CHURNING STILL WATER

A BRIEFING PAPER ON THE STATE OF URBAN WATERBODIES, CONSERVATION AND MANAGEMENT IN INDIA

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1. INTRODUCTION

Indian cities today are facing huge water crisis, the city supply is not sufficient and sometimes the supplied water is not of appreciable quality . Both the surface and groundwater sources for the cities are declining. Cities have started to face torrential rains which lead to water logging. Thus the impact of climate change has become inevitable in the changed rainfall pattern of many cities. Its time to engineer about tackling more ferocious events of rain. Channelising and holding rain water must become the nation's mission[1]. Rainwater harvesting should be taken up by the cities at war footing. Lakes, ponds, tanks and other waterbodies, which are built to hold rain, should be safeguarded.

Waterbodies have variable functions like providing drinking water, fish, fodder, supporting wild life and controlling the rate of run-off in urban areas which subsequently control flooding in these areas. There are historical evidences that the areas around lakes, ponds and tanks always provided recreational spaces to the societies. These bodies of water also help in recharging the groundwater. The urban waterbodies of India, whether man-made or natural, fresh water or brackish play a very vital role in managing the ecological balance like maintaining water balance, flood prevention, biodiversity and support food security and livelihoods. India's waterbodies are extraordinarily diverse – ranging from lakes and ponds to marshes, mangroves, backwaters and lagoons. Lakes, ponds, tanks along with other waterbodies in India occupy 58.2 million hectares (this includes the areas under paddy cultivation)[2].

The interaction of the human world with the urban bodies of water in the last few decades has been a reason of concern. Today these waterbodies across the country are systematically converted into "real estate" by vested interests or simply used as a dumping ground for sewage and garbage and are receptacles for toxic waste. Entry of raw sewage causes prolific growth of aquatic weeds (eutrophication) in many lakes and ponds. Even treatment using high technological tools cannot improve the water quality. The deterioration of water quality also occurs due to immersions of idols (as in cities like Mumbai, Hyderabad, Kolkata etc.). Sometimes the water quality deteriorates to such an extent that there is a serious damage of the biodiversity. The catchments feeding the bodies of water are also subjected to encroachment and degradation (*for example refer to Surajkund and Badkhal lakes in section 3*). Over-exploitation, discharge of industrial effluents and domestic sewage, uncontrolled siltation and weed infesta-

tion are the main reasons of the destruction of the waterbodies in India. The urban lakes, ponds, tanks and other bodies of water are getting extinct due to intensified human activity, unplanned development, absence of management process, lack of proper legislation and lack of awareness.

For prevention of pollution and encroachment, the government has come up with different policies and acts. Programme like National Lake Conservation Programme (NLCP) has been launched in order to restore the lakes, tanks and other waterbodies of urban areas by central governmnet. India is also signatory to the Ramsar Convention on Wetlands, for conservation and wise use of wetlands (which include the waterbodies). In India, this convention on wetlands came into force in February 1st 1982. Under this, 25 wetlands have been identified from India for conservation. India is also a party to the Convention on Biological Diversity (CBD). CBD addresses concern related to water ecosystems through its international programme of work on Inland Waters Biodiversity. The state governments have also taken some initiatives—like Guwahati Waterbodies (Preservation and Conservation) bill, East Kolkata Wetland Conservation and Management Bill were passed in order to preserve the waterbodies. There has been initiative to declare parts of the waterbodies as sanctuary to protect them from further degradation (example—*waterbody at Kaladeo Ghana Bird Sanctuary in Rajasthan which was declared a protected sanctuary in 1971*).

Concerned citizens and non profit organisations have also filed several public interest litigations in order to save the urban waterbodies. There has been few dramatic court actions but it has been seen that absence of a legally enforceable national regulation has hampered any real progress in many of these cases. Sometimes the court verdict takes a very long time and within that time the waterbody gets totally degraded. In December 2010, the Ministry of Environment and Forest has come up with the Wetlands (Management and Conservation) Rules, 2010. The objective of this rule is to ensure that there is no further degradation of the waterbodies. The bodies of water in urban areas fall under the jurisdiction of different departments like fisheries, irrigation, tourism, forestry, local bodies etc. This causes confusion in both planning and management. Lack of apex authority in many cases led to the encroachment of the urban lakes, ponds, tanks, marshes and other waterbodies. Few states like Jammu and Kashmir, Uttarakhand, Karnataka have developed apex authority for the proper management of lakes. The management and the conservation of the urban bodies of water has also been complicated by the absence of proper policy on the conservation and protection. The problem has also been aggravated by the lack of any appropriate mapping of waterbodies in the country. In 2011, Ministry of Environment and Forest along with Indian Space Research Organisation has developed Geographic Information systems (GIS) for mapping of all the wetlands (including the waterbodies) of India. This is surely a positive step towards the management of waterbodies in India.

In order to restore the poor state of waterbodies, there have been several initiatives by the citizens and the government. Many public-private partnerships are in action for conservation of lakes, ponds and tanks. De-weeding and desilting have taken place in different ponds, lakes and tanks to restore the original state of these waterbodies. Technologies like aeration, bioremediation and biomanipulation have been applied to clean different lakes and tanks. Few lakes of Nainital, Thane and Jaipur have been revived to great extent after application of these technologies. Initiatives have also been taken to restore the catchment of the waterbodies also (example – *Maharshtra government is working on the catchment treatment and protection for Charlotte lake, Matheran and Yamai lake, Pandharpur since 2007*)

The paper tries to raise the different issues of related threats to the urban waterbodies in the country. It also provides a review of the existing policies, acts and laws to tackle the loss of the urban bodies of water.

2. THREATS AND LOSS OF URBAN WATERBODIES IN INDIA

Human interference has considerably contributed towards the deterioration of the urban waterbodies in India. Over the years, the numbers of lakes, ponds and other types of waterbodies in the urban and peri-urban areas decreased continuously. Bengaluru in the beginning of 1960 had 262 lakes but right now only ten of them hold water. In 2001, when the collector of Ahmedabad listed the waterbodies in the city following a High Court order, it was seen that 65 out of 137 listed lakes were already encroached[3]. The lakes in the urban areas are built over as the urban planners cannot see beyond land. Not only the waterbodies but the catchments are also built over.

The urban waterbodies are under the land owning agencies like departments of revenue, fisheries, urban development, public works, municipalities or panchayats. These departments fill up the waterbodies and show these cases as change of land use patterns. The vital roles played by the urban waterbodies in flood moderation and groundwater recharge are completely underestimated, unaccounted and overlooked.

In Guwahati, Sola *beel*, used to collect a huge amount of rainwater that flowed from the surrounding hill catchment. The *beel* used to protect the city from flood events and even helped to recharge water. The revenue department legalised encroachment of the *beel* in 1995 in spite of the resolution of the wetland committee. When controversy arose, the department cancelled the allotments for the poor but allowed construction of eye-hospitals and similar other constructions[3].

Few of the major threats which affect the urban waterbodies in India are as follows:

I. **Encroachment of the waterbodies- both planned and unplanned/unauthorised**
II. **Mining activities in the catchment area**
III. **Pollution of the waterbodies/catchment and disposal of untreated/partially treated sewage**
IV. **Groundwater decline leading to fall in the level of lake**
V. **Absence of administrative framework to manage the waterbody.**

There is also threat to the highland waterbodies like Tso Morari lake in Ladakh area due to unplanned tourism activities[4]. Disturbance of wildlife, pollution by solid waste, changes in local lifestyles and loss of cultural heritage are some of the other impacts of tourism in the area. In the absence of garbage disposal facilities, the practice of dumping garbage into nearby waterbodies has become quite common in recent years, leading to many high altitude lake pollution and degradation[5].

The loss or degradation of water-bodies can lead to serious consequences, including increased flooding; species decline, deformity, or extinction; and decline in water quality. These losses, as well as degradation of catchment, have resulted in loss of waterbodies across all continents. Decline in water quality results in increased undesirable eutrophication and algal blooms. When these algal blooms decompose, large amounts of oxygen are used up, depriving fish and other aquatic organisms, resulting in their death. Most of the urban lakes and other waterbodies in India are degraded mainly because of eutrophication and toxic flow[6].

3. CASE STUDIES

The above mentioned threats are discussed in the following section with case studies

I. Encroachment of waterbodies

Case study: Charkop lake in Mumbai, Maharashtra encroached by real estate developers.

Charkop lake, Mumbai was a paradise for fishermen folk about 50 years ago. According to the experts of Bombay Natural History Society (BNHS), the lake acts as a sponge in the city absorbing the peak flood events and also recharges the groundwater in the area. In 1972, the lake bed was leased out to Kumbhar Kala Industrial Society for a period of 30 years. This is because good clay for the industry was easily available from the lake soil. The same land was released to the Kumbhar Kala Society in 2004. This time, it was in the name of Kumbharkala Cooperative Housing Society Limited and only 4.5 acres out of 5 acres was leased. Remaining 0.5 acres was given to other builders namely Sagarmata CHS Limited and Laxmannagar CHS limited. In 2005, the builders started to fill up the lake. Heavy monsoon lashed Mumbai that year and the Charkop area faced severe water logging. The area around the lake was flooded with 3 feet high water even when just 11 per cent of the lake area was covered . In 2006, United Association for Social, Educational and Public Welfare, a Mumbai based non-profit organisation started their movement for saving the lake with the support of the residents near Charkop. The lake filling was temporarily stopped.

Photograph 1: Building on dry Charkop lake bed.
Source: Urban Water Unit, CSE

Three years later, Reji Abraham, President of the non-profit organisation filed a Public Interest Litigation (PIL) in the High Court of Mumbai against the encroachment of the lake. He brought to the notice of the court the threat of flooding in the area due to such encroachment. The court directed the builders to construct a stormwater drain to channel out extra runoff from the area. No attention was given to the conservation of the lake by the administrator or by the builders. The builders resumed the filling of the lake. Currently more than eighty per cent of the lake is dry[7].

II. Mining activities in the catchment

Case study: *Surajkund and Badkhal lakes in Faridabad, Haryana: Degraded due to mining in the catchment area*

The Surajkund and the Badkhal lakes, which were once tourist hot spots with a range of water sports facilities, are completely dry today. The lakes contribute towards the recharging of the groundwater in the area. The Surajkund waterbody is an ancient man-made water body constructed by Tomar king Anang Pal in 1020 AD to impound rainwater from the Aravalli hills. The Badkhal Lake was formed by joining the base of two hillocks and constructing a *bundh*. It served to control flood water and soil erosion in the area also. These two lakes were largely fed by rainwater and needed the catchments to be maintained in order to retain good water levels throughout the year. According to a study by the Geological Survey of India, mining activities, over the years, have denuded the catchments areas, which led to soil erosion and increased runoff without recharging the groundwater. Mining in the catchment area also generates huge amounts of debris which block the flow of rainwater into the lakes.

The issue of the impact of mining on the water resources of the Aravalli has been the subject of litigation for almost 25 years when environmental lawyer, M C Mehta first filed a PIL against mining and stone crushing in the Aravallis citing the drying up of these water bodies in the area. In October 1996, the Supreme Court (SC) directed that “no construction of any type shall be permitted then onwards within 5 km radius of the Badkhal lake and Surajkund” lakes in Haryana. SC ordered the Haryana government to construct a 200 metre wide green belt along Surajkund and Badkhal. Further the SC stated that no mining lease should be renewed in the 2-5 km radius unless a no-objection certificate (NOC) is obtained from Central

Photograph 2: Dry Badkhal lake bed *Source: Urban Water Unit.*

Pollution Control Board (CPCB) and Haryana Pollution Control Board. However, mining is such as flourishing and lucrative economic activity that the activity continues unabated and government has failed to take appropriate steps to ban/regulate mining. Right now both Surajkund and Badkhal lakes are in a degraded dry condition.

III. Pollution of waterbodies

Case study: *Deepor beel in Guwahati, Assam – polluted and encroached*

Deepor *beel* is a fresh water lake located about 18 kilometres to the southwest of Guwahati . The *beel* links to the Brahmaputra River in the north which is the only outlet of the *beel*. The freshwater lake receives rain water from the adjacent hills. Deepor *beel* has, for a very long time, served as the only major storage basin of Guwahati, helping the city drain the stormwater during monsoon season. However, encroachment of the lake bed has led to a rapid reduction in the lake area. Decreased lake area along with heavy siltation (due to deforestation and unregulated mining in the catchment area) on the lake bed, have decreased water retention capacity of the water body. This situation causes problems of chronic waterlogging for the urban area of Guwahati, putting pressure on the city authorities. The residential colonies, brick kilns and railway tracks occupy different portions of the lake bed.

In addition to the encroachment, Deepor *beel* is also facing menaces of municipal garbage dumping. There is a dumping ground in the catchment area of the *beel* from which effluents leach into the water body. Continuous flow of city sewage and entry of fertilisers and pesticides from agricultural fields have degraded water quality, leaving the *beel* prone to eutrophication, which in turn have negative impacts on fish and other aquatic organisms. Eutrophication are gradually taking over vast tracts of the *beel*. In fact, the lake and its adjoining areas are fully covered with weeds, dominantly water hyacinth. The polluted waterbody is a potential health threat.

Besides functioning as a major rainwater storage basin for Guwahati, Deepor *beel* has an immense biological and ecological significance. It was designated as a Wildlife Sanctuary in a preliminary notification in 1989 and was declared a Ramsar site in 2002. The *beel* is also an important staging site for migratory waterfowl. The waterbody is a home to a large number of vegetation and animals, including some endangered species such as spotbilled pelican and greater adjutant stork. However, the high biodiversity of the wetland ecosystem is being threatened due to degradation in water quality, illegal poaching and considerable human-induced disturbances.

Photograph 3 : A building constructed in the middle of Deepor beel, Guwahati, Assam *Source: Urban Water Unit*

Photograph 4 : High growth of water hyacinth due to pollution of Deepor beel, Guwahati, Assam *Source: Urban Water Unit, CSE*

Photograph 5 : Encroachment of the Deepor beel by railway tract, Guwahati, Assam *Source: Urban Water Unit, CSE*

VI. Groundwater decline leading to fall in the level of lake

Case study: *Khurpatal in Nainital district, Uttarakhand shows decline of groundwater level due to extensive groundwater extraction in the nearby area*

Khurpatal is one of the many lakes in Nainital district. It has been developed due to tectonic movement in the earth crust. Steep slopes surround this water body. The area is just 10 km from Nainital and is a very popular tourist place. The lake is fed by both surface run-off and groundwater from the surrounding hill areas. The lake in turn feeds the springs for the villages in the down hill areas. A housing project was announced in 2000-2001 by the Army Welfare Housing Organization (AWHO). The builders have bored in the adjacent areas of the lake in 2002 and since then the lake water started to decline. Residents of at least seven villages downhill of the lake are facing water shortage because of the project. They observed the reduction in the flow of water in their springs first in the summer of 2003, a year after AWHO began construction work on its colony of 80-housing units. The spring flow in these villages become negligible during the lean period and most people in the area have already abandoned farming and started migrating for contract labour[8] . Dr. Ajay S. Rawat, Professor of History in Kumaon University was successful in bringing the case to the notice of Uttarakhand High Court in 2009.

Photograph 6: Upcoming housing project near Khurpatal, Uttarakhand. *Source: Urban Water Unit, CSE*

VII. Absence of administrative framework to manage the waterbody.

Case study: *Ousteri lake, Puducherry encroached due to long awaited court order*

Ousteri (Osudu) lake in Puducherry helps in recharging the groundwater as well as acts as an alternative source of drinking water for the city. It is also home for different flora and fauna. It is an important wintering ground for migratory birds, and has been identified as one of the heritage sites by International Union for Conservation of Nature (IUCN) and has been ranked among the most important wetlands of Asia. In 2004, Lakshmi Ammal Education Trust submitted a proposal for construction of a medical college to the State Town Planning Department. The department rejected the proposal in the year 2005 on grounds of proposed development location being too close to Ousteri Lake, estimated ground water requirement and resultant wastewater generated. However the trust managed approvals from Pollution Control Committee (PCC), Agriculture Department and the Irrigation Department.

21 NGOs in Puducherry formed the Ousteri Protection Coordination Committee (OPCC) in order to save the waterbody. In 2006, OPCC protested against the Environment Impact Assessment report submitted for the project clearance. OPCC also filed a PIL in the High Court of Tamil Nadu against the Union of India, PWD, Pondicherry Pollution Control Committee and the Trust, regarding the illegal construction of Medical College and Hospital adjacent to the Ousteri Lake. The case is pending in the court for more than five years. The college has already started functioning. In spite of all the efforts by the civil societies, the movement is facing an uphill battle because of absence of any administrative framework to protect the waterbody.

Photograph 7: Construction near the Ousteri lake, Puducherry, February 2006 *Source: Poovulagin Nabargal, Puducherry*

4. REVIVAL AND RESTORATION OF WATERBODIES: SOME EFFORTS

Restoration and revival of a waterbody means returning the ecosystem to its original state. During the restoration process, the catchment should be considered as an integral part of the waterbody and should be given equal importance. In urban India, there are several such waterbodies which need restoration. It is easier to prevent degradation of waterbodies with proper support from legal and regulatory mechanism. However, several citizens, non profit organisations and government institutions came forward to restore some of these bodies of water. The revival of the waterbody can be done in two parts: one is managing and reviving the catchment and the other part is to manage and restore the waterbody itself[9].

For the treatment purpose, efforts have been taken to desilt or dredge the waterbodies. Deweeding or control and removal of water hyacinth has been taken both at citizen as well as government level. A polluted waterbody also shows a high level of dissolved organic matter which is reflected in its high Biological Oxygen Demand (BOD) and low dissoloved oxygen (DO). High organic matter in water increases the toxic material like Hydrogen sulphide which causes foul smell and fish kills. Aeration helps in reducing the organic load in the water column.

Technologies like bioremediation and biomanipulation have been widely used by different government departments to restore the lakes and waterbodies in India. Apart from this, technology like Greenbridge has been a promising technology for cleaning lakes, nalas and rivers in India.

The entry of the sewage from the domestic and industrial areas can be prohibited from entering the water body by physical, chemical and biological methods. Creation of vegetation belt along the inflowing drains or streams. nutrient retention basins, constructed wetlands and macrophytic filters are also used to prohibit or reduce the flow of nutrients in the lake. Special Phospohorous Elimination Plants (PEP) is used in Germany to reduce the entry of nutrients in the waterbodies[13].

There are also techniques to reduce eutrophication by reducing the nutrient load in water. The nutrient can be flushed out after dilution with water low in nutrient content. New techniques for the nutrient elimination have been practised by the European countries. Processes for the elimination of Phosphorous like Pelicon-technology has been widely used[13]. Fish stocking and harvest have also been tried for reducing the phosphorous content of the lakes. Use of salts in some waterbodies can also help in precipitation of large amount of phosphorous. In shallow waterbodies, where macrophytes dominate, removal and composting of the plants may remove large amount of phosphorous.

REVIVAL TECHNOLOGIES POPULAR IN INDIA

Bioremediation: This is a treatment process by which the naturally occurring micro-organisms like yeast, fungi and bacteria help in breaking down the toxic pollutants of the waterbodies into less toxic or non toxic components. The process generally include steps like physical cleaning, aeration and bioaugmentation[10].

Biomanipulation: This is a process to control the eutrophication in the waterbodies through a process of biological engineering. The process uses the food chain relationship of phytoplankton, zooplankton and fish, to remove the nutrient load from the water. This process involves selective removal or encouragement of growth of particular herbivorous fishes which can be efficient grazers of algae[11].

Greenbridge: In this technology, the absorption property of cellulosic or fibrous materials are used for the removal of toxic materials. Cellulosic or fibrous materials like coconut coir or dried up water hyacinth are compacted to form a bridge which is strengthened by stones and sand. All coarse pollutants are trapped by the bridge and thus the turbidity of the water is reduced to large extent[12].

4.1. Case studies on restoration of lakes

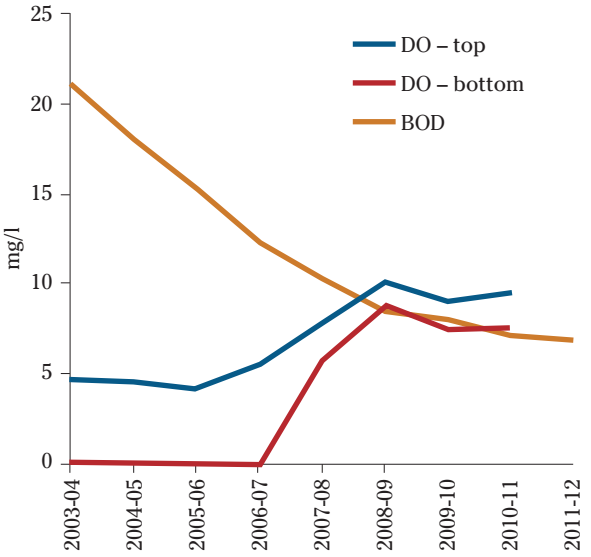
A. Conservation of Naini lake, Uttarakhand through aeration and Biomanipulation

Naini Lake is a natural freshwater lake, of tectonic origin, located amidst Nainital city of Uttarakhand. It is lunar-shaped and has an outlet at the south-eastern end. Naini Lake is one of the four lakes in Kumaon hills. Balia Nala is the main feeder-stream of the lake. Other than this, 26 major drains, including the three perennial ones, feed it. The water of Naini lake was suitable for drinking to end of 19th century. The water quality of the lake has been steadily deteriorating as the catchment got degraded. Large scale tourist influx is the main reason of catchment encroachment and degradation. There is also high siltation in the lake resulting in the reduction of lake depth, the depth of lake has reduced from its original depth of 29 m in 1871 to only 13 m in 2007. With an increasing amount of sewage, both municipal and domestic the quantity of organic mat-

ter in the lake water has risen sharply. The Biological Oxygen Demand (BOD) increased from 15.5 parts per million (ppm) in 1981 to 357.23 ppm in 1991. By the end of the year 1980, presence of total coliform was also reported in water[14]. The state of the lake deteriorated and extensive eutrophication was observed in the waterbody in late nineties. The transparency of the lake became very poor and the lake experienced fish mortality during this period. *Mahaseer*, the most important fish in Himalayan ecosystem was no more found in the lake. Gambusia, a laricidal fish, which is harmful to the lake ecosystem increased.

The National Lake Region Special Area Development Authority started aeration in the lake during 2006-07 and the result is documented in graph 1. Due to effective aeration, the Dissolved Oxygen (DO) of the surface and the bottom water increased and the BOD got decreased in the two areas[14]. The project was supported by National River Conservation Directorate (MOEF) and executed by National Lake Region Special Area Development Authority. The conservation process also included biomanipulation.

Graph 1: Decline in the trends of BOD and increasing trend of DO in the Naini lake post revival programme



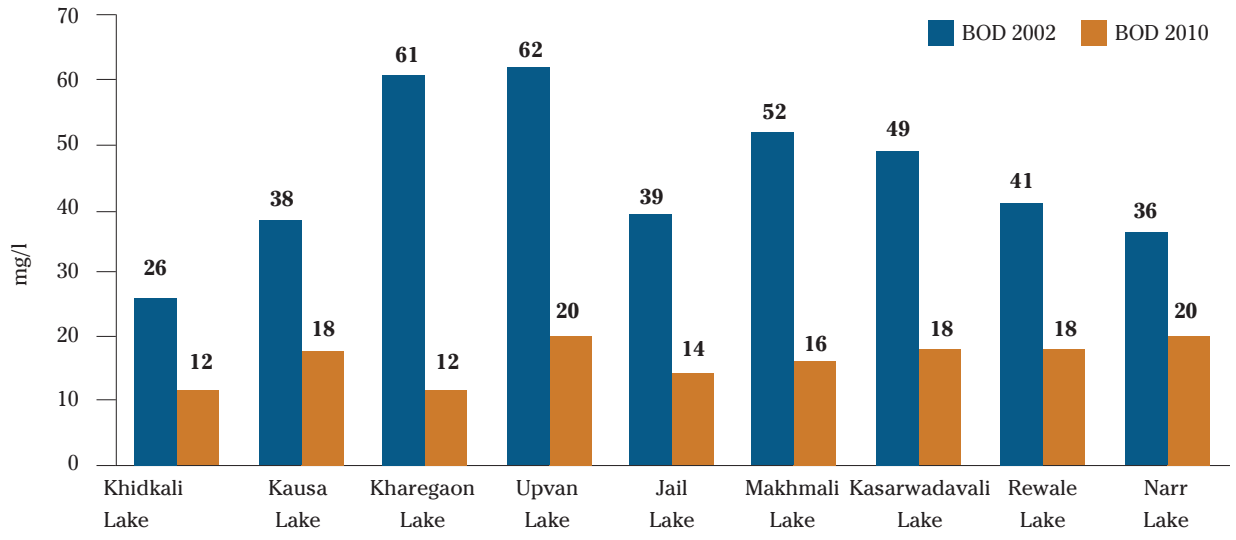
Source: Rawat, A.S. and Raju, S. 2010. Nainital Beckons. 60 p.

Photograph 8: Conserved Naini lake, Nainital, Uttarakhand *Source: Water Unit, CSE*

B. Case study: *Conservation of lakes in Thane district, Maharashtra through Bioremediation.*

There are over all 35 lakes in the district of Thane, Maharashtra. The lakes are fed by the run off from the surrounding highlands. These lakes help in the over all recharge of the groundwater in the district. There have been threats to the lakes as well as the catchment areas due to unplanned development. Thane being very close to Mumbai faces huge influx of migrated population. This has resulted in the encroachment of both the waterbodies and catchment for planned and unplanned development. Degradation of the catchment also resulted due to huge deforestation and this resulted in flow of silt into the lakes. Solid waste disposal is also noticed in these lakes. The poor state of lakes has drawn the attention of the Thane Municipal Corporation (TMC). Nine lakes within the municipal area was leased out on BOT (Build Operate and Transfer) purpose for 25 years to private contractors in 2004. The funding was done under NLCP. As a first step of restoration, the lake boundaries were identified and demarcated. Short reinforced cement concrete walls were raised around the waterbodies. This measure prevented further encroachment into the lake beds. Lake beds were desilted. The pollution level of the lakes was tackled through bioremediation and surface aeration processes. Filter beds, comprising of small irregular rocks have been put around lakes. These rock pieces give a primary level filtration to the the impurities entering into the lakes. The corporation has implemented a three- level plantations around the lake peripheries. Vativar and typha plantations have been planted at the lowest level followed by flowering plants and big trees along the jogging track. The concept of "Nirmalya Kalash" has been introduced by the TMC around each lake bed to collect the solid waste. The waste collected is further sent for vermi composting. The compost thus generated is used as manure for landscaping purposes and is also sold to the city's nurseries. The BOD and DO levels in the water of the revived nine lakes are well within the permissible limits.

Graph 2: Decrease in BOD levels in the nine revived lakes of Thane



Data source: Thane Municipality

Photograph 9: Upvan lake before the restoration process *Source: Thane Municipality*

Photograph 10: Restored Upvan lake *Source: Water Unit, CSE*

5. EXISTING POLICIES AND LAWS FOR CONSERVATION OF WATERBODIES

There are several policies which deal with the conservation, management and restoration of lakes, tanks and other waterbodies. The first National Water policy was adopted by National Water Resources Council in the year 1987. The revised National Water Policy was notified in 2002. This policy only mentions about the revival of traditional systems only and not more than this. Since then, 18 states have so far come up with the state policies in which they refer to the protection, management and conservation of water bodies.

Other important policies which deal with the conservation and management of waterbodies are listed in table 1.

The Ministry of Environment and Forests has developed the National Wetland Conservation Programme in 1983 for conservation of lakes and other waterbodies. Since most of the lakes are in urban areas and face more threats of pollution and encroachment, the ministry developed a separate programme in 2001 called NLCP to conserve the

Table 1: Highlights of the existing plans and policies related to urban waterbodies

Policy documents/Ministry reports/Action Plans	Highlights
The National Conservation Strategy and Policy Statement on Environment and Development (1992)	• Control and abatement of pollution of water bodies from municipal and industrial wastes generated from urban habitats by intercepting and diverting such wastes away from water bodies • Protection of land near water bodies and prevention of construction there upon
National Project for Repair, Renovation & Restoration (RRR) of waterbodies directly linked to agriculture (2005)	• The estimated cost is Rs. 300 crores which will be shared by Centre and State in the ratio 3:1. • The scheme was approved for 26 districts in 15 States • With a view to expand the scheme of repair, renovation and restoration of water bodies, Government of India approved two more schemes for RRR of water bodies
Regional plan-2021, National Capital Region (NCR) (2005)	• It is mandatory for NCR towns to protect the identified water bodies and to reserve 2-5% of land for ground water recharging
National Water Mission under National Action Plan on Climate Change (2009)	• Conservation of lakes and other waterbodies • Expeditious implementation of programme for repair, renovation and restoration of waterbodies in areas / situations sensitive to climate change • Developing an inventory of waterbodies, especially those with unique features • Mapping of catchments and surveying and assessing land use patterns with emphasis on drainage, vegetation cover, silting, encroachment, conservation of mangrove areas, human settlements and human activities and its impact on catchments and water bodies • Creating awareness among people on the importance of ecosystems of the waterbodies • Formulating and implementing a regulatory regime to ensure wise use of waterbodies at the national, the state, and district levels
Report for development of National Sustainable Habitat Parameters on Urban Stormwater Management' (2010) ***National Sustainable Habitat Mission is one of the components of National Action Plan for Climate Change for making cities sustainable***	• The report suggests an allocation of 2 to 5% of urban area should for water bodies to work as recharge zone.

Source: Different policy documents

lakes of the urban areas. For the conservation process, a cost sharing is done between the centre and the state governments. A study on 'Identification of Lakes for Conservation under NLCP' was carried out during the implementation of the programme with an institutional support. Keeping the local demands in view, the state government listed out lakes to conserve under NLCP. The NLCP programme focusses on the development of the national level policies and actions for the urban lakes. The main objectives of the programme includes prevention of pollution of the waterbody from the point and non point sources, catchment treatment, desilting and de-weedingg of the waterbodies, research of the flora and fauna related to the waterbody and also other activities related to the lake. The policy also takes care of the interaction of the human population and the lake. Under the NLCP, the Central and State governments share the costs in the ratio of 70:30.

State like Maharshtra has separately developed State lake Conservation Plan (SLCP) to restore the polluted lakes of Maharashtra. So far five projects have been identified and funded. The state government shares seventy to ninety per cent of the project cost and remaining is borne by the local bodies. The activities covered under this program are same as NLCP.

UPDATE ON NLCP

According to 2011 report published on MOEF website, 58 lakes have been identified from 14 states. The source also states that 351.99 crores have been released by the centre till the end of March 2011 and only eighteen lakes have been revived.

Lakes are at present under different departments like Public Health Engineering, Water Supply, Fisheries, Irrigation, Urban Development, Tourism and Forests, Public Works Department, Forest and Environment etc. Similarly the catchments are controlled and used by different agencies. The controlling and management agencies for the waterbodies and their conflicting interests is the main cause of degradation of waterbodies. It has been seen that creation of an single apex authority in place of different lake owning agency is very essential. This apex authority will also be in charge of managing the waterbodies.

To improve the process of implementation and

Table 4: Apex Authorities for the protection of the lakes

State	Lake	Apex Authority	Year of constitution	Additional comments
Karnataka	Lakes of Bengaluru in the Bangalore Metropoliton Region Development Authority jurisdiction but later on will be extended to other lakes of Karnataka	Lake Development Authority	2002	Formed as registered society under the Karnataka Societies Registration Act, 1959
Madhya Pradesh	Bhoj wetland system	Lake Conservation Authority	2004	Formed under Madhya Pradesh Societies Registration Act 1973
Manipur	Loktak lake	Loktak Lake Development Authority	1987	Formed under the Manipur Loktak Lake (Protection) Act, 2006 (Manipur Act 3 of 2006)
Orissa	Chilika	Chilika Development Authority	1991	Formed under Resolution no.20369/F&E (Forest and Environment)
Jammu and Kashmir	Dal-Nagin	Lake and Waterways Development Authority	1997	Formed under Development Act of 1970
Uttarakhand	Lakes of Nainital region	National Lake Region Special Area Development Authority	1989	Formed under Uttar Pradesh Special Area Development Act, 1986

Source: Websites for different Lake Development Authority

coordination between the centre, state or urban local bodies the Ministry of Environment and Forest directed all the states to constitute City Level Monitoring Committees (CLMCs). Many international agencies also help in conservation and restoration of lakes and other waterbodies through out the world. United Nations Educational, Scientific and Cultural Organisation (UNESCO), United Nations Environment Programme (UNEP), United Nations Development Programme (UNDP), International Lake Environment Committee (ILEC), and World Health Organisation (WHO) have specific programmes for the restoration of inland aquatic/ freshwater ecosystems. Other agencies like International Union for Conservation of Nature (IUCN), World Wide Fund (WWF) for Nature-India, Wetlands International and International Union of Biological Sciences (IUBS) also contribute towards the conservation of the wetlands. There are also international funding agencies which contribute towards the revival programmes of the waterbodies.

The lakes and waterbodies of India are directly influenced by a number of legal and regulatory framework. Under Article 48-A of the constitution, it is stated, "The State shall endeavour to protect and improve environment and to safeguard the forests and wild life of the country". Similarly under Article 51-A (g), the fundamental duty of each citizen is "to protect and improve the natural environment, including forests, lakes, rivers and wild life, and to have compassion for living creatures".

Few of of the legal policies and acts which control the development and restoration of the lakes and the waterbodies in India are as follows:

- The Indian Wildlife (Protection) Act, 1972
- The Indian Fisheries Act, 1897
- The Indian Forest Act, 1927
- The Territorial Waters, Continental Shelf, Exclusive Economic Zone
- The Water (Prevention And Control Of Pollution) Act, 1977
- Water (Prevention And Control Of Pollution) Act, 1974
- The Maritime Zones Of India (Regulation Of Fishing By Foreign Vessels)
- Forest Conservation Act , 1980
- The Environment (Protection) Act, 1986
- Coastal Zone Regulation (Crz) Notification
- Wildlife (Protection) Amendment Act, 1999
- National Conservation Strategies On Environment & Development
- The Biological Diversity Act , 2002
- Convention On Wetlands (Ramsar, Iran, 1971
- Convention On Biological Diversity, June 1992
- Bonn Convention On The Conservation Of Migratory Species Of Wild Animals.
- International Convention For The Protection Of Birds
- National water policy, 2002
- National Policy for Hydro Power Development
- Convention on Conservation of Migratory Species of Wildlife Animals (CMS)

In Guwahati, the state government, pushed by the judicial intervention, passed the Guwahati Water Bodies (Preservation and Conservation) Bill 2008. The aim was to preserve wetlands and to re-aquire lands in the periphery of the waterbody for its protection. Earlier in 2006, the East Kolkata Wetland Conservation and Management bill was passed to protect some 12,000 ha of wetland. This bill includes provision for penalties – Rs. 1 lakh for encroachment. The Andhra government's 'Water, Land, Trees Act' empowers state agencies to take steps to protect water bodies and to prevent conversion. The act also requires measures to permanently demarcate the boundaries of the water bodies and to "evict and prevent encroachment[3]. The Kerala Government has also came out with Kerala Conservation of Paddy Land and Wetland Act, 2008. This Act has provided imprisonment for not less than six months and fine up to Rs. 1 lakh.

MOEF had worked for the last four years to publish a rule to protect the waterbodies of India. Giving in to the clamour for a national regulation, the Ministry of Environment and Forests (MOEF), issued a rule for conservation and management of wetlands in December, 2010, under the provisions of the Environment (Protection) Act, 1986, called the Wetlands (Management and Conservation) Rules, 2010.

Fishing, farming, pastoral communities and other villagers and city-dwellers living adjacent to wetlands have no role at all in the identification, management, and regulation of wetlands.

UPDATE OF NATIONAL WATER POLICY

About ten years have passed after the National Policy had been revised and passed. 18 states have already framed their water policy but there is little or no emphasis given on the control of pollution in the waterbodies in the states. The Comptroller and Auditor General's (CAG) report was tabled in December 2011 confirms this. The report also says that the Ministry of Environment and Forest has so far not undertaken any inventory of lakes[14].

6. FIGHTING WATERBODIES IN COURT

In few states, citizens and NGOs have filed legal cases for protection of lakes. Public interest litigations (PILs) have been filed for the protection of the waterbodies in many cities. The courts have responded with dramatic verdicts, which provide the learnings for how these water-systems can be regenerated for the city's future. In spite of all the efforts of the civil society groups, working through judicial intervention, the movement to protect and revive the lakes is facing an uphill battle.

Case study: *Court case on Delhi waterbodies continuing for more than eleven years in absence of proper legal framework.*

In 2000, a PIL was filed by Vinod Kumar Jain of Tapas (a Delhi based non profit organisation), in the High Court of Delhi to save the waterbodies of Delhi. The next year the court gave directions to form a joint survey committee to assess the number of natural water bodies in Delhi. The land owning agencies along with Archeological Survey of India and Indian National Trust for Art and Cultural Heritage, a New Delhi based NGO formed a committee to find out the number of waterbodies. Different agencies came up with different number of waterbodies and the dispute over the number continues till today. While the waterbodies are being discussed in court, the encroachment and pollution continue. The court directed the different land owning agencies to revive the lakes under them. The deadlines were also given by the court. The waterbodies still remain degraded due to inaction by concerned land owning agencies.

Case study: *The urban tanks of Howrah, West Bengal saved by the court.*

In April 1995, Subhash Dutta on behalf of the Howarh Gantantrik Nagarik Samiti (HGNS), a Kolkata-based non-governmental organisation, filed PIL in the SC against the Government of West Bengal and the civic authorities of Howrah, a satellite township near Kolkata. In his 486-pages petition, along with other civic issues, Dutta pleaded for judicial intervention for protection of 110 urban water tanks located in Howrah, SC referred the matter back to the Calcutta High Court (HC) on

Photograph 11 : Neela Hauz, New Delhi, encroached by a bridge. Growth of water hyacinth is observed all over the lake. May, 2010 *Source: Water Unit, CSE*

April 16, 1996. In a historic move, it directed the HC to form a special 'green bench'—for the first time in India— to deal with the petition. The impact was spectacular. In 2001, The HC issued its final verdict. The final verdict of the HC banned the filling up of urban water bodies in Howarh. The court directed the Howrah municipal corporation to list the ponds under the jurisdiction of all the police stations in the area. The officers-in-charge have been given the responsibility to protect the water-bodies in their respective regions[14].

Case study: *Karnataka High Court committee discourages commercial involvement in lake conservation processes of Bengaluru*

In 2004, Lake Development Authority of Karnataka started leasing off the lakes of Bengaluru for their conservation and restoration under the public-private partnership. Hebbal, Nagawara, Vengaiahkere and Agara were the four lakes which were given on a lease basis for a period of fifteen years to the Oberoi Hotel group, the Lumbini group, the Par – C group and the Biota group respectively. In 2008, Environment Support Group (ESG) Bengaluru based non profit organisation filed a PIL in the HC against the privatisation of the lakes. ESG claimed that the private parties are converting these lakes into recreational hub neglecting the conservation programme.

In response to the PIL filed by ESG group, a nine member legal service committee was set up in 2010 in order to examine the ground realities and prepare an action plan for the preservation of lakes. The committee was headed by Justice N K Patil of Karnataka High Court. A report on the long term sustainability of the lakes of Bengaluru was submitted which was also accepted by the court. In an interim judgement the court requested the committee to frame a policy on public private partnership for rejuvenation and maintenance of the lakes. The committee was also recommended to frame separate parameters for cases where there is no involvement of commercial interest as well as where the consequential commercial interest was involved. Justice Patil's committee held five meetings with the stake holders before preparing the policy report . The report stated ten recommendations for the sustainability of the lakes in the city. The most important point stated that under no condition commercial exploitation of the lake can take place[15].

Table 5: Some significant battles fought in the courts

Cities	Lakes	Individual/group fighting case	Status
Kolkata	East Kolkata wetlands	People United for Better Living in Calcutta (PUBLIC) in 1992	Supreme Court ordered closure of tanneries. Later a bill was passed for the protection of the area. But the case continues as encroachments are brought to its attention.
	Rabindra Sarobar	Subhash Dutta, Howrah Gantantrik Nagarik Samiti (1997)	In 2001, Green Bench ordered squatters should be evicted. After much protest, the area was cleared and fenced.
	Howrah urban tank	Subhash Dutta, Howrah Gantantrik Nagarik Samiti	In 1995 filed in Supreme Court, which referred it to High Court. It directed court to form a green bench to deal with petition
Srinagar	Dal lake	Syed Mujtaba Hussain (lawyer) and Green Kashmir	Case filed in 2000 in Supreme Court. Since 2001, case being heard by High Court, which has passed a series of directions to remove encroachments and to clean up the water body. to clean lake. Plans continue
Guwahati	Deepor *beel*	Unnayan Samiti	Two cases filed. First against encroachment. Stay order given by high court. In 2007 case against garbage dumping in area along the lake. Despite orders, degradation and encroachment continue.
	Sola bheel	Unnayan Samiti	Filed first in 2000 and then in 2006 to stay encroachment. Guwahati high court directed government to protect all wetlands in the state. But in spite of this revenue department allotted lake-bed for construction. Based on contempt case, stay order was granted.

Continue……

Table 5: Some significant battles fought in the courts

Cities	Lakes	Individual/group fighting case	Status
Mumbai	Powai lake	Bhrashtachar Nirmulan Sanghatan and local residents	First case filed in 2000 for cleaning of lake. In 2004 case filed against hostels adjoining the Powai lake, which had been built without permission. In 2006 order given for removal of encroachments.
	Charkop	United Association for Social, Educational and Public Welfare	The first effort was to clean the lake and remove garbage and debris. This was done successfully by a city NGO. Then in 2009, case was filed for the protection of mangroves and encroachments.
Hyderabad	Hussainsagar	K L Vyas, Save the lake campaign and others	PIL filed seeking protection of 170 lakes in Hyderabad. In 2000 Hyderabad Urban Development Authority issued notification to protect lakes. But the battle continues as encroachment is unchecked.
	Saroornagar	K L Vyas, Save the Lake campaign	1995 case filed on all lakes, with particular reference to Saroornagar
Chennai	Chembaram-bakkam	P Raju, president welfare association on lake drinking water consumers	Lake is 40 km from city, but polluted by its waste. In 2009 court ordered strict compliance of its directions to clean the lake.
Bangalore	All lakes in city	Zafar Futehally (1995), Leo Saldanha, Environment Support Group (2007)	The cases have had major impacts as government has been directed to protect the lakes. A Lake Development Authority has been created. The battle for protection continues as the Authority has decided to privatise the lakes, which is being opposed by civil society groups.
Delhi lakes	All lakes in city	Vinod Kumar Jain/Tapas	Case filed in 2000 and in following year, court asked for survey of the number of waterbodies in Delhi and directed for protection. Case continues as petition finds that encroachment continues.
Udaipur	Fatehsagar, Swaroopsagar	Balwant Singh Mehta (1992); Praveen Khandelwal, Jheel Sanrakshan Samiti (1997)	In 2007, the judgement directed the government to form a lake development authority and to take effective steps to protect the no-construction zone. It also said that conversion and construction in and around the lakes and their catchment would be permission except in 'rare occasions'.
Nainital	Naini lake	Ajay Rawat, Nainital Bachao Samiti (1993) and again in 2006	In 1995, the Supreme Court passed directions banning construction of multi-storey group housing societies in catchment. In 2006, Rawat filed another petition seeking a ban on buildings in the catchment. The construction of a park (Hanuman Garhi) on the lake's catchment be stopped.
Ahmedabad	Chandola	Shailesh R Shah (2000)	In 2000 filed case on revival of Chandola lake. In April 2001, the court passed directions restricting construction within 500 metres of lakes smaller than 5000 sq mt and one km in bigger waterbodies. But in 2002, bowing to pressure from buildings this restriction was removed.

Source: State of Environment 7-A citizens' report. 2012. Centre for Science and Environment

The common features in all the lake cases are as follows[3]:

- The cases have been filed in the face of water shortage and government apathy. In fact, most of the petitioners say that the government is the main problem.
- They are responses to encroachment (under political patronage) or government-authorised changes in the use of the land of the lakes or their catchment areas.
- Several petitioners faced resistance, even threats, from land and real estate developers with political connections.
- Although water policies talk about protection of water-bodies, there is no clear framework to ensure that lakes are not protected. In fact, there is no clarity about the number of waterbodies in a city.
- There are not clear laws to protect urban waterbodies and their catchment.
- Corruption charges on agencies responsible for protection.
- Multiple agencies without clear mandate in terms of role and responsibilities

The points to be addressed for the protection of urban waterbodies[3]

- Ownership of the waterebodies
- List mapping and earmarkings of the waterbodies on ground in the city
- The waterbodies to be protected
- Map and work on ground the buffer zone around the waterbodies
- Map and work on ground the catchment and channels feeding the waterbodies and precautions to be taken.
- Lack of information sharing about the legal framework for the protection of the waterbodies for key stakeholders.

People concerned about lakes have been forced to go to court because there was no other legal framework to identify and protect the city's waterbodies; Giving in to the clamour for a national regulation, the Ministry of Environment and Forests (MOEF), issued a rule for conservation and management of wetlands in December, 2010, under the provisions of the Environment (Protection) Act, 1986, called the Wetlands (Management and Conservation) Rules, 2010.

7. THE NEW WETLAND RULE

The new wetland rule is applicable to all the waterbodies including lakes, reservoirs, tanks man made or artificial. The rule also covers the protection of the drainage and catchment areas of the waterbodies. The rule lists the banned and prohibited activities. The banned activities include conversion of wetlands for other uses, setting up and expanding industries and dumping untreated waste water and any other activity that will have negative impact on the waterbodies. Fishing, temporary constructions, desiltatition would need prior permission.

Missing points:

- The rule states that the initiation of the identification of the waterbody under threat starts with the identification of the waterbody by the state. The involvement of the stakeholders and other citizens near the waterbodies has been ignored.
- No clarification on the traditional rights
- The way by which the stakeholders would approach the wetland authority in case the state fails to identify a threatened waterbody is not clear.
- The rule does not mention about a well defined penalty for the people who do not abide by these rules.
- The new rule prohibits any entry of untreated sewage into the wetlands — but it is not mentioned how wetlands like East Kolkata wetlands which helps in treating the waste water —will be categorised.
- No mention on capacity building and preparing inventory or mapping in general

At present the majority of the urban lakes and waterbodies are under varying degrees of environmental degradation. The main causes of degradation being apathy of the different government departments, citizens etc. in preventing the domestic as well as industrial wastes into the waterbodies, lack of proper sewage system, encroachments by the government departments, builder lobbies and also unclear laws. The process of restoration gets delayed because of the lack of understanding the ecology of the waterbodies, conflict of interests between the land owning agencies and the stakeholders.

The coordination between the citizens, government departments and the non governmnetal

CHURNING STILL WATER

The protection of waterbodies and their catchment is only half the story. The real challenge lies in ensuring that these bodies are supplied unpolluted rainwater, that is, they are recharged[3].

organisations is completely lacking and this is the most difficult hurdle in the steps towards water-body conservation. The policies and the funding of the government departments and the international agencies are restricted to only small number of waterbodies in India. Creation of single authority for the management and restoration of the water-bodies in each state is very important.

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