Beyond Technology: How Governance and Culture Shape Wastewater Reuse in the United States and Israel

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Introduction:

Israel has developed one of the most advanced wastewater reuse systems in the world, driven largely by the country's natural water scarcity. With a semi-arid climate and rapidly growing population, Israel was compelled to treat wastewater not as waste, but as a critical resource (U.S. Environmental Protection Agency, 2023). Today, the country recycles approximately 87–90% of its wastewater, setting a global benchmark for water reuse (U.S. Environmental Protection Agency, 2023). This system operates through a highly coordinated national infrastructure that integrates municipal wastewater collection, advanced treatment facilities, and large-scale distribution networks. After initial treatment at regional plants, wastewater undergoes further purification (most notably through systems such as the Shafdan Wastewater Treatment Plant) before being transported through a centralized pipeline network for agricultural use, particularly in the Negev Desert (Mekorot, n.d.). This closed-loop system conserves freshwater for domestic consumption while ensuring a reliable, year-round supply for irrigation.

While Israel's success demonstrates how large-scale wastewater reuse can be effectively integrated into national infrastructure, it also raises critical questions; for example, why has the United States not implemented similar systems at scale? The U.S., despite having comparable technological capabilities, while engaging in wastewater reuse, does so only at limited and regionally fragmented scales (U.S. Environmental Protection Agency, n.d.). This limited adoption is not due to a lack of innovation, but rather fundamental differences in how water is governed, managed, and perceived culturally (OECD, 2015; Smith et al., 2018).

Unlike Israel's centralized and coordinated system, water management in the U.S. is highly fragmented across federal, state, and local levels, limiting the ability to implement unified, long-term strategies. This governance fragmentation can be seen by looking into the structure of how water in the U.S. gets delivered. The EPA notes that about 90% of the population gets their drinking water from about 50,000 independently regulated public water systems known as community water systems (U.S. Environmental Protection Agency, 2026a). This number of independent and currently uncoordinated systems would make the implementation of a nationwide system like that of Israel's a very tall task. Israel is well known for its long-term water planning strategies, including the National Long-term Master Plan for the Water Sector through 2050 (OECD, 2021). In the U.S., with its decentralized, dependent sourcing, the ability to coordinate long-term planning and implement large-scale infrastructure strategies across the country is

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limited. There are some federal agencies such as the U.S. Environmental Protection Agency that promote water reuse through initiatives like the Water Reuse Action Plan, though participation is mostly voluntary and implementation is left to individual states and municipalities (U.S. Environmental Protection Agency, 2026b). Because of this regulatory inconsistency and lack of coordination, significant gaps in what could otherwise be a cohesive national system become difficult to avoid (OECD, 2015). This lack of national coordination has some major consequences. As already noted, Israel reuses approximately 87 percent of its wastewater; in contrast the U.S. only reuses about 6 percent of its wastewater (U.S. Environmental Protection Agency, n.d.). As the U.S. is not a technologically limited nation in comparison to Israel, this dramatic difference in water reuse is not due to technological limitations, rather it is the inability to implement reuse systems at a national scale. The fragmentation of water systems in the U.S. is only one part of the problem, as deeper challenges related to infrastructure design and public perception also contribute to the limited adoption of wastewater reuse systems in the U.S. (OECD, 2015; Smith et al., 2018; Virginia Water Resources Research Center, 2024).

This paper argues that despite having the technological capacity to implement large-scale wastewater reuse, the U.S. has not done so due to three primary barriers: 1) fragmented governance structures; 2) infrastructure systems designed for disposal rather than reuse; and 3) cultural resistance driven by public perception. By examining these differences, this analysis will show that the primary challenge facing the U.S. is not technological, but institutional and societal.

Barrier 1: Fragmented Governance in the United States

In terms of trying to replicate the system that Israel has in place in any capacity, the fragmented structure of the U.S. water operations poses significant challenges for scaling water reuse technologies. In contrast to Israel's nationally coordinated approach where water resources are managed through a national water-sector planning framework (OECD, 2021), the U.S. treats water as a regional responsibility shaped by state, local, and federal institutions (US Water Alliance, 2018). One must understand that this is just how the U.S. has been doing things since the inception of the country, and water isn't the only resource that is treated as something that can be managed at different levels and by differing entities. According to the OECD (2015), decentralized water governance systems often struggle to align policies and investments across jurisdictions, limiting the ability to implement large-scale, coordinated solutions. This decentralization represents a key to explaining why the U.S., despite having the technological capacity for advanced treatment and reuse, has not approached wastewater reuse at the scale seen in Israel.

Political factors further reinforce these structural limitations. In Israel, water scarcity has long been treated as a national planning priority, reflected in the country's National Long-term Master Plan for the Water Sector through 2050, which defined Israel's vision, goals, and policies for future water management (OECD, 2021). Over time, this national focus developed into coordinated water policy, long-term infrastructure investment, and pricing mechanisms intended to support conservation and cost recovery (OECD, 2023). In contrast, the U.S. has not historically been a water scarce nation, even though water availability has become a rising concern in many western communities and rural areas (Anderson & Woosley, 2005). In the U.S., there has historically been less national urgency to manage water scarcity aggressively because there were fewer water constraints at the national level. This lower level of national urgencyled to more permissive water policies over time in the U.S. that are often influenced by state and local priorities rather than one coordinated national strategy (World Bank, 2017; U.S. Environmental Protection Agency, 2020). In addition, water is often undervalued in developed countries, including the U.S., with pricing systems that fail to incentivize conservation or investment in reuse technologies (U.S. Environmental Protection Agency, 2020). The U.S. has historically experienced few water constraints at a national level, reducing the urgency to adopt large-scale reuse strategies (World Bank, 2017).

It is clear that the lack of urgency lies within the major differences in water scarcity between the two nations. As the World Bank (2017) notes, countries facing severe resource constraints are more likely to adopt aggressive management strategies, while resource-rich nations often delay such investments. Many western U.S. states are currently experiencing or have recently experienced drought conditions, including California, Arizona, Colorado, Nevada, and New Mexico (National Integrated Drought Information System, 2025). Climate change has also intensified drought conditions in the Southwest by increasing evaporation and drying soils, with Drought.gov reporting that human-caused climate change contributed to about 42% of the region's soil moisture deficit since 2000 (National Integrated Drought Information System, n.d.). California is however leading a change in perception and action in the waterfront: in 2014, former Governor Jerry Brown and Israeli Prime Minister Benjamin Netanyahu signed an agreement to expand the cooperation between California and Israel (Office of Governor Edmund G. Brown Jr., 2014). This California-Israel agreement laid the groundwork for projects related to water scarcity, water conservation, and different kinds of agricultural technology. California shows that the U.S. isn't completely disconnected from Israeli water innovation. However, it also illustrates that these efforts are taking place mostly at the state and regional levels instead of through one coordinated national system.

Barrier 2: Infrastructure and Path Dependency

While the U.S. has the resources to implement advanced wastewater recycling systems, structural, political, and cultural barriers - rather than technological limitations - are the primary obstacles preventing adoption at the scale seen in Israel. The structural barriers are rooted in the historical development of sewer systems, treatment plants, and water distribution networks designed to remove waste, not recover it (Virginia Water Resources Research Center, 2024). This disposal-oriented design presents a broader infrastructural challenge, where systems prioritize disposal efficiency rather than circular reuse.

The path dependency of pipes created in the 19th and 20th-century creates the primary infrastructure design issue that prevents simpler implementation of wastewater reuse systems. "The Washington Post recently reported that the average age of a pipe in D.C. is 77 years, but a great many were laid in the 19th century. Sewers are even older" (Cohen, 2012). Early urban sanitation systems emerged in response to public health crises caused by unmanaged waste in the expansion of cities. "Many working-class families are compelled to reside in poorly ventilated, damp, and unsanitary dwellings with minimal access to clean water or proper sewage disposal. These circumstances have facilitated the rapid spread of infectious diseases, which has catastrophic consequences" (Vaishali & Boopathy, 2024). The introduction of indoor plumbing led to reduced crises, and sewer systems were rapidly built to transport the waste away from populated areas. Most cities adopted a combined or separate sewer system, determined by whether stormwater runoff flowed in the same pipe as sewage. The first systems discharged sewage directly into nearby waterways, often without treatment. The 'collect and discharge' model became the foundation for shaping modern water management practices in the U.S.

The infrastructure of waste removal did not change until the Clean Water Act of 1972: "The CWA prohibits pollution discharges into navigable, fishable, and swimming waters, which requires significant water treatment to increase effluent value and usage" (Kandou, 2023). Yet, the core purpose of the system remained unchanged: safe disposal. By the time the Clean Water Act was implemented, nearly all urban wastewater was treated, but was primarily disposed of into rivers, lakes, and oceans. The foundation of the modern U.S. infrastructure is to collect, treat, and discharge. This collect-treat-discharge model creates a one-way flow of water management that prioritizes disposal over circularity, which disrupts the potential for utilizing existing systems.

In contrast, Israel demonstrates how infrastructure can be reoriented towards integration rather than separation. Israel's water system operates as an interconnected network of desalination plants, wastewater treatment facilities, and natural water sources. "There is a major pipe and small pipes and smaller and smaller and smaller. And all the resources are connected to this pipe, including of course, all the desalination factories" (Water Resources Podcast, n.d.). The system is linked through the national water carrier and redistributes water across the country, functioning like an energy grid optimized for real-time decision-making. The National Water Carrier is a centralized pipeline system that transports water across Israel, which has allowed for advanced, coordinated distribution and integration of recycled and desalinated water. “So it's nice that you have this national water carrier then to allow you to transport water throughout Israel” (Water Resources Podcast, n.d.). The level of integration highlights the importance of infrastructure design for the scaling of reuse.

The linear model of water treatment used in the U.S. would require the implementation of a new distribution system to convert wastewater to reusable water. Most of the U.S. water systems consist of pipes that were primarily installed between 1950 and 1980 during the rapid expansion of urban areas: “Ductile iron pipes were introduced in the 1950s, a time of rapid population growth, and were marketed as an improvement over their cast-iron predecessors” (Cohen, 2012). The transition to a reuse-oriented system would require large-scale capital investments and coordinated planning across multiple sectors. This large-scale infrastructure investment is already evident in existing U.S. projects. For example, in Richmond Hill, Georgia, the construction of the Sterling Creek wastewater reuse facility in 2016 cost approximately $25 million, making it the largest single infrastructure expenditure in the city’s history (U.S. Environmental Protection Agency, 2025). Because of the high upfront costs and disruptions many cities are hesitant to pursue reuse projects. In Israel, the government overcame these barriers with large-scale investment and centralized planning. For example, the development of the National Water Carrier enables water to be transported across regions and integrated with innovations, such as desalination and recycled wastewater (Water Resources Podcast, n.d.). The centralized system reduces distribution costs and efficiently incorporates new water sources, enabling long-term flexibility and reuse.

The structural paradox of the U.S. system is the presence of unplanned water reuse. Treated wastewater is discharged into rivers and reused downstream. Many U.S. communities already rely on water that contains a majority of upstream effluent: “Some drinking water treatment plants use waters from which a large fraction originated as wastewater effluent from upstream communities, especially under low-flow conditions” (National Research Council, 2012). However, reuse occurs without intentional infrastructure, and the level of treatment is lower than planned reuse projects. Ray et al. (2005) explain that some drinking water supplies utilize streams that “might have been compromised in their quality due to the discharge of wastewater effluents or other waste streams. The system currently recycles water indirectly, but lacks infrastructure to do so efficiently, safely, and transparently.

The U.S. faces significant structural barriers to wastewater reuse rooted in its historical infrastructure. Sewer systems, treatment plants, and distribution networks were designed to move water away from cities instead of circulating within them. Overcoming these barriers would not only require updating the current system but also a fundamental reconfiguration of the water system to integrate a circular water management model. Israel’s system demonstrates that integration of infrastructure is a long-term investment that reduces dependency on natural resources: “Wastewater is a major source of the water being used for irrigation in Israel, actually, about 60% of the overall water being used for irrigation is from treated wastewater” (Water Resources Podcast, n.d.). Ultimately, the contrast between the U.S. and Israel underscores that the primary challenge is not the availability of technology, but the willingness to redesign infrastructure to support an integrated, circular water system.

Barrier 3: Public Perception and the “Yuck Factor”

On top of structural and political constraints, public opinion towards water reuse certainly has an impact on capital investment into adoption of large-scale water reuse strategies in the U.S. One major example of this public resistance is the ‘yuck factor,’ which refers to the psychological disgust associated with recycled wastewater, has become one of the main roadblocks standing in the way of support for reuse projects; occurring even when the technology has been proven to be both safe and effective (Ormerod, 2019). This concern is not just a generalized assumption, but is supported by research. Studies have shown that perceived health risks and the “yuck factor” are some of the most influential factors in terms of whether or not the public is willing to accept recycled water or not (Smith et al., 2018). This research bolsters the idea that resistance to wastewater reuse is driven as much by public perception as it is by policy or national infrastructure.

This public perception barrier brings us back to one of the most glaring contrasts between the two nations being compared here: unlike Israel, where water scarcity has created an entire culture of conservation and has normalized the use of treated wastewater, the U.S. has not approached the same level of public acceptance. “In addition to growing water demands, the further adoption of water reuse will be affected by a variety of issues, including water rights, environmental concerns, cost, and public acceptance” (National Research Council, 2012). The lack of public trust in the U.S. influences policy decisions and reduces political willingness to invest in reuse infrastructure, reinforcing existing institutional barriers. It thus becomes less about whether the technology works, and more about whether people are willing to accept it, which as of right now, it is clear that public acceptance remains limited in the U.S. Ultimately, even with viable technology in the U.S., the success depends on public trust and institutional support, an issue that extends beyond national borders.

Conclusions:

Global research suggests that the underutilization of wastewater reuse is not because of technological limitations, but rather institutional, public opinion, and policy barriers (Qadir et al., 2010). The U.S. is just one of many nations reflecting hesitation to wastewater reuse adoption that is centered around governance fragmentation, inconsistent policy frameworks, and a lack of political and financial incentives. Taken together, these structural, political, and cultural factors demonstrate that the primary barriers to wastewater reuse in the U.S., as well as other countries, are institutional rather than technological.

Once all these barriers are taken into consideration, a rather clear pattern begins to emerge: the challenge facing the U.S. isn’t just a matter of isolated policy mishaps or infrastructure that is past its due date, rather a much broader lack of alignment between governance, infrastructure, and public perception. Each of these barriers have an impact on one another, making it that much more difficult to implement large-scale solutions even when the technology to do so already exists. Unlike Israel, where water management operates as a unified national priority, the U.S. approaches water as a fragmented and regionally managed source. This fragmented approach is the main underlying disconnect that is preventing the nation from scaling solutions that have already been proven to be both efficient and successful.

Israel’s success in wastewater reuse shows that large-scale water recycling is not only possible, but very effective when the needed support is provided by coordinated systems and national priorities. However, the U.S. displays how structural fragmentation, political decision-making, cultural perceptions, and infrastructure design can collectively limit the adoption of even the most advanced technologies. Even with technology that is needed to scale wastewater reuse at high levels already existing, the lack of alignment across governance, policy, and the general acceptance of the public is what continues to prevent implementation of these systems in the U.S. This implementation challenge is a multifaceted issue and it is going to take a lot more than technological investment to get the ball rolling for wastewater reuse strategies to get serious traction. It will take a complete shift in how water is perceived, valued, and managed in the U.S. Until some of these realities change, wastewater reuse will likely remain underutilized in the U.S., despite its proven potential as a sustainable solution for ever increasing water demands.

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