

Members of the Committee:

1	Additional Chief Secretary, Urban Development Department, Bangalore.	Chairman
2	Commissioner, Bangalore Development Authority, Bangalore.	Member
3	Member Secretary, Karnataka State Pollution Control Board, Bangalore.	Member
4	Chairman, BWSSB, Cauvery Bhavan, Bangalore.	Member
5	Chief Executive Officer, KLCDA, Bangalore.	Member
6	Secretary, Dept. of Minor Irrigation, Bangalore.	Member
7	Commissioner, BBMP, Bangalore	Member
8	Deputy Commissioner, Bangalore Urban District, Bangalore	Member
9	Chief Engineer, WMM, BWSSB, Cauvery Bhavan, Bangalore.	Member
10	Chief Executive Officer, Namma Bangalore Foundation, Bangalore.	Member
11	Prof. T.V. Ramachandra, IISc, Bangalore.	Member
12	Prof. Ramaprasad, Chief of Technical Committee, LDA	Member
13	Dr. Yellappareddy, Environment Specialist, Bangalore.	Member
14	Dr. Sharachchandra Lele, ATREE, Bangalore.	Member
15	Chairman, Bellandur Residents welfare Association, Bangalore.	Member
16	Sri Ramamurthy, Original Applicant of PIL, Regarding Bellandur lake.	Member
17	Sri Siddaiah, IAS, (Retd) Commissioner, BBMP, Bangalore.	Member
18	Engineer Member, Bangalore Development Authority, Bangalore.	Executive Member

TABLE OF CONTENTS

ACKNOWLEDGEMENTS	4
LIST OF ABBREVIATIONS	5
1. BACKDROP.....	7
2. FORMATION OF THE COMMITTEE.....	8
3. TERMS OF REFERENCES OF THE COMMITTEE	9
4. ACTIVITIES UNDERTAKEN and APPROACH.....	10
5. FINDINGS /FIELD OBSERVATIONS BY THE COMMITTEE	10
6. BASIC FEATURES OF THE LAKES.....	10
7. CONTEMPORARY RELEVANCE OF THE LAKE AND BENCHMARKS FOR LAKE MANAGEMENT	13
8. DESCRIPTION OF THE PROBLEM.....	14
8.1 POLLUTED CONDITION OF THE LAKES	14
8.2 SOCIO-ENVIRONMENTAL IMPACTS OF LAKE WATER POLLUTION:	15
9. CAUSES OF THE PROBLEM.....	22
9.1 SINGLE MAJOR PROXIMATE CAUSE.....	22
9.2 AGGRAVATING FACTORS	24
9.3 DEEPER CAUSES.....	25
10. RECOMMENDATIONS.....	26
10.1 THE SUCCESS OF REJUVENATION.....	26
10.2 SHOTR TERM REMEDIAL MEASURES	27
10.3 LONG TERM REMEDIAL MEASURES.....	29
10.4 LONG TERM MONITORING AND COMPLIANCE í í .. í í í í 0.....	31
REFERENCES.....	34

ANNEXURE 1	COMMITTEE NOTIFICATION AND TERMS OF REFERENCES
ANNEXURE 2	LIST OF COMMITTEE MEETINGS AND FIELD VISITS
ANNEXURE 3	(I) TENTATIVE ESTIMATE FOR DESILTING AND DEVELOPMENT
	(II) COMPARITIVE ASSESSMENT OF DRY DESILTING AND WET DREDGING
ANNEXURE 4	DETAILS OF EXISTING, ONGOING AND PROPOSED SEWAGE TREATMENT PLANTS AND OTHER DETAILS PERTAINNIG TO BWSSB
ANNEXURE 5	LIST OF SURVEY SKETCHES BY REVENUE AUTHORITIES
ANNEXURE 6	INFORMATION FURNISHED BY K.S.P.C.B.
ANNEXURE 7	LIST OF TECHNICAL AND FINANCIAL PROPOSALS RECIEVED
VOLUME-2	DETAILS OF SURVEY SKETCHES OF STORM WATER DRAIN AND
ANNEXURE 8	SLAUGHTERHOUSES IN THE CATCHMENT BY B.B.M.P.
ANNEXURE 9	õ U C X G " D G N N C P IOW PLAN BY NAMMA BENGALURU FOUNDATION.

ACKNOWLEDGEMENTS

The Committee could not have completed its task without the support of many individuals and organizations. While acknowledging all of them is practically impossible, we would like to thank all of them.

LIST OF ABBREVIATIONS:

MoEFCC	Ministry of Environment and Climate Change
CPCB	Central Pollution Control Board
KSPCB	Karnataka State Pollution Control Board
BDA	Bangalore Development Authority
NGO	Nom-Government Organisation
UDD	Urban Development Department
BWSSB	Bangalore Water Supply and Sewage Board
BMRDA	Bangalore Metropolitan Development Authority
KLCDA	Karnataka Lakes Conservation Development Authority
KIADB	Karnataka Industrial Development Board
BBMP	Bruhath Bengaluru Mahanagara Palike
CMC	City Municipal Council
WMM	Waste water Management
ATREE	Ashoka Trust For Research in Ecology and Environment
MLD	Million Litres Day
K & C valley	Koramangala & Challaghatta Valley
STP	Sewage Treatment Plant
ETP	Effluent Treatment Plant
DO	Dissolved Oxygen
BOD	Biochemical oxygen demand
DOC	Dissolved Organic Carbon
ENVIS	Environmental Information System
CES	Centre For Ecological Science
STPP	Sodium Tri Poly Phosphate
Cd	Cadmium
Pb	Lead
Cu	Copper

Ni	Nickle
Co	Cobalt
Fe	Ferrous
Mn	Manganese
Zn	Zinc
SWD	Storm Water Drain
UGD	Under Ground Drainage
RMP	Revised Maser Plan
CDP	City Development Plan
C & D	Constructional Debris
G.O.	Government Order
MLA	Member Of Legislative Assembly
MP	Member Of Parliament
NGT	National GreenTribunal
TMC	Thousand Million Cubic Feet

1. BACKDROP:

The landscape in and around Bangalore is dotted with hundreds of man-made lakes which were originally irrigation tanks constructed over the past centuries. They were also important as sources of drinking water, for washing, fishing and wider aquatic habitat. As the city grew, agricultural lands got converted into built-up areas, and the importance of tanks as irrigation structures declined. While some traditional uses continue, viz., washing, fishing, and reed collection, the lakes have gained much more importance for the environmental amenities they provide in a highly urbanized context, viz., recreational space, micro-climatic benefits, aquatic and bird habitat, including the birds that migrate from far ofa region for breeding purposes, for vegetable growing in the downstream areas, groundwater recharge, etc.

Unfortunately, while urbanization proceeded at a very high pace in the Bangalore region, the mismanagement of urban wastewater in particular and other environmental processes accompanying urbanization (such as solid waste generation, protection of natural stream flow channels) resulting in the pollution of most lakes during the past two decades, has led to a variety of adverse environmental including health issues: stinking lakes, fish kills, contamination of ground water, contamination of the food chain, etc.

Bellandur and Varthur lakes are the two largest lakes, of Koramangala & Challaghatta Valley in Bangalore that have been receiving the largest amount of wastewater. During the pre-monsoon of 2015, due to high wind coupled with rainfall, massive froth and aerosol formation was noticed in the southern waste weir of Bellandur lake eventually overflowing onto the neighbouring road obstructing traffic (**Figure 1**).



Figure 1: Froth at the waste weir of Bellandur lake

To make things worse, on **May 16, 2015**, the froth at the northern waste weir (Yamalur weir) of Bellandur lake caught fire and this created fear and anxiety in the minds of the people living in that region, leading to a major public outcry (**Figure 2**).

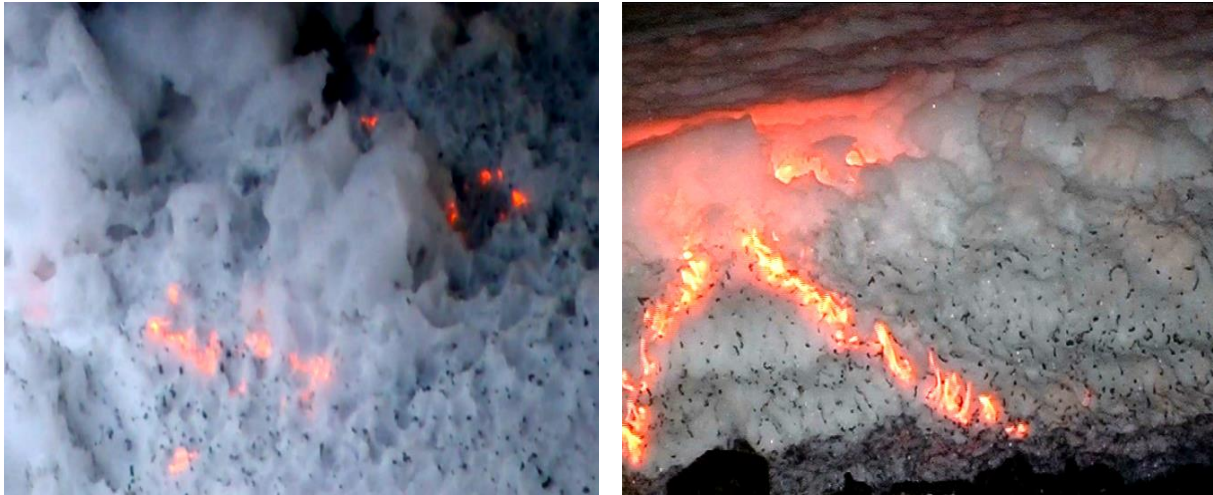


Figure 2. Fire in the froth at Bellandur lake

Responding to these concerns, The Ministry of Environment, Forests and Climate Change (MoEFCC), Government of India instructed the regional office of the Central Pollution Control Board (CPCB) to carry out an analysis and submit a report within a month. According to CPCB findings, the causal factors for froth and fire are due to sustained inflow of untreated sewage and industrial effluents. Subsequently, Bangalore Development Authority (BDA) submitted two Detailed Project Reports to MoEFCC for restoration and comprehensive development of Bellandur and Varthur lakes. Subsequently, a consultative meeting on this issue was conducted on 5 May 2016 involving all stakeholders (Government Officials, Representatives from NGOs, Academic Institutions, Industries, etc. Discussants of the meeting requested the Government to setup an expert committee to understand the problem and for sustainable solutions towards the rejuvenation of lakes.

2. FORMATION OF THE COMMITTEE AND ITS TERMS OF REFERENCES:

In response to this, an Expert Committee comprising of experts in the field under the chairmanship of Additional Chief Secretary to Government, Urban Development Department, Government of Karnataka was constituted to take up a study addressing the problems of lake contamination as well as the feasible technical solutions towards the restoration of lakes. Consequently, Urban Development Department, Government of Karnataka issued an order constituting an Expert Committee under the chairmanship of Additional Chief Secretary to Government of Karnataka, Urban Development Department vide Government Order No. UDD 212 MNJ 2016, dated 10-05-2016 with the following as members.

1	Additional Chief Secretary, Urban Development Department, Bangalore.	Chairman
2	Commissioner, Bangalore Development Authority, Bangalore.	Member
3	Member Secretary, Karnataka State Pollution Control Board, Bangalore.	Member
4	Chairman, BWSSB, Cauvery Bhavan, Bangalore.	Member
5	Chief Executive Officer, KLCDA, Bangalore.	Member
6	Secretary to Government, Minor Irrigation Department, Bangalore.	Member
7	Commissioner, BBMP, Bangalore	Member
8	Deputy Commissioner, Bangalore Urban District, Bangalore	Member
9	Chief Engineer, WMM, BWSSB, Cauvery Bhavan, Bangalore.	Member
10	Chief Executive Officer, Namma Bangalore Foundation, Bangalore.	Member
11	Dr. T.V. Ramachandra, Professor, IISc, Bangalore.	Member
12	Prof. Ramaprasad, Chief of Technical Committee, KLCDA	Member
13	Dr. Yellappareddy, IFS (Rtd.), Environment Specialist, Bangalore.	Member
14	Dr. Sharachchandra Lele, ATREE, Bangalore.	Member
15	Chairman, Bellandur Residents welfare Association, Bangalore.	Member
16	Sri Ramamurthy, Original Applicant of PIL, Regarding Bellandur lake.	Member
17	Sri Siddaiah, IAS, (Retd), Bangalore.	Member
18	Engineer Member, Bangalore Development Authority, Bangalore.	Executive Member

3. TERMS OF REFERENCES:

- (1) To suggest vendor agnostic appropriate technology that can be used / adopted for one-time Restoration / Rejuvenation of the lake.
- (2) To recommend targeted quality parameters of the lake water to be achieved at the end / completion of the restoration project, for short term as well as long term.
- (3) The mode of maintenance after completion of the project.
- (4) To suggest structure and support for planning and implementation as well as follow up of sustainable and effective " d k q f k x g t u k v { " e q p u g t x c v k q p ö " r
- (5) Prepare timely detailed or summarized technical reports, letters and documents.
- (6) Arrange individual or group field visits to the project sites to monitor the progress.
- (7) To document the events properly, prepare news for the website and communicate with media for advocating the project.
- (8) To work closely with project staff members, e q p u w partners stakeholders to facilitate fulfillment of the project objectives.
- (9) Provide communications input to project activities where required.
- (10) Support activities related to organization of conferences, seminars, training courses etc.

The Committee was given a time frame of 6 weeks to submit the report.

4. ACTIVITIES UNDERTAKEN AND APPROACH ADOPTED BY THE COMMITTEE.

Ever since the formation of an Expert Committee, the Committee has conducted as many as 10 meetings commencing from 24-05-2016 under the chairmanship of Additional Chief Secretary, Urban Development Department. The Committee deliberated on the subject as extensively as possible and elicited the views from experts as well as from others. The Committee also carried out field visits and went round the lakes (Bellandur lake on 1st June and Varthur lake on 9th June 2016) in the boat to understand the magnitude of the problem. The Committee also conducted a public hearing, (at Varthur kodi on 9th June 2016) and received representations from affected local residents, NGOs and resident welfare associations.

5. FINDINGS / FIELD OBSERVATIONS BY THE COMMITTEE

The Committee took note of the prevailing environmental conditions of the lakes, evident from intolerable levels of smell and a very poor unhygienic conditions. The Committee was in full agreement with the view that the management of waste water that flows into these lakes has not kept pace and as a result, the lakes have come to suffer abnormal levels of pollution in terms of septicity, obnoxious odour, aerosols with toxic volatile organic compounds, eutrophication, breeding of mosquitoes, disappearance of native fish species, algal bloom, and profuse growth of invasive exotic aquatic macrophytes. There have been adverse environmental and public health consequences. The local community complained about the water borne diseases, contaminated bore well water (due to poor environmental conditions), etc. The Committee is convinced of the problems faced by the local biological entities (humans, livestock, etc.) of serious water and soil contamination and consequent impacts in the food chain. The Committee also witnessed massive formation of froth / foam and floating of froth with aerosols in the atmosphere. The Committee took note of earlier event of fire possibly due to industrial effluent contamination.

6. BASIC FEATURES OF THE LAKES

Bellandur and Varthur lakes are located in the south-eastern portion of Bangalore metropolitan region (**Figure 3**) with spatial extent of 370 hectares and 180 hectares respectively. Catchment of these lakes (**Figure 4**) ranges from 158.5 sq.km. to 279. sq.km.

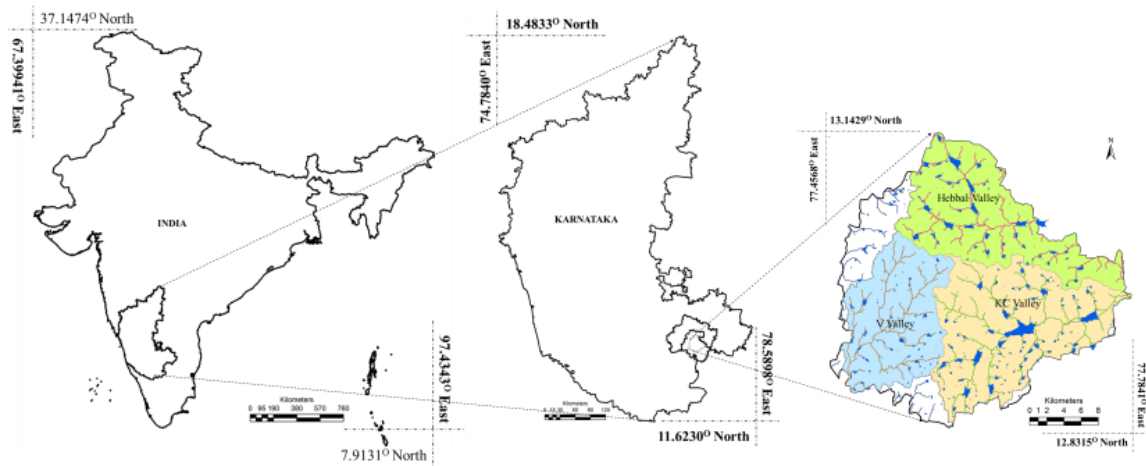


Figure 3: Interconnected Lake systems in Bruhat Bangalore

These lakes were originally built by our ancestors to meet the domestic and irrigation demands in the region. Their current storage capacities (after sedimentation) are estimated to be 5.5 Mm³ and 1.6 Mm³ respectively.

Currently, due to the complete urbanization of the Bellandur catchment and partial urbanization of the remaining Varthur catchment, they are estimated to receive a steady (dry season) flow of 480 MLD from the K&C valley (city sewage) and 60 to 70 MLD from local storm water drains (at Varthur lake)¹. In addition, of course, during the monsoon, the lakes receive surface runoff (precipitation) through storm water drains.

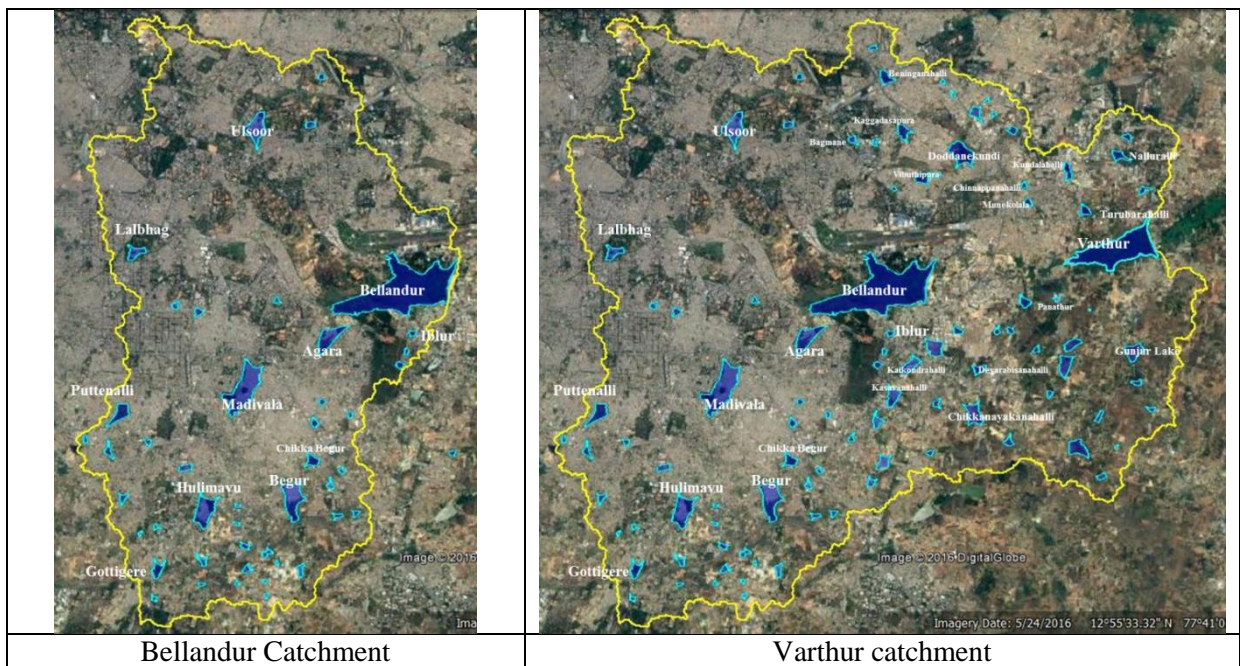


Figure 4: Bellanduru and Varthuru Lake Catchments

¹These measurements are from 2008. The flows need to be re-measured now.



Figure 5: Location of inlets to Bellandur Lake

Figure 6: Locations of inlets into Varthur lake

These inflows come from various inlets. As seen in **Figure 5 and 6**, Bellandur lake itself has 4 main stormwater drain inlets (2 inlets from K&C Valley STP). The 4 main inlets are Ejjipura drain, Agara valley drain, Challaghatta valley drain and Ibbalur drain (**Figure 5**). For Varthur lake, the main inflow comes from Bellandur lake, in addition to which there are 28 local minor inlets(**Figure 6**) for details.

