EDITORIAL

Can floodwater in estuaries be developed as drinkable water without desalination?

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In 2015, members of the United Nations (UN) assessed the crisis that human has now and developed 17 Sustainable Development Goals (SDGs) which have been collectively endorsed by UN's 193 members, and the deadline is 2030 to achieve these goals. Amongst them, SDG6 relating to water is the most challenging to achieve given the water stress that most countries globally face along with lack of revolutionary new methods to provide safe and affordable drinking water for all. Currently more than 40% of the global population is affected by water scarcity, and this percentage is only going to rise. In other words, if no new technologies are developed or adopted by the 193 members, the promise will be far from fulfilled. Under these conditions, the "coastal reservoir" system is a paradigm shift in water resources development, which could be a timely solution for countries, proving "The true test of commitment will be implementation".

In 2017, the International Association for Coastal Reservoir Research (IACRR) was established to provide an option towards accomplishing SDG6 using a new technology. The coastal reservoir (CR) is a system whereby the dam is situated in the seawater environment to develop floodwater. IACRR's vision is to provide sufficient, clean and affordable water with minimum environmental and social impacts. IACRR is already receiving tremendous support from several entities including decision-makers, researchers, engineers and journalists. In fact, the papers listed in this issue provide an in-depth view into CR, its use, technology underpinnings, and its applicability in the south-Asian context. On behalf of the authors and readers, I thank JSUPP for its generous support for publishing these papers. I believe this issue will be the first of its kind documentation on CR as it clearly answers the following questions:

Is CR technology applicable to developed countries like Australia? First paper[1].

A quick look at the CR map of the world shows that almost all CRs have emerged in developing countries, except in Singapore and Hong Kong, with very few in developed countries like USA, and Australia (only one in the 1930s). Many possible reasons may exist for this like less population and small water gap between supply capacity and demand, high environmental and water quality standards, etc. This paper clearly shows that Australia uses only 5% of its annual runoff, and desalination and wastewater reuse are not its water solution priorities. Coastal Reservoirs, if design properly, have minimum environmental impacts relative to other solutions, also the water quality is comparable with the existing dam water, if not better. This paper presents preliminary CR designs for each capital city and an interesting conclusion is that CRs can also solve inland regions' water crisis. A criteria has been proposed to justify the feasibility of water diversion projects.

How to enhance water quality in a large river's coastal reservoir? Second Paper[2].

The worst enemy of CR is not seawater pollution, but land based pollution. There exists a high risk for any CRs to develop water from a large river. Qingcaosha Reservoir (QR) is a typical example, where the quality of incoming water is not very good. This paper discusses purification of water using natural systems such as wetlands. The research outcome shows that after the continuous purification through wetlands, the quality of raw water has improved. The average value of NH_4^+-N, NO_3-N, TN, TP in the outlet are 81%, 65%, 77% and 66% of the inlet respectively, after flowing through the natural wetland in the reservoir. The wetlands can solve two major problems facing the coastal zone reservoirs which are enhance intake water quality and stabilize water quality. In the design of coastal reservoirs, the authors suggest that we should make full use of existing wetlands, enhance the function of wetland water purification through ecological engineering methods, and construct artificial wetlands as a supplement.

Is CR technology environment-friendly and socially acceptable? Third Paper[3].

It is well known that for infrastructural development in almost every country, environmental impacts assessment (EIA) is a must. While the authors did not conduct any detailed EIA research to address this paramount question, they used a simple and convincing method to answer it, i.e., using secondary sources to examine papers in the largest database of research community, i.e., the web of science. The result of this literature search is astonishing as the existing CRs show almost no negative impacts. By examining images in google, the authors compared the social impacts of different projects. The research method used in this paper is interesting and novel and the conclusion is convincing, i.e., the existing CRs have minimum environmental/social impacts relative to other methods.

Is CR technology applicable to China? Fourth paper [4].

China is the most populous country in the world with a substantial chunk of its population highly concentrated along its eastern coastline. Globally, Hong Kong is the first city whose drinking water comes from its CRs. In the 1990s, the UN predicted that Shanghai would be one of the largest cities with severer water shortage induced by pollution. This crisis has been avoided by Shanghai CR, which is the largest CR in the world. Given this, it is important to discuss whether the successful applications can be extended to other coastal cities, and whether China's historical problem which is, 50 km^3/year water gap between its demand and supply capacity can be solved. This paper clearly answers these questions and goes further to provide the preliminary CR layout for each city. The interesting finding is that the huge water gap is only 2.7% of its runoff lost to the sea. The data clearly reveals that China is not running out of water, but water is running out of China.

Is CR technology applicable to lagoons or coastal lakes? Fifth paper [5].

It is often that water is available in abundance but not a drop is drinkable. Can a brackish lake be developed as a coastal reservoir for high quality freshwater storage? Australia attempted this in 1930s for its Alexandrina Lake, but failed. This paper presents an innovative CR design where the mistake in Australia's early attempt is avoided. The feasibility study is positive for the formation of fresh water reservoir in a typical brackish water lake. Ashtamudi Lake in southern India was taken as a case example to test this. The result shows that the water is good enough for urban water usage in the coastal town of Kollam, India.

Is there any option to Inter-link Indian rivers? The case study of Netravathi River. Sixth paper [6].

For a long time now, India has had a heated debate on its ambitious river inter-linking project. This very costly (about US$168 billion) project tries to divert water from the Himalayas to its southern tip. Given its contentious nature, it is important to assess alternatives to this project. This paper presents a vivid case similar to China or most other places of the world, showing that India is not running out of water, but possibly water is running out of India. The southern part of India in particular is in fact not short of water, but is lacking in ways and means to store it. Its CR feasibility study clearly shows that a large amount of flood waters exist. From the detailed hydrological analysis of Netravati and Gurupura rivers, this paper estimates the runoff into the sea, at 388 TMC from Netravati River and shows that just 2.5% of this amount would be sufficient to meet the present water shortfall of Bengaluru, the largest city in the Southern Indian Peninsula. It is postulated that India's water thirst can be completely quenched using coastal reservoir technology, even without the Rivers interlink project.

How wetland pre-treatment enhances performance? Seventh paper [7].

This paper highly recommends productive/agricultural wetland to pre-treat river water for CR's storage. Different from Qingcaosha CR, the Caofeidian CR is small and its catchment is also very small, even then, the water quality becomes a big issue caused by serious agricultural non-point source pollution. In this paper, agricultural/productive wetlands are introduced to purify water. The productive wetland by floodplain could reduce 450 tons of COD, 18 tons of total nitrogen, 3.6 tons of total phosphorus annually, and reduce the water evaporation by 14,000 m^3 annually. Agricultural wetland (Paddy field ecological ditch) can effectively remove the storage of pollutants with 4 tons of total nitrogen, 0.8 tons of total phosphorus annually, and conserve 1,000 m^3 water nearly. Their results show that Caofeidian CR's water quality has been significantly improved after wetland purification. Thus, it is certain that, if designed properly, CRs can provide very high quality water to the users without incurring high cost.

Meeting India's SDG6 through Coastal Reservoirs? Eighth paper [8].

What is India's Sarovarmala? Why is it important for the Indian government to keep its promise, of providing sufficient, clean and affordable water to its 320 million people who live in water-starved conditions and ensure provision for 840 million by the year 2050? This paper first analyses India's recorded rainfall pattern and finds that no significant changes can be observed. The author then makes the case that "Increase in population" and "inefficient management of precipitation" are the main reasons for water scarcity. The most sustainable solution for India's water problem is to make provisions to store rainwater during the monsoons and wetter seasons in coastal reservoirs, and use it in drier seasons when needed. This paper estimates that potential runoff to the sea from India is about 4,400 thousand million cubic feet. This paper suggests constructing coastal reservoirs along the Indian coastline along the west and east to form a necklace (mala) which can then help alleviate India's water crisis. Further, doing so can make SDG6 achievable in India.

References

[1] Yang S Q, 2017, Will coastal reservoirs dominate future Australian water supplies? *Journal of Sustainable Urbanization,*

Planning and Progress, vol.2(2): 4-15.
http://doi.org/10.26789/JSUPP.2017.02.003

[2] Wang Q, Wang F Y and Xiong L H, 2017, The role of wetland in water quality purification and maintenance of coastal reservoirs: a case of Qingcaosha Reservoir. *Journal of Sustainable Urbanization, Planning and Progress*, vol.2(2): 16-18.
http://doi.org/10.18063/JSUPP.2017.02.005

[3] Yang S Q, Smith L and Sivakumar M, 2017, Assessment of social and environmental impacts of coastal reservoirs. *Journal of Sustainable Urbanization, Planning and Progress*, vol.2(2): 19-26.
http://doi.org/10.26789/JSUPP.2017.02.001

[4] Yang S Q, 2017, Application of coastal reservoirs in China and its feasibility. *Journal of Sustainable Urbanization, Planning and Progress*, vol.2(2): 27-33.
http://doi.org/10.26789/JSUPP.2017.02.010

[5] Sitharam T G, Kolathayar S, Samuel M P, *et al*., 2017, Feasibility study on formation of fresh water reservoir and impounding the surface runoff for urban water survival in a coastal brackish water region of Kollam, India. *Journal of Sustainable Urbanization, Planning and Progress*, vol.2(2): 34-37.
http://doi.org/10.26789/JSUPP.2017.02.004

[6] Kolathayar S, Sitharam T G, Ramkrishnan R, *et al*., 2017, Feasibility of creating a fresh water reservoir in the Arabian Sea impounding the flood waters of Netravathi River. *Journal of Sustainable Urbanization, Planning and Progress*, vol.2(2): 38-42.
http://doi.org/10.26789/JSUPP.2017.02.006

[7] Chen X Y, Lu J J, Wang Q, *et al.*, 2017, Characteristics of water purification pattern of Caofeidian freshwater reservoir. *Journal of Sustainable Urbanization, Planning and Progress*, vol.2(2): 43-48.
http://doi.org/10.26789/JSUPP.2017.02.007

[8] Sitharam T G, 2017, Efficacy of coastal reservoirs to address India's water shortage by impounding excess river flood waters near the coast. *Journal of Sustainable Urbanization, Planning and Progress*, vol.2(2): 49-54.
http://doi.org/10.26789/JSUPP.2017.02.008