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RECOURSES OF WATER, ITS RECYCLISATION AND ITS ENVIRONMENTAL BENEFITS IN INDIA

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Abstract
The world's supply of fresh water is finite and is threatened by pollution. Rising demands for water to supply agriculture, industry and cities are leading to competition over the allocation of limited fresh water resources. The present investigation examines how water reuse increases the available supply of water and enables human needs to be met with less fresh water. The paper is illustrated with water reuse case studies in agriculture, urban areas, industry and water resource supplementation in India and other countries. Water conservation and water reuse produce substantial environmental benefits, arising from reductions in water diversions, and reductions in the impacts of waste water discharges on environmental water quality. The paper also describes the economic and environmental.
Keywords: effluent reuse; environmental benefits; water conservation

Introduction

A Water Prayer from Vedic Times
'The waters of sky, the waters of rivers and water in the well, whose source is the ocean, may all these sacred waters protect me.'- Rig Veda

The natural water cycle in nature, water (like energy) is neither created nor destroyed but is converted from one form to another. In the natural water cycle, rain falling on the land is mostly transpired by the vegetation. But some percolates to groundwater and some run off to the rivers and flows to the oceans to evaporate and return as rain. Almost all of the world's water (97%) occurs as salt water. Of the remaining 3%, two-thirds occurs as snow and ice in the polar and alpine regions. So only about 1% of global water occurs as liquid freshwater, More than 98% of the freshwater occurs as groundwater, while less than 2% is available in streams and lakes. So the liquid freshwater is a finite and limited resource. The modified water cycle Mankind has significantly altered the natural water cycle by overlaying new water cycle elements including: (a) extractions from rivers and ground water for urban, industrial and agricultural use, (b) urban and agricultural runoff, and (c) return of treated or untreated waste waters to streams. In many areas of the world, ground water is the main water resource and often rates of extraction greatly exceed the rates of recharge, so ground water levels are declining. The economic, social and environ-mental impacts have been disastrous. Urban development also has had a significant impact on the water cycle. Water drawn for urban water supply reduces stream flows in rivers. At the same time, storm water runoff and wastewater discharges, which [1] often carry high levels of pollution, cause a decline in the water quality of rivers. Serious degradation has been observed in some rivers, which have high levels of urban development in their catchments [2].

EMERGING WATER SHORTAGES

The world's supply of fresh water is finite and is threatened by pollution. Rising demands for water to supply agriculture, industry and cities are leading to competition over the allo-cation of limited fresh water resources. In many countries, the available fresh water resources are already heavily committed and in some cases perhaps already over-committed. To avoid a water crisis, many countries must conserve water, manage supply and demand, pollute less and reduce the environmental impacts of growing population. Current projections indicate that water demand will exceed available supplies soon after the year 2020 [3].Water recycling in action The mission of water suppliers is to provide reliable high quality services that meet customer needs and protect the environment. In recent years they have implemented successful water recycling projects in many countries. This experience has demonstrated the feasibility of water reuse on a large scale and its role in the sustainable management of the world's water. The examples are following as a small sample of the projects, which have been implemented. These are referred to reuse of agriculture, urban reuse, industrial reuse, and recycling to supplement water resources [4].

REUSE FOR AGRICULTURE

The very rapid urban growth of the last few decades has produced increasing demands for potable water. As a result of this growth and the associated industrialization, near-urban surface water resources typically become either fully utilized or of poor quality unless the city is located on a major river system. The improved sanitation coverage in large cities with water-borne sewerage systems produces enormous volumes of wastewater for disposal. With the increasing scarcity of freshwater resources in arid and semi-arid regions, but ever-growing demand for more efficient food production for the expanding populations, much wider recognition is being given to wastewater as an important resource. Wastewater reuse is likely to become more widely practiced, and it is already becoming incorporated into some national water resources management plans, and therefore will need to be taken account of in groundwater protection strategies. The expanding demand for groundwater for potable supply and the desire to utilize wastewater to conserve scarce freshwater often occur together, and wastewater reuse can have major impacts on groundwater. In some situations, the substantial volumes of additional recharge may completely alter the local hydrogeology. The impacts may be both positive for water conservation and negative in relation to groundwater quality. Improper disposal of untreated wastewater directly into aquifers or use for irrigation at the ground surface above important aquifers can cause serious pollution problems. On the other hand, properly controlled and managed reuse can provide significant additional resources of good quality nutrient-rich water for arable agricultural purposes [5].

INDIAN SCENARIO: THE CHALLENGE

• More & more urbanization (40% + …?)
• Growing population (that could perhaps stabilize by 2050) (1.6 billion..+)
• MDG 2015
– Food security
– Water Security
– Health Security

India's Water –The Impending Crisis & the Challenge

• Per Capita Water Availability
– 1951- 5177 Cubic meters per annum
– 2001- 1869 Cubic meters per annum
– 2025 -1341 Cubic meters per annum
– 2050 - 1140 Cubic meters per annum

• There is a rapid increase in demand for water in various sectors
- 2000 – 634 Cu.m per person
- 2025 – 822 Cu.m per person
• More & More basins are moving from Water stress to Water Scarce conditions
• The present as well as the projected situation in respect of some are alarming

Increasing population and increased demand for water would render many of the river basins as water scarce by 2025 i.e. per capita availability would be reduced to less than 1000 cubic meter. To prevent such scarcity from overtaking large parts of the country, interlinking of rivers and transfer of water from surplus basins to deficit areas would be essential

INDIA, WATER BUDGET

Total Precipitation - 4000 bcm
Total River Flow - 1869 bcm
Total utilizable water
Surface sources - 690 bcm
Ground water - 432 bcm 1122 bcm

Even this 1122 bcm utilization is possible only if we manage to take the storage capacity from present 177 bcm to ultimate 384 bcm)
Agr. demand by 2025 901 bcm
Agr. demand by 2050 1022 bcm

SEWAGE GENERATION AND TREATMENT CAPACITY IN INDIA

 WW generated in 893 cities: 29,129 MLD (2001), 33, 212 MLD (2005)
 Existing treatment capacity of STPs: 6,190MLD -21.3%
 Actual capacity utilization of STPs : 72.2 %
 Actual WW treated : 3,932 MLD -13.5%
(Source: CPCB, 2005-05)

Scope for Irrigated Agriculture with treated Waste Water in India

Scenario	Volume of Wastewater (Mm3)	Est. irrigated area (ha)
Using 75% of the treated ww	1,070	130,000
Treating 50% of collected WW	4,850	600,000

DRINKING WATER

Drinking water supply sources are subject to close monitoring to ensure that the supply is safe. As an overall goal, water reuse projects should provide at least the same degree of public health protection as conventional water supplies. Water quality issues for resource supplementation reuse projects are the same as with any potable water supply project.

Parameters to be addressed include pathogens, organics and in organics [6]. Due to the waste-water origin of recycled water, treatment technologies must address the potential higher levels of microbiological and chemical contamination. In the absence of specific standards covering potable reuse applications, the industry has developed a "multiple barriers" approach to ensure the appropriate levels of safety and reliability. In this concept, multiple unit processes or other mechanisms are provided to remove or inactivate each quality parameter of concern, particularly the microbiological parameters [7].

WATER REUSE AND INTEGRATED URBAN WATER PLANNING

Traditionally, water authorities have managed their water supply, sewerage and storm water drainage systems as separate entities. Integrated urban water planning is a structured planning process to evaluate concurrently the opportunities to improve the management of water, sewerage and drainage services within an urban area in ways which are consistent with broader catchment and river management objectives. A simple framework of hazard identification, assessment and management underpins the management of both catchments and urban water cycle [8].The conduct of an integrated urban water planning study is often a less costly process than traditional separate water and sewerage strategy studies. The integrated urban water planning produces a rapid screening and short listing of potential opportunities in partnership with the community. The process can lead to significant savings in project investigation and development costs, as well as the sorts of capital and operating costs savings which have been identified in the pilot studies [9].

ENVIRONMENTAL BENEFITS OF WATER REUSE

Given the water shortages which are now occurring, it is increasingly difficult to justify the old wasteful "use once and throwaway" approach which has traditionally been used by urban societies. Water conservation, reuse and recycling can greatly increase the benefits obtained from limited supplies of freshwater. Many rivers are experiencing declines in water quality due to high discharges of pollutants. Recycled water is a valuable resource. Instead of being thrown away, appropriately treated water can be recycled – used a second time–to reduce the demand on high quality freshwater sources and improve environmental water quality. Water recycling increases the available supply of water and enables greater human benefit to be achieved with less freshwater. Therefore, water recycling can make a substantial contribution to meeting the world's water needs and to lessening mankind's impact on the world's water environment [10].

IDENTIFYING THE BENEFITS

In the past there has been a focus on the cost of implementing water reuse schemes, but less consideration of the benefits side of the Equation. Often the indirect benefits and the environmental benefits have not been accounted for in the evaluation of the merits of a project. Using reclaimed water in place of fresh water for existing uses can free up existing water supply system capacity to cater for new water needs. This results in savings in the cost of developing new water sources, water transfers, treatment and distribution systems. It can also result in significant improvements in downstream river water quality. The benefits include:(a) agriculture benefits such as: (i) reduced diversion costs, (ii) value of a secure "drought-proof" supply of reclaimed water, (iii) increased farm production, and (iv) value of reclaimed water nutrients = savings in fertilizer applications;

(b) urban water supply benefits such as: (i) savings in the capital cost of diversion structures, drought storage, transfer systems and water treatment and (ii) savings in operation and maintenance costs including pumping energy and treatment chemicals;

(c) Urban wastewater benefits such as: (i) savings in discharge pump stations and pipelines and (ii) savings in treatment and nutrient removal costs required for discharge to sensitive waters;(d) environmental water quality benefits such as: (i) Reduction in fresh water diversions (ii) reduction in pollutant discharges (iii) better downstream water quality = improved recreational values of waterways [11].

Conclusions

Successful water recycling projects have been implemented in many countries. This experience has demonstrated the feasibility of water reuse on a large scale and its role in the sustainable management of the world's water. Both project experience and comprehensive health studies have demonstrated the potential to use recycled water to supplement drinking water supplies. An integrated approach to urban water, sewage and storm water planning can identify opportunities that are not apparent when separate strategies are developed for each service. The result is better-integrated, more sustainable solutions and substantial cost savings for local communities. Water conservation and water recycling measures are key elements in integrated urban water planning. Water conservation and beneficial reuse can reduce freshwater diversions from streams and improve downstream water quality. There are many direct and indirect benefits which result from reduced diversions and improved downstream water quality. These benefits should be evaluated and taken into account when assessing the merits of implementing new water reuse projects. Water reuse increases the available supply of water and enables greater human needs to be achieved with less fresh water, thus lessening mankind's impact on the world's water environment. A move from the old "use once and throw away" approach, to a new sustainable "conserve, use wisely and recycle" water economy will benefit the whole world. There is still much to do to improve water recycling technologies and improve the evaluation of project economics and sustainability. While the World' swatter problems may seem great, we have seen enormous progress in water conservation and recycling in the last 20 years.

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