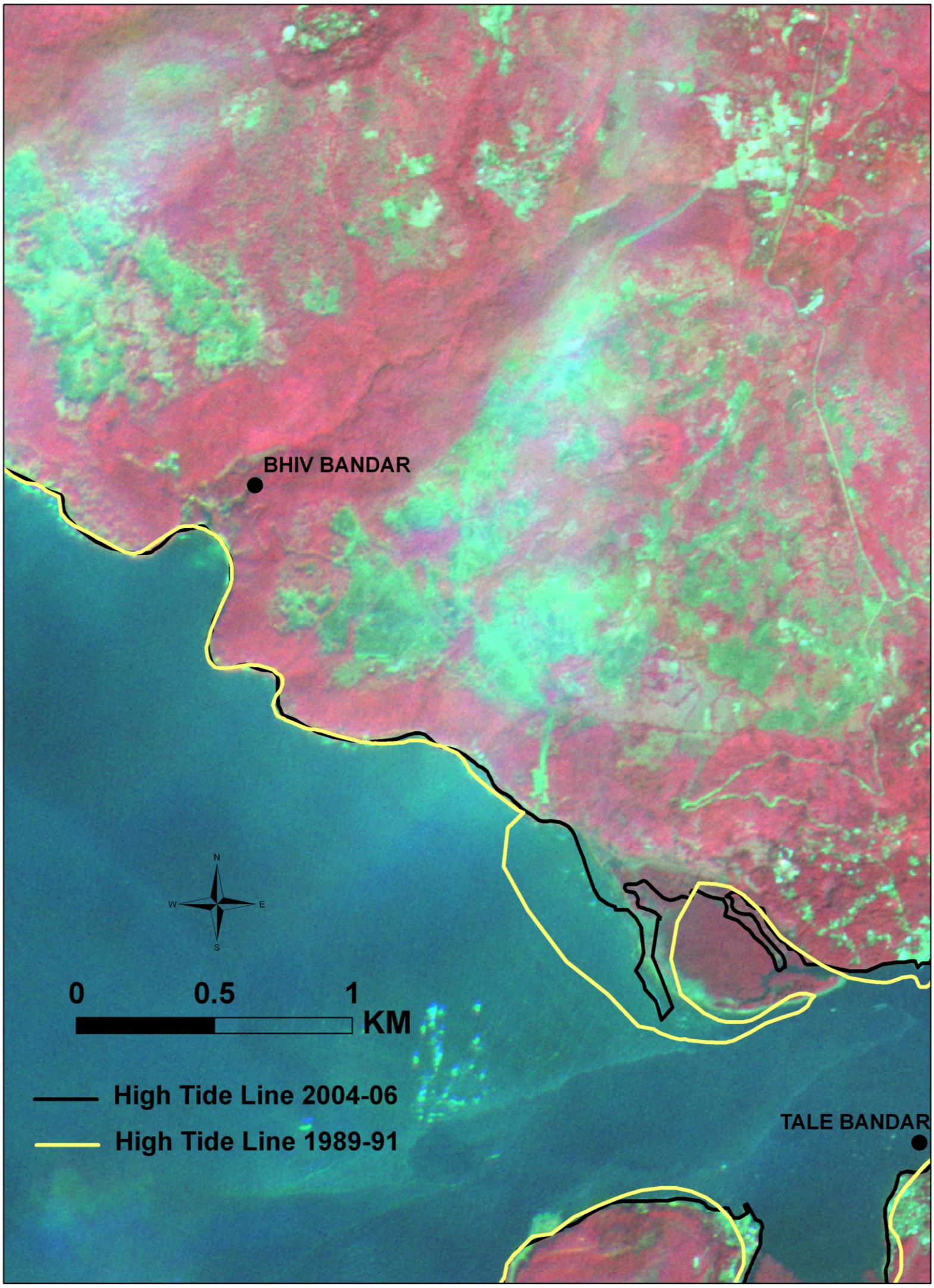



Plate 4: 2011-12 LISS IV image overlaid with high tide line of 2004-06 and 1989-91, showing erosion at Vashishti River mouth in Ratnagiri District (47G02SE).

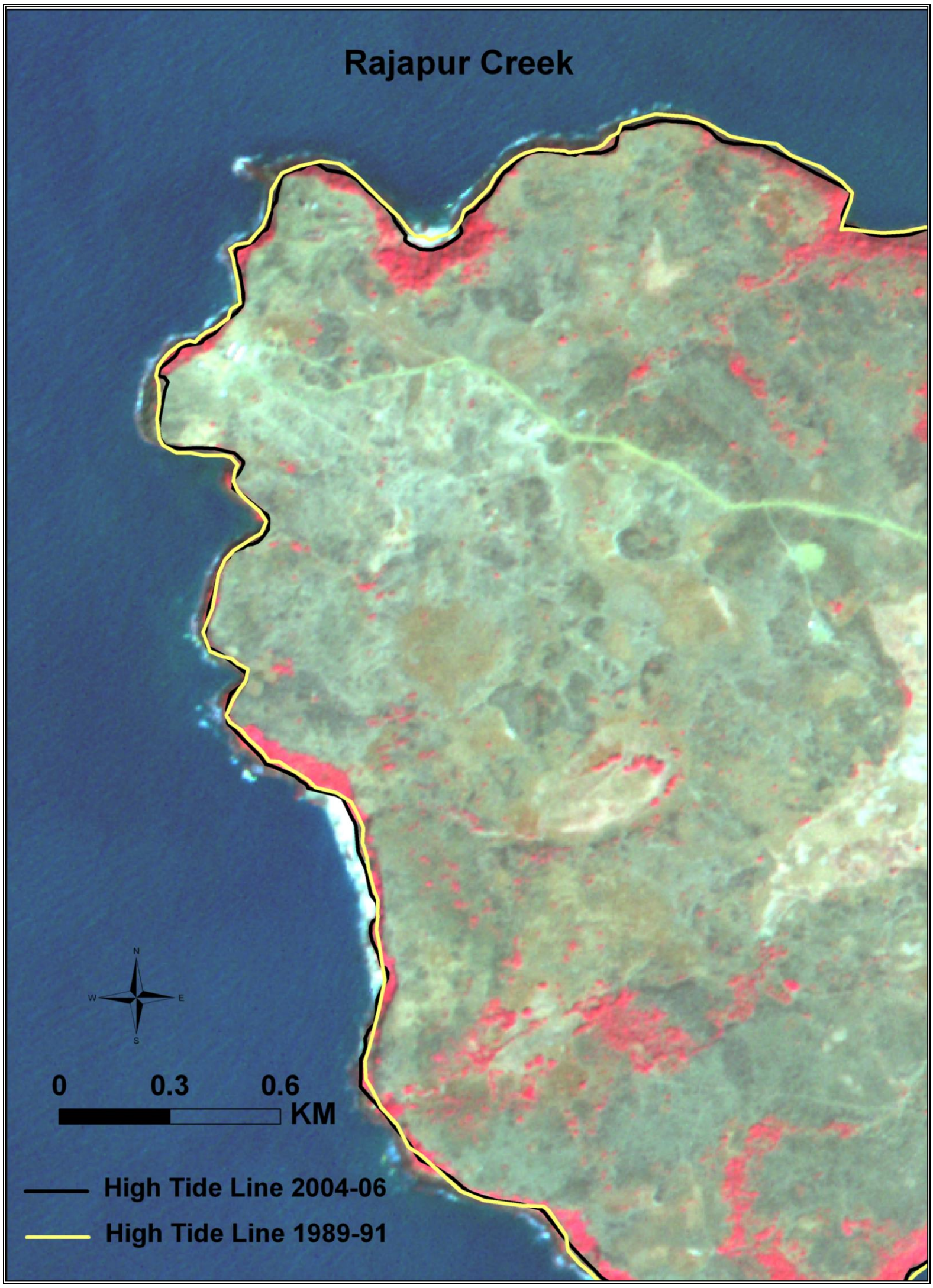



Plate 5: 2011-12 LISS IV image overlaid with high tide line of 2004-06 and 1989-91, showing the stable coast to the south of Rajapur creek in Ratnagiri district (47H06SW).


Plate 6: 2011-12 LISS IV image overlaid with high tide line of 2004-06 and 1989-91, showing the accretion at the Kalavali creek mouth in Sindhudurg district (47H08SE).

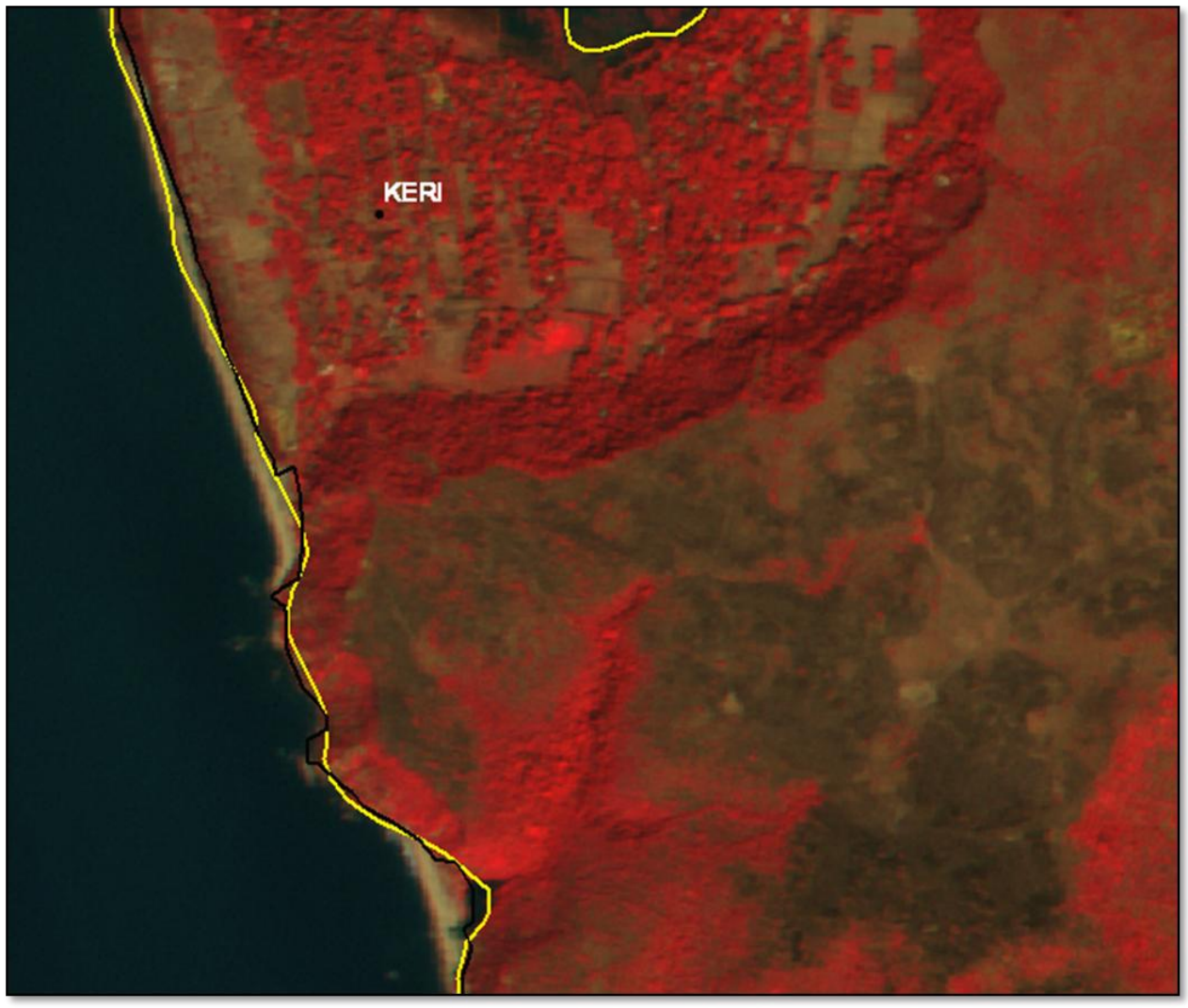



Plate 7: Eroding coastal segment around Keri, Map Sheet no. 48E10NE (Image: LISS IV January2012).

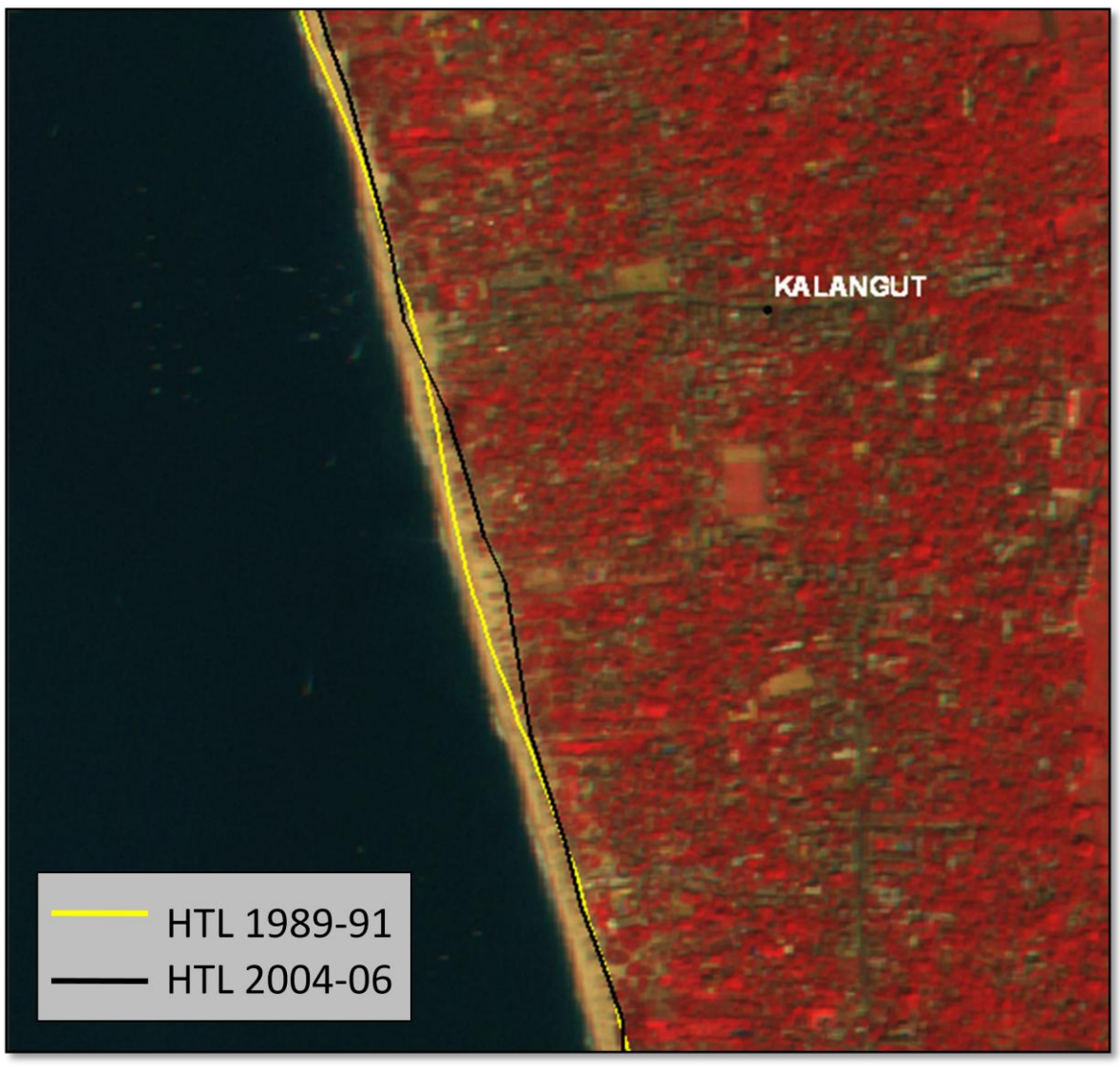



Plate 8: Eroding areas around Kalangut, and stable coast south of Kalangut, Map Sheet no. 48E14SW (Image: LISS IV January2012).

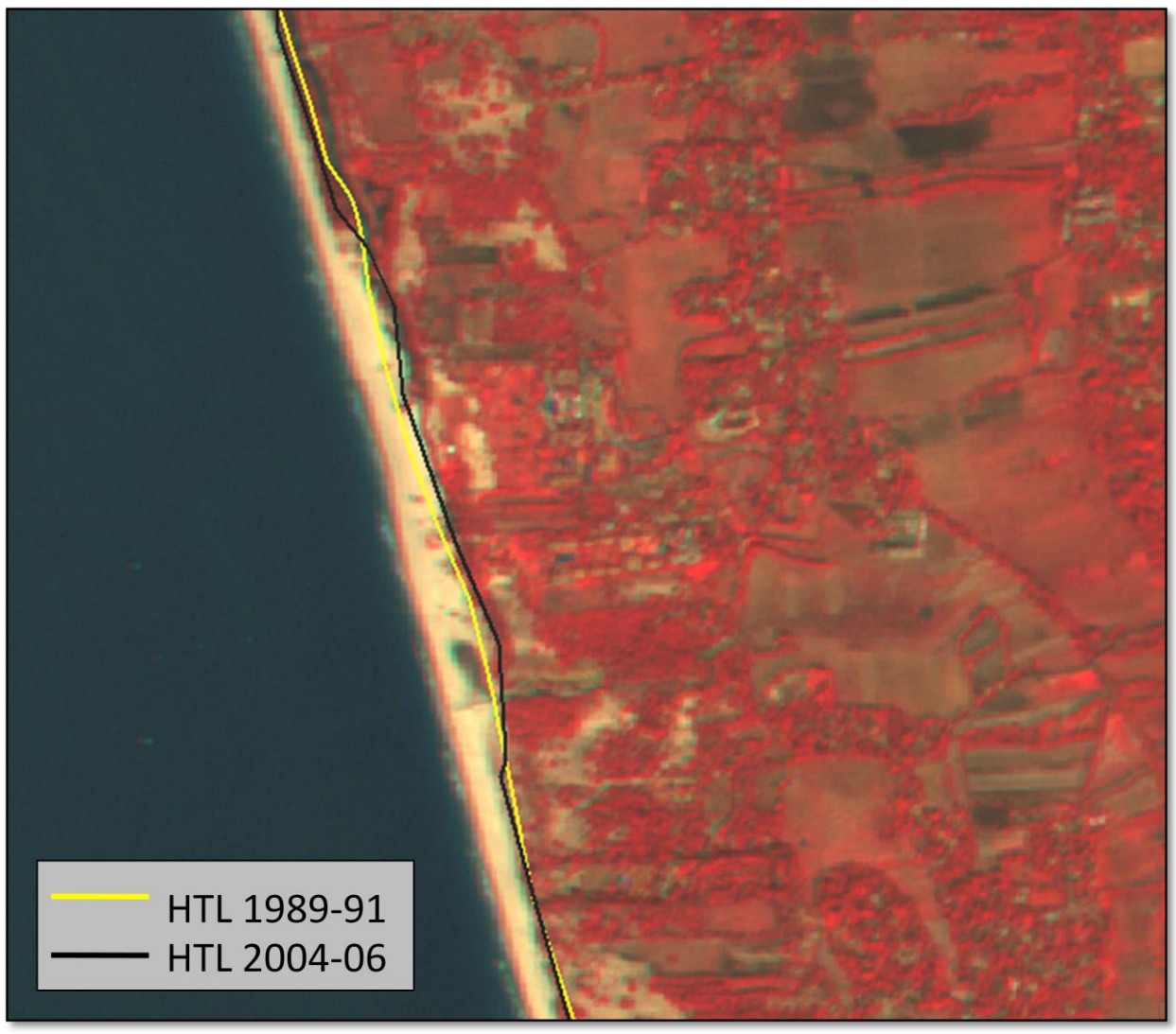



Plate 9: Eroding and stable coast north of Fatrade, map sheet no. 48E16NE (Image: LISS IV January 2012).

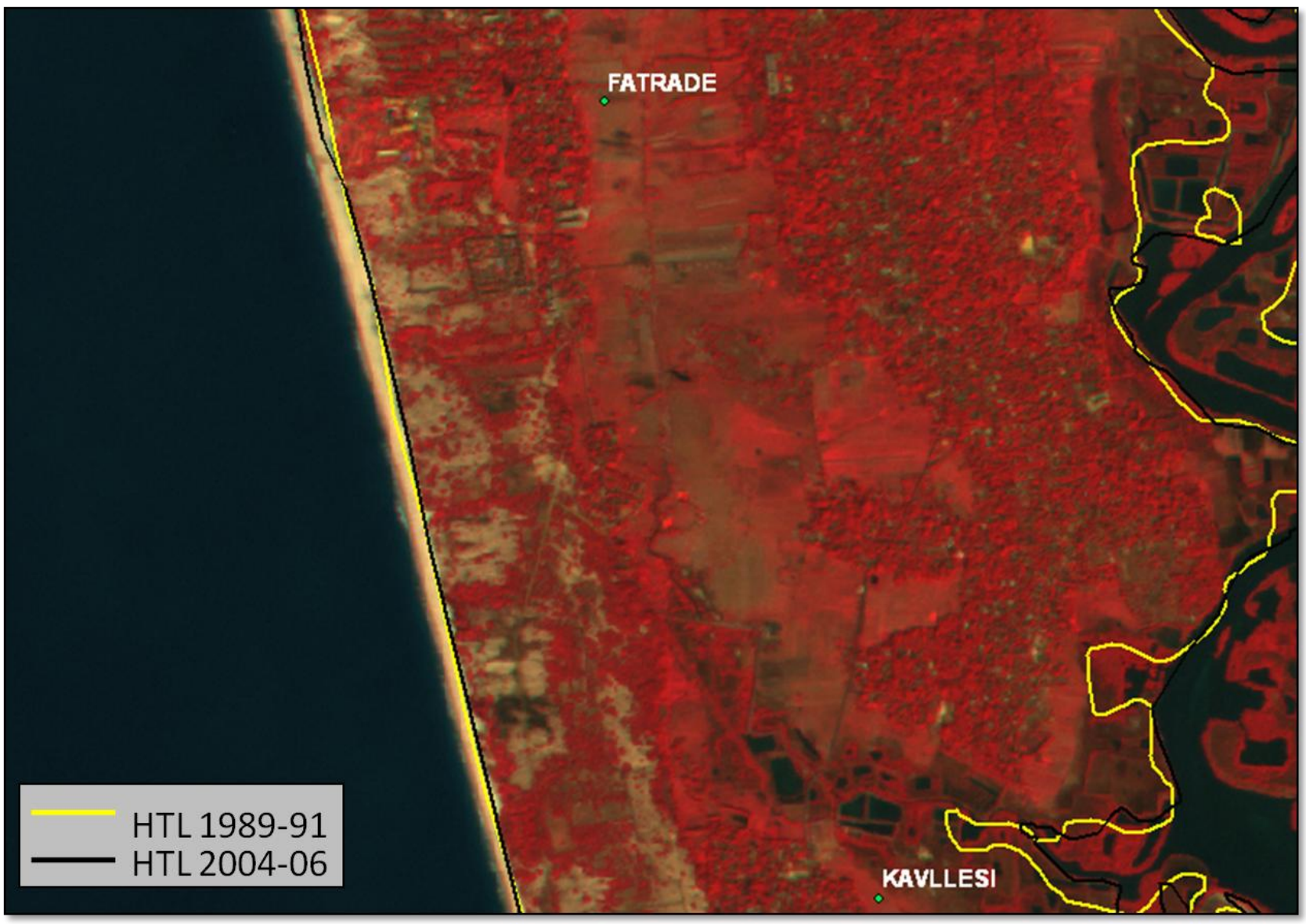



Plate 10: Stable coastal stretch from Fatrade to Kavllesi, map sheet no. 48E16NE (Image: LISS IV January 2012).

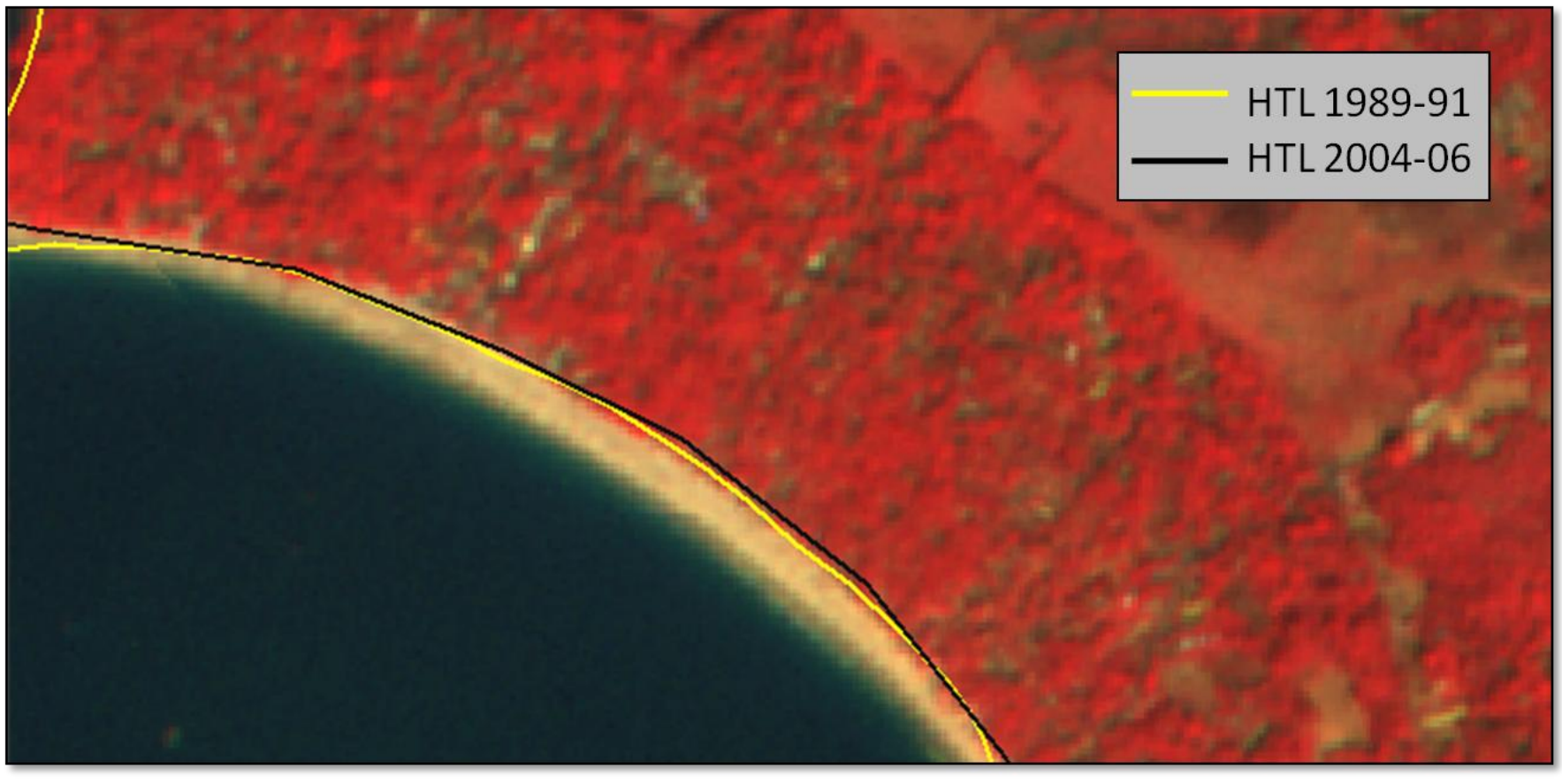



Plate 11: Stable coastal stretch south of Palolen, map sheet no. 48I04SW (Image: LISS IV January 2012).

# FIELD PHOTOGRAPHS

## Maharashtra

Plate 12: Casuarina plantation between Gholvad and Bordi coast (46D12SE)

Plate 13: Eroding coast at Gholvad coast (46D12SE)

Plate 14: Seawall constructed at Gholvad (46D12SE)

Plate 15: Casuarina plantation near Chikhle (46D12SE)

Plate 16: Uprooting of Casuarina near Chikhle (46D12SE)

Plate 17: Eroding coastal stretch near Chikhle (46D12SE)

Plate 18: Seawall at Dahanu (47A09NE)

Plate 19:  Eroding coast at Dahanu (47A09NE)

Plate 20:  Coastal segment near Varor (47A09NE)

Plate 21: Uprooting of Casuarina plantations, Nallasopara, Bhuigaon (47A15NW)

Plate 22: Coastal segment near Nallasopara, Bhuigaon (47A15NW)

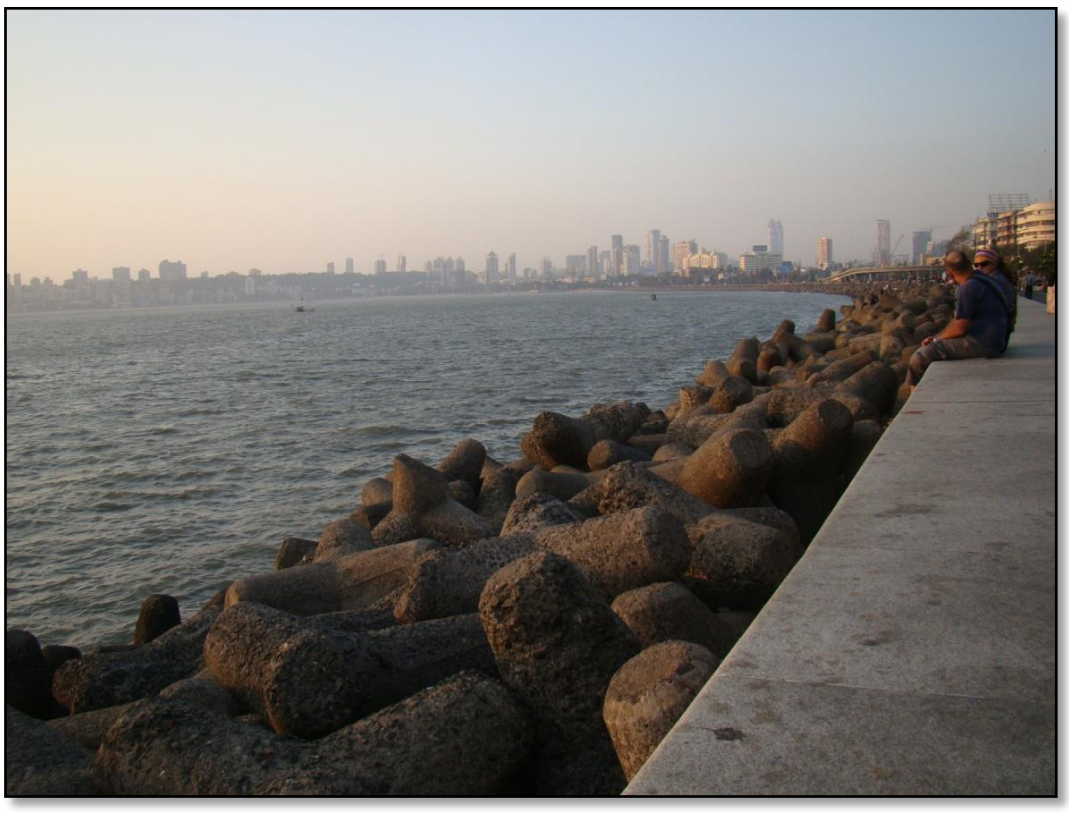


Plate 23: Tetra pods placed along the Mumbai coast (47B13NW)

Plate 24: Accreting beach with Casuarina plantation and stable dunes at Akshi (47B14NE)

Plate 25: Stable coast near Revdanda (Map Sheet no. 47B14SE)

Plate 26: Coastal stretch at Shrivardhan

Plate 27: Coastal stretch at Shrivardhan

Plate 28: Mangroves, Savitri River, north of Velas (47G01NW)

Plate 29: Coastal segment north of Velas (47G01NW)

Plate 30: Stable rocky coast near Murud (Map Sheet no. 47G01SW)

Plate 31: Mangroves near Murud (Map Sheet no. 47G01SW)

Plate 32: Coast near Murud (Map Sheet no. 47G01SW)

Plate 33: Coastal protection measures at the northern bank of Vashishti River mouth (47G02SE)

Plate 34: Coastal protection measures at the northern bank of Vashishti River mouth (47G02SE)

Plate 35: Stable dunes north of Vada Mirya (47G08SW)

Plate 36: Stable coast north of Vada Mirya (47G08SW)

Plate 37: Protection measures near Mirya Bandar (47G08SW)

Plate 38: Erosion south of Pirawadi, near Achra (47H08NE)

Plate 39: Coast at Achra (47H08NE)

Plate 40: Southern growth of the spit at Kalavali creek mouth (47H08SE)

Plate 41: Seawall at Tarkali (47H08SE)

Plate 42: Coast at Tarkali (47H08SE)

Plate 43: Eroding coast at Valagar (47H08SE)

Plate 44: Sand dunes and uprooting of Casuarina at Valagar (48E09SE)

Plate 45: Severe erosion at Keri (46E10NE)

Plate 46: Severe erosion at Keri (46E10NE)

Plate 47: Sea wall and Casuarina plantation at Keri (46E10NE)

Plate 48: Damaged sea wall at Keri (46E10NE)

Plate 49: Recent protection measures (tetrapods) at Keri (48E10NE)

Plate 50: Accreting to stable coast near Mandre (48E10NE)

Plate 51: Coastal stretch along Morjim (48E10NE)

Plate 52: Coastal stretch along Vagator, near Chapora (48E10SE)

Plate 53: Stable coastal stretch along Sinquelim (Aguada) near Nerul (48E14SW)

Plate 54: Stable coastal stretch along Aguada fort near Nerul (48E14SW)

Plate 55: Protection measures at Coco beach (48E15NW)

Plate 56: Stable pocket beach at Bogmalo (Bogmoha) (48E15SW)

Plate 57: Uprooting of Casuarina plantation due to coastal erosion and protection measures taken near Betalbatim (48E15SE)

Plate No.58: Sea wall at Betalbatim (48E15SE)

Plate No.59: Sea wall at Betalbatim (48E15SE)

Plate 60: Stable coast near Karmona, north of Kavllesi, South Goa (48E16NE)

Plate 61: Spit near Mahi, South Goa (48E16NE)

Plate 62: Stable, rocky coast along Loliem with pocket beaches (48J01NW)

# Annexure-III

(List of Data Used)

Table-3: Satellite data used for Maharashtra Coast (1989-91 time-frame).

| Sr.No | Map Sheet No. | Satellite | Sensor | Path | Row | Date |
|---|---|---|---|---|---|---|
| 1 | 46D/12SE & NE | SPOT-1 | HRV1-MLA | 202 | 310 | 11-3-1989 |
| 2 | 47A/16NW | SPOT-2 | HRV1-MLA | 203 | 312 | 23-11-1990 |
| 3 | 47B/13SE & SW | SPOT-2 | HRV1-MLA | 203<br>204 | 312<br>313 | 23-11-1990<br>13-11-1990 |
| 4 | 47B/14NE | SPOT-2 | HRV1-MLA | 204 | 313 | 13-11-1990 |
| 5 | 47B/14NW | SPOT-2 | HRV1-MLA | 204 | 313 | 13-11-1990 |
| 6 | 47B/14SE | SPOT-2 | HRV1-MLA | 204 | 313 | 13-11-1990 |
| 7 | 47B/15NE | SPOT-2 | HRV1-MLA | 204 | 313 | 13-11-1990 |
| 8 | 47B/15SE | SPOT-2 | HRV1-MLA | 203<br>203 | 313<br>314 | 13-11-1990<br>23-11-1990 |
| 9 | 47B/16NE | SPOT-2 | HRV1-MLA | 203 | 314 | 23-11-1990 |
| 10 | 47B/16SE | SPOT-2 | HRV1-MLA | 203 | 314 | 23-11-1990 |
| 11 | 47E/03SE | SPOT-2 | HRV1-MLA | 203 | 311 | 23-11-1990 |
| 12 | 47E/03SW | SPOT-2 | HRV1-MLA | 203 | 311 | 23-11-1990 |
| 13 | 47E/04NW | SPOT-2 | HRV1-MLA | 204 | 312 | 13-11-1990 |
| 14 | 47E/04SW | SPOT-2 | HRV1-MLA | 203 | 312 | 23-11-1990 |
| 15 | 48E/09NW | SPOT-1 | HRV1-MLA | 206 | 318 | 14-05-1988 |
| 16 | 48E/10NE | SPOT-1 | HRV1-MLA | 206 | 319 | 22-11-1990 |
| 17 | 47F/01NW | SPOT-2 | HRV1-MLA | 203 | 312 | 23-11-1990 |
| 18 | 47F/01SE | SPOT-2 | HRV1-MLA | 203 | 312 | 23-11-1990 |
| 19 | 47F/01SW | SPOT-2 | HRV1-MLA | 203 | 312 | 23-11-1990 |
| 20 | 47F/02NW | SPOT-2 | HRV1-MLA | 204 | 314 | 13-11-1990 |
| 21 | 47F/02SE | SPOT-2 | HRV1-MLA | 203 | 313 | 13-11-1990 |
| 22 | 47F/02SW | SPOT-2 | HRV1-MLA | 203 | 314 | 13-11-1990 |
| 23 | 47F/03NW | SPOT-2 | HRV1-MLA | 204 | 313 | 13-11-1990 |
| 24 | 47F/03SW | SPOT-2 | HRV1-MLA | 204 | 313 | 13-11-1990 |
| 25 | 47F/04NW | SPOT-2 | HRV1-MLA | 203<br>204 | 314<br>314 | 23-11-1990<br>12-11-1990 |
| 26 | 47F/04SE | SPOT-2 | HRV1-MLA | 204 | 314 | 12-11-1990 |
| 27 | 47F/04SW | SPOT-2 | HRV1-MLA | 203 | 314 | 23-11-1990 |
| 28 | 47F/08NW | SPOT-2 | HRV1-MLA | 204 | 314 | 12-11-1990 |
| 29 | 47F/08SE | SPOT-2 | HRV1-MLA | 204 | 68 | 12-11-1990 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 30 | 47F/08SW | SPOT-2 | HRV1-MLA | 204 | 314 | 12-11-1990 |
| 31 | 47G/01NE | SPOT-2 | HRV1-MLA | 204 | 314 | 12-11-1990 |
| 32 | 47G/01NW | SPOT-2 | HRV1-MLA | 204 | 314 | 12-11-1990 |
| 33 | 47G/01SE | SPOT-2 | HRV1-MLA | 204 | 314 | 12-11-1990 |
| 34 | 47G/01SW | SPOT-2 | HRV1-MLA | 204<br>204 | 314<br>315 | 12-11-1990<br>12-11-1990 |
| 35 | 47G/02NE & NW | SPOT-2 | HRV1-MLA | 204 | 315 | 12-11-1990 |
| 36 | 47G/02SE | SPOT-2 | HRV1-MLA | 204 | 315 | 12-11-1990 |
| 37 | 47G/03NE | SPOT-2 | HRV1-MLA | 204 | 315 | 12-11-1990 |
| 38 | 47G/03SE | SPOT-2 | HRV1-MLA | 204 | 315 | 12-11-1990 |
| 39 | 47G/04NE | SPOT-1 | HRV1-MLA | 205 | 316 | 22-11-1988 |
| 40 | 47G/06NE | SPOT-1 | HRV1-MLA | 205 | 315 | 14-05-1988 |
| 41 | 47G/06NW | SPOT-1 | HRV1-MLA | 205 | 315 | 14-05-1988 |
| 42 | 47G/06SE | SPOT-2 | HRV1-MLA | 205 | 315 | 14-05-1988 |
| 43 | 47G/06SW | SPOT-2 | HRV1-MLA | 204 | 315 | 12-11-1990 |
| 44 | 47G/07SE | SPOT-1 | HRV1-MLA | 205 | 316 | 22-11-1988 |
| 45 | 47G/07SW | SPOT-2 | HRV1-MLA | 204 | 315 | 12-11-1990 |
| 46 | 47G/08NE | SPOT-1 | HRV1-MLA | 205 | 316 | 22-11-1988 |
| 47 | 47G/08NW | SPOT1 | HRV1-MLA | 205 | 316 | 22-11-1988 |
| 48 | 47G/08SE | SPOT-1 | HRV1-MLA | 205 | 316 | 22-11-1988 |
| 49 | 47G/08SW | SPOT-1 | HRV1-MLA | 205 | 316 | 22-11-1988 |
| 50 | 47G/10SW | SPOT-1 | HRV1-MLA | 205 | 315 | 14-05-1988 |
| 51 | 47G/12NW | SPOT-2 | HRV1-MLA | 206 | 318 | 22-10-1990 |
| 52 | 47H/05NE | SPOT-1 | HRV1-MLA | 205 | 316 | 22-11-1988 |
| 53 | 47H/05NW | SPOT-1 | HRV1-MLA | 205 | 316 | 22-11-1988 |
| 54 | 47H/05SW | SPOT-1 | HRV1-MLA | 205 | 316 | 22-11-1988 |
| 55 | 47H/06NE | SPOT-1 | HRV1-MLA | 205 | 317 | 22-11-1988 |
| 56 | 47H/06NW | SPOT-1 | HRV1-MLA | 205 | 317 | 22-11-1988 |
| 57 | 47H/06SE | SPOT-1 | HRV1-MLA | 205<br>206 | 317<br>317 | 22-11-1988 |
| 58 | 47H/06SW | SPOT-1 | HRV1-MLA | 205,<br>206 | 317 | 22-11-1988 |
| 59 | 47H/07NE | SPOT-1 | HRV1-MLA | 205,<br>206 | 317,<br>317 | 22-11-1988 |
| 60 | 47H/07NW | SPOT-1 | HRV1-MLA | 205 | 317 | 22-11-1988 |
| 61 | 47H/07SE | SPOT-1 | HRV1-MLA | 205 | 317 | 22-11-1989 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | & SW | | | 206 | | |
| 62 | 47H/08NE | SPOT-1 | HRV1-MLA | 205<br>206 | 318<br>318 | 14-05-1988<br>14-05-1988 |
| 63 | 47H/08SE | SPOT-1 | HRV1-MLA | 206 | 318 | 14-05-1988 |
| 64 | 47H/11NW | SPOT-1 | HRV1-MLA | 206 | 317 | 22-11-1988 |
| 65 | 47H/12NW | SPOT-1 | HRV1-MLA | 206 | 318 | 14-05-1988 |
| 66 | 47H/12SE | SPOT-1 | HRV1-MLA | 206 | 318 | 14-05-1988 |
| 67 | 47H/12SW | SPOT-1 | HRV1-MLA | 206 | 318 | 14-05-1988 |
| 68 | 48E/05NE | SPOT-1 | HRV1-MLA | 206 | 318 | 14-05-1988 |
| 69 | 48E/09SE | SPOT-1 | HRV1-MLA | 206 | 318 | 14-05-1988 |
| 70 | 48E/09SW | SPOT-1 | HRV1-MLA | 206 | 318 | 14-05-1988 |

Table-4: Satellite data used for Goa Coast (1989-91 time-frame).

| Sr.No | Map Number | Satellite | Sensor | Path | Row | Date |
|---|---|---|---|---|---|---|
| 1 | 48E/10NE | SPOT-1 | HRV1-MLA | 206 | 319 | 22-11-1988 |
| 2 | 48E/10SE | SPOT-1 | HRV1-MLA | 206 | 319 | 22-11-1988 |
| 3 | 48E/13SW | SPOT-1 | HRV1-MLA | 206 | 318 | 14-05-1988 |
| 4 | 48E/14NE | SPOT-1 | HRV1-MLA | 207 | 319 | 25-11-1990 |
| 5 | 48E/14NW | SPOT-1 | HRV1-MLA | 206 | 319 | 22-11-1988 |
| 6 | 48E/14SE | SPOT-1 | HRV1-MLA | 207 | 319 | 25-11-1990 |
| 7 | 48E/14SW | SPOT-1 | HRV1-MLA | 206<br>207 | 319<br>319 | 22-11-1988<br>25-11-1990 |
| 8 | 48E/15NE | SPOT-1 | HRV1-MLA | 207 | 319 | 25-11-1990 |
| 9 | 48E/15NW | SPOT-1 | HRV1-MLA | 207 | 319 | 25-11-1990 |
| 10 | 48E/15SE | SPOT-1 | HRV1-MLA | 207 | 319 | 25-11-1990 |
| 11 | 48E/15SW | SPOT-1 | HRV1-MLA | 207 | 319 | 25-11-1990 |
| 12 | 48E/16NE | SPOT-1 | HRV1-MLA | 207 | 320 | 17-03-1989 |
| 13 | 48E/16SE | SPOT-1 | HRV1-MLA | 207 | 320 | 17-03-1989 |
| 14 | 48I/02SW | IRS-1B | LISS-II | 29 | 57 | 05-03-1993 |
| 15 | 48I/03SW | SPOT-1 | HRV1-MLA | 207 | 320 | 25-11-1990 |
| 16 | 48I/04NE | IRS-1B | LISS-II | 29 | 57 | 05-03-1993 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 17 | 48I/04NW | SPOT-1 | HRV1-MLA | 207 | 320 | 17-03-1989 |
| 18 | 48I/04SW | SPOT-1 | HRV1-MLA | 207 | 320 | 17-03-1989 |
| 19 | 48J/01NW | SPOT-1 | HRV1-MLA | 207 | 320 | 17-03-1989 |

Table-5: Satellite data used for Maharashtra Coast (2004-06 time-frame).

| Sr. No | Map Number | Satellite | Sensor | Orbit | Scene | Date |
|---|---|---|---|---|---|---|
| 1 | 46D12NE | IRS P6 | LISS IV | 10629 | 62, 63 | 3-11-2005 |
| 2 | 46D12SE | IRS P6 | LISS IV | 10629 | 63 | 3-11-2005 |
| 3 | 47A09NE, 47A09SE | IRS P6 | LISS IV | 10629 | 63, 64 | 3-11-2005 |
| 4 | 47A10NE | IRS P6 | LISS IV | 12462 | 110, 111 | 12-3-2006 |
| 5 | 47A10SE | IRS P6 | LISS IV | 12462 | 111, 112 | 12-3-2006 |
| 6 | 47A13NW | IRS P6 | LISS IV | 12462 | 109, 110 | 12-3-2006 |
| 7 | 47A13SW | IRS P6 | LISS IV | 12462 | 110 | 12-3-2006 |
| 8 | 47A16NE | IRS P6 | LISS IV | 10757 | 2 | 12-11-2005 |
| 9 | 47A16NW | IRS P6 | LISS IV | 10345 | 2 | 14-10-2005 |
| 10 | 47A16SW | IRS P6 | LISS IV | 10757 | 2 | 12-11-2005 |
| 11 | 47B13NE, 47B13NW | IRS P6 | LISS IV | 8512 | 91 | 7-6-2005 |
| 12 | 47B14NE | IRS P6 | LISS IV | 6466 | 26 | 14-01-2005 |
| 13 | 47B14NW | IRS P6 | LISS IV | 8512 | 92 | 7-6-2005 |
| 14 | 47B14SE | IRS P6 | LISS IV | 6466 | 26, 27 | 14-01-2005 |
| 15 | 47B16SE | IRS P6 | LISS IV | 6878 | 96 | 12-2-2005 |
| 16 | 47E04NW | IRS P6 | LISS IV | 8512 | 89, 90 | 7-6-2005 |
| 17 | 47F01SE | IRS P6 | LISS IV | 6878 | 92, 93 | 12-2-2005 |
| 18 | 47F02SE | IRS P6 | LISS IV | 6878 | 93, 94 | 12-2-2005 |
| 19 | 47F02SW | IRS P6 | LISS IV | 6466, 6878 | 26, 27, 94 | 14-01-2005, 12-02-2005 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 20 | 47F03NW | IRS P6 | LISS IV | 6878 | 94, 95 | 12-2-2005 |
| 21 | 47F03SW | IRS P6 | LISS IV | 8029 | 92 | 4-5-2005 |
| 22 | 47F04NW, 47F04SW | IRS P6 | LISS IV | 6878 | 96 | 12-2-2005 |
| 23 | 47F04SE | IRS P6 | LISS IV | 7972, 8029 | 97, 93 | 30-04-2005, 04-05-2005 |
| 24 | 47F08NW | IRS P6 | LISS IV | 7972 | 96 | 30-04-2005 |
| 25 | 47F08SE | IRS P6 | LISS IV | 11851 | 101 | 28-01-2006 |
| 26 | 47F08SW | IRS P6 | LISS IV | 7972 | 96, 97 | 30-04-2005 |
| 27 | 47G01NE | IRS P6 | LISS IV | 7972 | 97, 98 | 30-04-2005 |
| 28 | 47G01NW | IRS P6 | LISS IV | 6878 | 96, 97 | 12-2-2005 |
| 29 | 47G01SE | IRS P6 | LISS IV | 7972 | 98 | 30-04-2005 |
| 30 | 47G01SW | IRS P6 | LISS IV | 7972, 8029 | 98, 94 | 30-04-2005, 04-05-2005 |
| 31 | 47G02NE, 47G02SE | IRS P6 | LISS IV | 7972 | 98, 99 | 30-04-2005 |
| 32 | 47G02NW | IRS P6 | LISS IV | 7972 | 98, 99 | 30-04-2005 |
| 33 | 47G03NE | IRS P6 | LISS IV | 7972 | 99, 100 | 30-04-2005 |
| 34 | 47G03SE | IRS P6 | LISS IV | 10558 | 103, 104 | 29-10-2005 |
| 35 | 47G04NE | IRS P6 | LISS IV | 11851 | 105 | 28-01-2006 |
| 36 | 47G06NE | IRS P6 | LISS IV | 11851 | 102, 103 | 28-01-2006 |
| 37 | 47G06NW | IRS P6 | LISS IV | 7972, 11851 | 98, 103 | 30-04-2005, 28-01-2006 |
| 38 | 47G06SE | IRS P6 | LISS IV | 11851 | 103, 104, 97 | 28-01-2006, 19-01-2005 |
| 39 | 47G06SW | IRS P6 | LISS IV | 11851 | 102, 103 | 28-01-2006 |
| 40 | 47G07SW | IRS P6 | LISS IV | 11851 | 104, 105 | 28-01-2006 |
| 41 | 47G08NE | IRS P6 | LISS IV | 6537 | 99 | 19-01-2005 |
| 42 | 47G08NW | IRS P6 | LISS IV | 11851 | 105 | 28-01-2006 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 43 | 47G08SE | IRS P6 | LISS IV | 6537 | 99, 100 | 19-01-2005 |
| 44 | 47G08SW | IRS P6 | LISS IV | 12263 | 124 | 26-02-2006 |
| 45 | 47G10SW | IRS P6 | LISS IV | 6537 | 97 | 19-01-2005 |
| 46 | 47G12NW | IRS P6 | LISS IV | 6537 | 98, 99 | 19-01-2005 |
| 47 | 47H05NW, 47H05NE | IRS P6 | LISS IV | 6537 | 100 | 19-01-2005 |
| 48 | 47H05SW | IRS P6 | LISS IV | 6537 | 100, 101 | 19-01-2005 |
| 49 | 47H06NE | IRS P6 | LISS IV | 6537 | 100, 101 | 19-01-2005 |
| 50 | 47H06NW | IRS P6 | LISS IV | 6537 | 101 | 19-01-2005 |
| 51 | 47H06SW, 47H06SE | IRS P6 | LISS IV | 6537 | 101, 102 | 19-01-2005 |
| 52 | 47H07NE | IRS P6 | LISS IV | 6537 | 102 | 19-01-2005 |
| 53 | 47H07NW | IRS P6 | LISS IV | 6537 | 102 | 19-01-2005 |
| 54 | 47H07SW | IRS P6 | LISS IV | 6537 | 102, 103 | 19-01-2005 |
| 55 | 47H08NE, 47H08SE | IRS P6 | LISS IV | 7759 | 28, 29 | 15-04-2005 |
| 56 | 47H11NW | IRS P6 | LISS IV | 7759 | 27 | 15-04-2005 |
| 57 | 47H12NW | IRS P6 | LISS IV | 7759 | 28 | 15-04-2005 |
| 58 | 47H12SE | IRS P6 | LISS IV | 6665 | 99 | 28-01-2005 |
| 59 | 47H12SW | IRS P6 | LISS IV | 6665, 7759 | 99, 29 | 28-01-2005, 15-04-2005 |
| 60 | 48E05NE | IRS P6 | LISS IV | 7759 | 29, 30 | 15-04-2005 |
| 61 | 48E09NW | IRS P6 | LISS IV | 7759 | 29 | 15-04-2005 |
| 62 | 48E09SE | IRS P6 | LISS IV | 6665, 11723 | 100, 117 | 28-01-2005, 19-01-2006 |
| 63 | 48E09SW | IRS P6 | LISS IV | 6665 | 100 | 28-01-2005 |
| 64 | 48E10NE | IRS P6 | LISS IV | 11723 | 117, 118 | 19-01-2006 |

Table-6: Satellite data used for Goa Coast (2004-06 time-frame).

| Sr. No | Map Number | Satellite | Sensor | Orbit | Scene | Date |
|---|---|---|---|---|---|---|
| 1 | 48E10NE, 48E10SE | IRS-P6 | LISS IV | 11723 | 117/118 | 19-01-06 |
| 2 | 48E14NW | IRS-P6 | LISS IV | 11723/ 7418 | 117/118/ 104 | 19-01-06/ 22-03-05 |
| 3 | 48E13SW | IRS-P6 | LISS IV | 11723 | 116/117 | 19-01-06 |
| 4 | 48E14SE, 48E14SW | IRS-P6 | LISS IV | 11723/ 6608 | 118/037/ 038 | 19-01-06/ 24-01-05 |
| 5 | 48E14NE | IRS-P6 | LISS IV | 6608 | 037/038 | 24-01-05 |
| 6 | 48E15NW | IRS-P6 | LISS IV | 11723/ 6608 | 118/119/ 039 | 19-01-06/ 24-01-05 |
| 7 | 48E15NE | IRS-P6 | LISS IV | 6608 | 038/039 | 24-01-05 |
| 8 | 48I03NW | IRS-P6 | LISS IV | 11581 | 122 | 9-1-2006 |
| 9 | 48I03SW | IRS-P6 | LISS IV | 11581 | 122/123 | 9-1-2006 |
| 10 | 48I02SW | IRS-P6 | LISS IV | 11581/ 6608 | 121/122/ 038 | 09-01-06- 24-01-05 |
| 11 | 48E15SW | IRS-P6 | LISS IV | 11723/ 6608 | 119/039/ 040 | 19-01-06- 24-01-05 |
| 12 | 48E15SE | IRS-P6 | LISS IV | 6608 | 039/040 | 24-01-05 |
| 13 | 48I04SW | IRS-P6 | LISS IV | 11581 | 123/124 | 9-1-2006 |
| 14 | 48I04NW | IRS-P6 | LISS IV | 11581 | 123 | 09-01-06/ 15-05-05 |
| 15 | 48I04NE | IRS-P6 | LISS IV | 11581/ 8185 | 123/058 | 09-01-06/ 15-05-05 |
| 16 | 48E16NE, 48E16SE | IRS-P6 | LISS IV | 6608 | 039/040 | 24-01-05 |
| 17 | 48J01NW | IRS-P6 | LISS IV | 11581 | 124/125 | 9-1-2006 |

Table-7: Details of Anti Sea Erosion bunds constructed along Maharashtra coast, provided by Central Water Commission (CWC).

| Sr. No. | District | Coastal length (km) | Naturally protected length in km | Artificial protection work | | Total protected length (in km) | Balance length yet to be protected (in km) |
|---|---|---|---|---|---|---|---|
| | | | | By wall in km | By ASE bund in km | | |
| 1 | Mumbai | 70.22 | 55.47 | 2.01 | 10.18 | 12.20 | 2.55 |
| 2 | Mumbai suburban | 43.78 | 33.85 | 1.95 | 5.70 | 7.65 | 2.29 |
| 3 | Thane | 127.00 | 76.43 | 2.08 | 30.91 | 32.98 | 17.59 |
| 4 | Raygad | 121.00 | 49.49 | 0.00 | 50.93 | 50.93 | 20.58 |
| 5 | Ratanagiri | 238.00 | 136.25 | 0.32 | 45.03 | 45.35 | 56.40 |
| 6 | Sindudurg | 120.00 | 49.00 | 0.00 | 33.51 | 33.51 | 37.50 |
| | Total | 720.00 | 400.49 | 6.36 | 176.25 | 182.61 | 136.90 |

Table-8: Location and specification of protection measures carried out in Mumbai.

| Sr. No. | Name of work | Length in m | Year of construction | Concrete Wall | Rubble Bund | Latitude/ Longitude |
|---|---|---|---|---|---|---|
| District : Mumbai City | | | | | | |
| 1 | Construction of Retaining Wall at Geetanagar, Mumbai Part 2 | 47 | 2000 | 47 | | 18° 54’50” N & 72° 48’ 31”E |
| 2 | Construction of anti sea erosion bund at Cuffe Parade, Mumbai | 30 | 2000 | 30 | | 18° 55’13” N & 72° 49’ 30”E |
| 3 | Construction of bund at Rajbhavan, Mumbai | 230 | 2000 | 230 | | 18° 56’21” N & 72° 47’ 38” E |
| 4 | Construction of Retaining Wall at Worli Koliwada Mumbai | 112 | 2000 | 112 | | 19° 01’32” N & 72° 48’ 56”E |
| 5 | Construction of Retaining Wall | 30 | 1999 | 30 | | 18° 55’09” N & 72° 49’ |

| | | | | | | |
|---|---|---|---|---|---|---|
| | atCuffe Parade Mumbai | | | | | 27”E |
| 6 | Construction of Retaining Wall at Geetanagar, Mumbai Part 1 | 25 | 2000 | 25 | | 18° 54’50” N & 72° 48’ 31”E |
| 7 | Strengthening of anti sea erosion bund at Worli Koliwada, Mumbai | 177 | 2000 | | 177 | 19° 01’10” N & 72° 48’ 57”E |
| 8 | Construction of anti sea erosion bund at Napean Sea, Mumbai | 96 | 2000 | | 96 | 18° 57’51” N & 72° 48’ 06”E |
| 9 | Construction of anti sea erosion bund and wall at Bajaj Bhavan, Bajaj Bhavan Road, Backbay sector, Mumbai | 175 | 2002 | | 175 | 18° 54’50” N & 72° 48’ 31”E |
| 10 | Renovation of Breakwater at Rajbhavan (No.3) | 45 | 2000 | 45 | | 18° 56'22"N & 72° 47'34" E |
| 11 | Renovation of Breakwater at Rajbhavan (No.4) | 45 | 2002 | 45 | | 18° 56' 40" N & 72° 47' 20"E |
| 12 | Renovation of Breakwater at Rajbhavan (No.2) Ch. 0 to 25 m. | 45 | 2000 | 45 | | 18° 56' 40" N & 72° 47' 47"E |
| 13 | Construction of anti sea erosion bund at Ramtek Bunglow, Length 40 m. | 40 | 2002 | | 40 | 18° 56' 49" N & 72° 47' 32"E |
| 14 | Construction of Protection wall (Govt. land) near Ramtek Bunglow | 40 | 2002 | 40 | | 18° 56' 50" N & 72° 47' 32"E |
| 15 | Construction of anti sea erosion Bund at Ramtek Bunglow, Length 45 m. | 45 | 2002 | | 45 | 18° 56' 50" N & 72° 47' 32"E |
| 16 | Construction of Protection wall at Narayan Dabholkar Marg, Opp. Ratnakar Building | 175 | 2003 | 175 | | 18° 57' 03" N & 72° 48' 15"E |
| 17 | Strenghening of Retaining wall at | 430 | 2003 | 430 | | 18° 56' 57" N & 72° 48' |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Chowpatty to Walkeshwar | | | | | 06"E |
| 18 | Strenghening of Retaining wall at Raj Bhavan Ch. 0 to 60 m. | 60 | 2003 | | 60 | 18° 56' 32" N & 72° 47' 43"E |
| 19 | Providing Protection to the sea wall at Rajbhavan | 80 | 2000 | | 80 | 18° 56' 22" N & 72° 47' 40"E |
| 20 | Construction of Protection wall at Worli Fort, Batteri Bunder | 200 | 2003 | 200 | | 19° 01' 30" N & 72°48'56"E |
| 21 | Construction of Anti Sea Erosion Bund at Amarsons,Mumbai Part-1 | 120 | 2003 | | 120 | 18° 58' 11" N & 72° 48' 06"E |
| 22 | Strengthening of Sea wall at Nariman Point to Giragaon Chowpaty ,Mumbai Part-1 | 610 | 2000 | | 610 | 18° 55' 38" N & 72°49' 11" E |
| 23 | Reconstruction of Supporting wall at Markandeshwar Nagar, Dr.A. B. Marg Ch.0 to 80 m | 80 | 2004 | 80 | | 18° 59' 33" N & 72°48' 49" E |
| 24 | Reconst. of Supporting wall at Markandeshwar Nagar, Dr.A. B. Marg Ch.80 to 60 m | 80 | 2004 | 80 | | 18° 59' 33" N & 72°48' 47" E |
| 25 | Strengthening of Sea wall at Nariman Point to Giragaon Chowpaty ,Mumbai Part-2 | 690 | 2005 | | 690 | 18° 56' 00" N & 72°49' 24" E |
| 26 | Strengthening of Sea wall at Nariman Point to Giragaon Chowpaty ,Mumbai Part-3 | 1185 | 2005 | | 1185 | 18° 56' 27" N & 72°49' 25" E |
| 27 | Strengthening of Sea wall at Nariman Point to Giragaon Chowpaty ,Mumbai Part-4 | 925 | 2006 | | 925 | 18° 56' 59" N & 72° 50' 07" E |
| 28 | Construction of Anti Sea Erosion Bund | 600 | 2008 | | 600 | 18° 59' 56" N & 72° 48' 40" |

| | | | | | | |
|---|---|---|---|---|---|---|
| | at Worli Sea Face in Mumbai Part - 1 | | | | | E |
| 29 | Construction of Anti Sea Erosion Bund at Mahim (Hinduja Hospital to Mistry Nagar) | 335 | 2007 | | 335 | 19° 01' 57" N & 72° 50' 15" E |
| 30 | Beach Nourishment Between Break Water No.2 & 3 at Rajbhavan Sea Shore, Mumbai | 140 | 2008 | | 140 | 18° 56' 43" N & 72° 47' 49" E |
| 31 | Construction of Anti Sea Erosion Bund at Amarsons,Mumbai Part-2 | 110 | 2009 | | 110 | 18° 58' 18" N & 72° 48' 07" E |
| 32 | Construction of Anti Sea Erosion Bund at Children's Park in Mumbai | 140 | 2009 | | 140 | 18° 58' 19" N & 72° 48' 10" E |
| 33 | Construction of Anti Sea Erosion Bund at Breach Candy Club in Mumbai | 200 | 2010 | 200 | | 18° 58' 19" N & 72° 48' 10" E |
| 34 | Construction of Anti Sea Erosion Bund at Mahatma Phule Nagar in Mumbai | 250 | 2009 | | 250 | 18° 55' 15" N & 72° 49' 29" E |
| 35 | Construction of Anti Sea Erosion Bund at Shivshakti Nagar in Mumbai | 130 | 2010 | | 130 | 18° 55' 21" N & 72° 49' 26" E |
| 36 | Construction of Anti Sea Erosion Bund at Geetanagar in Mumbai Part-1 | 200 | 2009 | 200 | | 18° 54' 48" N & 72° 48' 33" E |
| 37 | Construction of Anti Sea Erosion Bund at Geetanagar in Mumbai Part-2 | 255 | 2011 | | 255 | 18° 54' 43" N & 72° 48' 33" E |
| 38 | Construction of Anti Sea Erosion Bund at J P Nagar in Mumbai | 200 | 2011 | | 200 | 18° 57' 21" N & 72° 47' 46" E |
| 39 | Construction of Anti Sea Erosion Bund at Haji Ali in Mumbai | 1100 | 2010 | | 1100 | 18° 58' 57" N & 72° 48' 52" E |
| 40 | Construction of Anti Sea Erosion Bund | 1500 | 2012 | | 1500 | 19° 00' 38" N & 72° 48' 56" |

| | | | | | | |
|---|---|---|---|---|---|---|
| | at Worli Sea Face in Mumbai Part - 2 | | | | | E |
| 41 | Construction of Anti Sea Erosion Bund at Worli Koliwada in Mumbai | 300 | 2012 | | 300 | 19° 01' 04" N & 72° 49' 14" E |
| 42 | Construction of Anti Sea Erosion Bund at Chaityabhoomi in Mumbai | 200 | 2010 | | 200 | 19° 01' 32" N & 72° 50' 03" E |
| 43 | Construction of Anti Sea Erosion Bund at Park Club and Shorewala in Mumbai | 180 | 2009 | | 180 | 19° 01' 49" N & 72° 50' 12" E |
| 44 | Construction of Anti Sea Erosion Bund at Shirish society to magdum palace in Mumbai | 280 | 2010 | | 280 | 19° 02' 06" N & 72° 50' 17" E |
| 45 | Construction of Anti Sea Erosion Bund at Kashinath Compound in Mumbai | 100 | 2010 | | 100 | 18° 57' 16" N & 72° 47' 43" E |
| 46 | Construction of Anti Sea Erosion Bund at Relewadi Mahim in Mumbai | 160 | 2011 | | 160 | 19° 02' 13" N & 72° 50' 18" E |
| | Total: | 12197 | | 2014 | 10183 | |
| District : Mumbai Suburban | | | | | | |
| 1 | Construction of Anti Sea Erosion Bund at Khardanda APS office, Mumbai (Ch. 0 to 120 m.) | 120 | 1995 | | 120 | 19° 04' 28" N & 72°49' 18" E |
| 2 | Construction of Anti Sea Erosion Bund at Khardanda, Tarinpada, Madhlapada to Kotpada (Upto Ram Mandir) Near Post Office Ch. 0 to 250m. | 250 | 2001 | | 250 | 19° 04' 33" N & 72°49' 18" E |
| 3 | Construction of Anti Sea Erosion Bund at Khardanda, | 250 | 2001 | | 250 | 19° 04' 41" N & 72°49' 20" E |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Tarinpada, Madhlapada to Kotpada (Upto Ram Mandir) Near Post Office Ch. 250 to 500 m. | | | | | |
| 4 | Construction of Anti Sea Erosion Bund at Khardanda, Tarinpada, Madhlapada to Kotpada (Upto Ram Mandir) Near Post Office Ch. 500 to 750 m. | 250 | 2002 | | 250 | 19° 04' 44" N & 72°49' 23" E |
| 5 | Construction of Anti Sea Erosion Bund at Khardanda, Tarinpada, Madhlapada to Kotpada (Upto Ram Mandir) Near Post Office Ch. 750 to 1000 m. | 250 | 2004 | | 250 | 19° 04' 43" N & 72°49' 28" E |
| 6 | Construction of Anti Sea Erosion Bund at Vesave Koliwada Ch. 0 to 100 m and 150 to 200 m. | 150 | 2004 | 150 | | 19° 08' 17" N & 72°48' 29" E |
| 7 | Construction of Anti Sea Erosion Bund at Vesave Koliwada Ch.200 m to 435 m. | 235 | 2004 | | 235 | 19° 08' 20" N & 72°48' 18" E |
| 8 | Construction of Anti Sea Erosion Bund at Bandstand, Bandra. Ch. 0 to 90 m. | 90 | 2007 | | 90 | 19° 02' 33" N & 72°49' 04" E |
| 9 | Construction of retaining wall at INS Hamla , Marve, Malad. | 400 | 2007 | 400 | | 19° 11' 25" N & 72°47' 45" E |
| 10 | Construction of Anti Sea Erosion Bund at Bandstand, Bandra Ch. 90 to 490 m. | 400 | 2009 | | 400 | 19° 02' 32" N & 72°49' 10" E |
| 11 | Construction of Anti Sea Erosion Bund at B,J. Road, | 380 | 2009 | | 380 | 19° 03' 15" N & 72°49' 22" E |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Bandstand, Bandra Ch. 0 to 380m. | | | | | |
| 12 | Construction of Anti Sea Erosion Bund at Versova Koliwada Ch.480 mt to 600m. | 120 | 2009 | | 120 | 19° 08' 28" N & 72°48' 11" E |
| 13 | Construction of Anti Sea Erosion Bund at Madh Patwadi Ch. 0 mt to 250m. | 250 | 2009 | 250 | | 19° 07' 53" N & 72°47' 18" E |
| 14 | Construction of Anti Sea Erosion Bund at Gorai koliwada Ch. 0 m to 530m. | 530 | 2009 | | 530 | 19° 14' 25" N & 72°46' 51" E |
| 15 | Construction of Anti Sea Erosion Bund at Gorai koliwada near Dejman Gudinho House | 165 | 2009 | | 165 | 19° 15' 47" N & 72°47' 04" E |
| 16 | Providing Protection to sea side wall by constructing C.C. protection wall along B.J. Road, Bandstand, Bandra. Ch. 380 to 650 m | 250 | 2010 | 250 | | 19° 03' 02" N & 72°49' 16" E |
| 17 | Construction of Anti Sea Erosion Bund at Versova Koliwada Ch.435 m to 480 m | 45 | 2010 | | 45 | 19° 08' 26" N & 72°48' 12" E |
| 18 | Construction of Anti Sea Erosion Bund at Gorai koliwada Ch.- 0 m to - 1300 m. | 1300 | 2010 | | 1300 | 19° 14' 55" N & 72°46' 57" E |
| 19 | Construction of retaining wall with beach nourishment at INS Hamla , Marve, Malad. | 500 | 2010 | 500 | | 19° 11' 38" N & 72°47' 48" E |
| 20 | Providing Protection to sea side wall by constructing C.C. protection wall along Carter Road promenade, Bandra. | 150 | 2011 | 150 | | 19° 04' 01" N & 72°49' 21" E |
| 21 | Construction of Anti Sea Erosion Bund at Carter Road Promenade, | 250 | 2011 | | 250 | 19° 04' 16" N & 72°49' 18" E |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Bandra.<br>Ch.1435 to 1685 m | | | | | | |
| 22 | Construction of Anti Sea Erosion Bund at Manori koliwada Ch. 0 m to 250m. | 250 | 2011 | 250 | | 19° 12' 13" N & 72°47' 09" E | |
| 23 | Construction of Anti Sea Erosion Bund at southern side of Gorai koliwada and Kulim Ch. 542 m to 1602 m. | 1060 | 2011 | | 1060 | 19° 14' 02" N & 72°46' 48" E | |
| | Total | 7645 | | 1950 | 5695 | | |

Table-9: Location and specification of protection measures implemented in Thane.

| Sr. No. | Name of work | Length in m | Year of construction | Concr -ete Wall | Rubb -le Bund | Lati -tude | Longi -tude |
|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| | Thane District | | | | | | |
| 1 | Construction of Anti Sea Erosion Bund at Usarni Tal-Palghar. | 695 | 1983 | | 695 | 19°34’45” N | 72°43’2” E |
| 2 | Construction of Anti Sea Erosion Bund at Tarapur Tal-Palghar. | 345 | 1986 | | 345 | 19°51’52” N | 72°40’49 ” E |
| 3 | Construction of Anti Sea Erosion Bund at Rangaon Tal-Vasai. | 580 | 1987 | | 580 | 19°22’13” N | 72°45’46 ” E |
| 4 | Construction of Anti Sea Erosion Bund at Kore Tal-Palghar. | 724 | 1986 | | 724 | 19°32’11” N | 72°43’36 ” E |
| 5 | Construction of Anti Sea Erosion Bund at Kambode, Tal-Palghar. | 365 | 1983 | | 365 | 19°9’18” N | 72°49’9” E |
| 6 | Construction | 675 | 1985 | | 675 | 19°42’2” N | 72°42’3” |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | of Anti Sea Erosion Bund (A)at Mathane, Tal-Palghar. | | | | | | E |
| 7 | Construction of Anti Sea Erosion Bund at Chinchni Dandipada, Tal-Dahanu. | 220 | 1984 | | 220 | 19°51’58” N | 72°40’53 ” E |
| 8 | Construction of Anti Sea Erosion Bund at Datiware,Tal-Palghar | 390 | 1986 | | 390 | | |
| 9 | Construction of Anti Sea Erosion Bund at Murbe,Tal-Palghar | 1200 | 1989 | | 1200 | 19°44’21” N | 72°42’3” E |
| 10 | Construction of Anti Sea Erosion Bund at Ucheli Dandi,Tal-Palghar | 1250 | 1985 | | 1250 | 19°40’15” N | 72°21’59 ” E |
| 11 | Construction of Anti Sea Erosion Bund at Satpati,Tal-Palghar | 766 | 1988 | | 766 | 19°41’8” N | 72°43’47 ” E |
| 12 | Construction of Anti Sea Erosion Bund at Chinchni,Tal-Dahanu | 370 | 1988 | | 370 | 19°52’35” N | 72°40’52 ” E |
| 13 | Construction of Anti Sea Erosion Bund at Gungwada,Tal-Dahanu | 270 | 1988 | | 270 | 19°57’18” N | 72°41’17 ” E |
| 14 | Construction of Anti Sea Erosion Bund at Arnala Fort,Tal-Vasai | 80 | 1989 | | 80 | 19°24’7” N | 72°43’9” E |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 15 | Construction of Anti Sea Erosion Bund at Kalamb,Tal-Vasai Part-I | 315 | 1990 | | 315 | 19°24’9” N | 72°44’9” E |
| 16 | Construction of Anti Sea Erosion Bund at Uttan,Tal-Vasai Part-I | 585 | 1989 | | 585 | 19°17’27” N | 72°47’32” E |
| 17 | Construction of Anti Sea Erosion Bund at Zai,Tal-Talasari Part-III | 247 | 1990 | | 247 | 19°7’92” N | 72°44’31” E |
| 18 | Construction of Anti Sea Erosion Bund at Wadrai,Tal-Palghar | 433 | 1990 | | 433 | 19°41’30” N | 72°42’72” E |
| 19 | Construction of Anti Sea Erosion Bund at Edwan(Koliwada) Tal-Palghar,Part-II | 427 | 1990 | | 427 | 19°41’50” N | 72°41’49” E |
| 20 | Construction of Anti Sea Erosion Bund at Borli,Tal-Dahanu | 306 | 1990 | | 306 | 19°58’20” N | 72°43’41” E |
| 21 | Construction of Anti Sea Erosion Bund (B) at Mathane Tal-Palghar,Part-II | 130 | 1989 | | 130 | 19°41’62” N | 72°42’62” E |
| 22 | Construction of Anti Sea Erosion Bund at Chinchni Moripada, Tal-Dahanu,Part-II | 152 | 1988 | | 152 | 19°53’11” N | 72°40’0” E |
| 23 | Construction of Anti Sea Erosion Bund | 960 | 1990 | | 960 | 19°23’32” N | 72°46’23” E |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | at Bhuigaon, Tal-Vasai,Part-II | | | | | | |
| 24 | Construction of Anti Sea Erosion Bund at Nandgaon, Tal-Palghar | 478 | 1990 | | 478 | 19°46’0” N | 72°41’55” E |
| 25 | Construction of Anti Sea Erosion Bund at Narpad, Tal-Dahanu | 425 | 1990 | | 425 | 20°0.74’0” N | 72°43’15” E |
| 26 | Construction of Anti Sea Erosion Bund at Vasai, Tal-Vasai Part-II | 400 | 1992 | | 400 | 19°23’0” N | 72°47’19” E |
| 27 | Construction of Anti Sea Erosion Bund at Varor, Tal-Dahanu. | 435 | 1992 | | 435 | 19°54’40” N | 72°41’0” E |
| 28 | Construction of Anti Sea Erosion Bund at Nirmal, Tal-Vasai | 304 | 1992 | | 304 | 19°24’23” N | 72°46’55” E |
| 29 | Construction of Anti Sea Erosion Bund at Chikhla, Tal-Dahanu. | 300 | 1993 | | 300 | 19°58’20” N | 72°43’8” E |
| 30 | Construction of Anti Sea Erosion Bund at Dahanu, Tal-Dahanu. | 813 | 1993 | | 813 | 19°59’72” N | 72°43’47” E |
| 31 | Construction of Anti Sea Erosion Bund at Dhakti Dahanu, Tal-Dahanu. | 316 | 1992 | | 316 | 19°57’9” N | 72°43’11” E |
| 32 | Construction of Anti Sea Erosion Bund at Navapur, Tal-Palghar. | 675 | 1992 | | 675 | 19°47’35” N | 72°41’38” E |
| 33 | Construction | 286 | 192 | | 286 | 19°46’40” | 72°42’82 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | of Anti Sea Erosion Bund at Mahim Tembhi, Tal-Palghar. | | | | | N | ” E |
| 34 | Construction of Anti Sea Erosion Bund at Kelwa Danda,Tal-Palghar. | 150 | 1992 | | 150 | 19°37’6” N | 72°44’17 ” E |
| 35 | Construction of Anti Sea Erosion Bund at Vasai(Pachub under), Tal-Vasai. | 45 | 1992 | | 45 | 19°19’5” N | 72°45’35 ” E |
| 36 | Construction of Anti Sea Erosion Bund at Satpale Rajodi | 500 | 1997 | | 500 | 19°17’2” N | 72°45’35 ” E |
| 37 | Construction of Anti Sea Erosion Bund (A) at Kelwa Mahim, Tal-Palghar.Part-I | 1255 | 1994 | | 1255 | 19°38’45” N | 72°44’1” E |
| 38 | Construction of Anti Sea Erosion Bund (B) at Kelwa Mahim, Tal-Palghar.Part-II | 150 | 1994 | | 150 | 19°37’55” N | 72°41’15 ” E |
| 39 | Construction of Anti Sea Erosion Bund at Ucheli Dandi,Tal-Palghar. Part-II | 500 | 1995 | | 500 | 19°48’6” N | 72°41’15 ” E |
| 40 | Construction of Anti Sea Erosion Bund at Bhuigaon,Tal-Vasai Part-III | 500 | 1998 | | 500 | 19°22’5” N | 72°45’55 ” E |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 41 | Temporary stone wall at Arnala,Tal-Vasai | 300 | 1999 | 300 | | 19°27’45” N | 72°45’58” E |
| 42 | Construction of Anti Sea Erosion Bund at Kalamb Tal-Vasai(Creek side) | 500 | 2000 | | 500 | 19°20’31” N | 72°49’1” E |
| 43 | Construction of Anti Sea Erosion Bund at Mathane | 330 | 2000 | | 330 | 19°41’52” N | 72°42’36” E |
| 44 | Construction of Anti Sea Erosion Bund at Satpati,Tal-Palghar. Ch.1000 to 1200 M. | 200 | 2002 | | 200 | 19°43’30” N | 72°42’31” E |
| 45 | Construction of Anti Sea Erosion Bund at Satpati,Tal-Palghar. Ch.750 to 1000 M. | 250 | 2002 | | 250 | 19°43’30” N | 72°42’31” E |
| 46 | Construction of Anti Sea Erosion Bund at Satpati,Tal-Palghar. | 250 | 2002 | | 250 | 19°43’30” N | 72°42’31” E |
| 47 | Construction of Anti Sea Erosion Bund at Satpati,Tal-Palghar.Ch.500 to 750 M. | 250 | 2002 | | 250 | 19°43’30” N | 72°42’31” E |
| 48 | Construction of Anti Sea Erosion Bund at Satpati,Tal-Palghar.Ch.0 to 250 M. | 250 | 2002 | | 250 | 19°43’30” N | 72°42’31” E |
| 49 | Construction of Anti Sea Erosion Bund at Satpati,Tal-Palghar.Ch.12 | 155 | 2002 | | 155 | 19°43’30” N | 72°42’31” E |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | 00 to 1355 M. | | | | | | |
| 50 | Construction of Anti Sea Erosion Bund at Mathane,Tal-Palghar | 300 | 2002 | | 300 | 19°41’58” N | 72°42’30” E |
| 51 | Construction of Anti Sea Erosion Bund at Dhakti Dahanu (Rampada), Tal-Dahanu. | 200 | 2003 | | 200 | 19°58’9” N | 72°43’11” E |
| 52 | Construction of Anti Sea Erosion Bund at Chinchani (Khadi naka to Baripada) | 200 | 2003 | | 200 | 19°51’58" | 72°40’54” E |
| 53 | Construction of Anti Sea Erosion Bund at Vasai Lage Bunder (Ch.520 to 720) | 200 | 2005 | | 200 | 19°19’34” N | 72°48’58” E |
| 54 | Construction of Anti Sea Erosion Bund at Zai,Tal-Talasari Part-I | 200 | 2005 | | 200 | 20°7’55” N | 72°44’15” E |
| 55 | Construction of Anti Sea Erosion Bund at Zai,Tal-Talasari Part-II | 200 | 2005 | | 200 | 20°7’55” N | 72°44’15” E |
| 56 | Construction of Anti Sea Erosion Bund at Vasai Lage Bunder Part-2 | 200 | 2005 | | 200 | 19°19’54” N | 72°48’28” E |
| 57 | Construction of Anti Sea Erosion Bund at Kalamb | 300 | 2003 | | 300 | 19°23’43” N | 72°45’43” E |
| 58 | Construction of Anti Sea Erosion Bund at Dahanu, | 1400 | 2007 | | 1400 | 19°59’2” N | 72°43’13” E |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Tal-Dahanu. | | | | | | |
| 59 | Construction of Anti Sea Erosion Bund at Diva Dandi, Tal. Dahanu | 150 | 2007 | | 150 | 19°58’24” N | 72°43’0” E |
| 60 | Construction of Anti Sea Erosion Bund at Satpale Rajodi, Tal. Vasai | 470 | 2008 | | 470 | 19°25’46” N | 72°45’20” E |
| 61 | Construction of Anti Sea Erosion Bund at Zai, Tal.- Talasari | 150 | 2008 | | 150 | 20°7’55” N | 72°44’15” E |
| 62 | Construction of Anti Sea Erosion Bund at Dahanu Tal.Dahanu Dis. Thane (Ch. 0/700 to 0/1400 m.) | 700 | 2009 | | 700 | 19°59’2” N | 72°43’13” E |
| 63 | Construction of Anti Sea Erosion Bund at Vadari Tal.Palghar Dis. Thane Ch. 0/0 to 0/105 m.) | 105 | 2010 | | 105 | 19°40’5” N | 72°42’37” E |
| 64 | Construction of Anti Sea Erosion Bund at Edvan Tal.Palghar Dis. Thane Ch. 0/0 to 0/140 m.) | 140 | 2009 | | 140 | 19°32’22” N | 72°43’25” E |
| 65 | Construction of Anti Sea Erosion Bund at Wattar Tal.Vasai Dis. Thane Ch. 0/0 to 0/120 m.) | 120 | 2010 | | 120 | 19°26’23” N | 72°45’7” E |
| 66 | Construction of Anti Sea | 230 | 2010 | | 230 | 19°26’45” | 72°45’20 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Erosion Bund at Satpale Rajodi Tal.Vasai Dis. Thane Ch. 0/470to 0/700m.) | | | | | N | ” E |
| 69 | Construction of Anti Sea Erosion Bund at Pachubandar Kinara Hotel to Jetty Tal.Vasai Dis. Thane (Ch. 0/0 to 0/280 m.) | 280 | 2010 | | 280 | 19°19’32” N | 72°48’41 ” E |
| 70 | Construction of Anti Sea Erosion Bund at Pachubandar Kinara Hotel to Jetty Tal.Vasai Dis. Thane (Ch. 0/280 to 0/420 m.) | 140 | 2010 | | 140 | 19°19’32” N | 72°48’35 ” E |
| 71 | Construction of Anti Sea Erosion Bund at Murbe Tal.Palghar Dis. Thane (Ch. 0/0 to 0/400 m.) | 400 | 2010 | 400 | | 19°44’34” N | 72°41’23 ” E |
| 72 | Construction of Anti Sea Erosion Bund at Ghivli Tal.Palghar Dis. Thane (Ch. 0/0 to 0/230 m.) | 230 | 2010 | 230 | | 19°50’52” N | 72°39’44 ” E |
| 73 | Construction of Anti Sea Erosion Bund at Pachubandar Kinara Hotel to Jetty Tal.Vasai | 300 | 2010 | | 300 | 18°30’46” N | 72°54’” E |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Dis. Thane (Ch. 0/0 to 0/300 m.) | | | | | | |
| 74 | Construction of Anti Sea Erosion Bund at Pachubandar Kinara Hotel to Jetty Tal.Vasai Dis. Thane (Ch. 0/300 to 0/550 m.) | 250 | 2010 | | 250 | 18°30’46” N | 72°54’” E |
| 77 | Construction of Anti Sea Erosion Bund at Satpale Rajodi Tal.Vasai Dis. Thane Ch. 0/700 to 0/1105 m.) | 400 | 2010 | | 400 | 18°30’46” N | 72°54’” E |
| 78 | Construction of Anti Sea Erosion Bund at Ghivli Tal.Palghar Dis. Thane Ch. 0/235 to 0/535 m.) | 300 | 2010 | | 300 | 18°30’46” N | 72°54’” E |
| 79 | Construction of Anti Sea Erosion Bund at Vadari Tal.Palghar Dis. Thane Ch. 0/140 to 0/350 m.) | 210 | 2010 | | 210 | 18°30’46” N | 72°54’” E |
| 80 | Construction of Anti Sea Erosion Bund at Wattar Tal.Vasai Dis. Thane Ch. 0/105 to 0/ m.) | 150 | 2010 | | 150 | 18°30’46” N | 72°54’” E |
| 81 | Construction of Anti Sea Erosion Bund at Edvan | 200 | 2010 | | 200 | 18°30’46” N | 72°54’” E |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Tal.Palghar Dis. Thane (Ch. 0/140 to 0/350 m.) | | | | | | |
| 82 | Construction of Anti Sea Erosion Bund at kalamb Tal.Vasai Dis. Thane (Ch. 0/700 to 0/1105m.) | 400 | 2010 | | 400 | 18°30’46” N | 72°54’” E |
| 83 | Construction of Anti Sea Erosion Bund at Arnala Killa Tal.Vasai Dis. Thane (Ch. 0/0 to 0/175 m.) | 175 | 2010 | 175 | | 18°30’46” N | 72°54’” E |
| 86 | Construction of Anti Sea Erosion Bund at kongaon Tal.Bhivandi Dis. Thane (Ch. 0/0 to 0/200 m.) | 200 | 2010 | | 200 | 18°30’46” N | 72°54’” E |
| 87 | Construction of Anti Sea Erosion Bund at Navapur Tal.Palghar Dis. Thane (Ch. 0/0 to 0/200 m.) | 200 | 2010 | | 200 | 18°30’46” N | 72°54’” E |
| 88 | Construction of Anti Sea Erosion Bund at Tembhi Tal.Palghar Dis. Thane (Ch. 0/0 to 0/400 m.) | 400 | 2010 | | 400 | 18°30’46” N | 72°54’” E |
| 89 | Construction of Anti Sea Erosion Bund at Gholwad Tal.Dahanu Dis. Thane (Ch. 0/0 to | 190 | 2010 | 190 | | 18°30’46” N | 72°54’” E |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | 0/190 m.) | | | | | | |
| 90 | Construction of Anti Sea Erosion Bund at Dahanu Tal.Dahanu Dis. Thane (Ch. 0/0 to 0/260 m.) | 260 | 2010 | 260 | | 18°30’46” N | 72°54’” E |
| 91 | Construction of Anti Sea Erosion Bund at Nandgaon Tal.Palghar Dis. Thane (Ch. 0/0 to 0/200 m.) | 200 | 2010 | | 200 | 18°30’46” N | 72°54’” E |
| 92 | Construction of Anti Sea Erosion Bund at Rangaon Tal.Vasai Dis. Thane (Ch. 0/135 to 0/330 m.) | 200 | 2010 | | 200 | 18°30’46” N | 72°54’” E |
| 93 | Construction of Anti Sea Erosion Bund at Kore Tal.Palghar Dis. Thane (Ch. 0/0 to 0/ 360 m.) | 360 | 2010 | | 360 | 18°30’46” N | 72°54’” E |
| 94 | Construction of Anti Sea Erosion Bund at Uttan Tal./Dis. Thane Barnard demelos House to Shanti doot Nivas | 200 | 2010 | 200 | | 18°30’46” N | 72°54’” E |
| 95 | Construction of Anti Sea Erosion Bund at Uttan Tal./Dis. Thane Anthoni bandyas | 100 | 2010 | 100 | | 18°30’46” N | 72°54’” E |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | house to Rinole Bhandaris House | | | | | | |
| 96 | Construction of Anti Sea Erosion Bund at Uttan Tal./Dis. Thane Blace Dharavis house to Robele Bavikar House | 220 | 2010 | 220 | | 18°30’46” N | 72°54’” E |
| 97 | Construction of Anti Sea Erosion Bund at Dandi Uchelli Tal Palghar | 250 | 2010 | | 250 | 18°30’46” N | 72°54’” E |
| | Total | 32982 | | 2075 | 21702 | | |

Table-10: Location and specification of protection measures implemented in Raygad district.

| Sr. No. | Name of work | Length in m | Year of construction | Rubble Bund | Latitude | Longitude |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 6 | 7 | 8 |
| | Raygad District | | | | | |
| 1 | Construction of Anti Sea Erosion Bund at Borlimandla, Tal. Murud | 170 | 1973 | 170 | 18° 30’46” N | 72° 54’40” E |
| 2 | Construction of Anti Sea Erosion Bund near Vihur Foot Bridge, Tal. Murud | 135 | 1974 | 135 | 18° 20’51” N | 72° 56’10” E |
| 3 | Construction of Anti Sea Erosion Bund at Danda Koliwada, Tal. Shriwardhan | 390 | 1974 | 390 | 18° 2’8” N N | 73° 0’47” E |
| 4 | Construction of Anti Sea Erosion Bund at Alibag, | 1650 | 1975 | 1650 | 18° 38’17” N | 72° 52’39” E |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Tal. Alibag | | | | | |
| 5 | Construction of Anti Sea Erosion Bund Near Agardanda Village | 350 | 1975 | 350 | 18° 16’43” N | 72° 59’31” E |
| 6 | Construction of Anti Sea Erosion Bund at Kabe Nagaon, Tal. Alibag | 15 | 1975 | 15 | 18° 37’8” N | 72° 53’24” E |
| 7 | Construction of Anti Sea Erosion Bund at Bodni Koproli, Tal. Alibag | 410 | 1975 | 410 | 18° 33’16” N | 72° 53’6” E |
| 8 | Construction of Anti Sea Erosion Bund at MILKAT Khar Baghdanda, Tal. Alibag | 375 | 1975 | 375 | 18° 48’30” N | 72° 55’50” E |
| 9 | Construction of Anti Sea Erosion Bund at Vihur (Pai Mohalla and Ulta Mohalla) Part 1 (Near Village), Tal. Murud. | 410 | 1976 | 410 | 18° 20’51” N | 72° 56’90” E |
| 10 | Construction of Anti Sea Erosion Bund at Mulgaon Koliwada, Tal. Shriwardhan | 200 | 1976 | 200 | 18° 2’8” N | 73° 0’47” E |
| 11 | Construction of Anti Sea Erosion Bund at Dive Aagar | 370 | 1976 | 370 | 18° 10’10” N | 72° 59’8” E |
| 12 | Construction of Anti Sea Erosion Bund at Thal Chalmala, Ch. 0 to 1005 | 1005 | 1976 | 1005 | 18° 40’20” N | 72° 51’47” E |
| 13 | Construction of Anti Sea Erosion Bund at Walwati, Tal. Shriwardhan | 570 | 1976 | 570 | 18° 4’58” N | 72° 59’47” E |
| 14 | Construction of Anti Sea Erosion Bund at Aadgaon, Tal. Shriwardhan Ch.0 to 160 mt | 500 | 1976 | 500 | 18° 13’11” N | 72° 57’10” E |

| | | | | | | |
|---|---|---|---|---|---|---|
| 15 | Construction of Anti Sea Erosion Bund at Diveagar groyans | 150 | 1978 | 150 | 18° 11’54” N | 72° 58’44” E |
| 16 | Construction of Anti Sea Erosion Bund at Baghmandla, Tal. Shriwardhan | 1200 | 1979 | 1200 | 17° 59’27” N | 73° 2’53” E |
| 17 | Construction of Anti Sea Erosion Bund at Rajpuri, Tal. Murud Part-1 Behind Muslim Mohalla, Part-2 Opp. S.T. Stand | 500 | 1979 | 500 | 18° 18’6” N | 72° 58’17” E |
| 18 | Construction of Anti Sea Erosion Bund at Korlaie, | 400 | 1980 | 400 | 18° 31’47” N | 72° 54’40” E |
| 19 | Construction of Anti Sea Erosion Bund at Hareshwar, Tal. Shriwardhan | 2100 | 1980 | 2100 | 17° 59’46” N | 73° 1’12” E |
| 20 | Construction of Anti Sea Erosion Bund at Dighi, near new Dighi bund, Tal.Shriwardhan, | 180 | 1980 | 180 | 18° 15’51” N | 72° 58’14” E |
| 21 | Const. of Anti Sea Erosion Bund at Borli Mandla Near Muslim cemetry, Tal. Murud. | 150 | 1981 | 150 | 18° 30’57” N | 72° 54’41” E |
| 22 | Construction of Anti Sea Erosion Bund at Velas, Tal. Shriwardhan | 50 | 1982 | 50 | 18° 15’0” N | 72° 56’33” E |
| 23 | Construction of Anti Sea Erosion Bund at Dighi Koliwada, Tal. Shriwardhan | 100 | 1982 | 100 | 18° 16’2” N | 72° 58’12” E |
| 24 | Construction of Anti Sea Erosion Bund at Karanja Tal.Uran, Part-2 | 845 | 1983 | 845 | 18° 50’46” N | 72° 56’31” E |
| 25 | Construction of Anti Sea Erosion | 155 | 1983 | 155 | 18° 33’49” N | 72° 55’4” E |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Bund at Revdanda, Part 2, Tal. Alibag | | | | | |
| 26 | Construction of Anti Sea Erosion Bund at Theronda, Tal. Alibag | 279 | 1983 | 279 | 18° 34’33” N | 72° 54’42” E |
| 27 | Construction of Anti Sea Erosion Bund at Sarva, Tal. Shriwardhan Ch.0 to 160 m | 135 | 1985 | 135 | 18° 15’15” N | 72° 56’31” E |
| 28 | Construction of Anti Sea Erosion Bund at Nagaon, Tal. Uran Part 1 Ch. 0 to 810 m. | 450 | 1986 | 450 | 18° 52’6” N | 72° 55’19” E |
| 29 | Construction of Anti Sea Erosion Bund at Kolgaon, Tal. Alibag | 1785 | 1986 | 1785 | 18° 52’18” N | 72° 55’8” E |
| 30 | Const.of Anti Sea Erosion Bund at Varsoli Tal Alibag Ch 0 to 720 and Ch.720 to 1426 m. | 1455 | 1986 | 1455 | 18° 39’54” N | 72° 51’49” E |
| 31 | Const. of Anti Sea Erosion Bund at Dive Aagar Near Muslim Mohalla, Tal. Shriwardhan | 50 | 1987 | 50 | 18° 11’26” N | 72° 58’45” E |
| 32 | Construction of Anti Sea Erosion Bund at Revdanda, Tal. Alibag Part 3 | 190 | 1987 | 190 | 18° 32’57” N | 72° 55’27” E |
| 33 | Construction of Anti Sea Erosion Bund at Nandgaon, Tal. Murud | 1200 | 1987 | 1200 | 18° 22’59” N | 72° 55’36” E |
| 34 | Construction of Anti Sea Erosion Bund at Murud, Tal. Shriwardhan | 1840 | 1988 | 1840 | 18° 19’30” N | 72° 57’25” E |
| 35 | Construction of Anti Sea Erosion Bund at Dighi, Dighi Muslim Mohalla, | 270 | 1988 | 270 | 18° 15’48” N | 72° 58’20” E |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Tal.Shriwardhan, Near Hindu cemetry. ch. 0 to 150 m | | | | | |
| 36 | Construction of Anti Sea Erosion Bund at Borli Mandla Groyans, Tal. Murud | 212 | 1989 | 212 | 18° 30’14” N | 72° 54’34” E |
| 37 | Const. of Anti Sea Erosion Bund near Akshi Bridge, Tal. Alibag Part 1 Ch. 0 to 630 m | 555 | 1989 | 555 | 18° 37’42” N | 72° 53’50” E |
| 38 | Construction of Anti Sea Erosion Bund at Koteshwari, Tal. Murud | 400 | 1989 | 400 | 18° 20’6” N | 72° 57’10” E |
| 39 | Construction of Anti Sea Erosion Bund at Dongri, Tal. Murud | 210 | 1989 | 210 | 18° 18’47” N | 72° 57’44” E |
| 40 | Construction of Anti Sea Erosion Bund near Murud Police Quarters, Tal. Murud | 155 | 1990 | 155 | 18° 20’6” N | 72° 57’7” E |
| 41 | Construction of Anti Sea Erosion Bund near Ekdara Bridge, Part 2 Tal. Murud | 155 | 1990 | 155 | 18° 19’3” N | 72° 57’39” E |
| 42 | Construction of Anti Sea Erosion Bund near Ekdara Koliwada, Part 1 Tal. Murud | 100 | 1990 | 100 | 18° 19’6” N | 72° 57’38” E |
| 43 | Construction of Anti Sea Erosion Bund at Kegaon, Tal. Uran Part 2 Ch. 650 to 1650 m | 955 | 1990 | 955 | 18° 53’54” N | 72° 55’47” E |
| 44 | Construction of Anti Sea Erosion Bund near Dighi Boudhawadi | 46 | 1990 | 46 | 18° 16’4” N | 72° 58’10” E |
| 45 | Construction of Anti Sea Erosion Bund at | 125 | 1990 | 125 | 18° 8’33” N | 72° 59’4” E |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Bharadkhol | | | | | |
| 46 | Construction of Anti Sea Erosion Bund at Borli Mandla Pardeshwadi, Tal. Murud. | 270 | 1990 | 270 | 18° 30’56” N | 72° 54’41” E |
| 47 | Construction of Anti Sea Erosion Bund near Vihur Masjid, Tal. Murud | 290 | 1991 | 290 | 18° 21’0” N | 72° 56’7” E |
| 48 | Construction of Anti Sea Erosion Bund at Korlaie Muslim Cemetry, Tal. Murud. | 210 | 1991 | 210 | 18° 14’49” N | 72° 54’36” E |
| 49 | Construction of Anti Sea Erosion Bund at Bandhara Mora, Tal. Murud | 235 | 1992 | 235 | 18° ’ ” N | 72° ’ ” E |
| 50 | Construction of Anti Sea Erosion Bund at Palav, Tal. Alibag, Ch. 0 to 135 m | 135 | 1992 | 135 | 18° 37’5” N | 72° 53’25” E |
| 51 | Construction of Anti Sea Erosion Bund at Akshi, Part 2 Ch. 620 to 1160 m | 575 | 1992 | 575 | 18° 37’18” N | 72° 53’18” E |
| 52 | Construction of Anti Sea Erosion Bund at Kegaon, Tal. Uran, Part 3 Ch.0 to 745 m | 575 | 1992 | 575 | 18° 53’54” N | 72° 54’31” E |
| 53 | Construction of Anti Sea Erosion Bund at Ranjankhar, Tal. Alibag. | 1150 | 1992 | 1150 | 18° 48’32” N | 72° 55’49” E |
| 54 | Construction of Anti Sea Erosion Bund at Navedar Navgaon, Tal. Alibag, Ch.0 to 45 m | 130 | 1992 | 130 | 18° 42’43” N | 72° 51’42” E |
| 55 | Construction of Anti Sea Erosion Bund at Jeevna Bunder | 60 | 1992 | 60 | 18° 3’17” N | 73° 0’8” E |

| | | | | | | |
|---|---|---|---|---|---|---|
| 56 | Const.of Anti Sea Erosion Bund at Shriwardhan Part-1, Tal. Shriwardhan Ch. 0 to 829 m. | 830 | 1992 | 830 | 18° 2’16” N | 73° 0’45” E |
| 57 | Construction of Anti Sea Erosion Bund at Kashid, Tal. Murud.Ch. 0 to 425 m | 425 | 1992 | 425 | 18° 26’22” N | 72° 54’22” E |
| 58 | Construction of Anti Sea Erosion Bund at Shriwardhan Part-2, Tal. Shriwardhan Ch.829.50 to 1595.30 m | 765 | 1993 | 765 | 18° 2’16” N | 73° 0’45” E |
| 59 | Construction of Anti Sea Erosion Bund at Shriwardhan Part-3, Tal. Shriwardhan Ch.1595.30 m to 2516.40 m | 921 | 1993 | 921 | 18° 2’16” N | 73° 0’45” E |
| 60 | Construction of Anti Sea Erosion Bund at Chikni, Tal. Murud.Ch. 0 to 145 m | 145 | 1993 | 145 | 18° 25’54” N | 72° 54’23” E |
| 61 | Construction of Anti Sea Erosion Bund at Thal, Tal. Alibag, Part 1, Ch. 0 to 590 m | 590 | 1993 | 590 | 18° 41’40” N | 72° 51’25” E |
| 62 | Construction of Anti Sea Erosion Bund at Thal, Tal. Alibag, Part 2, Ch. 590 m To 1180 m | 375 | 1993 | 375 | 18° 41’40” N | 72° 51’25” E |
| 63 | Construction of Anti Sea Erosion Bund at Thal, Tal. Alibag, Part 3, Ch. 1180 To 1770 m | 590 | 1993 | 590 | 18° 41’40” N | 72° 51’25” E |
| 64 | Construction of Anti Sea Erosion Bund at Salav, | 250 | 1993 | 250 | 18° 32’3” N | 72° 55’30” E |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Tal.Murud, Ch. 0 m To 226.50 m | | | | | |
| 65 | Construction of Anti Sea Erosion Bund at Kegaon, Tal. Uran Part 3 Ch.0 to 745 m | 745 | 1994 | 745 | 18° 52’18” N | 75° 55’7” E |
| 66 | Construction of Anti Sea Erosion Bund at Shriwardhan Part-4, Tal. Shriwardhan Ch.2516.40 m to 3285.20 m | 769 | 1994 | 769 | 18° 2’55” N | 73° 0’30” E |
| 67 | Const. of Anti Sea Erosion Bund at Agardanda, Tal.Murud, Near Hindu cemetry. Part 1 | 305 | 1994 | 305 | 18° 16’28” N | 72° 59’38” E |
| 68 | Construction of Anti Sea Erosion Bund at Dive Aagar, Tal. Shriwardhan (Muslim Mohalla) | 60 | 1996 | 60 | 18° 0’72” N | 72° 58’54” E |
| 69 | Construction of Anti Sea Erosion Bund at Dighi near cargo jetty | 150 | 1996 | 150 | 18° 16’18” N | 72° 58’17” E |
| 70 | Construction of Anti Sea Erosion Bund at Ekdara ( Near bridge side) Tal. Murud Janjira | 80 | 1996 | 80 | 18° 19’6” N | 72° 57’36” E |
| 71 | Construction of Anti Sea Erosion Bund at Barshiv Hindu cemetry | 250 | 1997 | 250 | 18° 29’12” N | 72° 54’50” E |
| 72 | Construction of Anti Sea Erosion Bund at Agardanda, Tal.Murud Janjira, Part 2 | 210 | 1999 | 210 | 18° 16’28” N | 72° 59’38” E |
| 73 | Construction of Anti Sea Erosion Bund at Rajpuri, (Muslim)Tal. | 145 | 1999 | 145 | 18° 18’15” N | 72° 58’7” E |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Murud | | | | | |
| 74 | Construction of Anti Sea Erosion Bund at Salav, Tal.Murud Janjira,. | 246 | 1999 | 246 | 18° 31’56” N | 72° 55’27” E |
| 75 | Construction of Anti Sea Erosion Bund at Rajpuri, (Navkhar)Tal. Murud | 165 | 1999 | 165 | 18° 18’25” N | 72° 58’7” E |
| 76 | Construction of Anti Sea Erosion Bund at Aagardanda, Tal. Murud Janjira | 210 | 1999 | 210 | 18° 17’7” N | 72° 59’26” E |
| 77 | Construction of Anti Sea Erosion Bund at Salav, Tal. Murud Janjira | 245 | 1999 | 245 | 18° 31’54” N | 72° 52’24” E |
| 78 | Construction of Anti Sea Erosion Bund at Dive Aagar, Tal. Shriwardhan (Muslim Mohalla) | 60 | 1999 | 60 | 18° 11’0” N | 72° 58’5” E |
| 79 | Construction of Anti Sea Erosion Bund at Barshiv ( farm side), Tal Murud | 195 | 1999 | 195 | 18° 29’29” N | 72° 54’0” E |
| 80 | Construction of Anti Sea Erosion Bund at Ramnath cemetry to Nyaydandadhikari, Tal.Alibag (Ch. 2165 to 2460 m) | 300 | 1999 | 300 | 18° 39’20” N | 72° 51’52” E |
| 81 | Construction of Anti Sea Erosion Bund at Ramnath cemetry, Tal.Alibag 3145 to 3445 m | 300 | 1999 | 300 | 18° 39’20” N | 72° 51’52” E |
| 82 | Construction of anti sea erosion bund at Barshiv, Tal. Murud (Farm side) | 195 | 1999 | 195 | 18° 29’29” N | 72° 54’7” E |
| 83 | Construction of anti sea erosion | 200 | 1999 | 200 | 18° 39’18” N | 72° 51’52” E |

| | | | | | | |
|---|---|---|---|---|---|---|
| | bund at Ramraj, Tal. Alibag | | | | | |
| 84 | Construction of Anti Sea Erosion Bund at Vihur, Tal. Murud Janjira | 285 | 2000 | 285 | 18° 20’54” N | 72° 56’10” E |
| 85 | Construction of Anti Sea Erosion Bund at new Gaonthan Korlaie, Tal Murud Janjira | 242 | 2000 | 242 | 18° 31’34” N | 72° 54’38” E |
| 86 | Construction of Anti Sea Erosion Bund near Barshiv Subhash Mahadik's farm, Tal. Murud | 250 | 2000 | 250 | 18° 29’19” N | 72° 54’3” E |
| 87 | Construction of anti sea erosion bund at Nagaon, Palav, Tal. Alibag | 200 | 2001 | 200 | 18° 37’28” N | 72° 53’13” E |
| 88 | Construction of anti sea erosion bund at Shriwardhan Danda, Tal. Shriwardhan | 500 | 2001 | 500 | 18° 2’28” N | 73° 0’40” E |
| 89 | Construction of Anti Sea Erosion Bund at Sakhar (Akshi), Tal. Alibag | 250 | 2001 | 250 | 18° 37’44” N | 72° 53’7” E |
| 90 | Construction of Anti Sea Erosion Bund at Gaonthan Borli Mandla, Tal Murud Janjira | 200 | 2002 | 200 | 18° 30’47” N | 72° 54’40” E |
| 91 | Construction of anti sea erosion bund at Sasavne Koliwada, Tal. Alibag | 270 | 2002 | 270 | 18° 47’30” N | 72° 51’52” E |
| 92 | Construction of Anti Sea Erosion Bund at Gaonthan Borli Mandla, Tal Murud Janjira | 95 | 2002 | 95 | 18° 30’47” N | 72° 54’40” E |
| 93 | Construction of Anti Sea Erosion Bund at Kondwil | 200 | 2003 | 200 | 18° 5’30” N | 72° 59’37” E |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Tal-Shriwardhan . | | | | | |
| 94 | Construction of Groyans at Varsoli, Tal-Alibag | 1000 | 2005 | 1000 | 18° 40’1” N | 72° 51’44” E |
| 95 | Construction of Anti Sea Erosion Bund at Theronda, Tal-Alibag | 955 | 2007 | 955 | 18° 34’48” N | 72° 54’46” E |
| 96 | Construction of Anti Sea Erosion Bund at Nagao, Tal-Alibag | 965 | 2008 | 965 | 18° 36’59” N | 72° 53’29” E |
| 97 | Construction of Anti Sea Erosion Bund at Awas, Tal-Alibag | 300 | 2008 | 300 | 18° 46’26” N | 72° 51’50” E |
| 98 | Construction of Anti Sea Erosion Bund at Korlai, Tal-Alibag | 300 | 2008 | 300 | 18° 31’51” N | 72° 54’30” E |
| 99 | Construction of anti sea erosion bund at Awas Tal:-Alibag dist:-Raygad | 900 | 2008 | 900 | 18° 46’25” N | 72° 51’50” E |
| 100 | Construction of Anti Sea Erosion Bund at Kavlekhar Borli Taluka Pen | 175 | 2009 | 175 | 18° 47’49” N | 73° 2’52” E |
| 101 | Construction of Anti Sea Erosion Bund at Ranjankhar Davli | 365 | 2009 | 365 | 18° 49’14” N | 72° 56’11” E |
| 102 | Construction of Anti Sea Erosion Bund at Thal, Tal-Alibag | 130 | 2009 | 130 | 18° 41’25” N | 72° 51’31” E |
| 103 | Construction of Anti Sea Erosion Bund at Mendi Koliwada Taluka Masala | 100 | 2009 | 100 | 18° 11’8” N | 73° 3’9” E |
| 104 | Construction of Anti Sea Erosion Bund at Pabre Koliwada Taluka Masala | 100 | 2009 | 100 | 18° 9’35” N | 73° 5’57” E |
| 105 | Construction of Anti Sea Erosion Bund at Awas , | 190 | 2009 | 190 | 18° 46’30” N | 72° 51’50” E |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Tal-Alibag | | | | | |
| 106 | Construction of Anti Sea Erosion Bund at Bharadkhol Tal Shriwardhan | 25 | 2009 | 25 | 18° 8’20” N | 72° 58’52” E |
| 107 | Construction of Anti Sea Erosion Bund at Rajpuri Koliwada Taluka Murud | 115 | 2009 | 115 | 18° 18’4” N | 72° 58’27” E |
| 108 | Construction of Anti Sea Erosion Bund at Korlai, Tal-Murud | 50 | 2009 | 50 | 18° 31’49” N | 72° 54’32” E |
| 109 | Construction of Anti Sea Erosion Bund at Murud Koliwada Tal Murud | 20 | 2009 | 20 | 18° 19’12” N | 72° 57’39” E |
| 110 | Construction of Anti Sea Erosion Bund at Nandgaon Tal Murud | 25 | 2009 | 25 | 18° 23’8” N | 72° 55’35” E |
| 111 | Construction of anti sea erosion bund at Ch no 892 to Rest house and D.S.P.Bangalow at Tal:Aliabag Dist:-Raygad | 900 | 2009 | 900 | 18° 38’49” N | 72° 54’1” E |
| 112 | Construction of antisea erosion at Yashant khar Tal:- Murud Dist:- Raygad Part 1 | 225 | 2010 | 225 | 18° 19’7” N | 72° 57’48” E |
| 113 | Construction of antisea erosion at Yashant khar Tal:- Murud Dist:- Raygad Part 2 | 650 | 2010 | 650 | 18° 19’3” N | 72° 58’1” E |
| 114 | Construction of antisea erosion at Yashant khar Tal:- Murud Dist:- Raygad Part 3 | 650 | 2010 | 650 | 18° 19’13” N | 72° 58’11” E |
| 115 | Construction of anti sea erosion bund at awas | 50 | 2010 | 50 | 18° 47’1” N | 72° 51’50” E |

| | | | | | | |
|---|---|---|---|---|---|---|
| | bhagat ali to Phatak ali Tal:- Alibag Dist:Raygad | | | | | |
| 116 | Construction of anti sea erosion bund at Revasgaon Tal:- Alibag Dist:Raygad part 1 | 130 | 2010 | 130 | 18° 47’30” N | 72° 55’49” E |
| 117 | Construction of anti sea erosion bund at Bahiricha pada bangala bandar Tal:- Alibag Dist:Raygad pat 1 | 450 | 2010 | 450 | 18° 45’48” N | 72° 59’12” E |
| 118 | Construction of anti sea erosion bund at palav Tal:- Alibag Dist:- Raygad | 320 | 2010 | 320 | 18° 35’16” N | 72° 54’49” E |
| 119 | Construction of anti sea erosion bund at Varsoli Tal:Alibag Dist:Raygad ch no. 0/300 to 0/370 | 70 | 2010 | 70 | 18° 39’48” N | 72° 51’49” E |
| 120 | Construction of anti sea erosion bund at Varsoli Tal:Alibag Dist:Raygad ch no. 0/370 to 0/400 | 30 | 2010 | 30 | 18° 39’48” N | 72° 51’49” E |
| 121 | Construction of anti sea erosion bund at Khargaon Aravi Tal:- Shriwardhan Dist:Raygad part 1 | 75 | 2010 | 75 | 18° 5’23” N | 72° 59’31” E |
| 122 | Construction of anti sea erosion bund at Theronda Tal:Alibag Dist:Raygad | 985 | 2010 | 985 | 18° 34’34” N | 72° 54’40” E |
| 123 | Construction of anti sea erosion bund at Nagaon Tal:Alibag | 1000 | 2010 | 1000 | 18° 36’29” N | 72° 53’45” E |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Dist:Raygad | | | | | |
| 124 | Construction of anti sea erosion bund at Alibag Koliwada Tal:Alibag Dist:Raygad | 890 | 2010 | 890 | 18° 38’16” N | 72° 52’41” E |
| | Total | 50930 | | 50930 | | |

Table-11: Location and specification of protection measures implemented in Ratnagiri district.

| Sr. No | Name of work | Length in m | Year of construction | Concrete Wall | Rubble Bund | Latitude | Longitude |
|---|---|---|---|---|---|---|---|
| | District : Ratanagiri | | | | | | |
| 1 | Construction of anti sea erosion bund at Utambar | 380 | 1975 | | 380 | 17°.53’ .43”.96 N | 73°.03’ .35”.78E |
| 2 | Construction of anti sea erosion bund at karanjgaon | 575 | 1978 | | 575 | 17°.42’ .34”46 N | 73°.08’ .05.”71E |
| 3 | Construction of anti sea erosion bund at Rajiwada | 500 | 1978 | | 500 | 16°.58’ .55”.39 N | 73°.17’ .53”.94E |
| 4 | Construction of anti sea erosion bund at Murud (Saldur) | 860 | 1979 | | 860 | 17°.45’ .33”.50N | 73°.07’ .09”.08E |
| 5 | Construction of anti sea erosion bund at Sakhari | 720 | 1980 | | 720 | 17°.22’ .51”.45N | 73°.12’ .23”.01E |
| 6 | Construction of anti sea erosion bund at Gavkhadi | 860 | 1980 | | 860 | 16°.48’ .24”.88N | 73°.19’ .18”.24E |
| 7 | Construction of anti sea erosion bund at Vetye | 200 | 1980 | | 200 | 16°.43’ .18”.30N | 73°.18’ .45”.49E |
| 8 | Construction of anti sea erosion bund at Vesavi | 325 | 1981 | | 325 | 17°.59’ .06”.03N | 73°.04’ .16”.84E |
| 9 | Construction of anti sea erosion bund at Ade | 1020 | 1981 | | 1020 | 17°.53’ .26”.55N | 73°.04’ .16”.54E |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 10 | Construction of anti sea erosion bund at Anjarla | 500 | 1981 | | 500 | 17°.51’ .00”.06N | 73°.05’ .02”.77E |
| 11 | Construction of anti sea erosion bund at Dhokambale | 579 | 1981 | | 579 | 17°.06’ .20”.72N | 73°.16’ .48”.30E |
| 12 | Construction of anti sea erosion bund at Velas | 1062 | 1982 | | 1062 | 17°.57’ .43”.16N | 73°.01’ .45”.58E |
| 13 | Construction of anti sea erosion bund at Bhandarwadi | 1517 | 1982 | | 1517 | 17°.29’ .18”.95N | 73°.11’ .05”.84E |
| 14 | Construction of anti sea erosion bund at Tavsal | 650 | 1982 | | 650 | 17°.18’ .22”.29N | 73°.14’ .37”.71E |
| 15 | Construction of anti sea erosion bund at Bhandarwada | 900 | 1982 | | 900 | 17°.28’ .58”.62N | 73°.11’ .16”.68E |
| 16 | Construction of anti sea erosion bund at Devache Gothane | 360 | 1982 | | 360 | 16°.35’ .35”.78N | 73°.19’ .09”.27E |
| 17 | Construction of anti sea erosion bund at Ansure Pangarwadi | 1200 | 1982 | | 1200 | 16°.35’ .37”.41N | 73°.19’ .19”.79E |
| 18 | Construction of anti sea erosion bund at Kelshi | 753 | 1983 | | 753 | 17°.55’ .19”.11N | 73°.03’ .07”.17E |
| 19 | Construction of anti sea erosion bund at Bhatye | 450 | 1983 | | 450 | 16°.58’ .50”.08N | 73°.17’ .50”.31E |
| 20 | Construction of anti sea erosion bund at Harnai | 390 | 1984 | | 390 | 17°.49’ .48”.46N | 73°.05’ .35”.27E |
| 21 | Construction of anti sea erosion bund at Ladghar | 750 | 1984 | | 750 | 17°.43’ .00”.44N | 73°.08’ .00”.34E |
| 22 | Construction of anti sea erosion bund at Burondi | 930 | 1984 | | 930 | 17°.42’ .27”.82N | 73°.08’ .03”.76E |
| 23 | Construction of anti sea erosion bund at Khalchapat | 232 | 1984 | | 232 | 17°.28’ .33”.44N | 73°.11’ .34”.46E |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 24 | Construction of anti sea erosion bund at Asgoli | 140 | 1984 | | 140 | 17°.27’ .53”.97N | 73°.11’ .33”.71E |
| 25 | Construction of anti sea erosion bund at Palshet | 450 | 1984 | | 450 | 17°.27’ .35”.85N | 73°.11’ .17”.26E |
| 26 | Construction of anti sea erosion bund at Adur Karul | 484 | 1984 | | 484 | 17°.24’ .41”.07N | 73°.11’ .00”.18E |
| 27 | Construction of anti sea erosion bund at Gavade Ambere | 860 | 1984 | | 860 | 16°.49’ .10”.78N | 73°.19’ .45”.63E |
| 28 | Construction of anti sea erosion bund at Bhatkarwada | 540 | 1984 | | 540 | 17°.00’ .14”.77N | 73°.16’ .55”.82E |
| 29 | Construction of anti sea erosion bund at Ambolgad | 760 | 1984 | | 760 | 16°.38’ .24”.98N | 73°.19’ .53.”67E |
| 30 | Construction of anti sea erosion bund at Ansure Dandawadi | 600 | 1984 | | 600 | 16°.33’ .35”.79N | 73°.21’ .29”.61E |
| 31 | Construction of anti sea erosion bund at Bankot | 475 | 1985 | | 475 | 17°.58’ .24”.27N | 73°.02’ .01”.47E |
| 32 | Construction of anti sea erosion bund at Velneshwar | 830 | 1985 | | 830 | 17°.23’ .01”.74N | 73°.12’ .14”.04E |
| 33 | Construction of anti sea erosion bund at Karde | 625 | 1986 | | 625 | 17°.44’ .48”.57N | 73°.07’ .23”.79E |
| 34 | Construction of anti sea erosion bund at Adur Kond | 450 | 1986 | | 450 | 17°.52’ .39”.99N | 73°.64’ .29”.71E |
| 35 | Construction of anti sea erosion bund at Hedvi | 600 | 1986 | | 600 | 17°.21’ .28”.35N | 73°.12’ .59”.41E |
| 36 | Construction of anti sea erosion bund at Wada Tiwari | 620 | 1986 | | 620 | 16°.40’ .15”.54N | 73°.19’ .49”.16E |
| 37 | Construction of anti sea erosion bund at | 800 | 1986 | | 800 | 17°.07’ .40”.56N | 73°.16’ .16”.51E |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Bhandarpule | | | | | | |
| 38 | Construction of anti sea erosion bund at Are | 538 | 1986 | | 538 | 17°.03’ .51”.20N | 73°.17’ .17”.70E |
| 39 | Construction of anti sea erosion bund at Bhatye | 310 | 1986 | | 310 | 16°.58’ .43”.84N | 73°.17’ .37”.53E |
| 40 | Construction of anti sea erosion bund at Sakhrinate | 260 | 1986 | | 260 | 16°.37’ .39”.30N | 73°.20’ .28”.39E |
| 41 | Construction of anti sea erosion bund at Jaitapur Danda | 600 | 1986 | | 600 | 16°.36’ .59”.64N | 73°.21’ .05”.41E |
| 42 | Construction of anti sea erosion bund at Bhagwati bunder | 820 | 1987 | | 820 | 16°.59’ .49”.63N | 73°.16’ .17”.03E |
| 43 | Construction of anti sea erosion bund at Kuveshi | 800 | 1987 | | 800 | 16°.34’ .41”.01N | 73°.20’ .25”.93E |
| 44 | Construction of anti sea erosion bund at sagwe | 180 | 1988 | | 180 | 16°.34’ .46”.31N | 73°.19’ .43”.02E |
| 45 | Construction of anti sea erosion bund at Mirkarwada | 780 | 1990 | | 780 | 17°.00’ .04”.42N | 73°.16’ .50”.01E |
| 46 | Construction of anti sea erosion bund at Kolthare | 100 | 1993 | | 100 | 17°.36’ .15”.62N | 73°.08’ .39”.27E |
| 47 | Construction of anti sea erosion bund at Jaitapur Anandwadi to Awara Jaitapur | 668 | 1993 | | 668 | 16°.36’ .59”.64N | 73°.21’.05”.81E |
| 48 | Construction of anti sea erosion bund at jakimirya | 1120 | 2001 | | 1120 | 17°.01’.12”.54N | 73°.16’.39”.60E |
| 49 | Construction of anti sea erosion bund at Bhandarpule | 100 | 2002 | | 100 | 17°.07’.40”.56N | 73°16’.16”.51E |
| 50 | Construction of anti sea erosion | 150 | 2004 | | 150 | 17°.53’.26”.55N | 73°.04’.16”.54E |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | bund at Ade | | | | | | |
| 51 | Construction of anti sea erosion bund at Kaeranjgaon Tamasthirthe | 247 | 2004 | | 247 | 17°.42’.34”.46N | 73°.08’.05”.71E |
| 52 | Construction of anti sea erosion bund at Kharviwada Dabhol | 100 | 2004 | | 100 | 17°.35’.19”.18N | 73°.10’.53”.69E |
| 53 | Construction of anti sea erosion bund at Amboshi | 90 | 2005 | | 90 | 17°.20’.25”.63N | 73.13’.12”.64E |
| 54 | Construction of anti sea erosion bund at Harnai Smashanbhoomi | 150 | 2006 | | 150 | 17°.48’.28”.21N | 73°.05’.49”.74E |
| 55 | Construction of anti sea erosion bund at Asgoli | 370 | 2007 | | 370 | 17°.27’.54”.83N | 73°.11’.33”.74E |
| 56 | Construction of anti sea erosion bund at Harnai Navanagar. | 150 | 2008 | | 150 | 17°.48’.23”.83N | 73°.05’.44”.96E |
| 57 | Construction of anti sea erosion bund at Someshwar | 550 | 2008 | | 550 | 16°.58’.18”.97N | 73°.21’.06”.91E |
| 58 | Construction of anti sea erosion bund at Bhatimirya | 1100 | 2009 | | 1100 | 17°.00’.57”.24N | 73°.16’.50”.47E |
| 59 | Construction of anti sea erosion bund at madban | 800 | 1993 | | 800 | 16°.36’.10”.30N | 73°.19’11”.42E |
| 60 | Construction of anti sea erosion bund at Tulsunde Kharviwada Tal Rajapur | 700 | 2009 | | 700 | 16°.35’.47”.61N | 73°.19’.09.”39E |
| 61 | Construction of anti sea erosion bund at Tulsunde | 100 | 2009 | | 100 | 16°.35’.47”.61N | 73°.19’.09”.39E |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Kharviwada Tal Rajapur | | | | | | |
| 62 | Construction of anti sea erosion bund at Pethkilla ShivGarjana to Gavdevichi Sahan | 240 | 2009 | | 240 | 16°.59’.16”.67N | 73°.16’.29”.32E |
| 63 | Construction of anti sea erosion bund at Bhagvati Bunder breakwater at Ratnagiri. | 457 | 2009 | | 457 | 17°.00’.00”.40N | 73°.16’.12”.04E |
| 64 | Construction of anti sea erosion bund at Bhatimirya Tal Ratnagiri. | 1100 | 2009 | | 1100 | 17°.00’.57”.24N | 73°.16’.50”.47E |
| 65 | Construction of anti sea erosion bund at Kumbhavade Agrewadi Tal Rajapur | 1000 | 2010 | | 1000 | 16°.30’.47”.15N | 73°.85’.30”.26E |
| 66 | Construction of Anti Sea Erosion Bund at Shivkhurd Taluka Khed | 500 | 2010 | | 500 | 17°.69’.04”.74N | 73°.37’.42”.52E |
| 67 | Construction of Anti Sea Erosion Bund at Khed sirsi bhoi Taluka Khed | 600 | 2010 | | 600 | 17°.70’09”.41N | 73°.38’.72”.10E |
| 68 | Construction of Anti Sea Erosion Bund at Kachare Taluka Ratanagiri | 500 | 2010 | | 500 | 17°.17’.07”.77N | 73°.16’.57”.85E |
| 69 | Construction of Anti Sea Erosion Bund at Palshet Taluka Guhagar | 1000 | 2010 | | 1000 | 17°.44’.04”.06N | 73°.19’.84”.71E |
| 70 | Construction of Anti Sea Erosion Bund at | 1000 | 2010 | | 1000 | 16°.58’.18”.97N | 73°.21’.06”.91E |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | SomeshwerTaluka Ratanagiri | | | | | | |
| 71 | Construction of Anti Sea Erosion Bund at Harne Navanagar beside dapoli harnai road Taluka Dapoli | 500 | 2010 | | 500 | 17°.48’.45”.00N | 73°.05’.30”.00E |
| 72 | Construction Anti Sea Erosion Bund at Harne Ram mandir approach road Tal Dapoli | 400 | 2010 | | 400 | 17°.48’.45”.00 | 73°.05’.30”.00E |
| 73 | Construction Anti Sea Erosion Bund at Rajiwada Ch 0 to 1480 | 650 | 2010 | | 650 | 16°.58’.55”.39N | 73°.17’.53”.94E |
| 74 | Construction Anti Sea Erosion Bund at Tulsunde Kharviwada Taluka Rajapur | 1000 | 2010 | | 1000 | 16°.98’.96”.51N | 73°.27’.54”.61E |
| 75 | Construction Anti Sea Erosion Bund at Ade Bridge to Ade Kharviwada Taluka Dapoli | 700 | 2010 | | 700 | 17°.53’.26”.55N | 73°.04’.16”.54E |
| 76 | Construction Anti Sea Erosion Bund at Ade Mohalla to Ade Bridge Taluka Dapoli | 75 | 2010 | | 75 | 17°.53’.26”.57N | 73°.04’.16”.56E |
| 77 | Construction Anti Sea Erosion Bund at Tulsunde Kharviwada near Bhogale house Taluka Rajapur | 100 | 2010 | 100 | | 16°.59’45”.26N | 73°.16’.29”.05E |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 78 | Construction Anti Sea Erosion Bund at Pethkilla Shiv garjana chown to gav devachi sahan Taluka Ratnagiri | 100 | 2010 | | 100 | 16°.59’.45”.26N | 73°.16’.29”.05E |
| 79 | Construction Anti Sea Erosion Bund at Karajgaon Tamastirth Taluka Dapoli | 250 | 2010 | | 250 | 17°.42’.34”.46N | 73°.08’.05”.71E |
| 80 | Construction of Retaining wall at Majerakashi Taluka Chiplun | 240 | 2010 | 220 | | 17°.56’.35”.20N | 73°.48’.82”.35E |
| 81 | Construction of A.S.E. Bund at Guhagar Khalcha Paat Tal. Guhagar | 225 | 2010 | | 225 | 17°.28’.33”.44N | 73°.11’.34”.46E |
| | Total: 45367 | | | | | | |

Table-12: Location and specification of protection measures implemented in Sindhudurg district.

| Sr. No. | Name of work | Length in m | Year of construction | Rubble Bund | Latitude | Longitude |
|---|---|---|---|---|---|---|
| | District : Sindhudurg | | | | | |
| 1 | Construction of Anti Sea Erosion Bund at Mithmumbri Tal. Deogad | 300 | 1984 | 300 | 16° 21'46.66"N | 73° 23'08.33"E |
| 2 | Construction of Anti Sea Erosion Bund at Tambaldeg (Mithbav) Tal. Deogad | 610 | 1984 | 610 | 16° 17'14.95"N | 73° 24'38.53"E |
| 3 | Construction of Anti Sea Erosion Bund at Kharpatan Tal Kankavali | 500 | 1987 | 500 | 16° 33'22.40"N | 73 °37'32.89"E |
| 4 | Construction of Anti | 770 | 1987 | 770 | 16° | 73° |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Sea Erosion Bund at Bagwadi Mithmumbri Tal. Deogad | | | | 24'10.84"N | 84'43.29"E |
| 5 | Construction of Anti Sea Erosion Bund at Tambaldeg (Mithbav) Tal. Deogad | 610 | 1987 | 610 | 16° 17'14.95"N | 73° 24'38.53"E |
| 6 | Construction of Anti Sea Erosion Bund at Manche Tal. Deogad | 268 | 1969 | 268 | 16° 17'14.95"N | 73° 24'38.53"E |
| 7 | Construction of Anti Sea Erosion Bund at Jamdul achara Tal. Malvan | 950 | 1990 | 950 | 16° 24'10.84"N | 73 °84'43.29"E |
| 8 | Construction of Anti Sea Erosion Bund at Pirwadi Tal. Malvan | 330 | 1991 | 330 | 16° 17'14.95"N | 73° 24'38.53"E |
| 9 | Construction of Anti Sea Erosion Bund at Waldar hanuman Mandir Tal. Deogad | 274 | 1991 | 274 | 16° 24'10.84"N | 73° 24'42.29"E |
| 10 | Construction of Anti Sea Erosion Bund at Kavvadi Masure Part - I Tal. Malvan | 1025 | 1985 | 1025 | 15° 55'43.53"N | 73° 31'14.43"E |
| 11 | Construction of Anti Sea Erosion Bund at Tokaltal Masure Tal. Malvan | 840 | 1983 | 840 | 15° 55'43.53"N | 73° 31'14.43"E |
| 12 | Construction of Anti Sea Erosion Bund at Tondwali Tal. Malvan | 1165 | 1979 | 1165 | 16° 05'12.41"N | 73° 27'42.62"E |
| 13 | Construction of Anti Sea Erosion Bund at Deobag Tal. Malvan Ch 2500 to 3200 m | 700 | 2004 | 700 | 15° 58'02.26"N | 73° 30'11.52"E |
| 14 | Construction of Anti Sea Erosion Bund at Deobag Tal. Malvan Ch 1290 to 1465 m | 205 | 2004 | 205 | 15° 58'02.26"N | 73 °30'11.52"E |
| 15 | Construction of Anti Sea Erosion Bund at Pankhot Juva Tal. Malvan | 1225 | 1979 | 1225 | 15° 56'15.42"N | 73° 31'18.46"E |
| 16 | Construction of Anti Sea Erosion Bund at Kandalgao Tal. Malvan | 690 | 1980 | 690 | 16 °7'9.01"N | 73° 29'55.31"E |
| 17 | Construction of Anti Sea Erosion Bund at Revandi Tal. Malvan | 1335 | 1979 | 1335 | 16° 5'40.72"N | 73° 28'01.58"E |

| | | | | | | |
|---|---|---|---|---|---|---|
| 18 | Construction of Anti Sea Erosion Bund at Revandi ( Sarjekot Side)Tal. Malvan | 630 | 1982 | 630 | 16° 5'40.72"N | 73° 28'01.58"E |
| 19 | Construction of Anti Sea Erosion Bund at near Moryadag Tal. Malvan | 1360 | 1981 | 1360 | 16° 5'40.72"N | 73° 28'01.58"E |
| 20 | Construction of Anti Sea Erosion Bund at Deobag Creek side Tal. Malvan | 1000 | 1980 | 1000 | 15° 58'02.26"N | 73° 30'11.52"E |
| 21 | Construction of Anti Sea Erosion Bund at Koachra Nivati Tal vengurla | 265 | 1983 | 265 | 15° 45'13.33"N | 73° 30'15.46"E |
| 22 | Construction of Anti Sea Erosion Bund at Shiroda Tal Vengurla | 314 | 1983 | 314 | 15° 45'28.90"N | 73 °40'12.47"E |
| 23 | Construction of Anti Sea Erosion Bund at Kinhale Juva Tal vengurla | 395 | 1980 | 395 | 15° 44'33.68"N | 73° 39'19.34"E |
| 24 | Construction of Anti Sea Erosion Bund at Arvali Tal vengurla | 450 | 1983 | 450 | 15 °47'03.56"N | 73° 39'54.17"E |
| 25 | Construction of Anti Sea Erosion Bund at Kolamb (Dhurwadi) Tal. Malvan | 500 | 1986 | 500 | 16° 4'27.94"N | 73° 28'2.15"E |
| 26 | Construction of Anti Sea Erosion Bund at Deobag Surve no 718, 719 Tal. Malvan | 470 | 1987 | 470 | 15° 58'02.26"N | 73° 30'11.52"E |
| 27 | Construction of Anti Sea Erosion Bund at Raowadi ( Masure) Part II Tal. Malvan | 770 | 1986 | 770 | 15° 56'15.42"N | 73° 31'18.46"E |
| 28 | Construction of Anti Sea Erosion Bund at Deobag ( Tarkarli) Part II Tal. Malvan | 545 | 1987 | 545 | 15° 58'02.26"N | 73° 30'11.52"E |
| 29 | Construction of Anti Sea Erosion Bund at SarjekotTal. Malvan | 690 | 1985 | 690 | 16° 5'40.98"N | 73° 28'40.12"E |
| 30 | Construction of Anti Sea Erosion Bund at Deobag (Sea Side) Tal. Malvan | 770 | 1987 | 770 | 15° 58'02.26"N | 73° 30'11.52"E |

| | | | | | | |
|---|---|---|---|---|---|---|
| 31 | Construction of Anti Sea Erosion Bund at Newalewadi ( Bhogve) Tal. Malvan | 598 | 1986 | 598 | 15° 45'13.33"N | 73° 30'15.46"E |
| 32 | Construction of Anti Sea Erosion Bund at Javawadi ( Kinhale) Tal. Malvan | 340 | 1988 | 340 | 15° 44'33.68"N | 73° 39'19.34"E |
| 33 | Construction of Anti Sea Erosion Bund at Revandi Stage 3 Tal. Malvan | 274 | 1989 | 274 | 16° 5'40.98"N | 73° 28'44.12"E |
| 34 | Construction of Anti Sea Erosion Bund at Sarjekot Part 3 Tal. Malvan | 433 | 1989 | 433 | 16° 7'53.50"N | 73° 28'16.21"E |
| 35 | Construction of Anti Sea Erosion Bund at Ranchi Nala Tal. Malvan | 644 | 1989 | 644 | 16° 01'22.17"N | 73° 29'11.38"E |
| 36 | Construction of Anti Sea Erosion Bund at Kawawadi Tal. Malvan | 400 | 1989 | 400 | 16° 5'40.72"N | 73° 28'01.58"E |
| 37 | Construction of Anti Sea Erosion Bund at Kelus Tal Vengurla | 427 | 1988 | 427 | 15 °54'35.44"N | 73° 35'15.20"E |
| 38 | Construction of Anti Sea Erosion Bund at Dandi Tal. Deogad | 200 | 1989 | 200 | 16° 03'00.08"N | 73° 28'11.85"E |
| 39 | Construction of Anti Sea Erosion Bund at Ambari Tal. Malvan | 950 | 1988 | 950 | 15° 02'00.10"N | 73° 15'12.33"E |
| 40 | Construction of Anti Sea Erosion Bund at Reddi Tal Vengurla | 800 | 1990 | 800 | 15 °44'33.68"N | 73° 39'19.34"E |
| 41 | Construction of Anti Sea Erosion Bund at Sonavde Tal. Kudal | 600 | 1988 | 600 | 15° 44'33.68"N | 73 °39'19.34"E |
| 42 | Construction of Anti Sea Erosion Bund at Kirpane Tal Sawantwadi | 100 | 1991 | 100 | 15 °44'33.68"N | 73° 39'19.34"E |
| 43 | Construction of Anti Sea Erosion Bund at Kerwadi ( Sheroda) Tal Vengurla | 448 | 1990 | 448 | 15° 45'28.90"N | 73° 40'12.47"E |
| 44 | Construction of Anti Sea Erosion Bund at Kelus Tal. Malvan | 750 | 1988 | 750 | 15° 54'35.44"N | 73° 35'15.20"E |

| | | | | | | |
|---|---|---|---|---|---|---|
| 45 | Construction of Anti Sea Erosion Bund at Masure Tokalwadi Tal. Malvan | 590 | 1995 | 590 | 16° 05'48.91"N | 73 °27'12.38"E |
| 46 | Construction of Anti Sea Erosion Bund at Deobag ( Sea Side) Tal Vengurla | 1730 | 2002 | 1730 | 15° 58'02.26"N | 73° 30'11.52"E |
| 47 | Construction of Anti Sea Erosion Bund at Talashi Tondavali Tal Vengurla | 500 | 2008 | 500 | 16° 05'12.41"N | 73° 27'42.62"E |
| 48 | Construction of Anti Sea Erosion Bund at Chivalavel Kotwade Tal. Malvan | 420 | 2001 | 420 | 16° 03'45.99"N | 73° 27'38.36"E |
| 49 | Construction of Anti Sea Erosion Bund at Navabg Ubhadanda Tal. Vengurla | 720 | 2009 | 720 | 15° 50'40.69"N | 73° 38'08.93"E |
| 50 | Construction of Anti Sea Erosion Bund at Mithmumbari Taluka Devgad | 300 | 2009 | 300 | 16° 21'46.66"N | 73° 23'08.33"E |
| 51 | Construction of Anti Sea Erosion Bund at Ubhadanda Muth Girpwadi Taluka Vengurla | 180 | 2009 | 180 | 15° 50'40.69"N | 73° 38'08.93"E |
| 52 | Construction of Anti Sea Erosion Bund at Shirola Velaghar Taluka Vengurla | 760 | 2009 | 760 | 15° 46'19.87"N | 73 °40'14.77"E |
| 49 | Construction of Anti Sea Erosion Bund at Tambaldeg Tal. Deogad | 225 | 2010 | 225 | 16° 17'14.95"N | 73° 24'38.53"E |
| 50 | Construction of Anti Sea Erosion Bund at Nivti Kochra Taluka Vengurla | 200 | 2010 | 200 | 15° 56'12.91"N | 73° 32'31.89"E |
| 51 | Construction of Anti Sea Erosion Bund at Achra Peerwadi Taluka Deogad | 600 | 2010 | 600 | 16° 10'44.54"N | 73° 26'05.96"E |
| 52 | Construction of Anti Sea Erosion Bund at Maldi Taluka Vengurla | 360 | 2010 | 360 | 16 °03'00.08"N | 73° 28'11.85"E |
| | Total | 33505 | | 33505 | | |

Table-13: Anti Sea erosion measures completed till the end of Xth Plan for Goa.

| Sr. No. | Place | Length (in m) | Latitude | Longitude |
|---|---|---|---|---|
| NORTH GOA | | | | |
| 1 | Reis Magos and Penha-de-France-Bardez | 1400 | 15 °29'N | 73° 48'E |
| 2 | Dona-Paula -Tiswadi | 400 | 15 °27'N | 73° 48'E |
| 3 | Miramar -Tiswadi | 400 | 15 °29'N | 73° 48'E |
| 4 | Cabo Hill, Raj Bhavan, Dona-Paula -Tiswadi | 100 | 15 °27'N | 73° 47'E |
| 5 | Near Mutt Temple, Guddem, Siolim-Bardez | 300 | 15 °36'N | 73° 44'E |
| | TOTAL: | 2600 | | |
| SOUTH GOA | | | | |
| 6 | Talpona Beach-Canacona | 200 | 14 °58'N | 74° 02'E |
| | TOTAL: | 200 | | |

Table-14: Anti Sea erosion measures/works completed till the end of XIth Plan for Goa.

| Sr. No. | Place | Length (in m) | Latitude | Longitude |
|---|---|---|---|---|
| | NORTH GOA | | | |
| 1. | Cabo Hill, Raj Bhavan, Dona-Paula -Tiswadi | 150 | 15 °27'N | 73° 47'E |
| 2. | Campal -Tiswadi | 1500 | 15 °29'N | 73° 48'E |
| 3. | Mithaghar -Tiswadi | 500 | 15 °36'N | 73° 44'E |
| 4. | Coco Beach, Nerul-Bardez | 200 | 15 °29'N | 73° 47'E |

| | | | | |
|---|---|---|---|---|
| 5. | Remedial measures for stabilizing unstable slopes of Cabo Hill adjacent to Raj Bhavan-Tiswadi | 700 | 15 °27'N | 73° 47'E |
| 6. | Keri-Pernem | 1600 | 15 °42'N | 73° 41'E |
| | SOUTH GOA | | | |
| 7. | Betalbatim-Salcete | 800 | 15 °17'N | 73° 54'E |
| | TOTAL: | 5450 | | |