Urban stormwater quality during the COVID-19 pandemic and stay-at-home orders

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Background

- Urban landscapes introduce impervious surfaces, such as roads and parking lots, which do not allow water to infiltrate as it would in a natural environment.
- Vehicles and traffic produce pollutants, including BTEX (benzene, toluene, ethylbenzene, and xylene), polycyclic aromatic hydrocarbons (PAH), and metals, from vehicle processes and parts, including exhaust, vehicle wear, breaks, and road abrasion (Müller, 2020).
- Pollutants adhere to impervious surfaces, and precipitation runoff picks up pollutants. These pollutants accumulate and concentrate in urban waterways, posing a threat to urban stormwater quality (Iarrapino and Attorney).
- The COVID-19 pandemic and stay-at-home orders impacted human activity, including car use and traffic. A May 2020 Brookings Institution report found that every metropolitan area in the US experienced a decrease in traffic by at least 53% since March (Tomer and Fishbane, 2020).
- The drastic change in traffic volume provided a unique opportunity to study the effects of traffic on urban stormwater.

Hypothesis: Urban stormwater quality will have improved during the COVID-19 stay-at-home orders due to the reduction in traffic and associated pollutants.

Methods

- Literature Review: Researching and collecting articles from the University of Utah's Marriott Library and Google Scholar on traffic related pollutants, urban stormwater, and the relationship between traffic and stormwater pollution.
- Water quality: Looking through databases and contacting state/local governments, non-profits, and universities in order to find consistent water quality sampling before, during, and after the stay-at-home orders. Acquired minimal data because either data collection stopped during the orders, and/or BTEX and PAHs weren't being measured.
- Flow: Collected flow data from the USGS National Water Information System for each storm event and dry weather sampling. For sampling sites that did not have a corresponding USGS flow guage, I used the values measured along with the samples.

Results

- Although we were unable to find any outside data sources that were suitable for our study and intended analysis, this established the novelty of our study.
- We plotted the flow and precipitation data together to create storm hydrographs. Figure 1 is one example of the resulting graphs. It represents a typical storm event in which the peak flow lags behind the peak precipitation due to the time necessary for the precipitation of a watershed to reach the downstream flow guage.

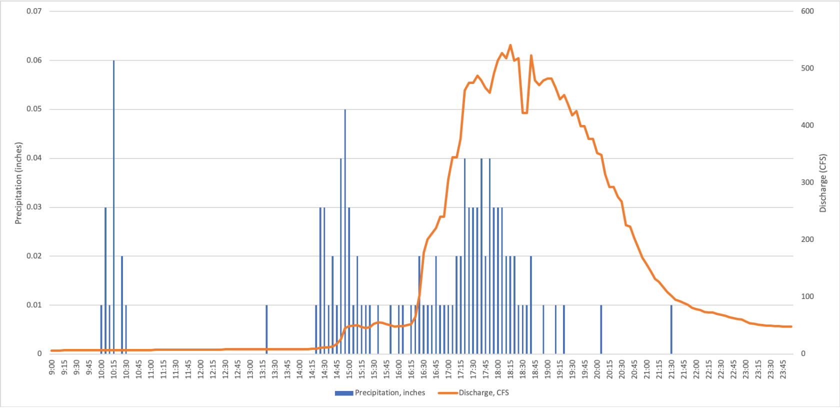

Figure 1. Storm hydrograph for Lakewood Gulch downstream from the city (LGDN) in Denver on May 24, 2020.

Figure 2. Sampling site, Lakewood Gulch where it meets the South Platte River in Denver, Colorado.

Future Work and Discussion

- Comparison of contaminants to storm hydrographs in order to gain an understanding of the loadings throughout a storm event and different flow flushes.
- Analysis of contaminant loadings compared with the traffic characteristics of the surrounding areas in the antecedent dry days to each storm event
- Final results to potentially support sustainable living scenarios with intention to reduce urban traffic.

References

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