Recognizing the inevitability of reuse, deteriorations in water quality imposed by use become significant. If water quality is degraded to the extent that reuse is impossible or inhibited, downstream water supplies are reduced just as if the water had been consumptively used upstream. Water supply and water pollution, therefore, are closely interconnected.

In earlier days, dilution and stream self-purification were relied upon to remedy pollution, and the most readily available or most economical natural fresh waters were tapped as supplies. During this century, biological waste treatment has been used to supplement dilution and self-purification for pollution control, and gradually deteriorating water qualities or more distant sources of water have been accepted for water supplies.

Recently, scientists have begun to investigate methods of augmenting natural water supplies, e.g., desalination and weather modification, and have begun to explore new and different techniques of waste treatment. The "Advanced Waste Treatment" (AWT) techniques under investigation range from extensions of biological treatment methods capable of removing nitrogen and phosphorus nutrients to physical-chemical separation techniques such as adsorption, distillation, and reverse osmosis. These processes can achieve essentially *any* degree of pollution control desired, and further, as waste effluents are purified to higher and higher degrees by such treatment, the point is reached when effluents become "too good to throw away." Such effluents can and will be deliberately and directly reused for agricultural, industrial, recreational, and even municipal purposes. This is true water renovation: the simultaneous alleviation of both water pollution and water supply problems.

Water Renovation—Today's Capability

Under the 1961 amendments to the Federal Water Pollution Control Act, the Division of Water Supply and Pollution Control of the Public Health Service (now the Federal Water Pollution Control Administration) has conducted its Advanced Waste Treatment Research Program. Under this program, about 30 treatment processes are being evaluated to assess their technical and economic feasibility. Several processes are now available for application; one was recently installed in full-scale municipal service. Several of the processes can even be operated in series under certain circumstances to produce potable water from municipal waste water. For each of these processes, however, some degree of overdesign must still be incorporated to assure reliable performance. The higher the potential difficulty or hazard involved in performance failure, the higher the degree of conservatism and overdesign required. The ultimate perfection of these processes to minimize capital expenditures and operating costs must await further full-scale testing and improvements in design, materials, and equipment by consultants and equipment manufacturers.

Although it is conceivable that today's conventional processes will be replaced in the future, for the present, AWT would be applied to the effluent from well-operated, conventional primary-secondary treatment plants. Alum or lime coagulation-sedimentation may be used to increase the removal of suspended solids from the conventionally attainable 90 per cent to a 99 per cent level and to reduce effluent phosphate concentrations to 1 or 2 mg./l. Coagulation-sedimentation would not be considered as an "advanced" process in water treatment and industrial practice. However, it is included here as an