

Integrated Water Resource Management and Analysis on Wardha River Basin

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Abstract:

This investigation of the IWRM technique in Wardha has combined the qualitative content analysis of the secondary sources. Because the frame is based on the 4 Dublin principles, the 3 E's principles, and the 3 orders of the IWRM model, it is necessary to compare the present water operation practise in Wardha to the fashionable practise of IWRM in order to satisfy the purpose of this exploration. The results show that the existing IWRM strategy in Wardha satisfies this order with a high standard in the enabling terrain order, one of the three orders of the IWRM model based on the theoretical evidence. This indicates that Wardha can support the IWRM model's enabling terrain order by executing well-designated swash receptable a well-defined operation with enforced water-related laws and regulations. It is evidently seen that the existing institutional arrangement associated to water provides operating in Wardha is likewise in relatively acceptable condition when three out of the nine conditions in the IWRM model's institutional placements order are collectively analysed. However, the Wardha original government was unable to provide financial support on its own for the IWRM prosecution because the Wardha original government's financial support and resourcing with tone-fund is infrequently seen in the operation of Wardha's water coffers, and the procedure to assist with the political will and commitment is subpar. The IWRM model's operating instruments order is seen as having the lowest ranking in the evaluation on a public scale. This coexists with the reality of operational shortcomings in the Wardha IWRM prosecution. These data suggest that this is due to a lesser cost recovery strategy and a poorer monitoring and evaluation system at the public level. This indicates that in order for the IWRM approach to be successfully implemented in Wardha, emphasis must be placed on the operational tools and institutional settings. The experimenter comments that if

the public has equal access to the hydrological data provided in accordance with social equity standards and the community has opportunities to provide formative input, the approach of IWRM implementation in Wardha will be more successful.

INTRODUCTION

IWRM is a strategy that promotes the equitable and integrated management of water, land, and related resources with the goal of maximising economic and social wellbeing without endangering the viability of critical ecosystems.

The cross-sectoral policy approach known as IWRM will replace the outdated, fragmented sectoral approach to managing water resources that has led to substandard services and unsustainable resource utilisation. IWRM is based on the understanding that water resources are a natural resource, a socioeconomic boon, and an essential component of the environment.

The concept of IWRM is based on the interdependence of the numerous uses of limited water resources. For example, contaminated municipal and industrial wastewater pollutes rivers and threatens ecosystems; if water must be left in a river to protect fisheries and ecosystems (environmental flows), less can be diverted to grow crops. High irrigation demands and polluted drainage flows from agriculture also reduce the amount of freshwater available for drinking or industrial use. There are many more instances that support the fundamental idea that the wasteful and fundamentally unsustainable use of limited water resources occurs when there is no regulation.

- UNEP assists Sudan's Ministry of Irrigation and Water Resources in managing its water resources and putting IWRM strategies into practise. This also contains:
 - Including environmental, industrial, agricultural, and household demands in the management of water catchments.
- Encouraging all water users to participate in inclusive participatory processes.
- Showcasing women's contributions to water management.
- Finding a balance between economic effectiveness, ecological sustainability, and social equity.

- This includes everything from funding studies on the sustainable use of surface and groundwater resources to urging donors and the global assistance sector to do environmental impact analyses of water infrastructure projects and create contingency and drought prevention plans.

The concept of IWRM is based on the interdependence of the numerous uses of limited water resources. Low freshwater availability for industrial or drinking purposes is a result of high irrigation demands and polluted drainage flows from agriculture. Polluted municipal and industrial wastewater also threatens ecosystems by polluting rivers and reducing the amount of water that can be diverted to grow crops. There are a lot more instances of the fundamental idea that the wasteful and intrinsically unsustainable use of limited water resources is caused by unrestricted use.

IWRM contributes to environmental protection, economic development, sustainable agricultural development, democratic government, and health improvement. The underlying interconnectedness of hydrological resources is starting to be reflected in water policy and management around the globe, and IWRM is becoming a widely recognised alternative to the sector-by-sector, top-down management method that previously predominated.

NATIONAL WATER POLICY (1987,2002,2012)

- The Government of India's Ministry of Water Resources creates national water policies to guide the planning and development of water resources and guarantee the optimal use of them.
- The First NWP was adopted in September 1987 and later changed in 2002 and 2012, respectively.
- According to NITI Aayog, India is presently going through its first water crisis, and if preventative steps are not taken, by 2030, the demand for potable water may outpace the supply.
- The water cycle no longer operates within a stable range of prediction, as shown by changing precipitation patterns and intensities as well as river discharge rates.

NATIONAL WATER POLICY 1987 FEATURES:

The first National Water Policy was established by the NWRC during its second meeting in September 1987. The central ministries and States received important views and the same for execution. The following are some of the key points of NWP-1987:

- Water is a valuable natural resource, a necessity for all living things, and a priceless national treasure. Water resource planning and development must be controlled by national viewpoints.
- A strong information system is a prerequisite for effective resource planning. Establishing a standardised national information system with a network of data banks and data bases, merging and bolstering the current Central and State level agencies, and enhancing the data quality and processing capabilities are all necessary.
- To the greatest degree feasible, the nation's water resources should be included in the category of utilisable resources.
- Water resource planning must be done for a hydrological unit, such as a whole drainage basin, or for a sub-basin.
- Water
- From the project's initial planning stages onward, integrated and coordinated development of surface and ground water, as well as their joint usage, should be considered.

NATIONAL WATER POLICY 2002 FEATURES:

The National Water Policy had to be reviewed since new problems in the water resources sector have arisen after the establishment of NWP in 1987. As a result, during its fifth meeting on April 1, 2002, the National Water Resources Council approved the updated National Water Policy-2002.

- It is important to develop standards for data coding, categorization, processing, and gathering techniques.
- To further increase the amount of usable water resources, both conventional and unconventional methods of water use—such as inter-basin transfers, artificial ground-water recharge, and desalination of brackish or sea water—as well as traditional water conservation methods—such as rainwater harvesting, including roof-top rainwater harvesting—must be used.
- Since irrigation uses the most fresh water, getting the most output per water unit should be the goal. Anywhere it is practical, sprinkler and drip irrigation systems, farming techniques, and scientific water management should be used.
- As part of the development plan for the command area, reclaiming land that has been impacted by waterlogging or salinization should be done using rational, cost-effective means.
- Before releasing effluents into untreated natural streams, they should be treated to appropriate levels and norms.
- Perennial streams should have a minimum flow to support environment and socioeconomic concerns.
- The 'polluter pays' principle should be used to the management of contaminated water.

NATIONAL WATER POLICY 2012 FEATURES:

India must balance dealing with the global threat posed by climate change with maintaining its rapid economic expansion. India needs a national plan to, first, adapt to climate change and, second, improve the ecological sustainability of India's growth route, while also cooperating with the international community to address this danger.

The National Action Plan on Climate Change (NAPCC) was created by the Indian government to address these challenges, and the Hon. Prime Minister announced it in 2008. Through eight National Missions, one of which was the National Water Mission, the NAPCC had established the guidelines and determined the strategy to be used to address the issues posed by the effects of climate change.

The following consultation meetings were held:

1. On July 28, 2010, the Parliamentary Forum on Water Conservation and Management met with the honourable members of the Parliamentary Standing Committee on Water Resources, the Consultative Committee for the Ministry of Water Resources, and the Committee for Consultation on Water Resources.
2. On October 26, 2010, with Academics, Experts, and Professionals
3. With Non-Governmental Organisations took place on January 11 and 12.
4. On March 21, 2011, a meeting with the corporate sector took place.
5. Meeting with Panchayati Raj Institutions officials on June 16 in Hyderabad, June 30 in Shillong, July 14 in Jaipur, and November 2 in Pune.

GLOBAL WATER PARTNERSHIP:

To encourage equitable and sustainable development, improve water resource governance and management.

A global network called the Global Water Partnership (GWP) was established to advance an integrated approach to IWRM and offer helpful guidance for managing water resources sustainably.

Water management organisations at the intergovernmental level

The headquarter is located at Stockholm, Sweden.

GWP with the support from the World Bank, the UNDP and the Swedish International Development Agency which was established in the year 1996.

The network's 68 accredited national water partnerships and 13 authorised regional water partnerships cover more than 170 nations.

IWRM (integrated water resources management) provides a way to evaluate the trade-offs between various development goals and, if at all feasible, select water investments that are advantageous to everyone. a structure for participants.

According to the GWP approach, a water secure world is one that maximises water's beneficial effects while minimising its negative ones. Every everyone has access to enough safe, reasonably priced water to live a healthy, clean, and fruitful life.

Objectives Of GWP:

1. To advance the GWP network's principles, beliefs, and policies.
2. To forge proactive partnerships in the management of water resources.
3. To encourage public involvement in the management of water resources.
4. To advance IWRM a strategy for getting the government to support IWRM implementation.
5. To make the Caribbean area hemispherical.
6. To increase water governance via advocacy, improvement, and efficient application.
7. To improve the systems for exchanging knowledge and expertise.

- Benefits Of GWP:

- Possibilities for partner interaction.
- Assists in locating serious water problems.

- Helpful advice
 - Possibilities for strengthening capacity
 - .
- Goals Of GWP:
 - Spark modifications to procedures and policies.
 - Produce and disseminate knowledge.
 - Improve relationships
- Obligation of GWP:
 - Freely exchanging knowledge and expertise with the other partners.
 - Aligning pertinent actions with those of other relevant organisations.

PRINCIPLES OF IWRM:

The need for collaboration across diverse water sectors and holistic methods began to get more attention in 1992 during the Dublin Conference, which was conducted to prepare for the Earth Summit in Rio de Janeiro (Gooch et al. 2010, p. 1). The widely accepted 1992 Dublin-Rio principles (Hasman 2014, p. 3) represent the global expert agreement on the consequences of IWRM. The Dublin statement, which was released by the Global Water Partnership (GWP) after the Dublin Conference, comprised the following four fundamental concepts, also known as the Dublin-Rio principles.

'Ecological' principle number one: Freshwater is a resource that is sensitive, limited, and necessary for sustaining life, growth, and the environment.

Principle 2: "Institutional": The management and development of water resources should be based on a cooperative strategy that involves everyone from users to planners to decision-makers at all levels.

Principle 3: 'Gender': Women are essential to the provision, management, and preservation of water.

Principle 4: Water itself should be considered an economic good and service since it has an economic worth in all of its competing applications.

The Earth Summit's Agenda 21 primarily calls for the use of integrated solutions to the management, development, and use of water resources. In order to effectively promote the goals of social fairness, economic growth, and environmental sustainability, the resource base is used in a few ways. IWRM, which is part of Agenda 21, offers a problem-solving strategy to address some of the major issues with the growth of the water sector in ways that prioritise economic effectiveness, social fairness, and ecological sustainability. The Agenda 21 recommendations issued at the 1992 United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro included the Dublin principles. Following that, these concepts had a big effect on the development of IWRM.

'Ecological' Principle No. 1: It promotes a comprehensive approach to managing water resources by linking socioeconomic growth to the preservation of natural systems. In accordance with Principle 1, which recognises the river basin or catchment region as the most crucial management unit for water resources, anthropogenic efforts that utilise and have an influence on water resources in a particular river basin should work together. By placing a focus on integration across all water sectors, the notion is included into IWRM techniques.

'Institutional' Principle No. 2: This all-inclusive strategy strives to increase public and political awareness of water challenges. It promotes the principle of subsidiarity, which states that management decisions should be made at the lowest level practicable while the national government retains its legislative and executive functions. It promotes increased stakeholder involvement of users in the planning and administration of water projects as well as increased transparency of management institutions. Certain minority persons may need to increase their ability and advance via professional development and targeted pro-poor policy efforts in order to participate effectively. The decentralisation and engagement notions of IWRM are examples of this approach in action.

The policy acknowledges the beneficial relationship between gender equity and ecologically sound water management in accordance with principle three, "Gender." IWRM prioritises institutional improvement and participative management, placing a high importance on women's empowerment.

The "instrument principle," as the approach is dubbed, acknowledges the usefulness of economic instruments in promoting the fair and effective use of water resources. Financial factors must typically be taken into account due to the water crisis, even though it is important to respect the civil right to affordable access to clean water and sanitary facilities. In circumstances when supply growth is not a viable option, economic techniques may also make a big contribution to figuring out the most effective and fair way to distribute limited water supplies. Since it guarantees full cost recovery, water management as an economic good is also essential for the long-term financial viability of water service delivery. IWRM depends on economic and financial viability.

The "three main Es" are Lenton, Muller, and Global Water's "three main Es," and the IWRM plan reflects some worries about achieving a balance between them. In accordance with International Water Association (IWA) 2021, the IWRM is founded on three primary E's principles:

- Equity - Social equity refers to giving everyone who uses water, including those living in poverty and those who are not, equal access to the quantity and quality of water that is necessary to maintain human well-being. Even when allocating water, it is necessary to take the right of access to water and the benefits of water use into consideration.
- Benefits and efficiency include the delight of utilising water resources for economic as well as recreational objectives. When the conclusion of an economic transaction benefits the greatest number of possible economic users, it is said to have achieved economic efficiency. The best alternative must be picked in order to take this into account. The cost and benefit to society and the environment, both now and in the future, should also be taken into account when determining the economic worth.
- Ecological sustainability entails considering ecological aquatic systems as consumers and allocating enough water for these rivers. Development that has a detrimental influence on natural systems must be avoided, according to this criteria (International Water Association (IWA)).

PROBLEM STATEMENT:

Given Wardha's water deficit, we must apply the IWRM Principle to the current water distribution resources. In the Satpura Range near Multai in the Betul district of Madhya Pradesh, the Wardha River originates at a height of 777 metres. After then, it goes 32 kilometres via Madhya Pradesh to reach Maharashtra. Before entering Wainganga in Chandrapur District at Seoni, it goes 528 kilometres. The catchment area for the river as a whole is around 48000 square kilometres.

The river is approximately 48000 square feet in size overall.

Projects Undertaken on Wardha River Basin:

Upper Wardha Project:

1. The Upper Wardha Project is situated in Maharashtra's Amravati district along the Wardha River in the Godavari Basin. The following elements make up the project:
 1. A 5588.50 m long earthen dam with a maximum height of 39.90 m and a 331.50 m long concrete dam with a 240.50 m long central spillway and a maximum height of 46.20 m spanning the Wardha River near the village of Simbhora in Tehsil Morshi of the Amravati district, respectively. Gross storage capacity of the newly built reservoir will be 678.27 MCM, and live storage capacity will be 564.05 MCM.
 1. A central spillway with an ogee form that is 240.50 m long and has 13 radial gates that are 15 m by 12 m in size to pass a flood of 19.57 cubic metres per second.
 2. A left bank canal of 42.40 km and a 95.50 km long right bank canal with a 10.42 cumec/second and 37.00 cumec/second discharge capacity, respectively.

Lower Wardha Project:

In the Godavari Basin in Maharashtra's Wardha district, the Lower Wardha Major Irrigation Project is being built. The following components are planned for construction as part of the project.

i. An 8884 m long earth dam with a maximum height of 22 m and a 580 m long composite masonry and concrete dam with a maximum height of 28 m, both located near the village of Dhanodi in the Arvi Taluka of Wardha district, have a 462.50 m long central gated spillway with 60 m long non-overflow blocks on the left flank while 57.50 m long blocks on the right flank.

ii. To pass the design flood of 20,778.10 m³/s, a 462.50 m long gated ogee-shaped spillway comprises 31 radial gates, each measuring 12 m by 8 m in size.

iii. The Pulgaon and Khard barrages iv. The Left Bank Main Canal (LBC), which is 44.425 km long and has a maximum discharge of 37.124 cumecs at the head.

v. A distribution system on LBC to serve the 78,870 ha Culturable Command Area (CCA). When the project is finished, 63,333 acres will have an annual maximum irrigation potential.

vi. For Pulgaon, Dhamangaon and its neighbouring villages, as well as MIDC, Dhamangaon, water has been set aside in the amounts of 12.07 Mm³ for drinking purposes and 40.20 Mm³ for industrial usage. Fisheries would be another advantage.

After receiving approval from the Technical Advisory Committee (TAC) at its 88th meeting, the project was authorised by the Planning Commission of the Government of India in March 2007 at an estimated cost of Rs. 857.70 crore at the pricing level of 2005-06. The Technical Advisory Committee (TAC) accepted the project's most recent projected cost of Rs. 2232.41 during its 108th meeting on January 4, 2011.

1	Irrigation Project Name	Lower Wardha Major Irrigation Project
2	Irrigation Project Name Alias	
3	Purpose	Irrigation
4	Type	Major
5	Engineering Type	Diversion, Lift, Storage
6	Status	Ongoing
7	State	Maharashtra
8	Districts Benefited	Wardha
9	Basin	Godavari
10	River	Wardha
11	Project Sharing	None
12	Intercountry	None
13	Interbasin	No
14	Work Started in 5 Year Plan	VI-Plan
15	Completed in 5 Year Plan	
16	Project Approval Status	Planning Commission
17	Year of Approval by Planning Commission	2007
18	Approved Cost (Rs. in cr)	857.7
19	Actual Cost (Rs. in cr)	
20	Culturable Command Area (CCA) (th ha)	78.87
21	Ultimate Irrigation Potential (UIP) (th ha)	63.33
22	Potential Created (PC) (th ha)	
23	Project Covered under ERM Scheme	No
24	Project Covered under CADA Scheme	No
25	Project Covered under AIBP Scheme	Yes
26	Studies Conducted	
27	Project Covered under Tribal Sub-Plan	

In order to successfully deploy IWRM, important sites or major challenges must be addressed first. By evaluating the existing state of the basin's water resources and how they are used, as well as urgent problems like water pollution, environmental degradation, natural catastrophes, etc., such priority regions may be found.

Investigate and catalogue the concerns and issues that the basin is presently experiencing, as well as any prospective future issues.

- It is crucial to first determine the amount of water that is readily accessible in the river basin and the level of water consumption. It is advisable to thoroughly research the basin's natural or original capacity if its water resources are being used. The basin's water budget will be useful in determining the basin's water resources' present state prior to coordinating the interests of sectors, it is preferable to establish priority regions (important locations and essential concerns).

- It is helpful to have knowledge of the historical background of water usage in the basin, the rules and how they have changed in the past. Examples of critical locations include areas where there is an overlap of interests due to a rapid increase in water demands or severe pollution loads, or areas of ecological significance such as a place where protecting endangered species is a critical concern. Examine historical papers and archives, or get in touch with local elders personally. Understanding locals' perspectives and the information is aided by hearing from them.

METHODOLOGY:

Understand IWRM's definition and advantages first. Consider basins where an IWRM strategy has been used. See how the IWRM concept has been applied in practise and how people are reaping the rewards. If the IWRM strategy wasn't applied properly, attempt to identify the issues or obstacles.

- Look for river basins in your nation or region that are home to river basin organisations. Check to see if an IWRM strategy has been adopted. Obtain their assessment results, etc.
- Research the present state of water resources management in your basin, even if an IWRM technique hasn't been used there frequently.
- IWRM is a spiralling, changing process. It's helpful to understand your position in that process.

Knowledge of national IWRM initiatives is beneficial. The existence of an integrated water resources management and water efficiency plan, as stipulated in the Johannesburg Plan of Implementation (JPOI) adopted at the World Summit on Sustainable Development in 2002, may be useful information to ascertain.

It is crucial to identify not only changes in society's immediate and urgent needs as a result of crises or disasters, but also slow, gradual changes in social values and water needs brought on by economic development or changes in the local or global environment, such as climate change.

Changes in a river basin include, for instance:

- The occurrence of significant disasters (drought and flooding). - Severe environmental deterioration and water contamination.
- Rapid economic and population expansion have increased the need for water. - Important national or regional events, like the Olympics
- A change in national strategy for managing water resources as a result of political upheaval.
- Gradual changes (such those brought on by climatic change or changes in societal expectations) are more challenging to detect. It takes time to educate society about these changes and create a force that will advance IWRM. Actively communicating information from the beginning is essential for keeping the public informed and influencing public opinion.

LITERATURE REVIEW:

SR NO	NAME OF AUTHOR	TITLE OF JOURNAL	REMARK
1.	Thorseten Schuetze, Lei Qu	Primary investigation of the IWRM and spatial planning research framework	This study takes a systems approach to grasp the complexity of the overall picture as it explores the intricate relationship between cities and their limited water supplies. It will integrate knowledge of the urban system with that of the water system. Although they are not often acknowledged in contemporary water policy, these relationships are fundamental to the idea of IWRM and existing practises.

SR NO	NAME OF AUTHOR	TITLE OF JOURNAL	REMARK
2.	Matthew D. Davis(2004)	IWRM in Chile: to be or not to be	<ul style="list-style-type: none"> • Watersheds are tiny with few users, and water stress is a widespread problem across the nation. <p>IWRM and watershed management are needed, and many government agencies are preparing for them.</p>

SR NO.	NAME OF AUTHOR	TITLE OF JOURNAL	REMARK
3.	Matthew D. Davis(2007)	IWRM and water sharing	In several places, efforts are being made to adopt IWRM plans more widely. The process by which broad frameworks are changed into effective river basin management and other forms of operational and local management, as well as how plans are translated into legal frameworks, is still to be seen.

SR NO.	NAME OF AUTHOR	TITLE OF JOURNAL	REMARK
4.	Lei Wang, Toshio Koike	Modeling the hydrologic responses of the Pampanga River Basin in Philippines: A quantitative approach for identifying droughts.	Additional field verification of the effects of the drought on the various types of communities is required in order to choose and execute the most effective adaptation measures.

OBJECTIVES OF PROJECT:

- To implement National Water Policy 2012 instead of National Water Policy 2002.
- To ensure that the water resources are managed sustainably, fairly and efficiently.
- To reduce the conflicts among the users and uses.
- To increase participation of communities and public sectors about the awareness of this project.

FUTURE SCOPE:

IWRM is a strategy that aids in balancing conflicting water demands from various sectors of the economy and society without jeopardising the sustainability of essential ecosystems. This is accomplished through integrated managerial structures, legal frameworks, and financial arrangements.

Implement integrated water resources management by 2030 at all levels, including where necessary through transboundary collaboration.

Make sure that everyone has access to water and is managed sustainably.

Table 2.1. IWRM implementation levels and their interpretation

Level	Score range	General interpretation for overall score, and dimension scores
Very low	0–10	Development of elements of IWRM has generally not begun or has stalled.
Low	11–30	Implementation of elements of IWRM has generally begun, but with limited uptake across the country, and potentially low engagement of stakeholder groups.
Medium-low	31–50	Elements of IWRM are generally institutionalized, implementation is under way.
Medium-high	51–70	Capacity to implement elements of IWRM is generally adequate, and elements are generally being implemented under long-term programmes.
High	71–90	IWRM plan and programme objectives are generally met, and geographic coverage and stakeholder engagement is generally good.
Very high	91–100	The vast majority of IWRM elements are fully implemented, with objectives consistently achieved, and plans and programmes periodically assessed and revised.

CONCLUSION:

The investigation of water resource management and IWRM strategies in Wardha and comparisons to the framework are all aspects of this study that involve reviewing the history of integrated water resource management, the context of water resource management in Wardha, and the nine conditions of IWA Publishing.

We come to the conclusion that the Wardha River Basin IWRM might help us attain the following goals:

- Increasing resource allocation and protecting water quality. Resolving disputes between water users and uses. Increasing water conservation and efficiency in its usage.
- To expand community and public sector engagement in this campaign by raising awareness of its goals; to take into consideration the social, economic, and environmental importance of water; and to promote it.
- To show the significance of IWRM, there should be an increase in water demand and/or a decrease in disputes between water users regarding quality and quantity.

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