

Urbanization's Threat to Water Systems and its Effect on Communal Health

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Abstract

This paper explores the civil dependence on groundwater and the urban repercussions on public water systems as population continues to climb in the United States (U.S.), consequently affecting public health. Research was conducted from evaluating secondary informational sources and collecting data weekly, for a total of three days, at McKellar Lake, Cypress Creek, and Bateman Bridge. This paper correlates primary research through analysis and observation with existing studies in order to fully understand the effects of urbanization on water systems and health.

Keywords: groundwater, urbanization, public health, impervious surfaces, hydrological cycle, water systems, aquifer, recharge, phenols, microbes, urban planning, trihalomethane

Urbanization's Threat to Water Systems and its Effect on Public Health

Numerous archival sources delineate the relationship between the hydrological cycle, groundwater, and impervious surfaces. However, field investigations are included as well in order to better comprehend how common acts, such as improperly disposing litter and waste, pouring hazardous waste into unsuitable drains, and not conserving water factor in the quality of drinking water in the U.S.. To understand how public health is affected by the quality of water systems, American urbanization, civil oversight should be studied, and groundwater research should be studied.

Hibbs' (2016) article summarizes the history of urban hydrogeology, emphasizing the importance for groundwater scientists and ongoing research in urban areas. Two decades of experiments conducting groundwater assessments in urban zones are included (Hibbs, 2016, p. 2). Hibbs also mentions papers from Larsen's studies evaluating water contributions in Memphis, Tennessee, which is where this paper will explore in depth using data collected from three trials.

Pedley and Howard (1997) delineate the relationship between microbial contamination and small or developing places, but the facts still hold true for developed areas, the U.S. included. City and suburban landscapes have high levels of impervious cover, causing pollutants to easily wash into streams, rivers, and lakes—our sources of drinking water. A country as populated and urbanized as the U.S. is no exception to the hazards poor water systems present.

Groundwater's capability to allow water to pass through underground soil and crevices in rock provides drinking water to 51% of the U.S. population and 99% of rural zones and 64% is used in irrigation for crops. Groundwater is perceived to be microbiologically 'pure' (Pedley and Howard, 1997), but with rapid urbanization, the drinking water supply becomes compromised. Hibbs (2016) includes a table in the article exhibiting urban factors that both increase and decrease recharge, proving that though population growth and the demand for water increases, human involvement can conserve aquifers and reduce risks that threaten clean water.

The following research aims to answer:

- 1) how urbanization affects water systems in the U.S.
- 2) how changing human habits greatly contribute to the conservation of land and drinking water.
- 3) how poor water quality affects public health.

Materials and Methods

To find the percentage of trash recyclable from the total trash collected at McKellar Lake, the recyclable trash and non-recyclable trash were put into separate bags and weighed in kilograms, and then the total weights were divided. The amount of phenols and chlorine in Cypress Creek were measured using vacuum vials and a photometer over a three-trial period. Copper, phenols, and chlorine samples were collected from Bateman Bridge in the same manner.

Results

The total of recyclable material found at McKellar Lake was 24% and 21% of the total litter collected was ruled non-recyclable.

Trial at Cypress Creek and Bateman Bridge

The following table shows the amount of chlorine found in the waterbody during the trial:

Table 1

Sample 1	0.19 mg/L
Sample 2	0.31 mg/L
Sample 3	0.14 mg/L

Table 2 shows amount of copper, phenols, chlorine, and dissolved oxygen found during the trial at Bateman Bridge:

Table 2 Copper	Phenols	Chlorine	Dissolved Oxygen
0.35 mg/L	0.24 mg/L	0.07 mg/L	6.78 mg/L
0.44 mg/L	0.20 mg/L	0.12 mg/L	6.85 mg/L
0.44 mg/L	0.26 mg/L	0.25 mg/L	6.42 mg/L
0.39 mg/L	0.22 mg/L	0.57 mg/L	6.47 mg/L

Discussion

The U.S. has enjoyed grand success with its urban progression giving way to a myriad of employment opportunities and easy access to goods and services, but with the influx of people from non-urban zones, poor urban planning leads to considerable issues, such as a lack of proper waste disposal systems, untreated waste and raw sewage, deadly epidemics, and pollution. Though city life can be exciting, it comes with a price, and the water supply should not be the toll.

When a rural area is transformed into housing complexes, shopping centers, industrial buildings, and roads, there is a significant change in how the land handles water from its exchange with the hydrological cycle. Natural lands filled with trees, bushes, and soil help soak rain and slow runoff in undeveloped terrain, but in urban zones, more storm runoff and erosion occurs because of the lack in vegetation. Sewage runoff travels into streams and causes pollution, killing wildlife and causing the water to become unusable.

In 1974, an outbreak of acute gastrointestinal illness at Richmond Heights, Florida, was traced to a supply well that was continuously contaminated with high levels of sewage from a nearby septic tank (Weissman et al. 1976). In 1984, an outbreak of gastro-enteritis, caused by *Cryptosporidium*, occurred in a suburban community in Texas (Pedley and Howard, 1997).

Furthermore, Flint, Michigan is a more recent example of poor water treatment. In 2014, city officials claimed that there were detections of coliform bacteria in the Flint River caused by the cold weather, aging pipes, and a population decline. In order to eliminate bacteria, higher

levels of chlorine were added, but this in turn rose unsafe trihalomethane levels and led to the city's unfortunate lead exposure and water crisis.

In Memphis, Tennessee, however, the Wolf River Conservancy has focused on preserving floodplains, which gives access to fresh water and fertile land for farming. Avoiding the land for non-natural agendas not only helps maintain the city's aquifers, but also public health.

Good things can come to an end, however, which is why planning ahead is crucial. "Although high-quality water from the wells in the Memphis area is clearly abundant by contemporary standard, recharge of the aquifer can become a major issue at some point in the future," WaterWorld Magazine writes. Researcher at the Ground Water Institute, Dr. Brian Waldron says that it is vital to plan ahead before it is too late in order to be sure that water is ample and good quality.

Despite the city's delight in its drinking water, its aquifers are still at risk for contamination. This is greatly due to civil activity, littering a major issue. McKellar Lake is victim to this kind of behavior with trash stretching out as far as the eye can see. Fortunately, most of the trash is recyclable (see **Results**), and about 200 volunteers have assisted in collecting litter along the shore's lake.

Oftentimes people believe throwing yesterday's soda can out of their car and into the streets will not do any harm because how much damage can one can do? Nevertheless, imagine every one thinking the same. Eventually, trash that gets tossed into the streets get swept into storm drains end up saying hello to lakes while humans and wildlife bid adieu to healthy

drinking water.

Once greeting career-hungry pups, cities are now filling up with an influx of people from new and past generations. This trend towards urbanization will continue to accelerate, and though a significant opportunity to connect with people from all backgrounds, poor management can worsen existing challenges, so emphasis on water quality and treatment planning should be placed to ensure good public health.

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