Draft prepared by cGanga for wider consultation and discussion

सत्यमेव जयते

NATIONAL MISSION FOR CLEAN GANGA
Ministry of Jal Shakti
Department of Water Resources, River Development & Ganga Rejuvenation
GOVERNMENT OF INDIA

RIVER RESTORATION AND CONSERVATION

A Concise Manual and Guide

cGanga
Centre for Ganga River Basin Management and Studies

DECEMBER 2019

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National Mission for Clean Ganga (NMCG)

NMCG is the implementation wing of National Ganga Council which was setup in October 2016 under the River Ganga Authority order 2016. Initially NMCG was registered as a society on 12th August 2011 under the Societies Registration Act 1860. It acted as implementation arm of National Ganga River Basin Authority (NGRBA) which was constituted under the provisions of the Environment (Protection) Act (EPA) 1986. NGRBA has since been dissolved with effect from the 7th October 2016, consequent to constitution of National Council for Rejuvenation, Protection and Management of River Ganga (referred to as National Ganga Council).

www.nmcg.in

Centre for Ganga River Basin Management and Studies (cGanga)

cGanga is a think tank formed under the ægis of NMCG, and one of its stated objectives is to make India a world leader in river and water science. The Centre is headquartered at IIT Kanpur and has representation from most leading science and technological institutes of the country. cGanga's mandate is to serve as think-tank in implementation and dynamic evolution of Ganga River Basin Management Plan (GRBMP) prepared by the Consortium of 7 IITs. In addition to this it is also responsible for introducing new technologies, innovations and solutions into India.

www.cganga.org

Acknowledgment

This Draft Document on Concise Manual and Guide for River Restoration and Conservation is a collective effort of a number of experts, institutions and organisations, in particular those who were instrumental in preparing the Ganga River Basin Management Plan which was submitted to the Government of India in 2015. Contributions to the photographs and images for this document by individuals are gratefully acknowledged.

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Draft Document on Concise Manual and Guide for River Restoration and Conservation by cGanga and NMCG

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PREFACE

IN FULFILMENT of its agreement with the Government of India, a Consortium of 7 IITs ("Indian Institute of Technology"s) had prepared the Ganga River Basin Management Plan (GRBMP) and submitted it to the National Mission for Clean Ganga (NMCG), Ministry of Jal Shakti (then Ministry of Water Resources, River Development and Ganga Rejuvenation), Government of India in the year 2015. The GRBMP recommendations were to some extent broad-based strategic measures, but they included some detailed ready-to-implement actions. There was, therefore, a felt need to have substantial further inputs to the Plan that addressed several other specific issues for comprehensive, policy-driven and technology-based solutions for the restoration and conservation of River Ganga and other rivers of the country. The Centre for Ganga River Basin Management and Studies ("cGanga") was hence created through a Memorandum of Understanding between Ministry of Jal Shakti (then MoWR, RD & GR), Government of India and IIT, Kanpur in April 2016. The main objective of cGanga was identified as Continual Scientific Support in the Implementation and Dynamic Evolution of the Ganga River Basin Management Plan.

In fulfilment of its objective, cGanga has been conducting many field and in-house studies as well as workshops and consultations with various stakeholders, executive bodies, monitoring agencies and experts on various components of GRBMP and its implementation. Based on these activities over the past few years, a clearer understanding emerged on some of the major implementation challenges of GRBMP. This led to a more refined and detailed strategic implementation procedure that combines robust scientific method with a socio-economic and administratively aligned policy framework as presented in this document.

The present manual attempts to describe in a concise manner the background, objectives, vision, knowledge-framework, methodology, governance principles, restoration strategy, monitoring, feedback and correction mechanisms, and financial management of the river restoration and conservation plan. The document is intended to act as both a guide for the non-specialist reader or stakeholder as well as a broad instruction manual for specialized government/implementing agencies who may need to take account of significant variations in physical and social particulars of river basins in implementing the restoration plan successfully.

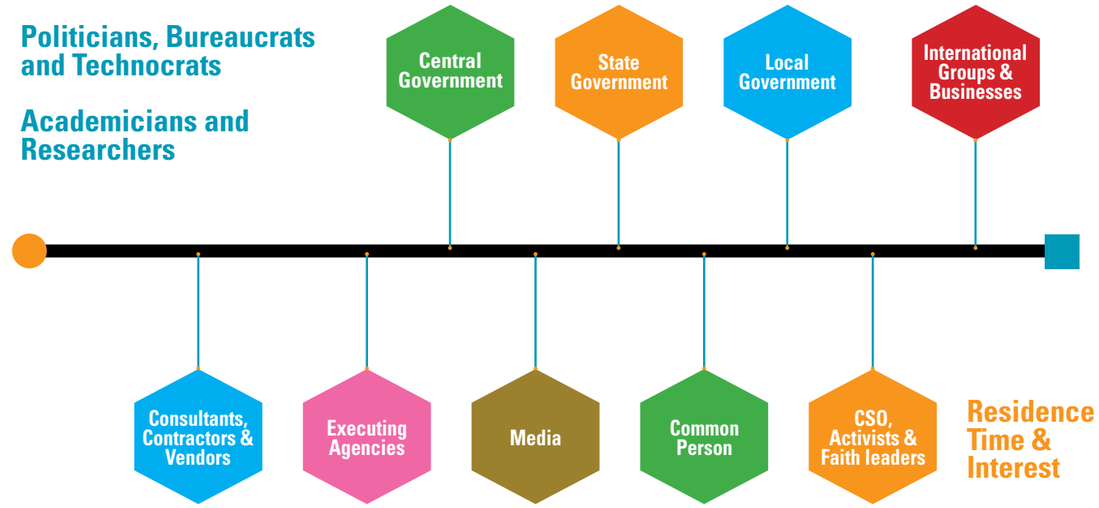
The preparation of this report was enabled by the various studies, surveys, analyses, and discussions carried out by dedicated members of the cGanga team. In addition, key stakeholders, experts and community representatives of many river basins interacted with cGanga members and gave their valuable inputs unreservedly on many aspects of the present document. This report is the outcome of this intensely co-operative venture of Team cGanga with dedicated members of river basin fraternities.

DR VINOD TARE
Founding Head, Centre for Ganga River Basin Management and Studies (cGanga), IIT Kanpur

PROLOGUE

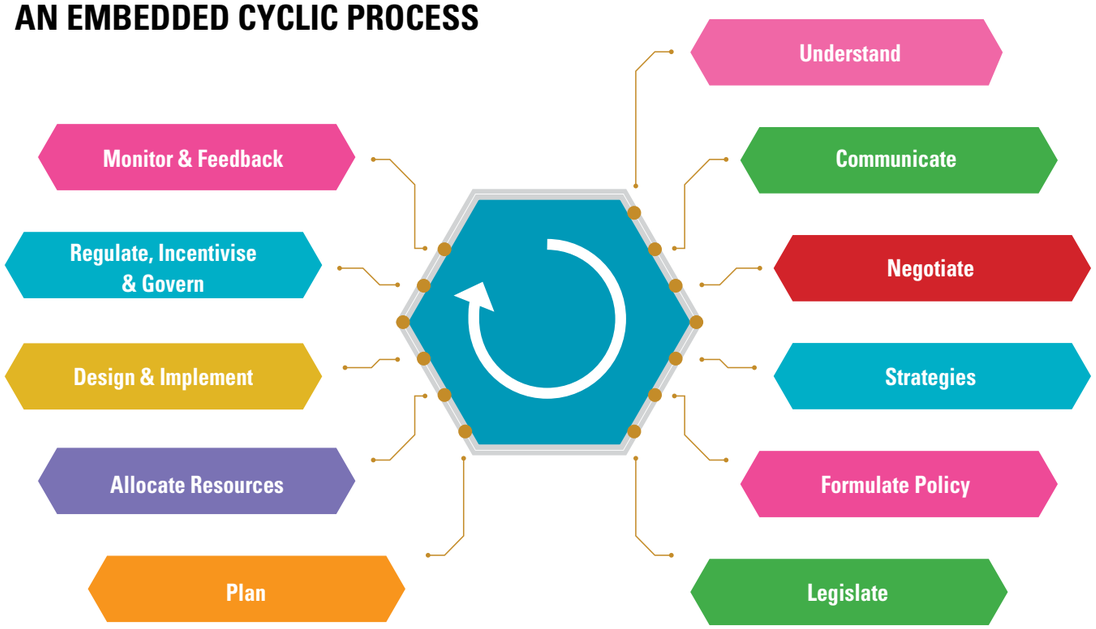
AT THE initiative of the Government of India a 7-IITs Consortium had prepared the Ganga River Basin Management Plan (GRBMP) and submitted it to the government in the year 2015. The subsequent progress in implementation of the Plan, which could lead to comprehensive revival of the steadily deteriorating National River Ganga, has been tardy to say the least. Close examination of the possible reasons for this failure led to the realization that there was inadequate understanding of the complexities of the entire planning and implementation process of such plans in the country. For river restoration and conservation must necessarily be a process of continuous understanding and revising (vide figure below), taking account of the various actors and stakeholders who may have conflicting interest or no interest at all in the venture (vide figure adjacent). Taking cognizance of this fact, a more sure-footed bottom-up approach is presented here that combines the river restoration enterprise starting at smaller scales with other social priorities to eliminate conflicts of interest among stakeholders and non-stakeholding actors and ensure a scientific and inclusive policy-driven revival process.

IMPLEMENTATION CHALLENGE:
DE-ALIGNED INTERESTS AND COORDINATION!



The major implementation challenge of River Basin Plans is the divergence of interests and outlook of different actors and the short and variable residence time of the agents of implementation. How can this problem be overcome? Approach River Basin Management as an Embedded Cyclic Process

RIVER REJUVENATION & CONSERVATION
AN EMBEDDED CYCLIC PROCESS



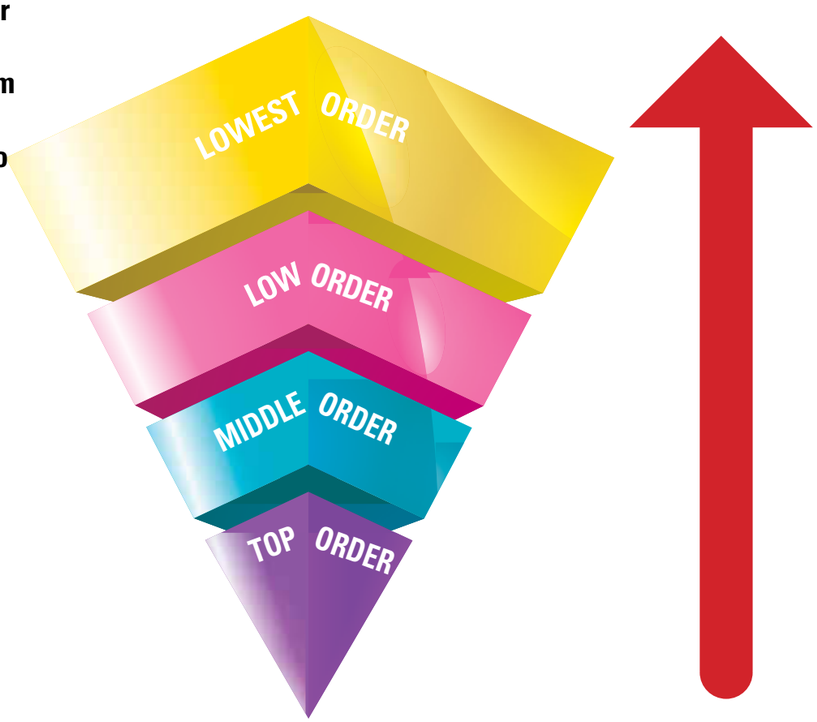
River Basin Management as an Embedded Cyclic Process

River restoration and conservation must necessarily be a process of continuous understanding and revising, taking account of the various actors and stakeholders who may have conflicting interest or no interest at all in the venture.

INTRODUCTION

While in normal times rivers are pleasant and fascinating to humans, they can also bring widespread death and destruction when they overflow with flood fury or suck away the hopes of life from parched lands when reduced to a trickle.

RIVERS ARE the lifeline of civilizations, not least the Indian civilization. For not only do rivers provide freshwater, food, energy and other valuables to humans, they also receive, purify and carry away wastewaters and provide economic means of transport by navigation. And, while in normal times rivers are pleasant and fascinating to humans, they can also bring widespread death and destruction when they overflow with flood fury or suck away the hopes of life from parched lands when reduced to a trickle. Rivers are thus dynamic actors on landscape scales matching human actions in their scope of spatial influence and impact. The degradation of rivers in modern times has, therefore, had equally far-reaching – and at times cataclysmic – consequences on humans, with unexpected floods, droughts and water-borne diseases being the most common disasters caused by distressed rivers. The restoration and conservation of rivers is therefore of utmost importance for sustaining humanity and ecology through present and future generations in India.

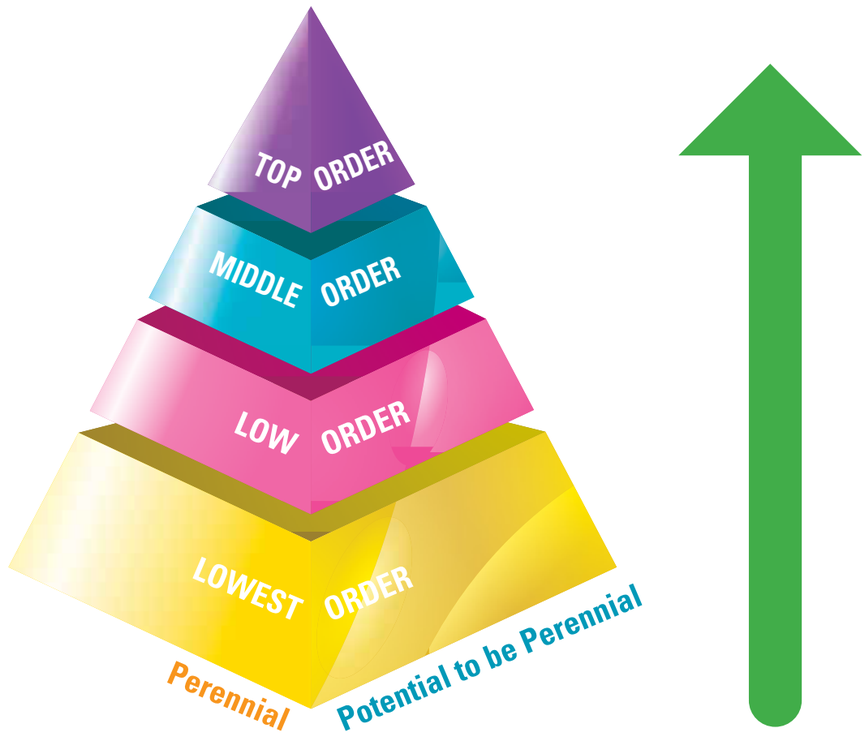


Unrealistic to built an Inverted Pyramid

Large rivers are formed by the coming together of smaller lower order rivers – the tributaries – like the tertiary and secondary roots of trees joining in stages to form the primary roots that support entire trees. The lower order tributaries – like the tertiary and secondary roots of trees – are therefore of crucial importance in maintaining the health of rivers. They not only feed water, nutrients and sediments, but also significant biodiversity into higher order tributaries and the main stem of the river. It is not surprising, therefore, that river degradation often begins in the smaller tributaries, especially those flowing through or near urban settlements.

The Committed and Focussed Approach

River rejuvenation efforts in India have often focused on large rivers as a whole, but have failed to make much headway, partly because the task is too enormous to be grasped in its entirety and carried out cogently within a limited time span. Not only is the river too large to be observed and monitored comprehensively, the anthropogenic factors affecting the river are also often too diverse and unevenly distributed across the river basin. The task becomes much simpler when the effort to reverse the degradation process is focused on the smaller urban and semi-urban tributaries/drains, especially those that are perennial or can be easily made perennial. The latter includes the natural storm water drains that often function at present as wastewater "nala"s in the cities, but which can be easily converted to perennial water bodies by supplying them with treated wastewater round the year. The multiple benefits accruing from such rejuvenation – economic, environmental, aesthetic and cultural – are also immediate, and they impact large population groups which can



Start Constructing a Right Pyramid

Real task of RBOs should be to focus on the overall long-term health of the river and ensure that it is not robbed of all its resources so quickly as to turn it into a lifeless trickle.

have a cascading effect on river rejuvenation initiatives in the rest of the basin. This is essentially a bottom-up approach (building a right pyramid) that ensures the stability of the restoration process as opposed to the top-down process (inverted pyramid) which often leaves vast chinks of deformity that makes the entire river system vulnerable to degeneration.

The failure or limited achievements of river restoration efforts in India, however, may not be only due to the enormity of the task. Even when the task is taken up in earnest on basin scales, it may be easily derailed by innumerable vested interests working for their own short-term or long-term benefits. The restoration effort must therefore clearly map out at the outset the real stakeholders of the river basin and the non-stake actors, some of whom may even claim to be stakeholders or their representatives. But only the real stakeholders should be closely involved in the river restoration plan.

The frequent failure of river restoration processes in India to actively involve real stakeholders instead of non-stakeholder actors may not be accidental. On the contrary, it is often because the river authority concerned was itself formed with an altogether different purpose than restoring and conserving the river. Thus, most river basin authorities in the country are effectively mandated with the task of exploiting the river to the hilt without necessarily being concerned about sustainability of the river. Whereas their real task should be to focus on the overall long-term health of the river and ensure that it is not robbed of all its resources so quickly as to turn it into a lifeless or sickly trickle. For nature and ecology have their own overwhelming value which we may not realize from our limited perspectives; but even from the strictly myopic interest of wealth creation one does not kill the goose that lays golden eggs. River Basin Organizations (RBOs) must therefore be re-tasked with a different priority, that of river conservation.

It should be noted here that once a RBO has been tasked with the primary goal of sustaining a river as a river for all time to come and the stakeholders are fully involved in achieving the goal, development in the river basin can be expected to accelerate rather than falter or waver as happens at present. This is because the realistic benefits from the river can now be availed confidently and systematically for sustainable development in the region. What constitutes realistic benefits and what protective measures humans need to take for the river then become the main concerns of the RBO. And if it has the confidence and cooperation of stakeholders, then river restoration and conservation can be achieved smoothly and rapidly.

While the confidence of stakeholders is vital, it is not enough to merely constitute RBOs with clear goals to earn it. RBOs must also comprise members who are committed to the goal, and RBOs should be accountable to the stakeholders. If the present method of protecting rivers from pollution or other harmful actions is largely a failure, it is seldom because the pollution standards and norms are deficient, it is non-compliance with standards is the problem. For, the present practice of policing by the government can at best be limited, but a vigilant society of committed stakeholders can readily prevent damaging activities in the basin. The only empowerment they need is the power of knowledge. And this is where RBOs can play a pivotal role by imparting scientific knowledge and understanding to stakeholders. As custodians of rivers, RBOs must themselves develop their own understanding and information base about the rivers, and communicate and negotiate on the needed restoration measures with stakeholders. Understanding, communication and negotiation are thus the three foremost steps that RBOs need to take, steps that are generally bypassed altogether at present. And it is through such interactions that RBOs could also be answerable to stakeholders.

As custodians of rivers, RBOs must themselves develop their own understanding and information base about the rivers, and communicate and negotiate on the needed restoration measures with stakeholders.

In view of its unambiguous focus and clarity about its goals, river restoration and conservation can be a veritable success and ensure sustainable development in the country by adopting a bottom-up approach starting with the rejuvenation of small perennial (or potentially perennial) rivers in and around urban areas before focusing on the larger tributaries or the main river. Further, the entire task should be carried out under the guidance of separate RBOs for each of those tributaries, the RBOs themselves adopting knowledge-creation, communication and negotiation with stakeholders as their most important tools.

Objectives of River Basin Organizations

In the light of the preceding discussions, the prioritized objectives of a River Basin Organization for the present approach may be summarized as follows:

a) Health of River to ensure that the river or natural water course is restored and maintained as a perennial river. This involves at least the following measures:

- Assured clean water (or uncontaminated water) input to maintain the minimum desirable flows round the year.
- Maintaining adequate width and depth of flow suitable for aquatic life by way of structural interventions (like weirs and bunds) if needed.
- Preventing the influx of wastes and pollutants.
- Protecting physical integrity of the river and floodplains.

b) Conformity with local Ecology and Environment, such as:

- Connectivity with local water bodies.
- Unblocked natural drainage routes.
- Reducing catchment runoff rates to enhance groundwater recharge.

c) Maximizing Benefits from River, such as:

- Surplus water storage for human use.
- Fish and other aquatic cultivation.
- Tourism & Recreation.
- Navigation & Transport.
- Increased public revenues from river-centric activities.

d) Minimizing Damages or Losses due to River, such as:

- Minimizing Flooding and Water-logging.
- Land Reclamation.

e) Enhancing Benefits for Downstream Regions, such as:

- Improved Water Quality downstream.
- Improved Biodiversity downstream.

Selection of Priority Rivers for Restoration

The foremost rivers to be selected for restoration in a large river basin should be low order streams that are not affected significantly by too many incoming tributaries needing independent attention. At the same time the water course selected should not be too small or insignificant, and it should be historically a perennial river – or at least one that can be made into a perennial stream, for only perennial rivers can meet the objectives round the year and ensure a stable course of action. If the selected streams are located in or around urban centres, then municipal wastewaters, industrial effluents and/or agricultural return flows, after necessary treatment, can be used to supplement the river flows. Thus, selection of low order urban streams or natural drains in cities has the dual advantage of restoring the stream easily as well as of conveying treated wastewaters through cities in a hygienic and aesthetic manner. The priority stream selection criteria are summarized in the points below:

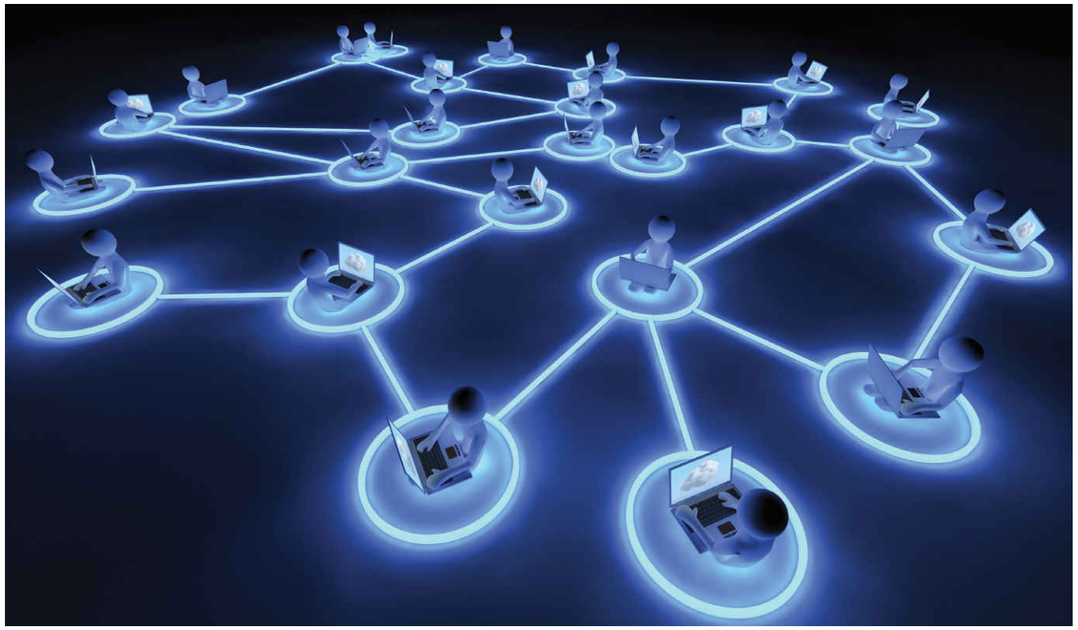
- The water course selected should be a low order stream.
- It should be a perennial stream – at least historically, or one that can be made perennial by water that is brought from other regions/watersheds for water supply, irrigation, etc. in the region.
- It should preferably be located in or around urban areas.
- It should be relatively prominent in size or extent in the region.

Stakeholder Involvement

Stakeholders, independent of their stakes in the status of the river, may have other independent and varied interests, which may or may not be aligned with the goals of river conservation. Hence, the crucial role of stakeholders in restoring and maintaining the river may need to be addressed and strengthened by RBOs through the development of stakeholders' Understanding and Knowledge, through meaningful Communication, and through purposeful Negotiation. These steps would generally involve the following components:

a) Understanding & Knowledge

- Rivers as Dynamic Freshwater Bodies (i.e. rivers, unlike lakes, ponds, and swamps, are constantly flowing; hence their characteristics can change rapidly over time and along the length of the river).
- Rivers as Integral Components of Water Resource Networks (i.e. rivers are usually connected hydraulically to floodplain wetlands, groundwater and other water bodies for at least part of the year).
- Water Quality changes & Nutrient Cycling through Biogeochemical Processes (i.e., the aquatic biota and the river bed and geological setting together establish chemical processes governing nutrient and material flows that maintain the chemical environment in river waters).

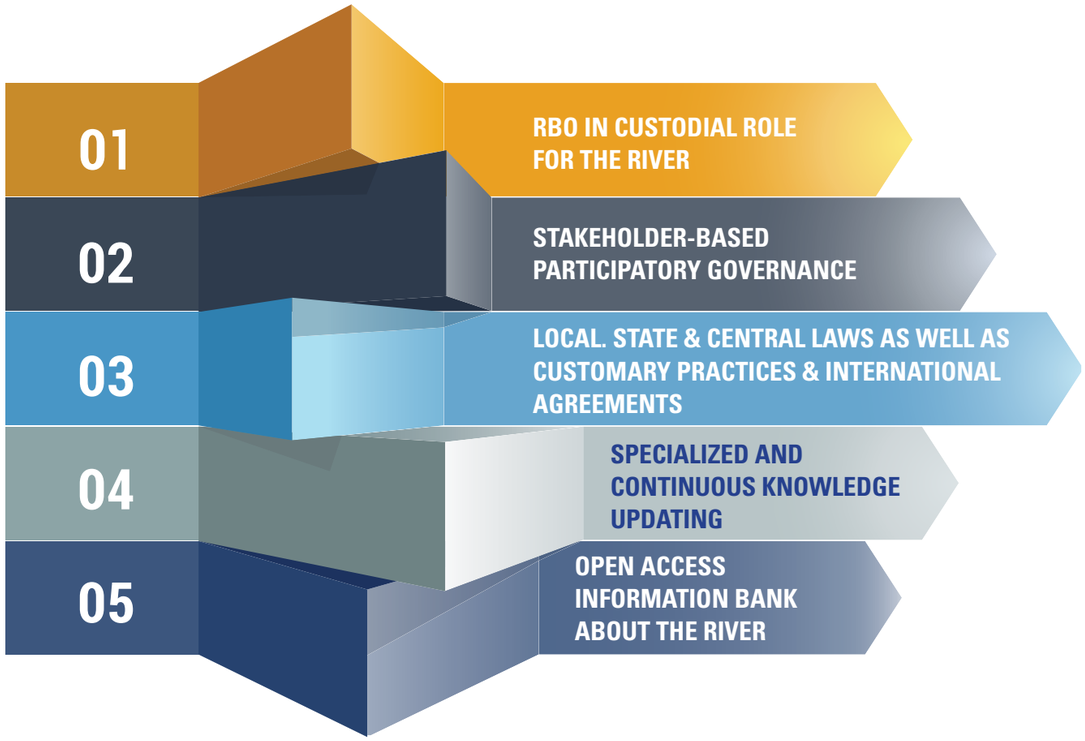


Low order

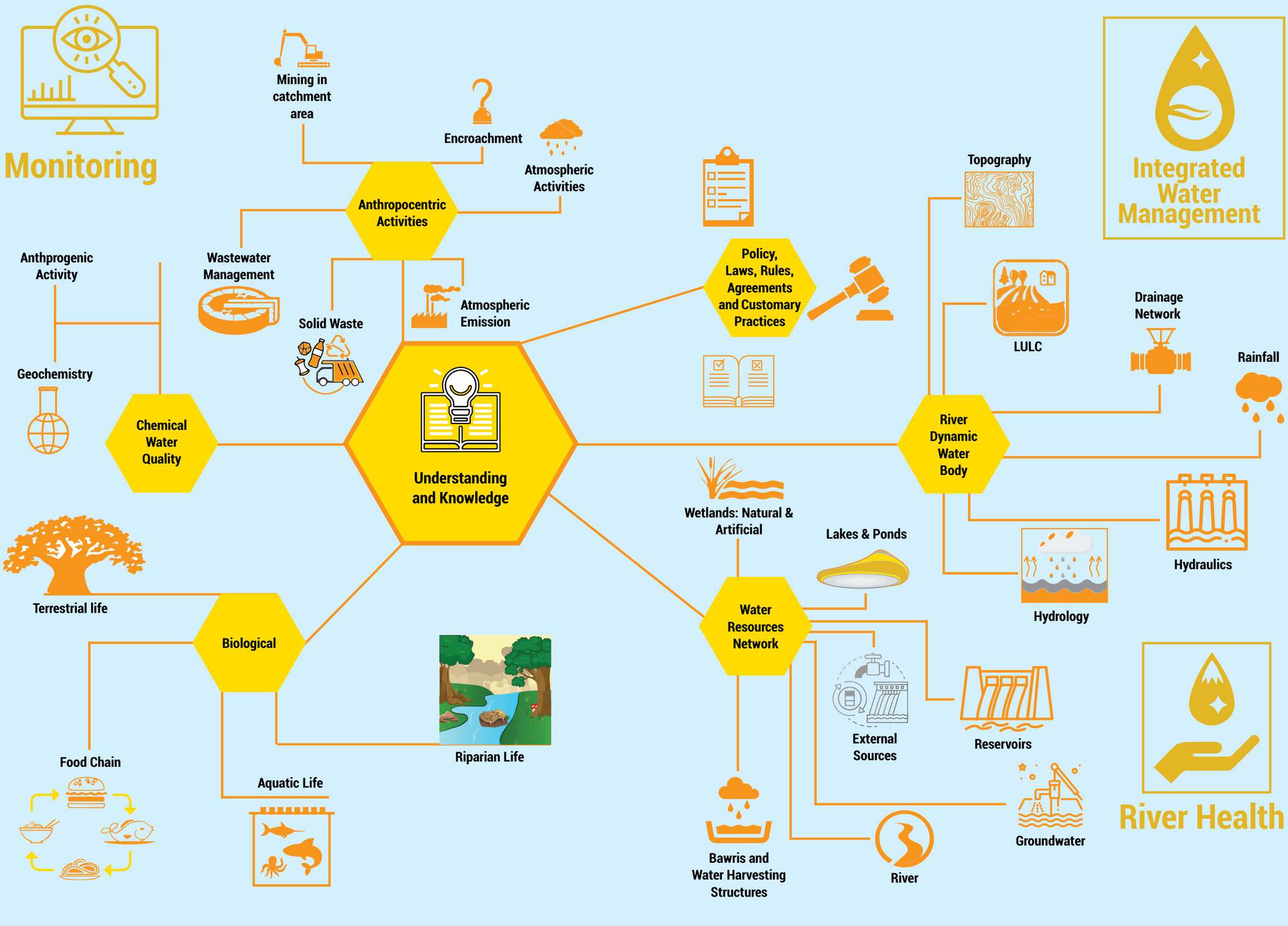
urban streams or natural drains in cities has the dual advantage of restoring the stream easily as well as of conveying treated wastewaters through cities in a hygienic and aesthetic manner.

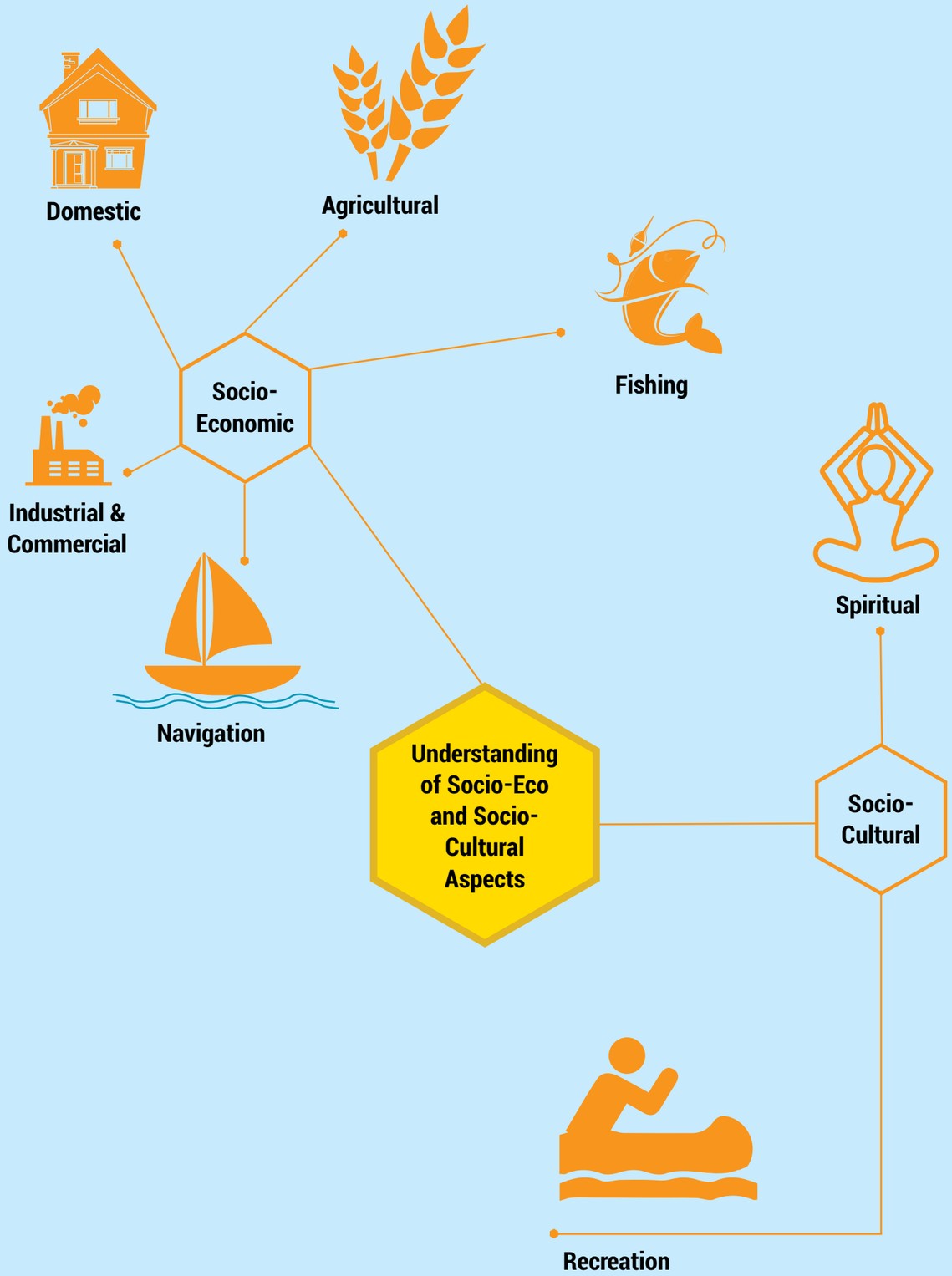
GOVERNANCE

THE BASIC GOVERNANCE PRINCIPLES THAT SHOULD BE ADOPTED BY RBOs:



HENCE THE RBO ITSELF SHOULD COMPRISE LARGELY OF PROMINENT LOCAL PERSONS AND STAKEHOLDERS BESIDES GOVERNMENT REPRESENTATIVES AND SUBJECT EXPERTS.


Monitoring
Mining in catchment area
Encroachment
Atmospheric Activities
Anthropocentric Activities
Wastewater Management
Solid Waste
Atmospheric Emission
Anthprogenic Activity
Geochemistry
Chemical Water Quality
Understanding and Knowledge
Policy, Laws, Rules, Agreements and Customary Practices
Integrated Water Management
Topography
LULC
Drainage Network
Rainfall
River Dynamic Water Body
Hydraulics
Hydrology
Wetlands: Natural & Artificial
Lakes & Ponds
Water Resources Network
External Sources
Reservoirs
Groundwater
River
Bawris and Water Harvesting Structures
River Health
Terrestrial life
Biological
Riparian Life
Food Chain
Aquatic Life



- Benefits (i.e. ecosystem services such as water, fishes, hydropower, cultural and spiritual benefits), and Threats or Losses (i.e. ecosystem disservices like floods and terrestrial barriers) from rivers.
- Anthropogenic activities affecting rivers adversely.
- River Health Indicators (from visual assessment to aquatic biodiversity including hydrological, hydraulic, geomorphological, etc. aspects).
- Policies, Laws and Rules (Local, State, Central and International agreements).

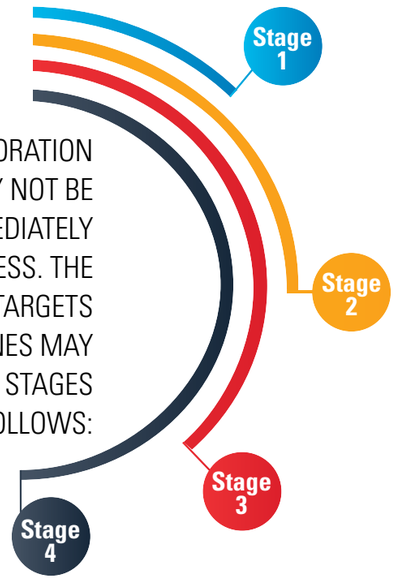
b) Communication

- Understanding and General Information about the River.
- The river's importance in the region and in the larger River Basin.
- What sustainable benefits can be obtained from the river.
- What precautions about anthropogenic activities are needed for the river.
- Stakeholder rights and responsibilities.
- Project Planning, Implementation and Monitoring Strategies.
- Continuous information collection and dissemination.

c) Negotiation

- River uses to be banned/ restricted (e.g. defecation, waste dumping, sand mining, washing, etc.) and those to be encouraged (e.g. riverside recreation, river studies & monitoring, etc.).
- Vacating occupied land on floodplains (river space).
- Regulating river water withdrawals.
- Implementing Catchment Improvement Measures (e.g. increasing vegetal cover, preserving surface and ground water bodies, reducing built-up area, solid waste disposal, wastewater, effecting livelihood changes, etc).
- Any sacrifices / compromises required to benefit downstream basins.

RESTORATION STAGES & TARGETS



THE RESTORATION GOALS MAY NOT BE ACHIEVED IMMEDIATELY IN COMPLETENESS. THE RESTORATION TARGETS AND MILESTONES MAY BE SET OUT IN STAGES AS FOLLOWS:

1. **Aesthetic Satisfaction (Visual appearance, Smell)**
2. **Recreational activity (e.g. boating) satisfaction**
3. **Structural integrity of river (stable bed & banks, unoccupied floodplains) and good water quality (physical-chemical & biological)**
4. **Achieving abundant-native-biodiversity**

Restoration Strategy

The restoration measures needed comprise comprehensive measures not only for the river but also for the floodplains and the entire catchment or watershed. Thus, attention should be paid on all aspects, namely:

Input Water Quality:
A Four-Stage Water Quality Improvement Cycle is proposed as shown in the adjoining figure for municipal, industrial, commercial and agricultural-returned flows management so that the freshwater body receiving the water is not only ecologically and aesthetically satisfying, but is also a reliable source of water for human use. Thus, while Primary (and, where possible, Secondary) Treatment of municipal sewage ensures significant removal of organic and inorganic wastes, phyto-remediation of the ensuing wastewater in Wetlands removes further organics, nutrients, and other pollutants, thereby preventing any harm to the receiving river or freshwater ecosystem while also fulfilling freshwater usability for human needs.

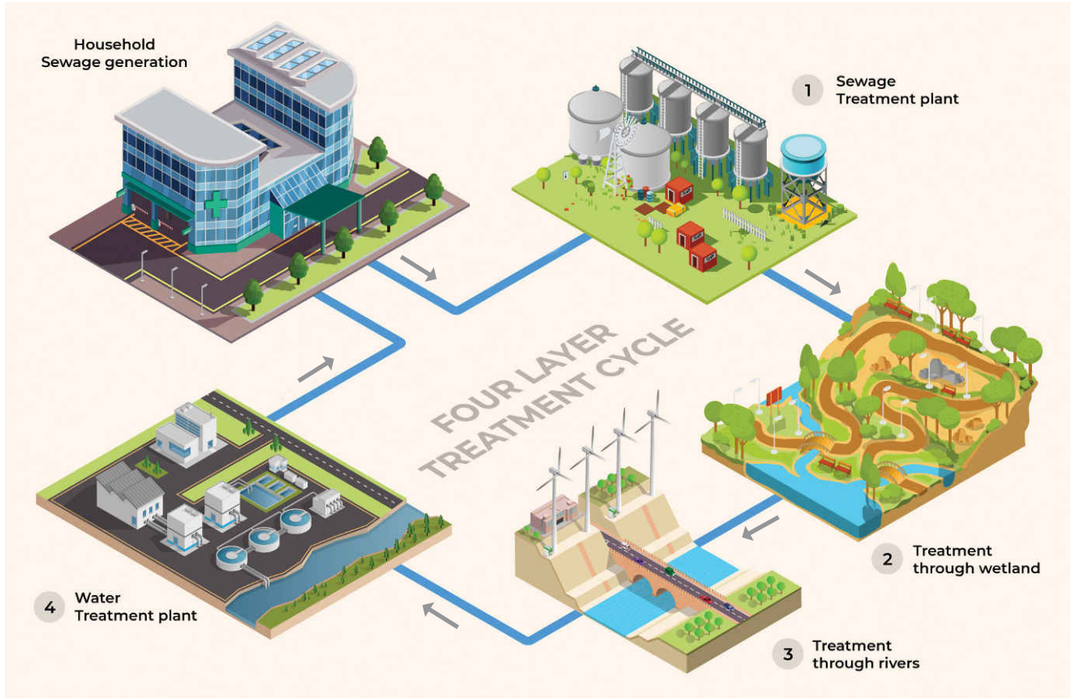
Integrity of the River System:
The river channel and banks need complete protection from human actions such as sand mining, constructions, and other interventions. Simultaneously, the floodplains, incoming drains and, in fact, the entire catchment or watershed need safeguards against encroachments, structural impairments, denudations and blockages of natural drainage paths.

Water Resource Integration:
While the primary focus is on the river as a freshwater body, water bodies seldom exist in nature in functional isolation, but are hydraulically and hydrologically connected to other water bodies in their neighbourhoods. Thus, ensuring the sustenance of and connectivity with other water bodies (including groundwater) in the region is of importance.

River-Related Infrastructure:
Some structural interventions may be necessary to ensure the functioning of the river as a secure perennial river without obstructing terrestrial activities. Thus, for instance, weirs may be needed in river stretches with steep gradients to provide the necessary flow depths or flow velocities needed for river biota; or, embankments may be needed in regions that are susceptible to flooding during heavy storms; or bridges may be needed to secure river crossings for human and terrestrial animals.

Restoring/ Developing Aquatic and Terrestrial Biota:
Both aquatic and terrestrial flora and fauna are essential for healthy rivers and their catchments. In catchments natural vegetation, in particular, helps in recharging water both in soils and in groundwater as well as in runoff purification; Hence efforts may be desirable to generate and maintain adequate levels of natural vegetal cover in the basin. Likewise, adequate levels of aquatic flora and fauna should be maintained in the river and water bodies by controlling over-exploitation of biotic products and seeding with suitable species where needed.

Continuous Records:
A complete inventory should be kept of all changes made and/or observed in the river and its basin (including key monitoring indicators) during the restoration-conservation period. These records will not only help assess the progress and success of the efforts, but can also help in overcoming unexpected obstacles in the progress as well as in implementing similar programmes in other river basins.



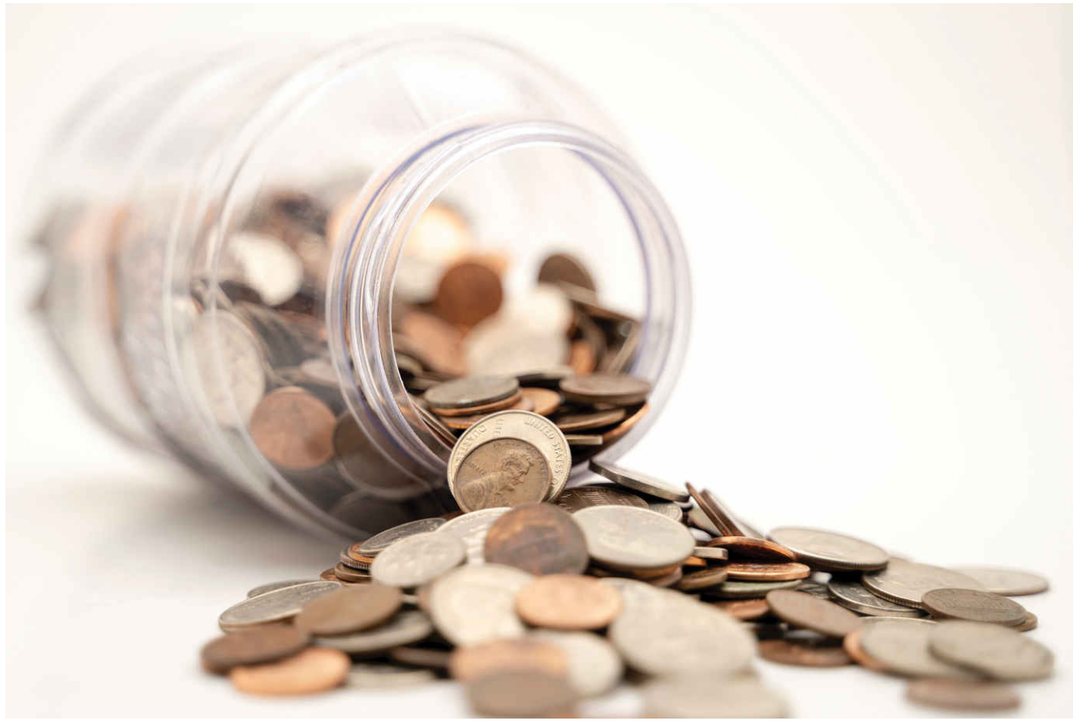
Establishing an Economic Approach

Integral to sustaining a riverine eco-system is establishing the value of water. Water as a resource must be accorded an economic value in order to identify the riparian conflicts as well as align the interest of all stakeholders

Prior to implementing any aspect of the restorative functions, the RBO must establish a water balance-sheet of the system it is managing. The balance sheet will provide it with a clear assessment of supply and demand of water throughout the year as well as the seasonal variations that might occur.

Once established the RBO will be able to assess the over or under supply of water as a resource to each of the riparian segments – agriculture, industry, households, hydropower and other eco-system services beneficiaries. The RBO would also be able to determine whether the various actors are paying adequately for water or not.

Whilst water rights' governance, water allocation, water markets and water pricing is a larger system issue, RBOs can take a pragmatic approach to develop a water market in absence of an established framework.



Financing the Different Components of River Conservation

The financing needs of any river conservation project can be assessed through the following framework:

Water as a resource must be accorded an economic value in order to identify the riparian conflicts as well as align the interest of all stakeholders

A. Direct revenue generating functions

This covers most utility functions such as:

i. Waste-water treatment
ii. Water supply
iii. Solid waste management

These functions are the easiest to finance as there is a clear revenue model established and the projects are, more often than not, developed through a public-private-partnership (PPP) construct. The projects can be financed through commercially available debt and equity financing streams.

B. Indirect revenue generating functions

a. Water surface transport
b. Recreational activities
c. Commercial activities on river-banks
d. Real estate development activities on river-banks
e. Commercial fishing/fisheries
f. Reduced municipal water supply/ transport & water treatment costs

Although the underlying functions may themselves be revenue generating, they are indirectly linked to the water body itself. However their very existence and success depends on the proper and sustainable development of the river. Therefore, it is essential that each of these functions pay their fair share in maintaining the river. This can be done through dedicated cess and taxes. However, great care must be given when designing these revenue contribution mechanisms, because, if not ring-fenced these can result in great financial inefficiency where despite the generation of capital sources the funds do not reach back to the intended functions in their entirety.

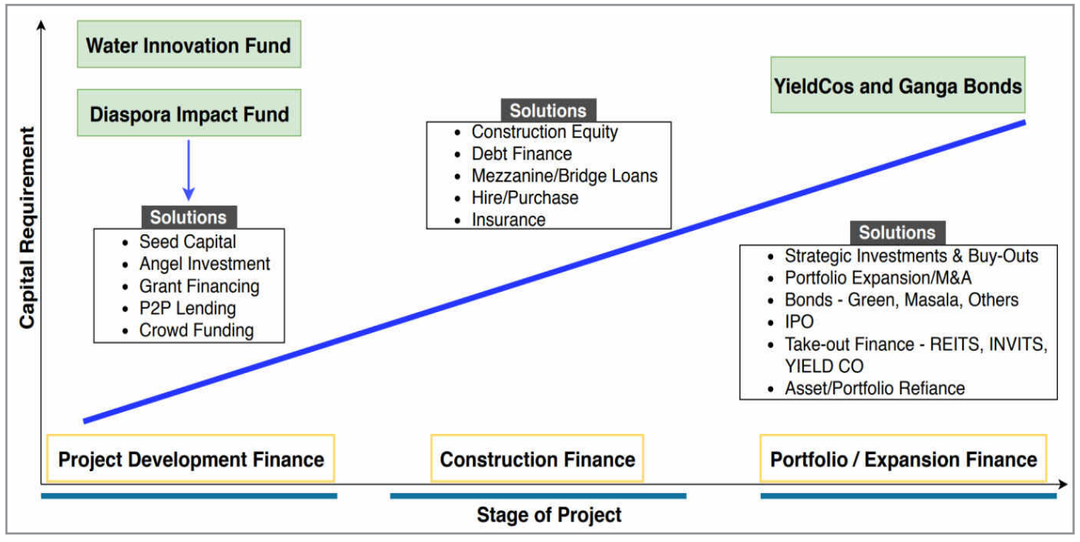
C. Non-revenue generating functions

a. Catchment improvement and development including restoration of drainage routes, plantation and rainwater harvesting structures
b. River works including for beautification and river front development, flood control through hydraulic structures such as weirs and dykes, conveyance adequacy functions, bank stabilisation, river dredging and desilting
c. Buffer storage and reservoir developments

The non-revenue generating functions have to be funded through Government mechanism. It is advisable that the financing is done through planned and not programmatic expenditure. This is essential for Governments to give indication to capital markets and lenders that they are committed to restoring and conserving the rivers.

Financing Instruments

Each of the components of a river conservation project can be financed through a number of financing instruments listed in the following illustration:



The most critical aspect in the financing value-chain is for the RBO to demonstrate a long-term commitment it has towards the programme.

There is a huge growth in the availability of finance for projects that score high ESG (Environment, Social, and Governance) factors. The RBOs are suggested to follow an approach that can clearly articulate and subsequently visibly demonstrate the ESG impact of any intervention that they may undertake.

The most critical aspect in the financing value-chain is for the RBO to demonstrate a long-term commitment it has towards the programme. This sends confidence up and down to the entire financing value chain.

Revenue generating assets can refinance their projects through issuance of green-bonds or free up the entire invested capital through secondary market vehicles such as YieldCos or InvITs. If the secondary markets are well established, then the entities that lend into the projects have a greater degree of confidence that once the assets are revenue generating, there will be an exit available to the lenders so that the balance sheet can support other projects.

For non-revenue generating assets, the RBOs can come together to pool the collective risk of their projects into a single vehicle and issue long-term bonds. The success of these bonds however depends a lot on the credit rating achieved which can be improved through specialist credit-enhancement instruments.

Guidelines for Developing and Implementing the Financing Strategy

The bankability of any river restoration programme and projects within it is highly coupled with the inherent systemic and project related risks. RBOs along with the other stakeholders can use the following 10 steps and guidelines to develop their financing strategy for the river conservation and restoration project:

1. Establishing an overall economic vision for the restoration programme

The first and most formidable step for the RBO has to be to establish an overall economic vision of the programme. It is important to emphasize the fact that the vision should not be constrained by lack of current financing as there it is possible to finance all individual components of the vision, if approached in the right manner.

2. Establishing the water balance-sheet

To initiate implementation of the economic vision and subsequent financing process, the RBO must start with this most important step which is to understand what (water) resources does-it-have at its disposal, what are the constraints and what will the demand look like in the future. This balance sheet will be very dynamic and the RBO must also factor in all current and future variations.

3. According value to water

In what will be the most critical step, the RBO must establish value for every litre of water that is available at its disposal including both fresh and grey water resources. This will enable establishing a tangible monetary value for the resources it is or will be managing.

4. Establishing revenue (direct or indirect) and non-revenue generating functions

Clearly breaking down the programme into its sub-components and identifying whether the sub-component is a revenue, profit or cost centre will help in clearly establishing the financing strategy.

5. Developing an expenditure model – capital and operational

The next step is to prepare the expenditure that the different components will require to make the programme a successful reality. It is important to emphasize the point that a total lifecycle cost should be taken into account when estimating future expenditure.

6. Developing a financing strategy

Blended finance is recommended as the right approach for financing of the entire restoration programme developed by any RBO. The approach encourages partnership between all public and private parties involved. It significantly expands the sources of finances available for the various components of the programme.

7. Creating the necessary financing vehicles and structures

Establishing the right financing vehicles and structures develops the right risk profile of the programme and project components. The vehicles could be both top-down whereby a dedicated holding or wholesale financing entity is established, or bottom-up whereby individual projects are financed through special purpose vehicles (SPV).

8. Securing the requite project/programme funding

A multitude of financing instruments will be required for financing of the programme. All of these have to be carefully slotted and programmed to work in tandem with each other in the overall financing value chain. An early dialogue with all prospective investors and lenders will also identify the shortfall in available capital for which the RBO can avail Central or State Government viability gap finance or a credit enhancing guarantee.

Blended finance is recommended as the right approach for financing of the entire restoration programme developed by any RBO

9. Funding the ongoing operations and maintenance

As projects come on stream and start becoming operational, it is important to ensure that there is no shortfall in the O&M financing as it can have a detrimental effect not only on the specific project but also the entire programme. The upkeep of the assets will increase the overall creditworthiness of the programme.

10. Refinancing and expanding the project portfolio

Finally, as the programme achieves a steady state, the RBO must look to refinance the project through the issuance of green-bonds thereby reducing the overall cost of financing. This will also help it in expanding its portfolio by going back to the very same capital markets where it has a good track record.

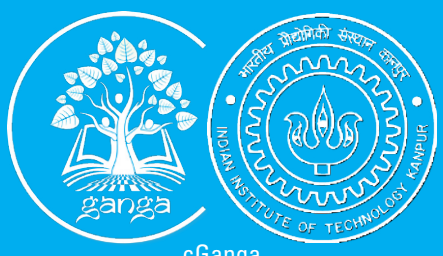
Monitoring, Feedback, Evaluation & Course Correction

Rivers are among the most complex ecosystems of nature, and in spite of the best efforts there may be temporary setbacks due to inadequate understanding of a specific river's characteristics. Moreover, restoration plans themselves as well as the implementation of the plans may also have unnoticed flaws that can cause such setbacks. Hence a system of rigorous monitoring, feedback, performance evaluation and course correction (if needed) is essential. The basic tasks to be carried out here are as follows:

- Monitoring of STPs, Wetlands & Drains by Specialized Agencies.
- Performance Feedback from Stakeholders.
- Performance Evaluation by Experts.
- Overall Evaluation by RBO.
- Corrective Measures for future to be appropriately devised by RBO.

The Way Forward

If riverine ecosystems have degraded considerably in the country in modern times, national concern about the issue has also been increasing rapidly. By combining this concern with the experience gained over the last few decades and knowledge of river management from all around the world, a clear path has been chalked out here to secure the revival of our rivers in a phased and steady manner that will also improve our water security and water environment. Our national concern for rivers, therefore, must now translate to comprehensive knowledge-based and stakeholder-inclusive action.



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