

RESERVOIR STORAGE.*

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AT the outset it must be admitted that the advantages of water storage are many and the disadvantages but few. In those days when the expression "stagnant water" carried with it all sorts of ill-defined fears, the opponents of storage were easy to find, and their enthusiastic statement that "abundance of light and air is essential to the proper conditioning of water for human consumption" received very general support. He who drank of the rapid stream was accounted greater in wisdom than he who selected a less aerated supply.

It is now almost trite to say that still water, rather than running water, purifies itself the better, and it equally lacks novelty to point out that the more rapidly a stream flows, the sooner is its load of pollution delivered to the thirsty consumer. In that connection, let it be said that a great deal more depends upon the number of hours required for stream flow than upon the distance in miles between the intake and the source of pollution, and a concise statement giving information as to time of flow should appear in a report covering the sanitary survey.

Stagnation has its disadvantages, of course. Increase in color naturally follows if water be permitted to long remain in contact with a muddy bottom loaded with soluble extractive matters. Not only is damage to the water's physical appearance a result of such contact, but the material passing into solution is likely to furnish abundant food for those minute forms of life which carry objectionable tastes and smells to many public waters.

To the layman's ear the word "stagnant" has a most unpleasant sound, intimately associated with the production of disease; and yet its origin is innocent enough, viz., "stagnum," a piece of standing water, not running in a current or stream.

Pools so overloaded with vegetable growth, both dead and alive, as to be unfit for human drinking are plenty and they are commonly stagnant, but the ill-favored word does not properly apply alone to those; it is just as applicable to a water of crystal clearness resting upon a bed of sand.

The condition of "standing water" just referred to, namely, that of being overstocked with vegetable growths, is practically the only one toward which objection can point when considering the pros and cons of reservoir storage.

The word "vegetable" is here to be taken in its broad sense, as it should include not only those growths which would be recognized by the public at large, but also those of the minute world as well, which latter constitute one branch of that lake life known as "plankton."

As an instance of excessive overgrowth, a small lake could be named which is so loaded with dense vegetation that decay gets ahead of new growth, and the use of its water is productive of temporary diarrhoea. It is a stained water, but its color is not to be considered as a measure of its objectionable qualities for table use, as many waters of much darker tint are of excellent quality for such purpose. Color and fitness for drinking bear no relation to each other.

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It is true that colorless waters are now demanded by the people, and "meadow teas" are growing in disfavor, but that change in public opinion is of recent date and is not based upon established hygienic grounds.

The deepening in color of the lower layers of a water stored upon an unclean bottom; the encouragement of growths of small organisms producing taste and smell by reason of an accumulation of extracted food suitable for their development; and a deficiency in dissolved oxygen in the bottom levels, constitute the sum of objections that can be raised to the impounding of water, and they are much more than balanced by the advantages that accrue from such storage.

The pollution from shore drainage that reaches a reservoir water is likely to be naturally much smaller in quantity than that received by a flowing stream; nevertheless, very serious pollution may occur in concentrated form, even when the efforts of the caretaker are the most earnest. Thus, the writer has seen numerous loads of stable manure spread upon the very steep banks of a small, cup-shaped distributing reservoir. The intention in this case was good, and much pride was taken in the fine lawns of the waterworks park, but a better choice of fertilizer could have been made for such a location.

It is entirely possible to protect a reservoir, and to a great degree the watershed also, if careful policing of the district be established. Country towns situated upon the banks of streams tributary to the reservoir are the sources of greatest danger, and an earnest effort should be made to remove all privies, manure heaps, farm yards, refuse dumps, and other sources of pollution from draining into the stream or any of its feeders. This is sometimes difficult to accomplish completely, but a high degree of thoroughness can be attained by suitable and tactful management.

Board of health rules are expected to cover care of public watersheds, but rules and laws will not enforce themselves, and the city official is commonly at a distance and more interested in the distribution system than in that of collection. The most simple arrangement would seem to be to appoint a local physician in each town or village upon the watershed as the sanitary inspector for that particular district, and to give him authority to employ an intelligent laborer as a sub-inspector to do the necessary work under his direction.

The writer has found this arrangement both efficient and cheap. In one noteworthy instance, besides caring for the sources of pollution noted above, the sub-inspector's duty included the daily patrol of a mile of railroad track which ran along the border of the reservoir. This question of possible danger from railroad pollution has but recently been recognized. Although it is always well worthy of consideration, there is no question but that it greatly varies in importance with change in topography, soil, or season. Rocky, steep slopes are easily washed by the rain, and frozen embankments naturally fall into the same classification, while flat road-beds and sandy soils offer better chances for polluting material to be disposed of by natural methods.

Whatever the character of the road-bed, it should be the sub-inspector's care to remove all night-soil dropped from passing trains, and he should exercise greater vigilance in winter than during summer.

The physician-inspector would be in a position to know of cases of disease, such as typhoid, in his district and, being so informed, could take proper precaution against contamination of the public water, which act on