

**REVIEW ARTICLE:****POLICIES AND PRIORITIES FOR HEALTHIER SUSTAINABLE WATER MANAGEMENT  
IN RIVER BASIN CITIES OF DEVELOPING COUNTRIES<sup>1</sup>****Naveen Kumar Mishra<sup>1</sup>, Meghkanta Mohapatra<sup>2</sup>****INTRODUCTION**

Rivers have played a vital role in the development of human civilization. Great civilizations have developed at the banks of large rivers like the Ganga, the Indus, the Euphrates and the Nile, because they provide water, food and shelter, the three most important necessities on which depends the survival of mankind. There is dire need of water for whole community of the society whether that is man or animal. Population growth, economic development and changing trade policies are the main driving forces behind increasing demand and need for water. Water use has been growing at more than twice the rate of the population increase during this century. By 2025, as much as two thirds of the World's population could be living in countries subject to water stress a majority of them in developing countries. In many developing countries water availability is subject to large seasonal or inter annual fluctuations. Water is essential for health and necessary for the production of food, economic growth and the support of the environment Water is used in households, industries and agriculture but also for energy, transport and recreation. Growing urbanization particularly in developing countries is increasing demand for water. Only 18% of the low-income residents in the developing world have a household connected water supply (Bjorklund, Gunilla. 2001). Those without access to safe water supply must buy from vendors at much higher costs than the piped city supply. It is also estimated that only 8% of the low-income dwellers have a house sewer connection (Bjorklund, Gunilla. 2001). The main parts of those low-income dwellers are living in suburban in the developing world more than 90 % of sewage water is discharged directly into rivers, lakes and coastal waters without any kind of treatment (Bjorklund, Gunilla. 2001). The ongoing depletion of water quality is having consequences not only on human but also on environmental health.

**WHY SUSTAINABLE RIVER BASIN DEVELOPMENT?**

Increasing demographic pressure on land and water resources has placed river basins under stress worldwide. Inappropriate land use practices have led to land degradation and consequent loss of economically useful areas. Dam construction for hydropower generation and water supply has involved the inundation of large areas of forest and agricultural land, and in some cases to involuntary resettlement of populations. Dikes and levees for flood protection have aggravated flooding problems downstream. Although irrigation development of agricultural areas has increased food production, it has sometimes also brought about increases in water logging and soil salinity, contamination of surface and ground waters with pesticides and fertilizer residuals, and the spread of waterborne diseases. Furthermore, the demand for potable and industrial water in growing urban and industrial centers has led to water scarcities, high costs of new water supplies, and increasing threats to ground and surface water resources from inadequate municipal waste and effluent disposal facilities. Prevention and mitigation of such problems requires cross sectoral and long-term planning and management efforts to ensure

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Sustainable River Basin Development. Successful implementation of the development plan requires appropriate legislative and regulatory frameworks, use of objective-oriented funding and cost recovery principles, effective monitoring and competent cross-sectoral management. International water issues may also play an important role. Sustainable River Basin Development therefore spans a broad spectrum of disciplinary boundaries, covering agriculture, engineering, economics, the environment and a wide range of social, institutional and management sciences.

#### **WHAT IS SUSTAINABLE RIVER BASIN DEVELOPMENT?**

The term Sustainable development was used by the Brundtland Commission which coined what has become the most often-quoted definition of sustainable development as development that “**meets the needs of the present without compromising the ability of future generations to meet their own needs**” (Clow, M. 1996). Similarly in the river basin cities sustainable policies are very much required people are consuming the resources and knowingly unknowingly they are disturbing the ecological flora and fauna of the river system in continuous manner. Most of the Perennial Rivers and non Perennial Rivers of the developing nations are affected by the activities of urban settlements at their banks. Increasing urban demographic pressure on land and water resources has placed river basins under stress worldwide. Inappropriate land use practices and excess of encroachment of the banks have led to land degradation and consequent loss of economically useful areas. Dam construction for hydropower generation and water supply through canals has involved the inundation of large areas of forest and agricultural land, and in some cases to involuntary resettlement of populations Sustainable River Basin Development is the integrated, long term planned development and management of a river basin’s water and other resources, to ensure their continued availability and renewability. This requires a process covering detailed assessment of available resources and existing infrastructure, analysis of present and projected demands, identification of constraints to development, determination of real costs and benefits of alternative actions, and evaluation of institutional capabilities and legal frameworks.

In Asian monsoon regions, traditional order or rule of water use for irrigation has been formed and it has also become a constituent factor in the regional culture in many cases such as “Subak” in Bali-Indonesia and “Cascade System” in Sri Lanka (Subijanto Tjoek, Walujo. 2004; Sukrasno Sastro, Hardjono. 2004) ,When establishing integrated water resources management, traditional order or rule on water must sufficiently be considered. The demand for potable and industrial water in growing urban and industrial centers has led to water scarcities, high costs of new water supplies, and increasing threats to ground and surface water resources from inadequate municipal waste and effluent disposal facilities. Prevention and mitigation of such problems requires cross-sectoral and long-term planning and management efforts to ensure Sustainable River Basin Development.

#### **ADOPTING A RIVER BASIN APPROACH**

Emphasis should be given to adopt a river basin approach or sub-basin-based approach, which integrates all aspects of water management namely water allocation, pollution control, protection of water resources, and mobilization of financial resources. Each state should prepare water policies according to their cultural setting

and financial positions. The National Water Policy of 1987 also needs to be revised urgently. Groundwater legislation needs to be promulgated in all states to promote sustainable water uses and development. People are using water for domestic and industrial consumption however two-thirds are appropriated for irrigation in agriculture. Reducing the flow of river water to the sea can lead to the intrusion of salt water into surface water and groundwater, rendering them undrinkable. Experts predict that water availability will be one of the major challenges facing human society and that the lack of water may be a key factor limiting development.

### **RAINWATER HARVESTING**

Rainwater harvesting should be given as the top priority for increasing water resource availability. Watershed development must be adopted more rigorously. In urban areas cities are fetching water for the drinking purpose but most of the cities are striving to feed the city for 24 hours. According to a World Bank study, of the 27 Asian cities with populations of over 1,000,000, Chennai and Delhi are ranked as the worst performing metropolitan cities in terms of hours of water availability per day, while Mumbai is ranked as second worst performer and Calcutta fourth worst. In most river basin cities and non river basin cities, Centralized water supply systems depend on surface water sources like rivers and lakes. Chennai, for instance, has to bring in water from a distance of 200 km whereas Bangalore gets its water from the Cauvery River, which is 95 km away. Where surface water sources fail to meet the rising demand, groundwater reserves are being tapped, often to unsustainable levels. In Delhi approximately 13 per cent households do not receive water every day and in Rajkot, Gujarat, water availability in April 2000 was only for 30 minutes every alternate day (Zerah Helene, M. 2000). The river water harvesting is the only way through which dependency over the river can be minimized. Rain water harvesting is old practice of India. In areas where there is inadequate groundwater supply or surface resources are either lacking or insufficient, rainwater harvesting offers an ideal solution. It helps in utilizing the primary source of water and prevents the runoff from going into sewer or storm drains, thereby reducing the load on treatment plants and reduces urban flooding with Recharging water into the aquifers help in improving the quality of existing groundwater through dilution (Chandrakantin, M.G. 2004; Bijrat Dlemu 2004; Bhat Mahadeo G. 2004). In various parts of India Rainwater harvesting is being used by the local community.

In the cities, rainwater could be harvested from building rooftops for residential use, and any surplus could be channeled through bore wells to replenish the groundwater other rain harvesting technology are to be used to their full potential, policy innovations must include institutional changes so that such common-pool resources are effectively managed. Also, all forms of government subsidies need to be removed to allow market mechanisms, to run their course (Pandey, Deep Narayan. 2001). Users would then find it practical not only to make efficient use of priced water, but they would also have the incentive to collect the gift in the form of rain.

### **APPROPRIATE TARIFF STRUCTURE**

An appropriate tariff structure for water services will have to be evolved to encourage wise usage. There is also a need to develop and implement cost-effective water appliances such as low-flow cisterns and faucets. In 1992 the Dublin Water Principles claimed "water as an economic good" for the first time in a UN setting. But

water has been recognized as an economic good for many centuries before 1992 (Bhatia Ramesh 2002; Peter Rogersa. 2002; Radhika de Silva 2002,). A water tariff is an important management tool that can be used to assist with the reform of the municipal water and sanitation sector. The pricing of water services is, however, controversial, and it is important for reformers to understand three of the many reasons why there is so little consensus on municipal water tariff issues. There are many different ways to promote equity, efficiency and sustainability in the water sector and water pricing is probably the simplest conceptually, but may be the most difficult to implement politically. First, there is disagreement over the objectives of water pricing and tariff design. Water pricing decisions affect several different objectives or goals of policymakers, often in conflicting ways. This means that if one person is looking solely (or mostly) at the consequences of a particular water pricing policy in terms of one objective, and another person is looking at the same water pricing policy in terms of its impact on another objective, they may reach quite different conclusions about the attractiveness of the policy. Many tariff structures are feasible and can partially accomplish some of the competing objectives of water pricing. There are typically an insufficient number of providers of piped water services for customers to reject inappropriate tariff structures. Bad ideas thus do not get weeded out of either the market or the policy historically, fixed charges were the first means used in most countries to calculate monthly water bills for customers on piped distribution systems. In many small and medium size Indian cities they are still the most prevalent way to calculate a household's monthly water bill. A typical practice would be for a household with a connection to the piped distribution system to pay Rs50 (US\$1.09) per month, regardless of the amount of water used. For example, in Chennai the fixed monthly charge for an unmetered connection is Rs50, whereas in Hyderabad it is Rs140 (US\$3.04) (Whittington, D. 2003). Most of the big cities are facing the problem of adequate infrastructure for collecting the water tax in the cities. In most of the small cities water commission are failed to supply the water to whole city for more than 12 hours as a result they couldn't succeed to get the price of the whole supplied water (Whittington, D. 2003).

### **TECHNOLOGICAL INTERVENTION**

Appropriate and advanced technological intervention is required to enhance effective treatment of wastewater. Adoption of cleaner technologies by the industry would help to safeguard surface water bodies. In the river valleys slope of natural levee can be used for the sludge disposal. The principle function of wastewater treatment is to remove solid, organic and microbiological components that cause unacceptable levels of pollution to the receiving water body. All wastewater treatment facilities should have compliance standards to meet in relation to biological oxygen demand (BOD) and suspended solids. The two key areas of continuing concern to the industry are energy and sludge. Energy comprises around 28 % of the operating cost of treating wastewater (Jefferson Bruce 2004; Noel Christopher. 2004; Simon Parson.; 2004). Energy savings are possible through better management practice. However, such savings will be difficult to sustain if the trend towards increasingly lower allowable limits of components continues. In this scenario, technological innovation is the only pathway through which long term reductions will be sustained. The application of anaerobic systems to wastewater treatment can be the promising route for the further development. Sludge makes up around two thirds of the total

costs of wastewater treatment and is a key area where the use of appropriate chemicals and chemical processes can greatly enhance performance and sustainability (De Lemos Carlos Augusto, 2002; Sperling, Marcos Von. 2002). However, current understanding of such systems is limited and is the critical barrier to improvements. Consequently, the treatment and disposal of sludge is potentially the area where chemistry can have the greatest short term impact. Chemistry will play an increasingly important role in wastewater treatment. Traditionally its main focus has been on analytic techniques to aid the engineer in understanding the biological and physical processes utilized. In the future, the need to remove more exotic components will result in a greater emphasis on chemical processes. In particular, the need to reduce nutrients to very low levels, removal of dissolved metals and specific organic compounds such as endocrine disrupting chemicals, will rely on chemistry to provide solutions. This will come from both an improved understanding of the nature of pollutants, and the development of innovative technologies to remove such components. The most likely areas for development in the short to medium term are new adsorbents, new sludge conditioning chemicals and technologies, and chemical oxidation technologies which can target specific compounds rather than deliver blanket solutions.

#### **PROPER SANITATION**

To provide proper sanitation for the city dwellers reflects the development of the cities and also signifies the efficiency of the municipal body of the city. In the developing world more than 90 % of sewage water is discharged directly into rivers, lakes and coastal waters without any kind of treatment. Another big challenge which these countries are posing is decomposition of the waste water treatment plant sludge, though there are various methods are there for their decomposition one is land filling and another is direct land application but before using these concepts pre treating of the sludge for making environment friendly waste is important and necessary (William Harrington, M. 1978). The ongoing depletion of water quality is having consequences not only on human but also on environmental health. The environmental concern for water is a pre-requisite for sustainable use, which was recognized in Agenda 21 (Bjorklund, Gunilla. 2001). Degraded water quality is also decreasing the amount of safe water; there is a clear linkage between water quantity and water quality. Water quantity and water quality would thus need to be managed together. In such management water pollution abatement is to be a pre-requisite. Developing nations are under constant pressure, from one side observing or attempting to follow the international trends of frequently lowering the limit concentrations of the standards, and from the other side of being unable to reverse the continuous trend of environmental degradation (Bjorklund, Gunilla. 2001). The increase in the sanitary infrastructure can barely cope with the net population growth in many countries. The implementation of sanitation and sewage treatment depends largely on the political will and, even when this is present, financial constraints are the final barriers to undermine the necessary steps towards environmental restoration and public health maintenance.

#### **SAFE AND HYGIENIC WATER TO THE CITY**

Providing safe and hygienic water to the city is top priority for the developing cities because the urban water supply situation in developing nations of the Asia is deteriorating particularly in river basin cities, and the urban

population continually adjusts to the worsening situation. Many people only have water in their pipes for a few hours per day. Households who can afford it drill their own wells and install both in-ground and overhead storage tanks. They increasingly buy bottled water, or treat their drinking water. They spend scarce resources on medical care for water-borne diseases that result from groundwater infiltration into the piped distribution system. State governments fail to provide subsidized municipal water to each and every household. Access to water and sanitation is a fundamental need for the poor, vital for their health and dignity and a key factor in improving economic productivity, therefore an essential component of efforts to alleviate poverty. At the beginning of 2000, 1.1 billion people (17% of the world's population) were without access to safe water supply and 2.4 billion people (40% of the world's population) lacked access to adequate sanitation (Bjorklund, Gunilla. 2001). The majority of these people live in Africa and Asia. The poor are often the ones who have to pay the highest price for accessing water of lower quality. Growing urbanization, in particular in developing countries, is increasing demand for water. Only 18 % of the low-income residents in the developing world have a household connected water supply. Those without access to safe water supply must buy from vendors at much higher costs than the piped city supply. It is also estimated that only 8 % of the low-income dwellers have a house sewer connection. So providing the safe and hygienic water to the city should be the top priority of the government (Bjorklund, Gunilla. 2001).

## **INTEGRATED WATER RESOURCES MANAGEMENT**

Integrated water resources management (IWRM) is now recognized across the world as the process to promote the coordinated development and management of water, land and related resources in river basins, to maximize the economic benefits and social welfare in an equitable manner without compromising the sustainability of vital ecosystems. The application of IWRM varies according to each river basin's specific conditions and requirements, yet in all cases IWRM is focused on delivering a triple bottom line of a balance of economic, social, and environmental benefits resulting from an integrated approach that carefully considers each trade-off. In the natural system, IWRM focuses on integrating management of:

- (i) Upstream and downstream interests of the public**
- (ii) Water quantity and quality**
- (iii) Surface and groundwater, and**
- (iv) Land and water resources.**

However, the water crisis in countries across the region is largely a challenge of improving water governance, and IWRM focuses equally on improving the human system, focusing on how people and their institutions work together, make the right decisions, and implement them effectively. Stakeholder participation, local actions and ownership are therefore necessary building blocks for achieving IWRM in the river basin. The active and informed participation of river basin stakeholders in planning and decision-making, including in water resources allocation, conflict resolution, and trade-off choices, is central to the success of IWRM. IWRM is a long-term process that needs sustained commitment by all stakeholders in the river basin. Its implementation will take decades of incremental improvements to achieve full results. The introduction of IWRM in a river basin needs a

positive enabling environment, clear institutional roles, and practical management instruments. The process can be anchored, and its achievements monitored, through a capable river basin organization, institutionalized stakeholder participation, and comprehensive river basin planning and monitoring. At the national level, the enabling environment includes an effective water policy, updated legislation, and conducive financing and incentive structures. Issues to be addressed through the enabling environment include cost sharing and recovery, water use rights, responsibilities of the national water apex body, river basin organizations, local governments, service providers and water user organizations, and the private sector, amongst others. protecting and restoring water resources and ecosystems to contribute to the long-term sustainability of water use.

## **PEOPLE PARTICIPATION**

The state cannot (and should not) direct the actions of citizens without their co-operation, any more than the market alone can be relied upon to address the challenges of our time, whether in dealing with climate change, proper river management or proper use of the river system. We are entering an era in which progress is only possible if individuals, communities and public services are each able and willing to contribute to the solution of the problem as far as urban areas are concerned. There is dire need for the people involvement either with the help of voluntary agencies or through NGOs. Promotion of the people participation is very must for the river related problem with the people participation not only awareness among the local public will be increased, it will provide the restrictive control over the government about the anti environmental policies formulation. People participation has set the nice examples of river protection and sustainable water recharging process. *Anna Hazare's Rale gaon siddhi* model is nice example people participation where once upon a time the village was reeling under drought, poverty, debt, and unemployment. With the community participation and *Anna Hazare's* involvement today *Ralegaon Siddhi* is being taken as a role model for other villages by the Maharashtra government and by other states too. Massive tree plantation has been undertaken, and hills have been terraced to check erosion. Large canals with ridges on either side have been dug to retain rainwater. As a result, the water table in this area is now considerably higher and the wells and tube wells are never dry, making it possible to raise three crops a year where only one was possible before. Another example is Rajendra Singh, who has undertaken extensive water conservation efforts through community participation in drought-prone eastern Rajasthan, wins the 2001 Ramon Magsaysay Award for Community Leadership (Basu Nandita. 2001). In the people participation the process of social learning and social network is very important. The framework shown in Fig. 1 connects context in a river basin, processes in social networks and outcomes in a feedback cycle of learning and change. The process of social learning for resource management is embedded in a context of governance structure and the natural environment. In the process of resource management, social involvement (e.g. the generation of social capital, the development of new social practices) is as important as content management (e.g. the development and communication of knowledge about the state of a water resource, use of models to predict the effects of measures to achieve a good ecological state of a river) (J. Tippett 2005; Pahl C.2005; Searle B.2005; Y Rees. 2005). Information and Communication tools may play a special role in

promoting relational practices which link the management of content with social involvement. For instance, group model building that includes elicitation of mental models and role playing games may provide evidence that actors frame the problems in a river basin differently. By going through a process of exploration of these frames, it is possible to see these framings change during a structured discussion. The outcomes of the management process are not only technical qualities such as an improved state of the environment but also relational qualities such as an improved capability of the actors in a basin to solve conflicts and come to co-operative agreements. The outcomes feed back into change and mutual tuning of governance structure and the state of the natural environment (J. Tippet, B. Searle; C. Pahl, Rees Y. 2005).

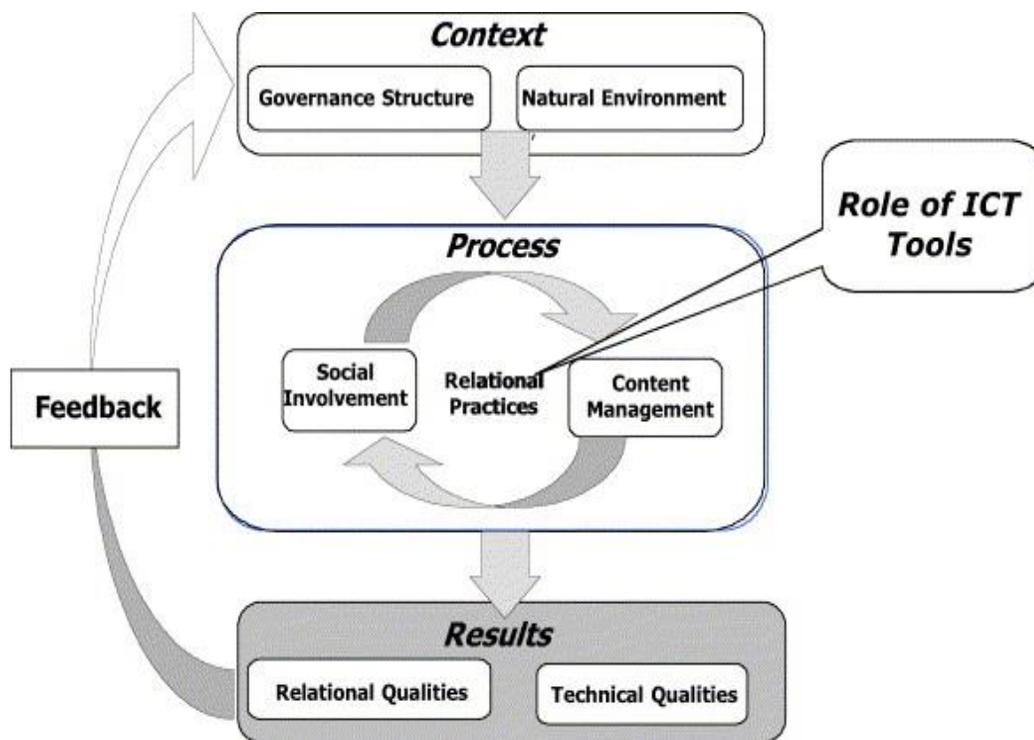


Figure 1. (J. Tippet; B. Searle; C. Pahl, Rees Y. 2005)

## POLICIES FOR THE RIVER BASIN CITIES

In Developing Countries River related policies are basically oriented towards the exploitation of the river. Whereas in most of the countries there is no clear cut policy related to the river water. Policy making in many countries tends to separate economic, social and environmental factors. Countries can no longer afford to make policies without considering environment and development issues (Gleick, Peter H. 1998). Agenda 21 proposes the full integration of environmental and developmental issues for government decision-making on economic, social, fiscal, energy, agricultural, transportation, trade and other policies. Governments should also seek a

broader range of public participation. Integrating environmental issues into policy-making will require more extensive information-gathering and improved ways for assessing environmental risks and benefits. Decision making techniques related to policies should be flexible enough to accommodate multiple goals and changing needs. Planning and management responsibilities should be delegated to the lowest levels of public authority, and indigenous methods of managing natural resources should be considered wherever possible. Developing countries need help in drafting effective legislation, enforcing laws, creating judicial procedures, complying with international agreements and training their own experts in environmental law. Prices, markets and government fiscal and economic policies play a complementary role in environmental policy-making. Environment costs should be incorporated in the decisions of producers and consumers, in order to reverse the tendency to treat the environment as a “free good” and to pass these costs on to other parts of society, other countries or to future generations. Governments should cooperate with business and industry to make use of economic instruments and market mechanisms to deal with water related issues and technology transfer. Businesses and industries with expertise in environmental matters, including transnational corporations, should organize training programmes for the private sector and other groups. Integrated environmental and economic accounting (IEEA) systems should be established in all countries. While policy formulation practice of Prohibitive policies making should be avoided because such type of policies have serious repercussion on the other related issues for example in China basin Ligian Upland of Naxi area is affected by the loss of income due to ban on logging (Xiaogang, Yu. 2001). Since June 2001, the Ministry of Urban affairs and Poverty Alleviation has made rainwater harvesting mandatory in all new buildings with a roof area of more than 100 sq m and in all plots with an area of more than 1000 sq m, which are being developed. Compulsive measures should be taken to provide better means of water preservations as the Central Ground Water Authority (CGWA) has made rainwater harvesting mandatory in all institutions and residential colonies in notified areas (South and southwest Delhi and adjoining areas like Faridabad, Gurgaon and Ghaziabad). This is also applicable to all the buildings in notified areas that have tubewells. The deadline for this was for March 31, 2002. The CGWA has also banned drilling of tubewells in notified areas (Bajpai Peeyush 2001, Bhandar Laveesh. 2001).

#### **POLICIES RELATED TO IWRM**

At the time of policy formulation there are certain criteria for the adoption of the IWRM through which the water management of the rivers can be done, firstly there should be river basin organizations focusing on the performance stake holders, internal business process, learning and growth and finance. In the stake holder participation is vital in the river basin planning and management process. Secondly River basin planning should be prepared with the comprehensive plan and IWRM principles in land use planning process. Thirdly public awareness should be including with promotion of the media role. Fourthly, Introduce effective water rights or entitlements administration that respects traditional or customary water use rights of local Fifthly, introduce or increase private sector participation in IWRM through corporate social responsibility (CSR)-type contributions Sixthly, Water education should be introduced school programs to increase water knowledge and develop leadership among the youth, including responsibility for water monitoring in local water bodies. Another criterion is

introduction of water shed management to protect and rehabilitate upper watersheds in collaboration with local communities and civil society organizations. The other interventions of the IWRM are:

1. Introduce a policy and implementation framework for introducing environmental flows and demonstrate its application.
2. Investments in combined structural and nonstructural interventions to reduce vulnerability against floods, droughts, chemical spills and other disasters in the basin.
3. Introduce or strengthen effective flood forecasting and warning systems.
4. Investments in the rehabilitation of infrastructure after floods.
5. Initiate or strengthen basin-wide water quality monitoring and application of standards.
6. Invest in structural and nonstructural interventions that reduce point and non-point water pollution.
7. Invest to conserve and improve wetlands as integral part of the river basin.
8. Introduce measures to protect and improve fisheries in the river.
9. Institutionalize and strengthen sustainable groundwater management as part of IWRM.
10. Institutionalize a policy and implementation framework to promote efficiency of water use, conservation, and recycling.

Improve on-line publicly available river basin information systems to support IWRM policy, planning, and the term watershed approach refers to an integrated perspective in water resources planning that provides a framework for integrating economic, natural and social considerations that share the same geographic space. This framework facilitates coordination of public and private sector efforts to address the highest priority problems within hierologically-defined geographic areas.

## **CONCLUSION**

Increasing demographic pressure on land and water resources has placed river basins under stress, such kind of practice need the way to develop the River basin cities through sustainable development programme. Sustainable River Basin Development is the integrated. Long term planned development and management of a river basin's water and other resources, to ensure their continued availability and renewability. There are some priority areas which should be taken into consideration when water related policies in the cities is being made. Integrated water resources management, traditional order or rule on water must sufficiently be considered. Emphasis should be given to adopt a river basin approach or sub-basin-based approach, which integrates all aspects of water management namely water allocation, pollution control, protection of water resources, and mobilization of financial resources. Each state should prepare water policies according to their cultural setting and financial positions. Along with these key points rainwater harvesting should be given as the top priority for increasing water resource availability. In most river basin cities and non river basin cities, centralized water supply systems depend on surface water sources like rivers and lakes. Degraded water quality is also decreasing the amount of safe water; there is a clear linkage between water quantity and water quality. Providing safe and hygienic water to the city is top priority for the developing cities because. State governments can no longer afford to subsidize municipal water providers. People participation is the key priority issue through which we can dream for the Sustainable river water management. Stake holder participation is vital in the river basin planning and management process. There should be the introduction of the effective water rights or entitlements administration that respects traditional or customary water use rights of local. Institutionalization & implementation of a policy to

promote efficiency of water use, conservation, and recycling of the waste water for the better management of the water resources in the river basin cities.

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