

Urban Ecosystems: Preservation and Management of Urban Water Bodies

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Abstract

The sensitivity of our fore fathers towards the environment and its resources never made us feel the agony of water scarcity. They understood the value of water and tapped it through artificial water sources, which became sources of survival even when our cities were not located near any natural water body. However, as the cities developed and grew into larger metropolises, land value grew and land invariably became an asset. The first casualties of such widespread development were the urban water bodies that got converted into cesspools of urban sewage, mosquito-breeding areas and slowly degraded. Incessant land filling of these water bodies, which once were pristine waters sustaining life gave more land to build upon.

The following paper studies and elaborates the methodology adopted by the development agencies to restore and conserve these urban wetlands and water bodies under the technical guidance of experts from national / international organizations. Three case studies from the city of Hyderabad, India are discussed with a focus on understanding the present status of lakes and physical condition of their surroundings, strategies for fund mobilization, types of local involvement and community participation, ways of continuous monitoring and maintenance, etc. thereby creating a self-sustainable and integrated management plan.

PART ONE – INTRODUCTION

Over the years, the importance of preserving and maintaining the tree cover has been recognized and significant progress has been made in improving the tree cover in urban areas of India. However, not enough attention has yet been given to the preservation of lakes that exist within metropolitan limits. Lakes often have cultural and religious significance for the local population. Festivals and religious ceremonies are also associated with these water bodies. Indian civilizations, for centuries, have either settled near existing water bodies or created artificial lakes and reservoirs by damming streams and rivers and harvesting rainwater. These impounded water bodies primarily provided water during periods of scarcity and served to control floods. However, with time, the demand on lakes has increased. As of now, they are also being increasingly used for hydropower generation, commercial fisheries, sports and other water-based recreation.

Unfortunately, increasing human intervention and interference in the catchment areas and shores of the lakes has also accelerated the sedimentation and siltation process within these water bodies. Many of our urban lakes and tanks are dying, thanks to the uncontrolled urbanization. It is, thus, imperative

Creative Space
Vol. 1, No. 1
July 2013
pp. 19–37



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that we make corrections to this situation by reviving and nurturing these reservoirs, besides adopting rainwater harvesting to prevent the desertification of urban areas. The major challenge before us being - which comes first – ‘Saving’ what is left? or ‘Restoring’ what is dead?

Global Watershed Treatment Policies and Strategies

Watershed treatment is an indispensable element of effective drinking water strategy. The solution for the problem is to develop a “Sustainable Water Resource Management Policy” based on the principles of:

20

- Holistic ecosystem based approach,
- Understanding behavior of urban water bodies,
- Private Sector involvement in maintenance, and
- People’s involvement

‘UNEP’s Global Perspective of Fresh Water Stress’ states, “Conservation and restoration requires a systematic and comprehensive plan to study selective and representative freshwater ecosystems.” Details of the study should include the status of lakes, their suitable use, management and conservation so that they serve as a good resource for future use and formation of strategies for long-term management in the urban areas.

‘The National Lake Conservation Policy, India (NLCP)’ carved out of the Wetland Program focuses on urban lakes that are subjected to anthropogenic pressures. Under this, the ‘Ministry of Environment and Forests (MoEF)’ has identified 10 polluted urban lakes for conservation and management in 1994 and has already released a large number of proposals for funding. Out of these, Bhoj Lake from Madhya Pradesh is already getting assistance under funds provided by Overseas Economic Cooperation Fund (OECF), Japan. Approval has also been given for Dal Lake Conservation Program (DLCP) in Jammu and Kashmir. Others like Nainital Lake, a number of lakes in Karnataka, Andhra Pradesh, Maharashtra and Haryana are in the pipeline waiting to be taken up depending on the pollution status and availability of funds.

Facts about Urban Water Bodies

Lakes perform various important and indigenous functions in any urban area. Each of these water bodies is unique and has its own ecological character that is defined by the flora and fauna and, the urban ecosystem service it performs. However, some of the common predominant factors that characterize all urban water bodies are:

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- Most urban lakes are manmade.
 - Urban lakes are greener than non-urban lakes.
 - They require high quality water treatment due to discharge of chemicals and oil into them.
 - They show higher seasonal variations in turbidity levels, and
 - Diagnostic sediment signature in them varies from place to place.

What does the present situation demand?

The impact of watershed development on lake quality is so pervasive that it is worth treating urban water bodies as a distinct group. A number of actions are required to restore a lake to a healthy state and then to ensure it stays in a good condition. Detailed surveys need to be undertaken to analyze the water quality and determine the fish and bird population. An individual strategy is required for each lake, which sets out its uses, management objectives and actions. The restoration work needs to be phased over years, while maintenance actions need to occur annually.

PART TWO – AREA OF STUDY

Hyderabad was created in 1591 by Mohammad Quli Qutub Shah on the banks of River Musi. Hyderabad with its twin partner Secunderabad combines to form an area of 1864 square kilometers that is managed by the Hyderabad Urban Development Authority (HUDA). Within the city's radius of 35kms, historically there existed about 532 lakes. The Kakatiya Rulers, who once ruled the region, pioneered the construction of a chain of lakes, which is until date recognized as a great effort of human beings to moderate floods and put the impounded water to beneficial use. These lakes provided water and fulfilled the religious and social needs of the people.

Hydrology of Hyderabad Urban Development Area

Hyderabad Development Area is located on the ridge of two major river basins - the Godavari and the Krishna. The lakes within the basin form a chain connecting one with the other to store and harvest as much water as possible before draining into the rivers.

A century ago, the Hyderabad Metropolitan Area (Figure 1) had around 400 lakes that collectively played a significant role in the urban ecology. These water bodies, in addition to supporting a multitude of habitats for a variety of flora and fauna, also acted as microclimate stabilizers (Figure 2). Most of them also had associated social, cultural and historical significance (Figure 3). They



Figure 2. The scenic beauty and variety of flora around Durgam Cheruvu lake



Figure 3. Nature's own rock creations are also under threat from rapid urbanization

With time, the reducing output and use of water from these water bodies have made them even more vulnerable. Introduction of sewage and pollutants has degraded the water quality for sustenance of aquatic life and pollution of underground water has been affecting the health of the people considerably. Added to this, there has been the increasing lacuna of development agencies and the growing reliability of consumers on packaged water that the situation has gone beyond repair in many cases. The seriousness of environmental deterioration and their implications were felt in the form of flash floods in



Figure 4. Encroachments along the undefined lake boundary

2000-2001, extreme underground water shortage, reduction in agricultural produce, spread of water borne diseases and loss of potential centers of tourism and recreation.

The lakes are facing many problems, but the major ones that have adverse effects on the society are contamination of ground water, reduction in water holding capacity, easy susceptibility to floods, increase in breeding of vectors like mosquitoes, garbage dumping resulting in eutrophication and foul odour (Figure 5), creation of cesspools due to discharge of waste and sewage (Figure 6, Figure 7 and Figure 8), and, deficient land use planning leading to encroachment of lakebeds by land filling

Let's Save Our Lakes – HUDA's Initiative

As part of the **Green Hyderabad Environment Program (GHEP)** about 170 major lakes in the Hyderabad metropolitan area have been notified and taken up for restoration since May 2000. The overall objective of the GHEP is "Sustainable Improvement of the Living Environment of the Urban Population in the Hyderabad Development Area". After the initial Lakes Notification being issued by HUDA, three lakes located at Safilguda, Saroor Nagar and Langar Houz were taken up as Pilot Projects for restoration.



Figure 5. Excessive eutrophication infestation



Figure 6. Immersion of idols during festivals



Figure 7. Vehicle washing add non degradable chemicals



Figure 8. Disposal of untreated domestic sewage

Base Line Data

HUDA collected information on the 170 lakes, out of which only 104 lakes were found to be of more than 10 hectares and intact with respect to the surrounding development. Out of these 104 lakes, 85 lakes were taken up for restoration for the first phase, and collection of base line data was initiated. A careful, scientific study was conducted to assess the present water quality status of the lake water.

Based on the study, the lakes were categorized into two categories -- Category 1 (high risk) comprising 18 lakes, and, Category 2 (low risk) comprising 67 lakes.

Apart from HUDA's Urban Forestry and Engineering Wing, which is the nodal agency, the other agencies which were also actively involved in the project were the Urban Forestry Wing of Municipal Corporation of Hyderabad (MCH), the Hyderabad Metro Water Supply and Sewerage Board (HMWS&SB), the Social Forestry and Territorial Divisions of Andhra Pradesh, Forest Department, Ten Municipalities and 105 Gram Panchayats (GPs), Residential Welfare Associations (RWAs), Non-Governmental Organizations (NGOs) and, various Community Organizations including Women's Groups.

PART THREE – AIMS

After the initial studies and collection of data, a number of aims and objectives were framed as follows:

- To derive a methodology for a systematic study of lake ecology and its surroundings
- To replenish ground water through revitalization of lakes
- To develop an integrated lake management plan for the execution of the whole process

Objectives

To understand each lake a set of objectives were identified which enabled a thorough study of the lake and its immediate surroundings. The main objectives were:

- Delineation of the Project Area
- Classification of lakes and wetlands with respect to various environmental parameters
- Preparation of guidelines and policies through interaction with local communities

PART FOUR – METHODOLOGY

Any kind of lake restoration measure should be specific to the character of the particular lake. The final methodology derived was based on the principle of DPSIR devised by **United Nations Environment Program (UNEP)**. The major components of DPSIR framework being:

- **Driving Forces** – Social / Cultural / Economic and Environmental Consciousness
- **Pressures** – Stresses caused by the human activities on the environment
- **State** – Present status of environment and assessment of causing factors and implications
- **Impacts** – Effects of environmental degradation
- **Responses** – Solutions with due consideration to all the above factors and feasibility for mutual coexistence of man and resources

PART FIVE – PILOT PROJECTS

Three of the 107 extant lakes were selected for consideration as Pilot Projects. In all the three pilot projects, similar techniques were implemented, but the end results achieved were quite diverse in nature. The characteristics of each of the three lakes is described as under:

Pilot Project One – Langar Houz Lake

In case of the lake at Langar Houz (Figure 9), the surrounding area is agrarian with paddy fields and cattle sheds. As a result, the inflow of nutrients into the lake was high, resulting in rapid growth of water hyacinth. By the time the pilot project was initiated, this kind of damage had become environmentally hazardous, as eutrophication in the lake had reached its final stage.

Pilot Project Two – Saroor Nagar Lake

In case of the Saroor Nagar Lake (Figure 10), the surrounding area has high-density housing and major commercial areas. Added to this, the encroachment of the lake area for housing, damaged inflow - outflow, surplus flow and construction of earthen dams had shrunk the water spread of the lake, as most of the land in foreshores was under private ownership.

It was observed that the net amount payable per individual for the operation of Sewage Treatment Plant (STP) was quite low and would be easy to collect. However, the major source of pollution were the slums that had cropped up

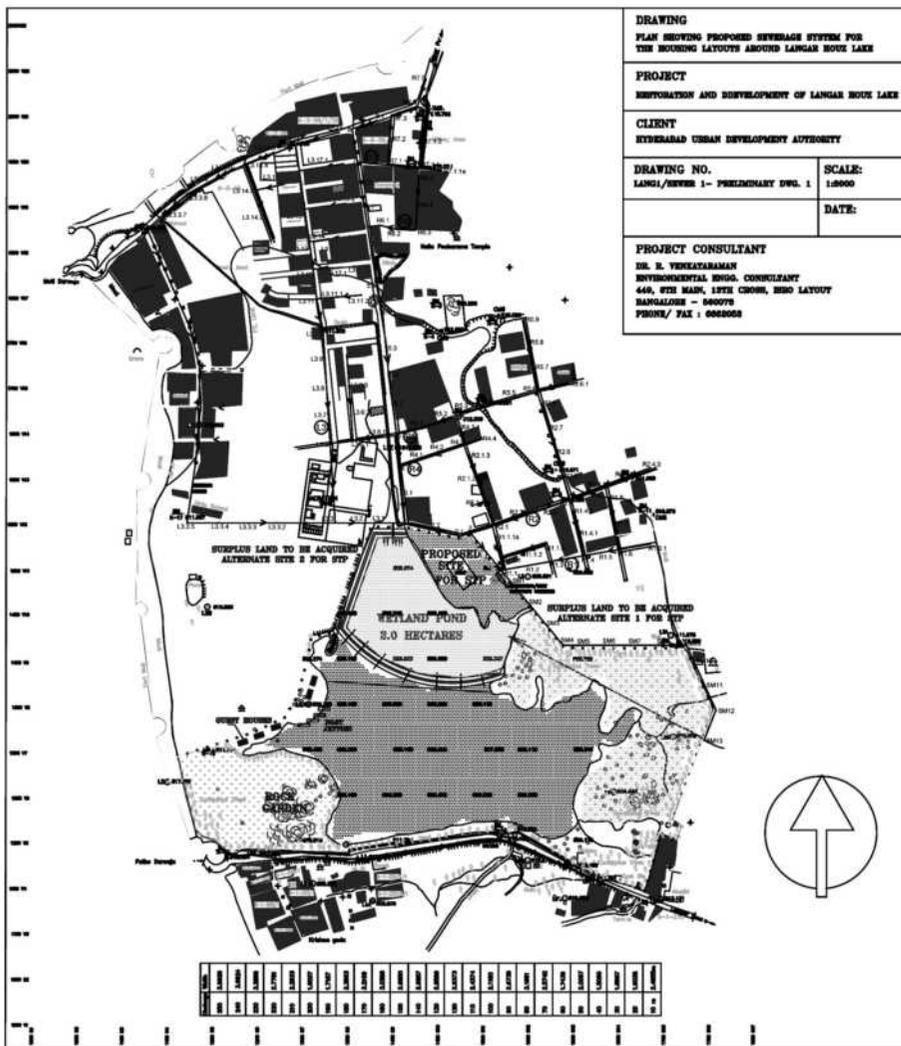


Figure 9. Survey Plan of Langar Houz Lake and its surrounding development

along one side of the lake boundary and, it was impossible to make the slum dwellers pay, as they were daily wagers and incapable to pay. Thereby, a difference in payment structure was decided which was opposed by others and all stakeholders could not be convinced, as most of them felt that the lake was more of a menace than an advantage.

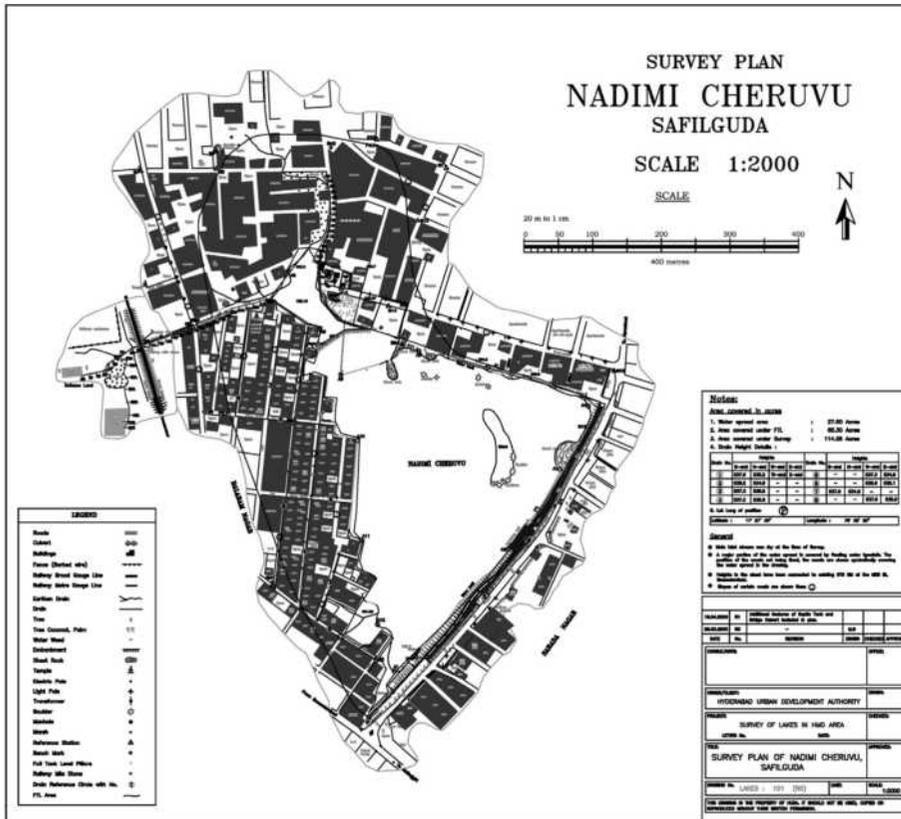


Figure 11. Survey Plan of Safilguda Lake and its surrounding development

lake and their own interest. The removal of water hyacinth and dredging of the lake at Safilguda was not well received by the local people. They felt that the work was a publicity stunt. They were also of the view that the siltation would continue, and in no time, the water hyacinth would grow back again. This kind of public opinion changed when Hyderabad received unprecedented heavy rains in August 2000. The rain was catastrophic and several lakes within Hyderabad breached leading to sudden flooding and submersion of major urban areas.

The local residents then realized the importance of lake protection and revitalization measures. These experiences brought a dramatic transformation in the mindset of the people and they actively participated in the lake development project. HUDA then took up measures to gain people's participation in the works to ensure sustainability of various interventions. For this, local resident

Koduru, S.
Dutta, S.

based Lake Protection Committees referred to as Sarassu Samrakshana Samitis (SSS) were created which contributed in laying the underground sewer lines.

With public confidence established, HUDA was able to complete the remaining activities of laying sewer lines, storm water drains, construction of STP, the inflow and surplus over flow arrangement without any problem. The revenue departments had stopped further registration of land transfer in lake area and assisted in demarcation of the Full Tank Level (FTL) of the Lake.

The local municipalities had stopped giving permission for construction in the FTL area. The local people took up patrolling of the lake surroundings to prevent land encroachment and anti-social activity. The local municipal authorities provided drainage connection to individual houses and prevented the sewage / sullage flow into the lake. They also provided door-to-door garbage collection facility to decrease garbage dumping into the lake.

32

PART SIX: RESULTS AND ANALYSIS

Given below is a summary of the results and analysis of the surveys.

Environmental Impact Analysis

HUDA developed a beautiful park on the widened main bund of the Safilguda Lake, which is now a major local attraction. The local people now use the park for morning and evening walks and for recreation. Boating has also become a major attraction. Women, who were earlier mute spectators, have now become supportive. They are showing interest in greenery and nursery activities around the lakes (see Fig. 12). The public park, boating activities and the plant nursery etc. generate revenue, which is used for maintaining the lake and its environment.

The Safilguda Lake development experience brought together stakeholders from all walks of life to keep vigil on the lake environment. With this experience, HUDA redefined its responsibilities in Lake Protection. The citizens also understood their role and were actively involved in protecting and developing the lake and its environments.

Health Factor and Economic Analysis

A reduction in the incidence of diseases was noted after the lake restoration work. Prior to the lake restoration work in Safilguda, the incidence of malaria was very high because of which 15 man-days, on an average, per earning member in a family per year were lost. At the rate of the minimum wage i.e., Rs.80/- per day, the wage opportunity was lost by at least Rs.1, 200/- per family per year.



Figure 12. Nursery along Safilguda lake under care of SSS members

In addition, water borne diseases like diarrhoea, jaundice etc., which were rampant in the lake neighborhood took another 10 days of work. Due to these illnesses, additional wage opportunity of Rs.2,000/- was lost per family per year. Apart from losing wages, the diseases also involved additional expenditure on health care. It was found that on an average a family spent about Rs.4,000/- per year on medical expenditure. In total, the sum of wage lost and additional expenditure, a family in Safilguda had to spend about Rs.7,200/- per year. However, after the restoration work of the lake, there has been a significant improvement in the wage income and reduction on medical expenditure.

PART SEVEN: INTEGRATED LAKE MANAGEMENT PLAN (ILMP)

Lake Revitalization Measures

After completion of the three pilot projects, HUDA came to understand certain facts, which helped in strengthening the approach towards lake revitalization and management measures. The success of an urban lake revitalization project is based on how successfully an In-Lake treatment approach is executed taking into consideration the following aspects:



Figure 13. View of 1.2MLD sewage treatment plant at Langar houz Lake



Figure 14. View of the restored wetland at Safilguda Lake

- It is important to remember that a single technique may not be applicable for all types of lakes.
- Attempt should be made to cure the causes of the problems and not just their symptoms.
- Lake Restoration should start with the delineation of the Catchment Area and the Lake Boundary to understand the behavior of the watershed. This process would also define the characteristics of flora and fauna in and around the lake.
- Lakes die if put to use as a drainage basin since they lose the life sustaining factor within them. Hence, all sewage should be treated through aerobic or anaerobic processes before discharging into the lake.
- At places where STPs (Figure 13) may not be feasible, the natural process of wetlands (Figure 14) along with certain species of vegetation should be utilized to treat the water.
- Surrounding development activities, which can have detrimental effects, should be minimized and emphasis should be on Low Impact Development (LID) activities.

Lake Management Measures

Some of the significant measures that should be made part of future lake management plans are as follows:

- Urban lakes should be used sustainably, as they are a scarce resource and our own acts can have detrimental effects on them.
- All lakes have to be viewed from a social and cultural perspective, not only as a resource output.
- The ecosystem service value of each lake should be redefined with the consensus of local development agencies and community to ensure lake specific planning interventions in the precinct (Figure 15 and Figure 16).
- Suitable institutions, which may be government bodies, NGOs or community-based groups should be engaged to administer revitalization of the lakes. A mechanism taking into view the interests of all the stakeholders should be developed to avoid conflicts and create a perfect example for others.
- Opportunities should be created for public to actively engage in lake protection and restoration activities.
- Lakes and wetlands should be made equally accessible to all so as to ensure that every section of the society is involved in the protection of these resources.



Figure 15. View of the park developed around Saroor Nagar Lake



Figure 16. Protection of avian fauna through creation of bird island at Safilguda Lake

CONCLUSION

Based on the study, it can be concluded that a managing body consisting of members from the local development agencies, citizen societies and NGO's should be formed to devise a Lake Management Program (LMP). It should try to incorporate as many stakeholders as possible in the planning process, either in an advisory or technical role. Technical committees should be setup to provide expertise on scientific issues, while citizen advisory committees can give the public a chance to voice their opinions in the management process. Finally, the body shall make recommendations to local development agencies and ensure successful implementation of the Lake Management Plan.

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