

# Restoration of Tanks in Bangalore Metropolitan Area: Issues and Guidelines

S. Gopi Prasad, B. Shankar

**Abstract:** Bangalore Metropolitan Area, India, is characterized by the integral presence of water bodies (Lakes/tanks) both manmade and natural, with over 400 in total and with over 90 tanks within the metropolitan area and City corporation limits respectively. The city has witnessed unprecedented growth at 3.25 % in the previous decade, while registering a 4.46 % annual growth rate in the past decade. The growth has led to a sprawl and led to indiscriminate use of land, encroachment of water ways/water bodies. The neglect by the authorities coupled with the letting of the sewage and waste water into the water courses have led to environmental degradation and loss of resources. Over the past decade, there have been series of policy and practice interventions adopted by the Government leading to the conservation and rejuvenation of the tanks with varied success. The efforts have been to direct the interventions to serve: better land use management and integration of open spaces. This being tackled through the formal land use plan documents such as the Master plan and protection from encroachments through use of legal instruments; better storm water management allowing the tanks to act as detention ponds and prevent flooding; integrating the tanks with the urban water supply system with provision of utilizing the tanks for storage of re-cycled water and supply reservoirs and improvements to surrounding urban environment and urban ecology/ bio diversity. The paper review various interventions by highlighting the significant results accrued and provides important directions for the strengthening the interventions with a mix of regulatory, ecological, technical and financial parameters at various levels through institutions.

**Keywords:** Tanks, Restoration, land use, management Policy Guidelines.

## I. INTRODUCTION

### BACKGROUND

Bangalore, the capital of Karnataka State is one of India's fast developing city. Today, it is India's fifth largest city, the momentum of its industrial and commercial growth unequalled in the country. Bangalore is located at 12° 50' North Latitude and 77° 57' E longitude, almost equidistant from both eastern and western coast of the south Indian peninsula and is situated at an altitude of 920 m above mean sea level. The mean annual total rain fall is about 970 mm with about 60 rainy days a year over the last ten years. The summer temperature ranges from 18° to 38° C while the winter temperature ranges from 12°C to 25°C.

Thus, Bangalore enjoys a salubrious climate all around the year. Bangalore is located over the ridges delineating four water sheds, viz. Hebbal. Koramangala, Challaghatta and Vrishabhavathi water sheds. The undulating terrain in the region has facilitated creation of large number of tanks providing for the traditional uses of irrigation, drinking, fishing and washing. Even in the early second half of 20<sup>th</sup> century, in 1961, the number of lakes and tanks in the city stood at 262. All lakes, tanks and ponds in Bangalore, without exception have suffered environmental degradation in varying degrees. The degradation is due to the encroachments, eutrophication and siltation due to lack of public awareness, lack of infrastructure and poor governmental interventions. There has been quantum jump in population during the last four decades in Bangalore without corresponding expansion of infrastructure and civic facilities resulting in water bodies in the urban areas to become sinks for contaminants. The main causes for the impaired conditions of the lakes could be summarized as under:

- Rain water runoff discharged in to the lakes through the storm water drain network polluted due to mixing of sewerage with storm water.
- Restricted flow of fresh water through storm water drain network due to diversions and excessive hard surfaces (concrete, pavements, etc).

The situation is changing and attention to the environment is given its due importance. Multiple organizations have been keen in the development of tanks including initiatives taken up BMP, BDA and LDA. Karnataka Forest department has also taken initiatives for the development of tanks. There are 158 tanks in Greater Bangalore while 128 require immediate attention and action towards the restoration and protection. The tanks chosen for the restoration under JnNURM has been part of the 128 tanks. Bruhat Bangalore Mahanagara Palike, Karnataka Forest Department, Bangalore Development Authority has taken up comprehensive development of over 40 tanks within the city. Chain link fencing along with marking of boundary for the water bodies are carried out. Though the intervention in a few tanks have shown remarkable improvements to the immediate environment, action on the larger number of tanks will provide the necessary benefit at the city level. In this regard, the restoration of tanks will contribute towards bettering the environment as well as contributing to a higher quality of life to the citizens at large.

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## II. PROBLEMS OF TANKS

The tanks requires the tank system integrity to be maintained in such a manner with the water bodies, the connection between the tanks in the upstream and downstream, the drains feeding into them, the water sheds or catchment area for protection and restoration. Further, the water bodies are natural depressions and therefore the structural components such as the over flow mechanism

(weir), water drawl mechanism such as sluice, Bunds and the embankment become very important. Due to the urbanisation provision of piped water supply and the reducing of the direct dependence of water bodies have changed the perceived value of the water bodies. However the tanks and the system are of tremendous bio diversity value and support various ecological processes. The Flora and Fauna studies indicate the wealth contained in these systems.

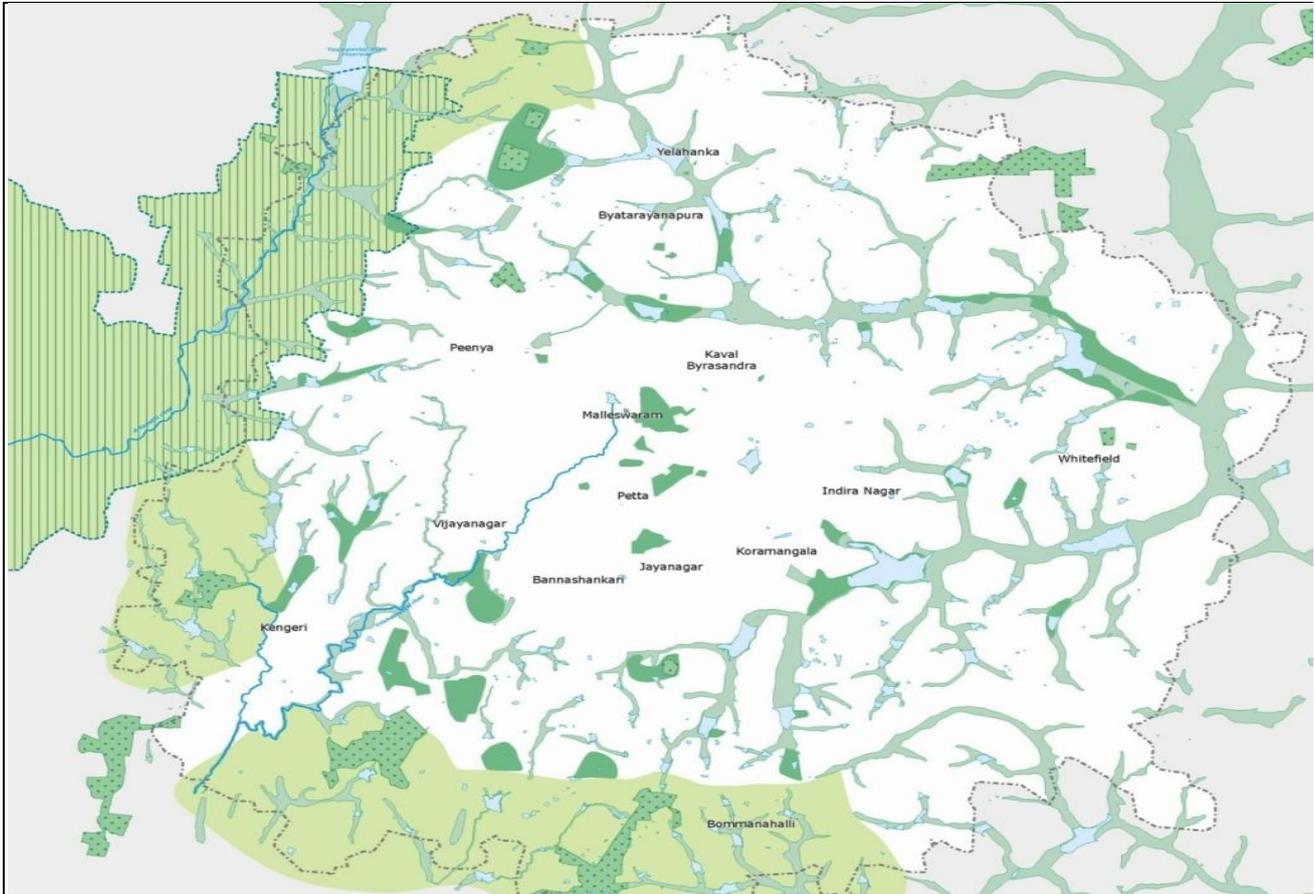


Fig.1 Tanks and Water Bodies in Bangalore; Source: Vision Document RMP, 2015

The present conditions of the tanks have chosen for improvement, which is in bad condition. The water entering the lake is largely comprised of sullage and sometimes sewage from the surrounding developments. The excessive inflow of the sewage/waste water has resulted in the tank to be filled with contaminated water and poses environmental danger. The water impounded in the tank is not fit for ecosystem propagation and can percolate into the ground water. The physical components of the tank such as the waste weir, draft channels are clogged and sometimes dysfunctional. The bundling system also requires repair /rehabilitation almost in all tanks due poor maintenance over the years. In view of improving the ecosystem, enhancing bio diversity and the hydraulic and as well as improving the quality of life /environment, various proposals have been made under the tank restoration projects. The tanks are located in developed areas and can serve as open spaces, passive recreation and lung spaces for the surroundings.

## III. NEED FOR RESTORATION OF TANKS

The proposed restoration programme will help in creating these water bodies as detention ponds, ground water recharge and as important recreational areas. The restoration of the tank is carried out by assessing the ecological aspects of the lake restoration and conservation. Normally the design is based on estimated rain fall, quantum of storm water reaching the tank, impounding capacity of the tank and establishing the linkages within the urban system. The above are substantiated with the studies carried out for physico-chemical characteristics of water, soil studies and the historical data concerning the impounding capacity of the tank. The basic requirement of the project is to restore the tank in terms of physical and hydraulic aspects along with the ecosystem preservation in order to enhance the quality of environment.

**A. Accrued Benefits:**

There would be significant impact in replenishing the ground water as well as addition of valuable open space that would positively impact the entire environment. The clear benefits of the restoring the tanks are:

- a) Improved Ground water conditions in the surroundings
- b) Improved water quality in tanks resulting in improved environment.
- c) Sensitizing and creating awareness about the environment.
- d) Addition of recreational space.
- e) Natural and passive means of treatment of water – downstream areas will benefit from better environmental conditions.
- f) Possible means of mitigating the flooding as the tanks.

**B. Operation and Maintenance of the Water Bodies:**

The individual water bodies are managed by the Lake Development Authority (LDA) or Bangalore Development Authority (BDA) and the Bruhath Bangalore MahanagaraPalike (BBMP). The maintenance activities include the sustenance of the water quality, carrying out minor structural repairs and rehabilitation, solid waste

management, upkeep of the walking tracks, toilets, etc. In case of Hebbal, Nagavara and Vengayanakere- the lakes are allocated for the Develop, Operate and Transfer (DOT) basis – a model based on the private sector initiative to operate and maintain the tank on a lake and land license concession. The private sector can develop the foreshore for recreational purposes as stipulated in the concession agreement. Though, this has led to development of the foreshore and some recreational uses, there has been a debate on whether the common property resources could be allocated to the private parties for commercial operations such as recreational activities, food courts, etc., on the foreshore area of the tanks. It is also contended that the commercial operations are leading to adverse environmental quality of the lake ecosystem. Another model developed by the BBMP and LDA is to allow local Resident Welfare Association (RWA's) to adopt a lake for maintenance. There are over about 76 lakes under this initiative.

The tank restoration involves both capital expenditure and a recurring operational & maintenance expenditure. It is inferred from experience that the restoration based on the natural system design will allow for lower Capital expenditure as well as lower O&M expenditures. In the current context, the conditions of the tanks are varied and are not amenable for levying user charges, recovery of any investment will be very limited in the current practice.

**Table 1: Institutional Mechanism for Conservation of Tanks**

Sl. No	Description	Stakeholder	Remarks
1	Land use around the tanks and wetlands.	BDA , BBMP	Land use management through approvals and sanction.
2	Maintenance of the water body	BDA/BBMP/ LDA/ KFD	Restricted to the legal boundaries of the water body- engineering options
3	Maintenance of feeder channels	BBMP	One time engineering effort- removal of silt , training and solid waste management entering the drains.
4	Pollution at Point and non point sources	BBMP/KSPCB/ BWSSB	Non monitoring of the pollution levels, Pollution at the water body through the quality of water tests
5	Pollution abatement at lakes	Not clear	Treatment plants at the tanks where feasible
6	Removal of Encroachments	Revenue department/ DC Bengaluru	Clearance of the encroachments.

**IV. MANAGEMENT OF LAKES**

The current functioning of the institutions viz., Lake Development Authority (LDA) is lacking the enforcement powers. The A.T. Ramaswamy Committee Report identified encroachments of about 2179 acres of tank bed land. The Government has recently constituted an authority to address the needs of the co-ordination, enforcement of the water bodies in the rural areas at the State level vide an act the Karnataka Conservation Act 2015. The State Government has recently identified BBMP as the sole player responsible for the lakes within the BBMP area. An apex body was also constituted to oversee the lake management in Bangalore.

**V. AGENDA FOR RESTORATION OF TANKS**

Setting the agenda for restoration of the tanks will require considering the new issues emerging from the various studies. The review of a few studies point to the following aspects:

- a) **Climate Change:** Raising temperatures are a concern; the water bodies and vegetative cover in the city have contributed to the lowering of temperature and maintaining the salubrious weather in the microzones of the city.

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- b) Water Conservation and Ground Water Recharge:** Studies carried out by Bangalore University and others point out that the water bodies are effective capture of the rain water and allow for ground water recharge. This is much needed as the ground water levels are falling drastically.
- c) Biodiversity:** Harini N et.al, identified the bio diversity value of the water bodies and the wetlands.
- d) Wetlands in the Urban Areas:** the value of the wetlands in treatment of the waste water and corresponding role in balancing the ecosystem is discussed by RamachandraT.V.et.al.
- e) Resources:** The future proofing of the city a report prepared also points to the direction of protection of water bodies and utilising them for augmentation of the city level scale water supply along with the other reuse strategies. Effective Storm water management thereby preventing of flooding
- f) Cultural and Image Elements in the City:** The water bodies and the wetlands are integral part of the City's landscape. The water bodies have played an important role in structuring a culture of the city. The various morphological studies carried out suggest the important role. The multiple meanings associated with the water bodies and lakes are significant for the urbanization process.

### VI. RECENT INTERVENTIONS BY THE AUTHORITIES

In order to clear the encroachments the administration has taken up a drive recently by demolishing and displacing of families in the Jaraganahalli tank bed. Though the encroachment has been occurring over two decades. Some of the residents were on the same place for over 20 years. The housing of the displaced residents is proposed to be housed in BDA layouts as humanitarian gesture. The NGOs and the Government departments have raised the encroachment and construction in the wetlands in the Agara-Bellanduru valley. This has been raised at the National Green Tribunal as possible obstruction to the flow of water, obstruction of connectivity between the tanks, pollution of the waters, and disturbance to the wetlands in the area.

### VII. PROPOSED POLICY GUIDELINES FOR RESTORATION OF LAKES

The water bodies and the wetlands along with the entire watershed drainage channels (natural Nallahs) are important for the sustenance of the water bodies. With the associated values to the entire ecosystem there is a need to shift the thinking from individual water bodies to the larger chain of water bodies or the ecosystem restoration in totality. There is a need for land use management along with land use planning and implementation mechanisms. As the water body and its ecosystem requires the investment and budgetary support, innovative ways to structure the financing and the development of the entire system is required. There is also a need for centralised technical support for bringing in diverse ways of improving the water quality and overall operations. The policy guidelines and formulation for implementation will require consideration during formulation :

1. Seasonal characteristics of the water bodies: The water bodies are dependent on the rain and this allows the tanks to experience seasonal changes. The water levels in a good monsoon covers the entire tank and sometimes inundates the surroundings too. During the drier seasons, the water spread recedes and sometimes appear very dry. This action is favourable to a number of ecosystems and a tank should not be perceived as “water full Body”.
2. Storage capacity : The tanks are varied in size and shapes though the morphometry may be similar. Some tanks are deep and cover vast areas. The categories of tanks under 40 ha and over 40 by the minor irrigation may be adopted with suitable sizes and storage capacity to develop generic typology.
3. Small to large wetland –The varied sizes area covered by the tanks include the water spread area, the fore shore areas ( bunds) and the wetlands. The marshy areas are vital for the tank ecosystem and they may not be evident in all sizes of the tanks. Care needs to be taken on this aspect as it is home to very large number of species. .
4. Connected vs. standalone –while most of the tanks are interlinked with the channels and the wetlands connecting between them. Some of the kuntas or pools are standalone on surface while being connected under by the underlying geology features.
5. Small catchment vs Large catchment: The integral part of the tank is the catchment it possess. The run off from the catchment finally reaches the tanks, therefore, disturbances in the catchment due to development or changes have adverse impacts on the sustenance of the tank. The size and composition of catchment goes beyond the hydraulic considerations. For intervention , the condition of catchment, size and composition in terms of soil quality, built up areas, vegetation, etc become important.
6. Condition mapping of the tank – The assessment of physical and structural condition of the tanks are required to be carried out. A ranking system can be developed.
7. Purpose of restoration of the water body: The historical purposes of the tanks are to be respected while the newer uses may be envisaged. Given the need for rain water harvesting structures and storage system for water, the tanks can be restored for varied purposes including for drinking water, recycling of water and others.
8. Income level of the surroundings- Tank operation and maintenance is impacted by the social and economic groups surrounding the tanks. Low income and squatter / informal housing is observed at many sites. Devising O&M policy as well as restoration must address this aspect. The often cited encroachment must be dealt with the alternate housing in the immediate surroundings through use of planning schemes, etc. Where the relocation is indispensable, adequate drainage measures and safe housing as well as engineering should be factored in the policy.

9. Clarity of edges/ boundaries: The tanks often have water spread covering private lands. Rarely , the tanks are formed on private lands too ( due to historical conditions). Going by ownership often limits the tank to specific revenue boundary. The edge/ boundary of the natural system requires policy inputs for demarcating the tank and its boundaries. The Nallahs/drains can be used as the spatial structures for organizing the development.
10. Bio diversity index: Each of the water body has the different bio diversity richness. An ecological approach is needed for sustenance and maintenance. This will also impact the type of development around the water bodies and the valley systems.

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### VIII. CONCLUSION

Comprehensive planning, operations and management with sustainable maintenance are possible only by adopting the integrated approaches with the help of Land use planning and implementation. The sensitive zones and the conservation areas require intervention through a mix of Technical, Managerial and Community based initiatives. An integrated model with various inputs can be developed for decision making. The implementation of the same will be best addressed by the planning interventions of varied plans and mechanisms.

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