

## 2.11 Lake Restoration: Two successful models of lake restoration in Rajasthan (Mansagar) and Karnataka (Kaikondrahalli)

*The Mansagar Lake in Jaipur, Rajasthan, and the Kaikondrahalli Lake in Bengaluru, Karnataka, have been successfully restored using two very different approaches. The restoration of Mansagar was achieved under a public private partnership (PPP) model while Kaikondrahalli was restored through a multi-stakeholder socially inclusive model. Both approaches have successfully revived the lakes and the ecologies dependent on them. They have also provided local communities with aesthetic and recreational spaces that are also sources of revenue.*

### Rationale

A large number of lakes in urban India are threatened and in dire need of conservation and restoration. The 300-acre Mansagar lake in Jaipur and the 48-acre Kaikondrahalli lake in Bengaluru, were among such lakes that were plagued by a host of issues, as presented in *Figure 1*. The severe problems these two lakes faced can be seen in *Image 1*. The biggest threat came from pollution, which destroyed the ecology of these lakes, contaminated the surrounding groundwater and caused a foul odour.

The impetus for the lake's restoration came with the recognition of its huge potential for tourism. Both the lake and the historic Jal Mahal Palace, which is situated at the centre of the lake, were in a state of decay and needed to be restored to their former pristine condition. The restoration strategy involved leasing out the lake and linking its health to revenues from tourism.<sup>1</sup> The road to redemption began with the creation of public-private partnership (PPP) between the Government of Rajasthan and the Jal Mahal Resorts Pvt Ltd (JMRPL). In



**Figure 1: Problems faced by Kaikondrahalli and Mansagar lakes**

#### Common Problems

- ❖ Severe inflow of sewage
- ❖ Silting and settled deposits
- ❖ Dumping of debris and waste
- ❖ Land formation owing to eutrophication
- ❖ Encroachments

#### Unique Problems (Mansagar)

- ❖ Water loss owing to downstream irrigation during summer
- ❖ Inflow of industrial effluents

Source: OneWorld Foundation India, 2014

2007, JMRPL took over the entire lake area on a 99-year lease from the Government of Rajasthan. Jaipur Development Authority (JDA) was appointed the nodal body for the restoration project.

In the case of Kaikondrahalli, the plan of its restoration began with administrative measures. The lake was earlier under the control of the Lake Development



**Image 1: (Left) Pre-restoration status of Kaikondrahalli; and (right) Mansagar**

Source: Bruhat Bengaluru Mahanagara Palike and Jal Tarang Pvt Ltd, 2013

<sup>1</sup> <http://www.downtoearth.org.in/content/mansagar-lakes-fate-hangs-balance>

Authority, Karnataka Forest Department. In 2009, the Forest Department transferred the management of 17 lakes to the Bruhat Bengaluru Mahanagara Palike (BBMP). One of these lakes was Kaikondrahalli. The BBMP took upon itself the task of restoring the lake and decided to opt for a community driven approach in which the maintenance and monitoring would be done by the community.

## Objective

Lake restoration and its sustainable maintenance were the primary objectives of the two projects focussed on Mansagar lake and Kaikondrahalli lake respectively.

## Key Stakeholders

For Mansagar, the important stakeholders are JMRPL, JDA, the Forest Department and the Irrigation Department. Whereas for Kaikondrahalli, the BBMP, Mahadevapura Parisara Samrakshane Mattu Abhivrudhi Samiti (MAPSAS), United Way and the Revenue Department are the key stakeholders.

Figure 2: Key stakeholders

Mansagar	
Agency	Role
Jal Tarang	Restoration, tourism development and maintenance
JDA	Nodal authority
Forest Department	Treatment and afforestation of lake catchment area
Irrigation Department	Lowering of waste weir and development of link canal

Kaikondrahalli	
Agency	Role
BBMP	Restoration, funding and maintenance
MAPSAS	Community maintenance
United Way	Maintenance funding
Revenue Department	Administrative and legal support



Image 2: Restoration work on Kaikondrahalli lake

Source: Bruhat Bengaluru Mahanagara Palike, 2014

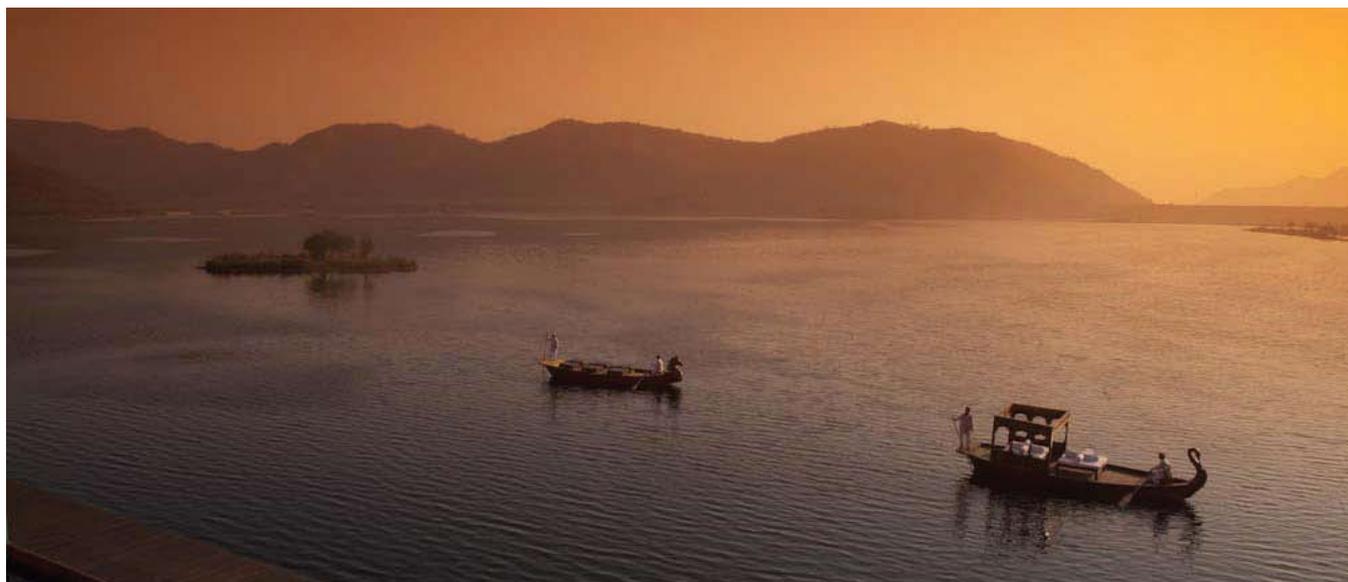
## Implementation Strategy

The implementation strategy for these two lake restoration projects is presented separately.

### a. Mansagar

Stopping any further pollution was the first prerequisite for the restoration of Mansagar lake. This required diversion of highly polluted drain water from Brahmipuri and Nagtalainalas drains. A 1.5-km channel was constructed as part of the initiative to divert drain and storm water into a 7-metre-deep sedimentation basin constructed on the east side of the lake. Using boulders, sand and dredged mud, a natural filter was created for the incoming waste by building a bund at the end of the depression. The waste passes through this bund, leaving behind large-sized pollutants, then moving into two chambers, which have vegetation in them. This strategy significantly lowers the Biological Oxygen Demand (BOD)<sup>2</sup> of water and makes it clean enough to sustain flora and fauna.

<sup>2</sup> Indicator of bacterial presence in water.



**Image 3: Mansagar lake after restoration**

Source: Jal Tarang Pvt Ltd

Work was carried out simultaneously to dredge the Mansagar Lake. This increased the lake's depth from 1.5 mt to more than 3 mt. It was important to lower the lake depth significantly so as to increase its storage capacity. The dredged mud was used to build embankments within the lake. Two sewage treatment plants were also constructed to treat 7 million litres of waste daily and discharge the treated water into the lake. The Mansagar Lake, which used to dry up in the summer before the restoration effort, now remains perennially full. To attract flora and fauna, five nesting islands were created to attract migratory birds, fish were introduced and giant bubblebers were installed to provide regular oxygen supply to the lake.

### b. Kaikondrahalli

The BBMP used a phased approach for lake restoration, primarily because it did not have access to adequate funds to begin with. The phased approach ensured regular availability of funds for the project. Phase I, which lasted from December 2009 to March 2011, began with demarcation of the lake's boundaries. This was necessary to enable a precise mapping of the lake and to stop any encroachment. The mapping was done in coordination with the revenue department, which is the custodian of land records. Revenue surveyors conducted a survey, leading to the establishment of the lake's boundaries. Lake encroachers were then served eviction notices through the tehsildar. With the lake administratively secured and cleared of encroachments, the next step was to stop pollution. As the inflow of sewage was a major reason for the lake's degradation, the inflow was diverted through a pipeline.

These two steps effectively stopped further degradation of Kaikondrahalli. The next step was aimed at de-silting of the lake. The unruly vegetation growth in the lake was cleared before de-weeding and de-silting of the lakebed. These efforts increased the lake's depth by an additional metre and increased its storage capacity

**Table 1: Restoration initiative's impact on Kaikondrahalli lake's storage capacity and depth**

Indicator	Pre-restoration	Post-restoration
Storage Capacity (Cu.m)	1,85,000.00	2,85,000.00
Tank depth	1.50 mt.	2.50 mt.

Source: Bruhat Bengaluru Mahanagara Palike, 2014



**Image 4: Kaikondrahalli lake after restoration**

Source: Bruhat Bengaluru Mahanagara Palike



**Image 5: New attractions at Kaikondrahalli lake**

Source: Bruhat Bengaluru Mahanagara Palike

by 54%. The restoration drive also involved the development of inlets and outlets to improve the flow of water, embankments and revetments, and a pathway around the lake.

In Phase II (September 2011 to March 2012) a fence was constructed around the lake in line with its administratively and cartographically demarcated boundary. Thereafter, the lake periphery was afforested to improve water quality and prevent soil erosion. As the dumping of items such as flowers and idols during religious festivals was also a major source of pollution in the lake, separate ponds were constructed for these activities, enabling citizens to continue with their cultural and religious practices without harming the lake.

Kaikondrahalli was then developed into an aesthetic and recreational urban space, with facilities like walking/jogging pathway around the lake perimeter, a 2.5-km cycling track, an amphitheatre for cultural performances, and pergolas<sup>3</sup> and toilets.

The BBMP regularly engaged with the local community throughout the implementation of the restoration project. After project completion, the task of monitoring and maintenance was handed over to the local community. To this end, a tripartite agreement was signed between the following agencies:

- 1) Mahadevapura Parisara Samrakshane Mattu Abhivrudhi Samiti (MAPSAS), a society formed by local residents and concerned citizens with the objective of safeguarding Kaikondrahalli
- 2) United Way, a U.S.-based NGO that funds community action
- 3) BBMP

While MAPSAS was given the responsibility of maintaining the facilities at the lake, BBMP agreed to fund any major repair work. The maintenance responsibilities included

security, gardening, cleanliness, maintenance of fences and lighting. All fishing activities in the lake were stopped. This gave the local community control over their common property and enabled more effective monitoring and maintenance of the lake.

## Resources Utilised

The cost of restoration in terms of the financial resources utilised by these initiatives, an estimated amount of Rs. 20 crore has been spent on the restoration of Mansagar lake. The finances were provided by the BBMP and JMRPL respectively. An estimated amount of Rs. 7.5 crore has been spent on the restoration of Kaikondrahalli lake.

## Impact

**Development of recreational urban spots:** Following the restoration drives, both Mansagar and Kaikondrahalli have gone from being eyesores and sources of pollution to charming recreational urban spaces. In the case of Kaikondrahalli, the local community is enjoying the new facilities, evident from the approximately 1,200 visitors the lake site receives every day. Even Nobel Laureate Elinor Ostrom visited the lake and planted a sapling in appreciation of the effort.

**Revival of local ecosystems:** A notable and successful strategy in the restoration of Mansagar Lake was the use of treated storm water as a primary water source for lake revival. The sedimentation basin in the lake is an inexpensive treatment system that costs far less than treating sewage. Both the lakes have also revived the local ecology and attract a large variety of birds including pelicans, ducks, black cormorants, shikhrājuvs, rufoustreepie and many others.

<sup>3</sup> Shelter structures for protection from rain and sun.

## Key Challenges

### Mansagar

The initiative to restore Mansagar Lake faced challenges from a different front. Public Interest Litigations (PILs) were filed against the project developer in 2010 and 2011, seeking to scrap the project and cancel the lease agreement. The argument was that a 99-year lease amounted to sale, and the lease agreement had undervalued the property. The matter is currently sub-judice at the level of the Supreme Court.

### Kaikondrahalli

Prior to its restoration, Kaikondrahalli was being destroyed by real estate developers, who were systematically dumping debris into the lake to create land for profit. These illegal activities were checked through boundary demarcation and construction of

a fence. However, Kaikondrahalli continues to be threatened by new sources of sewage coming from the recently urbanised parts of Bengaluru.

There are multiple administrative agencies involved in regulating the generation and management of sewage and solid waste, and effective coordination for concerted action remains a challenge. Also, the local community currently lacks funds to provide for adequate security personnel, owing to the high cost of human resources, thereby limiting the efficacy of security and site monitoring.

## Replicability and Sustainability

### Mansagar

Mansagar's sustainability is currently in question, as the private partner is embroiled in a legal case over the alleged purchase of public property at undervalued rates. The verdict is not out yet, but the case points to



**Image 6: Birds at Mansagar lake**

Source: Jal Mahal Resorts Pvt Ltd

the importance of framing a clear and socially acceptable tender that is not likely to be targeted in future. Thus, for effective replicability, the terms of the agreement in a public-private partnership must be precise and legally robust when public heritage monuments/spaces are involved. In such cases, the lease period could also be reduced to avoid controversies and ensure that historical and cultural public resources are not appropriated.

### Kaikondrahalli

The lake has now been restored, but keeping it pristine requires urgent reduction and control of incoming pollutants like sewage, effluents and solid waste. This cannot be achieved without effective administrative coordination between various agencies like the Public Works Department and the Pollution Control Board. This is difficult to achieve as the lake is currently under the control of a municipality, which is a local government body with limited ability to effectively coordinate with these agencies/departments and take necessary actions.

The same concern emerges with regard to the financial sustainability of the model. Effective maintenance and monitoring of the lake require regular supply of funds. However, the municipality has a limited ability to generate resources. The maintenance and monitoring of the lake is now largely dependent on funding from

an international NGO, which could stop at some point. Thus, it is imperative that a stable source of funding be developed, either through commercial activities in the lake or through budgetary allocation.

The replicability of the Kaikondrahalli restoration model will be enhanced if an active local community/civil society shows the willingness to legally undertake monitoring and maintenance of the water body. Institutional mechanisms are required to facilitate dialogue between various administrative agencies involved in keeping the lake clean. The nodal agency must also be sufficiently empowered to effectively coordinate with these bodies and take decisions.

### Conclusion

The two different yet successful strategies for lake restoration offer replicable models that other states can learn from. However, there is a need to address the sustainability related challenges the two models face. In this regard, the Mansagar model could be strengthened through a robust PPP agreement in which the lease duration with the private partner is reduced and the valuation carefully done. The Kaikondrahalli model could be enhanced by putting a state-level nodal authority in charge of the lake and providing budgetary allocation for community-based monitoring.

### Fact Sheet

Theme	Environment
Nodal Implementing Agency	Mansagar Lake, Jaipur, Development Authority and Kaikondrahalli Lake, Bruhat, Bengaluru Mahanagara Palike
Geographical Coverage	300 acres of Mansagar Lake in Jaipur and 48 acres of Kaikondrahalli Lake in Bengaluru, Karnataka
Target Groups	Local community/tourists in Jaipur and local community in Bengaluru
Years of Implementation	2006 - Present (Mansagar), 2009 - 2012 (Kaikondrahalli)