Limnology of Some Water-Reservoirs of Darbhanga Town

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Abstract : Reservoirs are generally used for water storage along a river course, for off-river water storage, or for inter-basin water transfer schemes. The latter usually require a variety of storage and transfer structures. An understanding of the natural and artificial influences common to these various uses helps in the interpretation or prediction of the physical, chemical and biological behaviour of the reservoir.

IndexTerms - chemical, Reservoir, Limnology, Water-reservoirs.

Introduction

Reservoirs are those water bodies formed or modified by human activity for specific purposes, in order to provide a reliable and controllable resource. Their main uses include:

i. drinking and municipal water supply,
ii. industrial and cooling water supply,
iii. power generation,
iv. agricultural irrigation,
v. river regulation and flood control,
vi. commercial and recreational fisheries,
vii. body contact recreation, boating, and other aesthetic recreational uses,
viii. navigation,
ix. canalisation, and
x. waste disposal (in some situations).

Reservoirs are usually found in areas of water scarcity or excess, or where there are agricultural or technological reasons to have a controlled water facility. Where water is scarce, for example, reservoirs are mainly used to conserve available water for use during those periods in which it is most needed for irrigation or drinking water supply. When excess water may be the problem, then a reservoir can be used for flood control to prevent downstream areas from being inundated during periods of upstream rainfall or snow-melt. Particular activities such as power generation, fish-farming, paddy-field management or general wet-land formation, for example, are also met by constructing reservoirs. By implication, they are also water bodies which are potentially subject to significant human control, in addition to any other impact. Reservoirs are, nonetheless, a considerable, frequently undervalued, water resource: approximately 25 per cent of all waters flowing to the oceans have previously been impounded in reservoirs (UNEP, 1991).

Reservoirs range in size from pond-like to large lakes, but in relation to natural lakes the range of reservoir types and morphological variation is generally much greater. For example, the most regular, and the most irregular, water bodies are likely to be reservoirs. This variability in reservoirs, allied to management intervention, ensures that their water quality and process behaviour is even more variable than may be characterised as limnologically normal. As reservoirs are so variable, it can often be misleading to make any general statements about them without significant qualification as to their type.

Reservoirs do, nevertheless, share a number of attributes with natural lakes and some are even riverine in their overall nature. Generally, all reservoirs are subject to water quality requirements in relation to a variety of human uses. The variation in design and operation of control structures in reservoirs can provide greater flexibility and potential for human intervention than in natural lakes (and, therefore, considerable scope for management and control) with the objective of achieving a desired water quality.

However, the nature of the intervention or control can complicate the development and operation of water quality monitoring programmes, as well as the interpretation of resultant data (especially as the nature of these controls may vary over time, altering the responses of the system). For reservoirs, therefore, the assessment process must take fall account of the direct management influences on the water body. Unfortunately, descriptive nomenclature of artificially created water bodies is frequently confusing. The term “dam” is often applied to both the physical structure retaining the water, and the water so retained. For the purposes of this chapter, dam will be used solely to describe the physical structure, and the term reservoir will be used to denote the artificially created water body. A reservoir is therefore:

- a water body contained by embankments or a dam, and subsequently managed in response to specific community needs; or
- any natural waters modified or managed to provide water for developing human activities and demands

Reservoirs formed by a dam across the course of a river, with subsequent inundation of the upstream land surface are often called impoundments. Water bodies not constructed within the course of the river and formed by partially or completely enclosed water-proof banks (and usually filled by diverted river flows or pipes) are often referred to as off-river, or bunded, reservoirs. Reservoirs created by dams or weirs serially along a river course form a cascade.

Impoundments and off-river reservoirs, therefore, form the two main artificially created water body types in which differing amounts of human control are possible, and which are usually very different in their morphology. Impoundments tend to be larger, more sinuous and dendritic than off-river reservoirs, and the main control of their contained volume of water can usually only be exercised at an outlet (in other reservoirs both input and output are controllable). Off-river reservoirs are often virtually completely isolated from the local terrain by enclosing and water-proofed embankments, whereas impoundments are subject to considerable interaction with the flood plain within which they were formed.

Conclusion and Suggestion :

Reservoirs are essential sources of freshwater for consumptive (e.g. drinking or process water) and non-consumptive (e.g. fisheries and recreational) human use. They have also contributed to industrial development by providing cheap sources of hydropower and hydroelectric power and many continue to provide hydroelectric power throughout the world. Although the development of reservoirs is usually economically beneficial to communities, in some geographic zones they can have negative impacts, such as encouraging the spread of water-borne diseases (e.g. bilharzia and river blindness). Some large impoundments may even require the displacement of the local populations while attracting new people to the reservoir shores.

Reservoirs are, essentially, managed water bodies and, therefore, there is a particular need for the managers to understand their physics, chemistry and biology. This knowledge is acquired through assessment of water quality data gathered during well- planned monitoring programmes. In turn, the management operations, themselves, can affect the water quality characteristics and behaviour of the reservoir. There is also a particular need for further evaluation of monitoring strategies in relation to operational changes over time. The objectives of the assessment programme and the associated monitoring strategies will often be governed by the operational requirements for a specified water quality. Nevertheless, in many situations, the monitoring activities will be similar to those carried out in natural lakes, although the interpretation and assessment of the data can differ markedly as a result of the modifying influences of the operating regime of the reservoir. Awareness of the effects of the location and depth of water withdrawal points on the water quality characteristics and behaviour within the reservoir is essential to their management to achieve the optimum water quality for intended uses. In addition, in order that managers may make the maximum use of physical and water quality data gathered from reservoirs, it is necessary to determine and understand the effects of inflows and outflows, retention time, in-basin facilities and actions, and morphometry and location of the reservoir within its watershed.

Reservoirs, and their associated water quality, can benefit from the ability to site and to construct them, within the limitations of topography, to best operational advantage. The water quality of established reservoirs can be managed by altering operating regimes, changing water uses, and blending waters of varying quality. In water-poor climates, the development of elaborate inter-basin transfer schemes provides additional opportunities to ensure safe and reliable supplies of water throughout countries and regions. Such schemes, however, can increase the likelihood of the transfer of undesirable species and habitat destruction. Unlike natural lakes, reservoirs create environmental impacts, as well as suffer from impacts due to human activity. By modifying the flow regime of natural water courses (in some cases completely diverting river flows from one watershed to another) reservoirs can alter species compositions both upstream and downstream, change thermal regimes, and also modify the chemical content of waters. In addition, changes in the quality andquantity of reservoir discharges, arising from changes in operational regime, into rivers and downstream lakes can affect the water quality of the receiving water body. The impact of these, possibly variable, water quality discharges should be taken into account in monitoring and assessment programmes for the receiving water bodies.

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