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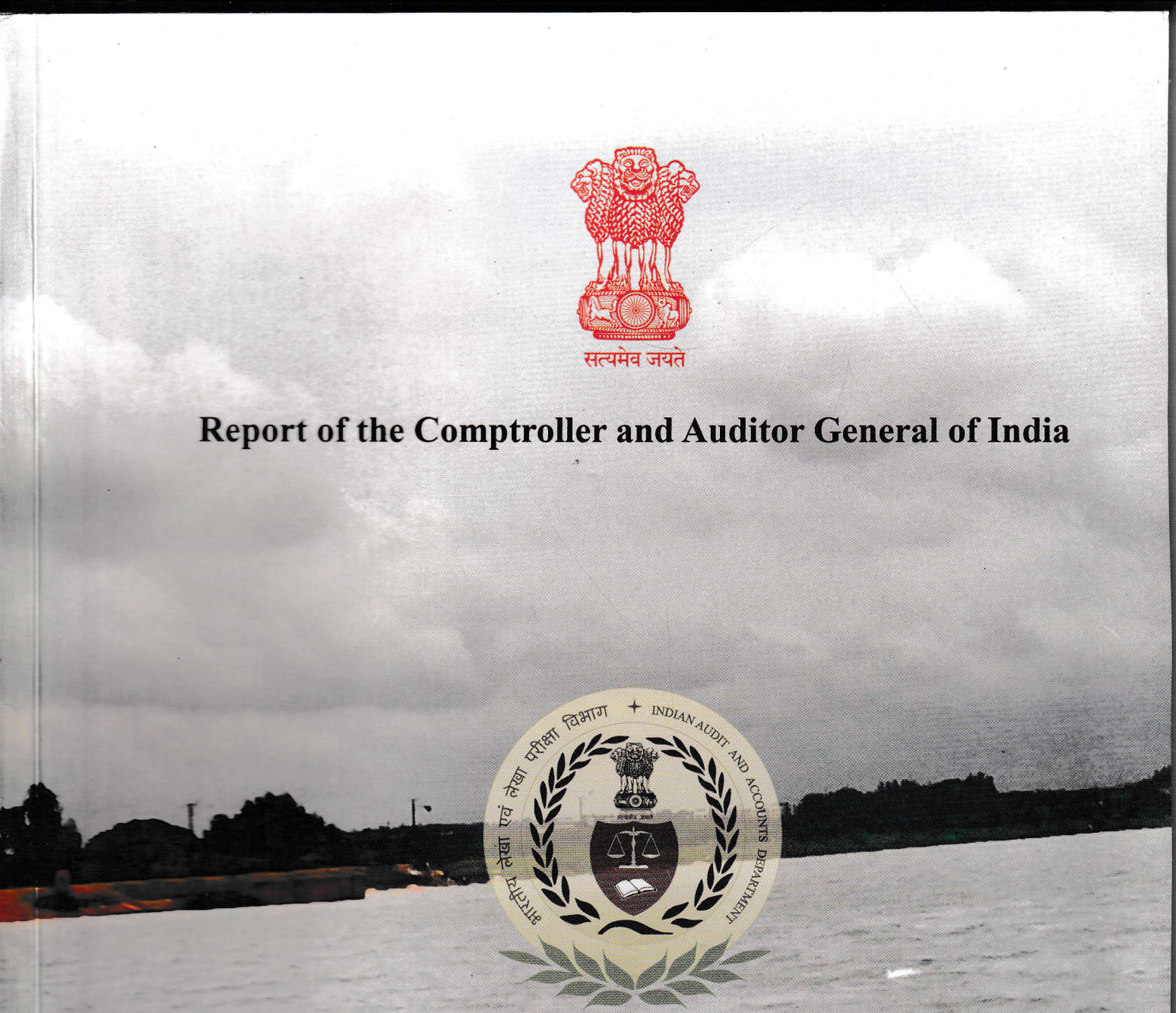
Report of the Comptroller and Auditor General of India



Performance audit on Conservation and Ecological restoration of Lakes under the jurisdiction of Lake Development Authority and Urban Local Bodies

GOVERNMENT OF KARNATAKA

Report No.1 of the year 2015

Report of the Comptroller and Auditor General of India

Performance audit on Conservation and Ecological restoration of Lakes under the jurisdiction of Lake Development Authority and Urban Local Bodies

Government of Karnataka

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PREFACE

1. This Report of the Comptroller and Auditor General of India for the year ended March 2014 has been prepared for submission to the Governor of Karnataka under Article 151 (2) of the Constitution of India for being laid before the State Legislature.

2. The Report covering the period 2009-14 contains the results of performance audit of 'Conservation and Ecological restoration of Lakes under the jurisdiction of Lake Development Authority and Urban Local Bodies'.

3. Audit has been conducted in conformity with the Auditing Standards issued by the Comptroller and Auditor General of India.

Executive summary

Lakes and reservoirs which are crucial for human survival are facing degradation all over the world. Deterioration of water quality, loss of biodiversity and fast depletion of water resources are the main challenges which need urgent attention. Further, urbanisation has increased pressure on water bodies with increasing demand on land for infrastructural needs.

A Performance audit on "Conservation and Ecological restoration of Lakes under the jurisdiction of Lake Development Authority and Urban Local Bodies" was conducted to assess the effectiveness of the initiatives taken by various agencies involved in conservation and rejuvenation of the lakes in urban and semi-urban areas.

The results of Performance audit showed that institutional mechanism for conservation and restoration of lakes was weak. Lake Development Authority, being the regulatory body for monitoring and supervising the activities of entities involved in restoration works of lakes, was inactive as it was not carrying out its mandated roles and responsibilities. Lake Development Authority did not initiate measures for an integrated approach in planning and prioritisation of lakes for restoration amongst all the entities responsible for conservation, restoration and development of lakes. Coordination among the implementing agencies was deficient, resulting in works taken up without adequate prioritisation, construction of sewage diversion channels, fencing without removal of encroachments, *etc*.

(Chapter III - Paragraphs 3.1 to 3.4)

Efforts to involve local communities in the conservation and restoration of lakes were absent as no lake management committees, involving voluntary organisations, had been established for any of the test-checked lakes. Grievance Redressal Mechanism was not effective as there was no move towards establishing a single window grievance redressal cell. Transparency in administration of lakes was poor as partial information only was available in public domain. While monitoring of restoration works was lacking, financial management needed strengthening.

(Chapter III - Paragraphs 3.5 to 3.7)

Survey and demarcation of the lakes test-checked remained incomplete. The extent of the lake area varied in different records indicating reduction in lake area over a period of time. This was mainly due to grant of lake area for construction of roads; infrastructure and residential layouts; and change in land use. Also, encroachment of lake area caused choking/blocking of catchment drains, loss of foreshore area and wetland thereby leading to shrinkage in water spread area. Instances of reduction in height/breach of waste weirs leading to shrinkage in water spread area were also observed.

(Chapter IV - Paragraphs 4.1 to 4.6)

Neither the Karnataka State Pollution Control Board nor the implementing agencies had complete data on the pollution levels in the lakes. The assessment of pollution was inadequate and the water quality of none of the test-checked lakes conformed to the prescribed standard. Major source of pollution in Bengaluru was sewage which could not be regulated by Bengaluru Water Supply and Sewerage Board. The construction of underground drainage lines to convey sewage was still under progress and the treatment of sewage was inadequate. The diversion of sewage, due to it being untreated, from the inlets to the waste weir of the lakes resulted in drying up of lake beds, and loss of its ecological characteristics.

(Chapter V - Paragraphs 5.1, 5.2 and 5.6)

Deficiencies were noticed in restoration works carried out by the implementing agencies. Works like de-silting were carried out excessively and without justification. Improper construction of embankments prevented free inflow of run-off water from the surrounding catchment areas thereby reducing the water inflow into the lakes. Instead of priortising core works for lake rejuvenation, non-core works were given undue significance. The agencies had not assessed the impact of pollution in lakes and related risks to human health, biodiversity and ground water.

(Chapter V- Paragraphs 5.5, 5.7 and 5.10)

Preservation of biodiversity in the test-checked lakes was badly affected due to destruction of gentle slopes on shorelines and formation of ringed elevated bunds. This caused irreparable damage to the fragile wetland ecosystem and resulted in loss of habitat of aquatic weeds and birds. No buffer zone within 30 metres of the periphery of the lake was ensured; instead it was observed that the buffer zone had been breached in several cases.

(Chapter VI)

Lake specific findings of the 12 test-checked lakes indicated that in most cases restoration works were carried out without arresting sewage flowing into the lakes and water quality was not being monitored. Works were also undertaken without removal of encroachments.

(Chapter VII)

Chapter I

Introduction

1 Background

Lakes are an important feature of the Earth's ecosystem. Lakes[1] are transitional areas between dry terrestrial and permanent aquatic ecosystems. They provide a wide diversity of values and uses such as for supply of water, food, fodder, fuel, fishery, aquaculture, timber production, transport, ecotourism, culture and heritage, research and educational values, *etc*. Lakes, in general, have the characteristics such as catchment area for water run-off/catchment drainage system, foreshore region, wetland formation with aquatic vegetation, water spread area with flora and fauna, bund for supporting storage of water, waste weir for excess outflow of water, *etc*. There are 36,568 lakes/tanks in Karnataka[2], which are under the control of various authorities.

Due to rapid urbanisation and change in land use pattern, the lake areas including catchment areas have been encroached in many cases. This led to reduced inflow of water into lakes, thereby resulting in numerous lakes being lost over the years. Many lakes have lost even their original characteristics. Some of the prominent lakes that have lost their characteristics are given in **Appendix 1**.

Owing to the above reasons, the State Government felt the necessity to constitute (July 1985) an expert committee (headed by Shri. N. Lakshman Rau, IAS (Retired)) to look into various aspects relating to preservation and restoration of the existing lakes/tanks. The Committee, *inter alia,* recommended that efforts should be made to ensure that these lakes are not breached but retained as water bodies. Lakes should not be polluted by discharge of sewage, effluent and industrial wastes; off-shore area of lakes should be protected and suitable areas adjoining the lakes should be earmarked for recreational and tourism activities. They also recommended the construction of more tanks along the natural valleys which have a run-off. The State Government accepted (1988) the recommendations made by the Committee. Important recommendations of this Committee are mentioned in **Appendix 2**. The State Government also constituted (July 2002) the Lake Development Authority (LDA) registered under the Societies Act to regulate and monitor the conservation, rejuvenation and restoration of lakes.

Despite the above measures, encroachments and pollution in lakes could not be contained, leading to several public interest litigations. The Hon'ble High Court of Karnataka, as part of its proceedings, appointed (November 2010) a Committee headed by Justice N.K. Patil and officers from the State Government as members, to examine the ground realities and prepare an

[1] A publication by Shri. Pratap K. Mohanty, Department of Marine Sciences, Berhampur University, Berhampur, Orissa

[2] A study report submitted to Infrastructure Development Department, Government of Karnataka by Infrastructure Development Corporation (Karnataka) Limited to assess the feasibility of conserving lakes in Karnataka

action plan for restoration and preservation of lakes. The Committee prepared a strategic plan for various entities to restore lakes in terms of the decision of the Hon'ble High Court of Karnataka in Writ Petition No.817/2008. Based on the decision of the Hon'ble High Court of Karnataka (April 2012), the State Government constituted (May 2013) various committees including an Apex Committee to monitor the conservation and restoration works of lakes.

Chapter II

Audit approach

2.1 Audit objectives

The performance audit was conducted with the objectives of ascertaining:

- whether the existing institutional mechanism and legal framework ensure effective and efficient long term environmental sustainability of lakes;
- whether the survey and demarcation of lakes were effectively carried out and action to prevent encroachments and diversions were effective; and
- whether the agencies undertook effective sustainable initiatives to restore water quality and maintain ecological health of the lakes.

2.2 Audit scope and sample

The performance audit for the period 2009-14 covered the activities relating to conservation and restoration of lakes in Revenue Department, Forest Department, Urban Development Department (UDD), and Fisheries Department. The role of various implementing agencies under these departments namely, LDA, Bruhat Bengaluru Mahanagara Palike (BBMP), Bengaluru Development Authority (BDA), two City Corporations (CCs) (Belagavi and Hubballi-Dharwad), Karnataka State Pollution Control Board (KSPCB) and Bengaluru Water Supply and Sewerage Board (BWSSB) has also been covered in the performance audit.

The performance audit covered 56 lakes selected by adopting simple random sampling method. The test-checked lakes include 13 lakes of BBMP; 19 lakes of BDA, three lakes of Belagavi and 10 lakes of Hubballi-Dharwad CCs. Besides, lakes under National Lake Conservation Plan (NLCP)[3] (six lakes including two in Bengaluru) and National Wetland Conservation Programme (NWCP)[4] (two lakes) and three lakes (out of State grants) under the control of LDA were also selected. Names of the lakes selected and the selection methodology has been elaborated in **Appendix 3**.

2.3 Audit methodology

The performance audit commenced in May 2014 by checking records related to protection, conservation, regeneration and restoration of lakes of the implementing agencies. An Entry Conference was held on 6 June 2014 with the Additional Chief Secretary to the Government of Karnataka, Forest, Ecology and Environment Department and Chief Executive Officer, LDA,

[3] A Centrally Sponsored Scheme exclusively aimed at restoring the water quality and ecology of lakes in urban and semi-urban areas

[4] Government of India Scheme for conservation of wetlands to benefit the local communities and biodiversity

Member Secretary of KSPCB and officers representing UDD, BBMP, BDA, BWSSB and other departmental officers.

Records relating to satellite images of selected lakes were collected from Karnataka State Remote Sensing Applications Centre (KSRSAC). Inputs were also taken from Indian Institute of Science while planning for the performance audit and subsequently for seeking clarifications during Audit. Joint Physical Verification (JPV) of 56 selected lakes was conducted by audit officials in association with the officials of departments and agencies concerned.

The Exit Conference was held on 2 February 2015 and the details of discussion have been appropriately incorporated wherever applicable.

2.4 Audit criteria

The audit criteria for the performance audit were derived from the following sources:

- Guidelines of NLCP and NWCP
- Shri Lakshman Rau Committee Report and Hon'ble Justice N.K. Patil Committee Report
- Government orders, notifications, circulars, instructions, proceedings, Action Plans issued from time to time by State/Central Government, monitoring committee reports, *etc.*
- Karnataka Financial Code, 1958; Karnataka Land Revenue Act, 1964; Karnataka Land Revenue Rules; 1966, Karnataka Town and Country Planning Act, 1961
- Karnataka Transparency in Public Procurements Act and Rules
- Karnataka Public Works Accounts and Departmental Code
- Water (Prevention & Control of Pollution) Act, 1974
- Reports on monitoring of level of pollution in lakes by KSPCB
- National Water Policy, 2002
- Environment (Protection) Act, 1986
- Memorandum of Association and Bye-Laws of LDA.

2.5 Acknowledgement

We acknowledge the cooperation extended by the departments/agencies concerned of the Government of Karnataka in the conduct of performance audit including JPV of lakes.

We also acknowledge the enactment (March 2015) of the Karnataka Lake Conservation and Development Authority Act, 2014 which would address various concerns expressed in this report. The Act has incorporated the definition of a "Lake" and empowered the Karnataka Lake Conservation and Development Authority with vast powers, functions and authority to levy penalties, *etc*. The salient features of this Act are detailed in **Appendix 4**.

2.6 Organisation of audit findings

The audit findings have been organised into three sections which are aligned to the three audit objectives set for the performance audit. An additional section has been devoted to lake specific findings of 12 lakes. The sections are as under:

Section I - Effectiveness of institutional mechanism and legal framework for long-term environmental sustainability of lakes

Section II - Effectiveness of survey and demarcation of lakes

Section III - Effectiveness of the initiatives to restore water quality and maintain ecological health of the lakes

Section IV – Lake specific findings of 12 test-checked lakes

S E C T I O N - I

Effectiveness of institutional mechanism and legal framework for long-term environmental sustainability of lakes

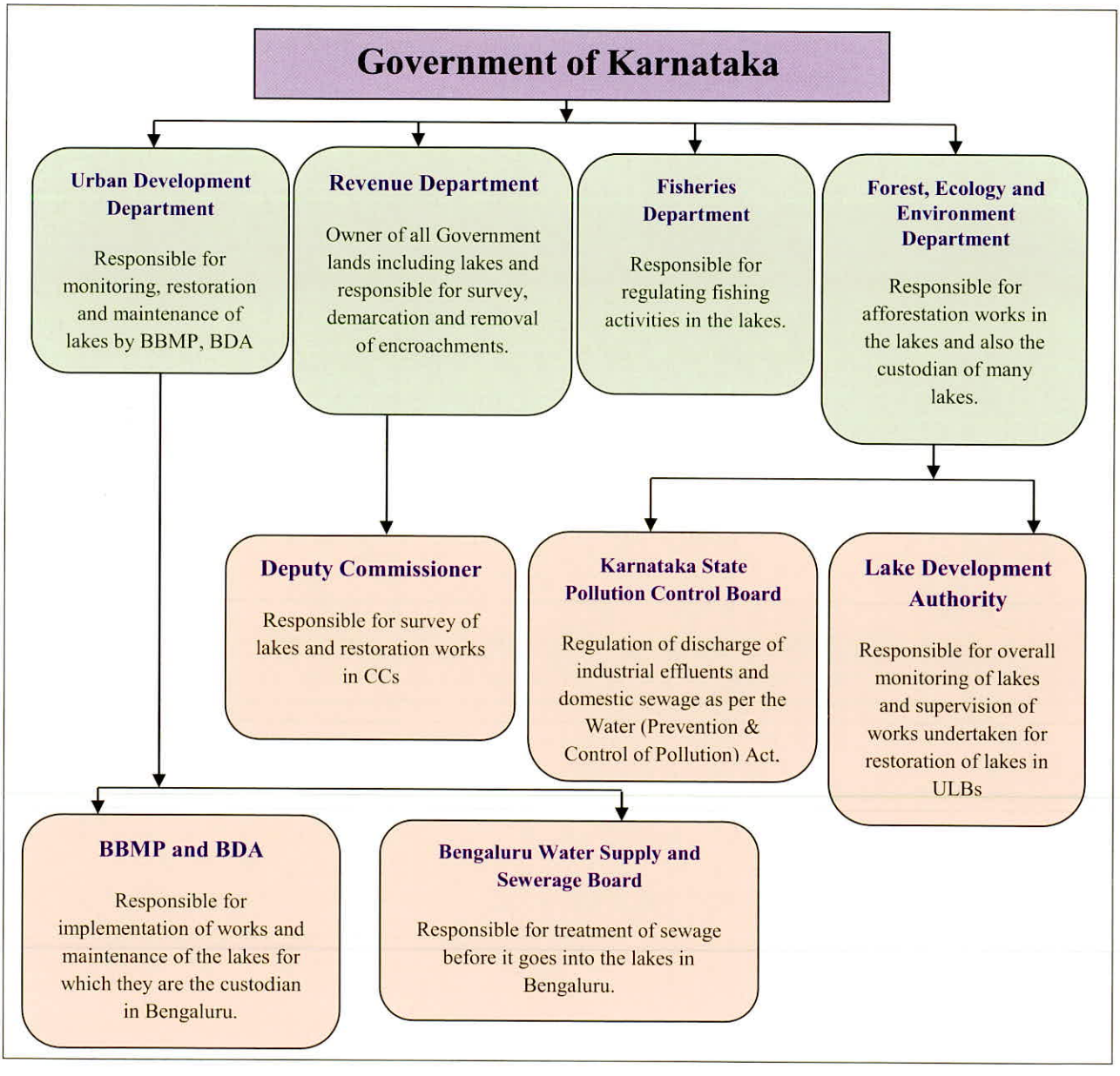
Chapter III

Effectiveness of institutional mechanism and legal framework in conservation and restoration of lakes

3.1 Entities involved in conservation and restoration of lakes

The responsibility of conservation and restoration of lakes in Urban Local Bodies (ULBs) including Bengaluru, vests with a number of Government departments and agencies. The powers and functions of these entities are elaborated in this Chapter. The entities involved and a gist of their roles are given in **Chart 1** below:

Chart 1: Entities responsible for conservation and restoration of lakes



3.1.1 Lake Development Authority

As per the Memorandum of Association and Bye-laws of Association of LDA (Bye-laws), LDA was established to exercise regulatory authority for all the lakes and act as planning and policy body to protect, conserve, reclaim, rejuvenate and restore lakes and its jurisdiction extended over the metropolitan area of Bengaluru including the green belt of Bengaluru and areas of CCs and City Municipal Councils (CMCs) in the State. LDA was required to restore the lakes by creating habitat for aquatic biodiversity including water birds and wild plants, monitor and manage water quality, create public awareness and involve community participation for lake conservation.

LDA has a Governing Council, headed by the Chief Secretary, Government of Karnataka and an Executive Committee headed by the Principal Secretary, Forest, Ecology and Environment Department. The Executive Committee functions as the Empowered Committee which provides technical guidance to LDA and scrutinises and approves Detailed Project Reports (DPRs) on lake conservation and maintenance.

Audit observed the following:

- The office of LDA is situated at Bengaluru and it does not have any branch offices though its jurisdiction is spread over other areas of CCs and CMCs in the State.
- It operates with skeletal staff which has not been reviewed by the State Government since its inception in 2002.
- LDA does not have any statutory powers. As a result, laxity in exercise of powers conferred as per Bye-law was observed.
- Environmental Planning was one of the objectives for which LDA had been constituted. LDA had not undertaken any integrated planning in association with all the entities involved in restoration of lakes.

While responding, LDA stated (December 2014) that because of these constraints, they only performed the role of a mediator between the public and the custodians of lakes. The State Government (UDD) admitted (March 2015) that the development of lakes was taken up based on fund availability and not based on any comprehensive planning. This indicated that the works were taken up in lakes in an *ad hoc* manner without prioritisation. The LDA subsequently replied (April 2015) that a proposal had been sent to the Government for sanctioning additional 60 posts and region-wise branches would be operated shortly.

3.1.2 Karnataka State Pollution Control Board

The KSPCB was required to assess the quality of water in the lakes periodically and report to the concerned agencies for taking follow up action. The agency was to levy penalties on the polluters of lakes.

- Audit observed that KSPCB monitored pollution levels in only 120 lakes out of 36,568 in the entire State which included 48 lakes in Bengaluru City.

- With regard to levy of penalties and action taken against polluters, KSPCB replied (May 2014) that they had filed a criminal case against BWSSB. However, no action was taken against the polluters of the lakes such as residential apartments which were pumping sewage directly into lakes like Horamavu-Agara Lake.

KSPCB stated (May 2014) that due to shortage of manpower and funds, the quality of water was not assessed in all lakes. The reply is not acceptable as it was the duty of KSPCB to perform its job properly and ensure adequate manpower by taking up the matter with the State Government.

Recommendation 1: In view of the fact that the KSPCB is unable to monitor pollution in all lakes due to shortage of manpower, it may consider taking inputs from other agencies carrying out assessment of pollution levels and water quality in lakes.

3.2 Revenue Department

Revenue Department is the owner of Government lands including water bodies. It is responsible for survey, demarcation of lake area and removal of encroachments in lake bed area. Audit observed that the department failed to carry out its responsibilities relating to conducting surveys and removing encroachments in lakes despite having mandate for the same.

The department stated (January 2015) that action is being initiated to create a separate cell with dedicated surveyors to complete the survey of lakes.

Inadequacies in survey, demarcation of lake area and ineffectiveness in removal of encroachments in lake beds are discussed in **Chapter IV** of this report.

3.3 Urban Development Department

The department is responsible for monitoring the development works of the lakes carried out by the implementing agencies such as BBMP, BDA and other ULBs under its jurisdiction. The lakes in the urban areas which were originally with the Minor Irrigation (MI) Department were transferred to agencies under UDD.

3.3.1 Bruhat Bengaluru Mahanagara Palike, Bengaluru Development Authority and City Corporations

Most of the lakes in Bengaluru were under the custody of BBMP and BDA. The lakes in ULBs (CCs and CMCs) outside Bengaluru were under the custody of the respective Deputy Commissioners (DCs). The DCs were responsible for development and restoration of lakes under their jurisdiction.

Audit observed the following deficiencies:

- BBMP had a dedicated Environment Cell and the work of conservation and restoration of lakes was overseen by the Chief Engineer, Lakes. But in BDA, there was no cell dedicated to lakes and the Engineer Member, assisted by four Executive Engineers, was responsible for development and restoration of lakes in addition to regular duties.

- The State Government directed (April 2010) that development and management of lakes may be carried out under close supervision of the Forest Department officials on deputation. However, only three and two forest officers were involved in restoration works of lakes in BBMP and BDA (up to 2011-12), respectively. The shortage of officials from the Forest Department is impacting the required ecological inputs for conservation, restoration and development of lakes.

Recommendation 2: Steps may be taken to introduce a dedicated cell in BDA for overseeing all the development and restoration works related to lakes with more Forest Department officials who are conversant with lake restoration works.

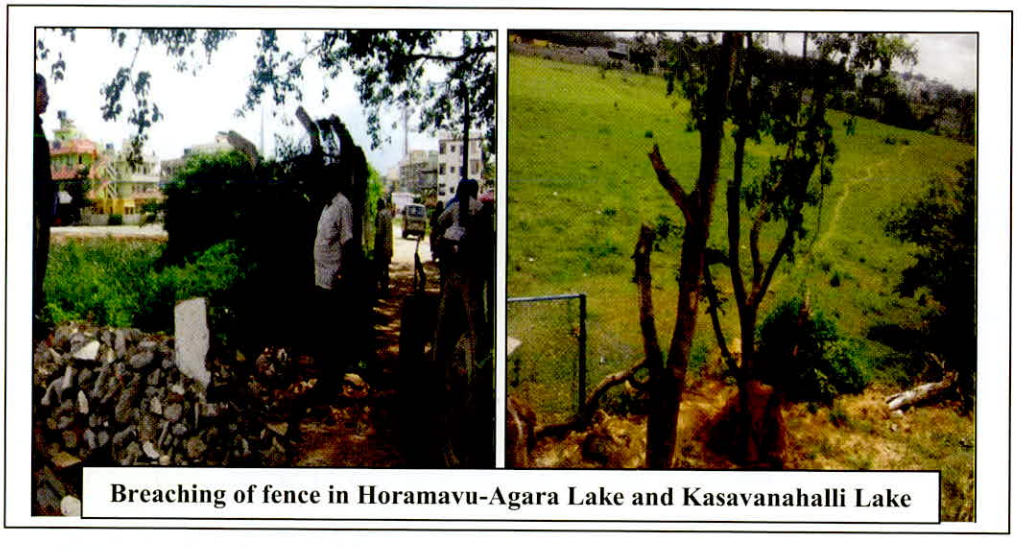
- No training related to ecological restoration of lakes was given to the officers of BDA, BBMP or other ULBs. It was observed that the restoration works carried out by these implementing agencies were mainly focused on engineering rather than ecological measures which is discussed in detail in **Chapter V**.

Recommendation 3: Action may be taken for the capacity building of the officials involved in lake restoration activities and the Government may consider engaging scientific research institutions and reputed educational institutions like Indian Institutes of Technology.

- There are six lake series in Bengaluru, each of which consists of a set of lakes. The restoration works in the lake series should be such that works in a downstream lake should be carried out after completion of restoration works of its upstream lake. This will ensure that the outflow of the upstream lake which flows into the downstream lake is free from pollution. However, it was observed that the distribution of lakes in the lake series was such that the upstream lake and the downstream lake was given to two different entities (BBMP and BDA) and restoration works were carried out independently without any coordination between the two agencies for ensuring proper planning and execution.

- As per the 2010 order, BDA was to transfer the lakes under their jurisdiction to BBMP for maintenance, as and when the developmental works were completed by BDA. However, even after communicating the completion of the development works, the transfer had not been effected till date (February 2015) citing financial constraints by BBMP. Of the test-checked lakes, it was observed that in three[5] lakes, BDA had incurred an expenditure of ₹30.31 crore for their restoration. However, since the lakes had not been transferred from BDA to BBMP as per the above order, the jurisdiction for maintaining the lakes was with neither of these agencies, resulting in their maintenance being neglected.

- There were cases of damage caused to fencing around lakes as can be seen from the photographs given below. BBMP had not engaged watch and ward staff in all the restored lakes. BBMP replied (February 2015) that miscreants were entering the lake area and stealing the fence materials. This indicated that there were inadequate security measures for protecting the assets related to the lakes.



Breaching of fence in Horamavu-Agara Lake and Kasavanahalli Lake

3.4 Non-coordination of all entities in restoration of lakes

The Bye-laws of LDA provide for integrated interventions and operational convergence with the departments/agencies concerned for integrated development and restoration of lakes. Lack of coordination among entities during restoration of lakes was observed by Audit as mentioned below:

- Implementing agencies were taking up conservation and development works in lakes in an *ad hoc* manner without adequate prioritisation and coordination with each other.

- Construction of sewage diversion channels was done by implementing agencies (BBMP and BDA) where BWSSB had already laid underground drainage (UGD) pipes. This has been dealt with separately in ***Paragraph 5.6.2***.

[5] Jakkur-Sampigehalli, Rachenahalli and Venkateshpura

- Fencing of lakes was done by BBMP and BDA without ensuring completion of survey, demarcation and removal of encroachments by Revenue Department. Details are given in ***Paragraph 5.7.4***.

- Information on fishing rights in lakes given to fishermen by the Fisheries Department was not shared with the custodian of lakes.

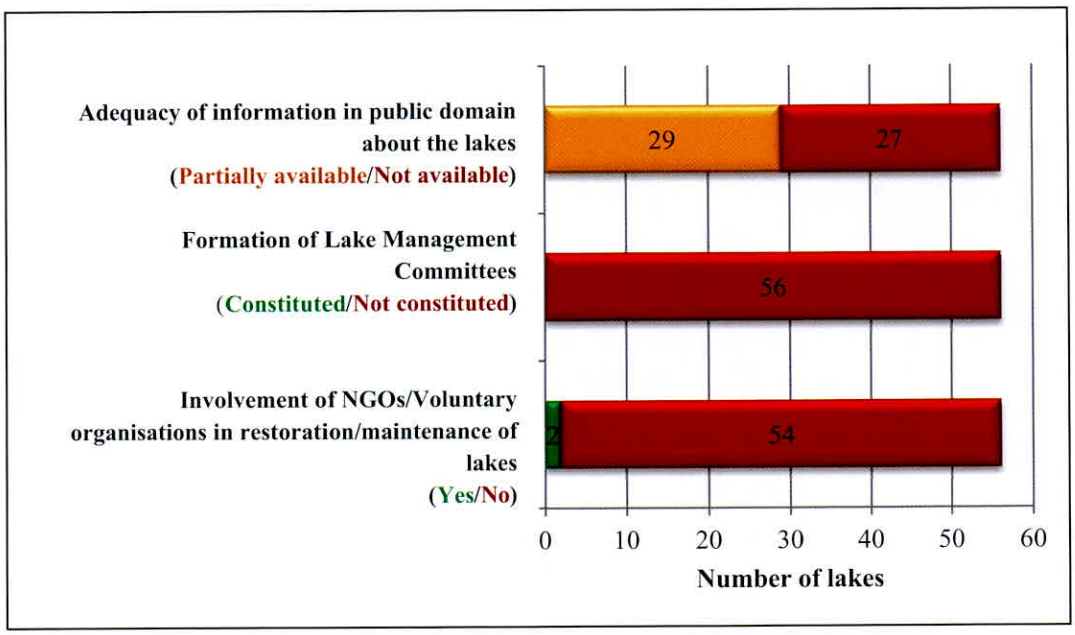
The Additional Chief Secretary, UDD stated during Exit Conference (February 2015) that coordination among all agencies was a must for integrated ecological restoration in lakes. The reply is not adequate as it was not ensured by the State Government.

3.5 Community participation in lake restoration

A successful conservation programme calls for active participation of the local community. The State Water Policy, 2002 talks about mobilising communities and stakeholder participation through user organisations by empowering them and providing training, technical support and creating public awareness.

The audit findings related to transparency and community participation are depicted in the **Chart 2** below:

Chart 2: Issues on transparency and community participation



There should be adequate information in the public domain for effective participation from local communities and voluntary agencies in activities which protect, preserve and conserve lakes. It was observed that the involvement of local communities and transparency in administration was minimal. The implementing agencies had not made adequate efforts in this direction. Following are the findings with respect to the test-checked lakes:

- Under the Public Disclosure Law, the ULBs were required to disclose the names of the existing water bodies like lakes, tanks, ponds, custodians of

lake, nature of works proposed, details of contractors, expenditure incurred, agencies involved in maintenance, grievance redressal contacts, *etc.*, on their websites. However, information on lakes of Bengaluru and the two test-checked CCs (Belagavi and Hubballi-Dharwad) in public domain was inadequate. Only minimal information such as names of lakes, budget and expenditure, jurisdictional officer's contact details were available on the website.

- An effective grievance redressal mechanism would enable citizens to voice their demands and help in public participation in restoration works. It was seen that BBMP, BDA and the two CCs did not have any mechanism to address complaints related to lakes.

- There was no single window agency to address the issues and grievances of public on lakes. The necessity of a single window agency was expressed by two Non-Governmental Organisations (NGOs) which were involved in maintenance of two test-checked lakes (Kaigondanahalli and Chinnappanahalli). BDA stated (February 2015) that the matter would be taken up at State Government level to constitute a single window agency for grievance redressal mechanism.

- Lake Management Committees, consisting of Residents' Welfare Association/Voluntary organisation and the implementing agency responsible for carrying out restoration and maintenance works in lakes, were to be formed as per the DPRs to provide inputs and guidance on restoration works of lakes. However, no such Committees were formed in respect of any of the test-checked lakes. The State Government (UDD) stated (March 2015) that monitoring committees have been formed in two test-checked lakes (Chinnappanahalli and Kaigondanahalli). It was, however, observed that these agencies were carrying out only maintenance works and were not involved in lake restoration works.

- "Adopt a Lake" Scheme was launched by LDA (July 2004), wherein interested parties were given custody of lakes for restoration. Six[6] lakes of Bengaluru were taken up under the Scheme. The Scheme was not effective due to the inability of LDA to redress the problems[7] faced by the adopting agencies. The State Government (UDD) admitted (March 2015) that the Scheme could not be implemented as planned. The LDA stated (April 2015) that these six lakes were taken back from adopting agencies as they had breached the terms and conditions in developing and maintaining lakes. The reply was silent about the steps taken by LDA to redress the problems faced by the adopting agencies.

The following recommendations are made with regard to community participation and transparency in administration:

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[6] Bairasandra Kelaginakere, Challakere, Kenchanahalli (Bachikere), Kundalahalli, Mahadevapura and Sheelavanthana

[7] such as dumping of construction debris, burial of dead bodies in lake area, trespassers, *etc.*

Recommendation 4: The State Government must ensure that adequate information is available in the public domain to bring about transparency in administration.

Recommendation 5: The State Government should establish a single window agency for grievance redressal mechanism.

3.6 Monitoring of lake restoration works

Monitoring is an important instrument for Governments to ensure proper execution of their policies and implementation of their programmes.

The State Government had constituted (May 2013) an Apex Committee, sub-committees, and district level committees to oversee and supervise the restoration and maintenance of lakes in Bengaluru Metropolitan Areas, CCs and CMCs.

Audit observed the following deficiencies in monitoring of lakes:

- The Apex Committee had not called for periodical progress reports on restoration works from the implementing agencies. None of the implementing agencies had any methodical system of inspections and reporting.

- LDA had not inspected (2009-14) any lake except 747 lakes in Bengaluru (Urban) district.

- Only 22 out of stipulated 140 meetings were conducted in the year 2013-14 in 14 districts. The LDA accepted the audit observation and stated (April 2015) that the matter had been brought (March 2015) to the notice of the Apex Committee and reminders would be sent to the DCs concerned.

3.7 Financial management

The various entities responsible for the lakes conservation had their own budgets and contributed financially towards lake conservation-related activities. However, with no overall plan or budget made out for a lake involving all entities concerned, the funds expended by these entities tended to be uncoordinated thereby resulting in non-achievement of the desired objectives. Also, no assessment had been made for financial resources required and the available financial resources were also not managed properly.

As of March 2014, BBMP, BDA, LDA and two CCs (Belagavi and Hubballi-Dharwad) had 55, 123, 28 and 32 lakes under their custody and an expenditure of ₹165.83 crore, ₹53.19 crore, ₹14.71 crore and ₹1.14 crore was incurred by BBMP, BDA, LDA and CCs, respectively. Details of expenditure incurred on restoration works in the test-checked lakes are given in **Appendix 5**.

The examination of expenditure and receipts of implementing agencies indicated that financial management needs to be strengthened. Audit observed the following:

- The provisions of Karnataka Town and Country Planning Act, 1961 empowered the ULBs for collection of a cess/fee for rejuvenation of lakes and water bodies while granting permission for development of land and building from the owner of such buildings under their jurisdiction. However, no rules were framed for utilisation of the cess amount.

- BDA had not collected cess amounting to ₹33.09 crore during the period 2009-10 to 2013-14. The State Government (UDD) replied (March 2015) that cess was now being collected for rejuvenation of lakes.

- The Belagavi Urban Development Authority and Tumakuru Urban Development Authority had collected cess of ₹38.79 lakh and ₹3.17 crore, respectively during 2012-14. However, this amount remained unused as rules for its utilisation had not been framed.

- LDA collected ₹12.18 crore towards annual lease rent from lessees in four[8] lakes as of August 2014, however this amount was kept idle. The LDA agreed (April 2015) to utilise the available funds.

- LDA had not collected (February/March 2014) the annual lease rents including interest thereon, from two lessees (M/s. Lumbini Gardens Limited and M/s. PAR.C), amounting to ₹48.64 lakh. On this being pointed out (April 2014) by Audit, LDA replied (August 2014) that ₹26 lakh had been remitted by the lessees during May/June 2014. The LDA further replied (April 2015) that notices had been issued to lessees for remitting balance amounts.

- DC, Belagavi retained lease rentals of ₹34.38 lakh in respect of Kotekere, Belagavi in a savings bank account without remitting it into Government account.

- GoI approved and released (February 2002) ₹44.04 lakh for conservation and management of Kamakshipalya Lake, Bengaluru under NLCP. The restoration work could not be taken up due to encroachments in the lake bed. Consequently, another proposal to develop an alternate lake was sent to GoI, which was rejected. Due to failure of State Government to ensure prevention of encroachments, the funds released by GoI had to be returned (April 2014), thereby losing the grant received for restoration work.

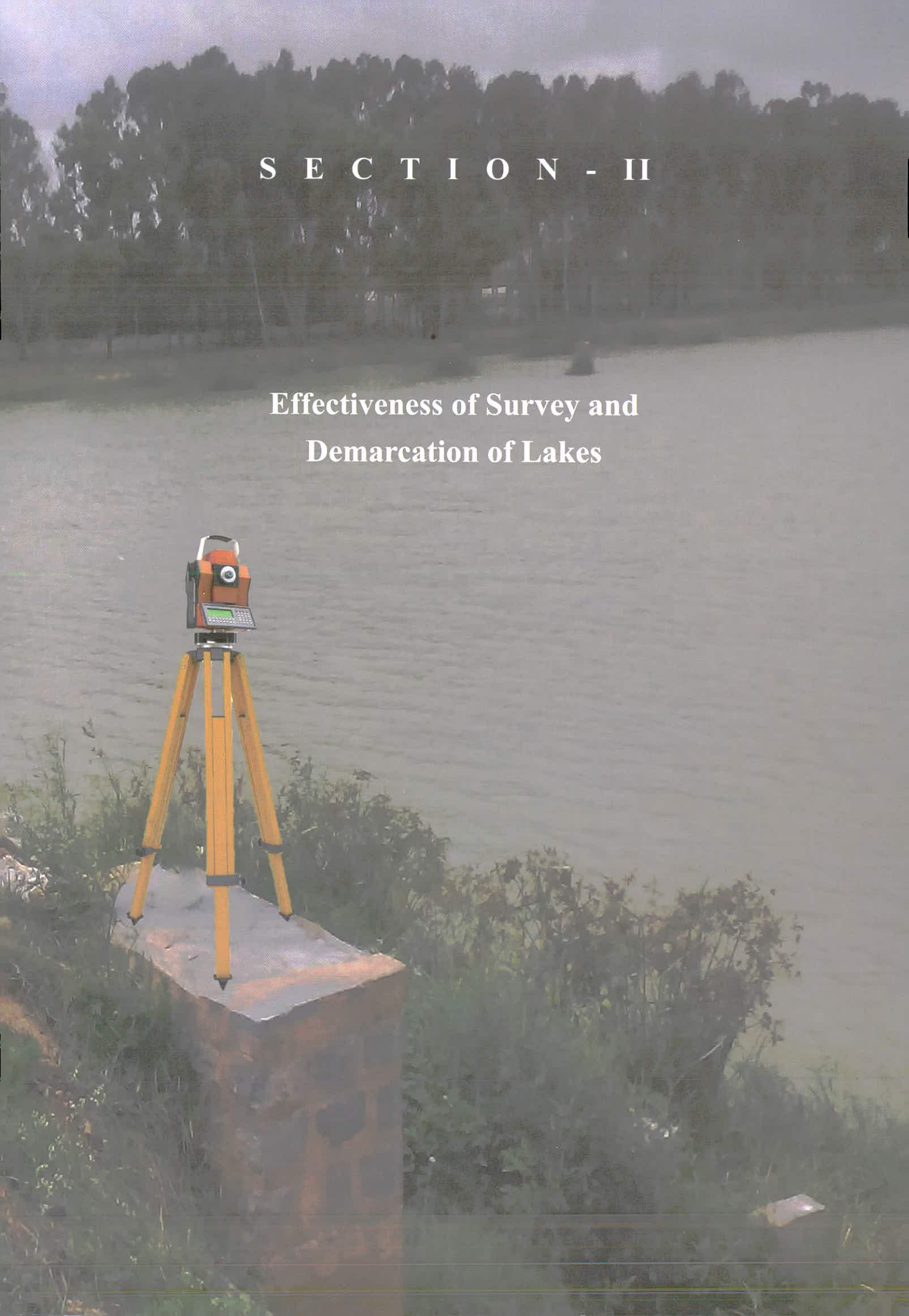
- An amount of ₹6.97 crore received (during 2002 to 2012) by LDA under NLCP grants remained unutilised as of March 2014. On this being pointed out by Audit, the LDA replied (April 2015) that the unspent amount, if any, would be reimbursed after obtaining UCs from implementing agencies.

[8] Agara, Hebbal, Nagavara and Vengaiahanakere

During Exit Conference (February 2015), the Commissioners of BBMP and BDA expressed constraints in getting financial support from the State and Central Governments for rejuvenation of lakes. However, the above instances indicate non-utilisation of even available resources.

S E C T I O N - II

Effectiveness of Survey and Demarcation of Lakes



Chapter IV

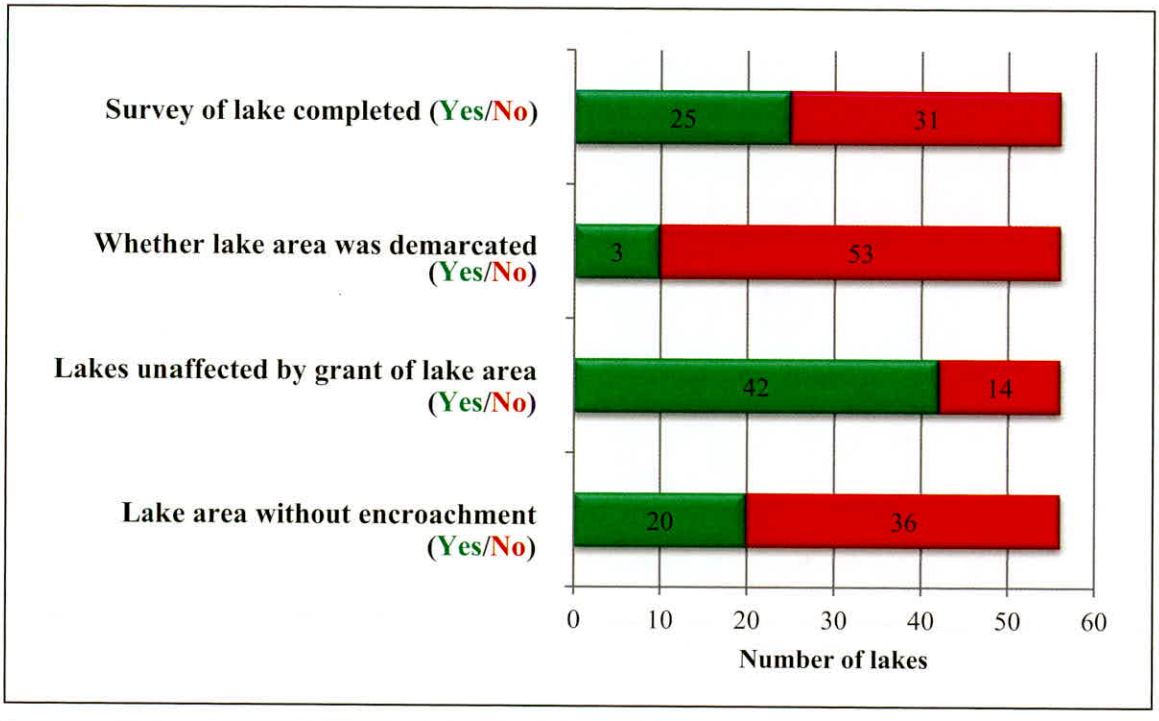
Effectiveness of survey and demarcation of lakes

4 Survey and demarcation of lakes

The primary task for conservation and restoration of lakes was survey and demarcation of the area of a lake. This was necessary to ensure that no encroachments take place in lake area. This chapter deals with the status of the survey and demarcation of lakes. It also contains audit findings on irregular grant of lake land, encroachments upon lakes, reduction of lake area, *etc*.

Issues on effectiveness of survey, demarcation and removal of encroachments in the 56 test-checked lakes as observed by Audit are depicted in **Chart 3** below:

Chart 3: Issues on effectiveness of survey and status of encroachments in the test-checked lakes



4.1 Status of survey in Bengaluru and other Urban Local Bodies

The State Government directed the Revenue Department as early as in 1988 to conduct the survey of the area of all lakes in the State. The bye-laws of LDA stipulated (2002) that survey of lake area needs to be carried out. The necessity of survey was also reiterated by the State Government during April 2010 and in May 2013. However, Audit observed that out of 56 test-checked lakes, survey of only 25 lakes was carried out by the Revenue

Department. Of these, survey maps in respect of two[9] lakes, were not certified by the concerned jurisdictional Tahsildar[10] of the Revenue Department.

The State Government (UDD) replied (March 2015) that action has been initiated to get the survey done for all the lakes.

4.2 Non-demarcation of lake area

As part of survey, boundary stones in concrete are to be fixed in three to four corners of the lakes to facilitate easy identification of the area for future re-survey of the lake, if need be. The survey should also record latitude and longitude values of the corner stones, so fixed, by using Global Positioning System (GPS).

During test-check of 34 lakes in Bengaluru, only three[11] lakes were found to be demarcated. Sign boards displaying details of the lakes including its area were seen only in seven[12] lakes.

4.3 Variations in lake area as per different records

Area of a lake is mainly determined by the water spread area which has a direct correlation with the height of the waste weir (full tank level) of the lake. Reduction in height or breach of waste weir would result in shrinkage of water spread area of the lake.

Audit observed in JPV that during restoration works of Rachenahalli Lake, the height of the waste weirs was reduced to 883.20 metre (approximately) from the existing full tank level of 884.40 metre above Mean Sea Level (as per DPR). This effectively reduced the area of the lake from 168 acres (as per survey map) to 128 acres (as per DPR). In another lake (Doddanekundi) the waste weirs which existed on both sides of the bund were breached and allowed out flow of water, resulting in reduction in area of the lake by 24 acres[13].

Audit also observed that the implementing agencies and LDA were not using satellite data for ascertaining the actual lake area. A comparative study of the lake area for 33 test-checked lakes in Bengaluru from the recent records of Revenue Department, Survey maps, Shri. N. Lakshman Rau Committee Report, DPRs, UDD and KSRSAC showed that there were inconsistencies in lake area as per these different records and the more recent records in many cases indicated reduction in the area of the lake. This was mainly due to construction of roads, infrastructure and residential layouts, and change in land use. Details are indicated in **Appendix 6**.

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9 Chinnappanahalli and Kasavanahalli

10 Authorised signatory on the survey maps

11 Dasarahalli, Kasavanahalli and Vibhuthipura

12 Amruthahalli, B.Channasandra, Chinnappanahalli, Gangashetty, Garebhavipalya, Kaigondanahalli and Kasavanahalli

13 135 acres as per 2006 Survey map of Revenue Department and 111 acres as per DPR

The State Government (UDD) accepted (March 2015) that there was difference in area of the lake with reference to the records and survey conducted. It also stated that the difference in area of the lake with reference to land records and certified sketch would be brought to the knowledge of jurisdictional revenue authorities for necessary action. The LDA stated (April 2015) that it was taking help from Indian Space Research Organisation (ISRO) to assess the actual area of lake. However, no documentary evidence was furnished to substantiate the reply.

4.4 Grant of lake land in violation of the Rules

The doctrine of Public Trust is an important canon of Environmental Law which primarily rests on the principle that certain resources like air, sea, water and forests have such great importance to the people as a whole that it would be unjustified to make them a subject of private ownership.

The National Water Policy, 2002 also states that encroachments and diversion of water bodies (like rivers, lakes, tanks, ponds, *etc.*) and drainage channels (irrigated area as well as urban area drainage) must not be allowed and wherever it has taken place, it should be restored to the extent feasible and maintained properly.

The provisions of Karnataka Land Revenue Rules prohibit grant of areas of tanks/lakes/water bodies to any person. Scrutiny of records of the test-checked lakes revealed that lake land had been granted irregularly to various Government bodies, private parties and others in violation of these provisions. This had resulted in reduction of lake area. Illustrative cases are as under:

i) Rachenahalli Lake: The lake land of 43.17[14] acres had been granted out of 76.05 acres in Survey No.82 to Government bodies and private parties in violation of Rule 108-I of the Karnataka Land Revenue Rules.

ii) Jakkur-Sampigehalli Lake: The Revenue Department had granted lake land of 41 acres to BWSSB for establishing a Sewage Treatment Plant (STP) and staff quarters. Audit observed during JPV that except for about 10 acres of land for establishing STP, the remaining area was fenced by BWSSB without any development. No efforts were made by the Revenue Department to take back the lake area, which was granted by the Government in violation of the rules.

iii) Allalasandra Lake: Lake area to the extent of 14,289.36 sq ft in Allalasandra Lake (Survey No.15) had been granted to unauthorised occupants under Section 94 (C)[15] of Karnataka Land Revenue Act, 1964. This was in contravention to Rule 108-I of the Karnataka Land Revenue Rules, 1966 read with Section 4 of Karnataka Regularisation of Unauthorised Construction in

[14] 20 acres to Mahatma Gandhi Institute of Rural Energy Development, 16.54 acres to Jawaharlal Nehru Centre for Advance Scientific Research, three acres to Ms. M.K. Indira and others, three acres to Wakf Board, 0.63 acre to BBMP for formation of road and gas line

[15] 94(C) - grant of Government land to unauthorised occupants prior to 1998

Urban Areas Act, 1991 which stipulated that unauthorised construction in tank bed should not be regularised.

iv) In five[16] lakes, the lake area had been granted during the period from 1991 to 2010 to various entities such as National Highways Authority of India, BDA and Karnataka Industrial Area Development Board (KIADB) for formation of residential layouts, road works, *etc.*

The State Government (UDD) replied (March 2015) that the above issues of grant of lake land were under consideration with the Revenue Department.

Recommendation 6: The State Government needs to review all cases of grant of lake land post 1988 and take steps to reclaim the land.

4.5 Encroachments in lake area

Audit observed that the Revenue Department had not maintained a database on lakes including the area under encroachments.

Audit scrutiny revealed that encroachment of lake area had caused choking/blocking of catchment drains, loss of foreshore area and wetland, thereby leading to shrinkage in water spread area. Despite repeatedly pointing out the need for removal of encroachments in lake area by the State Government since 1988, the removal of encroachments was not complete. During the JPV and review of records of test-checked lakes, Audit came across cases of encroachments which are listed in **Appendix 7**.

The State Government (UDD) stated (March 2015) that the jurisdictional revenue officers had been instructed to evict encroachments and action would be taken to fence all the lakes soon after the completion of survey. It was also stated that the issue of recording of GPS reading is under consideration of Government.

4.6 Change in land use leading to conversion of lake areas

According to the provisions of the Karnataka Town and Country Planning Act, 1961, the Comprehensive Development Plan (CDP)/Revised Master Plan (RMP) shall include the areas reserved for parks, play grounds and other recreational uses, public open spaces, public buildings and institutions and areas reserved for such other purposes, *etc.* The Act does not explicitly describe the area preserved as tanks or lakes in the CDP/RMP.

Scrutiny of records and information furnished by the Town Planning Wing of BDA in respect of 27 out of 34 lakes test-checked in Bengaluru revealed that there was change in status of lake area (residential, roads, agricultural land, *etc.*) as per the RMP of 2015 when compared to the CDP of 2005 which described the status of lake area as tanks, parks and valleys. The change in

[16] B.Narayanapura Lake granted to BDA, Dasarahalli Lake to KIADB for road, Mestripalya Lake to BDA (1991); Shivanahalli Lake to National Highways for road; Vengaiahanakere to National Highways for road

land use/status of lake area in RMP of 2015 for formation of roads, residential layouts, *etc.,* led to reduction in lake area.

Instances of the change in land use pattern as per the CDP 2005 and RMP 2015 and as observed by Audit during JPV of test-checked lakes are described in **Table 1** below:

Table 1: Details of change in land use pattern as per CDP 2005, RMP 2015 and as noticed during JPV

Sl. No.	Name of the Lake	Status as per CDP 2005	Status as per RMP 2015	Status of lake noticed during JPV
1	Allalasandra	Tank, park	Lake, partly residential	Lake bed encroached by slum and Forest Department.
2	Dasarahalli (Chokkasandra)	Tank, park	Lake, partly park, partly residential	The lake area encroached, reduced due to formation of roads.
3	Garebhavipalya	Park and Tank	Lake and residential area, 67 metre road	The lake area covered with industrial and residential layouts.
4	Kowdenhalli	Tank	Lake, mainly residential, industrial and 18 metre road, High tension line	Lake bed area granted for Educational Institutions and market place. BBMP road in the lake area.
5	Rachenahalli	Tank	Residential, roads measuring 18 metre road	New road formation/Park on lake bed.
6	Shivanahalli	Lake, road, railway line	Lake, railway line, 45 metre road, mainly residential with 12 metre, 15 metre road	Formation of National Highway and railway line.
7	Yelahanka	Green belt, Tank	Residential mainly, and partly lake	Graveyard noticed in lake area.

Source: Information furnished by BDA

The State Government (UDD) accepted (March 2015) that lake areas of Bellanduru, B.Channasandra, B.Narayanapura, Chinnappanahalli, Mestripalya, Mahadevapura and Shivanahalli lakes had been shown as residential, road, railway line in the RMP 2015 and the error would be rectified in the RMP 2035 which was under preparation. The reply is not acceptable as the lapse on the part of BDA in changing the land use would facilitate use of lake land for other purposes.

Recommendation 7: All cases where lake area has been revised/reduced in the Revised Master Plan 2015 be restored to its pre-RMP 2015 status with immediate effect.

S E C T I O N - III

Effectiveness of the initiatives to restore water quality and maintain ecological health of the lakes

Chapter V

Efforts and initiatives to restore water quality in lakes

5 Background

The Water (Prevention and Control of Pollution) Act[17], 1974 defines pollution to mean such contamination of water or such alteration of the physical, chemical or biological properties of water or such discharge of any sewage or trade effluents or of any other liquid, gaseous or solid substance into water (whether directly or indirectly). Pollution in lakes leads to eutrophication[18] and ground water contamination causing loss of habitat and healthy environment.

5.1 Inadequate assessment of levels of pollution in lakes

The responsibility of assessing the pollution levels in lakes and determining the quality of water vests with KSPCB.

The levels of quality of water as per NLCP and KSPCB are given in **Table 2** below:

Table 2: Classifications for quality of water

Designated best-use	Class of water
Drinking water source without conventional treatment but after disinfection	A
Outdoor bathing (organised)	B
Drinking water source after conventional treatment and after disinfection	C
Propagation of wild life and fisheries	D
Irrigation, industrial cooling, controlled waste disposal	E

Source: KSPCB and NLCP guidelines

The quality of water in lakes was required to be of 'B' Class *i.e.* suitable for outdoor bathing. Out of 56 test-checked lakes, KSPCB conducted the water quality testing in only six[19] lakes (Bengaluru) and in nine[20] lakes (other ULBs). The water quality in all these lakes was categorised as either 'D' or 'E'. The implementing agencies had also not undertaken any exercise to assess the pollution levels in those lakes which were rejuvenated by them. Thus, the objective of ensuring the standard of 'B' class outdoor bathing was not achieved.

The State Government (UDD) stated (March 2015) that in addition to KSPCB, private agencies would be identified and entrusted the job of testing water

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17 Section 2 (e) of the Act

18 A process where water bodies receive excess nutrients that stimulate excessive plant growth.

19 D Category - Jakkur-Sampigehalli, Yelahanka; E Category-Chinnappanahalli, Doddanekundi, Kaigondanahalli and Kasavanahalli

20 Dalvoy, Kelageri, Kolikeri, Kotekere, Navalur, Nuggikeri, Sadankeri, Someshwara and Unkal (Main) lakes

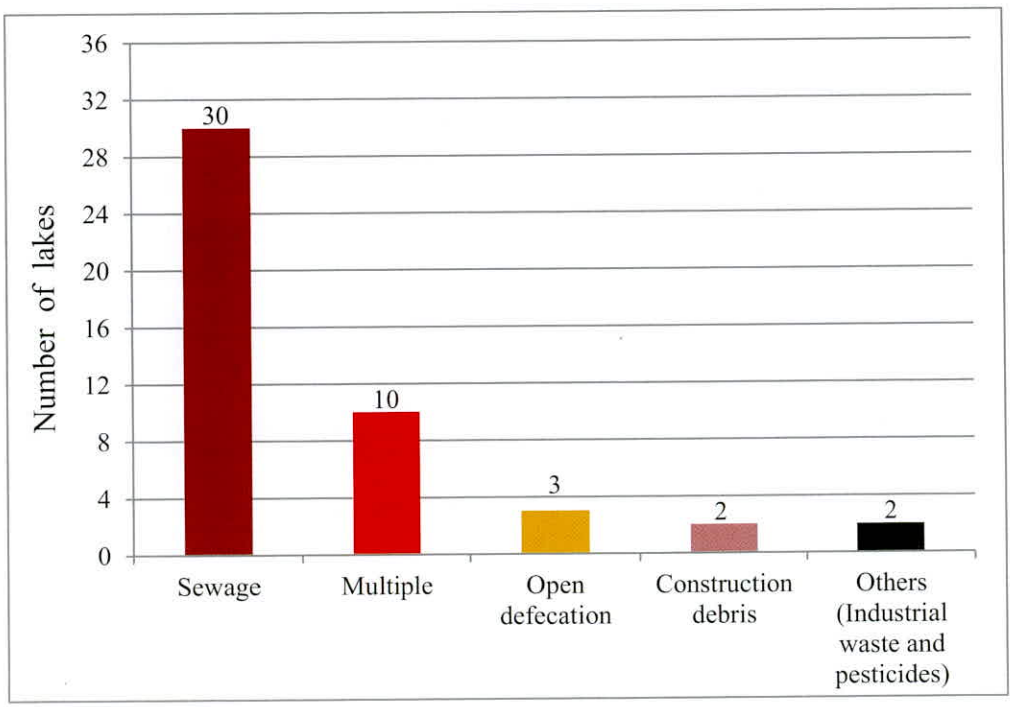
quality and monitoring of pollution levels in lakes. The reply, however, did not specify the penal provisions to be imposed on polluters.

5.2 Sources of pollution

It was observed during JPV that out of 56 test-checked lakes, 47 lakes were severely polluted. Sewage was the major cause of pollution in 30 lakes. Apart from the inflow of sewage, it was observed during Audit that the lakes were being polluted by dumping of municipal solid waste and construction debris, open defecation, industrial effluents, *etc.* Details of pollution in test-checked lakes are given in **Appendix 8**.

The kinds of pollution noticed in test-checked lakes are given in the **Chart 4** below:

Chart 4: Kinds of pollution in test-checked lakes



The lakes were not free from sewage primarily because the Storm Water Drains (SWDs) which were to bring in rain water run-off were carrying sewage. This was attributed to the fact that UGD lines were laid by BWSSB inside the SWDs at many stretches in Bengaluru. The UGD pipes laid almost 40 years back in core areas of Bengaluru were also corroded, encroached upon, choked and blocked.

5.3 Status of restoration works

The implementing agencies undertake various works for restoration and improvement of lakes. During 2009-14, no fresh works were sanctioned under NLCP, but 16 works sanctioned prior to 2009 were under progress. Two works under NWCP and four works under State Sector Programme were sanctioned during 2009-14. As per the progress reports of BBMP and BDA,

out of the 55 and 123 lakes in their respective custodies, 34[21] and 45[22] lakes were taken up for restoration during 2009-14.

The position of works executed in the test-checked lakes is given in **Table 3** below:

Table 3: Position of works executed in test-checked lakes

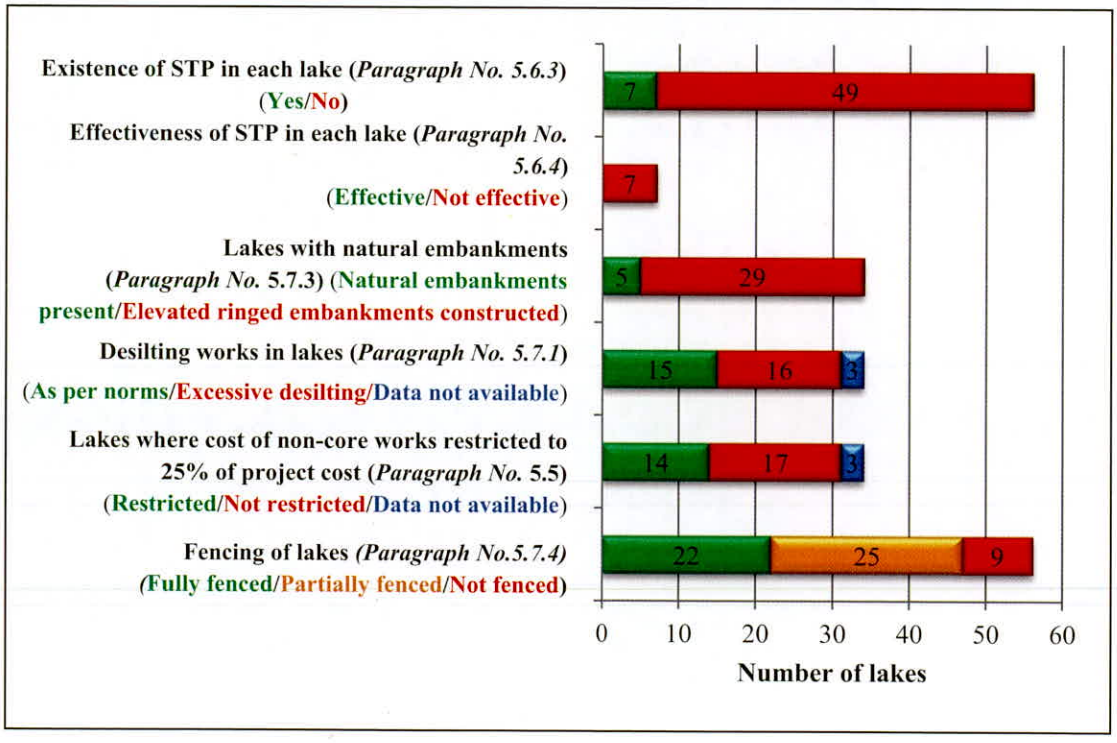
Implementing agency		Number of test-checked lakes	Number of lakes where works were executed	Expenditure (₹ in crore)
BBMP		13	12	54.16
BDA		19	08	40.81
LDA	NLCP	06	06	25.03
	NWCP	02	02	1.00
	State Grants	03	03	1.45
CCs	Hubballi-Dharwad	10	0	0
	Belagavi	03	03	0.63
Total		**56**	**34**	**123.08**

Source: As furnished by implementing agencies

Details of execution of works in test-checked lakes are given in **Appendix 5**.

The main findings of Audit on lakes where restoration works were taken up are depicted in **Chart 5** below:

Chart 5: Restoration works in test-checked lakes



The audit findings are discussed in the succeeding paragraphs.

[21] 32 lakes – work in progress and in two lakes – preparation of DPRs is underway

[22] 12 lakes – already developed, 25 lakes – work in progress and eight lakes – works to be taken up

5.4 Approval of DPRs by LDA

The State Government directed (April 2010) that the DPRs for the works be approved by LDA. In respect of NLCP works, the DPR required the approval of GoI. Deficiencies in approval of DPRs, monitoring of lake restoration works, pollution and creation of biodiversity are dealt in subsequent chapters.

In the test-checked lakes, out of 34 lakes where works were taken up, LDA had given approval for 21 works and in the remaining 13[23] cases, works were taken up without approval of LDA.

Audit observed the following deficiencies in the approved DPRs and monitoring by LDA of execution of works as per DPRs.

- Delays in approval of DPRs up to nine months were noticed;
- LDA had approved DPRs in 11[24] cases where the cost provided for non-core works (such as boat jetty, guard rooms, play stations, *etc.*) was much more than the stipulated 25 *per cent* of the total project cost proposed in the DPRs (detailed in the succeeding paragraph).
- DPRs did not conclusively state the pollution classification level as followed by KSPCB though NLCP guidelines required prioritisation of lakes for rejuvenation with reference to the severity of pollution levels.
- The works proposed in the DPRs varied with the works actually taken up in eight[25] test-checked lakes.

The LDA accepted the audit observations and attributed (April 2015) the delays to improper preparation of DPRs by BBMP and BDA. It was stated that care would be taken to provide less than 25 *per cent* of the project cost for non-core items and DPRs would be approved in future only on submission of pollution classification level. It was further stated that variations in works were mainly due to local site condition.

5.5 Categorisation of works *i.e.* core and non-core works

As per the NLCP guidelines, the development works in lakes were categorised as core and non-core works. The core works associated with ecological restoration included the works such as strengthening of bund, desilting, foreshore planting, inlet and waste weir restoration works, *etc.* These works were significant for maintaining a healthy ecology of lakes. The non-core activities included construction of walkways, boat jetties, idol immersion

[23] Alarwad, Allalasandra, Attur, Chinnappanahalli, Dasarahalli, Jakkur-Sampigehalli, Kaigondanahalli, Kowdenhalli, Kuduchi, Kuduchi (small), Rachenahalli, Venkateshpura and Yelahanka

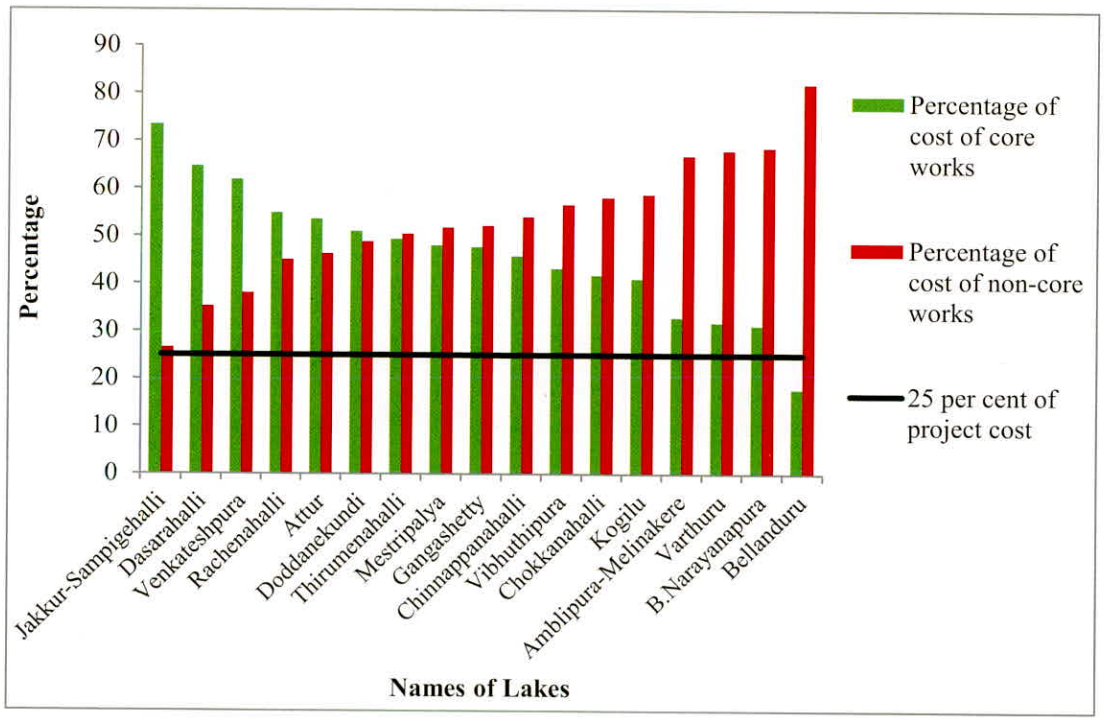
[24] Amblipura Melinakere, B.Narayanapura, Bellanduru, Chokkanahalli, Doddanekundi, Gangashetty, Kogilu, Mestripalya, Thirumenahalli, Varthuru and Vibhuthipura

[25] B.Narayanapura, Chokkanahalli, Doddanekundi, Gangashetty, Kogilu, Mestripalya, Thirumenahalli and Vibhuthipura

tanks, children play area, gazebo, toilets, food courts, *etc*. Over emphasis on these works would adversely impact the bio-diversity of the lakes.

Further, according to the NLCP guidelines, the expenditure on non-core activities was permitted up to 25 *per cent* of the project cost. However, Audit observed that in 17 out of 56 test-checked lakes, the cost provided for non-core works was much more than the stipulated 25 *per cent* of the project cost amounting to ₹185.18 crore as per DPRs/estimates. In respect of 11 out of these 17 test-checked lakes, cost provided for non-core works was even higher than that of core works. This has been depicted graphically in **Chart 6** below:

Chart 6: Provision for core and non-core works as per DPRs/estimates



Audit observed that the implementing agencies had not segregated the expenditure based on core and non-core works. In the absence of a stringent system of monitoring by LDA of the expenditure on lake related activities, there would be difficulty in maintaining the ratio of expenditure between core and non-core activities. This would impact the expenditure on essential core works necessary for the ecological health of the lakes.

The State Government (UDD) stated (March 2015) that in urban lakes, requirement of executing non-core components were very essential and works were carried out based on site specific requirements. The DPRs for these lakes were also technically approved. The reply cannot be accepted as execution of non-core works in excess of norms is detrimental to the ecological health of the lake.

Recommendation 8: The provisioning of funds for both core and non-core works needs to be maintained as per norms in the interest of the ecological health of the lakes.

5.6 Works impacting pollution

According to a Government Order (April 2010), works were to be taken up only after removal of sewage. The Apex Committee, headed by Principal Secretary, Revenue Department, had also directed (May 2013) that regular inflow of fresh water into the lakes should be ensured and sewage inflow should be stopped before taking up any restoration work by the agencies responsible for development of lakes.

However, these conditions were not adhered to as elaborated in the succeeding paragraphs.

5.6.1 Overhaul of sewage network by BWSSB

Audit observed that the implementing agencies in Bengaluru were taking up restoration works in lakes in which sewage continued to enter. This was happening due to the fact that BWSSB had not completed the work of overhauling the entire existing sewage network in the core area and newly added areas of Bengaluru by its scheduled completion date of December 2014.

BWSSB stated (October 2014) that as at the end of August 2014, the re-laying of UGD lines in the core area was complete. This was, however, not the position as seen during JPV of test-checked lakes in core areas.

BWSSB informed during Exit Conference (February 2015) that it would ensure zero sewage flow into the water bodies.

Thus, it is evident that the problem of sewage entering lakes will continue to persist until the UGD works are completed and therefore works taken up in such lakes will be rendered largely unfruitful.

5.6.2 Improper construction of sewage diversion channels

Implementing agencies had proposed the construction of sewage diversion channels in the DPRs/estimates of 13[26] lakes. It was observed during audit that in 12 of these lakes (except Doddanekundi), the implementing agencies were diverting the sewage entering the lake through box drain or Reinforced Cement Concrete (RCC) diversion channels, even though none of the other inlets were bringing in rain water into the lake. Consequently, the rejuvenated lakes remained dry and the sewage diverted was polluting the downstream lakes.

During JPV of seven[27] of these lakes, it was observed that BWSSB had also laid UGD pipelines in parallel. Thus, the expenditure incurred for the sewage

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[26] B.Narayanapura, Chinnappanahalli, Chokkanahalli, Dasarahalli, Doddanekundi, Gangashetty, Jakkur-Sampigehalli, Kaigondanahalli, Kasavanahalli, Kowdenhalli, Rachenahalli, Vibhuthipura and Yelahanka

[27] Doddanekundi (₹1.26 crore), Jakkur-Sampigehalli (₹0.24 crore), Kaigondanahalli (₹1.15 crore), Kowdenhalli (₹0.21 crore), Rachenahalli (₹0.95 crore), Vibhuthipura (₹0.04 crore) and Yelahanka (₹2.26 crore)

diversion channel for which the estimated cost was ₹6.11 crore was unwarranted as these works were taken up without coordinating with BWSSB.

BDA replied (February 2015) that diversion drains were laid in a few lakes as the BWSSB work of UGD was not complete as anticipated and that diversion drains were still required to prevent entry of sewage mixed rain water into the lake during the first few showers of the monsoon. The State Government (UDD) also stated (March 2015) that BWSSB is laying UGD lines in common places such as roads, common utility areas and lakes which are situated quite below the levels of the trunk lines.

The replies are not acceptable as diversion drains led to drying up of lake beds, loss of characteristics and eventual death of the water bodies and expenditure was rendered unfruitful where UGD lines had been laid by BWSSB in parallel.

5.6.3 Inadequacy in establishment of Sewage Treatment Plants

In the State of Karnataka, out of 219 local bodies, only 55 local bodies had been provided with STPs. KSPCB stated (May 2014) that directions had been issued to the local bodies to ensure that STPs are provided to prevent entry of sewage into water bodies. The DPRs had suggested establishment of STPs to treat sewage based on the inflow through all the inlets of the lake. This would ensure that the entire sewage flowing into the lake be treated and thereafter the treated water alone would enter into the lake, thereby improving the ecological health of the lake.

In Bengaluru, approximately 900 Million Litre per Day (MLD) of water was being consumed. Out of this, 80 *per cent* was generated as waste water. KSPCB norms require BWSSB to treat the entire waste water to secondary level before letting it into water bodies. Although BWSSB had the capacity to treat 721 MLD in the existing STPs, only 521 MLD of waste water was being treated and the remaining untreated sewage (200 MLD) was let into the lakes. BWSSB (November 2014) stated that construction of STPs of additional capacity of 339 MLD was under progress. Regarding apartment complexes which had their own STPs, BWSSB during Exit Conference (February 2015) stated that treated water from such apartments which had their own STPs[28] should be let into the lakes rather than into the sewer lines. However, KSPCB and BWSSB need to ensure that only treated water is let into the lakes from all such apartments.

There were two cases where STPs had not been established which are as under:

i. In Nagavara Lake in Bengaluru, the lease holder of the lake did not provide for a five MLD STP (on the north-western side of the inlet) even though it was a pre-requisite for leasing of the lake as per the contractual obligation.

[28] apartments which have 50 dwelling units or generating 50 cum of sewage daily were required to operate an STP within their premises

ii. In Kotekere tank of Belagavi, the rejuvenation works, which included the component of establishment of an STP, were completed (May 2009) incurring an expenditure of ₹5.73 crore. However, the item of STP was deleted and during JPV (March 2014) it was seen that the sewage continued to pollute the lake.

The State Government (UDD) stated (March 2015) that establishing STPs for other lakes will be extended on priority basis, while keeping in view budgetary allocations.

5.6.4 Inefficient functioning of STPs

Audit examined the functioning of STPs in the test-checked lakes in Bengaluru. The following deficiencies were noticed:

- The STP established in Dasarahalli Lake by BBMP was for a lesser capacity of one MLD although the sewage entering the lake was 2.3 MLD. The State Government (UDD) accepted (March 2015) the deficiency and explained that the lesser capacity was for dry weather flow. The reply cannot be accepted because sewage flow for dry weather alone cannot justify establishment of a capacity lesser than the requirement.

- In Vengaiahanakere, an STP of 20 MLD was provided for letting treated water into the lake. During JPV, it was observed that the STP was not working to its full capacity and the treated water was let into the SWD filled with raw sewage flowing into the lake through the same inlet. The BWSSB replied (November 2014) that the raw sewage was being diluted due to mixing with treated water. The reply is not tenable as the purpose of treating the sewage was defeated once the sewage is mixed with the treated water.

- BWSSB had constructed an STP of 60 MLD capacity in Nagavara Lake and it was not functioning due to frequent power failures. BWSSB admitted (November 2014) that this was due to not providing captive power to the STP and the same would be provided.

- The treatment of sewage was not to the installed capacity of 10 MLD in Jakkur-Sampigehalli Lake also. This affected aquatic species in the lake and mass death of fish was reported during January 2015.

All these instances indicate that the functioning of STPs was not effective and due to under-utilisation and lesser capacity of these STPs, sewage entering the lakes could not be contained. The Additional Chief Secretary, Forest, Ecology and Environment also stressed during the Exit Conference (February 2015) the need for direct supervision of STPs to ensure that the sewage is being treated to the desired level before being let into lakes.

Photograph below taken during JPV also illustrates the level of pollution in a test-checked lake.

Dasarahalli Lake main drain (inlet 1 of the lake) receives all the effluents from Peenya Industrial area as evident from the thick viscous black water flowing in the drain

Recommendation 9: BWSSB should, in coordination with implementing agencies/custodians of the lake, construct STPs and use them optimally to ensure that untreated sewage is not let into the lakes.

5.7 Other works carried out in lakes

5.7.1 Excessive desilting works

As per the NLCP guidelines, increase in the lake depth through de-siltation has an adverse impact on its flora and fauna. Execution of de-siltation component should be carried out scientifically under expert guidance. The DPRs pointed out that excessive desilting would affect the lake ecology due to hydrological retention time[29]. The Principal Chief Conservator of Forests (PCCF) highlighted (2008) the need for preserving natural foreshore region without substantial desilting and without formation of steep embankment. The Technical Advisory Committee of LDA suggested that desilting of the lake should be restricted to the quantity required for formation of embankment. The State Government also instructed (April 2010) LDA to supervise and monitor the works executed by BBMP and BDA.

Scrutiny of records revealed that desilting was undertaken for increasing the impounding capacity of water, replenishment of ground water, *etc*. It was noticed that the quantity of desilting carried out was much higher when compared to the estimate and the DPR. There was no justification on record for the excess excavation and the expenditure incurred on the excess desilting was ₹4.02 crore in 13[30] test-checked lakes. Further, it was observed that

[29] Hydrological retention time is the mean time that water is retained in a lake. If the retention time is longer, pollutants stay longer in the lake and the lake is less often flushed, thereby increasing the pollution of the lake.

[30] Allalasandra, Attur, B.Narayanapura, Chinnappanahalli, Dasarahalli, Doddanekundi, Gangashetty, Jakkur-Sampigehalli, Kaigondanahalli, Kowdenhalli, Mestripalya, Rachenahalli and Yelahanka

though desilting activities were not proposed in the DPRs of three[31] lakes, desilting work was carried out incurring an expenditure of ₹99.78 lakh. Excessive desilting had, therefore, increased the hydrological retention time and consequently increased pollution level in the lakes.

LDA also failed to supervise and monitor the excessive desilting works executed by BBMP and BDA. The LDA accepted the audit observation and stated (April 2015) that it did not have sufficient technical staff to carry out regular inspection and monitoring of lakes.

The BDA stated (January 2015) that the deepening of the lake bed was carried out to bring saucer shape to the lake bed. The reply is not acceptable as this was contrary to the expert guidance given (July 2008) by the PCCF. The State Government (UDD) admitted (March 2015) that there was excessive desilting due to accumulation of debris and other wastes in the lakes which was due to delay in the process of preparation of DPRs and execution of the work. Also, slushy soil cannot be used for formation of embankment. The reply is not acceptable as accumulation of debris and other wastes should be avoided once the lake has been handed over to the implementing agencies. For categorising the soil as 'slushy soil', there should be proper soil test reports which were not there. Also, bills showed that that even dry soil was transported out of the lake area. As such, the issue calls for investigation and fixing of responsibility for doing excess excavation as compared with DPRs.

Saucer shaped desilting and formation of elevated ring bunds seen in B.Narayanapura and Chokkanahalli Lakes

5.7.2 Irregular payment of lead charges

Lead charges are payable to the contractor for carrying material from the quarry to the work site and also for disposing of unused/unwanted material to the identified dumping place.

Audit noticed that the excess desilting also increased the expenditure incurred on the lead charges paid to contractors for the work of dumping the excavated soil. The payments were made to contractors even though there were no lead charts/maps enclosed with the approved technical estimates as required under

[31] Kogilu, Thirumenahalli and Venkateshpura

codal provisions. There were no details of transportation for lead charges claimed by the contractors. It was also seen that instead of utilising the available soil, the soil was brought from burrow areas without justification such as soil suitability test reports. In 13[32] test-checked cases, ₹4.91 crore was paid as lead charges.

The State Government (UDD) admitted (March 2015) that there was variation in lead calculation due to non-availability of dumping area near the lakes. The reply is not tenable, as it does not address the issue of non-availability of the lead charts/maps for calculation of the lead charges which are to be enclosed with the approved technical estimates, for which responsibility may be fixed.

5.7.3 Embankment work

According to the NLCP guidelines, engineering works on bund should be minimised with naturalisation of bunds as a preferred option. Further, the cost of these works was to be restricted to 10 to 15 *per cent* of the total project cost. However, excessive desilting was carried out in the lakes directed with the purpose of formation of elevated ring bunds. Action Plan for restoration of lakes stipulated formation of a packed-mud/cobble stone ground level walkway with a width not exceeding three metres, instead of ringed elevated jogging tracks. It was envisaged that ground level walkways should not obstruct the inflow of run-off water from the surrounding catchment area. This work was required to be carried out all around the lake perimeter beyond the high-water mark or close to the perimeter fence. This was also reiterated by the Conservator of Forest, LDA, during his inspection (February 2008) of Kunnirkatte Minor Irrigation tank that bund all around the lake and mound in the middle of lake would reduce the water spread area and block the entry of water into lake.

It was, however, observed that ringed elevated jogging tracks at an average height of above three metres and width up to 29 metres had been provided in 17[33] test-checked lakes. This work was also not objected to by LDA. The ring bunds were formed utilising the soil desilted and in some cases, soil was brought from burrow areas without utilising the entire available desilted soil. This prevented free inflow of run-off water from the surrounding catchment areas of the lakes. Due to execution of these works, the avoidable expenditure in respect of these lakes amounted to ₹11.32 crore.

LDA admitted (December 2014) that it had not carried out any supervision and monitoring of rejuvenation works in BBMP and BDA lakes. Failure on the part of LDA to monitor and supervise lake rejuvenation activities in BBMP/BDA lakes resulted in works adversely affecting the ecology of the lakes.

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[32] Amblipura Melinakere, Attur, Chinnappanahalli, Dasarahalli, Gangashetty, Jakkur-Sampigehalli, Kaigondanahalli, Kogilu, Mestripalya, Rachenahalli, Thirumenahalli, Vibhuthipura and Yelahanka

[33] Allalasandra, Amblipura Melinakere, Attur, B.Narayanapura, Chinnappanahalli, Dasarahalli, Doddanekundi, Jakkur-Sampigehalli, Kaigondanahalli, Kasavanahalli, Kogilu, Kowdenhalli, Mestripalya, Rachenahalli, Venkateshpura, Vibhuthipura and Yelahanka

The State Government (UDD) replied (March 2015) that the ring bunds were provided after ensuring inlets for flow of water into the lake and the expenditure incurred on ring bunds was actually necessitated. The reply is not acceptable, as the ring bunds obstruct the inflow of run-off water from the surrounding catchment area.

5.7.4 Fencing of lake

Fencing of the lake area was one of the works to be taken up on priority. Out of 56 test-checked lakes, 22 lakes were fully fenced, 25 lakes were partially fenced and there was no fence for nine lakes. During 2009-14, fencing works were taken up in 17[34] lakes and ₹11.13 crore expenditure was incurred on these works.

In Bellanduru Lake, BBMP had incurred an expenditure of ₹3.31 crore during 2009-12 and BDA had also proposed (2012-13) to undertake fencing at an estimated cost of ₹3.03 crore. The tender had been finalised and work was yet to commence (November 2014).

The expenditure on fencing and its effectiveness needs to be seen in the light of the fact that survey had not been completed and lake area was not decisively demarcated.

The State Government (UDD) admitted (March 2015) that some miscreants in order to dump debris had damaged fencing for easy access and this would be rectified. The reply is not acceptable, as the primary duty of implementing agencies was to safeguard the lake area by deploying sufficient security soon after the lake was taken over.

5.8 Absence of efforts to preserve the natural wetlands

The DPRs of the test-checked lakes invariably highlighted the significance of preserving the wetlands. However, they also suggested construction of artificial wetlands instead of providing the road map to preserve the natural wetlands. As per the instructions (July 2008) of PCCF, the formation of wetland should not be less than 25 *per cent* of the lake area.

Audit observed that constructed wetlands were provided in 14[35] lakes and the area of wetlands in all of these lakes was much less than the desired minimum 25 *per cent* of the lake area. It was also seen that the wetlands were provided inside the ringed elevated bunds whereas the diversion drains in these lakes (except Allalasandra and Attur) were provided outside the ringed elevated bunds. This resulted in the wetland region (and water spread area of the lake) remaining dry through most part of the year. During JPV of the lakes, it was

[34] Allalasandra, Attur, B.Narayanapura, Bellanduru, Dasarahalli, Doddanekundi, Gangashetty, Jakkur-Sampigehalli, Kaigondanahalli, Kowdenhalli, Mestripalya, Rachenahalli, Thirumenahalli, Varthuru, Venkateshpura, Vibhuthipura and Yelahanka

[35] Allalasandra, Attur, B.Narayanapura, Chinnappanahalli, Chokkanahalli, Dasarahalli, Doddanekundi, Gangashetty, Jakkur-Sampigehalli, Kaigondanahalli, Mestripalya, Rachenahalli, Vibhuthipura and Yelahanka

observed that the wetland region remained dry even during monsoon season and was devoid of even aquatic weeds.

The constructed wetlands were also felt to be insufficient to absorb the pollutants due to absence of aquatic weeds. Due to lack of multilayered slope design in wetland construction, the backlash of sewage to the drain was entering the settlements near the foreshore region, as observed in the case of Allalasandra Lake.

Allalasandra Lake wetland was breached to let sewage water directly into the lake without filtration

The State Government (UDD) accepted (March 2015) the observation and stated that action would be taken to rectify the breached bunds as well as inlet levels would be ensured in the lakes.

Of the test-checked lakes, the Nagavara Lake in Bengaluru was the only lake in which a natural wetland formation was noticed. However, even this wetland was full of water hyacinth and floating debris due to lack of maintenance.

Recommendation 10: LDA should insist on creation and preservation of natural wetlands instead of constructed wetlands while approving the DPRs for rejuvenation of lakes.

5.9 Lacunae in execution of afforestation works

Afforestation around the lake is an important measure to retain the natural features of the lake. Audit observed the following deficiencies:

- The State Government instructed (April 2010) that disused tanks should also be restored to their original status. However, contrary to the instructions, the planting of trees was carried out on the lake bed itself in seven[36] test-checked cases.

[36] Amblipura Melinakere, Attur, B.Channasandra, Chikka Bellanduru, Chokkanahalli, Kogilu and Thirumenahalli

- In two test-checked lakes, Chokkanahalli and Thirumenahalli, the afforestation works were carried out during 2010-11 in the lake bed and thereafter lake rejuvenation works including desilting were done during 2013-14. Audit observed during JPV, that no plantations had survived after the rejuvenation works were carried out. The efforts towards afforestation, therefore, did not yield the intended result.

Absence of plantation in Thirumenahalli Lake and Chokkanahalli Lake

The State Government (UDD) agreed (March 2015) that the works of afforestation were carried out while fencing works were in progress. This was necessary to bring the evicted area of encroachment under plantation. The reply is not acceptable as these plantation works were destroyed due to desilting and formation of elevated ring bunds in the lake. This resulted in the expenditure incurred on these afforestation works as wasteful.

Conversely, during JPV of Kaigondanahalli Lake, Audit observed that trees had been cut indiscriminately to pave way for laying sewage diversion pipe line.

Cutting of trees in Kaigondanahalli Lake

5.10 Impact assessment

Assessment of the programmes implemented over a period of time would provide insight into the deficiencies observed in planning and operation of the programmes. It would also provide necessary corrective and remedial measures to be adopted for the lacunae noticed.

Audit observed that impact assessments were not done by any of the implementing agencies on lakes after restoration works were carried out. There was also no assessment on the impact of ground water levels; water quality; damage caused to the wetlands, keystone species, flora, fauna and aquatic birds due to pollution; and the health of human beings in the vicinity of lakes before and after restoration works.

The State Government (UDD) stated (March 2015) that the KSPCB was responsible for assessing the impact of pollution of lakes on human health. Reply is not tenable as there was no effort on the part of the implementing agencies to assess the impact of pollution on lakes before or after restoration works were carried out. Also, BBMP, being the civic agency, was responsible to assess any outbreak of diseases due to deterioration of environmental conditions.

Chapter VI

Biodiversity of water bodies

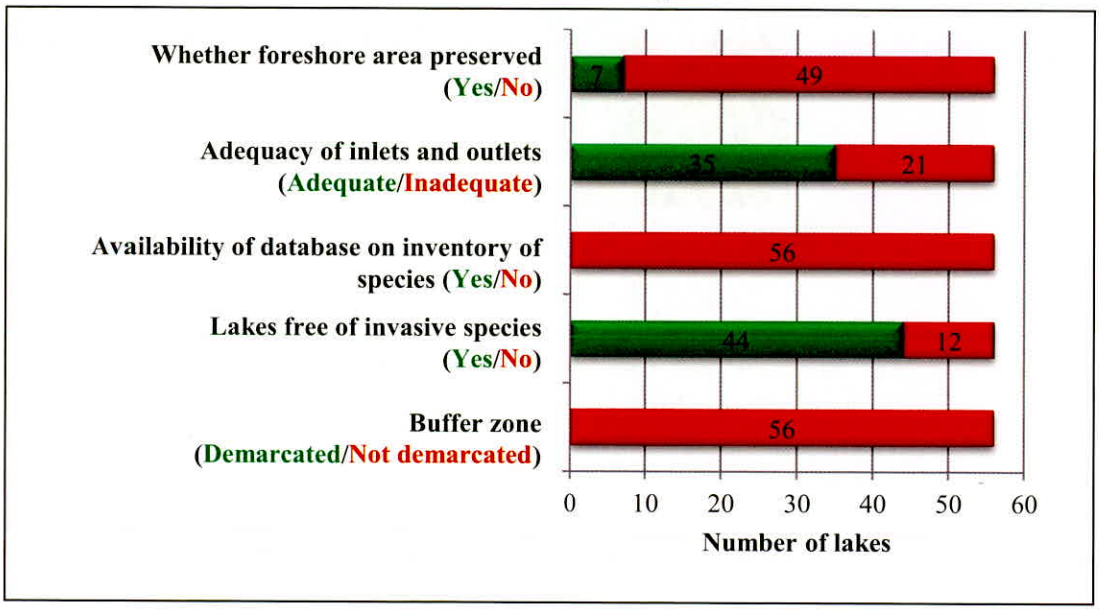
6 Efforts to preserve biodiversity

Lakes constitute habitats for a wide variety of flora, fauna and other aquatic life. They also act as important life support systems by recharging aquifers[37] and hydrological regime. Wetlands are lands transitional between terrestrial and aquatic ecosystems where the water at or near the surface of the land is covered by shallow water. It is highly important to preserve the wetlands for sustenance of a wide variety of species of flora and fauna.

This chapter examines the efforts of the implementing agencies to restore and preserve the biodiversity in a lake. These efforts include providing a lake rejuvenation plan by preserving natural wetlands and formation of wetland along with preserving the shorelines with gentle slopes, buffer zones on the outer periphery with indigenous trees to act as a protective cover to the lakes from anthropogenic disturbances, *etc.*

Main issues on biodiversity are depicted in **Chart 7** below:

Chart 7: Biodiversity issues



The audit findings are given below:

6.1 Non-preservation of foreshore area of the lake

According to the NLCP guidelines, the rejuvenation of lakes has to be carried out by preserving the gentle slopes of the shorelines. As far as possible, naturalisation of slopes was to be provided by suitable vegetation with proper

[37] an aquifer is an underground layer of water-bearing permeable rock or unconsolidated materials (gravel and sand) from which groundwater can be extracted using a water well.

selection of species (macrophytes). The Forest Department instructed (March 2008) LDA and other implementing agencies on the need for preserving the natural slopes in the foreshore region.

However, instead of preserving the natural slopes in the foreshore area, Audit found that even the estimates and DPRs provided for deep cutting and formation of elevated ring bunds with stone pitching in the 20[38] test-checked lakes. This was also seen during JPV. Deep cutting of lake area was carried out to utilise the soil excavated for formation of elevated ring bunds within the periphery of the lake. The execution of these works in the test-checked lakes thus disturbed the gentle foreshore slopes and shallowness at the mouth of the lake which would, therefore, not support flora and fauna.

Photographs of such embankment works at Chokkanahalli Lake and B.Narayanapura Lake are given below:

Deep cutting and ring bund formed in Chokkanahalli Lake and B.Narayanapura Lake

The State Government (UDD) replied (March 2015) that due to urbanisation, vast area was not available for maintaining the foreshore area. The reply is not acceptable as the available foreshore area has been destroyed to create elevated ring bund contrary to the directions issued and could therefore not support the flora and fauna and aquatic life.

6.2 Inadequate inlets and outlets of lakes

SWD *(Raja Kaluves)* are the inlets and outlets for the lakes. They are the lifelines for the survival of lakes and harbour immense potential for biodiversity conservation. During JPV of lakes, it was noticed that five[39] lakes did not have inlets, the inlets of two[40] lakes were encroached upon and there

[38] Allalasandra, Amblipura Melinakere, Attur, B.Narayanapura, Chinnappanahalli, Chokkanahalli, Dasarahalli, Doddanekundi, Gangashetty, Jakkur-Sampigehalli, Kaigondanahalli, Kasavanahalli, Kogilu, Kowdenhalli, Mestripalya, Rachenahalli, Thirumenahalli, Venkateshpura, Vibhuthipura and Yelahanka

[39] B.Channasandra, Chikka Bellanduru, Heggeri, Mahadevapura and Venkateshpura

[40] Amblipura Melinakere and Thirumenahalli

were no outlets in eight[41] lakes. Audit also observed from the records that the SWDs leading to the lakes were encroached upon/diverted in 14[42] test-checked lakes of Bengaluru. As such, there was no free inflow from *Raja Kaluves* and there was no outflow through the SWD.

Of the 56 test checked lakes, 16[43] lakes had shrunk considerably or dried up as the inlets were either encroached upon or diverted.

The State Government (UDD) stated (March 2015) that inlets and outlets were technically designed and constructed and that there were no incidents of inundation surrounding the lakes developed by BBMP. The reply was contrary to the fact that after Revenue Department survey, it was found that the *Raja Kaluves* for 14 test-checked lakes were either encroached upon or diverted.

Recommendation 11: The implementing agencies should ensure adequate inlets and outlets in all lakes in coordination with concerned agencies to restore water in lakes and make way for excess outflow.

6.3 Absence of database on inventory of species

None of the agencies which were entrusted with the development of lakes was in possession of the details of flora and fauna including keystone species[44] available in the lake after restoration works.

The State Government (UDD) admitted (March 2015) that there was no database of lakes and species therein. The Government, however, agreed to take action to maintain a database.

6.3.1 Invasive species in lakes

An invasive species is a plant or animal that is not native to a specific location (an introduced species) and has a tendency to spread, which is believed to cause damage to the environment and human health.

Audit examined the impact of one of the most common invasive plants *i.e. Eichhornia crassipes*, commonly known as water hyacinth. This kind of plant doubles itself within two weeks time. When not controlled, it blocks the sunlight reaching native aquatic plants and starves the water of oxygen, killing the fish/turtles. The rapid growth of water hyacinth was due to entry of

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41 Amblipura Melinakere, B.Narayanapura, Chokkanahalli, Horamavu-Agara, Mahadevapura, Mestripalya, Rachenahalli and Vibhuthipura

42 Attur, B.Narayanapura, Bellanduru, Chokkanahalli, Gangashetty, Horamavu-Agara, Jakkur-Sampigehalli, Kaigondanahalli, Kalkere-Rampura, Kasavanahalli, Kogilu, Kowdenhalli, Varthuru and Yelahanka

43 Amblipura Melinakere, B.Narayanapura, B.Channasandra, Chikka Bellanduru, Chokkanahalli, Doddanekundi, Gangashetty, Heggeri, Horamavu-Agara, Kogilu, Mahadevapura, Mestripalya, Shivanahalli, Thirumenahalli, Venkateshpura and Vibhuthipura

44 species whose presence and role within an ecosystem has a disproportionate effect on other organisms within the system

sewage into the lakes. Unless this menace of pollution is tackled, the growth of water hyacinth cannot be controlled.

In the test-checked lakes, Audit observed in three[45] lakes that the entire water spread area was covered with water hyacinth. In nine[46] lakes, this invasive species was found near the inlets/outlets. In 10[47] lakes under BBMP, ₹9.83 lakh had been spent on works to de-weed the invasive species.

The State Government (UDD) stated (March 2015) that due to diversion of sewage entering the water body, growth of water hyacinth was noticed and the agency maintaining the lakes would remove such invasive species. The reply was contrary to the concept that growth of water hyacinth was mainly due to entry of sewage in to the lakes leading to eutrophication. The solution lies not just in removal of the species but in ensuring entry of only treated water into the lakes.

Amruthahalli Lake and Kalkere-Rampura Lake affected by water hyacinth

6.3.2 Harmful invasive species of fish

The Fisheries Department is responsible for regulating fishing activities in the lakes. It had to ensure that native fish are reared and invasive species are avoided to enhance fish fauna in the lakes. The implementing agencies were not aware about rearing of invasive species of fish which were harmful for the survival of native fish. Scrutiny of records revealed that the Assistant Director of Fisheries, Mysuru had issued instructions (July 2014) to fishing leaseholders not to rear African catfish in Dalvoy Lake, Mysuru. However, due to lack of monitoring and strict enforcement of penal provisions by Fisheries Department, the rearing of catfish was continued. In Kaigondanahalli Lake, the agency[48] maintaining the lake informed Audit that this invasive species of fish had entered the lake from catchment area and are devouring the native fish.

[45] Amruthahalli, Garudacharpalya and Kalkere-Rampura

[46] Amruthahalli, Bellanduru, Garudacharpalya, Kalkere-Rampura, Kempkere, Kolikeri, Unkal, Varthuru and Yelahanka

[47] Amblipura Melinakere, Attur, Chinnappanahalli, Dasarahalli, Kaigondanahalli, Kasavanahalli, Kogilu, Kowdenhalli, Thirumenahalli and Yelahanka

[48] Mahadevapura Parisara Samrakshane Matthu Abhivruddhi Samithi (MPSMAS)

6.4 Creation and preservation of buffer zone of lakes

The State Government issued[49] instructions to create a buffer zone to an extent of not less than 30 metres along the periphery of the lake. A buffer zone which consists of diverse vegetation along the perimeter of water body, preferably one of natural habitat, stable species serves the functions such as sediment and nutrient transformation; metals and other pollutant reduction; storm water run-off reduction through infiltration; reduction of water temperature; reduction of human impacts by limiting easy access and by minimising edge effects from noise, light, temperature and other changes; and protection for interior wetland species and a barrier to invasion of exotic species (such as water hyacinth). In addition, buffer zones facilitate space for recreational activities and prohibit encroachments.

Buffer zones had not been created by acquiring land or regulating construction activities on the periphery in any of the test-checked lakes. Instead, the lake periphery was breached upon by slums, formation of roads and residential layouts, construction of buildings/apartments, functioning of schools, construction of quarters by Forest Department, *etc.* Possible breach of buffer zone was noticed in all the 34 test-checked lakes in Bengaluru. Illustrative cases are indicated in **Appendix 9**.

In the case of Chinnappanahalli and Kaigondanahalli Lakes, the Town Planning Wing of BBMP did not take into account the concept of buffer zone while sanctioning building plans which led to violation of buffer zone. In both the above test-checked lakes, breach of buffer zone was observed during JPV. The NGOs involved in maintenance works of these lakes had also stated that buffer zones were breached by land developers and they advocated for creation of buffer area for lakes. Member, Town Planning (BDA) stated (November 2014) that residential layout plans were approved excluding buffer zone of 30 metres. During JPV, it was, however, observed that private/BDA layouts had come up within the buffer zone in four[50] test-checked lakes.

The State Government (UDD) replied (March 2015) that the buffer area of lakes are owned by private people and development activities are going on at a rapid pace due to escalation of land prices. They also stated that the enforcement of buffer zone vests with the planning authorities. The reply is not acceptable as it indicates that the State Government has not taken any effective measures over the years for ensuring protection of the buffer zones.

Recommendation 12: The State Government should consider acquiring land or prescribing norms for regulating activities in buffer area and the buffer limits need to be reviewed to increase the norm progressively to facilitate development of buffer in the form of tree parks, walking paths, etc.

[49] during March 2008 and corrigendum during October 2008
[50] B.Channasandra, Horamavu-Agara, Jakkur-Sampigehalli and Kalkere-Rampura

S E C T I O N - IV

Lake specific findings of
12 test - checked lakes

Chapter VII

Lake specific findings of 12 test-checked lakes

Unplanned rapid urbanisation in Bengaluru and other CCs in Karnataka witnessed large scale conversion of catchment areas of the lakes to residential and commercial layouts that altered the hydrological regime and enhanced silt movement in the catchment area. In this section, an overview of twelve lakes test-checked by Audit in Bengaluru and other ULBs are highlighted indicating the present status of these lakes.

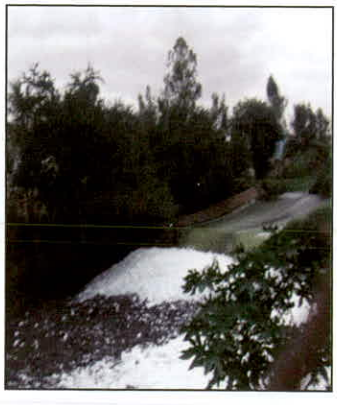
1. Bellanduru Lake

The lake is situated in south eastern part of Bengaluru in Koramangala-Challaghatta valley. It is one of the biggest lakes (919 acres) in Bengaluru and forms part of the Varthuru lake series. The lake is at present under the custody of BDA. The lake received around 400 MLD of the waste water generated from the above valleys.

- The area of the lake was only 597 acres as per the satellite map of KSRSAC (2011). Thus, there was a reduction in lake area as per the revenue records.
- The lake area was fenced partially, incurring an expenditure of ₹3.31 crore due to non-removal of encroachments.
- At Kempapura village side, SWD alignment was seen diverted by private parties resulting in encroachment and reduction in lake area.
- KSPCB categorised the water quality in the lake as 'E'. Discharge of polluted water with obnoxious odour and foam formation was observed in the waste weir region of the lake and the lake was also covered with hyacinth, which resulted in polluted water.

A view of lake from south-west side

Illegal diversion of SWD

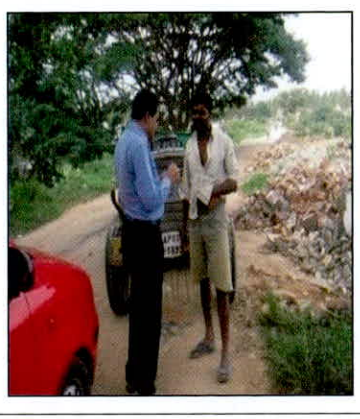


Contaminated water with foam formation in waste weir

2. Horamavu-Agara Lake

The lake is located on the eastern part of Bengaluru and is under the custody of BDA.

- The survey map of 2006 indicated that an area of 5 acres 0.25 gunta[51] was under encroachments. The lake was not demarcated and did not have a waste weir.
- During JPV, it was observed that the lake area was filled with construction debris and fencing was damaged.
- A residential apartment was pumping untreated sewage generated from the houses directly into the lake, causing pollution.
- Lake area was encroached upon for construction of bus-stand near north-west inlet. Several apartments and other residential houses had breached the buffer zone. This indicated implementing agencies were not taking measures to safeguard the buffer zone.
- The pollution level was not being monitored by any of the agencies and no works were taken up during 2009-14.

		
A tractor driver filling the lake bund with construction debris	**Bus stand construction in lake area**	**An apartment complex pumping raw sewage**

3. Chikka Bellanduru Lake

The lake is located in Bengaluru (East) Taluk and at present is under the custody of BDA.

- As per 2006 Revenue Department survey, an extent of 10 acres of lake area was encroached upon. During JPV, it was observed that the lake area was also encroached upon by slum dwellers.

[51] Gunta is a unit of measurement of area. 40 guntas is one acre.

- The village map and other records revealed that the adjoining Survey.No.63 of Mullur village which was part of the lake is now shown as private land in the latest certified revenue survey map (2010).

- BBMP had planted trees in the lake bed area and no restoration works were taken up either by BBMP or BDA to revive the lake as a fresh water body.

- There were no inlets to the lake and thus, the entire lake bed had dried up.

- Lake was polluted with solid waste and construction debris and the pollution level was also not being monitored by any of the agencies.

Dried up lake bed

Construction debris dumped inside the lake bed and solid waste dumped near huts in the lake area

4. Vengaiahanakere

The Vengaiahanakere is situated in Bengaluru (East) taluk with an area of 64.89 acres. The lake was developed by the LDA during 2002-03 using NLCP grants and was leased to M/s. PAR.C, Bengaluru since 2005 for a period of 15 years.

- The lessee was operating motor boats, violating the agreemental clause and polluting the lake. The LDA stated (April 2015) that lessee had been directed not to use motor boats in the lake.

- The Bengaluru-Kolar National Highway was formed on the main bund of the lake. On the eastern side of the lake, a vast area was being filled with earth for formation of a road inside the lake area. The LDA stated (April 2015) that the Hon'ble High Court had given permission to utilise lake land for constructing National Highway. The reply is not acceptable as the road passing over this lake was not raised on pillars and slabs, which contravened the directions of the Hon'ble High Court.

- BWSSB's UGD line inside the lake bed was seen overflowing into the lake area. The treated water from STP and untreated sewage was mixed and was entering the lake. The water quality of the lake was not being monitored by any of the agencies. The LDA stated (April 2015) that BWSSB had been directed to make provision for diversion of sewage and lay down separate pipeline for entry of treated water into the lake.

❖ A walkway bridge (near Tambuchettypalya Road) was seen damaged, posing danger to the lake users. The LDA replied (April 2015) that walkway bridge had been repaired.

Lake area with solid waste

Motor boats in lake area

Inlet from STP side bringing polluted water

5. Allalasandra Lake

Allalasandra Lake forms part of the Yellamallappa Chetty Lake Series and is at present under the custody of BBMP.

❖ Residential quarters for the staff of Forest Department were provided inside the lake area and a vast area of lake was also occupied by slum dwellers.

❖ The lake rejuvenation works carried out (2010-13) incurring an expenditure of ₹7.58 crore were mainly non-core works as detailed below.

- Rejuvenation of lake was focused mainly on beautification works such as landscaping along the ring bund, gazebo and resting place, *etc*.
- Boat jetty was non-functional without boats.
- Island constructed was without plants.
- During JPV, it was observed that only four play stations had been installed in childrens' play area inside the lake bed though payment of ₹36.80 lakh had been made for seven play stations. This had resulted in excess payment of ₹15.76 lakh.

Island seen without plantation

Children's play area erected in lake bed

Residential quarters of Forest Department inside lake area

6. Rachenahalli Lake

Rachenahalli Lake is in the custody of BDA. The lake rejuvenation works were carried out incurring an expenditure of around ₹14 crore and the lake was not maintained thereafter.

- ❖ Restoration works carried out without removal of encroachments.
- ❖ BDA had formed a residential layout in the lake area. It also irregularly diverted 11 acres of lake for formation of park as part of rejuvenation works in violation of rules.
- ❖ Fencing was breached and left open in many stretches to provide access roads to the nearby residential areas.
- ❖ The level of pollution was not assessed by any agency. BWSSB laid UGD network very close to the water spread area with the approval of LDA and BDA.
- ❖ The treated water flowing from Jakkur Lake was not entering the lake as the inlet was connected to sewage diversion channel and wetland remained dry.

BWSSB trunk sewer chamber close to the water spread area

Lowered waste weir without flow

Constructed wetland without any water

7. Nagavara Lake

Nagavara Lake is situated in Bengaluru (East) taluk and the outer ring road had been constructed on one side of the lake. The lake was developed by LDA during 2002-03 with NLCP grants. The lake was given on lease to M/s. Lumbini Gardens in 2004.

- ❖ There was no demarcation of lake area and a portion of lake area on the south east corner was diverted for providing connectivity to the upcoming Special Economic Zone. LDA stated (April 2015) that letters had been addressed to BBMP and BDA to stop the road formation in the lake area. It was further stated that a police complaint had been lodged as BBMP was in the process of laying sewage pipeline and connecting it to SWD of Nagavara Lake.

- The lessee had provided restaurants, party halls, amusement and water theme parks, motor boats *etc.*, thereby polluting the lake area. Due to sewage ingression, the entire wetland region was covered with water hyacinth and floating debris. The level of pollution was not assessed by any agencies. LDA replied (April 2015) that action would be taken to improve the ecological health of the lake.

		
Sewage with floating debris from SWD entering the lake	**Formation of Special Economic Zone in the Buffer zone**	**Wetland fully covered with water hyacinth and weeds**

8. Chokkanahalli Lake

Chokkanahalli Lake forms part of Yellamallappa Chetty Lake Series. The lake is at present under the custody of BBMP.

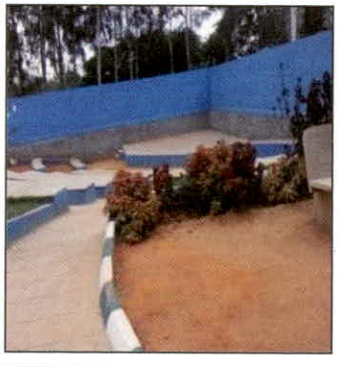
- The *atchcut* area across the main bund had been demarcated for residential site formation.
- The lake bund was used as a road to provide connectivity to the nearby areas.
- During JPV, a graveyard was noticed inside the lake area. Local people were fishing in the lake.
- The constructed inlet was defective as the opening of inlet was below the existing waste weir. The inlet provided with silt trap, screen barrier *etc.*, was clogged and the excess water was not flowing into the lake.
- The pollution level was not being monitored by any of the agencies.

		
Fishing in the lake	**Graveyard inside the lake**	**Inlets opening to the lake below the level of waste weir**

9. Kaigondanahalli Lake

Kaigondanahalli Lake is part of Varthuru Lake series and the lake is at present under the custody of BBMP.

- The Sarjapura main road is passing through the lake bund, thereby reducing the lake area.
- Natural flow of rain water/storm water had been restricted to flow through pipeline due to the formation of ring bund.
- Sewage diversion line was laid inside the water spread area by cutting trees.
- The foreshore area on the southern part of the lake was being developed into residential complex, breaching the buffer zone.
- An open amphitheatre was constructed in the lake bed, reducing the lake area.
- KSPCB (November 2013) classified the quality of water of lake as "E" category, which was below the prescribed standard "B" for outdoor bathing in developed lakes.
- An NGO (MPSMAS) had taken up the responsibility to maintain the lake.



Amphitheatre inside the lake

Diversion pipeline laid inside lake

Loss of foreshore area due to formation of ring bund in the lake

10. Kowdenhalli Lake

Kowdenhalli Lake is located adjacent to the Indian Telephone Industries (ITI) factory in Ramamurthynagar. The lake is at present under the custody of BBMP.

- The natural wetland was encroached by the ITI factory and a road was formed in the centre as a connecting route to K.R. Puram.
- The lake is spread over 55 acres 5 guntas and half of the lake area had been encroached upon by a college, slum, residential layouts, road, market, *etc.* The conservation and restoration works were, therefore, carried out only in the remaining area of 20 acres and 35 guntas.
- The lake was full of weeds which was removed and dumped alongside the pathway.

- The silt traps/sedimentation tanks were blocked, thus disallowing any inflow into the lake and instead the *Raja Kaluve* (SWD) with sewage and solid waste was flowing from the surrounding settlements into the lakes, thereby polluting the lake.

- The pollution level was not being monitored by any of the agencies.

		
Removed weeds dumped alongside the pathway	***Raja Kaluve* with sewage and solid waste**	**Blocked silt traps/sedimentation tanks without water entering the lake**

11. Bhishma Lake

Bhishma Lake with an area of 103 acres (41.70 hectare) is the only water body in Gadag-Betageri City and the lake is under the custody of Forest Department.

- The lake has been de-watered for restoration work and for erection of the statue of Lord Bashweshwara. The lake area where the statue was erected had dried up as indicated in the photograph below.

- The inflow of sewage from one inlet had stagnated on one side of the lake as indicated in the photograph below.

- The pollution level was not being monitored by any of the agencies.

	
Sewage being collected at one side	**Dried up area near statue**

12. Akkamahadevi Lake in Haveri

Akkamahadevi Lake is a major water body of Haveri City with an area of 13.70 acres. The lake is under the custody of CMC, Haveri. Restoration of the lake was carried out under NLCP during 2004-12 by incurring an expenditure of ₹2.64 crore.

- Due to non-maintenance, the lake periphery and the bund were full of bushes/weeds as shown in the photograph below.
- Open defecation was prevalent and clothes were being washed in the lake polluting the lake. This was shown in the photograph below.
- KSPCB categorised the water quality as "D" which did not conform to the required standard of "B" class.

Bushes/weeds growing in the periphery of lake

Washing clothes in lake area

Chapter VIII

Conclusion

The Performance Audit on 'Conservation and Ecological restoration of Lakes under the jurisdiction of Lake Development Authority and Urban Local Bodies' indicated weak institutional mechanisms and legal framework, with assigned functions and responsibilities not being effectively carried out by the entities involved in the conservation and restoration of lakes.

Community participation, which plays an important role in the conservation, restoration and maintenance of lakes, was also found to be minimal. Transparency in administration and disclosure of information on lakes in public domain was inadequate and no effort had been made to constitute a single window agency for a grievance redressal mechanism on lakes. LDA, the overall monitoring agency, did not have any substantial authority and acted mainly as a mediator between the public and the entities involved in conservation of lakes.

It was also observed that restoration works were carried out without adequate planning with no integrated approach amongst the different implementing agencies responsible for lake rejuvenation work. The disconnect in the efforts of the various implementing agencies resulted in irreparable damage in achieving the goal of conservation and ecological restoration of the lakes. The emphasis of the implementing agencies was seen to focus more on engineering measures rather than ecological preservation and restoration of the lakes.

One of the key requirements for preservation and ecological restoration of lakes is to update the survey and demarcation records. However, much work is left for completion of the same. Also, the implementing agencies did not have any proper database on encroachments, and hence the work of removal of encroachments from lake areas was only partial. Apart from encroachments, lake areas have also been diverted and given away in the form of grants by the Revenue Department.

Most lakes continued to remain polluted with the efforts to reduce sewage entry into lakes being inadequate. Sewage Treatment Plants did not have adequate capacity for treating fully the contaminated water and many of the existing plants also did not function effectively. Works were also carried out without proper planning and prioritisation as evidenced from numerous executions of non-core works. Even core activities were undertaken in a haphazard manner as observed from excessive desilting, formation of elevated ringed bunds, ineffective wetland constructions, *etc.*

Despite undertaking various restoration works, preservation of biodiversity of lakes was not adequate as seen from the loss of natural wetland with aquatic species, spread of invasive species, absence of buffer zones along the periphery of many lakes and destruction of habitat of aquatic weeds and birds. The implementing agencies had also not assessed the impact of pollution in lakes and its risks to human health, biodiversity and ground water.

The lake specific findings of the 12 test-checked lakes indicated that sewage was the major source of pollution. Also, many encroachments persisted and proper fencing of lake boundaries was inadequate. Restoration works carried out in these lakes were seen to have been more for providing recreation facilities rather than for preservation of the ecosystem.

Thus, the various agencies involved were not effective in taking sustainable initiatives for restoring water quality and maintaining ecological health of the lakes. If adequate and effective measures are not taken, we will continue to lose lake areas and will not be able to conserve, preserve and restore our lakes for the benefit of future generations.

Bengaluru
The 27 MAY 2015

(Subhashini Srinivasan)
Principal Accountant General
(General and Social Sector Audit)

Countersigned

New Delhi
The 28 MAY 2015

(Shashi Kant Sharma)
Comptroller and Auditor General of India

APPENDICES

Appendix 1

Lakes that have lost their characteristics

(Reference: Paragraph 1/Page 1)

Sl. No.	Name of the Lake	Converted as
1	Marenahalli Lake	Marenahalli
2	Sarakki Agrahara Lake/Doresanipalya	JP Nagar 4th Phase
3	Chinnagara Lake	Ejipura
4	Challaghatta Lake	Karnataka Golf Club
5	Domlur Lake	Domlur Second Stage
6	Siddapura Lake	Siddapura/Jayanagar 1st Block
7	Geddalahalli Lake	RMV II Stage, I Block
8	Nagashettihalli Lake	RMV 2nd Stage, 2nd Block
9	Kadirenahalli Lake	Banashankari 2nd Stage
10	Tyagarajanagar Lake	Tyagarajanagar
11	Tumkur Lake	Mysore Lamps
12	Ramshettypalya kere	Milk Colony (Playground)
13	Agasana Lake	Gayathri Devi Park
14	Ketamaranahalli Lake	Rajajinagar (Mahalakshmipuram)
15	Gangashetty Lake	Minerva Mills & Open Ground
16	Jakraya Lake	Krishna Flour Mills
17	Dharmambudhi Lake	Kempegowda Bus Terminal
18	Agarahar hosakere	Cheluvadipalya
19	Kalasipalya Lake	Kalasipalya
20	Sampangi Lake	Kanteerava Stadium
21	Shoolay Tank	Ashoknagar, Football Stadium
22	Akkitimmanahalli Tank	Sai Hockey Stadium
23	Sunkal Tank	KSRTC Regional workshop
24	Koramangala Lake	National Dairy Research Institute
25	Kodihalli Lake	New Thippasandra/Government Buildings
26	Hoskere	Residential/Railway Stockyard
27	Sonnenehalli Lake	Austin Town (RES Colony)
28	Gokula Tank	Mathikere
29	Vidyaranyapura lake	Vidyaranayapura (Jalahalli East)
30	Kadugondanahalli Lake	Kadugondanahalli
31	Hennur Lake	Nagavara (HBR Layout)
32	Banaswadi Lake	Subbayanapalya Extention
33	Chennasandra Lake	Pulla Reddy Layout
34	Vijinapura Lake (Kotturu)	Rajarajeshwari Layout
35	Murugeshpalya Lake	Murugeshpalya
36	Parangipalya Lake	HSR Layout
37	Mestripalaya Lake	Mestripalaya (Open Ground)
38	Timberyard Lake	Timberyard Layout
39	Gangodanhalli Lake	Gangodanhalli
40	Vijayanagar Chord Road Lake	Vijayanagar
41	Oddarapalya Lake	Rajajinagar (Industrial Area)
42	Saneguruvanahalli Lake	Shivanahalli (Play Ground)
43	Kurubarahalli Lake	Basaveshwaranagar

Source: Annexure XII of Report of Committee constituted by the Hon'ble High Court of Karnataka to examine the ground realities and prepare action plan for preservation of lakes.

Appendix 2

Important recommendations of Shri. N. Lakshman Rau Committee

(Reference: Paragraph 1/Page 1)

- The existing tanks should not be breached but retained as water bodies;
- Efforts should be made to ensure that these tanks are not polluted by discharge of effluent and industrial wastes;
- To prevent silting up of these tanks, off-shore development is to be taken up by large scale tree planting and also removal of encroachments;
- These tanks which have already been breached should not be utilised for formation of sites but taken up to create tree parks;
- Existing tanks should be de-weeded and aquatic life must be developed;
- The BDA/Bengaluru CC/MI Department must immediately remove encroachments on the tank areas;
- Government should set up an implementation agency and review the implementation of the recommendations periodically;
- The responsibility for the maintenance of water bodies in clean and safe condition should be by Bengaluru Water Supply and Sewerage Board; and
- The possibility of construction of more tanks along the natural valleys which now have a run-off water should be examined and implementation taken up.

Appendix 3

Sampling methodology

(Reference: Paragraph 2.2/Page 3)

LDA: LDA had provided funds for 16 lakes under NLCP, six lakes under NWCP and six lakes under State Fund to implementing agencies for development of lakes.

Eleven of these lakes (NLCP: 6 lakes, NWCP: 2 lakes and State Fund: 3 lakes) were selected for detailed audit. Further, 33 *per cent* of CCs having lakes (two out of six CCs excluding Bengaluru) were taken for review.

CCs: Selection of CC was done by applying simple random sampling method after arranging the CCs in alphabetical order excluding Bengaluru.

Bengaluru: BBMP lakes were selected by selecting three out of eight zones. Out of the three zones, 33 *per cent* of the lakes (13 lakes) under the jurisdiction of those zones were selected by adopting the simple random sampling method. Similarly, lakes of BDA were selected by selecting two out of four zones. Out of the two zones, 33 *per cent* of the lakes (19 lakes) under the jurisdiction of those zones were selected by adopting the random sampling method.

Lakes selected for the Performance audit

	Names of the Lakes
NLCP Lakes (6 lakes)	Akkamahadevi Lake, Haveri; Amanikere, Tumakuru; Bhishma Lake, Gadag; Kotekere, Belagavi; Nagavara Lake and Vengaiahanakere, Bengaluru.
NWCP Lakes (2 lakes)	Gudavi Wetland, Shivamogga and Magadi Wetland, Gadag.
State Fund (3 lakes)	Dalvoy Lake, Mysuru; Kunnirkatte Lake, Channapatna and Rangarayanadoddi Lake, Ramanagara.
BBMP (13 lakes)	Allalasandra Lake; Amblipura Melinakere; Attur Lake; Chinnappanahalli Lake; Chokkanahalli Lake; Dasarahalli (Chokkasandra) Lake; Kaigondanahalli Lake; Kasavanahalli Lake; Kogilu Lake; Kowdenhalli Lake; Kundalahalli Lake; Thirumenahalli Lake and Yelahanka Lake.
BDA (19 lakes)	Amruthahalli Lake; B.Channasandra Lake; B.Narayanapura Lake, Bellanduru Lake, Chikka Bellanduru Kere, Doddanekundi Lake, Gangasetty Lake, Garebhavipalya Lake, Garudacharpalya (Achanakere) Lake, Horamavu-Agara Lake, Jakkur-Sampigehalli Lake, Kalkere-Rampura Lake, Mahadevapura Lake, Mestripalya Lake, Rachenahalli Lake, Shivanahalli Lake, Varthuru Lake, Venkateshpura Lake and Vibhuthipura Lake.
Hubballi-Dharwad (10 lakes)	Heggeri Lake, Kelageri Lake, Kempkere, Kolikeri, Navalur Lake, Nuggikeri, Sadankeri, Someshwara Lake, Unkal Main Lake and Unkal Small Lake.
Belagavi (3 lakes)	Alarwad tank, Kuduchi big tank and Kuduchi small tank.
Total (56 lakes)	

Appendix 4

Salient features of the Karnataka Lake Conservation and Development Authority Act, 2014

(Reference: Paragraph 2.5/Page 5)

The salient features of the Act are as under:

1. The Authority shall exercise regulatory control over all the lakes within the limits of Municipal Corporations and Bengaluru Development Authority including prevention and removal of encroachment of lake.

2. The Authority shall be a body corporate, having a Governing Council, Executive Committee and conduct periodical meetings;

3. The Functions of the Authority shall be to protect, conserve, take up environmental impact assessment studies, mapping of lakes, plan for integrated development, create habitat (wetlands) for aquatic biodiversity, augmenting recharge of ground water, aquifers, to improve and monitor water quality to utilise the lakes for purpose of drinking water, fishing, irrigation, tourism, *etc.*

4. The Authority shall have powers to cause entry upon or authorise any officer to enter upon any land to survey, demarcate and make maps of lakes, to receive grants, donations, *etc.*

5. The Act prohibits use of lake for any purpose other than storage or impounding water.

6. The Act gives the Authority powers to direct any officer of Government or any local or other authority who is the custodian, or in control of any lake to permanently demarcate its boundaries, to remove encroachments or unauthorised occupation of such lake.

7. The Authority shall have powers to summarily evict encroachments and seizure of property liable for confiscation.

8. The Authority shall create a fund and spend money for performing its duties and functions; maintain accounts and other records, prepare budget and annual financial statements, Annual Reports, *etc.*

9. The Authority shall have delegation powers, prosecution powers and powers to make rules and regulations.

Appendix 5

Details of expenditure incurred on restoration[52] works in test-checked lakes

(Reference: Paragraph 3.7/Page 14)

Sl. No.	Name of the lake	Period of Execution	Estimated cost (₹ in crore)	Expenditure (₹ in crore)
Bengaluru				
1.	Allalasandra Lake, BBMP	2009-13	9.04	7.58
2.	Amblipura Melinakere, BBMP	2012-13	2.70	1.47
3.	Attur Lake, BBMP	2009-11	3.75	3.68
4.	B.Narayanapura Lake, BDA	2014-15	1.91	0.99
5.	Bellanduru Lake, BDA	2009-12	3.78	3.31
6.	Chinnappanahalli Lake, BBMP	2009-10	0.78	1.59
7.	Chokkanahalli Lake, BBMP	2013-14	1.40	1.51
8.	Dasarahalli Lake, BBMP	2008-14	10.31	5.97
9.	Doddanekundi Lake, BDA	2013-14	9.07	6.13
10.	Gangashetty Lake, BDA	2013-14	2.40	0.99
11.	Jakkur-Sampigehalli Lake, BDA	2009-12	21.98	14.93
12.	Kaigondanahalli Lake, BBMP	2009-14	8.41	6.06
13.	Kasavanahalli Lake, BBMP	2013-14	3.00	3.24
14.	Kogilu Lake, BBMP	2012-13	4.90	2.62
15.	Kowdenhalli Lake, BBMP	2008-11	3.96	4.22
16.	Mestripalya Lake, BDA	2012-14	2.29	0.87
17.	Nagavara Lake, Bengaluru		6.00	3.35
18.	Rachenahalli Lake, BDA	2009-12	19.00	14.65
19.	Thirumenahalli Lake, BBMP	2012-14	2.20	2.33
20.	Varthuru Lake, BDA	2013-14	2.33	0.87
21.	Vengaiahanakere, Bengaluru		2.12	2.01
22.	Venkateshpura Lake, BDA	2009-10	0.47	0.74
23.	Vibhuthipura Lake, BDA	2013-14	3.37	0.68
24.	Yelahanka Lake, BBMP	2011-13	16.15	14.34
Other cities				
25.	Akkamahadevi Lake, Haveri	2005-12	2.64	2.52
26.	Alarwad Tank, Belagavi	2012-13	1.00	0.63
27.	Amanikere Lake, Tumakuru	2008-14	13.37	9.09
28.	Bhishma Lake, Gadag	2004-12	2.50	2.33
29.	Dalvoy Lake, Mysuru	2013-14	1.17	0.82
30.	Gudavi Wetland, Shivamogga	2005-13	0.98	0.61
31.	Kotekere Lake, Belagavi	2004-09	5.64	5.73
32.	Kuduchi Tank (Big), Belagavi	2011-12	0.23	---
33.	Kuduchi Tank (Small), Belagavi	2012-13	0.36	---
34.	Kunnirkatte Lake, Channapatna	2007-11	0.46	0.41
35.	Magadi Wetland, Gadag	2005-14	0.66	0.39
36.	Rangarayanadoddi Lake, Ramanagara	2007-11	0.24	0.22

Source: As furnished by the implementing agencies

[52] de-watering, dredging, earthwork excavation, fixing foundation, construction of granite/trap size stone masonry in basement, *etc.*

Appendix 6

Comparative study of lake area of test-checked lakes

(Reference: Paragraph 4.3/Page 18)

Sl. No.	Name of the lake	Survey No.	Area of the lake as per Shri Lakshman Rau Committee Report (Acres-guntas)	Area as per 2006 revenue survey (Acres-guntas)	Area as per Government Order (2011) (Acres-guntas)	Area as per DPR (Acres-guntas)	Area as per KSRSAC (Cadastral maps) (Acres-guntas)	Area as per Record of Rights, Tenancy and Crops (RTC) (Acres-guntas)
1	2	3	4	5	6	7	8	9
1.	Allalasandra Lake	15	43-1.09	41-23	41-23	NA	49-31.77	41-23
2.	Amblipura Melinakere	36	47-29.80	61-11	12-16	12-15.97	13-7.8	12-16
3.	Amruthahalli Lake	115	23-3.78	24-36	24-36	NA	25-20.752	24-36
4.	Attur Lake	81	74-0.52	56-29	56-23	90-6.2	84-9.06	56-29
		92, 39, 12		33-15	33-15			33-15
5.	B.Channasandra Lake	64	18-19.02	19-17	19-17	NA	44-6.22	19-17
6.	B.Narayanapura Lake	109	19-36.32	15-06	14-20	12-18.94	0-18	15-06
7.	Bellanduru Lake	1		284-02	284-02		597-1.1	
		6		13-15	13-15			
		12		399-14	399-14			399-14
		62			4-3			3-04
		43		166-15	166-15			166-15
		2				915-0		
8.	Chikka Bellanduru Lake	9	Not listed	67-14	67-14	NA	68-1.824	67-14
9.	Chinnappanahalli Lake	01-15	27-19.64	11-39	11-39	14-1.18	12-37.16	11-33 (Sy. No.15) 11-10 (Sy. No.17)
10.	Chokkanahalli Lake	2	8-35.68	8-02	8-02	08-02	8-24.49	8-02
11.	Dasarahalli (Chokkasandra) Lake	24		3-29	3-29	20-01	28-13.02	3-29
		5	26-12.22	24-04	26-30			24-04
12.	Doddanekundi Lake	200, 13, 25	116-11.504	56-39 (Sy. No.200) 3-15 (Sy. No.13)	118-32	111-34.65	122-20.528	56-39 (Sy. No.200) 3-15 (Sy. No.13) 75-16 (Sy. No.25)
13.	Gangashetty Lake	58		18-32	18-32		18-2.109	18-32
		46		2-35	2-35			2-35
14.	Garebhavipalya Lake	41	22-12.16		18-04	NA	17-39.017	
15.	Garudacharpalya Lake (Achanakere)	31	Not listed	5-36	5-36	NA	5-39.115	5-36
16.	Horamavu-Agara Lake	77	134-16-89	51-34	51-34	NA	52-7.831	

Sl. No.	Name of the lake	Survey No.	Area of the lake as per Shri Lakshman Rau Committee Report (Acres-guntas)	Area as per 2006 revenue survey (Acres-guntas)	Area as per Government Order (2011) (Acres-guntas)	Area as per DPR (Acres-guntas)	Area as per KSRSAC (Cadastral maps) (Acres-guntas)	Area as per Record of Rights, Tenancy and Crops (RTC) (Acres-guntas)
1	2	3	4	5	6	7	8	9
17.	Jakkur-Sampigehalli Lake	19, 16, 17, 23	123-22.08	3-14, 3-01, 38-33	160-30	160-30	156-35.182	
		55		58-16				1-04 58-16
18.	Kaigondanahalli Lake	78, 7	68-11	18-18	18-18	41-38.72	49-22.44	NA
		7	43-1.8		30-05			4-13
19.	Kalkere-Rampura Kere	22	12-14.2	3-04	3-04			
		71		12-15	11-35			
		86	88-38.2	108-07	108-07			
		162	185-13	64-25	64-25	NA	184-32.204	
20.	Kasavanahalli Lake	50	43-1.09	20-30	21-30	52-28.78	55-19.84	21-30
		32		33-18	33-18			33-18
21.	Kogilu Lake	84	444-31.2	40-04	40-04	73-28	73-32.08	40-04
		117		33-24	33-24			38-24
22.	Kowdenhalli Lake	27	44-24.92	55-05	55-05	34-4.42	59-30.81	55-05
23.	Kundalahalli Lake	5	25-35.42		30-20	NA	32-8.34	2-17
24.	Mahadevapura Lake	187	Not available	13-11	13-11	NA	13-22.132	
25.	Mestripalya Lake	28, 29, 30, 32	11-7.56		10-34	11-21	12-32.09	
26.	Nagavara Lake	58, 12, 13	108-13.36		90-23			
27.	Rachenahalli Lake	69	148-8	18-16			163-12.88	18-16
		82		42-07				
		61		73-23				73-23
28.	Shivanahalli Lake	48	24-28	14-30	14-30	NA		14-30
		38		3-22				3-22
29.	Thirumenahalli Lake	63	9-35.2	7-10	22-27	23-08	7-20.61	
		68-78, 84-86, 105-107						21-08
30.	Varthuru Lake	319	445-31.12	439-34	445-14	445-14	463-6.56	445-14
31.	Venkateshpura Lake	12	6-36.72	6-35	10-34.72	10-35	7-9.74	
		37		11-29				
32.	Vibhuthipura Kere	175	36-25.20	45-18	45-18	44-20.37	46-22.59	
33.	Yelahanka Lake	29	197-27.36	53-36	53-36	297-28	288-36.90	53-36
		15, 39, 19		238-08	238-08			238-08
		49		18-04	8-18			18-04

NA: Not available

Appendix 7

Encroachment of lake area

(Reference: Paragraph 4.5/Page 20)

Sl. No.	Name of the lake/Custodian	As per DPR	As per Joint Verification
Bengaluru			
1.	Allalasandra/BBMP	DPR not produced to Audit	Road, slum
2.	Amblipura Melinakere/BBMP	The tank is land locked with compound walls of properties abutting tank	Inlet encroached by Defence authorities
3.	Amruthahalli/BDA	DPR not produced to Audit	A family settled inside, road passes through the main bund. Lake bed being filled up and cutting trenches for BWSSB's UGD work
4.	Attur/BBMP	Building and solid wastes are unloaded in the lake bed and on bund and road; Farmers have encroached the lake area, formation of road in lake bed	100 ft. asphalted road, raising of nursery inside lake
5.	B.Channasandra/BDA	DPR not produced to Audit	The inlets to the lake missing and considerable area of the lake was taken by BDA while forming OMBR layout to allot compensatory sites
6.	B.Narayanapura/BDA	Outer Ring Road, service road and approach road to nearby localities. In addition lake land is encroached by settlements	Outer Ring Road, service road and approach road to nearby localities. In addition, lake land is encroached upon by temple, slum and other settlements
7.	Bellanduru/BDA	Encroachment in 16 acres identified	Change of water course by diverting inlet at Kempapura village noticed
8.	Chikka Bellanduru/BDA	DPR not produced to Audit	The lake inlet was missing. Earth filling, solid waste dumping
9.	Chinnappanahalli/BBMP	No encroachments indicated	Temple and a house
10.	Chokkanahalli/BBMP	No encroachments indicated	Lake bund was used as road
11.	Dasarahalli/BBMP	Road, slum	Road, slum, temple
12.	Doddanekundi/BDA	As per topographical survey in DPR the lake spread over only 111 acres. There were four inlets to the lake	Road inside fenced area of lake, temple, children's' park, *etc.* During JPV, only three inlets were available. South-west inlet channel was missing
13.	Gangashetty/BDA	Encroachment, allotment for government school building slum and road	Inlets missing and road formed on the lake bed
14.	Garebhavipalya/BDA	DPR not produced to Audit	The lake area encroached and formation of roads on the lake area. Also a temple exists inside the lake. Earth filling inside the lake area
15.	Garudacharpalya (Achanakere)/BDA	DPR not produced to Audit	Road connecting Garudacharpalya to Outer Ring Road. Sheet houses on the northern region of the lake
16.	Horamavu-Agara/BDA	DPR not produced to Audit	Roads formation on all four sides and encroachments. Outlet encroached upon. Earth filling, breaching fencing and new encroachments for formation of bus stand noticed

Sl. No.	Name of the lake/Custodian	As per DPR	As per Joint Verification
17.	Jakkur-Sampigehalli/BDA	Not specifically indicated	Road formed inside the lake
18.	Kaigondanahalli/BBMP	No visible encroachment was seen. Downstream flow of lake is seen obstructed with development of *atchcut* area	Auditorium, lake area used as playground by school
19.	Kalkere-Rampura/BDA	Not available	A graveyard inside the lake. Earth filling was under progress at fore shore area during JPV
20.	Kasavanahalli/BBMP	Specific encroachments not mentioned	Inlet encroached by apartment builders
21.	Kogilu/BBMP	Road exist on the south east side of the tank	*Kutcha* road
22.	Kowdenhalli/BBMP	More than 50 *per cent* of the tank area has been encroached by various buildings. A college has come up in the tank area	Road, residences, market place, college, dumping of debris, Government school, slum, inlet encroached
23.	Kundalahalli/BBMP	DPR not prepared	Graveyards, metal road, slum, dumping of debris
24.	Mahadevapura/BDA	DPR not produced to Audit	Outer Ring Road, service road and approach road to nearby localities. In addition, lake land is encroached upon by temple and slum
25.	Mestripalya/BDA	The lake is dry for past twenty years and original inlets and outlets lost	Three new narrow inlets drawn without identifying any catchment area to the lake. Private nursery in lake area
26.	Rachenahalli/BDA	Not specifically indicated	Encroachments and lake area diverted for formation of roads and park
27.	Shivanahalli/BDA	DPR not produced to Audit	A culvert is constructed on lake bed to provide connectivity to upcoming five star project
28.	Varthuru/BDA	Encroachment identified	Varthuru main road is main bund of the lake
29.	Venkateshpura/BDA	No encroachment	Inlet not clearly defined
30.	Vibhuthipura/BDA	Waste weir filled up and road formed	Lake area demarcated and encroached area identifiable. Earth filling noticed
31.	Yelahanka/BBMP	Solid waste and building waste are being dumped	Inlet drain encroached by granite stone walls, temple, graveyard
Other cities			
32.	Amanikere/DC, Tumakuru	As per Minutes of Meeting of District Lake Monitoring Committee dated 05.06.2014	Encroachments by human settlements were noticed
33.	Bhishma/DC, Gadag	Encroachment on the fringes of the lake as per lake inspection report of LDA dated 30.10.2003	Encroachments by human settlements were noticed
34.	Gudavi Wetland/DC, Shivamogga	As per Management Action Plan encroachment to the extent of 8 hectares	Encroachments by human settlements were noticed
35.	Kunnirkatte, Channapatna/ DC, Ramanagara	As per correspondence during execution of work	Encroachments by human settlements were noticed
36.	Rangarayanadoddi/DC, Ramanagara	Not indicated in DPR	Encroachments were noticed

Appendix 8

Sources of pollution identified during Joint Physical Verification in selected lakes
(Reference: Paragraph 5.2/Page 24)

Sl. No.	Name of the lake	Main source of pollution
Bengaluru		
1.	Allalasandra Lake, BBMP	Sewage
2.	Amblipura Melinakere, BBMP	Construction debris
3.	Amruthahalli Lake, BDA	Sewage
4.	Attur Lake, BBMP	Sewage
5.	B.Channasandra Lake, BDA	Defecation
6.	B.Narayanapura Lake, BDA	Sewage
7.	Bellanduru Lake, BDA	Sewage
8.	Chikka Bellanduru Lake, BDA	Multiple (construction debris and solid waste)
9.	Chinnappanahalli Lake, BBMP	Sewage
10.	Chokkanahalli Lake, BBMP	Sewage
11.	Dasarahalli Lake, BBMP	Multiple (industrial effluents, sewage and human defecation)
12.	Doddanekundi Lake, BDA	Sewage
13.	Gangashetty Lake, BDA	Sewage
14.	Garebhavipalya Lake, BDA	Multiple (sewage, solid waste and industrial waste)
15.	Garudacharpalya Lake, BDA	Sewage
16.	Horamavu-Agara Lake, BDA	Sewage
17.	Jakkur-Sampigehalli Lake, BDA	Sewage
18.	Kaigondanahalli Lake, BBMP	Sewage
19.	Kalkere-Rampura Lake, BDA	Multiple (sewage and construction debris)
20.	Kasavanahalli Lake, BBMP	Sewage
21.	Kogilu Lake, BBMP	Others (pesticides and fertilizers)
22.	Kowdenhalli Lake, BBMP	Sewage
23.	Kundalahalli Lake, BBMP	Multiple (solid wastes, debris and sewage)
24.	Mahadevapura Lake, BDA	Sewage
25.	Mestripalya Lake, BDA	Sewage
26.	Nagavara Lake, Bengaluru	Multiple (human defecation, construction debris, sewage and industrial effluents)
27.	Rachenahalli Lake, BDA	Sewage
28.	Shivanahalli Lake, BDA	Sewage
29.	Thirumenahalli Lake, BBMP	Industrial waste
30.	Varthuru Lake, BDA	Sewage
31.	Vengaiahanakere Lake, Bengaluru	Sewage
32.	Venkateshpura Lake, BDA	Construction debris
33.	Vibhuthipura Lake, BDA	Sewage
34.	Yelahanka Lake, BBMP	Multiple (solid wastes, sewage and industrial effluents)
Other cities		
35.	Akkamahadevi Lake, Haveri	Human defecation
36.	Amanikere Lake, Tumakuru	Sewage
37.	Bhishma Lake, Gadag	Multiple (sewage and open defecation)
38.	Dalvoy Lake, Mysuru	Sewage
39.	Kempkere, Hubballi-Dharwad	Multiple (open defecation and sewage)
40.	Kolikeri, Hubballi-Dharwad	Sewage
41.	Kotekere Lake, Belagavi	Sewage
42.	Magadi Wetland, Gadag	Human defecation
43.	Navalur Lake, Hubballi-Dharwad	Sewage
44.	Nuggikeri, Hubballi-Dharwad	Sewage
45.	Sadankeri, Hubballi-Dharwad	Sewage
46.	Unkal Main Lake, Hubballi-Dharwad	Sewage
47.	Unkal Small Lake, Hubballi-Dharwad	Multiple (human defecation and cattle washing)

Appendix 9

Details of possible breach of buffer zone

(Reference: Paragraph 6.4/Page 43)

Sl. No.	Name of the lake	Survey Numbers and Village/Hobli	Nature of possible breach of buffer zone
1	Amblipura Melinakere	Survey numbers 33, 34, 35 and 36 of Amblipura Melinakere	Private Apartments - Sai Shree Apartments
		Survey numbers 33, 34 and 36 of Amblipura Melinakere	Manoj lake view residency, No.21, Ward No.150
		Survey numbers 29 and 33 of Amblipura Melinakere	Jana Jeeva Silver Palm Apartments
		Survey numbers 27 and 30 in Amblipura Melinakere	SJR Park Vista Apartments
2	Allalasandra	Survey number 14 of Allalasandra village	Janapriya Apartments abbutting lake and storm water drain
3	Chinnappanahalli	Survey numbers 16 and 44 of Chinnappanahalli village	Private Apartments, Chinnappanahalli village
		Survey numbers 14 and 44 of Chinnappanahalli village	Shri Lorven Nest Apartments, Chinnappanahalli village
		Survey numbers 14, 16 and 44 of Chinnappanahalli village	Saroj Aquila Apartments, Chinnappanahalli village
4	Dasarahalli	Survey number 15 of Dasarahalli village	Slum
5	Kasavanahalli	Survey numbers 47, 48 and 49 of Kasavanahalli village.	Private Apartments construction
		Survey numbers 8, 27, 31 and 32 of Kasavanahalli/Haralur village	Private Apartments construction
6	Kaigondanahalli	Survey numbers 69/1, 69/2 and 63(P)	Construction of villas Kasavanahalli, Haralur Road
		Survey number 63 of Kasavanahalli village	Private Apartments Kasavanahalli, Haralur Road
		Apartments in Survey number 9 of Kaigondanahalli village	Mitra Spring Valley Apartments, Kaigondanahalli village
		Survey number 11 of Kaigondanahalli village and Survey number 68 of Kasavanahalli village	Water Mark Homes Apartments, Kaigondanahalli and Kasavanahalli villages

Source: Survey numbers and location as per KSRSAC maps

GLOSSARY	
BBMP	Bruhat Bengaluru Mahanagara Palike
BDA	Bengaluru Development Authority
BWSSB	Bengaluru Water Supply and Sewerage Board
CC	City Corporation
CDP	Comprehensive Development Plan
CMC	City Municipal Council
DC	Deputy Commissioner
DPR	Detailed Project Report
GoI	Government of India
GPS	Global Positioning System
ITI	Indian Telephone Industries
JPV	Joint Physical Verification
KIADB	Karnataka Industrial Area Development Board
KSPCB	Karnataka State Pollution Control Board
KSRSAC	Karnataka State Remote Sensing Applications Centre
LDA	Lake Development Authority
MLD	Million Litre per Day
MPSMAS	Mahadevapura Parisara Samrakshane Matthu Abhivruddhi Samithi
NGO	Non-Governmental Organisation
NLCP	National Lake Conservation Plan
NWCP	National Wetland Conservation Programme
PCCF	Principal Chief Conservator of Forests
RCC	Reinforced Cement Concrete
RMP	Revised Master Plan
RTC	Record of Rights, Tenancy and Crops
STP	Sewage Treatment Plant
SWD	Storm Water Drain
UDD	Urban Development Department
UGD	Underground Drainage
ULB	Urban Local Body