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THE ENVIRONMENTAL AWARENESS AND RIVERFRONT DEVELOPMENT PROJECTS

A case study of the Adyar River in Chennai, India

CORNOU Alice

2014-2015

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FORMATION PAR LA RECHERCHE ET PROJET DE FIN D'ETUDES EN GENIE DE L'AMENAGEMENT

La formation au génie de l'aménagement, assurée par le département aménagement de l'Ecole Polytechnique de l'Université de Tours, associe dans le champ de l'urbanisme et de l'aménagement, l'acquisition de connaissances fondamentales, l'acquisition de techniques et de savoir faire, la formation à la pratique professionnelle et la formation par la recherche. Cette dernière ne vise pas à former les seuls futurs élèves désireux de prolonger leur formation par les études doctorales, mais tout en ouvrant à cette voie, elle vise tout d'abord à favoriser la capacité des futurs ingénieurs à :
Accroître leurs compétences en matière de pratique professionnelle par la mobilisation de connaissances et de techniques, dont les fondements et contenus ont été explorés le plus finement possible afin d'en assurer une bonne maîtrise intellectuelle et pratique,
Accroître la capacité des ingénieurs en génie de l'aménagement à innover tant en matière de méthodes que d'outils, mobilisables pour affronter et résoudre les problèmes complexes posés par l'organisation et la gestion des espaces.

La formation par la recherche inclut un exercice individuel de recherche, le projet de fin d'études (P.F.E.), situé en dernière année de formation des élèves ingénieurs. Cet exercice correspond à un stage d'une durée minimum de trois mois, en laboratoire de recherche, principalement au sein de l'équipe Ingénierie du Projet d'Aménagement, Paysage et Environnement de l'UMR 6173 CITERES à laquelle appartiennent les enseignants-chercheurs du département aménagement.

Le travail de recherche, dont l'objectif de base est d'acquérir une compétence méthodologique en matière de recherche, doit répondre à l'un des deux grands objectifs :
Développer toute ou partie d'une méthode ou d'un outil nouveau permettant le traitement innovant d'un problème d'aménagement
Approfondir les connaissances de base pour mieux affronter une question complexe en matière d'aménagement.

Afin de valoriser ce travail de recherche nous avons décidé de mettre en ligne les mémoires à partir de la mention bien.

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A Chinese proverb says "The water which supports a boat can also sink it."
It perfectly resembles the relationship between human beings and water.
Water which supports life systems can also be a threat to human survival if not managed properly.
M. M. Rahaman, O. VarisWater and Development Research Group

SYNOPSIS

Chennai est la quatrième plus grande métropole indienne avec aujourd'hui une population d'environ 4,7 millions d'habitants, qui ne cesse de croître depuis l'Indépendance dans la limite municipale de 200 km². Localisée le long de la mer du Bengal à l'ouest, l'expansion urbaine de Chennai s'effectue vers l'est, le nord et le sud. La croissance démographique et urbaine de Chennai qui a eu lieu très rapidement cause aujourd'hui plusieurs problèmes de pollution majeurs dans la ville. Le niveau de congestion sur les grandes artères routières a augmenté huit fois en moins de 20 ans, et par conséquent la qualité de l'air dépasse aujourd'hui les recommandations de l'OMS. Le problème d'élimination des déchets est également un souci récurrent au sein de la ville. La plupart sont stockés dans des décharges à ciel ouvert, sans mesures préventives, sur des espaces encore peu urbanisés ou en friche, souvent près de masses d'eaux telles que les fleuves et zones humides. Les composants chimiques solubles altèrent alors la qualité du sol et celle des eaux de surfaces et souterraines. Par ailleurs la croissance urbaine de Chennai, répondant à l'explosion démographique, n'a pas toujours su mettre en place un réseau d'assainissement efficace pour le traitement des eaux usées. Ainsi le nombre et la capacité des stations d'épuration demeurent bien inférieur comparés à la quantité d'eau usée générée chaque jour à traiter. Très peu d'eaux usées quelles soient industrielles, domestiques ou commerciales sont efficacement épurées et elles sont alors évacuées directement dans les rivières de Chennai. Au-delà des conséquences environnementales, la présence de ces eaux courantes dont la qualité est dégradée engendre aussi une certaine insécurité sanitaire dans l'aire urbaine. Ce sont des zones idéales pour la reproduction des moustiques et la prolifération de bactéries pouvant causer de nombreuses maladies.

Cette pollution grandissante des eaux de surfaces est d'autant plus alarmante au vues de la localisation de Chennai, marquée par la proximité de nombreuses eaux de surfaces : rivières, fleuves, eaux stagnantes et zones humides. En effet la ville de Chennai comprend trois principaux cours d'eaux : les deux rivières Cooum et Adyar ainsi que le canal Buckingham. Ce dernier est un cours d'eau artificiel construit par l'Homme en tant que voie de transportation dans la ville, parallèle la côte Coromandel. Il permet de relier les deux rivières naturelles Cooum et Adyar qui s'écoulent perpendiculairement à la côte. La rivière Cooum sépare la ville horizontalement en deux parties, et la rivière Adyar divise la partie sud de la ville. La rivière Cooum est longue d'environ 65 km, dont 18 km dans Chennai, et l'Adyar est longue de 42 km et parcourt 15 km dans la ville avant de se jeter dans la mer du Bengale. Ces deux rivières sont des eaux de surfaces temporaires et sont principalement alimentées de manière saisonnière pendant la mousson. Elles collectent les surplus de plusieurs tanks et réservoirs d'eau environnant, et leur capacité de charge varie alors énormément au cours de l'année.

Aujourd'hui ces trois cours d'eau sont extrêmement pollués principalement à cause des eaux usées s'y déversant provenant des industries, des zones résidentielles formelles et informelles, des espaces commerciaux et des eaux de ruissellement pluviales. Toutes ces eaux chargées de polluants se déversent grâce aux égouts directement dans les fleuves. Cependant la ville de Chennai commence à se pencher concrètement sur ces problèmes environnementaux autour de la qualité de l'eau des rivières. En effet au niveau de l'estuaire de l'Adyar, un Eco Parc, l'Adyar Poonga, a été créé. A cet endroit la rivière fait un tournant vers l'intérieur des terres avant de se jeter dans la mer, formant alors un ruisseau. Le gouvernement a entreprit une première phase de restauration écologique sur un espace de 58 acres. Le site a été nettoyé des déchets solides y étant stockés, les boues chargées de polluants accumulés ont été retirées, des espèces végétales autochtones y ont été plantées sur les berges, et le flux d'égouts non traités s'y déversant a été stoppé. Le gouvernement commence désormais une seconde phase de restauration dans le prolongement de la première phase, cette fois sur une surface de 300 acres. L'Adyar Poonga sert aujourd'hui de centre de sensibilisation à l'environnement pour les écoliers depuis 2010 et est ouvert au public de manière restrictive depuis plusieurs mois.

A partir d'un corpus théorique établis à partir d'articles de journaux locaux, de thèses d'étudiants et de chercheurs, des sites gouvernementaux et des ONG, ainsi qu'à l'aide des documents d'urbanisme établis par le CMDA, en ressort à première vue qu'un mouvement général vers une préservation de l'environnement et plus particulièrement de la qualité de l'Adyar, a lieu à Chennai. Une prise de conscience environnemental émerge vers une restauration globale de la rivière, peut être jusqu'à un éventuel redéveloppement du front d'eau.

Ceci mène alors à la question de recherche suivante : *Comment se présente aujourd'hui la conscience environnementale autour de la rivière Adyar à Chennai ?* Mon hypothèse qui en découle est que la réflexion engagée sur la rivière de l'Adyar par le gouvernement, les étudiants, la société civile, les journalistes et les citoyens prouve une conscience environnementale généralisée qui favorise et promouvoir une meilleurs préservation de l'Adyar à Chennai.

L'objectif est de collecter une pluralité de points de vue et une analyse des projets concernant la rivière Adyar afin d'examiner la conscience environnementale aujourd'hui autour de la rivière. A partir des échéances politiques et des programmes de restauration, grâce à une compréhension globale des différents projets le long de l'Adyar (origines, motivations, objectifs et moyens de mise en place), par des observations directes le long de la rivière et des entretiens des représentants du gouvernement, de la société civile, des universitaires et des habitants, j'ai pu évaluer les conditions sous lesquelles se présente la prise de conscience environnementale autour de la rivière Adyar.

Chennai prend ses origines en tant que ville coloniale et sa croissance initiale est étroitement liée à l'importance de sont port et son centre commercial. La ville se forme au milieu du 17ème siècle lorsque la Compagnie Britannique des Indes Orientales décide de former le Fort St George sur la cote Coromandel. Par la suite Chennai s'est développé principalement grâce à l'acquisition de nombreux villages aux alentours. Chacun d'entre eux étant organisés de manière singulière, autour d'un temple central avec sa propre histoire. En moins de 350 ans ces quelques villages dispersés ont été développés dans une ville métropolitaine tout en conservant leurs traditions et religions. A la fin du 19ème siècle le développement de Chennai ressemble déjà à ce que l'on peut observer aujourd'hui tandis que la ville ne cesse de se densifier. En 1971 Chennai comprenait environ 2,5 millions d'habitants, soit cinq fois plus que 70 ans auparavant, tandis que l'aire urbaine n'avait même pas doublé. Au début du 20ème siècle Chennai doit sa croissance principalement grâce à une forte vague immigration lors de l'industrialisation et de la modernisation du port et de nouvelles industries. Suite à ces migrations importantes la ville fait face à un manque de logements abordables, ce qui a engendré la formation de bidonvilles dans les espaces urbains encore libres. En 2011 28,5 % de la population de Chennai vit dans un bidonville (Census 2011) et il est de plus en plus difficile de contrôler la pollution engendrée par cette urbanisation massive. Il a été estimé en 2010 qu'environ 340 exécutoires d'eaux usées se déversaient dans les rivières de Chennai. Parmi ces exécutoires certains peuvent supposément être légaux ou illégaux, et provenant d'industries, d'institutions, de commerces et de zones résidentielles. Ce sont des quantités de pollution importante qui se déversent quotidiennement dans les rivières de la ville, et donc dans la mer. En outre l'urbanisation a contribué fortement à l'imperméabilisation des sols, causant de forts risques d'inondation lors des moussons : les rivières recueillent de plus en plus d'eau tandis que leurs berges sont urbanisés et figées.

L'Adyar est historiquement un fleuve sauvage bordé d'une végétation dense tropicale et connecté à de nombreux marécages et marais. La rivière constitue pendant longtemps un espace libre naturel très peu occupé par l'Homme. Lorsque la Compagnie Britannique des Indes Orientales s'installe à Chennai les anglais commencent à utiliser cet espace pour la chasse. C'est à la fin du 18ème siècle que les anglais commencent à s'installer le long de la rivière Adyar, qui constitue un espace vert idéal pour échapper à la chaleur et au sable près du Fort St George. Ainsi se construisent quelques résidences privées sur la berge nord, comprenant à la fois une propriété imposante et un vaste jardin tropical. Au 19ème siècle s'installent également des clubs privés le long de l'Adyar, comme le Madras Club et le Boat Club, réservés initialement aux hommes européens. En 1840 la construction du pont de l'Adyar permet une rapide conquête de la berge sud de la rivière. La Theosophical Society est crée au niveau

de l'estuaire de l'Asyar et constitue à l'époque la propriété la plus large et la plus verte. C'est d'ailleurs encore aujourd'hui l'un des plus importants espaces verts de la ville. A la fin du 19ème siècle les berges de l'Adyar restent encore très partiellement urbanisées et ce n'est qu'au 20ème siècle que la plupart du développement urbain a lieu avec la création d'instituts (Central Leather Research Institute, the Boston High School, Anna University,...), d'hôpitaux (The Durgabai Deshmukh General Hospital), et de nuouveaux clubs privés (The Ganghi Nagar Tennis Club) aux environs de la rivière. Après la construction du pont Kotturpuram en 1987 les quartiers principalement résidentiels et institutionnels de Kotturpuram, Gandhi Nagar s'établissent au sud de la rivière. Finalement dans les années 2000 c'est au niveau du ruisseau de l'Adyar et de l'estuaire que l'on observe des changements conséquents, avec la construction d'immeubles de grande hauteur, d'hôtels et de résidences de luxe (the Rani Meyyammai Towers, the Somerset Greenways Chennai and the Leela Palace) juste sur le front de mer.

Mon terrain d'étude pour cette recherche se concentre sur la partie la plus en avale de l'Adyar, à partir du pont Kotturpuram jusqu'à l'estuaire. Le long des berges nord, d'ouest en est, se trouvent le Madras Club, le Boat Club, le bidonville d'Annai Sathya Nagar, un large espace vert gouvernemental où sont installés les ministères de Chennai dans les anciennes résidences coloniales, quelques anciennes institutions et parcelles privées du 20ème siècle, les hauts buildings luxueux récents, puis le bidonville de Srinivasapuram qui donne directement sur la plage. Sur la berge sud se trouve le Kotturpuram Tree Park, de nouvelles résidences pour les classes moyennes et aisées, le St Louis College et la St Patrick High School, le Gandhi Nagar Tennis Club, le bidonville de Malligaipoo Nagar, le Malar Hospital et la Theosophical Society. L'utilisation des sols a très peu changé au fil du temps le long de l'Adyar et sur le long des berges se trouvent toujours de nombreuses institutions et résidences de l'époque coloniale, devenus des espaces plus ou moins ouverts au public.

Aujourd'hui la vie aquatique de l'Adyar se dégrade et les oiseaux se font plus rares à cause des développements urbains intensifs, sources de pollution constante dans l'eau et dans l'air. Les berges naturellement végétales de la rivière ne sont plus aussi denses qu'auparavant et l'écosystème de l'Adyar disparait vite au dépend des développements symboliques d'une avidité commerciale. Une des transformations la plus surprenante et prédominante le long de l'Adyar est celle des développements en gratte-ciel le long de l'estuaire conçus uniquement pour un usage commercial et adressé aux plus riches. Cependant les bords de l'Adyar demeurent encore aujourd'hui très recherchés pour ses agréables espaces de vie et de loisirs puisqu'ils n'ont pas été aussi dégradés que d'autres parties de la ville et gardent malgré tout un aspect encore naturel à certains endroits. L'Adyar et ses environs ont tout de même réussi à garder leur image historique de jardins et résidences coloniales, malgré les constructions modernes des dernières décennies.

Afin d'analyser la conscience environnementale autour de la rivière, j'ai tout d'abord cherché à savoir comment la rivière Adyar était perçue par les habitants de Chennai. La première observation qui en ressort est que l'ensemble de la population décrit aujourd'hui les rivières de Chennai en tant « qu'égouts à ciel ouvert ». Cette représentation de la rivière fut récurrente lors de mes entretiens, et ceci prouve dans un premier temps une perception péjorative généralisée de l'Adyar. Deuxièmement la rivière Adyar est souvent appelée « Adyar Cooum », faisant référence à la rivière Cooum plus au nord, qui elle-même est beaucoup plus polluée. Une confusion entre ces deux rivières se créer alors, malgré le fait qu'elles aient une histoire et une évolution différentes qui tendent à être négligées. De plus le nom « Cooum » signifie également « douve profonde », nom qui est désormais donné à l'Adyar dans le langage courant du fait de sa mauvaise qualité qui se rapproche de celle de la rivière Cooum. Finalement la rivière Adyar n'est plus perçue comme un élément naturel dans la ville, mais comme une voie uniquement fonctionnelle d'évacuation des eaux usées de la ville.

Par ailleurs la rivière est assez peu visible et difficile d'accès. Sur la berge nord, la majorité du front d'eau appartient aux ministères gouvernementeux ou à des résidences, institutions et clubs privés, ce qui ne laisse pas l'occasion aux habitants d'accéder aux bords du fleuve. Sur la berge sud se trouvent de hautes broussailles, des murs de bétons et à nouveau des clubs et institutions privées. Même au

niveau de la Theosophical Society, qui est un parc ouvert au public longeant la berge sud, il n'existe aucun cheminement possible le long de la rivière, qui est en fait entièrement cachée par la végétation dense locale. De plus parmi les trois ponts qui permettent de traverser la rivière sur mon terrain d'étude, un seul offre une vue est et ouest sur l'Adyar. En effet sur le pont Kotturpuram deux murs de bétons ont été bâtis, et de même sur le pont Adyar qui possède un haut mur à l'ouest. C'est uniquement par le pont ferroviaire, où passe le train, que la rivière est nettement visible pour une petite minute. En définitive les citoyens ont très peu de possibilités pour apprécier l'élément naturel qu'est encore aujourd'hui la rivière Adyar. L'accès y est limité et il est difficile de se rendre compte qu'elle est toujours bien présente. Aucune interaction n'est recherchée puisqu'elle est ancrée dans les esprits comme un égout, une source de pollution continue, de moustiques et de maladies. Par conséquent la rivière de l'Adyar tend à s'effacer dans le tissu urbain puisqu'elle demeure ignorée et majoritairement cachée. Le lien des habitants avec l'Adyar devient extrêmement restreint malgré l'intérêt écologique qu'elle possède encore aujourd'hui, où des espaces naturelles ont su être préservées ainsi que plusieurs espèces d'oiseaux.

Une certaine partie de la population manifeste tout de même un intérêt pour l'Adyar. Les membres du Boat Club font de l'aviron quotidiennement sur la rivière et tous apprécient son aspect partiellement sauvage, au-delà de la mauvaise qualité d'eau. De la même manière les membres du Madras Club peuvent approcher les bords de l'Adyar et faire de la course à pied ou se promener sur les chemins le long de la rivière. Ce sont des espaces privés exceptionnels qui permettent d'échapper au bruit et à la pollution de Chennai, mais ils demeurent réservés à la plus haute classe sociale de Chennai. Aussi plusieurs résidences situées dans les quartiers résidentiels près du fleuve prouvent un intérêt pour l'Adyar. Certaines d'entre elles sont appelées « River View » ou encore « Riviera », ce qui montre qu'une relation spécifique et privilégiée est paradoxalement souhaitée en lien avec l'Adyar, malgré un désintérêt initial. D'ailleurs un peu plus en recul de la rivière se trouve derrière les clubs privés de la berge nord le quartier résidentiel au foncier le plus cher de Chennai. Enfin en mars 2015 dans un quartier un peu en recul de la berge sud, une affiche publicitaire pour la promotion d'un nouveau bâtiment luxueux met en avant une vue imprenable et relaxante sur la rivière Adyar, l'estuaire et la Theosophical Society. Finalement on observe à Chennai en parallèle un mouvement qui tend vers une reconnaissance de la rivière Adyar puisque les classes moyennes et riches souhaitent y habiter à proximité et y exercent des activités de loisir. Cependant ces logements et ces clubs privés sont réservés pour l'élite de Chennai et l'intérêt tourné vers la rivière ne concerne qu'une portion de la population. Ce mouvement demeure également limité puisque seule une qualité visuelle sur la rivière est appréciée et peu d'aménagements près des résidences sont réalisés pour créer un réel lien avec le fleuve. Une certaine distance persiste toujours et il convient tout de même de ne pas trop s'approcher de cet « égout », image qui perdure avant tout.

Un mouvement en faveur de la rivière Adyar se ressent également dans les projets de développement de fronts d'eau réalisés par les étudiants. Plusieurs thèses ont été écrites dès les années 1990s en biologie, chimie, aménagement et architecture. Elles révèlent à la fois de la mauvaise qualité d'eau et de la nécessité d'agir au plus vite mais également d'une volonté de rendre le front d'eau accessible aux habitants. Les projets d'architecture et d'aménagement incluent généralement au préalable des installations théoriques d'épuration des eaux, un dégagement de l'estuaire pour un écoulement constant de l'eau et la délocalisation des bidonvilles présents au bord du fleuve. Ces mesures sont, selon ces projets, nécessaires et primordiales pour rendre la rivière propre, sans risque de contamination ni dérangement olfactif, et dégagée de pollution visuelle que sont les bidonvilles. Sous ces conditions la rivière regagnera un intérêt grandissant de la part des citoyens et pourra être de nouveau un élément naturel reconnu dans la ville. Les projets proposent par la suite un développement d'activités de loisirs et commerciales sur le front d'eau afin d'offrir un nouveau centre attractif. Beaucoup planifient l'installation de boutiques, centre commerciaux et culturels, pistes cyclables, sentiers au fil de l'eau, esplanades et panoramas. L'organisation spatiale de ces éléments est au centre des projets, où l'objectif est de transformer le front d'eau en une plateforme culturelle avec des services de loisir et d'animations vibrantes, et où la vision du fleuve supposément dépollué sera pleinement appréciée. Malgré le désir fort de regagner ce front d'eau aujourd'hui négligé, cette

reconnaissance de la rivière est réduite à une commercialisation centrée sur ces espaces publics à proximité de l'eau. Finalement la rivière est très peu intégrée en tant qu'élément central dans les plans exposés, qui se contentent seulement de sa présence. En effet l'apparence visuelle des propositions et l'organisation du front d'eau sont particulièrement mises en avant, tandis que l'aspect social ou environnemental que peuvent avoir ces espaces est très peu abordé. De plus les exemples inspirant ces projets sont tirés des redéveloppements de front d'eau américains et européens (Chicago, Londres, Paris,...), qui ont été réalisés à une époque révolue et dans un contexte différent. Ils ne sont pas spécialement adaptés aux rivières saisonnières indiennes, dont la capacité change extrêmement au cours de l'année, ni au contexte urbain des villes indiennes, dont les enjeux sont incomparables.

En parallèle de ces projets universitaires, la société civile a entrepris quelques initiatives pour l'amélioration de la qualité des berges de l'Adyar. L'une d'entre elles est le Kotturpuram Tree Park, situé sur la rive sud de la rivière. Auparavant une décharge de déchets à ciel ouvert, c'est aujourd'hui un espace vert de 5 acres dont s'occupe l'ONG Nigzhal. Grâce à l'investissement de bénévoles sur plusieurs années, la terre a été travaillée et des espèces locales ont pu y être plantées. Aujourd'hui le parc est ouvert gratuitement à tout le monde et connait un succès grandissant. Néanmoins la participation citoyenne pour ce type de projets en faveur de l'environnement reste parfois difficile à mettre en place. A ses débuts l'association Nigzhal comptait seulement une dizaine de bénévoles et ce pendant plusieurs années. Peu de citoyens se sont mobilisés au commencement du projet, aux vues de l'ampleur du travail mais également parce que ce sont des actions dont ils ne sentent pas responsables. Beaucoup attendent que le gouvernement et les autorités supérieures entreprennent les projets répondant à leurs attentes, et ils estiment alors que ce n'est pas leur rôle de contribuer à l'aménagement urbain. Cette attitude passive est d'autant plus remarquable chez les classes riches, où le travail manuel de la terre et des plantes est perçu comme dégradant. Malgré un départ plutôt laborieux, les volontaires pour participer au maintien, à l'amélioration et même à une future extension du Kotturpuram Tree Park se font désormais de plus en plus nombreux. Ce projet est particulièrement stimulant et entrainant pour promouvoir une prise de conscience environnementale. Cela attire l'attention de tous, âges et classes sociales variés, afin d'améliorer la qualité des espaces verts de la ville, et notamment ceux en bord de fleuves. Le Kotturpuram Tree Park prouve également qu'un certain pouvoir se trouve toujours dans les mains des citoyens, qui sont sans aucun doute les plus aptes à créer les projets dont ils ont besoin.

Un autre projet est celui de l'Adyar Eco Park, à l'initiative du gouvernement de Chennai et mis en place sous forme d'un partenariat public privé. Cet espace de 58 acres était lui aussi pendant longtemps une décharge à ciel ouvert peu sécurisée et a été restauré en parc contenant un centre d'éducation à l'environnement pour les scolaires. Inauguré en 2010, l'entrée du par est payante (20 ₹, soit 0,30 €) et limitée à 20 personnes afin de ne pas perturber l'écosystème encore fragile.

Ces deux projets le long de l'Adyar montrent clairement un intérêt de restauration écologique pour les espaces pollués de Chennai, qui sont principalement localisés autour des rivières. Cela contribue à sensibiliser la population sur les soucis environnementaux auxquels la ville fait face et permet d'engager une première étape vers un souci de préservation des abords de la rivière Adyar. Cependant ces deux parcs, ainsi que la Theosophical Society, restent isolés le long du front d'eau et ne font pas l'objet d'une réflexion globale sur les espaces verts des berges de l'Adyar.

Par ailleurs les intentions politiques et économiques du gouvernement derrière ces projets ne sont pas principalement motivées par une préservation de l'environnement. La première raison qui ressort implicitement est l'intention de délocaliser les zones de bidonvilles, qui se trouvent aux abords de la rivière et de la mer. Il a été démontré qu'une des motivations principales pour la création du parc Adyar Poonga était avant tout d'éjecter les bidonvilles de cet espace, qui sont perçus comme les premiers pollueurs de la rivière et qui ne confèrent pas à Chennai « une image convenable ». Il existe en réalité de fortes confusions concernant les responsables de la pollution de la rivière Adyar. La majorité de la population considère que les bidonvilles installés sur les berges du fleuve sont la première cause de l'état actuel de l'Adyar, notamment parce que leurs rejets d'eaux usées sont visibles

et qu'ils sont directement déversées dans le fleuve sans traitements. Cependant la quasi-totalité des eaux usées provenant des zones industrielles, commerciales et résidentielles autour du fleuve sont elles aussi rejetées dans l'Adyar sans traitements, grâce des connexions souterraines illégales. Ainsi il est beaucoup plus identifiable de relever les rejets causés par les bidonvilles, que ceux causés par les espaces bâtis environnants qui sont inapparents et inaccessibles. Par ailleurs les bidonvilles et leurs habitants sont généralement mal perçus par le reste de la population, considérés comme une nuisance quotidienne dans la ville, à la fois visuellement mais aussi socialement. La majorité s'accordent alors à penser qu'ils doivent être éliminés de Chennai, bien qu'une étude ait montré qu'ils ne sont responsables que d'1 % de la pollution du fleuve. Finalement derrière le discours annoncé depuis ces 20 dernières années par le gouvernement en faveur de l'écologie à Chennai, c'est officieusement l'exclusion des bidonvilles et des classes les plus pauvres qui est organisée.

Le gouvernement se concentre alors sur une politique de relogement des bidonvilles au sein des périphéries de la ville, dans de nouveaux grands ensembles afin de leur offrir à première vue des conditions de vie plus saines et sécurisées. Malheureusement la délocalisation de ces populations se fait au détriment de l'emploi exercé à proximité de leur ancien logement, des liens sociaux établis dans leur quartier précédent et des habitudes quotidiennes. Bien souvent les relogements, rapidement préparés et conçus, sont loin de répondre à leurs réels besoins et les politiques mises en place échouent. Par ailleurs les arguments officiels du gouvernement qui prônent une meilleure protection de l'environnement sont contradictoires puisque les zones de relogement se font sur les rares espaces disponibles, qui sont bien souvent des terrains gagnés sur des lacs et zones humides. En pensant restaurer l'espace de l'actuel Adyar Poonga au cœur de Chennai, un autre écosystème fragile est détérioré par la construction de nouveaux logements, qui de plus ne sont pas efficacement sécurisés face aux risques naturels. Enfin la restauration de l'Adyar Poonga est d'autant plus contestée face aux constructions imposantes des luxueux hôtels sur l'estuaire de l'Adyar, autorisés par le gouvernement quelques années auparavant, dégradant irrémédiablement cet écosystème.

Finalement derrière un discours officiel de préservation de l'environnement apparait une stratégie officieuse pour attribuer certains espaces urbains aux classes moyennes et riches de la ville. Les classes aux bas revenus ne peuvent accéder au parc Adyar Poonga payant, offrant un privilège exclusif à ceux qui peuvent y rentrer. De même les nouveaux développements construits sur les anciens bidonvilles ne sont pas adressés à ces derniers. Ceci ajoute une nouvelle fragmentation dans la société, stigmatisant les moins puissants financièrement. Il m'a souvent été dit que les classes les plus basses n'ont aucun sens de l'écologie et sont la première cause de pollution dans la ville, ne méritant donc pas le droit d'accès aux espaces verts préservés qui risqueraient alors de se dégrader.

Les projets à l'initiative du gouvernement ont tous une première visée économique, avant la protection et sensibilisation à l'environnement. D'ailleurs la dépollution de la rivière résoudrait bien des problèmes de santé publique, mais puisque le lien de cause à effet n'est pas direct et que le retour sur investissement n'est pas percevable, peu de mesures sont envisagées. Le gouvernement ne s'est pas encore engagé sur des programmes environnementaux lourds et la politique actuelle est tournée vers un développement économique puissant.

Lors de mon travail de terrain j'ai aussi pu remarquer un manque de coordination parmi les différents acteurs des projets, ainsi qu'au sein des différentes institutions gouvernementales, ne favorisant pas un travail collaboratif efficace. Les différentes autorités publiques en charge de l'urbanisme et de la préservation des ressources naturelles sont très isolées et se consultent peu entre elles, exerçant leurs compétences presque en autonomie complète. De plus très peu de responsabilité est engagée lors de la mise en place d'un projet, et il est presque impossible de connaitre les porteurs des propositions. En effet lorsque je souhaitais rencontrer la personne en charge d'une certaine partie d'un projet, chaque service préférait en désigner un autre, soit disant plus qualifié, quitte à m'envoyer vers une autre administration surement plus compétente sur le sujet. Il m'apparait assez utopique que ces différentes parties puissent s'unir pour agir vers une restauration globale de la rivière Adyar, et plus amplement pour créer un développement du front d'eau de la même manière qu'en Occident.

Les tâches de chacune sont bien réparties et la consultation est aujourd'hui presque inexistante, offrant une occasion de voir se développer un nouveau phénomène.

Finalement cette organisation gouvernementale très distincte et indépendante laisse la possibilité de voir un autre système d'aménagement urbain se réaliser. Il serait alors envisageable que le développement des berges de la rivière Adyar soit motivé par une accumulation de projets isolés sans concertation générale, qui constitueront au fil du temps une requalification de ces espaces au bord de l'eau et favoriseront un retour vers ce fleuve oublié. Ainsi la prise de conscience environnementale autour de l'Adyar, aujourd'hui fragmentée, pourra conquérir chaque part de la population grâce à plusieurs projets initiés à la fois par le gouvernement, les ONG, les universitaires et autres nombreux corps mobilisateurs.

En conclusion la conscience environnementale à Chennai est aujourd'hui isolée et partielle, dont seulement une partie de la population se sent concernée. Tout d'abord les représentations actuelles de la rivière sont majoritairement péjoratives et le chemin pour reconnaitre l'existence de la rivière Adyar en tant qu'élément naturel à fort potentiel est encore long. De plus les classes aisées qui reconnaissent le charme de l'Adyar se mobilisent peu pour contribuer à son amélioration et pour révéler son importance. Enfin la vision du gouvernement est tournée vers le développement économique de Chennai, où le profit et la renommée de la ville sont prioritaires. Les projets qui ont lieu actuellement aux abords de l'Adyar, la préservation de certaines parties des berges, les résidences et institutions établies aux environs et les propositions réalisées par les universitaires prouvent par ailleurs que l'Adyar n'a pas perdu tout son potentiel, et qu'un intérêt en sa faveur ne peut que croître. Il est peu probable que le processus de revitalisation de la rivière s'effectue de la même manière qu'il s'est réalisé en Amérique du Nord et en Europe. En France la réhabilitation des fronts d'eau s'est principalement effectuée par un puissant mouvement politique organisé, tandis qu'il est fort possible qu'à Chennai un autre processus se produise, grâce à des projets locaux initiés par tous types de participants.

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CMA	Chennai Metropolitan Area
CMDA	Chennai Metropolitan Development Authority
COC	Corporation of Chennai
CMWSSB	Chennai Metropolitan Water Supply and Sewerage Board
CRRT	Chennai River Restoration Trust
DMK	Dravida Munnettra Kazhagam
GoI	Government of India
GoTN	Government of Tamil Nadu
MoEF	Ministry of Environment and Forest
NGO	Non - Governmental Organization
PWD	Public Works Department
TNSCB	Tamil Nadu Slum Clearance Board
UN - Habitat	United Nations Human Settlements Programme
WHO	World Health Organization

Introduction

At the beginning of the XXth century, the US President Theodore Roosevelt laid stress on what would become a century of unprecedented and profound transformation of the Earth's river. It opened a new chapter in humanity's long history with water, one that viewed human control of rivers as fundamental to economic and social advancement. Water has become a crucial requirement for people across all cultures and regions, not just for drinking or cleaning purposes but for ritual or recreation activities as well.

Clean and plentiful water provides the foundation for prosperous communities. We rely on clean water to survive and depend on rivers for transportation, commerce, production of drinking water, to carry goods, provide food and other substances across nations, and to carry away our wastes. Most of the human activities have had an inseparable impact upon the rivers. Since the XXth century humans tend to control even more than before the Earth's surface water. We dredged river channels for shipping, dyked river banks to contain unruly floodwaters, built dams for irrigation, flood control, hydropower generation and water supply. Rivers after rivers have been transformed for human purposes as the request for water, electricity, sanitation, and flood protection was growing.

Simultaneously the abandonment of the old ports, during the deindustrialisation process, serves for city revitalization and waterfront development. This movement began in the years of the Second World War, when the emergence of the container shipping industry accelerated the abandonment of old ports all over the world. As a result it opened great opportunities for new developments in the cities centres. First in North America, then in Europe and now in Asia, the reconversion of the waterfronts of rivers and ports are designed again, by public institutions and privates developers, to create new public spaces with recreational, cultural and commercial purposes.

Chennai located in Tamil Nadu, in India, also started a reflexion on the rivers of the city. The three mains waterways of the city, the Cooum river, the Buckingham Canal and the Adyar river, once served as primary mode of transportation. Today they have turned into dumping yards and carriers of untreated sewage. It generates breeding grounds for mosquitoes and poses health hazards to those residing along the banks.

According to TNPCB, all the water bodies in Chennai are polluted and not suitable for any designated uses such as drinking, bathing, propagation of wild life, washing and agriculture. Also the CMDA stated in the Master Plan 2006 that "pollution levels in the water bodies of Chennai needs to be monitored and needs to be reduced to the level that it could be used for recreational purposes, in the longer term. Measures need to be taken include, eviction and rehabilitation of encroachments, strengthening of banks and other structured measures for flood alleviation, desalting, introducing green cover on its banks, etc." (Second Master Plan, Chapter XII Environment). Moreover an integrated eco-restoration plan has been chalked out around a creek formed by the Adyar river before the estuary. In this area of 58 acres the sledges have been removed, the solid wastes have been taken up, the outfall of untreated sewage has been stopped and indigenous vegetation has been introduced. In the second phase, the restoration will expand to 300 acres and in phase three, the remaining stretch of the river would be covered under the eco restoration plan (The Hindu, April 2013).

It appears that Chennai gets involved in the struggle against pollution of its rivers, querying whether intention for riverfront development is engaged. The study focuses primarily on the Adyar river in Chennai and look at the actual environmental awareness. The thesis studies the objectives and motivations behind the ecological restoration projects on the Adyar river, such as the eco-restoration

of the park, and analyses whether a process of revitalization movement on the river is possible and under which conditions.

The first part introduces the city of Chennai, describes the environmental issues on the rivers and explains the research method. Then the case study, the Adyar river, is analyzed in the second part. Finally the reflexion and analysis of the environmental awareness in Chennai is presented.

Part I Context and issues on the rivers of Chennai

1. Chennai, the fourth largest city of India

In India about 70 % of the urban population live now in the largest metropolitan areas of the country, including Chennai (Marius-Gnanou, 2010). Thus a broad presentation of the situation in Chennai might be necessary to understand the context of the study.

1.1. A massive population in Chennai

Chennai is located in the north of the Tamil Nadu State in the east southern part of India. It is situated on the coast of the Bay of Bengal, the Coromandel Coast, and the land is a flat coastal plain. Chennai city and its region are ranging from 2 to 10 meters above the sea level, with very few isolated hillocks in the South West near St. Thomas Mount, Pallavaram and Tambaram.

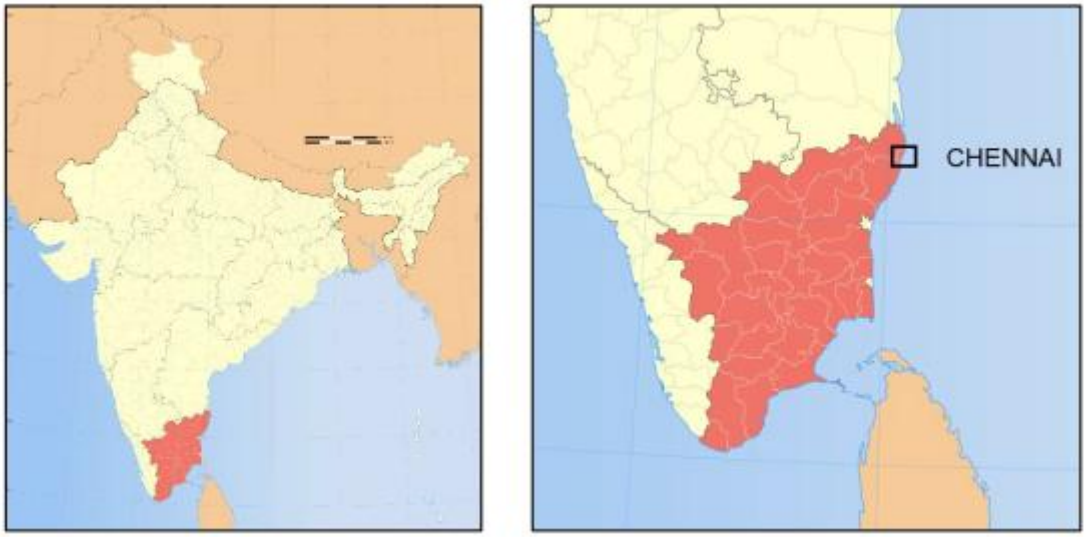


Figure 1: Localisation of Chennai in Tamil Nadu, India. Source: Hochart, 2014.

Under the British Empire, the city was the capital of the Madras Presidency, and was known as Madras until 1996, when the name was officially changed to Chennai.

Chennai is the largest metropolitan city in South India with 8.7 million inhabitants in 2011 (Census of India) and the fourth largest metropolitan area of India, after Delhi, Mumbai and Kolkata. It is the provincial capital of the large State of Tamil Nadu (population of 72 million in 2011 according to the Census of India). Tamil Nadu has become the most urbanized state of the Indian Union (44 % of urban dwellers against 28 % nationally), the three cities Chennai, Madurai and Coimbatore comprising one third of the urban population (Marius-Gnanou, 2010).

Chennai's city population was estimated to be 4,68 million within its municipal corporation, spread over around 200 km² (Census of India 2011). Chennai population has grown constantly since Independence. The Table 1 shows the growth rate of population of Chennai city and Chennai Metropolitan Area between 1971 and 2011. Today the population is growing in the Chennai Metropolitan Area, instead of the City itself. The periphery of Chennai is still experiencing a high population increase even if the growth rate has been slowing down for both Chennai city and Chennai Metropolitan Area, as shown in Table 2.

	Population					Annual				AREA
	1971	1981	1991	2001	2011	1971-1981	1981-1991	1991-2001	2001-2011	km²
Chennai city	2,642,000	3,285,000	3,843,000	4,343,000	4,681,087	2.2	1.58	1.23	0.75	176
Chennai	3,504,000	4,601,000	5,818,000	7,041,000	8,696,010	2.76	2.37	1.93	2.11	1189

Table 1: Chennai population's growth between 1971 and 2011.
Source: CMDA Second Master Plan, Vol 1-Demography, based on Census 2001 and Census 2011

	Actual	Projection					Gross density Persons/Hectars
Years	2001	2006	2011	2016	2021	2026	2026
Chennai city	434,400	462,800	495,000	523,900	554,000	585,600	333
Municipalities	158,100	185,200	217,500	256,000	302,000	356,900	149

Table 2: Projected population for CMA and Chennai City.
Source: CMDA Second Master Plan, Vol 1-Demography, based on Census 2001 and Census 2011

Chennai has two administrative boundaries; the inner boundary is the Corporation boundary, also called city boundary, which include very dense urban areas; the outer one is Chennai metropolitan boundary (CMA), which encompasses the suburban areas. In 2011 Chennai city had a density pattern of 247 persons/ha, and the average gross density in CMA is around 59 persons/ha. The projection of the population of Chennai estimates the city density to be 333 persons/ha in 2026.

Because of the sea of Bengal on the East Side of the Chennai, the spatial expansion has forces in other directions. The Chennai Metropolitan Area is almost seven times larger than Chennai city area. The Indiapolis database evaluates the total surface of Chennai built up area currently at 588 km² (e-Geopolis, Indiapolis database, 2010).

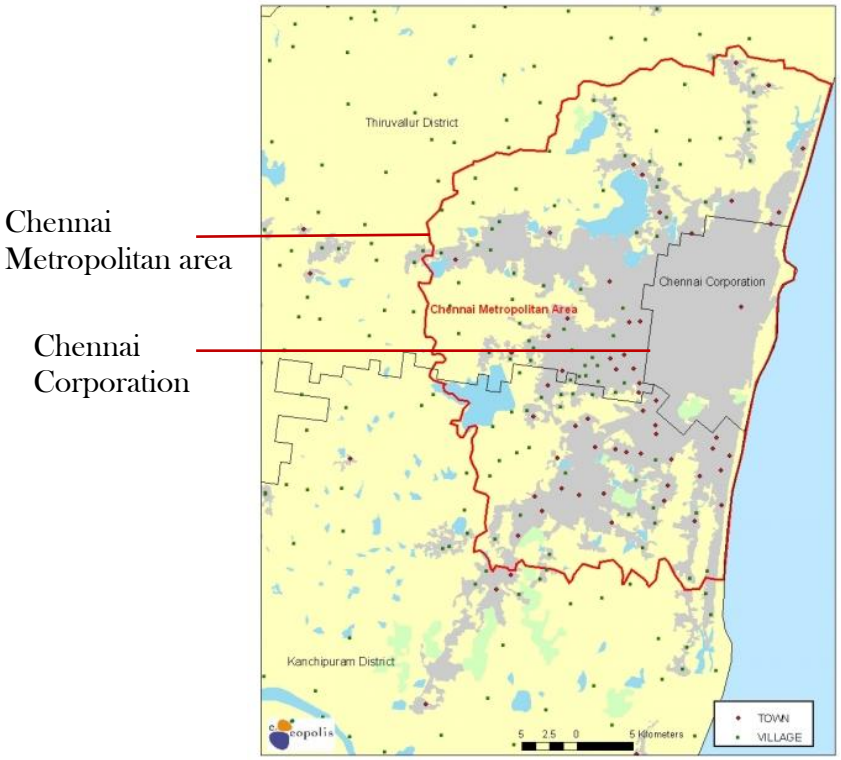


Figure 2: The urbanisation of Chennai Metropolitan Area and Chennai Corporation.
Source: http://cybergeo.revues.org/24798

The increasing population in Chennai causes many problems of pollution in the city. There is a very intense traffic and peak hour's congestion is daily common.
The level of congestion on arterials and other major roads has increased eight-fold over the period 1984 to 2008. According to the estimates of the Chennai Corporation there were ten key arterial roads in 1993-94 with journey speed of 31-40 km/hour. Now only three roads have a similar speed. There were only two roads with average peak hour journey speed of 11-20 km/hour then. Now the number of roads in the class has increased to 20 (Samajdar, 2013). As a consequence in 2010 a study conducted in Chennai conclude that the air pollution was above the WHO guidelines. The WHO standard for particulate matter is 20 microgram per cubic metre and the measured emissions in Chennai, however, range between 60 and 120 microgram per cubic metre (The Hindu, March 2012).

Another pollution problem which Chennai faces is the enormous amounts of solid waste produced in and around Chennai urban areas. These are dumped openly where free space can be found in the city, for example along the water bodies, or dumped nearer to Pallavaram solid waste open landfill site. The harmful chemicals, such as heavy metals, transfer to the ground altering the soil quality, the ground water and surface water. This should even more taken into account since Chennai's location is also marked by three major rivers beds, backwaters and marshlands.

Figure 3 : Traffic congestion and open dumpsite near the river are causing air and water pollution in Chennai. Sources: http://www.livechennai.com/ and A. Cornou

1.2. Chennai, a city surrounded by water bodies

Located on the coast the metropolitan shoreline is about 50 km. The Marina Beach, on the east side of Chennai is the second longest beach in the World: it is 13 km long.
On the West side Chennai city has no perennial water body. It has only seasonal source of water bodies like seasonal rainfall, streams, rivers, lakes and other water bodies depending on the monsoon. Sholavaram Lake, Red Hills Lake and Chembarambakkam Lake are the three large lakes in the Metropolitan area of Chennai. They are part of the main sources for the water supply from surface water for the metropolitan area of Chennai.

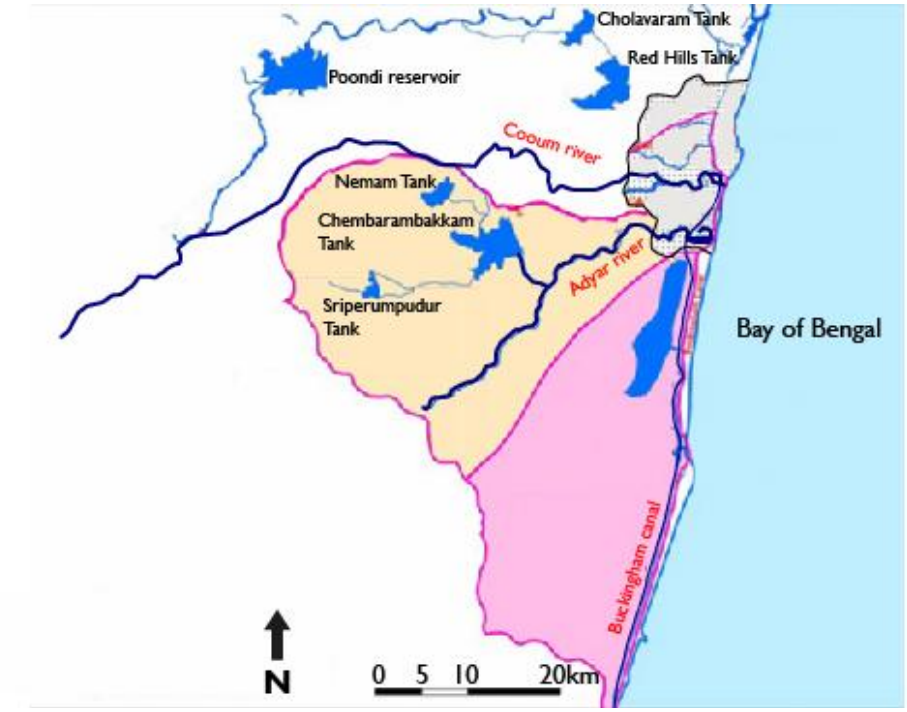


Figure 4: Main water bodies around Chennai city.
Source: CMDA Second Master Plan

Chennai's location is marked by two main rivers, the Cooum River and the Adyar River. They are placid rivers and meander on their way to the sea of Bengal (the Indian Ocean).
The Buckingham Canal, a man made canal (constructed in 1806) is 4 km long, and runs parallel to the coast. It is also another important water way, which runs North-South almost through the entire length of the city and links the two rivers. It was originally a navigation channel and waterway till 1954 but now it serves only as drainage channel

There are a number of other smaller canals and nullahs (Otteri Nullah, Captain Cotton Canal and Mambalam Drain) draining into these main waterways.
Cooum and Adyer rivers in Chennai city are almost stagnant and do not carry enough water except during rains. These rivers play a major role during floods. They collect surplus water from tanks: about 75 for the Cooum and 450 tanks for Adyar, in their respective catchments. Thus the flood discharge of Adyar river is almost three times more than of the Cooum river.

The Cooum river almost divides the city into half, whereas the Adyar river divides the southern half of the city into two. The length of the Cooum river is about 65 km which 18 km fall within the city limits of Chennai. The Adyar river is 42 km long, it falls 24 km within the Chennai Metropolitan Area and 15 km within the city limit.

Since the beginning of the 20th Century, Chennai has witnessed a steady deterioration of and decrease in water bodies and open spaces. The extinct of water bodies in Chennai is one of the major crises facing the city. This is due different factors:

- "High and rapid urbanisation the past years
- Illegal sewage outfalls, illegal dumping of building rubble, debris, open air defecation
- Heavy pollution load, high Biochemical Oxygen Demand (BOD), low Dissolved Oxygen (DO), high Suspended Sediment Concentration (SSC)
- Population growth, densification, slum development
- No tourism and recreation- no walkways, lawn, gardens, parks: unsafe for pleasure boating, bathing, swimming, fishing; denial of sustainable tourism asset

- Lack of political will, co-ordination among institutions, inability to solve environmental problems, improper/inadequate management, poor planning, lack of public awareness and knowledge
- Illegal encroachments along banks of the river
- Non coverage by the sewerage system of the population. It has been estimated that approx. 30 % of the population along the banks of the Cooum is not connected to sewers
- Flooding and overflowing during monsoon; slow flow and stagnation during the dry season" (Kavitha, 2013).

Nowadays all these waterways, Cooum river, Adyar river and Buckingham canal, are polluted due to outfalls from industries, commercial institutions, sewage treatment plants, pumping stations, sewers, storm water drains and slums. This wastewater discharge contributes contaminating or polluting water to the waterways and leads to unsanitary conditions. The poor quality of the stagnant river water leads to proliferation of virus, bacteria and mosquitoes breeding, thus causing diseases and endangering the health of people who come on the riverside. The water bodies are basically used as urban open sewers and act as an eyesore within the city limits.

1.3. The federal planning system in India

India is a federal State with are twenty-eight States and seven union territories. Each State has his own government. According to the entry 18 of the Seventh Schedule (the State List) of the Constitution of India, land falls within the legislative competence of the States. Therefore spatial planning and water management are the responsibility of the various state governments in India.

Spatial planning occurs at different levels: national, state, metropolitan area, and local levels:

- At the national level, the spatial planning is done by the Central Government. It is limited to evolving policies, guidelines and formulating development plans and policies for union territories. The Central Government agencies are divided in different departments: the National Planning Commission, the Ministry of Urban Development (MoUD), the Ministry of Rural Development, the Ministry of Housing and Urban Poverty Alleviation (MoHPA), and the Town and Country Planning Organisation (TCPO). Another ministry having a role in spatial planning, and particularly regarding the natural areas and water resources, is the Ministry of. Environment and Forest (and the Central Pollution Control Board - CPCB)
- At the state level the Ministry in charge of urban development is responsible for the spatial planning. The Ministry launches a national scheme, which has to be approved by the Planning commission of India. The Department of Town and Country Planning, the Urban and Regional Development Authorities, the specialised or single function agencies (such as State Housing Board, State Electricity Board, Water Supply and Sewage Disposal Board etc.) and the Master Plans are also involved in the spatial planning.
- For the Metropolitan Area Level, Metropolitan Development Authorities are deciding the spatial planning, for Chennai it is called the Chennai Metropolitan Development Authority (CMDA).
- Finally at the local level the Department of Town and Country Planning or City Development Authorities are preparing and implementing Master Plans of urban centres for a comprehensive spatial planning. The Town Planning department of the Corporation of Chennai is involved for the local planning of the city.

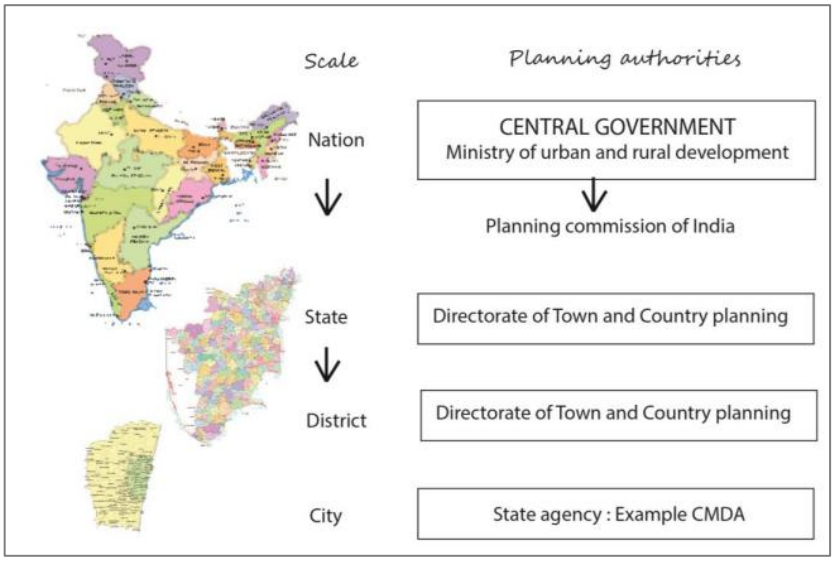


Figure 5: Scheme of the different governmental levels for planning.
Source: Hochart, 2014.

Both in the city and at the metropolitan area level, the CMDA and the Chennai Metropolitan Water Sanitation and Sewage Board (CMWSSB) are playing a major role for planning urban spread and water management.
Regarding only the city area, the Corporation of Chennai is in charge of coordinating the different stakeholders for planning and water management. Thus projects of the CMWSSB, the Public Works Department and the Chennai River Restoration Trust (CRRT), which are local governmental institutions, will be coordinated by the Corporation of Chennai. The second part of the thesis explains their roles in more details.

2. Towards a recognition of the rivers

From the countryside village to the metropolis, every settlement is likely to led sewage outlets on the surface water, mostly rivers and sea. With the development of techniques and technologies, sewages are treated more efficiently and have less impact on the surface waters. Thus rivers flowing into cities tend to become not as polluted as they once were. Despite that the water of rivers in urban areas remains still unhealthy for drinking and bathing, citizens enjoy again the rivers, for other activities such as fishing, boating, walking... Beside this cleaning water process, a general movement has been observed worldwide: the riverfront development in urban areas. This movement is also noticeably responsible for a new recognition of the river, as a natural element in the city.

2.1. A genesis in the western countries[1]

The early stages of human settlements began with a precise choice of geographical location. Most of the time, the early formation of cities and their development occurred along the rivers. The history of urban river front is therefore a localized organization of a concentrated population and activities. They have gradually accumulated to enjoy and benefit of advantages under control of the water: water as a resource, water as energy for manufacturing activities and water as a way of transportation. Thus the urban water front was often a very crowded space, with industries, buildings for production or areas dedicated to storage.

[1] Written by merging the sources from Beauchene, Bonin (2008), Gravari (1991) and Lechner (2006).

This scheme worked in the western world cumulatively throughout the second half of the nineteenth century and during a good half of the twentieth in various cities of all sizes.
During the decades 1960-1980 profound changes affected these water fronts, mainly under the effect of de-industrialization of the productive system which happened in North America and Europe. From this time the proximity to water is not as important as before and the activities along the river tend to be decentralized. The productive function of waterfronts disappears but still the space available is not totally neglected and other opportunities could set up. These new urban spaces are soon taken into account and we observe a change from industrial cities to post-industrial cities. The river is seen as an identity space for the city, as a memory element and a good transmitted. It is now possible to reveal the river, to make it accessible and practicable for the citizens, to invent a new destiny and new uses for the water fronts and to bring it with the aspirations and needs of the time.

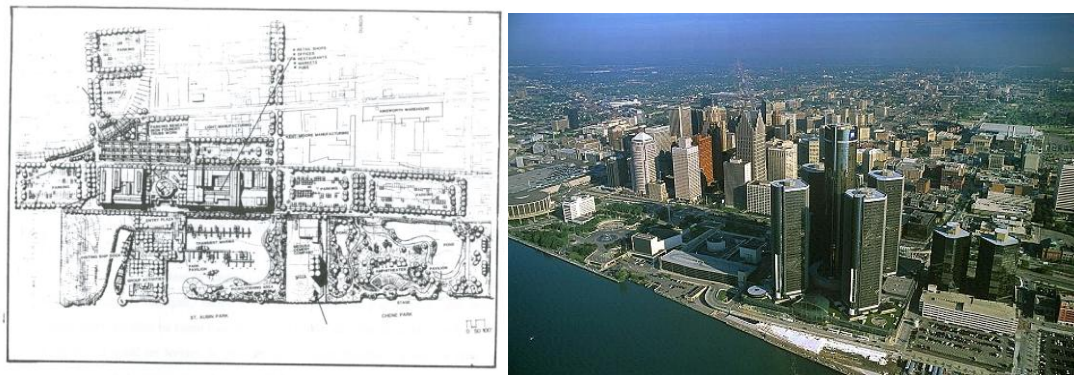


Figure 6: Example of a waterfront development in Detroit.
Sources: Gravari and http://www.airphotona.com/

The waterways became themselves a structural element for development projects at a larger scale: they are a strong planning element for the city. The urban regeneration of the river combines wishes of new appropriation, development of new uses, continuity between city and river, integration of the environmental component of water, restoration of facades on docks, creation of riverside parks and so on.

From now the river is at the core of the metropolitan dynamics. The first reconversions of large harbours and inland waterways started in North America (Baltimore, Boston, Chicago...) during the 1960s, followed by the major European cities during the 1980s (London, Paris, Berlin...).

Moreover the reallocation of these spaces leads to a new urban lifestyle. In general these spaces are reserved for attractive activities in the areas of commercial real estate, housing, leisure, tourism and culture. The 1980s are years of a starting reflection on the historical look at both the city and the river and the confrontation of ideas. Then the first studies and planning competitions happen in the following decade. Today the waterfront development is considered as an urban field itself.

Initially the drivers of water front changes are rooted in an economic context, because of fundamental economic changes of the deindustrialisation process. This led to a reflection on a new development and economic exploitation of these spaces. However over time these changes converge to recognition of these areas as combining landscape values and ecological potential. Nowadays the studies on the revitalization process of rivers show a deviation from the study of landscape in a sense of decor, to a significance of landscape in terms of living conditions, and emergence of social and environmental concerns.

2.2. The riverfront development in India

Some cities in India also started to develop waterfront of rivers, for contributing to the quality of life in all of its aspects like economic, social and cultural. They are many objectives behind these

riverfront development projects. It is done to improve spatial structure and habitat of the river and adjoining areas. The waterfront development will bring attract investment opportunities to further enhance the economic growth and stability of the city. It helps to develop the city as a major commercial and service centre with international class facilities. It appeals to leisure and entertainment function and increase the overall living standards of people in the city, making an excellent living environment. The rivers are restored, improved and beautified, to promote recreational and commercial activities.

The pioneer project in riverfront development in India is claimed to be the Sabarmati Riverfront Development project in Ahmedabad. As announced by the Sabarmati RiverFront Development Corporation Ltd in charge of the implementation of the project, "[it] aims to provide Ahmedabad with a meaningful waterfront environment along the banks of the Sabarmati River and to redefine an identity of Ahmedabad around the river. The project looks to reconnect the city with the river and positively transform the neglected aspects of the riverfront."

This project inspired other riverfront development schemes across the country, for example in Nanded, Lucknow, Guwahati or Pune. As it happened before in North America and Europe, India is also now rethinking the role of river in cities and the river banks uses.

However this project has been criticized, because the channelization of the river appears to be a threat to flooding and ecology, and the relocation of those livings on the banks was only partially assured.

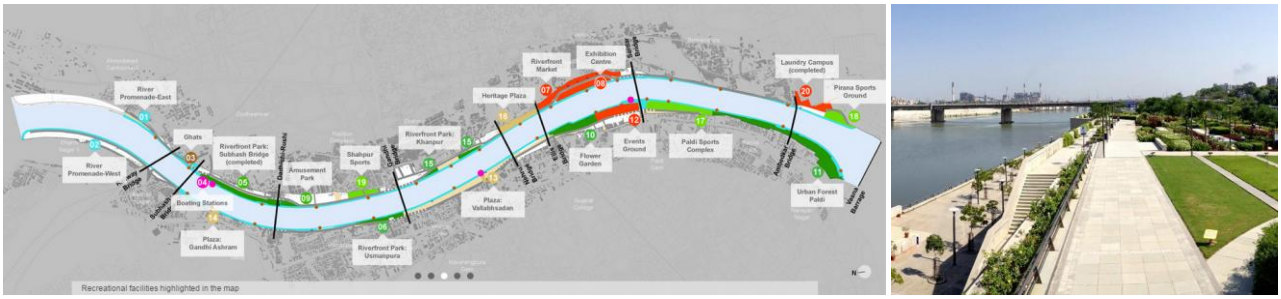


Figure 7: Masterplan and view of the finished Sabarmati riverfront.
Sources: http://sabarmatiriverfront.com/ and http://economictimes.indiatimes.com/

3. Methodology of the research thesis

My reflexion on the rivers and city of Chennai started with a theoretical research at my home university in France. During this period I collected diverse information about movement of revitalization of river in North America, Europe, and India, state of rivers in Chennai, and projects happening on the water bodies of the city. I got a general idea of the situation on the water quality and water front projects of the rivers in Chennai by talking with teachers knowing Chennai and Indian students in Tours, and by reading books newspaper articles available on Internet on water management in India and Chennai.

The rapid industrialization and urbanization of Chennai city and the river banks have led to severe contamination of the rivers. They are mostly polluted due to disposal of sewage and solid wastes. However the two natural rivers Cooum and Adyar are not at the same stage of pollution. The Cooum river is much more polluted than the Adyar river (The Hindu, September 2011). Moreover the Cooum river surroundings are denser and urbanized areas, with less free spaces along the riverbanks compared to the Adyar river. Also the Adyar river was for a long time a barren land, then become the southern limit of the city, and now the urbanization has even expanded further south.

According to my interviews in France, the banks of Adyar river are actually not fully contaminated by dumping areas, they are polluted only in particular stretches and some parts of the banks are occupied by slum dwellers. In the past the river was actually used for drinking, fishing, and domestic purposes, like clothes washing. Today the water quality is harmful for human health and causes environmental disasters, on biodiversity for example.

Finally the beginning of the research was also focused on a project of ecological restoration that has started in 2003 at the estuary of the Adyar river, where it turns into the land and forms a creek. The project has been launched by the government and implemented by external consultants. The first objective is to restore the degraded area and rehabilitate the coastal ecology of the Adyar estuary. The project also aims at rehabilitate the watersheds of the area with minim interface of public for sustainable maintenance, and to introduce environmental education with a research base. No sewage outfalls are led into this part anymore and about 17 plant species have been planted, and the animal diversity has successfully increased (Auroville Today, January 2011).

3.1. Premises for an environmental awareness on the Adyar river

The actual state of rivers in Chennai combined with the possible development of river banks, led my choice to focus on the Adyar river. Despites the recent urban sprawl, it is intriguing that the river has not become as damaged as the Cooum river. Also the first eco restoration project in Chennai is located at the very downstream part of the Adyar river, on the estuary. The phase I is now completed and it appears to be a first step towards a rejuvenation of the Adyar river. This project, as a premise to an environmental awareness on the water quality of rivers in the city, is a coherent reason to study this part of the Adyar river.

Moreover the General secretary of the Federation of Associations of Anakaputhur and Pammal, E. Arumugham, said that "the major sources of pollution in Chennai are the untreated effluents and the beautification of the river will not work until action is taken against sewage discharge and garbage dumping" (The Hindu, July 2014). This discourse, centred on an environmental awareness, induce a possible entire restoration of the Adyar river in a very soon future.

3.2. Research question and hypothesis

Based from a theoretical corpus (interviews, thesis, books, articles, documents available online), my statement is that most parts of the population of Chennai are taking into consideration the pollution on water bodies. Again the Government has taken measures and implemented projects to address the issues on the Adyar river's pollution. To me it demonstrates a start towards an environmental awareness. Also if the restoration of the Adyar river is pursued on the whole stretch, a movement of riverfront development in Chennai might happen later.

I assume that there is an environmental awareness from the governments, civil society and citizens in Chennai, leading to the restoration of the river banks and water quality to its original state. Chennai has engaged the first steps for a restoration of the Adyar river and care for the environment preservation.

Research question

Today what are the environmental awareness circumstances on the Adyar river in Chennai?

- Is it sufficiently advanced to observe an efficient restoration of the river?
- Who is actually concern on the Adyar water pollution?
- What is happening today along the river?
- Is environment preservation the main purpose behind the projects?

Hypothesis

The reflection involved on the Adyar river shows us an environmental awareness, in favour of the preservation of the water bodies in Chennai.

The hypothesis will be verified by looking at the governmental measures, the riverfront projects, and the ecological restoration projects, by exploring the discourse of newspaper, analysing the discussions with the different parts of the society of Chennai, investigating on the direct site the happenings, and examining theses about the Adyar river in various fields (chemistry, biology, planning and architecture).

Objectives of the study

- To understand what is currently happening along the Adyar river : the origins, the purposes, objectives and implementation of projects
- To gather and analyse the representations of the river by the government, stakeholders, civil society and citizens
- To put into perspective the different points of view and assess the environmental awareness

3.3. Definition of terms

During the research thesis I realized the importance of defining and explaining the words that I use, especially when the terms are quite scientific, or when it refers to concepts with no accurate definition existing.

First a very important key word of this thesis is "environmental awareness". Under this I refer to groups, movements and people who are concerned with preserving the environment and natural resources. The awareness can have different stages. People can only be concerned by the environmental issues, knowing what can threaten the environment and how to preserve it. More advanced is the environmental awareness when citizens take ownership of their environment and act as responsible consumers by participating in several actions to rehabilitate it. At the end the protection of nature and the environment becomes a social norm that permeates the daily lives of people.

For this research the environmental awareness is evaluated by analysing the following elements:

- Programs aimed to support the decontamination of river, at the national, state and local levels
- Political deadlines to restore the rivers
- Projects aimed to restore the rivers
- Academic theses regarding the Adyar river
- Articles, from scientists and newspaper, detailing the pollution data, the stage of advancement of programs and projects and the actual concerns
- Interviews of different parts of Chennai's population

For the interpretation of the interviews, two major terms should not be misunderstood: perceptions and representations. Both of them may vary from person to person but there are distinct processes.
Perception is when a human being translates sensory impressions into a coherent and unified view of the world around the person itself. Persons perceive different feelings and sensations by observing a situation or an object which are just there.
More than that we will assign later different images to what we perceive. These are called **representations**. They are a product of the human spirit that he recreates for himself as a "complicated picture" of its environment to better think and act on it. It is a symbolic interface between the individual and his perceived environment in its absence. The images are such as personal interpretations that we keep in mind after the observation of a situation or object.

In the case of my thesis on the Adyar river, each person will have their own perception and representation of the river. Some might perceive it as bad smelling and overload of wastes, and they will represent this river as an open sewage.

Furthermore since the research is turned towards landscape and ecology planning, I would like to precise the terms of restoration, rehabilitation, reclamation, conservation and preservation, based on definitions from Bradshaw, 1996.

The definition of **restoration** is the act of restoring to a former state or to a "perfect" condition. To restore aims at bringing back to the original state or to a healthy or vigorous state an area. There is both the implication of returning to an original state and to a state that is perfect and healthy.

Rehabilitation is defined as "the action of restoring a thing to a previous condition or status." It appears similar to restoration, but there is little or no implication of perfection. Something that is rehabilitated is not expected to be in as original or healthy state as if it had been restored.

Reclamation is defined as "the making of land fit for cultivation" and bringing it back to a proper state. There is no implication of returning to an original state but rather to a useful one, a proper one.

Conservation means that the environment and its resources should be used by humans and managed in a responsible manner. The value of the environment is seen as goods and services that it can provide to people. This requires that the environment is used in a way that is sustainable and it ensures that the natural resources will be used in a manner that will meet the present day needs for the resource without jeopardizing the supply of the resource for future generations.

The method of **preservation** is much stricter than the conservationist approach. Preservation means that the environment, lands and their natural resources should not be consumed by humans and should instead be maintained in their pristine form. Humans can have access to the land, but they should only utilize it for its natural beauty and inspiration. The value of the land is considered not to be what humans can use from it, but instead the land has an intrinsic value, valuable in itself simply by existing.

3.4. Data collection method: theory and fieldwork

a) The initial idea

Firstly to get a complete overview and then analyse the environmental awareness, my method was to collect a maximum of oral and written information from different persons in Chennai.

In order to deepen my literature survey, I went to various libraries in Chennai. As the regulations in Indian libraries are quite strict the consultation of books and thesis was not always an easy task but perseverance and motivation have led me to access written documents. These documents have provided information on the history of Madras and urbanization of the city, articles on the evolution of the use of the river and the practices of the river as well as the actual state pollution. Moreover, the research works realized by the students from different universities on riverfront projects have helped me in understanding the context and the state of environmental concerns about this issue.

As for the oral information, I decided to run interviews with stakeholders from various backgrounds. I identified four categories of persons I could interview. First since they all are citizens of Chennai, they know problems on the Adyar river and can express their opinion, everyday interactions and proposals about it. Secondly their particular function allows them to be quite specific in this field and provides a professional point of view:

- The representatives of the governments, such as the CRRT, the CMDA and the PWD

- The researchers, teachers and students, from the School of Architecture and Planning, the Centre for Water Resources of Anna University, from the Architecture Department of SRM University, from the Madras Institute of Development Studies
- The civil society, and particularly the NGO Nigzhal
- The inhabitants of Chennai

The discussions with academics and students were quite easy to run, as we could speak easily together without censure, and they could bring up their vision of the river freely. Moreover I met professors, NGOs and researchers, more specialized in urbanism and projects on the river, with whom the interviews led to very useful knowledge and advices about the research work. The difficulties for interviewing appeared when I tried to get contacts from the representative of the government.

b) The limitations

I encounter most of the difficulties when I met representatives of the government. As a foreign student and women, I decided to go to the government organizations with an Indian colleague, who could introduce my project better in Tamil, and this could also help to gain their confidence. But the access to information is not so simple thus interviews were often refused. We had to come back many times and insist again to meet the appropriate person. A bonafide letter from the university was a little more helpful, but still representatives were not totally open to a discussion about the Adyar river and projects. Most of the time the person we were talking to redirected us to meet someone else, supposedly more qualified with better knowledge and in charge of the area in question. In fact this other person himself redirected us again to someone else, and this could happen three, four, five, times in a row, until we finally meet a representative who agreed speaking to us in more details.
Another fact was that sometimes they even told us to refer to another governmental organization, or to the website, where all the data needed are supposed to be available online. Also with the time I noticed that the representatives were very cautious in their answers. These were restrictive and themselves were not so open to talk about the issues on the river.

I decided to change the way I was asking the questions. Whenever I asked open questions, for example about the representation of the river, the thought on the future, the reflection on the issues and the environmental awareness, they were often too broad to be understood and answers were not appropriate. So I readjusted my questions to be more precise and practical, sometimes even closed questions. For example instead of asking *"How was the project implemented?",* I asked more accurately *"Who had the initiative? Who are the different stakeholders who took part in it? Did you encounter any problems?"*. Also instead of asking *"What do you think of the river today?"* I asked *"Do you sometimes come on the river side?", "Do you enjoy the river?"*. Thus it turns to become more like a questionnaire, with a rhythm "questions/answers" about the technical process of projects, the environmental regulations, and lifestyle with the river, than a sociologic discussion about the environmental awareness of the Adyar river.

For this research I lacked easy access to the information because the employees of the governmental institutions were not easily open to receive external students. It can take a long time before meeting a conciliatory representative or it needs a long administrative procedure. Thus the materials I got on the projects happening were less than expected.

A number of limitations have been identified. Nonetheless, what can first be perceived as a lack of abundance of the data to get a complete overview, has to be analysed in the study context. There is an explanation to this organization and responses from the representatives of the government. With the benefit of hindsight it can be understood and for example, it showed me first that the environmental issues on the river does not seem to be a common theme, and might not be part of the priority problems in Chennai.

Part II The Adyar riverbanks in Chennai, with preserved nurtured edges and trees

1. Chennai, a "village" of 8 million inhabitants

1.1. The formation of Madras: from the Fort St George to a metropolitan area[2]

a) Madras take its origins during the British occupation

The present day city of Madras, renamed Chennai in 1996, started as an English settlement known as Fort St. George. The region was then a part of Vijayanagara Empire. The genesis of Madras started from Francis Day and Andrew Cogan of the East India Company, who accepted a ground of land on the Coromandel Coast and founded a "factory": a trading post which was the first counter of the East India Company and port in the Gulf of Bengal (Muthiah, 2008). They accepted the piece of land for three reasons: the hinterland with cloths was 20 % cheaper, it was well protected from the south and west by the Cooum and Elambore rivers, and from the east by the sea, and thirdly the rulers were friendly and could help for trade and settlements. As a result the origins of Madras began the 20th February 1640.

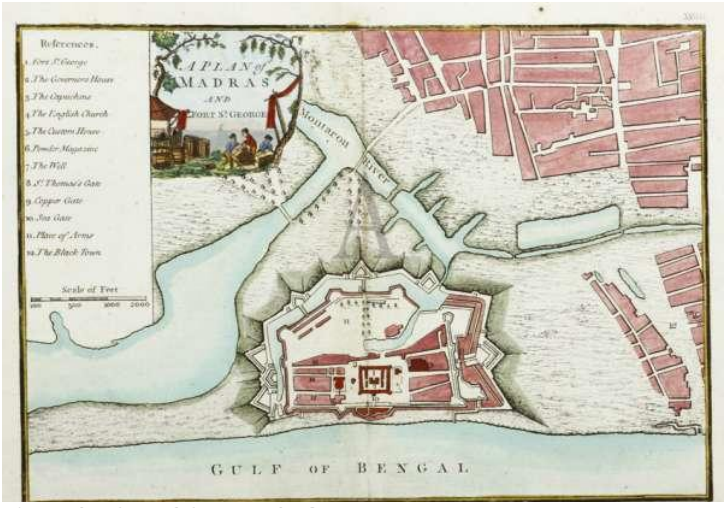


Figure 8: Plan of the Fort St George.
Source: http://www.antiqueprintroom.com/

The English factory was a small fortified enclosure, with the main Fort House and 15 huts for their residence. This is what is called latter the Fort St George. Their small fortified settlement quickly attracted other East Indian traders and as the Dutch position collapsed under hostile Indian power they also slowly joined the settlement. By the 1646, the settlement had reached 19,000 persons and with the Portuguese and Dutch populations at their forts substantially more. White houses of settlers started to be built in the north and south of the Fort, hence surrounding its walls and bastions.

Thus "White Town" was formed. According to the treaty, only Europeans, principally Protestant British settlers were allowed to live in this area. The north of the Fort was the Out Town, also called Gentu Town, which is the High Court campus of today. Over time, Indians also arrived in ever greater numbers and soon, the Portuguese and other non-Protestant Christian Europeans were outnumbered. Following several outbreaks of violence between the communities, White Town's defenses and its territorial charter was expanded to incorporate most of the area which had grown up around its walls thereby incorporating most of its Catholic European settlements. In turn the non-European merchants and their families and workers outside of the newly expanded White Town were resettled. To differentiate this non-European and non-Christian area from "White Town", the new settlement was termed "Black Town", also surrounded by walls.

Collectively, the original Fort St. George settlement, "White Town", and "Black Town" were called Madras in 1640. The name Madras is derived from Madraspatnam, local name given to the site. It is composed collectively of the inner Fort, (the Factory House and the official European Quarter), the Outer Fort which enclosing increased, with European homes and the St Andrew's Chapel. In-

[2] Written by merging sources from Love (1913), Muthiah (2008), Krishan and Doshi (2014)

between the White and Black Town is a market place. On the north of the Fort, the Black Town is composed of about 300 to 400 families from Andhra.

Figure 9: Map of early Madras, with the Fort St George at the bottom left, White Town and Black Town in 1747. Source: http://www.oldworldauctions.com/

b) A growing process by addition of urban "patches"

In the early XVIII[th] century the most part of the city is still considered as a "kuppam", which means a fishing hamlet. From south to west the limits are the river, and on the north the boundary is a line of about 500 yards beyond the Elephant Gate Street. Many changes in the city occurred, like demolitions and constructions of new major houses, walls ad road. From the end of the XVIII[th] century, the city of Madras has expended considerably.

It started in 1676, when Triplicane was the first village to be added. In 1720 the Company acquire four more villages: Triplicane, Egmore, Purasawalkam and Tondiarpet. They are named the four "Old Towns". After that five more villages are added to the growing town, named the five "New Villages": Tiruvottriyur, Nungambakkam, Vyasardapy, Ennore and Sathangadu. Thirty years later, in 1742 Vepery, Periamet, Pudupakkam, Ernavore and Sadayankuppam are also part of Madras. The year 1749 see the first growth of Madras through the use of force when acquiring Santhome and Mylapore that are occupied by the English during the ongoing Wars of Carnatic with France. In 1755 the southern boundaries of the city are a national line of 1000 yards south of the Cooum mouth, including a part of Triplicane. The Elambore river is still the western boundary and the north boundary is the northern edge of Black Town.

Later in 1775, after further expansion the limits of Madras are the Adyar river in the south (at Mount Road and Charmiers Road Junction), on the west from the junction between Mount Road and Nungambakkam Tank Road to Chetpuk and Vepery, and on the north at a point a mile from Black

Town's northern wall. In 1798 the limits of the city remains the same to the south and west, including the acquisitions mentioned earlier. The western limits moved north, past Chetpuk and takes into account Kilpauk and Perambur. From the north of Perambur, the northern boundary ran from the sea and incorporated Tondiarpet.

Altogether at the end of the XIXth century, Madras had almost taken its present shape. In 1939, at the tercentenary of the city, the village of Mambalam (T-Nagar) is added and the western boundary is symbolized by the railway line. Since that time Madras has not stopped growing. The suburbs of Adyar, Guindy, Saidapet are added to the south and West Mambalam, Kodambakkam, Aminjikkarai and Ayyanavaram are included in the west. In fact about 28 villages (19 sq miles) are incorporated between 1941 and 1951, adding nearly 65 % to the city earlier expanse. During that time only the northern boundary did not really change.

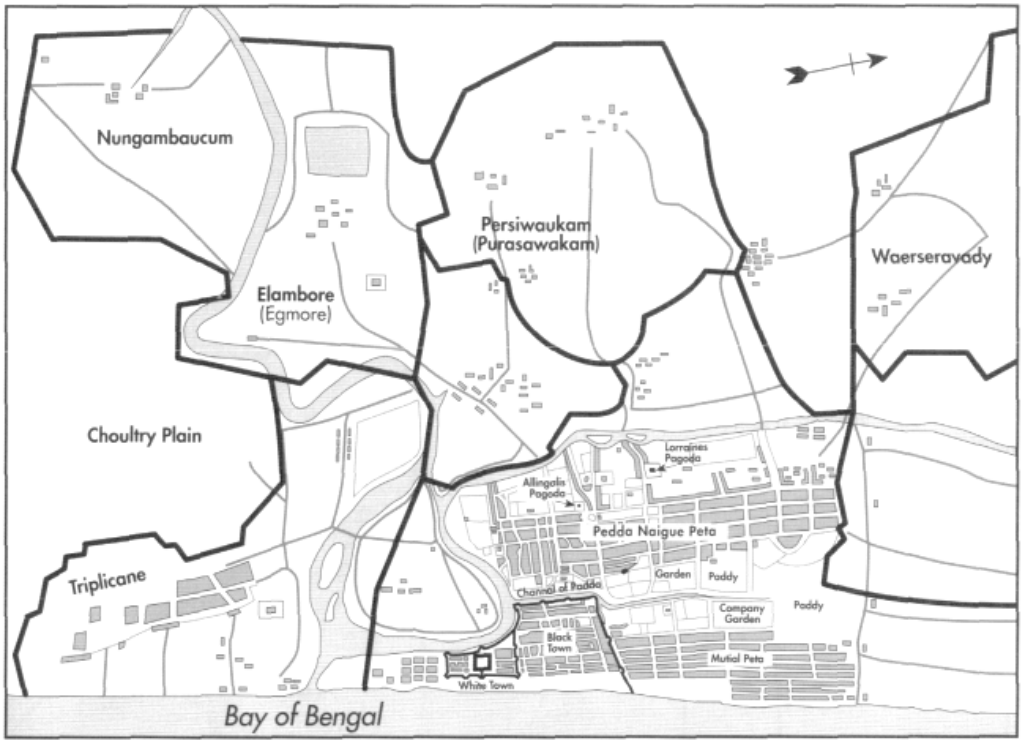


Figure 10: Development of Madras in 1755.
Source : http://publishing.cdlib.org/ucpressebooks/view?docId=ft6v19p0zf;brand=eschol

Between 1951 and 1976 new developments in the west (Anna Nagar and KK Nagar), in the south (Velachery and Tiruvanmiyur) and the north with Erukaancheri occurred. Today the boundaries of the metropolitan area of Madras are Minjur on the north, Sholinganalur and Navalur on the south and Neman – Thirumazhisai on the east. It covers a surface of 1 150 km^2 for 7 million inhabitants. The Development Authority intents on taking over those suburbs too and expands Chennai to Gummidipondi, Tiruvallur and Maraimalai Nagar.

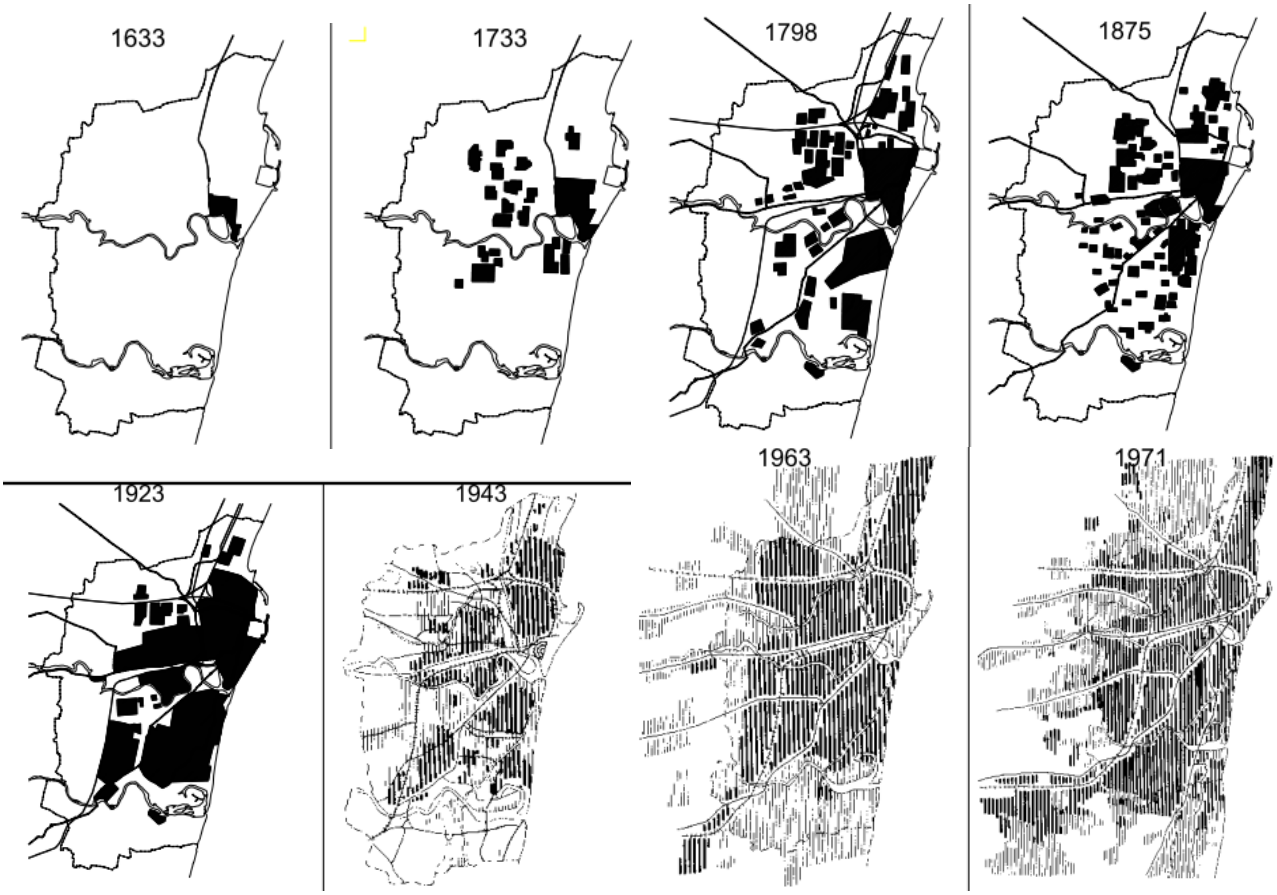


Figure 11: Urban development of Madras, from 1633 to 1971, showing the addition of villages as a growing pattern. Source: CMDA

In conclusion Madras has its origins as a colonial city and its initial growth was closely tied to its importance as an artificial harbour and trading centre. Modern Chennai was formed with the time by accumulation of scattered settlements separated by long distances. Each settlement grew around a nucleus of a temple and has its own history (Kalpana, Schiffer, 2003). Within 350 years the few scattered villages (important being Mylapore, Triplicane and Chennai patnam) developed into a modern metropolitan city without shedding its tradition customs and religion.

1.2. Population growth caused by intense migrations

In 1901, the city of the area of 70 km² had a population of 540,000 inhabitants. In 1971 Madras had about 2.5 million inhabitants, meaning that it has almost five fold increased in 70 years, whereas the city area was not even the double of what it was at the beginning of the century. Ten years later in 1981, 1 more million people are living in Madras. The surface is 16 km² more, meaning that it has more than doubled compared to 1871, but the population is now 8 times more than what it had been then. The city Corporation area recorded a higher growth of more than 2 % per annum during the decades 1951-61 and 1961-71. The reasons for this rapid growth rate can be attributed to industrial developments and increase in economic activities and employment opportunities in the City and its suburbs attracting large migrant population. (Sujatha and Janardhanam, 2014)

It is obvious that cities exist and grow because of economies of urban agglomeration associated with industrial and trade activities. In the recent past, liberalisation, rapidly growing IT sector, an educated, hardworking and disciplined work force, accelerating economic development also contributed to the growth of urban areas in Tamil Nadu. Madras owes its growth in the early twentieth century, not so much due to the addition of many villages, but mostly because of immigration when industrialization and modernization of its port and new industries (textile, tannery) happen, causing the arrival of new work force. In the 1920s the city was already considered as the military and administrative

commercial centre across southern India and it attracted many migrants from Tamil Nadu (Marius-Gnanou, 2010).

Tamil Nadu has emerged as the third largest economy in India. The cosmopolitan nature of Chennai is a reflection of its attractions to migrant groups from all over India. Migrants came not only predominantly from the surroundings of Tamil Nadu, but also from southern and northern India. Since 1980s, the migration flows remained significant in Chennai .These migrant groups from other states have made their distinctive mark on the patterns of residential and social organisations within this Chennai Metropolis. According to 2001 Census, migrants to Chennai City from other parts of Tamil Nadu State constitute 74.5 % and this trend is reinforcing over time. Migrants from other parts of India constitute 24 % and the remaining 1.7 % of the migrants is from other countries.

Year	Total Population	Total migrants to the City from						Un- classified	Total migrants in lakhs	% of Total Migrants to total population
		Other parts of Tamil Nadu		Other parts of India (Excluding Tamilnadu)		Other Countries				
		No. in lakhs	%	No. in lakhs	%	No. in lakhs	%			
1961	17.29	4.47	69.45	1.71	26.60	0.25	3.90	--	6.44	37.24
1971	24.69	5.51	70.61	2.00	25.63	0.29	3.76	--	7.80	31.59
1981	32.84	7.19	71.28	2.55	25.31	0.34	3.41	--	10.08	30.70
1991	38.43	6.44	70.51	2.42	26.47	0.28	3.01	0.04	9.18	23.90
2001	43.44	6.98	74.49	2.23	23.80	0.16	1.71		9.37	21.57

Source: Census of India, 1961, 1971, 1981, 1991 & 2001 Social and Cultural Table

Table 3: Migration to Chennai City.
Source: CMDA, Vol 1-Demography, using Census of India 1951,1971,1981,1991 & 2001

The population of the city has mostly increased substantially in the effect of migration, despite a general migration decrease from 37 % in 1961 to 22 % in 2001. People migrate mainly to search for work (21.5 %), to follow the family (19.9 %) and to get married (12.5 %). (Marius-Gnanou, 2010)

This migration flow, combined with the absence of affordable housing has resulted in the formation of slum areas in the urban gap of the city. Chennai has the fourth highest population of slum dwellers among major Indian cities, with about 820,000 people living in slum areas. This number represents about 19 % of Chennai Municipal Corporation population in 2001 and 28.5 % in 2011 (Census of India 2011). It represents 5 % of the total slum population of India.

1.3. Shortage of decent housing as a consequence of massive urbanisation

The UN-HABITAT defines "a slum household as a group of individuals living under the same roof in an urban area who lack one or more of the following:

- Durable housing of a permanent nature that protects against extreme climate conditions.
- Sufficient living space which means not more than three people sharing the same room.
- Easy access to safe water in sufficient amounts at an affordable price.

- Access to adequate sanitation in the form of a private or public toilet shared by a reasonable number of people.
- Security of tenure that prevents forced evictions."

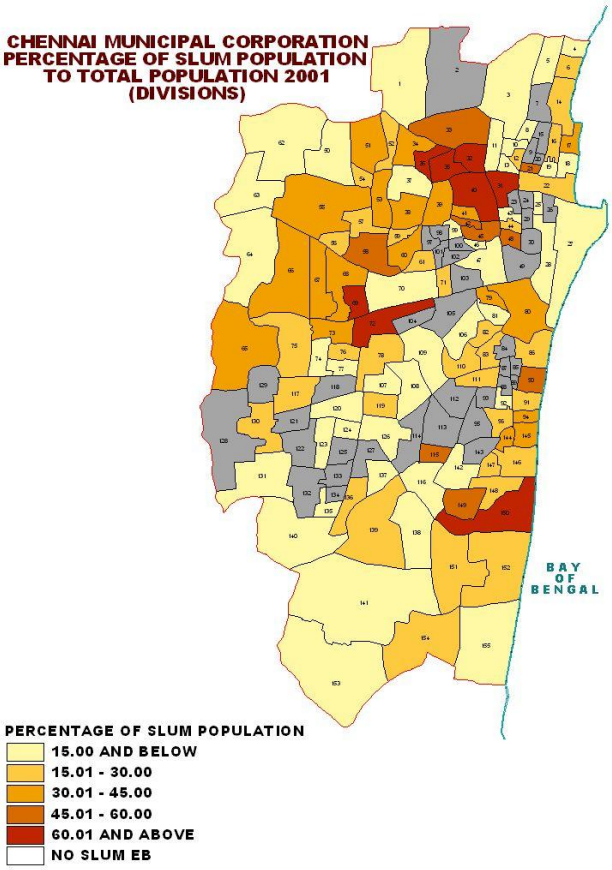


Figure 12: Repartition of slum population in Chennai
Source: Census of India

The phenomenon of slums raises a major development challenge, illustrating inequalities and a non-control of the urban growth. Initially derived from the lack of affordable housing near the job areas or due to an inadequacy of the housing to the practices and constraints of the population with precarious living conditions, the slum is developed by its inhabitants and both the housing and infrastructure are constructed outside the usual market and public service mechanisms.

These informal areas are often highly populated, tight and built by "non-skilled persons" in areas unsuitable for living, implying health, environment and social issues. The slum area is also mainly defined by its non-integration in the "formal" city and lacks infrastructures such as piped water, electricity supply and sewage disposal facilities. The informal settlements grow on land without status and are usually found in the periphery of cities, public parks, or near railroad tracks, rivers, canals, lagoons, city trash dump sites or vacant land because swampy or unhealthy (Hochart, 2014).

According to a government report on slums in Chennai, "slum problem is not only a problem of shelter; it is a problem of health and hygiene. A number of widespread epidemic diseases emanate from the slums. These slums are not only a nuisance and danger to the slum dwellers but to the rest of the population." (Industrial and Economic Planning Division of TCPO, "Slums in Chennai")

To sum up dominant discourse portrayed the slum population mainly as a problem and not as a resource for environmental management and city development. As a consequence the Tamil Nadu Slum Clearance Board (TNSCB) was formed in 1970 by the Tamil Nadu Slum Areas (Improvement & Clearance) Act of 1957 to address the specific problem of slums. The four official objectives of the TNSCB are to "clear all the slums in Chennai & to provide self contained hygienic tenements, to prevent the growth of slums & encroachments, prevent the eviction of slum dwellers by private owners and to provide the slum families with security of tenure and to provide basic amenities like water supply, street lights, storm water drains, sewer line, etc to the slum areas". Consequently it has been implemented various Housing, Slum Improvement and Rehabilitation and Resettlement schemes to ameliorate the living conditions of the slum dwellers in Tamil Nadu.

A survey conducted in 2003-2004 by a private consultant for the Tamil Nadu Urban Infrastructure Financial Services (TNUIFSL) listed 242 "undeveloped" slums within the limits of Chennai Municipal Corporation, concerning 330,000 people who account for less than 10 % of the city

population. 65 % of these settlements were actually located on government land. Out of these 242 identified slums, 122 were categorized as "objectionable" slums, which comprised a majority of squatter settlements located along water ways. The rest is located along roads margins, railways and the seashore.

For this the TNSCB implemented three main broad strategies. First they help for in situ development, such as providing basic infrastructure and amenities (water supply, road and sanitation) on the site. Secondly they can provide in situ reconstruction and multi storied tenements at the same location for the slum dwellers. Thirdly the rehabilitate and resettle the slums communities by providing dwelling units in blocks of flats at alternative locations along with infrastructure and services. The best examples of these policies are Kannagi Nagar and Semmenchery resettlement colonies, two large complexes established in the 2000s in the southern periphery of Chennai, outside the limits of the Municipal Corporation, built for cleaning the slums of the city. In Chennai, people from 78 urban settlements have been relocated on these two sites which contain 22,390 multi-storied tenements and house about 103,774 people (PUCL Report). The Perumbakkam scheme is under construction near Semmenchery, and is planned for a total capacity of 20,000 tenements. The 6,000 tenements of the first phase is nearing completion. This intent to accommodate the residents of slums located on objectionable land. However news reports indicate that nearly 20 % of allotted homes in Kannagi Nagar are vacant and 50 % of the original beneficiaries are no longer living in them (Transparent Chennai, 2013).

Figure 13: Different type of housing, between a typical kutch house in Attur Nagar a on the left, and the resettlement site in Kannagi Nagar. Source: Hochart, 2014

Actually a research thesis by K. Hochart concluded that they are various reasons for the failure of the resettlement projects, from the location to the planning and housing design of the site. In has been analysed that the representation of slums by the planning authorities, and especially by the residents in Chennai, "as poor and non-educated and demanding people" is one the reasons. Thus "unless a truly inclusive and integrated approach is implemented, slum clearance policies will remain limited to being policies for the eradication of the symptoms of housing poverty in the most visible urban spaces, without reducing urban poverty" (Hochart, 2014).

Finally until the mid to late 1980s, "slum clearance" was more interpreted as in situ improvement of slums through tenement construction or sites-and-services schemes. Thus evictions and relocations were largely avoided thanks to a dialogic process of negotiation and accommodation between electoral strategies of the Dravida Munnetra Kazhagam (a political party in Tamil Nadu), the official policies of the TNSCB, and anti-eviction struggles in the city.

However a succession of processes through the 1980s and early 1990s led to the collapse of this anti-eviction scheme and inaugurated negotiations over slum relocation and resettlement. To go further K. Coelho and A. Raman explain that slum eviction and population displacement gained momentum in the 2000s, because of construction of urban transport infrastructure, and several restoration projects of waterways, canals and riverbanks and the beautification of Marina beach. Nowadays "the slums

evictions are located in two 'salvage' discourses, which are ecological restoration and secure tenure of slum resettlement" (Coelho and Raman, 2010).

2. Scarcity and pollution: redounding water problems

2.1. Shortage of water supply for Chennai's citizens

Chennai has the lowest per capita water availability out of all the metros in the country, with 108 Litres Per Capita per Day (LPCD) compared to 270 LPCD in Delhi, 260 LPCD in Mumbai, 250 LPCD in Calcutta and 140 LPCD in Bangalore (Asian Development Bank, 2007). In addition there is a wide difference in accessing the water supply between geographical zones in the city and between income groups. The poorest and least connected residents suffer most from the water shortage in part because they have less flexibility to find alternative affordable sources of water.

The Chennai Metropolitan Water Supply and Sewerage Board (CMWSSB) has been playing a crucial role in delivery of protected water supply and sewerage services to the Chennai Metropolitan Area. 80 % of the water is from ground origin, because of the particularity Chennai faces due to scarcity of local surface sources. In the absence of perennial rivers, the Metro Water had to exploit ground aquifer to complement water from reservoirs.

The ground water is taken in six well fields located in Araniyar and Koratalaiyar river basin adjoining the reservoirs around Chennai, representing 68 MLD (Million Litres per Day). There is also an extractable quantity of local groundwater in the city of Chennai for other purpose than drinking and cooking; and multiple wells. The drinking water requirement of Chennai city is met by taking water from surface reservoirs around Chennai city: Poondi, Redhills, Cholavaram and Chembarambakkam lakes (about 227 MLD) and also from Veeranam lake in Cuddalore District (180 MLD at 228 km south of Chennai). Water is also received from the Kandaleru reservoir in Andhra Pradesh under Krishna Water Supply Project (837 MLD). In addition to this, CMWSSB is drawing about 100 MLD of water from the Desalination Plant at Minjur. At present, the Board supplies about 765 MLD () to domestic consumers in the City area and about 65 MLD of water to bulk consumers such as adjacent local bodies and industries located in Chennai Metropolitan Area. In total Metro Water system provides 44 % of the consumption and serves 310,000 consumers. (Ruet, Saravanan and Zerah, 2002)

2.2. Lack of efficient water sanitation to polluted rivers

Sewerage and sanitation is relatively poor in Chennai. Sanitation and safe disposal of human waste is a critical element of public health, directly impacting the well being of people. The absence of adequate number of toilets linked underground sewerage scheme, absence of sufficient and well maintained public/community toilets and the age old practice of open defecation are posing serious sanitation problems and health hazards.

For improving the water sanitation and supply Exnora, one of the main NGO in Chennai, has both an action in the field as well as some credibility with the Metro Water Board since "it helps in forming committees among the dwellers to organise the water distribution through tankers; it carries a strong lobbying action with the Metro Water Board to build toilets and rehabilitate storm water drains; and it is also part of the consumer committee of the Metro Water Board, as well as the vigilance committee."

Up to now, treatment is of 60 % of the Board-water (thus a substantially lesser percentage if one takes into account the non-board supplies), divided in 5 % re-used by the industry, 10 % re-used by the electrical industry, and 45 % put back to rivers as interviews in the sewerage wing of the Board show.
At present the sewage generated in Chennai city is being treated in the following nine number of treatment plants:

Sl. No	Location	Capacity (Million Litres per Day)
1	Kodungaiyur STP Zone - I	80
2	Kodungaiyur STP Zone - II	80
3	Kodungaiyur (New) STP Zone I & II	110
4	Villivakkam STP Zone - II	5
5	Koyambedu STP Zone - III	34
6	Koyambedu (New) STP Zone - III	60
7	Nessapakkam STP Zone - IV	23
8	Nesapakkam (New) STP Zone - IV	40
9	Perungudi STP Zone - V	54
	Total Capacity	**486 MLD**

Figure 14: Sewage treatment plants in Chennai. Source: CMWSSB

Point sources of contamination to surface water bodies are an expected side effect of urban development. Examples of point sources include direct discharges from sewage-treatment plants, industrial facilities, storm water drains and direct discharge from household and other activities. Despite improvements of the treatment of wastewater, still high quantities of untreated sewage are led into rivers, lakes, sea and marshlands in Chennai Metropolitan Area. Today the three major waterways of Chennai are still polluted due to outfalls from industries, commercial institutions, sewage treatment plants, pumping stations, sewers, and storm water drains. This wastewater discharge contributes to contaminated or polluted water of the waterways and leads to unsanitary condition.

It has been estimated that nearly 60 million litres of untreated sewage are released into the Buckingham Canal, Cooum and Adyar rivers The Buckingham Canal is the most polluted of the three major waterways in the city with nearly 60 % of untreated sewage being let into it daily (CMWSSB, in K. Lakshmi, The Hindu 2014) About 30 % of the untreated sewage gets into the Cooum river and the Adyar river receives the rest (Lakshmi, The Hindu 2014).

In 2010 about 340 sewage outfalls into the waterways of Chennai city were identified (CMWSSB). Of these, nearly 220 outfalls were through storm water drains. The rest sewage outfalls can be supposedly, legal or illegal, industrials or households' untreated sewage. The neighbourhoods located along the banks and even government agencies release sewage without any previous treatment into rivers. It has been estimated that about 50 residential and commercial buildings directly let out the sewage into the waterways without any previous treatment (CMWSSB).

Nevertheless it is often misunderstood that the slums areas, situated directly on the river banks, are not the main polluters of the rivers. Indeed T. K. Ramkumar, the principal advisor of Exnora International, said that discharge from "informal settlements" was very minimal when compared to those from private and government institutions. "Though other basic amenities have been provided to residents of several areas, they do not have sewer lines. Common collection facilities must be provided in areas where settlements are at a lower level than the sewer network" (Lakshmi, The Hindu 2011).

Furthermore a consultancy report commissioned by the Corporation of Madras, found that less than 1 % of the pollution in the river was attributable to the slums in 1989. In 1995 another report

concluded that untreated or partially-treated effluents from Metro Water's sewerage plants and pumping stations were by far the most important sources of pollution in the Cooum and Adyar rivers (Coelho and Raman, 2010).

2.3. Flooding, a permanent risk during monsoon seasons

Other problems that Chennai experience are the rainfalls. Most of its rainfall happens during October to December associated with depressions and frequent cyclones during this period. Average annual rainfall is about 1200 mm – 1300 mm being situated on the coastal side.

Figure 15: Heavy rainfall causing flooded roads in April 2015.
Source: A. Cornou

Of these rainfalls some causes catastrophic events, such as the floods in the years 1976, 1985, 1996, 1998, 2005, 2008 and 2010 caused heavy damages. Nowadays, unexpected holidays due to heavy downpour are quite common especially from October to December. In short, Chennai is not starving for rain; it is starving for water which is due to mismanagement of water storage. In 2010 Chennai received about 760 mm rainfall only during the October – December period (Lavanya, 2012). Recent highest rainfall in a day was 423 mm on the 27th of October 2005.

The risk of flooding has increased considerably because of changes in the land use of Chennai city due to urbanization from 1995 to 2000. Looking at the diachronic maps below we can observe that most of the green covers have declined and have been converted to non-vegetative or a concrete space. Due to this, the surface run-off is too high and the infiltration capacity of land has gone down drastically (Gupta and Nair, 2010). Also the increase in impervious areas causes severe floods in Chennai during every heavy rainfall Chennai with the fast pace of developments has witnessed a steady deterioration and decrease in the number of water bodies. It is estimated that more than half of the wetlands have been converted for other uses (Lavanya, 2012). Chennai had about 650 small and big water bodies in and around the city, but today the number has been reduced to less than 30. Ownership of water bodies is scattered among various government departments and the few of coordination between them is the root cause for lack of proper management.

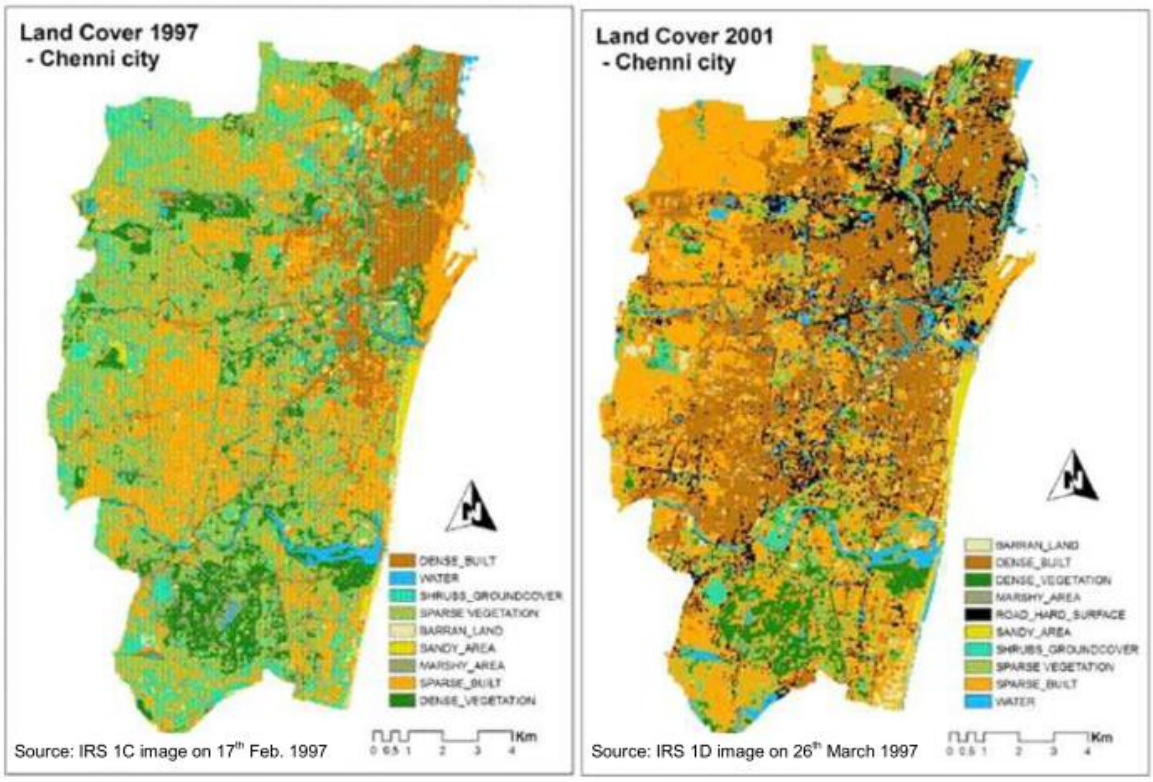
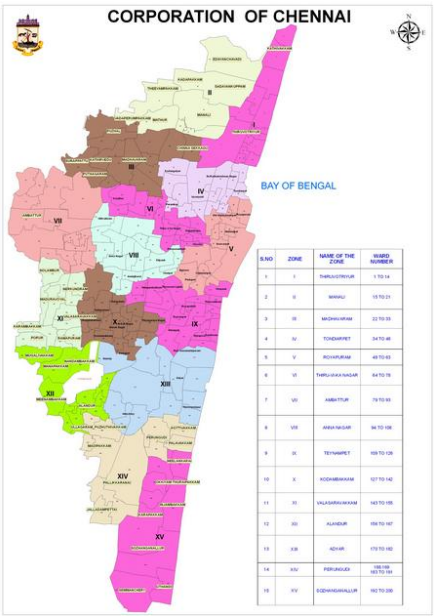


Figure 16: Change of land use in Chennai city.
Source: Gupta and Nair, 2010

3. Chennai's governmental institutions for urban planning and water management

Indeed pluralities of authorities are responsible for the development of the city and the water management of Chennai at different levels.

3.1. The Corporation of Chennai (COC)



The Corporation of Chennai represent the first inner boundary of the city. The boundaries have extended since 2011: the area is 140 % more than what it was before, 426 km² from 176 km² earlier. Now it is merging 42 local bodies, including 9 municipalities, 8 town panchayats and 25 village panchayats. The city is divided into 15 zones, consisting of 200 wards.

The Corporation is composed of 14 departments, which are Parks, Roads, Health, Bridges, Building, Revenue, Electrical, Education, Town Planning, Land & Estates, Small Savings, Storm Water Drain, Mechanical Engineering and Solid Waste Management. In other words the Corporation is responsible for the maintenance of infrastructure such as roads, streetlights, and flyovers, the maintains of the city's cleanliness and hygiene levels, the removal of solid waste within city limits, the maintenance of parks, the building of health and education centres.

Figure 17: Map of the Corporation of Chennai.
Source: http://chennaicorporation.gov.in/

In order to organise the economic and urban development at a larger scale, the CMDA has been created.

3.2. The Chennai Metropolitan Development Authority (CMDA)

Because of the demographic growth, the Chennai Metropolitan Development Authority (CMDA) was constituted in 1974 under the Tamil Nadu Town and Country Planning Act, 1971.

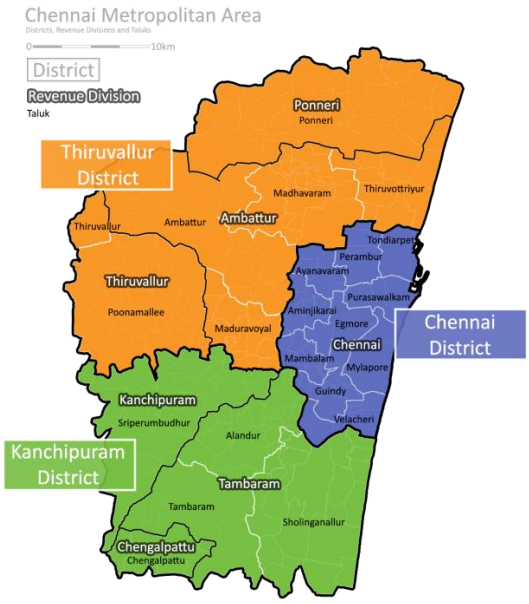


Figure 18: Map of the Chennai Metropolitan Area.
Source: http://en.wikipedia.org/wiki/Chennai_Metropolitan_Area

The area of Chennai Metropolitan Area (CMA) extends over 1189 km² and comprises of Chennai Corporation, 16 Municipalities, 20 Town Panchayats and 214 villages covered in 10 Panchayats Unions. It is divided in three disctrics of the Tamil Nadu state: the entire Chennai district (176 km²), part of Thiruvallur district (637 km²) and part of Kancheepuram district (376 km²). (CMDA website)

The CMDA, compared to the Chennai Corporation is not an elected body but rather an administrative structure. It is the nodal planning agency within the Chennai Metropolitan Area.

Despite the COC and CMDA institutions, the management of the two overlapping areas, the CMA and the Chennai Corporation Area, has become extremely complicated. For setting up mid-term and long-term development goals and land uses rules, the CMDA developed the first Madras Urban Development Plan in 1974 and then the Madras Metropolitan Development Plan in 1975. After that the CMDA might have drawn up numerous plans over time, but there was no new Metropolitan Plan until the Second Master Plan for Chennai Metropolitan Area 2026, approved in 2007.

Recently new agencies and special vehicles purpose have been created, thus by-passing the pre-existing agencies. For example the Tamil Nadu Road Development Corporation (TNRDC) was set up in 1998 to attract private investments for road infrastructure and to encourage construction under Public Private Partnership (PPP).

3.3. The Chennai Metropolitan Water Sanitation and Sewage Board (CMWSSB)

The Board was established under “The CMWSSB Act” in 1978. As explained in the previous chapter, the Board is attending to the growing needs of and for planned development and appropriate regulation of Water Supply and Sewerage Services in the Chennai Metropolitan Area. The mission of the Board is "to contribute positively towards health and quality of life of the citizens of Chennai city by providing good quality safe drinking water at reasonable price" (CMWSSB). In 2011 Metro Water was catering for a population of 5 million. It supplied about 830 million litres of water every day to residents and commercial establishments (Lakshmi, The Hindu, 2012).

Chennai City Sewage System was designed in 1910 for an estimated 1961 population of 660,000 inhabitants. A comprehensive improvement to the city sewerage system was designed in 1958 for an estimated population of 255,000 inhabitants in 1976 and 272,000 inhabitants in 1991. Presently the sewerage network in Chennai city has covered 98 % of its area. As the capacity of sewers was limited, during rainy days they became surcharged due to increase of storm water. Any surplus of sewage in excess of pumping stations capacity was drained into the nearby natural water courses of the city: the Cooum river, Adyar river and Buckingham canal.

3.4. The Public Works Department (PWD)

The Public Works Department (PWD) is the oldest department in the Government of Tamil Nadu and was founded at the time of the British Raj during 1800. It became a government body in 1858 and is divided into two wings: the Buildings Organisation and the Water Resources Department.

Under the Building Organisation, the Public Works Department performs different major activities and functions, such as renovation and restoration of heritage buildings, planning, designing and construction of buildings for Central Government Undertakings, State Universities, Monuments and Memorials, but also bridges and roads, and carrying out research and development in construction

The Water Resources Department is serving in the construction field and maintenance of Irrigation Structures. Many dams stand as a testimony to our engineering skill. The organization marches towards better service delivery to the people. The department is working very hard to realise maximum irrigation efficiency, apply better water management, restore water bodies, and involve water user's participation in the projects.

3.5. The Chennai River Restoration Trust (CRRT)

Formerly known as Adyar Poonga Trust formed in 2006, it was renamed as The Chennai River Restoration Trust in 2010. It is a new agency, bypassing the Chennai Metropolitan Water Sanitation and Sewage Board, the Tamil Nadu Slum Clearance Board and the Public Works Department. It is wholly owned by Government of Tamil Nadu, primarily entrusted with Restoration of water bodies in Tamil Nadu. The CRRT has different objectives:

- To facilitate the development, maintenance and conservation of Eco Park "Adyar Poonga" and to bring best practices in order to create a demonstration and replicable model project of international standard
- To fulfil the recreational and open space needs of the city creating a new landmark of international interest, to restore the natural state of the Adyar estuary and to enable the citizens of Chennai or any other place to interact with nature and learn about sustainable living
- To formulate plans and undertake implementation of programmes, to regenerate the indigenous fauna and flora, maintain the forests, wetlands and other eco-systems and towards preservation of ecological and natural resources, such as flora and fauna, water ways, water bodies, waste water recycling, preserving rare and all species
- To formulate, evolve and identify suitable mechanism for augmenting necessary revenues through commercial operation or otherwise of some/all facilities of Eco Parks either by way of fees, charges, donations, entrance ticket charges, sale of produces and the like.

Today the eco-restoration projects of CRRT are the Eco-Restoration of Adyar Creek (58 acres), the Eco-Restoration of for Adyar Estuary (300 acres) and the Integrated Cooum River Eco-Restoration Plan. Because this new organisation mainly focuses on the Adyar river restoration projects, I decided to study this area in more details. It shows a first step towards the will of restoring the natural state of the environment, and of fighting against the river pollution that Chennai faces. Additionally by creating an Eco Park near the Adyar estuary, they clearly say that they want to raise citizen's awareness on rivers issues, and environment generally.

Figure 19: The Adyar Poonga Ecopark. Source: A. Cornou

4. The Adyar river, a not so degenerated part of the city

4.1. History and urbanisation phases along the Adyar River

a) A wild river with dense evergreen scrub forests

The Adyar River, one of the three prominent water channels of Chennai, is an ancient river. Its history dates back to the period when the great epic Ramayana was written. On the 7th century the northern bank of the estuary is believed to have been the Pallava port of Mylapore, but was destroyed by a tsunami.

In 1629 the Establishment of East India company in Chennai is the first step which led to the development of the madras city. The Quibble Island, a part of the Adyar estuary with its expanses of swamp and marshes, attached hordes of marchlands and was a favourite hunting ground for the British. In between 1640-1800 the river was a crucial boundary between the British city Chennai and the French city Pondicherry and wars were fought at the river banks.

The acquisition by Europeans of land to south west of the Fort for country houses started in 1763. Since then the acquisition went on gradually. The mansions then lied in inland, which announce a change of scene. The British who lived and toiled in White Town at one point saw enough of the sea and the sand. They decided to build country houses, which are not permanent residences and used mostly for weekends and holidays. The great feature of these houses was the garden with fruit and flowers. It was also convenient for communication, from Triplicane to St Thome located half a mile from the sea without highway along the shore.

At the time the principal highways in Chennai were Mount Rood (leading to the south) and Egmore-Poonamallee (towards the west). Thus a group of country mansions had arisen on the south side of the Triplicane bridge, crossing the Cooum river. It was a Choultry Plain where uncultivated ground was available. Near Amir Mahal existed the Mariette's garden, and the houses of Henry Brooke and George Dawson existed since 1764 near Royapetta already.

Figure 20: Development of British houses in Triplicane. Source: A. Cornou

b) The settlement of Brithish large properties

In 1798 the Adyar was marked as a suburb. On the south of Royapetta the whole country was under wet cultivation, eastward to the Luz Church and southwards to parks of Adyar River. The Moubray's Road was skirted by few parcels of private property, notably the Sulivan's garden, owned by Benjamin Sulivan. On the banks of Adyar because of dense and flourishing vegetation, the British found it to be the best place for their Garden Houses built between 1790s and 1890s. Developments on both banks of the river started slowly. The Quibble Island was also occupied for garden houses.

Figure 21: Alignment of the Adyar river around 1814. Source: Madras – The Architectural Heritage, in Regional Study, Adyar River Revitalization, 2007

Around 1800 the banks of Adyar river had not the alignment which they possesses the present day. The Quibble Island was more extensive and the bar was further north. In those days was found the Brodie castle on the northern bank of the river in 1796 (it is now the Government Music College) and there was one single house in the late 18th century on the southern bank belonging to the Huddleston, on the actual side of the Theosophical Society. In 1806 the Buckingham Canal was built, linking the Cooum and Adyar rivers.

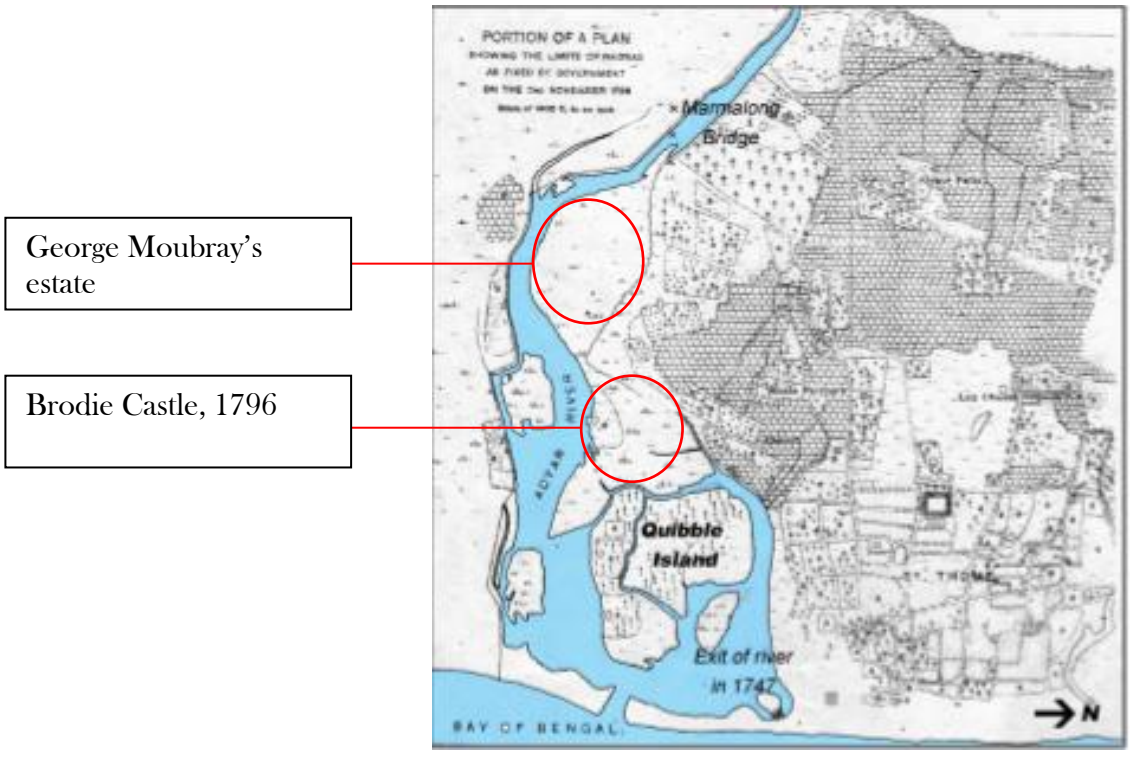


Figure 22: Plan of Adyar River in 1798.
Source: Madras – The Private Diary of Anada Randa in Regional Study, Adyar River Revitalization, 2007

During this century a new period of white commerce and leisure began. In 1832 The Madras Club was founded as a residential European Club, where "Indians, Women and Dogs" were not admitted. Located on the 105 acres of land that originally belonged to George Moubray who lived in Madras from 1771 to 1792, the Madras Club still exists today with the famous Moubray's Cupola.

Figure 23: Plan of Adyar River in 1822. Source: History of the city of Madras, in Regional Study, Adyar River Revitalization, 2007

In 1840 the Elpheston bridge was constructed, crossing the Adyar river near the Quibble Island. As a result the southern bank gained popularity, as well as boating and fishing. The St Patrick High School on the southern bank is built in 1875.

In 1882 the Huddlestons made an acquisition of 270 acres of land, the Huddleston's Garden became then the Theosophical Society headquarters. It was the largest and the greenest private holding and it still remains the nature vegetation along the Adyar bank today. In 1891 near the Madras Boat Club, a new house is built, the Adyar Club was founded. The two clubs merged in 1963 and reopened as the official Madras Club.

The Quibble Island merged with the northern bank before the late 19th century, until then. It was some time shortly after that, that the Quibble Island Cemetery came into existence, shared by Roman, Catholics and Protestants of all denominations. The change from island to peninsula also created the back water that lie north of Quibble Island, called now the Adyar Creek. In the late 19th century the southern bank of the Adyar river still remains largely undeveloped (see Figure 23).

Figure 24: Brodie Castle on the left, and the Madras Club on the right.
Sources: https://frank.itlab.us/iit_2004/waking.html
and http://www.thehindu.com/features/metroplus/reverberates-with-tradition/article4995727.ece

c) A fast urbanization within a century

Early in the 20th century the Chettinad Palace was built on the northern bank, near the Brodie Castle (1902-1912). More urban development occurs on the southern bank: the Central Leather Research Institue, The Ganghi Nagar Tennis Club, and The Durgabai Deshmukh General Hospital. In the mid 20th century the fisheries department (belonging to the Government of Tamil Nadu) had set up fish farmers and related institutions in the Adyar creek area. By the time the Adyar river banks had started losing its vegetation and the land was exploited for residences.

In the 1960s the Boston High School settles south of the river near the Buckingham Canal and in the 1970s the Anna University campus develops, which main building the College of Engeneering Guindy was founded in 1858. In the 1980s the area of Kotturpuram is urbanized, and the

Kotturpuram Nandanam bridge is built in 1987 for easier access. In the 1990s the area of Gandhi Nagar and Indira Nagar are urbanized, followed by Besant Nagar. Finally in the 2000s the Adyar Creek and MRC Nagar areas which include the sea front are developed with high raises, such as the Rani Meyyammai Towers, the Somerset Greenways Chennai and the Leela Palace. Behind the Madras Club and Boat Club, the Raja Annamalaipuram is today site of one of the most posh residences of Chennai.

Figure 25: View n the Rani Meyyammai Towers,
the Somerset Greenways Chennai and the Leela Palace
Source: A. Cornou

From late 1950s until today the river banks are encroached by slums at certain areas, especially JafferKhanpet and Saidapet. Saidapet is now considered as a backyard of the not so wealthy shanty developments. The residential developments in the Adyar area had treated the river as the backyard space and the river carried the sewage and waste to the sea. The water quality started coming down. Bird population (native and migratory) also started to decrease. Until late 20th this happened within the city limits, from Nandhambakam and outside the city the river was clean. Nowadays this part tends to become polluted as well because of the spread of urbanization.

Late 20th and 21th century direct letting out of sewage, dumping of garbage and debris along the river, estuary and creek pollute the water. Few industries also contributed to the pollution. Aquatic life is degrading and bird species found in this region has decreased. This disappearing "bird sanctuary" has not even had the good luck of being ordained a Reserve Forest. Heavy construction activity along the creek and the Quibble Island can now be found and a thin strip of riparian vegetation found along these edges become rarely. The area is no longer what it once was, with its rich ecosystem fast disappearing and he once green bank giving way to huge blocks of modern high rise, nothing but a symbol of commercial greed.

S. Muthiah concludes that "though the Adyar is not what is once was – a teeming with birds, small animals and trees filling its edges, this area has fortunately not degenerated as much as other parts of the city. Still largely green, its unique environs are much sought after for living and recreation, and will remain so thanks to the mighty presence of its educational and philosophical friends and the safeguards that goes with the Guindy National Park. [...] In spite of modernising developments, the Adyar and its environs have managed to retain its historic garden image to a certain extent and will continue to remain, only if its wealthy and powerful occupants play an active role in keeping it so."

Figure 26: Vegetation remaining on the surroundings of Adyar river.
Source: Regional Study, Adyar River Revitalization, 2007

4.2. The Adyar river catchment

a) Hydrology: the Adyar plays a major role by collecting surplus water

The Adyar river is has its catchment area in the Kancheepura District and originating from the Pillapakkam Tank Group and Kavanur Tank Group. The Adyar river has two arms. The northern arm comes from Chembarambakkam basin, the southern arm comes from Guduvancheri at an elevation of about 40 m above the sea level, and they join at Tiruneermalai. The Adyar river collect a surplus from about 450 tanks in its catchment, apart from overflows from the large Chembarambakkam tank. The Mambalam drain is also a flood accommodator which originates from Mambalam area, passes through T. Nagar, Nandanam and joins Adyar river.

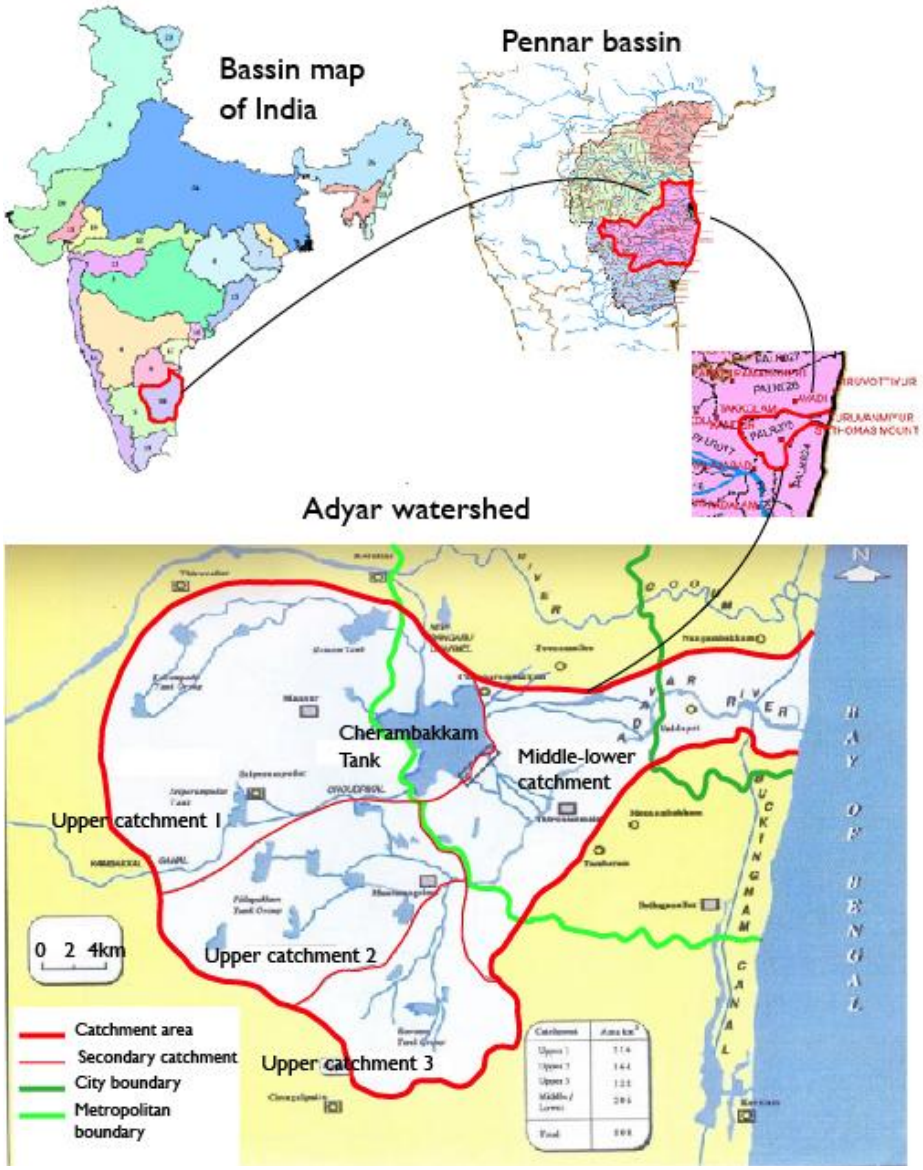


Figure 27: The Adyar watershed, as part as the Pennar basin.
Sources: Regional Study, Adyar River Revitalization, 2007
http://cgwb.gov.in/watershed/about-ws.html
http://slusi.dacnet.nic.in/watershedatlas/indexnew.html

The flood plain of Adyar River is stressed due to unplanned development and encroachment. The change in the land use and land cover pattern due to rapid urbanization adversely affects the hydrological processes in the catchment, leading to a deteriorating water environment. Several Government agencies like Tamil Nadu Public Works Department (PWD), Corporation of Chennai, Tamil Nadu Slum Clearance Board (TNSCB), Chennai Metropolitan Water Supply and Sewerage Board (CMWSSB), Tamil Nadu Pollution Control Board (TNPCB) and Chennai Metropolitan Development Authority (CMDA) have attempted in the rehabilitation and management of river. These agencies have focused mainly on the technical/structural interventions in the system such as clearing of sand bar, dredging the sludge, constructing check dams and lining the river banks to improve the flow in the river. (Suriya and Mudgal, 2014)

b) Geology: the alluvium character of the Adyar river

The Chennai district fall into an alluvial plain of the Coum and Adyar river, coastal plains, and pediplains in south-west corner of the area, south of the Adyar river. The altitude of the landforms varies from 10 m above the sea level in the west to nearly sea level in the east. The Adyar river is of 42 km length and has a catchment area of 80 km^2. It drains the southern part of the district

and remains flooded during monsoon. At high tides the backwaters of Bay of Bengal reaches up to 4 km along the bed towards west. The alluvium consists of sand, clay, sandy clay, silt and occasional gravels and is under crystalline rocks mostly of charnockite suits.

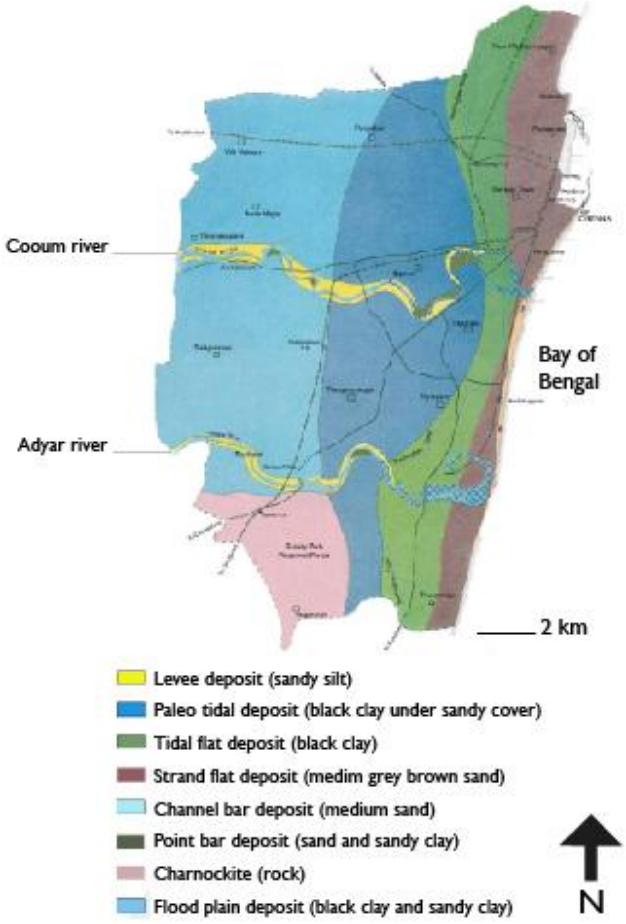


Figure 28: Geology of the Chennai city area.
Source: Regional Study, Adyar River Revitalization, 2007

c) Pollution: a high level of contamination in the river

Rapid urbanization and industrial development during last decade have provoked some serious concerns in environment and especially in the heavy metal contamination in river, which is one of the major quality issues in many fast developing cities. In Chennai particularly the maintenance of water quality and sanitation infrastructure did not increase along with population: every year the demand of consumption of water increases and subsequently lead to the generation of enormous quality of waste water. Moreover it is common to see that the establishments led their sewage into the water system without proper prior treatments. Thus, the waste water is discharged directly into the rivers of Chennai city Adyar and Cooum rivers.

A study from CMDA on the Cooum and Adyar river looked at the BOD and COD[3], that are most widely used as parameters for calculating pollution load applied to both wastewater and surface water. The biodegradability of the organic compound depends on the BOD: COD ratio in the wastewater. For typical untreated domestic wastewater with high organic content has the BOD5 /COD ratio above 0.7. The study resulted that the average BOD:COD ratio obtained in Cooum and Adyar River is in

[3]BOD is a commonly-used broad indicator of water quality that measures the quantity of oxygen required by the decomposition of organic waste in water. High values are indicative of heavy pollution; however, since water-borne pollutants can be inorganic as well, BOD cannot be considered a comprehensive measure of water purity.
DO is similar to BOD except that it is inversely proportional to pollution; that is, lower quantities of dissolved oxygen in water suggest greater pollution because water-borne waste hinders mixing of water with the surrounding air, as well as hampering oxygen production from aquatic plant photosynthesis.

the range of 0,28 to 0,38, which indicates poor biodegradability and also extensive industrial pollution.

According to the following table from the Second Master Plan CMDA, we can notice that the DO of the Adyar river level is not as less as in the Cooum river. It induces that the river contains still few organisms and it can mix a little with the air, for decontaminating naturally.

	Adyar river			Cooum river		
	Site I-II Upstream	Site III-IV Middle stream	Site V-VI Brackish water downstream	Site I-II-III-IV Moderate pollution	Site V-VI-VII High sewage pollution	Site VIII-IX High industrial pollution
DO	2.8-9.4	1.1-9.4	1.3-18.5	0.0-11.7	0.0-0.0	0.0-0.6
pH	8.1	8.0	8.0	7	7.5	8
Cl	47-115	51-130	80-4000	0.8-326	298-336	326-1100
So_4	30-75	31-75	43-127	70-132	99-132	116-142
No_2N	0.01-0.32	0.01-4.7	0.01-0.42	0.01-0.12	05-0.07	0.01-0.19
NH_4N	0.16-1.46	0.06-2.86	0.46-18	0.2-1.2	6.9-9.9	5.8-9.5
BOD	1.0-6.6	1.7-32.7	2.3-53.0	8.2-34	23-47	62-74
COD	9.5-195	10-72	10-830	29-316	159-5081	289-840

Table 4: Pollution data on the Adyar and Cooum river. Source: CMDA Second Master Plan

Moreover, according to the graphics below, it is evident that the BOD and DO levels in the Adyar river are not conform to the legal norms instituted by the Government of India..

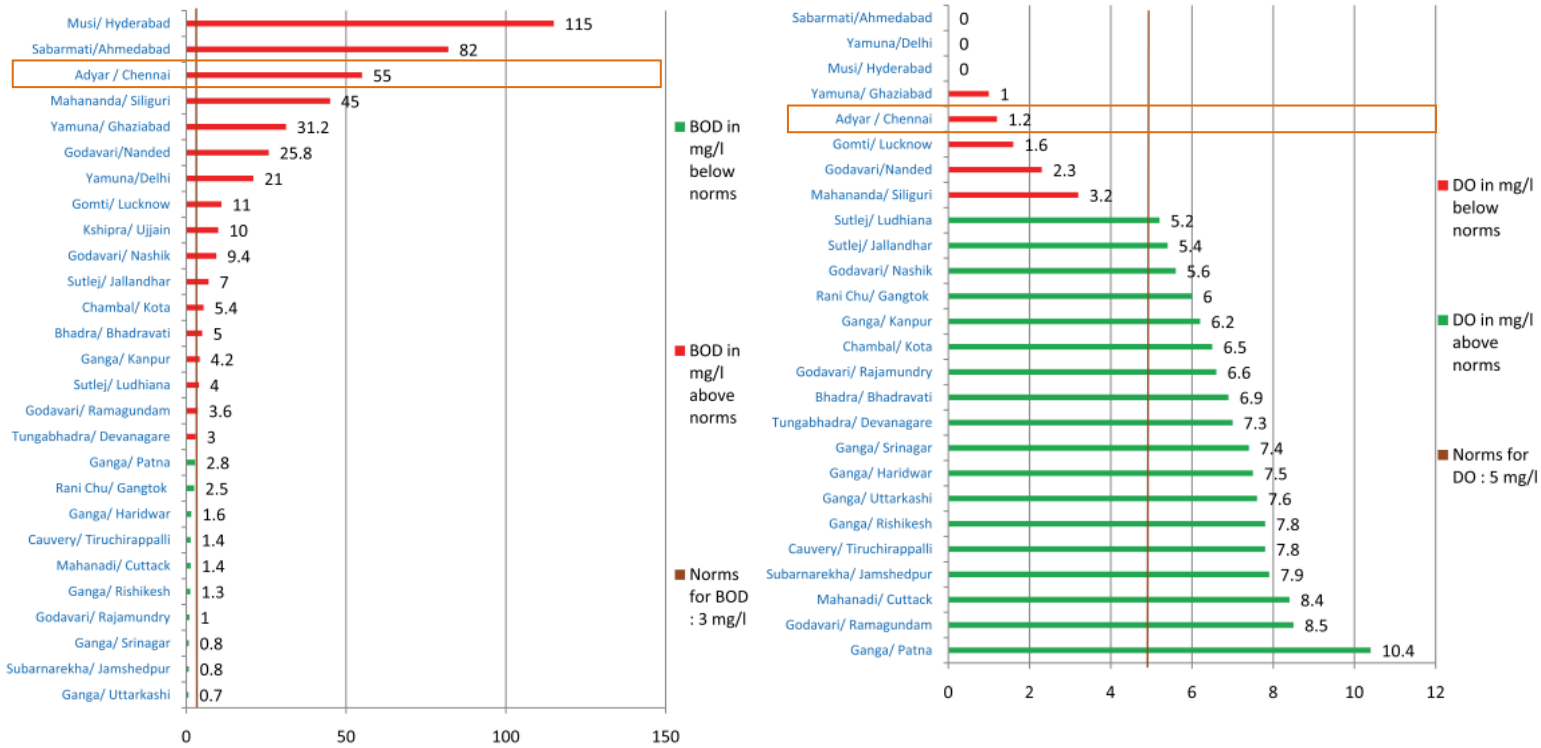


Figure 29: Chart showing actual BOD and DO (mg/l) in Indian rivers against the norms of the Government of India. Source: Supreme Audit Institute of India 2011

Another study from A. Janakiraman, et al. observed that because of heavy tidal stream during summer and pre monsoon months in the mouth of estuary, the sand-bar is formed. Thus no exchange of water between the marine and fresh water habitat occurs and the water of the estuary

decreases in salinity. This temporary stagnant untreated domestic sewage leads to eutrophication in the estuarine water body.

These data proves that there is an urgent need to control or restore the discharge of domestic sewage and other sewage activities in the rivers of Chennai: firstly for the benefit of Chennai coast, with restoration of the ecological habitat of the species living, and secondly for avoiding public health damages.

5. Choice for a relevant case study

After studying the history of the Adyar river, the different stakeholders who can act on it, the geological and hydrological data, and the pollution state, I chose a particular stretch of the river for the thesis. As part of the research program on cities and river, and since I analysed the environmental awareness, a stretch in the urbanized part of the river where the pollution issues are particularly strong would be relevant for the thesis. In addition, the Adyar Poonga Eco Park, located at the estuary of the river and showing a first step towards an ecological restoration, should be part of the case study.

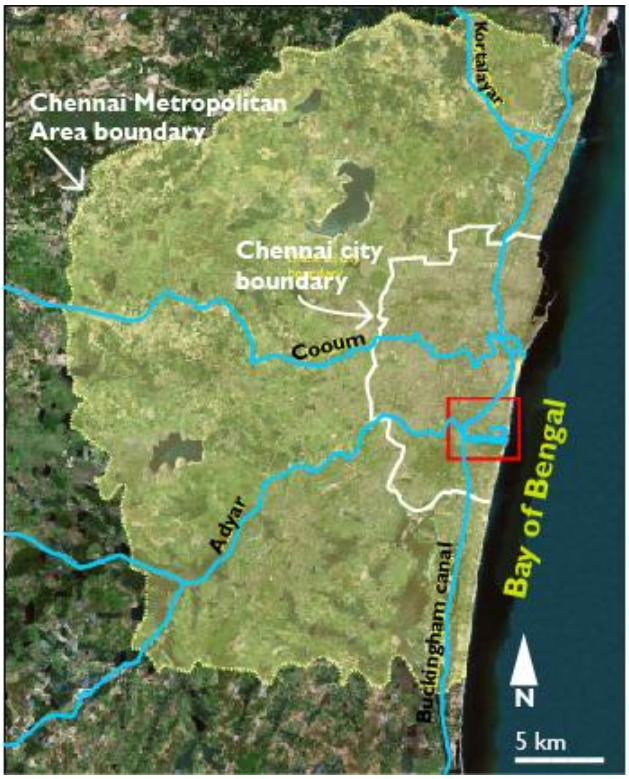


Figure 30 : Localisation of the study site in Chennai, downstream of Adyar river. Source : A. Cornou

My investigation area starts from the estuary of the river, and ends at the Kotturpuram bridge. The stretch is pertinent because it includes all the estuary of the river, with the Theosophical society, but also an important historical part of the river banks since most of the previous mansions of the British remains here. Also private Clubs, such as the Madras Club the Boat Club, and the Ganghi Nagar Tennis club are located here and many institutions as well. The whole stretch is about 4 km long.

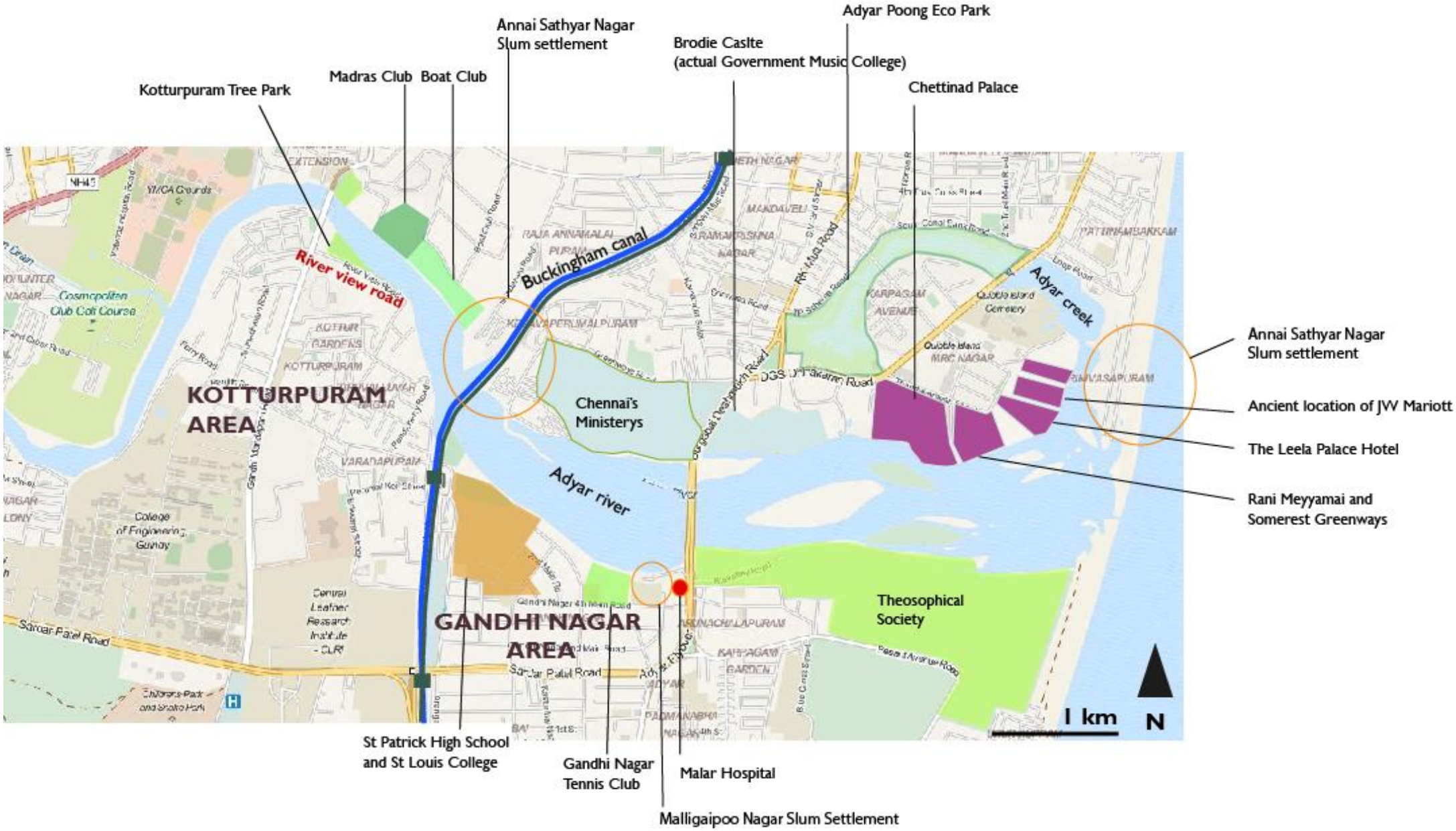


Figure 31: Landmarks around the case study. Source A. Cornou

6. Land use of the Adyar river stretch: between history and modernity

6.1. An unchanging land use over time: institutional and private holdings

According to a Master thesis in Architecture written 1995, the stretch from the estuary to the Adyar bridge is described as such: "There is a beach area along the junction of the river and the sea, which is occupied by the blocks of slums of The Clearance Board. They have an ugly look and block the view of the sea. Little up are found large open spaces used as play ground areas and behind is the Chettinad Palace. Further behind is the Music College and the Sathya Studio which activities are hidden inside the huge compound wall. On the other bank is the Theosophical Society, with green and dense trees hiding old buildings. In this stretch the four land uses are found: residential, institutional, industrial and commercial" (Habeeb Rahman, 1995).

Further "on the north stretch from the Adyar bridge to Kotturpuram bridge, the land is fully occupied by the residents of VIP such as judges and ministers. Both sides of the Buckingham canal are encroached by the slums huts. On the southern side of the river are the towers of the Malar Hospital and west beyond it the residential area of Gandhi Nagar. The area on the west of it, from the canal to the Kotturpuram bridge is occupied by the residents of the Kotturpuram area, who are belonging to the low, middle and high income group people. There is a linear planted area nearer to the Kotturpuram bridge. On the northern bank of the river, from the Kotturpuram bridge to the Buckingham canal, the area hosts the Madras Club, the Adyar Boat Club and a residential area, one of the costliest of the city. To conclude this part of the river is mostly residential with some recreational clubs."

What I noticed during my field work on the area is that there are very few big changes compared to 1995 when the thesis was written. After the construction of the Kottupuram bridge in 1987, the Kotturpuram area develops latter in the 1980s, followed by the Gandhi Nagar area in the 1990s. This stretch of the Adyar river banks was mostly residential and institutional in the 1990s, as observed by M.J. Habeeb Rahman, and it still remains the same today.

According to two chronological maps showing the land use, we can conclude that almost only the urbanisation of the Adyar Creek has drastically changed. The land was still vacant in the1970s, but it has been urbanised recently in the 2000s. As described in the history along the Adyar river, here are the Leela Palace, the Somerset Greenways Chennai, and the Rani Meyyammai Towers, dedicated for the high income society of Chennai. Located just near the sea and the river, they enjoy a full view on what was previously a bird sanctuary.

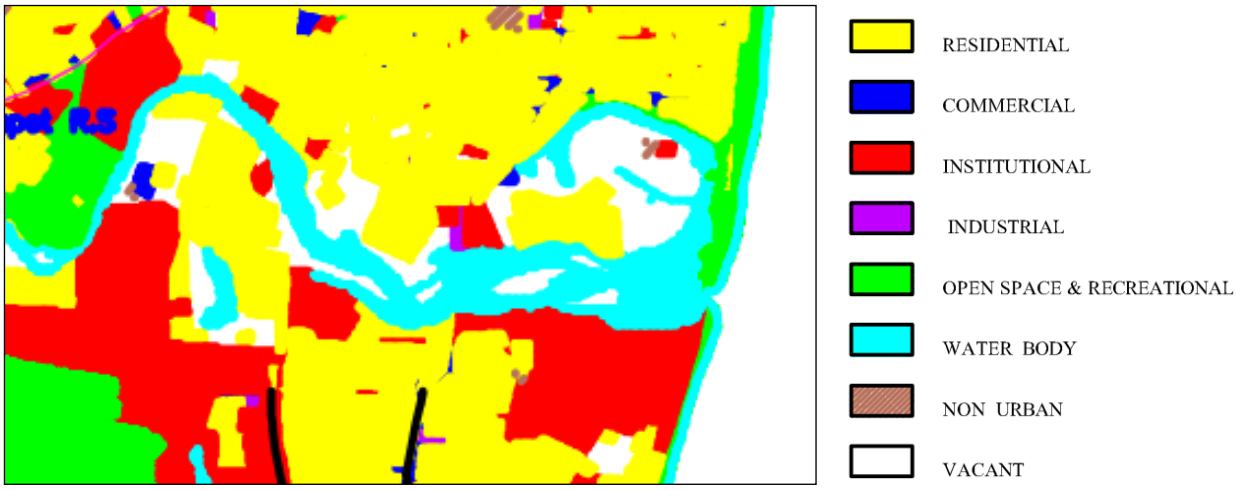


Figure 32: Land use of the case study in 1973. Source: CMDA

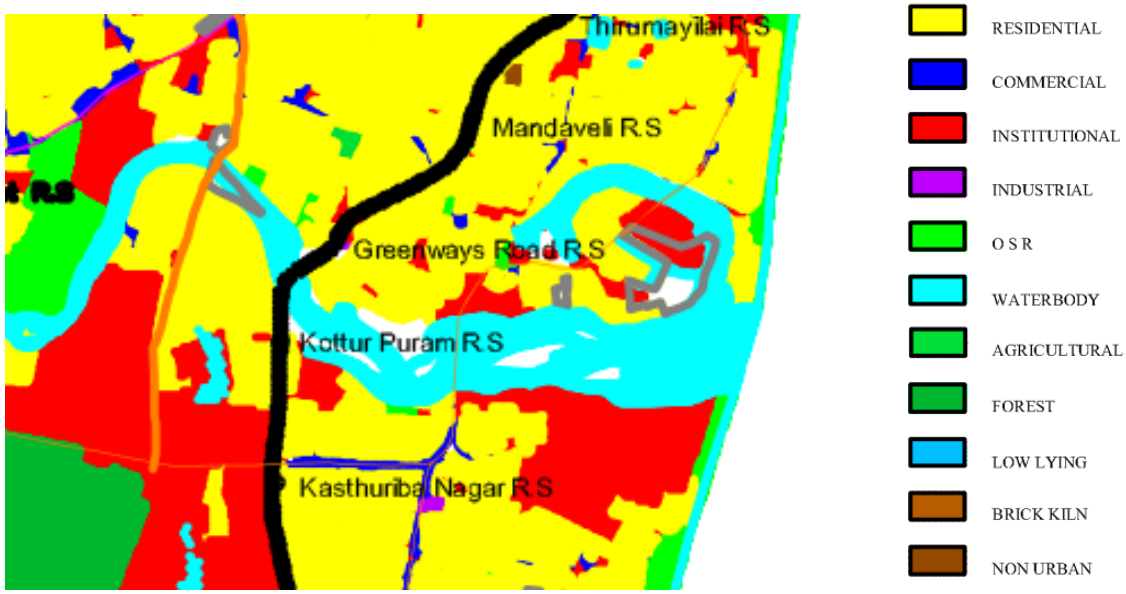
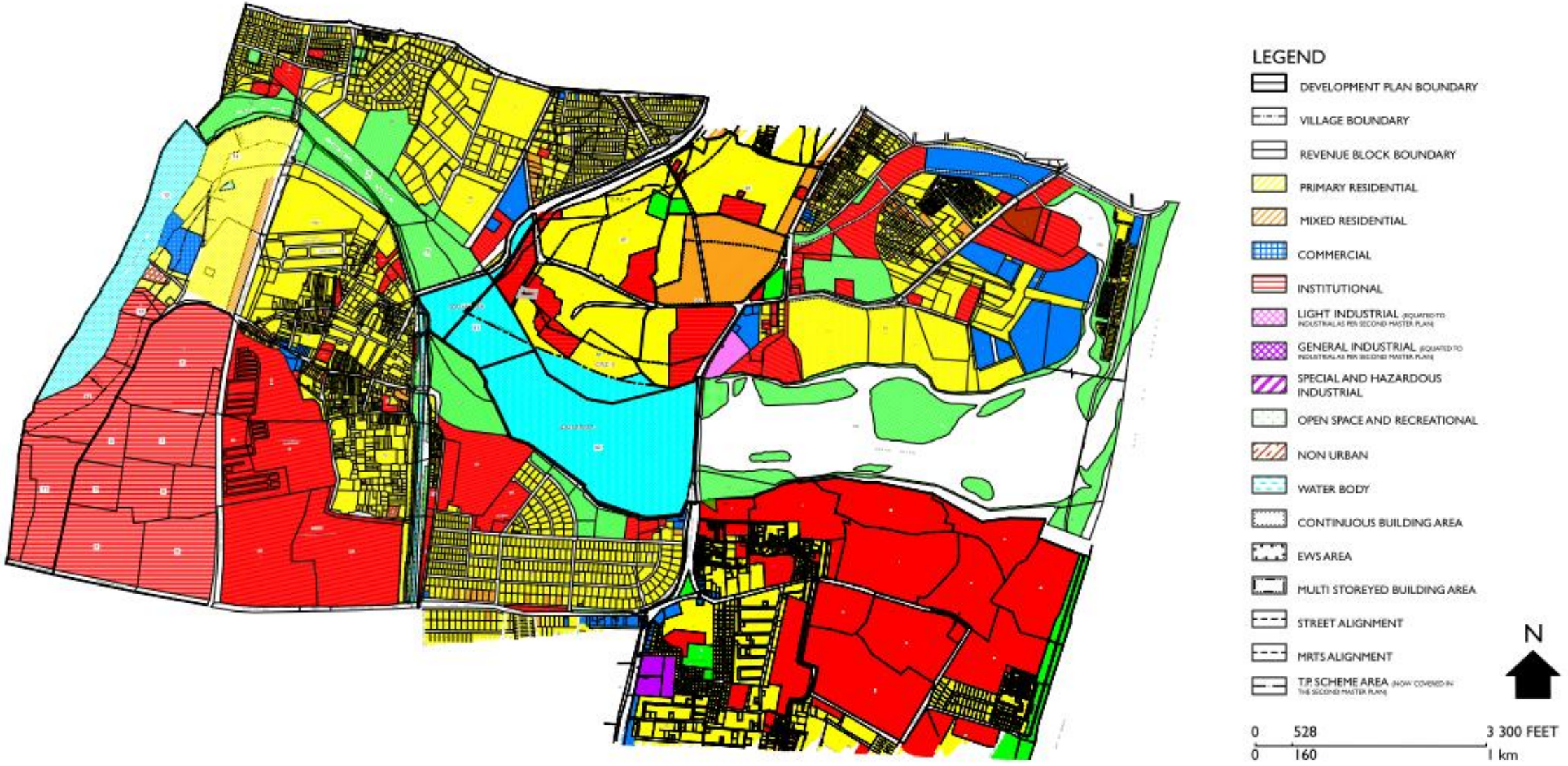


Figure 33: Land use of the studied stretch of the Adyar river in 2006. Source: CMDA

In the CMDA Second Master is proposed a land use for Chennai Vision 2026. The plan is more detailed and need some precisions.
The Theosophical Society has always been described as "institutional", and the plan neglect to precise that it is an important public green area of the city after all. Also the Madras Club and the Kottupuram Tree Park have the same land use colour. However those two spaces are slightly different: everyone is allowed to enter the Kotturpuram, which could almost be described as "public green spaces" whereas strictly members can enter the Madras Club.

To conclude the Vision 2026 of the Adyar stretch studied is evolving very much around the Adyar Creek; where further commercial developments are envisaged.

Proposed land use along the Adyar River in Chennai for 2026, from the estuary to Kotturpuram bridge (source MMDA)



6.2. A cohabitation of slums area and real estate developments

The major slums area located today on my study site are Annai Teresa Nagar, Srinivasapuram, and Malligaipoo Nagar Slum near the Malar Hospital. Some of them have been part of rehabilitation programs directly on the site, for example in Srinivasapuram where buildings from the TNSCB can been seen. The slums are often designated as the major polluters of the river, because they are living next to it and not connected to any sewage treatment plan. More implicitly, they are also blamed for a "visual pollution" because their houses do not appear as the global society wants it.

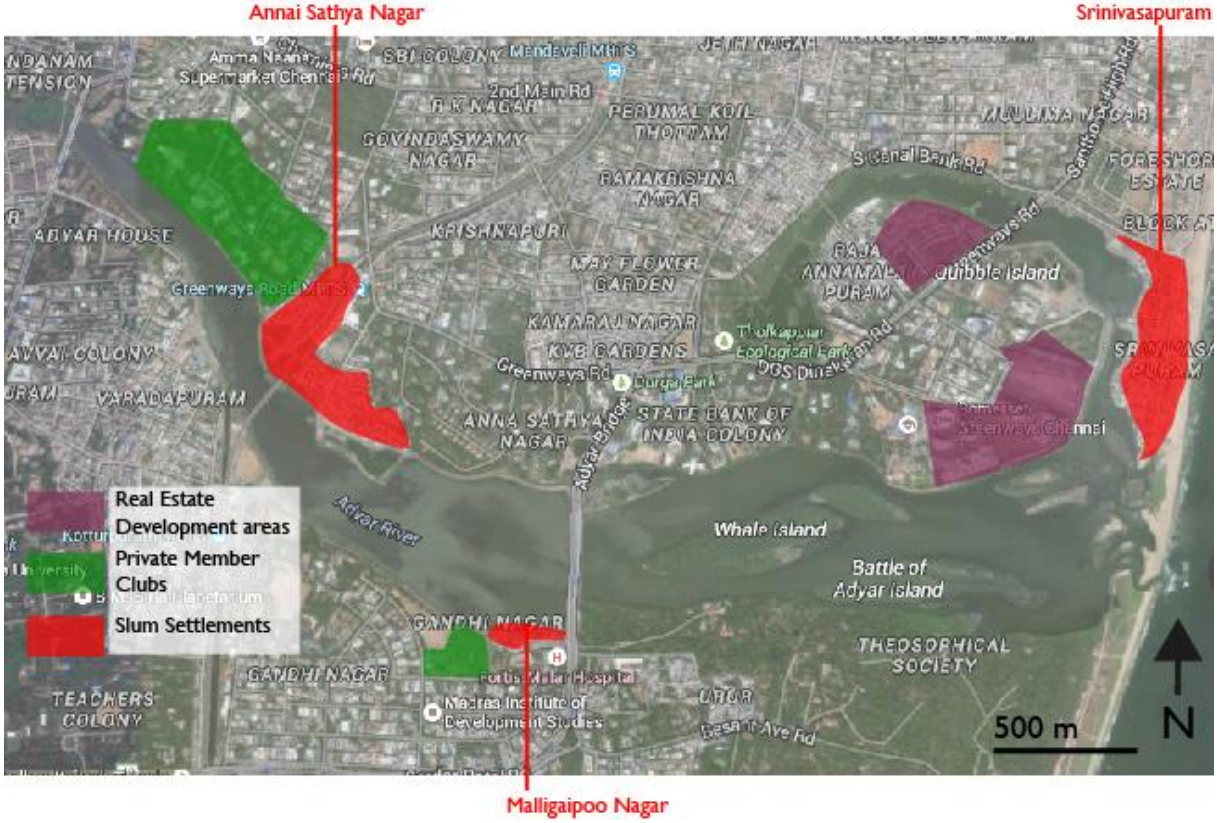


Figure 34: Location of slums settlements, contrasting with real estate developments and private member clubs. Source: A.Cornou

One important happening we can notice is the rapid development of the Quibble Island in the 2000s into high-rises and five stars hotels that only high income groups can afford. The Leela Palace is a 5star luxury and business hotel in Chennai, actually the first and only seafront hotel in the city today. Next to it are the Somerset Greenways Chennai, luxurious serviced apartments, and the Rani Meyyammai Towers, a ready to move in residential development. These new buildings, located just ten minutes from the central business district in Chennai, and the minister area of Greenways Road, are located very near to the sea. The urbanization of such buildings is quite intriguing, especially when located so close from the ecologically fragile seashore and riverside. The slum settlements of Srinivasapuram situated just in front of the high-raises express a socio spatial fracture, as a result of a contrasting society in Chennai between the different income classes. To limit such developments in sensitive areas the Coastal Regulations Zones were established, as per the notification issued in February 1991 under the Environment Protection Act of 1986.

Figure 35: The Leela Palace behind Srinivasapuram and the view from the hotel on the slum settlement.Source: A. Cornou

6.3. The Coastal Regulations Zones

The Coastal Regulation Zone is an area of precise delineation where the set up and expansion of any industry, operations or processes and manufacture or handling or storage or disposal of hazardous substances are restricted, with a view to ensure livelihood security of fisher and local communities, to conserve and protect coastal stretches and to promote development through sustainable manner (The Coastal Regulations Zone Notification).

The CRZs in India are classified into four types:

- The CRZ I category comprises of important ecological areas, areas rich in natural beauty and heritage such as: national and marine parks, wildlife sanctuaries, reserve forests, mangrove forests, wildlife habitats, coral reefs, areas nearby breeding/spawning grounds of marine life, areas of outstanding natural beauty, important historical or heritage areas, areas rich in genetic diversity, and areas that may be affected due to rise in sea level because of global warming.
- In the CRZ II category are included developed areas that are between the Low Tide Line (LTL) and High Tide Line (HTL) and are close to the shoreline. Developed area refers to area within the municipal limits and that have proper drainage, approach roads, water supply, sewerage lines, and infrastructure facilities.
- The CRZ III category consists of relatively undisturbed areas that do not belong to either CRZ I or CRZ II. It includes coastal zones in rural areas and urban areas which are not substantially developed.
- The Andaman and Nicobar Islands, Lakshadweep islands and other small islands that are not included in category I, II and III are included in the CRZ IV category.

According to the Coastal Regulations Zone Notification, the CRZ delineation for the landward side along the sea front is the area starting from the High Tide Line (HTL) up to 500 meters. The CRZ area for developments along rivers, creeks and backwaters shall be governed and regulated by the distance up to which the tidal effects are experienced. The CRZ apply generally to the land area between the HTL to 100 meters.

The banks and coastal zone of the Adyar river are concerned by the CRZ II category since the area has been developed up to or close to the shoreline. For the Adyar estuary, the CRZ is the area from the landward side along the river starting from the HTL up to 200 meters, in the Adyar creek and to

the Buckingham canal. Further west the CRZ of the Adyar river is the area starting from the HTL up to 100 meters.

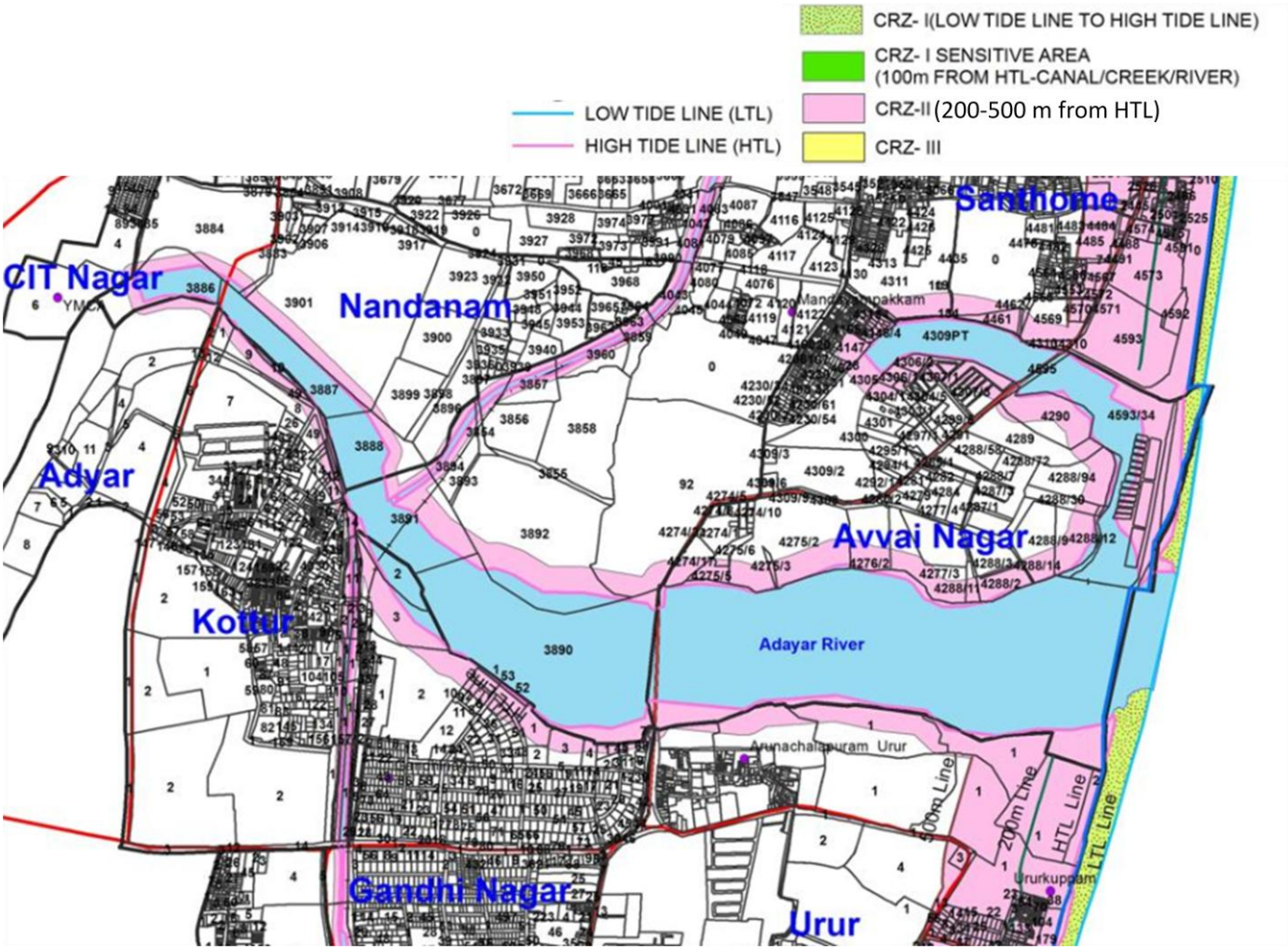


Figure 36: Areas in pink are under Costal Regulation Zone II. Source: CMDA.

According to the regulations of the Coastal Regulations Zone, these areas have to follow these notifications:

- "Buildings shall be permitted **only** on the landward side of the existing road (or road approved in the Coastal Management Plan of the area) or on the landward site of existing authorised structures.
- Buildings permitted on the landward side of the existing and proposed roads/existing authorized structures shall be subject to the existing local Town and Country Planning Regulations including the existing norms of Floor Space Index / Floor Area Ratio
- Reconstruction of the authorised buildings to be permitted subject to the existing FSI/FAR and without change in the existing use.
- Activities prohibited within the CRZ are the set up of new industries and expansion of existing industries; expect those directly related to water front or directly needing foreshore facilities. The expression "foreshore facilities" means those activities permissible under this notification and they require waterfront for their operations such as ports, harbours, jetties, quays, wharves, erosion, control measures, breakwaters, pipelines, lighthouses, navigational safety facilities, coastal police stations and the like."

To summarize there are today important issues on the Adyar river: it is heavily polluted and subject to high floods. As the population in Chennai increases, the urbanization still spreads over the land. The space inside Chennai city tends to get scarce. The first human's settlements are surrounded by new developing areas that contribute to marginalize them city, the ones who cannot afford a living settle in "urban pockets" and river margins, and high income classes wish a close privilege location to the seaside. However no one ignores that the pollution of the river contributes to health problems and the government intend to restore the river in the aim of developing the riverfront for new activities. The third part of the thesis analyses the relationship between the citizens and the river. It also examines the purposes behind the programs and projects of riverfront development and ecological restoration, showing a distinction between theoretical discourse and practical reality.

Part III Reflexion on environmental awareness on the Adyar river

1. The cosmetic changes of riverfront movement in India

Despite of the water quality of the rivers, India is also showing interest to the urban rivers of the cities. The country has taken programs for the restoration of water bodies, the CRZ regulations limits the development of activities damaging the environment on the sea side and the citizens wish to enjoy the river side with views, accesses and activities. Some cities in India have started to plan their river banks, creating new urban spaces. It gives an alternative to the urban density that most of them are facing, by giving open and large areas, and it allows a new dynamism inside the city, a revitalization process which can be enjoyed by everyone.

1.1. The Sabarmati Riverfront development, a controversial model

The pioneer project, often cited as the best example, is the case of the Sabarmati river in Ahmedabad, in Gujarat State. The reflexion about the water front of the river started in 1997 already. An Ahmedabad-based urban planning consultancy firm, Environmental Planning Collaborative, envisaged to develop a stretch of 10,4 km of the banks on both side of the river, by creating concrete embankment walls with walkways. Later a special purpose vehicle is created: the Sabarmati Riverfront Development Corporation Ltd (SRFDCL) for the implementation of the project. "The project aims to provide Ahmedabad with a meaningful waterfront environment along the banks of the Sabarmati River and to redefine an identity of Ahmedabad around the river. The project looks to reconnect the city with the river and positively transform the neglected aspects of the riverfront." (SRFDCL)
On the website of SRFDCL, three objectives are shown:

- "Environmental Improvement: reduction in erosion and flood to safeguard the city; sewage diversion to clean the river; water retention and recharge.
- Social Infrastructure: rehabilitation and resettlement of riverbed dwellers and activities; creation of parks and public spaces; provision of socio-cultural amenities for the city.
- Sustainable Development: generation of resources, revitalisation of neighbourhoods."

The river has been channelled and uniformly narrowed to a constant width of 275 m, when naturally a average width of the channel was 382 m and the narrowest cross-section was 330 m. The riverbed land has been reclaimed to create 11.25 km of public riverfront on both the banks. The total land reclamation is 202.79 hectares (Bharat Lal Seth, 2007). The work started in 2004 and was inaugurated in 2012. SRFDCL says today that "the river has added vibrancy to the urban landscape of Ahmadabad with its open spaces, walkways, well-designed gardens along with activities which contribute to economic growth."

Figure 37: The different steps of the Sabarmati riverfront project.
Sources: http://indiatogether.org and http:// http://sabarmatiriverfront.com/

However the Sabarmati Riverfront project received some critics as well and raises some apprehensions. One of them is that SRFDLC decided to change the natural flow of the river: the Sabarmati is not a seasonal river anymore but a perennial river. The water is flowing really slowly, almost stagnant because kept in the course throughout the year in the 10,5 km stretch. At the end of the river the Vasna Barrage is retaining the water of the river in the city of Ahmedabad.

Figure 38 : Retention of the Sabarmati river downstream south of Ahmedabad (left) and pollution released in the river after the Vasna Barrage (right). Sources: Google Map and https://sandrp.wordpress.com/2014/09/17/riverfront-development-in-india-cosmetic-make-up-on-deep-wounds/

Moreover to ensure the availability of water all the year and a continuous flow during the dry season, the surplus water in the Narmada main canal is being diverted. This canal is located north from the city, and its water is meant for drought prone areas of Kutch, Saurashtra and North Gujarat (General Administration Department, Government of Gujarat website), not for Ahmedabad city. CR Babu, the Chair of the committee expert appraisal for the Yanuma River said about the project that "there is no Sabarmati river. It's stagnant water with concrete walls on two sides. The floodplains have been concretized to make pathways and real estate projects."

Figure 39: Dhobi Ghats on the banks of the Sabarmati project. Source: http://www.frontline.in/static/html/

Moreover there has been a poor rehabilitation of the slums displaced and the most controversial aspect of the project that is supposed to have affected 4,400 families living on the riverbanks, most of them dhobi wallah[4]. As a result of the project, 3,000 to 4,000 families were evicted from the riverfront in the year 2004-2005 (Mathur, 2012). These families have been shifted with negligible compensation to a marshland at the city's edge in Piplaj, which lay under electricity transmission towers and adjacent to a municipal solid waste dump site. The families were provided open plots of 10 by 15 feet, with little and infrequent access to drinking water and minimal sanitation facilities. On the other side they were verbally promised education, health and sanitation facilities, as well as compensation and loans to build new housing. None of these promises were actually delivered in the seven years that the evictees have been languishing in Piplaj. In conclusion, those who used the river for generations have been thrown out.

1.2. The "beautification" approach of riverfront development

a) A priority to economic revenue and visual aspect

Another example of riverfront development in India is the case of the Godavari river in Nanded. Here the river has a high historic, cultural and religious significance, due to the Sikh religion, the culture of worship and bathing. A reflexion about the riverfront has started in 2006 in the City Development Plan: in the vision 2025 Nanded plans to "revitalize the river Godavari as the core functional element of the city". Thus a 5 km stretch of river front development was planned, by the design consultant Pradeep Sachdeva Design Associates – New Delhi, with the program managers IL&SF.

The strategy options announced are to:

- *Revitalize and conserve key heritage elements such as the river Godavari*
- *Develop a master plan for the development of the riverfront in Nanded city*
- *Restore its functional relevance and scenic beauty*

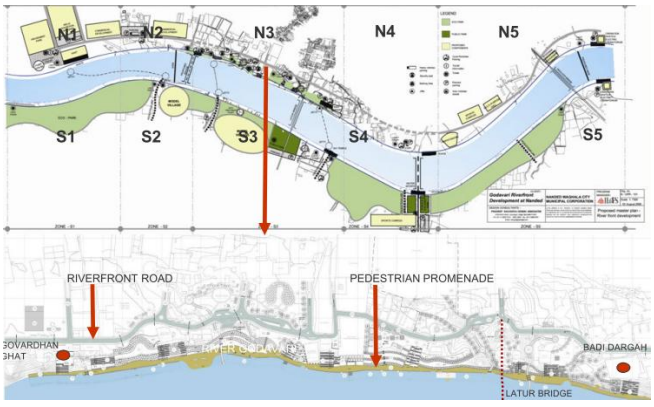


Figure 40: Master plan of the riverfront development of the Godavari river in Lucknow, and Before/After pictures of the project. Sources: Nanded Godavari Riverfront and Nanded City Deveopment Plan, 2006

[4] Dhobi (English: washerman) is a caste group and are said to be specialized in washing clothes. The word Dhobi is derived from the Hindi word dhona, which means to wash. They are found throughout North India, Gujarat, Maharashtra as well as the Punjab province of Pakistan. A dhobi is likely to be of many different origins, whose ancestors took the occupation of washing clothes evolving over time into a distinct caste. (Source: http://en.wikipedia.org/wiki/Dhobi)

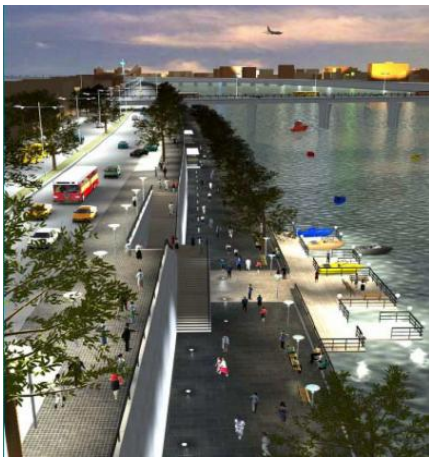


Figure 41: Two computer graphics images for the Gomti Riverfront development. Source: The Times of India

On the same idea, the Gomti river in the city of Lucknow is also part of a riverfront development reflexion over the past years, where it is planned to "beautify" a length of about 15 km stretch. The Lucknow Development Authority (LDA) is the stakeholder for the implementation of the project, with the Project consultant: Darashaw & Company Private Limited. The project is inspired by the Sabarmati riverfront development and the Thames riverfront in London.

There is a proposal to erect an iconic structure "Lucknow Eye" of about 70-80 metres on the patterns of London Eye on the riverbank. The project envisages a cable-car facility alongside the embankment connecting important recreational and heritage points along this stretch, and there is also a wish to build a hanging bridge that would be suspended across the river for pedestrians. The project recommends also the construction of pathways and cycle-tracks along peripheral embankment.

The landscaping work also includes theme-based parks, joggers' park, water sports, greeneries, promenades, kiosks and other recreational amenities on both sides of the river. Finally "a retaining wall would be made along the river stretch to strengthen its banks. Only then, would the above mentioned structures be constructed beyond 250 metre range of the river. A major part of the riverbank would be covered under landscaping which has least impact on the river's heath" as a senior official said (P. Singh, The Times of India, July 2013). However the project could not take off due to lack of coordinate on between different authorities (Times News Network, The Times of India, April 2013). The project is lead by the Consultants The Mukesh Ambani-led Reliance Foundation The Standard Chartered Bank.

Similarly the Mithi river in Mumbai is today at the centre of reflexion on riverfront development project. The Municipal Corporation of Greater Mumbai (MCGM) and Mumbai Metropolitan Region Development Authority (MMRDA) made a plan to "restore" the river which also involves "beautification". They envisage the-development plan for the riverfront on the lines of the Cheonggyecheon river rejuvenation scheme in Seoul South Korea, developing promenades and other commercial activities (The Mumbai Mega Project Website).

The riverfront projects in India are most often developed on a Public Private Partnership (PPP). As a conclusion, these riverfronts projects are essentially based on river bank beautification. They promote activities typically including promenades, boat trips, shopping, petty shops, restaurants, theme parks, walk ways and even parking lots in the encroached river bed.

b) An inspiration based on different context and situation

The riverfront of Thames in London and Seine in Paris, or Asian rivers in Malaysia, Singapore and others, are often cited as successful models of riverfront development in India. However, the ecological as well as social setting of Indian rivers and the challenges that they face are significantly different from these foreign models. A blind replication of these "models" cannot be a solution for solving the issues on Indian rivers, because the culture, the urban context, the pollution rates, and even the seasonal character of the river are particular and unique to India.

c) A need for river "rejuvenation"

These riverfront developments essentially changes the ecological and social aspects of the river by transforming it rather into an urban commercial space than a natural, social, cultural, ecological landscape. Most of them include brief components of water treatment or river restoration space. It is more a successful landscape-based development project, based on visual aspects, which also look at "reclaiming" the river banks for activities like shops, entertainment area, promenades, and economic revenues generally.

These projects are not aimed for a restoration of the river, especially when they change the essential character of it. For example stream channelization and alteration of shoreline disconnect the river stretch from adjacent ecosystems and leads to risks of habitat degradation, changes in the flow regime and siltation, whereas flow, connectivity and flood are fundamental characteristics of rivers and they need space for that. When these are violated, the river water spreads uncontrolled through the habitation causing catastrophic events.
The real need for the river is river rejuvenation first, with cleaning up actions against pollution by sewage outlets and solid waste dumping, which occurs in most of the Indian rivers. When ecology preservation and human security is ensured –flooding and pollution-linked disease-, river front development of the river can be envisaged. The natural aspect of the river should be a priority and the good environmental quality of the water and the banks a target. Building retaining walls and channelizing the river only degrade the rivers further.

Also it is important to evaluate economic, social and environmental improvements, thus allowing the project to evolve all along with the request over years and decades. For this democratic participatory is required during every stage of the decision making process. Not only the high powerful stakeholders should decide what they want to implement, otherwise the project will be at the cost of the poor, the environment, and future generations. At the short term the riverfront developments in India benefit to real estate developers and a section of urban middle class. The projects, alienated from the river, aim at commodifying the river and achieve successfully cosmetic changes of urban spaces.

2. The limits of environmental measures and regulations to preserve water bodies

2.1. From the failure of the National River Conservation Plan

The National River Conservation Plan (NRCP) as well as the National Plan for Conservation of Aquatic Eco-systems'(NPCA), are led by the National River Conservation Directorate (NRCD) in the Ministry of Environment, Forests and Climate Change (MoEF) for the implementation of conservation of rivers, lakes and wetlands in the country. The river conservation programme in the country was initiated with the launching of the Ganga Action Plan (GAP) in 1985. The Ganga Action Plan was expanded to cover other rivers under National River Conservation Plan (NRCP) in the year 1995.

"The objective of the River Action Plans is to improve water quality of rivers through implementation of pollution abatement schemes in identified polluted stretches of rivers. NPCA aims at conserving aquatic ecosystems (lakes and wetlands) through implementation of sustainable conservation plans, and governed with application of uniform policy and guidelines" (MoEF). Today 40 rivers in India are under the NRCP, the Adyar and Cooum rivers are part of it. Regarding the rivers, much of the focus of the NRCP is actually centred on domestic pollution control initiatives over the years (Asian Development Bank, 2007). In fact the core of the plan has been and continues to be the Sewage

Treatment Plant (STP) with the interception, diversion, and treatment of sewage through piping infrastructure and treatment plant construction, and also installation of community toilets, crematoria, and public awareness campaigns to curtail domestic pollution.

However the NRCP has been criticized in the media for a variety of reasons, including poor cooperation among participating agencies, imbalanced funding of sites and inability to keep pace with the growth of sewage output in India's cities (Suresh et al, 2007, in Greenstone, 2011).

S. Yadav wrote in December 2009 in The Indian Today that "the NRCP is not a focused, successful environmental plan but a bureaucratic abacus whose only job is to add up the moving columns." In fact the Officers of NRCP have spent a lot on foreign trips to the USA, the UK, Israel, the Netherlands, Japan, Austria and Australia to study the pollution control mechanism of these countries. The program costs enormous amount of money, but the consequences have been a series of failure and the Central Pollution Control Board (CPCB) keep saying that the rivers are getting even dirtier than they used to be. The reasons are that the pollution load has increased much beyond their expectation and "the sewage treatment plans are not running at their full capacity, due to the inability of the urban local bodies to provide for full operation and maintenance cost" (Jairam Ramesh, Minister of State for Environment and Forests, in S. Yadav, The Indian Today December 2009).

An example of the failure for the implementation of the NRCP is that in March 2009 152 towns (out of 165 towns) were officially covered under NRCP and have been approved for Sewage Treatment Plant (STP) capacity building. However, only 82 of those towns have actually built any capacity. Additionally at the same time, there has not been any spending of federal or state monies on the NRCP in fifteen NRCP towns (National River Conservation Directorate, 2009).

In addition the job of implementation and enforcement was delegated to the CPCB and local departments for public health, development, water, and sewage (Ministry of Environment and Forests, 2006). With the times it becomes mostly in the hands of local bodies to implement and manage the subsidies of the NRCP for cleaning the rivers. In reality very few cities engaged themselves to implement any improvements despite the subsidies. A former CPCB chairman summed up the problem quite clearly: "When it comes to doing things, it is not up to the CPCB, even in the area of air pollution" (Sharma and Roychowdhury, 1996, in Greenstone 2011). What is even more alarming is that the State and local bodies have been accused of financial mismanagement, including diversion, underutilization, and incorrect reporting of funds (Ministry of Environment and Forests, 2006).

Coming back to the case of Chennai, where Cooum and Adyar rivers are known for industrial pollution and untreated domestic sewage outlets, there is always a sorry story to tell with a lack of accountability. "Chennai Metro Water emphasises that only treated sewage is discharged into the water sources. But it is not happening", said the state's environment president, L. Antonysamy. There is a need for coordination among all the stakeholders, for accepting the actual pollution facts, recognizing where the problems remain and uniting to avoid untreated sewage outlets.

In fact it seems that the solution for cleaning the rivers does not depend so much on money, but rather on the integrity of those in charge of implementation, and the swiftness and conscientiousness of the Governmental Institutions in charge of implementing National Plans. Above all it is obvious that a restoration of a river cannot be done in short time, but it is more an integrated process over years of decontamination. Thus implementation in not a short phase but a continuous procedure where the results and benefits are seen after the ecosystems had enough time to recover.

2.2. Towards a better management at the local scale in Chennai

The Government of Tamil Nadu is mostly engaged in the Conservation, Development and Management of the agricultural land and water resources of the state. "Watershed Management" and "Water Management" are the two major strategies of the state for contributing to the sustainable increase in agricultural production.
As said earlier in Part II, the absence of any perennial source of water makes the average annual rainfall of the state the major source of water. Nowadays because of the backdrop of having exhausted almost all irrigation potential in the State, the strategies available for sustainable water management are:

- "Rain water harvesting with construction of farm ponds and check dams for ground water recharge to stabilize drinking water and irrigation wells
- Scientific use of water in Canal irrigated areas and reduction of water loss
- Rehabilitation of Water Bodies
- Introduction of water saving irrigation methods
- Construction of Community Wells to promote conjunctive use of surface and ground water"(GoTN)

The schemes implemented by the Tamil Nadu mostly focus on the scarcity of water in the rural areas, for water supply and agriculture.

In order to protect the lakes and rivers and also to provide healthy environment, the Government of Tamil Nadu is forming institutions at a local level. It is in the hands of the local bodies to empower the restoration of their own water bodies concerned. Thus the Government of Tamil Nadu established a Trust, the Adyar Poonga Trust (APT) in the year 2006. The trust's role was principally to plan, implement and achieve the project of The Adyar Poonga: the restoration of the estuarine creek near the mouth of the Adyar river (part II). Later it was renamed as Chennai Rivers Restoration Trust (CRRT) whose objectives are the restoration of the waterways of Chennai.

Today the restoration of the Adyar creek is finished; the CRRT has started a new larger phase of restoration on the estuary, as well as an integrated restoration of the Cooum river. However no deadlines have been established about the end of the restorations projects. Moreover my colleague and I went twice for interviewing the CRRT and knowing more about the Adyar Poonga and the future restoration projects. The first time the officers of the CRRT were really brief and conclude by recommending us to get the information on the website. The second time, we had to go through a long administrative process to get a third appointment. Finally we deduced that the communication on the projects was restricted, as they did not want to announce anything officially to a public of students. This raised some questions about the motivations of the projects: what were the purposes behind it and why is the information hidden. Since it is a successful ecological restoration, why are they so quiet about it? Above all for an inclusive understanding of the projects happening on the river, a reflexion on the relation to the Adyar river and the citizens might help.

3. The environmental awareness of the Adyar river

3.1. A pejorative representation of the Adyar river

When doing the field work in Chennai along the Adyar river, I first noticed that many discussion led to a negative point of views on the Adyar river, not even considered as a river anymore. Secondly the relations between the citizens of Chennai and the river are scarce. Their everyday life can happen

close to the river, no longer interaction with this element happen. As a result, it tends to be forgotten and alienated from the urban city.

a) The Adyar river considered as an "open sewage"

When explaining my study on the Adyar river, the person I was talking to often alluded to *"The Adyar cooum"*. I first did not understood why such a name, making confusion in my mind between the two rivers. When becoming precise and adjusting that my study was only on the Adyar river and not Cooum, the response I got was *"Adyar or Cooum, to me it is the same"*. Explanation came later, when doing some research on the name "cooum" and with discussing with sensible persons on the rivers issues.

Figure 42 : Pollution in the Cooum river in February 2015. Source: A. Cornou

The name of *"Cooum"* appears to be derived from Tamil literature. The name has been derived from the Tamil term coopam meaning "well" or **"deep pit"**. (Epaper, Times of India) In fact the Cooum was earlier known as the Triplicane river. For centuries, the Cooum has been an integral part of the socio-economic and cultural life of the city. Till the early twentieth century, it was a clean river, most suitable for navigation. In recent decades, the river has become one of the dirtiest rivers in the region. As it passes through some of the most congested and thickly populated localities of Chennai, the river carries a large portion of solid wastes, untreated sewage and cattle-wash. With the time the name change and it is called now the Cooum river.

With the name *Adyar Cooum*, the inhabitants refer to the bad quality of the water of the Adyar, that is becoming similar to the quality of the Cooum river. Even though the two rivers are not on the same level of pollution, the actual stage of the Adyar and without any measure, the citizens consider the future Adyar river as a second Cooum river.

In addition, when asking to persons *"How would you describe the river?"*, they answered clearly: *"It is an open sewage. We call it Cooum or Koovam, which means sewage water river"* (Vinay, April 2015). The Adyar river is considered as a waste output channel, a way out for embarrassing wastes where the natural aspect of the river is neglected. The Adyar is pleasant to look at, however people all keep in mind its smell anyway.

Facing the evidence that people do not consider the rivers of Chennai as natural elements in the city, but as an open sewage systems, their responses and behaviours in relation to the environment of the Adyar will be linked with this representation.

b) Rare interactions between the inhabitants and the Adyar river

First of all, there are very few places to access, see and approach the Adyar river. On the northern side of the river, the banks belong to private bodies such as the Chettinad Palace, Ministers and private member clubs. It is not possible to enter these areas as a citizen, unless for the private Clubs by becoming a member. Similarly the southern bank does not allow lots of views or accesses to the river: there are hills of rubbles, institutions or private clubs as well. Even in the Theosophical Society, having a long stretch along the river bank, this side is closed by dense vegetation and brambles. The river can barely be identified in-between the leaves.

Figure 43: The riverbanks hold by the Theosophical Society, where dense historical vegetation remains (top) and the Adyar bridge with a wall on the west side (bottom). Source: A. Cornou and http://3.bp.blogspot.com/-ZNhqMykOGc0/VNzFGujVPuI/

By contrast the river banks are easily accessible in the slums areas, Malligaipoo Nagar (next to the Malar Hospital), Anna Sathya Nagar (near Greenways road) and Srinivasa Puram, are slums area encroached on the river banks were we can freely access to the Adyar river side. Because there are no houses directly built on the banks, an entire view of the river is available. The houses are built few meters behind in the hinterland and the banks are usually used as dumping side, and for open defecation.

Nevertheless these areas are quite hidden and informal behind the slum settlements. No one can guess that the slums enjoy such a river view. However, no one –not even the inhabitants of the slums leaving close by- would enjoy spending time here, enjoying the river view or experiencing any leisure activity, because of smell of wastes and unsanitary conditions on the riverbanks.

Apart from the banks difficult to access, the river crossed by three bridges: two of them are regular roads circulation and one is the railway bridge. One could think that bridges are the ideal place for observing river, however on those bridges the Adyar river remains complicated to see.

On the Kotturpuram bridge walls on both sides have been built, making the view on the Adyar river impossible. On the Adyar bridge, one wall on the east side has been constructed. The view on the river towards the west is conceivable. In fact these walls have been erected to avoid suicides. The Chennai Corporation has allotted 1.2 crores ₹ to build a suicide barricade on the Kotturpuram bridge in 2014, with one-meter concrete walls above which another one-meter of vertical metal hand grills will curve inwards (Handrababu, The Times of India, June 2014). The bridge was known as a suicide spot, and in the last ten year there have been 20 suicides on the Kotturpuram bridge and six suicide

on the Adyar bridge (Vijayakumar -Sneha suicide prevention centre-, The Times of India, June 2014). On the bridges the only sensations when crossing the river is the smell and the lack of buildings on the surroundings.

Taking the railway Velachery-Beach permits to have a look at the Adyar river for about one minute: on the west side is the estuary and on the east side the Kotturpuram area. Finally these are the rare moments where citizens can enjoy a part of the river, with a sea breeze hopefully covering the sewage smell.

To conclude the citizens do not have any possibility to appreciate the natural landscape of the river. There is no veritable public access on the banks and the view is very limited. There is no reason to look for a close interaction to the river, since it is literally an "open sewage". Having a view on an open sewage does not make any sense, except from a certain distance without mosquitoes and smell. The Adyar river today brings more inconvenient than opportunities in the everyday life. In other words: the further people are from the river, the better they feel.

c) The Adyar river becomes a forgotten element in the city

As a matter of fact most of the citizens of Chennai tend to forget that the Adyar river is a natural landscape after all. However it is polluted still is present in the city and there are still few wild vegetation and animals using it. The Adyar river remains always present but it tends more and more ignored.

Since it is polluted, the water quality is unhealthy and can bring many diseases. The riversides are sanitary insecure. Additionally it is a perfect breeding site for mosquitoes, and people living next to it suffer from it every day. Also during the monsoon season flooding can occur rapidly, source of material and human damages. Finally the smell of the river, because of heavy metals, organic matter and other hazardous discharge, is omnipresent. To sum up the banks of the Adyar river are associated as a danger area. As a consequence people neglect the river. They avoid talking about it and sometimes they do not answer when asking questions, or simply answer *"It is as it is."* It is not even considered as a landmark in the city. For example when going on the fieldwork, confusion in the directions often happens. Few citizens use the river as a key element in the city, a natural landmark.

Furthermore having no view on the river it is not helping for its recognition. It is complicated to become sensitive to the Adyar river when it is not possible to observe it. Many ignore the actual reality of the river, apart that it is polluted. But do they sometimes take a look at it? Have they been on the banks? Do they know places where we can actually enjoy the river view, observe mangroves and watch local birds flying? When the river is hidden by concrete walls or because of a lack of access, it is difficult to be more sensitive of its natural beauty. By hiding it the citizens feel alienated and separated from the river. They do not have any link and relation to the river as is was before. They neither feel responsible nor feel that they can play a role for its improvement. The river should be revealed for everyone, because it belongs to the inhabitants, and should not be separated from their everyday life. Only be creating a relation and a social link with the river, people will start being involved and concerned about it. Then a real environmental awareness can happen.

3.2. But a positive attitude towards the river from the high income group

Another interesting point is that some people know specific places for an incredible experience with the natural landscape that the Adyar river provide. Some of them even enjoy everyday activities, near the riverside or even on the river.

This is the case of the rowing member of the Boat Club, who used to boat on the river. They enjoy the slow flowing water for leisure and sport activities. Of course the river is still perceived as a danger because of the water quality: *"Thanks God, I never felt into the river"* said Vinay, member of the Club. Also the limits of the garden of the Boat Club go just on the riverbanks. Thus similarly the members of the Boat Club, located just next to it, walk and jog every mornings and evening when the temperatures cool down. These want to exercise in less dense areas, away from the noise and traffic pollution. Thus the river itself and its private banks are the ideal place.

Figure 44: Members of the Boat Club rowing on the Adyar river. Source: A. Cornou

One exceptional public place, accessible for everyone, remains wild and with natural beauty on the Adyar: the broken bridge. Located just at the estuary, this bridge was built in 1967 to facilitate the movement of fishermen from Santhome beach to Elliot's beach over the mouth of the Adyar river. However during the year 1977, the bridge partly collapsed due to strong currents of the river, and has never been repaired since. Today some parts of the bridge remain, and it is a place of scenic beauty. It even turned out to be a popular shooting spot where many stars of Tamil film industry come here for a shoot.

Figure 45: View on the Adyar Estuary and the Broken bridge from the Leela Palace (left) and the view on the sea from the Broken bridge (right). Source: A. Cornou

Moreover some living areas on the south, near the river, shows that the inhabitants actually still appreciate this natural element. On the southern bank of the river, from Kotturpuram bridge to the railway bridge, some apartments buildings and houses are called "Riverview", "Riviera" or even "Riverside", in the Kotturpuram and Gandhi Nagar areas. On the "Riverview Road", new residences have been built, where high income population group live. These are quite recent, and it means that people despite of the neglected attitude with the river, want to get a specific link with the river.

Figure 46: Names of houses promoting a view on the Adyar river. Source: A. Cornou

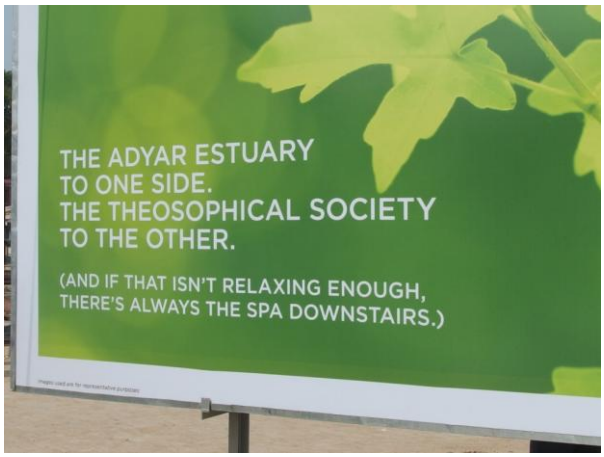


Figure 47: Advertisement for a new high-raise building on the southern side of the Adyar river. Source: A. Cornou

Even though the relation remains limited, because only a view of the Adyar river is possible and no access has been created, there is a proof of a movement towards the river. Additionally, a new construction has started in Adyar, the TVH Quadrant close to the Theosophical Society, which is announced to be finished in February 2017.

According to the amenities provided, it seems to be planned on the same way of a Gated Community, with a swimming pool, tennis and badminton court, a gymnasium, a garden, security and club house. At the moment huge panels in front of the building site are used for promoting the sale of flats: one of them is referring to the Adyar river describing the view on "the Theosophical society and the Adyar estuary" as a very advantageous and relaxing location.

To sum up, there is a movement towards the Adyar river, and people show interest by being next to it. It participates protecting the area because people get involved for the preservation of the spaces they enjoy. However these areas are organised only to host a certain category of persons: the high income group are the one supposed to live in the new residences near the Adyar river. The members of the Club are the elite of the city, and the inhabitants of the areas are earning much. As a result the interest towards the Adyar river is only manifested by the middle-high income group and with limited relation to it: most of the time only the visual aspect is requested and appreciated. A distance always remains away from the river and no open access to go on the banks are created for the people living in the "Riverview" houses. They do not interact with the river but only watch it from their flat. The people living here are sensitive to the beauty of the river, but the wish for a restoration is not strong yet. A passive attitude is still present: *"We all want it clear, so if the government cleans it [the Adyar river] then it would become more pleasant"* says a friend of Vinay. The citizens often refer to the

government for implementing a restoration, saying that they are one with enough power for changing the actual situation. Again when visiting the Adyar Eco Park, one visitor told me clearly *"In a country like India, we wait for the Government to do things."*

4. Isolated and partial projects along the Adyar River

4.1. A priority for recreational spaces and aesthetics

There are quite many thesis made on the Adyar river. Dozens student in Architecture and Planning chose to make their final year thesis (Bachelor or Master) on a riverfront development project. Secondly students in chemistry and biology wrote reports on the pollution of the water. Already theses have been written in 1993 about the development of the Adyar river, and in 1985 about the water pollution. The reflexion on the river from the students started then in the early 1990s.

However, taking a closer look to the theses about the riverfront development shows that the visual appearance is actually an important aspect of the projects. Firstly the literature study, taking other examples of waterfront development very often refers to American and European riverfront development, such as the Thames, The Seine, the Millennium Park Chicago, the Mandurah waterfront Australia, and so on. In Asia it is generally the Singapore's river that is taken as a model, as for India the Sabarmati riverfront is cited. Also the theses objectives, with the scopes for a waterfront development, are frequently the following:

- To stop the flow of sewage, keep the river clean and pollution-free
- Reduce risk of erosion and flooding in flood prone neighbourhood, with construction of retaining to prevent the soil from eroding and check dams at regular intervals to prevent the river from drying up areas for waterfront development
- To make the riverfront accessible to the public by provide permanent housing for riverbed slum dwellers
- To develop the waterfront along the river in the specified area. This means creating riverfront parks, promenades, cycle tracks and Ghats to enjoy the water. Landscaping, mangrove plantations, walking paths and promenades, street planting and eco systems, lighting, street furniture, art and sculptures are the design criteria. Navigation can also be provided in some cases.

Most of the waterfront designs include the four following steps to be coherent:

1) Decentralized sewage treatment plants at regular intervals, to stop polluting the river
2) Clearing the blocks at the river neck and cleaning the silt deposit, so that the water is no more stagnate and starts flowing
3) Once the above measures are taken, the river becomes free from mosquitoes, non-toxic, habitable place for water organisms. Then the encroachments along the river are removed, so that the entire width of the river is visible.
4) Once the above points are carried out, the river becomes accessible for the public. Therefore recreational activities along the river can be prepared .This may include various built structures like shops, cultural centres, visitor centres, walk ways, bicycle tracks, promenades and viewing deck for promoting tourism.

Despite these belong to the Architecture branch; the visions on the projects are very much towards a visual aesthetic, and not so much about a design on the environmental and social aspects of the river,

for instance. Again the spatial dimension is the core of the project and the aim is to transform the riverfront as a unique cultural platform with recreational and entertainment facilities serving the city, where the people and tourists can enjoy a new dimension towards the supposed clean river.

The architectural projects do not take into account the natural context of the rivers of Chennai, which are typically seasonal flowing sources of water, and which level can extremely vary. They propose rather a design for economic purposes and recreational activities along the river but not inclusively connected to the river. However there is a strong reflexion on improvement towards the view of the river and there is a holistic approach for a visual perception.

It is important to keep in mind that riverfront development may imply significant changes in water management and land use and thus economic impacts on certain economic activities. It may hamper navigation or agriculture for instance. As said previously, the Sabarmati riverfront project is criticised because it takes water from a canal aimed for drought areas in priority. Also the water flow stopped downstream of Ahmedabad is restricting the irrigation of the coming areas and recharge of groundwater. In order to support river basin planning and decisions in river related policies, it is therefore very important to assess these impacts with appropriate and transparent methods, and weigh them against the benefits.

Finally architectural projects rarely aim at the decontamination of the river itself, or envisage awareness of the fragile ecosystem around, and river restoration schemes and landscape ecology planning might suggest accurate proposals for preservation for the Adyar river.

4.2. Federate projects by the civil society

Independently of the theoretical design thesis, projects and changes happen along the Adyar river banks by different organizations.

One of them is the Kotturpuram Tree Park, a 5 acres garden launched by Nigzhal. This NGO was created in 2005 and "promote tree culture in urban areas, create awareness on the role of trees, plant the right kind of trees and care for trees through collaborative efforts" (Nigzahl). The Kotturpuram Tree Park is located on the southern bank of the river, eastward from the Kotturpuram bridge. The project started in 2007, when the area was a rubbish dump. The Public Works Department approached Nizhal to come up with a blueprint for regeneration of this waste land. They converted this land into a biodiversity hotspot and arboretum for indigenous tree species, with limited resources and extensive voluntary efforts. There are now around 100 species of fauna recorded and the Tree Park is also used as a Tree Learning Centre by students. Shobha Menon, the Founder Trustee of the NGO and the person who began the creation of the Park is today very proud of the project today, where people from every income groups enjoy coming for a walk during the day. The use of the park is increasing: over the years more citizens visit it, tend to come back again and it becomes more known in the city.

Figure 48: The Kottupuram Tree Park today (top), where all income groups come and share the urban space, and the voluntary work in the past (bottom). Source: A. Cornou

The success of the park is due to all the voluntary work that has never failed over the years. The NGO started with about ten founder persons, who believed in a positive ecological reconversion of the land. With the time other volunteers joined them. Nowadays there are about 100 people who participate in the maintenance of the Kotturpurma park and the rehabilitation of a second piece of land. Still today the preservation of the park is hold by the voluntary workers only; no help from any governmental institution is implemented. Shobha Menon is very proud to see that more citizens get involved in the project. However it has not always been so easy she says: *"At the beginning during the first years we, the few volunteers of the new NGO, had to be persevering. We used to come every day, removing the ground, making it suitable for plantations, water the seeds and young trees, with only one water source for the entire 5 acres area. The work was hard, but we still kept on going and we trusted in an ecological improvement. Now we can observe how great the result is. But to be honest, it was difficult to get more volunteers. When it comes to handwork with the nature, such as touching the soil, grabbing the leaves, pouring water, people consider that it is not of their business. In fact I observed that it is even more complicated to involve rich persons in the creation of the park."*

Indeed many high income people enjoy today the Kottupuram Tree Park, especially for walking and doing exercises away from the urban pollution. Everyone is thankful for the initiative but few can admit that they participated in its implementation. Again this shows an increasing request for more green areas in the city, but the step for participating in environmental projects for restoring the polluted areas persist. Even though the population is more and more aware of the environmental issues, they are not entirely ready to make a contribution for an improvement of the actual situation, waiting for the government to take actions.

4.3. A piece of green within the urban fabric

The Adyar Eco Park has been launched by the Government, when they created the Adyar Poonga Trust in charge of the project. Then IL&SF Ecosmart was designated as the consultant for the

Eco Restauration Plan and other activities for the project and in fact a 50/50 joint venture Special Purpose Vehicle between IL&SF and TNRDC was set for managing, developing, improving and maintaining the EcoPark. The restoration work was done by the Pitchandikulam Forest Consultant based in Auroville.

Figure 49: Adyar Poonga Eco Park Master Plan. Source: http://www.tnudf.com/adyar_poonga/aep.asp

The concerned area is 58 acres and it used to be a waste dumping site: a filthy place, with debris strewn around. Since it is a creek the backwater of the Adyar river is not flowing away, and because of a continuous domestic untreated sewage outlets, the area was full of stagnant sledge.
This ecological restoration is aimed at an eco-park that will be a showcase ecosystem of the Coromandel Coast with fresh water ponds, brackish areas, mangroves, mud flats, dunes, and islands.
According to an Inception Report by IL&SF, the objective of the draft landscape and architectural design of the park would be:

- "To develop the Adyar Estuary and its surroundings as an asset to Chennai City
- To integrate measures to control proliferation of unplanned development along the river front
- To convert the estuary from a neglected waterfront to a vibrant, recreational, urban public space"

Also there is a communication and education strategy behind the project: "The ecological restoration is something that needs to be inculcated in the minds of people especially youngsters. [...] it would be a meaningful venture if the park and the entire area of Adyar Estuary are made into a hub of education and communication. The project will focus on the objectives of creating awareness on the ecological concerns, enabling public and possible users of the park and the people who would be related to the estuary understand the environmental issues by developing live models/areas for observations." (Inception Report, IL&SF)

The Adyar Eco Park has been inaugurated in 2010 and hosted different environmental education programs and workshops. Student's community from different educational institutions have been invited to visit the estuary and learned about the ecological relationships, causes for degradation and elements needed for its restoration. Moreover the State Government recommended a minimum human interference in the park because of the fragile ecosystem of the park. "The state does not want crowds thronging the Poonga like Marina Beach or Vandalur zoo. It is an eco-restoration project and we do not want to disturb the ecological balance in the creek. A decision on public access will be taken at a later date, and again it will be limited. It is not for all," a senior government official told (Times of India, February 2011). Now it has been opened to public Tuesdays and Thursday for six months, and the entry fee is 20 ₹ (additional 50 ₹ for a camera) for each citizen. The group is limited

to 20 persons and the opening hours remain the same than before: 9.30 am to 12.30 pm for students and teachers/staff of the educational institution (entree fee of 5 ₹), and from 2.30 pm to 4.30 pm for public.

Figure 50: The restored Adyar Creek, inside the Adyar Poonga.
Source: A. Cornou

A second phase of eco restoration has started further on the estuary, between the Theosophical Society and Srinivasapuram slum settlement, covering an area of 300 acres. On the same intention than the first phase, there will be water body restoration, removal of invasive exotic species, habitat restoration, monitoring pathways, sanitation, solid waste management and measures to enhance tidal influx in Adyar estuary and creek (The Hindu, May 2013). It also requires to work on additional storm water drains in residential localities and to take measures to plug illegal sewer connections in the drains to prevent mixing of sewage in the area.

In conclusion theses two projects have been differently implemented and the results are not the same. The Kotturpuram Tree Park is aimed at improving the banks of the Adyar by planting local species whereas the Adyar Poonga Park's objectives also include water quality improvement by stopping the sewage outlets. The area of the Adyar Poonga is about ten times bigger, but the process is more impressive too: 230 million ₹ for the Adyar Poonga (Xavier Lopez, The Hindu May 2011), with a Public Private Partnership, whereas only 7,000 ₹ have been spent for the Kotturpuram Tree Park with volunteer's work. Everyone is very welcome in the Kotturpuram Tree Park, which is not the case for the Adyar Poonga, where the reasons for a restricted access remain sometimes unclear.

Obviously both of these prove an interest for an ecological restoration of previously wasted areas. Such projects contribute making people more aware on the ecological issues and it is a first step towards a river restoration. However these greens spaces along the banks, including the historical garden of the Theosophical Society, remain isolated in the city, without any global reflexion between

them which could improve a generalized movement for enhancing the riverbanks ant environmental quality of the river.

5. The economics and politics intentions behind the projects

5.1. Slum eviction as a prime objective to reach

In the Inception Report written by IL&SF, it was decided that "the scope of work for [identifying the causes of pollution], [...] revised to study and survey the settlement encroaching upon the water edges and identify the mitigation measures to control pollution and also suggest policy level measures that will stop proliferation of slums/encroachments along the waterfront of Adyar Creek and Estuary." As a result of the eco restoration, within the slums area concerned by the Adyar Poonga project, about hundreds of huts were evicted, and thousands more homes of the poor threatened with demolition (Coelho and Raman, 2010).

In fact the government has carefully decided "making and unmaking communities" (P. Arabindoo) for justifying a necessary need of eco restoration that starts with the eviction of the slums. Doing this by a democratic and legal process, they involved an official approach of public participation by creating the Friends of Adyar in Poonga (FAPA) in 2007. This organisation is made of about 40 members from the neighbourhood of Adyar Poonga, and has "the initiative for promoting environment conservation. It is aiming at helping in creating environmental awareness and primarily serve to build and support the relationship between the parks, local communities, and interested constituents like volunteers"(Madras Musings, June 2010).

IL&SF Inception report clearly announce that "a project of public utility becomes effective when public participation is facilitated at all stages of its development. It increases the sense of belonging and it also clears apprehension of any quarter of the society. [...] IL&FS Ecosmart team would take into confidence the residents of the Chennai City, residents of the immediate surroundings, the Community Action Group (CAGs) and other interested parties working in the project area by organizing interactive consultations at various stages of the project." However P. Arabindoo analysed that "the genealogy of existing communities in and around the site were unimagined to create a new identity and history for FAPA as an imagined community produced by the state.", thus directly resulting in the "illegitimisation and incrimination of the poor living within the boundaries of the eco-park leading to their eviction. By creating the FAPA, the citizens are encouraged to adopt the role of stakeholders and partners with the state: it is not a civil society anymore but a state mercenary" (Arabindoo). Furthermore is raises questions about the coherence of creating such an association, "particularly when communities are heterogeneous (class, caste, language, ethnicity) and uncertain about what constitute a collective 'environmental good' ".

A study by K. Coelho and V. Raman reinforces the previous explanations, by saying that "scapegoating the poor has become part of the official discourse of salvaging urban ecologies over the past two decades" although it has never been officially claimed. "[The river restoration projects], make its bid for credibility by proposing to cut through the thicket of familiar problems typically besetting river cleaning efforts, and focusing on slum eviction as an achievable first step" (Coelho and Raman, 2010).

Actually there is a misunderstanding on the environmental problem of the river. Most of the population consider that the slums are the principal reason causing the pollution of the river. This has

been even confirmed during my fieldwork when asking simply *"Why is the river polluted?"* most of the answers converge saying that *"These people [the slums] pollute."* As said in the Part II, "less than 1 % of the pollution in the river was attributed to the slums" (Environmental Improvement of Watercourses of Greater Madras, 1989). One discourse behind the projects is that the slums are settlements absolutely need to be eradicated of the city, for a better image of the city, because *"[they] are dirty people who spoil the city"* (Citation in Hochart, 2014).

As a solution, the government propose to relocate the slums population in the periphery of Chennai whatever the social, financial and environmental costs are. K. Coelho explains that there has been a study commissioned by Metro Water on low-cost sanitation for slums on the city's waterways in 2004, concluding that there was a potentially feasible and low-cost option for improving conditions in slums and reducing their environmental impact on the river. Despite of this the TNSCB dismissed the report with a short note: "As it is proposed to rehabilitate all the waterways families, this study may not be helpful", and chose the high cost resettlement of 35,000 households.

5.2. The contradiction of the slum relocations arguments

As explained, the intention of evicting slums people because they pollute the water of the river is not a justifiable reason. On the same way, it does not make any sense to say that the riverbanks and the Adyar estuary should be protected, when looking at the relocation policies and the recent development of the Adyar Creek.

Indeed mass relocation settlements of slums are almost always situated on low-lying marshlands or flood plains on the city's peripheries. This is the case of Kannagi Nagar colony that is built on land reclaimed from the Pallikaranai marsh. As a consequence the urbanisation of this previous wetland has contributed to the recent intensification of flooding as well as the significant reduction of groundwater. Besides their distance from the economic opportunities of the city, the vulnerability of their livelihoods is now enhanced by flood susceptibility, and severe liquidity crunches. When thinking of restoring a wetland in the Adyar Creek, in reality another sensitive area is being destroyed.

To go further the efforts of restoring the Adyar Creek were already challenged as the government had already over the preceding decade permitted intensive development in the form of IT office buildings, multi-storied luxury residential complex with the Rani Meyyammai Towers, the Somerset Greenways Chennai, and the five stars hotel Leela Palace on the estuarine land near the mouth of the Adyar river.

Figure 51: Real estate developments visible
from the Adyar Poonga Eco Park. Source: A. Cornou

In the 1990s M.A.M Ramaswamy, who owned large amount of land in the estuary began to sell and/or build on this land, large parts of which comprised tracts protected from building by the Coastal Regulation Zone rules. Despite a court case against this project, the court ruled in M.A.M. Ramaswamy's favour and construction was permitted on the majority of the land (Coelho and Raman, 2013). Moreover a road was build along the land shore, then being regulated under the specific case of the CRZ rules when "buildings shall be permitted **only** on the landward side of the existing road". Today despite the eco-restoration of the creek, the fragile ecology of the estuary is irreversibly damaged for expansion of real estate development.

Figure 52: Real estate developments along the Adyar estuary. Source: Google Images

To summarize the environmental approach openly announced is directly linked to the wish of the middle-high income class, who want to enjoy exclusive spaces and seek distinction from the mass society. "The restoration projects [...] by besetting river cleaning efforts and focusing on slum eviction is [the] approach openly announced [but] confidently addressing a growing urban middle class constituency who hold slum-dwellers responsible for the state of the rivers, and regard their summary removal as the crux of eco-restoration" (Coelho and Raman, 2010).

5.3. The elite of Chennai at the forefront

"The proposed development is expected to attract a significant number of visitors belonging to different socio economic strata", says the Inception report of IL&SF about the Adyar Poonga. This appears not to be true. For a citizen, the entrance fee is at least 20 ₹. Not everyone can afford paying much for entry into a man-made environmental park. In Chennai for the low income classes, it could be the price of an entire meal, or four railways tickets for travelling in the city. These people's first priority is whether their primary needs are fulfilled, such as food, water, housing, electricity, transportation and other amenities... Thereafter they would be worried about the environment and would spend money for entering the park. Asking such a fee entrance is similar to "building" a strict barrier, acting as a filter, allowing only the middle and high income classes to enter the park. Moreover it is possible to book online the entrance tickets, in order to insure having an access to the park on the booking date. Just by showing the ticket on your phone or printing it, you can be sure to go inside (this procedure still require the entrance fee). However not everyone has a smart phone, or a computer, or internet access to go on the site, or a printer.

Even more intriguing, it seems that the people who can afford the park entrance do want the area to remain the entrance fee, and thus restrict to the poorer. When visiting the park, I engaged an informal discussion with one of the other visitors: *"They don't want to open the park to all the public because they will litter and not respect the park. People are not environmentally aware of the damages caused by pollution. They are not interested in a restored park, that's why we are so less visiting the*

park today". Indeed only five visitors including myself were visiting the Adyar Eco Park. This can be explained because of the price, but also because it was on a Thursday afternoon, from 2.30 pm to 4.30 pm, according to the schedule. Closed on Saturdays and Sundays, the visit of the park is permitted only during the week day's afternoon for the public. These particular conditions are not helping for a promotion of the park and do not encourage people for visiting it.

It is obvious that the Adyar Eco Park is a very sensitive ecosystem, even more after a restoration where the new environment is not as entirely stable yet, and need time to get more resistant. No deterioration can happen, now we should let the nature recover and it takes time. However there is again a gap between the arguments and the reality. The park could be restricted to public, but remaining accessible to every Chennai's citizens. First the park could stay closed two days in a week, but not on the entire weekend, when people are more likely to be free for visiting it. Also by keeping the area restricted to 20 people, what if the price for getting inside would be adapted to the income of people? What if the people below the poverty line could have free access? *"It is probably not a so good idea to open it to public"* says one of the visitors of the Adyar Eco Park. In my mind it sounded like if the person does not want to see the poorer, "those who pollute", coming into the park. People who can afford the park want to distinguish themselves from the main society. They feel having the privilege of enjoying a wild nature free of pollution. They do not wish to be mixed and want to show how eco-friendly they are. The park has been made only for them, by people like them.

As explained by P. Arabindoo, the government used the association of Friends of Adyar Poonga for creating a constructed sense of ecology and promote an "aestheticized commodification of nature":"the surrounding middle and upper class residents suggested a cosy alliance between the state and a specific form of civil society promoting a post-materialist understanding of nature in a city". She also argues that the FAPA even posses little ecological knowledge and their reasons for joining were mostly related to NIMBY[5] concerns and implicitly slum eviction. The FAPA was drawn mostly from the middle class neighbourhoods surrounding and their politics is "an example of commodified citizen politics where the participatory space it occupies alongside the state in the management of the park indicates the domination of an elite consumer interest" (Arabindoo)

At last but not least, the Adyar Eco Park today is hidden in the city. Surrounded by closed walls and bars, one cannot easily identify it from the outside as an Eco Park. Hence despite that it can be claimed as one of the first eco-tourism venture in the state, it is not considered as a landmark in the city: few and particular citizens are aware of the Adyar Poonga. Most part of the population ignores it or thinks that they are not allowed to enter it. According to P. Arabindoo, FAPA has been unable to increase the visibility of the park within the geography of the city.

To sum up beyond the ecological restoration of the Adyar Creek, the Adyar Park scheme looks like a disguised project which first aim was slum eviction, and second aim the creation of new leisure space for the middle-high income group.

5.4. Towards a new process of riverfront development on the Adyar ?

More generally the projects for developing riverfronts are aimed for economic revenues. In Chennai when founding a project, there is always first a financial profit, beyond environmental objectives or social improvement. Thus only a return of investment is a motivating reason for decontamination of the river. *"Cleaning the river should solve many health problems. But since [the*

[5] "Not In My Backyard" or NIMBY is a characterization of opposition by residents to a proposal for a new massive developments, or impacting projects, because it is close to them. Often such residents believe that the developments are needed in society but should be further away. In the case study the residents wants the slums to be relocated further way.

government] don't see the direct link between pollution and disease, and because there is no return of investment, they think up spending lot of money whereas the financial benefits would be too few", confirms a friend of Vinay. Also by evicting slums population, the costs of resettlement can be balanced by selling the new land available in the city to private developers, which brings in perfection the image of the city. As K. Coelho and A. Raman complete, "waterfront development, beautification, and eco-restoration, along with high-end infrastructure serve multiple purposes – both as direct strategies for capital accumulation through real estate value, as well as idioms through which cities position themselves in the global arena."

Secondly during the fieldwork I particularly observed a lack of coordination between the different stakeholders. First asking who was in charge of a particular project, I could get different answers from diverse persons. Secondly when interviewing the representatives of the government I have always been redirected several times, ensuring that someone else would be more expert on the subject. It even happens that I ended back in one of the offices I went at the beginning. Thus it appears to me that there is a lack of organization of the different governmental body, between and within institutions, making them less able to work together effectively.

Regarding all the aspects of the case study, what is likely to happen on the riverfront of the Adyar river could be more an addition of small projects isolated. Firstly land on the riverside is owned by different bodies: institution of the Theosophical Society, the civil society of the Kotturpuram Tree Park, private property of owners of the Madras and Boat Clubs, the Government for the Adyar Eco Park and private companies on the Adyar estuary. Secondly different income class on citizen live on the banks of the Adyar and different type of stakeholders have started projects on the banks.

As it might become a utopian challenge to unify all these parties involved on the riverfront, a generalized movement towards the river is not likely to happen on the riverside of the Adyar. A generalized movement for a riverfront development might not likely happen, however each institution can improve and redesign little by little the river banks. With social and environmental respect, this would be a re-appropriation by every part of the society of Chennai.

To conclude the environmental awareness about the Adyar river is isolated, partial and only a specific part of the population is be concerned. This cannot lead yet to a comprehensive action in the city towards a decontamination and then revitalization of the river, on the same way than Western Countries. Giving a structuring role to the river as a major natural element by a global movement on the river can happen only if the government imposes a project. In France the waterfront rehabilitation was mostly guided by an ordained political movement, however in Chennai another process of riverfront movement is more likely to happen: through partial and local projects initiated by all type of participants.

Conclusion

Today no one can ignore that the rivers of Chennai are polluted, as well as most of the Indian rivers. The government of India launched the National River Conservation Plan for improving the water quality and the Chennai River Restoration Trust cares for upgrading the waterways of Chennai. These last years, many theses have been written: students investigate on the water pollution and propose waterfront developments. Articles by The Hindu, The Times of India and Madres Musings communicate on the environmental issues caused by river pollution and reveal the ongoing projects.

Because of constant industrials effluents and untreated sewage outlets, the Adyar river remains highly polluted. However its environs have managed to retain its historical gardens from the British Empire. On the Adyar river banks are still present today the Brodie Castle, the Theosophical Society, The Madras Club, The Boat Club, the Chettinad Palace, and the Ministery Area, housing many mansions and country houses who belonged to Europeans. More recently the Kotturpuram Tree Park and the Adyar Eco Park which are restored parks opened on the riverside. The first one has been founded by volunteers and the civil society whereas the second one was launched initially by governmental institutions of Chennai. The Adyar river banks are not so degenerated as other parts of the city.

On the other hand the environmental awareness is limited. Today no plan has been established for stopping the untreated sewage outlet in the Adyar river. The Adyar Eco Park seems closed for the poorer and most of the banks are in fact owned by private clubs and private companies on the estuary. Also the riverfront development projects, implemented in Indian cities or designed by the students, mostly focus on the spatial dimension with priority to visual aspects and recreational and commercial activities. North America, the Thames and the Seine are inspiriting models for riverfront development, where the environmental and social issues are not the essence of the projects. The lack of coordination between and within the different stakeholders challenges the implementation of a general movement towards a revitalisation of the river. Thus along the Adyar river the riverfront development is more likely to happen by a succession of isolated projects, improving the riverside strep by strep.

At the personal and professional level being in Chennai for this research work was a very enriching and positive experience. I accepted that my own models were unique and therefore not universal, to open my mind to Indian and Tamilian culture. Every day I was learning something new, from everyday life habits and spiritual thinking, to architecture and planning. The study went beyond my expectations, with unending rich reflexions and a constant wish for explanations. Thus it led me to expand my though on ecological planning and the pollution issues in the world generally. I personally think that when income levels will rise beyond a point for everyone, individuals will no longer be willing to trade off environment quality for economic growth. I believe that at this point, economic growth will be correlated with environmental improvements. By doing this research I also wonder whether the city should rather be conceived by the citizens freely, with basic needs regulations from the State.

To conclude this study could be continued by looking deeper at the representation of the river by the different citizens of Chennai, reflecting their behaviour and particular relationship with the river to plan adequate projects. Moreover it would be interesting to investigate in more details the actions of the civil societies in Chennai, if they bring social or environmental issues, if their impact and power is growing and for what purposes.

BIBLIOGRAPHY

Online literature

Websites

Chennai Metropolitan Development Authority, http://www.cmdachennai.gov.in/, visited the 25/04/15

Chennai Metro Water Supply and Sanitation Board: www.chennaimetrowater.tn.nic.in/, visited the 21/04/15

Chennai River Restoration Trust, http://www.chennairivers.gov.in/, visited the 26/04/15

Epaper Times of India, http://epaper.timesofindia.com/Default/Scripting/ArticleWin.asp?From=Archive&Source=Page&Skin=TOINEW&BaseHref=TOICH/2012/07/14&PageLabel=49&EntityId=Ar04900&ViewMode=HTML, visited the 14/02/15

Government of Tamil Nadu – Department of Environment, http://www.environment.tn.nic.in/, visited the 04/03/15

Government of Tamil Nadu – Water Resources Organisation, http://www.wrd.tn.gov.in/, visited the 06/02/15

Ministry of Environment, Forest and Climate Change: http://envfor.nic.in/, visited the 02/03/15

Mumbai Mega Project Website: http://mumbaimegaproject.com, visited the 20/04/15

Tamil Nadu Slum Clearance Board: www.tnscb.org.in, visited the 21/04/15

Transparent Chennai, www.transparentchennai.com, visited the 21/04/15

Online articles

BHATTACHARYA S., "Chromium detected in Adyar river", The Hindu, published the 15/05/02 http://www.thehindu.com/thehindu/2002/05/15/stories/2002051506560300.htm, visited the 08/02/15

CHANDRABABU D., "Chennai's suicide hotspot Kotturpuram Bridge to get a barricade", The Times of India, published the 25/06/14. http://timesofindia.indiatimes.com/city/chennai/Chennais-suicide-hotspot-Kotturpuram-Bridge-to-get-a-barricade/articleshow/37192633.cms, visited the

D'MONTE D., "Sabarmati's sorrow", Frontline, published the 15/01/11. http://www.frontline.in/static/html/fl2802/stories/20110128280208500.htm, visited the 06/04/15

LAKSHMI K., "Metrowater starts plugging sewage outfall", The Hindu, published the 30/09/14 http://www.thehindu.com/news/cities/chennai/chen-infra/metrowater-starts-plugging-sewage-outfalls/article6460577.ece, visited the 26/02/15

LAKSHMI K., "Untreated sewage pollutes waterways.", The Hindu, published the 29/09/11 http://www.thehindu.com/todays-paper/tp-national/tp-tamilnadu/article2495513.ece, visited the 01/02/15

LAL SETH B., "Concerns over Sabarmati Riverfront Development Project," Down to Earth, published the 15/04/07. http://www.downtoearth.org.in/node/5786, visited the 21/02/15

LOPEZ A. X., "Survey of waste-tainted spots along Cooum", The Hindu, published the 01/12/2011 http://www.thehindu.com/news/cities/chennai/article2677102.ece, visited the 27/02/15

LOPEZ A.X., "Chennai River Restoration Trust to seek nod for Adyar Poonga second phase", The Hindu, published the 15/05/11 http://www.thehindu.com/todays-paper/chennai-river-restoration-trust-to-seek-nod-for-adyar-poonga-second-phase/article2020477.ece, visited the 12/02/15

PRADHAN A., "Riverfront development in India Cosmetic make on deep wounds", SANDRP Wordpress published the 17/09/2014, https://sandrp.wordpress.com/2014/09/17/riverfront-development-in-india-cosmetic-make-up-on-deep-wounds/, visited the 06/02/15

PUCL Report, Fact Finding Team on Forced Eviction and Rehabilitation of Slum Dwellers in Chennai. Fact Finding Report, Organized by People's Union for Civil Liberties-Tamil Nadu and Puducherry, 2010

RAMAKRISHNAN T., "City awash with dreams of a clean Cooum", The Hindu, published the 14/12/09 http://www.thehindu.com/todays-paper/tp-national/tp-tamilnadu/city-awash-with-dreams-of-a-clean-cooum/article117182.ece, visited the 14/02/15

RAMAKRISHNAN T. "Has Chennai river conservation project achieved targets?", The Hindu, published the 22/08/05 http://www.thehindu.com/2005/08/22/stories/2005082206390300.htm, visited the 11/02/15

SAMAJDAR P., "Chennai faces a unique pollution challenge – pollution levels that appear to be low or moderate but are not so", CSE India, published the 6/08/2013 http://cseindia.org/content/chennai-faces-a-unique-pollution-challenge-%E2%80%93-pollution-levels-appear-be-low-or-moderate-are-

SINGH P., "Gomti Riverfront project start by September", The Times of India, published the 27/07/13 http://timesofindia.indiatimes.com/city/lucknow/Gomti-Riverfront-project-to-start-by-September/articleshow/21381629.cms, visited the 13/02/15

SPECIAL CORRESPONDENT, "Adyar Poonga gets ready for the public", MadrasMusings, published the 1/06/2010 http://madrasmusings.com/Vol%2020%20No%204/adyar-poonga-gets-ready-for-the-public.html, visited the 09/02/15

STAFF REPORTER, "Issues of pollution raised at meeting for Adyar river restoration", The Hindu published the 10/07/14 http://www.thehindu.com/news/cities/chennai/chen-society/issues-of-pollution-raised-at-meeting-for-adyar-river-restoration/article6194140.ece, visited the 03/02/15

STAFF REPORTER, "One lakh mangroves in Adyar Creek soon", The Hindu, published the 9/05/13 http://www.thehindu.com/news/cities/chennai/one-lakh-mangroves-in-adyar-creek-soon/article4696453.ece, visited the 25/02/15

STAFF REPORTER, “More good news for Cooum and Adyar rivers”, The Hindu, published the 02/04/13 http://www.thehindu.com/news/cities/chennai/more-good-news-for-cooum-and-adyar-rivers/article4570821.ece, visited the 15/02/15

STAFF REPORTER, “Lucknow development Authority to get new blueprint of Gomti riverfront Development project”, The Times of India, published the 23/04/13 http://timesofindia.indiatimes.com/city/lucknow/Lucknow-Development-Authority-to-get-new-blueprint-of-Gomti-riverfront-development-project/articleshow/19687344.cms, visited the 17/02/15

STAFF REPORTER “Ecosensitive Adyar Poonga open only for school children”, Times of India, published the 13/02/11http://www.thehindu.com/todays-paper/chennai-river-restoration-trust-to-seek-nod-for-adyar-poonga-second-phase/article2020477.ece, visited the 24/02/15

STAFF REPORTER, “Clean waterways, a mirage for Chennai?”, The Hindu, published the 21/04/08 http://www.thehindu.com/todays-paper/tp-national/tp-tamilnadu/clean-waterways-a-mirage-for-chennai/article1243536.ece, visited the 24/02/15

YADAV S., “Streams of filth”, Indiatoday, published the 17/12/2009 http://indiatoday.intoday.in/story/Streams+of+filth/1/75460.html, visited the 24/02/15

Reports and theses

ARABINDOO P., Constructed ecologies, imagined communities - The politics of Adyar Poonga in Chennai

AVITHA A., Impact of urbanization on rivers of Chennai, International Journal of Scientific & Engineering Research, 2013, 6p.

BEAUCHENE S., Les bords de fleuve, de nouvelles ambiances urbaines, Maison du Fleuve Rhône, 31p.

BONIN S., Fleuves en ville : enjeux écologiques et projets urbains, 2008, 11p.

BRADSHAW A.D., Underlying principles of restoration, NRC Canada, 1996, 7p.

CHENNAI METROPOLITAN DEPARTMENT AUTHORITY
CMDA Seminar on Waterways in Chennai, March 2010, 18p
CMDA Session 3 – River and Drainage system in CMA, 45p
CMDA Session 5 – Studies on Chennai drainage system – rivers canals creeks estuaries lakes
CMDA Second Master Plan 2026, approved in 2007

- Volume I Chapter II Demography, 7p
- Volume III Chapter XII – Environment, 8p
- Volume III Chapter II Development planning in CMA, 17p
- Volume III Chapter VI Maps, 5p
- Volume III Chapter XIV Landuse Planning and strategy, 18p

CMDA Sewage treatment report, 5p

CHENNAI METRO WATER SUPPLY AND SEWAGE BOARD, Session 5: Studies on Chennai drainage system: rivers, canals, creeks, estuaries, lakes. 34p.

COELHO K., RAMAN V., Salvaging and Scapegoating: Slum Evictions on Chennai’s

Waterways, Economic & Political Weekly, May 2010, 5p

GOVERNMENT OF INDIA, Results of programmes for control pollution in India, 2011, 11p

GREENSTONE M., Environmental regulations, Air and Water Pollution, and Infant Mortality in India, September 2011, 48p

Asian Development Bank, Annual report 2007 Volume I, 2008, 125p

GUPTA A. K., NAIR S. S., Flood risk and context of land-uses: Chennai city, December 2010, 8p

KAVITHA A., Impact of urbanization on rivers of Chennai, International Journal of Scientific & Engineering Research, May 2013, 6p.

KENNEDY L., VARREL A. *et al*, Engaging with sustainability issues in Metropolitan Chennai City Report, Chance to Sustain, April 2014, 63p.

KULSHRESTHA S. K., Planning System in India, March 2013, 31p

LAVANYA A. K., Urban Flood Management-A Case study on Chennai city, 2012, 7p

MARIUS-GNANOU K., «New economic activities and metropolitan restructuring: the case of the southern periphery of Chennai», Annales de géographie, October 2010, 23p

MATHUR N., On the Sabarmati Riverfront, Urban Planning as a Totalitarian Governance in Ahmedabad, Review of Urban Affairs, December 2012, 12p.

NAVEED M. S., JANAKIRAMAN A., ALTAFF K., Impact of domestic sewage pollution on rotifer abundance in Adyar Estuary, 2012, 8p

SUJATHA P., JANARDHANAM P. V. S., Population growth-Trends, projections, future plan and development, August 2014, 13p

SCHOOL OF ARCHITECTURE AND PLANNING, Regional Study, Adyar River Revitalisation, Anna University, 2007

SURIYA S., MUDGAL B. V., Assessment of Flood Potential Ranking of Sub watersheds: Adyar Watershed a case study. July 2014, 12p

Printed literature

Theses/Dissertations/Reports

DHARANI P., Impact of urban development on water bodies in Chennai Metropolitan Area, M Plan Thesis, School of Architecture and Planning, Anna University, 2010

GRAVARI M., La mer retrouvée, Baltimore et autres reconquêtes de fronts d'eau urbains, Volumes I,II,III, 1991

HOCHART K., Perspective on slums and Resettlement policies in India, The case of Kannagi Nagar resettlement colony, Chennai, 2014, 100p

HABEEB RAHMAN M. J., Adyar River Front Development, School of Architecture and Planning, Anna University, 1995, 57p

LECHNER G., Le fleuve dans la ville, la valorisation des berges en milieu urbain, Direction Générale de l'Urbanisme, de l'Habitat et de la Construction, 2006, 118p.

JAYALAKSHMI, Environmental planning for Adyar Creek, M Arch Thesis, School of Architecture and Planning, Anna University,1999

JUVILASRI N., Landscaping for Adyar Riverfront Development in Chennai, M Arch Thesis, School of Architecture and Planning, Anna University, 2008

USHA K. V., Development of Adyar Creek Area, M Arch Thesis, School of Architecture and Planning, Anna University, 1994

Books

COELHO K., V. RAMAN, From The Frying-Pan to the Floodplain: Negotiating Land, Water And Fire In Chennai's Development, in Anne Rademacher and K.Sivaramakrishnan Ecologies of Urbanism in India: Metropolitan Civility and Sustainability, Hong Kong University Press, 2013

GOPINATHA RAO C. H., Urban land at what cost a price in Madras Metropolitan Area, 1991

KALPANA K., SCHIFFER F., Madras: The Architectural Heritage – An INTACH guide, Chennai 2003 - 348p

KRISHAN N, DOSHI T., Madras Then Chennai Now, 2014

LOVE H. D., Vestiges of old Madras, Volume I, II, III, IV, 1913

MUTHIAH S., Madras rediscovered, A historical guide to looking around, supplemented with tales of Once Upon a City, East West, Chennai 2008

RUET J., SARAVANAN V.S., ZERAH M-H., The Water & Sanitation Scenario in indian metropolitan cities : Resources and Management in Delhi, Calcutta, Chennai, Mumbai, Publication of the French Research Institutes in India, 2002, 94p.

APPENDIX 1 – QUESTIONNAIRE TO ANALYSE ENVIRONMENTAL AWARENESS

Governmental institutions

General

- What is your role/function for the city of Chennai?
- What are your objectives?

Projects

- What projects have you achieved?
- On what projects are you working now?
- What are the future projects?

- Who are the stakeholders of the projects?
- Who has the initiative for the project?
- How is the project implemented?
- Have you encounter any problems?

State of mind

- Why the river is polluted?
- Have you heard about the Sabarmati river in Ahmadabad?
- According to you is it a good example?
- Did you go to Adyar Poonga when it has been finished?
- Will the project be replicated? Continued? What is the next stage of the project?

Students - Academics

State of mind

- Can you describe the river?
- Do you observe and look at the river? Is there any changes?
- Do you enjoy the view on the river? Would you like to live near the river?
- Do you come on the river bank? Do you have any activity linked to the river?
- According to you what is the best urbanism that can be constructed near the river banks? (which function and for whom)

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Environmental awareness and riverfront development projects

Case study of the Adyar estuary and river banks in Chennai

Around the world cities are revitalizing their waterfronts. These "new" designed areas develop regional tourism, bring people back into long neglected urban spaces and it has been proven to be a popular and successful economic development strategy.

In Chennai the high level of pollution on waterways remains a constant obstacle for sanitary conditions and attractiveness towards the riverside. However an ecological restoration project has begun on the estuary of the Adyar river, questioning whether Chennai intends a future development of the Adyar riverfront.

This study aims to examine the actual environmental awareness on the Adyar river. The thesis analyses different observations, such as riverfront development projects in India, representation of the Adyar river by the citizens and objectives behind the projects -especially ecological restoration & proposals- and their implementation process. On the one hand it assesses the limits of the environmental awareness and the social consequences of the restoration projects. On the other hand this research shows a wish for developing waterfront, in India generally and Chennai, with other purposes than environment preservation.

Key words: environmental awareness, riverfront development, restoration, slums resettlement policies, "bourgeois environmentalism", real estate,