Contaminants of Emerging Concern

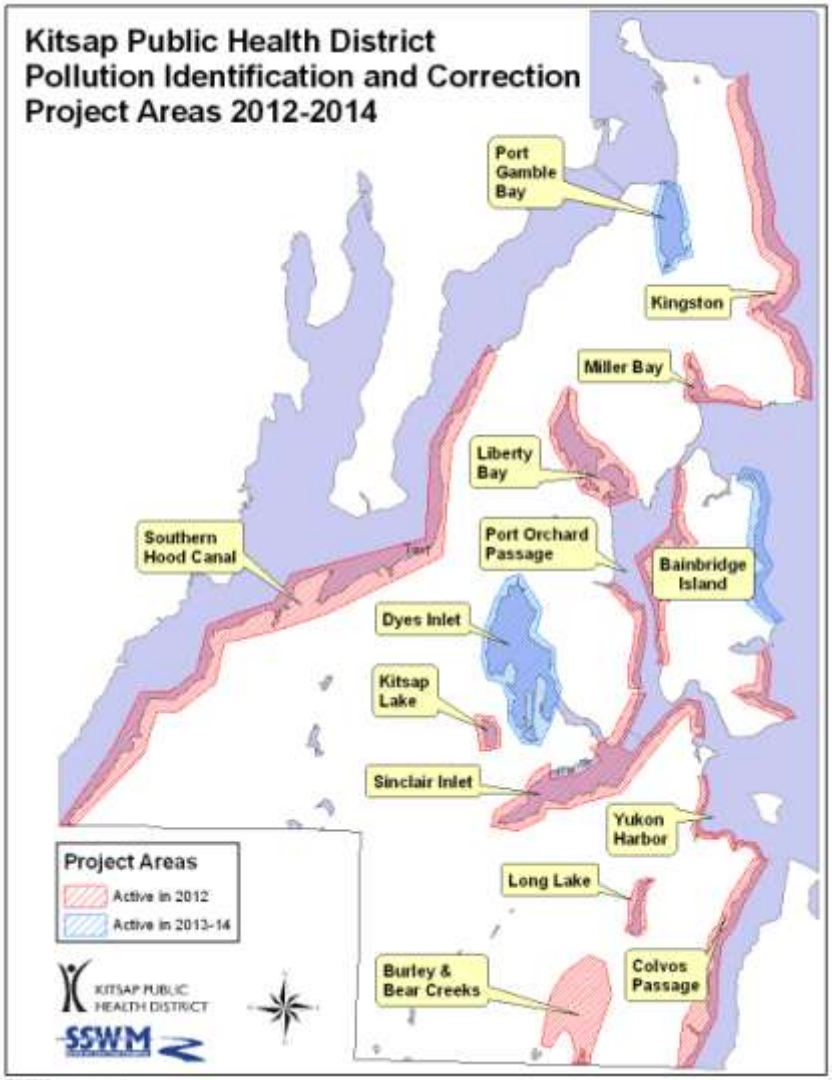
Kitsap Public Health District
UW Center for Urban Waters, Tacoma

Funded by a grant from
The Russell Family Foundation

KITSAP PUBLIC HEALTH DISTRICT

KPHD PIC Program

- Over the last 20 years;
  - 7,712 property inspections
  - 744 failing septic systems
  - 149 miles of shoreline
- Hard to find pollution sources in some areas
- Tried MST, Bacteroides
- Need a better tool



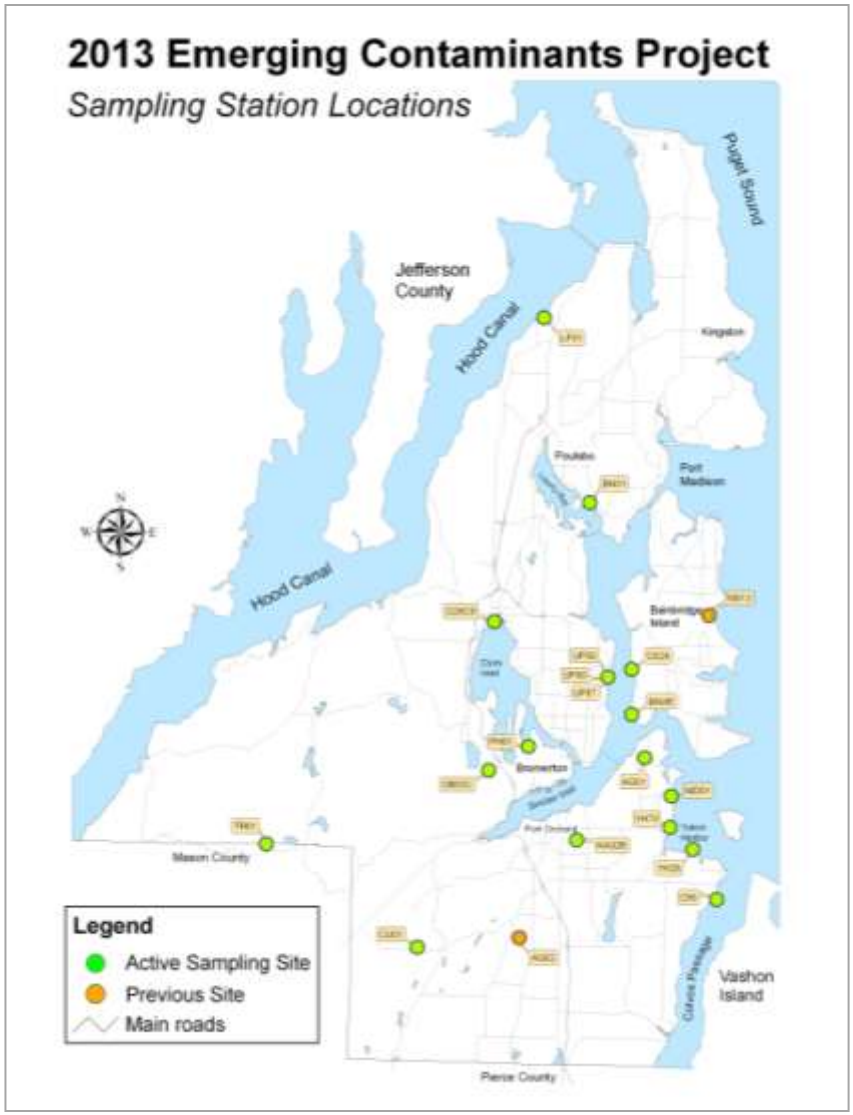
Research Project

Investigation Goal:

- Contaminants of Emerging Concern (CEC)
- Differentiate pollution from human activities?

Field work:

- 18 Sampling Sites
- 4 Sampling Events
- 6 Categories

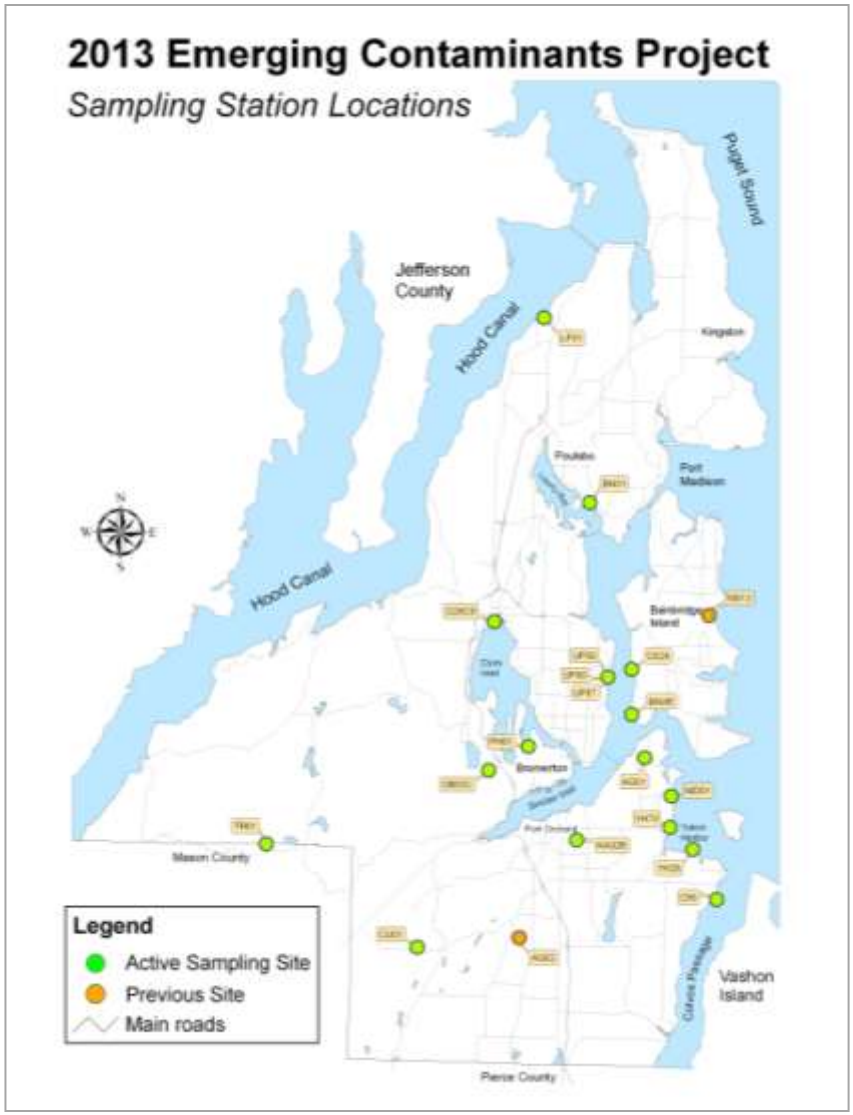


Research Project

Categories included the following:

- Background (clean)
- Agricultural sites
- Failing Septic Systems
- Suspected sewer leaks
- Unknown sources

Analyzed for 19 chemical compounds



Examples of Chemicals

- Caffeine
- Nicotine
- Sweeteners
- Pain medicines
- Herbicides

Provide “finger print” of pollution coming from human activities

Sample Collection & Analysis

- Samples collected from streams, beach seeps, and storm water outfalls
- Each sample analyzed for Fecal coliform bacteria, nitrogen, phosporous, and 19 CEC
- CEC analysis done using filtration process followed by UHPLC with tandem MS
- Compounds detected down to ng/Liter (parts per trillion)

Example Results

Kitsap Public Health/UW Emerging Contaminants Project

Sampling Event May 28, 2013

FC/110 ml	# Compounds Detected	Name	Type of Source	Nicotine Conc if >LOD (ng/L)	Sucralose Conc if >LOD (ng/L)	Carbamazepine Conc if >LOD (ng/L)	Ensulizole Conc if >LOD (ng/L)	Atrazine Conc if >LOD (ng/L)	Mecoprop Conc if >LOD (ng/L)	Ractopamine Conc if >LOD (ng/L)	Sulfamethoxazole Conc if >LOD (ng/L)	Ibuprofen Conc if >LOD (ng/L)	Cotinine Conc if >LOD (ng/L)	Paraxanthine Conc if >LOD (ng/L)	Vanillin Conc if >LOD (ng/L)	Caffeine Conc if >LOD (ng/L)	Acetaminophen Conc if >LOD (ng/L)	Methylparaben Conc if >LOD (ng/L)	Ethyl Paraben Conc if >LOD (ng/L)	Propylparaben Conc if >LOD (ng/L)	Sulfamethazine Conc if >LOD (ng/L)	Benzylparaben Conc if >LOD (ng/L)	trans-Cinnamic Acid Conc if >LOD (ng/L)	Ethyl Vanillin Conc if >LOD (ng/L)	Sulfadimethoxine Conc if >LOD (ng/L)
	Detected	METHOD LOD (ng/L)	Source	0.0367	5.5806	0.0099	0.2180	0.0194	0.0405	0.0078	0.0083	0.9738	0.3790	0.2839	54.2345	5.2708	2.5377	3.4029	1.9808	1.8493	0.0056	0.0777	4.3372	1.5909	0.1203
9	3	UP60	OSS Failure	0.06	35.4	0.022	ND	ND	NP	NP	NP	NP	NP	ND	ND	ND	ND	ND	ND	ND	NP	NP	ND	ND	ND
30	3	UP50	Greywater	ND	169	0.016	ND	ND	0.099	NP	NP	NP	NP	ND	ND	ND	NP	ND	NP	ND	NP	NP	NP	ND	ND
190	8	BW45	OSS Failure	0.323	204	0.018	0.566	ND	NP	0.02	0.06	NP	NP	ND	106	ND	ND	4.33	ND	ND	NP	NP	NP	ND	ND
120	3	CO56 AVG	OSS Failure	0.237	31.0	NP	0.252	ND	NP	ND	NP	ND	NP	ND	ND	ND	ND	ND	NP	ND	NP	NP	ND	ND	ND
180	7	MD01	Stormwater	0.939	121	0.084	0.421	0.04	2.31	0.03	ND	NP	ND	ND	ND	ND	ND	ND	ND	ND	NP	NP	ND	ND	ND
778	12	KAO2B AVG	Sewage+	1.64	88.5	ND	ND	0.03	1.83	0.01	0.09	70.2	4.10	3.07	74.9	14.00	77.05	ND	ND	ND	NP	NP	ND	ND	NP
2290	10	UP67	OSS Failure	0.322	105	2.29	1.93	0.03	NP	0.02	0.33	1.73	0.7	0.442	ND	ND	ND	ND	NP	ND	NP	NP	ND	ND	ND
2980	13	BN01	OSS Failure	46.0	24.4	0.056	1.96	ND	208	0.02	0.25	319	32.4	8.87	ND	175	10.14	ND	ND	4.60	NP	NP	ND	ND	ND
940	4	CS28	Unknown	0.106	NP	ND	ND	0.02	0.101	NP	NP	NP	NP	ND	135	ND	ND	ND	ND	ND	NP	NP	NP	ND	ND
40	9	028CS	Stormwater	1.28	52.5	2.74	0.368	0.13	0.443	0.02	0.06	NP	1.2	ND	ND	ND	ND	ND	NP	ND	NP	NP	ND	ND	NP
970	6	OBO3C	Unknown	0.527	84.0	0.026	0.294	0.25	0.516	NP	NP	NP	NP	ND	ND	ND	ND	ND	ND	ND	NP	NP	ND	ND	ND
	7	OBO3C DUP	Unknown	0.174	73.0	0.019	0.829	0.21	0.391	0.02	NP	ND	NP	ND	ND	ND	ND	ND	ND	ND	NP	NP	NP	ND	ND
780	12	YH70 AVG	OSS Failure	0.440	107	0.204	2.40	0.03	0.677	0.05	ND	315	23.7	1.63	ND	25.6	ND	ND	NP	ND	0.21	NP	NP	ND	ND
9	5	TR01	Clean	0.05	ND	0.040	ND	0.02	NP	0.02	NP	1.03	NP	ND	ND	ND	ND	ND	NP	ND	NP	NP	ND	ND	ND
9	7	CU01	Clean	0.467	14.7	ND	0.282	0.02	NP	NP	NP	1.50	NP	ND	104.7	ND	ND	3.92	ND	ND	NP	NP	ND	ND	ND
1290	14	PH01	OSS Failure	3.52	21.3	0.549	2.65	ND	2.19	0.01	5.71	50.5	2.74	7.63	ND	76.4	31.80	3.57	6.0	ND	NP	NP	ND	ND	ND
	15	PH01 DUP	OSS Failure	2.11	17.2	0.478	1.48	0.03	1.77	0.02	6.30	25.4	0.8	4.37	58.4	37.3	19.87	ND	2.2	ND	NP	NP	NP	ND	ND
390	7	LF01	Unknown	0.298	72.7	0.056	ND	1.81	9.18	NP	0.31	NP	NP	ND	65.3	ND	NP	ND	ND	ND	NP	NP	ND	ND	ND
570	7	YH28	Unknown	0.169	26.8	0.059	0.299	0.03	0.274	NP	0.38	NP	NP	ND	ND	ND	ND	ND	ND	ND	NP	NP	ND	ND	NP
		# Compounds Detected		18	17	15	14	13	13	11	9	8	7	6	6	5	4	3	2	1	1	0	0	0	0
2990		AG01		Very low flow, FC sample only																					
		Hit/Miss Ratio			Artificial sweetener used in products like Splenda	Prescription drug, antiseizure, nerve pain, and bipolar.	Used in sunscreen	Herbicide	Herbicide used on: ornamentals, sports turf, forestry, drainage ditch	Livestock growth additive	Prescription antibiotic	OTC Pain killer	Metabolite of nicotine	Metabolite of caffeine	Natural Vanilla flavoring		OTC Pain killer	Preservative used in food, medicine, and cosmetics.	Preservative used in food, medicine, and cosmetics.	Preservative used in food, medicine, and cosmetics.	veterinary antibiotic	Preservative used in cosmetics.	Used in flavorings, medicines and perfumes.	Vanilla substitute	veterinary antibiotic

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Example Results

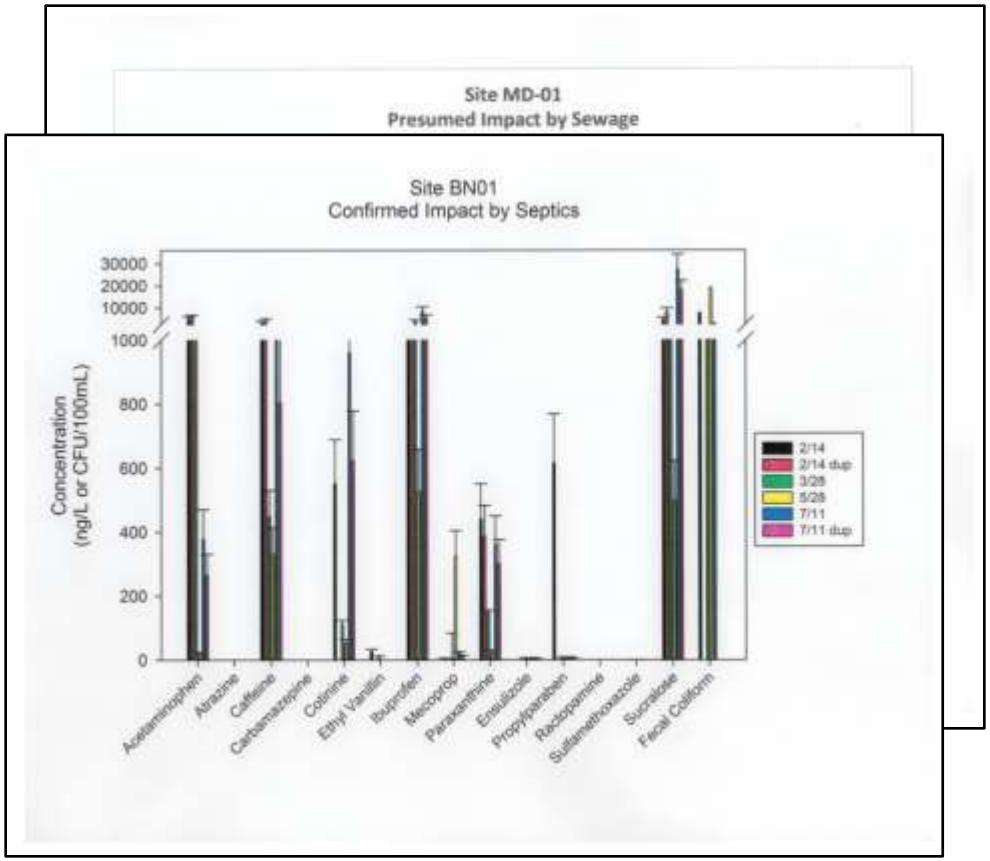
Pathways make a difference:

- Stormwater

  (over land flow mixed with water)

- Direct Discharge

  (end of pipe, no degradation or dilution)



Summary of Findings

- Some CEC compounds are persistent and widespread, while others are rarely detected.
- Depends on source, pathway, and site conditions
- No one compound is adequate to identify human impact
- A group of CEC show potential correlation
- Additional compounds may be useful as indicator if sufficiently elevated above background
- Need to further refine which compounds and concentrations work best for different conditions

Questions?

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Example results – a closer look

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		METHOD LOD (ng/L)		**0.0367**	**5.5806**	**0.0099**	**0.2180**	**0.0194**	**0.0405**	**0.0078**	**0.0083**	**0.9738**	**0.3790**	**0.2839**	**54.2345**	**5.2708**	**2.5377**
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