Citizen's report on the 2015 floods in Chennai

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

This is a collaborative report undertaken by CAG as part of the WFC Initiative.

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About CAG

CAG came into existence on 7 October 1985 as a non-profit, non-political, non-religious, voluntary and professional citizens group based in Chennai, India. Specifically, issues affecting the common citizen such as extreme pollution, lack of access to information, poor quality health care and civic amenities have emerged as priorities in the work undertaken by CAG.

Making good governance a reality has been CAG's mission which is largely done by demanding transparency and accountability and by promoting participatory decision making. To achieve this CAG interacts with the government and provides inputs for better governance. CAG firmly believes in a bottom-up approach for decision making especially with regard to planning processes the government undertakes, and this requires involving stakeholders to achieve a participatory decision making process. CAG addresses various issues such as urban planning with regard to developmental activities in urban areas, safeguarding open spaces and public spaces, traffic regulation, trade related issues, citizen's charters etc.

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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 Chennai during December 2015 are a stark reminder of the challenges that lie ahead if Chennai continues on its current trajectory of development and urbanization. Therefore, we must not only understand what transpired during event, but also what happened before and after the event; more importantly what we can learn along with the actions required in order to make Chennai a resilient city.

Chennai, a coastal city requires a disaster management strategy that is equipped to deal with realities of changing climate beginning with amendments to the existing state disaster management policy, updated district disaster management plans as well as its implementation by concerned authorities and departments so that the city and state of the Tamil Nadu is better prepared to deal with such events in the future. The Coastal Regulation Zone notification issued in 1991 that was subsequently revised in 2011 was intended to address the problem of coastal zone management. However it has failed to regulate development within coastal areas over the years. In spite of being a metropolitan city, Chennai suffers from the lack of a scientific and practical approach to solid waste management. Construction and Demolition waste arising from urban expansion further complicate matters in the city. The urban poor have become easy targets for eviction and relocation by the state machinery in the event of a disaster or city infrastructure projects with scant regard to the improvement in their livelihood prospects. Being part of the large urban informal sector means that they do not come under the state's purview even during normal business days.

There is an urgent ask to map and assess the current state of water bodies and drainage systems in the city; to develop a restoration plan and undertake flood mapping exercises to reduce city's vulnerability to extreme climatic events. This information should be made available to the public so as to empower citizens to gain an accurate picture of flooding events as they occur as well as ensuring transparency in decision making related to flood relief measures. Increased public participation in management of natural resources, particularly water bodies maintained by urban local bodies may very well be one of the solutions to be strongly considered.

The 2015 floods in Chennai can be the trigger to facilitate change; beginning with civil society organizations coming together to convert individual action into collective strength. The timing is extremely important since many cities across India such as Mumbai, Srinagar and most recently Hyderabad have experienced flooding and there is ample opportunity for cities to draw upon each other's learnings resulting in a framework for cities to respond to extreme events.

This report is an attempt to enable citizens to improve their understanding of the events surrounding the floods from different perspectives as well as approaches that can be adopted for risk mitigation. It also aims to serve as a tool for advocacy with stakeholders specifically government authorities/departments. While working within the existing governance structures, the report attempts to feed into policy, its enforcement and monitoring together with government to jointly shape the vision for the city.

3 Disaster Induced Forced Eviction and Relocation

Esther Mariaselvam, ActionAid

3.1 Introduction

Forced eviction, given the rapid urbanisation across the globe is one of the most serious challenges of our time. It not only violates the fundamental human rights of the urban deprived community but also prevents them from reaching their full potential. It is imperative to end such violations, as it is essential for the progress and prosperity of our society.

The practice of forced eviction is "the permanent or temporary removal against their will of individuals, families and/or communities from the homes and/or land which they occupy, without the provision of, and access to, appropriate forms of legal or other protection."[1] Forced eviction not only exacerbates global problems of inadequate housing and homelessness but is a blatant violation of human rights.

3.2 Rapid urbanisation

"Accelerating urbanization, climate change, globalization, financial and other global crisis have contributed to making forced evictions even more acute and complex."[2]

By 2050, the world's urban population is expected to nearly double, making urbanization one of the 21st century's most transformative trends. As the population, economic activities, social and cultural interactions as well as environmental and humanitarian impacts are increasingly concentrated in cities, this poses massive sustainability challenges in terms of housing, infrastructure, basic services, food security, health, education, jobs, and natural resources amongst others.

Urban construction and development, funded by private enterprise and commissioned by government bodies has occurred without sufficient regulation and with no regard for environmental consequences. Chennai-based environmentalist IH Sekar has voiced his grave concerns for the current state of affairs. "Environmental damage has been caused in the name of 'development' widely across Chennai. For example; construction on Pallikaranai marshland; including the corporation's garbage dump, the airport runway

[1] Committee on Economic, Social and Cultural Rights, general comment No. 7 (1997) within Forced Evictions (Rev 1), United Nations Human Resources, 2014 UN Doc. Fact Sheet No.25/Rev.1, p 3.

[2] Forced Evictions (Rev 1), United Nations Human Resources, 2014 UN Doc. Fact Sheet No.25/Rev.1, p 1.

on the Adyar River and the MRC Nagar neighbourhood which was built within the Adyar estuary have all contributed to environmental degradation."

Pattern of disaster induced eviction across Tamil Nadu

In 1971, the Tamil Nadu Slum Clearance and Improvement Act were passed which stated the need for the identification, declaration and improvement of slums. The act was progressive, with an overarching goal to improve the lives of slum dwellers. The benefits of the act included protection against eviction, tenure security and access to government provided improvements, benefits and schemes. Although well intentioned, the act has caused many issues in subsequent years. In 1971 1,202 slums were declared, and 'improvements' provided. In 1985, only 17 additional slums were given a 'declared' status. These are still the most recent slums to be recognized within Tamil Nadu, despite the erection of countless new slum areas since 1985. As a result, families living within undeclared slums are highly vulnerable and have little access to resources, services and education. Living under the constant threat of eviction, they are denied many of their basic human rights such as housing rights in the recent flood.

Evictions have been implemented in the interest of city beautification and infrastructure projects, not for the improvement of marginalised and excluded communities. Although having a declared status has its advantages, the slums also suffer from insufficient protection from eviction and access to resources. Therefore, since 1971, many legal evictions have taken place in both declared and undeclared slums which has served to further disadvantage the urban deprived community.

The state's determination to use disaster as a mode of forcibly evicting the urban deprived community is an all too common pattern in recent history. From the early 1990s, in an effort to advance and modernize the state's infrastructure with the underlying agenda of removing informal and 'illegal'[3] dwellings, bulldozers have literally moved in on the urban poor living alongside rivers, lakes and other water bodies. For instance, the Tamil Nadu Protection of Tanks and Eviction of Encroachment Act of 2007, sought to do just this; by forcibly removing slum dwellers from their homes and resettling them on other low lying, flood prone areas on the south and south-west sections of the city. The communities of Semmencherry and Kannagi Nagar are an example of this; where complex social and economic problems of relocation are still felt today. These dire effects are a pattern that is expected to play out again in both Perumbakkam and Ezhil Nagar, as the current relocation progresses.

The state intervened in the life of the tsunami survivors by proposing a resettlement plan coupled with economic arm twisting policies. The coastal communities who had been residing within the 200 metres of the high tide line for ages were suddenly planned to be relocated under the guise of "Safety". The state had devised a housing

[3]Tamil Nadu Slum Clearance Act 1971.

policy which forces these affected communities to forgo their traditional habitation. Further taking advantage of this opportunity, the state had proposed resettlement sites far off from the original place of habitation which would lead to a strategic loss for these affected communities in terms of their livelihood prospects. Yet the people agreed to move out to these unfavourable resettlement sites as they had no other choice, were in the struggle to regain lost foothold and therefore completely dependent on the rehabilitation packages which would become inaccessible if they chose to confront the state by staying back in their original sites. The Tamil Nadu Government order GO. Ms. No. 172 dt. 30/03/2005 states that "all the house owners of fully damaged and partly damaged Kutcha and pucca houses within 200 metres of the High Tide Line, will be given the choice to go beyond 200 metres, and get a newly constructed house worth Rs.1.50 lakh free of cost. Those who do not choose to do so will be permitted to undertake the repairs on their own in the existing locations, but they will not be eligible for any assistance from the Government".

"Evictions are not an inevitable side-effect of urbanization, development and reconstruction. They are the result of human interventions."[4]

3.3 History of eviction and relocation

The urban deprived community and the location of their inhabitancy alongside water bodies has been cited by some as a contributing factor to the 2015 Chennai flood. However, this claim is unfounded as evidence from urban planners' state that the flood which was largely human induced and attributed to large-scale unregulated urban development that has obstructed water channels, reservoirs and the natural environment. The government owns many of these encroaching structures, including the Chennai airport, Koyambedu bus terminus, the entire IT corridor and Adyar Eco Park. The government has ignored environmental cautions and given private parties the ability to build structures upon known flood plains, catchment areas and marshlands. Forty years prior, the waterbeds of Chennai were twice their current size, which has now greatly reduced their ability to carry water during heavy rains.[5] According to The Economic Times, there are three areas to focus on: the reservoir, the bodies of water, and the drainage systems[6].

The forecast leading up to the 2015 flood, predicted 500 mm of rain for Chennai; more than what the Chembarambakkam reservoir could handle without an increased water release. However, the state administration failed to order the release prior to the rains, which caused an uncontrollable overflow to the river. In addition to the lack of preventive measures, the government also failed to warn people living in low-lying

[4] Forced Evictions (Rev 1), United Nations Human Resources, 2014 UN Doc. Fact Sheet No.25/Rev.1, p 2.
[5] The Economic Times, Chennai's Encroachments on Water Bodies Caused Floods, 20 December 2015.
[6] The Economic Times, Chennai's Encroachments on Water Bodies Caused Floods, 20 December 2015.

sections of the potential danger high levels of water could bring.[7] Thus the tragic Chennai flood of 2015 and significant losses were not a consequence of the location of slum dwellings, but man-made due to issues regarding poor urban planning and governmental neglect.

Current evictions and relocations

Despite already losing their homes, their belongings, and in some cases their family members in the flood; the city's most vulnerable are now being forcibly relocated. The government has plans for 50,000 families to be evicted and relocated to the city's periphery. Here, they will be housed in one-room apartments of 310-390 sq. ft. in high rise apartments at one of two sites; Perumbakkam or Ezhil Nagar.

The first of the two relocation sites is located at Perumbakkam, Kanchipuram District. Undertaken by the Tamil Nadu Slum Clearance Board (TNSCB), it consists of 188 high rise blocks within the marshland of Perumbakkam village where 10,000 people will be forcibly moved. The irony of this relocation is that in constructing these multi-storey apartment blocks, the natural water systems that existed have been destroyed and therefore created a highly flood-prone area.

The Ezhil Nagar slum relocation project plans to shift 40,000 slum dwellers to 84 newly constructed high-rise blocks, that are also being built amongst wetlands. Similarly to the Perumbakkam project, the location of the new dwellings are breaching the natural drainage capacity of the area. Therefore, the urban poor are being moved from one risk laden site to another. This is in complete contradiction to Jawaharlal Nehru National Urban Renewal Mission's (the funder for this relocation) 'Basic Services for the Urban Poor' (BSUP) component, whose very mandate is to 'improve living conditions of the urban poor in their existing locations'.

Effects of eviction and relocations

According to the United Nations Human Resources (UNHR) guidelines, the relocations issued by the TNSCB are classified as 'forced evictions'. Various elements, separately or combined, define a forced eviction:

"Carried out without the provision of proper alternative housing and relocation, adequate compensation and/or access to productive land, when appropriate."[8]

and

"Carried out without the possibility of challenging either the decision or the process of eviction, without due process and disregarding the State's national and international

[7] *Times of India*, Delay in Decision to Open Sluice Gates Caused Flood of Trouble, 09 December 2015.
[8] Forced Evictions (Rev 1), United Nations Human Resources, 2014 UN Doc. Fact Sheet No.25/Rev.1, p 3.

obligations."[9]

These violations are both directly and indirectly related to the manner in which the relocations have been handled. According to United Nations[10], the TNSCB has violated the human rights of its citizens through relocation, in terms of the following:

The way evictions have been decided; no consultation or participation with slum dwellers, no information given, no recourse mechanisms in place.

The way evictions were planned; no notification given, site of relocation non-negotiable, inadequate compensation provided, delayed or subject to unjustified conditions.

The way evictions are being carried out; at night and/or in bad weather, no protection for people or their belongings, no time allowed to assemble their belongings.

The use of harassment, threats, violence or force; forcing people to sign agreements, using bulldozers when people are still salvaging their belongings.

The results of the eviction the disruption of children's education, access to medical treatment, mental trauma, loss of jobs and livelihoods, inability to vote because of homelessness, inadequate access to basic services or justice because identity and property papers were destroyed during the evictions.

These relocations are unacceptable and inadequate for the residents for many reasons. Firstly, they are situated very far from the relocated family's location of work or not conducive to the conducting of their daily work, especially in that they are high-rise apartments. Evidence from past relocations has shown in similar cases; jobs and incomes are significantly negatively affected post-relocation.

Secondly, the resettlement colonies are not equipped with adequate services including schools, child or health care centres and ration shops. Furthermore, the relocation in itself disrupts family's ability to access their education centres. In addition, such circumstances create a high risk of psychological damage, trauma and violence related impacts. Under International law, forced evictees have the right to an adequate standard of living including education, healthcare, and employment.[11] Yet these rights are not being recognised in current plans.

Of immediate and vital concern is the fact that these new settlement colonies are situated amongst floodplains, catchment areas and marshlands. Therefore the risk of re-flooding is significantly high, especially as these areas already faced severe flooding in November and December of 2015. In Semmencherry, twelve people have been

[9] Ibid.
[10] Ibid, p 6.
[11] Forced Evictions (Rev 1), United Nations Human Resources, 2014 UN Doc. Fact Sheet No.25/Rev.1, p 6.

reported to have drowned in the floods. Therefore, all these relocations serve to move marginalised people from one flood prone area to another.

3.4 Recommendations

States have the responsibility to protect and promote the rights of the urban deprived. International law, according to the UNHR states that every person has "the right to an adequate standard of living, including the right to adequate housing, food, water and sanitation.[12] In line with this, we recommend that the state commit to develop urban planning and financing policies to prevent the growth of informal settlements, spatial segregation (ghettoization) and forced displacements. We further recommend in-situ housing must be mandated. Displacement and relocation of slums as well as informal settlements into urban peripheries must be prevented.

We urge the state to commit for housing policies that support the progressive realization of the right to adequate housing for all as a component of the right to an adequate standard of living. This should address all forms of discrimination resulting in zero evictions with focus on the needs of women, children, informal sector workers, dalits, Indigenous people, homeless communities, persons in vulnerable situations, low income groups, persons with disabilities and other marginalized groups. The states should enable the participation as well as engagement of communities and relevant stakeholders supporting the social production of habitat, in the planning and implementation of these policies.

The protection of the rights of the urban poor who are relocated or threatened by forced eviction and relocation must be strengthened in law and practice. Legal provisions on secured land tenure must be fully implemented and specific provisions on the rights of dalits and fisher folks should be included in laws on internally displaced persons wherever appropriate. States, national human rights commissions, all humanitarian and development actors including civil society must ensure that all those in need are treated equitably and in a non-discriminatory manner, including access to protection and assistance, livelihood opportunities and the realization of durable solutions.

We also recognize that urban centres worldwide, especially in developing countries, often have characteristics that make them and their inhabitants especially vulnerable to the adverse impacts of climate change and other natural as well as man-made hazards.

[12] International Covenant on Economic, Social and Cultural Rights, Art. 11, and related Human Rights Council Resolutions, Forced Evictions (Rev 1), United Nations Human Resources, 2014 UN Doc. Fact Sheet No.25/Rev.1, p 6.

Special representative of the Secretary General of the UN, Walter Kälin states, "Effective disaster risk reduction is essential for protecting lives and preventing or at least reducing displacement caused by the effects of natural disasters.[13] Furthermore, special Rapporteur Chaloka Beyani noted that "Human rights obligations engage State responsibility before disaster strikes as well in its aftermath".[14]

3.5 Conclusion

The persistence of multiple forms of poverty, growing inequalities and environmental degradation owing to a lack of human rights perspective and over reliance of the government on private sector remain among the major obstacles to sustainable development worldwide. As a result, social and economic exclusion as well as spatial segregation are often an irrefutable reality in cities and human settlements. Disasters provide a real opportunity to bring about social and policy change. They can facilitate or catalyse a shift in power structures; in favour of those who are most disempowered in terms of equitable and just share of resources for the greater fulfilment of the rights of urban deprived communities across the globe.

[13] Report of the Representative of the Secretary-General on the human rights of internally displaced persons, Walter Kälin, Addendum, Protection of internally displaced persons in situations of natural disasters, 5 March 2009, U.N. Doc.A/HRC/10/13/Add.1, p 17.

[14] Report of the Special Rapporteur on the human rights of internally displaced persons, ChalokaBeyani, 20 December 2010, U.N. Doc.A/HRC/16/43, p 64.

4 Need for Social Vigilance

Jayaram Venkatesan, ArapporIyakkam

In a democracy, we all know citizens are masters. However, it really does not translate directly on the ground as citizens seem to have no role in governance except for electing their representatives to the assembly or parliament. We are in a state where our elected representatives portray their own greed or that of the large corporate while ignoring the needs of the common people. This could only be overturned by building coordinated pressure by the citizens on the elected representatives.

The floods that Chennai witnessed in December 2015 were a big wake up call for everyone especially - Citizens and the Government. It was a message that the immense damage that we are carrying out on nature will hit us back if we don't take proper care of it. First, we must acknowledge the problem that the flood is a result of a series of man-made mistakes over several decades and not a natural one. Centuries before, water bodies and waterways were mostly constructed, controlled and maintained by the local community. This community control over natural resources ensured that there was active participation of the people who primarily benefitted from the resource and there was a constant need to maintain it free of any encroachment or pollution as it was a lifeline to their livelihood. Since then, there has been centralized control during the British raj and more so after independence.

Even though smaller water bodies are under the control of local municipal bodies, politicians have become the biggest threat and they are the first to encroach water bodies in many places. In other places, water bodies / waterways are being legitimized for construction by first erecting a government building, then handing it over to a series of builders and other private entities. The city does not have any answer to three of the largest polluters in our waterways – Untreated sewage, Garbage and Construction debris. These three continue to be a major threat to our waterways and played an important role in causing the floods. The corruption in the dredging of canals and desilting of our waterways has also contributed in a major way to the problem. Most of these activities have been occurring right before our eyes in the water bodies located near our homes.

A sustained social vigilance by the local residents is the need of the hour. The idea of social audit and public hearing was used extensively by Aruna Roy's group MKSS in the villages of Rajasthan to question the money spent by local government that later led to a powerful legislation, The Right to Information Act.

An unprecedented number of citizens came forward for the relief work during the floods. A sustained effort of such citizens to question and pressurize the government

requires a reasonable understanding of the state of local water bodies. A recent audit of waterways conducted by Arappor Iyakkam where nearly 150 citizens participated across four stretches of waterways gave them a first-hand understanding of the waterways and how it is being systematically and intentionally taken over to serve certain vested interests. Direct auditing by local residents turned out to be the one of the keys to understand waterways and it provided them with huge motivation to continue working towards solving the problem in a sustained way.

Technology also plays a major role as GIS mapping of our water bodies and comparing their state over a period of time gives us a clear picture of the amount of damage caused. With the government very reluctant to part with their data, citizens have to form a consortium where technology as well as waterway experts can provide knowledge and directions to the citizens who have to continuously build a large vigilant community on the ground in each area.

Auditing of the waterways, getting official data through the Right to Information Act, carrying out public hearing on waterways, questioning and petitioning the concerned authorities, fighting the battle in the court through public interest litigations, exposing corruption in the waterways and holding peaceful nonviolent protests are all essential elements of a strong vigilant community. Citizens need to take ownership of their natural resources and public infrastructure; only a strong socially vigilant community can turn around the state we are in today. The problem may lie with the government but the solution clearly lies with us.

5 Evictions and the river restoration project (planned projects being distinct from natural disasters)

Jacintha Chitra, Citizen consumer and civic Action Group

5.1 Purpose

Since the early 80's, successive state governments in Tamil Nadu have attempted to clean Chennai's rivers. In the past, any political party elected in Tamil Nadu proposed plans to clean the Cooum River and allocated a large budget during its regime. However, the plans either did not take off or failed at the foundation stage. The formation of the Adyar Poonga Trust was initiated by the DMK government during its five year regime between 2006 to 2011. This proposal contained both Adyar and Cooum River Front Development plans. In the year 2012, the Cooum River Restoration Trust - CRRT (erstwhile Adyar Poonga Trust) initiated a project called Integrated Cooum River Eco-Restoration Plan. This plan was prepared by a LKS India Pvt Ltd, a consulting firm which carried out the study at the ground level and submitted its plans to the CRRT which is headed by the members of the Tamil Nadu Urban Infrastructure Financial Services Ltd. The project had a budget of approximately 2000 crores, many have questioned what happened to the previously allocated budgets.

Critics state that the project is similar to the Sabarmati Riverfront Development project in Gujarat. The Cooum plan advocates for an eco-restoration of the river. But, RTI information and maps in the plan clarify that the project intends to clear the encroachments on the river bank as well as creating parks, walkways, cycling tracks and infrastructure for similar activities.

5.2 Objectives of the project and proposed activities

The project proposes to reduce pollution and protect the river through a sustainable approach; maintain the ecological flow of the river with the aim of ensuring water quality supporting sustainable development. It also attempts to improve and maintain flood-carrying capacity of the river, create a riverfront while exploring the possibility of navigation and other future uses.

The project proposed both short and long term measures which include sewage and sanitation management, solid waste and silt disposal, inundation (flood) management, riverfront development, flora and fauna development, social and environmental assessment report and finally a financial management plan.

5.3 Implementation of the plan in the year 2015 and its impact on slum dwellers

In September 2015, the implementation of the project began in the Cooum River by building a short canal as well as dredging activities by the PWD Department. This was to ensure free flow of water even during the summer. On the other hand, the

Tamil Nadu Slum Clearance Board was evicting families who were living on the banks of the river whose livelihoods were based in the neighbouring areas. But the Corporation of Chennai did not have plans for government and private buildings which were located on the floodplain of the river causing more harm by encroachment rather than the slum communities. An NGT case related to the cleaning of Chennai's waterways filed by Mr. Edwin Wilson showed that three major companies were polluting the river by releasing untreated wastewater directly into the river. The NGT had asked for an explanation from the State Pollution Control Board (SPCB) about actions taken against the companies to prevent pollution, the SPCB delayed providing this information at every stage of the hearing. Reports also mention that Sewage Treatment Plants (STP) which have been built to treat clean the city's wastewater have not been upgraded to meet the needs of the growing population. This facet of the issue was not highlighted either in the recent proposal of Integrated Cooum River Eco Restoration Plan or the NGT hearings.

Another facet of the issue was forcefully relocating the families living on the banks of the river and resettling them at Kannagi Nagar, Semmenchery and Perumbakkam which lay on the outskirts of the city away from their livelihoods without any public consultation. There were no prior checks to see if the relocation sites had sanitation facilities, people who had already settled in these areas were already facing issues with lack of proper connectivity to the drains and water logging on the streets. This led to many health and mobility issues for the dwellers who had long commutes to their livelihood stations on a daily basis.

5.4 CRRT and Floods in Chennai

The three relocation zones experienced higher losses as a result of the floods and deaths were also reported[15]. Loss of lives, livelihood and loss/repair of household amenities were the some of the impacts of the flooding. People and CSOs felt that the situation was similar to the Tsunami crisis, where in people had to rebuild from scratch. Post the floods, the government announced permanent shelter to be provided to affected families. These shelter homes were again located at existing tenements at Perumbakkam and Kannagi Nagar which were affected during the floods.

It is also necessary that the state government brings amendments in the State Disaster Management Policy, 2003 to improve prevention, rehabilitation and relocation measures based on recent events. The state should ensure implementation of the policy by staffing the relevant authorities/departments and upgradation of operational processes and systems. Dissemination of relevant sections of the State Disaster Management Plan to the general public in the local language is useful as well. Unless

15 http://scroll.in/article/773230/while-chennais-sanitation-workers-help-the-deluged-city-whos-looking-after-them

these things go hand-in-hand, Chennai is bound to face another crisis in the next monsoon.

6 Drainage systems and Chennai floods

Dr. S. Janakarajan, Madras Institute of Development Studies

Chennai is geographically very uniquely placed and has a well spread out drainage system. We have three waterways that run through the city, something very few other places can boast of. We have the Kosasthalaiyar River running through the Northern part of Chennai; the Cooum River which takes care of Central Chennai; the Adyar caters to southern Chennai; further south, Chennai is blessed with the Palar River. And there is the Buckingham Canal which cuts across all the four. Unfortunately, these major drainage systems are in pretty bad shape due to heavy encroachment, reduction of bed-width by more than two-thirds, siltation and formation of sandbars at the mouth of the rivers.

In addition to these major drainage systems, there are medium drainage systems such as the Mambalam canal, Velachery canal, Kodungaiyur drain, Otteri nallah, Virugambakkam / Arumbakkam canal, Veerangal Odai, Captain cotton canal, Villivakkam canal, Okkiyam maduvu and so on. At the moment, it is difficult to trace these medium canals. The Pallikaranai marsh land (which was originally spread over 7000 acres of land) has currently shrunk to less than 500 acres. Indeed, most of Chennai's IT corridor on the Old Mahabalipuram Road (OMR) is situated on the floodplains of Pallikaranai wetlands. And finally, there are the storm water drains constructed by the government mostly prevalent in the older parts of the city, which are heavily clogged due of solid waste. They are quite narrow that they may not carry flood water if there is persistent rain of 1 cm every hour.

These networks collectively failed to carry water during the recent rains and one could arrive at the conclusion that the Chennai's most important "fundamentals" have failed. A little bit of investigation would reveal the kind of human errors responsible for such catastrophic consequences. They are

- Mindless urban expansion and unscientific urban land use policy
- Encroachments on drainage systems, rivers, floodplains and marshlands
- Lack of comprehensive risk assessment, vulnerability analysis, risk mitigation policy as well as policy for building resilience capacity for the city and its people
- Myopic development agenda

- Lack of respect and institutional mechanism to act swiftly upon weather reports and early warnings available from IMD, WMO, National Oceanic and Atmospheric Administration (NOAA) and other international weather offices

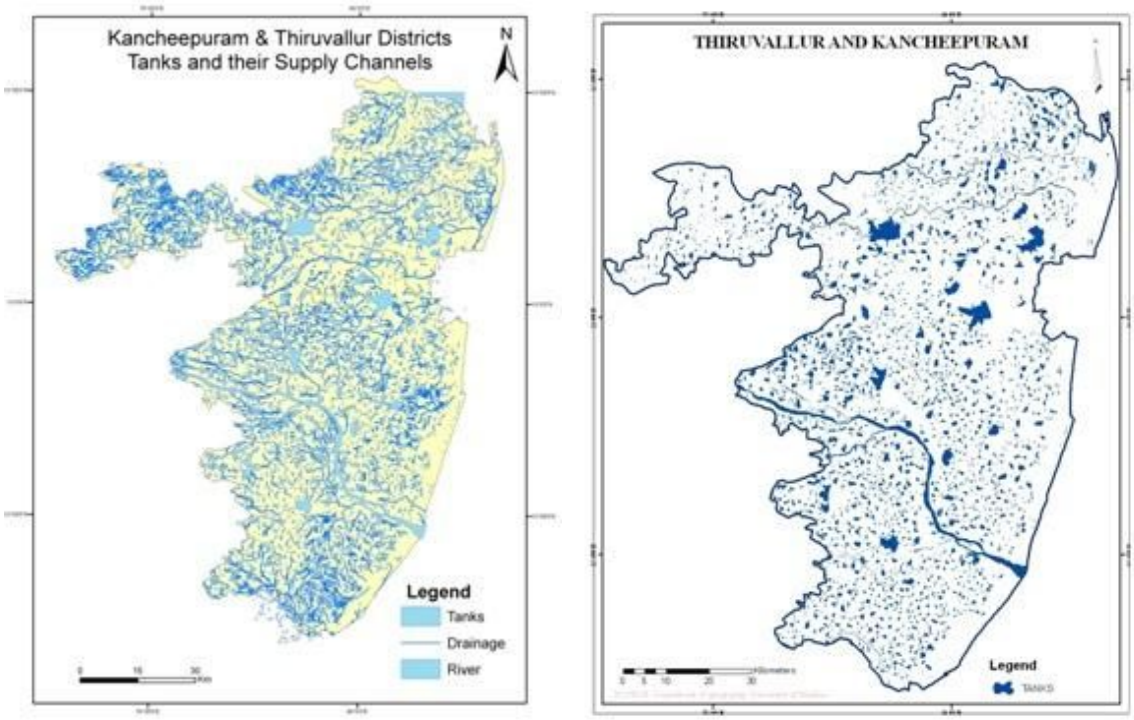

Figure 1 Water bodies and Drainage Map of Kancheepuram & Thiruvallur districts

In order to further understand the flood situation, it is important to have knowledge about the upstream/downstream watersheds, ecology, rainfall pattern and characteristics of monsoons.

Chennai and its two adjoining districts of Thiruvallur (TVR) and Kancheepuram (KPM) primarily get rainfall through the north-east monsoon (October-December) and the annual average is around 1300 mm. The character of north-east monsoon is such that it always brings heavy rainfall in a few days only through low pressure, depression and cyclones. Rainfall during the last 50 years has always been more than the state and national average.

Chennai and the adjoining districts are also endowed with wonderful watersheds. There are 1942 and 1646 irrigation tanks in TVR and KPM districts respectively as per the tank memoirs, some of which are very large. These are man-made but magnificent watersheds created through a series of earthen embankments constructed across streams which have helped immensely in storing water. These tanks were constructed

in such a way that surplus from an upstream tank serves as a feeder to a downstream tank. These are called tank chains and each tank played an important role in recharging groundwater and influencing local ecology. Unfortunately, these tanks are completely neglected at the moment, silted up with broken control structures. In addition, many of the catchment areas, flood plains, feeder and supply channels for these tanks are heavily encroached. The net result is there is very little water storage in these tanks and runoff is very high resulting in flood damage.

Even within the Chennai Metropolitan Area (CMA) as per the 1971 topo-sheet, there seems to be around 142 tanks. The total capacity of these tanks is 2.45 TMC feet or 68,600 million liters with water spread area of these tanks being 97.26 sq km or 9726 hectares. One is not very sure how many of these tanks have disappeared and shouldn't we protect at least the existing ones?

What needs to be done immediately?

1. Undertake a comprehensive survey of all water bodies (including temple tanks and irrigation tanks) in Chennai city, CMA and in two adjoining districts of TVR and KPM, their present conditions, level of encroachments, level of siltation etc.

2. Study the elevation and undertake elevation mapping

3. Map the rivers, streams and entire drainage system in this region

4. Map the flood plains, catchment areas of rivers, streams and water bodies

5. Map the low lying areas and ecological hot spots in this region

6. Undertake the simulation exercise of runoff during monsoon months with and without encroachments

7. Undertake a serious vulnerability analysis of the region with/without floods and droughts

8. Since floodplains are hydrologically and ecologically sensitive and productive, a survey of human encroachments in these areas should be carried out; all encroachments should be evicted immediately but the poor after eviction need to be resettled and rehabilitated within 3 kms from their last place of domicile.

9. Most importantly, declare the entire region Chennai, Thiruvallur and Kancheepuram districts as one important ecologically sensitive region and demarcate this region as one mega watershed. Protect this region from all illegal encroachments in the water bodies and floodplains.

7 Popular Control of the Commons: Choice or Necessity

'The fruits of the earth belong to everyone but the earth itself to none.'
K. Sudhir, Citizens Platform

7.1 Background Context

While the floods that ravaged Chennai, Thiruvallur, Kanchipuram and Cuddalore in November-December 2015 form the particular context for this enquiry, the series of urban floods – Srinagar 2014, Uttaranchal 2013 & 2016, Mumbai 2005, 2014, 2015 & 2016 – that it punctuated and the patterns of drought, flood, and extreme climate events that it reflected delineate the larger context of the environmental crisis in which we are mired.

The immediate causes for the massive flooding and consequent damage sustained by Chennai and its surrounds were a combination of factors, the most important of which include the rate and scale of growth, the serious failure of the governance of water resources in Tamil Nadu, the degraded state of its rivers and the poor maintenance of its water bodies. In addition, obstruction of flood waters caused by huge construction encroaching waterways and floodplains as well as the failure of disaster mitigation measures.

The Chennai-Thiruvallur-Kanchipuram region is drained by five non-perennial rivers – the Araniyar and Kosasthalaiyar in the north, the Cooum and Adyar centrally and the Palar in the south – running generally from the West-Northwest to the East to empty into the Bay of Bengal. Barring the Tirupathi Hills in the Northwest and the Pallavaram Hills in the Southwest, the relatively flat terrain is comprised of rich alluvial deposits and sandy clay. Despite the limited gradient, people living in the region have assiduously built thousands of tanks and channels – including the Buckingham Canal – over the last 100 years and more to harvest the monsoon rains for use around the year. Numerous wetlands such as in Velachery, Pallikaranai, Perumbakkam and Thoraipakkam act as holding ponds for flood waters to drain via underground streams across the sand dunes that parallel the southern part of this coastline. The coastal ecosystem itself is rich in biodiversity with long stretches of sandy beaches and intertidal zones interspersed by mangroves, backwaters and salt pans supporting a variety of flora and fauna.

However, very few patches of forest remain, especially in the foothills to the North and Northwest and in the reserves carved out in the South. In 1976, the Chennai Metropolitan Area (CMA) with an extent of 1189 square kilometres and including parts of Thiruvallur and Kanchipuram districts had 72% of its land under agriculture with rice paddies, lentils, groundnuts and mango orchards dotting the landscape. In 2006, only 12% of the CMA remained under agriculture. And though the relationship between forestry, animal husbandry and agriculture is well known and suggests the extent of forest, grazing and water commons that have been swallowed up by the city, the actual loss of the commons to urban growth remains deliberately undocumented.

The repeal of the Urban Land Ceiling Act in 1998 and the executive exemption and regularisation of the illegal transfer, sub-division and 'encroachment' of lands under ceiling, the promulgation of the TN Acquisition of Land for Industrial Purposes Act 1997 and the Special Economic Zones Act 2005 were all milestones in the now overt thrust of governments both at the center and states to 'partner with the private sector', 'foster an investor-friendly climate' and in general facilitate the commodification of land and core urban services. The state's proactive initiatives in promoting the construction of several major infrastructural projects including the IT Corridor (Phase 1:1998-2008), the East Coast Road (improvement project 1998), Chennai Outer Ring Road (Phase 1:2011-2014), the Chennai Metro Rail (Phase1: 2009-2015) and its pending proposals for a new greenfield airport in Sriperumbudur, more desalination plants and making Chennai a 'smart' city, with significant private sector and international financial institutional participation, all have serious implications for the continued access of the common people to the water, forest, grazing and public space commons which are instrumental in bolstering their livelihoods even today.

Extensive sand mining in the Kosasthalaiyar in Thiruvallur district – extending to include village homesteads, grazing lands and even graveyards and school buildings – and the Palar and Cheyyar in Kanchipuram district – where the clay of the riverbed has been exposed, has wiped out the aquifer in those parts. Water-bottling plants – such as the Rail Neer plant at Palur – siphon off lakhs of liters of groundwater away every day, while the wells of a drinking water scheme – to pipe water from the Palar to Pallavaram in Chennai – have been allowed to run dry and a check dam built across the Kosasthalaiyar at Thirukandalam in 2014-15 at a cost of Rs. 34 crores – to impound drinking water for Chennai – was washed away by the flood waters in November 2015.

The forcible acquisition and large scale conversion of multi-crop farmlands in Sriperumbudur and Oragadam in the lake district of Kanchipuram into industrial estates and telecom and automobile SEZs, have inevitably enclosed hundreds of water bodies, channels, associated wetlands and grazing commons, besides placing an enormous burden on the groundwater resources of the region due to the concentration of mega-consumers of water and exposing its air, water and soil to a range of toxic

industrial wastes. The coastal commons which have traditionally supported tens of thousands of families engaged in fishing, farming and salt pans have been usurped to build private ports (Kattupalli), power plants (Ennore, Athipattu), desalination plants (Ennore, Nemmeli) and a host of complementary infrastructural facilities including ash ponds, gas pipelines, truck terminals and elevated roads. The southern segment of this coastline has been converted into prime real estate on the beach, beginning with MRC Nagar (awarded executive exemption from land ceiling law) and stretching for about 20 kilometers from Thiruvanmiyur to Muttukadu along the East Coast Road, where palatial 'farm' houses and beach resorts jostle for space with middle-income residential layouts, depriving the hundreds-of-years old fishing villages of their customary domain and squeezing them onto narrow, intermittent sections of the beach. Incidents of illegal alienation of community forest land (Thervoy-Kandigai) or bhoodan (ChennaKuppam), annadhinam (Kaverirajapuram) and panchami lands assigned to marginal cultivators from the depressed classes over the last 100 years, abound – both in Kanchipuram and Thiruvallur districts – despite stiff resistance by the occupants who have even refused to accept the compensation amounts paid.

7.2 Statement of the Problem

There are several readily apparent general implications of the particular developments described above, the most serious among them being the complex of environmental crises stemming from the narrow and dominant pursuit of growth and consumption which have compromised the future of our species and many others, besides generating historically unprecedented levels of inequity and deprivation, all of which is maintained by the increasing use of violence which is both overt and covert, perpetuating these conditions and preventing the emergence of viable responses.

It is a good measure of our lack in breadth or depth of understanding of our world that we tend to see these developments as the necessary price of progress rather than as a threat to the survival of our species. More specifically, these developments point to the absence of a systemic perspective that includes an assessment of the potentials and constraints faced by human beings from diverse regions and cultures – including ourselves – in consciously evolving the integrated and open-ended responses necessitated at this critical juncture of our history, which may be recognized as an age of bifurcation.

Also hidden is the vast reservoir of our cultural heritage which sufficed to negotiate the simpler world of 150 years ago and currently remains an integral part of the lives of a vast majority of humanity. While it must be acknowledged that this heritage includes its own complement of sharply divisive practices – such as patriarchy and caste – enforced to this day by violent repression, we cannot afford to ignore the immensely creative and inherently sustainable livelihood and environmental stewardship practices associated

with the commons supporting basic levels of consumption and therefore of special relevance to us today.

However, the space for the continued practice of these diverse older forms of production and their associated natural and cultural heritage conservation systems has shrunk considerably – and in many societies been erased completely – as the modern state replaces commoning in the name of emancipated governance, only to mediate the rapid exploitation of common-pool resources on behalf of the same or new elites, now steering an increasingly homogeneous industrial mode of production. In the last 30 years, the power of transnational corporate business and finance capital have grown to eclipse that of most governments and the rate and scale at which they have pursued extraction and promoted consumption have contributed alarmingly to the escalation of warming and environmental pollution, as even the semblance of checks and balances promised by the state was vacated.

Rather than regarding the commons as mere common-pool resources or a social institution, it is necessary to comprehend the commons as a dynamic, evolving socio-cultural practice. Thus the commons always consists of a distinct, active community that recognizes the boundaries of the resources in question, negotiates rules of access and use, assigns responsibilities and entitlements, monitors and punishes free riders and shirkers, and so on – often because their very survival depends on it. It is in this respect that the potential for self-organization expressed in the stewardship of the commons has a seminal role, far beyond the reordering of power relations to protect meaningful livelihoods and human dignity: to reaffirm the integral contribution of life in shaping the conditions for life.

7.3 Popular Control or Stewardship of the Commons

The emphasis suggested by the phrase 'popular control of the commons' is perhaps more suited to the current adversarial context, where it is necessary to draw attention to the inevitable resistance that the markets and the state encounter in their attempts to erase the commons by seeking to establish their writ over the common-pool resources that have often been part of one commons or the other for thousands of years. Now, this resistance is a form of power though not equivalent to the form of power displacing it.

The quality of difference is crucial: popular control of the commons may be better understood as the power to create the commons which are the dynamic, self-organized, inter-dependent sets of relationships among the mutually committed individuals of a group (community) and between them and their landscapes, which are reflected in their practices with respect to the natural world and among themselves (culture). The power to create has natural corollaries in the power to refuse to cease creating or to refuse to

create, both of which have tremendous transformative potential as expressions of resistance.

However, the power of the markets and the state – which are naturally allied in the formidable alliance represented by the power of finance capital backed by the coercive power of state authority – is expressed as the power over the community and 'un-owned' or common-pool resources, exercised by non-communicating, self-interested, utility-maximizing individuals and corporations and is clearly the antithesis of the 'power to' or 'popular control'. It is also self-evident how the 'power over' or the 'power to dominate' is the fountainhead of the exploitative and violent relationships that are extended to subdue both the natural and socio-cultural worlds.

Further, the use of the phrase 'popular control of the commons' in framing the transformative discourse around the commons today, demands acknowledgement and recognition of the precedence of these sets of relationships and practices that are distilled in customary rights whose legitimacy is drawn from outside state power. Hence, it may be forcefully argued that the inherently stable commons evolved over thousands of years is certainly a better bet than the failed attempts of the state and the market when it comes to governing the natural world, and that the recognition of the persistent existence of the popular control of the commons is not a choice before the state but a necessity that may provide the key to the survival of the species.

7.4 Steps to Stewardship of the Water and related Commons in Tamil Nadu, towards Water Security for ourselves and future generations

1. Commission a series of ongoing hydro-ecological studies led by the local people – with watersheds as the basic units integrated in catchments and river basins – that map and monitor the present condition and usage of all water, wetlands, forests, grazing, coastal and other commons in the state of Tamil Nadu while simultaneously recording their superseded or current customary practices and relationships with respect to these commons, prioritized to yield real-time inputs to inform all efforts to reclaim and rehabilitate these life-complementing systems.
2. Formulate an open-ended, climate-change adaptive, regenerative water security policy guided by the Consensual Framework for Stewardship of the Commons and enact legislation sufficient to the sensitive implementation of this policy, prioritising the retrieval, restitution, reclamation, rehabilitation, regeneration, protection, creation, assignment and maintenance of all water resources, associated common lands and resources and existing water management structures and appurtenances built by the people over time, recognizing the deleterious and life-threatening impact of large-scale extraction, conversion, encroachment, construction, abuse and waste disposal by public and private

sector projects on these essential, life-complementing systems and integrating the continuous inputs from the people-led hydro-ecological studies.

3. Support a scaled series of time-bound interventions by the Gram Sabhas or equivalent people's assemblies in urban areas or other special interest collectives to achieve the foregoing policy objectives in the broader interests of the community and future generations.
4. Halt immediately the forced eviction of squatter settlements, until a comprehensive relocation and rehabilitation policy for these groups is detailed in consultation with them, such that wherever relocation is necessary for reasons of safety, the community concerned is rehabilitated at a site chosen by them, within a radius of 2-3 kilometres from the place of original residence and provided with tenure security, basic services and housing assistance, to their satisfaction, before resettlement is undertaken.
5. Formulate an open-ended, climate-change adaptive, regenerative, comprehensive urban land-use policy guided by the Consensual Framework for Stewardship of the Commons and enact legislation sufficient to the sensitive implementation of this policy, prioritising the retrieval, restitution, reclamation, rehabilitation, regeneration, protection, assignment and maintenance of the urban commons, including all homesteads, common lands, urban forests, hills, all water resources, wetlands, all coastal commons and lands voluntarily donated under 'bhoodan' or assigned by government under various schemes for the use of the depressed classes, lands expropriated under urban land ceiling law, 'government' lands 'belonging' to various ministries or departments of government or public sector enterprises whether State or Central including land allocated for the housing of government and public sector employees and elected representatives, and urban physical and social infrastructure for water, sanitation, waste, electricity, transport, communication, health, education, recreation, livelihoods, industry and commerce, culture and local governance and conflict resolution, recognizing the destabilising, dehumanizing and homogenizing influence of local through global finance capital on the diverse landscapes, communities and cultures that are the very life-blood of the urban fabric and securing the primacy of the need for clean air, water and soil, vegetation and natural refuge, basic housing and amenities, physical and social infrastructure, and avenues for meaningful livelihoods, creative and cultural pursuit and commoning for all, beginning with the labouring poor and the excluded among them, effected through the direct democratic actions initiated by people's' assemblies at neighbourhood level and local special interest collectives and integrating the continuous inputs from the people-led hydro-ecological studies.
6. Halt the creeping privatization of water resources and attendant commons in the name of eco-restoration or decontamination of rivers, efficient and quality

provision of water supply services or technology transfer by desalination promoters, unregulated commercial extraction and commodification of groundwater by water tanker suppliers and packaging companies in the public and private sector, hidden gifts of water to industry and business in illegal, unregulated extraction of groundwater from water and related commons alienated in their favour by the State and proposals to introduce user charges for water supplied by SPVs in Smart Cities and user charges levied by water user associations for irrigation of farms.

7. Free all water bodies, water courses, wetlands, forests, grazing, coastal and other commons of large-scale encroachment by permanent structures of public and private sector projects that block and obstruct the drainage of water, prevent recharge of ground water, displace flood waters or that otherwise constitute a significant interference with the hydro-ecological functions of the concerned commons, as determined by the foregoing water security policy and legislation, without fear or favour.
8. Fix responsibility for large-scale encroachment by permanent structures of public and private sector projects constructed in water bodies, water courses, their catchments, floodplains, wetlands, forests, grazing, coastal and other commons, hitherto prohibited by law, on all officials under whose watch these violations have taken place, including the heads of the departments and/or ministries up the concerned chain of command, regardless of their current position and initiate appropriate departmental and criminal action against them for dereliction of duty, commission of offences and related illegal acts.
9. Clear all obstructions such as accumulated construction debris or garbage and weeds from all types of water bodies and water courses, de-silt them and dredge the mouths of rivers periodically and repair bunds, sluices, overflow weirs and other control structures to enable the free flow of water, enhance groundwater recharge and increase their storage capacity.
10. Immediately halt all dumping of solid and liquid wastes by sewage treatment plants, public and private sector industrial, commercial and residential complexes, into water bodies, water courses, wetlands, forests, grazing, coastal and other commons, support and facilitate the construction of ecologically sound sanitation facilities for communities lacking them, ensure serviceability of existing sewage collection, treatment and disposal systems and their separation from storm water drainage networks besides vigorously enforcing the existing ban on manual scavenging.
11. Impose an immediate ban on the production and use of plastics in packaging, banners, advertisement hoardings and other temporary uses, make compulsory the source-segregation and local recycling-processing of municipal/solid wastes and support or facilitate the composting of food and other biodegradable wastes at source or locally.

12. Revive and expand rainwater harvesting to harness runoff from paved surfaces of roads, restore feeder channels and link storm-water drains to temple or other tanks and strictly implement rainwater harvesting in all government buildings and campuses throughout the state of Tamil Nadu.
13. Review and regulate the use of water especially by cities, towns, industry, power plants, sports and tourist facilities and entertainment parks, by a graded scale of water consumption that sets limits and imposes obligations on these mega-consumers, prioritizing the essential water needs of the general population for drinking, cooking, washing and animal husbandry, with food crops and single-crop farming in dry regions, landless-tenants or sharecroppers and marginal and small farmers receiving precedence in irrigation schemes.
14. Halt immediately the illegal appropriation of sand dunes, intertidal zones, mangroves, backwaters or other coastal commons, for large-scale public and private sector projects such as power plants, ports, coastal SEZs, desalination units and rare-earth mining, involving the coercive dispossession of thousands of fish workers and other coastal communities of their livelihoods, culture and dignity and violating the collective human rights of large groups and their future descendants, by causing coastal erosion and other adverse environmental impacts including the threat to water security from pollution and the loss of biodiversity, until further review.
15. Recognize the rights of fishing and coastal communities by implementing the Coastal Regulation Zone Notification 2011 in letter and in spirit, while initiating steps to formulate an open-ended, climate change-adaptive, regenerative coastal livelihood security policy and enact suitable legislation conveying to them the power and the necessary resources to govern the use of the coastal commons in the broader interests of the community and future generations.
16. Halt immediately the forcible acquisition and conversion of agricultural lands whether irrigated or rain-fed, multi-crop or single crop and their associated commons, for large-scale public and private sector projects such as greenfield city, airport and institutional building projects, industrial-economic corridors, SEZs, industrial estates or regions, power plants, sewage treatment and waste dumping facilities, involving the coercive dispossession of thousands of farm workers and peasants of their livelihoods, culture and dignity and violating the collective human rights of large groups and their future descendants, by imperilling food and water security due to pollution, environmental degradation and the loss of biodiversity, until further review.
17. Revive the socio-cultural and socio-economic potential of agriculture and its complementary commons – which even today engages the largest number of workers and producers – through the introduction of a comprehensive food and agriculture policy, including the redressal of the uneven distribution and widespread conversion of agricultural land to urban, industrial and other

non-agricultural uses, the restitution of lands reserved for the depressed classes, distribution of land to the landless and the tiller including share-croppers, favouring the collective ownership of land and small and marginal producers, the prioritization of food crops especially for rain fed and dryland farms and the reintroduction of traditional, nutritious, naturally pest- and drought-resistant varieties of cereals, pulses, fruit and vegetables, extending and strengthening the state's food warehousing, procurement and distribution networks and revising the minimum support prices offered for various agricultural produce to reflect the costs of production and reasonable rates of return while firmly rejecting the corporatisation of food production by banning the introduction of genetically modified seeds, phasing out chemical and industrial farming, animal husbandry, forestry and aquaculture, resisting pressure to dismantle tariffs and permit dumping and disallowing trade in agricultural commodity futures.

18. Implement an immediate ban on river sand mining across the state of Tamil Nadu, giving effect to the recommendations contained in the Report of the PUCL-Greater Chennai Fact Finding Team on River Sand Mining in the Palar and Cheyyar Basins in Kanchipuram District dated 14-11-2013 and transferring the power and necessary resources to Gram Sabhas or local special interest collectives, to govern the mining, extraction or tree felling from the commons within their jurisdiction, in the broader interests of the community and future generations.
19. Halt immediately the illegal conversion of forests, hills, river valleys and associated commons, for large-scale public and private sector projects such as coal, iron-ore, bauxite, copper, uranium, lignite, limestone, granite, dolomite and other mines, oil, natural gas and coal bed methane extraction and their connected processing, refining, manufacturing and waste dumping facilities, spent nuclear waste repositories or other major scientific or military underground testing projects, mega-dams, reservoirs, power infrastructure, and river-interlinking projects, involving the coercive dispossession of thousands of tribal forest and fish workers and peasants of their livelihoods, culture and dignity and violating the collective human rights of large groups and their future descendants, by irreversibly destabilising the ecological balance, poisoning the environment, killing off biodiversity and imperilling food and water security, until further review.
20. Recognize the rights of forest dwelling communities by implementing the Forest Rights Act 2006 in letter and in spirit, while initiating steps to extend its ambit to include the conveying to them of the power and the necessary resources to govern the use of the forest in the broader interests of the community and future generations.
21. Initiate a people-led review of existing development priorities and processes and the particular large-scale public and private sector projects in their region

compared with inputs from the ongoing people-led hydro-ecological studies, involving the Gram Sabhas, equivalent people's assemblies in urban areas and local special interest collectives, in as wide and sustained a discussion as practically feasible, to determine the short and long term impact and viability in the given context and to evolve a broad consensus on the permissible locations and scales of such existing, under-construction and proposed projects currently under review.

22. Remove or remedy the man-made causes for coastal erosion, environmental degradation and destabilisation of the ecological balance, pollution and biodiversity attrition jeopardising food and water security, while implementing measures to prevent further degradation or erosion and assisting in the natural repair, recovery and regeneration of the water, forest and coastal commons and other affected ecologies, including remediation of pollutants and toxic wastes, to promote the rehabilitation of the natural habitat of local flora and fauna, in the broader interests of the community and future generations.
23. Enact a law to obligate the time-bound digitization and placement of all information relating to land and the commons across the state of Tamil Nadu, in the public domain, including maps, survey records, information on current and proposed use, status and other relevant revenue records at state, district, block and village/ward level and compile and publish a directory of all information relating to land and the commons across the state of Tamil Nadu, available with various departments at all levels of government, including the contact details of the concerned Public Information Officers.
24. Formulate an open-ended, climate-change adaptive, regenerative commons policy delineating a Consensual Framework for Stewardship of the Commons and enact legislation recognizing the natural and customary rights of local communities to their commons and sufficient to the sensitive implementation of this policy, integrating the continuous inputs from the people-led hydro-ecological studies and implementing the transfer of power and necessary resources to Gram Sabhas, equivalent people's assemblies in urban areas and local special interest collectives, to govern the commons within their jurisdiction, beginning with their local water, forest, land and information commons and enabling them to reclaim and rehabilitate these socio-cultural ecosystems such that they secure the community's inalienable rights to clean drinking water, water for animals and farms, safe sanitation, food, fodder and fuel needs, secure places to live and sustainable building materials, meaningful livelihoods, protection from floods and droughts, share or exchange surplus and uphold the dignity of the individual and the collective in the process.
25. Establish statutory Registries of the Commons at watershed, catchment and basin levels built on the ongoing inputs from the people-led hydro-ecological studies, created, integrated and continuously updated by the commoners at the

local level by supporting the Gram Sabhas, equivalent people's assemblies in urban areas and local special interest collectives with the necessary resources to digitize, compile, manage and network the relevant information on open access platforms.

26. Set up disaster management infrastructure from state level down to local nodes at village and neighbourhood level fully accommodating local knowledge and customary practice, build real-time monitoring systems that are integrated with the relevant national and international networks and deploy necessary early-warning systems, develop risk and vulnerability assessment capabilities, mapping and location-specific guides/manuals, integrating communities settled in vulnerable locations in risk reduction measures and disaster rescue and relief skills.

This note explores the paradigm of the commons building on the 'Lessons & Demands' document of the Citizens Platform, with ideas-expressions from Jean-Jacques Rousseau, Leo Elison, Peter Linebaugh, David Bollier& Hilary Wainwright.

8 Livelihood issues of the Unorganized sector and its impact pre & post disaster: The need to understand and develop policy measures

Ramasubramanian, Samanvaya

8.1 Purpose

The purpose of this chapter is to document the

- Issues that impact the lives of the unorganized sector employees and entrepreneurs in the context of a disaster including their safety and security
- Measures of relief and rehabilitation

This would ensure that decision makers can take into account and address this sector in their relief and rehabilitation plans.

8.2 Livelihood impact in the Unorganized Sector

About 1.5 lakh workers of the unorganized sector were reportedly affected by the December 2015 floods in Chennai. Not much is known about what happened to them since and what kind of compensation was awarded if any at all. We are referring to two sections of people in this case –

(a) Those in the informal / formal sector with inadequate proof of residence paperwork living in a disaster prone area who may also be employed in the same locality and

(b) Those who are self-employed in the unorganized sector with businesses in the vulnerable parts of the city that are prone to natural disasters, having a history of being affected by previous disasters.

Chennai like most modern urban centers boasts of a large number of people that are either employed or self-employed on the fringes of its burgeoning economic activity. These vary from the migrant labourers employed in the construction industry to the domestic help who resides in the slum and attends to several houses in the neighbourhood.

Although there are several laws that govern the employment of the construction workers and guidelines for the contractors, most of these are either designed from the prism of labour rights or safety of the construction project or forced upon due to law and order. It is assumed that under the 'rights' perspective, people left to market conditions will be able to take care of themselves in the city. As there are no clear guidelines for this class of people even during normal circumstances, they are not included in the planning by city authorities while responding to disasters of any magnitude.

During the December 2015 floods, many of them migrated to their parts of the country where they originally came from, never to return. There were reports of labourers from the North East leaving Chennai and reaching their respective states and towns in a state of trauma and desperation. The few studies that were carried out post-disaster were limited in nature and region, gave a glimpse of the amount of loss suffered by those who chose to stay back and not those who left with whatever they could gather. It took more than 4 months before many of the construction projects could recommence. One study estimated that 40-60 days of livelihood was lost by those employed in the informal sector during the floods; however, what it failed to mention is the economic loss suffered by the big construction firms due to the inadequacy of labour in the subsequent months.

The case of the self-employed / entrepreneurs is much worse if they were to live in the most disaster prone areas with all their investments locked up. They form a significant part of the urban economic landscape and the loss of their business assets would never be adequately compensated as there is neither an assessment of the value of their assets nor is there any documentation to support their place of residence or business in most cases. The pavement hawkers, small traders and service providers in the urban slums are all part of this sector. One of the assessments post the December 2015 flood, estimated their individual loss to be in the magnitude of Rs. 50,000 to 80,000. The author is aware of others who lost much more in terms of goods and equipment during the disaster. While their individual losses as compared to that of larger firms are relatively small, the sheer number of them living and managing their businesses in these areas have not been enumerated, leave alone compensated.

8.3 Recommendations

1. A study on the unorganized livelihoods in the most vulnerable areas of a natural disaster (Beginning with areas where floods were seen in their worst form during December 2015). The scope for the study to be outlined on the basis of this report.
2. Identify methods for dynamic enumeration of the shifting population of the urban informal sector.

3. Design frameworks for estimating loss suffered by people in the urban informal sector and propose solutions to protect their property and livelihoods.
4. Research and survey is to be planned.
5. A detailed report is to be prepared along with policy recommendations and improvements to the current system that could be incorporated in an existing or new city management framework.

If these recommendations are implemented, proper risk management will ensure improved labour turnaround thereby reducing loss of working days for the organized sector as well as quick recovery of the unorganized enterprises that are often the most critical service providers for the organized sector.

9 Violations of the CRZ and its Implications on the Waterways and the Coast

Jesurathinam, Coastal Action Network, Tamil Nadu

9.1 CRZ Notification & CZMAs

The Coastal Regulation Zone (CRZ) notifications of 2011 replaced the original notification of 1991, which classified coastal regions into four distinct zones based on their fragility and the level of development already present. CRZ I zones are highly protected, while CRZ IV zones are least sensitive — at least according to the law. Issued in 1991, revised and reissued in 2011, the CRZ notification is one of the most abused environmental laws. The notification claims to set out the regulatory framework for limiting urbanisation and industrialisation in dangerous and ecologically sensitive areas close to the sea, while providing for the security of tenure for fisher folk. District Coastal Zone Management Committees involving District Collectors, the local Pollution Control Board, the State Coastal Zone Management Authorities (SCZMA), and the National Coastal Zone Management Authority are vested with planning and regulating coastal development along with monitoring and enforcing the law. But without exception, these agencies are nothing more than wasteful rubber stamps — politically susceptible, corrupt, and spineless.

The rate of approval for projects in the Coastal Regulatory Zone across the nine coastal states is 80%. "However, this does not mean that the remaining 20% are rejected: out of this 20%, a large proportion is of cases that are deferred, dropped, closed or kept pending without a decision', says a report titled "Coastal Zone Management Authorities (CZMAs) and Coastal Environments"[16] by the Centre for Policy Research (CPR) and Namati. The SCZMAs which were constituted to take crucial decisions regarding the use of coastal lands and the management of coastal environments, conducted site visits to only 8% of the total number of projects seen. The report further noted the sombre

16 http://cprindia.org/sites/default/files/CZMAs%20and%20Coastal%20Environments-%20Two%20Decades%20of%20Regulating%20Land%20Use%20Change%20on%20India%E2%80%99s%20Coastline.pdf

condition of post-clearance monitoring by the SCZMAs as none of the states had uploaded the half-yearly compliance reports received from the project proponents on their respective websites as required under the CRZ notification, 2011. Poor post-clearance monitoring leads to more violations and their legalization. Tamil Nadu is one among the coastal states that has poor planning and monitoring along the coast, the state is a big violator of its own legislations.

9.2 CRZ Violations –A Few Instances

North Chennai

In North Chennai, a section of water body identified as saltpans and mudflats in revenue maps is now being filled with soil dredged from the Ennore harbour. Kamarajar Port, a company owned by the Government of India, is eating into a water body where the Kosasthalaiyar River flows into the Bay of Bengal. This has a direct effect on the lives and properties upstream when floods or storm tides visit.

The Tamil Nadu Coastal Zone Management Plan 1996, declared these areas as ecologically sensitive area CRZ I. After 2000, the zones were reclassified through the orders passed by the CZMAs to suit the needs of the industrial development.

South Chennai

Most of the coastal part of south Chennai falls under CRZ II, while the remainder falls under CRZ III. Therefore, construction without prior permission and clearance is strictly prohibited. With most of these areas falling under CRZ II, buildings are permitted on the landward side of an existing road or roads approved in the area's Coastal Zone Management Plan. The modus operandi in many cases is for a kuccha road to be built first. This literally paves the way for buildings and other developments on its landward side. In many cases, a road that is built recently is shown to exist earlier, thus making the constructions 'legal'. The Tamil Nadu State Coastal Zone Management Authority, who is in charge of regulation, either don't know about the violations or if they do, are doing little about it.

Apart from eating into the coastline, much to the detriment of fishing communities, these illegal roads and constructions are also a threat to the Olive Ridley sea turtles – an endangered species that is legally protected in India. The turtles have been nesting in these beaches for many centuries. In the last few years, with development eating up land that they have used traditionally, many nesting grounds have been lost and turtles are being constantly pushed away.

A walk along Chennai's southern beaches will give 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 is gone, replaced by unoccupied villas with pools overlooking the sea, gated communities and weekend getaways. Some properties in places such as Kanathur 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.

Pallikaranai Swamp area

The city has large marsh in the south (about 20 km south of the city centre), smaller satellite wetlands around it and large tract of pasture land. The southern marshland called Pallikarnai marshland is known as the flood sink area of the city as it drained about 250 sq km of the city in the 1980s. The marshland is housed in the Chennai Metropolitan Area. There were smaller wetlands around the marshland that served as a source of irrigation in the area that once cultivated paddy. The marshland that was around 5000 hectares (ha) at the time of independence has reduced to almost 600 ha around 2010-11, the primary reason being rapid urbanisation. During this time, the marshland along with all other wetlands of Chennai became sites of waste disposal, housing, commercial and industrial usage. As the city expanded in the south, Pallikaranai marsh became fragmented. As with other states, the state of Tamil Nadu only valued the land and not the water body which came to be treated as wasteland. The Chennai Metropolitan Development Authority found this marsh most suitable place for urban development. Considering its importance and drainage system in the area, the contiguous Pallikaranai marshland had been declared as swamp area for conservation, prohibiting development therein. Description of the Pallikaranai Swamp area prohibiting the development is given in Map No. MP-II/CMDA.13/2008.

The consequences

In a 2006 review of post-tsunami relief and reconstruction efforts, the Controller and Auditor General of India (CAG) noted that violation of the CRZ norms and the resultant overcrowding of coastal areas "played a major role in loss of human lives and property during the tsunami". It also noted that the "Ministry of Environment and Forests had amended the CRZ Notification and the range of amendments presented a trend that allowed commercial and industrial expansion in coastal areas"[17].

It is evident that the rampant CRZ violations have resulted in destruction of the coast and its ecosystem that had once protected the very coast as well as the coastal communities from all disasters; the water logging and floods in the settlements due to shrinking of all water bodies that formed the natural drain system.

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17 http://www.cag.gov.in/sites/default/files/old_reports/union/union_performance/2005_2006/Civil_%20Performance_Audits/Report_no_20/introduction.pdf

9.3 Recommendations and Way Forward

CRZ 2011 notification violates the traditional customary rights of fishing communities to their homeland along with their right to self-determination. In order to effectively implement CRZ Notification 1991, it is important to strengthen the authorities for monitoring and taking action against the violators. Under the CRZ Notification 2011, the CZMAs have been reduced to a mere recommendatory body and the powers of the NCZMA have been totally diluted. This is a violation of the Supreme Court 1996 order and the Union Government is in contempt of court for this policy decision. Moreover, a mere notification by executive fiat with no legislative sanction is unacceptable to protect vast areas of coastal environment and the homeland, livelihood and resource rights of the traditional fishing communities and other coastal poor.

Therefore, the Ministry of Environment, Forests and Climate Change (MoEFCC), Government of India, should act immediately on the following demands:

i) Withdraw the CRZ Notification 2011 immediately, and ensure strict implementation of existing Coastal Regulation Zone Notification 1991.
ii) Unconditionally and immediately withdraw 23 amendments made to the CRZ Notification 1991 which diluted the 1991 CRZ Notification.
iii) Together with the concerned state governments, CZMAs and the NCZMA, take action against all the violators of CRZ 1991.
iv) Support the litigants who have filed cases in various courts in India against CRZ 1991 violations.
v) Enact a comprehensive legislation for protecting the rights of the fishing communities, coastal ecology and ocean resources.

10 Construction and Demolition waste management

Mohan Ramanathan, Advanced Construction Technologies Pvt. Ltd. &
Tara Murali Architect, Advisor for Citizen, Consumer and Civic Action Group

Due to growing infrastructure requirements of expanding metropolitan cities in India ranging from new projects such as metro rail and airports to re-development of housing; the quantum of solid waste generated has been rapidly increasing, Construction and Demolition (C&D) waste is a significant contributor to this. A study by IIT Madras in 2016 has shown that 1.25 million tonnes of C&D waste is being generated in the city of Chennai annually which forms ~30% of the total solid waste generated in the city. C&D waste generated by homes and small construction sites are dumped on the streets and find their way to the storm water drains. Improper management of C&D waste has indirectly impacted the carrying capacity of natural waterways and built storm water drains thereby contributing to the floods in December 2015. Dr. KN Satyanarayana, Professor at the department of Civil Engineering, IIT Madras expands on Chennai's problem by stating that "Without a proper policy or a disposal system in place, C&D waste is either sent to the city's dump yards or illegally deposited in rivers, canals and marshlands, posing a civic conundrum. When a building is demolished, the wood, steel and wire components are resold in secondary markets, while masonry and concrete waste is discarded, which ends up in dump yards or lakes, rivers and marshes." [18]

Construction activities generate huge amount of construction and demolition (C&D) waste materials each year. The activities include site formation, demolition of structures and reconstruction as well as new construction and maintenance. The types of C&D materials include both inert materials such as earth, rocks and concrete as well as non inert ones such as metals, glass and wood, all of which can be reused or recycled if handled properly. In previous decades, when materials were scarce and expensive in comparison to labour costs, C&D materials were salvaged and reused to its maximum potential. With economic prosperity, "use and throw way" habit, demolition before the end of its design life as well as lower cost of acquisition due to modern technology, there is a high dependence on extraction of natural resources to keep up with the growing demand[19]. As a result, we not only have to handle the large amounts of C&D waste

[18] http://www.dtnext.in/News/City/2016/02/21201929/Closing-the-loop-on-CampD-waste.vpf

[19] Proceedings from the Workshop On Construction & Demolition Waste Recycling (CDWR) 28th February, 2015 JNTUH, Kukatpally, Hyderabad

generated but the rate of consumption of natural resources is greater than their re-generation rate. Therefore, there is a need for proper C&D waste management for sustainable development of cities and towns in India.

In order to achieve sustainability goals in handling C&D waste, material selections as well as management have to be considered. During material selection, products with high recycled content, renewable materials from sustainable sources and materials with low environmental impact must be prioritized. Material management objectives include waste avoidance and minimization, returning surplus and waste segregation. This should be planned, implemented and monitored at all stages of the project, with life cycle cost on waste disposal taken into consideration. In addition, energy and water should also be considered to be part of an overall C&D waste management strategy.[20]

During a demolition process, firstly, selective Demolition must to be planned so that proper segregation of the waste can be done at source itself. This will greatly enhance the C&D Waste Recycling Systems.[21]

In a nutshell, C&D Waste management involves

- Minimizing the generation of waste in the first instance
- Reusing the C&D Waste materials in its original from as far as possible
- Recycling with minimal input of energy
- Disposing of the waste using an environmentally sound approach
- Dissemination and awareness for sustainable construction

In the long run, the following strategies can be adopted

- Advanced zero waste recycling solutions
- Innovative production process for products and materials
- Development of sustainable circular business models

The central government deemed it necessary to revise the existing Municipal Solid Waste management rules with an emphasis on the roles and accountability of waste generators and various stakeholders thereby giving thrust to segregation, recovery, reuse, recycle at the source of C&D waste generation. It attempts to address in detail the management of construction and demolition waste. The Construction and Demolition

[20] Tara Murali, 2016, Presentation notes

[21] ICI Workshop on Recycling, Use & Management of C&D Wastes, Chennai, April 21, 2016.

Waste Management Rules, 2016[22] state that "waste generators shall keep the construction and demolition waste within the premises or get the waste deposited at collection centre authorized by the local body or handover it to the authorised processing facilities of construction and demolition waste; while ensuring that there is no littering or deposition of C&D waste so as to prevent obstruction to the traffic or the public or drains." The waste generators shall pay relevant charges for collection, transportation, processing and disposal while State Pollution Control Board will be responsible for monitoring the implementation of these rules by the concerned local bodies and authorities.

It is equally necessary to disseminate information about recycling as well as promoting the use of recycled materials with all stakeholders which include architects, consultants, building/demolition contractors, product manufacturers, local bodies and authorities as well as civil society at large.

[22] Construction & Demolition Waste Management Rules, 2016
http://www.moef.gov.in/sites/default/files/C%20&D%20rules%202016.pdf

11 The role of the Secondary Runway Bridge and Chennai Floods

Captain A. Ranganathan

The purpose of this note is to document how the gross violation of the environmental clearance for the construction of secondary runway bridge by the Airports Authority of India (AAI) resulted in obstruction of the path of the Adyar River during the floods in December 2015.

In 2007, AAI decided to build a bridge across Adyar River and extend the secondary runway. AAI obtained an environmental clearance (No.10-140/2007-IA-III) [23] for the expansion which stated that the bridge with a span of 200 m x 415 m will be constructed 1.4 m high above the High Flood Line (HFL) on the Adyar River. In 2005, the Public Works Department (PWD), Tamil Nadu indicated that the HFL was 11 m above Mean Sea Level (MSL). HFL refers to a level which is higher than danger level and corresponds to a flood return period of more than 10 years.

In a press release dated September 2010, the presiding director of the Chennai Airport mentioned that the 200 m long and 462 m wide bridge across the river will be completed by October that year. A subsequent presentation made by AAI to the Airports Economic Regulatory Authority of India (AERA) stated the bridge size to be 200 m x 447.5 m and R.L. at the bridge level being 11 m which refers to the bridge being 11m above MSL. This clearly shows deviations from the environmental clearance specified dimensions obtained from the Ministry of Environment & Forests. The AAI also claimed that the bridge design was approved by IIT Madras which was denied by the Head of Department of Structural Engineering, IIT Madras. Not only is the bridge structure built in violation, the embankments on either side are also in clear violation as no wall can be built within 100 meters of a water body.

23 http://environmentclearance.nic.in/writereaddata/Form-1A/EC/27_Aug_2016_1909441103FQY6Q6JAnnexure-PreviousECletter.pdf

Impact of Secondary Runway Bridge during the deluge in November/December 2015
On 16th November 2015, water was released from Chembarambakkam reservoir after the first deluge and the river level was just touching the bottom of the bridge. On 1st December 2015 with the second deluge, the bridge structure above the columns was the obstruction that caused the huge overflow, destroying everything in its path.

PWD mentions that the High Flood Line at the airport during the December deluge was 13.39 m (~44 ft.) above MSL. This means that the runway on the bridge, which AAI claims is at an elevation of 45 ft. should not have been under water. In fact, the main runway with an elevation of 52 ft. at St. Thomas's Mount end was also under water.

The secondary runway bridge will most likely never be used by wide body aircraft since they cannot install an Instrument Landing System (ILS) due to the upcoming Metro rail line on one end and existing housing at the other end. No wide body aircraft would use a runway that is not equipped with an ILS.

The government should seriously consider demolishing the bridge which serves no purpose other than being a major obstruction on the path of Adyar River. The bridge is a danger to the entire city and the next bout of heavy rain may cause large scale destruction. The runway, short of the river, as existed prior to the extension is more than sufficient for the operation of flights using Boeing 737s and Airbus A 320s.

If the above recommendation is implemented; in the event of a flood, there will be free flow of flood waters in this stretch of the Adyar river as a result of which areas upstream of the airport will not be affected to a large extent while minimizing losses to those downstream. This also reduces the possibility of the Airport shutting down during a flood event.

12 Geo-spatial analysis of the flood vulnerability of Chennai City

Craig D'Souza, Society for Promoting Participative Ecosystem Management (SOPPECOM) & Satyarupa Shekar, Citizen consumer and Civic Action Group

12.1 Purpose

The purpose of this suggested exercise is to document the extent of floodplains (and flood inundation prone areas) in the city of Chennai for rainfall events of different magnitudes.

So that civic and state authorities can make more informed decisions in

1) preparing flood resilient public infrastructure & relief infrastructure

2) mitigating flood damages when floods do occur and

3) in the aftermath, accurately estimating the extent of flood damages for better targeting of compensation.

12.2 Context

Tamil Nadu experiences severe water shortages, and water stagnation and flooding every year. The recent policy focus in the state has been on groundwater recharge through rain water harvesting, but in practice, the public water utility has been acquiring 'water fields' - agricultural lands in the peripheries of Chennai where the level and quality of ground water is amenable for supply to the city's burgeoning water demands. Simultaneously, poor planning practices and enforcement of building rules has resulted in the majority of the city's lakes and ponds built over, obstructing the 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. For example, the Tamil Nadu government is currently in the process of framing exemptions for multi-storey buildings, reducing the parking requirements within property premises, and reducing the permissible distance between buildings and aquifers, among others.

This degradation of the urban ecology has amplified the magnitude of risks that Chennai faces, particularly weakening the resilience of the city's residents.

The city has a poorly planned and severely inadequate storm water drain network, which is in a high state of disrepair despite the large amounts of funds allocated to the construction. A significant feature of the government's spending on all public infrastructures is that the focus is on construction but negligible attention is paid to maintenance. The built channels for water do not adequately meet the infrastructure needs of the city. The Buckingham Canal, the city's main waterway, was built to convey water from the inland to the sea but has been encroached. The commuter train line is almost wholly built over the Canal. The government has also frequently allocated land and built low income housing in large marshlands and natural catchment areas in the city, amplifying the vulnerabilities of the urban poor. All of this has resulted in Chennai experiencing water stagnation every monsoon and severe floods every 7-10 years.

In 2013-2015 we worked with the Corporation of Chennai (CoC), the city government, on building their capacity to collect and use (spatial) data for planning and monitoring. Despite several contracts and commissions to private businesses and universities, the city government lacks data and maps that it can use to plan and monitor public services, including storm water drains. In October 2014, we worked with city engineers to map water stagnation points in the city and documented possible causes and solutions to create a micro plan. The relevant department relied on an incomplete map that was neither geo-referenced nor to scale. During our engagement we saw that city engineers relied on their latent knowledge to address problems that were of a routine nature, but because of the informal nature of the knowledge and actions, the interventions remain ad hoc and in reaction to water overflows or stagnation. For example, they were aware that the drain network was illegally connected to the sewerage network at several places and this was being carried to the city's waterways and water bodies untreated, but were helpless in institutionalising this knowledge and leveraging it for planning and monitoring. At that time, CoC had requested our support in creating a geo-referenced map of the sub-surface storm water drain network but we did not have the capacity to undertake this task.

The flood map can help us make a compelling case for local actions to combat climate change. Often, city officials have wrongly attributed the devastation from unexpected flooding to the results of climate change when in fact it is a result of poor planning and infrastructure. It has diluted the strategies that cities need to adopt to address climate change and improve resilience.

12.3 Objectives

The objective of our short research project was to make recommendations for the designation of flood risk zones within the Chennai Metropolitan Area. In order to do this, we needed to determine the actual extent of the inundation caused due to the

floods in November and December 2015. Next we examined the possible influence of some factors in determining whether a given part of the metropolitan area will flood or not to identify the most relevant causal factors behind flood inundation in different parts of the city.

While the potential determining factors are many, only a few of them such as height above Mean Sea Level, proximity to water bodies (existing and reclaimed), proximity to water channels and size of upstream catchment area were considered. Other factors such as soil type, prevailing soil moisture levels, slope of land, and effect of operations of upstream manmade water structures were not considered for the current timeline and resources. These limitations in scope could be addressed by developing a watershed model for the Chennai watersheds which factor in these variables.

The geographical scope of this exercise is limited to the Chennai Metropolitan Area. The temporal scope is limited to the floods of the first week of December, since based on available rainfall data and news reporting the flood inundation was at its peak during this period.

12.4 Methodology

We primarily relied on three sources of information. We identified the flood inundated areas from the satellite image we obtained from the National Remote Sensing Centre, ISRO for the 4th of December through a Web Map Service (WMS). This image captures the extent of flooding in the region with reasonable accuracy. For the map of water bodies we used the 1955 US Army map. To estimate the elevation of the Chennai Metropolitan Area we used a Digital Elevation Model (DEM) from NASA[24].

Using these maps and information, we created the following four maps

- A coastal flood risk estimation map
- A historic water bodies map
- A water channels map
- A flood inundation map (for the 4th of December 2015)

Figure 2 Coastal Flood Risk Estimation Mapping

This map attempts to predict or estimate zones in proximity to the coast within the Chennai metropolitan area that are at risk of flooding due to the heavy rains. The line of reasoning follows that coastal areas below sea level or within a few metres of sea level are more prone to flooding both because of ingress of sea water as well as the longer time taken for drainage of storm water.

[24] http://chennaifloodmanagement.org/en/reports/cag-flood-inundation-mapping/#_ftn1

We edited the DEM data to indicate the areas of high and low vulnerability with different colours in QGIS. The blue colours in the map indicate areas below Mean Sea Level (0 m) red indicates 0-4 m, pink 4-8 m and shades of brown indicate elevations greater than 8 m.

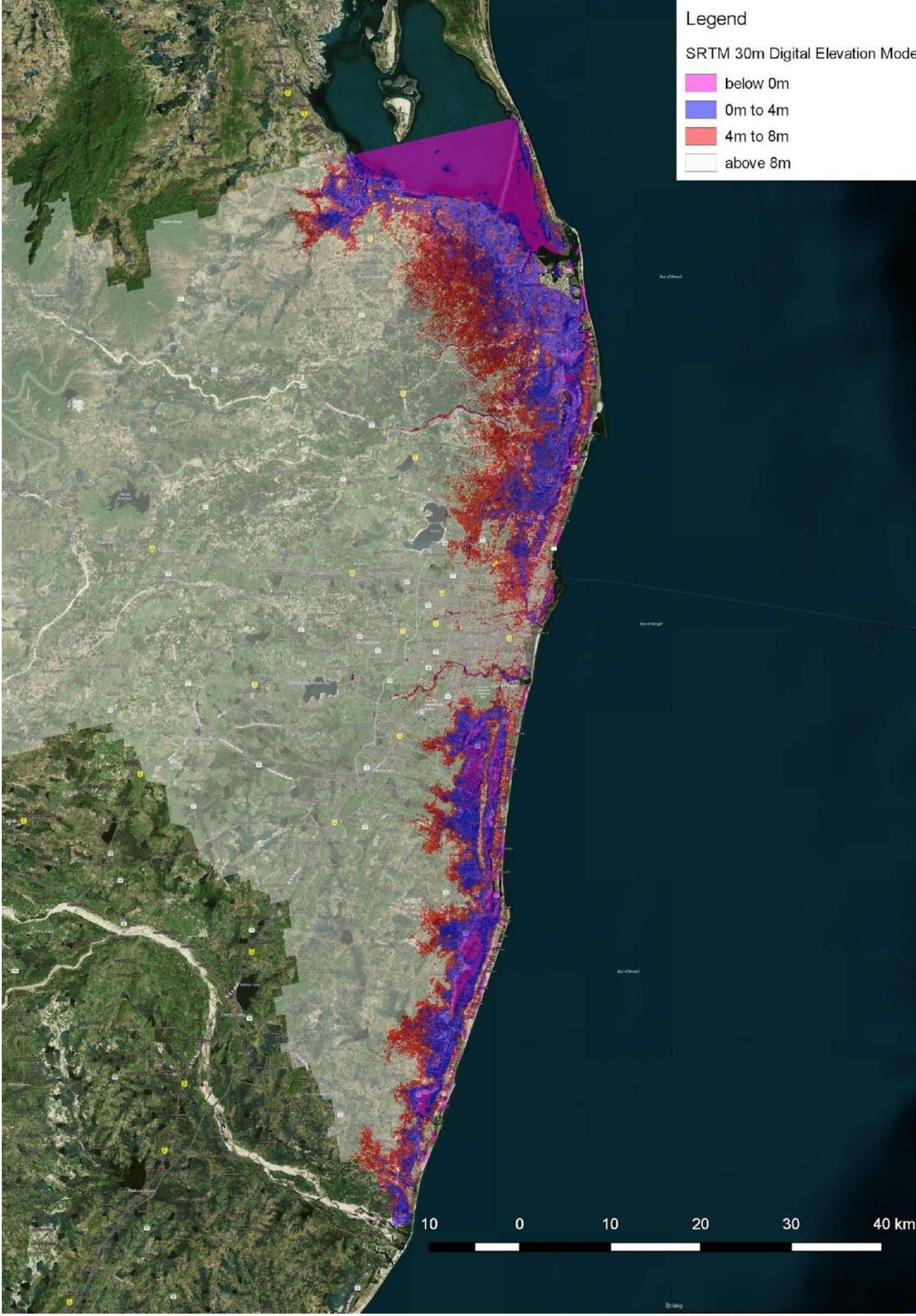

Legend
SRTM 30m Digital Elevation Mode
below 0m
0m to 4m
4m to 8m
above 8m
10
0
10
20
30
40 km

Figure 3 Historic Water Bodies Mapping

Digitising both the currently existing as well as the former water bodies in the Chennai Metropolitan Area is important to understand the effect that water bodies and their reclamation may have on flood inundation. The US Army Topographic Maps (1955) showing water bodies for the Chennai area are the best available reference showing old water bodies in the region[25]. We first edited these maps in GIMP/Photoshop, a photo editing software, to filter out pixels from the map that showed water bodies. This was possible by converting into a binary format, with blue showing water bodies and white showing everything else. We then converted the jpg to a geo-referenced tiff file, which in turn, we converted to a polygon vector showing water bodies.

Since this map was pre-satellite era we cannot be completely certain of the precise location of these old water bodies. However, the fact that the water bodies shown on the map clearly align with several currently existing water bodies lends credibility to it.

[25] http://chennaifloodmanagement.org/en/reports/cag-flood-inundation-mapping/#_ftn1

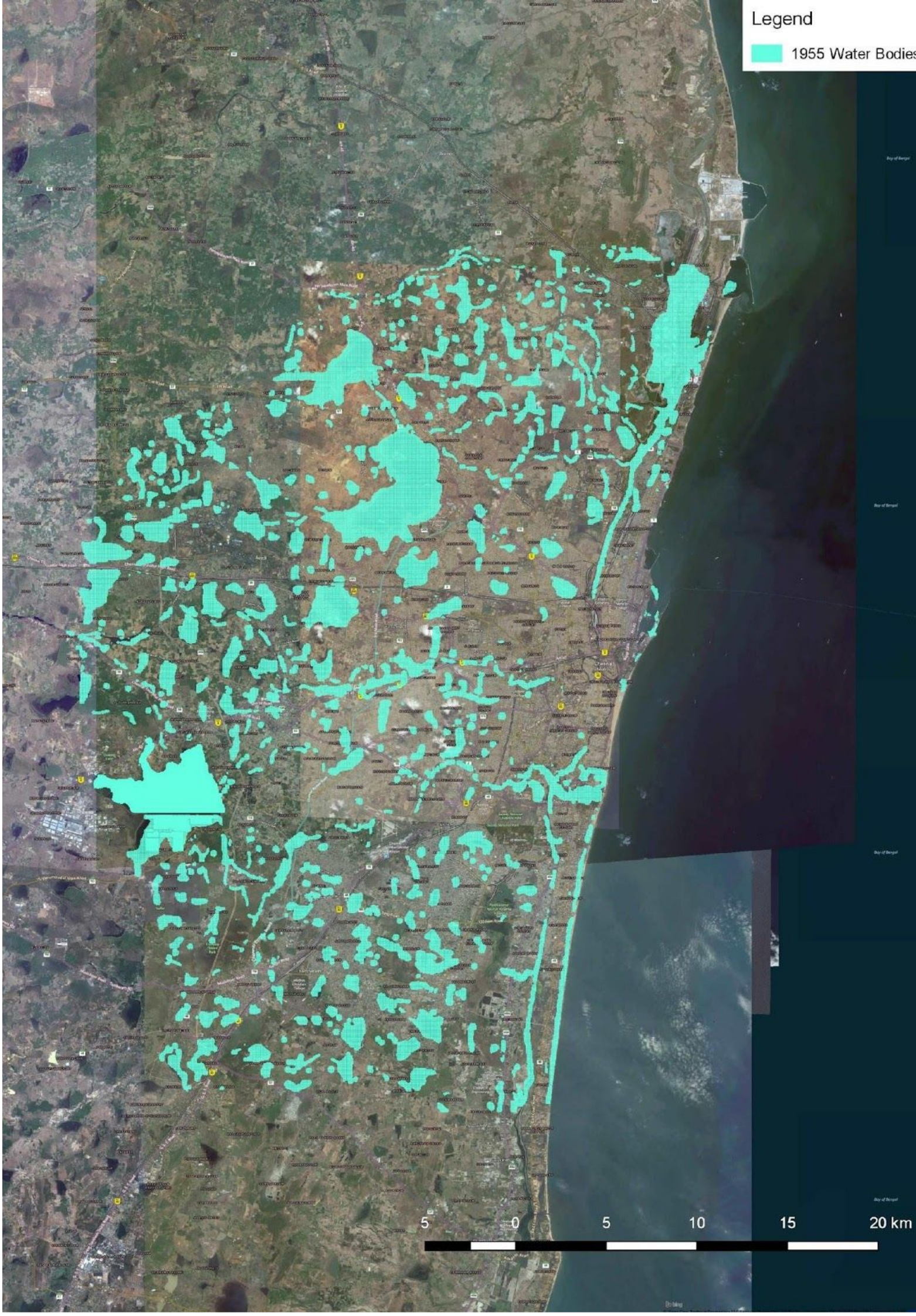

Legend
1955 Water Bodies
5
0
5
10
15
20 km

Figure 4 Chennai Drainage System Mapping

In addition to the water bodies, we also identified water channels, i.e. the path water would take when it rains. The term ' does not necessarily indicate that water flows via these channels perennially.

As a first step we applied a 'sink fill' algorithm to the DEM to smoothen out any gaps. Next we made flow direction and flow accumulation rasters using tools from the SAGA toolbox in QGIS[26]. The flow accumulation raster assigns different values to each pixel on the raster. If the pixel has a large number of pixels upstream bringing water towards it, then it will have a correspondingly high number on the flow accumulation raster, i.e. larger water channels. After we prepared the flow accumulation raster we filtered out pixels with higher values using raster calculator. We then used the QGIS Polygonise tool to convert the raster files to vector, to obtain a water courses map with different line patterns indicating the size of the watersheds of each water channel.

[26] http://chennaifloodmanagement.org/en/reports/cag-flood-inundation-mapping/#_ftn2

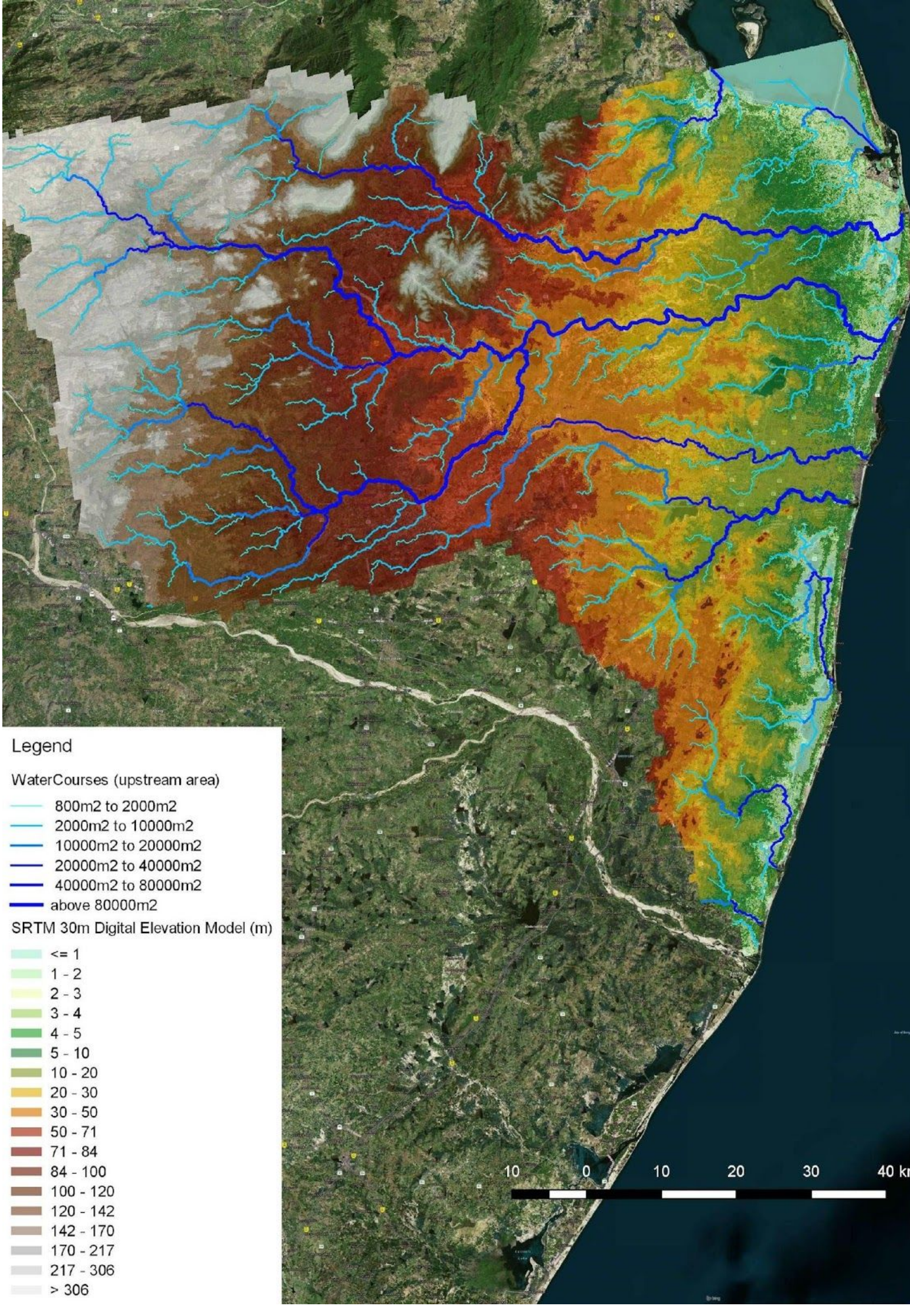
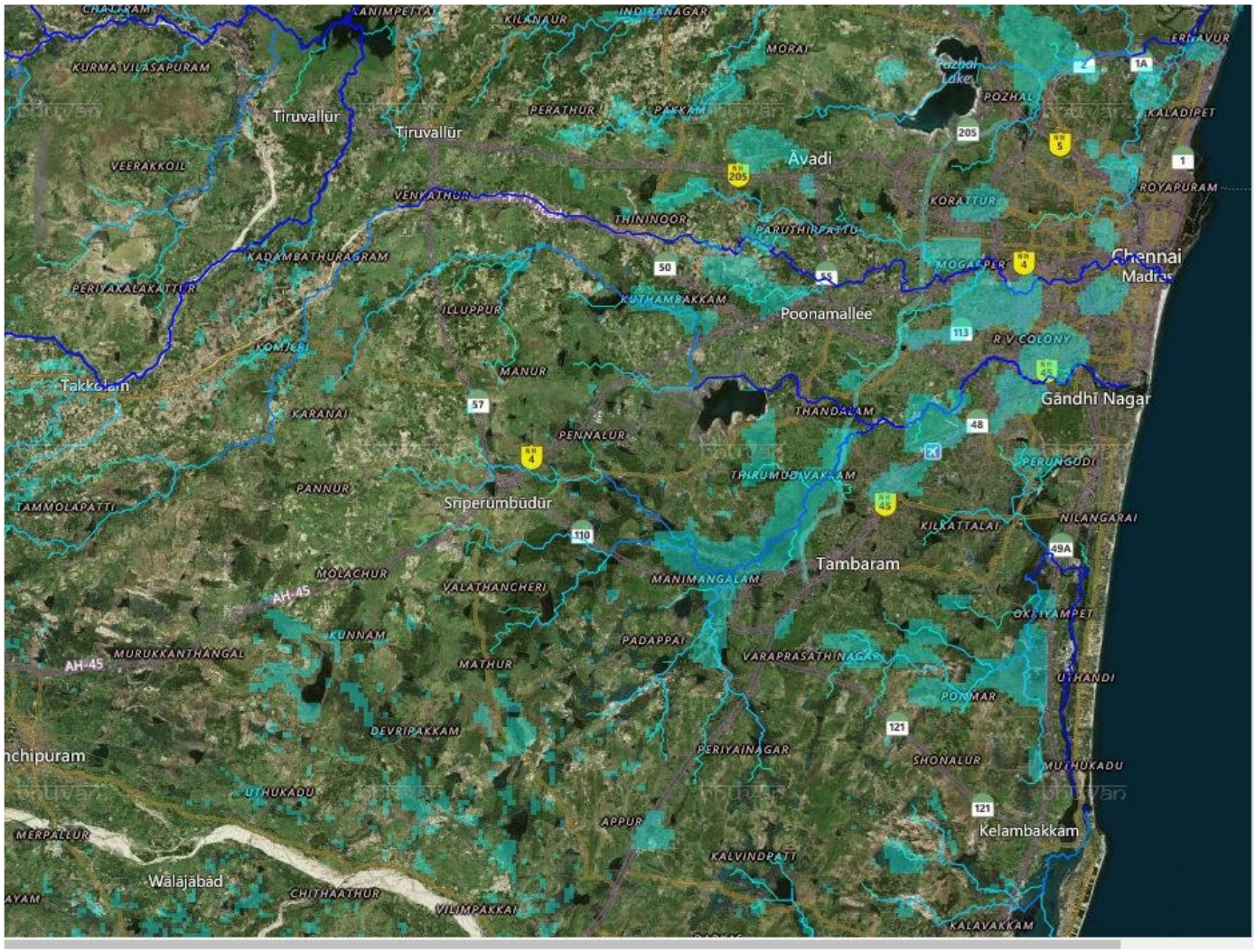

Legend
WaterCourses (upstream area)
800m2 to 2000m2
2000m2 to 10000m2
10000m2 to 20000m2
20000m2 to 40000m2
40000m2 to 80000m2
above 80000m2
SRTM 30m Digital Elevation Model (m)
<= 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 10
10 - 20
20 - 30
30 - 50
50 - 71
71 - 84
84 - 100
100 - 120
120 - 142
142 - 170
170 - 217
217 - 306
> 306
10 0 10 20 30 40 km

Figure 5 Flood Inundation Mapping

To complete the analysis we used a map of actual flood inundation for the city. Bhuvan, the web-platform of the National Remote Sensing Centre, published three maps of flood inundation of the Chennai Metropolitan Area for the dates of December 3, 4, 5 and 7 as Web Map Services that they gave us access to. We found the map for the December 4 most suitable for this analysis because it had the highest resolution. We viewed the map using QGIS, took geo-referenced snapshots and saved these as png files. We then converted the png files to polygon vector format using the QGIS Polygonize tool to obtain a vector file that shows us the boundaries of the flood inundated areas.

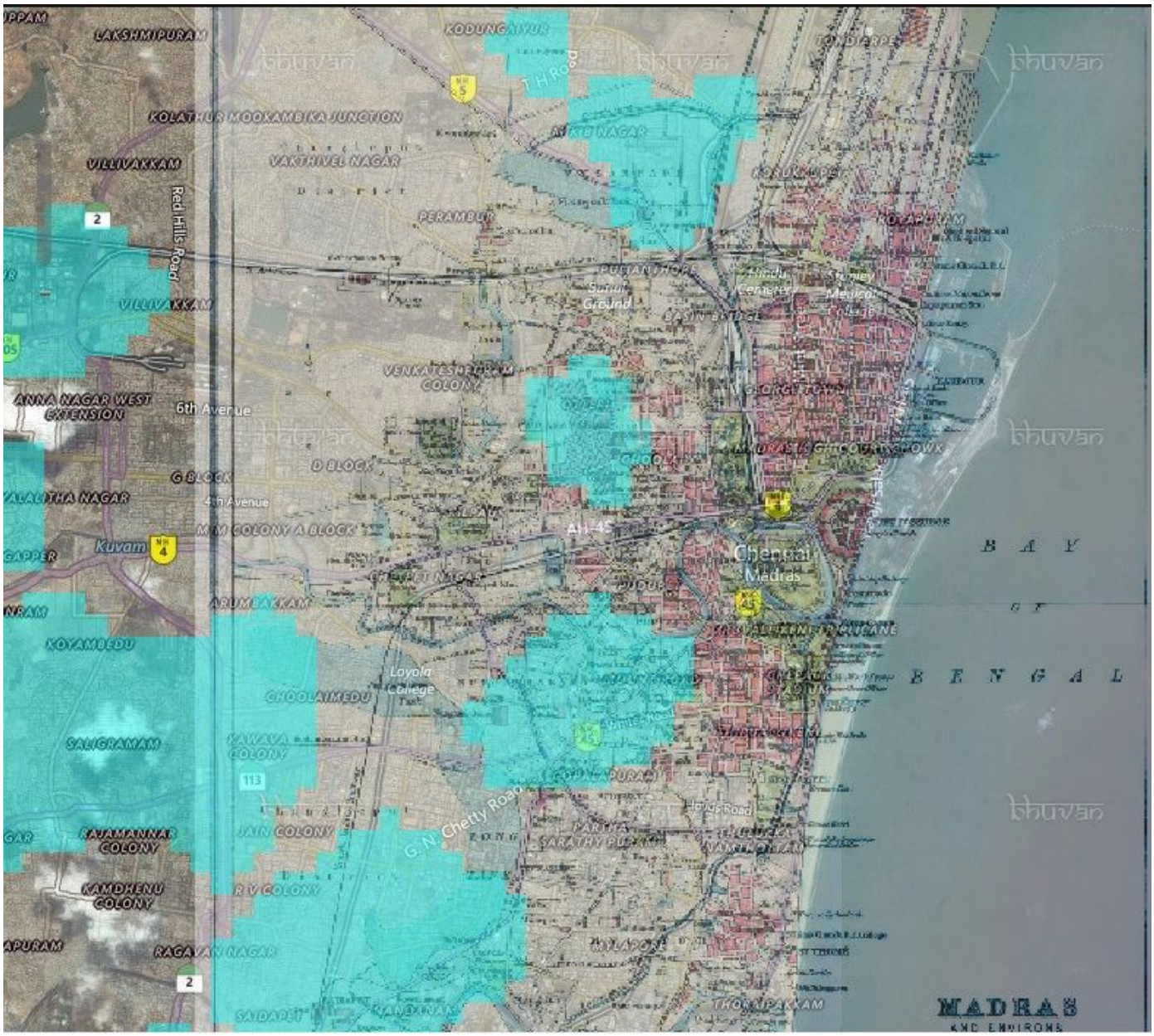


12.5 Insights

Overlaying the satellite observations of inundated areas in the December 2015 floods with the Madras City 1909 map[27] shows a significant correlation between the built environment in 1909 and the floodplains of 2015.

The 1909 urban areas (Figure 6 Overlay map of inundated areas in the December 2015 floods with the Madras City 1909 map) are generally built in locations that were not inundated in 2015.

Between 1909 and the present day, the continued expansion of Chennai has resulted in property development on these flood prone areas.



12.6 Recommendations

Survey extent of 2015 flooding

- Develop flood inundation maps to survey the actual extent of the flooding in Dec 2015. This can serve as reference for validating models. {CAG, done}

Model possible future flood scenarios

- Share in open source format, high resolution LIDAR data pertaining to the Chennai metropolitan area (CMA) for citizen flood modelling exercises {Anna University}
- Share engineering specifications (specifically discharge rates and reservoir operation models) for the large reservoirs surrounding the Chennai metropolitan area. This is important because besides the magnitude of rainfall the operation of the reservoirs also significantly might dictate the extent of flooding {Whoever manages the reservoirs}
- Develop floodplain & flood inundation maps for the CMA for rainfall events of different magnitudes, taking into consideration different scenarios of the reservoir's status {any group with hydrology expertise}
- Develop maps of old water bodies that have been reclaimed in the city. {CAG, done} Model scenarios to predict whether restoration of these bodies would have desired effect. This would facilitate a conversation on whether restoration of some of these bodies might reduce the city's flood vulnerability

Engage with citizens

Hold citizen meetings to discuss

- the state of Chennai's flood preparedness given the floodplain maps, juxtaposed on top of other vital infrastructure (transport lines, communication lines, hospitals, relief provision centres etc)
- possibilities for redesigning the urban landscape to make the city more flood resilient, by restoring certain old water bodies, marshlands etc {could be the city government, also CAG}

12.7 Benefits

If these recommendations are implemented, we expect to see the following benefits:

Pre-floods:

Decision making in the city would be truly informed, transparent and collaborative with the open publishing of data and information and open forums that empower citizens together with government to shape their vision of the city.

During floods:
Citizens and policymakers would have an accurate idea of whether they can expect flooding to occur based on where they are located within the city and based on the magnitude of rainfall. Citizens could receive real time location based flood warnings. The government's response with relief measures would also be informed rather than ad-hoc.

Post floods:
There would be transparent decisions made about rehabilitation and marginalized groups could be relocated to safer zones. Compensation would be decided based on affected areas where special attention could be focused.