Development of an Early Warning System for Cross-Border Sewage Flows in the Tijuana River Valley

Background:

The Tijuana River Watershed is a large binational watershed of approximately 1,750 square miles that lies across the California - Mexico International Border (Border). A large portion of the watershed (approximately 75%) is within Mexico and encompasses the densely urbanized City of Tijuana, Mexico. The watershed drains into the Tijuana River Estuary in the U.S. and ultimately to the Pacific Ocean in the City of Imperial Beach.

Over the past 30 years, tremendous population and industrial growth along with rapid urbanization in Tijuana, Mexico has put a strain on the aging and in some areas non-existent, Mexican sewage infrastructure in the City of Tijuana, resulting in sewage overflows and direct discharges to streams. At times, sewage generated on the Mexico side of the watershed travels north into California through the Tijuana River or other cross-border canyon tributaries, entering the Tijuana River Estuary, the largest functioning wetland in Southern California, and discharging directly into the Pacific Ocean. As an example, dry-weather cross-border flows have increased in volume from 21 million gallons (MGs) annually in 2015, to 36 MGs in 2016, and to 145 MGs in the first half of 2017. Last winter, an alarming volume of raw sewage, which also contained untreated industrial wastes with unknown chemical mixtures, overflowed across the Border through the Tijuana River Valley, which is the Tijuana River and the Tijuana River Estuary collectively, to the Pacific Ocean, leading to continuous beach closures in the City of Imperial Beach and, at times, as far north as the City of Coronado. The shoreline of Imperial Beach, stretching from the end of Seacoast Drive to the International Border, has been continuously closed since November 21, 2016. Many people that live and work in the Tijuana River Valley and in Imperial Beach have reported ill effects, including headaches, nausea, and stomach cramps, from the municipal/industrial raw sewage-contaminated water and air.

Occurrence of cross-border flows does not follow specific patterns, posing a challenge to regular monitoring efforts (e.g., taking grab water samples at night) and revealing the need for an in-situ real-time (or near real-time) water quality monitoring system that can provide timely alerts to water managers and decision-makers about pollution events. Additionally, easily accessible water quality data is needed to inform communities on both sides of the Border when the shoreline at the mouth of Tijuana River is unsafe for recreational use.

Fortunately, existing regulations allow for the use of new technologies for faster enumerating fecal pathogens or fecal indicator bacteria. As an example, USEPA specified a process for comparing enumeration methods, including new methods, in its December 2014 technical document[1].

Results:

In the summer of 2017, the San Diego Regional Water Board completed a Comparability Study to evaluate the feasibility of using an in-situ sampling and analysis device - the ALERT system by Fluidion

[1] USEPA, *Site-Specific Alternative Recreational Criteria Technical Support Materials for Alternative Indicators and Methods.* December, 2014.

Inc., for *E. coli* and total coliform measurements at the Tijuana River Valley. In the study, the ALERT system was tested over different water matrices observed in the Tijuana River Valley, including groundwater discharges, dry-weather flows in storm drains, and raw sewage discharges. Test results by the ALERT system were compared with parallel sampling and analysis results with the USEPA approved method, Colilert-18.

Primary results show that the ALERT system and Colilert-18 results are in good agreement over a broad range of *E.coli* concentrations. In particular, the response time (three to five hours) of the ALERT system at elevated concentrations of *E. coli* (i.e., 1e+6 to 1e+7 colony forming unit (CFU)/100 ml) which indicate raw sewage contamination, is much faster than the 18 hour response time required by the Colilert-18 tests. These results show the ALERT system has great potential to serve as an early warning system of cross-Border sewage flows.

Next Steps:

San Diego Regional Water Board staff will continue to test the reliability of the ALERT system in the Tijuana River, particularly targeting winter rain events to evaluate the system's performance in more complex water matrices. The data collected will likely be included in the application package by Fluidion to seek approval of the ALERT system as an alternative enumeration method for *E. coli* by USEPA. Additionally, Regional Water Board staff will work with relevant entities (including the USEPA, the County of San Diego Department of Public Health, and the International Boundary and Water Commission) to facilitate the establishment of a communication server to help broadcast water quality measurement results to impacted communities in a timely manner. Finally, the Regional Water Board will work with Fluidion and the Southern California Coastal Water Research Project (SCCWRP) to pilot a new line of Fluidion product, the ALERT-LAB, a portable version of the ALERT system, throughout rivers and streams in the San Diego Region. Doing so will enhance our in-house bacteria analysis capacity as well as promote the use of novel technologies in water quality monitoring.

Photos showing sampling stations where Fluidion/Alert has been used:

A. Groundwater discharge point (discharging to Tijuana River) near the border Line;
B. Goat Canyon Sewage Collector
C. IBWC gauge in the main stem of Tijuana River

* IBWC – International Boundary and Water Commission