

## NEW STRATEGIES FOR WATER CRISIS IN THE 21<sup>ST</sup> CENTURY

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### Abstract

this paper discusses how to deal with the worldwide water crisis-too little water or water deficit, and provides a possible solution-ocean reservoir. First this paper summarizes the world's problems related to water, and measures that have been taken, then the concept of ocean reservoirs is introduced, the feasibility of applying the proposed strategy to solve the water crisis is presented in coastal countries including USA, China, Egypt, Singapore etc. Detail comparison between the ocean reservoirs and water-diversion projects or desalination projects is provided using the examples of China's South-to-North water transfer project is presented and Singapore Newater, the advantages and disadvantages are analyzed. It is found that Ocean Reservoirs is an effective way to restore the damaged ecosystem; it provides a buffer to balance the bi-polar issues of floodwater and drought. Finally, the technologies involving in the construction of ocean reservoirs are discussed; probable locations of ocean reservoirs are stipulated.

The writer also proposes the following guidelines for floodwater resource development:

- 1) Construction of ocean reservoirs and the pump station at the river mouth. The freshwater could be detained and stored in the sea. the ocean reservoir may contain several sub-reservoirs according to water quality and user's requirements. The stored water could be released as and when required. Over time, the initial seawater inside the reservoirs will be eventually replaced by the river runoff.
- 2) Construction of weirs, sluice gates or inflatable rubber dams along a river course for bi-directional water conveyance. The water inside the ocean reservoirs could be transferred to the upper reaches of a river using pipelines or along the river course. The rainwater flows to the sea along one canal, and the better quality water could be retained. During the dry period, the pumping system delivers the freshwater from the ocean reservoirs to an upstream location whereby the water-stressed river valley and delta could be relieved. During the flooding seasons, the pumping system could be used to pump the floodwater to the sea and the good quality water will be kept in the ocean reservoirs and in so doing, mitigate the flooding potential at the lower reaches.
- 3) Construction of the water diversion system along the shoreline and water bag transportation is also recommended. It is often essential to divert water from water-rich watershed to those water-deficient watersheds. The diverted water could be transported via longshore canals. The route along the longshore canals would be more economical in comparison to diverting water overland through canals and waterways. The longshore canal also has the advantage of lowering the freshwater-seawater interface in the coastal aquifer.

The solid barriers or embankments separating freshwater from seawater have been used

since eons ago. Sandbag construction is an old technique used to prevent or reduce floodwater damage, recently large scale sandbags have been used successfully for embankment construction along the Yangtze river mouth. This embankment is used to secure navigation channel. Sandbag breakwater will also be constructed against wave and tidal attacks at latter stages.

The writer proposes the following guidelines for pollution control:

1) heavy metals are not allowed to be discharged into streams. It is also suggested that these industry locate in the coastal zone, or even islands, thus the water quality in continental streams would not be polluted by the wastes being released by these industries.

2) In theory, virtually all pollutants can be treated and removed from the aquatic system. In practice, treatment or decontamination of water, especially in the case of toxic substances, is prohibitively expensive and requires sophisticated techniques. Thus, the writer would like to suggest that organic chemicals, especially the waste water from selected industry (paper and pulp, for example) which greatly damage the hydro-eco system be discharged to the desert first. The filtered, infiltrated water will return to the water system while the desert will be nourished. This approach could be a potential win-win solution to combat desertification and treatment of industrial waste water.

3) although a general wastewater treatment plant could be designed to treat the point source pollution from industry and urban runoff, the non-point pollutions from agriculture are discharged to lakes where the water may be an enclosed system. In most areas, the major water quality problem identified has been caused by widespread irrigation, i.e., the non-point pollution volumes are far higher than those of point discharges. In the Asia and Pacific regions, in addition to domestic and industrial wastes, there are also high sediment loads in rivers owing to the large scale logging or clearing of forest for farm lands. The direct result of the deforestation is usually large scale soil erosion and the high sediment deposition in lakes. The writer would like to suggest that an artificial bypass-canal surrounding a lake be constructed to divert all incoming sediment and pollutions, be released from the industry or domestic sources, to by-pass the lake and flow into the downstream waterways during normal flow period, while the clean floodwater will be impounded in the lakes. Thus the amount of wastewater inside the lakes would be reduced and the life span of the lake will be extended.

to reduce the flood disaster, the following guidelines are proposed:

1) to establish Quick-response Task Force for Flood defense and rescue. From 1991, the writer has suggested the formation of the task force. The writer clearly defined the designation of the task force, its role and responsibility and the administrative office and management required for a successful launch of the task force. It comes to the great satisfaction of the writer that the Express Force was set up in China in June 2002.

2) To configure the lakes in the floodplains as reservoirs. The obvious results are that the lakes are full of water at the beginning stage of the flooding season which will greatly reduce the lake's storage capacity and hence the capacity for flood control. To overcome this condition, the writer proposes that a bypass canal be constructed so that the lake may be taken out of the water way system. In so doing, the lake water level could always be maintained at a relatively low level, in readiness for the imminent flood peak. Thus the storage capacity of lake will be available to retain the floodwater during an emergency and greatly enhance the lake's role in flood control and disaster mitigation.