

BACWA Hot Topics: Contaminants of Emerging Concern

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January 10, 2020

CEC and Microplastic Team at SFEI



Contaminants of Emerging Concern

Pesticides



William Duke,
NYTimes

PFOS
PFAS

PBDEs &
Flame
Retardants

Microplastics

Anticipating the Next Silent Spring



Reactionary
monitoring

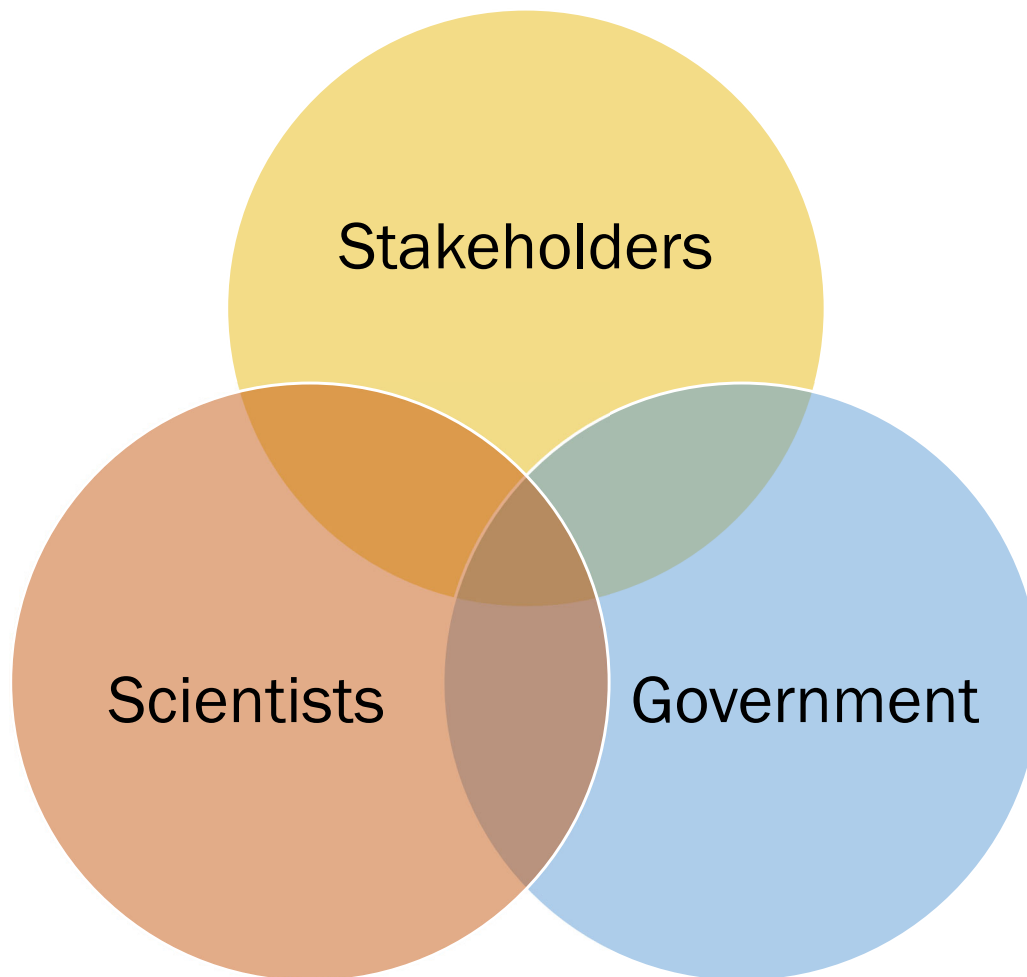


Anticipatory
monitoring



Regional Monitoring Program

Partnership to monitor the health of San Francisco Bay in support of management decisions



Implemented by

SFEI | AQUATIC
SCIENCE
CENTER
SAN FRANCISCO ESTUARY INSTITUTE & THE AQUATIC SCIENCE CENTER



Monitoring San Francisco Bay



Bivalves



Fish



Bird Eggs



Mammals

Tiered risk-based framework

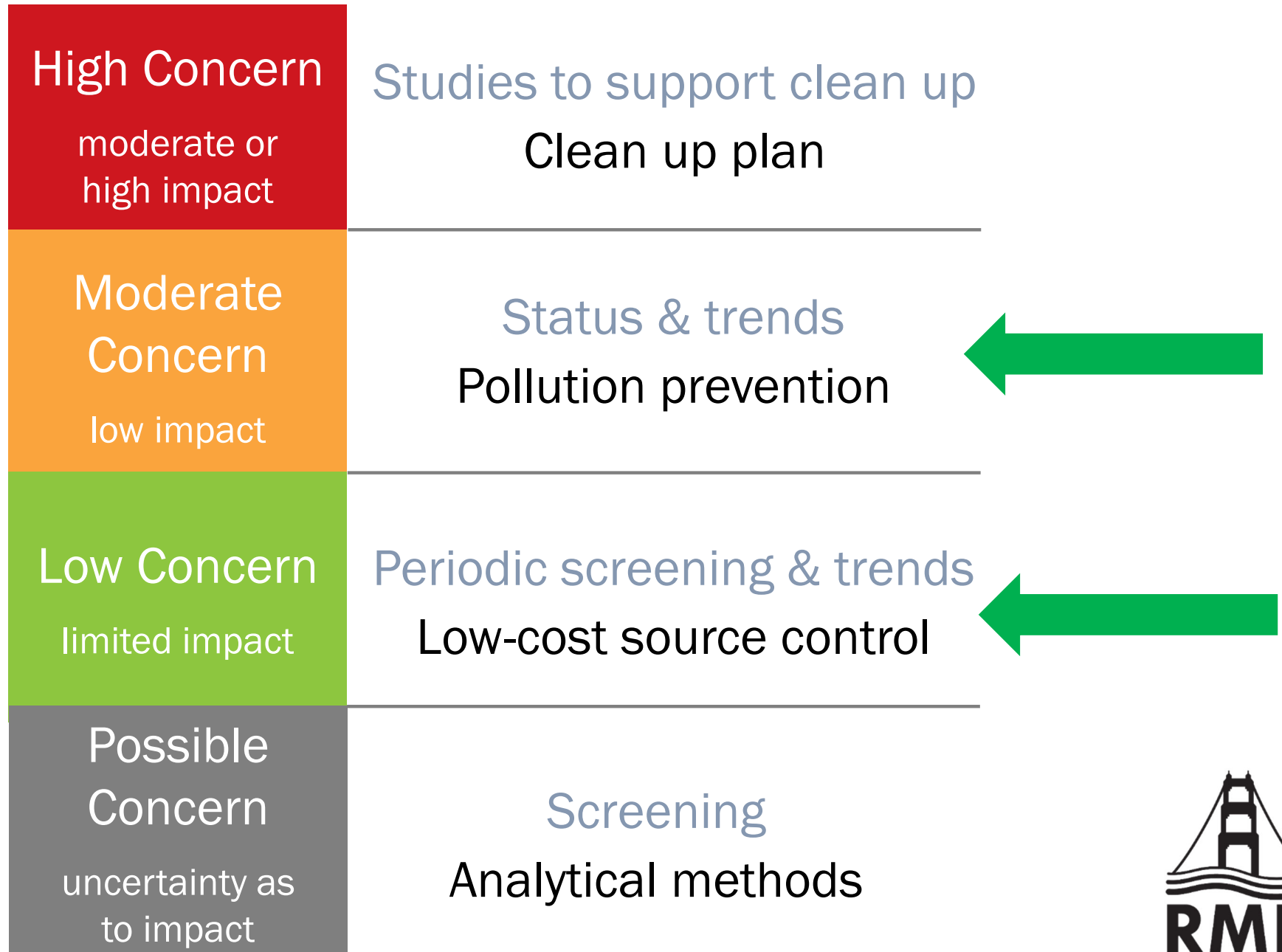
High Concern

moderate or
high impact

Bay levels above
observed effects



Monitoring & management actions



Presentation Outline



1. Microplastics

2.
PFOS
PFAS

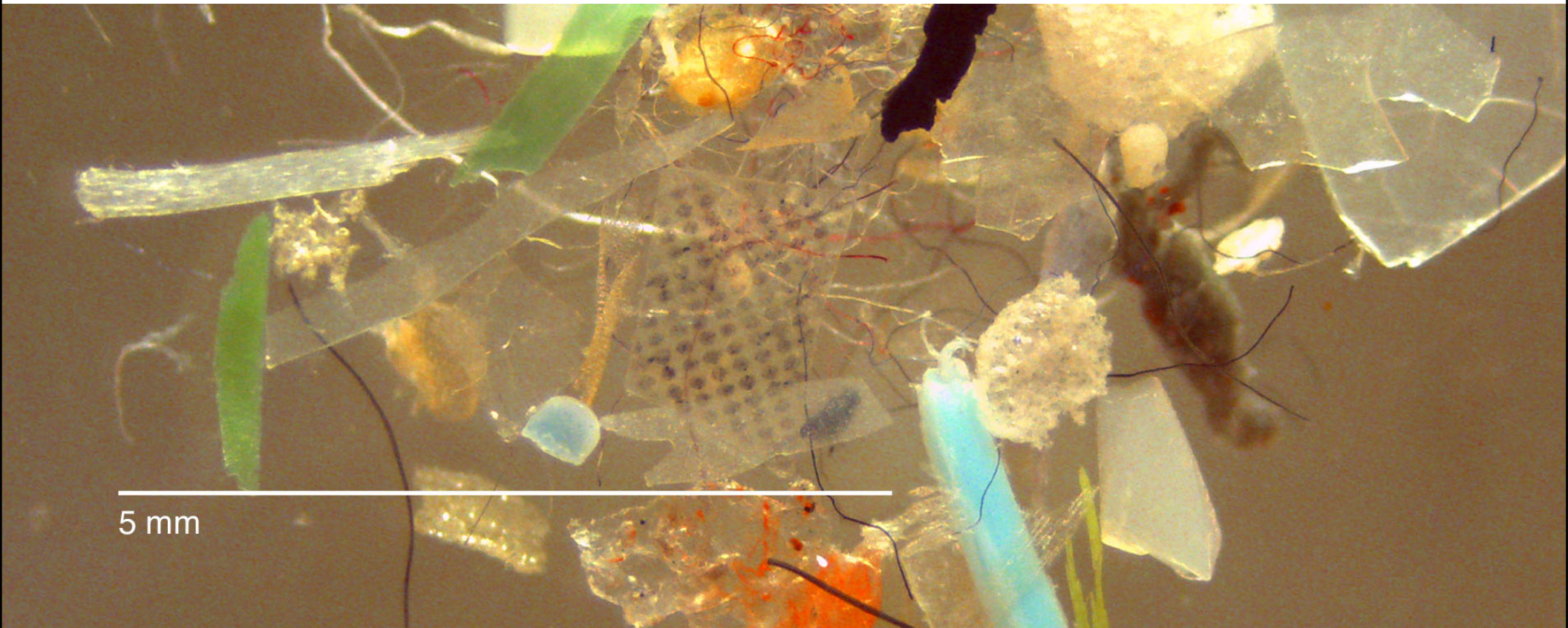
3.
Wastewater
Monitoring

4. CEC
Synthesis



What are microplastics?

Particles of plastic smaller than **5 mm**



Impacts to Wildlife



Zooplankton *Centropages typicus*

Cole et al. 2013

Microplastics Study

First comprehensive regional study

SFEI



GORDON AND BETTY
MOORE
FOUNDATION



San Francisco Bay Study Design

Bay Monitoring

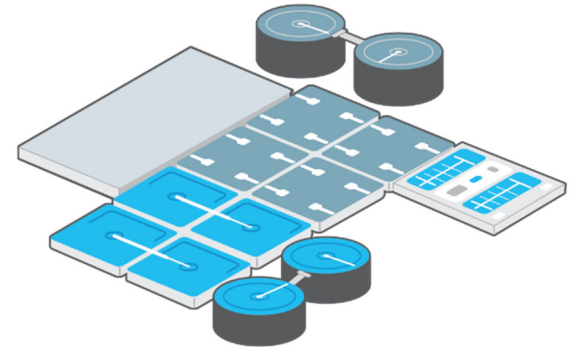
Ocean

Fish

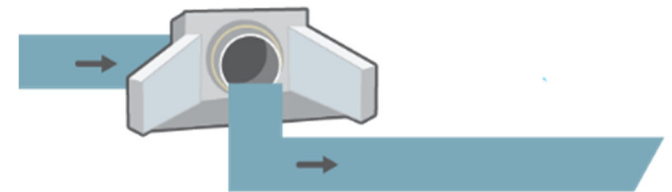
Water

Sediment

Pollution Pathways



Wastewater



Stormwater

Transport Model



UCDAVIS

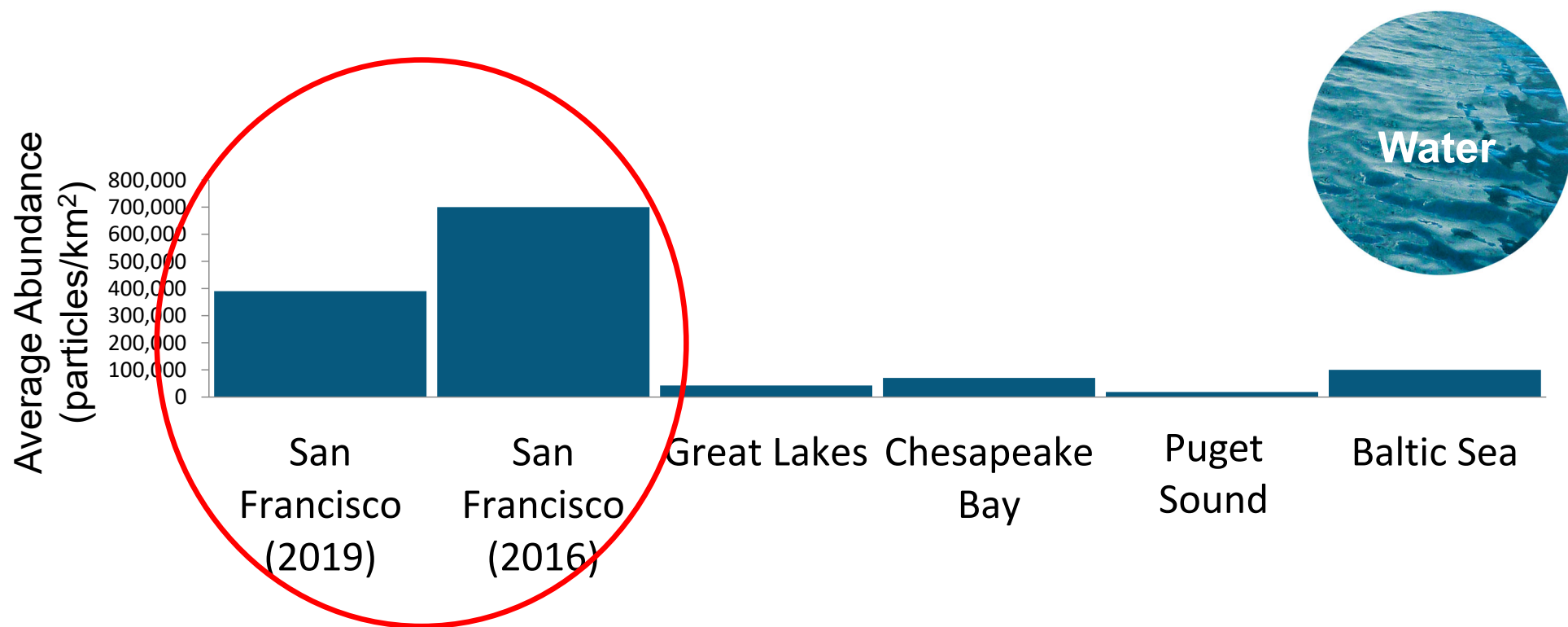
CENTER FOR
WATERSHED SCIENCES

Microparticles and Microplastics

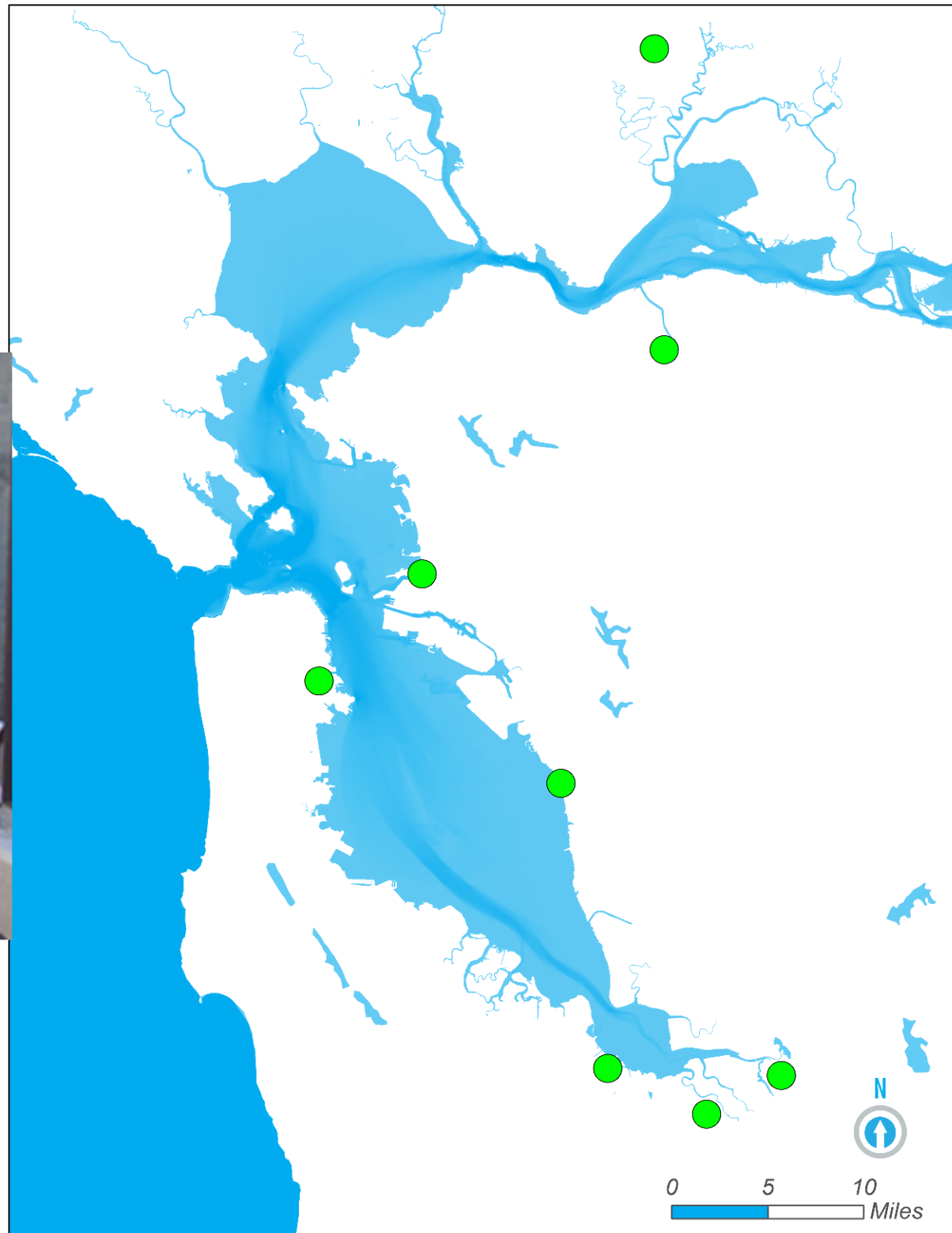
Sorted → Characterized
Microparticles → FTIR / Raman
Microplastics



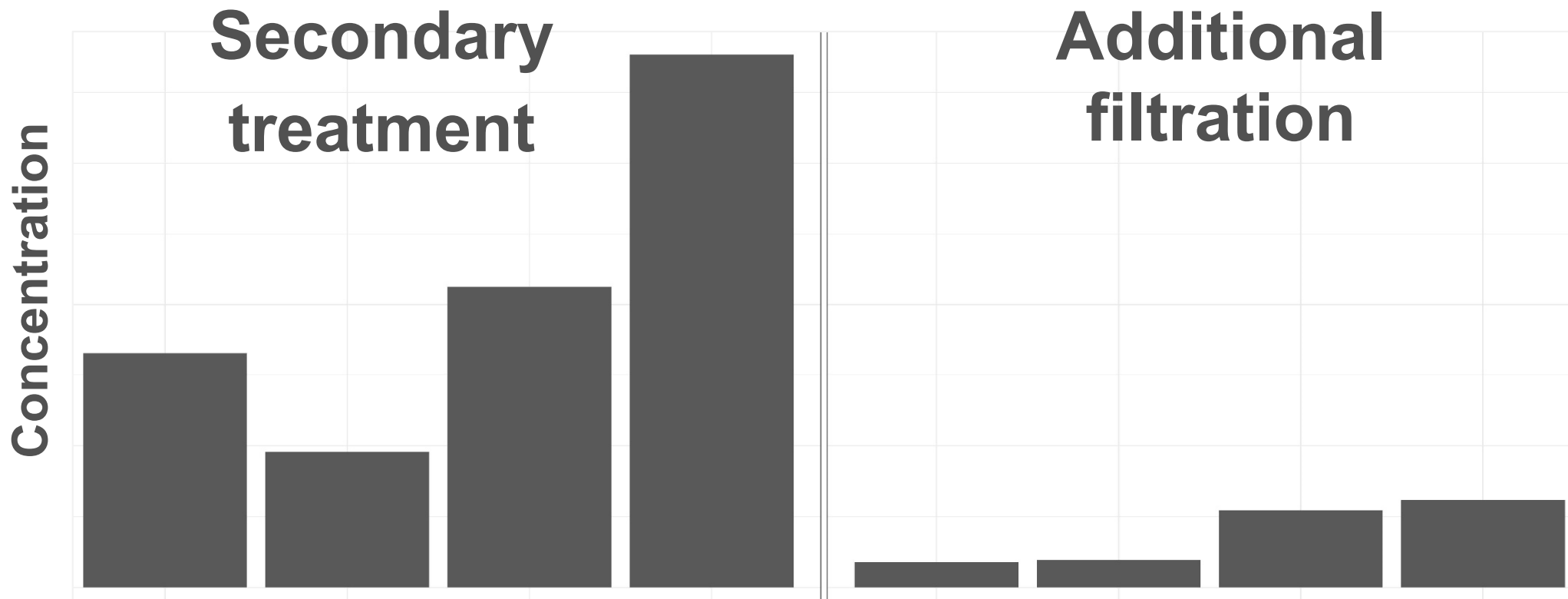
Bay microparticle levels higher than other urban coastal areas



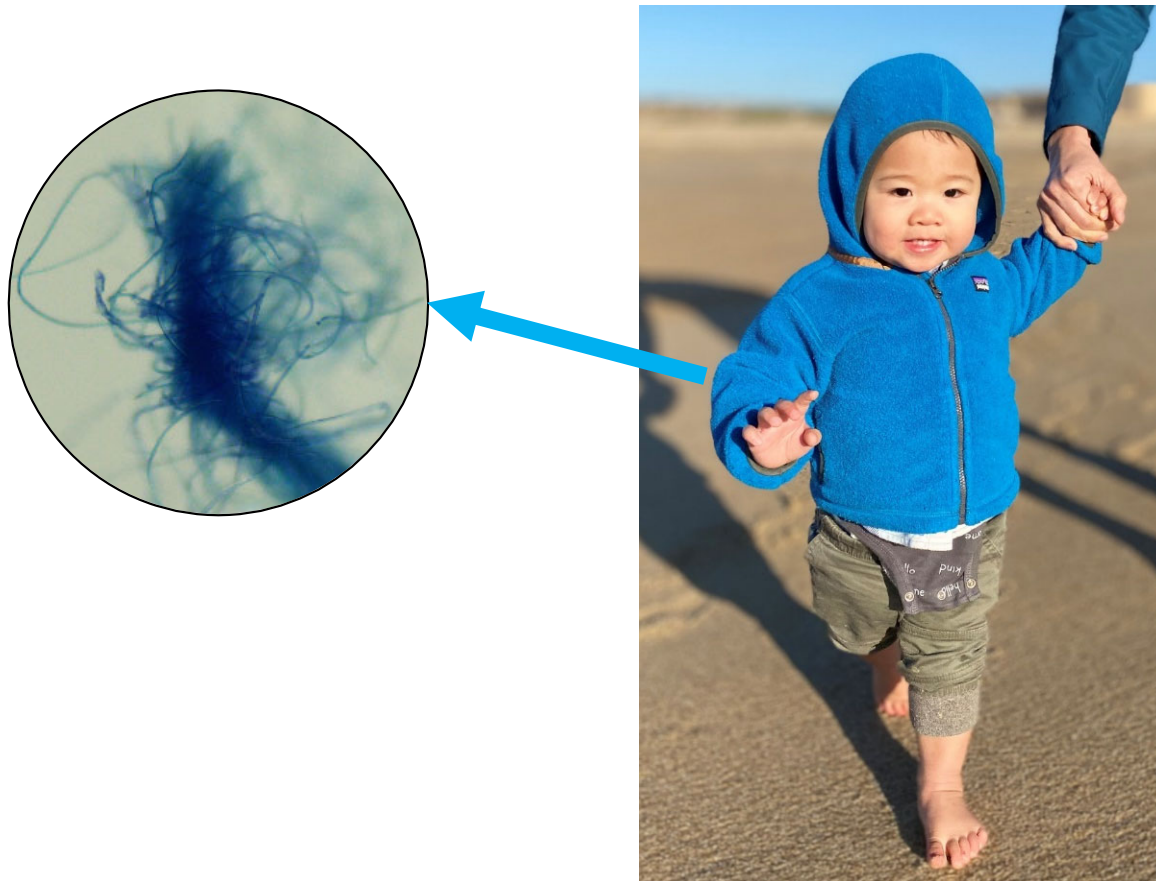
Wastewater Sampling



Facilities using additional filtration release lower levels

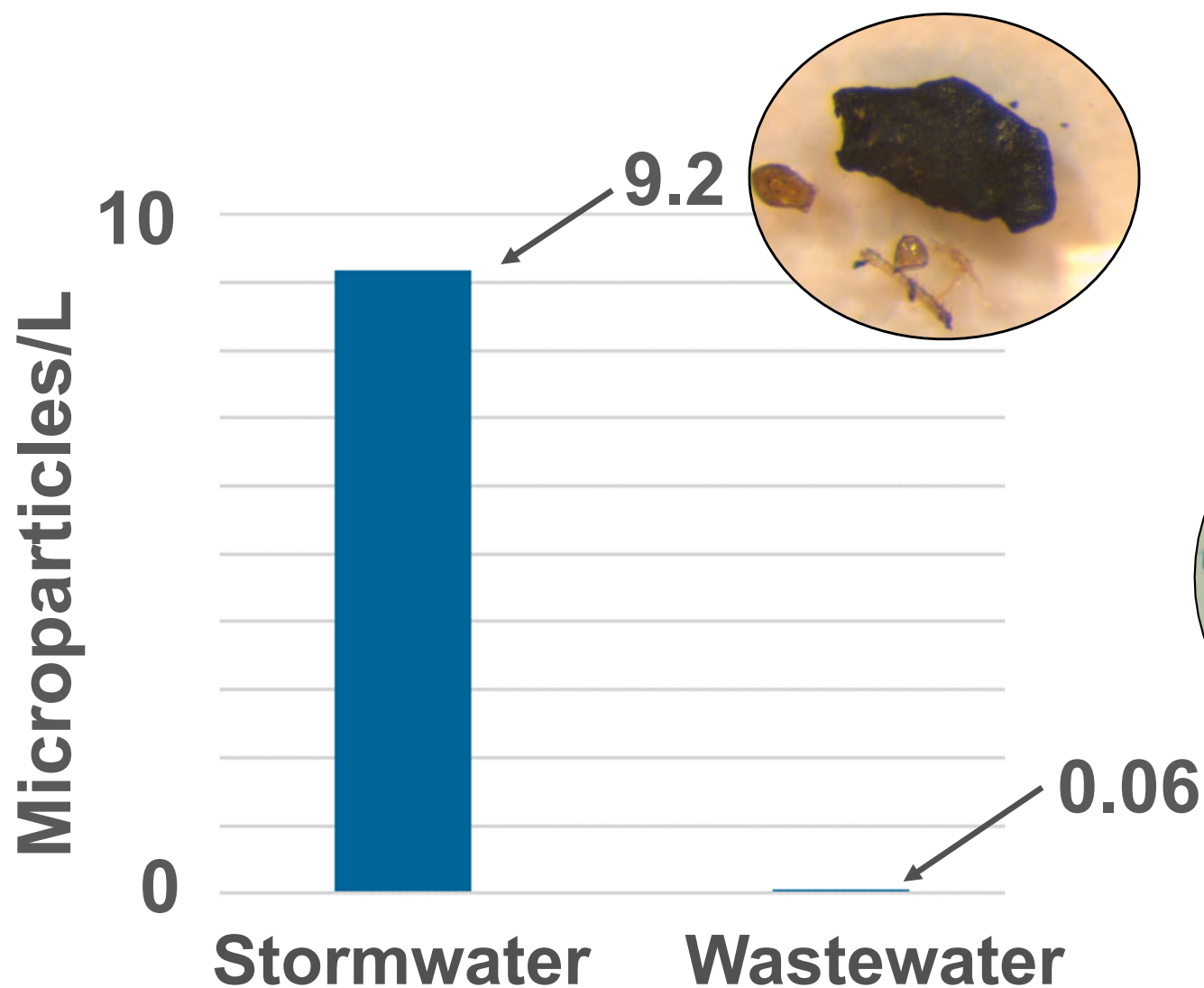


Fibers were most abundant in effluent samples



- **Average 0.06 microparticles / L**

Average microparticle abundance is greater in stormwater



Stormwater Sampling

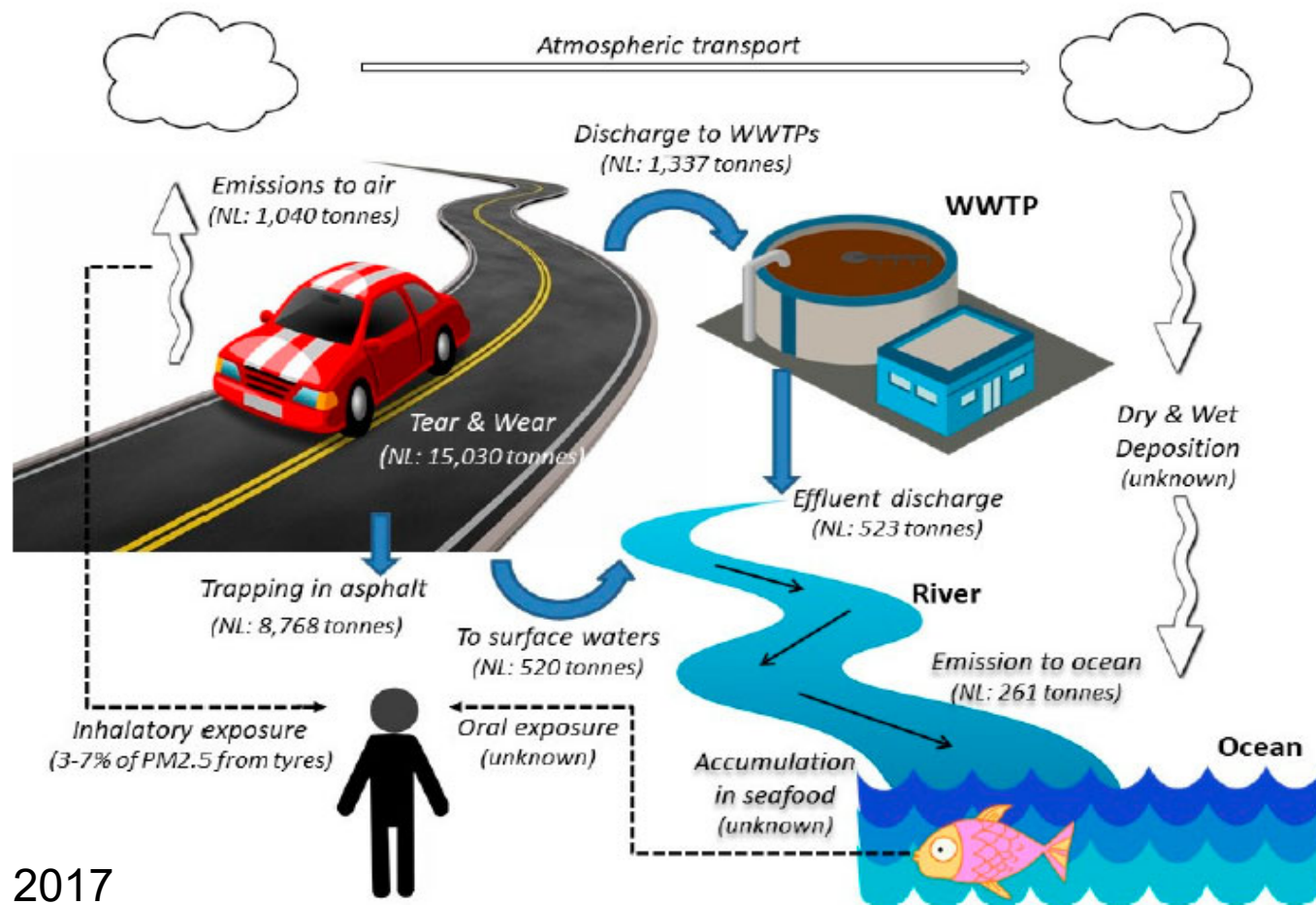


**Wastewater: 17 billion
Stormwater: 7 trillion
estimated microplastics to Bay annually**

**Stormwater load is over 300
times greater than the
wastewater
load to the Bay.**

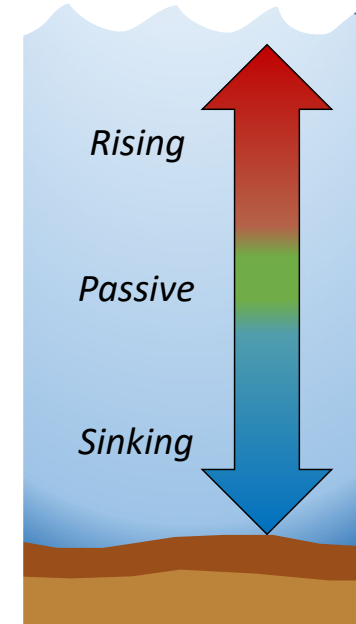
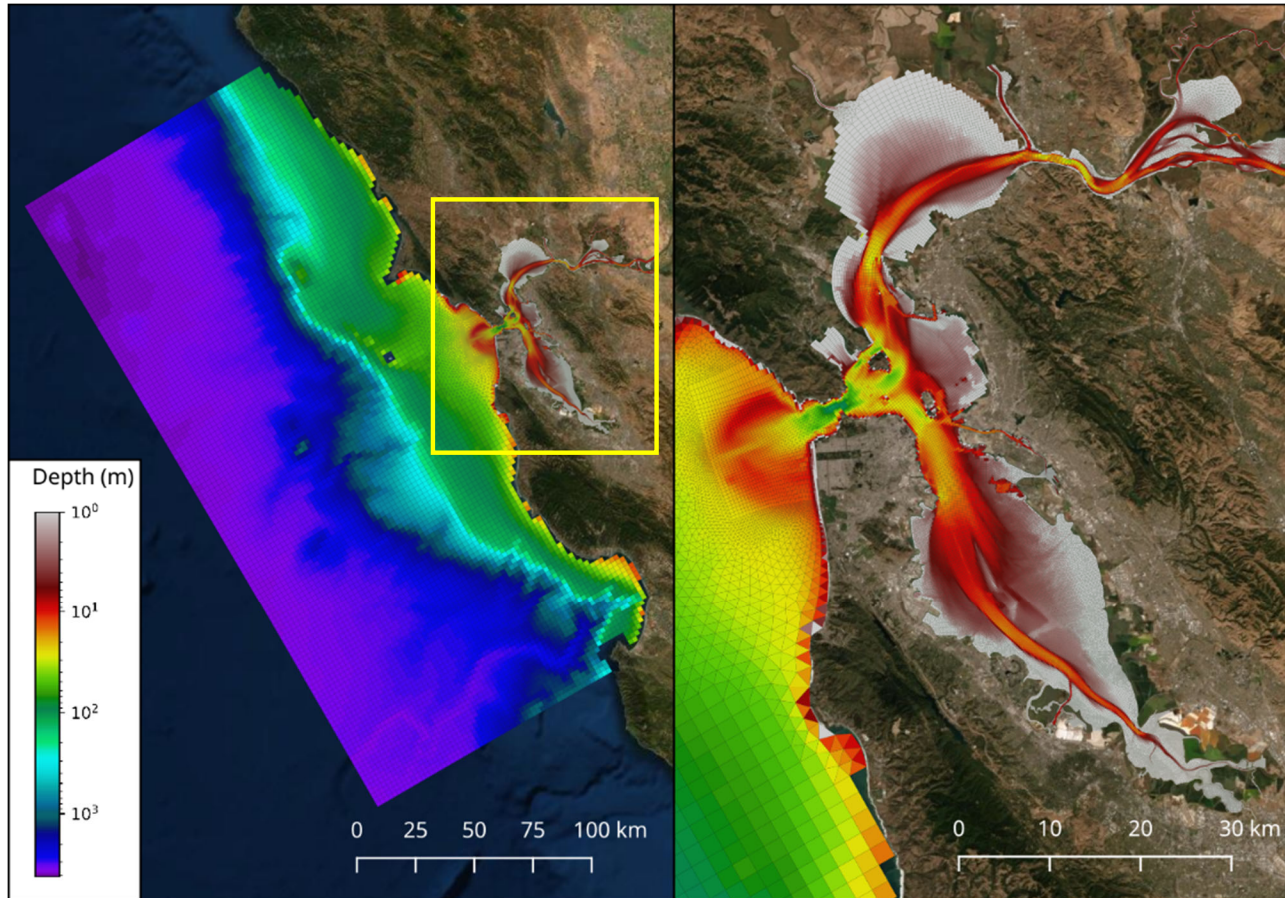


New RMP Study: Understanding Urban Stormwater

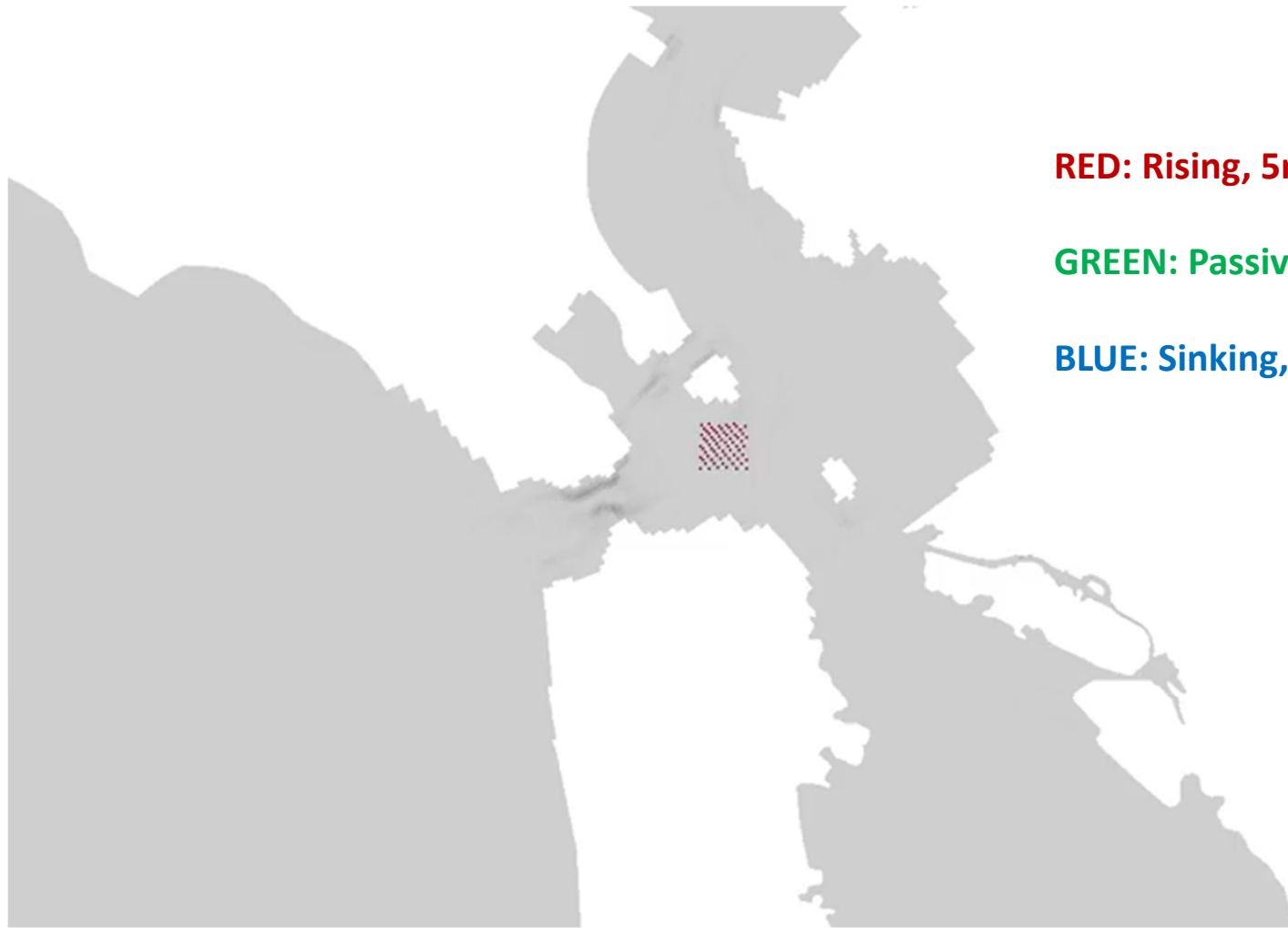


Kole et al. 2017

Transport Model



Particle Tracking: Currents + Particle Buoyancy



RED: Rising, 5mm/s

GREEN: Passive

BLUE: Sinking, 5mm/s



Presentation Outline



1. Microplastics

2.
PFAS

Poly- and Perfluoroalkyl Substances (PFASs)

Moderate
Concern

PFOA

Perfluorooctanoic acid



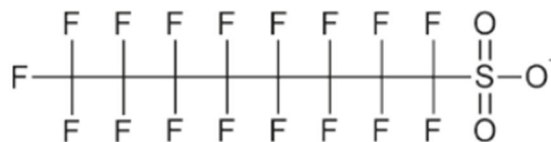
PFOS

Perfluorooctane
sulfonic acid

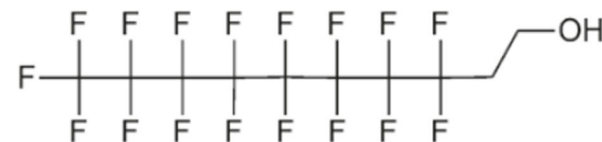




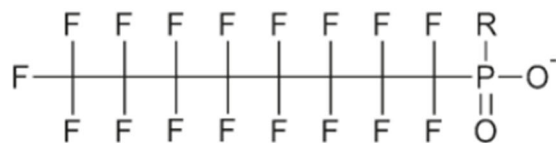
Perfluorocarboxylic acids
(ex. PFOA)



Perfluorosulfonic acids
(ex. PFOS)



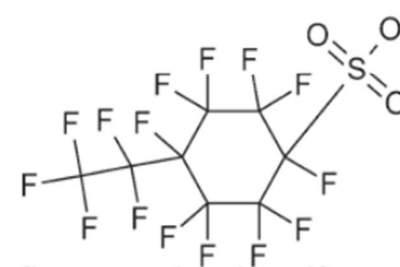
Fluorotelomer alcohol
(ex. 8:2 FTOH)



Perfluorophosphonic/phosphinic acids
(ex. If R=OH then PFOPA
If R=C8 perfluoroalkane then 8:2 PFPI)



Perfluorosulfonamide
(ex. FOSA)

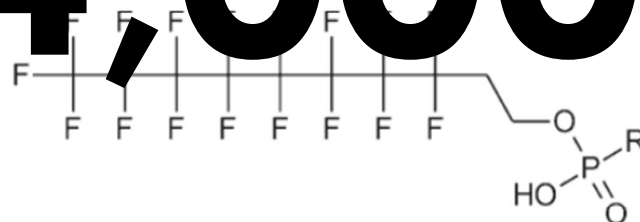


Perfluorinated cyclo sulfonates
(ex. PFECHS)

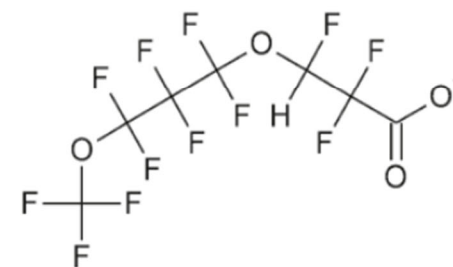
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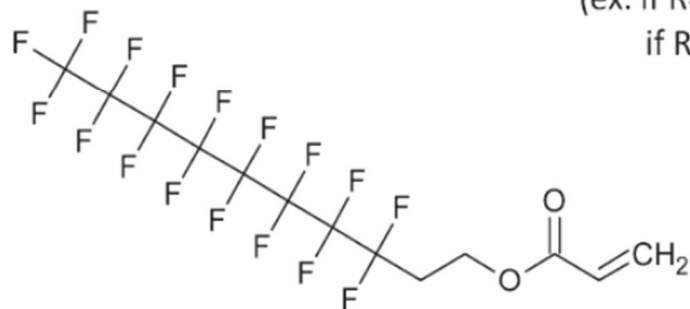
Perfluorosulfonamidoethanol
(ex. N-EtFOSE)



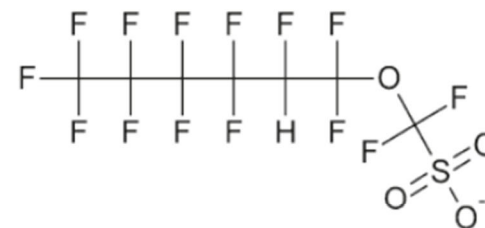
Fluorotelomer phosphate esters
(ex. if R= OH then 8:2 monoPAP
if R= 8:2 FTO ester then 8:2 diPAP)



Polyfluorinated ether carboxylates
(ex. 4,8-dioxa-3H-perfluorononanoate)



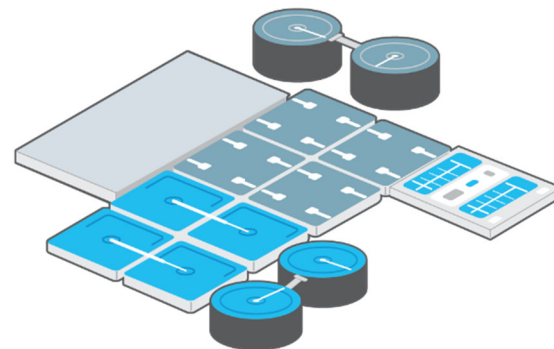
Polyfluorinated polymeric unit
(ex. 1H,1H,2H,2H-perfluorodecyl acrylate)



Polyfluorinated ether sulfonates
(ex. Perfluoro [hexyl ethyl ether sulfonate])

RMP Studies

- 2009 and 2014 Studies
- Important pathway
- Changes
 - PFOS and PFOA ↓
 - Short chain ↑
 - Many unknown PFAS present
- Airport, military, and industrial operations: high concentrations and unique profiles



Presentation Outline



1. Microplastics

2.
PFAS

3. Current
Monitoring

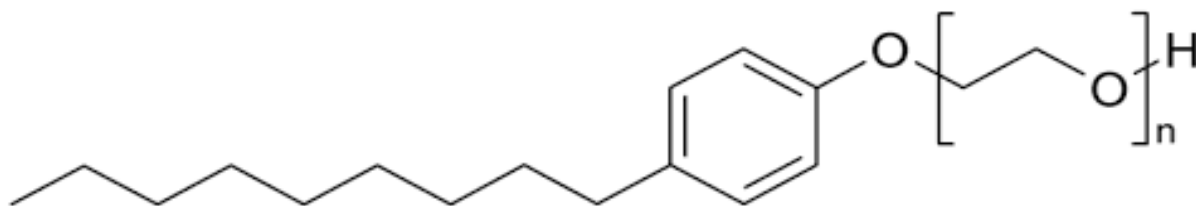
4. CEC
Synthesis



Wastewater Monitoring

- **Completed: Ethoxylated Surfactant Sampling**
- **Upcoming: Data results**

Moderate
Concern

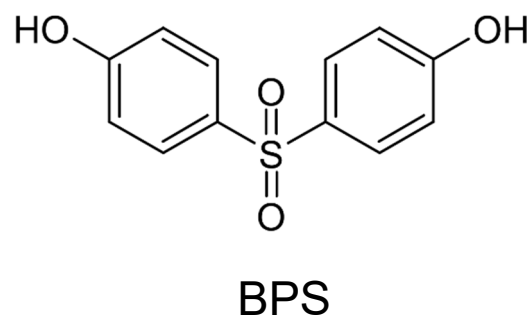
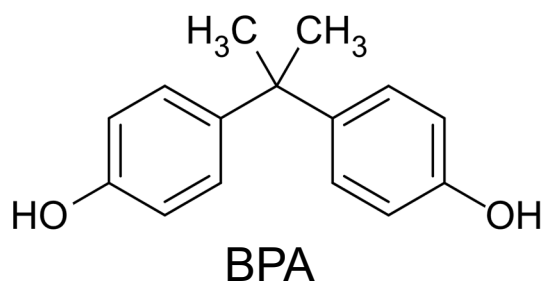


Duke
UNIVERSITY



Wastewater Monitoring

- Completed: Ethoxylated Surfactant Sampling
- Upcoming: Data results
- **Upcoming 2020: Bisphenols sampling**

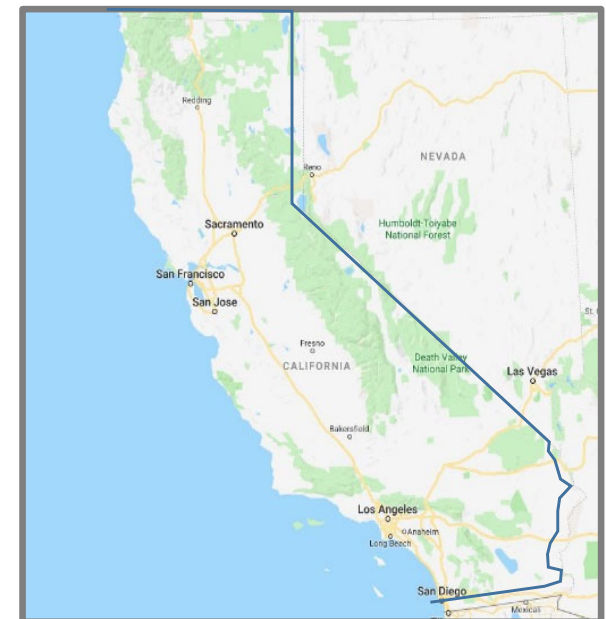


Moderate
Concern

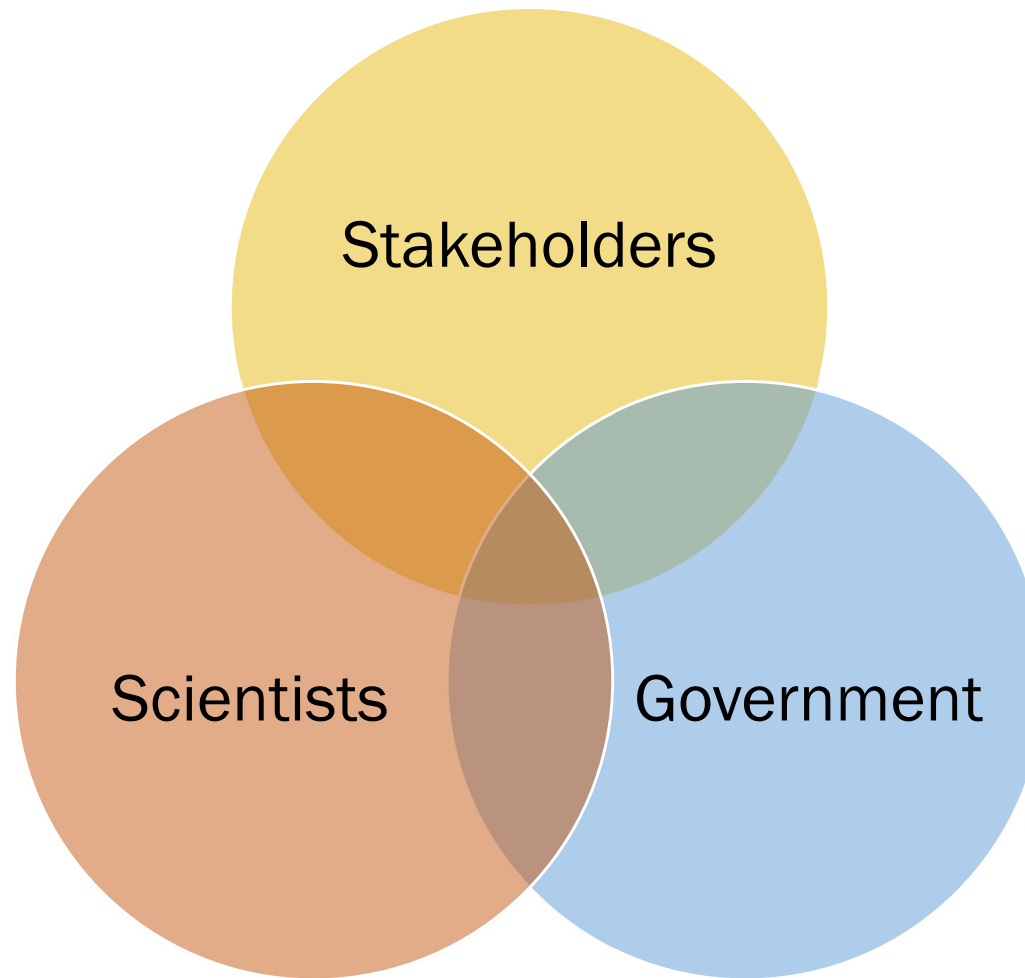


CEC Synthesis

- **Tiered risk framework**
- **Inform priorities for monitoring and management**
- **Stakeholder input on scope and priorities**
- **2-year Study**



Thank you for your support





Thank you

www.sfei.org/CECs

diana@sfei.org