GCC DISASTER MANAGEMENT PLAN 2017

PREFACE

Be it a natural disaster or manmade disaster, preparedness plays a crucial role in protecting lives, property and public infrastructure. As witnessed in the last two years, our preparedness and disaster management needs to be improved to ensure our objective of safety.

Towards achieving this objective, experts and stakeholders from various domains worked together tirelessly to being out this Disaster Management Guidelines.

It is comprehensive, encompassing all types of disasters that are likely to affect us a community. It has all the relevant data such as topography, rainfall pattern, position and extent of water bodies, riverine and storm water drainage system, fire and medical emergency facilities, telecommunication facilities and coastal tidal pattern. Besides collation of these data, they were analysed to arrive at appropriate plans in case of emergency.

With climate-related extreme weather events being on the rise, it becomes essential that we are always ready for an emergency. We believe this set of guidelines would help us to be prepared better; and also to work effectively and efficiently to ensure safety to people and property when emergency situations do arise.

We have worked with a strong commitment and conviction in preparing this set of guidelines. We welcome feedback and suggestions to strengthen our efforts.

PREFACE

Chennai is a coastal city with a tropical wet and dry climate and is often subjected to disasters both natural and non-natural. Chennai's terrain is very flat with most of the area at an average elevation of barely 2m above mean sea level and certain areas are even below the sea level, which makes it difficult to manage inundation and de-watering during monsoon times. Greater Chennai Corporation's primary responsibility is to effectively coordinate the Disaster Management arrangements across the City.

While natural disasters are beyond our control, our capabilities to reduce risk, prevent losses, prepare, respond and recover can be further improved by effective planning and efficient interdepartmental co-ordination. In this context, Greater Chennai Corporation has come up with this City Disaster Management Plan to assist and guide all the stake holders in all phases of Disaster Management. The plan takes into account the Global and National trends in Disaster Management and it incorporates the approaches suggested in the Sendai Framework for Disaster Risk Reduction 2015 – 2030.

While the plan provides much clarity and sound frame work, the implementation requires sincere cooperation of various agencies, effective coordination among various departments and active participation of the civil society, community based organizations and private sector. Hence, I request all the stake holders to work together as a Team to make our city truly disaster-resilient.

D.Karthikeyan I.A.S
Commissioner
Greater Chennai Corporation

VISION

To enhance the disaster preparedness, to maximize the ability to cope up with disasters and significantly reduce the losses of lives, livelihoods and properties. To minimize the vulnerability to disasters and thus make the city of Chennai disaster resilient and make it a safe place to live in.

MISSION

- Increase resilience and prevent the emergence of disasters by strengthening scientific and technical capabilities on all aspects of preparedness.
- Identifying vulnerability of the different parts of the city to disasters and specify minimum standard measures to be adopted for prevention and mitigation of disasters.
- To assign well defined roles and responsibilities to various administrative units in the Greater Chennai Corporation to prepare, mitigate and respond to any disaster.
- Co-ordination with Government Departments, NGOs, Other Institutions as partners to reduce and manage disaster risks.
- To increase the capacity development comprehensively at all levels to effectively respond to multiple hazards of a disaster.

RATIONALE

As per Section 31 of the Disaster Management Act, 2005(DM Act), District Disaster Management Authority (DDMA) of each district in the country shall prepare City Disaster Management Plan (CDMP) which is to be approved by State Disaster Management Authority (SDMA). It is to be reviewed and updated annually. The DM Act further provides that DDMP shall, inter alia, include areas in the district vulnerable to different forms of disasters; measures to be taken for prevention, mitigation, capacity-building and preparedness. The DDMP shall also include response plans and procedures, in the event of a disaster providing for allocation of responsibilities to the Departments of the Government at the district level and the local authorities in the city; prompt response to disaster and relief thereof; procurement of essential resources; establishment of communication links; and the dissemination of information to the public to respond to any threatening disaster situation or disaster.

EXECUTIVE SUMMARY

The City Disaster Management Plan (CDMP) is framed as a set of guidelines to be followed for effective disaster management at the district level and thus forms an action plan for the city of Chennai in its disaster preparedness, prevention, mitigation and also for the monitoring of impending disasters. This plan taken into account on the vulnerabilities of this city for disasters based on its geography, demography, past history of disasters and its social and environmental aspects. This plan has been prepared based on the principles in National Disaster Management Plan (NDMP) and State Disaster Management Plan (SDMP).

The CDMP covers inter alia identification of areas in the district vulnerable to different forms of disasters, through proper investigation and measures to be taken, for prevention and mitigation of disaster, by the Departments of the Government and local authorities in the city. Based on this detailed study of capacity building and preparedness measures are required to be taken by the Government Departments concerned and the local authorities in the city in order to respond to any impending disaster or disaster itself.

Based on the response plans and procedures, in the event of a disaster, concerned responsibilities will be fixed to the Departments concerned at the city level and the local authorities and prompt response to disaster, will be intimated by taking immediate relief and rehabilitation measures by mobilizing essential resources with the proper dissemination of information to the public.

This plan outlays the overall details about the city of Chennai alone with the infrastructure available with the corporation in order to deal with any disaster. It also lays the stress as to how the corporation is to have continuous coordination with various Governmental and NGO / Institutions so as to avert any disaster and to prevent any catestrophe thereafter. The Disaster Management Plan has to be revised on an yearly basis based on the requirements and on past experience.

TABLE OF CONTENTS

Heading No	Description	Page No
1.0	INTRODUCTION	1
1.1	Disaster Management and Planning	1
1.2	Needs of Disaster Management Plan	2
1.3	Scope of the Disaster Planning	2
1.4	Objectives of Disaster Planning	3
1.5	Types of Disasters	4
1.6	Response Planning	4
1.7	Integrating Sendai Framework into CDMP	5
2.0	GCC PROPERTIES	7
2.1	City Profile	7
2.2	Chennai Population	7
2.3	Evolution, Administration & Functions	9
2.4	Services Rendered by Greater Chennai Corporation	11
2.5	Essential Services by other Authorities	11
2.6	Geography and Geology of City	14
2.6.1	Geology	14
2.6.2	Topography	14
2.6.3	Green Cover and Wetlands	15
2.6.4	Weather and Climate	15

Heading No	Description	
2.7	**Hydrology of City**	17
2.7.1	**Water bodies and waterways**	17
2.7.2	**Major Drainage system**	17
2.7.3	**Minor Drainage Network**	21
3.0	**OCCURRENCE OF NATURAL CALAMITIES IN PAST**	23
3.1	**Flood**	24
3.1.1	**Scene during flood 2015**	41
3.1.2	**Government response**	43
3.1.3	**Mitigation**	43
3.1.4	**Centralized relief materials & role of NGOs/Volunteers**	45
3.1.5	**Distribution of relief materials and Role of NGO's/ Volunteers**	47
3.1.6	**Clearance of Garbage**	48
3.1.7	**Causes of flood**	48
3.2	**Cyclone**	51
3.2.1	**Nada Cyclonic Storm - 2005**	51
3.2.2	**Varadah cyclone - 2016**	51
3.2.2.1	**Damages Caused**	52
3.2.2.2	**Strategies and Restoration**	52
4.0	**INSTITUTIONAL FRAMEWORK AND ARRANGEMENTS**	54
4.1	**Control room arrangements**	54

Heading No	Description	
5.0	**DISASTER PREVENTION, PREPAREDNESS & MITIGATION PLAN**	56
5.1	**Earthquake**	56
5.1.1	**Impact of Earthquake**	58
5.1.2	**Earthquake Mitigation Strategies**	59
5.1.3	**Earthquake Preparedness Measures**	59
5.1.4	**Assembly Points**	60
5.2	**Tsunami**	64
5.2.1	**Tsunami in Bay of Bengal**	65
5.2.2	**Tsunami Hits in India**	65
5.2.3	**Tsunami in Chennai**	66
5.2.4	**Tsunami Preparedness Measures**	68
5.3	**Cyclone**	68
5.3.1	**Impacts of Cyclone**	71
5.3.2	**Cyclone Mitigation Strategies**	71
5.3.3	**Common Cyclone Preparedness Measures**	72
6.0	**STANDARD OPERATIONAL PROCEDURES**	73
6.1	**Major Projects taken to mainstream the Disaster Mitigation and Adaption**	73
6.1.1	**In Extended areas of Greater Chennai Corporation**	73
6.1.2	**In Core city**	74
6.1.3	**Waterways Cleaning**	74
6.1.4	**Tamil Nadu Vision 2023**	74
6.2	**Preparedness of Waterways & Water Bodies**	74

Heading No	Description	
6.3	Water Stagnation Locations	75
6.4	Preparedness of Relief Centres	76
6.5	Common Kitchen	78
6.6	Subways	78
6.7	Tree Fall	81
6.8	Transport Equipments / Lorries	83
6.9	Preparedness of Streets	84
6.9.1	Preparedness of Streets - don't require evacuation	84
6.9.2	Preparedness of Streets - require evacuation	84
6.10	Lighting Facilities	87
6.11	National Disaster Response Force/ State Disaster Response Force	88
6.12	Health Department	88
6.13	Veterinary Support	91
6.14	Role of Financial Advisor	92
6.15	Role of Public Relation Officer	92
6.16	Ward Committee	93
6.17	Other Departments Mitigation Plan	94
6.18	Contact Details	98

Chapter No	Description	Page No
1	**Zone - 1 Thiruvottriyur Plan**	105 - 138
2	**Zone - 2 Manali Plan**	139 -168
3	**Zone - 3 Madhavaram Plan**	169 - 214
4	**Zone - 4 Tondiarpet Plan**	215 - 266
5	**Zone - 5 Royapuram Plan**	267 - 304
6	**Zone - 6 Thiru. Vi. Ka Nagar Plan**	305 - 346
7	**Zone - 7 Ambathur Plan**	347 - 388
8	**Zone - 8 Anna Nagar Plan**	389 - 426
9	**Zone - 9 Teynampet Plan**	427 - 468
10	**Zone - 10 Kodambakam Plan**	469 - 510
11	**Zone - 11 Valasaravakkam Plan**	511 - 554
12	**Zone - 12 Alandur Plan**	555 - 586
13	**Zone - 13 Adayar Plan**	587 - 640
14	**Zone - 14 Perungudi Plan**	641 - 682
15	**Zone - 15 Shozhanganallur Plan**	683 - 712

1.0 INTRODUCTION

1.1 Disaster Management and Planning

Disaster is a hazard causing heavy loss to life, property and livelihood. The term disaster management deals with relief and rescue operations before and after the occurrence of the disaster. The disaster risk management is the systematic process of using administrative decisions, organization, operational skills and capacities to implement policies, strategies and coping capacities of the society and communities to significantly minimize the impacts of natural hazards and related environmental and technological disaster. The disaster management plan has to be implemented to minimize the adverse impact of the multiple hazard with the broad context of sustainable development. The disaster management is the process of organization, planning and application of measures preparing for prevention, responding to and initial recovery from disasters. The management of resources and responsibilities for dealing with humanitarian aspects of emergencies.

Disaster Management Cycle

The pie chart shows the typical disaster management action plan for any kind of disaster occurrence. The disaster is a result of the combination of many factors such as the exposure to hazards, the conditions of vulnerability that are present and insufficient capacity or measures to reduce or cope with the potential negative consequences. Disaster impacts may include loss of life, injuries, disease and other negative effects on human physical, mental and social well-being, together with damage to property, destruction of assets, loss of services, social and economic disruption and environmental degradation.

1.2 Needs of Disaster Management plan

The natural disaster is an unexpected event that cannot be prevented but its effect can be minimized. The disaster management plan has been framed for the prevention of danger or threat of any disaster, mitigation or reduction of risk of any disaster or its severity or consequences, capacity-building, preparedness to deal with any disaster, prompt response to any threatening disaster situation or disaster, assessing the severity or magnitude of effects of any disaster evacuation, rescue and relief and rehabilitation and reconstruction. The plan is framed based on the collection of catastrophic events. The disaster causes major threat to lives and property.

Protection includes the installation of alarms, fire suppression systems, establishment of basic building security measures, the assembly of emergency supply kits and the organisation of an in-house disaster response team. Response includes actions to be undertaken to deal with the demanding situation often with the help of outside expertise and advice. The plan should be easy and provide a speedier response. The necessary resources should be identified and the sources of assistance also should be identified.

The management plan can avert the disaster before it occurs, anticipating the future course of natural occurrence such as flood will reduce the vulnerability, to provide rehabilitation programme like construction of dwellings and other infrastructures, to undertake the liaison works, to protect and preserve the environment and to prevent the losses of life and property.

1.3 Scope of the Disaster Planning

The scope of this Chennai disaster plan's entities (e.g., departments, agencies, private sector, NGOs, citizens) and covers entire geographic area of Greater Chennai Corporation. The guidelines of the Disaster Management Authority used largely for preparation of Disaster Plan for Greater Chennai Corporation covering revenue districts of Chennai, part of Tiruvallur and Kancheepuram Districts.

The purpose of the statement should include enough information to establish the direction of the plan. The scope should include all disaster phases such as Prevention, Preparedness, Mitigation, Response and Recovery, redressal to multiple hazards to be implemented in whole city/ in certain areas of the city and zone wise Disaster Management Plan on a micro scale.

Special care has been taken for special groups including disabled, aged, children, sick and pregnant women to ensure that the relevant Disaster Risk Reduction (DRR) concerns are integrated in the Plan. The plan is also focussed on the relief measures and necessary mitigation plans that are to be undertaken by the government bodies

1.4 Objective of the Disaster Planning

The main objective of this disaster plan includes prevention, mitigation, preparedness measures, response plan and procedures for Chennai City.

The following are the indicative list with possible objectives.

* Closely follow the NDMA/SDMA directions in identifying impending disaster and to enhance the preparedness to face it.

* Improve the timely warning and alerts to be delivered in precise manner so as to alert the people from major risks associated with the disaster.

* Receive swiftly scientific/ technical advice from Government/ Institutions and ACT.

* The quick response system to be implemented for proper communication to people in flood affected area.

* Utilizing all agencies capable of providing assistance.

* Effective co-ordination are the integral components of effective disaster management as the team have to work with good rapport to perform the work effectively.

* The help and rescue operation has to be carried out with minimum delay so the needs are fulfilled within time to reduce the maximum losses and damages.

* The field workers and officials should bring solace to the troubled minds by interacting with the people and encouraging them to be free from problem caused by the disaster.

1.5 Types Of Disasters

There are 28 types of common natural and manmade disasters, which can be classified into these following 5 sub-groups.

i. **Hydro- Meteorological Disasters (8)**

Cyclones, Droughts, Periodical floods/ Urban floods, Hailstorm, Cloud burst, Heat wave, Coastal Erosion, Thunder and Lightning.

ii. **Geological Disasters (3)**

Landslides, Earthquake and Tsunami.

iii. **Chemical, Industrial and Radiological (3)**

Industrial Fires, Gas & Chemical Leakages, Nuclear Disaster

iv. **Accidents Disasters (10)**

Forest Fires, Electrical Fires, Collapsing of Buildings, Urban Fires, Oil Spills, Serial Bomb Blasts, Festival Fire, Stampedes, Road/Rail Accidents, Air Crash and Boat Capsizing .

v. **Biological Disasters (4)**

Pest attacks, Food poisoning, Water borne diseases and Cattle epidemics.

1.6 Response Planning

The disaster response structure will be activated on the receipt of disaster warning /on the occurrence of the disaster. The aim of this plan is to establish an understanding of the structure and operating procedures for addressing all aspects of disaster preparedness and response in Chennai city. This plan seeks to ensure that the disaster preparedness for response is carried in a coordinated and collaborative manner, ensuring the greatest protection of life, property, health and environment.

Disaster early warning is a major element of disaster risk reduction. Early action can often prevent major catastrophes. To be effective and sustainable, they must actively involve the communities at risk.

Response mechanism of the concerned line departments along with the roles and responsibilities of each one of them and immediate relief to be provided to the affected population is also inclusive.

Greater Chennai Corporation Plan will essentially focus on

i. Co-ordinating with Metrological Department to get the warning report against the severe weather phenomena like tropical cyclones, heavy rain, floods, seismicity etc.,

ii. Establishment of contact centres for people through Telephones and Web connectivity. For all weather related enquiries to contact, Duty Officer, Area Cyclone Warning centre – 044 28271951

iii. An early disaster warning system with very high frequency equipment and public address systems with sirens, addressing public through air media will be established.

iv. Tsunami Alert has to be received from the Indian Tsunami Early Warning Centre (ITEWC) of the Indian National Centre for Ocean Information Services (INCOIS).

v. The Greater Chennai Corporation has introduced individual complaint helplines at Head Quarter in each of the 15 zones. The 24-hour helpline will function till the end of the North-East monsoon. The complaint numbers will be directly picked up by the zonal Officers, helpline operators and complaints are forwarded to the concerned authorities for necessary action.

vi. Working in close quarters with State Disaster Centre regularly to get disaster related information for necessary action.

1.7 Integrating Sendai Framework into CDMP

The CDMP incorporates substantively the approach enunciated in the Sendai Framework and will help the county to meet the goals set in the framework. By 2030, the Sendai Framework aims to achieve substantial reduction of disaster risk and losses in lives, livelihoods, and health and in the economic, physical, social, cultural, and environmental assets of persons, businesses, communities, and countries. The CDMP has been aligned broadly with the goals and priorities set out in the Sendai Framework of DRR. The framework states that to realize this outcome, it is necessary to prevent new and reduce existing disaster risk through the implementation of integrated and inclusive measures that prevent and reduce hazard exposure and vulnerability to disaster, increase preparedness for response and recovery, and thus strengthen resilience. These measures must cover various sectors such as economic, structural, legal, social, health, cultural,

educational, environmental, technological, political, and institutional. The plan includes measures that will be implemented over the short, medium, and long-term more or less over the time horizon of the Sendai Fremework ending in 2030. The incorporation of four priorities for action under the Sendai Framework into the CDMP is summarised for quick reference in the table given below.

Incorporation of four priorities for action under the Sendai Framework into the CDMP.

Sendai Fremework for DDR (2015-2030) Priority	Chapters with the priority as its dominant theme
1. Understanding disaster risk	Chapters 3 & 5
2. Strengthening disaster risk governance to manage disaster risk	Chapters 4 & 6
3. Investing in disaster risk reduction for resilience	Chapter 6
4. Enhancing disaster preparedness for effective response and to "Build Back Better" in recovery, rehabilitation and reconstruction	Chapter 6

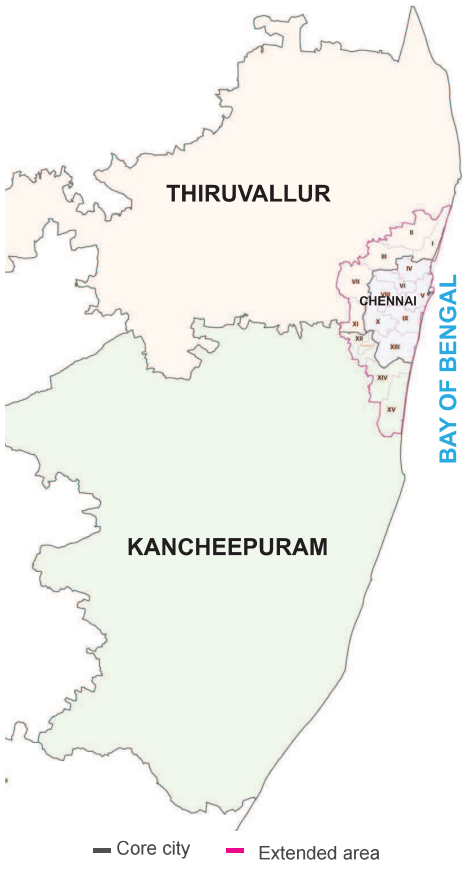
2.0 GREATER CHENNAI CORPORATION PROPERTIES

2.1 City Profile

Chennai formerly known as the Madras or Madarasapattinam is the capital of the Tamil Nadu state. It is reffered to as the “Gateway of South India”. Tamil Nadu is one among the most urbanized States in the Country and Chennai city is the fourth most populous Metropolitan city in India, next to Mumbai, Kolkatta and Delhi. Chennai City is situated in the North East end of Tamilnadu on the coast of Bay of Bengal. Chennai city is bounded by the Northern Latitudes of 12°59’ 10” and 13°08’ 50” and the Eastern Longitudes of 80°12’ 10” and 80°18’ 20”.

It is also called as the port city with a long coastal line of about 43 kms from Kathivakkam in the north to Uthandi in the south along the Bay of Bengal. The jurisdiction of the city has been expanded in the year 2011 by increasing the area from 174 sq.km to 426 Sq.km covering 3 revenue Districts namely Chennai, partly Kanchipuram and Thiruvallur. Chennai is one of the four cities in India through which the country is connected with the rest of the world through undersea fibre-optic cables, the other three being Mumbai, Kochi, and Tuticorin.

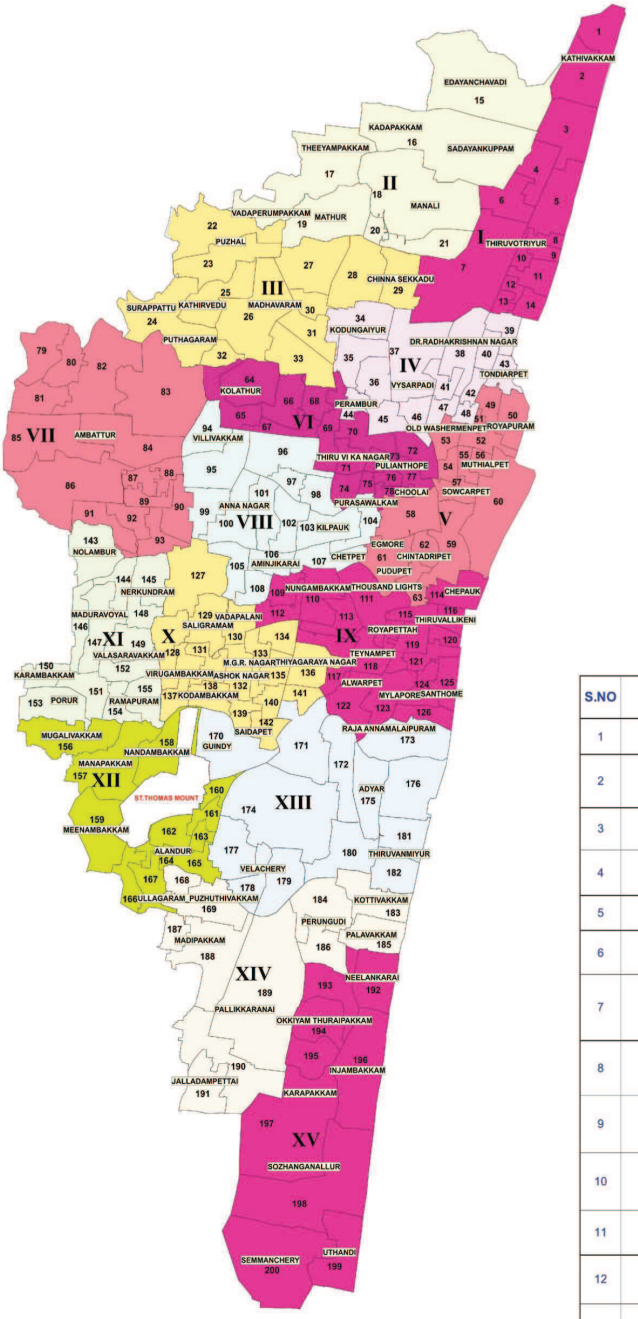
GCC with Adjacent Districts



2.2 Chennai Population

The average population of Chennai city is about 66.72 lakhs based on 2011 census with a sex ratio of 989 females for every thousand males, much above the national average of 929. TNSCB estimates that 1.08 Lakhs economically weaker section families living in undeveloped slums of which 72,827 families are living in objectionable slums. TNSCB has also estimated that there are about 37,000 families living in unobjectionable areas and 9,687 families in Adyar river banks and 14,237 families in Cooum river banks . The birth and death rate in Chennai is 400 and 160 respectively. The average literacy rate in the city is 81.27% much high compared to national average of 72.99%. The ward wise population of every zone is mentioned in the zonal chapters.

ZONAL BOUNDARY



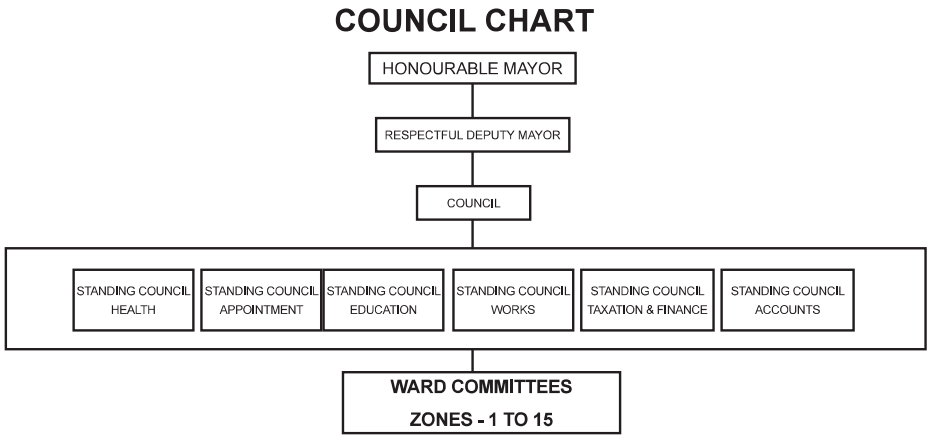
S.NO	ZONE	NAME OF THE ZONE	WARD NUMBER
1	I	THIRUVOTRIYUR	1 TO 14
2	II	MANALI	15 TO 21
3	III	MADHAVARAM	22 TO 33
4	IV	TONDIARPET	34 TO 48
5	V	ROYAPURAM	49 TO 63
6	VI	THIRU-VI-KA NAGAR	64 TO 78
7	VII	AMBATTUR	79 TO 93
8	VIII	ANNA NAGAR	94 TO 108
9	IX	TEYNAMPET	109 TO 126
10	X	KODAMBAKKAM	127 TO 142
11	XI	VALASARAVAKKAM	143 TO 155
12	XII	ALANDUR	156 TO 167
13	XIII	ADYAR	170 TO 182
14	XIV	PERUNGUDI	168,169 183 TO 191
15	XV	SOZHANGANALLUR	192 TO 200

2.3 Evolution, Administration and Functions

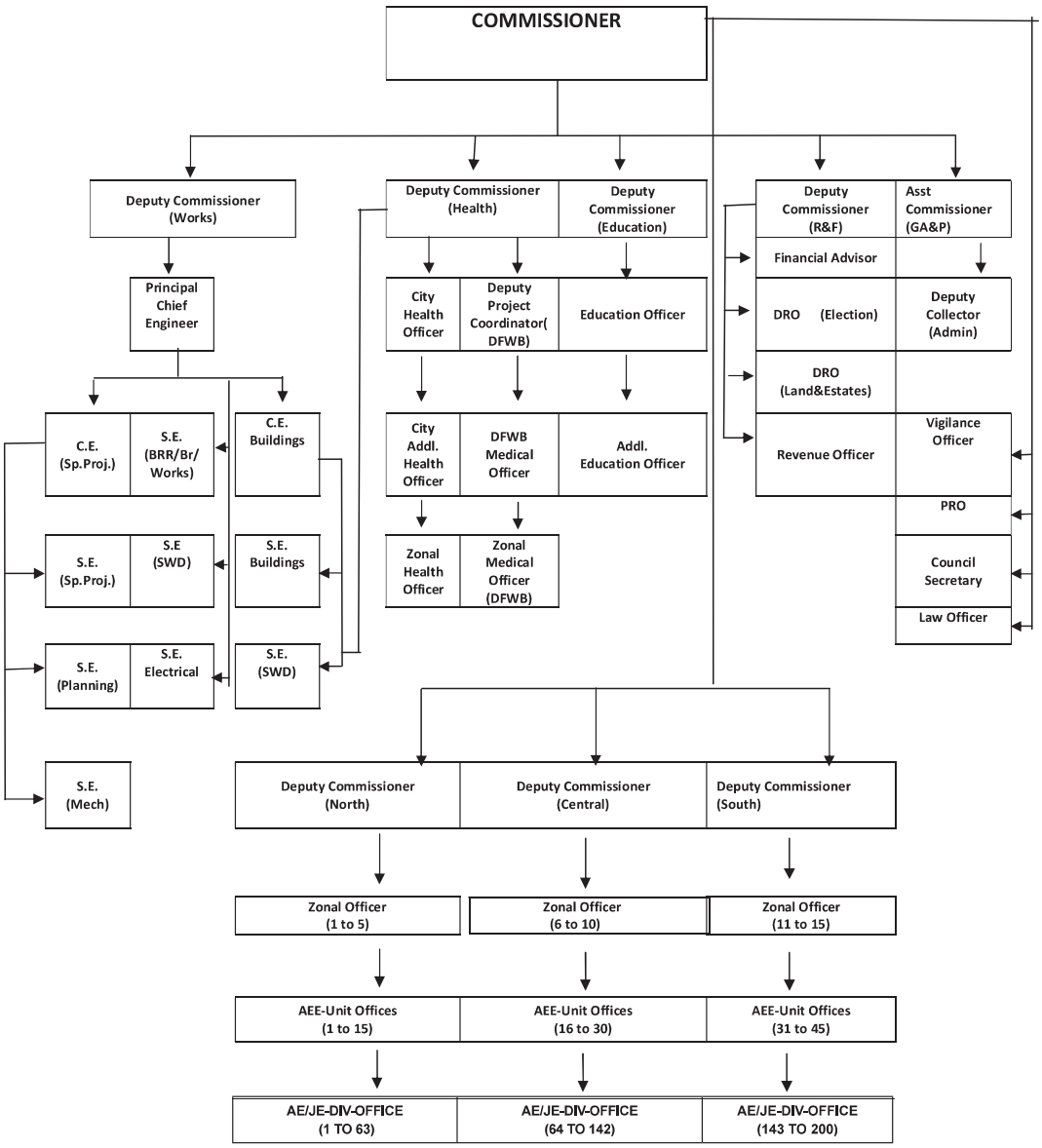
The office of Greater Chennai Corporation is located at the Ripon Building, commissioned in 1913. Chennai city is governed by the Greater Chennai Corporation. It is being headed by the Mayor, who presides over 200 councilors each of whom represents one of the 200 wards of the city.

The Greater Chennai Corporation is administered by the Commissioner. There are 4 Joint/Deputy Commissioners in the Head Quarters assisting the Commissioner looking after Works, Health, Education and Revenue & Finance each. The functions of the Deputy Commissioners at the Head Quarters are to head the respective departments and report to the Commissioner. For effective administration and to render better service, the Greater Chennai Corporation is divided into three regions namely North, Central and South having 15 Zones, comprising 45 Units further divided into 200 Divisions. At 3 regional levels, Regional Deputy Commissioners North, Central and South are heading the regions each looking after 5 zones. The Zonal Officers/Assistant Commissioners are heading 15 Zones each with 2 Executive Engineers per Zone followed by “Unit offices” headed by Assistant Executive Engineer and “Divisional Offices” at grass root level headed by an Assistant Engineer/ Junior Engineer.

The administration of the Greater Chennai Corporation is being systematically organized with proper hierarchy. The administrative structures, duties and responsibilities of each officials, issues and preparedness plan are well discussed in detail for each zone in the zonal chapters.



ADMINISTRATIVE CHART



2.4 Services Rendered by Greater Chennai Corporation

The major works carried are formation and maintenance of roads. Greater Chennai Corporation maintains 33,374 interior roads measuring a total length of 5,525 km and 471 bus route roads for 387 km. The Greater Chennai Corporation is maintaining 2,77,902 Street Lights, out of which 1,74,784 street lights have been converted in to LED lights. Greater Chennai Corporation is maintaining the storm water drains about 1894 km, and also maintains Canals, Flyovers, Health buildings, Schools, Parks, Community center, Burial ground etc., in the city. Greater Chennai Corporation is involved providing the basic amenities such as maintaining 525 Parks, 120 Traffic Islands and 113 community halls.

GCC runs 119 Primary Schools, 92 Middle Schools, 38 High Schools and 32 Higher Secondary Schools, totalling 281 Schools with 3116 teachers and 88,524 Students. GCC also runs 200 Kinter Garden Schools with in the existing school premises.

GCC provides Health Services through 138 Urban Primary Health Centers , 14 Urban Community Health Centers, 3 Emergency Obstetric Centers, 1 Communicable Disease Hospital with 238 medical officers, 1043 paramedical staff. On an average every day 17,800 out patients are treated in the above health centers.

Greater Chennai Corporation provides quality/hygienic food and drinking water through Amma Unavagam. As on date around 407 Amma Unavagam and 50 Amma Kudineer plants are functioning.

2.5 Essential Services by Other Authorities

The following Authorities like Madras High Court, Chennai Metropolitan Development Authority (CMDA), Greater Chennai Police, Chennai Metropolitan Water Supply and Sewerage Board (CMWSSB), Tamil Nadu Generation and Distribution Corporation (TANGEDCO), Tamil Nadu Fire and Rescue Service (TNFRS), Airport, Ports, Railways, Road ways etc. also delivers essential service to the citizens.

High Court

AirPort

Chennai Metro Rail Limited (CMRL)

Road ways

Chennai Port

The services of authorities and departments are mentioned in detail in the following.

DEPARTMENTS	FUNCTIONS OR SERVICES
Madras High Court	Highest Judicial authority in the State
Chennai Metropolitan Development Authority (CMDA)	Responsible for planning and development of Chennai Metropolitan Area.
Greater Chennai Police	Maintains law and order, traffic in the city.

DEPARTMENTS	FUNCTIONS OR SERVICES
Chennai Metropolitan Water Supply and Sewerage Board CMWSSB)	It is exclusive agency which provides drinking water and maintains sewage systems in the city.
Tamil Nadu Generation and Distribution Corporation Limited(TANGEDCO)	Supply of electricity to house holds, street lights and other institutions.
Tamil Nadu Fire and Rescue Service (TNFRS).	Involved in fire and rescue operations.
Airways	The Chennai Airport handles both International and Domestic flights through Anna International terminal and Kamaraj Domestic terminal respectively. It is the third busiest airport in India and handles 12 million passengers in a year. The Airport located at a distance of 25 km from the city and is accessible by road, train and metro transport services.
Ports	The city is served by two major ports namely Chennai Port and Ennore Port. The Chennai port is the largest artificial port situated in Bay of Bengal handling an annual cargo tonnage of 61.46 million (2010–2011) and it is India's second busiest container hub, handling general industrial cargo, automobiles, etc. Chennai Port has 21 alongside berths in three distinct zones of the Chennai port namely the Ambedkar Dock, Jawahar Dock and Bharathi Dock. The Ennore port currently handles cargo such as coal, ore etc.
Railways	Chennai is the birthplace of the railway system in India. Chennai Central is the headquarter of the Southern Railway Zone. The city has two main railway terminals. Chennai Central station, provides access to other States and Chennai Egmore stations is a terminus primarily within Tamil Nadu; it also handles a few inter–state trains. The Chennai suburban railway network, one of the oldest in the country, consists of four broad gauge sectors terminating at two locations in the city, namely Chennai Central and Chennai Beach. The elevated Mass Rapid Transit System which links between Chennai Beach and Velachery. The Chennai Metro, officially Chennai Metro Rail Limited (CMRL), is a rapid transit system serving the city. The first stretch covering the seven stations from Koyambedu to Alandur over a distance of 10 kilometres being operated since June 29th 2015, the section between Chennai Airport and Little Mount commenced operation on 21st September 2016 and the stretch between Alandur and St.Thomas Mount commence operation on 14th October 2016. The stretch between Thirmangalam and Nehru Park over a distance of 7.36 KM commenced operation on 14th May 2017.

DEPARTMENTS	FUNCTIONS OR SERVICES
Roadways	Chennai is connected by four major National Highways (NH) that originates in the city. They are • NH 4 to Mumbai (via Bangalore) • NH 5 to Kolkata (via Bhubaneswar) • NH 45 to Theni (via Tiruchirapalli) • NH 205 to Anantapur, Andhra Pradesh (via Tirupati) The Chennai Mofussil Bus Terminus (CMBT), is one of the largest bus terminal in Asia, serves as the terminus for all intercity buses from Chennai.The Metropolitan Transport Corporation operates public transport buses in the City covering an area of 3,929 square kilometre.

2.6 Geography and Geology of City

2.6.1 Geology

The geology of Chennai comprises mostly of clay, sediment rocks and sandstone. The city is classified into three regions based on geology as sandy area, clayey area and hard-rock area. Sandy area are found along the river banks and the coast. Most of the cities were covered by clayey regions.

The main part of Chennai city such as T-Nagar, West-Mambalam, AnnaNagar, Perambur and Virugambakkam are covered with clayey. Hard rock areas are Adambakkam and a part in Saidapet. The sandy areas are Tiruvanmiyur, Adyar, Kottivakkam, Santhome, George Town, Tondiarpet and the rest of coastal Chennai.

The groundwater table in most of the area in Chennai is about 4 to 5m depths below the ground. The rainwater run-off in Chennai city percolates very quickly near the coastal area but in clayey and hard rock areas rainwater percolates slowly and held by the soil for a longer period of time.

2.6.2 Topography

Chennai is a plain terrain low-lying area and the land surface is almost flat like a pancake. The terrain is very flat with contours ranging from 2 m to 10 m above mean sea level with a few isolated hillocks. It rises slightly as the distance from the sea-shore increases but the average altitude of the city is not more than 7 m above mean sea level and the average slope varies at 0.7 m per km, while some localities are just at sea level and even in minus level. Terrain slope varies from 1: 5,000 to 1:10,000.

2.6.3 Green Cover and Wetlands

Green space distribution plays a imperative role in urban planning since they contribute significantly in enhancing ecological quality of metropolitan areas. Indian National Forest Policy aims at maintaining 33% of countries geographical area under forest and tree cover. Reserved Forest in Chennai city covers 2.71 Sq.km around Guindy National Park.

The land usage pattern in Chennai can be broadly classified as tree cover area of 72.82 Sq.km, Buildings cover 241 Sq.km, Parks cover 1.36 Sq.km, Water bodies cover 35.73 Sq.km and other area 104.40 Sq.km.

Name	Area in Sq km	Percentage
Buildings	241.50	56.7
Parks	9.20	2.2
Tanks	35.72	8.9
Temples	0.84	0.2
Trees	72.81	17.1
Others	65.93	15.5
Total	426.00	100.0

The Pallikaranai marsh land serves as a buffer for rain water draining from Velachery, Pallikaranai, Perungudi, Narayanapuram lake, Kilakattalai, Velachery and from a string of upstream lakes. GCC maintains 525 parks to an area of 1.36 Sq.km, 763 Open Space Reservation (OSR) land to an area of 16.05 lakhs Sq.km

2.6.4 Weather and Climate

The geographical location determines the weather and climate, being proximity to the sea and thermal equator and weather in Chennai relatively consistent with less variation in the seasonal temperature. The weather in Chennai is mostly hot and humid.

Experiencing the 3 major seasons namely summer, monsoon and winter, the city of Chennai has a tropical climate. April to June are the hottest months in Chennai recording maximum temperature during these months vary from 38-42 °C thus making Chennai very hot. However the cooling breeze at night comes as a relief to the residents of Chennai.

Climate data for Chennai													
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Record high °C (°F)	33 (91)	37 (99)	39 (102)	43 (109)	45 (113)	43 (109)	41 (106)	40 (104)	39 (102)	39 (102)	34 (93)	33 (91)	45 (113)
Average high °C (°F)	29 (84)	31 (88)	33 (91)	35 (95)	38 (100)	38 (100)	36 (97)	35 (95)	34 (93)	32 (90)	29 (84)	29 (84)	33.3 (91.8)
Average low °C (°F)	19 (66)	20 (68)	22 (72)	26 (79)	28 (82)	27 (81)	26 (79)	26 (79)	25 (77)	24 (75)	22 (72)	21 (70)	23.8 (75)
Record low °C (°F)	14 (57)	15 (59)	17 (63)	20 (68)	21 (70)	21 (70)	22 (72)	21 (70)	21 (70)	17 (63)	15 (59)	14 (57)	14 (57)
Average precipitation mm (inches)	16.2 (0.638)	3.7 (0.146)	3.0 (0.118)	13.6 (0.535)	48.9 (1.925)	53.7 (2.114)	97.8 (3.85)	149.7 (5.894)	109.1 (4.295)	282.7 (11.13)	350.3 (13.791)	138.2 (5.441)	1,266.9 (49.878)
Source: Indian Meteorological Department													

Chennai experiences two monsoons namely South West Monsoon from June to September and North East Monsoon from October to December every year. South West Monsoon sets in over the extreme south western tip of the peninsula by the end of May. The onset of Monsoon is characterised by a sudden spurt of rainfall activities. It progresses inland in stages and covers the entire country by the middle of July. The average rainfall of South West Monsoon is 439.10 mm. North East Monsoon essentially contribute the rainfall for the city. The city gets average rainfall of 760 mm during North East Monsoon. The average rainfall of the city throughout the year is about 1,300 mm.

The winter in Chennai is short period of time. In November to February Chennai experiencing the winter season. This is the most comfortable and pleasant time in Chennai. During the winter months, Chennai maintains an average maximum and minimum temperature of 24°C and 20 °C respectively. Moderate rainfall is also received in the winter months by the city. This makes the weather and climate in Chennai pleasurable as well as comfortable.

The lowest temperature that has been recorded in Chennai is 15.8 °C (60.4 °F) while the highest temperature being recorded as 45 °C (113 °F). The highest yearly rainfall in the city has been recorded to be 2,570 mm (101 in) in 2005. The formation of Cyclones in the Bay of Bengal has great influence in the city. The winds that prevail in Chennai in between April and October are the southwesterly wind while the remaining year experiences the northeasterly winds.

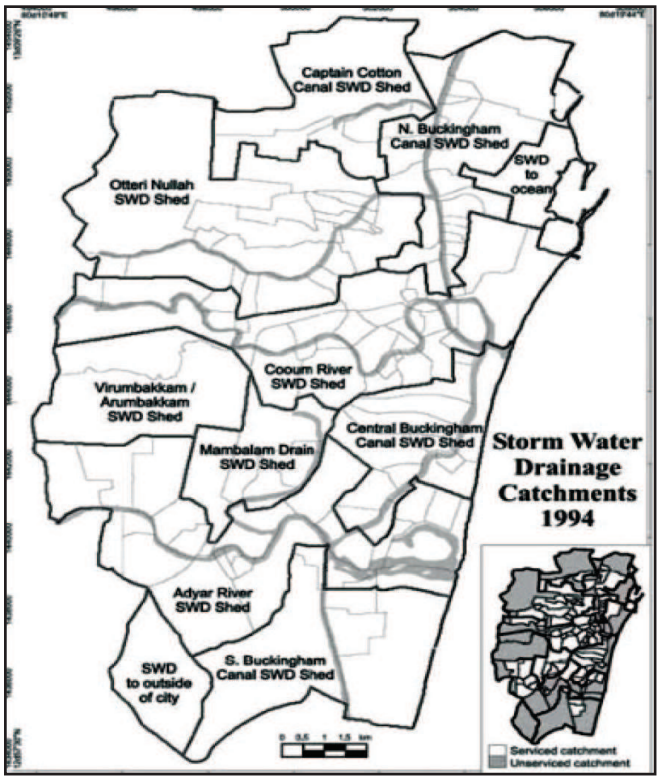
In Chennai IMD has two rain recording stations and 4 automated warning systems, the details are

1. Regional Meteorological Department, Nungambakkam

2. Airport Meteorological Department, Meenambakkam and four Automated Warning Systems in Avadi, DGP Office, Egmore, Sozhinganallur and Madhavaram.

2.7 Hydrology of City

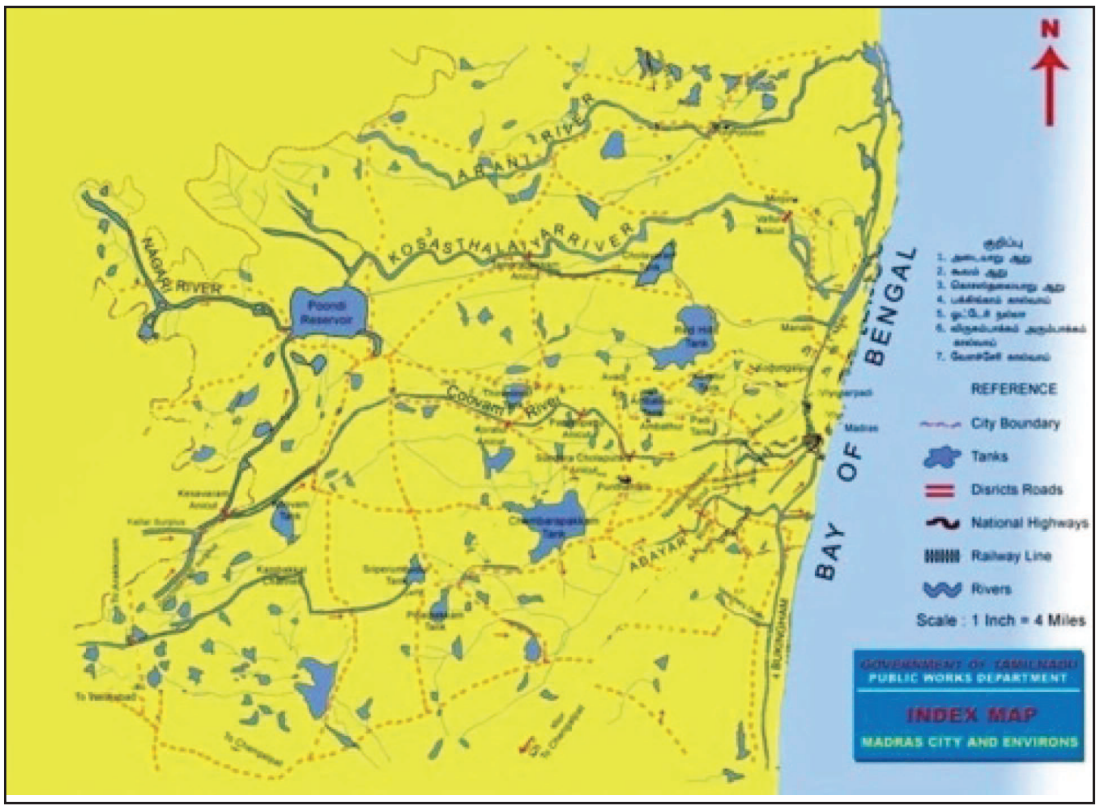
2.7.1 Water Bodies and Water Ways



There are 5 major water ways in the city maintained by the Public Works Department (PWD) and 31 minor Canals maintained by Greater Chennai Corporation. There are 7,360 storm water drains in the city for a length of 1,894 km which are drained to major and minor drainage systems. The storm water drainage catchment of Chennai city is presented in the map. The drainage systems in the city is divided into two types i) Macro Drainage and ii) Minor Drainage System.

2.7.2 Major Drainage System

Two major rivers meander through Chennai are the Cooum and Adyar River. A third river, Kosathalaiyar flows through the northern fringes of the city before draining into the Bay of Bengal, at Ennore. The Buckingham Canal, runs parallel to the coast, linking the two rivers. The OtteriNullah, an east–west stream, runs through north Chennai and meets the Buckingham Canal at Basin Bridge. Several water bodies of varying size are located on the western fringes of the city. The drainage system with water bodies is given in detail in the following map.



Kosasthalaiyar River originates near Kaveripakkam near pallipet in Tiruvallur district and flows in eastward direction. It bifurcates into Cooum River and Kosasthalaiyar at Keshavaramanicut. The main branch of Kosasthalaiyar River then flows northwards and enters into Poondi Reservoir. Nagari River originating in Chittoor district, is a northern tributary and joins the Kosasthalaiyar River at Poondi reservoir. On the downstream side of Poondi reservoir, Kosasthalaiyar River flows through the Thiruvallur district and Chennai, and finally confluence with sea at Ennore.

Cooum River bifurcates from the main Kosasthalaiyar River at the Keshavaramanicut and flows eastwards through Kanchipuram district into Chennai and finally joins the sea near NapierBridge. Surplus from about 75 tanks in the catchment reaches are linked with CooumRiver.

Adyar River originates from two tank groups namely Pillapakkam and Kavanur in Kanchipuram District and flows through the Chennai before it joins the sea at Adyar Mouth. Surplus from about 450 tanks in the catchment, including a major tank at Chembarambakkam, reaches the Adyar River.

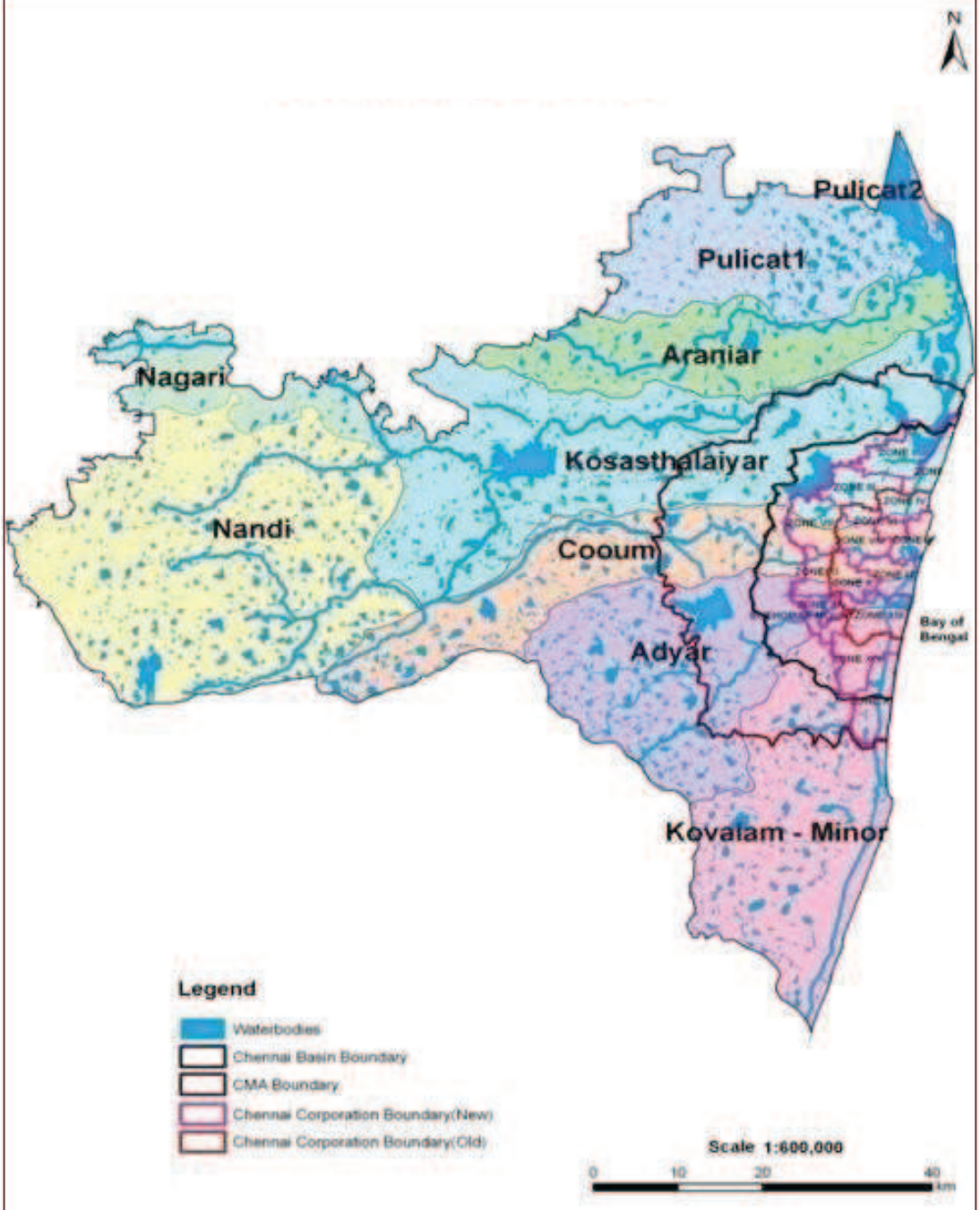
The Buckingham canal has been constructed more than 200 years ago, as a navigation channel. It originates close to Kakinada in Andhra Pradesh and runs along the east coast for a total length of 418 km. Its entry point into Chennai is near Athipattu village and the exit point is near Semmencheri village. While the three rivers run west to east, Buckingham canal runs north to south and connects all these three rivers at different points.

Besides the above three major river system, there are 31 minor canals runing in the city linked with major drainage systems. While OtteriNullah, Kodungaiyur drain and Captain Cotton Canal drain into the Buckingham canal, Veerangalodai and Velacheri drain discharge into Pallikaranai marsh. Virugambakkam drain discharges into the Cooum River.

The waterways maintained by Public Works Department are detailed as follows.

Sl. No	List of Waterways	Length in Km
1	Adyar River	42.50
2	Buckingham Canal	47.90
3	Cooum River	65.00
4	OtteriNullah	8.70
5	Virugambakkam&Arumbakkam Canal	6.36
	Total	**170.46**

CHENNAI RIVER BASIN



2.7.3 Minor Drainage Network

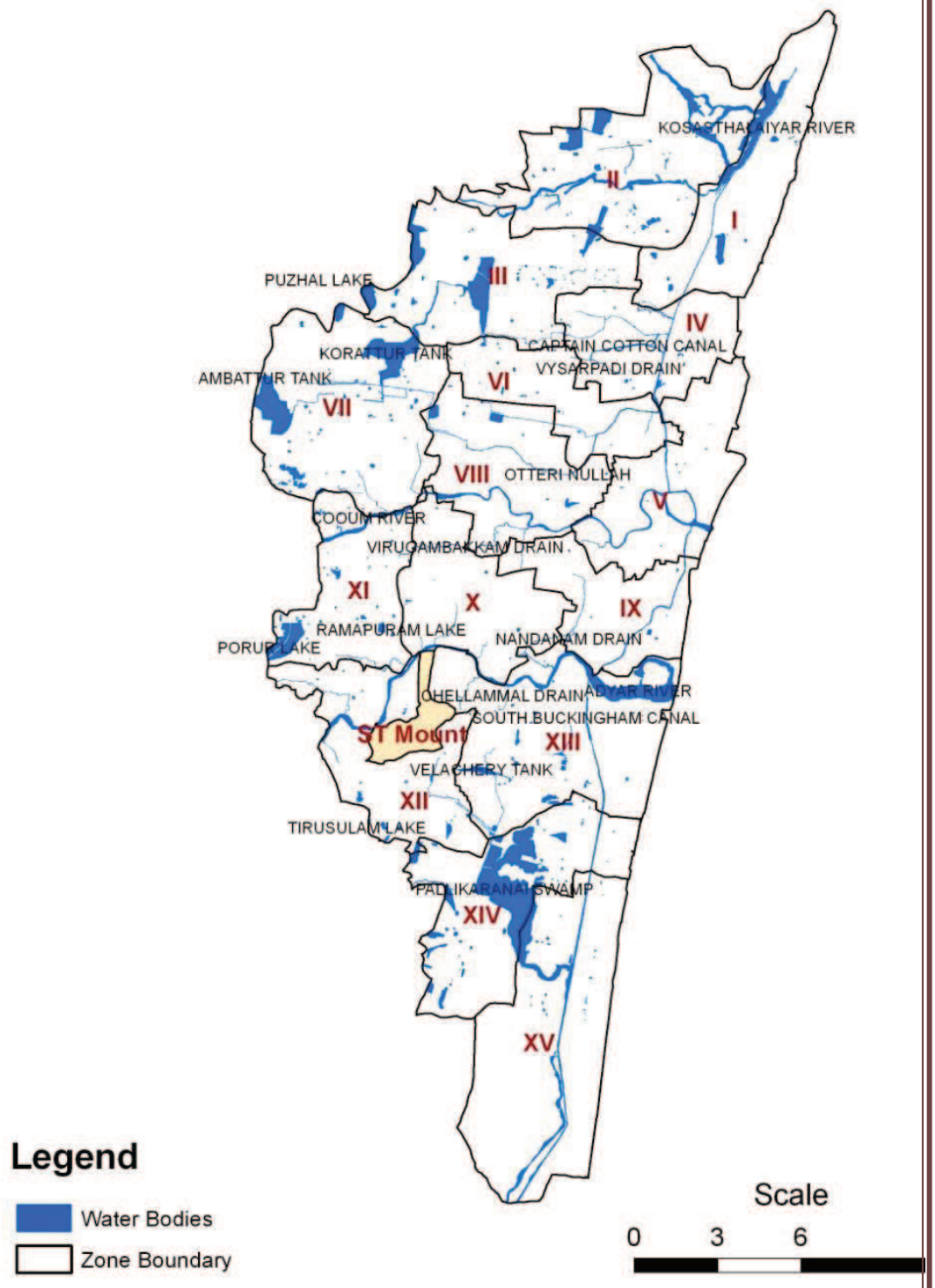
There are 31 minor natural drainages in the city connected with the macro drainages (16 in old city and 15 in the expanded areas) which are maintained by the Greater Chennai Corporation. In addition to this, a network of storm drains to the length of about 1,894 km discharges storm water into the sea through major / minor drains.

The Minor drainage or canals maintained by Greater Chennai Corporation with their respective zones are listed in the Table.

Minor Drainage system in Chennai city

SL No.	List of Water ways	Zone
1	Thamaraikulam Canal	I
2	Captain Cotton Canal	IV
3	Kodungaiyur Canal	IV
4	Link Canal	IV
5	Old Napalayan Canal	II
6	Thulasi Nagar Canal	II
7	MalaniPudurTNHB Canal	II
8	PeriyaEatchankuzhi Canal	II
9	Kadapakkam Lake Surplus Canal	II
10	Madhavaram – Manali Lake Canal	II
11	Vyasarpadi Canal	IV
12	Ekangipuram Canal	VI
13	Jawahar Canal	IV
14	T.V.S. Canal	VI
15	Nungambakkam Canal	IX
16	Nolambur Canal	VII &XI
17	AmbatturSidco Canal	VII
18	PadiKuppam Canal	VII
19	Trustpuram Canal	X
20	Mambalam Canal	IX &XIII
21	Nandanam Canal	IX
22	Chellammal College and Guindy Industrial Estate Canal	XIII
23	Reddykuppam Canal	X
24	M.G.R. Canal	X
25	Jafferkhanpet Canal	X
26	Rajbhavan Canal	XIII
27	Pallikaranai Canals	XIV
28	Nandambakkam Canal	XI & XII
29	Adambakkam Canal	XII
30	Large Lake Link Canal	XV
31	Secretariat Colony Canal	XV

ZONE BOUNDARIES WITH WATER BODIES



3.0 OCCURRENCE OF NATURAL CALAMITIES IN PAST

The Chennai city has come across various natural calamities in the last three decades. In the following paras some of major disasters are discussed in detailed. During heavy flood in 1976 resulted in submergence of TNHB Quarters in Kotturpuram bank of Adayar river coupled with high & storm tide in the sea.

In 1996 the city was flooded by Adayar, Cooum and Kosasthalaiyar rivers. The surplus water from Poondi reservoir has collapsed Karanodai Bridge at Redhills. Similarly surplus water from Chembarambakkam Tank has flooded Adayar. In 1998, Thanikachalam Nagar, a residential colony in Madhavaram was flooded by Kodungaiyur canal.

An earthquake in the Indian Ocean occurred on 26 December 2004 with the epicentre off the west coast of Sumatra, Indonesia. The shock had a moment magnitude of 9.1–9.3 and a maximum Mercalli intensity. The undersea megathrust earthquake was caused when the Indian Plate was subducted by the Burma Plate and triggered a series of devastating tsunami wave along the coasts bordering the Indian Ocean. Inundated coastal communities with waves up to 30 metres (100 ft) high affected 25 kuppams in 4 coastal revenue villages affected 73,000 people, 30,000 people evacuated, 206 human loss, 9 injured and damaged 17,000 houses and other properties in Chennai city.

During 2005, Chennai experienced an unprecedented maximum rain fall in a day. Cooum, Adayar, Otteri Nullah, B - Canal, Virugambakkam and Arumbakkam Canal flooded and people residing in the nearby areas were evacuated and many people became homeless. On 18th December 2005 in a school situated in MGR Nagar, K.K.Nagar where the relief material were distributed by the Government to the people affected by severe flood, 42 people died and 37 injured due to stampede.

In the same year the city was also exposed to a Cyclone named as Fanoos with a wind speed of 85 km/hr east of Chennai on 9th December.

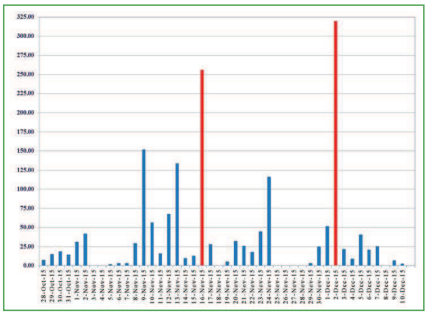
In 2008 again there was Nisha cyclone with wind speed of 83 – 102 km/hr hits the city on 26th November by which the city was badly affected. The following are some of the cyclones that hit Chennai in different periods, Cyclone Jal in 2010 with the wind speed of 100 – 110 km/hr, Cyclone Thane in 2011 with the wind speed of 140 -165 km/hr, Cyclone Nilam in 2012 with the wind speed of 85 -100 km/hr.

3.1 Flood

The North East Monsoon sets on 28th October 2015, initially has not shown any disaster kind of down pouring, whereas from the second week of November heavy rain occurred which recorded as the wettest month of the last 100 years for receiving 1113.80 mm of rainfall.

Date	22.10.1969	27.10.2005	9.11.2015	13.1.2015	16.1.2015	02.12.2015	12.12.2016
Rainfall in mm	279.7	272	166.8	147	256	319.6	119.10

This heavy rainfall coupled with a high speed wind resulted in fall of more than 911 trees in the City. Way back in 1918 Chennai has received 1088.40 mm in a month which remains maximum till date. The maximum rainfall recorded as 319.60mm on 02.12.2015 is the highest record on a single day. The day wise details of rainfall is depicted in the following table

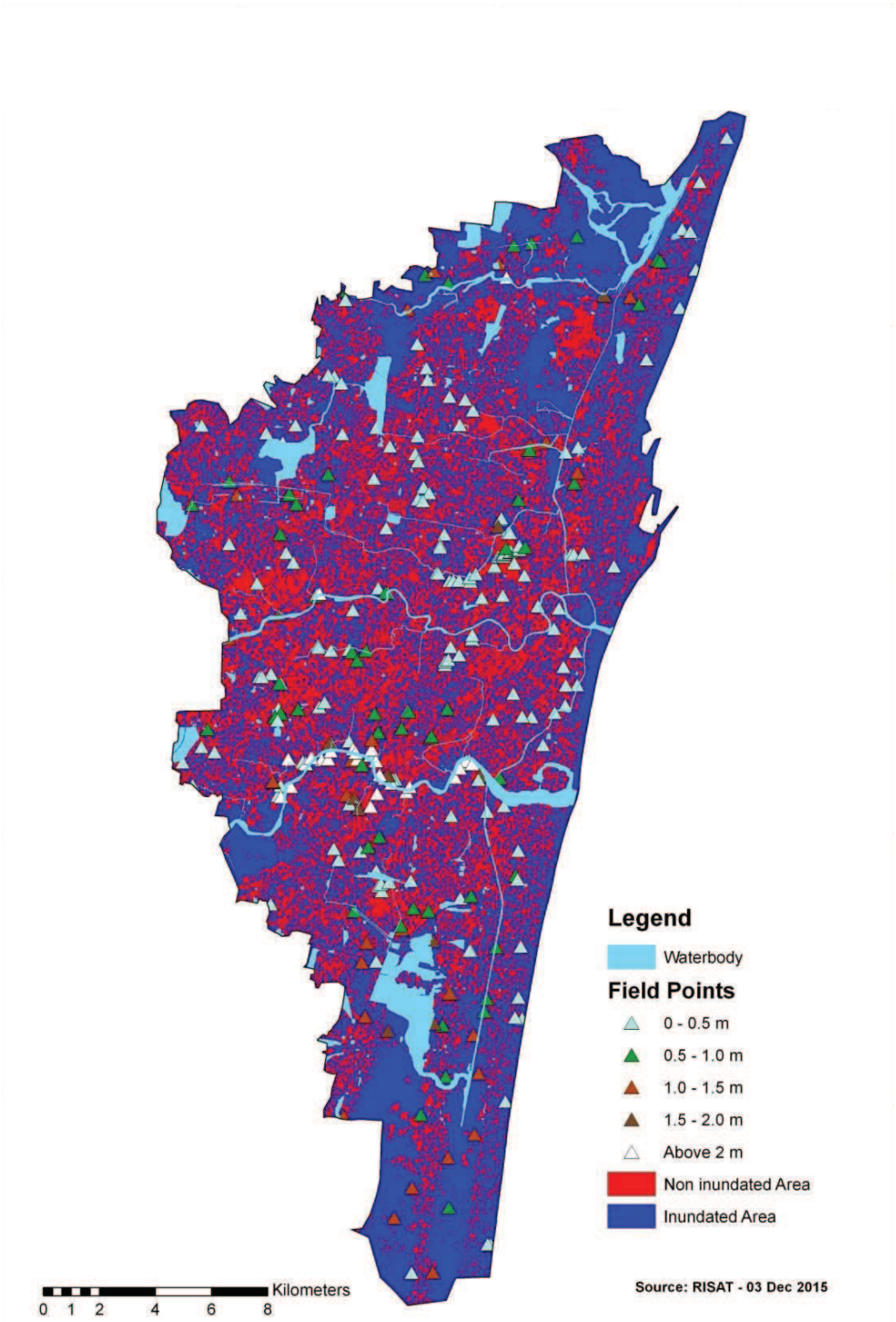


In Kanchipuram District out of 912 tanks 908 tanks were over flowing due to which excess water fed into Chembarambakkam lake through 170 drains causing flood in Adyar, Coovam rivers and link canals. Similarly in Kovalam basin 65 tanks were over flowing causing inundation in Sholinganallur and Perungudi areas. In Tiruvallur District surplus water released from Puzhal – Redhills, Poondi reservoir causing flood in Kosasthalaiar basin.

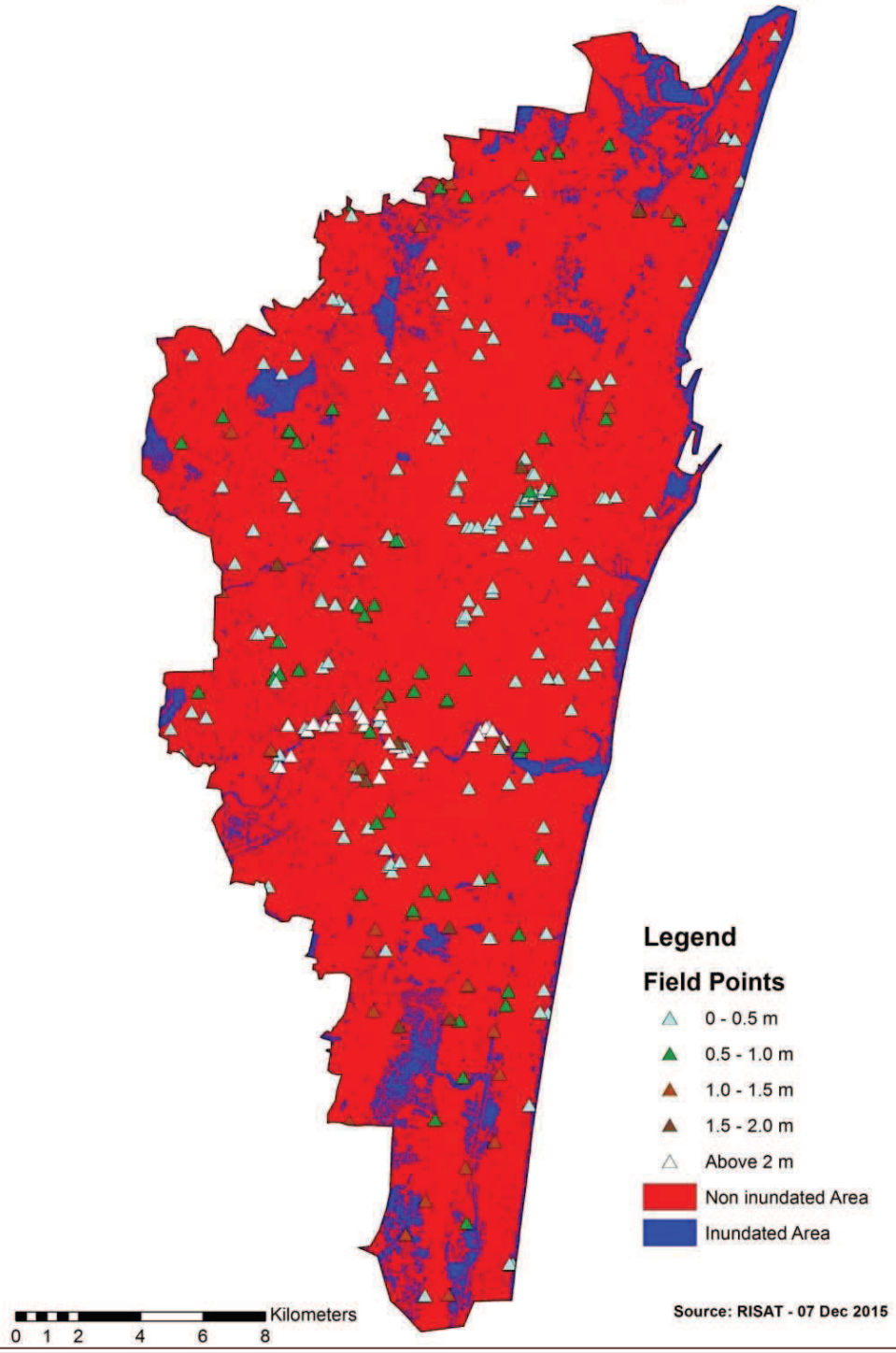
Some of the most affected areas are Mudichur, West Tambaram, Manapakkam, Saidapet, Jafferkhanpet, Kotturpuram etc. Many inundated areas were with more than 2 m height of water. The carrying capacity in Coovum and Buckingham canal exceeded beyond its designed capacity. Canals including 31 minor canals in Chennai city has flooded the near by areas. As a result of about 859 places in Chennai City were inundated due to heavy rainfall and Greater Chennai Corporation jointly with Other Departments cleared water stagnation and 911 fallen trees.

The satellite pictures showing nature and intensity of inundation during flood 2015 taken on 3rd and 7th December is given in the following pages

Inundation on 3 Dec 2015



Inundation on 7 Dec 2015



Chronic Inundation Locations During Monsoon - 2015						
Sl. No	Zone	Very High Vulnerability Above 5 Feet	High Vulnerability 3 to 5 Feet	Medium Vulnerability 2 to 3 Feet	Low Vulnerability less than 2 feet	Total
1	I	1	7	0	6	14
2	II	0	0	0	3	3
3	III	2	6	1	1	10
4	IV	0	7	0	7	14
5	V	0	1	0	12	13
6	VI	0	0	0	36	36
7	VII	0	0	0	6	6
8	VIII	1	1	0	7	9
9	IX	5	20	0	40	65
10	X	0	9	0	0	9
11	XI	4	13	0	9	26
12	XII	0	0	0	8	8
13	XIII	24	17	0	26	67
14	XIV	0	0	0	16	16
15	XV	0	3	0	7	10
TOTAL		37	84	1	184	306

Depth of Inundation During Monsoon - 2015							
S.No	Zone	Ward	Location	Very High Vulner-ability Above 5 Feet	High Vulner-ability 3 to 5 Feet	Medium Vulner-ability 2 to 3 Feet	Low Vulner-ability less than 2 feet
1	1	5	TH Road jn.of MRF Road				Yes
2	1	6	Kalaignar nagar	Yes			
3	1	1	SVM Nagar I main road				Yes
4	1	1	SVM Nagar II main road				Yes
5	1	1	Kamaraj salai		Yes		
6	1	4	AD Colony, Ernaavoor		Yes		
7	1	7	Kargil nagar, Rajaji nagar		Yes		
8	1	1	SVM Nagar, Ulaga-nathapuram		Yes		
9	1	10	Nandhi odai , Sadayank-uppam battai		Yes		
10	1	12	Srinivasapuram, B.K.N Colony				Yes
11	1	4	Kathivakkam high road				Yes
12	1	5	T.H. Road (MRF road junc-tion)		Yes		
13	1	5	T.H. Road near Liftgate				Yes
14	1	6	Manali Express road, (Mul-lai nagar, Jothi nagar, TKS Nagar)		Yes		
15	2	15	Manali New Town 60 Feet Road				Yes (Only during flood)
16	2	16	Rajiv Gandhi Nagar from TPP Salai to Andarkuppam Main Road				Yes (Only during flood)
17	2	16	From Kanniammanpet pond to Kadappakkam Lake				Yes (Only during flood)
18	3	22	Mahalakshmi Nagar		Yes		
19	3	23	Punitha Anthoniyar Street		Yes		
20	3	23	Othai vadai Street		Yes		
21	3	31	Ambedhkar Nagar		Yes		
22	3	32	Sarathy Nagar				Yes
23	3	22	KS Nagar (Thirumalai Nagar)			Yes	
24	3	25	Collector Nagar	Yes			
25	3	25	Aringhar Anna Nagar,	Yes			
26	3	24	Ambattur Redhills road (Highway)		Yes		
27	3	25	GNT Road (Near Roundana)		Yes		

S.No	Zone	Ward	Location	Very High Vulner-ability Above 5 Feet	High Vulner-ability 3 to 5 Feet	Medium Vulner-ability 2 to 3 Feet	Low Vulner-ability less than 2 feet
28	4	41	Carnesh Nagar				Yes
29	4	45	Sundram Power Lane				Yes
30	4	45	B.V Colony 19 and 20th Street				Yes
31	4	45	Annai Sathya Nagar				Yes
32	4	45	Ganesapuram Main Road				Yes
33	4	47	KH Road		Yes		
34	4	34	Construction of RCC Open Box type Retaining Wall and Bed including chain link fencing to Kodungaiyur canal North wing from Ch.0.0 to Ch.850m		Yes		
35	4	34	Construction of RCC Open Box type Retaining Wall and Bed including chain link fencing to Kodungaiyur canal North wing from Ch.850 to Ch.1150m		Yes		
36	4	34	Construction of RCC Open Box type Retaining Wall and Bed including chain link fencing to Kodungaiyur canal North wing from Ch.1675 to Ch.2191m		Yes		
37	4	40	Dismantling and Reconstruction of RCC Box type storm water drain of size 1200x1200mm along Kamarajar salai from Elaya street to AE koil st		Yes		
38	4	39	Dismantling and Reconstruction of RCC Box type storm water drain of size 1200x1200mm along T.H Road from North Terminal road to AE koil st				Yes
39	4	41	Providing Re-sectioning concrete lining and laying service road in link canal from Ch.2500 to 2940 in Captain Cotton Canal		Yes		

S.No	Zone	Ward	Location	Very High Vulner-ability Above 5 Feet	High Vulner-ability 3 to 5 Feet	Medium Vulner-ability 2 to 3 Feet	Low Vulner-ability less than 2 feet
40	4	41	Providing Re-sectioning concrete lining and laying service road in link canal from Ch.2940 to 3360 in Captain Cotton Canal		Yes		
41	4	46	Sathya Moorthy Nagar 24th Block				Yes
42	5	54	Walltax Road				Yes
43	5	61	Ghandhi Irwan Bridge Road				Yes
44	5	58	EVK Sampath Salai,				Yes
45	5	61	Egmore High Road,				Yes
46	5	62	Arunachalam Road,				Yes
47	5	63	Chella pillayar Koil Street,				Yes
48	5	63	G.P. Road,				Yes
49	5	53	Vijayaragavalu Roundana,		Yes		
50	5	58	Sydnams Road,				Yes
51	5	53	Walltax Road				Yes
52	5	62	Singanna Chetty Street,				Yes
53	5	54	Walltax Road				Yes
54	5	59	VOC Salai,				Yes
55	6	64	Poombugar Nagar 1st Main Road				Yes
56	6	64	Poombugar Nagar 2nd Main Road				Yes
57	6	64	Dhanammal Nagar				Yes
58	6	64	Samuthirya Colony 1st Street				Yes
59	6	64	Anjugam Nagar 4th Street				Yes
60	6	64	Poombugar Nagar 11th Cross Street				Yes
61	6	64	Gandhi Street				Yes
62	6	64	MN Nagar				Yes
63	6	65	Hussain Colony 4th Street				Yes
64	6	65	Teachers Colonly				Yes
65	6	66	Gandhimathi Street				Yes
66	6	66	Jawahar Nagar				Yes
67	6	67	Rangasiyee Street				Yes
68	6	68	Andiyappan Street				Yes
69	6	66	Kamaraj Street				Yes

S.No	Zone	Ward	Location	Very High Vulner-ability Above 5 Feet	High Vulner-ability 3 to 5 Feet	Medium Vulner-ability 2 to 3 Feet	Low Vulner-ability less than 2 feet
70	6	68	Pallavan Street				Yes
71	6	71	Konnur High Road				Yes
72	6	72	Decaster Road				Yes
73	6	72	Doss Nagar Pallam				Yes
74	6	73	Ammaiyammal Street				Yes
75	6	74	Sec Colony 1st to 9th Street				Yes
76	6	75	Vallavan Street				Yes
77	6	77	Demellous Road (Near Haj Committee)				Yes
78	6	78	V.V.Koil Street				Yes
79	6	68	Maduraiswamy Madam				Yes
80	6	70	Bharathi Main Road				Yes
81	6	76	Straganas Road				Yes
82	6	76	Angalamman Koil Street				Yes
83	6	72	Dr. Ambedkar College Road				Yes
84	6	66	Shanthi Street				Yes
85	6	66	Ragavan Street				Yes
86	6	68	Mohamadin Salai				Yes
87	6	73	Lal Singh Street				Yes
88	6	73	Mannarswamy Street				Yes
89	6	67	Gopal Reddy Colony				Yes
90	6	73	New Ferrance Road				Yes
91	7	82	Gnanamoorthy Nagar & EB Colony				Yes
92	7	83	NAS Garden & TVS Nagar				Yes
93	7	86	Cth Road near Petrol Bunk				Yes
94	7	86	Annai Sathya Nagar				Yes
95	7	90	Thirumagalam road				Yes
96	7	93	Vandiamman Koil st				Yes
97	8	94	Annai Sathya Nagar from Wheels India Culvert to Padi Bridge Culvert	Yes			
98	8	94	Villivakkam Sidco Nagar 2nd main road I main road to Burial Ground Com-pound Wall		Yes		

S.No	Zone	Ward	Location	Very High Vulner-ability Above 5 Feet	High Vulner-ability 3 to 5 Feet	Medium Vulner-ability 2 to 3 Feet	Low Vulner-ability less than 2 feet
99	8	95	Anna Nagar 18th main road (South) Ch.500m (Reach I) from 100 feet road to Ch.500m				Yes
100	8	95	Anna Nagar 18th main road (South) from Ch.500m (Reach 2) to Ot-teri Nullah canal				Yes
101	8	95	Anna Nagar 18th main road (North) Ch.425m from Vasantham Colony to 2nd street (Reach II)				Yes
102	8	95	Anna Nagar 18th main road (North) from 100' road to Ch.425m (Reach I)				Yes
103	8	95	Kumarasamy Nagar ,Ag-athiyar canal				Yes
104	8	101	2nd Avenue, Anna Nagar (Roundana)				Yes
105	8	103	Kellys Road				Yes
106	9	109	Vanniyar 2nd Street				Yes
107	9	109	Gill Nagar 1nd street				Yes
108	9	110	School Road				Yes
109	9	110	Kamarajapuram Main Road				Yes
110	9	111	Maakkis Garden	Yes			
111	9	111	Thideer Nagar	Yes			
112	9	111	Conron Smith Road				Yes
113	9	113	Habibullah Road				Yes
114	9	113	G.N.Chetty Road				Yes
115	9	113	North usman street				Yes
116	9	113	Kodambakkam High road				Yes
117	9	114	C.N.K. Road				Yes
118	9	114	Sydoji Street				Yes
119	9	114	John Mohammad Street				Yes
120	9	114	Lock Nagar				Yes
121	9	115	Dr. Besant Road				Yes
122	9	116	Dr. Besant Road				Yes
123	9	117	North Usman Road		Yes		
124	9	117	G.N.C.Road	Yes			

S.No	Zone	Ward	Location	Very High Vulner-ability Above 5 Feet	High Vulner-ability 3 to 5 Feet	Medium Vulner-ability 2 to 3 Feet	Low Vulner-ability less than 2 feet
125	9	117	South boug road		Yes		
126	9	117	Thirumalai pillai Street				Yes
127	9	113	Sarathapuram Street		Yes		
128	9	118	Kasthuri Estate 1st street				Yes
129	9	118	Kasthuri Estate 2nd street				Yes
130	9	119	Avvai Shanmugam Salai		Yes		
131	9	119	Lakshmipuram 2nd Street				Yes
132	9	119	Avvai Shanmugam Salai 1st Lane	Yes			
133	9	119	Royapettah High Road				Yes
134	9	119	P.S.Siva Swamy Street		Yes		
135	9	120	Dr. Natesan Road				Yes
136	9	121	Dr. Radha Krishnan Salai(jn of Thiru.Vi.Ka.High Road)				Yes
137	9	121	Dr. Radha Krishnan Salai (jn of Dr.Natesan Road)				Yes
138	9	121	Dr. Radha Krishnan Salai (infornt of Reliance Build-ing)				Yes
139	9	122	K.B.Dasan Road		Yes		
140	9	122	Cresent Road		Yes		
141	9	122	Seethammal colony 3rd Street,		Yes		
142	9	122	Seethammal colony 4th street,		Yes		
143	9	122	Tankbund Road	Yes			
144	9	122	Nandhanam extension 1st Street		Yes		
145	9	122	Nandhanam extension 2nd Street		Yes		
146	9	122	Nandhanam extension 3rd Street		Yes		
147	9	122	Nandhanam extension 4th Street		Yes		
148	9	122	Nandhanam extension 5th street		Yes		
149	9	122	Nandhanam extension 6th Street		Yes		
150	9	122	Nandhanam extension 7th Street		Yes		

S.No	Zone	Ward	Location	Very High Vulner-ability Above 5 Feet	High Vulner-ability 3 to 5 Feet	Medium Vulner-ability 2 to 3 Feet	Low Vulner-ability less than 2 feet
151	9	122	Nandhanam extension 8th Street		Yes		
152	9	122	Nandhanam extension 9th Street		Yes		
153	9	122	Nandhanam extension 10th Street		Yes		
154	9	122	Seethammal 1st Main Road		Yes		
155	9	123	R.A.Puram 1st main road				Yes
156	9	123	Eldams Road				Yes
157	9	123	R.A.Puram 3rd cross street				Yes
158	9	124	Kutcherry Road				Yes
159	9	125	Karaneswarar Pagoda Street				Yes
160	9	126	Santhome Hign Road				Yes
161	9	111	Whites Road				Yes
162	9	112	Railway border road				Yes
163	9	112	Sowrastra nagar 5th street				Yes
164	9	112	Trustpuram 1st cross street				Yes
165	9	112	Bharathishwarer colony 3rd street				Yes
166	9	112	Sivan koil street				Yes
167	9	118	Mayor Sundra (rao) road				Yes
168	9	121	Thiru-Vi-Ka 3rd street				Yes
169	9	113	Improvements of storm water drain at North Us-man Road				Yes
170	9	113	Improvements of storm water drain and construc-tion of 3 road crossing culverts Habibullah Road				Yes
171	10	127	Kaliamman Koil Street(from CMWSSB STP to Sai nagar annex)		Yes		
172	10	131	Rajamannar Salai		Yes		
173	10	134	Rangarajapuram		Yes		
174	10	128	Vembuliamman Koil street		Yes		
175	10	130	100 feet Road (junction of periyar pathai)		Yes		
176	10	136	North Usman Road		Yes		

S.No	Zone	Ward	Location	Very High Vulner-ability Above 5 Feet	High Vulner-ability 3 to 5 Feet	Medium Vulner-ability 2 to 3 Feet	Low Vulner-ability less than 2 feet
177	10	127	100 feet road (junction of Kaliamman Koil Street)		Yes		
178	10	127	Kaliamman Koil Street (infront of police station)		Yes		
179	10	111 & 127	Construction of Storm water drain of size 900x900mm RCC Box type drain along Kaliam-man koil street at Koy-ambedu from Metro Water Office in Dn.111 to 100 ft road in Dn.127		Yes		
180	11	144	MMDA Colony 4th , 5th & 6th block				Yes
181	11	145	Pallavan Nagar				Yes
182	11	143	Gajalakshmi nagar	Yes			
183	11	143	VGN nagar phase III		Yes		
184	11	143	Sakthi nagar				yes
185	11	143	Vembuli amman koil street				Yes
186	11	146	Metro nagar				Yes
187	11	147	Krishna nagar		Yes		
188	11	147	Alapakkam main road		Yes		
189	11	147	Pallavan nagar				Yes
190	11	148	Anbu nagar		Yes		
191	11	148	Balavinayagar street		Yes		
192	11	148	CDN nagar				Yes
193	11	149	Radha avenue		Yes		
194	11	149	Sri Lakshmi nagar		Yes		
195	11	150	Mullai street				Yes
196	11	150	Arcot road		Yes		
197	11	151	Officers colony		Yes		
198	11	151	Annai sathya nagar		Yes		
199	11	153	Ganesh avenue 1st to 10th street		Yes		
200	11	155	Amman nagar	Yes			
201	11	155	Royala nagar	Yes			
202	11	155	Bakthi vedhandha avenue	Yes			
203	11	154	Bharathi salai		Yes		

S.No	Zone	Ward	Location	Very High Vulner-ability Above 5 Feet	High Vulner-ability 3 to 5 Feet	Medium Vulner-ability 2 to 3 Feet	Low Vulner-ability less than 2 feet
204	11	148	Construction of storm water drain of size 1200x1200mm along IAS Qtrs road and Pachaiam-man koil street from Dead End to Virugambakkam Canal				Yes
205	11	152	Sairam avenue		Yes		
206	12	156	Bhell Nagar				Yes
207	12	157	Kaviya Garden, CRR Puram Phase III, Purachi Thalivi Nagar, Bhell Nagar, Dharmarajapuram, Sathiya Nagar, Astalakshmi Av-enue and Sedhu Lakshmi Avenue, River view colony				Yes
208	12	165	Bharathidasan Nagar,				Yes
209	12	167	Nanganallur 44th street				Yes
210	12	158	Construction of storm wa-ter drain along Ganapathi Colony from Thulasingapu-ram to Adayar river of size 1200x1200mm				Yes
211	12	165	Bhuvaneswari Nagar,				Yes
212	12	165	Income Tax colony Area Back flow of sewage water				Yes
213	12	162	Thillai Ganga Nagar 25 th Street, 27th Street, 28th Street, Thillai Ganga Nagar 2nd MainRoad, and 4th Main Road				Yes
214	13	173	Mayflower garden		Yes		
215	13	173	R.A Puram IV cross street		Yes		
216	13	173	Valleswaranthottam		Yes		
217	13	173	Srinivasa avenue		Yes		
218	13	174	Mosque street				Yes
219	13	179	Gandhi road	Yes			
220	13	179	Vallalar street - Annai Indra nagar	Yes			
221	13	179	Sivasakthi street - Annai Indra nagar	Yes			

S.No	Zone	Ward	Location	Very High Vulner-ability Above 5 Feet	High Vulner-ability 3 to 5 Feet	Medium Vulner-ability 2 to 3 Feet	Low Vulner-ability less than 2 feet
222	13	179	Kamatchiamman street - Annai Indra nagar	Yes			
223	13	179	Sastri street (Part)	Yes			
224	13	179	Udayam nagar & extn	Yes			
225	13	177	Astalakshmi nagar II, III, IV & V streets				Yes
226	13	173	MRC Nagar		Yes		
227	13	173	Vasantha avenue		Yes		
228	13	173	Kasthuri avenue		Yes		
229	13	175	L.B road				Yes
230	13	175	Kasthuribai nagar				Yes
231	13	175	Indra nagar				Yes
232	13	175	Anna avenue				Yes
233	13	176	Sastri nagar II, IX & XV cross street		Yes		
234	13	178	A.G.S Colony	Yes			
235	13	179	V.G.P Selva nagar Extn I to V streets	Yes			
236	13	179	V.G.P Selva nagar I cross street & I main road	Yes			
237	13	179	Bhuvaneshwari nagar I & III cross street & III main road	Yes			
238	13	179	Veenus colony II street	Yes			
239	13	181	Dr.Radhakrishnan nagar				Yes
240	13	181	Valmigi street				Yes
241	13	180	C.S.I.R road				Yes
242	13	174	Nehru nagar - Veerapandi-ya Kattabomman street		Yes		
243	13	174	Nehru nagar - Periyar street		Yes		
244	13	174	Nehru nagar - Anbil Dhar-malingam street		Yes		
245	13	174	Velachery main road		Yes		
246	13	182	Journalist colony		Yes		
247	13	171	Construction of SWD of size 1500x1500mm along and across Sardar Patel road (Opp to Rajbhavan)		Yes		

S.No	Zone	Ward	Location	Very High Vulner-ability Above 5 Feet	High Vulner-ability 3 to 5 Feet	Medium Vulner-ability 2 to 3 Feet	Low Vulner-ability less than 2 feet
248	13	177	Construction of RCC Box type storm water drain along EB colony 2nd street from EB colony main road to Radha Nagar extension main road		Yes		
249	13	177	Construction of storm water drain along Lakshmi nagar 2nd street from Lakshmi Nagar main road to Rajiv Gandhi nagar main road		Yes		
250	13	182	Avvai nagar				Yes
251	13	182	Kannappa nagar				Yes
252	13	182	Ganapathy colony				Yes
253	13	172	Chitra nagar, Kotturpuram	Yes			
254	13	177	Ambedkar nagar II main road				Yes
255	13	177	Kamarajar street - Nehru nagar				Yes
256	13	177	TNHB Colony III main road				Yes
257	13	177	A.G.S Colony VI street				Yes
258	13	177	ASK Nagar				Yes
259	13	177	Ex Service man colony				Yes
260	13	177	Ambedkar nagar I cross street				Yes
261	13	177	TNHB Colony - EWS lanes				Yes
262	13	177	Nethaji colony I to IV cross streets				Yes
263	13	177	Andal nagar extn I to III streets				Yes
264	13	177	Venkateswara nagar III main road				Yes
265	13	177	A.G.S Colony III main road				Yes
266	13	177	Mahalakshmi nagar III cross street				Yes
267	13	177	Brindavan nagar II street		Yes		
268	13	179	Seshadripuram I main road	Yes			
269	13	170	Nagi (R) Thottam	Yes			

S.No	Zone	Ward	Location	Very High Vulner-ability Above 5 Feet	High Vulner-ability 3 to 5 Feet	Medium Vulner-ability 2 to 3 Feet	Low Vulner-ability less than 2 feet
270	13	170	Chetti thottam	Yes			
271	13	170	Neruppumedu	Yes			
272	13	170	Vinayagapuram	Yes			
273	13	170	Anusuyamandapam	Yes			
274	13	178	Vijayanagar area	Yes			
275	13	178	Ram Nagar area	Yes			
276	13	179	Tansi nagar II, III, V, VII & X streets	Yes			
277	13	179	Dhandeeswaram nagar	Yes			
278	13	179	Seetharam nagar	Yes			
279	13	179	Sarathy nagar	Yes			
280	13	180	Velachery Taramani road (100' road)				Yes
281	14	184	MGR Salai, MRTS (Near ICDS)				Yes
282	14	187	Karthikeyapuram				Yes
283	14	187	New Kubera Nagar 5th & 7th Street				Yes
284	14	169	Ram Nagar (North)				Yes
285	14	169	Annai Therasa nagar				Yes
286	14	169	Puzhuthivakkam Bust Stand				Yes
287	14	186	OMR, Jn. of Thirumalai Nagar				Yes
288	14	185	ECR, Palgalai Nagar				Yes
289	14	183	ECR, Near BATA Show-room				Yes
290	14	183	ECR Opp. Fish market				Yes
291	14	184	OMR, MGR Salai Jn.				Yes
292	14	185	ECR, Govindan Nagar				Yes
293	14	188	Rajesh Nagar				Yes
294	14	188	Rajaji Nagar				Yes

S.No	Zone	Ward	Location	Very High Vulner-ability Above 5 Feet	High Vulner-ability 3 to 5 Feet	Medium Vulner-ability 2 to 3 Feet	Low Vulner-ability less than 2 feet
295	14	188	LIC Nagar				Yes
296	14	188	Madipakkam Bus Stand				Yes
297	15	192	Ellaiamman koil street				Yes
298	15	193	MCN Nagar				Yes
299	15	194	OMR - Mettukuppam (VPG Avenue Junction)		Yes		
300	15	197	Wipro Salai		Yes		
301	15	192	Construction of SWD of size 600x750mm along Kumaraguru Avenue , Neelankarai				Yes
302	15	192	Construction of SWD of size 1200x1200mm along Pandian Salai, Nee-lankarai				Yes
303	15	192	Construction of SWD of size 600x750m along Saraswathi Nagar South, Neelankarai		Yes		
304	15	193	Construction of SWD of size 900x900mm along Karpaga Vinayagar Koil Street, Vettuvankeni				Yes
305	15	196	Construction of storm wa-ter drain along Ist Avenue Main Road, Vettuvankeni				Yes
306	15	197	Lalbahadhur Sasthiri Street				Yes

3.1.1 Scene During Flood 2015

All the residential areas including encroached areas along with water bodies were totally marooned for more than 10 days.

280 boats and choppers were used for rescuing people and supplied relief materials to the low lying areas such as Kargil Nagar, Manali, Madhavaram, Villivakkam, Kolathur, Tondiarpet, Mambalam, K.K.Nagar, Jafferkhanpet, Ashok Pillar, Ekkatuthangal, Guindy Industrial Estate, Defence colony, Ramapuram, Sri Nagar colony, Saidapet, Valasaravakkam , Manapakkam, Kotturpuram,Madhya kailash, Velachery, Pallikaranai, Thiruvanmiyur, Neelangarai, Perungudi, Madipakkam, Ram Nagar, Karapakkam, Sholinganallur, etc.,

Some of the areas were also experienced road “CAVE-INS” at Sardar Patel Road near Madhya Kailash, P.S.Sivasamy Salai, T.T.K Road, Rajaji Salai, VIth Avenue in Anna Nagar, Anna Salai in Teynampet, Dr. Nair Road in T. Nagar, Devanathan Road in Mylapore.

Velachery flooded area

Chennai Flood Relief Army Force

Pump set deployed in subways

Residences shifted through Boats

Fire Service vehicle

Medicine Distribution

The mobile communication network was down/off in various parts of Chennai. Major inter city and inter state roads were cutoff during flood and severely affected the public movement. The city was totally cut off from other cities due to disconnection of roads, city was severely affected and the supply of basic commodities like vegetables, milk and bread etc., were stopped. The train services were stopped and the operation of airport was closed was more than a week. Due to failure of continuous power supply in Chennai city, it was difficult to rescue the people at night time.

3.1.2 Government Response

Due to the severity of rain and excess flow of water in the rivers and canals, the Government has appointed 15 senior level IAS officers as Monitoring Officers one for each zone. These officers headed relief and rehabilitation works in each zone in a planned and systematic manner. The involvement of these officers was very effective because they have co-ordinated with various head of departments for speedy execution of relief works.

3.1.3 Mitigation

Flood water was cleared by using 470 Pumpsets, 82 JCB and Poclains, 49 Fire Service machines and 75 super suckers of CMWSSB.In addition 6 heavy duty pumps having capacity of 250 HP each were supplied by Confederation of Indian Industry (CII), New Delhi and 4 from Neyveli Lignite Corporation Ltd. (NLC) were used in heavily inundated areas. In flooded/marooned areas 280 boats and choppers were used for rescuing people and supplying relief materials to the low lying areas.


JCB
JCB
NDRF
NDRF

About 176 relief centres were opened in Chennai city by GCC and more than 1.2 lakhs individuals were sheltered in these relief centres for more than 20 days. Necessary relief materials like mat, bed sheets and food materials were supplied promptly. In addition to this, donors and NGO's themselves distributed food and relief materials to the affected people in pockets. Apart from inhouse kitchens in some relief centers, food was also prepared and distributed from Amma Canteen and from all four common kitchens of Greater Chennai Corporation.

Sheltered in relief center

Distribution of food

3.1.4 Centralised Relief Material Center

A centralised Relief Material Distribution Center for Chennai, Thiruvallur, Kanchepuram and Cudalore was opened at Jawaharlal Nehru Indoor Stadium for prompt and speedy distribution of relief materials to flood affected people.

The relief materials were received from the Districts Collectors, Co-operative Societies, Aavin, MTC and Southern Railways, Indian Navy, various Public Sector Undertakings, Indian Military, NDRF, NSS and NGOs includes 1,99,244 General food packets, 32,992 Mats, 2,07,433 Bed sheets, 12,500 liters of Milk, 54,448 Water Bottles, 2,122 Rice Bags, 10,390 Dress Material Packs, 3,004 Medicine Boxes and 2,38,568 liter of water totalling 1577.65 tonnes over a period of 15 days.

More than 250 MT of bleaching powder for sanitation of the flood affected areas was received from Government and NGO's. Supply of bleaching powder was very much useful to clean the sumps, over head tanks etc., to control infections and diseases out break. The NGO's and volunteers have not only contributed for door to door distribution of relief materials but also for applying bleaching powder in the flood affected areas. The services of residential welfare associations were also fully utilised to spread the bleaching powder in their areas.

All these relief materials were sorted out and packed for each families at Nehru Indoor Stadium by the volunteers. These sorted materials were taken to the affected areas and distributed door to door. This was done with the help of NGO's, volunteers, GCC staff, Police, Army, NDRF, SDRF, Homeguards, NCC and NSS. The distribution of relief materials including perishable items like fruits and vegetables were distibuted to victims without delay and wastages are to be appreciated.

3.1.5 Distribution of relief materials and role of NGOs / Volunteers

Previous day the GCC was informed to be ready to receive and distribution of huge quantity of relief materials from various agencies. GCC's entire team was already preoccupied in doing relief works in the field. So we have decided to appeal to NGO's and volunteers to assist GCC for disbursing relief materials. Over night we have sent message through various social medias, radio channels for NGO's and volunteers services.

It was surprise to see more than 1,000 volunteer/NGO's turned out on the next day at Nehru Indoor Stadium. It is very interesting to mention some foreigners, school children and families with the kids were whole heartedly participated in the operation. Many of them took much risk to travel to Nehru Stadium with restricted road accessibility. Initially we had problem to arrange food for volunteers. In the first two days they managed with biscuits., snacks came along with relief materials. Later GCC was able to arrange food for them. Nearly around 4,000 volunteers and NGO's turned up and played key role for smooth distribution of relief materials at door step. After flood relief work GCC has sent appreciation letter to all the Volunteers/NGO's through e-mail.

3.1.6 Clearing of Garbage

Greater Chennai Corporation owns 115 HMV Lorries, 122 LMV Lorries, 15 HMV Tipper, 29 LMV Tipper, 21 Front end loaders for Garbage removal and 80 HMV lorries, 45 Bobcats for debris removal, for clearing the city. GCC's average daily collection of garbage is between 4,500 MT and 5,000 MT.

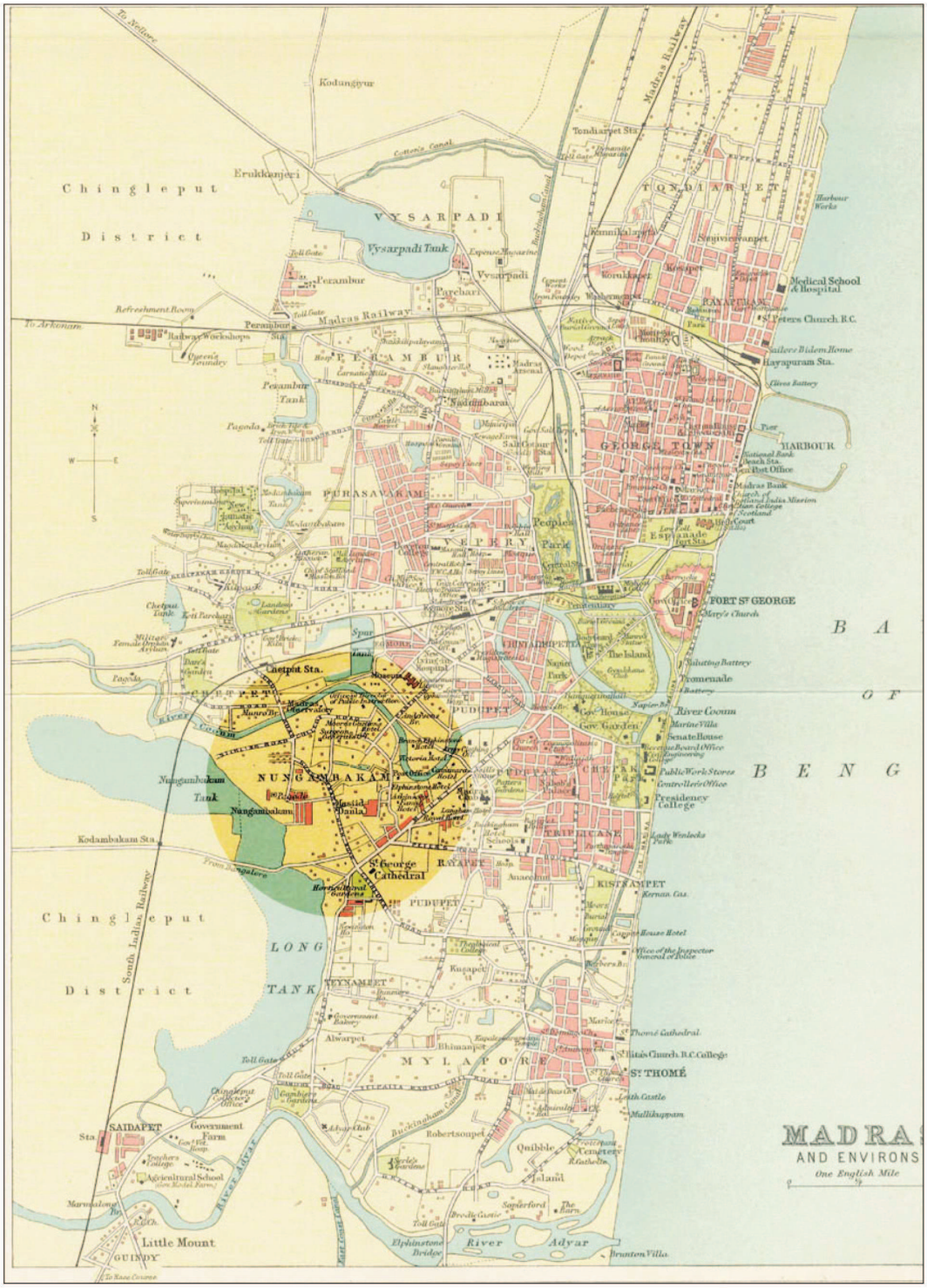
The biggest challenge to GCC after receding flood water was to remove the garbage with sludges from the roads and streets. And every day the residents were throwing huge quantity of damaged house hold articles/debris on roads/streets. The GCC could not handle the situation with its own conservancy labours due to less strength and continuous restless work. To come out of the situation 16,111 sanitary workers and labours with 675 lorries and 100 JCB were mobilized from other local bodies. Necessary safety gears like gumboots, masks, gloves, raincoats were given to all the sanitary workers. GCC has arranged accommodation and food for sanitary workers who have come from outside city.

The entire team along with 2,500 labours of GCC were deployed for cleaning the debris throughout the city on war foot manner. It is worth to mention that between 7.12.2015 and 2.01.2016 GCC has cleared 2.2 Lakhs MT of garbage/ debris at 8,148 MT per day.

3.1.7 Causes of Flood

Chennai is the only drainage basin for all the water bodies located in 2 adjoining districts around Chennai. Over the years, the water bodies have shrunk due to various reasons in Chennai Metropolitan Areas. Furthermore, rapid urbanization and industrialization has led to large scale encroachment in the water bodies.

The old map of 1909 which shows the locations of several water bodies, comparing this with recent map is a clear evident that many water bodies have shrunk and several have completely disappeared.



The City of Chennai in 1909

The City of Chennai in 1981.

Chennai has experienced many floods during the last three decades. The reasons for flood in the city shall be narrowed down as follows

1. Plain terrain of Chennai with an average altitude of 7m height.
2. Sand bar formation at the mouths of rivers, which slow down the discharge rate.
3. Clogging of the drains due to indiscriminate dumping of solid waste and construction debris.
4. Inadequate design capacity of storm water drain in Highways and other roads.
5. Lack of continuous connectivity of storm water drainages with macro drainage and absence of storm water drain network in added areas.
6. Encroachments.
7. Influence of high and low tide.
8. Flow of excess surplus water than the designed carrying capacity into minor water bodies through the tanks in upstream.
9. Construction of less number of cross culverts/vents with inadequate sizes wherever the road is passing across the water flow.

3.2 Cyclone

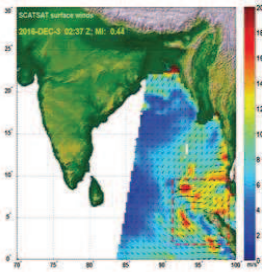
3.2.1 Nada Cyclonic Storm 2005

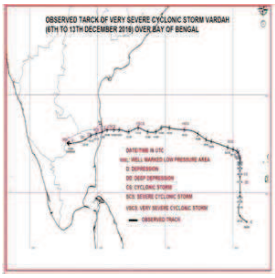
Under the influence of a trough, low pressure area formed in extreme southeast Bay of bengal. It slowly consolidated enough to be classified as a depression BOB 2005 on 29 November. This was followed by the Joint Typhoon Warning Center (JTWC) issuing a Tropical Cyclone Formation Alert (TCFA) for the system while it was rapidly concentrating to a deep depression. Remaining as a deep depression for a short time, the storm quickly intensified into a cyclonic storm and was named Nada by the IMD. Shortly thereafter, the storm reached its peak intensity with winds exceeding 75 km/h and a minimum central pressure of 1,000 mbar. Over the following days, the storm encountered high wind shear, which together with land interaction caused it to rapidly weaken and cross the coast of Tamil Nadu near Karaikal as a depression. The system was last noted as a well marked low pressure area over southern Karnataka.

3.2.2 Vardah Cyclone 2016

Low pressure formed over South East Bay of Bengal on 6th December 2016 intensified in to Depression, Deep Depression, Cyclonic Storm and further intensified in to very severe cyclonic storm on 10 th December 2016 and crossed north Tamil Nadu near Chennai as a severe cyclonic storm with a maximum sustained wind speed of 100-110 kmph gusting to 140 kmph during 1500 -1700 hrs IST of 12 th December.

Cyclonic storm “Vardah” made landfall in Chennai city on 12th December, 2016 and barreled inland packing wind speed more than 140 km/hour which created a sea of devastation and an average rainfall was recorded as 119.10 mm. This cyclonic storm was the most severe in two decades which uprooted lakhs of trees, devastated 1000s of lamp posts, spoiled several electrical installations such as transformers, brought several kutcha rooftops to the ground, disabled communication lines and brought the transport system to a grinding halt.





3.2.2.1 Damages Caused

Heavy loss to Chennai green cover as 17,157 avenue trees were uprooted by the cyclone, by which 558 bus route roads and 24761 interior roads were blocked. Gantry boards, Signages were also ripped away. 65 bus route roads damaged to a length of 14.5 km and 3500 interior route roads to a length of 400 km were damaged. 81 electricity installations were covered with fallen trees which delayed the restoration of power supply. 6133 street lamp poles were damaged along with 2226 street lamp fittings. 30 storm water drains to a length of 4.35 km, 2030 footpaths to a length of 21.3 km and 531 bus shelters were damaged.

3.2.2.2 Strategies and Restoration

The G.C.C men and machinery swung into action immediately and a massive war footing exercise to clear the roads by removal of uprooted trees and debris was undertaken. 4197 men from other districts along with G.C.C workers totaling to 19,411 were rushed in for the restoration work. 565 saws were deployed for tree cutting. 449 JCB's and 819 lorries were put in service on this war footing exercise to clear the fallen trees. The total damages have been estimated at Rs.321.94 Crores. By working round the clock, all the bus route roads and interior route roads were cleared for traffic which were blocked by fallen trees. This work continued till 24th December 2016.

The damaged lamp posts and light fittings were restored jointly by GCC and TANGEDCO. Tamilnadu Fire and Rescue services deployed their field personnel and were very effective in these operations. 176 relief centres were kept ready, out of which 27 was opened immediately in which 9,696 people were evacuated from coastal areas in Zone-I (Kathivakkam, Periyakuppam, Tiruvottiyur), Zone –II (Edayanchavadi, Manali New town), Zone-XIII (Kuppam Beach road, Srinivasapuram) and Zone-XV (Neelankarai and Okkiam thoraipakkam). More than 6 lacks food packets were given to affected persons and 610 health camps were conducted.

The removed garden debris have been stored in 78 temporary storage locations across the city to speed up the restoration work. The severity of damages due to cyclone were minimized by meticulous planning and coordination with various Government departments and fore warning the people throughout 9th and 10th December, 2016. This effort had given a lot of insight for future disaster management. Maximum precautionary measures were taken along with the co-ordination of TANGEDCO.

The G.C.C. mobilized men and materials rapidly and left no stone unturned for the restoration of normalcy in the City of Chennai.The Corporation also availed the services of Indian Meteorological Department, National Disaster Response Force(NDRF), State Disaster Response Force(SDRF), Fire and Rescue Services Department and Health and Family Welfare Department strategically. Medical teams with all necessary medical equipments were pressed into service.

Ayanavaram

Whites Road, Royapettah

Nandanam

Haddows Road

Thiru.Vi.Ka Bridge

Manali

4.0 INSTITUTIONAL FRAMEWORK AND ARRANGEMENTS

GCC has formed a Relief Committee with the following members,

S.No	Committee Members	Designation
1	Commissioner, Greater Chennai Corporation	Chairman
2	Collector of Chennai	Member
3	Executive Director, Metro Water Chennai	Member
4	Joint Commissioner of Police (Traffic), Chennai	Member
5	Chief Engineer, Highways and Rural works	Member
6	Chief Engineer, PWD (Chennai & Environ area)	Member

The Chief Engineer in-charge of MRTS and the Joint Director /Deputy Director of Fire Services may also be invited for the meetings whenever required.

The duties of this committee is to monitor the following thrust area for disaster mitigation.

1. To evict the encroachments on regular basis, to maintain the free flow of rainwater.
2. To identify the vulnerable roads, subways, level crossings within the Greater Chennai Corporation limit which are likely to get inundated during the heavy rain periods.
3. To identify road and areas which are prone to inundation/ traffic congestion during periods of heavy rainfall.
4. To identify the areas which are likely to cause damages due to non-free flow of drainage water during the heavy rain periods.
5. To see the major drainage channels and also waterways like Adayar river, Cooum and Buckingham Canal, Otteri Nullah etc., free from encroachments, blocks etc., due to MRTS and other works.
6. To identify new drainage systems and also interlinking the existing drainage systems for efficient discharge of rain water during monsoon period.

4.1 Control Room Arrangements

The control room in Greater Chennai Corporation is functioning at Ripon Building. The control room is functioning under overall supervision of the Joint / Deputy Commissioner (Works) with other staff functioning 24x7.For perfect co-ordination, the officers/staffs from the other line departments like TANGEDCO, CMWSSB, FISHERIES, PWD, POLICE will also be pooled at control room during monsoon/emergency time.

The intensity of rainfall will be collected on daily basis from the Metrological Department. The Control room is to monitor the overall flood situation in the field and collect details of water stagnation, tree fall, status of subways, relief centres, food packets issued, pumps utilized for the removal of inundated water, evacuation operation, collection and distribution of relief materials etc. For every one hour, reports will be collected from the Zonal Office and will be submitted to the Commissioner. The issues related to flood mitigation pertaining to other departments will also be coordinated by the control room.

The Public Works Department is periodically contacted for the status of flood levels in reservoirs around Chennai like Chembarabakkam lake, Narayanapuram, Red hills, Puzhal eri, etc., In case of breakdown of telephone and other communication networks, wireless network of GCC will be largely used for continuity. Whatsapp group is formed with all officials engaged in flood work to exchange the information which will be coordinated by the control room duty staff.

A dedicated Public Relation Officer/Assistant Public Relation Officer will be posted in the control room for media management. He will collect datas and details of relief operations from the field for press release. Press release will be done periodically with due approval of the Commissioner.

The other control rooms functioning at Secretariat, State Emergency Operation Center and Commissionerate of Revenue Administration office will also be coordinated. The contact details of all three control rooms are given in page number 98 of this booklet.

5.0 DISASTER PREVENTION, PREPAREDNESS & MITIGATION PLAN

Chennai City has its boundaries facing the Bay of Bengal thereby susceptible to various natural disturbances like floods, cyclone, sea surge, tsunami etc & further the city has been classified as moderately susceptible to earthquakes also.

Greater Chennai Corporation, in this handbook, compiled and brought out a compendium of plan of action evolved by line departments in organizing rescue, relief and rehabilitation measures on the eve of the impending northeast monsoon season.

Chennai is not seismically as active as compared with the northern and western parts of the country, small to moderate earthquakes have occurred in the state of Tamil Nadu. The frequency of earthquakes is low i.e. the gap between moderate sized events is fairly long and therefore, this Contingency Plan is more concentrate on flood and cyclone .

The occurrence of flood is often in Chennai city. The measures have to be taken periodically and the development of prevention method is essential to minimise the damage. The preparedness strategy in the Greater Chennai Corporation is necessary for securing the lives of the people. In the following pages a subject wise detailed preparedness for disaster management will be discussed. Therefore the measure are considered as a bench mark to derive the well secure mitigation plan for the future to strive to keep the people away from flood.

5.1 Earthquake

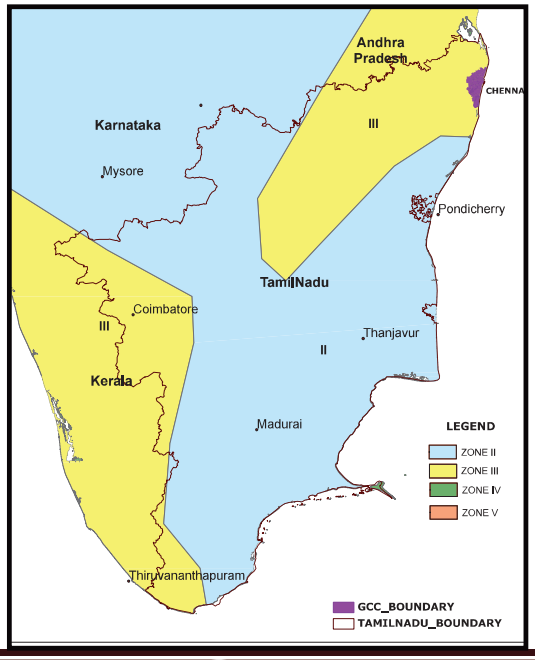
Earthquake is a sudden and violent shaking of ground causing great destruction as a result of movement of earth's crust. An earthquake has the potential to tsunami or volcanic eruption.

Chennai has not witnessed a serious earthquake so far although Chennai lies in high-risk seismic zone III as per Bureau of Indian Standards 1893 criteria for earthquake resistant design of structures IS 1893(Part 1) :2002 . The biggest earth quake 5.2 magnitude earthquake has occurred 15 years ago at 14:56 September 25, 2001 UTC with Epicenter at 11.956, 80.214 at 39.2 km from Marakkanam (24.2 miles) with close proximity to Chennai and 4.6 magnitude earthquake has occurred 29 years ago at 18:15 December 03, 1987 UTC with Epicenter at 15.525, 80.246 21.2 km from Ongole (13.2 miles). Mild tremors were felt in some part of the cities in 2012, 2015.

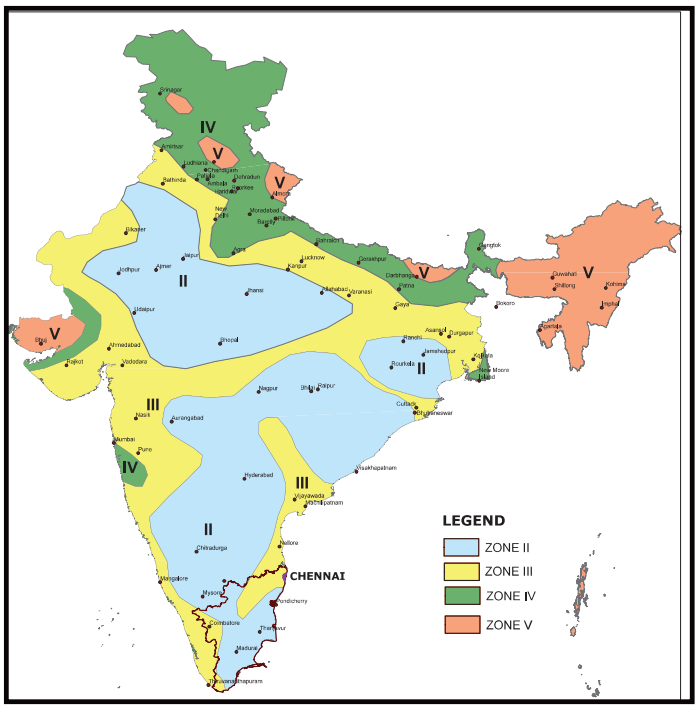
The probability of an earthquake can be roughly estimated, there is no accepted method at present to predict the time and intensity of earthquake. The following table illustrates the maximum intensity expected in different seismic zones and probable impact.

Seismic zone	Magnitude	Probable max. intensity	Probable Impact
II	Below 4.5	VI	Felt by all many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight
III	4.5 - 5.5	VII	Damage negligible in buildings of good design and Construction; slight to moderate in well built ordinary structures; Considerable damage in poorly built or badly designed structures; same chimneys broken.
IV	5.5 - 6	VIII	Damage slight in specially designed structures; Considerable damage in ordinary substantial building with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stocks, columns monuments, walls, Heavy furniture overturned
V	6 or Higher	IX or Higher	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial building, with partial collapse. Buildings shifted off foundations.
Maximum intensity Expected in Different seismic Zones			

Seismic Zones in Tamilnadu



Seismic Zones in India



5.1.1 Impact of Earth Quake

Earthquakes results in primary, secondary and tertiary impacts.

Primary impacts include surface vibration, surface rupture and displacement along the fault plane, total or partial damage and collapse of buildings, dams, tunnels, pipelines and other rigid structures.

Secondary impacts of earthquake include liquefaction, landslides, fire, tsunami and floods, regional subsidence or emergence of landmass, change in course of river, changes in ground water level, etc. Most of the deaths by earthquake are caused mainly due to building collapse, falling debris, broken glass panes. Earthquakes also lead to minor and severe injuries, loss of limbs, etc. Apart from these, earthquake impacts routine services due to the damage caused to lifeline buildings, roads, railway tracks, bridges, highways, disruption of traffic, large amount of debris, disruption of water supply and electricity, etc.

Tertiary impact of earthquake includes Post Trauma Stress Disorder (PTSD), long term psychological issues, loss of livelihood, disruption of social capital due to relocation related issues, etc.

5.1.2 Earthquake Mitigation Strategies

- Existing critical facilities built on reclaimed land should be inspected and retrofitted if necessary to ensure earthquake resistance.
- Future critical facilities should not be located on reclaimed land because of the high potential for liquefaction.
- Older unreinforced masonry buildings should be inspected and retrofitted if necessary to increase earthquake resistance.
- Older unreinforced masonry buildings should not be used for critical functions.
- Ensuring all the Government building & GCC buildings are constructed as per IS 1893(Part 1) : 2002.
- Motivating public to construct building as per IS 1893(Part 1) : 2002.

5.1.3 Earthquake preparedness measures

- Organise camps in school, colleges and public for awareness of do-s and do n'ts for earthquakes.
- Ensure preparation of disaster management plans and first aid kits in all schools, colleges and all offices.
- Identify safe schools and colleges which can be used as relief shelters for short duration of time in aftermath of any earthquake.
- Ensure that all critical life saving equipment are maintained and ready to use.
- Ensure that open and safe places in the corporation area, vacant land like roads, parks & play grounds for mass evacuation are identified.
- Ensure that safe buildings in the corporation area are identified for purpose of relief camps in post disaster.
- Develop plan for hospital preparedness and mass casualty management.
- Prepare a database of registered private hospitals, clinics, diagnostic labs, blood banks, etc. along with their capacities and facilities provided.
- Ensure availability of adequate supply of life saving equipments and drugs, portable supplies like portable oxygen cylinders, portable x-ray machines, triage tags, etc.

- Prepare for quick deployment of rescue teams including volunteers for providing safety to affected population and evacuated structures/ houses.

5.1.4 Assembly Points

Open and safe places in the corporation for mass evacuation during disaster are identified as vacant land like parks, playgrounds and roads. The location of parks is mentioned in each zone shall be utilized as buffer zone during disasters and the list of playgrounds which will also serve as assembly points during earth quake is given below.

Zone	Ward	Name/Location of Play Ground
1	10	Poonthottam School play ground
2	15	Manali New Town, Eday-anchavadi Chennai Primary School
2	16	Manali TNHB Phase - 2, Sadayankuppam
2	16	Burma Nagar
2	17	Kathakuzhi Near Perumal Koil Street
2	17	Chettimedu
2	19	Chinna samy Nagar, Periya mathur
2	19	MMDA 4th Main Cross Street
2	20	Periya thoppu
2	21	Ambedkar Playground
3	27	ASSISI Nagar 10th Street
3	28	Krishna Nagar Play Ground, Periyasekkadu
3	29	Chandramman Koil Street, Chinnasekkadu
3	30	Thiruvalluvar 2nd St
3	23	Thanthai Sivaraj Foot Ball Ground EMS Street
4	36	Sharma Nagar 9th street
4	36	Sharma Nagar Ist main road
4	36	16th West Cross Street MKB Nagar
4	36	18th West Cross street MKB nagar
4	36	Vasugi nagar

Zone	Ward	Name/Location of Play Ground
4	37	3rd Crsoss street, MKB nagr
4	37	4th Cross Street, MKB Nagar
4	37	Central Avenue road
4	37	East avenue road
4	37	18th Central cross street
4	37	KKD Nagar7th Block
4	37	Srinivasan Street
4	37	SM nagar
4	40	Chelliamman Koil Street
4	46	Kalyanapuram Ground
4	46	Sathyamoorthy naagr main road
4	48	Kanni Koil street
5	52	Cementry Road Near Metro Water Office Area-5
5	52	OSH Road, Royapuram, Near Stanly Hospital
5	55	Barracks 1st Lane Near Stanly Hospital
5	58	Thirunarayanaguru salai
5	61	Vengu street
5	61	Sami (R) Puram - Ran-gachari park
6	64	V.V Nagar
6	64	TNHB Play Ground
6	66	Ram Nagar 2nd Main Road
6	66	Jawahar Nagar 2nd Circular Road
6	66	Jawahar Nagar 2nd Cross Street
6	67	Rangasayee Street

Zone	Ward	Name/Location of Play Ground
6	67	Parthasarathy Play Ground
6	67	Loco Scheme 2nd Street
6	68	Thiru-Vi-Ka Nagar
6	68	Madurai Samy Madam
6	72	Kannigapuram
6	72	VOC Nagar
6	72	Kasthuri Bai Colony
6	74	Barackka Road
6	74	AK Samy Nagar 1st Street
6	74	Reddy Colony
6	74	SVM Nagar
6	76	KM Garden 1st Street
6	77	Sundarapuram
6	77	Old Slaughter House
7	84	Korattur TNHB 2nd street
7	89	Officers colony main Road, Anna nagar West extension
7	91	Mogapair Eri Scheme 1st main road , Ambedkar nagar
8	94	North Jaganathan Nagar 3rd Street
8	94	Rajamangalam 2nd Main Road Chennai Primary School
8	94	Redhills Road 4th Street Chennai Primary School
8	94	Baba Nagar 3rd Cross Street
8	95	I-Block 7th Street, Vallalar Kudiyuruppu
8	95	I-Block 28th Street, Kambar Kudiyuruppu
8	95	I-Block 18th Street, Thiru-valuvar Kudiyuruppu
8	95	I-Block, 34th Street, Iswarya Colony
8	95	Mullai Nagar 6th street
8	95	Vasantham Colony Ist Street
8	95	Vasantham Colony 2nd Street
8	95	Agathiyar Nagar N-Block 3rd Street

Zone	Ward	Name/Location of Play Ground
8	95	Agathiyar Nagar O-Block 9th Street
8	95	Agthiyar Nagar O-Block 12th Street
8	95	Thirumangalam Road, Pus-phanjali Appartments
8	95	Thendral Colony 2nd Street
8	96	K.K. Nagar 10th Street
8	97	Solai Street
8	97	Vellala Street
8	97	Pachaikal veeraswamy Street
8	98	Dr. Ambetkar 2nd Street
8	98	Solai Amman Koil Street
8	98	Aspiran Garden 1st Street
8	98	Lockma Nagar Main Street Chennai Primary School
8	99	J-Block 10th Street
8	99	H-Block 14th Street
8	99	H-Block 16th Street, Brinley Garden
8	99	A.F.-Block Ist Street
8	99	N.V.N. Nagar 6th street Junction of 8th Street
8	99	N.V.N. Nagar 14th street
8	99	Temple Colony 15th Main Road
8	99	Kathiravan Colony Main road
8	99	Appu Colony, Ponni Colony Main Road
8	99	Thiriveni Flat Belli Area
8	99	Sangam Apartments Belly Area
8	99	G-Block 2nd Street, Forest Department
8	100	AE-Block Play Ground
8	100	AL-Block Play Ground 3rd & 4th Street
8	100	7th Main Road Near Foot bridge at HIG Flats
8	101	VI Cross Street
8	101	Cresent Play Ground

Zone	Ward	Name/Location of Play Ground
8	101	N-Block 24th Street
8	101	O-Block
8	101	K-Block Tennis Court
8	102	L-Block
8	102	1st Cross Street, East
8	102	Shenoy Nagar Park and Play Ground
8	102	Big Street Childrens Play Ground
8	102	Canal Road Children Play Ground
8	102	V.S.Puram
8	105	E-Block, M.M.D.A.Colony, Arumbakkam
8	105	D-Block, M.M.D.A.Colony, Arumbakkam
8	105	Kalki Nagar Main Road, Arumbakkam
8	106	Rajaram Metha Nagar
8	106	Collectrate Colony Main Road
8	107	Mayor Sathyamurthy Salai
8	107	Mayor Ramanathan Salai
8	107	Brindavanam 1st Street
8	108	R-Block, Elango Street, M.M.D.A.Colony, Arumbakkam
8	108	P-Block MMDA Colony, Arumbakkam
9	109	Gil Nagar
9	110	Lake area IV cross street, Nungambakkam Village
9	111	Conron Smith Road, Gopalapuram Play Ground
9	111	Greams Road
9	111	Model School Road, 1000 light Play ground
9	112	Varadarajanpet Main Road
9	112	Ganga nagar
9	112	Puliyur 1st Main Road
9	112	Trustpuram 10th Cross Street

Zone	Ward	Name/Location of Play Ground
9	115	Mirza Hyder Ali Khan Street, Childrens Play Ground
9	117	Ramakamathupuram Play Field O &Q Block
9	117	Ramakamathupuram Play Field R &T Block
9	120	lloyeds Colony, Childrens Park
9	120	Nadukuppam, Childrens Park
9	121	Kamarajar Salai, Scating ground
9	121	Thiruveethiamman Koil Street
9	122	Turnbulls Road
9	122	Nandanam Play Ground
9	122	S.M.Nagar, Near A Block
9	123	Pallakumaniyam
9	123	St.Mary's road
9	124	Ramakrishnapuram
9	125	14, Papa Nasam Sivan Salai
9	125	Rosary Church Street
9	126	4th Trust Link Street
9	126	South Canal bank Road
10	132	9th Avenue , Ashok nagar
10	132	6th Avenue , Ashok nagar
10	132	14TH SECTOR, 102 STREET
10	133	Ashok Nagar 17Th Street Play Gorund
10	134	Corporation Colony 1St Main Road Play Ground
10	135	Bakthavatchalam Street Play Ground
10	136	Venkat narayana road
10	136	Somasundharam play ground
10	137	10th Sector Play Ground
10	138	Parinagar Kannagi Street
10	138	Thiru Nagar VOC Street
10	138	Thiru Nagar Ganaolivu Street

Zone	Ward	Name/Location of Play Ground
10	138	Thirunagar Valluvar Street
10	138	Bharathidasan Colony Main Road
10	138	Bharathidasan Colony 4th Street
10	138	VM Balakrishnan Street
10	138	Annai Sathiya Nagar
10	139	Ragava reddi colony
10	140	Palmore Street
10	141	CIT Nagar 4 th Main Road
10	142	Godhamedhu
11	144	MMDA Colony 6th Block
11	144	MMDA Colony 7th Block
11	147	Alappakkam Main Road, Thanthai Periyar
11	149	Ramakrishna Nagar
11	149	Palaniappa Nagar
11	151	Lakshmi nagar 5th cross street
11	151	Lakshmi nagar Extn. 4th Main Road
11	152	Veerappa nagar 2nd Street
11	152	Bharathi colony
11	152	Kadamban Street
11	152	Sairam avenue, Hospital Road
11	152	Chowdry Nagar Main Road
11	150	Rajeswari Nagar 2nd cross street
13	171	Subbupillai thottam
13	171	Venkatapuram
13	172	Lake view road
13	172	Kottur garden II cross street
13	172	Kotturpuram II main road
13	172	Kotturpuram III main road
13	172	Kottur garden IV main road
13	172	Ambadi road
13	173	Kamaraj salai
13	173	Kamaraj salai
13	173	Kamaraj salai
13	173	D.G.S. Dhinakaran salai
13	173	Karpagam avenue IV street
13	173	Karpagam avenue IV street – indoor stadium
13	174	Annagarden, end of IIT gate
13	174	Velachery main road, oppo-site to kannigapuram
13	175	Kottur canal bank road
13	175	Venkatarathinam nagar
13	175	Induira nagar VIII cross street
13	175	Thiruvengadam street
13	175	Indira nagar XI lane
13	176	Sastri nagar XI cross street
13	176	Besant nagar XXI cross street
13	176	Besant nagar XXXII street
13	176	Besant nagar IV main road
13	176	SBI Colony
13	177	Mahalakshmi nagar I main road
13	177	L.H.nagar III cross street
13	177	Sastri nagar IV cross street
13	177	Ramakrishna nagar I main road, Erikarai road
13	177	Indra Gandhi nagar IIIstreet
13	177	Telephone colony II main road
13	177	Kakkan nagar II cross street
13	177	Shawwalace colony II street
13	177	Andal nagar II main road
13	177	New NGO colony, II main road
13	177	Dr.Ambedkar nagar I main road
13	178	Ram nagar north extn. I street
13	178	Ram nagar VII main road
13	178	Padmavathy nagar extn. main road
13	178	Ram nagar I street
13	178	Bhel sakthi nagar main road
13	178	A.G.S. Colony VI main road
13	178	Jaganathapuram I main road

Zone	Ward	Name/Location of Play Ground
13	178	AGS colony V cross street
13	179	Seethapathy nagar IIIcross street
13	179	Tansi nagar VI street
13	179	Baby nagar II main road
13	179	Seetharam nagar I street
13	179	Pillayar koil street, Annai Indra nagar
13	179	Sachidanantha nagar, Sanjay garden
13	179	SPIC Nagar
13	179	Shanthi I cross street
13	179	VGP selva nagar I main road
13	179	Bethal avenue
13	179	Ramagiri nagar II street
13	179	VGP selva nagar, Bethel avenue main road
13	180	Nehru street, Kanagam
13	181	Lakshmi puram, Muthulakshmi salai
13	181	Rukmani street, Kalakshetra main road
13	181	Vaigai Street
13	181	Thirumurugan II Street
13	181	Thirumurugan III Street
13	181	C.G.E Colony
13	181	Besant Nagar XXIX Cross Street
13	182	Thiruvalluvar Nagar VII Cross Street
13	182	Thiruvalluvar Nagar 44th Cross Street
13	182	Thiruvalluvar Nagar VI Main Road
13	182	Thiruvalluvar Nagar VII Main Road
13	182	Valmigi Nagar 69th Street
13	182	Valmigi Nagar Extn., IV Seaward Road
13	182	Kurunji Appartments
14	169	Balaji Nagar 24th street
14	169	Sheela Nagar 1st street
14	183	AGS Colony, Beach
14	183	Jaganathan Street
14	183	A.G.S. Colony, ECR 2nd street
14	187	Sendhuran Colony 3rd Street
14	189	Kamakotti Nagar 5th Street, Junction of 4th Street
14	189	V.G.P Shanthi Nagar Santhosh Street
14	189	Kamakoti Nagar 6th cross street, North side
14	189	Kamakoti Nagar 6th cross street, South side
14	189	Kamakoti Nagar 9th cross street, South side
14	190	Kovalan street
14	191	Gandhi Street, Jalladianpet
14	191	Pallavan nagar

5.2 Tsunami

Tsunami is a giant waves, initiated by a sudden change, usually in relative position of underwater tectonic plates or in other words a tsunami is a series of waves with a long wavelength and period (time between crests) and time between crests of the wave can vary from a few minutes to over an hour. The sudden jerk is enough to propagate the wave; however, its power can be enhanced and fed by lunar positioning and boundaries that focus its energy.

5.2.1 Tsunami in Bay of Bengal

The Indian coastal belt has not recorded many severe tsunamis in the past. Waves accompanying earthquake activity have been reported over the North Bay of Bengal. During an earthquake in 1881 which had its epicenter near the Andamans in the Bay of Bengal, tsunamis were reported. The earthquake of 1941 in Bay of Bengal caused some damage in Andaman region. This was unusual because most Tsunamis are generated by shocks which occur at or near the flanks of continental slopes. During the earthquakes of 1819 and 1845 near the Rann of Kutch, there were rapid movements of water into the sea. There is no mention of waves resulting from these earthquakes along the coast adjacent to the Arabian sea, and it is unlikely that Tsunamis were generated.

A list showing the Tsunami that affected Indian coast in the past is given in Table. The information given in the Table for the first three events is sketchy and authenticity cannot be confirmed except the Tsunami of 26th December 2004. Above facts indicate the coastal region of Gujarat is vulnerable to Tsunamis from great earthquakes in Mekran coast. Earthquake of magnitude 7 or more may be dangerous. It may be noted that all earthquake do not generate Tsunami.

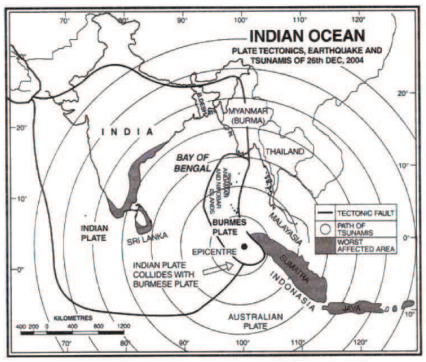
5.2.2 Tsunami Hits in India

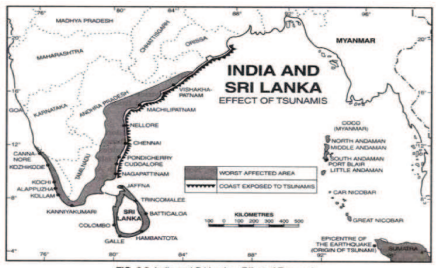
S.No	Year	Affected area / locations
1	April 12, 1762	1762 Eq. in the Bay of Bengal generated tsunami wave of 1.8 m in coastal Bangladesh
2	August 19, 1868	Earthquake Mw 7.5 in the Bay of Bangal. Tsunami wave run-up level at Port Blair, Andaman Island 4.0 m
3	December 31, 1881	Earthquake of magnitude Ms 7.9 in the Bay of Bangal, reported tsunami run-up level of 0.76m at Car Nicobar, 0.3m at Dublat , 0.3 m at Nagapattinam and 1.22 m at Port Blair in Andaman Island
4	1883	Karakatau, volcanic explosion in Indonessia. 1.5 m tsunami at Chennai, 0.6 m at Nagapattinam.
5	1884	Earthquake in the western part of the Bay of Bengal. Tsnamis at Port Blair & mouth of Hoogly River
6	June 26, 1941	Earthquake of magnitude MW 8.1 in the Andaman Sea at 12.90 N,92.5o E. Tsunamis on the east coast of India with amplitudes from 0.75 to 1.25 m. Some damage from East Coast was reported.
7	November 27, 1945	Mekran Earthquake (Magnitude Ms 8.3). 12 to 15 M wave height in Ormara, 13 m at Pasni, and 1.37 m at Karachi (Pakistan) . In Gulf off Cambay of Gujarat wave heights of 11.0 m was estimated, and 2 m at Mumbai, where boats were taken away from their moorings

S.No	Year	Affected area / locations
8	December 26, 2004	An earthquake of rear Magnitude (MW9.3) generated giant tsunami waves in North Indian Ocean. Tsunmai made extensive damage to many coastal areas of Indonesia, India, Malaysia, Maldives, Srilanka and Thailand. A trans-oceanic tsunami, observed over areas beyond the Ocean limit of origin. More than 2,00,000 people lost their lives in above countries which is a record.

5.2.3 Tsunami in Chennai

Earthquake of magnitude 9.2 on the Richter's scale in 2004 in Indonesia is the second largest earthquake ever recorded which caused tsunamis which are considered to be the most catastrophic in the living memory of the inhabitants of the coastal areas of India. This earthquake had its epicenter off the coast of Sumatra in Indonesia at 3.5° north latitude and 95° east longitude.



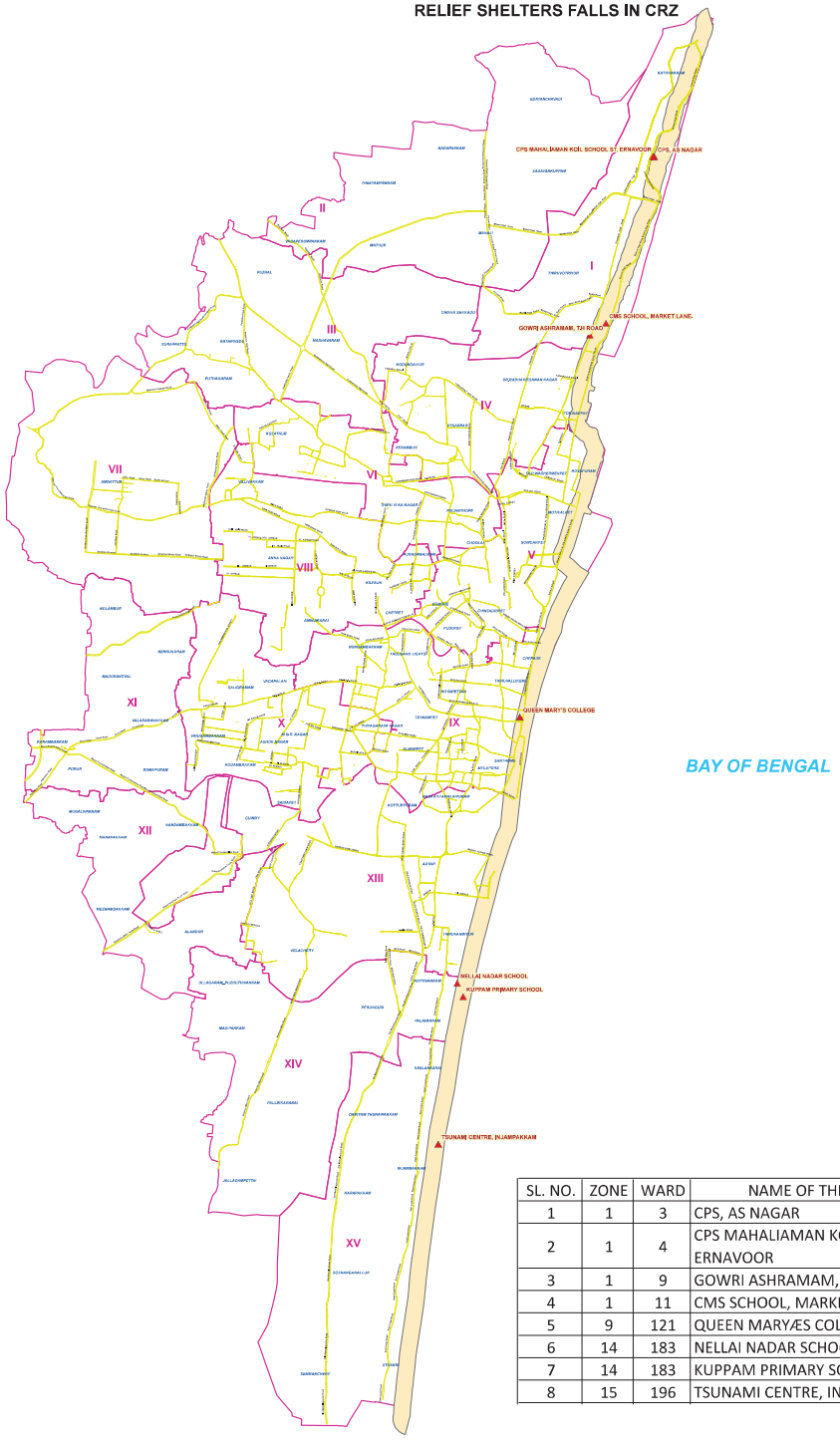


This place happens to be at the tri-junction of the Indian, Australian and Burmese (Myanmarese) plates. Tsunami attack coastal areas of mainland of India including Tamil Nadu, Andhra Pradesh and Kerala after travelling more than 2,000 km in a short span of about three hours. Of these three states, Tamil Nadu suffered the most. The largest number of deaths was reported from Nagapattinam, Kanniyakumari, Cuddalore and Chennai districts.

The location of relief shelters with in Coastal Regulation Zone in Chennai city are shown in the following map. These relief centres should be avoided to house the tsunami victims.

GREATER CHENNAI CORPORATION

RELIEF SHELTERS FALLS IN CRZ



SL. NO.	ZONE	WARD	NAME OF THE RELIEF SHELTER
1	1	3	CPS, AS NAGAR
2	1	4	CPS MAHALIAMAN KOIL SCHOOL ST, ERNAVOOR
3	1	9	GOWRI ASHRAMAM, T.H ROAD
4	1	11	CMS SCHOOL, MARKET LANE.
5	9	121	QUEEN MARYÆS COLLEGE
6	14	183	NELLAI NADAR SCHOOL
7	14	183	KUPPAM PRIMARY SCHOOL
8	15	196	TSUNAMI CENTRE, INJAMPAKKAM

▲ RELIEF SHELTER CRZ ZONE BOUNDARY

5.2.4 Tsunami preparedness measures

- Organise camps in schools, colleges and public for awareness of do-s and don't s for earthquakes.
- Ensure availability of disaster management plans and first aid kits in all schools, colleges and public buildings.
- Identify safe schools and colleges located atleast 500 m away from High Tide Level which can be used as relief shelters.
- Ensure that all critical life saving equipment are maintained and ready to use.
- The open places alike parks, playgrounds may be identified for assembling the people.
- Ensure that safe buildings in the corporation area are identified for purpose of relief camps.
- Develop plan for hospital preparedness and mass casualty management.
- Prepare a database of registered private hospitals, clinics, diagnostic labs, blood banks, etc. along with their capacities and facilities provided.
- Ensure availability of adequate supply of life saving equipments and drugs, portable supplies like portable oxygen cylinders, portable x-ray machines, triage tags, etc.
- Prepare for quick deployment of home guards, relief teams and volunteers for providing safety to affected population and evacuated structures/ houses.

5.3. Cyclone

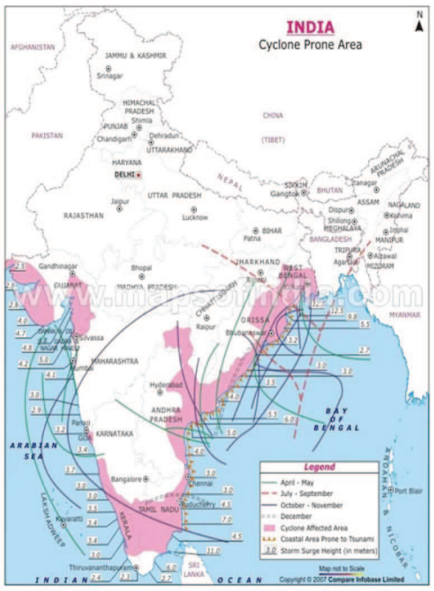
A cyclone (or more properly called Tropical Cyclones) is a system of wind with very low pressure at the centre and sorrounded by high pressure outward that occurs over the ocean near the tropics. Cyclones are one of the natural hazards that affect East coast of India almost every year causing large loss of lives and properties. Tropical Cyclone (TC), also known as 'Cyclone', is the term used globally to cover tropical weather systems in which winds equal or exceed the minimum of 34 knot (62 kmph). Hazards associated with tropical cyclones are long duration rotatory high velocity winds, very heavy rain and storm tide (the combined effect of storm-surge and astronomical tide).

Although the North Indian Ocean (the Bay of Bengal and Arabian Sea) generates only about 7% of the world's cyclones (5 to 6 TC's per year) their impact is comparatively high and devastating, especially when they strike the coasts bordering the North Bay of Bengal. Further the Bay of Bengal(BOB) produces more frequent and fiercer cyclones than the

Arabian Sea(AS). For better understanding of severity of wind speed, the cyclones are broadly classified as "Cyclonic Disturbances" with the maximum wind speed of 17 knots or more, "Cyclone" measuring wind speed of 34 knots or more and "Severe Cyclones" exceeding wind speed of 48 knots. Following table illustrates the annual frequencies of cyclonic disturbances, cyclone, severe cyclone over BOB and AS for the period 1900 to 2015.

Frequency of Disturbances

YEAR	CYCLONIC DISTURBANCES				CYCLONES				SEVERE CYCLONES			
	BOB	AS	LAND	TOTAL	BOB	AS	LAND	TOTAL	BOB	AS	LAND	TOTAL
1900 TO 2015	1110	208	122	1440	460	116	13	589	210	68	3	281



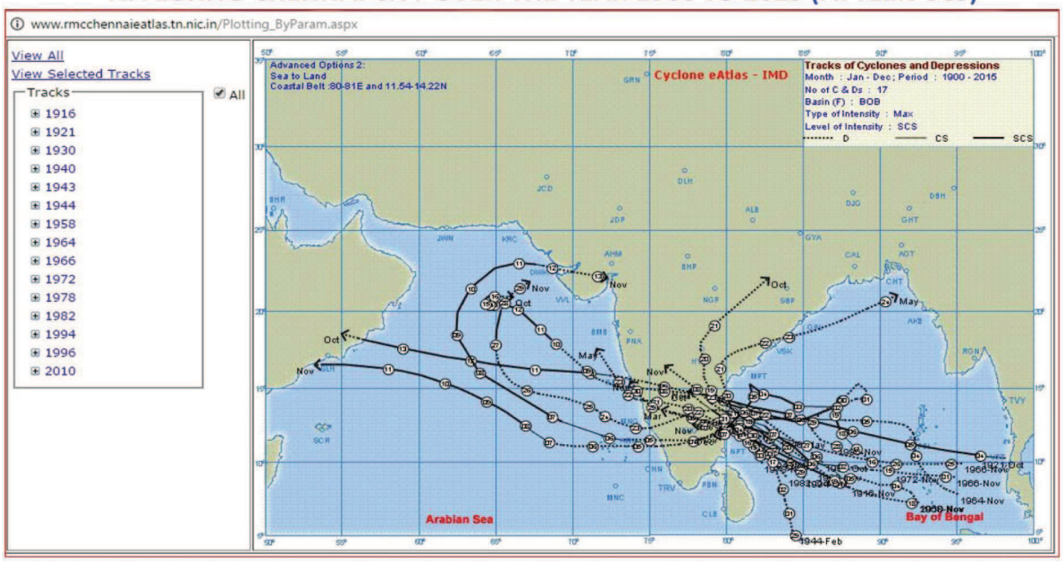
National Cyclone Risk Mitigation Project

The major Tropical cyclones which struck the coastal districts in India during the period 1891-2002

WEST COAST	MAJOR TROPICAL CYCLONES	EAST COAST	MAJOR TROPICAL CYCLONES
Kerala	3	West Bengal (69	69
Karnataka	2	Odisha (98)	98
Maharashtra	13	Andhra Pradesh (79)	79
Goa	2	Tamil Nadu (54)	54
Gujarat	28	Pondicherry (8)	8

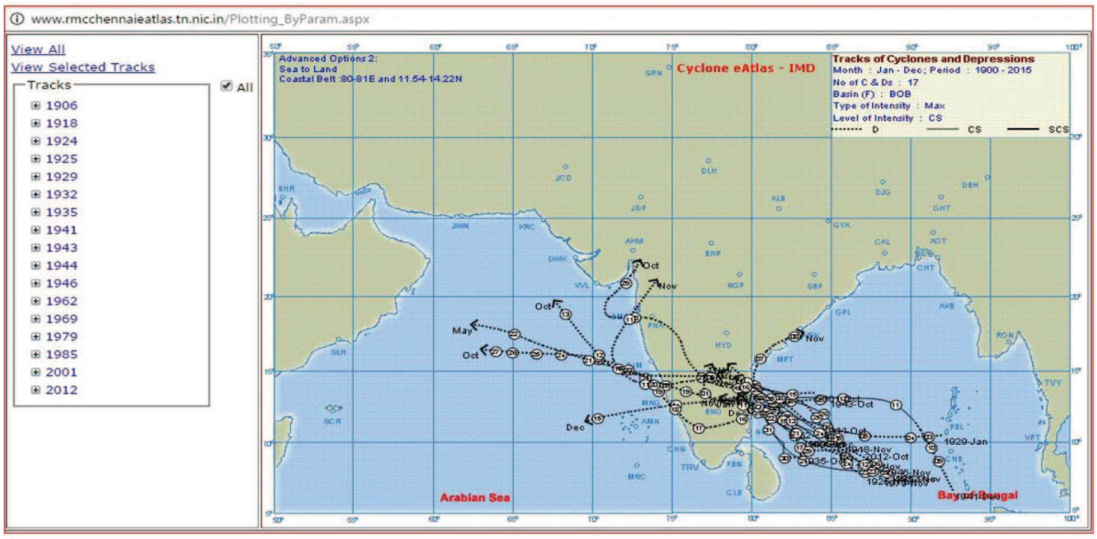
Tamil Nadu (54)	Chennai	18
	Cuddalore	7
	Southarcot	5
	Tanjavur	12
	Pudukkottal	5
	Ramnathpuram	3
	Tirunelveli	2
	Kanyakumari	2

SEVERE CYCLONIC STORM CROSSED BETWEEN NELLORE AND PONDICHERY (LATITUDE 14°22`10``N – 11°54`34``N) AFFECTING CHENNAI CITY OVER THE YEAR 1900 TO 2015 (FIFTEEN SCS)



SOURCE : IMD

CYCLONIC STORM CROSSED BETWEEN NELLORE AND PONDICHERY (LATITUDE 14°22`10``N – 11°54`34``N) AFFECTING CHENNAI CITY OVER THE YEAR 1900 TO 2015.(SEVENTEEN CS)



SOURCE : IMD

5.3.1 Impacts of Cyclone

- The impact of tropical cyclones can be very significant in terms of the detrimental aspects.
- There are three main features of cyclone (high wind, rainfall and storm surge) which can cause widespread damage.
- A major factor in the growing losses caused by meteorological hazards is the concentration of population and economic activity in coastal plains and low-lying areas that are subject to storm surges and land-borne flooding.
- High wind can damage structures like houses and other infrastructure (bridges, dams, embankments etc.); uproot electricity supply and telecommunication lines etc.
- Extremely heavy rain can cause flooding. Floods wash away human beings and animals and make water unfit for drinking. There can be outbreak of diseases like cholera, jaundice or viral fever due to intake of impure water. Water gets contaminated because of floating carcasses and corpses and mixing of sewage. Movement of stored food supplies also gets severely affected due to floods as rail tracks and roads are breached. The floodwaters turn the fields salty.
- Storm surge inundates low-lying coastal areas resulting in life loss and destruction of property. Besides it destroys vegetation and reduces soil fertility. It also affects environment as coral reefs can often suffer damage.

5.3.2 Cyclone mitigation strategies

- Future critical facilities should not be located in areas of accelerated winds.
- The most significant aspect of structural damage to buildings by high velocity wind results from roof damage. The roofs of existing buildings should be inspected and if necessary retrofitted to adequate standards.
- The roofs of existing critical facilities should be retrofitted to a higher standard to ensure wind resistance.
- Building openings such as windows and doors also suffer damage from high velocity winds. These openings if not constructed of wood or metal should be protected with shutters or temporary covers of adequate design.

5.3.3 Common Cyclone preparedness measures

- Communication plans with easily understandable terminology and methods.
- Proper maintenance and training of cyclone disaster services, including mass human resources such as community based disaster response teams.
- Development and exercise of cyclone warning methods combined with cyclone shelters and evacuation plans.
- Stockpiling and inventory, management of essential supplies and equipments.

The detailed disaster management plan which has been detailed in this book for flood disaster will holds good for cyclone also.

6.0 STANDARD OPERATIONAL PROCEDURES

The City starts its preparedness in the month of September every year. This is includes clearing of water bodies, storm water drains, removal of floating materials, strengthening the bunds, preparing relief centres, common kitchen, stopping road cut works, pruning of trees etc. A detailed discussion on each areas are discussed in the following paras.

6.1 Major Projects taken to mainstream the Disaster Mitigation and Adaption

The Sendai Framework for Disaster Risk Reduction was developed to guide efforts on disaster-risk reduction in the period between 2015 and 2030. Greater Chennai Corporation has taken up the following projects to reduce the flooding during North East monsoon.

6.1.1 In Extended areas of Greater Chennai Corporation

Greater Chennai Corporation has already proceeded towards construction of Integrated Storm Water Drain Project in the expanded areas of the Chennai Corporation to avoid inundation and Detailed Project Report has been prepared by the Consultant dividing the project into 4 basins viz. Adyar, Cooum, Kovalam and Kosasthalaiyar Basins at a project cost of about 4,034 crores.

In first phase, Adyar and Coovum basins work have been taken up under World Bank fund under Tamil Nadu Sustainable Urban Development Project (TNSUDP) at a project cost of Rs.1,101.43 crore to mitigate flood problems in Ambattur, Alandur and Valasaravakkam.

With respect to Kovalam Basin a German Development Bank, KfW has been identified as funding agency to implement the project costing Rs.1,243.15 crore to mitigate flood problem in Perungudi and Shozhinganallur.

In regards Kosasthalaiyar basin is concerned, Japan International Co-operating Agency (JICA) has been identified as funding agency to implement the project at a cost of Rs.1,881.66 crore to mitigate flood problem in Thiruvottiyur,Manali and Madhavaram. More than 30 lakhs people will be benefitted after completion of this project.

6.1.2 In Core city

92 missing links were identified and same was rectified by demolition and reconstruction of existing drains in 11 places and with construction of new drains in 81 places. The following area are mainly benefitted

- RK Nagar, Tondairpet, Kodungaiyur
- Kolathur, Sidco Nagar, Villivakkam
- Korattur, Anna Nagar
- Rajbhavan and Srinagar colony, Saidapet
- Purasawakkam, T.Nagar
- Velachery, Shozhinganallur, Adyar

6.1.3 Waterways Cleaning

- 30 macro canals maintained by Greater Chennai Corporation are being desilted and Hyacinth removed using modern machineries.
- GCC has procured an amphibian vehicle from Finland at a cost of Rs. 4.10 crore for desilting of macro water ways. So far 2,42,046 Cu.m of Silt and Hyacinth was removed from North B canal, Kodungaiyur canal and captain cotton canal.
- GCC has procured three Multipurpose Robotic Excavator at a cost of Rs. 19.65 crore for de-siltation of micro drains from Liechtenstein. So far 74,574 Cu.m of Silt and Hyacinth was removed.
- Thus carrying capacity of all these major water carrying channels have been increased by the deployment of such modern machineries.

6.1.4 Tamil Nadu Vision 2023

Under Vision 2023 It is proposed Creation and Restoration of Water Bodies and Restoration of Chennai Waterways at a cost of Rs. 500 Crore and Rs. 10,000 Crore respectively. The works pertaining to this assignment have already been commenced and is in progress.

6.2 Preparedness of water ways and water bodies

GCC will remove water hyacinth and floating materials from canals maintained by them periodically, using floats on annual maintenance basis well in advance to maintain un hindered water flow and to control the mosquito menace.

Sl.No	Measures before Monsoon	Actions to be taken during rain
1	Chute Pipe Cleaning.	Examine manhole cover to be in good condition.
2	Inlet chamber cleaning of sands / Debris near the chute pipe.	Continuous cleaning of garbage in chute pipe / inlet chamber / vertical gratings.
3	Missing link of storm water drain to be constructed and covered with precast slab.	Ensure the flow of water from road to SWD to monitor periodically by inspection.
Sl.No	Measures before Monsoon	Actions to be taken during rain
4	Ensuring the network connection of SWDs	Pump / Motor can be used to maintain
5	Every year SWD to be cleaned	Block in SWDs to be cleared by motor / sucker lorry if necessary
6	Tools materials like, cow-bar, Manhole lifting hook, rope, FRC door cover slab, kept ready for use.	Keep open the manhole cover of SWDs so as to drain water more with safety precaution sign around the manhole cover.
7	Repair in SWD structure to be attended.	Make temporary kutcha drain to drain out water from higher level to lower level on emergent situation.
8	Street joints of SWD to be ensured.	If needed enlarge the chute pipe.
9	Garbage removal around bins to be done.	Providing Barricade, sign board for diverting traffic in the above places.
10	Manhole cover to be in good condition, damaged one to be replaced.	Flow of water inside the SWD is periodically monitored to ensure that the water is running full capacity inside the SWD.
11	Removal of Debris / silt inside the SWDs.	The SWD at its joining point with canals and rivers is frequently checked for removal of any blocks at the draining point with rivers and canals.
12	Streets where SWD require cleaning	Diesel / Submersible pumps are provided in the needed location to drain out water in SWDs.
		Road cut may be done in order to drain more water with safely sign boards.

6.3 Water stagnation locations

In city various water stagnation locations were identified in all zone 1 to 15. The list of mild, moderate, heavily inundated area, streets likely to be inundated

and the areas where the people are to be evacuated are given in detail in each zone chapters. Strict vigil is maintained in these areas. From those areas stagnated water to be disposed to the particular disposal points like storm water drain and canal. The table shows the preparedness of Water stagnation locations in pre monsoon and during rain.

Sl.No	Measures to be taken before rain
1	RWH structures to be cleaned and refilled.
2	Chute pipe should be cleaned.
3	De-silting of disposal points and Storm water drains/canals.
4	Keep JCB, Bulldozers, cranes, pumps and super sucker Lorries ready.
5	Provide inlet chambers and pipe connections to the existing nearest drain.
6	De-silt storm water drains.
7	Break the top slabs and desilt the SWD where chronic obstruction is noted and cover with precast slab.
8	Missing link of storm water drains to be constructed and covered with precast slabs.
9	Available machineries/pumps to be checked and kept in ready condition. A log book to be maintained by AEE regarding the same.

6.4 Preparedness of Relief Centers

The GCC has identified and notified around 197 relief centers across the city keeping in mind the vulnerability of areas prone for inundation and need for eviction. The community halls, schools and public buildings are identified to act as relief centers. The details of relief centers locations, contact persons are given in there respective zonal chapters.

The relief centers are to be provided with safe drinking water, toilet facilities, lighting arrangements, food packets, bread and Aavin milk for children, senior citizens, differently abled persons are also to be kept in readiness in the relief centers. The action plan for relief centers before and during rain is discussed in the following table.

Measures before Monsoon	Actions to be taken during rain
• Clean the relief centre	• Ensure regular supply of water by CMWSSB
• Surrounding area should be cleaned	• Ensure adequate water available in sump and water tank
• Necessary arrangement of water facilities by deploying CMWSSB 3000 Ltrs tanks.	• Ensure the Toilets are cleaned regularly
• Clean sump and water tank	• Cooking should be done regularly and food supplied
• Clean Toilets	• Ensure the sufficiency of cooking gas.
• Clean Vessels/Gas Stove	• Groceries & vegetables to be purchased.
• Ensure supply of Cooking gas.	• Vehicle arrangements with sufficient labourers for food distribution to all required places.
• Availability of lights/ fans to be ensured.	• Light and fan to be operated
• Medical facilities	• Spraying of disinfectant.
• Cooking staff should be arranged	• Supplying food to affected people.
• List of provision materials/ vegetables to be purchased during rain to be kept ready.	• Receive VVIP's / VIP's / NGO's at relief centre and explain to them.
• Identification of place for storage of provision materials/ vegetables	
• Keep ready Vehicle arrangements with sufficient labourers for food Distribution to all required places.	
• Light, Fan Switches to be tested	• Be polite towards the people.
• Generator to be provided.	• Garbage removal must be continuous.
• Assessing the requirements of food / Bread / Milk	• Station ambulances where ever possible.
• Instruction should be given to all staff at the relief centre to ensure the quantity and quality of food etc.	• Distribute relief material in a systematic manner
• Ensure temporary electric arrangements to be kept always ready to operate during power failure.	• Ensure police bond bust
• Ensure good sanitation in and around the relief centre by fogging, cleaning etc.	
• Inform police and Fire and Health, Metro water about the location of relief centre.	• Keep record of food distribution and relief material distribution.
• Deploy Police	

6.5 Common kitchen

The Corporation maintains 4 dedicated common kitchen centers with a capacity to cook 5000 food packets per hour, at Chintadripet, Basin Bridge, Perambur barracks Road and Gopalapuram.

All these common kitchens were stacked with required quantities of rations / provisions and cooking materials well before on set of monsoon. The vehicles will be kept ready in all these kitchens to transport the food to the affected areas and relief centers.

In each common kitchen one Sanitary Inspector will be posted round the clock to monitor food preparation & food hygiene. Temporary food centres will also be set up in private marriage halls depending on the gravity of situation. Assistant Revenue Officers are put in charge to prepare the required quantity of food for common kitchen/relief centre kitchen.

To supplement above arrangements the food from Amma Unavagam also will be lifted to the affected areas. Aavin will be requested to supply milk to the flood affected children and aged persons. Supply of Bread will be arranged from modern food industries. The supply of drinking water will be arranged from Amma Kudineer and by CMWSSB.

6.6 Subways

There are 22 subways in Chennai city of which GCC maintains 16 subways (Sl.No. 1 to 16) and 6 subways (Sl.No. 17 to 22) are maintained by Highways department. The details of locations of subways are given in the respective zonal chapters. The 16 subways maintained by GCC are running for surpass for the passenger in different location and the subways in Chennai are given below.

1. Ganesapuram subway, at Dr.Ambedkar College Road to the East of Vyasarpadi Jeeva Railway Station.
2. Reserve Bank Subway at RajajiSalai Near Reserve Bank of India.
3. Stanley Nagar Subway 1 along Cochrane Basin Bridge Road South of Stanley Nagar near Post Office.
4. Stanley Nagar Subway 2 along Cochrane Basin Bridge Road South of Stanley Nagar near Post Office.
5. Perambur Subway at Perambur High Road to the West of Perambur Railway Station.

6. Gengu- Reddy Road Subway at Egmore near Nehru Park.
7. In Redhills Road at Villivakkam LC-2.
8. Nungambakkam Subway near Nungambakkam Rly. Station.
9. Harrington Road Subway near Pachaiyappa's College.
10. Dheeran Sivalingam Subway connecting Doraisamy road and BrindavanRaod.
11. Madley Subway connecting Madley road and EaswaranKoil Street on Southern Side of Mambalam Railway Station.
12. Thyagi Aranganathan Subway connecting Kannammapet and Reddikuppam Road.
13. Saidapet Bazaar Road Subway.
14. C.P. Pavalavannan Bridge in Jones Road.
15. In Monegar Choultry Road near stanley hospital.
16. Pedestrian cum two wheeler subway at Rangarajapuram level crossing.
17. St. Thomas Mount Subway.
18. Thillai Ganga Nagar Subway.
19. Palavanthangal Subway.
20. Jain College, Meenambakam Subway.
21. Viyasarpadi Subway.
22. Kathivakkam High Road Div- 2 Subway.

These subways are equipped with pump sets to bail out water from the subways. Depending upon the necessity, pump sets from Agriculture Engineering Department, Fire Service Department and Private Sources will be deployed. The preparedness of subways before monsoon and steps to be taken during the monsoon are described in the following tables.

Measures before Monsoon	Actions to be taken during rain
• Clearance of garbage and sand in the subway and surrounding areas	• The Diesel engines/electric pumps to be kept at an elevated level/platform.
• Remove rank vegetation.	• Ensure that all regular and stand by pumps are kept in working condition
• Cleaning of chute pipes/inlet chambers in the subway.	• Keep sufficient stock of diesel, petrol, oil, grease.
	• Keep GENSET in ready condition.

Measures before Monsoon	Actions to be taken during rain
• De-silting collector well.	• Ensure Starting handle availability.
	• Check condition of foot valve /suction valve.
• Disposal channel to be de-silted and free flow in its route to be ensured	• Check the metallic rope in pump.
	• Carryout trial run of pumps.
• Service lanes in subway to be cleaned.	• Mark danger water levels in red paint on both sides of subway above which the subway should be closed for traffic.

Preparedness of Manpower in the Subway

Action to be taken during rain	
• Operate the pumps as and when required.	• Ensure stock of POL.
• Closely watch the inlet /chute pipe.	• Continuously operate the pumps.
• Remove choking if any found.	• Check the water disposal at the outlet.
• Check the hose pipe and ensure that it is intact.	• Ensure the movement of traffic in the subway.
• Ensure the traffic movement without hindrance.	• Caution the two wheelers riding in subway.
• Monitor the water level and to inform the higher level officer and submit a report every two hours.	• Do not to allow senior/ disabled people to cross the subway.
• Photograph the subway to ascertain its status and to ensure traffic movement and share through WhatsApp.	• Close the subway if water in the subway is above the danger mark normally more than 3 feet at the lowest level.

Action if Subway is flooded to the brim
• Operate reserve pumps and submersible pumps to control water level in the subway.
• Put heavy duty pumps to suck out water.
• Have two (or) three disposal points.
• Keep sufficient lorries, JCBs, dozers and men for removal of silt, garbage and floating materials etc., in the subway once rain stops.

Action if Subway is flooded to the brim
• Keep sufficient lorries, JCBs, dozers and men for removal of silt, garbage and floating materials etc., in the subway once rain stops.
• Supervisory Officer to monitor the water level and to inform the status to the higher official.
• Keep de-silting the outlet points in case of block.

6.7 Tree fall

The Preparedness of tree falls includes pruning of trees, anticipation of the uprooting of trees during cyclone etc. Vehicle mounted saws and power saws are kept ready in all zones 1 to 15 to cut and remove the fallen trees on the roads and the following measures to be taken before rain and during rain.

i. Keep sufficient labourers to attend tree falls in wards.

ii. Sensitize the conservancy labourers to report the tree fallen in streets to Assistant Engineer.

iii. Keep private contractors with tree cutting tools and vehicles for removal of dead trees and slanting trees if regular staff is not available.

Preparedness of Tree Fall in City.

Measures before Monsoon	Actions to be taken during rain
• Inspect BRR and other roads to assess the stability of trees and low branches	• Keep in close contact with control room, traffic, law & order, fire dept. and TANGEDCO to know about the tree falls.
• Form teams with Park overseers, vehicles, labours &equipments& deploy them	• Immediately reach the spot with vehicles.

Measures before Monsoon	Actions to be taken during rain
• Keep the following equipment with specific area jurisdiction a. Manual Saw. b. Power Saw. c. Vehicle Mounted Saw. d. JCB, Open lorry, Crane etc., e. Sufficient stock of POL, f. Finalise Private contractor. g. Ropes - sufficient length h. Temporary Barricades i. Temporary lighting arrangements.	• Electric lines to be switched off
Measures before Monsoon	**Actions to be taken during rain**
• Conduct trail run of manual and Power operated saws	• Make use of conservancy, road and malaria labourer to cut the branches
• Attend complaints for removal of trees and branches.	• Deploy JCB, Crane, Bobcat and Open Lorry to remove the branches and trunks
• Trees at low level touching overhead TANGEDCO line to be reported	• First priority is to restore traffic movements
	• Deploy Private Contractors where ever required to clear fallen trees
	• Providing suitable barricades to protect the unstable trees
	• Report the road blocks and tree removal to the Head Office with WhatsApp Photos stage wise

6.8 Transport equipments /Lorries

Measures before Monsoon	Actions to be taken during rain
• Inspect lorry stations and keeping it ready for operation.	• Ensure 100% march out for conservancy
• Instruction to be given to the time keeper and other field staff to maintain reserve of diesel, oil and spare materials related to repair works and maintain 24 x 7 operation.	• Tree cutting and debri clearance
• Have contact details and address of Lorry driver and Mechanic.	• Clear garbage without accumulation.
• Engage private contractor if needed.	• Deploy JCB / Lorries & Bobcat wherever necessary.
• Necessary purchase of important items like tyres, spare parts etc to be done in advance.	• Ensure continuous fuel supply
• Lorries / JCBs / Bobcats to be kept in good condition	• Send water tanker lorry to suck out water stagnation.
• Instruction to be given to Lorry station A.E to monitor the vehicle condition and to inform the higher official to plan for shifting the Vehicles from Low Lying Area to high land.	• Procure POL to supply to Health dept vehicle and for fogging Machine.
• Planning of lighting arrangements and mobilisation of DG Set	• Keep drivers at Night time also.
• Keep reserve drivers.	• Engage contractors to attend repair works immediately.
• Planning of lighting arrangements and mobilisation of GENSET	• Engage private contractors if necessary.
• Sufficient mechanic / helpers for vehicle repair and maintenance.	• Drivers allocation plan to be prepared and informed proactively to drive the vehicles
• Inspect lorry stations and keeping it ready for operation.	• High capacity HP pumps to be kept at ready state
	• Contact RTO in case of more lorry required.

6.9 Preparedness of Streets

6.9.1 Preparedness of Streets do not require evacuation

During every monsoon GCC will identify vulnerable spots in all zones and action will be initiated to dispose the rain water through storm water drain into river, canal etc. The precautionary measures to be taken are as follows.

i. Stock sand bags in Ward offices and in important streets.

ii. Keep ready pumps with required capacity to pump out water entering in to houses.

iii. Instruct public to clean the RWH structures in the private premises and GCC to clear RWH structures within their jurisdiction.

iv. Advising house owners to increase the height of low lying area within their compound to match with road level and their basement.

v. Identify dilapidated buildings and alert people who are living there.

vi. Identification of place for dumping Debris.

vii. Engaging the Private Contractor with necessary machineries to remove debris in case of building collapse.

viii. Mobile Super Sucker & Pumps to pump out water.

ix. Identify the location and route through which water can be pumped out.

6.9.2 Preparedness of Streets require evacuation

During heavy flood occurred in the year 2015, people evacuated from various locations were accommodated in relief centres/public buildings provided with basic amenities in all the zones. The following section gives the detailed action plan for evacuation in different circumstances

a) **Streets where Rivers/ Lakes/ over flow and need evacuation*:***

i. Monitor river levels and releases from upstream

ii. Arrange mobile public address system for announcement of evacuation, inform media and through other possible sources.

iii. Making necessary transport arrangements to evacuate.

iv. Stock sand bags along the canal, lake and river bunds.

v. Mobilize mobile lighting system.

vi. Heavy (giant) pumps to be kept ready.

vii. Identify Relief Centres for street wise evacuation.

viii. Keep the relief centres ready with water supply, toilets, sanitation, medicines, food& lighting facilities.

ix. Make arrangements for cooking food.

x. Supply from Ammaunavagam

xi. Assess numbers to be evacuated at R.C.

xii. Ambulance, boats with life jacket medical team, Police escort, NDRF to be kept ready.

xiii. Sufficient staff and labourers to be trained and posted.

xiv. JCB /Cranes /Bulldozers and other machineries to be procured and kept ready.

b) Air Lifting Operations:

- Deployment plan for airlifting in the whole area
- Food supplies through Air craft
- Necessary fuel to be kept at RC
- Gas operated emergency lights to be rented / procured.
- Necessary financial arrangements to be made to meet out unforeseen expenditure.
- Prior information to nearest UPHC / private hospitals to handle casualties during rain .
- Burial grounds to be equipped with fuel and labourer arrangements and approaches. Gas burners / Gen sets to be kept ready.
- Divers and swimmers team to be made available.
- Sufficient rain coats to be made available.
- Special team of conservancy to clean the floating garbage / debris / etc round the clock.
- Fire service to be alerted.

c) Inundated Streets

i. Chute pipes / water table to be de-clogged regularly & water to be kept flowing.

ii. De-silting the disposal point periodically.

iii. Use brush to clear water

iv. Ensuring the sufficient number of super sucker/sewer lorries and pumps are mobilized and deployed to drain water.

d) Streets where water entering houses

i. Power should be disconnected.

ii. Piped water to be stopped

iii. Mobile water supply to be arranged

iv. Prior announcement to be made to safeguard household materials and to move upstairs.

v. Manpower for relief material distribution.

vi. Alerting people in dilapidated buildings

vii. Deployment of Fire service, SDRF and NDRF to evacuate people through boats regularly. Arrange food to those who are stranded upstairs.

viii. Garbage cleaning to be done

ix. Cleaning of sumps with Bleaching powder and filling fresh water before starting same.

x. Applying of lime and bleaching powder

xi. Snake catchers to be put into job.

xii. Silt, debris/rubbish etc., removal in the streets.

e) Streets where Rivers/ Lakes/ over flow and Need evacuation

i. Use sand bags to prevent overflow.

ii. Issue warning to evacuate low lying areas as soon as you anticipate overflows.

iii. Deployment of rescue teams to help the public evacuate.

iv. JCB/ bulldozers/ cranes/ lorries to be deployed to spot immediately.

v. Fumigation and application of disinfectants / powders in the affected area.

vi. Continuous monitoring of materials available.

vii. Alternate substitute staff / labourers to be kept ready with prior training.

viii. Medical camps to be available round the clock.

ix. Deploy boats to evacuate and distribute food and water for people.

x. Deploy helicopter for air dropping of supplies and evacuation

6.10 Lighting facilities

At the time of disaster most of the operation will be taken place on 24x7 as like war period. Therefore establishing alternate sources of lighting is a prerequisite in all areas. Eighteen mobile high mast lights are deployed in all zones in case of power cut during flood and cyclone, these light shall be used. The following table shows the preparedness of lighting facilities in monsoon period.

Preparedness of Lighting Facilities

Measures before Monsoon	Actions to be taken during rain
• Inspection of all street lights.	• Check street lighting at nights and attend in case failure.
• Replace the damaged street light poles and report.	• Check lighting in parks and public convenience
• Ensure lighting facilities in streets, relief centres, UPHC & officers.	• Ensure the operation of substation in wards.
	• Electrician labourers to be kept ready during night times
• Details of one of more private contractors for providing temporary power supply and lights to be maintained.	• Night patrolling of street lights.
	• Instruction to be given to electrical in-charge for preparing duty arrangement.
	• Engaging private contractor for arrangements of DG set .
• Keep sufficient labourers to attend complaints regarding lighting.	• Power Supply.
	• Run DG set in case of power failure in Relief campus/ UPHC/ govt offices/ schools.
• Cables on the streets to be checked	• Keep sufficient bulbs/ tube lights ready.
• Rectify low lying TANGEDCO cables.	• Keep stock of emergency lights.
• Rectify open broken TANGEDCO pillar boxes.	• Put up emergency lights to rescue operation in high time.
• Rectify open broken TANGEDCO pillar boxes.	• Keep ready candles in bulk.
• Keep POL in ward / Zonal Offices.	• Plan for utilization of solar panels.
• Inspection of all street lights.	• Keep Gen-set in BG's to operate lighting arrangement also.

6.11 National Disaster Response Force/ State Disaster Response Force

The relief teams from National Disaster Relief Force (NDRF) are also pressed into service for urgent relief operations. The services of coast guard are requested in the event of very heavy flooding.

NDRF

The Commandant, 04, Battalion (NDRF), Suraksha Campus, Takkolam, Arakkonam, Vellore District – 631 152 : **Contact. 04177 – 246594/246269**

The State Disaster Response Force (SDRF) has been constituted and stationed at Commando Force Head Quarters, Adyar. The Commissioner, Greater Chennai Corporation will request for the assistant of SDRF/NDRF in case of any disaster.

The NDRF to be stationed in the designated locations & deployed to needy points for commencing evacuation operations. A detailed mentioned about housing of NDRF/SDRF and pre positioning locations are discussed in each zone. The following are the precautionary measures to be taken before rain:

i. Identified vulnerable places should be informed to NDRF for pre positioning the force. Contact with commandant to deploy in vulnerable areas in case needed.
ii. Identify station place to accommodate them.
iii. Procure fuel for them.
iv. Joint inspection with NDRF / SDRF/ QRT
v. Accommodate NDRF in chosen place. Deploy them in selected location for evacuation and supply of food to victims.

6.12 Health Department Support

At the time of any disaster preparedness medical facilities is more important to save the people from various infections and diseases. In GCC there are 238 Medical Officers and 1,043 Paramedical Staff working at 152 health centers and a Communicable Diseases Hospital. 3 Medical Teams focused in each zones to give medical care during the flood emergency period round the clock. Whenever flood relief camps are opened, Medical officer, Paramedical Staff and Sanitary Inspector will be posted round the clock to ensure Health, Hygiene and sanitation of the affected population. The following Preparedness are given to control the disease at the time of disaster.

1. Essential medicines have to be stocked in adequate quantity in all the Urban Primary Health Centers and Communicable Disease Hospital. At Present 2 month's stock of disinfectants and medicines are available in each zone. At any moment procurement of necessary requirement of disinfectants and medicines can be purchased from TNMSC within a week's time.
2. All the diarrheal infected patients in the Communicable Diseases Hospital are to be intimated to the respective Zonal Health Officers to take appropriate preventive and control measures immediately in their residential areas.
3. Adequate quantity of bleaching powder, chlorine tablets and phenyl are stocked at Unit Offices and Stores. Adequate resources are available for maintaining hygiene and sanitation in a flood situation in the flood prone areas.
4. Spraying with MLO is being carried out in all the water stagnation places once in a week. The frequency of this should be increased depends on the ground reality. 568 sprayers are engaged for this activity.
5. The potential sources of contamination of water such as sewage overflow is being identified and it will be intimated to the Metro water engineers for appropriate action. Joint inspection with Zonal Health Officers and Metro water officials are being conducted regularly.
6. Both during and after any disaster, outbreak of epidemics is a major fall out. A strong health support system would largely mitigate this situation. Considering the fact, the respective Sanitary Inspectors are to take up the anti mosquito fogging in all the streets and anti larval spraying for storm water drain networks and canals periodically.
7. The concerned sanitary officers and santitary inspectors will ensure residual chlorine of 0.2 to 0.5 ppm in drinking water supply in co-ordination with CMWSSB staffs. Distribution of bleaching powder to individual houses to clean the overhead tanks and sumps to avoid water contamination.
8. Vector control activities will be carried out by the Entamologist in all the zones.
9. The zonal health officers are to supervise the Medical officers, Entomologist, Sanitary officers, Veterinary officers are to co-ordinate with conduction of health camps at required habitations.

The following table shows the Preparedness of action taken for disease control in monsoon period.

Measures before Monsoon	Actions to be taken during rain
• Assess the streets where spraying of disinfectant needed.	• Sector ALO work to be done
• Keep sufficient lime/ bleaching powder in S.I Office.	• Fogging to be done
	• Spray disinfectant in water logged streets.
• UPHCS to be kept ready	• Supervise sector programme.
	• Chlorine level to be maintained.
	• Fogging operation to be intensified.
• Sector ALO work to be strangled.	• Analysing the trend of diseases in UPHCS – op
	• Administer DT Vaccination to employees.
• Intensify fogging activities.	• Give bleaching powder to each family.
	• Spray disinfectant to all streets.
• Clean SWD blocks	• Check chlorine level in all water lorries.
	• Put up medical camps in relief centre, low laying areas, disease prone areas.
• Procure drugs for UPHC	• Mobilize doctors to the needed location with vehicles.
	• Arrange food for the medical team,
• Distribute Mask hand cloves / boot to labours.	• Keep the BGs in open and ensure labourers availability there.
	• Give masks, hand cloves, boots to sanitation employees.

The health department in GCC will be geared up with the following activities.

i. Intensify Activities for control against Dengue and Other Communicable Diseases

ii. Source Reduction activities to be intensified mainly in Hospitals, Schools, Colleges, Railway Yards, Vacant plots, New Construction sites, domestic sources, etc.

iii. IEC Activities to be carried out by audio and video measures at all Hot spot areas, Hospitals, Schools, Colleges, Government institutions, Slums and places where people gather.

iv. Distribution of Nilavembu Kudineer to the General Public.

v. Protective gears like Gloves, Mask, Shoes, Over Coat to be provided for workers who are involved in anti – mosquito activities.

vi. Health application to be developed for fever notification, patient details for follow activities and treatment, control centre.

6.13 Veterinary Support

The GCC conducts Mass Veterinary Camps in collaboration with Tamil Nadu University for Veterinary and Animal Sciences 30 Camps (two per Zone) will be conducted. The following activities are undergone for veterinary support.

i. Treatment of Large Animals and Small Animals

ii. Anti-rabies Vaccination and Deworming

iii. Distribution of Nutritional supplements for pet animals

iv. Distribution of Nutritional supplements for large animals

v. Distribution of free mineral mixture/ salt licks

vi. Distribution of green fodder

vii. Distribution of Paddy Straw at subsidized rate of Rs. 2/Kg @ Perambur and Pudupet Cattle depots

The GCC will form Animal Rescue Teams, one for each zone to support the animals at the time of disaster. The composition of rescue teams are as follows.

1. One Veterinarian
2. Two Animal Attendants

These rescue teams with the help of Dog Catching Vehicles and Cattle Catching Vehicles will conduct animals health camps. The dead animals found on roads, streets, water bodies will be disposed by carcass and buried at Kodungaiyur and Perungudi dumping yards following sanitary measures.

The GCC have arranged the Emergency Animal Rescue stations for the purpose of treatment. Table shows the details of Cattle and horse Rescue Stations.

Rescue Station for Cattle & Horses (Domestic Animals)

Sl. no	Hospital Name	Place	Contact No.
1.	Greater Chennai Corporation 'G' Cattle Depot	Perambur	9445197444
2.	Greater Chennai Corporation 'D' Cattle Depot	Pudupet	9445026046
3.	Government Veterinary Hospital	Saidapet	04424352478
4.	Government Veterinary Hospital	Tondiarpet	04424892536
5.	TANUVAS Veterinary Hospital	Vepery	04425304000
6.	Blue Cross Animal Rescue Centre	Velachery	04422300666

Rescue Station for Dogs, Cats & Birds (Pet Animals)

Sl. no	Hospital Name	Place	Contact No.
1.	Greater Chennai Corporation Pet Clinic	Thiru .Vi.Ka.Nagar	9445026042
2.	Greater Chennai Corporation Pet Clinic	Nungambakkam	9445194747
3.	Greater Chennai Corporation Pet Clinic	Kannammapet	9445026049
4.	Greater Chennai Corporation Animal Rescue	Centre Lloyds Road	9445194746
5.	Greater Chennai Corporation Animal Rescue	Centre Basin Bridge	9445026047
6.	Government Veterinary Hospital	Saidapet	04424352478
7.	TANUVAS Veterinary Hospital	Vepery	04425304000
8.	TANUVAS Peripheral Veterinary Hospital	Madhavaram	04425551586

6.14 Role of Financial Advisor

Arrangements shall be made to disburse advance amounts to the Zonal Officers, Head of the Departments, Officer in charge of the Relief Centres and other officers for carrying out relief works.

Arrangements shall be made to function the Treasury of Greater Chennai Corporation, including holidays, to disburse advance amounts, to the Zonal Officers, who are involved in the flood relief works.

6.15 Role of Public Relations Officer

On receipt of warning message from the Control Room, all arrangements shall be made to warn the people living in the low-lying areas to move to relief centres in advance.

Arrangements shall be made to communicate the messages of the Commissioner to the public through medias. PRO shall also publish press release about the relief activities that are under taken by GCC to build confidence and subdue panic among the public.

6.16 Ward Committee

The ward committee is formed for each ward by drawing officials from various departments to work in close coordination. The objective of forming such ward committee is to ensure co-ordinated mitigation work in the field without lapse of time.

Defining the role of line departments is very essential and should play a supportive role to ensure smooth functioning of the Entire Disaster Management Operation. The duties and responsibilities of staffs/ officials of ward committee are described as below. Table shows the responsibilities for the various designation in the ward committee. The composition of ward committees with contact details mentioned in detail in the respective zones.

Responsibilities of Officials

Designation	Responsibilities
Assistant Engineer/Junior Engineer, GCC	Removal of water stagnation on roads & subways, desilting SWD and cleaning chute pipes, arranging pumps for dewatering, evacuating people at times of flood and providing them food
Assistant Engineer/Junior Engineer, GCC– Electrical,	Inspecting & replacing the non-burning street lights, alternate arrangement for lighting during power failure
Sanitary Inspector, GCC	Ensuring the proper sanitation for the zone, Anti mosquito fogging on all the streets and anti-larval spraying for storm water drains and canals, spraying disinfectant on streets
Veterinary officer, GCC	Animal health issues and disposal of dead animal carcass
Conservancy Inspector, GCC	Clearing of garbage and spreading the lime powder around the bins debris
Assistant Revenue Officer, GCC	Ensuring the readiness of common kitchen, food materials and drinking water in the relief centres during evacuation at time of flood
Park Overseer, GCC	Removal of fallen trees/branches and pruning of trees.
Assistant Engineer, TANGEDCO	Proper maintenance of the electric cables, ensuring 24x7 power supply, attending to cable faults

Designation	Responsibilities
Assistant Engineer/Junior Engineer, CMWSSB	Ensuring proper water supply and removing sewer blocks.
BSNL	Assuring uninterrupted communication & attending to faults
Fire Service	Rescuing people from burning and from collapsed buildings
Police	Maintaining law & Order, patrolling the areas for protecting people & property
PWD	Desilting of canals and rivers
TNSCB	Providing the basic amenities to the slum tenements

These ward committees have to look after any kind of emergency or disaster occurrence in the ward. The preparedness of ward committee during the disaster time is show in the table below.

Preparedness for Inter department coordination

Measures before Monsoon	Actions to be taken during rain
• Conduct co-ordination meeting at Zonal / Regional / Ward level.	• Assemble at one point and monitor it.
• Familiarize with line departments.	• Inspect jointly the vulnerable areas.
• Discuss the issues with line departments	• Deploy machineries at required location.
• Conduct co-ordination meeting with line departments.	• Joint inspection
• Inspect jointly the vulnerable areas	• Deploy JCBs. dozers to clear garbage in canals and culverts.
• Request the service departments to keep the logistics in good condition	• Communicate the need to service department
• Request PWD, Highways department to clean SWDs/ Canals and De-silting it.	• Co-ordinate with service dept.

6.17 Other Departments Mitigation Plan

The civic and essential services to the public in Chennai city is being provided by various departments independently. Unless there is effective coordination plan with other departments preparedness, relief and rehabilitation of affected people will not be done effectively. The Commissioner, GCC will conduct regular meetings with the Head of Departments before monsoon. The role of each department with regards to monsoon preparedness is described in the following table.

S. NO	DEPARTMENT	MITIGATION PLAN
1	Meteorological Department	To issue periodical weather warning before 24 or 48 hours and cyclone alert at the appropriate time. The rainfall details, wind speed and duration will be periodically updated for the city. GCC will also discuss with Meteorological Department well before monsoon to asses the intensity of forthcoming monsoon.
2	Chennai Metropolitan Water Supply and Sewerage Board	To avoid major road cuts during monsoon period and the road cuts done hitherto to be restored well in advance before commencement of monsoon. To replace all the missing sewer manhole covers. To display sign boards incase of unavoidable road cuts are made with a view to prevent pedestrians and vehicles from falling into the sewer and barricade the areas wherever necessary To ensure working conditions of sewerage pumping stations and to keep generator sets in pumping stations. Injection of necessary quantity of chlorine into drinking water supply line. Announcement to the public through Mass Media regarding the need for chlorination in private wells. Erection of water tanks at relief camps and flooded areas where the regular supply is stopped.
3	Director of Information and Public Relation	To disseminate the forecast and publish periodically about mitigative actions under taken by Greater Chennai corporation.
4	Public Works Department	Removal of sand bars at river mouth of Cooum, Adyar and Muttukadu to ensure free flow of flood water into sea from water ways. To procure adequate quantity of sand bags and to be kept ready. Desilting of water bodies, clearing of debris /floating materials/ garbage/ hyacinth maintained by PWD. Clearing of culverts, vents under the bridges. The level and discharge from Chembarambakkam Tank, Puzhal tank, Redhills shall be updated to GCC control room. The flow level of rivers and discharge quantity at mouth shall be intimated to control room. Perennial issues like debris under MRTS bridge along Central Buckingham Canal, widening mouths of Coovum, Adyar, Kosasthalaiyar and B canal at Muttukadu shall be addressed in advance. One representative shall be nominated to work in the control room of GCC during monsoon period for coordination.
5	Highways & Rural Works Department	Blockages below the culverts/ Bridges along the water ways has to be removed. Storm water drain in highways road to be de-silted. Manholes, chute pipes should be checked. Patch works should be attended. Footpaths shall be rectified. Pruning of trees shall be carried out.

S. NO	DEPARTMENT	MITIGATION PLAN
6	Tamil Nadu Electricity Board	To attend the faults, check transformers and pillar boxes to avoid electrocution. To vigil open LT lines in extended areas of GCC. Power supply to be cut off during flooding, if required.
7	Fire Service Department	To keep rescue teams with necessary machineries, tools, equipments, boats etc at designated locations. Readiness to commence evacuation and rescue operations in case of marooning of people.
8	Telephone Services	To ensure disruption of free service of important telephones of Greater Chennai Corporation and other Departments. Immediate temporary installation of connectivity facility may be made on request at certain important places like relief camps etc. The generators within their premises shall be kept in an elevated location to avoid submergence.
9	Chennai Metropolitan Transport Corporation	To keep buses on road in good condition for transportation of essential commodities of food packets to the inundated and marooned areas. If necessary the vehicles may be provided to evacuate the marooned people preferably high chased vehicles.
10	M.R.T.S. / Railways	To clear the blockade in rivers, canals beneath the tracks to ensure free flow of water.
11	Chennai Metro Rail Limited (CMRL)	Clearing the blockage of earth and concretes at canals, rivers and beneath of track line.
12	Indian Air Force	Indian Air Force shall get prepared with latitudes and longitudes of marooned areas for dropping food packets and air lifting.
13	Director of Medical Services	To keep ready medicines and ambulances at all Government Hospitals. To spare health personnel for mass inoculation, if required by Greater Chennai Corporation.
14	Director of Public Health	To work in close coordination with GCC for preventive measures have to be taken in advance before the outbreak of epidemics.
15	Tamil Nadu Civil Supplies Corporation Limited	To stock required commodities in all PDS shops.
16	Tamil Nadu Agro Industries Corporation	To supply tractor mounted pump sets with complete suction and lengthy delivery hose pipes.
17	Tamil Nadu Housing Board / Tamil Nadu Slum Clearance Board	To look after relieving of stagnant water, desilting of storm water drain within slum tenements area, clearing debris & garbage.

S. NO	DEPARTMENT	MITIGATION PLAN
18	Fisheries Department	To provide boats and catamarans as and when required by Fire Service Department, Police Department etc. To keep ready the contact details of boat operators engaged in rescue operation.
19	General Officer Commanding Head Quarters	To consider the suggestions made.
20	Director of Veterinary Service	To consider the suggestions made.
21	Greater Chennai Police	The communication equipment shall be installed in the Control room of Ripon Building. To share informations like traffic clogging due to water stagnation, tree fall, status of traffic flow in subways etc.
22	Army Commandant	Will deploy Army personnel and other resources as and when the situation arises at their command.
23	Director of Ex-Servicemen	They will render assistance in the flood affected areas in the rescue operations.
24	Coast Guard	To render assistance in flood affected areas using their resources in the rescue operations.
25	Red Cross Society	For assisting in the flood affected areas with vehicles, men and materials.
26	Blue Cross, NGO, Volunteers	To render assistance with men and materials.
27	Chennai Metropolitan Development Authority	To consider the suggestions made.
28	Collectors of Chennai, Thiruvallur & Kancheepuram	Flood warning message shall be propagated to public if necessary in cooperation with GCC. Distribution of relief materials incase of huts damages, diseased cases etc. To identify and clear the encroachments.

6.18 Contacts

Control Rooms

Sl.No.	Office	Contact No.
1	Chief Secretary Control Room	25671388/25670372
2	Secretariat EPABX	25665566
3	Revenue Department	25671821
4	State Relief Commissioner	28593990/28593988/1070(Toll free)
5	Director General of Police	28447777
6	Commissioner of Police Control Room	23452359 - 362
7	Home Guards	9443312255/25385740(R)/28441617(O)
8	Collectorate, Chennai	1077(Toll Free)/25268320,21,22
9	Public Works Department	28410402 – 10/Ext. 194
10	Highways Department	28544370
11	Fire & Rescue Services Department	28294132,30,35,65
12	IMD, Chennai	28271951/28230091/28230092/28230094
13	Indian Coast Guard	25395016/23460404
14	Fisheries	24341757

State Emergency Operation Center in CRA office	
Toll Free	1070
Land Line	044 - 28414513 044 - 28593990
Fax	28410577 28414512
E-mail	tnstateeoc@gmail.com

NAME/DESIGNATION	OFFICE PHONE NO.
Hon'ble Mayor	044-25384436 044-25384438 044-25381328 044-25619300
Deputy Mayor Office	044-25382979 044-25619210

NAME/DESIGNATION	MOBILE NO.	OFFICE PHONE NO.
COMMISSIONER	9445419966	044-25381330 044-25619200
Joint / Deputy Commissioner (Works)	9445190998	044-25369444 044-25619306
Joint / Deputy Commissioner (Health)	9445190996	044-25619336 044-25386386
Joint / Deputy Commissioner (Education)	9445190997	044-25383693 044-25619205
Deputy Commissioner (R&F)i/c.	9445190995	044-25384231 044-25619351
Assistant Commissioner(GA&P)	9445190300	044-25619231
Principal Chief Engineer	9445190500	044-25383692 044-25619350
Chief Engineer(Buildings)	9445190200	044-25383781 044-25619260
Chief Engineer (Mechanical)	9445190736	044-25303316 044-25303317
Superintending Engineer (Roads, Bridges,works)	9445190735	044-25619281
Superintending Engineer(Buildings)	9445190738	044-25303910
Superintending Engineer(Spl.Project)	9445190733	044-25619302
Superintending Engineer(PH,SWM& Mechanical)	9445190731	044-25619362
Superintending Engineer(SWD)	9445190732	044-25619318

NAME/DESIGNATION	MOBILE NO.	OFFICE PHONE NO.
Superintending Engineer(Co-ordination,Planning,Training, QC,Park&Playfields)	9445190016	044-25619283 044-25619397
Superintending Engineer(Electrical)	9445190739	04425303369 044-25619371
Accountant Officer (H.O.)	9445026005	044-2533801
Revenue Officer	9445190742	044-25383614 044-25619370
City Health Officer(i/c)	9445190744	044-25619337 044-25619330
Vetnairy Medical Officer	9445190746	044-25303657
City Medical Officer	9445190857	044-25619338
Addl.City Medical Officer	9445190858	044-25619653
Addl.City Medical Officer (G)	9445194936	044-25619652
Education Officer	9445190747	044-25619462 044-25384232

Office Regional Deputy Commissioner (North)

NAME/DESIGNATION	CONTACT NUMBERS
RDC (North)	9445025800, 044-25200025
Deputy Collector (Administration)	9445477657, 044-25201076
Deputy Collector(Revenue)	9445467336, 044-25201076
Addl. GCC. Health Officer	9445026001
Head Accountant Officer	9445026063
Superintending Engineer	9445467372

Regional Deputy Commissioner Office (Central)

NAME/DESIGNATION	MOBILE NO.
RDC (Central)	9445190150 9445190698 044-26640224
Deputy Collector(Administration)	9445477660
Deputy Collector (Revenue)	9443019915
Addl. GCC. Health Officer	9445026002
Head Accountant Officer	9445026037
Superintending Engineer	9445190734

Regional Deputy Commissioner Office (South)

NAME/DESIGNATION	MOBILE NO.
RDC (South)	9445190100 9445190830 044-24425981 044-24425982
Deputy Collector (Administration)	9445191439 044-24425982
Deputy Collector(Revenue)	9445477653
Addl. GCC. Health Officer	9445026003
Head Accountant Officer	9445026036
Superintending Engineer	9445190737

Emergency Contact Numbers

Institution	Contact Number
Police	100
Traffic Police	103
Ambulance	108
Fire Control	101
Ambulance of Fire Services Dept.,	102
Child Line	1098
Women Help Line	1091
Lions Blood Bank	28415959
Apollo Ambulance	1066
St. Johns Ambulance Association	28194630
Trauma Care Consortium	28150700
Government General Hospital	25305000
Government Kilpauk Hospital	28364951
Govt. Kasturba Hospital for Women	28545449
Institute of Child Health & Hospital	28191135
Government Royapettah Hospital	28483051
Government Stanley Hospital	25281347
Child Trust Hospital	42001800
Voluntary Health Service	22541972
Red cross	044-28554548
Blue cross	044-22354959 / 22300666 / 22300655

Contact details of the Officials at the Zonal level

Zone	Zone Office	Zonal officers	Executive Engineers	Assistant Health officers	Assistant Revenue Officers
Zone 1	04425993494, 9445190201	9445190001	9445190021, 9445194727	9445190061	9445190081, 9445467332
Zone 2	04425941079, 9445190202	9445190002	9445190022,	9445190062	9445190082
Zone 3	04425530427, 9445190203	9445190003	9445190023	9445190063	9445190083
Zone 4	04425951083, 9445190204	9445190004	9445190024, 9445190940	9445190064	9445190084, 9790797999
Zone 5	04425206655, 9445190205	9445190005	9445190025, 9445190461	9445190065	9445190085, 9445071039
Zone 6	04426741802, 9445190206	9445190006	9445190026, 9445190038	9445190066	9445190086,
Zone 7	04426253331, 9445190207	9445190007	9445190027, 9445194759	9445190067	9445190087, 9444576365
Zone 8	04426412646, 9445190208	9445190008	9445190028, 9445190727	9445190068	9445190088,
Zone 9	04428170738, 9445190209	9445190009	9445190029, 9445190864	9445190069	9445190709
Zone 10	04424838968 , 9445190210	9445190010	9445190030, 9445191466	9445190070	9445190090, 9841534974
Zone 11	04424867725, 9445190211	9445190011	9445190031, 9445190853	9445190071	9445190091
Zone 12	04422342355, 9445190212	9445190012	9445190032, 9445190037	9445190072	9445190092
Zone 13	04424425961, 9445190213	9445190013	9445190033, 9445026077	9445190073	9445190093
Zone 14	04422420600, 9445190214	9445190014	9445190034, 9445026083	9445190074	9445190094
Zone 15	04424500923, 9445190215	9445190015	9445190035,	9445190075	9445190095