Master SHS

Mention **Sciences Sociales**

UMR 6173 CITERES

Cités, Territoires, Environnement et Sociétés

CNRS-Université de Tours

Comparative Study of flood management and Land use Zone Plan in France & India

Master dissertation

Tutor: Kamal serrihini

Thathappa Navaneetha Krishnan

Année 2010

UNIVERSITÉ FRANÇOIS - RABELAIS TOURS

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Summary: In the world wide major problem are the natural and artificial disasters, natural disasters are the earth quake, landslides, volcanoes, Tsunami, floods and cyclones. Then the artificial disasters are the terrorism & Industrial disasters.

In this research I going to present the comparative study on the actors and land use zoning plan for the flood risk management for the both nation France and India, with this comparative study, map for identifying the flood area for Chennai city has been made by the AutoCAD software.

In the identification of flooded area map for Chennai has been done by different analysis. How the people living in the flooded area can be evacuated by quick process and how the people can be recovery and safe living after flood hazard.

In the flood area map of Chennai includes were existing hospitals, institution, railway and road ways to identify and rescue the person during flood. The main thing that how the land use should be zoned in the major cities particularly flood hazard cities.

Keywords + geographic location: comparative analysis of the actors involved in flood risk management (FRM). Land use zoning in France & India; Flood area map for Chennai.

ACKNOWLEDGEMENT

A sincere word of thanks to each and every one who has helped me in completing this research.

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Last but not the least I extend my thanks to my parents who always help me to make my dream reality.

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Comparative Study of flood management and Land use Zone Plan in France & India

1. Abstract:

In this research I going to present comparative study of flood management particularly the non- structural methods (roles & responsibilities of the actors who are involved in the disaster management and particularly flood hazard), and the land use zone planning of the both nation France and India, then my case study on Chennai district says the growth of Chennai from 1633 to 1971 and major problems of the growth particularly about the flood problems in Chennai to reduce these problems I going to produce map for identifying the flood area for Chennai city and this has been made by the AutoCAD software.

In the identification of flooded area map for Chennai has been done by different analysis. How the people living in the flooded area can be evacuated by quick process and how the people can be recovery and safe living after flood hazard.

In the flood area map of Chennai includes were existing hospitals, institution, railway and road ways to identify and rescue the person during flood.

Keywords: comparative analysis of the actors involved in flood risk management (FRM). Land use zoning in France & India; Flood area map for Chennai

2. Introduction:

In the world wide major problem are the natural and artificial disasters, natural disasters are the earth quake, landslides, volcanoes, Tsunami, floods and cyclones. Then the artificial disasters are the terrorism & Industrial disasters.

In this artificial disasters having remedies to stop the reactions, but for the natural disaster there is no remedies only precaution and preventions

In India - The seasonal disaster is the flood its affect the major cities**,** due to this seasonal flood there is more losses and damages for the public life, public and government properties, it is mainly due to the absence of proper planning and

encroachment near by the river areas. There is no specific map to identify the flood areas and no proper drainage for storm water during the rainy season. Different approaches to the control of floodplain 'encroachment' exist in France and India.

In France, a 'coercive' approach emphasizes strong central government intervention within a system of designated risk zones for all natural hazards.

3. Objective and Methodology:

Objective:

1. The research is mainly based on the comparative study of actors those involved in the disaster (flood) management of France and India.
2. The second is how the countries like France and India classifying the land use zone according to their natural phenomena mainly towards flood hazards in the major cities.
3. According to the guidelines and land use zoning the flood Area is identified for the Chennai city.

Methodology:

In this research comparative methodology used to evaluate the different analysis Of studies on both countries France & India for the:

1. Actors involved in the disaster (flood) management
2. Land use zoning plans, Prioritization & policies for flood hazards.
3. Identifying Flood risk area in Chennai by AutoCAD software

4. Definitions with literature review

In this literature review I understand there is the broad relation between these disaster, hazard, vulnerability and risk.

Disaster it should be the natural or artificial (man made) disaster and this can be changed in to hazard.

Hazard due to earth quake, landslides, volcanoes, Tsunami, floods and cyclones and if makes the vulnerability. Hazard and vulnerability creates risk it may be affect the human life (death, injuries), economic conditions (damages to public and government properties), & environmental damages (damages to forest, water bodies, canals).

4.1. **Disaster** ***(****catastrophes****)***

A disaster is a serious disruption triggered by a hazard, causing human, material, economic or (and) environmental losses, which exceed the ability of those affected to cope.

(Source: Reducing Disaster Risk, UNDP 2004).

4.2. **Hazard** ***(****Alea****)***

Hazard is defined as a function of probability, primacy,

Predictability, prevalence and pressure.

Primacy: shock value based on time elapsed since previous occurrence.

Predictability: degree of warning available.

Prevalence: the extent and duration of hazard impacts.

Pressure: the intensity of impact.

(Source: Webb and Harinarayan, 1999; Sharma et. Al., 2000).

4.3. **Vulnerability** ***(****Vulnérabilité****)***

Vulnerability is the condition determined by physical, social, economic and environmental factors or processes, which increase the susceptibility of a community to the impact of hazards.

(Source: Living with Risk, UN ISDR 2002).

4.3.1. Vulnerability was defined by a function of a given process intensity on physical structures and was therefore expressed as the expected degree of loss for an element at risk as a consequence of this impact.

(source: Fuchs et al., 2007a).

4.4. **Risk** *(Risque)*

Risk is the probability of harmful consequences, or expected losses (deaths, injuries, property, livelihoods, economic activity disrupted or environment damaged) resulting from interactions between natural or human-induced hazards and vulnerable conditions.

(Source: Reducing Disaster Risk, UNDP 2004).

4.5. Risk equation

Risk is conventionally expressed by the equation

Risk = Hazard × Vulnerability

$R_{i,j} = f(pSi, pOj,Si, AOj, vOj,Si)$

Process Extent of damage

Ri, j = risk, dependent on scenario *i* and object *j*

pSi = probability of occurrence of scenario *i*

AOj = value of object *j* ('values at risk')

vOj, Si = vulnerability of object *j*, dependent on scenario *i*

pOj, Si = probability of presence of object *j* for scenario *I*

Hazard (Alea) × Vulnerability (Vulnérabilité) = Risk (Risque)

5. Urban flood management :

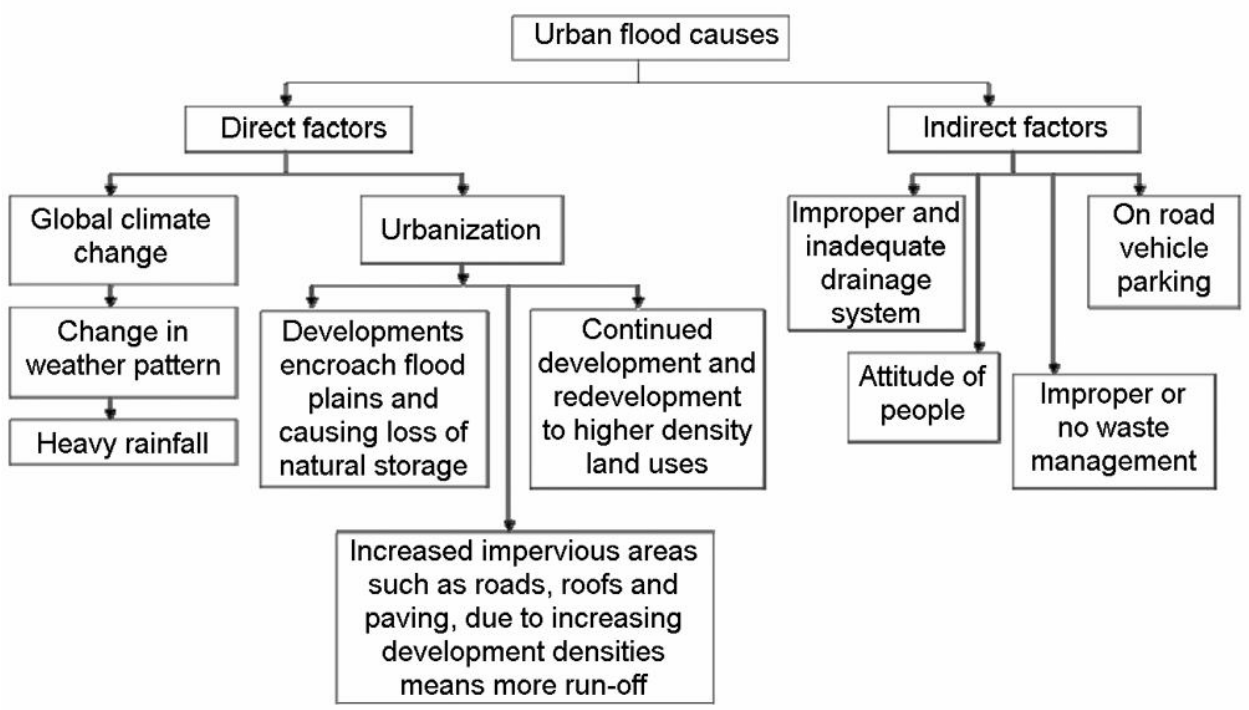


Figure 4 urban flood causes

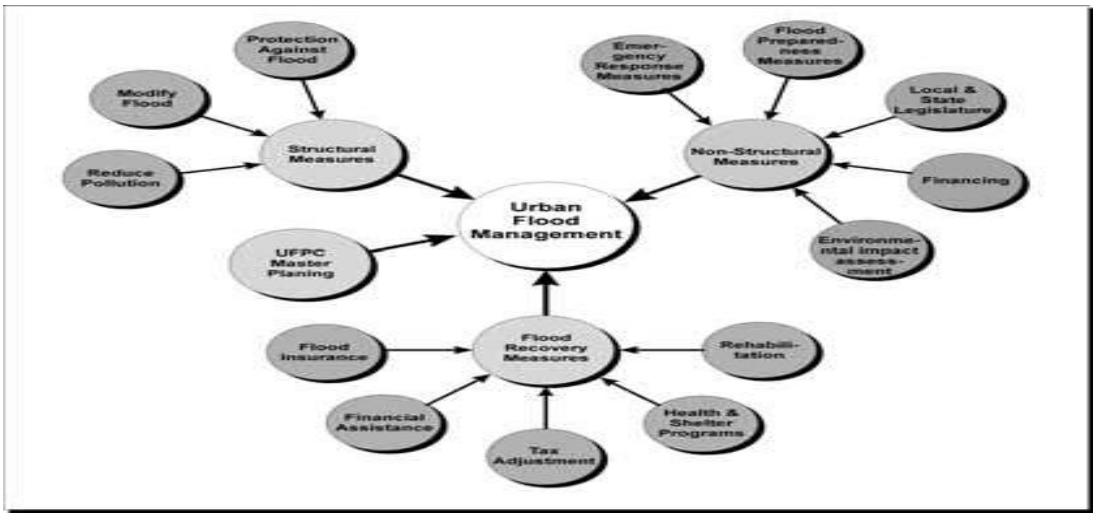


Figure: 2 Urban Flood Management

5.1 Structural Methods:

Stakeholders in Risk Management:

Risk management is evaluated in this part of the paper by two methods they are Structural and Non-structural methods

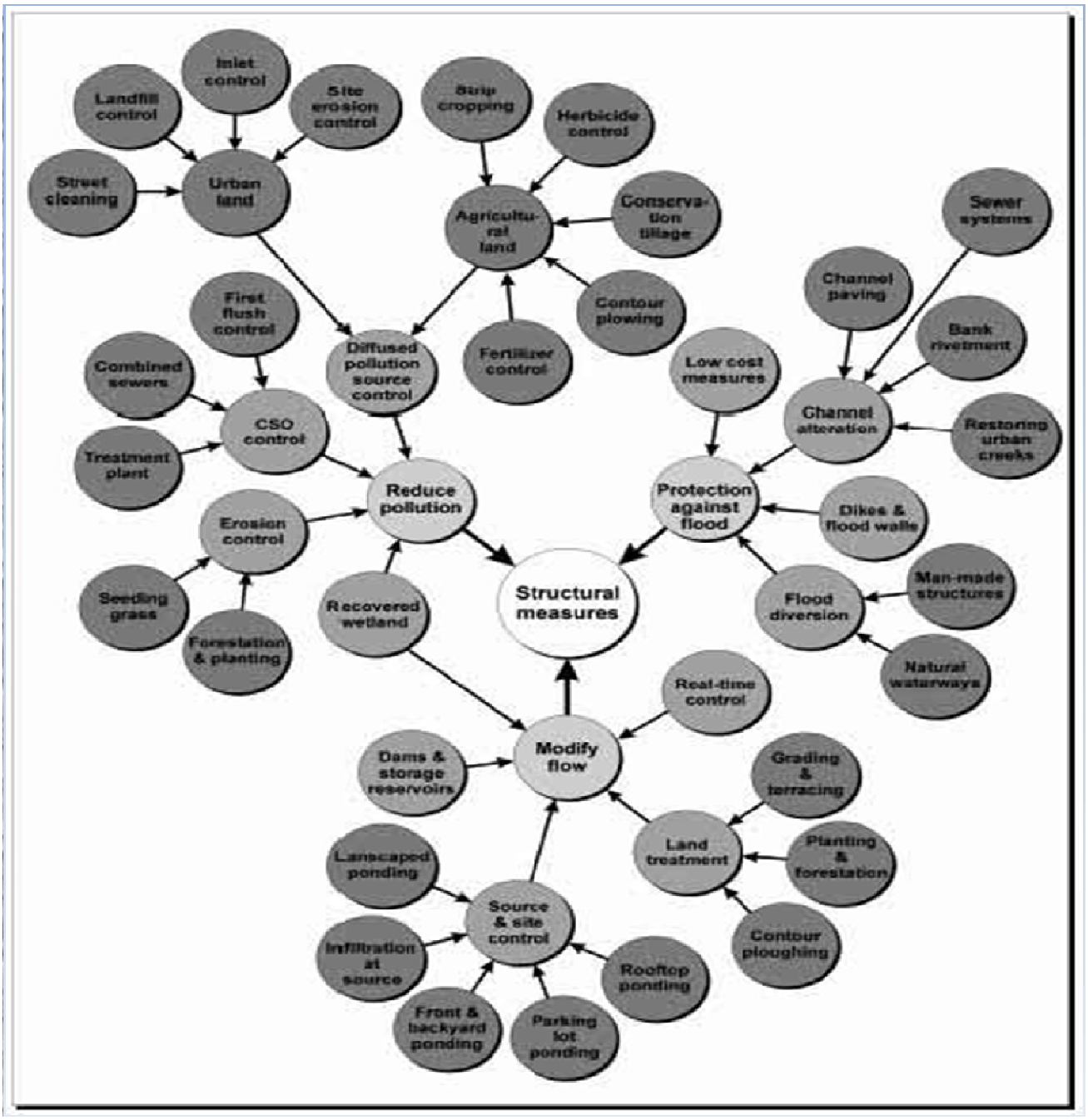


Figure: 3 Structural Methods

5.1.1. Structural master plan of flood mitigation measures

S.NO	Measures that reduce damage by reducing discharge	Measures that reduce damage by reducing stage	Measures that reduce damage by reducing existing damage susceptibility	Measures that reduce damage by reducing future damage susceptibility
1.	Reservoir	Channel improvement	Levee or floodwall	Land-use and construction regulation
2.	Diversion		Flood proofing	Acquisition
3.	Watershed management		Relocation Flood warning and preparedness planning	

Table: 7 Structural Master Plan of Flood Mitigation Measures

SOURCE: Structural master plan of flood mitigation measures, A. Heidari Iran Water and Power resources development Co. (IWPC), Tehran, Iran Received: 21 July 2008 – Revised: 6 October 2008 – Accepted: 5 November 2008 – Published: 20 January 2009.

5.1.2. Structural regulations:

	HOUSING	IMPORTANT BUILDINGS	CYCLONE SHELTER/VERY IMP INSTALLATION
WIND SPEED	IS:875(3)	IS:875(3)	PMWS
FACTOR KL	1.0	1.08	1.08

FOR K2 PRESSURE K3	1.05 1.00	1.05 1.00	1.05 1.00
SEISMIC COEFF, IS:1893(1)	I=1.0, R as per code	I=1.5, R as per code	I=1.8, R as per code
Storm surge	As per Vulnerability Atlas of India, 1997, riding over maximum astronomical tide level		
Fire safety	1.5 hr rating	2 hr rating	≥2 hr rating
Flood safety	Plinth height at recorded high flood level or for		
	10 yr flood	50 yr flood	100yr flood
	OR use plinth height of 60 cm above ground level & needed stilts		

Table: 8 showing the structural regulations for disaster prone buildings

Source: showing the structural regulations for disaster prone buildings Structural Code ISO: 1893

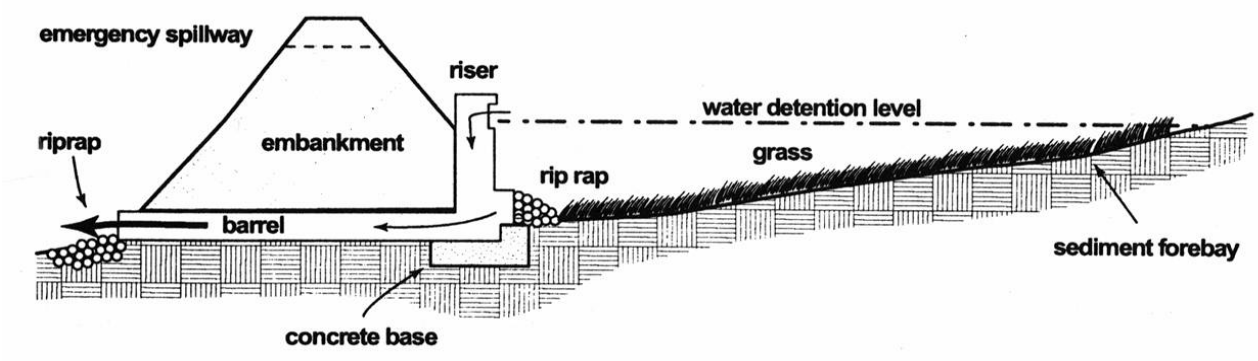
5.1.3. Images of Structural methods in flood areas

Weir

off-site runoff

open retention basin

Runoff volume control



Dry Ponds

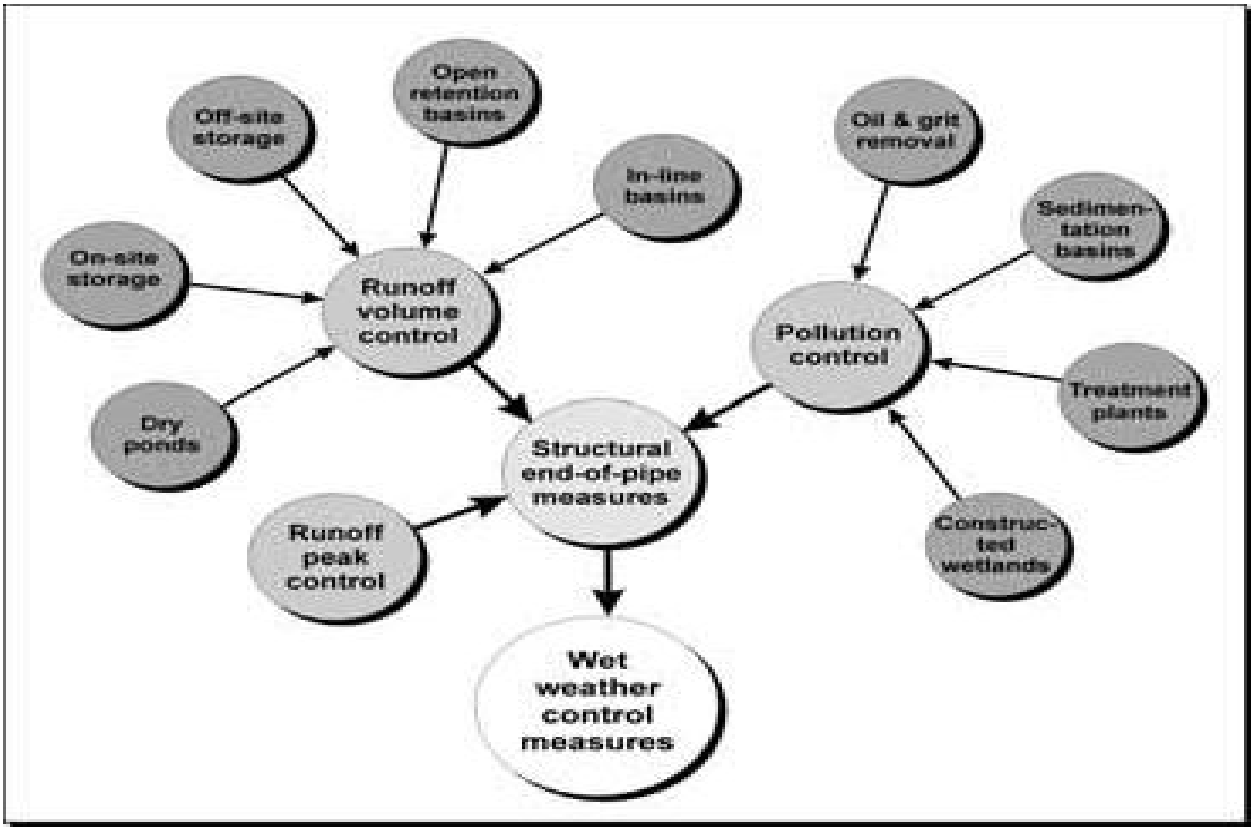


Figure: 4 Runoff Volume Control

5.2. Non-Structural Methods:

Nonstructural measures are complete or partial alternatives to traditional structural measures. Nonstructural measures include modifications in public policy, management practice, regulatory policy and pricing policy

Risk reduction initiatives must be multidisciplinary partnerships involving a range of stakeholders- national and local actors, government, private sector and civil society.

Government Stakeholders:

Ministries

Line Departments

Armed forces (army, air force, navy, coast guard and others).

Defense wings (police, rapid action force).

6. COMPARITIVE METHOD OF ACTORS & RESPONSIBILITIES IN INDIA & FRANCE FOR THE DISASTER MANAGEMENT

6.1. Main actors, Roles & intervention in India

Levels	Actors	Roles	Intervention
Central Level	I. Central Ministries and Public Departments II. Ministry of Home Affairs III. Ministry for drought management IV. Ministry of civil aviation V. Ministry of railways VI. Ministry of environmental and forests VII. Ministry of	I. Contingency Action Plan (CAP) II. Relief and Response and overall natural disaster management III. Department of Agriculture & Cooperation IV. Air accidents V. Rail accidents VI. Chemical disasters VII. Biological disasters VIII. Nuclear disasters	NDRF(National Disaster Response Fund), National Calamity Contingency Fund (NCCF)

	health VIII. Department of atomic energy		
State Government	Chief Secretary of the State & Department of Revenue	Relief and Rehabilitation measures, under the overall direction and control of the state level committee.	SDRF(State Disaster Response Fund),
District and Local Level	Collector/ District Magistrate/Deputy Commissioner	Implementation of all governmental plans and activities.	DDRF(District Disaster Response Fund)

Table: 9 Main actors, Roles & intervention in India

Figure: 5 India central and state levels Administration Boundary

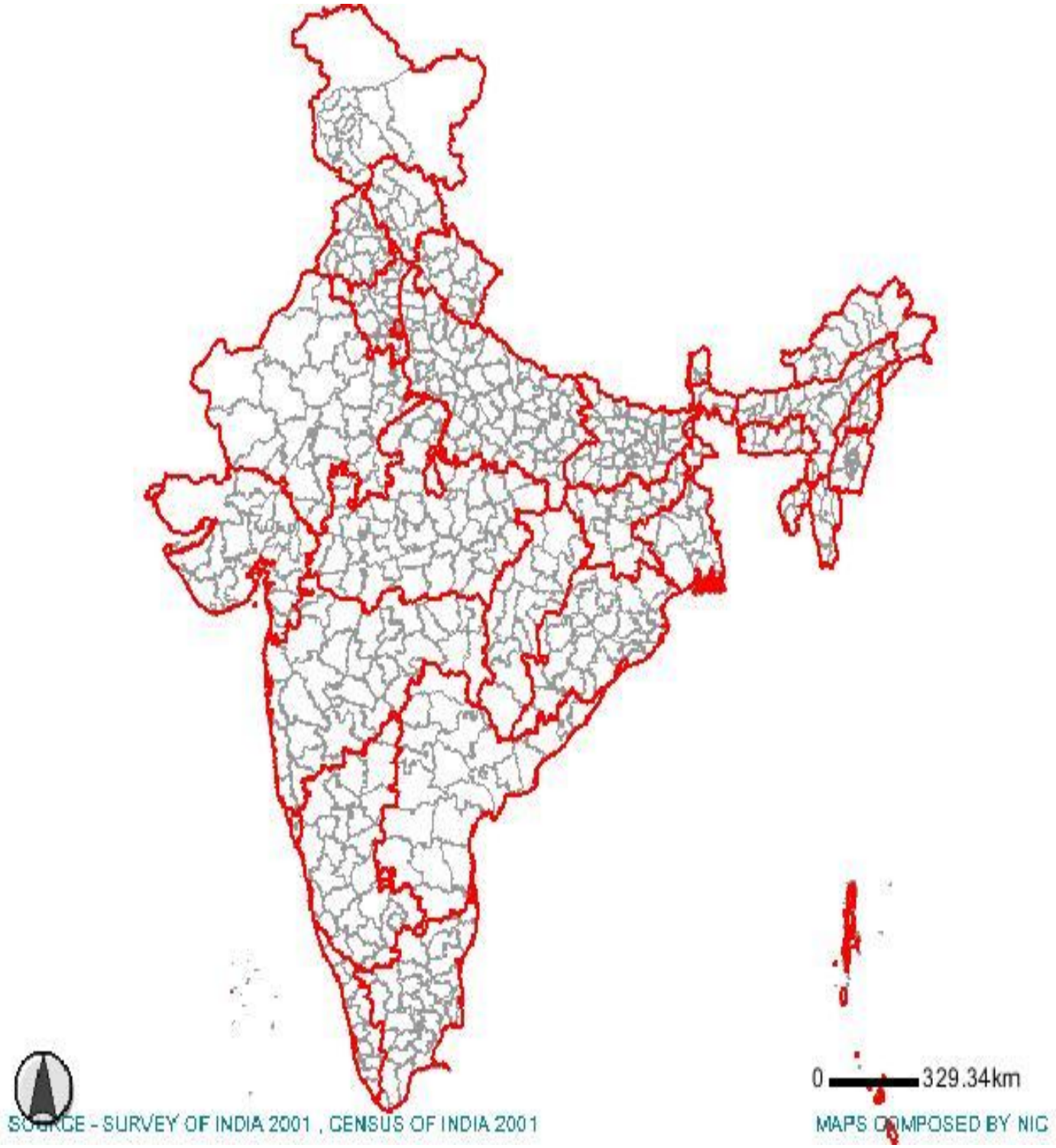
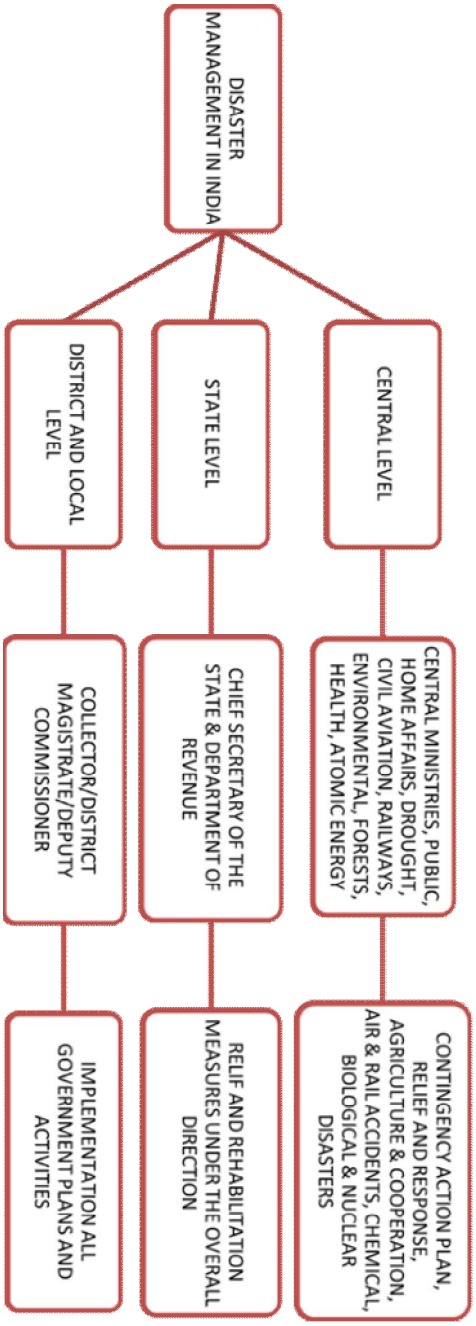


Figure: 6 India District Administration Boundaries

Figure: 7 Roles and Responsibilities of actors involved in Disaster Management in India



6.2. Main actors, role and intervention in France

Level /scale	Actor	Role	Intervention
COUNTRY (GOVERNMENT)	Minister of Environment	Prevention	Documents of Protection
	Interior Ministry	Protection, Management	Documents /Plan of Management(law)
CATCHMENTS BASIN	Basin Council	Statutory	SDAGE,SAGE,survey
	Public Establishment (Ep Loire)	Information Research	Scientific report
REGIONAL	DREAL (DIREN)	Information, prevention , forecast	Survey, Data Base, Advice
DEPARTMENT	Prefet(chief of police), DDT(ex DDE)	Crisis Management Knowledge	PPRi, DDRM
COMMUNE	Mayor	Management Information	Pcs, DICRIM
OTHERS	Others: Association, Insurers		

Table: 10 Main actors, role and intervention in France

Figure: 8 Different levels of Administration in France

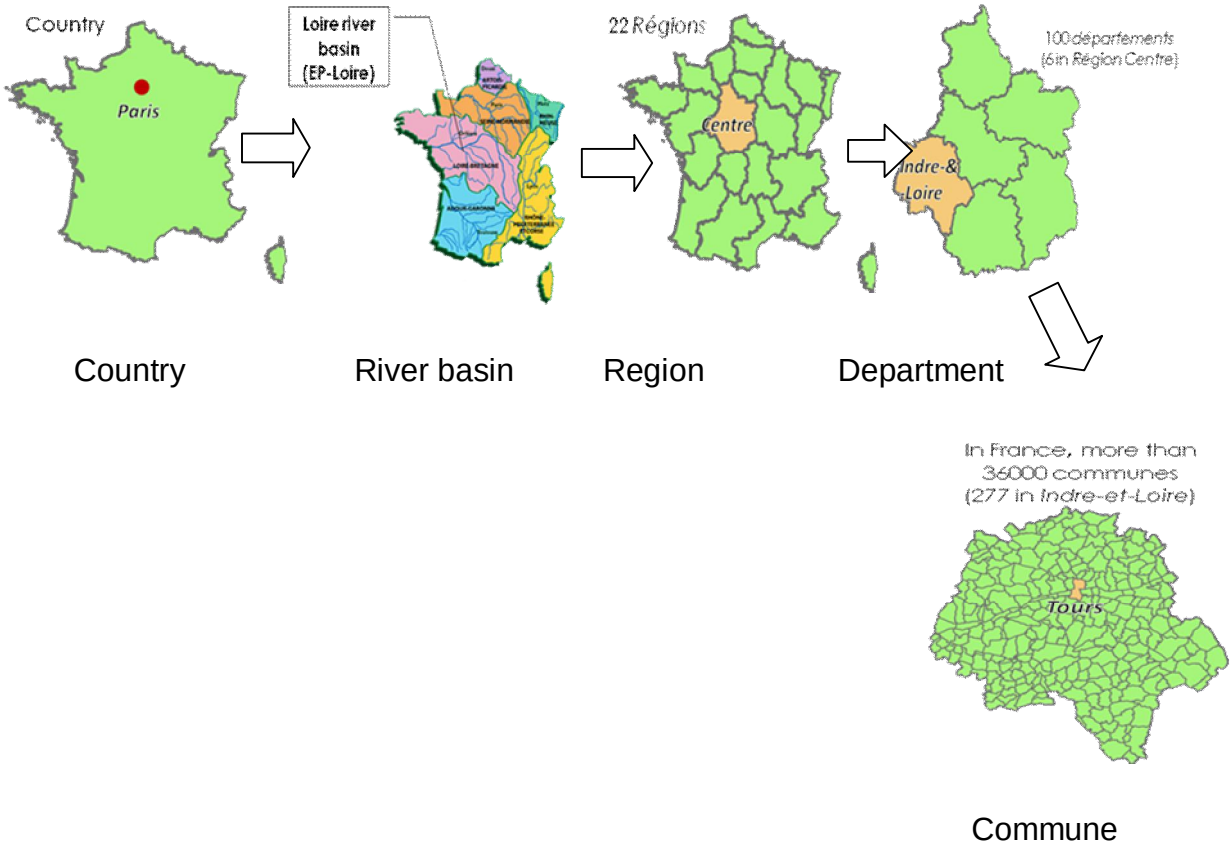
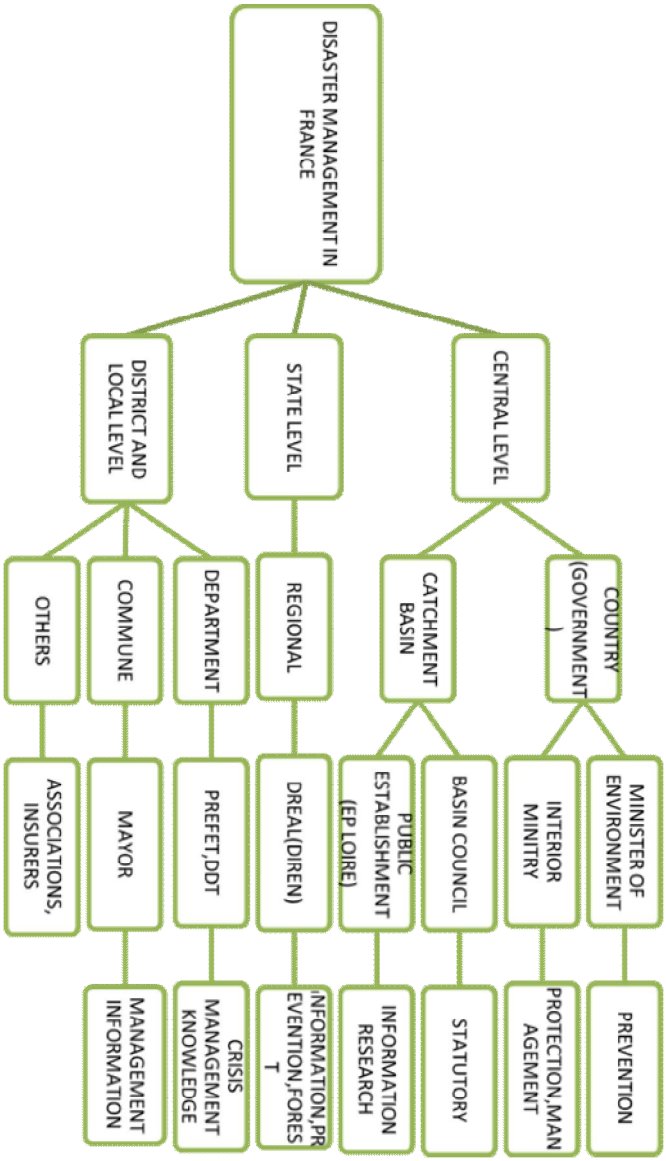


Figure: 9 Roles and Responsibilities of actors involved in Disaster Management in France



Le schéma directeur d'aménagement et de gestion des eaux (SDAGE)

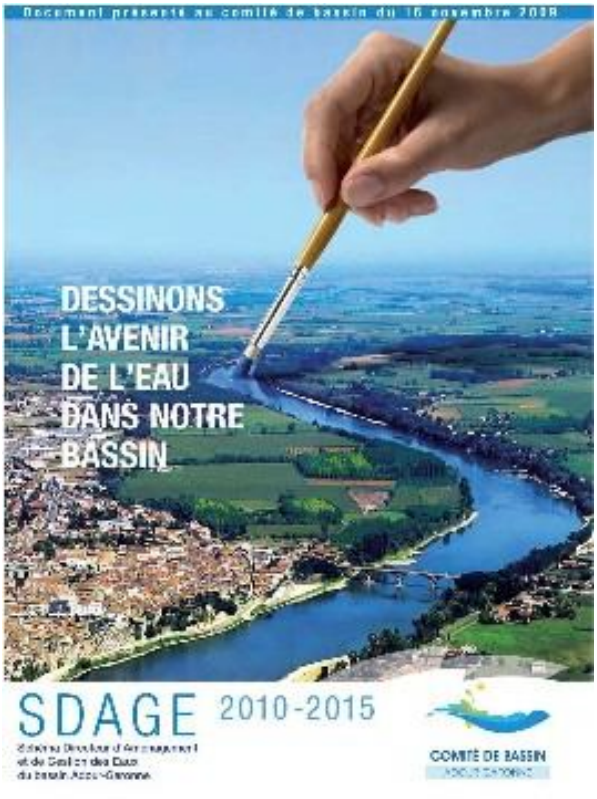


Figure: 10 Master Planning and Water Management (SDAGE)

In metropolitan France, the **master planning and water management** (SDAGE) was first appointed (in 1990) planning document designed to implement the principles of water law 3 January 1992.This SDAGE was developed (in France) by basin committees on the scale of large watersheds (or catchments). By involving local elected officials, state representatives, users (manufacturers and farmers) and associations. This work was prepared in the regions by the water agency and the regional state in charge of the environment.

Since the twenty-first century, the blueprint has become in France on behalf of the planning document called " *Management Plan* "by the European Framework directive on water (WFD) of 23 October 2000 (it's actually the old SDAGE 1996 which is adapted and made consistent with the *management plan* impose by the Directive

Surveying the Agents of Galaxy Evolution (SAGE)

Surveying the Agents of Galaxy Evolution (SAGE) will trace the life cycle of observable matter that drives the evolution of a galaxy's appearance. The key transition phases of matter are traced via dust emission in the interstellar medium, the newly forming stars and the evolved dying stars. The study consists of Spitzer Space Telescope images of the Large Magellanic Cloud (SAGE-LMC) and the Small Magellanic Cloud and Magellanic Bridge (SAGE-SMC) in addition to Spitzer spectroscopy of the dust composition in the Large Magellanic Cloud (SAGE-Spec, 30 Doradus) and Small Magellanic Cloud (SMC-Spec). The emission from the coldest dust will be traced by the Herschel Observatory in the imaging program HERschel Inventory of The Agents of Galaxy Evolution (HERITAGE) in the Magellanic Clouds. The data will provide fundamental insights into the physical processes of the interstellar medium, the formation of new stars and the injection of mass by evolved stars and their relationships on the galaxy-wide scales of the Large and Small Magellanic Clouds. SAGE will be the crucial link between Spitzer's and Herschel surveys of individual sources in the Milky Way (GLIMPSE, Hi-Gal) and its surveys of galaxies (e.g., SINGS, KINGFISH) and a stepping stone to the deep surveys (e.g., GOODS & SWIRE).

SAGE-LMC, SAGE-SMC and SAGE-Spec are legacy projects using the Spitzer Space Telescope. 30 Doradus is an open time program. SMC-Spec is a guaranteed time program. HERITAGE is an open time key program me using the Herschel Space Observatory.

The Spitzer Space Telescope is a space-borne, cryogenically-cooled infrared observatory. Spitzer Space Telescope was launched by a Delta rocket from the Kennedy Space Center on August 25, 2003.

Figure: 11 Surveying the Agents of Galaxy Evolution (SAGE)

This image layout reveals how the appearance of the North America nebula can change dramatically using different combinations of visible and infrared observations from the Digitized Sky Survey and NASA's Spitzer Space Telescope, respectively.

In this progression, the visible-light view (upper left) shows a striking similarity to the North America continent. The image highlights the eastern seaboard and Gulf of Mexico regions. The red region to the right is known as the "Pelican nebula," after its resemblance in visible light to a pelican.

The view at upper right includes both visible and infrared observations. The hot gas comprising the North America continent and the Pelican now takes on a vivid blue hue, while red colors display the infrared light. Inky black dust features start to glow in the infrared view.

In the bottom two images, only infrared light from Spitzer is shown -- data from the infrared array camera is on the left, and data from both the infrared array camera and

the multiband imaging photometer, which sees longer wavelengths, is on the right. These pictures look different in part because infrared light can penetrate dust whereas visible light cannot. Dusty, dark clouds in the visible image become transparent in Spitzer's view. In addition, Spitzer's infrared detectors pick up the glow of dusty cocoons enveloping baby stars.

Color is used to display different parts of the spectrum in each of these images. In the visible-light view (upper right) from the Digitized Sky Survey, colors are shown in their natural blue and red hues. The combined visible/infrared image (upper left) shows visible light as blue and infrared light as green and red. The infrared array camera (lower left) represents light with a wavelength of 3.6 microns as blue, 4.5 microns as green, 5.8 microns as orange, and 8.0 microns as red. In the final image, incorporating the multiband imaging photometer data, light with a wavelength of 3.6 microns has been color coded blue; 4.5-micron light is blue-green; 5.8-micron and 8.0-micron light are green; and 24-micron light is red.

Cartographie du plan de prévention du risque inondation (PPRI)

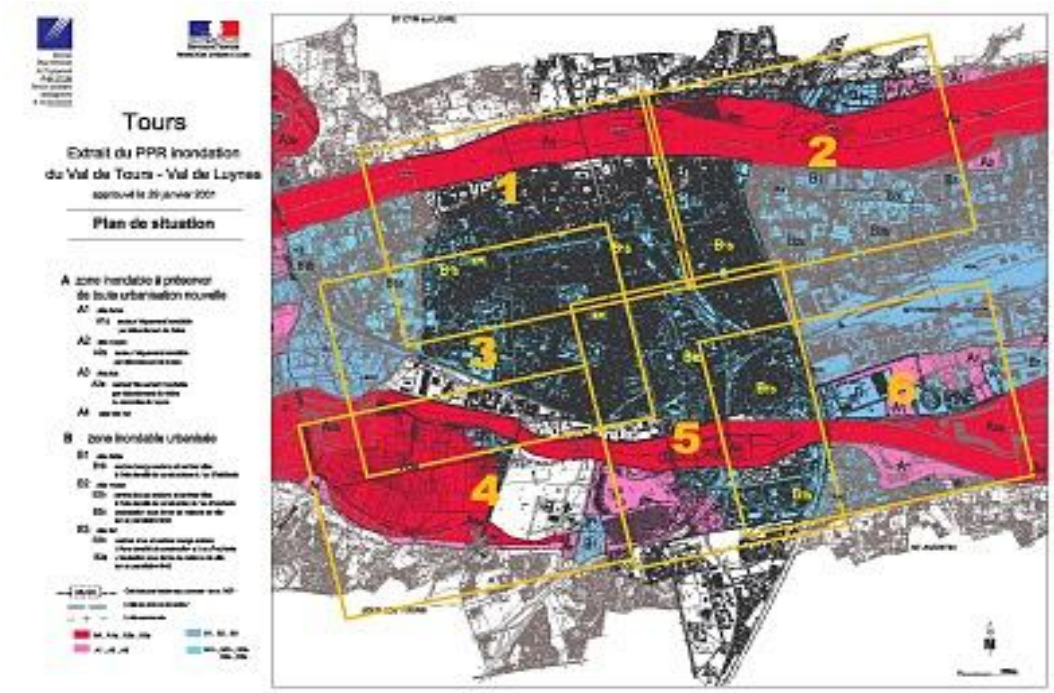


Figure: 12 Cartography du plan de prevention du risqué inundation (PPRI)

The major natural hazards, particularly in France, floods, landslides and forest fires have been very early in the history of the state, legislative and regulatory measures.

Le dossier départemental des risques majeurs (DDRM)

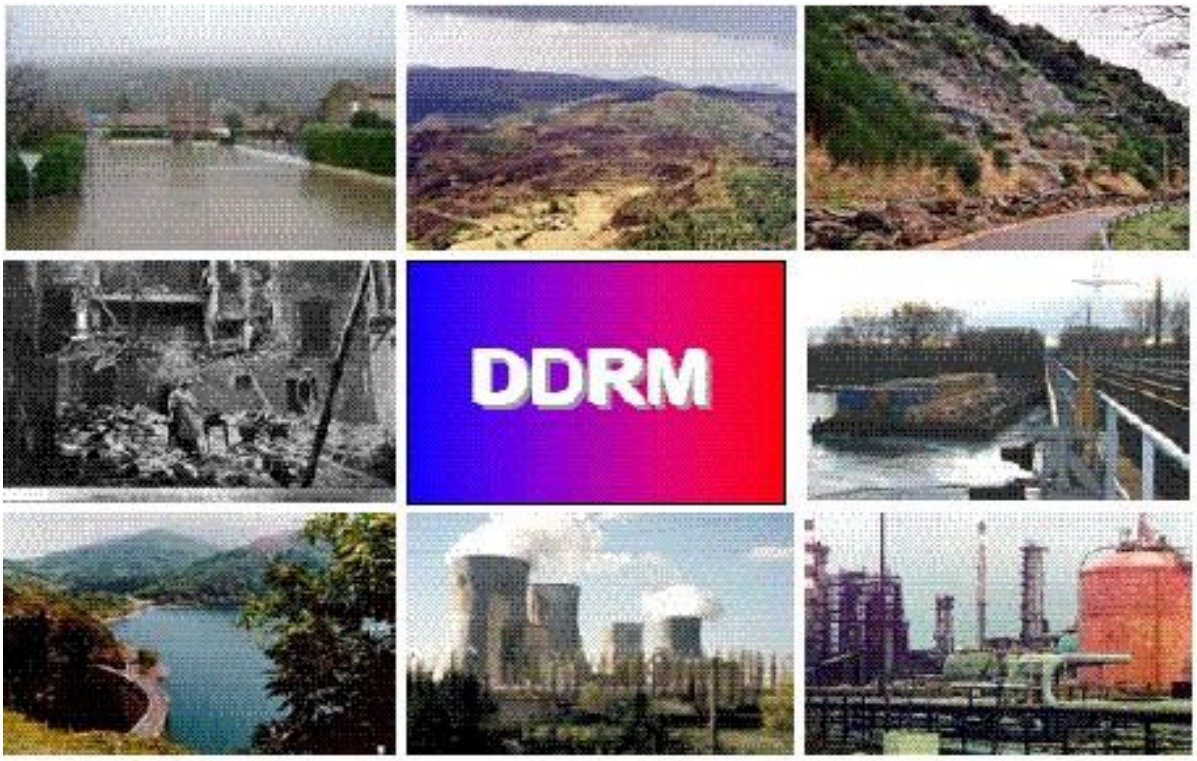


Figure: 13 Le dossier departmental des risqué majeure (DDRM)

The DDRM is an information tool and Outreach on the major risks for all population, elected officials, and business services, professional. The departmental record of major risks (DDRM) is an information document on preventive citizens natural and technological hazards to which they are likely to be exposed. It is prepared in accordance with articles L 125-2 and R 125-11 of the Environmental Code.

Approved by decree dated December 23, 2005, the DDRM the Ardeche will be updated depending on change in knowledge of risks, within a maximum of five years.

With the aim of preventive information and development of risk culture, a prefectural update annually a list of major risks identified in the Ardèche communes.

The DDRM the Ardeche this:

- Major risks to which the municipalities in the department are exposed;
- Their likely consequences for people, property and environment;
- A chronology of know events and significant;
- General measures of prevention, protection and backup provided by public authorities in the department;
- The main ad vice for behavior.

Document d'information communal sur les risques majeurs (DICRIM)

Then it comes to flooding in Tours, most people think of the great floods of the XIX century and ignore the risk from rising water or flood resulting from heavy rainfall.

The recent flood of the Loire has reminded all that we do not live on the edge of a bed of roses. The rising water under the bridge in December, Wilson is a consequence of these violent storms which have caused disaster in south-east.

It did not rain on the western slopes of the Massif Central where many rivers tributary of the Loire has its roots, and our waterways "locals" were not swollen by Heavy Ocean! That it is the combination of these factors has produced 3 times the XIX century a broken levees, and flooded our city under several meters of water!

Figure: 14 The Loire at Tours on 12/9/2003 - Credit Prévention2000

6.3. National Disaster Management Framework of Government of India formulated in 2009-2010

levels	Agencies/sectors to be involved and resource linkages	Areas of intervention
Nodal agency for disaster management at the national level with appropriate systems	Ministries/ Departments of Health, Water Resources, Environment and Forests, Agriculture, Railways, Atomic Energy, Defense, Chemicals, Science & Technology, Rural Development, Road Transport & Highways etc.	1. Constitution of National Emergency Management Authority with appropriate legal, financial and administrative powers. 2. Roles and responsibilities of the NEMA: -Coordinating multihazard Mitigation, prevention, Preparedness and response programmers. - Policies for disaster risk reduction and mitigation -Preparedness at all levels. -Coordination of response -Coordination of post disaster relief and rehabilitation.

		-Amendment of existing laws, procedures instructions.
Creation of State Departments of Disaster Management	State Governments/ UT Administration.	Departments of Relief & Rehabilitation to be redesignated as Department of Disaster Management with enhanced areas of responsibility to include mitigation, prevention and preparedness
Setting up State Disaster Management Authorities	Ministers for Agriculture, Home, Disaster Management, Water Resources, Health, Road &Transport, Civil Supplies, Environment & Forests, Rural Development, Urban Development and Public Health Engineering Departments as Members	1. State Disaster Management Authority to be headed by the Chief Minister. (ii) The Authority to lay down policies and monitor mitigation, prevention and preparedness as also oversee response.

Table: 11 National Disaster Management Framework of Government of India

SOURCE: A COMPENDIUM ON DISASTER RISK MANAGEMENT, 2002-2007, GoI- UNDP Disaster Risk Management Programme

6.4. Legal / Political Framework in India

Disaster Management to be listed in List III [Concurrent List] of Seventh Schedule to the Constitution	Ministry of Home Affairs/ Ministry of Law (Legislative Department)	i) Bill to be drafted. (ii) Bill to be brought before Parliament
State Disaster Management Acts	Ministry of Home Affairs State Governments	Model Act to be circulated to the States.
National Policy on Disaster Management	Ministry of Home Affairs, Ministry of Finance, Planning Commission, Ministry of Environment & Forests,RuralDevelopment, Urban Development and other relevant Ministries to be consulted.	(i) Mainstreaming disaster management into planning and development process. (ii) Mandate safe Construction. (iii) Coordinated action by all relevant Departments as per Policy
States to enunciate Policy on Disaster Management.	State Governments	(i) Mainstreaming disaster management into planning and development process. (ii) Mandate safe construction. (iii) Coordinated action by all relevant Depart ments

		as per policy
State Disaster Management Codes	State Governments	Amendment of existing relief codes/scarcity codes/famine codes to incorporate mitigation, preparedness and planning measures at all levels from community to State, constitution of Emergency Support Teams /Disaster Management Teams/Committees /State Disaster Management Authorities, delegation of administrative and financial powers to disaster incident managers etc, protocol to update the inventory of resources and plans.

Table: 12 Legal / Political Framework in India

SOURCE: A COMPENDIUM ON DISASTER RISK MANAGEMENT, 2002-2007, GoI- UNDP Disaster Risk Management Program me

c6.6. CONCLUSION:

1. According to the political set up there is the small difference in the both countries in the central level
   A. In India the central level has the more actors they involved each and every responsibilities as a separate ministry but in France in the central level is divided into two and its is governing by a individual person.

      Because of this in France they make the prevention and response in the quick process but India they want to get the order from each and every single ministry for the response and precaution measures.
   B. In France each and every level they are preceding their actions towards the official guide lines.
      I. Country (central level) ⇨ Documentation of protection(law)

      II. Catchment Basin (central level) ⇨ SDAGE,SAGE survey, Scientific Report

      III. Regional (state level) ⇨ survey, data base, advice

      IV. Department (district Level) ⇨ PPRi, DDRM

      V. Commune (local level) ⇨ Pcs, DICRIM
   C. In India there is an master plan that includes all activities that represent the disaster management , the official guide lines in India are:
      I. Central Level ⇨ Master Plan
      II. State Level ⇨ Regional Plan
      III. District and Local Level ⇨ Area development plan

7. LAND USE ZONING IN INDIA AND FRANCE

7.1. Introduction

Land forms such an important component of environment that if its quality is protected properly, it can help protecting the quality of all other aspects of environment, At the time of creation of the earth the nature had put the land-water forest ecosystem in a balanced juxtaposition. Any alteration of it results to an equal and opposite reaction within the same system. Such reactions may affect the mankind, a part of the same ecosystem, and may not be very comfortable to it. Hence any activity which disturbs this balance should be conducted with special care so that this balance is minimum disturbed.

The above referred system is composed of four spheres the lithosphere, hydrosphere, biosphere and atmosphere. The first three together form the ecosystem. Mining, though a developmental activity, is bound to damage this balanced ecosystem by disturbing greeneries, land and water resources, thus the land's usability and LUP of the concerned region gets altered very prominently.

It is very much required that these damages are repaired and the concerned lands are reclaimed at the earliest, because the effects of damage to land are cumulative. The matter is very serious in Indian condition because mining started here long back in nineteenth century. When the need of environmental protection was beyond realization, and even now the proper technology to repair the damages has not been developed in some aspects.

7.2. Land use zoning

The purpose of land use zoning is to segregate certain uses particularly hazardous and environmentally unsuitable uses from other urban uses of work, housing and recreation to reduce the effect of negative externalities, which the former have on the latter. By providing spatial segregation of highly conflicting uses it benefits some uses to find advantage in being grouped together with other similar uses. Thus separation of

hazardous industries would enable provision of special infrastructure to safeguard environmental quality at the same time providing reduction of costs in providing certain common public services. Because of zoning's vital role in planning, modern strategies encompass expanded objectives for supplying essential public amenities such as open spaces for recreation, conservation of prime agricultural land and protection of ecologically sensitive areas from unsustainable uses.

Ever since independence, India's planners and Policy makers have shown concern for efficient use of land, water and other natural resources for accelerated as well as sustainable economic development. The questions of efficiency, equity and environment protection have been flagged in almost all Five Year Plans. However, notwithstanding these concerns, it is often reported that the problems of land degradation and groundwater depletion have assumed serious proportions in many areas which threaten not only the sustainability of agriculture, but also the overall livelihood system of the people. To make the situation worse, there is a growing misconception in the minds of many scholars and administrators, particularly in the wake of economic liberalization that market alone should determine the land use patterns, even though in reality the relevance of land use planning for efficiency, equity and sustainability remains intact. The present workshop primarily intends to discuss the need for and major issues in land use planning in India for efficiency, equity and overall sustainable development.

7.3. Need for Land Use Planning

In a developing country like India, land is not only an important factor of Production, but also the basic means of subsistence (if not prosperity) for majority of the people. Agriculture contributes less than 30 percent to India's Gross Domestic Product, but absorbs nearly 64 percent of the country's working population. About three-fourth of the total population draw their livelihood from agriculture. But there is evidence to indicate that the land sector cannot bear the burden of growing population, notwithstanding the untapped potentials for agricultural productivity growth in many regions. Therefore, there is a felt need for both horizontal and vertical diversification of the agricultural economy. This is particularly so because all lands and locations are not equally suitable

for profitable, alternative farming and hence, there is need for cluster approach to development.

However, tend is required for both agriculture and non-agricultural purposes, including establishment of industries, housing, roads, parks, railway lines etc. The problem arises because market driven, albeit unplanned diversification as well as urbanization often results in non-sustainable patterns of development. A market driven land use pattern may yield higher returns in the short run, but may pose several unmanageable problems for future generations due to unplanned overexploitation of land, water and other natural resources. Hence arises the need for appropriate land use planning. There is no denying the fact that under free market forces, it is the relative profitability of various enterprises and their suitability from the points of view of agro-climatic characteristics which largely determine the land use patterns. But, while market forces should be allowed to operate, the management of land, water and other natural resources and also our orientation of technological and institutional changes should be such as to meet both present and future needs. In other words, the development process should be sustainable both in the short run and long run, based on conservation, of land, water, plant and animal genetic resources. Besides, such sustainable development would be environmentally non-degrading, technically appropriate, economically viable and socially acceptable.

Changes in Land Use Patterns over Time:

At the macro level, there are two main sources of land use data, namely Bureau of Economics and Statistics and National Remote Sensing Agency. However, there are some definitional and consistency problems with these two main sources of data, although some attempts have been made to reconcile and reduce the inconsistencies in recent years.

7.4. Land use zoning in India

- Zoning regulations are legal tools for guiding the use of land and protection of public health, welfare and safety.

- Such regulations also include provisions for the use of premises/property and limitations upon shape, size and type of buildings that are constructed or occupy the land. Further, these provide both horizontal as well as vertical use of land.

- These regulations also improve the quality of life in urban centers For instance in flood zones, the land use may be parks, playground & gardens while restricting any building activity in such vulnerable areas.

- Life line structures should also be protected likewise while either proposing land uses or otherwise.

7.4.1. Identification of flood prone areas

- The flood prone areas in river plains (unprotected and protected by bunds) are indicated in the Flood Atlas of India prepared by the Central Water Commission and reproduced on larger scale in the state wise maps in the Vulnerability Atlas of India.

- Besides, other areas can be flooded under conditions of heavy intensity rains, inundation in depressions, backflow in drains, inadequate drainage, failure of protection works, etc.

- Have to be identified through local contour survey and study of the flood history of the planning area (Survey of India or local survey teams, and by reference to the Central Water Commission and the departments of the state or U.T dealing with the floods).

7.4.2. List of recent floods around proximal areas (*1990- 2009*)

25th to 30th Nov-08	Cyclone Storm / Floods
29th Oct to 1st Nov-07	Heavy Rains/Floods
14-22nd Sept-2006	Cyclone Storm / Floods
15-16th Dec-2003	Cyclonic Storm / Flash Floods

15-17th Oct-2001	Heavy Rains / Flash Floods
13-15th Nov'1998	Very Severe Cyclone Storm
28 Nov-7 Dec'1996	Severe Cyclonic Storm with core of hurricane winds
11-15 Nov'1991	Cyclonic Storm

Table: 8 List of recent floods around proximal areas

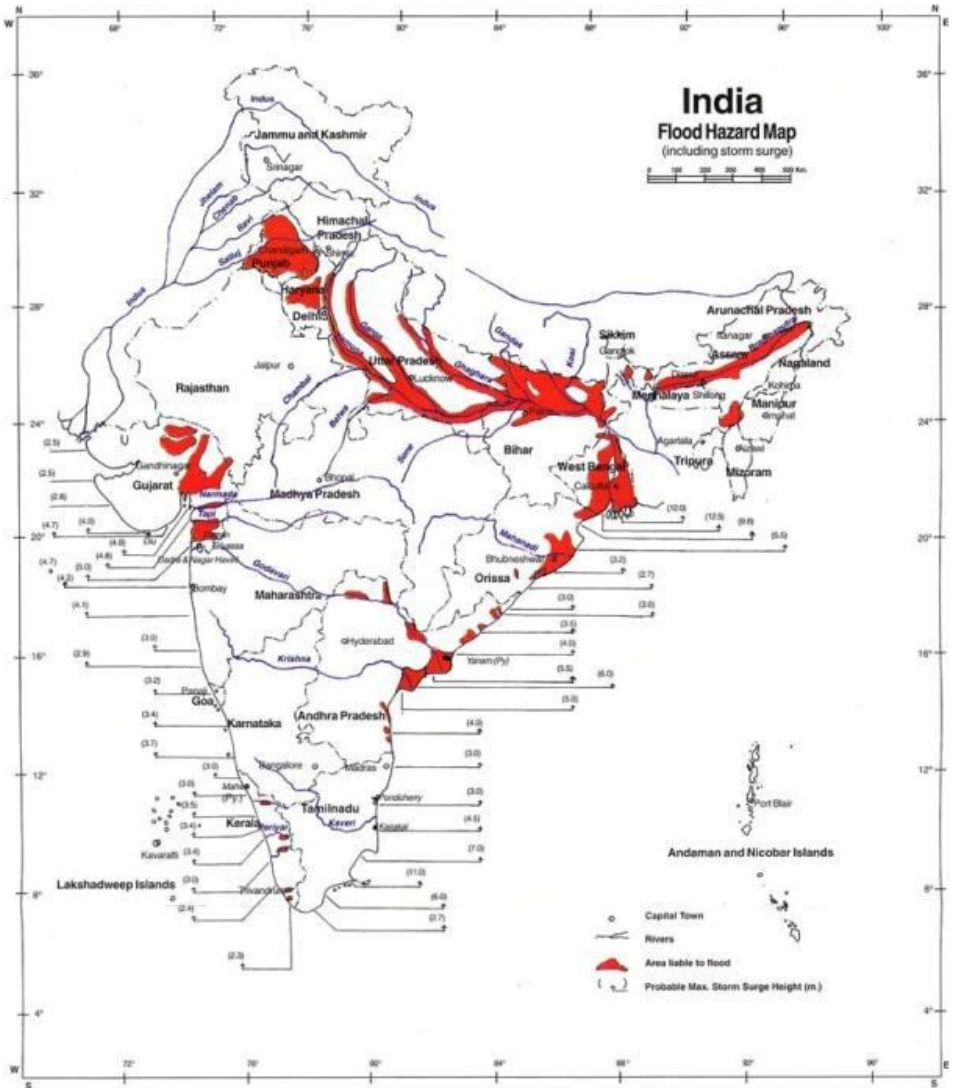


Figure: 15 Map Showing Flood prone areas in India Source: BMTC Vulnerability Atlas

7.4.3. Prioritization & Regulation for land use zoning

In regard to Land Use Zoning, different types of buildings and utility services are grouped under three priorities as indicated below.

Priority 1. Defense installation, industries, public utilities, life line structures like hospitals, electricity installations, water supply, telephone exchange, aerodromes and railway stations; commercial centers, libraries, other buildings or installations with contents of high economic value.

Priority 2. Public and Semi Public institutions, Government offices, and residential areas.

Priority 3. Parks play grounds, wood lands, gardens, green belts, and recreational areas.

Regulation for land use zoning:

Installations and Buildings off Priority 1 to be located above the levels corresponding to a 100 year flood or the maximum observed flood levels whichever higher.

Buildings of Priority 2 to be located outside the 25 year flood or a 10 year rainfall contour,, provided that the buildings if constructed between the 10 and 25 year contours should have either high plinth level above 25 year flood mark or constructed on columns or stilts, with ground area left for the unimportant uses;;

Activities off Priority 3 viz. Play grounds,, gardens and parks etc... *Can* be located in areas vulnerable to frequent floods.

7.4.4. Existing land use zone in 2006

	Chennai City		Rest of CMA	
	Extent in Hectares	%	Extent in Hectares	%
Residential	9523	54.25	22877	21.87
Commercial	1245	7.09	390	0.37
Industrial	908	5.17	6563	6.28
Institutional	3243	18.48	3144	3.01
Open Space & Recreation	366	2.09	200	0.19
Agricultural	99	0.57	12470	11.92
Non Urban	82	0.47	2433	2.33
Others (Vacant, Forest, Hills, Low lying, Water bodies etc.,)	2087	11.89	56507	54.03

Table: 9 existing land use zone in 2006

Source: Second Master Plan for Chennai Metropolitan Area, 2026 Volume I Vision, Strategies and Action Plans, September 2008(*Approved by the Government of Tamil Nadu in G.O.Ms. No. 190 H&UD dated 2.9.2008. Notification was made in the Tamil Nadu Government Gazette Extraordinary No.266, Part II-Section 2 dated September 2, 2008)*

7.4.5. Proposed Land use 2026

	Chennai City		Rest of CMA	
	Extent in Hectares	%	Extent in Hectares	%
Primary Residential use zone	5916.35	33.58%	32090.68	31.68%
Mixed Residential use zone	2426.90	13.78%	13503.10	13.34%
Commercial use zone	714.24	4.05%	880.35	0.86%
Institutional use zone	2868.97	16.28%	3888.85	3.83%
Industrial use zone	691.83	3.93%	7274.33	7.18%
Special and Hazardous Industrial use zone	130.67	0.74%	3416.08	3.38%
Open Space &	1000.65	5.68%	392.86	0.38%

Recreational use zone				
Agriculture use zone	------	-------	7295.81	7.20%
Non Urban	113.31	0.64%	2332.92	2.30%
Urban sable			2075.89	2.05%
Others (Roads, water bodies, hills, Red hills catchments area, forests etc.,)	3754.79	21.31%	28147.55	27.79%
Total	17617.70	100.00%	101298.42	100.00%

Table: 10 Proposed Land use 2026

Source: Second Master Plan for Chennai Metropolitan Area, 2026 Volume I Vision, Strategies and Action Plans, September 2008(Approved by the Government of Tamil Nadu in G.O.Ms. No. 190 H&UD dated 2.9.2008. Notification was made in the Tamil Nadu Government Gazette Extraordinary No.266, Part II-Section 2 dated September 2, 2008)

7.4.6. The Policy Making

- ✖ Convergence of disaster management and development planning.
- ✖ Formulation of disaster management plans at all levels taking into account the local conditions

- ✖ Focusing on the reduction of vulnerability of communities instead of mere disaster relief
- ✖ Fostering a culture of prevention among the community and various organs of Government through training and awareness campaigns

7.4.6.1. Pre-Disaster Policies

Prevention, Mitigation and Preparedness Strategy

- ✖ Development of a culture of prevention as an essential component of an integrated approach to disaster reduction.
- ✖ Prepare and maintain in a state of readiness 'Preparedness and Response Plans' at local body level
- ✖ Adoption of a policy of self reliance in each vulnerable area.
- ✖ Education and training in disaster prevention, mitigation and preparedness for enhancement of capabilities at all levels.
- ✖ Identification and strengthening of existing centres of excellence in order to improve disaster prevention, reduction and mitigation capabilities

7.4.6.2. Post-Disaster Policies

- ✖ Evaluation of relief and rehabilitation activities in order to assess the nature of state intervention and support, suitability of the organization structure, institutional arrangements, adequacy of Operating Procedures, monitoring mechanisms, information tools, equipment and communication system.
- ✖ Organizational and institutional arrangements for (i) Notification/ Warning, (ii) Immediate Public Safety, (iii) Property Security, (iv) Public Welfare, and (v) Restoration.
- ✖ The Organizational and institutional setup consisting of a crisis group, emergency manager and emergency control room to be constituted.
- ✖ Responsibilities of the organization is to communicate the public warning, to organize local force for rescue and evacuation, Requisition resources, materials and equipment, establishment of transit and/ or relief camps, feeding centre and cattle camps.

7.5. Land use zoning in France

- The French system involves a 'coercive' approach within the strong national focus implemented by central government.

(Handmer 1996; Johnson & Handmer, 2004; May & Handmer, 1992).

- The system of land use and building regulation in the hazard zones is initiated by the MEDD (Ministry for Ecology and Sustainable Development—ex MATE)4 and implemented by its decentralized services provided by Departments (the 2nd level of government).

- This is done under the authority of the Prefects of Departments and these, crucially, are directly nominated representatives of the central government operating locally.

- The regulation must be approved and applied by the local authorities at the commune scale headed by the Mayor (Maire).

- The relevant circulars and decrees are directives (not advice) to those communes that are chosen by central government to be subject to this system (i.e. those deemed to have significant hazard exposure, whether its Mayor has requested the arrangement or not).

7.5.1. IDENTIFICATION OF FLOOD PRONE AREAS IN FRANCE

(from Methodological Guide PPR for floods PPR, 1997 and 1999)

Regulated flood zone	**Appropriate planning response—PPR regulation**
White zone of the PPR [Insignificant (ne´gligeable) or low risk areas]	No constraints

Depth of flooding<0.50 cm. Low to medium flow velocities	Some alternative urban flood control techniques can be implemented to limit urban runoff or landslides (e.g. land drainage, retention basins)
Blue zone of the PPR [Low to medium risk areas]	Suitable for most development
Depth of flooding<0.50 cm and fast flowing	For this and higher risk-zones, the regulation principle is 'not to urbanize exposed areas'. It must be strictly applied when buildings have an impact on natural values in floodplains or make risks worse in the whole floodplain storage areas (l'ensemble du champ d'expansion des crues), even if the risk is low
0.50 cm<Depth of flooding>1.0 m and medium flowing	If other development solutions are not possible, most development is suitable with prescribed modifications to land use and to existing and future buildings belonging to public and private owners (flood resistant construction, evacuation systems, etc.)
Urban centers in high risk areas	No directly exposed areas (e.g. plateaux and valley sides) can also be regulated

	when some development or building may make worse the risk downstream, in the valley. They must be included into blue or red PPR zones
Developed areas with defenses	In developed areas with defences such as dikes, it is necessary to maintain a strip behind them where building is prohibited (its width depending on local conditions)
No directly exposed areas (worsening risk zones)	
Red zone of the PPR [High risk areas]	Most development forbidden
Depth of floodingO1.0 m and fast to very fast flowing waters	the wide bans on development (l'e´tendue des interdictions) can be discussed and varied according to local situations:
Annual probability of flooding: 1% or greater (rivers)	In existing urban centers: these may be suitable for development provided there are local flood prevention, protection and safeguarding measures
Floodplain storage even with low risk and even with defenses	In areas where the risk may be totally controlled previous to the development

Not directly exposed areas (worsening flood risk generating zones)	For land uses compatible with risk (especially agricultural or forestry activities, sports grounds and water recreation areas)
	For developing essential transport and utilities infrastructures that must be located there
	In flash flood areas, where bans are less easily debatable. For example, reconstructing a building destroyed by a flash flood is forbidden, as are new camping sites and other facilities open to the public. For those already existing, flood warnings/ evacuation procedures and other conditions may be required (e.g. seasonal opening) depending on the PPR

Table: 11 Identification of Flood Prone Areas in France.

8. CASE STUDY

Flood Risk area for Tours (France) and Chennai (India)

8.1. About France and Tours

History of France

Archeological excavations indicate that France has been continuously settled since Paleolithic times. The Celts, who were later called *Gaul's* by the Romans, migrated from the Rhine valley into what is now France. In about 600 B.C., Greeks and Phoenicians established settlements along the Mediterranean, most notably at Marseille. Julius Caesar conquered part of Gaul in 57–52 B.C., and it remained Roman until Franks invaded in the 5th century A.D.

The Treaty of Verdun (843) divided the territories corresponding roughly to France, Germany, and Italy among the three grandsons of Charlemagne. Charles the Bald inherited *Francia Occidentalis,* which became an increasingly feudalized kingdom. By 987, the crown passed to Hugh Capet, a prince ling who controlled only the Ile-de-France, the region surrounding Paris. For 350 years, an unbroken Captain line added to its domain and consolidated royal authority until the accession in 1328 of Philip VI, first of the Valois line. France was then the most powerful nation in Europe, with a population of 15 million.

Tours: Tours (t**OO**r) city, capital of Indre-et-Loire dept., central France, in Touraine, on the Loire River. It is a wine market and a tourist center, with metallurgical, chemical, electrical, clothing, and printing industries. An old Gallo-Roman town, it grew rapidly after the death (397) of its bishop, Saint Martin, whose remains are buried in the Basilica of St. Martin (built 1887–1924). The city was a center of medieval Christian learning, notably under Gregory of Tours and Alcuin. It was there that Charles Martel halted (732) the Moorish conquest of Europe. The city became an archdiocese in 853. The history of Tours is essentially that of Touraine, of which it was the capital. It was favored by many kings, including Louis XI, who held his State's General there and who died in the nearby château of Plessis-lès-Tours. The city has produced great painters, sculptors, goldsmiths, and tapestry weavers. During the Franco-Prussian War (1870–71), Tours was the headquarters of the government of national defense. In World War II

it was briefly (June, 1940) the seat of the French government. Points of interest include Gallo-Roman ruins and the splendid Gothic Cathedral of St. Gatien (13th–16th cent.).

France is about 80% the size of Texas. In the Alps near the Italian and Swiss borders is Western Europe's highest point—Mont Blanc (15,781 ft; 4,810 m). The forest-covered Vosges Mountains are in the northeast, and the Pyrénées are along the Spanish border. Except for extreme northern France, the country may be described as four river basins and a plateau. Three of the streams flow west—the Seine into the English Channel, the Loire into the Atlantic, and the Garonne into the Bay of Biscay. The Rhône flows south into the Mediterranean. For about 100 mi (161 km), the Rhine is France's eastern border. In the Mediterranean, about 115 mi (185 km) east-southeast of Nice, is the island of Corsica (3,367 sq mi; 8,721 sq km).

Figure: 16 River Catchment Basin in France.

Figure: 17 Aerial View of Loire River.

8.2. About India and Chennai.

In India from 1980 t0 2010 there are many natural hazards occurred in that the Major disaster is the earthquake in uttarkashi (1991), latur (1993), charnoli (1999), Bhuj (2001), and avalanche in (2005), and India had ever seen this disaster is the Tsunami in 2004.

The seasonal disaster is the flood its affect the major cities like Mumbai, Chennai, Kolkata, Delhi, bhuvaneshwar and in some parts of Andhra**,** due to this seasonal Flood there is more losses and damages for the public life and government Properties, it is mainly due to the absence of proper planning and encroachment Nearby the river areas. There is no specific map for the flood areas and no proper drainage for storm water during the rainy season.

To avoid these types of major losses and damages there should be specific map for the mitigation and land use process. So my research studies based on preparing Flood risk maps and land use process for the cities like tours (France) and Chennai (India), because this both cities are the oldest and ancient cities in France & India. And this is my idea to reduce the major losses and damages in both cities.

Figure: 18 Case Study Area Location Map.

Geographical view of Chennai:

Chennai is on the southeast coast of India in the northeast of Tamil Nadu on a flat Coastal plain known as the Eastern Coastal Plains. Its average elevation is around 6.7 meters (22 ft), and its highest point is 60 m (200 ft).The Marina Beach runs for 12 km along the shoreline of the city. Two rivers meander through Chennai, the Cooum River through the centre and the Adyar River to the south. A third river, the Kortalaiyar, flows through the northern fringes of the city before draining into the sea at Ennore. Adyar and Cooum rivers are heavily polluted with effluents and waste from domestic and commercial sources. The state government periodically removes silt and pollution from the Adyar River, which is much less polluted than the Cooum. A protected estuary on the Adyar forms a natural habitat for several species of birds and animals. The Buckingham Canal, 4 km (2.5 mi) inland, runs parallel to the coast, linking the two rivers. The Otteri Nullah, an east-west stream, runs through north Chennai and meets the Buckingham Canal at Basin Bridge. Several lakes of varying size are located on the western fringes of the city. Red Hills, Sholavaram and Chembarambakkam Lake supply Chennai with potable water. Groundwater sources are becoming brackish Chennai's soil is mostly clay, shale and sandstone. Sandy areas are found along the river banks and coasts, such as Thiruvanmiyur, Adyar, Kottivakkam, Santhome, George Town, Tondiarpet and the rest of coastal Chennai. Here rainwater runoff percolates quickly through the soil. Clay underlies most of the city including T. Nagar, West Mambalam, Anna Nagar, Villivakkam, Perambur and Virugambakkam. Areas of hard rock include Guindy, Perungudi, Velachery, Adambakkam and a part of Saidapet. Chennai is divided into four broad regions: North, Central, South and West. North Chennai is primarily an industrial area. Central Chennai is the commercial heart of the city and includes an important business district, Parry's Corner. South Chennai and West Chennai, previously mostly residential, are fast becoming commercial, home to a growing number of information technology firms, financial companies and call centres.

The city is expanding quickly along the Old Mahabalipuram Road and the Grand Southern Trunk Road (GST Road) in the south and towards Ambattur, Koyambedu and Sriperumbdur in the west. Chennai is one of the few cities in the world that accommodates a national park, the Guindy National Park, within its limits.

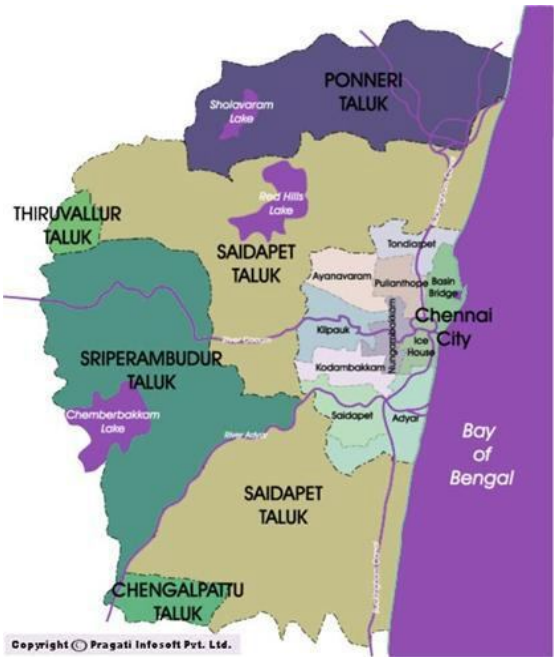


Figure: 19 Chennai Taluk Map

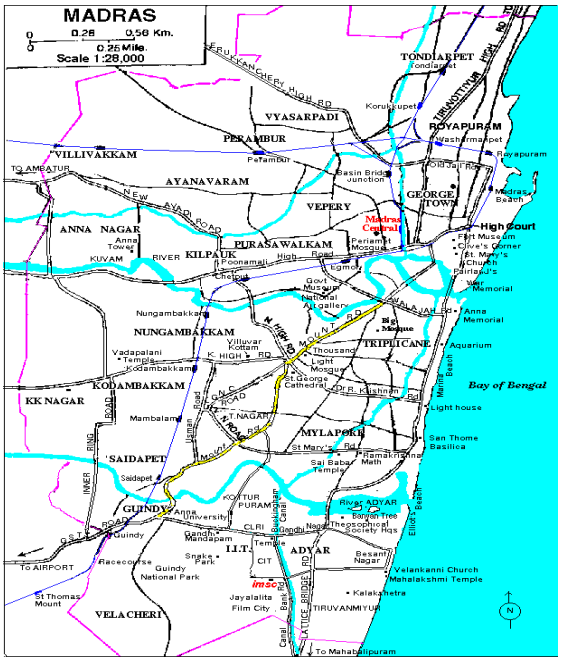


Figure: 20 Chennai river map

Climate:

Chennai has a tropical climate, specifically a tropical wet and dry climate. The city lies on the thermal equator and is also on the coast, which prevents extreme variation in seasonal temperature. The weather is hot and humid for most of the year. The hottest part of the year is late May to early June, known locally as Agni Nakshatram ("fire star") or as Kathiri Veyyil,with maximum temperatures around 38–42 °C (100–108 °F). The coolest part of the year is January, with minimum temperatures around 18–20 °C (64–68 °F). The lowest temperature recorded is 15.8 °C (60.4 °F) and highest 45 °C (113 °F) The average annual rainfall is about 140 cm (55 in). The city gets most of its seasonal rainfall from the north-east monsoon winds, from mid-October to mid-December. Cyclones in the Bay of Bengal sometimes hit the city. The highest annual rainfall recorded is 257 cm (101in) in 2005. Prevailing winds in Chennai are usually south westerly between April and October and northeasterly during the rest of the year.

8.3. Growth of Chennai from 1633:

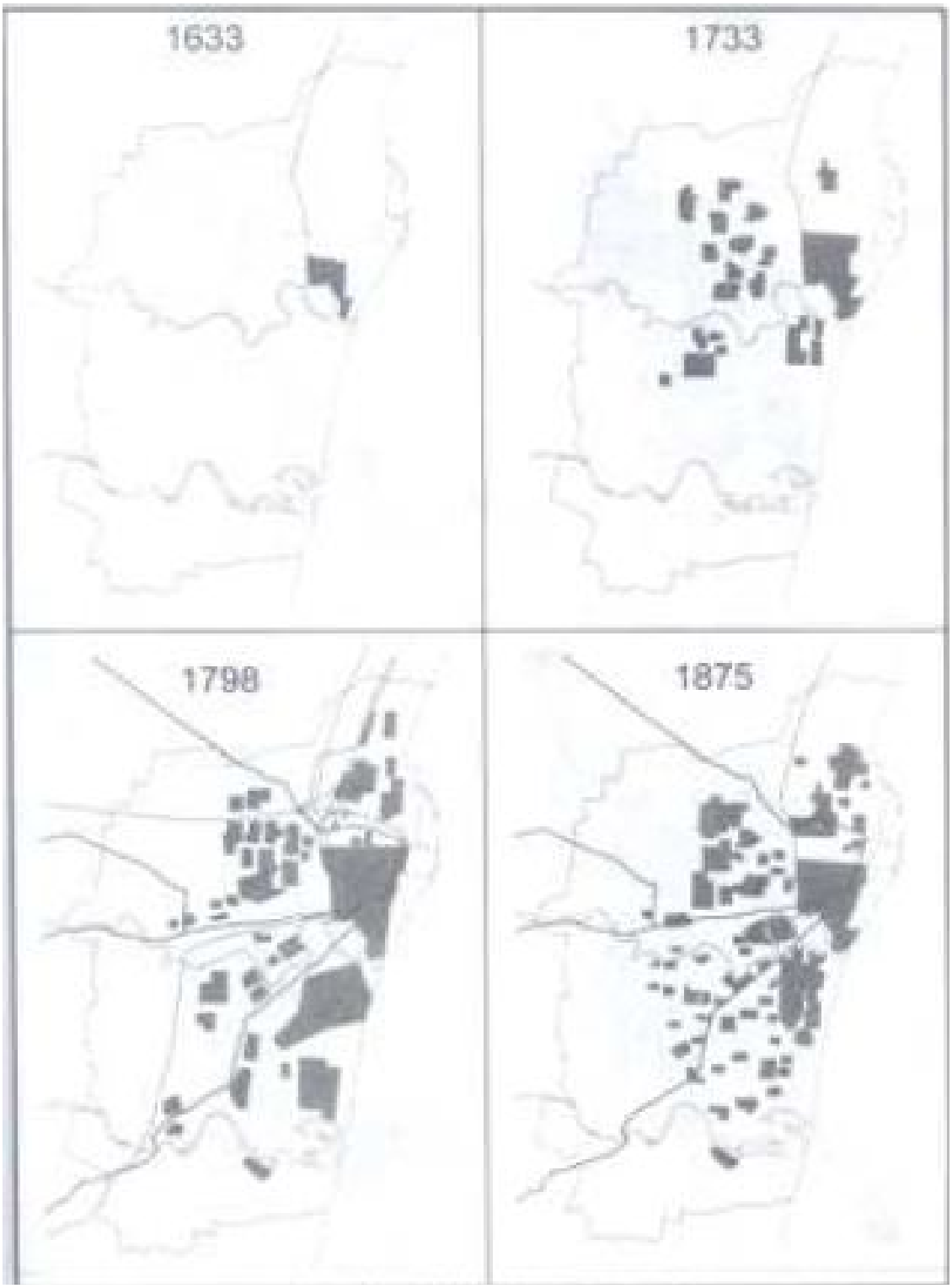


Figure: 51 Growth of Chennai Since 1923(source gupta and Nair).

Growth of Chennai from 1923 since:

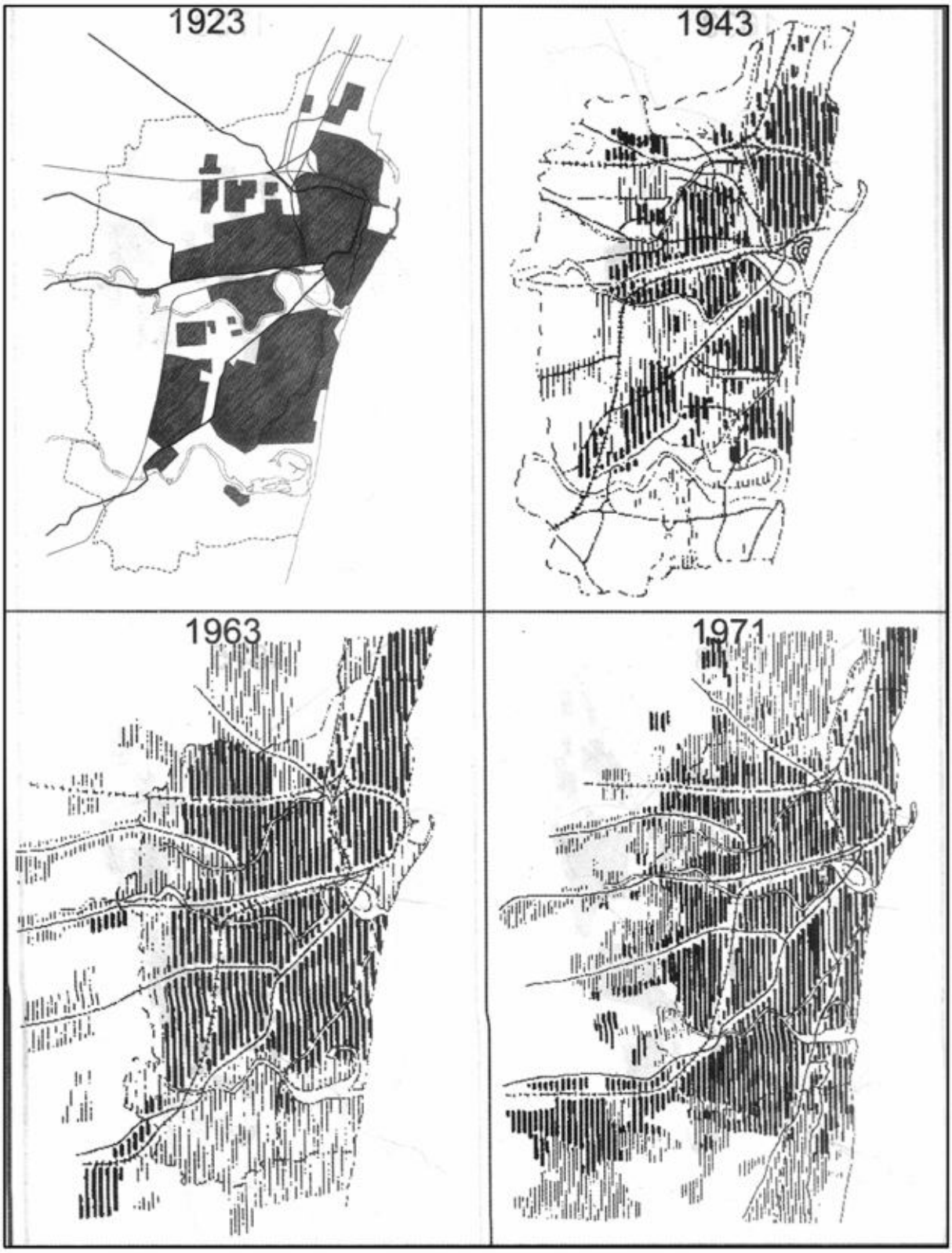


Figure: 22 Growth of Chennai Since 1923(source gupta and Nair).

8.4. Main problems causes flood in Chennai:

Chennai faces a number of risks, partly climate-related, but also human-induced such as waste disposal, water contamination and lack of drinking water, suburban sprawl and Mismanagement in urban planning.

Due to the plain terrain Chennai lacks natural gradient for free run-off. This necessitates an effective storm water drainage system. The sewage system in Chennai was originally designed for a population of 0.65 million at 114 liters per capita per day of water supply; it was further modified during 1989–1991, but is now much below the required capacity. Cooum and Adyar rivers in Chennai city are almost stagnant and do not carry enough water, except during the rains. These rivers play a major role during floods, collecting surplus water from about 75 and 450 tanks in their respective catchments. Chennai municipal area has a network of canals and channels within its boundary. Buckingham canal, originally a navigation channel and waterway till 1954, now serves only as a drainage channel.

The physical growth of Chennai from 1923 to 1971, the population has grown by eight Times in the period 1901–2001 and per hectare population density have increased from 80 to 247. Chennai has a large migrant population from other parts of Tamil Nadu and other parts of the country, accounting for 21.57% of the Chennai population in 2001. There are three major water courses (Cooum, Buckingham Canal and Adyar) in Chennai city and the banks of all the areas encroached by Slums (number recorded to be 30,922) have developed here without basic amenities and are subjected to flood every year. They often pollute the water courses, thus worsening the health situation.

8.5. Meteorological and hydrological aspects:

Several catastrophic floods in Chennai in the past (1943, 1976, 1985, 1996, 1998, 2005, 2010) were caused by heavy rain associated with depression and cyclonic storms, leading to floods in major rivers and failure of drainage systems. Chennai was severely flooded due to heavy rains (16–20 cm, attributed to a trough of low pressure from the Gulf of Mannar to the Southwest Bay off the Tamil Nadu coast) during 30 October–2 November 2002. Residential areas became ‘islands’ and were cut-off, paralyzing life, services and trade, including transport, communication, etc. On 5 November 2004, heavy rainfall (6 cm within 24 h or less) caused flooding and water logging in many areas, inundating most of the slums. A deep depression over the Bay of Bengal brought 42 cm rainfall in around 40 h during the NE monsoon of 2005. Several floods were reported during 2006, 2007 and 2008. Closing of schools due to flooding every year is Common in many parts of Chennai. The Chennai Municipal Corporation has identified 36 localities as flood risk hotspots.

Since the beginning of the 20th century, Chennai has witnessed a steady deterioration of and decease in water bodies and open spaces. It is estimated that in Chennai city more than half of the wetlands have been converted for other uses. Chennai had about 150 small and big water bodies in and around the city, but today the number has been reduced to 27. The important water bodies include Adyar Estuary, Adambakkam Lake, Ambattur Lake, Chitlapakkam Lake, Ennore creek, and Korattur swamp, Madhavaram and Manali Jheels, Pulicat Lake, Vyasarpadi Lake, besides Buckingham Canal, Coovum and Otteri nullah. Ownership of water bodies is scattered among various

government departments and is the root cause for lack of proper management. The Protection of Tanks and Eviction of Encroachment Act came into effect on 1 October 2007.

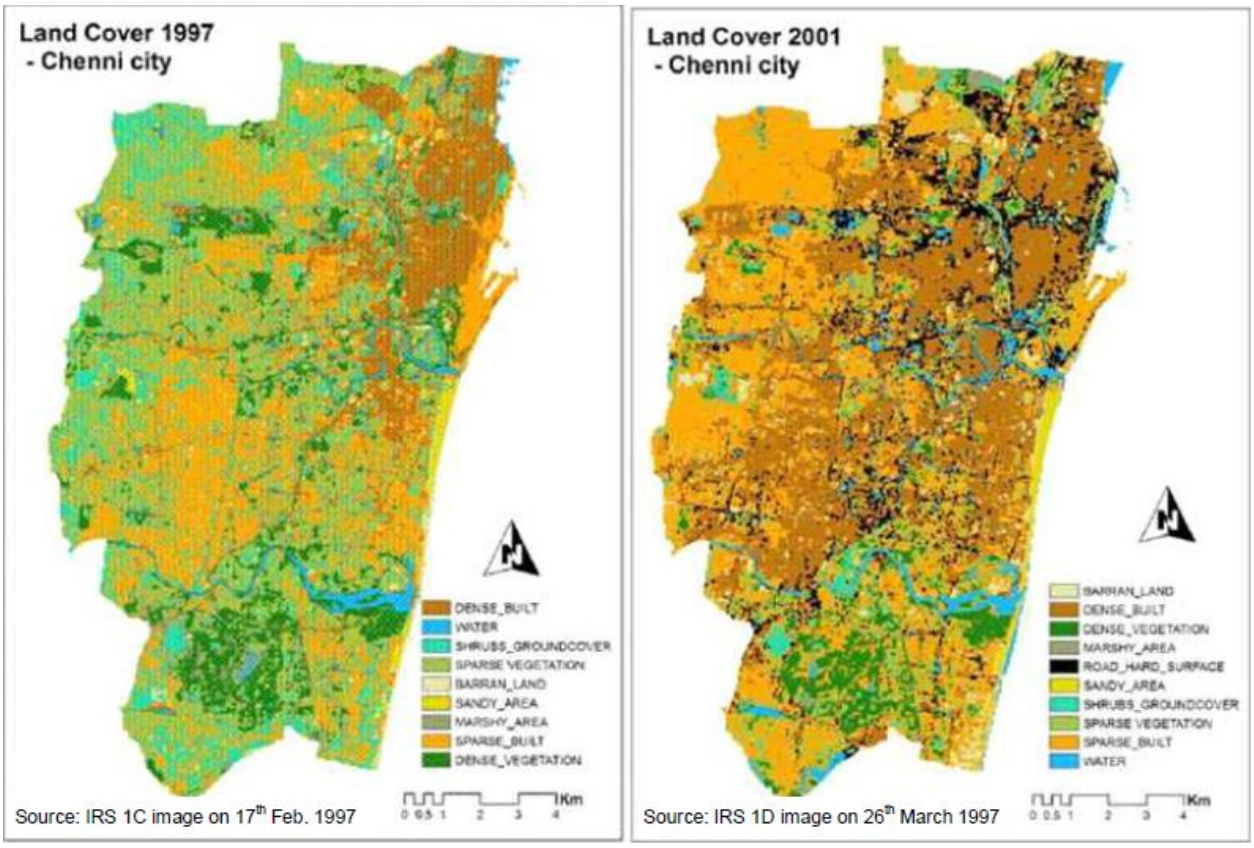


Figure: 23 Chennai city's land-cover (Source: Sundaram, map India, 2009).

8.6. Urban land use changes, governance and floods:

Causes of increased flooding in Chennai are identified as

(a) Uncontrolled urban sprawl and loss of natural drainage. Drainage channels have been blocked and urban lakes filled and encroached, canals degraded and polluted, heavily silted and narrowed. A 1994 survey revealed waterways contamination and anaerobic digestion led to sludge accumulation causing hydraulic hindrances.

(b) Inadequacy of storm water drainage system and lack of maintenance (Dresher et al., 2007). City has only 855 km of storm drains against 2,847 km of urban roads. Plastic and polythene constituents to the storm water stream along poor or no maintenance aggravates floods.

(c) Increase in impervious surfaces. Paving of roadsides, park and open areas causing flood severity and condition for following droughts.

(d) Lack of coordination between agencies. Lack of unified flood control implementing agency that could integrates the functions of Corporation, Development Authority, Public Works Department, Slum Clearance Board, Housing Board, etc., adds to weak points.

Figure: 24 Degradation of Lake Madhuravayal.

Figure: 25 Loss of temple tanks.

Figure: 26 *a*, residential area backing onto the Cooum river, Cooum river narrowed by encroachments.

Figure: 27 Slums and high-density poor settlements.

8.7. Comparative analysis on Chennai and Tours city.

S.NO		CHENNAI	TOURS
1.	COUNTRY	INDIA	FRANCE
2.	REGION (state)	TAMIL NADU	CENTRE
3.	DEPARTMENT	CHENNAI	Indre – et – Loire
4.	COMMUNE(municipality)	16 MUNICIP, 20 TOWN PANCHAYAT, 214 VILLAGES, 10 PANCHAYAT UNION	7 commune
5.	MAYOR	M.SUBRAMANIAM	JEAN GERMAIN
6.	AREA	174 KM²(67 SQ MI)	34.36KM²(13.27 SQ MI)
7.	POPULATION	4,681,087(2011)	1,36,942(2006)
8.	DENSITY	26.903/KM²(69.678/sq mi)	3.986/KM²(10,320 /sq mi)

9.	TRIBUTORIES	KOOVAM – CENTER ADAYAR – SOUTH	LOIRE – NORTH CHER - SOUTH
10.	TRANSPORT	ROAD,MRTS,AIRWAYS ,SEA PORTS	TGV, AIRWAYS
11.	WATER BODIES	RED HILL LAKE, SHOLAVARAM LAKE,CHEMBARAMBAKKAM LAKE	
12.	CANALS	BUCKINGHAM CANAL	
13.	FOREST AREAS	33%,3.01 SQKM AREA	
14.	LANGUAGE	TAMIL	FRENCH
15.	ELEVATION	6.7 M – 60 M	44 M – 109 M
16.	TYPE OF SOIL	CLAY,SHALE AND SAND STONE	
17.	CITY REGIONS	NORTH – INDUSTRIAL AREA SOUTH & WEST– COMM/RESIDE CENTRAL – COMMERCIAL	CENTRAL – COMMERCIAL NORTH & SOUTH – COMMERCIAL/RESIDENTIAL
18.	CLIMATE	TROPICAL	OCEANIC
19.	MAX – TEMP	38 – 42°C	32°C

20.	MIN – TEMP	18 - 20°C	-4°C
21.	AVERAGE RAIN FALL	140CM(55inch)	652MM(25.7inch)

Table: 12 Comparative Analyses on Chennai & Tours City.

8.8. Flood images in Chennai:

Figure: 28 Arial Views from Olympia IT Park. 100 feet road looks like a lake.

Figure: 29 Water stagnation in inner ring road.

9. Flood Area Map for Chennai city.

9.1. Map of Chennai

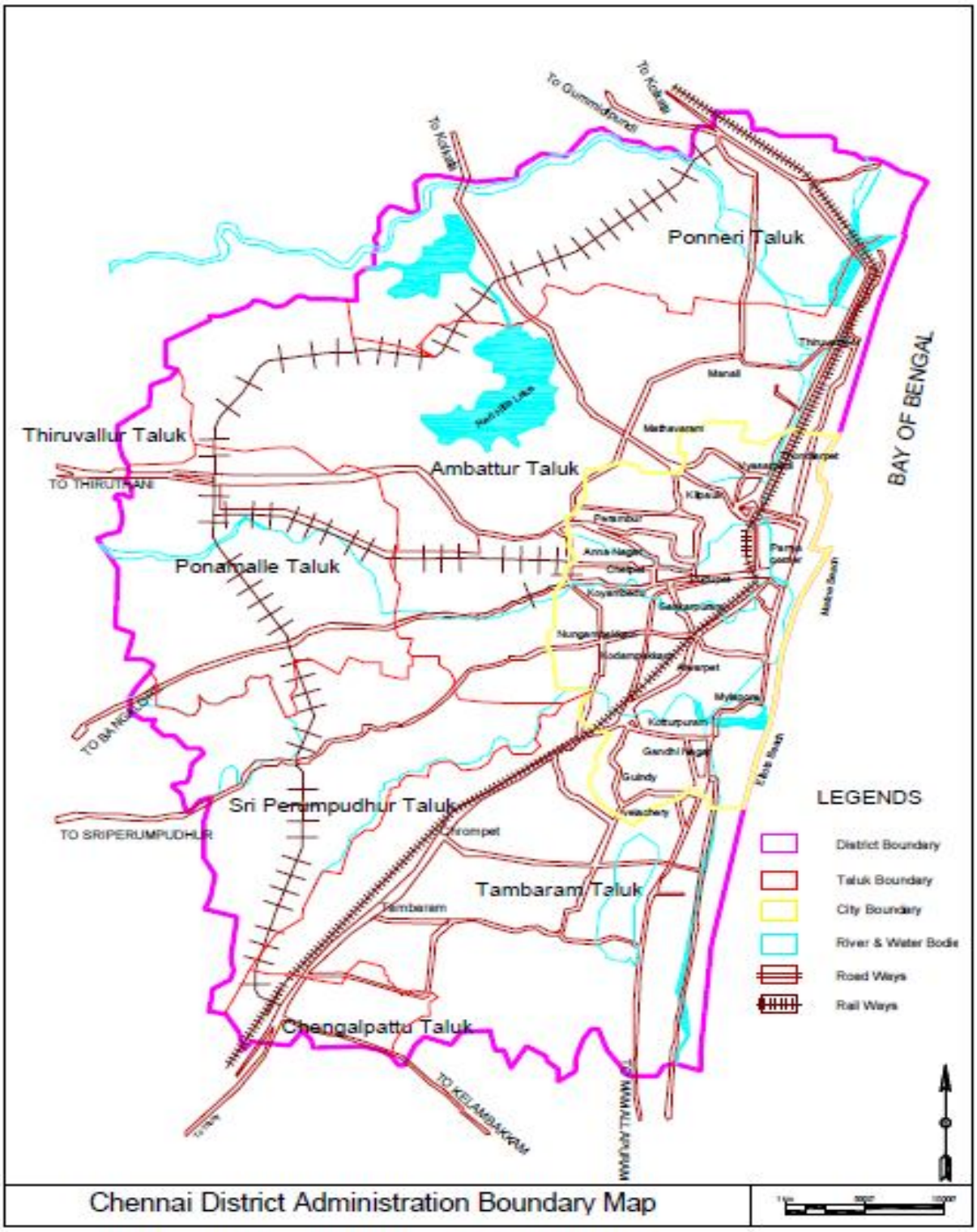


Figure: 60 Chennai District Boundary Map

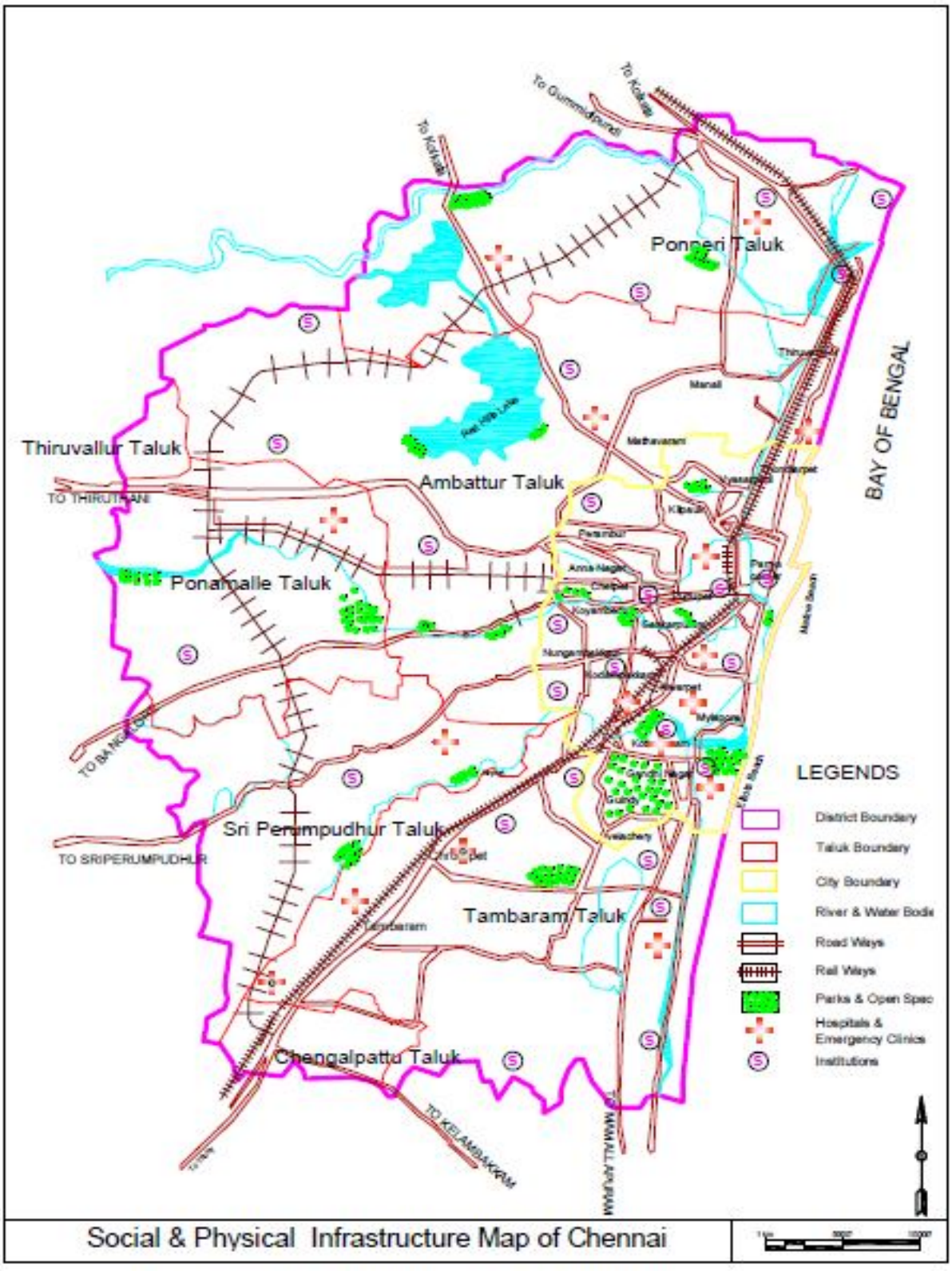


Figure: 31 Social & Physical Infrastructure Map of Chennai

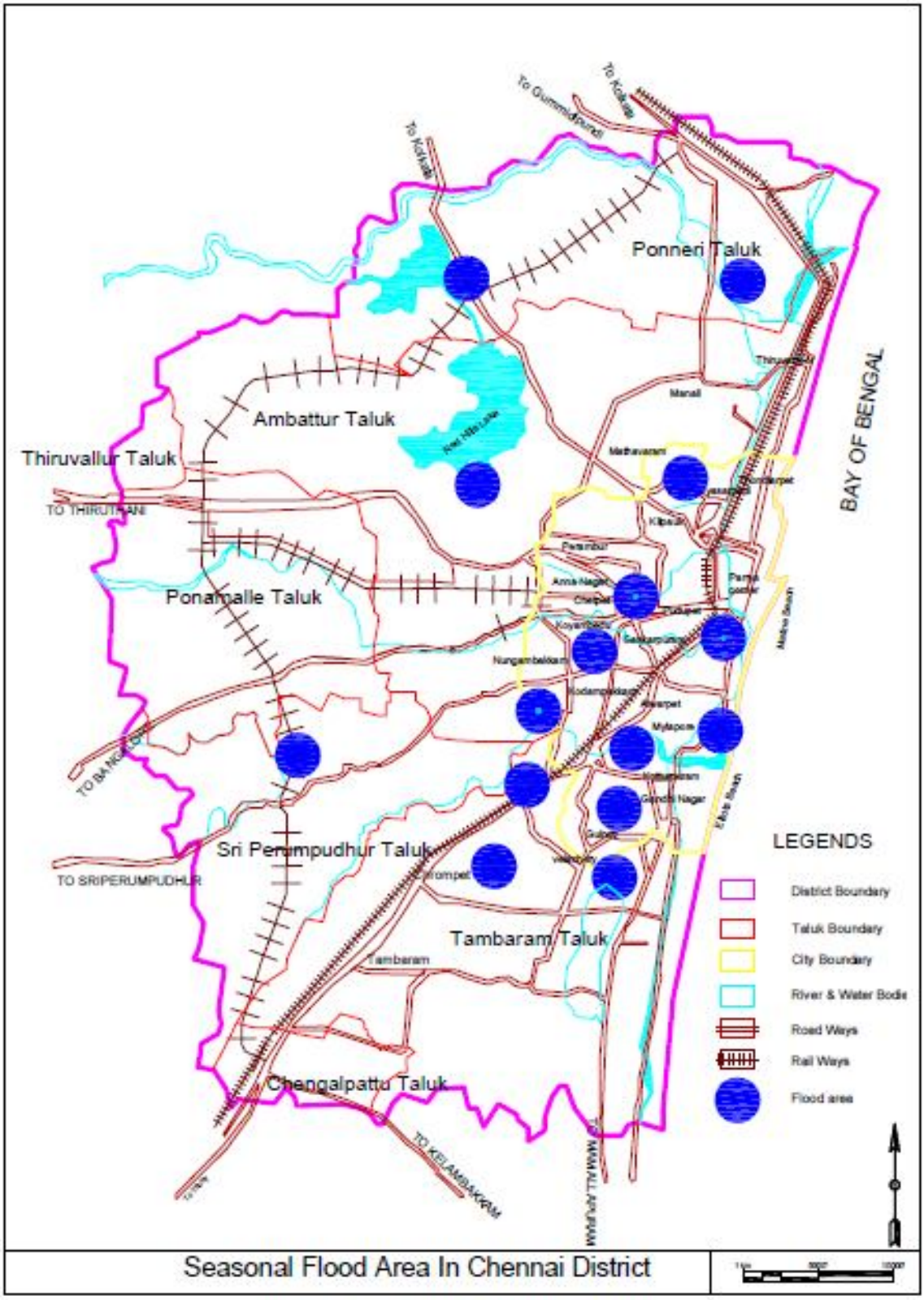


Figure: 32 Seasonal Flooded Area of Chennai.

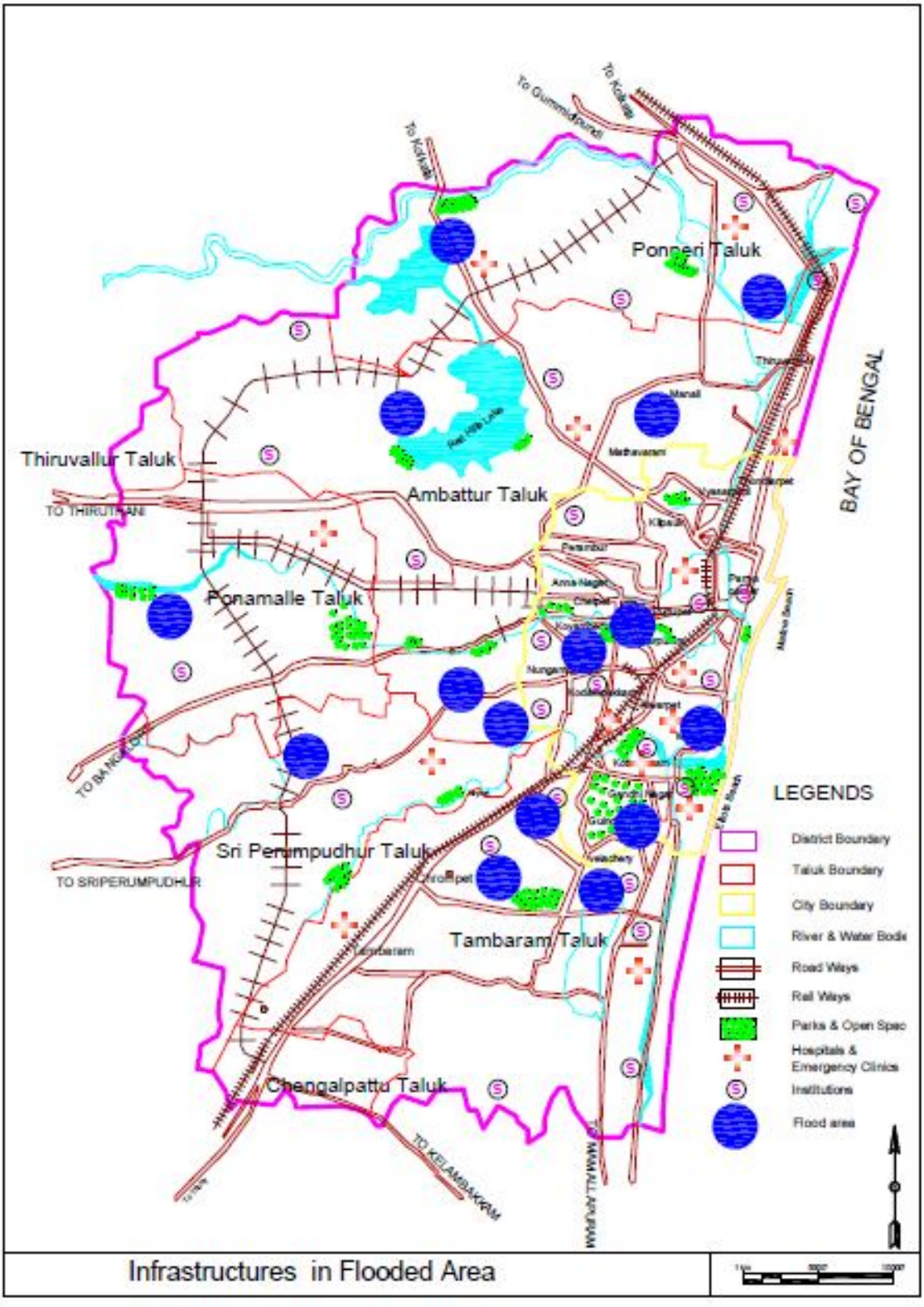


Figure: 33 Mitigation & Recovery Area Map of Chennai.

10. Conclusion.

In this research I conclude the comparative study of flood management particularly the non- structural methods (roles & responsibilities of the actors who are involved in the disaster management and particularly flood hazard), and the land use zone planning of the both nation France and India, then my case study on Chennai district says the growth of Chennai from 1633 to 1971 and major problems of the growth particularly about the flood problems in Chennai for this I made different maps for Chennai city.

1. Identification of major flooded areas.
2. And mitigation areas near by the flooded areas they are Hospitals and Institutions.
3. And these maps are useful for reduce the major losses and damages for public and private.

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