**The Economic Cost of Wastewater Quality Standards**

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**Abstract**

Population growth steadily increases the demand for food and for freshwater for domestic and industrial usage, where the former rises the demand for irrigation water and the latter generates sewage. Consequently, water masters in dry and populated areas such as Israel, Spain, and California view sewage as an irrigation-water source, which can substitute freshwater irrigation provided that it is treated to meet specific quality standards. To meet these standards, various wastewater-treatment technologies can be applied, which differ in costs and reclamation efficacy with respect to different wastewater-quality measures. The quality standards of treated wastewater (TWW) thus affect the economic viability of wastewater agricultural reuse, and thereby the whole structure of water allocation and infrastructural development of water-supply systems. We assess the implications of three wastewater-quality regulations on the water economy of Israel: (1) the "In Practice" standards enforced since 2010 (known as the Inbar-committee criteria), (2) the previous "20/30" regulation (20mg/l BOD, 30mg/l TSS), and (3) a hypothetical strict regulation entitled "RO-Only", which mandates desalination of all TWW. To that end, we develop a dynamic mathematical programming model that integrates the Israeli water and vegetative agricultural sectors. The model maximizes the welfare in both sectors by setting the trajectories of water infrastructural development and allocation of different water types to the urban and agricultural demand regions, subject to a set of constraints, among them the TWW quality standards. We find that the optimal combination of wastewater-treatment technologies under the In-Practice standards integrates AS (Activated Sludge), BNR (Biological Nutrient Removal), MF (Micro Filtration), and RO (Reverse Osmosis). The costliest standards are those associated with TSS (Total Suspended Solids) and salinity (measured in dS/m (deciSiemens/meter) indicating EC – Electrical Conductivity), with an average per cubic meter shadow value of 0.14 cents per mg/l and 0.16 cents per dS/m, respectively. Relative to the In-Practice scenario, the transition back to the 20/30 regulation saves $166×106 a year (on average, ¢6/m3)—this is a measure of the minimal benefit associated with the cleaner wastewater obtained by the In-Practice regulation that renders it warranted from a social perspective. Similarly, the minimal added benefits associated with the enactment of the RO-Only regulation instead of the In-Practice one amount to $315×106 a year (on average, ¢12/m3). The water consumers in the urban sector face almost all of the changes in the wastewater-treatment costs, whereas changes in the welfare allocation in the agricultural sector are minor.