Indirect Potable Reuse in the Phoenix Metropolitan Area: How Much Wastewater is in Central Arizona-Phoenix Source Waters?

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BACKGROUND

DEFINITIONS

Indirect potable reuse: an occurrence in any watershed for a drinking water treatment plant (DWTP) that contains discharges of wastewater

Contaminants of Emerging Concern (CECs): a term used to identify chemicals, microbes and other substances that have no regulatory standard, have been recently "discovered" in natural streams, and potentially cause harmful effects at environmentally relevant concentrations.

SIGNIFICANCE

The goal of this summer project was to quantify the percentage of wastewater effluent throughout Central Arizona-Phoenix source waters by analyzing sucralose as a wastewater tracer. Due to the persistence of sucralose in the environment it has been analyzed as a tracer of wastewater effluent. The Colorado River contains 1-2% wastewater from Las Vegas downstream of Lake Mead, and additional wastewater contributions in Lake Havasu increase the percentage – during average flow conditions. During drought conditions, Colorado River water may contain 14% wastewater at Lake Havasu. Throughout the southwest, stress on water resources will increasingly contain larger percentages of wastewaters effecting water quality. This project will quantify the extent to which wastewater effluents are present throughout Phoenix water sources during the summer months of 2012.

APPROACH

- 1-Liter grab samples collected from:
  - Wastewater Treatment Plant effluent
  - Central Arizona Project (CAP) Canal
  - Salt and Verde River System
- Samples concentrated by solid phase extraction (SPE)
- Sucralose analyzed by liquid chromatography mass spectrometry (LC/MS)
- Average sucralose concentrations from 3 WWTPs used to calculate the percentage of wastewater in all field samples

VALLEY-WIDE STUDY

ANALYSIS OF SUCRALOSE AS A WASTEWATER TRACER

WWTP Effluent Samples	Sucralose (ng/l)
Phoenix Metro Area WWTP #1	1800
Phoenix Metro Area WWTP #1 DUP	1700
Phoenix Metro Area WWTP #2	1870
Phoenix Metro Area WWTP #2 DUP	1840
Phoenix Metro Area WWTP #3	2000
Phoenix Metro Area WWTP #3 DUP	1774
Average WWTP Sucralose Concentration	1831

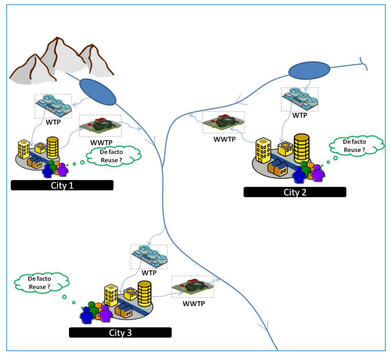


Figure 1: Illustration of Indirect Potable Reuse

SAMPLING SITES

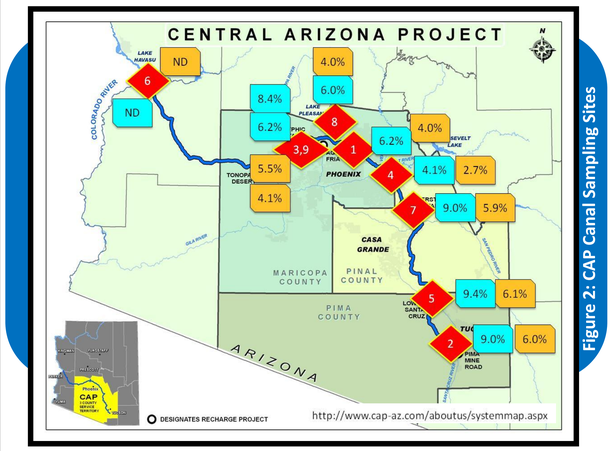


Figure 2: CAP Canal Sampling Sites

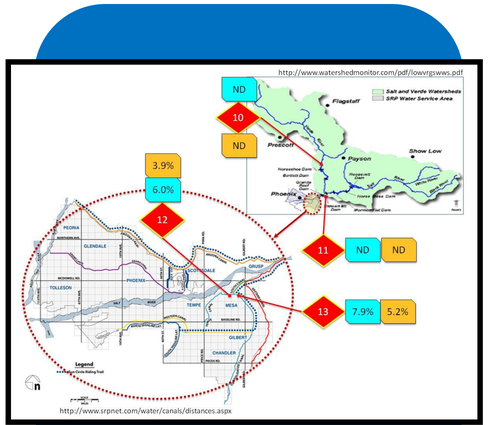
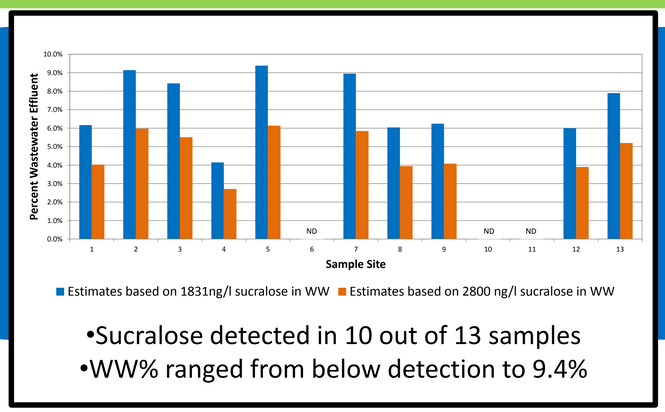


Figure 3: Salt and Verde Watershed Sampling Sites

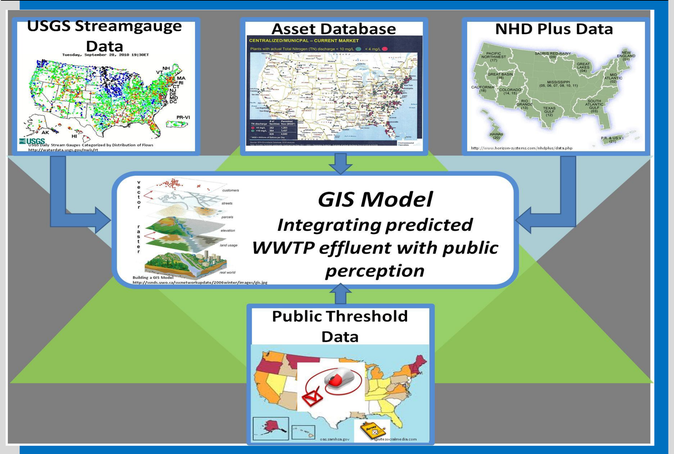
Estimate derived using the average WWTP tracer concentration from this analysis
Estimate derived using average value from a previous study, Torres et. al (2800 ng/l)

RESULTS



- Sucralose detected in 10 out of 13 samples
- WW% ranged from below detection to 9.4%

ONGOING APPROACH



Geographical Information Systems (GIS) Model

Developed utilizing vector and raster layers from several sources (Figure 2). The underlying mathematical basis for the model is a mass balance linked to online river flow data.

Validation through the Analysis of Sucralose

Grab samples to be taken at selected WTP intakes. Samples will be prepped and are to undergo Solid phase extraction (SPE), extracts to be analyzed through liquid chromatography-mass spectrometry LC/MS.

Temporal Variations

Streamgauge data obtained from the USGS will be used to assess the changes in wastewater effluent percentages, due to seasonal river flows and wastewater flows.

Social Survey

National web survey to be conducted on the Survey Monkey site. STATA will be utilized to perform a multiple regression analysis.

ACKNOWLEDGEMENTS

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