

# MAKING WATER SENSITIVE CITIES IN GANGA BASIN AIMED AT IMPROVING RIVER HEALTH/FLOWS

*Urban Lakes and Waterbodies Management*

# Structure of Presentation

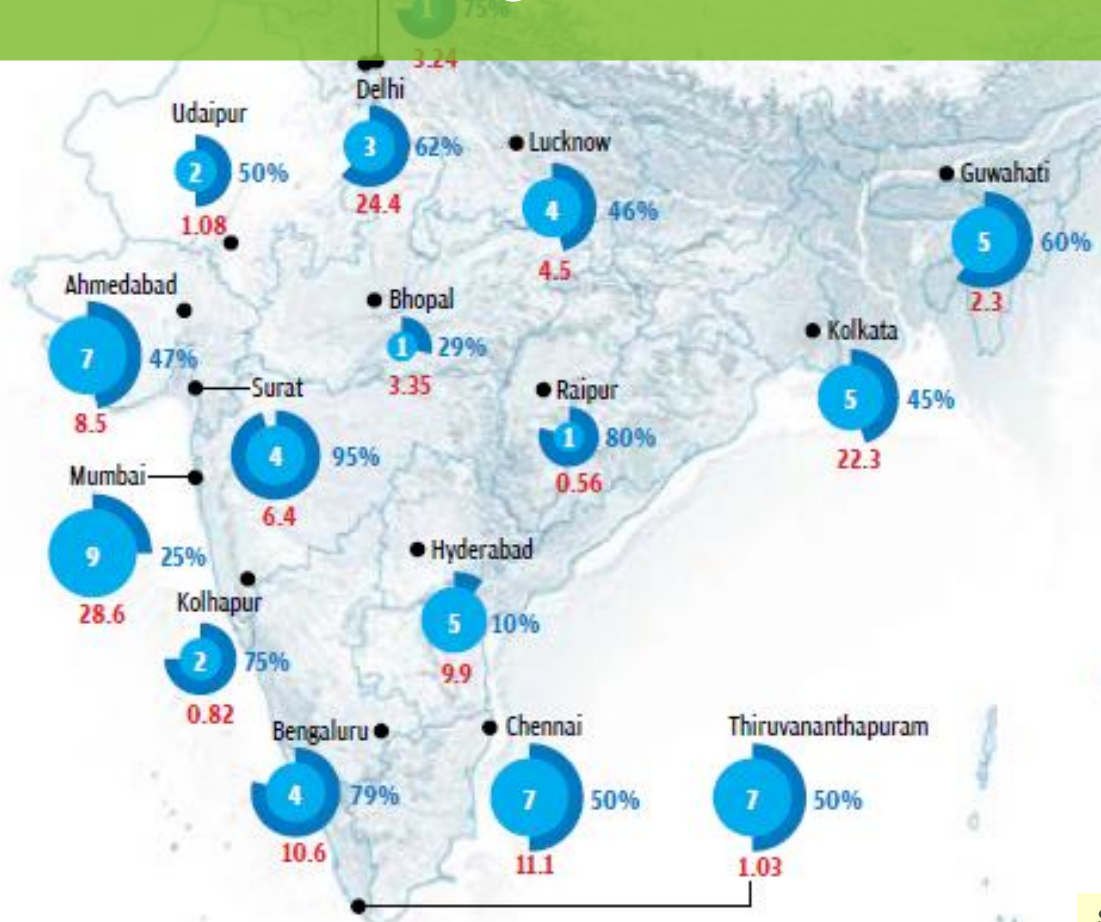
*In this session will be discussing on CSE's approach for urban lakes and waterbodies management in India*

- Research Aim, objectives, Structure and Methodology
- Issues, challenges and opportunities
- Model Framework for Urban Lake Management Plan - CSE's approach
- Menu of Strategies – Watershed focused Strategies | Shoreline Stabilization Strategies | Management Strategies | In- Lake focused Strategies
- BMPs for Urban Lake Management in India

## Indian Cities losing it's waterbodies Over the Years

### Losing base

So, the question is, where did the half of the total lakes, i.e. 117 million lakes (not necessarily urban) worldwide would go in around 2 decades??



#### Population in urban India

Year	Population
2011	377 million
2031	600 million

#### Metropolitan cities

Year	Population
2011	52 million
2031	87 million

#### Population in metropolitan area

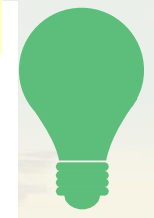
Year	Population
2011	160 million
2031	255 million

#### Level of urbanisation

Year	Level of urbanisation
2011	31%
2031	50%

- Number of major flood events after 2000
  - Loss in water bodies/water spread due to urbanisation
  - X Population projected in 2021 (in million)
- Sources: Research articles and documents; personal communication with government officials and researchers; newspaper articles

Source: Why Urban India floods, CSE.



## 117 Million Lakes Found in Latest World Count (not necessarily urban) (2014)

Using satellite photos and computerized mapping technologies, an international research team (**Global Lake Ecological Observatory Network (GLEON)**) counted all of the lakes on Earth. They found about 117 million lakes, covering almost **4%** of the world's land surface, not counting the glaciers on Greenland and Antarctica.



## How Do the Numbers Compare to Previous Counts? (1993)

The latest number is smaller than the previous statistical estimate of **304 million lakes**. Large- and intermediate-sized lakes, such as Lake Baikal, dominate the total surface area of lakes on Earth, contrary to what was found using statistical methods.



“**size-distribution of water bodies decrease drastically across altitude, where 85 percent of lakes, and 50 percent of lake area, and 50 percent of total lake perimeter are located at altitudes lower than 500 meters** (about 1,600 feet) above sea level.”



Of the total, about **90 million lakes are in the smallest size category, between 0.2 and 1 hectare** (0.5 to 2.5 acres) in size, according to the study. This means that about **27 million** of the world's lakes are what I would refer to as “**bigger than a farm pond.**”

# Significance of Urban Lakes

Urban lakes form **vital ecosystems supporting livelihood with social, economical, ecological and aesthetic benefits.**



Biodiversity at Chilka lake



Recreational aspect like at Sultana lake, Chandernagore



High property value and tourism aspect at Lavassa lake

- Improve Water Quality
- Managing Urban Water Cycle
- Supporting Bio diversity

### Ecological/ Environmental Benefits

Important part of the Urban Water Cycle  
Fostering bio- diversity, flora and fauna.  
Supports migratory species.

- Cultural and Natural Landscapes
- Benefits of Therapeutic & Public Health
- Educational Benefits
- Recreation/ social Public Space
- Spiritual/ Religious/ Cultural Activities

### Social/ Cultural Benefits

Benefits of Public Health  
Educational Benefits  
Recreation (for swimming, boating and taking a leisurely walk around it)  
Provide both cultural and natural landscapes.  
Spiritual/ Religious/ Cultural and Traditional Activities

- Livelihood
- Means of Communication
- Increase amenity and property value

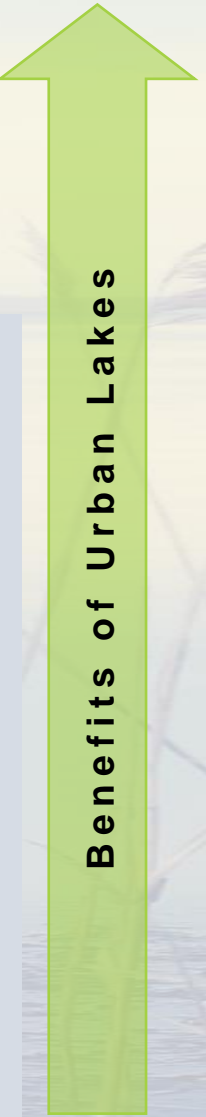
### Economical Benefits

Livelihood Benefits  
Means of Communication  
Recreation (for swimming, boating and taking a leisurely walk around it).  
Tourism  
Hydropower energy generation.  
Increase amenity and property values.  
The salt lakes yield common salt. For example, Sambar lake

- Water Supply
- Management (Flood Control Mitigation)
- Water Harvesting
- Water Recharge

### Urban lakes provide ecosystem services as infrastructure

Fulfill a flood control structures for mitigation purpose.  
Regulating river flows, e.g. Hoover Dam on the River Colorado and the Bhakhra and Nangal Dams on the Sutlej in India.  
Store Rainwater/ Water Storage, Part of overall storm water drainage system  
Urban Lakes acts as retention and detention structures holding back peak flows and moderating storm water impacts.  
Recharge role, stored water slowly percolates into aquifer.  
Modern role that urban lakes play as recipient of treated wastewater.



# What an Urban Lake has to offer???

**Natural Storm water technique:**  
Control floods by absorbing excess water and protect nearby settlements from flooding

**Buffer against hydrological extremes**

**Rainwater Harvesting:**  
Stores surface water during the monsoons and ensure water availability in dry season for people, wildlife and nature

**Economical & livelihood opportunities:**  
Fishing  
Agriculture  
Domestic Purposes  
Drinking Water

**Cultural and Religious Value**

**Supports Biodiversity:**  
Natural Habitats for flora and fauna.  
Breeding and migratory grounds for birds

**Recreation and Tourism Opportunities also for Education opportunities**  
Green spaces for recreation and outdoor activities  
fishing, Bird watching

**Microclimate Moderation**



**Dissipates Stream Energy**

**Source of Water supply in some Cities**

**Improve air Quality and abate heat islands**

**Filter and Improve Water Quality:**  
Natural filters that trap solid and nutrient load, pollutants and sediments. Can help in reducing water treatment costs for cities

**Replenish/ Recharge Groundwater**  
Carbon is stored in wetland sediment and dissolved in surface and groundwater. Have highest carbon density among land ecosystems.

**Increases Land and Real Estate Value**

**ECOSYSTEM SERVICES**

**ECONOMICAL BENEFITS**

**SOCIAL BENEFITS**



# What an Urban Lake become in our cities???

**Agricultural Runoff:**  
Inorganic fertilizer and manure Runoff directly/ indirectly from peri Urban areas. (Nitrates and Phosphates)

**Industrial Waste:**  
Dissolving of nitrogen oxides (from internal combustion engines and furnaces)

**Anthropogenic Pressure:**  
Extensive unsustainable Fishing practices  
Dhobhi Ghats: Discharge of detergents  
Animal Washing and Littering

**Anthropogenic Pressure:**  
Open Defecation  
Unsustainable kitchen farming/ introduced faunal species  
Shoreline Water Extraction

**Natural Habitat for flora and fauna is lost**  
Fish kills  
Breeding and migratory grounds for birds are lost  
**Weed and Invasive species infestations**

**Tourist Pressure, Plastic Waste littering, solid waste issues**

**Runoff from roads, streets, lawns, and construction lots (nitrates and phosphates)**

**Feeder Tributary clogged with solid Waste**  
**Loss of Wetlands and Littoral Habitat**

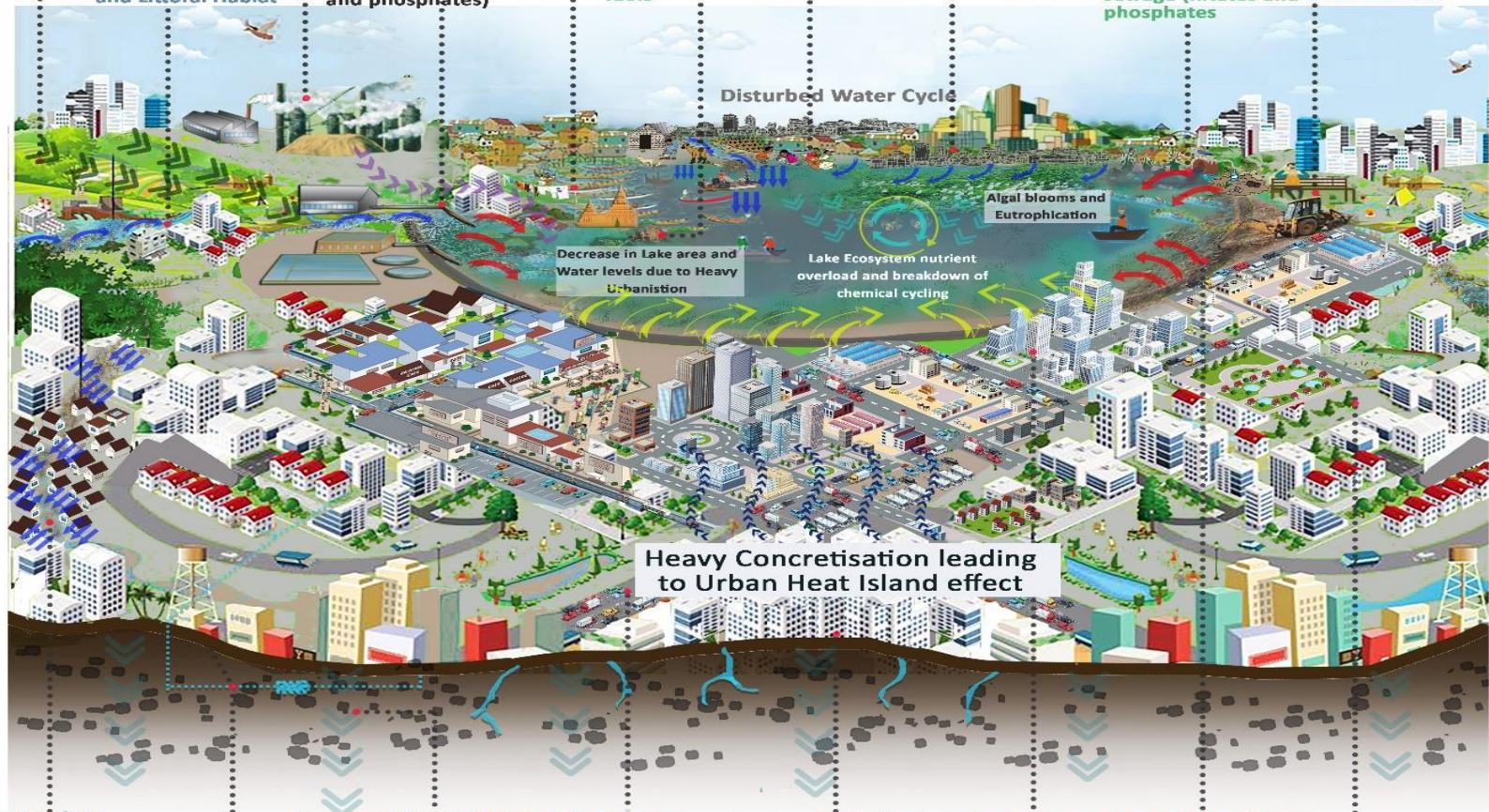
**Discharge of treated municipal sewage (primary and secondary) treatment: nitrates and phosphates)**

**Cultural siltation with Immersion of Idols**

**Shoreline Encroachment by slum developments:**

**Discharge of untreated Municipal sewage (nitrates and phosphates)**

**Shoreline Sedimentation and Erosion**



**Disturbed Water Cycle**

**Algal blooms and Eutrophication**

**Decrease in Lake area and Water levels due to Heavy Urbanisation**

**Lake Ecosystem nutrient overload and breakdown of chemical cycling**

**Heavy Concretisation leading to Urban Heat Island effect**

**Natural Stormwater process Disturbed: Clogged/landfilled/encroached natural drains leads to increased floodwater frequency in monsoon season**

**Water Shortages in Lake due to exploited water resources**

**Decreased Groundwater Recharge**  
**Groundwater pollution due to lake water pollutants**

**Infrastructure development, housing pressure and encroachments have resulted in converting all urban lakes into hyper eutrophic state.**

**Urbanized watersheds generate large amounts of pollutants, including eroded soil from construction sites, toxic metals and petroleum from roadways, industrial and commercial areas, and nutrients and bacteria from residential areas.**

**Poor Design Attributes: Heavy Concretisation of Shoreline, Intensive development of real estate, Deforestation, Change of Landuse**  
**Urbanised catchment attributes (e.g. increased impervious area, loss of infiltration, directly connected drainage infrastructure)**

INDIAN CONTEXT EXAMPLES



Bellandur Lake, Bengaluru catches fire due to the illegal dumping of waste mixed with mass untreated sewage.



Cultural Siltation: Idol Immersion at Hussain Sagar Lake, Hyderabad



Weed and Invasive species infestations at Dal Lake, Kashmir



Dead fish washed up on the banks of Ulsoor Lake in 2016. Photograph: Jagadeesg Nv/EPA

This research is an attempt at assisting practitioners and government agencies to prepare an urban lake management plan to look at it holistically in order to conserve, revive and manage them through short-, medium- and long-term sustainable solutions.

Its purpose is to explore possible innovations both structural and non-structural. The guide highlights the key elements of an 'urban lake management plan' focusing from the watershed to shoreline to the lake itself moving to long-term planning and management approach

### **The objectives of this study are to:**

1. To sensitize practitioners regarding the existing issues and importance of urban lakes in India
2. To provide various approaches focusing catchment/watershed analysis and water quality enhancement
3. To provide interventions aligned with strategic goal aim to address urban liability, livelihoods, equity and social justice through a sustainable urban lake management plan.
4. To highlight the need for preparing short, medium and long-term strategies for sustainable implementation of Urban Lake Management Plan
5. To showcase the case studies elaborating urban lake management plans in India and across the world.

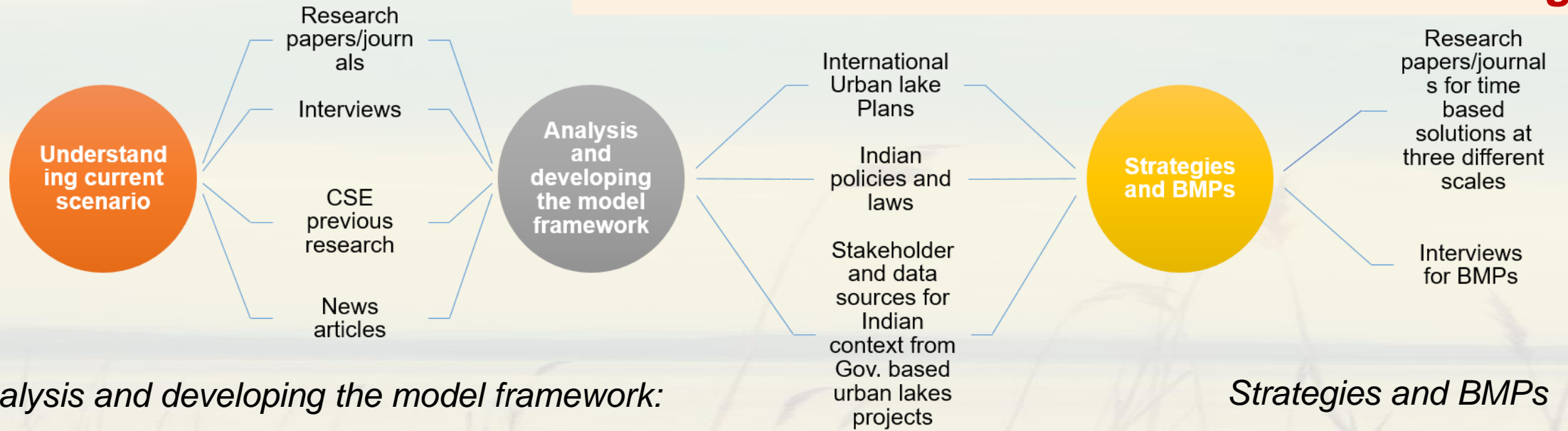
Presently under the government schemes like Jal Shakti mission, AMRUT 2.0, s and Namami Gange, the revival /rejuvenation of water bodies is observed through a ***piecemeal approach with short term measures like cosmetic beautification, enhancing recreational activities, addressing immediate solid waste dumping into waterbody, surface cleaning, using/storing treated wastewater*** to revive lakes.

Under these projects, the ***catchment of the water body is often ignored or mismanaged***. Although, many cities have initiated the work towards rejuvenation of waterbodies, the long-term approach is still missing.

Since the lake is a reflection of its catchment area, it is essential to understand the significant changes or trends concerning the primary land uses within the catchment area/watershed of the lake.

Presently, there is ***hardly any approach which defines the comprehensive planning process*** for preparation of action plans for lake rejuvenation considering its watershed area. It is essential to have a document which guides how to develop a good lake management plan with clear understanding of lake's watershed area, specific goals, objectives, and time-based action plans. Focusing on planning process rather than quick-fix solutions makes the lake rejuvenation a manageable process. However currently, lake management in India is project oriented and not comprehensive.





Analysis and developing the model framework:

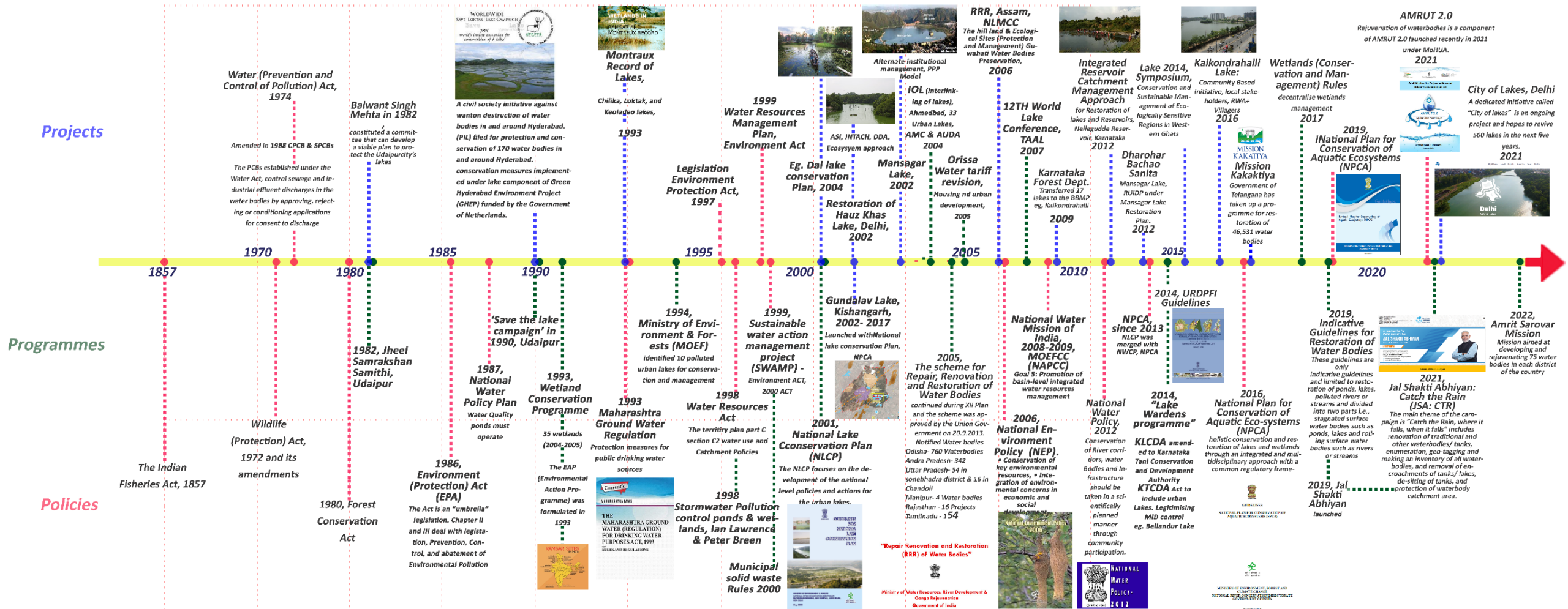
Strategies and BMPs

Objectives	Chapters	Content
<b>Objective 1</b>	Introduction	<ul style="list-style-type: none"> <li>• Significance of urban lakes</li> <li>• Need for the guide</li> <li>• Scope of guide</li> <li>• Methodology of the report</li> <li>• Target group</li> <li>• Key issues observed under 'Urban Lake Management' in India</li> <li>• Target group</li> </ul>
	Understanding urban lakes	<ul style="list-style-type: none"> <li>• What are urban lakes</li> <li>• Lake and Watershed Interaction</li> <li>• Policies and programmes for urban lakes management</li> <li>• Governance of urban lakes</li> <li>• Stakeholders and their linkages with Urban Lakes</li> <li>• Importance of local communities as stakeholders</li> </ul>



Objectives	Chapters	Content
<b>Objective 2 &amp; 3</b>	Model Framework for Urban Lake Management Plan	<ul style="list-style-type: none"> <li>• Stakeholder Analysis</li> <li>• Gather Information and Identify Concerns</li> <li>- Characteristics of watershed/ Catchment</li> <li>- Physical features of the lake</li> <li>- Hydrological values</li> <li>- Ecological features</li> <li>- Status Report</li> <li>• Identification of issues and Data Analysis</li> <li>• Develop Vision, Goals and Objectives</li> </ul>
	`Take Actions	<ul style="list-style-type: none"> <li>• Menu for strategies               <ul style="list-style-type: none"> <li>• Watershed focused Strategies</li> <li>• Shoreline Stabilization Strategies</li> <li>• Management Strategies</li> </ul> </li> <li>- Land use Planning of Waterbody in Master Plan</li> <li>- Proposed Institutional Set-up</li> <li>- Regulations and enforcement</li> <li>- Stakeholder’s involvement and engagement</li> <li>- Public Education and Outreach</li> <li>- Revenue generation opportunities</li> <li>• The In- Lake focused Strategies</li> </ul>
	Evaluate, Monitor the plan	<ul style="list-style-type: none"> <li>• Re- asses and Modify/ Update Plan</li> <li>• Economic valuation of urban lakes</li> </ul>
<b>Objective 4</b>	Case studies and BMPs	<ul style="list-style-type: none"> <li>• International BMPS</li> <li>• Indian case studies</li> <li>• Examples of existing ULMPS all over the world</li> </ul>

# Timeline of policies and guidelines relevant to lakes



# Key issues in 'Urban waterbodies management' in India

## Issues that are difficult to see with naked eyes

### Insensitivity of masterplan towards water bodies and floodzone area

Lack of acknowledgement of a Waterbody as a Land Use/ Water Use Category in **Master Plan, Land Records**

- Urban lakes/ wetlands are **rarely recorded under municipal land laws**, so they are not recognised.
- **Lack of attention** towards **conserving and regulating floodplains** of water bodies have increased the threat of urban flooding
- There is **no legal protection for city lakes, catchment and drainage systems**. Hence many urban water bodies and their catchment have been encroached upon or taken away for housing and other buildings.

### Inventory of Waterbodies

**No city has a public inventory of waterbodies**, on a GIS platform with information relating to physical features, ownership, catchment details, socio-economic linkages, rights and privileges

### Stakeholders? Technical capacities Community?

**Unclear roles and responsibilities** among agencies currently undertaking different aspects of waterbodies management, leading to either **overlaps or gaps** in management and **stakeholder conflicts**

### Lack of Awareness, poor community participation

**Lack of awareness** and commitment from public and politicians with **poor stakeholder participation**

### Insensitivity towards science of waterbodies

**Poor understanding of the lake dynamics:** Catchment, shoreline, buffer area, in-lake ecology and processes.

### Lack of a national/state policy, legislation, appropriate action plan and guidelines, manuals on nature – based – solutions

The existing legislation and policies are mostly declarative, they **lack established targets or prioritised planned actions**.

They generally are **focused on fast track development programmes** (including cosmetic beautification of shoreline, ecologically insensitive chemical & expensive mechanical methods) and **lack holistic approach**.

## Definition of Urban Lake according to National Lake Conservation Plan (NLCP)

The definition provided by NLCP is based on broad hydrological and morphometry criteria of a lake.



According to NLCP, a water body should have a minimum water **depth of 3m** and should cover a water spread of **more than ten hectares** to be considered as a lake and have no or very little aquatic vegetation (Forests, 2010)".



The definition provided under the guideline of NLCP acknowledges only broad hydrological criteria to define a water body as a lake.

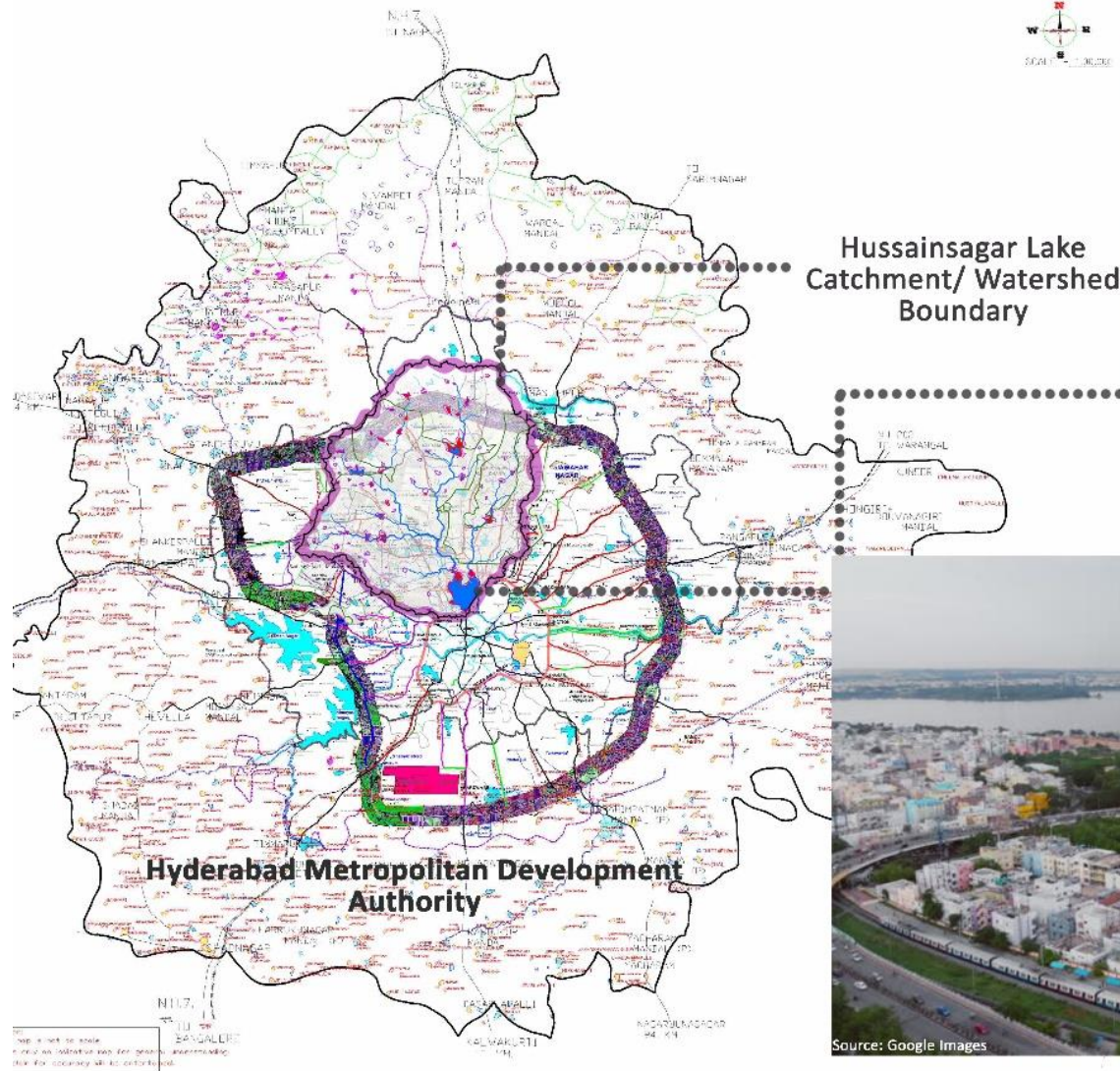
This definition ignores the fact that the water depth and spread keep changing every year depending on the various environmental factors.

In fact, there are very few urban lakes that fit into this definition since most of them occupy a small area, are seasonal and shallow.

# AAETI What are Urban Lakes?

The apparent definition of urban lakes seems to those located entirely within city limits (**census town**) or likely urbanisable areas in the **master plan** and directly surrounded by urban developments, with some recreation facilities limited to the shoreline area (parks, playgrounds).

Hussainsagar Lake in Hyderabad, Shahpura Lake in Bhopal can be called true urban lakes.



Urbanization around Hussainsagar Lake, Hyderabad, India  
(Map and Aerial view)



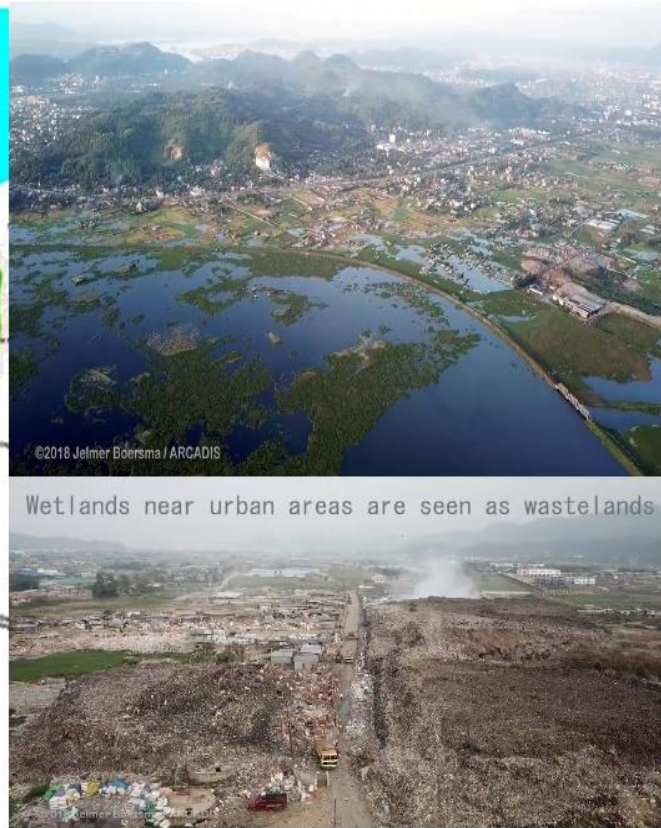
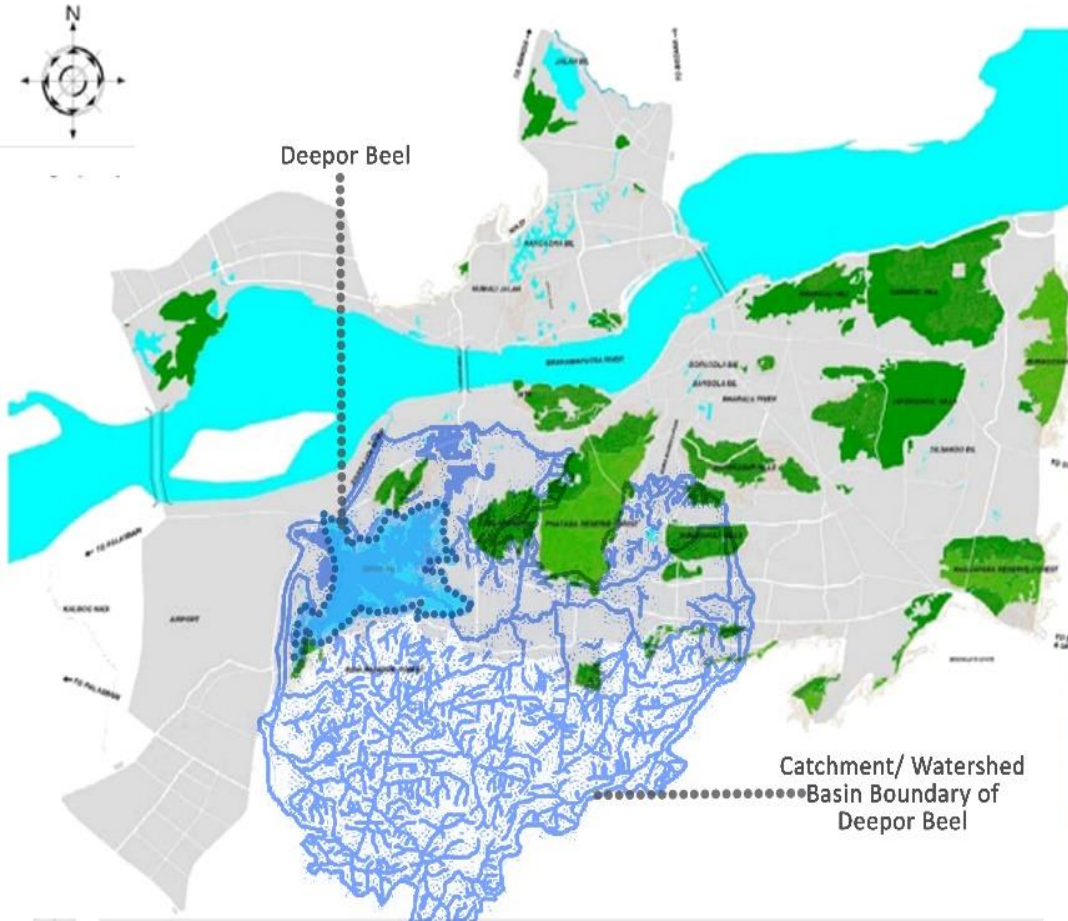
Source: Google Images

Map of Hussainsagar Lake with its catchment and Development authority Boundary, Hyderabad, India (In context with the definition)



# How Can we define Urban Lakes?

## What are Urban Lakes?

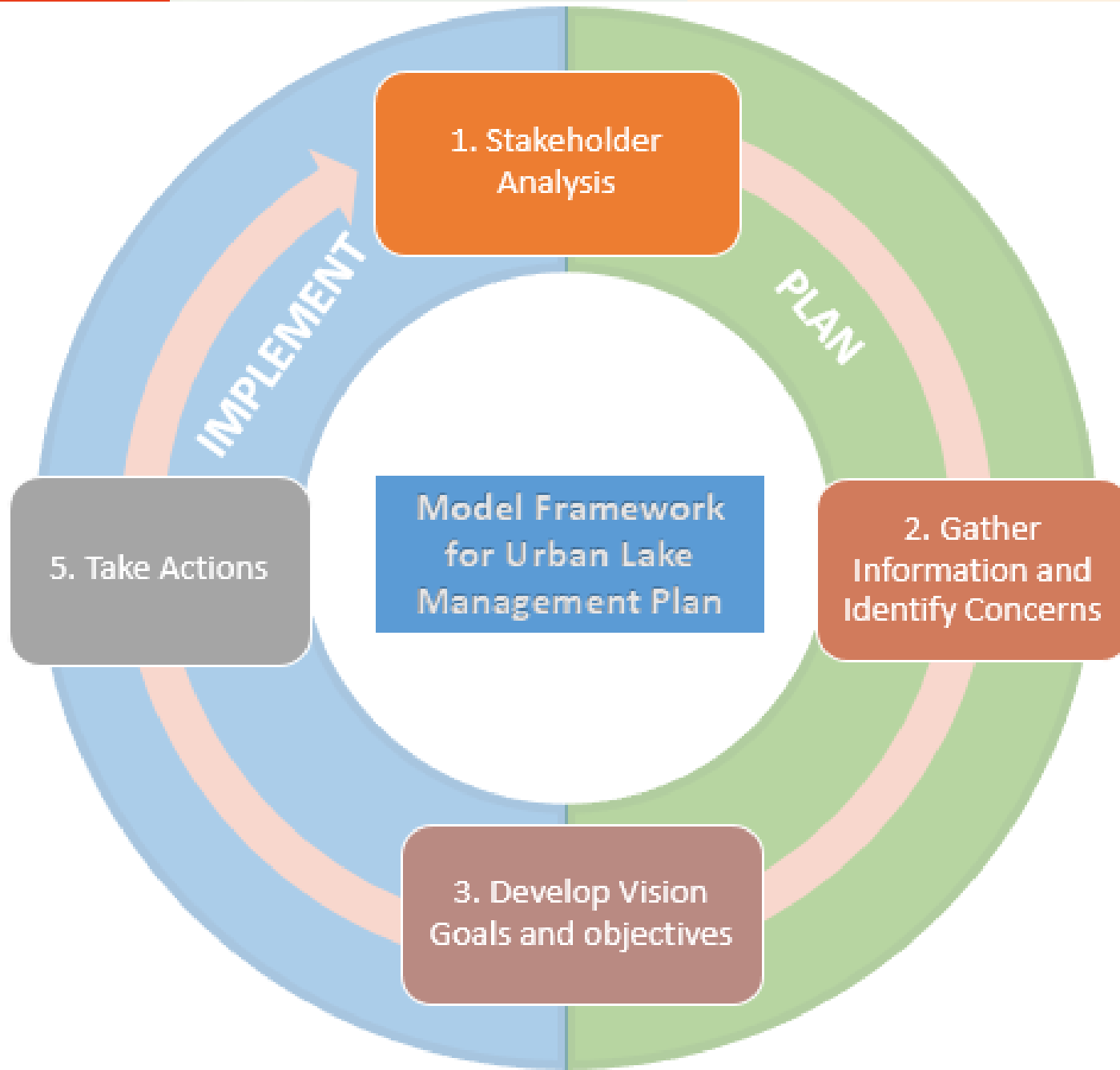


The lakes which are **predominantly affected by human urban population and their damage basin** dominated by urbanization, rather than geology, soils or agriculture. Such lakes, are lakes **situated only partially within city limits, or attached but not necessarily surrounded entirely by city development** but can urbanise in future.

Lakes in India like Deepor beel, Guwahati, Assam; or Loktak Lake in Manipur would come under this category.

Map of Deepor Beel with its catchment being city boundaries, Guwahati, India

# Model Framework for Urban Lake Management Plan



The development of a successful lake management depends on the fact that **each lake and its associated catchment is unique** by its physical characteristics, the assemblage of living and non-living components in its surroundings, geographical location on the landscape and anthropogenic uses and dependency.

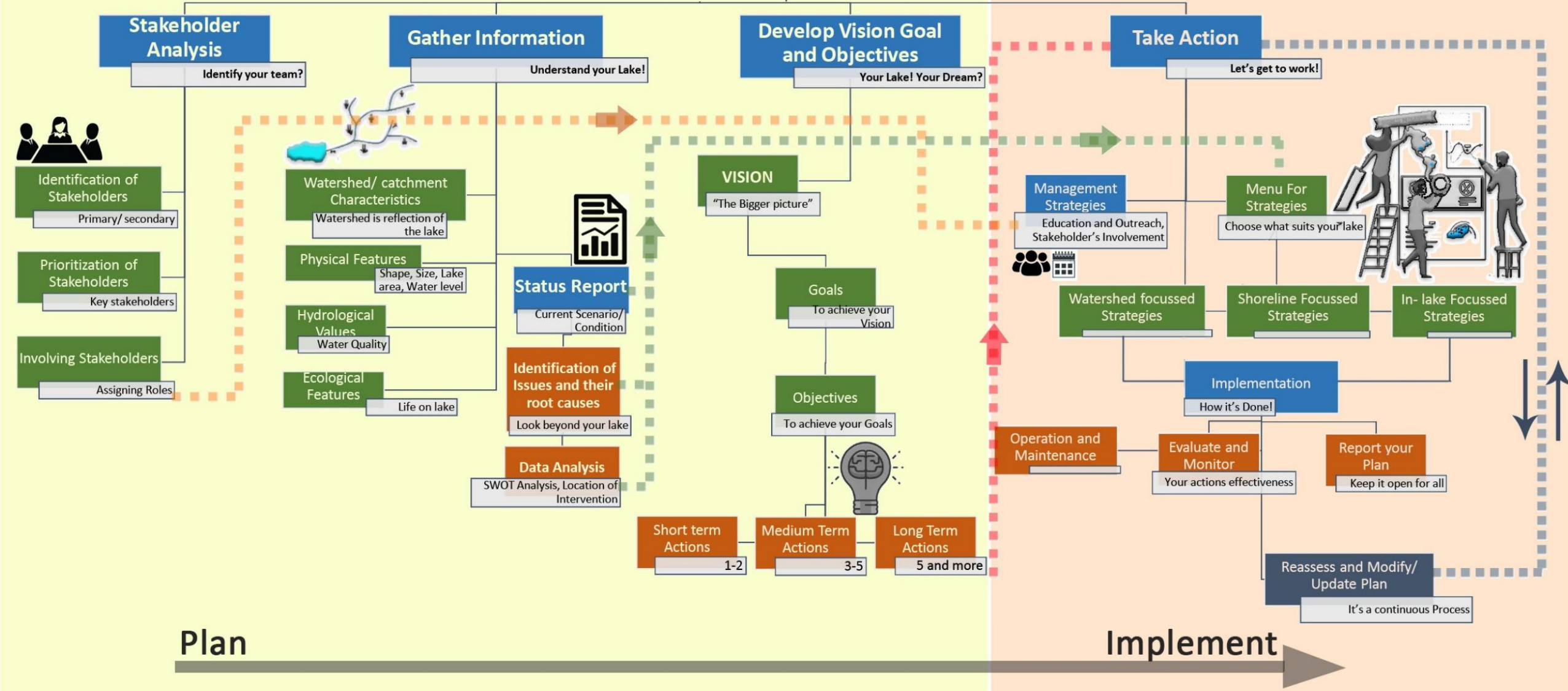
At the same time, lake management process is a fluid process altogether.

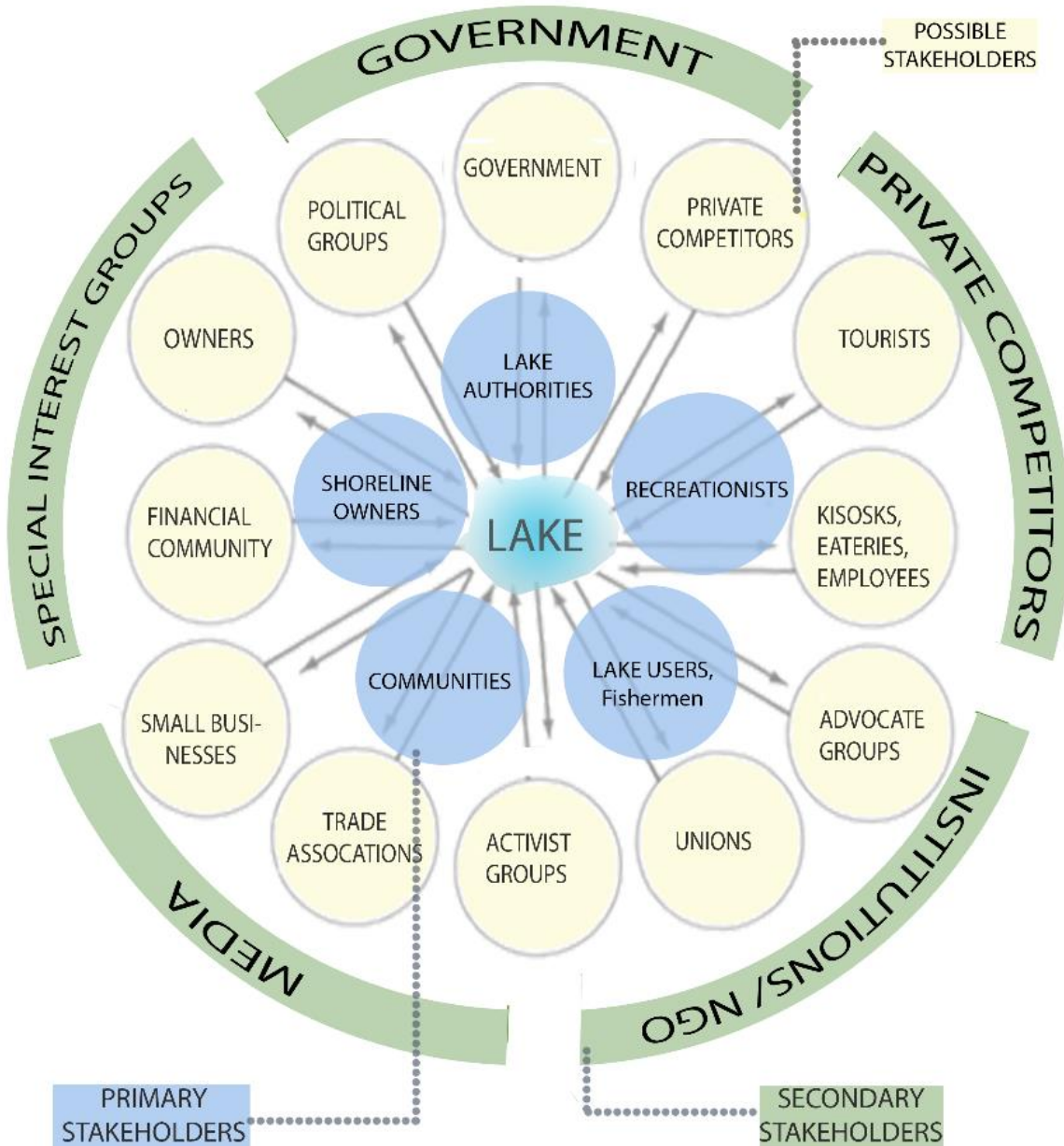
To have a systematic approach for conservation, protection, management and restoration of an urban lake, **this model framework provides step to step guidance** to move forward for sustainable urban lake management Plan



# Hierarchy of steps for model framework for Urban Lake Management Plan

AAETI





**Identification** - Identification of Stakeholders and their Selection.

**Prioritization** - Assessment of the stakeholder's interest, importance and influence.

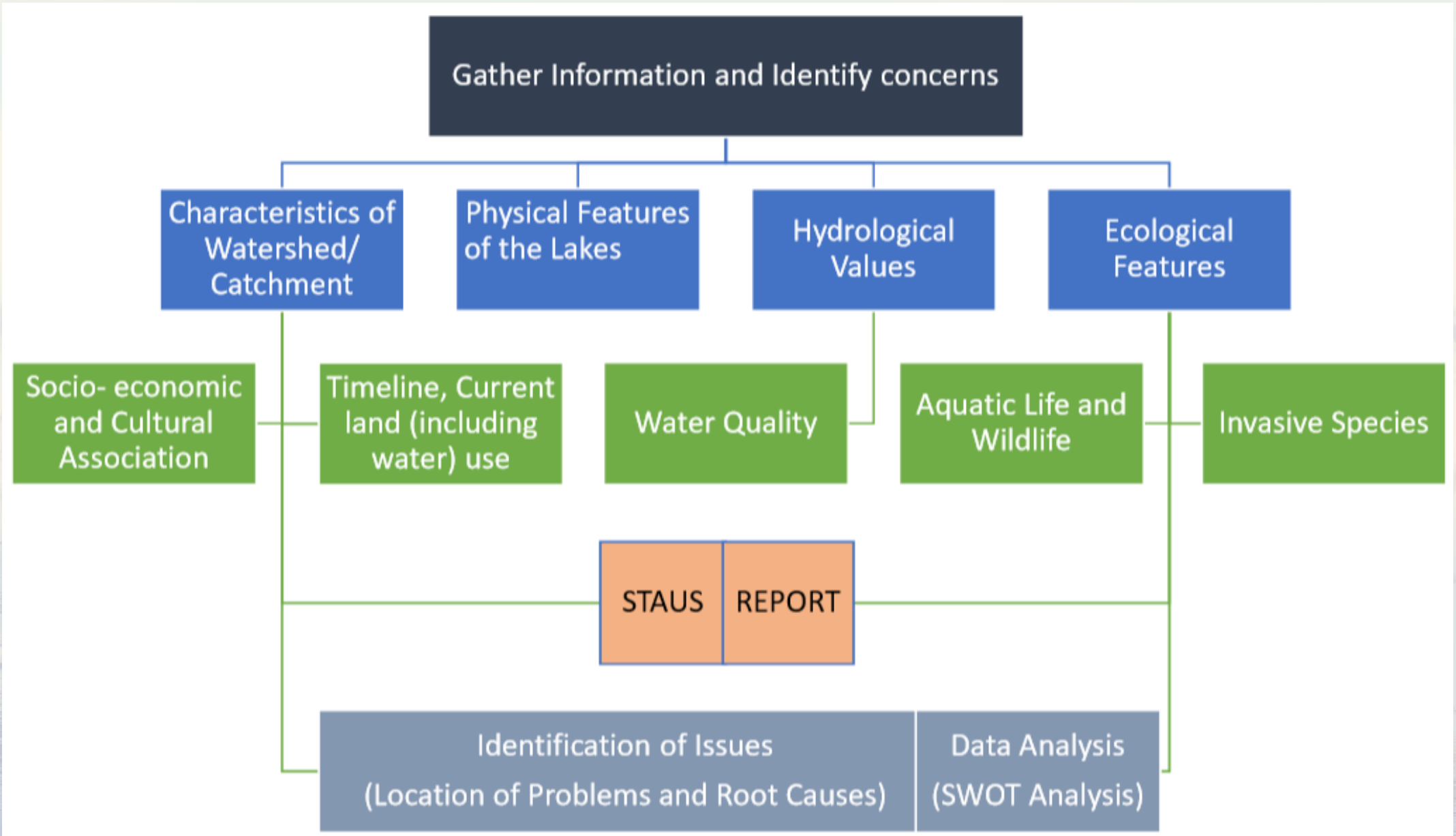
**Involvement** - Summarizing a participation strategy and public outreach.

	Stakeholders	Returns	Rights	Responsibilities	Relationships
User Communities/ Business	Fisherman	For domestic purposes Income from selling fish	The relevant national policies, laws, regulations, and local custom promotes sustainable fishing	Compliance with provisions in the community lakes management plan, laws, regulations and local rules	Fisherman depend on wetlands for food and income. They are governed by community institutions and local govt.
	Recreationists				
	Owners at Shoreline etc.				
Government	Municipal Government				
	State Government				
	Central Government etc.				
Special Interest Groups	Institutions and NGO's				
	Conservation Clubs				

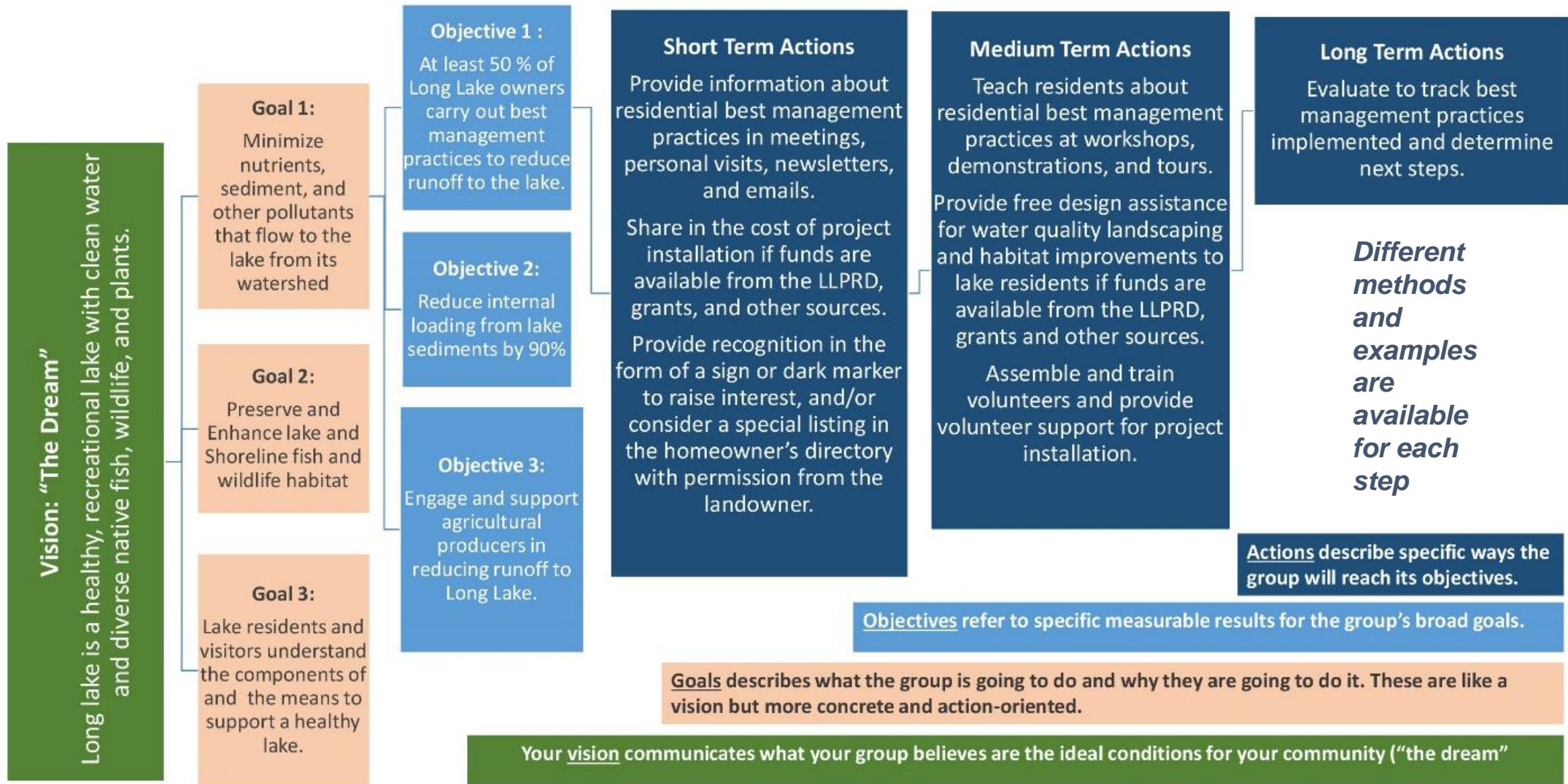
for Analysis of stakeholders involved in the utilization and management of urban lakes

# Gather Information and Identify Concerns

AAETI



# Develop Vision, Goals and Objectives



Long Lake Plan Vision, Goals, Objectives, and Actions 2014-2023

Source: [https://www.co.polk.wi.us/vertical/Sites/%7BA1D2EAAA-7A29-46D6-BF1A-12B71F23A6E1%7D/uploads/Long\\_Lake\\_Lake\\_LMP\\_2013\(2\).pdf](https://www.co.polk.wi.us/vertical/Sites/%7BA1D2EAAA-7A29-46D6-BF1A-12B71F23A6E1%7D/uploads/Long_Lake_Lake_LMP_2013(2).pdf)

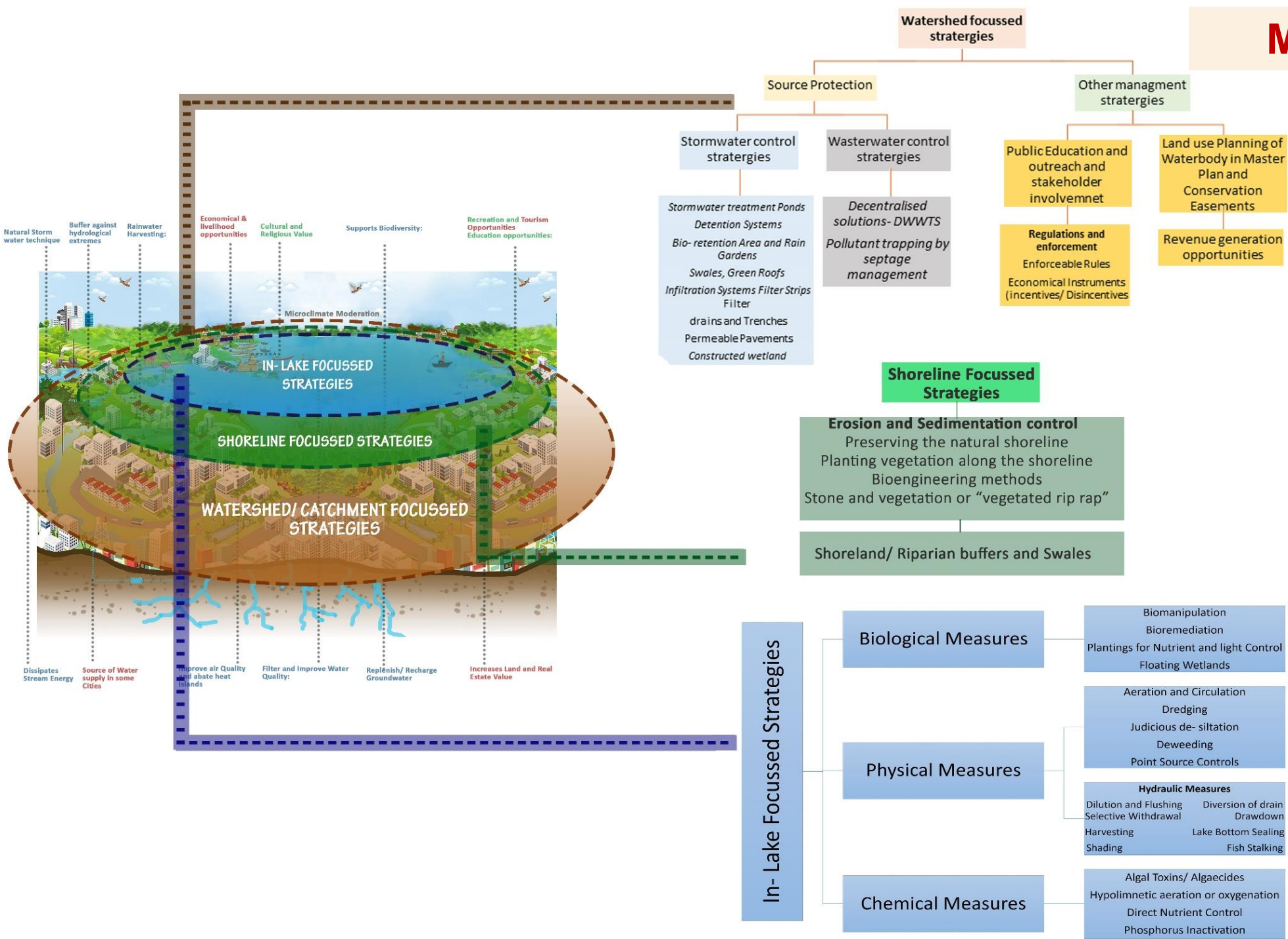


*Type of action plans tailored for type of lake management plan*

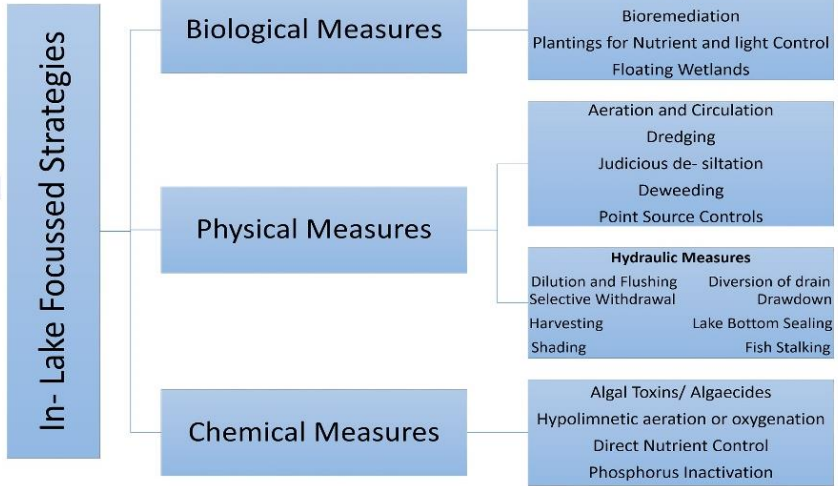
Management oriented Action Plans	Revenue generating Action Plans	Protection Oriented Action Plans	Restoration Oriented Action Plans
<p><b>The action plans focussing on informed management recommendations to address the issue</b></p>	<p>The action plans focussing on generating revenue by introducing new activities in and around lake however, also keeping in consideration that eco-sensitivity Is not compromised</p>	<p>Action plans focussing on protecting the ecosystems of lake</p>	<p>The actions plans focussing towards restoring the in-lake processes directed at large-scale manipulations to make significant changes or improvements</p>
<p><b>For example Education programmes of the general public, lake Association members, local officials, and children to improve lake conditions by limiting human activities</b></p>	<p>For example: Recreation activities along the urban lake-fronts, if promoted in well planned methods, can serve as a new revenue generating measure</p>	<p>For example</p> <ul style="list-style-type: none"> <li>• Prevent the introduction of non-native species</li> <li>• Protect current natural shorelines, catchment areas, feeder channels and command areas of lake.</li> </ul>	<p>For example;</p> <ul style="list-style-type: none"> <li>• Reduce in-lake phosphorus levels to a certain amount</li> <li>• Re-establish a balanced fishery in the lake.</li> </ul>

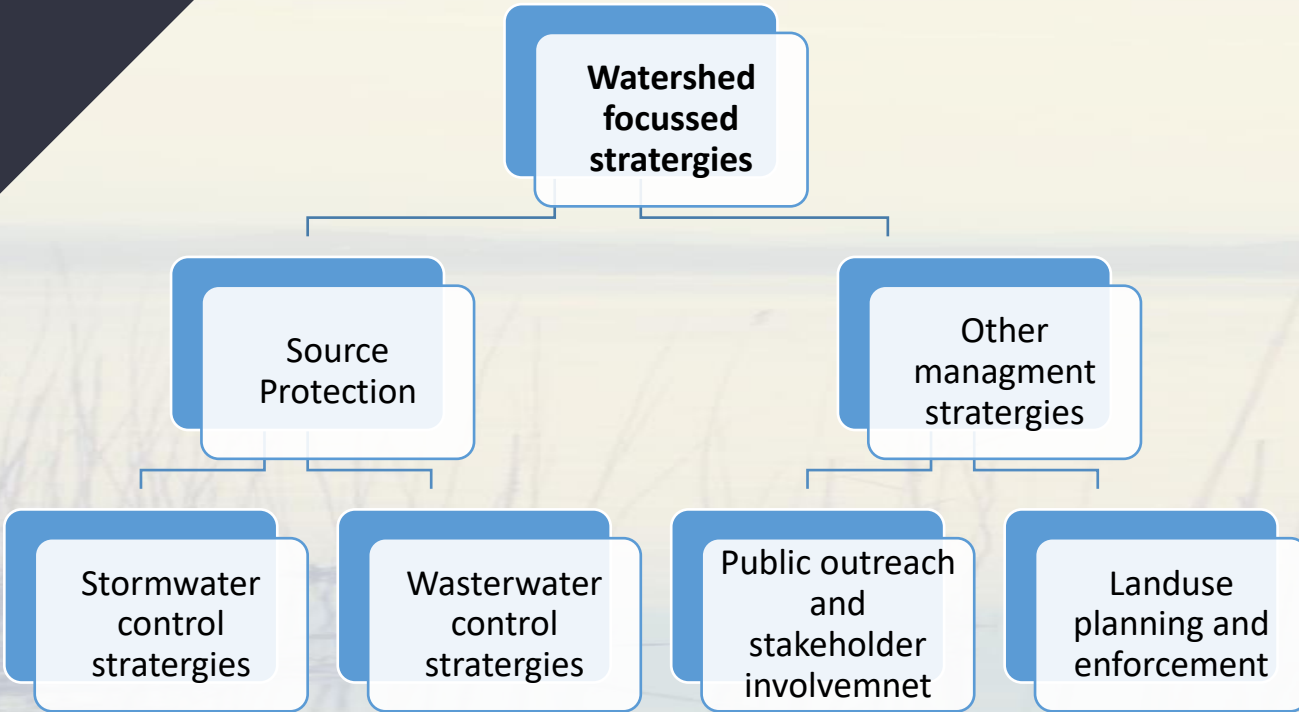
The **selection of the right technology** (for protection and restoration oriented action plans, Refer table) for lake protection and restoration **will vary from lake to lake depending** on the time as well as area/ scale of intervention for restoration. This can be divided into three approaches **Watershed focussed Strategies, Shoreline focussed Strategies and In- Lake focussed Strategies.**

# Menu for Strategies



For each of the interventions in the graphic, the **technology has been explained (guidance) briefly with diagrams for understanding, Advantages and Disadvantages/ Limitations has been reviewed and also a case study representing that intervention has been given**





Urban stormwater management	Domestic wastewater pollutant control	Shoreline Stabilization
<ul style="list-style-type: none"> <li>a) Stormwater treatment ponds</li> <li>b) Detention systems,</li> <li>c) Bio- retention areas and Rain gardens, Swales</li> <li>d) Infiltration systems</li> <li>e) Permeable Pavements</li> <li>f) Wetland Protection and Restoration</li> <li>g) Constructed Wetlands</li> </ul>	<ul style="list-style-type: none"> <li>a) Decentralised waste water treatment systems at neighbourhood scale</li> <li>b) Pollutant trapping by managing septic system</li> </ul>	<ul style="list-style-type: none"> <li>a) Erosion and Sedimentation control</li> <li>- Preserving the natural shoreline</li> <li>- Planting vegetation along the shoreline</li> <li>- Bioengineering methods</li> <li>- Stone and vegetation or vegetated rip rap</li> <li>a) Shoreland/ Riparian buffers and Swales</li> </ul>



# Shoreline Stabilization Strategies

## Methods: NOT to be preferred!



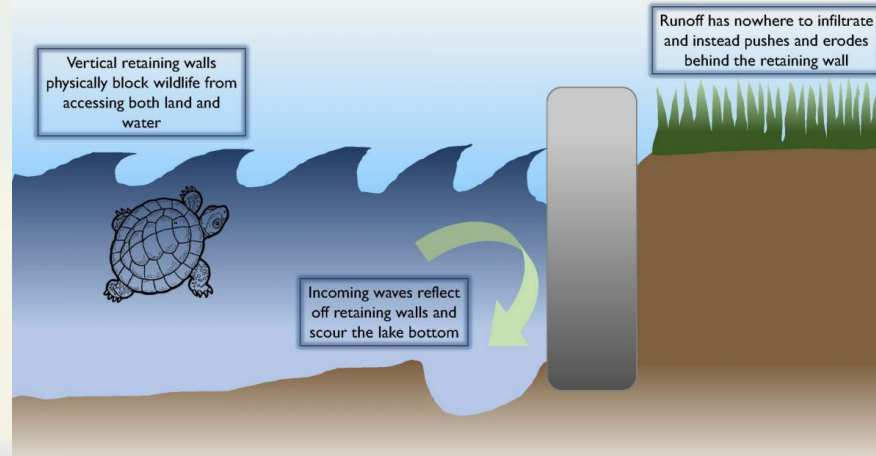
**Solid vertical walls are hardscaping methods** used to stabilize a shoreline, whether they are made of concrete, railroad timbers, or gabion baskets, these walls create a sterile disconnect between the water and upland areas, and eliminate the littoral habitat needed by fish and wildlife. By disrupting the natural transition between the two zones, vertical retaining walls physically block turtles, frogs, waterfowl and other wildlife that require free access to both land and water as part of their life cycle.

Retaining walls:

Hard pavements:

## Cosmetic Beautification of a lake's shoreline in the name of 'Restored lake's surface':

Beyond the *introduced non-native plants, heavy concretisation, jogging tracks and fancy infrastructure, systemic faults remains constant for instance; runoff from non-point sources, continued inflow of untreated sewage, dumping of solid waste on lakebeds, tourist pressure, unchecked encroachments* and poor maintenance.



## What to be done: Shoreline Stabilization Strategies

- a) Erosion and Sedimentation control
- Preserving the natural shoreline
- Planting vegetation along the shoreline
- Bioengineering methods
- Stone and vegetation or vegetated rip rap
- a) Shoreland/ Riparian buffers and Swales



1. *Land use Planning of Waterbody in Master Plan and Conservation Easements*
2. Proposed Institutional Set-up
3. Regulations and enforcement
4. Enforceable Rules
5. Incentives and Disincentives
6. Stakeholder's involvement and engagement
7. Public Education and Outreach
8. Revenue generation opportunities

<b>Water linked livelihood</b>
<b>Increased tourism potential</b>
<b>Increased Business opportunities, commercial ventures related to lakes</b>
<b>Increased Property Values</b>
<b>Employment through Pisciculture and Animal husbandry</b>
<b>Employment through cottage industry like pottery</b>
<b>Employment through tourism infrastructure maintenance and temporal activities</b>

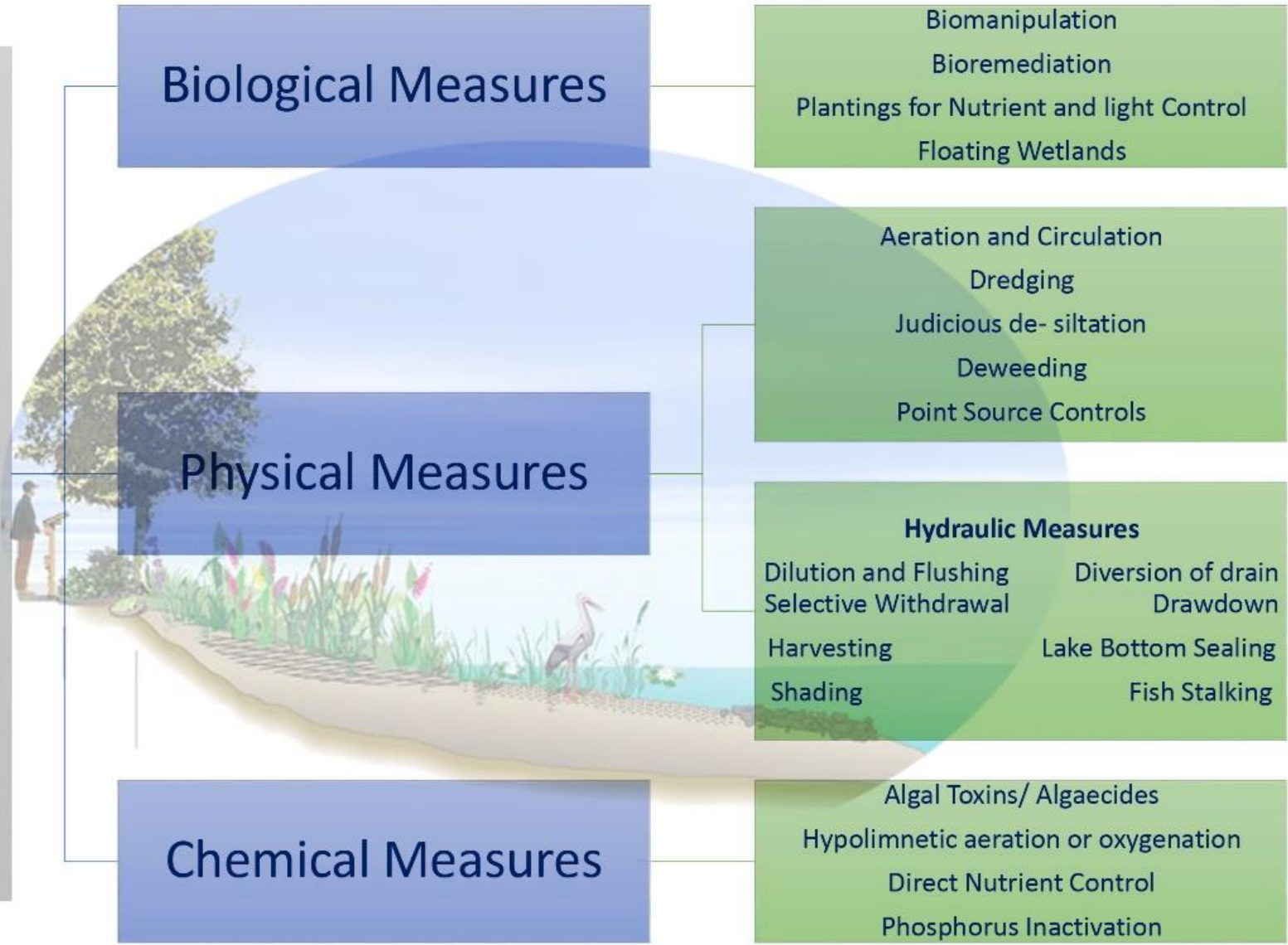
*Each of these measures are detailed out and also presents a case example where these have been undertaken*

The most common **non-structural best management strategies (Management oriented and Revenue generating Action Plans)** includes the measures that can help changing of the practices that causes the problems in the first place. It may include **land use planning laws and their enforcement, building codes and byelaws, research and assessment**, information resources and public awareness programmes.

Management strategies focussing on lake as well as watershed **considers all of the environmental, cultural and biological factors affecting the lake** and sets a higher priority on **finding lasting solutions than on pursuing quick, cosmetic treatment of symptoms**.

The effective long-term management strategy includes the **combination of watershed, shoreline and in-lake based management**.

# In- Lake Focussed Strategies



## In- Lake focused Strategies

The in- lake management approach is generally a **short term solution** for lake management plan.

These actions are generally done to **manage eutrophication, restore lake depth, enhance fisheries or increase the area** of lake for **recreation** and used to control invasive species.

In-lake activities caters to the **symptoms and may succeed for the short term**, but more often misses out on the source of these problem but **long term sustainability and holistic solutions** will often support the **prioritization of watershed based corrective actions** or can be assured with **combination of watershed, shoreline and In-lake focussed management strategies**.

For each of the interventions in the graphic, the technology has been explained (guidance) with diagrams, Advantages and Disadvantages/ Limitations has been reviewed and also a case study representing that intervention has been given



### BMPs for Urban Lake Management in India

1. *Case Study: Upper and Lower Lakes, Bhopal (India)*
2. Case Study: Hussain Sagar Lake, Hyderabad (India) Enforceable Rules
3. Case Study: Dal Lake, Srinagar (India)
4. Case Study: Pichola and Fatehsagar Lakes, Udaipur (India)

Monitoring	Evaluation
Clarifies program objectives.	Analyzes why intended results were or were not achieved.
Links activities and their resources to objectives.	Assesses specific casual contributions of activities to results.
Translates objectives into performance indicators and set targets.	Examines implementation process.
Routinely collects data on these indicators, compares actual results with targets.	Explores unintended results.
Reports progress to managers and alerts them to problems.	Provide lessons, highlights significant accomplishment or program potential, and offers recommendations for improvement.

Evaluation is compliment to monitoring when a monitoring system sends signals that the efforts are off track. (For example, the target population is not making use of the services, that costs are accelerating, that there is real resistance to adopting an innovation, and so forth), then good evaluative information can help clarify the realities and trends noted with the monitoring system.

a. Re- asses and Modify/ Update Plan

- Urban waterbodies management needs to **focus on resource sustainability**, to **build local water resources**, and **strengthen resilience** against climate change.
- Approach for waterbodies rejuvenation needs to start with **analysing the catchment**, the **linkages** of the waterbody with stormwater, groundwater and wastewater, and with **buffer** area management and **water quality** enhancement. Moving **beyond the piecemeal approach and cosmetic beautification**.
- Concepts of **biodiversity** are essential for successful waterbodies rejuvenation
- Extensive **stakeholder** review and **active community participation** are essential for sustainable project implementation
- **Land use planning** (masterplan, etc.), **inventory of waterbodies**, are key for protection and future use of waterbodies of Delhi
- **Drop the 'model project / one-size fits all'** approach and focus on **context-based analysis** and solutions for waterbodies rejuvenation and management. It must be noted that once the lake is deteriorated it can never achieve or restored to its original physical, chemical and biological conditions. However, the lake's current degraded condition can be improved and strategies could be applied to maintain the improved condition
- The **long-term sustainability and holistic solutions** will often support the **prioritization of watershed based corrective actions** or can be assured with a **combination of watershed, shoreline and In-lake focused management strategies**
- The 'lake management plan' is a fluid and continuous process altogether which requires constant reassessment and modification when required

**Thank you**

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