

The role of Policies of Lake Water Management in Bangalore, India

Lavanya Vikram¹, Neelima Reddy²

^{1,2}MSRIT, Bangalore, Karnataka

Abstract: Water pollution is a serious problem in India as its surface water resource and a growing percentage of its groundwater reserves are contaminated by pollutants. The high incidence of severe contamination near urban areas indicates that the industrial and domestic sectors contributing to water pollution is much higher. Water as an environmental resource is regenerative in the sense, that it could absorb pollution loads up to certain levels without affecting its quality. In fact there could be a problem of water pollution only if the pollution loads exceed the natural regenerative capacity of a water resource. The control of water pollution is therefore to reduce the pollution loads from anthropogenic activities to the natural regenerative capacity of the resource. The benefits of preservation of water quality are manifold. Agricultural run-offs affect groundwater and surface water sources as they contain pesticide and fertilizer residues. Fertilizers have an indirect adverse impact on water resources. Indeed, by increasing the nutritional content of water courses, fertilizers allow organisms to proliferate. Storm water runoff from urban areas is a major source for contamination of water. It should be clearly understood that the role of policies to be compensated fully for the damages from any kind of pollution.

Using available data and case studies, this paper aims to provide an overview of the extent, impacts, and control of water pollution in India, taking the case of lakes in Bangalore.

Keywords: water pollution, environmental issues, lakes, land use, guidelines

1. INTRODUCTION

The lakes in the Bangalore region were constructed in the Sixteenth century by damming the natural valley systems by constructing bunds, since there are no rivers passing by. The earliest history of creation of lakes in and around the city is traced to the founders of Bangalore or Bengaluru, The Kempegowda, in the Sixteenth century and later by the Wodeyars of Mysore Kingdom and the British. Most of the lakes and tanks were purposes of drinking water, irrigation and fishing needs and they have also influenced the climate of the city. The lakes have also served to ground water resources in the vicinity, which are tapped through wells for drinking water. Slowly the condition of lakes in and around Bangalore started getting spoiled due to many reasons

like sewage, block inlets and outlets of the lake, encroachments, dumping of urban domestic waste and many were filled up by municipal authorities in the past to combat malaria.

Lake development authority of Bangalore has instituted as a Society in 2002 to achieve the Preservation and maintenance of all lakes in the metropolitan areas in Karnataka. For sake of convenience and closer monitoring lakes distributed in the custody of various departments. The Action plan approved by the Hon'ble High Court of Karnataka Committee provides Survey and demarcation of the lake, eviction of encroachment, installing boundary fence, stop the inflow of raw pollution into the lake, strengthening the basic structures of the lake, de-silting, de-weeding, laying of embankments and rejuvenation of lakes. Let's see the details in specific to some of the existing lakes

2. ULSOOR LAKE

Significance - The only lake which is existing built by Kempegowda II in 16th century. The British Military station was set up in 1807. Later built by Sir Lewin Bentham Bowring. One of the oldest planning district and densest part in Bangalore established during the 18th century. Previously known as Halasuru Lake, it served as an economic hub for the British with residential quarters, Russell market, Commercial Street, Cantonment railway station. Percentage of open space is the lowest. Ulsoor Lake is the only lung space available.

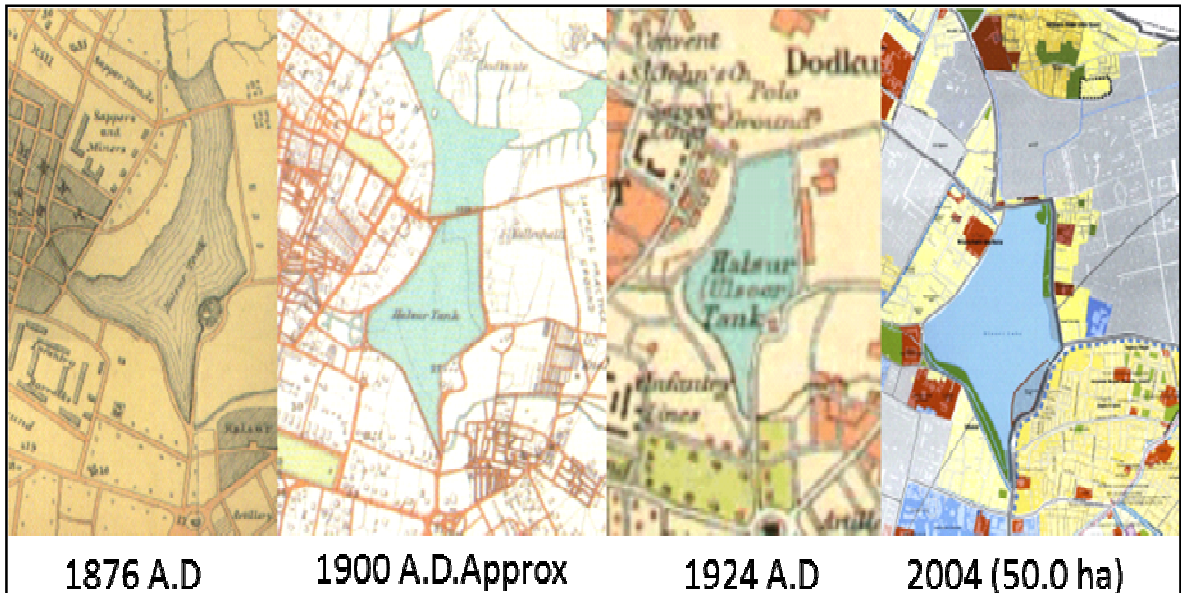
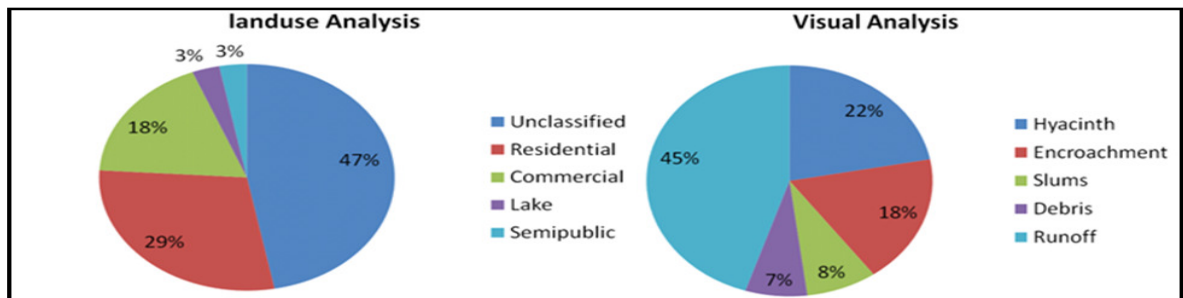


Figure 4 Evolution of Ulsoor Lake since 1537 onwards



Figure 5 Visuals of Ulsoor Lake

Ulsoor Lake Specification	
Coordinates Central Bangalore, 12° 58'53.3" N, 77°37'9.17" E	Sewage pipelines Separate pipelines
Area 50.0 ha	Water quality Stinks but moderately good
Lake Type Man-made Reservoir	Islands 6 no's
Catchment 1.5 Sq. km. Slight slope towards lake	Avg. Depth 19' approx. Not dried completely
Source of Water Rainfall, city drainage	Elevation 931.0m lvl



Pie Chart 1 Landuse and Visual Analysis of Ulsoor lake

Landuse Analysis				Proposed Landuse Analysis -2015			
S.No.	Landuse 2004	Area ha.	Area %	S.No.	Description	Area ha.	Area %
1.	Residential	109.7	35.5	1.	Residential (Main)	19.71	6.38
2.	Commercial			2.	Residential (Mixed)	58.60	18.97
	Trades and business	28.8	9.3	3.	Commercial (Central)	46.48	15.04
	Corporate offices and services	3.4	1.1	4.	Commercial (Business)	12.62	4.09
3.	Industrial	1.1	0.3	5.	Mutation Corridor	-	-
4.	Public and Semi public	35.7	11.6	6.	Commercial Axes	5.15	1.67
5.	Public utilities	-	-	7.	Industrial	-	-
6.	Parks and open spaces	11.3	3.6	8.	Tlgh Tech	-	-
7.	Transportation			9.	Public and Semi Public	29.87	9.67
	Transport facilities	12.2	3.9	10.	Green (Parks and Open Spaces)	50.93	16.48
	Roads + Railway lines	40.2	13.0	11.	Traffic And Transportation	64.57	20.90
8.	Other Spaces			12..	Public Utilities	-	-
	Quarries	-	-	13.	Unclassified	21.00	6.80
	Lakes and Tanks	41.2	13.3	Total		308.95	100.00
	Agricultural land	-	-	Population - 70,669 (Year 2004)			
	Vacant	3.1	1.0				
	Unclassified	22.3	7.2				
Total		309	100				

Landuse and Visual Analysis of Ulsoor lake: There are three drains joining Ulsoor lake at different points: 1st drain starting from the Madras Engineering Group (MEG) 1km. 2nd drain starts from Jeevanahalli, around 2kms from the lake. 3rd starts from Doddigunta and traverses through Kattariyamma garden, Godhandappa garden, Munivenkattappa garden, Muthamma garden and New Corporation colony. All these areas are slums, 1km from lake (2000 houses). MEG maintains the lake. Boat training is undertaken. In 2001 desilting of the lake by Bangalore Mahanagara Palike. Vandalism is strictly prohibited from 2006. 1/4th is covered by algae/hyacinth. Children Park placed near the untreated water which stinks. Aerators provided but not in use. Separate sewage pipelines provided. Separate idol immersion pond provided.



Figure 6 Visuals of Ulsoor Lake

Restoration works have resulted in improvements in the lake environment: Aeration of wastewater that is lead into the lake. Park and swimming pool improved. Desilting of the lake bed and thus increasing depth and the capacity of the lake. Installation of silt traps at the mouth of the storm water inlets. Diversion of underground sewages lines from the eastern part of the City through 900pipes bypassing the lake. Restoration of Aquatic life by introduction of fish species natural to the lake and induction of suitable water plants. Chain-link fencing to prevent people dumping garbage into the lake. Boat training facility of Madras Engineering Group (MEG) improved. Access to public from 9 am to 6 pm with holiday on Wednesday. It is reported that cleanliness drive has breathed new life to the lake.

Table - Ulsoor Lake

WATER QUALITY ANALYSIS				
S.No.	Parameters	Units	L-1	Desirable
1	P/R Ratio	units	Less than 1	saprobic
2	Dissolved Oxygen (DO)	Mg/l	0.1-4.4	High
3	Phosphate	Mg/l	2.02-2.49	High
4	Nitrogen	Mg/l	2.41-3.7	High
5	Chlorophyll	Mg/l	583-1086	Very High
6	Heavy metals	Mg/kg	130-95300	Very High
7	Depth of the sludge	ft	5	Eutrophication

Table - Shivpura Lake

WATER QUALITY ANALYSIS					
S.No.	Parameters	Units	L-1	L-2	Desirable
1.	pH		8.5	7.8	6.5- 8.5
2	Color	Hazen units	20	20	5-25 max.
3	Turbidity	NTU	5	5-10	5-10 max.
4	Total dissolved solids	Mg/l	1835	1779	500-2000max.
5	Hardness	Mg/l	800	1000	300-600max.
6	Sodium	Mg/l	445	550	200-400 max.
7	Chlorides	Mg/l	>920	>1150	250-1000max.
8	Magnesium	Mg/l	87	36	30-100 max.
9	Calcium	Mg/l	170	105	75-200 max.

Karihobanahalli and Shivpura Lake

Location: Herohalli, as a peripheral planning district limiting the city’s urbanization in the western part, this has the potential for redevelopment of the old industrial area. It also establishes future residential areas while protecting the vast expanse of green areas.

Significant Elements: In 1950’s -60’s the Govt. set up Peenya Industrial Area. Small scale industries developed by KSIDC. The KIADB also developed bigger industrial units. In NorthEast – Industrial area, Central & South East –Layouts, extension of the city West - green areas and agricultural land. The natural features along Magadi Road are encroached by industrial and housing. **Water supply:** BWSSB does not cover this area.100.9 connection per 1000 inhabitants. Bore wells are their only source.

Shivpura Lake Specification:	
Area: L-1= 34.81 ha, L-2= 15.50 ha	Max. Depth: 12’-15’ Approx. Not dried completely
Lake Type: Man Made Reservoir	Catchment: L-1= 220.71 ha, L-2= 63.43 ha. Slope of 15 deg
No. of industries: 3500	STP: Few industries only
Source of Water: Rainfall, Drain, Waste water drain	Water quality: Unfit for industrial use. Hazard zones
Sewage pipelines: None	



Figure 7Karihobanahalli and Shivpura Lake

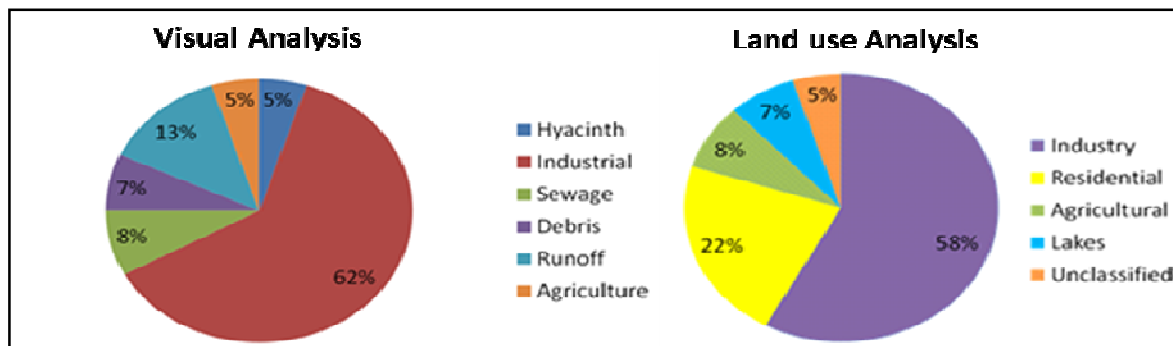


Figure 8 Visual and Land use Analysis of Shivpura Lake

Analysis: Source of pollution: domestic sewage, industrial effluents, storm water runoff, and chemical runoff. Status of pollution: Toxic. Biodiversity: aquatic plants vanished, weed growth. Birds are vanished. Dead fishes found. Unsuitable for industrial use.

Management recommendation: Declare the wetland as a hazard zone. Ban all grazing animals and agricultural activities from this area. Declare the moratorium on fishing as fishes may be contaminated. Divert all industrial effluents. Isolate the lake by fencing and blocking all routes that traverse through the lake basin and bunds.

<u>Existing Landuse Analysis</u>				<u>Proposed Landuse Analysis -2015</u>			
S.No.	Landuse 2004	Area ha.	Area %	S.No.	Description	Area ha.	Area %
1.	Residential	690.4	11.9	1.	Residential (Main)	2310.76	64.01
2.	Commercial			2.	Residential (Mixed)	61.36	1.7
	Trades and business	36.1	0.6	3.	Commercial (Central)	-	-
	Corporate offices and services	1.0	0.0	4.	Commercial (Business)	1.14	0.03
3.	Industrial	390.9	6.7	5.	Mutation Corridor	52.97	1.47
4.	Public and Semi public	174	3.0	6.	Commercial Axes	36.68	1.02
5.	Public utilities	3.1	0.1	7.	Industrial	342.20	9.48
6.	Parks and open spaces	5.8	0.1	8.	High Tech	-	-
7.	Transportation			9.	Public and Semi Public	133.17	3.69
	Transport facilities	-	-	10.	Green (Parks and Open Spaces)	153.92	4.26
	Roads + Railway lines	418.9	7.2	11.	Traffic And Transportation	466.48	12.92
8.	Other Spaces			12.	Public Utilities	51.21	1.42
	Quarries	-	-	13.	Unclassified	-	-
	Lakes and Tanks	130.9	2.2	Total		3609.89	100.00
	Agricultural land	2376.1	40.9	Population - 2,06,263 (Year 2004)			
	Vacant	1583.6	27.3				
	Unclassified	-	-				
Total		5810.8	100.0				

Koramangala Tank-National Sports Complex(NGV Complex):

(Vanished lake)

Formed by BDA in 1970's to cater to the housing demand. The former Koramangala Tank was drained out and the National Games village apartment complex was built. Consists of 14 blocks of 2500 houses. NGV Township in Koramangala is huge concentration of high profile residents, including judges, army officers and top bureaucrats

Location: Surrounded by high end residential areas like -North Richmond Town, N –W Shatinagar West Lakkasandra, N –E Unclassified area

Significant Elements: High level commercial activity along the main street. It has the right proportion of residential uses, commercial, industries and educational institutions. Slums occupy the left over areas, especially along the drain that passes through Austin Town .Does not require fresh infrastructure but needs better management.

Water and Sanitation: Majority of the household depend on water from bore wells, which has put strain on the existing water resource.

Roadways: Intermediate Ring Road connecting to the Airport. Major Urban Road connects with Madiwala National Highway (NH-7) Hosur Road

Planning Recommendation: Delineate the parcels of the land opposite the National Sports Village and the area adjacent to the drain with the area improvement perimeter to promote the basic infrastructure facilities and housing for the economically weaker section –the objective is to facilitate livable condition.



Figure 9 Photos on site showing the drainage line behind NGV. Slums are encroached to the boundary. Sewages are left directly to the drainage nala indicating point source pollution. Water overflowing from open drains into the residential area.

<u>Existing Landuse Analysis</u>				<u>Proposed Landuse Analysis -2015</u>			
S.No.	Landuse 2004	Area ha.	Area %	S.No.	Description	Area ha.	Area %
1.	Residential	340.6	44.5	1.	Residential (Main)	306.85	40.09
2.	Commercial			2.	Residential (Mixed)	68.20	8.91
	Trades and business	21.5	2.8	3.	Commercial (Central)	-	-
	Corporate offices and services	14.8	1.9	4.	Commercial (Business)	2.42	0.32
3.	Industrial	21.4	2.8	5.	Mutation Corridor	14.38	1.88
4.	Public and Semi public	147.9	19.3	6.	Commercial Axes	18.74	2.45
5.	Public utilities	-	-	7.	Industrial	19.71	2.58
6.	Parks and open spaces	25.4	3.3	8.	High Tech	14.55	1.90
7.	Transportation			9.	Public and Semi Public	160.53	20.98
	Transport facilities	2.6	0.3	10.	Green (Parks and Open Spaces)	25.16	3.29
	Roads + Railway lines	106.4	13.9	11.	Traffic And Transportation	125.40	16.39
8.	Other Spaces			12..	Public Utilities	7.84	1.02
	Quarries	-	-	13.	Unclassified	1.54	0.20
	Lakes and Tanks	-	-	Total		765.32	100.00
	Agricultural land	-	-	Population - 1,78,784 (Year 2004)			
	Vacant	79.5	10.5				
	Unclassified	4.1	0.5				
Total		764.3	100				

3. AFTER EFFECTS OF CONVERTING THE TANK:

The trauma has just started with the first few summer showers. We had water overflow from the drains reach areas near the center court in Tungabhadra, NGV on 22 April 2010. BBMP had earlier taken an on the spot decision to open up the drains. The drains are opened up completely in spite of several protests and requests from NGV. Court order– Ensures the boundary wall would be built and wire mesh placed on top to ensure water does not overflow. Presently Karnataka Housing Board (KHB) officials, maintain the NGV Township. Karnataka Government promises Construction of 1,512 quarters for the Economically Weaker Section (EWS) at Ejipura near National Games Village in Koramangala. (*Karnataka HC clears construction of EWS quarters Aug. 25, 2012*)

{Source: Social networking forum and interviews}

4. CONCLUSION

The land of thousand lakes, Bangalore is today in search for the remnants of a glorious heritage that boasted of a well laid and inter-connected chain of tanks and lakes that quenched the thirst and irrigated its fields. The policies seem to have addressed only the issues of public recreation, livelihood and fencing but not on the very important aspects of removing encroachments, water recharge and maintaining the existing biodiversity. The city's forefathers including Kempegowda and the Britishers had given a lot of thought and constructed many lakes and tanks in the absence of any known water source to fulfill the needs of the then miniscule population. The climate of Bangalore was salubrious and temperatures bearable in the summer months because the 400 odd lakes in the city used to act as the perfect carbon sink apart from fulfilling the water needs of the populace. But, over the next century, with rapid industrialization and urbanization, these water sources have disappeared in the guise of 'degraded lands' and even the authorities have colluded with real estate sharks to hand over these lung spaces for building bus stands, shopping complexes, residential layouts and apartment complexes. The government has not enforced any proper policy to retain or regain water bodies in the city of Bangalore. According to water management experts, with most lakes in Bangalore surrounded by garbage dumps and solid waste, there is an urgent need to first clean the area around the lake to ensure free flow of water into the lakes. But till date, only visible rejuvenation measures like erecting walking pathways, colorful benches and decorative boards are evidently seen.

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