Aging wastewater collection and treatment systems have not received as much attention as other forms of infrastructure, even though they are vital to public health, economic growth, and environmental quality. Wastewater systems are responsible for transporting and treating human and animal waste, which must be removed to avoid disease or contamination of drinking water and other water bodies. Problems associated with wastewater systems can include infiltration, inflow, and combined sewer overflows (CSOs). Infiltration, inflow, and combined sewer overflows (CSOs) pose risks of sanitary system overflows (SSOs), which can lead to the release of untreated wastewater into surface water bodies, potentially affecting aquatic life and human health. The United States Environmental Protection Agency (USEPA) and the Environmental Protection Agency (EPA) have identified infiltration, inflow, and combined sewer overflows (CSOs) as priorities, with the goal of reducing their impact on local waterways and the environment.

**Abstract**

Aging wastewater collection and treatment systems have not received as much attention as other forms of infrastructure, even though they are vital to public health, economic growth, and environmental quality. Wastewater systems are responsible for transporting and treating human and animal waste, which must be removed to avoid disease or contamination of drinking water and other water bodies. Problems associated with wastewater systems can include infiltration, inflow, and combined sewer overflows (CSOs). Infiltration, inflow, and combined sewer overflows (CSOs) pose risks of sanitary system overflows (SSOs), which can lead to the release of untreated wastewater into surface water bodies, potentially affecting aquatic life and human health. The United States Environmental Protection Agency (USEPA) and the Environmental Protection Agency (EPA) have identified infiltration, inflow, and combined sewer overflows (CSOs) as priorities, with the goal of reducing their impact on local waterways and the environment.

**Introduction**

Engineered public infrastructure is vulnerable to natural hazards and must consequently be evaluated in terms of failure risks. Such considerations often influence the siting of new facilities, the design and construction of existing facilities, and the decisions to close or abandon existing facilities. In terms of aging infrastructure, there is considerable interest in evaluating the failure risks of systems that have been operating for several decades or longer. A system that has been operating for several decades or longer is often referred to as aging infrastructure. Aging infrastructure is typically characterized by the following:

1. **Corrosion and wear:** The material of the infrastructure may degrade over time, leading to the formation of cracks, holes, or other defects that can allow water to enter the system.
2. **Crack formation:** The infrastructure may develop cracks due to the stresses imposed by the water pressure or the weight of the water.
3. ** Settlement:** The infrastructure may settle due to the weight of the water or the weight of the infrastructure itself, leading to the formation of cracks or the development of gaps between the infrastructure and the surrounding ground.
4. **Erosion:** The infrastructure may be eroded by the water flow, leading to the formation of cracks or the development of gaps between the infrastructure and the surrounding ground.

In the case of a large-scale wastewater treatment plant, the failure of the infrastructure could result in the release of untreated wastewater into surface water bodies, potentially affecting aquatic life and human health.

**Results**

The Washington and Wilmington Regional Offices of NC DEM reported a total of 123 NFPS-permitted discharges in eastern North Carolina as of 2010-2011. This total included a large number of industrial discharges without extensive collection systems as well as discharging water treatment plants (WTPs) that generate discharges from water treatment operations, none of which were examined in this study. Among the 28 eastern North Carolina counties administered by the DEM and WCD, all but 1 (Carteret, Chatham, Craven, Carteret, and Craven) had one or more permitted WTPs serving residential and municipal customers. A total of 10 WTPs in these 23 counties generated data for complete analyses of I&I. Seven of these, all in low volume systems, had no significant effects of rainfall or temperature on system flows, likely as all would have had minimal collection systems, e.g., North Lenoir WWPO or Harrodsburg WWTP in Lenoir County, WIRO. None of the 66 systems were generally or even statistically significant effects of rainfall and/or temperature on system flows.

**Conclusions**

Statistically significant increases in flow from central sewage collection systems into wastewater treatment plants in eastern North Carolina are common and are driven by infiltration. Infiltration of groundwater into sewage collection systems appears to be more pronounced than surface inlets. I&I together except 10% of rainless flows into WTPs in over 40% of the systems examined over a two-year period with approximately average rainfalls. Excessive flows into WTPs pose several problems for sewage management, particularly elevated risks of sanitary system overflows, the effects of which may be easily conflated with storm water runoff.

**References and links available on request to Cahoon@uncw.edu**

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