Floods in Chennai in 2015

A documentation of urban flood management and disaster preparedness for lessons for urban governance

Citizen consumer and civic Action Group (CAG)

This report provides a summary of the research and documentation efforts undertaken by CAG as part of the Way Forward Chennai initiative and was supported by a grant from Action Aid. It was authored by Pavithra Sriram and Satyarupa Shekhar, with support from Om Prakash Singh, Pramyudh Muralidhar, Madonna Thomas and Rajesh Ramamoorthy, CAG, with overall guidance and support from Kirtee Shah, INHAF and Tara Murali. CAG.

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1 Way Forward Chennai - a pan India initiative

In the last few years, several cities in India, including Mumbai, Srinagar, Chennai and several towns in Assam, Arunachal Pradesh and Nagaland, have experienced disasters and calamities caused by heavy rains and droughts. These have disrupted normal life, caused death and destruction, and paralyzed vibrant city economy.

Early perceptions and the authorities' claims of "natural disaster" have come under public scrutiny. Poor city planning; governance failure; inadequate disaster preparedness and management; illegal and unauthorised constructions, violation of planning norms and building byelaws; neglect, abuse and destruction of the natural ecosystem in form of waterways, streams rivers, mangroves, vegetation, etc.; and communications and administrative failures have surfaced in different measures as causes of the destruction and devastation. While the resilience of the city's middle and upper classes are eroded by these occurrences, the ability of the poor to absorb the stresses and adapt to the shocks are worn down.

Often in respite we forget to learn from these experiences to build a better future and improved resilience to future disasters. Instead, we resign ourselves to the inevitability of calamities and disasters with questionable accountability. It is imperative to understand the phenomenon and dig into the causative factors in some depth to find and suggest remedial measures. The repeated cycles of floods and droughts are a serious warning for us to act in addressing the matter collectively to ensure a safer tomorrow that is inclusive.

1.1 Who we are

In response to this context, Way Forward Chennai (WFC) is a platform focussed on bringing together individual practitioners and organisations to advocate for inclusive and credible responses to urban disasters by looking at the areas of (a) city planning and development, (b) protection of the natural ecology, (c) disaster preparedness and management, (d) post disaster relief and rehabilitation, and (e) governance.

It has three interdependent objectives:

1. **Understand** urban floods by looking at factors that contribute to losses and damages; relief, rehabilitation and restoration response efforts; urban systems that are required for urban infrastructure and disaster management; and the gaps that exist.
2. **Develop** a set of viable responses to urban disasters drawing from the experiences of citizens; promote knowledge sharing between citizens, practitioners, experts and institutions; and foster a multi-dimensional and multi-sectoral understanding of urban disasters.
3. **Support** the advocacy for systemic changes that respond to the local contexts and address the needs of city residents, especially the most vulnerable groups; and foster partnerships between communities, governments and organisations.

The platform measures success against its vision statement: WFC supports practitioners to create knowledge, develop credible responses to urban disasters, and influence agendas to build inclusive and sustainable urban cities.

1.2 What we do

WFC does not discount the roles and responsibilities of city and state authorities in urban planning and disaster management. It, however, emphasises and underscores a need for citizen action and participation, and lays stress on leveraging the latent capacity and potential of communities and civil society.

To meet its objectives, the partners of the coalition will undertake the following activities

1. Support the collection, creation and curation of information, data and analysis on various aspects of urban floods in order to understand the causes of the devastation, the institutional structure for planning and disaster management, and to identify the gaps in information and response strategies.
2. Learn about the experiences and the relief, rehabilitation and restoration efforts made by conducting interviews and public hearings, and developing a set of credible responses by fostering partnerships between citizens, civil society, academia, media and business groups.
3. Share knowledge gathered from research and public hearings, and fostering partnerships with city governments to make interventions that draw from this knowledge

1.3 Who we work with

Way Forward Chennai (WFC) is an inclusive and open forum conceived and designed by three core team members of the coalition are Habitat Forum – INHAF, Action Aid and Citizen Consumer and Civic Action Group (CAG), with CAG functioning as the secretariat for the platform. The platform will build a larger network of professionals, organisations, volunteers and philanthropists to aid and support the objective of creating inclusive and responsive cities.

Habitat Forum (INHAF), a non-profit society, was set up in 1999. It serves as a national level 'synergy' platform for NGOs, individuals, groups and agencies to exchange information, share learning, debate, plan joint action, advocate causes, represent concerns, undertake capacity building, and network on issues shaping urban and rural development. INHAF deliberates on policies, programs, projects, investments, and institutional arrangements that shape urban and rural settlements, within the framework of inclusivity, equity, disaster resilience, and sustainability.

ActionAid India is an anti-poverty agency, working in India since 1972 with the poor people to end poverty and injustice together. Together with the people, we claim legal, constitutional and moral rights to food and livelihood, shelter, education, healthcare, dignity and a voice in decisions that affect their lives.

Citizen consumer and civic Action Group (CAG), established in 1985, is a non-profit and non-political organization that works towards protecting citizens' rights in consumer and environmental issues, and promoting good governance processes including transparency, accountability and participatory decision-making.

2 Introduction

The floods in December 2015 were a warning to Chennai. Fuelled by a strong El-Nino, an excessively warm Bay of Bengal led to relentless rains through November. On December 1st,the century record for 24 hour rainfall was broken, causing a deluge across the city, its suburbs and even adjoining districts. On the face of it, the problem may be simple to understand. Historically high rainfall, pouring down over a very short period of time, overwhelmed the capacity of our principal reservoirs and drainage systems leading to extreme flooding. Apart from the fact that the city was paralysed for over a week and there was no warning to communities of the impending disaster, there are two more disturbing factors that complicate the analysis. First, our natural drains were overwhelmed not just because of the quantum of rainfall, but rapid unrestricted urbanisation had led to significant shrinking of the size of water bodies as well as inadequate capacity of drainage networks; Secondly, while this might be a historic high, effects of long term climate change may lead to an increase in frequency and severity of extreme weather events. For the city to avoid such a catastrophe in the future and become resilient to the threats of climate change requires a radical analysis of this problem and a profound shift in the manner in which we distribute urban resources, plan our cities and govern them.

There has been a lot of debate over the poor management of storage at the primary reservoirs of the city and whether or not, the release of surplus water played a critical role in flooding the city. While this might be an immediate cause for the deluge, it is important to recognize that urbanisation of Chennai, has rendered dysfunctional, the region's flood mitigation system that had evolved over centuries prior to the emergence of Chennai. It is to be noted that the city is very flat and has trouble draining water into the sea during the North-East Monsoon season, (which is particularly known for its short, heavy spells of rain) Thus the region had evolved a network of artificial tanks and lakes that could not only act as storage of runoff water, but also help in regulating the flow of water by channeling the flood waters to rivers and marshlands before draining into the sea.

Over the last many decades, the concentration of economic activity and the growing urban population has encroached upon large parts of this intricate network of tanks, canals and overflow channels, leaving the system in disarray. Faced with the need for increased housing, developing transport networks and providing civic amenities to the burgeoning population, urban planning under CMDA has not prioritised the preservation of these water bodies and canal networks. These issues have only become accentuated with the neoliberal turn in our economy where there is a pressure to unlock urban land and resources for enhanced economic activity, rather than balancing social and environmental development. Legislations and judicial interventions have not been able to stem the loss of water bodies to public agencies, private institutions, and residential and commercial interests.

Any attempt to comprehensively tackle this issue and prepare for the effects of climate change over the next few decades will necessitate a complete evaluation of the extent of the losses of ecologically sensitive lands and the short as well as longer term consequences. This involves a comprehensive mapping of the loss of storage capacity of water bodies, the loss of catchment areas due to urban growth, the extent of reduction of the carrying capacity of our rivers, marshlands, canals and other drains, due to

incessant construction on the water bodies, dumping of debris and encroachments. While many groups and individuals have already worked on various sections of the city, a systematic collation of the data and a city wide mapping of this information is an essential requisite moving forward.

3 Literature review

3.1 Urban flood management

This paper, authored by Carlos Tucci, was a collaborative effort of the World Meteorological Organisation and Cap-Net International Network for Capacity Building in Integrated Water Resources Management.[1] According to Tucci, flood impact is one of the most significant disasters in the world. More than half of global flood damages occur in Asia. Causes of floods are due to natural factors such as heavy rainfall, high floods and high tides, etc., and human factors such as blocking of channels or aggravation of drainage channels, improper land use, deforestation in headwater regions, etc.

The Urbanisation Process

Urban development accelerated in the second half of the 20th century with high concentrations of population in small spaces, and impacts on the terrestrial and aquatic ecosystems and on the population itself through flooding, disease and reduced quality of life. This process occurs owing to poor control of the urban area leading to direct effects on the water infrastructure: supply, sanitation, urban drainage and river flooding, and solid waste.

The process of urbanisation spearheads an unhealthy situation of

- Unsustainable growth
- Degradation of quality of life and environment
- Constant population increase. However, population could be stabilized if migration is controlled.

Impact of Urbanisation

- Over-population in small areas within a larger context of city
- Uncontrolled growth of cities
- Urbanisation is spontaneous
    - Planning is concentrated for middle and high income groups
    - Absence of spatial planning thus building on dry rivers and flood plains
- Inability of the municipality to plan and anticipate urbanisation and invest in the planning of safe and suitable spaces for urban development.
- High employment, income and housing deficit.

[1] Tucci, K. E. (May 2007). Retrieved from http://www.gwp.org/Global/GWP-SAm_Files/Publicaciones/Gesti%C3%B3n%20de%20Inundaciones/Gestion-de-inundaciones-urbanas-ing.pdf

Urban Infrastructure Planning

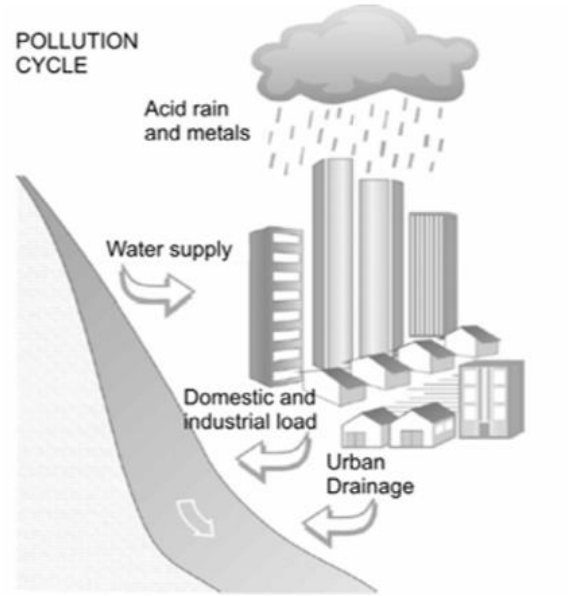
Urban planning is carried out for the formal city, and there is hardly any analysis of land-use trends for the informal city. The main problems related to water infrastructure in the urban environment are as follows:

- Untreated Sewage
- Sewage discharge
- Settlement of Flood plains
- Silt accumulation in urban rivers
- Deterioration in water quality
- Insufficient knowledge for the authorities
- Inadequate professional engineers
- Sectoral approach to urban planning
- Lack of management skills

Urban Water Systems

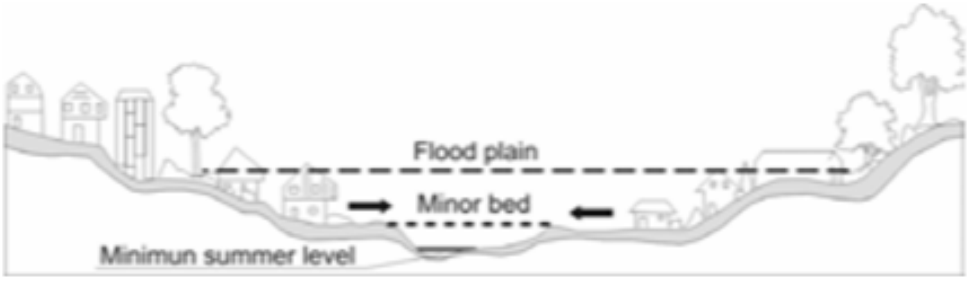
The main systems related to water in the urban environment are as follows:

- Source water
- Supply of the water
- Treatment of sewage effluent
- Urban Drainage control
- River Flooding Control



Flooding of Riverside areas

Rivers generally have two beds: the minor bed, where the water runs most of the time. The minor bed is delimited by the risk of 1.5 to 2 years. Flooding occurs when the water runs above the level of the minor bed and enters the major bed. The levels of the major bed determine the magnitude and risk of the flooding.



Flooding of a river's major bed is a natural process, as a consequence of the water cycle. When the population settles the major bed, which is a risk area, impacts are frequent. These conditions are caused by the following actions:

- Cities' urban development master plans generally impose no restrictions regarding the settlement of areas at risk of flooding; the number of years without flooding is enough for entrepreneurs to divide up these areas for urban settlement;
- Invasion of government-owned areas near rivers, by low income population;
- Settlement of medium-risk areas, less often flooded, but when they are they suffer significant damage.

The main impacts on the population are:

- Material damage and loss of life;
- Interruption of economic activity in the flooded areas;
- Infection by water-borne diseases such as leptospirosis, cholera, etc.;
- Water pollution by flooding of dumps of toxic materials, treatment plants, etc.

Current management offers no incentive to prevent such problems, since when a flood occurs the municipality declares a public emergency and receives resources that are not monitored since there is no need to make public invitations to tender to spend them. When most sustainable solutions involve non-structural measures and restrictions on the population, a mayor is unlikely to choose such a solution, as the public generally expects some structural works to be carried out. To implement non-structural measures, the government will have to interfere with the interests of the owners of risk areas, which is politically complex at local level.

Flooding due to Urbanisation

Flooding is becoming more frequent and severe owing to the impermeabilisation of the soil and the construction of storm drain systems. Urban development can also create obstructions to runoff, such as sanitary landfills, bridges, inadequate drainage, obstructions of runoff and conduits, and clogging.

As the city develops, the following impacts generally occur:

- Increase in peak flows (up to 7 times, Figure 1.5) and in frequency owing to the higher runoff capacity through conduits and canals, and impermeabilisation of surfaces;

- Increased sediment production from unprotected surfaces and production of solid waste (refuse);
- Deterioration in quality of surface and ground water, owing to street cleaning, transport of solid material and clandestine sewage and storm water connections;

Flood Management

The institutional environment of flood control in developing countries is not generally conducive to a sustainable solution. There are only a few isolated measures by a few professionals. In general, flooding receives attention only after it occurs. The problem tends to be forgotten after each flood, and remembered the next time. This is due to several factors, including:

- City planners uninformed about flood control;
- Disorganisation at federal and provincial (or departmental) levels on flood management;
- Insufficient technical information on the topic for engineering graduates;
- Political losses for public administrators when implementing non-structural control (zoning), as the public is always expecting a hydraulic structure;
- Public uninformed about flood control;
- In some places there is no interest prevention flooding, as when it occurs, resources are handed out free of charge.

River-Flood Control Measures

- Structural Measures
  Structural measures are those that alter the river system by means of structures in the watershed (extensive measures) or in the river (intensive measures) to prevent flood water overflowing into the flood plain.
    - Extensive measures
        - Vegetation Cover
        - Control soil Erosion
    - Intensive Measures
        - Reservoirs & dams
        - Dykes and Polders
        - Alterations to the river
            - Deepening the section of the river
            - Reducing roughness of the river bed
- Non-Structural
  Non-structural measures are those in which the losses from flooding are reduced for the convenience of the population, using preventive measures such as flood warnings, zoning of risk areas, flood insurance, and individual protection measures ("flood proofing").
    - Forecasting and early warning systems
    - Zoning areas prone to flooding

Zoning of Flood map

Zoning is actually the definition of a set of a rules for the settlement of the areas at most risk of flooding, with the aim of minimizing future material damage and loss of human life as a result of major floods. This means that urban zoning will allow rational development of riverside areas.

- Flood Belt
    - Construction of roads and bridges should ensure no blockage
    - No backfills to obstruct run off
- Restricted belt
    - Farming
    - Sports grounds
    - Parking lots
- Low-risk belt
    - Small scale development with warning of minimum flooding

In any urban planning, these area must therefore remain unobstructed. The following technical criteria are generally used:

- Determine the high water level for a 100 year return time of the level that delimits the flood plain.
- The flood belt is the one that avoids raising levels for the main bed and for the flood plain. Since this value cannot really be zero, a minimum acceptable increase is adopted for the main bed.

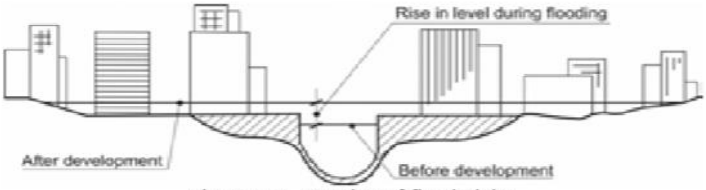
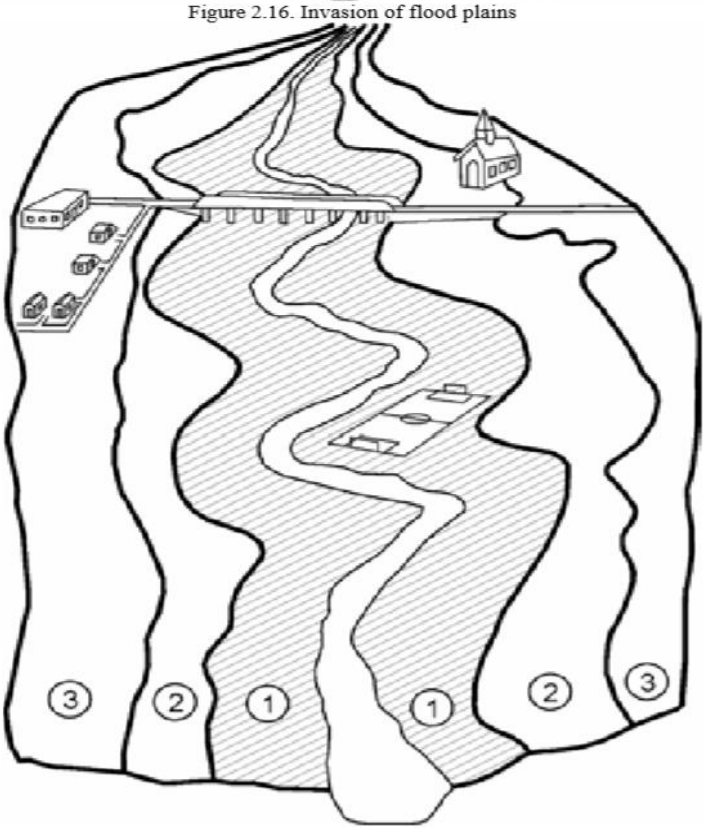
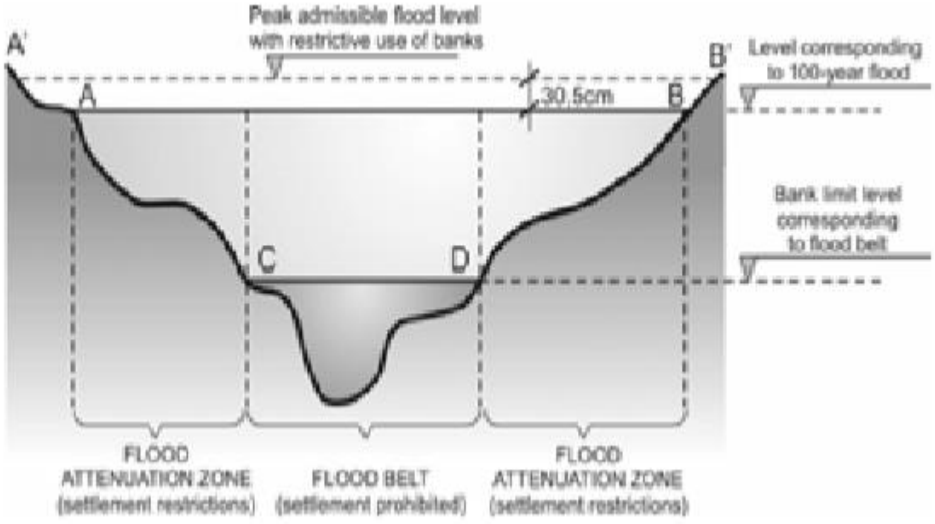
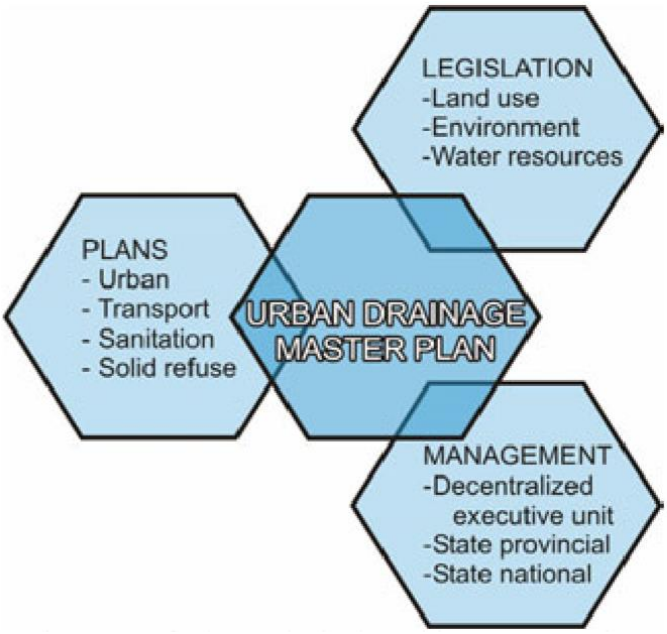


Figure 2.16. Invasion of flood plains





Integrated management, in the sense of interdisciplinary and intersectoral integration of the components of urban water, is a necessary approach for achieving results in line with sustainable urban development.

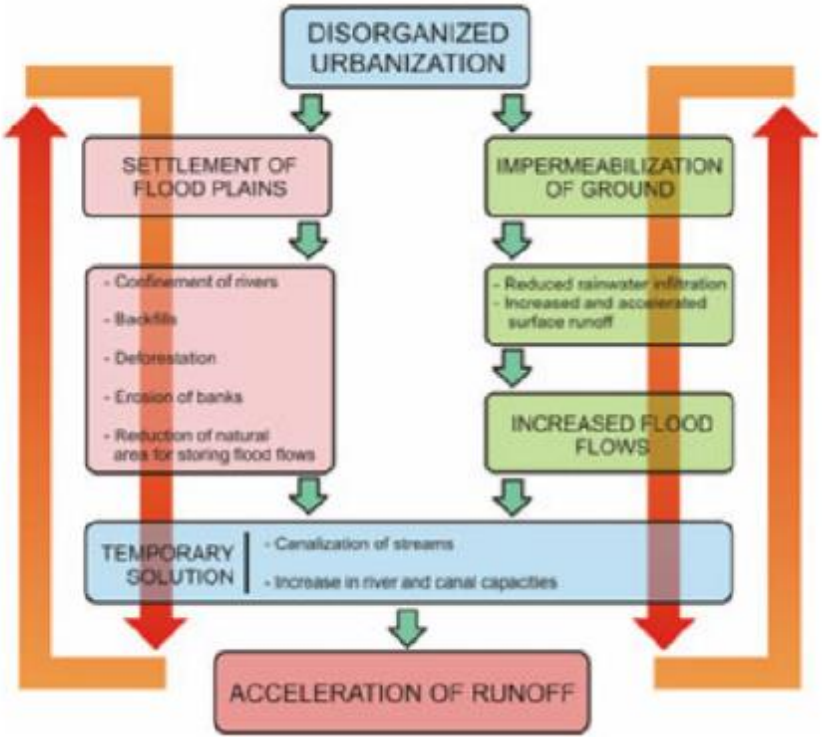


What is wrong and what can be done to remedy the situation?

- Urban development must not take place without considering the sustainability of the place where people are settling. In order to achieve this rules for land use and settlement must be defined that preserve the natural conditions and enable the system to handle transport, water supplies, sanitation systems, effluent treatment, urban drainage, and refuse collection, processing and recycling;
- The water supply must be provided from reliable sources that are not contaminated by other sources upstream;
- Excess sewage must be treated so that the water used is not contaminated and the water system can recover;
- Urban drainage must preserve natural infiltration to avoid transferring downstream the increased flow, volume and contaminant load from storm water runoff and soil erosion;
- Solid refuse must be recycled to encourage sustainability, financial exploitation of this resource, and the disposal of the remaining material must be minimized.

The development of planning of urban areas mainly involves:

- planning of urban development;
- Transport;
- Water supply and sanitation;
- Urban drainage, and flood and erosion control;
- Solid refuse;
- Environmental control.



3.2 Legislative Framework

3.2.1 Water (Prevention and Control of Pollution) Act, 1974

This is an Act to provide for the prevention and control of water pollution and the maintaining or restoring of wholesomeness of water, for the establishment, with a view to carrying out the purposes aforesaid, of Boards for the prevention and control of water pollution, for conferring on and assigning to such Boards Powers and functions relating thereto and for matters connected therewith.[2]

3.2.2 Coastal Regulation Zone

A notification under Section 3(1) and section 3(2)(v) of the Environment (Protection) Act, 1986 and the Rule 5(3) (d) of the Environment (Protection) Rules, 1986 declaring the coastal stretches as Coastal Regulation Zone (CRZ) and imposing restrictions on industries, operations and processes in the CRZ was published vide S.O. No. 114(E), dated 19th February, 1991.[3]

According to the CRZ notification 1991, the coastal stretches of seas, bays, estuaries, creeks, rivers and backwaters which are influenced by tidal action (in the landward side) up to 500 metres from the High Tide Line (HTL) and the land

between the Low Tide Line (LTL) and the (HTL) are called Coastal Regulation Zone. The notification imposes restrictions on the setting up and expansion of

[2] Ministry of Environment and Forests http://envfor.nic.in/legis/crz/crznew.html

[3] Ministry of Environment anf Forests http://www.moef.nic.in/legis/water/wat1c1.html

industries, operations or processes etc., in the Coastal Regulation Zone (CRZ). For the purpose of this notification, the High Tide Line (HTL) will be defined as the line up to which the highest high tide reaches at spring tides.

The distance from the High Tide Line (HTL), to which the proposed regulations will apply in the case of rivers, creeks and backwaters, may be modified on a case by case for reasons to be recorded. However, this distance shall not be less than 100 metres or the width of the creek, river or backwater, whichever is less.

3.2.3 Penal Action – Deviation of building bye-laws

The Authority reserves the right to take action and to debar/black list the Town Planner, Architect, Engineer, Supervisor or Plumber, if found to have deviated from professional conduct or to have made any misstatement or on account of misrepresentation of any material fact or default either in authentication of a plan or in supervision of the construction against the building Bye-Laws and the sanctioned building plans.

3.3 Governance Framework for Urban Flood Management in Chennai

3.3.1 Chennai City Topographical survey

On the basis of a topographical survey and its detailed analysis, the city was divided into 4 drainage basins and these basins further sub divided into 12 watersheds:

- North Basin
  - Kolathur Water Shed
  - Captain Cotton Canal Water Shed
  - Otteri Nullah Water Shed
- Central Basin
  - Mambalam & Nandanam Water Shed
  - Cooum Water Shed
  - Virugambakkam & Arumbakkam Water Shed
- East Basin
  - Royapuram Water Shed
  - North B Canal Water Shed
  - Central B Canal Water Shed
  - South Canal Water Shed
- South Basin
  - Adyar Water Shed
  - Velachery Water Shed

Quality checks for Storm Water Drains and Canals

- Usually Storm Water Drain will be provided in 12 m road and above.
- The minimum size of the drain will be 600X750 mm; the size will be designed depending upon the catchments area, land pattern and discharge.
- Under JnNURM Scheme, Storm Water drains are designed to relieve Water Stagnation in the Water logging areas irrespective of the width of the road.

- In Bus Route Roads Storm Water drains are provided usually in the footpath.
- The height of the drain top will be 6 inch above the road level.
- The Slab level should be lowered at all the entrance gates. The top Level of the Slab and man-hole doors should be flush with the footpath Slab level.
- In all roads crossing the Slab Should be flush with road level. The drain should be in straight alignment.
- SFRC (Steel Fibre Reinforced Concrete) / FRP (Fibre Reinforcement Polymer) Man-hole door with chute pipes to be provided at every 5 m interval with chute pipe.
- In addition to that Inlet Chambers with Rain Water Harvesting is also provided at every 30m intervals to collect the rain water and to increase the ground water level.
- Pre-cast RCC drains are proposed according to the site condition with inlets at 10m interval.
- PVC Pipes should be provided to accommodate the electrical and other utilities in Storm Water Drain crossings

3.3.2 Corporation of Chennai (CoC)[4]

The departments under the CoC include Town Planning, Storm Water Drains, and Solid Waste Management.

Town Planning

The CoC issues building permits to all types of buildings including the special buildings, multistoried buildings and group developments for which planning permissions are issued by CMDA.

Storm Water Drains

The flat terrain of Chennai City needs effective Storm Water Drainage System to prevent water stagnation in roads. The terrain of Chennai city is flat and average level of the land in the city is only 2.5m above the Mean Sea Level (MSL). Because of this flat terrain and partial coverage of roads with storm water drains, flooding and water stagnation happens in the city during the monsoons.

- The Storm Water Drain Department of Greater Chennai Corporation Constructs and maintains a network of Storm Water Drains and Canals of 1660.31 km in the city.
- Greater Chennai Corporation also maintains 31 canals criss crossing across the Chennai City. Rain Water runoff gets drained through Storm Water Drain network & canals and reaches the Sea Via five Waterways- Otteri Nullah, Buckingham Canal, Adyar River, Cooum River and Kosathalaiyar River -running across the city.
- Building Plans are sanctioned only if Provision is made for Rain Water Harvesting in the plans.

De-silting of Storm Water drains

[4] Corporation of Chennai http://www.chennaicorporation.gov.in/

- De-silting operations of Storm Water Drains are done by the respective zones. The de-silting of Storm Water Drain is done in a cyclic manner and is carried out twice in a year. This activity is being carried out in a weekly programmed manner throughout the year either with the use of departmental de-silting gang or through contract labors.
- Greater Chennai Corporation maintains 16 canals in the old city and 15 canals in the expanded areas. De-silting of canals maintained by COC is done every year using men and machineries.
- The silt removed is taken away and dumped in Kodungaiyur and Perungudi dumping grounds or at designated places.

Solid Waste Management

Headed by a Superintendent Engineer, the department looks after removal of solid waste which is a major responsibility of the Corporation. Every day 4500 MT of garbage is collected and removed from the city.

Location	Kodungaiyur
Extent	Area around 200 acres.
Total number of years in use	30 Years
Neighborhood	Within one K.M (are in existence)
Daily Waste disposed	2100 to 2300 M.T
Location	Perungudi
Extent	Area around 200 acres .
Neighbourhood	Within 0.5 KM (formed after dumping)
Number of years in use	25 years
Daily waste disposed	2200 tons to 2400 MT

3.3.3 Chennai Metropolitan Development Authority (CMDA) [5]

The Chennai Metropolitan Development Authority (CMDA), formerly known as Madras Metropolitan Development Authority (MMDA) is the nodal planning agency within the Chennai Metropolitan Area.

For the purpose of defining building bye-laws, CMDA is enforcing the Tamil Nadu Town & Country Planning Act, 1971 with rules called Development Regulations (DR) and Greater Chennai Corporation enforces Chennai City Municipal Corporation Act, 1919 governed by rules called Chennai City Building Rules, 1972.

In 1995, CMDA initiated a programme for improvement of environment in Urban Local Bodies (ULB) within the Chennai Metropolitan Area. It has to abide by CRZ area regulations, including:

- The coastal stretches of seas, bays which are influenced by tidal action in the land ward side up to 500 metres from the high tide line (HTL)
- Estuaries, creeks, rivers and back waters which are influenced by tidal action in the land ward side up to 100 metres from the high tide line (HTL) and the land between the low tide line (LTL) and the high tide line (HTL).

[5] Chennai Metropolitan Development Authorityhttp://www.cmdachennai.gov.in/

- Developments in this area shall be regulated with reference to the CRZ classifications and regulations notified by the Government of India from time to time under section 3 of the Environment (protection) Act, 1986. Details of the Regulations (on the date of preparation of Master Plan) are given in Annexure X.
- Aquifer recharge area: The areas, which have good aquifers and recharge potential have been declared as aquifer recharge area.
- Catchment area: Redhills and Puzhal lakes are the main sources of water supply to the Chennai city. In order to protect this water source from the negative impacts of the urban development's contiguous areas in the catchments of these lakes has been declared as 'Red Hills catchments area'.

3.3.4 Public Works Department (PWD) , Government of Tamil Nadu[6]

The **Public Works Department of Tamil Nadu** is a state government-owned authority, and is in charge of public sector works in the State of Tamil Nadu. It is part of the Ministry of Public Works Department, and is entrusted with the construction and maintenance of buildings for most of the government departments and public undertakings, and the construction of bridges, roads, and infrastructure.

3.3.5 Disaster Management and preparedness

The **National Disaster Management Authority** constituted by GoI under the provisions of the Disaster Management Act, 2005 (Act), concentrates on preparedness, mitigation, rehabilitation and reconstruction and also formulates appropriate policies and guidelines for effective national disaster response and relief works.[7] The **State Disaster Management Authority** headed by the Chief Minister of the State, the State Executive Committee headed by the Chief Secretary of the State. The **District Disaster Management** Authorities are headed by the District Collectors.

National Level

- NCMC
  - Under the Cabinet Secretary
  - To oversee commands, control and co-ordination of Disaster Management in the country
- MHA – Min. of Home Affairs
  - To co-ordinate the response and relief work
  - To provide financial aid and logistic support to the State Govt
- NEC – National Executive Committee
  - To co-ordinate response
  - To give directions to Ministries and Departments, State Governments, State Authorities
- All other concerned national level departments, ministries and organisations to help provide Emergency Support Functions (ESF)

[6] Public Works Department, Government of Tamil Nadu http://www.tn.gov.in/department/25

[7] Standard Operating Procedure for Responding to Natural Disasters (2010). Disaster Management Division, Ministry of Home Affairs, Government of India http://ndmindia.nic.in/SOP-NDM-2010.pdf

State Level

- SEC – State Executive Committee
  - Provides directions to any department of the state government
- DDM – Dept of Disaster Management
  - To work in co-ordination with the SEC and implement decisions of the SEC
- All other concerned state level departments, ministries and organisations to help provide Emergency Support Functions (ESF)

District Level

- DDMA
  - Directly under the Collector/ Dist. Magistrate/ Deputy Commissioner
  - Co-ordinate response
  - The collector directly is the focal point for command and control for disaster management

Emergency Operations Centre

- To receive and process disaster alerts and warnings from nodal agencies
- To monitor emergency operations

National Level

- NIOC – National Integrated Operations Centre
  - At New Delhi – 24x7 operational with state of the art equipment
- Back-up NIOC
  - In case the main NIOC is not functional
- SEOC – State Emergency Operation Centre
- DEOC – District Emergency Operation Centre

National Disaster Response Force

- General direction and control of NDRF is vested with NDMA
- Command and supervision of the Force is vested in Director General of Civil Defense and NDRF
- Constitutes 8 battalions drawn from Central Para Military Forces
- 18 specialized search and rescue teams

NDMRC – National Disaster Mitigation Resource Centre

- Co-located with NDRF battalions
- Stores sufficient resources for 72-96 hours
- Act as facilitators between State/UT departments and the Centre

RRC – Regional Response Centre

- Set up by CPMF
- Equipped with minimum cache of equipment to deal with floods, cyclone, earthquakes etc.
- NDRF teams can be prepositioned in these RRCs when disaster in imminent.

SDRF – State Disaster Response Force

- Responsible for taking preparedness measures and building response capacity as per their vulnerability to disaster
- Undertaken by the state government in consultation with the NDMA and MHA

SDMRC- State Disaster Mitigation Resource Centre

- State govt to set up resource centre based on their requirements to pre-position essential supplies.
- The state responsible to constantly evaluate their own capabilities to handle the situation

Fire & Emergency Services

Civil Defense

Armed Forces

- The NDRF should progressively reduce deployment of the Armed Forces.

3.4 Criticism of institutional performance

3.4.1 Comptroller and Audit General (CAG)

The report states that the State Disaster Management Authority (SDMA) was constituted in 2008 and the District Disaster Management Authority was established in January 2012.[8] However, the SDMAs and DDMSs in five out of the six test-checked districts did not meet even once and did not perform its statutory duties.

- A State Disaster Management Plan prepared in May 2010 is yet to be approved by the State Disaster Management Authority. Disaster Management rules have not been framed by the State Government. There was no dedicated manpower for the Disaster Management Authority.
- The vulnerability profile of geographical areas located within the districts has not been prepared and efforts to reduce the risk by disaster preparedness measures have not been spelt out.
- The Emergency Operations Centres which are the nerve centres of early warning system were non-functional and not in a state of operational readiness in the test-checked districts.
- 14 out of 59 early warning systems in Cuddalore district and all the 30 early warning systems in Nagapattinam district were not in working condition.
- The state has not constituted the Disaster Mitigation Funds at the State and District levels and has also not constituted the District Disaster Response Funds.
- Inadmissible expenditures under Calamity Relief Fund (which is allocated for immediate relief to victims on account of natural disasters), wherein the audit scrutiny of 2009-10 revealed that a sum of 20.39 crores was accounted for construction and reconstruction of bridges under the head 'Tsunami" and

[8] General and Social Sector, Report of the Comptroller and Auditor General of India for the year ended March 2012 (2013). Government of Tamil Nadu, Report 3 of 2013 http://www.agtn.cag.gov.in/audit1/GSS%20Audit%20Report%202011-12%20English.pdf

another sum of 0.45 crores was incurred for setting up automatic spinning units in tsunami affected areas.

- Vulnerability assessment of structures, prioritization and retrofitting of the lifeline structures and infrastructure were not done in Chennai city, which is in seismic zone III.
- The report also states that as per NDMA guidelines, mapping of the coastal wetlands, patches of mangroves and shelterbelts, identification of potential zones for expanding bio-shield based on remote sensing tools were to be done, which was not done.

3.4.2 Centre for Science and Environment (CSE) – Report on Urban Floods

In a press release after the floods, CSE said that the reasons of the flood episode can be attributed to bad urban planning, encroachment of water bodies, increase in extreme weather events, and the lack of preparedness. [9]

In a report in February 2016, Susmita Sengupta, CSE's expert on water, wrote:

- Groundwater was not considered critical for water supply, recharge was neglected by urban planners as they valued land, not water.
- There is no legal protection for city lakes, catchment and drainage systems. Water bodies and their catchment have been encroached upon or taken away for housing and other buildings
- South India – loss of lakes has been widespread
- Banglore had 262 lakes, not even 10 are healthy today.
- In Hyderbad, 3,245 ha of water bodies were lost between 1989 and 2001.
- Chennai – Pallikarnai marsh – which was 5000 ha in 1947 go reduced to 600 ha in 2010-11 due to urbanisation and mismanagement.
- Chennai had more than 600 water bodies in 1980s, but the master plan published in 2008 said that only a fraction of the lakes could be found in a healthy condition. According to records of the state's Water Resources Department, the area of 19 major lakes has shrunk from a total of 1,130 hectares (ha) in the 1980s to around 645 ha in the early 2000s, reducing their storage capacity. The drains that carry surplus water from tanks to other wetlands have also been encroached upon.
- Chennai's human-made drainage is no replacement for its natural drainage systems. A CSE analysis shows that there are natural canals and drains that directly connect the city with wetlands, water bodies and rivers such as the Cooum and the Adyar that run through Chennai. The Cooum is supposed to collect surplus water from 75 tanks in its catchment area within the Chennai Metropolitan Area, while the Adyar is supposed to carry the surplus water of about 450 tanks in its catchment area and also from the Chembarambakkam tank (which is not in its catchment).
- The analysis shows that there are natural canals and drains that directly connect the city with wetlands, water bodies and rivers such as the Cooum and the Adyar that run through Chennai. The Cooum is supposed to collect surplus water from 75 tanks in its catchment area within the Chennai

[9] Centre for Science and Environment. http://www.cseindia.org/content/cse-press-note-chennai-crisis

Metropolitan Area, while the Adyar is supposed to carry the surplus water of about 450 tanks in its catchment area and also from the Chembarambakkam tank (which is not in its catchment).

- "The government's own studies accept that the waterways in Chennai convey treated and untreated sewage and garbage together. These waterways, which are also the city's flood discharge channels, are encroached and built upon as well, severely reducing their flow," said Sengupta.
- Chennai's storm water drains are for a length of 855kms, against its urban roads are about 2847 kms

CSE made the following recommendations

- Need for strong laws to protect urban lakes
- Protection of lakes, feeder and catchment channels
- Urban planning should be integrated with the study of the geology and hydro-geology of the area
- Need for an umbrella association to protect and conserve the water bodies
- Central government should provide funds for water supply to only those cities that have brought their own water sources under protection. The cities must show they have optimized local water potential before claiming access to water from far away sources. The city can invest the saved money in treating sewage which pollutes the lakes and ponds in the first place.

4 Interviews

4.1 V. Geeta

A writer, translator, social historian and activist, V. Geetha is a freelance editor with a number of small research journals.

The reasons for the failure during the floods have been many, V.Geeta cited the primary reason to be the scale of the floods. On the same note she mentioned "Having spoken to several affected families, early warning systems and administrative failure have significantly contributed to the extent of damage". However, she does hope we have learnt the importance of planning ahead. She said "We can't hope to battle floods from August, when heavy showers are expected from September end. We have to be well prepared throughout the year, have mechanisms in place, say from April, and carry out surveys and study new settlements".

She authored the report of survey of losses during the floods and says "We must underlay the State's policy and understand that government manuals are of less help. There should be an introspection of the state government to cement the loop holes. Much of this lies on Political will. Advocacy groups must work alongside the public to create solutions and plan practically and essentially be area specific". In her opinion, the next steps to negate future events like this is important. She said "As a first step, flood maps will have to be made 10 areas minimum and understand the reason for destruction, fix culpability and the coping mechanism will have to be addressed. However, the most critical of them all would be to rebuild livelihoods" She concluded saying "It would be a lie to believe that we have recovered from the calamity. There is still undocumented loss in valuables, data, livelihood etc."

4.2 Jayashree Vencatesan

An environmental researcher, Jayashree Vencatesan works on issues of conservation and sustainable use of biodiversity and ecological restoration, with a special interest in wetlands. She has to her credit 30 scientific publications and one book.

"Failure was caused by all of us. Urban Planning in the city does not include experts from the concerned fields. They address only certain aspects and areas like geology, ecology get left behind with increase in the involvement of non-experts and their respective opinions. There is unfortunately also a disdain for science, and a belief that development and science are two different study aspects". Jayashree's expertise in biodiversity conservation resonated through the conversation with her. She mentioned that her organisation Care Earth has been working on the floods since 2005 from an ecological and habitat perspective.

However, she doesn't think that the city and its administrators have learnt anything from this episode. She said "I have attended about 16-17 meeting in Chennai post floods. Most came as an immediate response encouraging the rampant volunteer mood then. All civil society organisations have arranged for meetings but much less has come off it. The issue is that it is assumed that the floods were a 1 in 10 year event which can be handled." With regard to administration she said "The government loves disasters and the inflow of monetary help and social issues with which they make political gains. The civil society, government and research institutions must list their corrective measures to find a way forward."

While questioning development she said "We have reached the tipping point and there is no return from here. The essential difference between water logging and flooding must be understood. Water Logging will happen every year. And it is essential that it happens so that the ground water is recharged. Water logging is basically stagnation of water. Flooding however is rapid, unexpected and piles up. Flooding in the Chennai 2015 case was caused due to the mismanagement of the Chembarambakkam."

4.3 R.R. Krishnamurthy

Head of Dept, Department of Applied Geology, University of Madras

Prof. Krishnamurthy suggests that the cause of the floods can be primarily attributed to illegal construction, encroachments into wetlands and siltation of river and lake beds. He mentioned that several publications have been issued regarding climate related disasters. And these are in the public domain. He suggested "Individual Wards have to be studied and active involvement of the Chennai Corporation is necessary. Sensitize the people, involve associations in the communities and corporation intervention if need be."

Having worked with several governments, he said political will alters the course of steps to mitigate disasters such as these. In 2008-11, the Mayor of Chennai was involved in several disaster mitigation, prevention conventions – Asian Ministerial Convention, 2010 at Indiana, a Global campaign on city resiliency. However, 2011-15 there has been no work done on this front.

Also on the citizen front, he said local level preparedness measures must be taken. Scientific documents and data can be used for our understanding but not for the public. The University of Madras under his leadership partnered with a village Nemeli and its

local community. He mentioned that the village and the community survived the floods with less damage. The professor went on to state the responsibility of the media. “The media should be sensitive while publishing and disseminating data and must do without creating much panic” he said.

4.4 S. Manoharan

Previously involved with the IAMWARM project with the Public Works Department in Tamil Nadu

Manoharan said that the Chennai floods cannot be studied within the potical, statutory boundaries of the city. The hydrological basin, Thondaimandalam region includes Chennai, Tiruvallur, Kanchipuram, parts of Vellore and Chittoor. He mentioned that there are 4000 traditional water basins still existing in this zone, while 600-700 have disappeared. The factors causing this could be attributed to the ignored water basins, missing feeder channels, silt accumulation and the sluices remaining damaged. This has amounted to a 40% reduction in its capacity.

“The primary failure is in community ownership. I believe that the citizens fail to have an emotional relationship with their water bodies. The Civil society must partner with the government to evoke results. People have forgotten about alternatives in political democracy. Both the ruling and the major opposition party are not useful for the state’s development” he said.

His hope for change is instilled in the citizens the catastrophe has affected. He says “We must rekindle community responsibility. Some of the water bodies are created by people, they must voice their opinions and raise to save them. Without cynicism, I think there is hope ahead, however, the hope is instilled in the undertakings of the citizens. We must probe into the fact that old madras, the original cores of the city did not get affected during the floods. Newer developments and un-monitored growth has led to this catastrophe. Water will take its own course, it will reach the destination whether the urbanisation makes way for it or otherwise.”

4.5 Sudhir Kumar

Principal architect at People Architecture Commonweal. Member of PUCL

The Chennai floods, to Sudhir, was a cumulative failure. “The seeds for the recent phase of policy ascendance were sown during the rise of imperial power. The situation emerged out of removal of ability of the common man to make decisions. The government also has been extremely hierarchical. And not much has changed since independence and administrative priorities loosen the control people have on their local environment” he said. Weighing out unsolicitous development and disasters to follow, he said “Encroachment itself is inevitable at this pace of urbanisation, we have to understand that climate change is not a lie. And we have potentially not learned anything from 2015’s catastrophe.”

The short term and long term solutions ahead of us entail decentralizing power. He said “We have raise our voices against cleaning, and creating obstructions. We must hand over local people the control over their local resources. The interest completely lies in the local people. We must prioritize getting back to the community. Much cannot be expected from a Citizen Platform. It is a one off event, a platform which communities

approach for help and could link them with support. That is how PUCL's efforts were conceived."

The way forward from here is essentially reviewing priorities of growth and our position of consumption of waste. "It is not the Government's responsibility alone, businesses and individuals also contribute to this development. People come with a consumerist attitude" he said.

4.6 Sandhya Chandrasekharan

Fellow on Multilateral Environmental Agreements, Centre for Biodiversity Policy and Law (CEBPOL)- National Biodiversity Authority

Sandhya opined that the failure was systemic. The catchment reservoir was left open, the decision of opening of the sluice gates, unaddressed water scarcity and problems in urban planning. She hopes that we have learnt human ingenuity post catastrophe. She emphasized on the importance of ecological conservation, sustainable design and learn from other cities.

Cities constitute 2% of the area, and they consume 60% of the world resources. Cities have to necessarily become more sustainable and conserve our waterways and manage our waste efficiently. The Local government must understand sustainability and its importance alongside development. We must gather the critical mass and ensure sustained efforts. If the real estate developers are the key in development, we must bring forward key models for the developers to choose healthier options. She said "We must Focus on Localization at ward/ road level involving people. We have effectively learnt response however, prevention of the extent of damage during floods has not been acted upon. It is a Hercules task bringing people together despite personal commitments and instigating individual motivation."

The essential way forward would be to implement better natural resource management at the local level. There must be personalized efforts. Understanding "my house-my road-my garbage" concept and effectively find ways to keep every person's immediate neighborhood clean would render change.

4.7 Tara Murali

Architect, Advisor for Citizen, Consumer and Civic Action Group

The major reasons for the cause of the floods could be attributed to the capacity of the Chembarambakkam Lake, the pressure of the water and the ecological damage of the Pallikarnai marsh. To forge a way ahead, we must concentrate on actions and demands of the various finding and reports assimilated. Focus must be on the 74th Amendment Act to empower to local urban bodies to plan for communities.

Way Forward Chennai must facilitate dialogue between the citizens and the local authorities. We must ensure that the councilors talk about their flood experience, building key relationships and educating them. The efforts must render communities coming together. Key issues such as capacity building, infrastructure planning, relief and rehabilitation will have to be discussed.

4.8 Raj Cherubal

Director, Chennai City Connect

"There were three rains in total as per IIT Madras reports. One normal, one bad – major infrastructure of the city survived this; and the last one being beyond control". Raj mentioned. Failure is definitely is on the Urban Planning, destruction of lakes, illegal construction blocking natural water flow. The city is outdated. We need to bring about big changes to see significant change. We must facilitate lake connections.

Disaster Management in the city is also poor. While the prediction was good, precautionary measures were scrambled. However, we must acknowledge the good work of the citizens themselves. All that happened in December were Knee-jerk reactions.

We must learn from other countries and absorb citizen initiatives. We must encourage volunteers and strengthen the official machinery of disaster management. We must facilitate water to flow from West to East and remove illegal constructions. Roads built must double up as channels to carry water during floods. We must create ponds and lakes which would act as basins during rains. Gigantic parks surrounding the city could be created to work as ponds during excessive rains.

To forge a way forward, we must force the corporation for a strategy. Implement storm water drain plans and lake restorations. We could hope to reduce the extent of damage by 20% in one year, 50% in two years. The development plans for the city must also progress with 3, 5, 10-year plans and not directly have it predict the scale of development in 20 years

5 People's report on the floods and the way forward in Chennai

5.1 Agenda

Over the past three months, CAG undertook a documentation of the efforts made in Chennai during and after the floods in Chennai. As part of this documentation, researchers have interviewed activists, academics and practitioners in Chennai, and have also curated media reports on the topic.

What was evident is that Chennai received an unprecedented amount of rain that can be seen to converge with multiple weather phenomenon. The rains were concentrated over a few days causing massive surface run-off. When combined with mismanagement of water resources in terms of storage in various reservoirs and discharge through rivers and channels, the problem was compounded. In addition, we have seen that the carrying capacity of the rivers and channels has been greatly reduced due to indiscriminate construction and encroachments, and the disposal of construction debris and municipal waste. We can also observe the rapid degradation and destruction of natural catchment areas through the development of large scale housing and industrial townships that have altered the natural topography and hydrology of the areas, resulting in the inundation of these and surrounding neighbourhoods. All of this can be seen to result from poor urban planning, monitoring and enforcement. The city's storm water drains and sewage networks are inappropriate and inadequate.

Aside from unprecedented rain, all the other issues indicate how we have used land with little thought over its effects on environment and ecology. This is not the difficult element to understand and it is already widely appreciated. The pertinent research is to unravel the various motivations of citizens, commercial interests, administrators and policy makers that have led to this scenario. It is also important to analyse how we can establish policy and enforce them that would allow us to preserve and protect our ecological balance while securing to the city's residents, a secure and prosperous living condition.

Following this documentation, CAG invited several organisations and individuals in Chennai for a meeting. The objective of the meeting was to discuss the next steps that the coalition can make to meet each of its three objectives:

- We will agree on specific impacts on policy and practice that we would like to see emerge from the coalition over the next 3-5 months.
- We will identify what tasks can be undertaken and who could lead them in order to achieve these impacts.
- We would also seek suggestions on inviting individuals and organisations that can leverage their expertise for a meaningful impact by joining the coalition.
- We will invite suggestions for design of a public workshop to share experiences and learning from across the country.
- Lastly, we will discuss how we can ensure the financial sustainability of the coalition by raising funds to support coalition members to undertake research and action.

5.2 Minutes of meeting

Following an introduction of the members who had come for the meeting, the discussion began with thoughts from the group on the reasons for the recent floods in Chennai. One thought was that climate change was responsible for the heavy rains, and that it has happened in the last few years. Bad planning has contributed to flooding. These are the realities and people have to learn to adapt to changing climatic conditions.

Flooding of river banks have been common but the lateral extent and fury was more in the December floods. Also the intensity of rainfall for the 24-48 hour period was called once in 100 years. The river channels were unable to take up this quantum of water. Members of Arappor Iyakkam, a non profit organisation, have surveyed some major water bodies in the city. It explained that of the two connection channels to the Adyar river, one was completely encroached and non-existent now. The area affected by flooding last year was beyond the usual flooding of the river. Also several smaller water bodies have been built upon. Perumbakkam and Pallikarnai experienced greater flooding because of this. With regard to Chembarambakkam the elevation of the water bodies is much higher than the land which resulted in flooding of the river banks.

Information about "small and narrow water bodies" is available only with the tehsildars (Revenue officers). The CMDA reply to CAG's RTI about this information states that their master plan is a broad brush plan and shows only the major water bodies. For smaller ones "which come under other land use such as agricultural, residential, institutional, etc come under Revenue maps". Questions, including those about the legal status or present status of these water bodies, the need for them to be protected, and the absence of this information from the public domain, were repeatedly raised during the

discussion. It was also not clear about which government department was responsible for water bodies. One opinion was that those water bodies that are capable of supplying water for agricultural land of 100 acres come under the Irrigation department of the Public Works Department. Those water bodies whose irrigated area (aiycut) is less than 100 acres are owned by the local bodies in whose jurisdiction they lay. These maps are not available in public domain nor can they be easily obtained through the RTI. Everyone agreed that this information asymmetry hindered people's ability to hold the government accountable, and that understanding ownership of land on water bodies is critical for planning and governance.

With regard to discussion on solid waste management and storm water drains the participants agreed that in the city the storm water drains are silted and also elevation of the drains is not sufficient for rain water harvesting. Much of the debris and excavated earth of the Metro Rail have been deposited around the Villivakkam Lake. There is no regulation or monitoring of these wastes by the government. There is no proper connection to macro drainage systems. These are generally built very badly and require frequent maintenance. Unfortunately, there is insufficient, and inaccurate data available with CoC, and these are not adequate for planning and maintaining this critical utility.

Flooding happens because of restriction of and encroachment into the floodplains. The article on Chennai maps done by CAG show that the low lying areas are mostly in Perumbakkam, Pallikaranai, Ennore and Ponneri. The mangroves that are found along the Kosasthalaiyar and Capt. Cotton canal in Ennore and Ponneri are also under threat by conversion of land which belongs to the coastal regulatory zones into Revenue land and into land use for special and hazardous industries. Another important part is the conversion of agricultural land and its development by Govt agencies like SIDCO in Oragadam, Sriperambadur and Villivakkam without understanding the link between water bodies and indiscriminate rising of road levels that has isolated plots without thought to connecting channels for water flow. There is a lot of research that has to be undertaken in identifying the legalities of building in floodplains and land use conversion.

The floods have been seen as an opportunity by public agencies to push the poor out of river banks and used as a threat for relocation. The recent floods not only affected the poor, but also families from other classes who were isolated for a couple of days by the flooding and did not know the means for reaching out for help. Ironically, some of the poor probably knew when to move to safer areas because it was an annual feature for them. The structures built by the poor were not impediments to the water flow. There are still examples as to how the government is the main violator of its own rules and constructed building or allowed private persons to build on water bodies for civil servants or other officials and institutions.

The actions of government agencies are in contradiction to the policies of the government articulated after other natural disasters like the tsunami. There is a need to verify whether the guidelines followed were based on available disaster preparedness policies with the government. The Master Plan prepared by the CMDA does not seem to have taken into account hydrological information. After the floods PUCL had several meetings with different groups of stakeholders and this has been brought out as a report of the demands of citizens. Knowledge on older water bodies and flow of water is

still available with local people, who should be considered as an important source of this information. They also have a way of dealing with these natural phenomena. The idea of teaching them mapping after the floods so as to improve their skills of documentation however did not take off.

Saravanan one of the coastal community leader's mapping exercise was seen as an extension of this approach of control of the commons by the local people themselves. He has also recorded how communities have resolved their own problems through this strategy. Power over the commons must be devolved to people – this would be "direct democratic power". The current power structure has not involved participation and decision making by people.

This is the context in which the issue of hawkers who have occupied the parking space and the pavements in certain localities of Chennai needs to be viewed. Originally it was the owners of the illegal buildings that had tried to appropriate this space. However, while the poor need to be identified and hawking as a livelihood by them needs to be part of planning, all the trade that is taking place on the streets today are not conducted by the vulnerable but often are encroachments where business is big. The volume of business by these hawkers needs to be seen in context and comparison with the violations of the big shopping malls.

The discussion came back to the absence of high quality data in the hands of the public and the potential for detailed data collection gathering by citizens themselves. Critical data is important while making a case but these is not always available in the public domain. Particularly, government departments hold data that they do not share. After the floods many groups have tried collecting data and Mr. Suresh Babu shared that their team is ready to share this data. Prof. Janakarajan has surveyed more than 1500 tanks across the Chennai basin as part of his research, and CAG intends to use a simplified version of his survey to create a mobile survey form that different groups can use. There was a general agreement that this was desirable and possible.

There was a question on the need to be cautious about citizens gathering information about land accumulation and encroachments and the potential conflicts that it may create within communities. However, everyone agreed that information and data gathering need not result in results but can be seen as a process for getting people together to create a shared understanding of the problems in a larger scenario. The data may not remain unchanged for long durations of time and therefore is not important.

Data on issues such as water bodies, floodplains and drainage basins need to be recorded accurately. There was also a cautionary note that it is the responsibility of the government to record such data and put into public domain. It was agreed that asymmetry of information does not lead to peoples or communities participation. Communities must be able to access data relevant to them.

Participants expressed that there is a need for a new way of thinking and not depend on existing structures of the state. Even the ward councillors have only become an extension of the political system and do not represent people. This opinion was countered by the opinion that the State reflects the need for checks and balances. Small groups can also be very narrow in their outlook, often adversely affecting women and other disadvantaged groups, and in such cases bigger agencies may be more liberal. Communities need to also be seen as representatives of culture and tradition. While in

the urban scenario, these communities are often not easily visually identifiable, they exist and during certain festivals and functions make themselves apparent. During such times the state and government agencies recognise them, even if only obliquely.

To bring to a close, the participants were requested to contribute to a collaborative report that can be taken forward as a tool for advocating with the government and education for the communities. So each person present was requested to write one chapter which would go as a single report to understand what had happened in the past and what are the plans in the present and will be proposed for the future. The topics are as follows:

1. Evictions linked to natural disasters
2. Solid waste management
3. Evictions and the river restoration project (planned projects being distinct from natural disasters)
4. Need for social vigilance
5. Drainage
6. Popular control of the commons
7. Rescue and relief by civil society
8. Failure of urban planning
9. Community-based resilience programming
10. Violations of the CRZ and the implications on waterways and the coast
11. The role of Construction and Demolition (C&D) waste
12. Disaster policy and preparedness
13. Wetlands and water bodies
14. The role of the airport runway in the floods
15. Roads and transportation
16. Sanitation
17. Spatial visualisation of risks and vulnerabilities

6 Media Reporting

S No	Type of Documentation	Date	Title of document	Name of document/ paper/ website	Summary of the article	Relevant excerpts from the article	Source
1	Newspaper/ E-paper	20/12/2015	Chennai's encroachments on water bodies caused floods	Economic Times	The Article points out various expert opinions on the ill-effects of bad governance and legal, legalized and illegal encroachments in the Wetlands.	..on November 27, the Madras High Court passed orders on a public interest litigation (PIL) seeking to regularise illegal encroachments along the Kolathur tank near Chennai. Four days later, torrential rains hit the city. On the fifth day, large swathes of Chennai went underwater for over 24 hours, as the Adyar river swelled, washing away homes and belongings of those living near its banks. Close to a 100 lives were lost in the floods in Chennai alone and damage to property is yet to be calculated. "When speaking about encroachments, everyone talks about clearing slums," said Nithyanand Jayaraman, environmental activist. "Government wants to relocate them in worse, far-flung places. Experts point to various government owned structures within the city that are actually encroachments, many built upon water bodies themselves. The second runway of the Chennai airport, Koyambedu bus terminus, the entire IT Corridor, ring roads flanking the city and the Adyar Eco Park are some examples cited by them. We keep focusing on the water bodies rather than on the watershed," argued L Venkatachalam, professor at the	http://articles.economictimes.indiatimes.com/2015-12-20/news/69186456_1_water-bodies-adyar-river-slums

						Madras Institute of Development Studies, an environmental economist. "The entire watershed needs to be taken care of. This consists of three parts — the upper catchment area where rain water collects, the water body itself and the drainage system which carries excess water out to the sea. All three need to be protected. Now there is complete encroachment in catchment areas as well as the natural drainage system. That is why the Adyar river flooded," he said. "There are 3,600 tanks in these areas together, all of which drain into the three rivers going through Chennai. The original storage capacity of these tanks is around 40 tmcft, which is three times the drinking water demand for Chennai city. Most of these tanks have been encroached and have disappeared. We need to desilt them, protect the watershed and ensure that encroachments are removed," -Professor S Janakarajan, president, South Asia Consortium for Interdisciplinary Water Resources Studies (SaciWATERS)	
2	Newspaper/ E-paper	14/12/2015	Firstpost Investigation: Were the Chennai floods a government-made disaster?	First Post	The FirstPost article explains the effect of growth on environment and the adverse effects of disasters caused. It points out the Ignored warnings of the various departments, the report which suggested	A comprehensive development plan for Chennai, which was submitted to the government in 2009, was prescient in its understanding of what could befall a city groaning under the burden of ultra-rapid development. The recommendations contained in this report, prepared by a former bureaucrat, were ignored by the Corporation of Chennai (CoC). ..by around 10 pm (1	http://www.firstpost.com/india/firstpost-investigation-were-the-chennai-floods-a-government-made-disaster-2544516.html

					rehabilitation of Chennai's waterways to ward off future threats. But the report, submitted to the CoC on its request in September 2009, was dumped. It also reasons out the causes of the exacerbated damage and attributes it to the inexisting drainage systems and governance issues.	December), the water was being released at 29,400 cusec into the Adyar river, which was already in spate as engineers feared a breach of Chembarambakkam's boundary. It took three to four hours for the water to reach the city from the reservoir 25 km away, but by midnight on 2 December, land in a more than four-km radius around Adyar, which flows through the heart of Chennai, had gone completely under. To add to Chennai's misery, the gates were opened at around midnight, and without warning. The city and its citizens went under overnight. "The urban waterways in Chennai were reasonably healthy and pollution free until the middle of the last century. However, their condition deteriorated because of severe pollution and reduced carrying capacities. This can be attributed to the urban pressures on the waterways," former IAS officer MG Devasahayam Another important water body, the 48.3-km-long Buckingham Canal, has been destroyed. "The effect of urbanisation and industrialisation in and around the city and inflow of waste has converted the canal into a virtual open sewer," Devasahayam said. "Planning and design of drainage systems are deficient and typically not integrated with the drainage in the surrounding catchment areas," he said. Overall conditions of these waterways, the report says, can be rated "very poor because of high loads of sediment and	

						nutrients, high turbidity, highly obnoxious odours and very low levels of dissolved oxygen". More importantly, there is no data on where the drains are. "There is no correct map. It is also is unknown what the lifecycle of the drain is. If we do not have the lifecycle of the drains, we cannot actually know when it is supposed to be maintained," said environmentalist Satyarupa Shekhar, director, government outreach and advisory services, of (Chennai-based) Citizen Consumer and Civic Action Group. Vikram Kapur, principal secretary/commissioner of the CoC, told Firstpost that the civic body is "responsible for provision and maintenance of adequate storm water drainage in the city area. The mandate for development, maintenance and management of major drainage systems such as rivers, streams, water bodies is given to Public Works Department (PWD)". While he wouldn't go so far as to admit culpability, Kapur accepted that the city's appendages were handicapped. "The extended areas virtually do not have storm water network," Kapur said. "The chief minister has announced the project and we have sanctioned works, which have just started."	
3	Newspaper/ E-paper	13/12/2015	Chennai floods result of bad town planning; the new project that never took off	The Economic Times	The article is based on an interaction with Mr. RR Kuberan, a retired chief planner at CMDA, who helped in setting up the plans for the New Chennai and developmental	The December 2 floods in the city have raised many questions since — about official apathy, delays in taking crucial decisions, reservoir management and lack of coordination amongst rescue agencies. Urban planners agree that all of these were failures of the state government, but the more pertinent issue that has steered Chennai towards a	http://articles.economictimes.indiatimes.com/2015-12-13/news/69006359_1_chennai-metropolitan-development-authority-krishna-water-project-

			could have averted the havoc		plans for those charted out in mid 1990's if followed, the disaster in 2015 could have been averted. The plan kept the watersheds in and around chembarabakkam alive and helped in surrecting the area with planned establishments.	disaster of this magnitude is the utter lack of political leadership for decades. "Currently Chembarambakkam tank is utilised for irrigation purposes and it is to be converted as drinking water storage for city water supply system under Krishna water project," said the New Chennai (Urban Node) Project report. "In this context, these ayacut land can no longer be kept as wet land and the necessity to convert as dry land accompanied by the other developmental factors will shoot up the urbanisation in this area," it said. "As the pressure on housing increases, the private developers come into the field and lay out the vacant and agricultural lands into house sites and sell to the people who are looking for housing," explains the project report. "Such developments are either authorised or unauthorised...also the private developers develop land in a piecemeal manner or it becomes impossible to build water and drainage systems," it said. The idea was to create a planned city, keeping intact water bodies and natural drains in the area so as to minimise ecological damage. Individual development would also mean that costs of land acquisition and development would come down significantly. The project report envisioned that 80% of land owners were likely to go in for development on their own, leaving 20% of development to the state. Acquisition and development of this chunk was	city-water-supply-system

						worked out to a little over Rs 150 crore, a pittance for the government. The New Chennai Project was officially shelved in 2000. "The PWD has reported that out of 13,000 acres of ayacut area, 6,000 acres have been developed as house and industrial sites," stated the CMDA response in June 2002. "But on perusal of our approval register, about 1,200 acres only have been approved as housing/industrial sites. Thus, an opportunity has been missed out by the planning department to arrest haphazard development in a site, with potential for making orderly development on the line of the project report 'New Chennai'. Despite being the most urbanised state in the country, with 48.5% urbanisation, the state and its capital city have paid a huge price in the recent floods. Political leadership of various parties in the state would now need to come together, setting aside differences, to work towards salvaging what remains of ravaged Chennai. Generations to come will never have to experience floods if the existing rules are simply implemented in letter and spirit.	
4	Newspaper/ E-paper	10/12/2015	TN Relief Work Crawls in Beat with Amma's Nod	The Economic Times (Bangalore)	The Article expains the various gaps in governance and effects of a centralized decision making government module, such as the case in Tamil nadu.	"This is a chief minister who handled the double whammy in 2004 (tsunami) and 2005 (floods) extremely efficiently. The state already has an administrative decision-making hierarchy and technical decision-making hierarchy," said Devasahayam, who was the chief administrator of the Haryana Urban Development Authority. "This has been	http://epaperbeta.timesofindia.com/Article.aspx?eid=31815&articlexml=TN-Relief-Work-Crawls-in-Beat-with-Ammas-10122015001089

						rendered redundant now with all decisions being centralised." Many reports are emerging now about the delay in decision-making, especially about releasing water from the sluice gates of the Chembarambakkam reservoir which flooded the already swelling Adayar river flowing through the heart of Chennai. DMK leader and former Public Works Department minister for many years, Duraimurugan said, "The decision of lifting the sluice gates of Chembarambakkam need not have been waiting at the Chief Secretary's office, who in turn was sending a note across to the chief minister for approval. If the PWD minister was in touch with his officials and was assessing the situation constantly, the situation could have been handled much more efficiently."	
5	Newspaper/ E-paper		Chennai Drowning	The Economic Times (Delhi)	The article is iniated with opposition party accusations on the flaws of government in power. City experts further extrapolate the ill-effects of poor planning and disrespect to course of water ways and illegal construction on wetlands and marshes.	The politics began along with rescue and relief efforts. "This government has not put in place adequate measures to prevent flooding during monsoon," said M Karunanidhi, leader of the opposition party Dravida Munnetra Kazhagam (DMK) in a statement. "After the chief minister's return from Kodanad on No vember 8, why has she not reviewed rain preparations with the officials?" he asked. The DMK has accused the ruling All India Anna Dravida Munnetra Kazhagam (AIADMK) of scuttling a scheme initiated by them in 2009 which, they argue, would have prevented flooding in the city. "In 2007-08, the Chennai Corporation under the DMK government initiated a study by a Hyderabad-based consultant on how to prevent	

						flooding in the city," said M Subramanian, then mayor of Chennai. "We got `1,448 crore under the JNNURM (Jawaharlal Nehru National Urban Renewal Mission) scheme to construct concrete walls on both sides of storm water drains. The scheme was also meant to interconnect storm water drains so that overflow from lakes and reservoirs would go straight into the sea without causing flooding on roads," he explained. Subramanian charges the AIADMK government of abandoning the project on coming to power in 2011. "More than 25% of the work had been completed by 2010-11," he said. "But this government has stopped all the work.The project should have been finished by 2013 but no work has happened until now. The Corporation does not conduct regular reviews or spot inspections," he charged. This scheme targets connecting all outflows into one of the three main rivers that drain Chennai city -the Kosasthalayar, Cooum and Adyar rivers -as well as the Buckingham canal. For instance, overflow from the Porur lake would connect into the Virugambakkam canal which in turn would overflow into the Cooum river and finally to the Bay of Bengal. The series of close to 900 km of storm water drains in the city, both large and micro, were to be hooked up to ensure water keeps flowing out of the roads during monsoon. The Comptroller and Auditor General, in its report in 2013 and 2014, came down heavily on the Chennai Corporation for not implementing this scheme properly, citing defects in flood	

						mitigation plans, delay in disbursal of funds by the corporation and inadequate efforts to remove encroachments and utilities. Chennai Corporation commissioner Vikram Kapur told ET Magazine. “In some places the police told us there was no way to block arterial roads. In a few places, encroachments were an issue. In some places there were too many utility lines to be shifted. Even if the remaining 5% of the work was done, it would not have helped. We have seen unprecedented rains this year,“ he said. Kapur argues that Chennai was hit by its wettest spell since 1918, compounded by the fact that these lashed the city within an exceptionally short period. “We have been prepared for the monsoon for the past six months,“ he said. “We have desilted all storm water drains in the city. There is no storm water drain network in the suburbs which saw heavy rainfall. There was huge rainfall in the catchment areas, all of which are surplusing. All that water is entering Chennai. It is simple physics. Water can only flow from a higher ground to lower ground. When rivers themselves are flowing in spate, water will stay. The Corporation is not God. We cannot go against the laws of physics,“ he said. Kapur added that 500 pumps and 75 super-sucker machines had been deployed immediately, ensuring that roads were not flooded for more than a day. “No amount of man-made storm water drains can make up for	

						natural drains," said Jayshree Vencatesan of Care Earth, an environmental non-profit. "Urban planning has excluded or remained oblivious to hydrological concerns of the city as well as the fact that it is a coastal city," she said. Vencatesan explains that Chennai's original terrain comprised of a large number of lakes and marshes which have now been concretised with abandon. Areas like the IT Corridor of Velachery, Pallikaranai and Old Mahabalipuram Road (OMR) continue to face flooding even during a normal monsoon. This is due to the fact that over 5,550 hectares of wetlands in that area have been developed into commercial real estate. Only 10% of the original wetlands remain, acting as a sponge, soaking up rain water. The rest are now concrete. Rain water runoff has nowhere to go and settles instead onto roads, causing flooding. "We need a plan for Chennai that looks at a 50-year period," said Vencatesan. "We have to understand that a city's growth is inevitable. A cautionary plan needs to be put into place which doesn't disturb the ecology of the region.Planning for the future needs to take into account the events of the past. We have witnessed intensive rainfall once every 10 years.We must take these into account when making a plan," she said.	
6	E-Magazine	25/11/2015	Government of India should penalise Tamil Nadu govern	rediff.com	Interview with Mr. Devasahayam on the Tamil Nadu Floods	The way the government is run in Tamil Nadu, by both the DMK (Dravida Munnetra Kazhagam and the AIADMK (All India Anna DMK), is with no concern for rules, regulations and the expert master plan of the city.Everything is centralised	http://www.rediff.com/news/interview/government-of-india-should-penalise-tn-government-for-

			ment for floods'			around one person. It is worse in the case of the AIADMK; there is some amount of democracy in the DMK. Chennai is a water-starved city, but water that can serve the entire city for one whole year has gone down the drain. So where is the management of land? What you see is mismanagement of land. There is no institutional or governance system. What is unique about Chennai is there is a total autocratic, arbitrary government and corruption has become a culture here. Opposition parties are weak. The media's job is to expose, but they have become inept. Look at Chennai. The most flooded area has the largest mall in the city, which is near the forest, the river and right inside a lake bed. One of the largest private hospitals in the city was completely flooded for three days.	floods/20151125.htm
7	Newspaper/ E-paper	19/11/2015	Expert report on flooding ignored by govt, city pays	The Times Of India		"We recommended that construction activity should be permitted only outside ecologically sensitive areas. We also suggested that high-density development should not be permitted near sensitive areas," says Devasahayam. Leading Canadian planner Rob Story was the chairman of the committee in which there were experts from various disciplines. "Not only did the government ignore our report, it also allowed rampant construction activity even in aquifer recharge areas near reservoirs, where any form of development is prohibited as	http://timesofindia.indiatimes.com/city/chennai/Expert-report-on-flooding-ignored-by-govt-city-pays/articleshow/49838897.cms?from=mdr

						per the second master plan. No agency monitors this," said Devasahayam. Development of satellite towns is the right way to save wetlands and ecologically fragile regions as cities expand, opined Devasahayam. "These towns can be connected to the main city by transport corridors," he said.	
8	Newspaper/ E-paper	2/12/2015	Hit thrice in same spot, Chennai drowns	The Telegraph India	An account on the series of events that occurred with interviews with local people exerting their distress.	Chembarabakkam, the largest lake on the city's outskirts, which was almost brimming from last month's rain, received 47cm rain between Tuesday and Wednesday mornings. It prompted the authorities to release over 20,000 cusecs into the downstream Adyar river, which deluged colonies on either bank and submerged three bridges. A dozen other lakes near the city breached their bunds, inundating scores of housing colonies that had come up recently on reclaimed agricultural land or erstwhile irrigation tanks that land sharks had levelled illegally. "People built houses on water bodies and expected the excess rainwater to go elsewhere. Corrupt officials were only too happy to collude in this plan that had disaster written all over it," observed retired IAS officer M.G. Devasahayam. The state administration struggled to cope with the catastrophe. The army, navy and the National Disaster Response Force had to be summoned to move people to safety and ensure that basic services were in place for those bailed out of their homes. A senior member of a farmers' association said floods had	http://www.telegraphindia.com/1151203/jsp/nation/story_56432.jsp

						washed out up to four agricultural districts in the state, a major rice and sugarcane producing region. Authorities said more than a million people were affected, with some residents bemoaning the slow response of the relief teams.	
9	Newspaper/ E-paper	18/11/2015	Are floods caused by unplanned construction?	DT Next	An interview by DT Next with opinions from Tara Murali and Devasahyam upon the reasons of failure.	The Collector also urged people living in the vicinity of the Kosasthalai river to leave the low-lying areas and relocate to safer places as 1800mcft of water was expected to be expelled from Poondi reservoir. "Change in land use policy and allowing construction on former paddy fields, such as Velachery, OMR and Sholinganallur, has resulted in a massive change in the natural flow of water in these areas. Most of the water bodies are not desilted properly whereby their carrying capacity has declined from 100 cusecs to 50 cusecs or less," Devasahayam says. Velachery is barely 10 km from Chennai Central Station and one that has come up on a water body. To see images of its residents being ferried by boat the last few days has highlighted the acute need for better drainage systems in the city. The failure to desilt and plan for collecting rain water is another reason for the floods, say experts. "We need a very good rainwater harvesting culture to reduce the 'storm water load'. For a start, all the temple tanks could be re-activated just as the Thiruvanmiyur temple tank was done some years ago," Devasahayam adds.	http://www.dtnext.in/News/City/2015/11/18163953/Are-floods-caused-by-unplanned-construction.vpf

						Not enough data on road levels: INTACH Tara Murali, architect and convenor, INTACH, pinpoints what ails Chennai's infrastructure There is a master plan, but all areas do not have detailed plans. Even the detailed plans in existence do not have data on road levels, slopes, connection to storm water drains and how they link up with each other and flow into water bodies or rivers. In the absence of such data there are no norms for the different agencies working on roads. Also, the rules in the master plan regarding road levels are hazy. A detailed study is needed before sustainable solutions can be suggested. Where does the problem lie? There is no document in the public domain that shows in a simple manner the natural surface flows, types of soil in various places or their absorption capacities. The Corporation or Highways Dept increases road levels which blocks the natural surface flows. The levels of building sites also keep getting raised. Also debris on roads and sites block water flow to designated areas.	
10	E-Magazine	3/12/2015	Why Chennai Gets Unbearably Flooded and What Can Be the Solution	The Quint		Proactive hydrological planning should have been done. Development in areas like Velachery, Madipakkam, Chitkapakkam, Tambaram etc should have not been happened claims KP Subramanian, Retired Professor, Urban Engineering, Anna University MG Devasahayam, retired IAS officer claims that the natural drainage system is dead. Neighbourhoods on the lakes and marshes hold back water and floods the new dwellings.	http://www.thequint.com/india/2015/11/19/why-chennai-gets-unbearably-flooded-and-what-can-be-the-solution

						Nityanand Jayaraman, Chennai based Environmental Activist claims that most of the Pallikarnai have been parceled off and given to the IT Sector, no wonder houses in those areas are severely flooded. CMDA's urban planning – Living in Denial – the macro-drainage section of the Master Plan reads, "Abundance of data Is available on the macro-drainage and with co-ordinated efforts of government agencies, involvement of stakeholder and with the applications of modern technology for map-making and networking, it is warnestly hoped that flooding in the CMA will become a thing of the past" What can be done? Chennai Master Plan has to be reworked by the CMDA from a hydrological point of view, and it has to be followed.. Holding areas and storage plans should not be built upon. -Storm-water drains have to be an integral part of laying roads. Mark Selvaraj, Urban Planning expert – "In the last five years, Chennai has spent Rs.10,000 crores to build storm water drains. But construction of these drains should be based on proper hydrological calculation which was never done. The city needs a separate agency which can plan, control and implement storm water drain prjects, responsibilities now being shared by PWD and the corporation. A central planning agency should replace CMDA in this regard"	
11	E-Magazine	12/1/2016	Karnataka govern	Down to Earth		Bengaluru, once called the "City of Lakes" is fast losing its water bodies due to encroachment, a	http://www.downtoearth.org.in/news/be

			ment reveals sad state of Bengaluru lakes			report released recently by the state government has revealed. At the end of last year, Chennai faced severe flooding. One of the major causes for this flood was unplanned urbanisation. Chennai is dotted with waterbodies and canals which carried the extra runoff away from the extensively flat city. Bengaluru is a city the lakes of which have been lost due to rapid concretisation and pollution. The 2015 report by the Indian Institute of Sciences (IISC) says that almost 54 per cent of the lakes in the city have been encroached due to illegal buildings. IISC also explains that between 1973 and 2013, there has been a 79 per cent decrease in the area of the waterbodies. Only 19 per cent of the tanks have been left which may show encroachment in the coming years if strong steps are not taken. The sponges of the city require immediate conservation—the city has already faced four major flood events post 2000 due to the concretisation of lake and tank beds. Poor urban planning and weak wetland rule are responsible for this.	ngaluru-not-yet-learnt-a-lesson-from-chennai-52407
12	E-Magazine	18/11/2015	Urban planning in denial: Why Chennai gets unbearably flooded and what can be the solution	The News Minute	The article explains the various views on the disaster.	Chennai's waterlogging issue is now on the brink of being beyond redemption and is a man-made disaster can be illustrated by one single fact: The city's largest mall, Phoenix, is on a lake-bed – Velachery. The word 'Ari' (as in Velach-ari) means 'lake' in Tamil. "Unplanned urban development and unwieldy growth with no hydrological plan is the reason," says KP Subramanian, retired professor of Urban Engineering, Anna University. "If urban	http://www.thenewsminute.com/article/urban-planning-denial-why-chennai-gets-unbearably-flooded-and-what-can-be-solution-36103

						planners had done proactive hydrological planning, development should not have happened in many areas like Velachery, Madipakkam, Chitkapakkam, Tambaram," he adds. "It is serious interference with nature," says urban planning expert and retired IAS officer MG Devasahayam, "the natural drainage systems are all gone." There is no further proof required than the Chennai Metropolitan Development Authority's Chennai Master Plan 2026. As Ola operates boat services on the streets of Chennai, it's comical to read the self-assuring claims government officials have made in the document, which is meant to lay the path to a better Chennai. "Look at the southern stretch of the Buckingham Canal, from Adyar Creek to Kovalam. It is currently being encroached upon with new colleges and other constructions. This is the western side of ECR and eastern side of OMR. The stretch looks empty but is a seasonal water body. Kovalam creek is also being encroached upon," he says. "They are planning a smart city in Ponneri, which received 37cms of rainfall now. The plan there is to do exactly what causes flooding – encroach upon water bodies," he says, "The CMDA's master plan is the master problem, if we follow it, what happens in Velachery will happen in other areas." - Nityanand Jayaraman. "There is no concept of city	

						government. Different organisations like PWD, water board and City Corporation are working under different ministries. We need a common authority to look after the city," says Devasahayam. "The city needs a separate agency which can plan, control and implement storm water drain projects, responsibilities now being shared by PWD and the corporation. A central planning agency should replace the CMDA in this regard," writes Selvaraj.	
13	News channel	27/11/2015	Why Chennai Was Flooded. Warnings Were Ignored	NDTV	The news piece showcases an interview with Jayashree Vencatesan and Nityanand Jayaramna on the effects on ecology of the city due to its rampant urbanisation.	The city's civic body pleaded helplessness, citing nature's fury. "Our role is limited to maintaining civic infrastructure," said city corporation commissioner Vikram Kapur, admitting to poor planning in the suburbs. "This did not happen overnight. But nature has a way of coming back if we don't respect it." But the state government had been warned against the fallout of rampant construction. A detailed development plan of the city, prepared seven years ago at the government's behest, had warned against building in marshlands, wetlands and low-lying areas. "What happened is we very clearly told them: High rise (construction) to be allowed in certain areas, medium rise in others, low rise in certain areas," said MG Devasahayam, a former bureaucrat who was a consultant for the 2009 report. But the reverse has been taking place, said Mr Devasahayam, with the result that natural drainage has been completely choked.	http://www.ndtv.com/chennai-news/why-chennai-was-flooded-warnings-were-ignored-1248276
14	Newspaper/ E-	16/11/	How Urban	The Wire		The recent rains in Tamil Nadu have caused havoc on the	http://thewire.in/2015/11

	paper	2015	Greed Washed Away the Accummulated Wisdom of India's Past			streets of Chennai and elsewhere. The misery which has unfolded is, of course, not unique to Tamil Nadu. All across India – from Srinagar to Chennai and Mumbai to Dibrugarh – rain is inevitably followed by water-logging on the streets of cities, causing immense suffering to the people. In September 2014, heavy rains turned the capital of Jammu and Kashmir into a lake, with many localities submerged under 20-30 feet of water. In my home town of Allahabad, many localities like Allahpur and Mumfordganj go under several feet of water every year after heavy rains. Kolkata's waterlogged streets are well known, and parts of Delhi, e.g. Minto Bridge, have severe waterlogging in the monsoons. What is the cause of this? -.people, in their greed, illegally built houses, shops, and other buildings on them, obviously in collusion with municipality officials, thus blocking the drains everywhere. In Srinagar, people illegally filled up both banks of the Jhelum river with earth, and built houses and other buildings on them, thus narrowing the width of the river. Obviously it will overflow in the rains. ..successive governments at the Centre and in the states have not bothered to invest in urban infrastructure – especially drains, pipelines and sewerage systems – despite the growing population of our towns and cities. Srinagar's celebrated Dal Lake has shrunk by 10 square kilometres since 1953. The lake covered 25 square kilometre in 1953 but is only 15 sq km today. Massive encroachments, the erection of many structures,	/16/how-urban-greed-washed-away-the-accummulated-wisdom-of-indias-past-15596/

						house boats and hotels have contributed to this reduction in the size of the lake. The depth of the lake has also been drastically reduced. Obviously when there are heavy rains, the lake will overflow its banks.	
15	Newspaper/ E-paper	10/1/2016	Tamil Nadu: Chennai floods cause a loss of Rs 50,000-cr	The Deccan Chronicle	Estimate of Financial losses caused due to the floods	The loss to the state and the people from the rain and flash floods this northeast monsoon season may have crossed a staggering Rs 50,000 crore already. And if the situation persists for the next few days, the total financial loss could escalate to a whopping Rs 1 lakh crore, a senior revenue official said. The official went on to elaborate that the state's official estimate of the rain damage crossed Rs 9,800 crore in the November rains itself even when such damage was restricted mostly to the state's infrastructure with roads and causeways broken while the damage to citizens' lives came mostly in the huts along the Cooum and Adyar rivers being washed away. The estimated revenue expenditure of Tamil Nadu for 2015 is around Rs 1,47,297 crores and the rain damage will push these expenses up to an alarming level, the official revealed. Furthermore, industrial units, factories, hotels and shops have suffered severe waterlogging and this loss is yet to be evaluated. The state's financial resources that may be spent first on relief and restoring the infrastructure would again run into crores of rupees, the official explained.	http://www.deccanchronicle.com/151206/nation-current-affairs/article/chennai-floods-caused-loss-50-thousand-crore
16	E-Magazin	15/12/	Tamil Nadu	Business-	The allocation of government	She has requested in a letter the Centre sanction a special	http://www.business-

	e	2015	wants Rs 5,000 cr for houses for flood-affected	Standard	funds for the purpose of rehabilitation of flood affected community	scheme of constructing 50,000 houses for the urban poor who are to be resettled from water courses and water bodies at a total cost of Rs 5,000 crore, as the existing schemes are not viable. ..it is very essential that a special programme is approved for the construction of houses at alternative locations for the 50,000 flood affected families residing along the Chennai water courses, with substantially enhanced Government of India contribution. the Tamil Nadu government would be able to accommodate 25,000 families in tenements already constructed and under construction by the Tamil Nadu Slum Clearance Board and the resettlement of these people is expected to commence within two weeks and to be completed in phases within a year. For the remaining 25,000 families, particularly those residing along the Buckingham Canal and for a further 25,000 families residing in the vicinity of other water courses and water bodies in Chennai city and its suburban areas, affected in the recent flooding, the state government has prepared a project to construct 50,000 multi-storeyed tenements on various pieces of land that are available with the state. The centre then allocated Rs 940 crore and appointed a team to visit the flood affected area. However, following the visit of the central team, further rains created havoc in Chennai and neighbouring districts and Modi, after visiting the affected	standard.com/article/current-affairs/tamil-nadu-wants-rs-5-000-cr-for-houses-for-flood-affected-115121400571_1.html

						area, announced relief of Rs 1,000 crore.	
17	Newspaper/ E-paper	23/11/2015	Tamil Nadu government pegs flood damage at Rs 8,481 crore, CM Jayalalithaa writes to PM Modi	DNA India	The article mentions the details of the state government's request for fund allocation for relief and rehabilitation from the central government.	..the state government on Monday pegged the damage at Rs 8,481 crore, with Chief Minister J Jayalalithaa urging Prime Minister Narendra Modi to immediately release Rs 2,000 crore to sustain relief work. .Jayalalithaa told the PM that despite her government's preventive efforts, the state had suffered severe damage on account of the "extremely heavy and sustained" rainfall which, she said, had left a trail of destruction and that her government had allocated Rs 500 crore for relief work. "The requirement of funds for immediate rescue and relief and the temporary and permanent restoration of infrastructure has been worked out at Rs.8,481 crore in all...." "This assessment has been made as an immediate measure since the Government of Tamil Nadu requires assistance from Government of India to meet the very high expenditure requirements that such a severe calamity has caused. The funds required are well beyond the resources available with the state, including the State Disaster Response Fund," she said. "In the meanwhile, I request that an on account release of Rs 2,000 crore may be sanctioned immediately to enable the state government to sustain the relief and restoration operations with the same vigour," Jayalalithaa said.	http://www.dnaindia.com/india/report-tamil-nadu-government-pegs-flood-damage-at-rs-8481-crore-cm-jayalalithaa-writes-to-pm-modi-2148012
18	Newspaper/ E-paper	6/12/2015	Why Chennai went down and	The Hindu Business Line	The article refers to CAG report from March 2013 which explains	..the performance audit report of the disaster management mechanism in the country by the Comptroller and Auditor General (CAG) in 2013 offers	**http://www.thehindubusinessline.com/opinion/why-chennai-**

			under		the gaps in the disaster management and preparedness programs and departments in Tamil Nadu. It points out that inspite of the excessive rains the extent of damge could have been curbed with adequate warning and preparations.	some heart-rending insights. While the latest figures may differ slightly, the wide gaps in the system, across the disaster management cycle, are unlikely to have changed drastically. ..there was excessive discharge of water from Chembarambakkam lake — the reservoir had been in surplus because of the heavy rainfall. The sudden discharge that came without warning displaced even more people from their homes. Much of the devastation and chaos could have been averted had the authorities altered the residents beforehand. ..But despite such elaborate efforts, you still hear appalling stories of families stranded in their homes for days without food or water, with no rescue in sight. The answer may lie in the inadequate and ineffective resources of the NDRF. Chennai and the 2013 disaster in Uttarakhand are clear wake-up calls. It is critical that effective disaster managing mechanisms are put in place to reduce the risks and damage from disasters to the maximum extent possible.	**went-down-and-under/article7955146.ece**
19	Newspaper/ E-paper	25/12/2015	Shock, but no awe	The Hindu		A walk along Chennai's southern beaches will give you a sense of the irrelevance of these agencies. Even 15 years ago, the space between any two fishing villages in the southern reaches of the city was just rolling dunes dotted with groves of pandanus and palmyra. All that's gone, and has now been replaced by unoccupied villas with pools overlooking the sea, gated communities, and weekend getaways. Some properties in places such as Kanathur	http://www.thehindu.com/opinion/op-ed/nityanand-jayaraman-on-chennai-floods-shock-but-no-awe/article8026139.ece

						Reddikuppam have compound walls inside the intertidal zone. If the walls don't get knocked down by the waves, fishermen knock it down to find safe beach parking for their boats during rough weather. All along Chennai's coast, elite encroachers have flattened sand dunes, denuded coastal vegetation, and interfered with natural water courses. Caught between a landward-moving sea and a seaward-moving city, the fisherfolk are being served up for slaughter on a platter. The CRZ Notification specifies that the management plan should incorporate long-term housing needs of the fisherfolk in the vicinity of the coast. But Tamil Nadu has not even begun developing a plan. Meanwhile, large chunks of coastal real estate are being parcelled off for ports, resorts and other projects, leaving the fishers with no future. The Corporation of Chennai, which was supposed to identify violations, is itself a keen encroacher of beach space. In October 2015, the Coastal Resource Centre, a non-governmental organisation programme that I advise, reported that the corporation had constructed 5.8 km of illegal roads at or near the high tide line within Chennai city limits.	
20	Newspaper/ E-paper	12/12/2015	In Chennai, a disaster foretold	The Indian Express		The challenging part will be compliance. The state government has repeatedly condoned building and land use violations. The coastal regulation zone offered some form of protection near rivers and the coast, but that too has been overlooked. In this context, promulgating a flood	http://indianexpress.com/article/opinion/columns/chennai-floods-rains-kerala/

						map and new regulations will not make a difference unless the state government is willing to commit to zero tolerance.	
21	Newspaper/ E-paper	4/12/2015	Explained why Chennai is under water?	The Indian Express		While Chief Minister J Jayalalithaa said, during the earlier phase of heavy rain last month, that damage during the monsoon was "inevitable", the fact remains that the mindless development of Chennai over the last two decades — the filling up of lowlands and choking of stormwater drains and other exits for water — has played a major part in the escalation of the crisis... Across Chennai, illegal construction has been making neighbourhoods unrecognisable — what may have been a tank, lake, canal or river 20 years ago, is today the site of multistorey residential and industrial structures. There are over 1.5 lakh illegal structures in the city, according to a report submitted by CMDA to the Madras High Court. Despite several HC orders ordering their demolition, the buildings stand — often after appeals to the Supreme Court, and due to the inefficiency of the CMDA's legal wing. Hundreds of stay orders against demolition orders have been obtained by both business houses and individuals. As the illegal structures sprouted in the city and suburbs, over 300 water bodies disappeared. The irreversible destruction of the city's natural water paths can be seen in the flooding in Mudichur, Velachery, and several other areas that have come up on wetlands or river basins.	http://indianexpress.com/article/explained/why-is-chennai-under-water/
22	Newspaper/ E-paper	6/12/2015	The tale of two	The Indian Expres		Like Adyar, Mithi too was lined with encroachments that were a testimony to the planning	http://indianexpress.com/article/india/in

			cities: the similar story of Mumbai and Chennai floods	s		body's sins of omissions (slums that come up owing to lack of affordable housing) and commissions (real-estate developments). The flood basin of Adyar was where the Chennai airport was built as is the runway of the Mumbai airport that was built across the Mithi.	dia-news-india/a-tale-of-two-cities-4/
23	Newspaper/ E-paper	4/12/2015	Chennai floods: Decoding the city's worst floods in 100 years	The Indian Express		As alarming as it may sound to the real estate industry, given the magnitude of the floods, the Chennai Metropolitan Development Authority must review permissions that have been granted given that it operates as the green channel for commercial constructions in the city and it reviews plans in accordance with the city's master development plan. A relook at the land-use in the master plan should also be among the top priorities for CM Jayalalithaa. How much land has been allotted to development projects? Is it commercial or settlement?	http://indianexpress.com/article/india/india-news-india/chennai-floods-rains-jayalalithaa-imd-reasons-rescue-news-updates/
24	Newspaper/ E-paper	8/11/2015	Chennai rains: what went wrong in the city?	Live mint		According to Satyarupa Shekhar, director of Citizen consumer and Civic Action Group, an NGO based in Chennai, "The lack of enforcement of planning rules has resulted in rampant building violations, such as encroaching roads and pavements, illegal connections of sewerage lines to storm water drains and construction on ponds, lakes, marshes and other natural catchment areas."	http://www.livemint.com/Politics/VdEZxTajfUS8fhVzytMWLI/Chennai-rains-what-went-wrong-in-the-city.html
25	E-Magazine	2/12/2015	Chennai floods are not a natural disaster—they've been created	Quartz India		Today, Chennai has a host of expensive infrastructure aimed at ushering in a "Make in Chennai" boom—a brand-new (though leaky) airport built on the floodplains of the Adyar river, a sprawling bus terminal in flood-prone Koyambedu, a Mass Rapid Transit System constructed almost wholly over	http://qz.com/563396/chennai-floods-are-not-a-natural-disaster-theyve-been-created-by-greedy-town-planners-and-

			by greedy town planners and dumb engineers			the Buckingham Canal and the Pallikaranai marshlands, expressways and bypass roads constructed with no mind to the tendency of water to flow, an IT corridor and a Knowledge Corridor consisting of engineering colleges constructed on waterbodies, and automobile, telecom special economic zones (SEZs) and gated residential areas built on important drainage courses and catchments. With every invitation to Make in Chennai, the city is unmaking itself and eroding its resilience to perfectly normal monsoon weather events. The infrastructure of big commerce has replaced the infrastructure to withstand natural shocks...he case of the Pallikaranai marshlands, which drains water from a 250 square kilometre catchment, is telling. Not long ago, it was a 50 sq km water sprawl in the southern suburbs of Chennai. Now, it is 4.3 sq km—less than a tenth of its original. The growing finger of a garbage dump sticks out like a cancerous tumour in the northern part of the marshland. Two major roads cut through the waterbody with few pitifully small culverts that are not up to the job of transferring the rain water flows from such a large catchment. The edges have been eaten into by institutes like the National Institute of Ocean Technology (NIOT). Ironically, NIOT is an accredited consultant to prepare environmental impact assessments on various subjects, including on the implications of constructing on waterbodies. Other portions of this wetland	dumb-engineers/

						have been sacrificed to accommodate the IT corridor. But water offers no exemption to the elite industry. Unmindful of the lofty intellectuals at work in the glass and steel buildings of the software parks, rainwater goes by habit to occupy its old haunts, bringing the back-office work of American banks to a grinding halt. The vast network of waterbodies that characterised Chennai can only be seen on revenue maps now. Of the 16 tanks belonging to the Vyasarpadi chain downstream of Retteri, none remains, according to professor M. Karmegam of Anna University. Virtually every one of the flood-hit areas can be linked to ill-planned construction.	
26	News channel	4/12/2015	Not just heavy rains, but poor urban planning and a callous administration behind Chennai floods	News18		Defending allegations over poor urban planning and callous administration, the state government claimed that it is capable of tackling the situation but thousands of pictures and videos from various marooned areas revealed the actual state of Tamil Nadu. As per the government's report, nearly 1.5 lakh illegal structures came out around Chennai, which led to the disappearance of more than 300 water bodies. The matter was raised several times but the government failed to take any punitive measures. Such rampant and illegal construction also led to improper drainage system in the city.	http://www.news18.com/news/india/not-just-heavy-rains-but-poor-urban-planning-and-a-callous-administration-behind-chennai-floods-1172666.html
27	E-Magazine	15/12/2015	Firstpost Investigation: How Chennai,	Firstpost		Experts argue the disaster was entirely man-made; a result of flawed urban planning, violation of laws and lethargic administration that allowed the gradual disappearance and encroachment of water bodies	http://www.firstpost.com/india/firstpost-investigation-how-chennai-hungry-for-growth-

			hungry for growth, devoured itself			and drains that could have absorbed the nature's fury. "Urban development has been reduced to chaotic construction. Every available plot of land is being used for construction to make a huge amount of money. In the course of construction, the needs of nature are being blatantly ignored," former IAS officer MG Devasahayam, who is national consultant for the preparation of revised city plan, Chennai, told Firstpost. December's flood, he says, establishes a clear link between "corruption, disaster, destruction and deaths". Environmentalist Satyarupa Shekhar, director – government outreach and advisory services, Citizen Consumer and Civic Action Group, agrees. "It is wrong to attribute the flood to climate change. It is a result of our inability to adhere to building norms and blatant violation of master plan," she told Firstpost.	devoured-itself-2546318.html
28	Academic journal	5/12/2015	Chennai's Raincheck: 15 year's and counting	Economic and Political Weekly		Simultaneously, poor planning practices and lax enforcement of building rules have resulted in the majority of the city's lakes and ponds being built over, obstructing its natural hydrology. Unfortunately, successive governments have allowed for weaker plans and poor enforcement of the rules; they have even pushed for amendments that regularise violations and exemptions that will benefit the more affluent...These are all human-made disasters and we need to take drastic steps to immediately arrest and reverse these developments.	http://www.cag.org.in/sites/default/files/database/Chennais_Rain_Check_0.pdf
29	News channel	27/11/201	Why Chennai Was	NDTV		But Jayshree Venkatecan, an environmentalist with an NGO, Care Earth says this was a man-	http://www.ndtv.com/chennai-

		5	Flooded. Warnings Were Ignored			made disaster. Ms Venkatecan, who studies the ecologically sensitive Pallikaranai marshes near Velachery, showed how the once-50 square kilometres wetland has shrunk to a fraction of its size because of unchecked construction and encroachment of land. She told us that the marsh would have acted as a sponge to soak up rainwater, thus reducing the impact of flooding... ..But the state government had been warned against the fallout of rampant construction. A detailed development plan of the city, prepared seven years ago at the government's behest, had warned against building in marshlands, wetlands and low-lying areas. "What happened is we very clearly told them: High rise (construction) to be allowed in certain areas, medium rise in others, low rise in certain areas," said MG Devasahayam, a former bureaucrat who was a consultant for the 2009 report. But the reverse has been taking place, said Mr Devasahayam, with the result that natural drainage has been completely choked. Ms Venkatecan says that no further development should be allowed in the marshlands. "These 231 sq. kms, where there is an issue of waterlogging, you need to protect it." But cranes are hard at work at the ELCOT industrial park, not far from the Pallikaranai wetlands, and newer edifices are coming up in the ever-expanding suburbs, as NDTV found out. Lessons have clearly not been learnt from Chennai's	news/why-chennai-was-flooded-warnings-were-ignored-1248276

						deluge.	
30	E-Magazine	18/11/2015	Chennai floods are not a natural disaster – they've been created by unrestrained construction	Scroll.in		The 2015 disaster was not just avoidable; it was a direct consequence of decisions pushed for by vested interests and conceded by town planners, bureaucrats and politicians in the face of wiser counsel... ...Virtually every one of the flood-hit areas can be linked to ill-planned construction. The Chennai Bypass connecting NH45 to NH4 blocks the east flowing drainage causing flooding in Anna Nagar, Porur, Vanagaram, Maduravoyal, Mugappair and Ambattur. The Maduravoyal lake has shrunk from 120 acres to 25. Ditto with Ambattur, Kodungaiyur and Adambakkam tanks. The Koyambedu drain and the surplus channels from Korattur and Ambattur tanks are missing. Sections of the Veerangal Odai connecting Adambakkam tank to Pallikaranai are missing. The South Buckingham Canal from Adyar creek to Kovalam creek has been squeezed from its original width of 25 metres to 10 metres in many places due to the Mass Rapid Transit System railway stations. Important flood retention structures such as Virugambakkam, Padi and Villivakkam tanks are officially abandoned.	http://scroll.in/article/769928/chennai-floods-are-not-a-natural-disaster-theyve-been-created-by-unrestrained-construction
31	Blog		Who Let Water into My CIty	FountainInk Series		..the entire area from Nungambakkam through T. Nagar, Mambalam and up to Saidapet (among the worst affected areas) was part of a massive continuous system called Nungambakkam Lake-Long Tank until the 1920s. Beginning in 1806 for the Buckingham Canal, it has been encroached upon by successive	http://series.fountainink.in/who-let-the-water-into-my-city/

						generations for various purposes. Today about 90 per cent of the marsh has been lost to development but the shrinkage was gradual until the IT corridor was designated. After that it was a virtual gold rush and free-for-all as the area was swamped by real estate developers, all frantically clearing, filling and building in a desperate rush to grab the jackpot. Pallikaranai was a place under siege	
32	Newspaper/ E-paper	20/12/2015	Chennai's encroachments on water bodies caused floods	Economic Times		"When speaking about encroachments, everyone talks about clearing slums," said Nithyanand Jayaraman, environmental activist. Environmental economist Venkatachalam agrees and urges immediate action from the state government. "Look at the quantum of damage inflicted by the flood," he said. "We need to remove existing encroachments and relocate those living in catchment areas immediately.	http://articles.economictimes.indiatimes.com/2015-12-20/news/69186456_1_water-bodies-adyar-river-slums
33	Newspaper/ E-paper	17/12/2015	Chennai Flood: Madras HC Forbids Encroachments And Garbage Dumping In Water Bodies	Huffington Post		..the Madras High court today made it clear there should be no further intrusions, nor dumping of garbage or solid waste, and directed the Tamil Nadu government to take steps in this regard. The petitioner also sought a direction to authorities to immediately take steps for identification of the entire length and breadth of Cooum, Adayar and Buckingham Canal and also barricading the river boundaries to avoid further encroachment or re-encroachments in the water areas.	http://www.huffingtonpost.in/2015/12/17/chennai-flood-water-encroachment_n_8824574.html
34	Newspa	5/9	Illegal	Deccan		“According to the second	http://www.d

	per/ E-paper	/2015	encroachments shrunk Adyar river	Chronicle		master plan of the Chennai Metropolitan Development Authority (CMDA), several catastrophic floods were recorded in Chennai during 1978, 1985, 2002 and 2005, caused by heavy rain associated with cyclonic activities. Subsequently, many recommendations were made by the CMDA and environmentalists," said former Chennai mayor M. Subramanian. "It is a fact that the width of Adyar river has narrowed down by more than 30 per cent and a few pockets like Ekattuthangal, Saidapet and Adyar are worse off. The drive by government officials over the past few years had only hit roadblocks due to political interventions," said former chief engineer of Chennai corporation A. Swaminathan. Chennai has recorded floods once every five years, and only when there is flooding, the encroachments are cleared, not otherwise," he added.	eccanchronicle.com/140905/nation-current-affairs/article/illegal-encroachments-shrunk-adyar-river
35	Newspaper/ E-paper	4/12/2015	Chennai floods: Development came at a major price	OneIndia		Due to illegal constructions which include several multi-storey buildings and industries nearly 300 water bodies have disappeared and this has been one of the main reasons for the city flooding in this manner. There has been development all around Chennai, but then it has come at a price. 5,550 hectares of wetlands in Velachery, Pallikaranai and Old Mahabalipuram Road are today commercial hubs.When there are concrete structures on wetlands, there is no place for the water to go, but flow into the city. The PIL filed by the Kasturba	http://www.oneindia.com/feature/chennai-floods-development-came-at-a-major-price-1945951.html

						Nagar and Indira Nagar Residents Welfare Forum had sought the removal of encroachments on the Canal Bank Road along the Buckingham Canal.The petitioners made it clear that the encroachments in question were not by slum dwellers. There are concrete structures that are coming up and this in turn was affecting the flow of water into the canal, the PIL also alleged.	
36	Newspaper/ E-paper	7/3/2016	This is how Chennai's water bodies are disappearing	Times of India		"Real estate firms backed by politicians are converting the ecologically sensitive zone into residential localities," another resident said, adding the government should take action.	http://timesofindia.indiatimes.com/city/chennai/This-is-how-Chennais-water-bodies-are-disappearing/articleshow/51283804.cms
37	E-Magazine	12/2/2016	A Mistake Chennai Cannot Afford to Repeat	Zingy Homes		..the Virugambakkam drain, which was 6.5 km long and drained into the Nungambakkam tank, is now present only for an of extent of 4.5 km. The remaining two km stretch of the drain is missing. Nungambakkam tank was filled and built. This along with the loss of Koyambedu drain has resulted in the periodic flooding of Koyambedu and Virugambakkam areas. Existing lakes continue to be taken over by land grabbers and developers for the sake of urban development. However the issues of soil stability in such areas raise serious questions about the kind of development and the safety of people in these areas. Slum dwellers also tend to take over the water sources by dumping solid waste which is not only a threat to their safety, but also contributes to	http://www.zingyhomes.com/latest-trends/groundwater-level-in-chennai-disappearing-water-bodies/

						the pollution of these waters in the city.	
38	Newspaper/ E-paper	3/7/2014	Water Bodies turned into Concrete Jungles	The New Indian Express		According to experts, it could be connected to structural flaws, including construction of huge buildings on the loose landfills that were once lakes. There were at least about 30 big water bodies in and around Chennai — a majority of them have been encroached upon, while a few have disappeared. Water bodies in Mogappair, Valasaravakkam, Virugambakkam, Seneerkuppam, Adambakkam, Talakanacheri and Ullagaram have ceased to exist. It is not just the profit-hungry private parties who are involved in this. For instance, Mogappair Eri was converted into a residential plot by the Tamil Nadu Housing Board. "The waterbodies in and around the city help in storing water for drought years, and take in floodwaters during rains. However, we are converting them into concrete jungle on one hand, but are dependent on desalination plants, which is turning fresh water areas in the coast saline," said MG Deivasahayam, a member of CMDA monitoring committee and managing trustee of Citizen's Alliance for Sustainable Living (SUSTAIN), a city NGO. Deivasahayam had highlighted the need for identifying eco-sensitive areas and the urgent need to stop construction in low lying areas under the City Development Plan initiative by the Corporation. But the recommendations were never paid attention to. Adding that the concept of town planning that is being followed was	http://www.newindianexpress.com/cities/chennai/Water-bodies-turned-into-concrete-jungles/2014/07/03/article2311172.ece

						totally flawed, he added that the land use plan in Master Plan is often tinkered by officials.	
39	Newspaper/ E-paper		Where are those water bodies?	Madras Musings		While some were filled in as part of a conscious decision to expand the city's land area, others have died out due to encroachments. The Maduravoyal Lake is only one-fifth of what it was around two decades ago. The Kadaperi Lake in West Tambaram has lost 15 acres in recent years, much of it to a burgeoning colony on its banks. With the continued dumping of garbage, the water body has become more of a cesspool and its degradation has led to the wells in the neighbourhood getting polluted. The lake is now viewed as the cause of the problem and there is a growing body of opinion that it ought to be filled in! It is a sad state of affairs that the civic body in charge remains silent when encroachments and pollution of water resources happen under its very nose. It wakes up when matters can no longer be set right.	http://madrasmusings.com/Vol%2022%20No%208/index.html
40	E-Magazine	17/12/2015	No further encroachments on water bodies: Madras HC	India Today		"The encroachments as well as preventing the dumping of garbage and solid waste are concerned, we are of the view that this matter needs urgent attention. The concerned authorities are thus directed to ensure there is no further encroachment or re-encroachment in the water areas nor dumping garbage and solid waste is permitted," the court said while passing interim orders on the issue. Citing various HC orders, it said the HC had pointed to "government apathy" to illegal activities like encroachments on water bodies and had come down heavily on the "unholy	http://indiatoday.intoday.in/story/no-further-encroachments-on-water-bodies-madras-hc/1/549137.html

						nexus between the government machinery and the private individuals".	
41	Legal Document		Anti Corruption Movement versus Government of Tamil Nadu	High Court of Madras		..filed in public interest, seek to highlight the maladministration and prevalent corrupt practices, because of which almost all the water bodies and water courses in and around the city of Chennai were allowed to be encroached upon, .. THE above figures would show that the wa"ter bodies initially having a total area of 0.86.70 Hectares have been reduced to 645.81.92 Hectareo, i.e. by almost 50%, thereby reducing the storage capacity of such water bodies, as a result of which the city of Chennai is compelled to draw its supply of drinking water from Veeranam Tank, which is hundreds of kilometers away from the city. ..the process of removal of the encroachments has been reviewed and accordingly, 29 tanks lo"cated in and around the city of Chennai have been broadly categorized into three types as mentioned below: Category A - Tanks that do not have any problem in taking up the rehabilitation and restoration work. Category B - Tanks that are relatively large and essentially required to be restored at least partially for improving and sustaining the sub-soil water levels and ensuring pollution free environment Category C - Tanks that are totally infested, with encroachments and cannot be restored for the present. The Collectors will decide the	http://www.cseindia.org/userfiles/Lake%20Protection%20and%20Management%20of%20Urban%20Lakes%20in%20India.pdf

						programme of evicting the encroachments preferably from October/ November, 2007 to May, 2008 depending upon the area specific issues involved. Mr. Raja Kalifulla, learned Government Pleader submitted that each tank, the encroachments involved are in hundreds and some places, in thousands and there will be strong resistance from encroachers. He sub"mitted that in view of such large number encroachments, it is not possible to identify large extent of vacant lands close to the urban habi"tations and hence. Government land, wherever available, even if, it is far away from the present location, has to be considered for re-location. He further submitted that in some tanks, the evictees can be re-located in one part of the tank itself after making proper layout, but this is limited to a few tanks only.	
42	Reports		Protection and Management of Urban Lakes in India	Centre for Science and Environment		Encroachment is another major threat to waterbodies particularly in urban areas. As more people are migrating to cities the availability of land is getting scarce. Today, even a small piece of land in urban areas has a high economic value. Hence, these urban water bodies are no more acknowledged for their ecosystem services but as real estate. Both for the government and the private builders these lakes are extremely valuable opportunities. Charkop lake in Maharashtra, Ousteri lake in Puducherry, Deepor beel in Guwahati are well known examples of encroachment. Another interesting example of encroachment and pollution, not by some private builder but the government itself is Pallikaranai marshland in	

						Bangalore. The size of this city wetland is decreasing rabidly. Once a bird sanctuary, it is now the dumping yard of Chennai City. The dumping of solid waste, sewage discharge, and construction of new buildings such as a railway stations and a new road have shrunk this wetland to a great extend. Today, Pallikaranai wetland is also one of Chennai's largest official dumping sites. Similarly, the case of government encroachment of Sola Beel in Guwahati where the state revenue department allotted lake-bed for construction in spite of Guwahati High Courts order to protect all wetlands in the state.	
43	Reports		Periurbanisation in Chennai: a city expanding southwards	South Asia Consortium for Interdisciplinary Water Resource Study - SACIWaters		South Chennai has since been growing as an IT corridor; in this process of expansion, the city has engulfed several fishing and agricultural villages and hamlets – of which Chennai has traditionally been an agglomeration - creating several ecological and environmental challenges that the current governance and administrative machinery is unable to cope with. Many of these problems have resulted from the growth of the city beyond its carrying capacity and the disconnect between urban and environmental planning. Within the city, there are several marshy areas and wetlands, that are gradually being encroached upon by the city. This constitutes an area for further research, moreso on strategies for reviving them and protecting the livelihoods of those who depend on them.	http://www.saciwaters.org/east-west-center/pdf/report.pdf
44	Reports		Report on Coastal Encroa	SIPCOT - Cuddalore		Western bank of Adyar Creek and Northern bank of Adyar River at the Adyar Estuary This tidal creek has experienced	http://sipcotcuddalore.com/downloads/coastal_encroa

			chments and Beach Use Conversion in Chennai			massive human intervention and land-use change over the past two decades. Till about 1997-98, the west bank of the Adyar Creek was partially a wetland and partially scrub, hosting a large variety of flora, and avian and terrestrial fauna. The features of the land started changing with the construction of a multi-storeyed building called Rani Meiyammai Towers on the southern end, near the Chettinadu palace. The Google Earth image from 2001 shows the southern portion as vacant land with scrub cover and the Northern portion as a wetland.	chment fact finding.pdf
45	Academic journal		Ecological Heritage Sites of Chennai - Wetlands	C.P.R. Environmental Educational Centre		Pallikaranai swamp Due to encroachments and other developmental activities, the Pallikaranai marsh is on the verge of extinction. It is shrinking day by day due to developmental activities such as dumping of solid waste, discharge of sewage, construction of buildings, establishment of a railway station and a new road to connect old Mahabhalipuram road and Pallavaram. The swamp is helpful in charging the aquifers of the region. It is one of the last few remaining natural ecosystems in the city of Chennai. Pulicat Lagoon: There are about 52 villages around the biodiversity rich Pulicat lagoon, the livelihood of whose people is in danger. Thousands of acres of land have been cleared for the North Chennai Thermal Power Station (NCTPS). The Ennore Satellite Port and a petrochemical complex are progressively damaging the Pulicat ecosystem. The NCTPS lets out hot water into the Buckingham Canal and	http://www.ecoheritage.cpreec.org/Viewcontall.php?$mFHxgACv$o49kYS5Na2

						discharges toxic fly ash, in the form of slurry, which causes siltation in the lagoon system.	
46	Newspaper/ E-paper	2/12/2015	Heavy Rain Floods leave Chennai isolated	Dinamalar (Tamil)	1) Water released from lakes were 'harmlessly diverted' 2) Mobile communications down 3) Additonal buses deployed to restore connectivity 4) Possibility of dengue outbreak 5) Anna Salai underwater		http://www.dinamalar.com/news_detail.asp?id=1401144
47	Newspaper/ E-paper	2/12/2015	Anbumani Ramdoss writes to PM seeking releif	The Hindu (Tamil)	1) Letter from Anbumani Ramdoss to the PM 2) Highlights the devastation of over 35000 cusecs of water collected by rain 3) Requested the PM for Rs. 10 crore as releif		http://tamil.thehindu.com/tamilnadu/%E0%AE
48	Newspaper/ E-paper	4/12/2015	The Hindu provides releif information online with #mazhaimugangal	The Hindu (Tamil)	1) Discusses the various ongoing relief efforts immediately after the damages 2) Lists the various hashtags and helplines that people stranded can use 3) Includes social media elements [twitter handles, tags, posts] 4) Lists out		

					district wise relief efforts with a contact in each district		
49	Newspaper/ E-paper	4/12/2015	Life returning to normal after heavy flooding	Daily Thanthi (Tamil)	1) 36 hours of rain leaves Chennai area floating in water 2) Buses and trains services have been disrupted 3) City is slowly returning back to normal		http://www.ndtv.com/tamil-nadu-news/12-killed-in-tamil-nadus-cuddalore-after-heavy-rain-1242257
50	News channel	5/12/2015	Cuddalore overwhelmed by heavy rains, underwater	NDTV (Tamil)	1) Heavy rains lash Cuddalore, killing 60+ people 2) Close to 10cm rain in some areas of Cuddalore 3) More than 700km of highways have been damaged 4) Thousands homeless in poor sanitary conditions		http://www.ndtv.com/tamil-nadu-news/12-killed-in-tamil-nadus-cuddalore-after-heavy-rain-1242257
51	Newspaper/ E-paper	6/12/2015	Central Govt officials visit flood affected areas in Chennai	The Hindu Business Line	1) In the aftermath, Center sends group of 8 to Chennai - meet Jaya 2) Meet affected residents in Mylapore and Kotturpuram 3) Affected residents feel Rs. 5000 not enough compensation 4) Lists area wise damages - Saidapet, Valasaravakam, Thiruvallur		http://www.thehindubusinessline.com/news/national/central-team-visits-floodhit-areas-in-chennai/article7919582.ece
52	Newspa	7/1	Locals	The	1) Several cattle		

	per/ E-paper	2/2015	angered by need to evacuate; refuse to leave the affected areas	Hindu (Tamil)	have died during the flooding 2) Humans, cars and homes have been washed away 3) Floods caused by lack of understanding of waterways 4) Talks about ALL the rivers and canals in the city in some detail		
53	Newspaper/ E-paper	8/12/2015	Stranded employees inside IT companies finally rescued	The Hindu (Tamil)	1) Many IT parks were affected during the floods 2) Major construction work without proper planning resulted in flooded IT parks 3) Some IT companies made employees come to work even during the heavy rains 4) Those stranded there were later housed in a safer place 5) Talks about how many employees were forced to work from home		
54	Newspaper/ E-paper	8/12/2015	Come on! Lets protect our cities	The Hindu (Tamil)	1) Highlights why various important parts of the city was submerged 2) Adyar and Cooum rivers - why did they overflow?		

					3) Were the canals useful in playing their role? 4) The need to lock the estuaries 5) Reduce human errors, clean the canals 6) Where has the allotted money gone for cleaning the Cooum river? 7) Waste water and solid waste management should have priority		
55	Newspaper/ E-paper	20/12/2015	Minister for Information reports damages to over 14000 MSMEs in Chennai	Daily Thanthi (Tamil)	1) 14000 factories affected druing the floods 2) Heaviest hit are the micro, small and medium factories 3) over 50000 workers have been affected 4) Union Minister Pon. Radhakrishnan announces insurance for factories		http://www.dailythanthi.com/News/State/2015/12/20051613/14000-MSMEs-affected-in-rains-and-flood-in-Tamil-Nadu.vpf