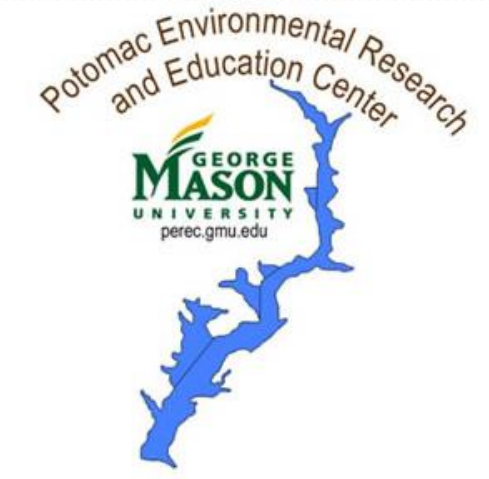
An Ecological Study of Hunting Creek 2013-2016



- **Potomac Environmental Research and Education Center**
- **http://cos.gmu.edu/perec/**
- George Mason University

In Collaboration with

Alexandria Renew Enterprises

Study Setting

- The study site it located on the tidal Potomac portion of the Chesapeake Bay system
- Hunting Creek is a half-moon shaped bay located just downstream of the Woodrow Wilson Bridge
- It is bounded on the west by the George Washington Memorial Parkway and has a large opening on the east directly to the Tidal Potomac mainstem

Hunting Cr.

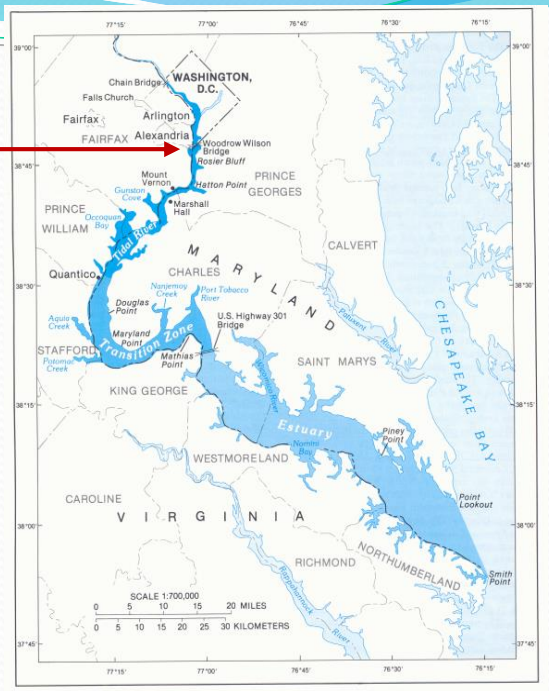
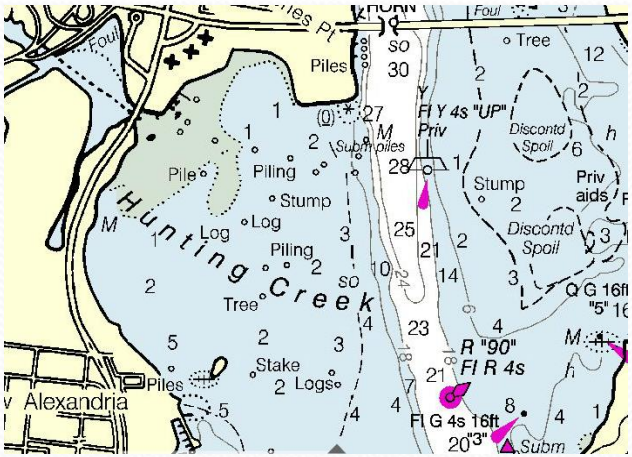
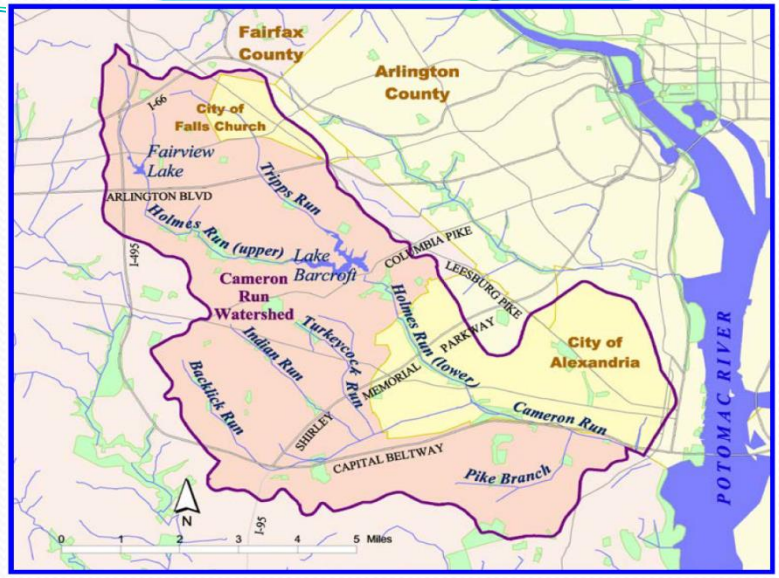


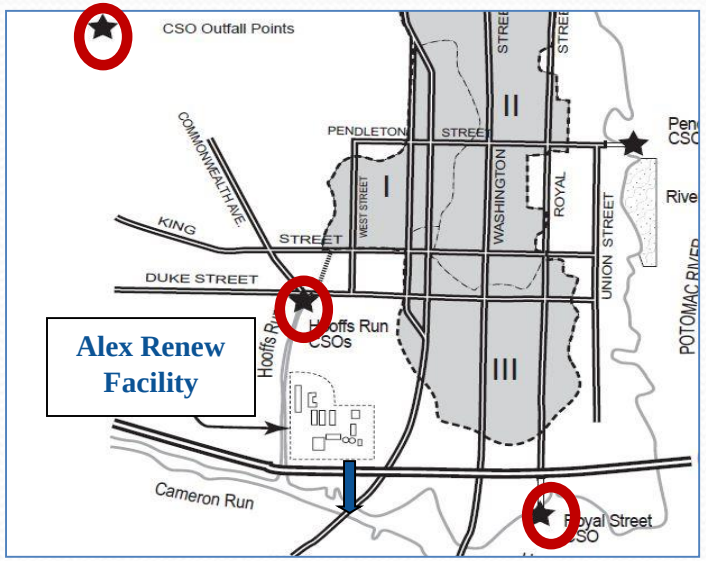
Figure 2. The tidal Potomac River and Estuary.



Study Setting

- The Hunting Creek embayment receives direct runoff from the Cameron Run Watershed
- This watershed includes portions of the City of Alexandria, Fairfax County, and the City of Falls Church
- The watershed is dominated by urban land uses
- There are also two combined sewer outfalls: one on Hoofs Run that enters Cameron Run and the Royal St CSO that enters directly into the very shallow northern end of Hunting Creek





Goals of Study

- To assess the Status and Long-Term Trends in Water Quality and Biological Resources in Tidal Hunting Creek and its Tributaries

Potential Water Quality Concerns

- Eutrophication
  - Excess growths of primary producers especially phytoplankton algae in response to nutrient loading from POTW's and nonpoint sources
  - May cause dissolved oxygen depletion, poor water clarity and biological resource changes
- Poor Water Clarity
  - Impairs recreational uses and biological resources
  - Due to excess phytoplankton as well as urban nonpoint and streambank erosion

Potential Water Quality Concerns

- Fecal bacteria contamination
  - E. coli standards may be exceeded owing to combined sewers and urban nonpoint sources
  - May impair recreational uses
- Organic micropollutants
  - Vast array of organic chemicals such as polychlorinated biphenyls (PCB's), pesticides, pharmaceuticals, and endocrine disrupting chemicals (EDC's)
  - May impair recreational uses, fish consumption, and other biological resources

Potential Biotic Resource Concerns

- Fish Habitat and Utilization
  - Tidal open water areas
  - Tidal shallow water areas
  - Head of tide areas
- Other Biotic Resources
  - Fish Food organisms such as Benthos and Zooplankton
  - Submersed Aquatic Vegetation (SAV)

Study Design

- Recognizes spatial and seasonal variation in water quality and biotic resources
- Balances need for comprehensive information with costs of sampling and analysis
- Where appropriate sampling to address multiple concerns is merged to save costs of field deployments

Water Quality Sampling

- Semi-monthly April – September to address seasonal variation
- Multiple sites to address general spatial variation
- Data mapping on selected dates to address fine scale spatial variation

Water flows in blue

Semi-Monthly Sites in Red

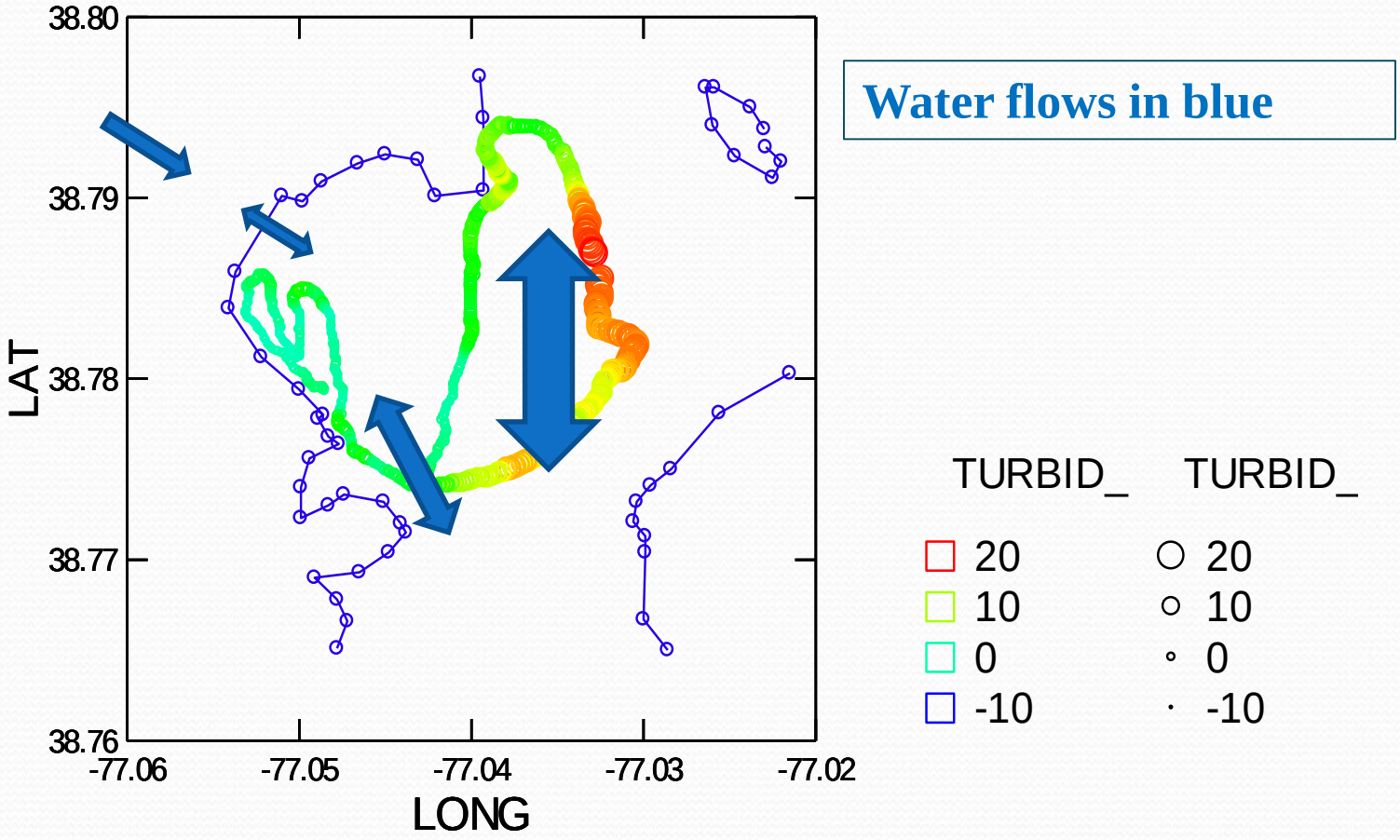
+1 semi-monthly site was located in the river channel

+2 semi-monthly sites are located in the Hunting Creek Embayment

+1 semi-monthly site at the GW Parkway Bridge

Water Quality Sampling*

- Data mapping on selected dates to address fine scale spatial variation (below Turbidity was measured at 15 second intervals moving slowly through the study area)

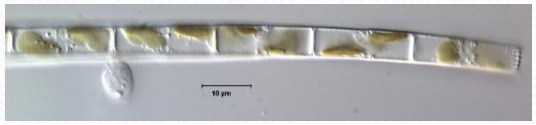


Parameter Selection for Water Quality Sampling

- Sonde Water Quality Variables (in field): Temperature, Specific Conductance, DO, pH, Turbidity, Chl a, Secchi depth, Light attenuation coefficient
- Lab Water Quality Variables (Alex Renew): NH_3-N, NO_3-N, NO_2-N, Organic N, Total P, Ortho P, BOD, TSS, VSS, alkalinity

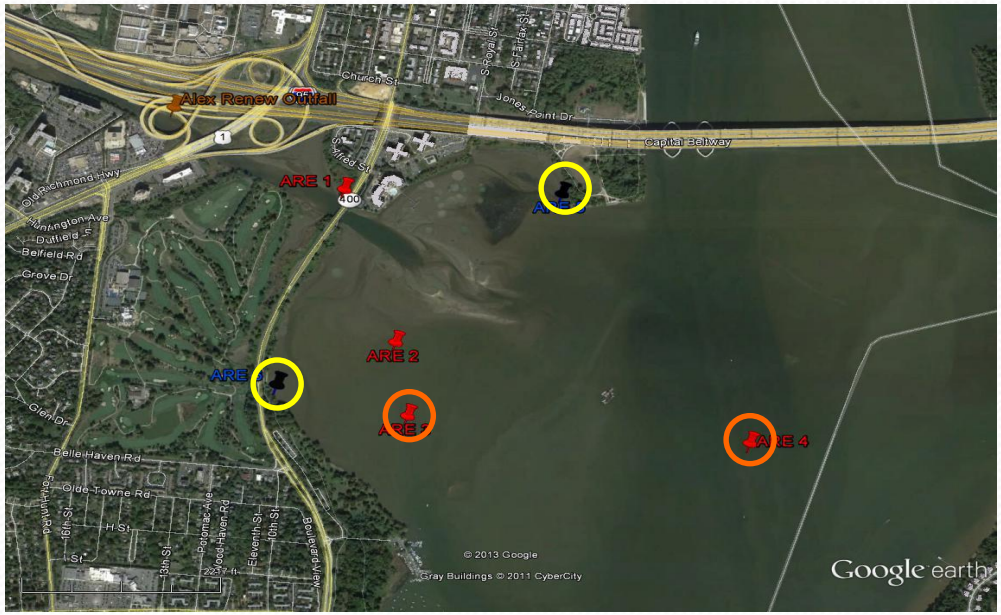
Parameter Selection for Water Quality Sampling

- Lab Water Quality Variables (GMU): E. coli, Chl a, TSS, VSS, phytoplankton cell density and biomass by taxon
- Lab Biotic Resource Variables (GMU): Zooplankton density by taxon, Benthos diversity by Taxon



Fish Sampling

- Semimonthly seines and trawls April – September to address seasonal variation
- Multiple sites for each to address spatial variation



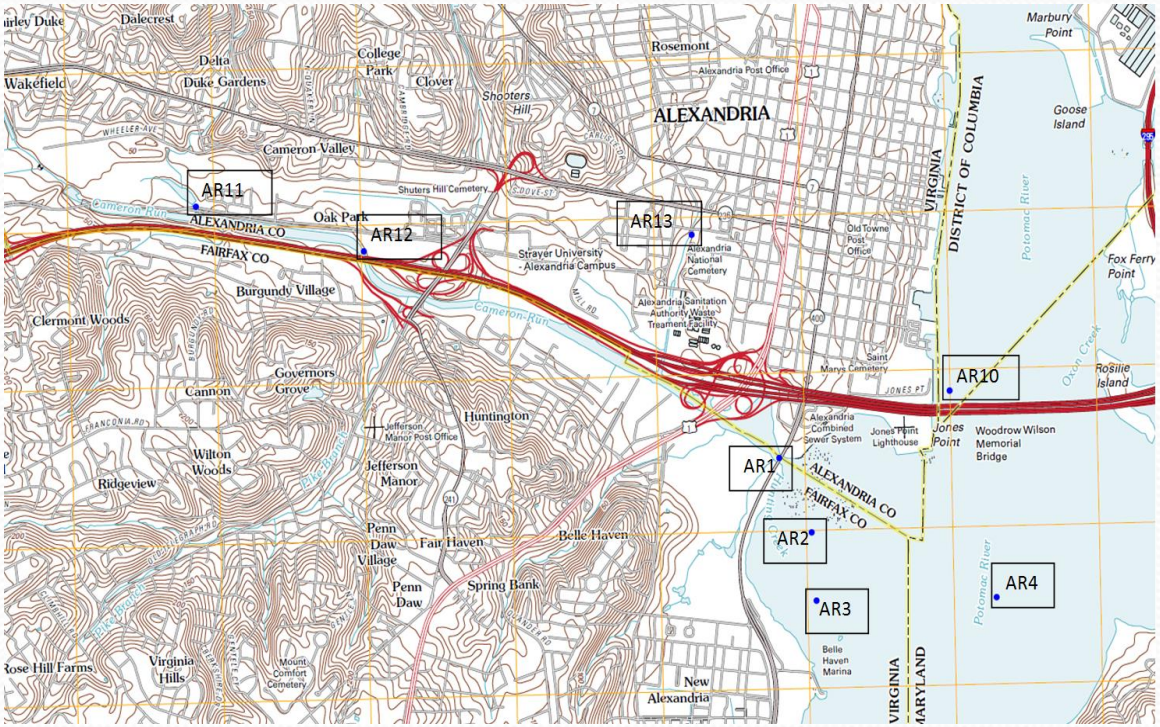
Seine sites shown with yellow circles
Trawl site shown with orange circles

Fish Sampling

- Intensive sampling at Head of Tide site March – May to address anadromous fish spawning utilization

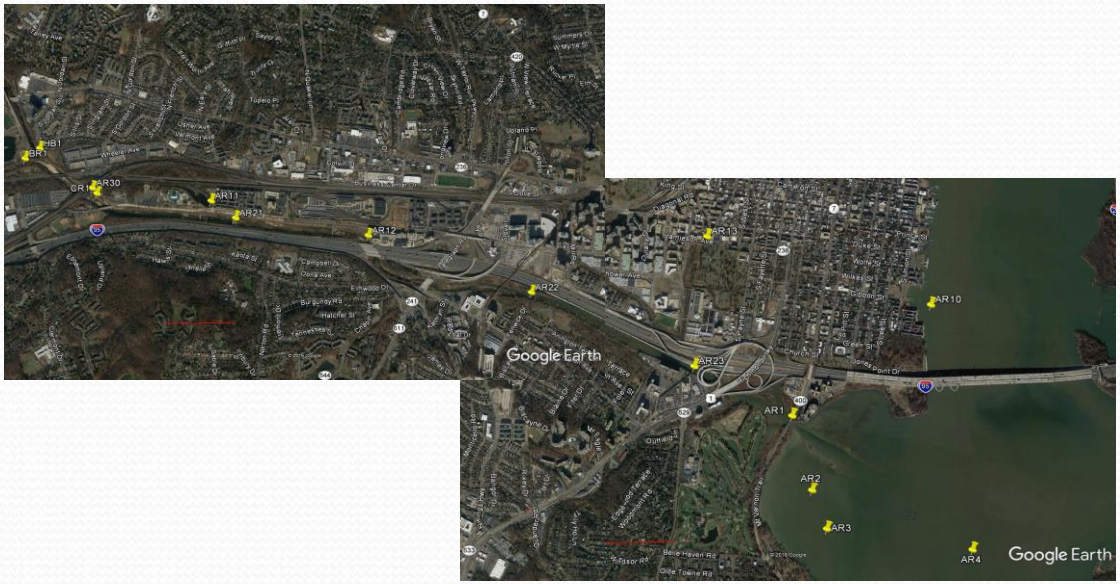
E. coli Sampling

- Similar temporal and spatial regime to basic water quality sampling but tributaries emphasized



E. coli Sampling

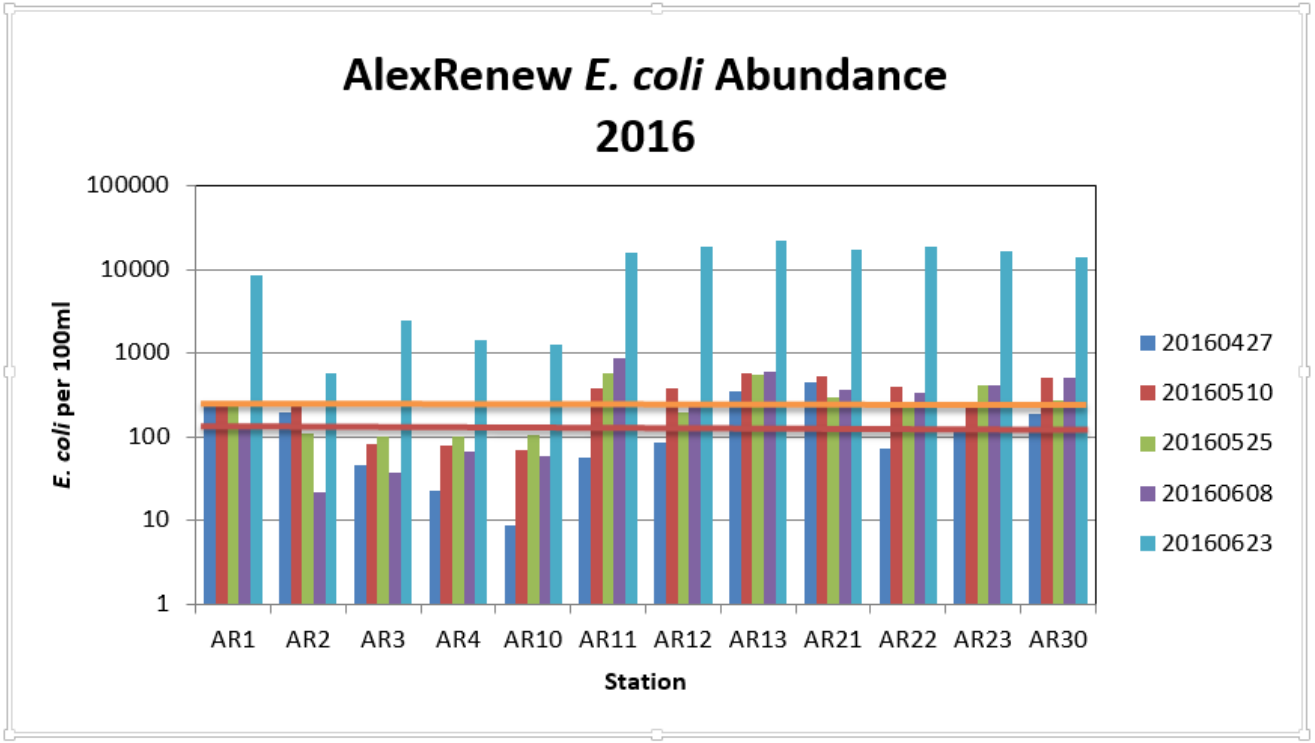
- Expanded in 2016 & 2017



E. coli Sampling

- First Half of 2016

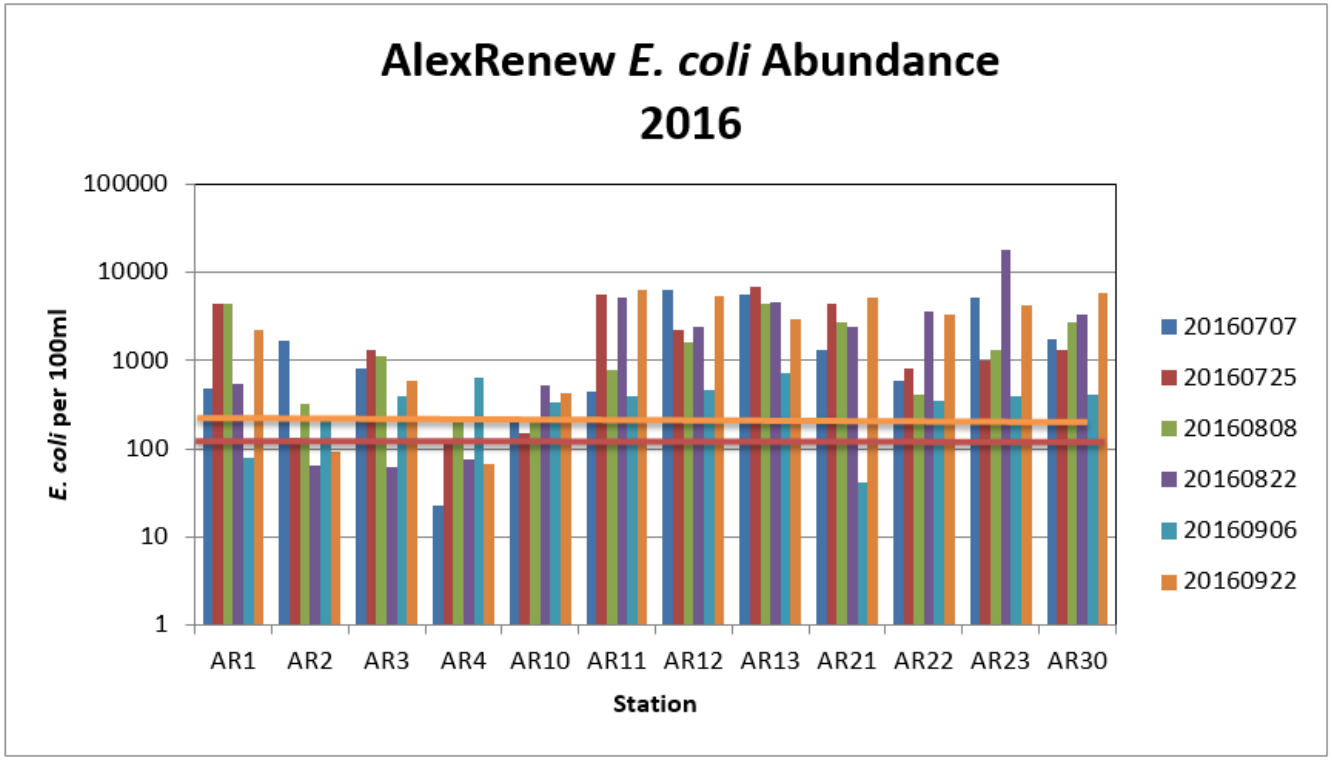
Figure EC1: *E. coli* abundance per 100 ml on 27 Apr, 10 May, 25 May, 08 June and 23 June, 2016 in Cameron Run, Hunting Creek and the adjacent Potomac River. The red horizontal line represents the *E. coli* criterion (126 per 100 mL) for the geometric monthly mean allowable abundance and the orange line represents the criterion (235 per 100 mL) for allowable abundance in the absence of four monthly samples.



E. coli Sampling

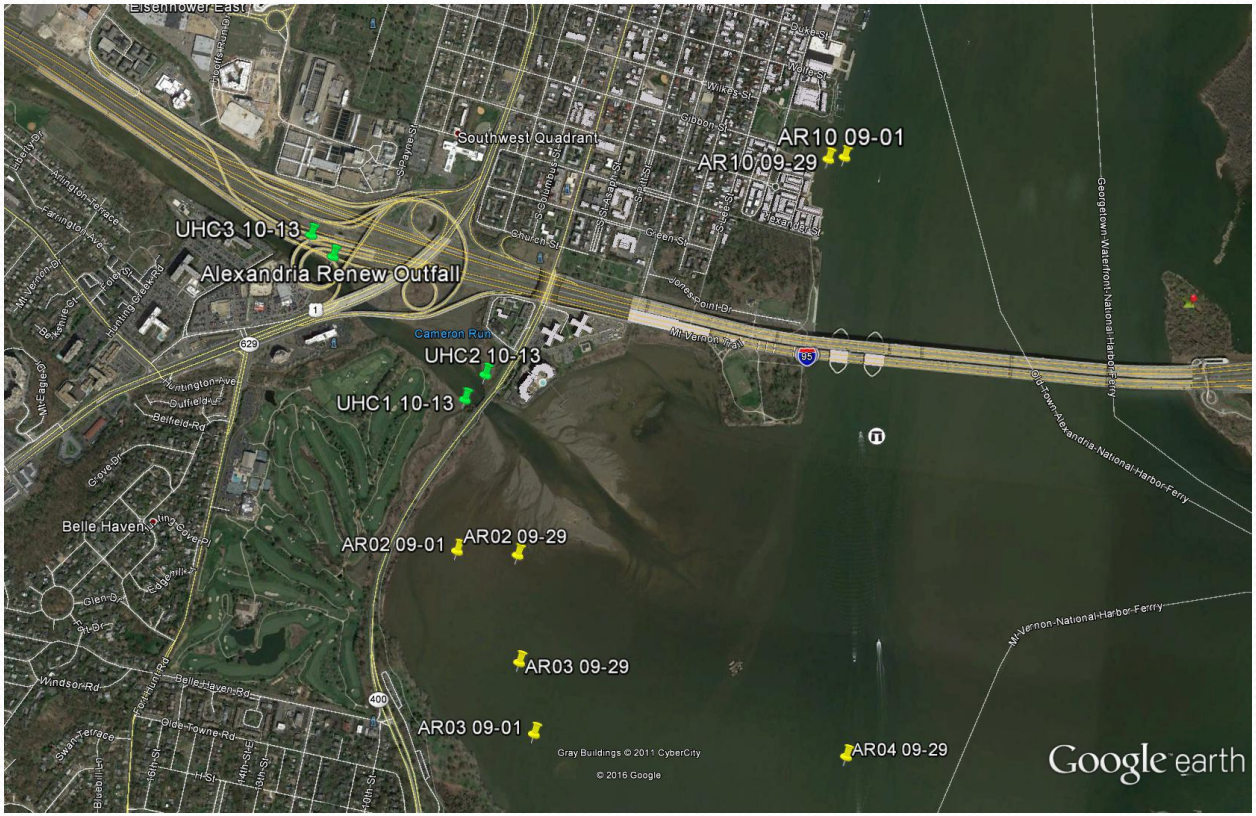
- Second Half of 2016

Figure EC2: *E. coli* abundance per 100 mL on 07 July, 25 July, 08 Aug, 22 Aug, 06 Sept and 22 Sept, 2016 in Cameron Run, Hunting Creek and the adjacent Potomac River. The red horizontal line represents the *E. coli* criterion (126 per 100 mL) for the geometric monthly mean allowable abundance and the orange line represents the criterion (235 per 100mL) for allowable abundance in the absence of four monthly samples.



Micropollutant Sampling

- Seasonal to annual sampling focused on sediment samples at a spatial network of sites
- Temporal changes are thought to be less important



Micropollutant Sampling

- Some Preliminary Results

Table 7: Summary of analytical results for pharmaceutical and personal care products (PPCPs).

Compound	Detection Frequency	Mean of Detected	Maximum Conc (ng/L)
trans-3'-Hydroxycotinine	22.6%	15.3	24.8
Albuterol	1.9%	1.1	3.8
Amoxicillin	49.1%	43.8	113.1
Cimetidine	3.8%	2.1	4.0
Atenolol	32.1%	21.5	45.4
p-Aminobenzoic acid	39.6%	23.0	11.9
Acetaminophen	41.5%	24.6	14.2
Oxycodone	28.3%	18.5	62.0
Hydrocodone	17.0%	10.0	14.8
Trimethoprim	62.3%	43.0	147.6
Triamterene	88.7%	57.1	110.7
Caffeine	100.0%	98.7	147.8
Sulfathiazole	20.8%	12.3	16.9
Metoprolol	98.1%	122.7	690.5
Sulfamethazine	5.7%	3.6	19.2
Propranolol	49.1%	34.6	82.4
Dextromethorphan	54.7%	42.6	113.8
Diphenhydramine	18.9%	13.9	60.4
Erythromycin	18.9%	11.1	15.2
Sulfamethoxazole	100.0%	106.9	431.9
Sulfaquinoxaline	43.4%	26.2	28.8
Sulfadimethoxine	5.7%	3.7	27.9
Benzocaine	0.0%	0.0	0.0
Atorvastatin	1.9%	1.1	3.9

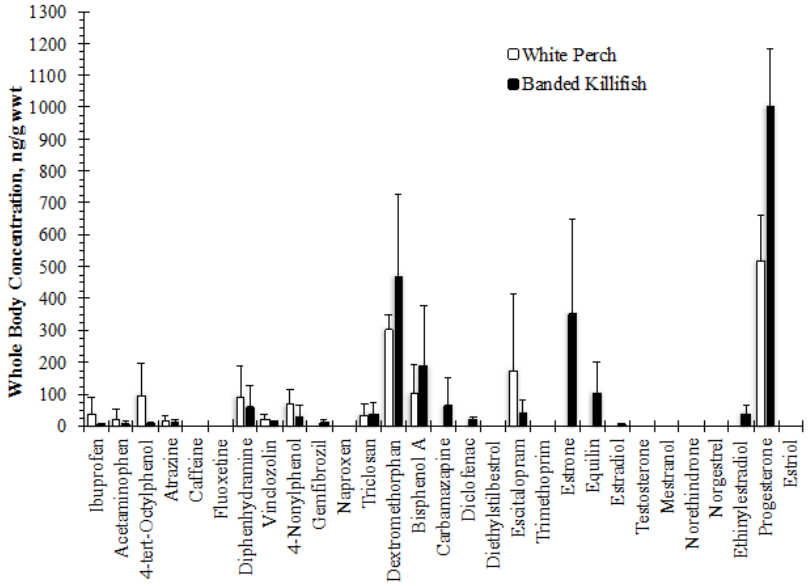
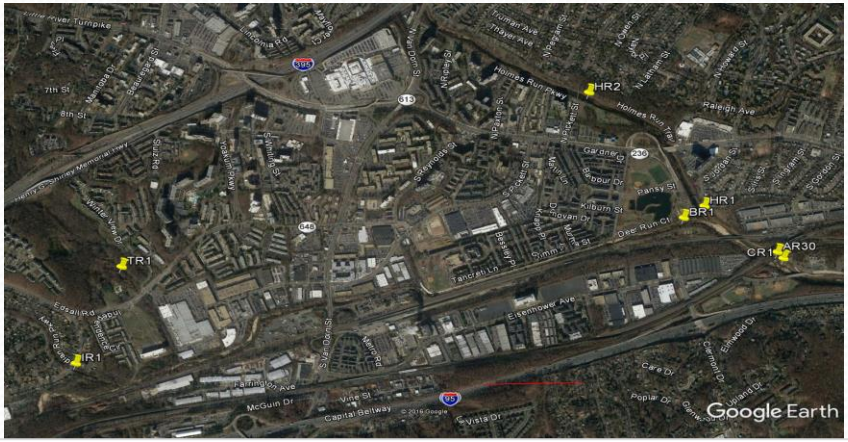
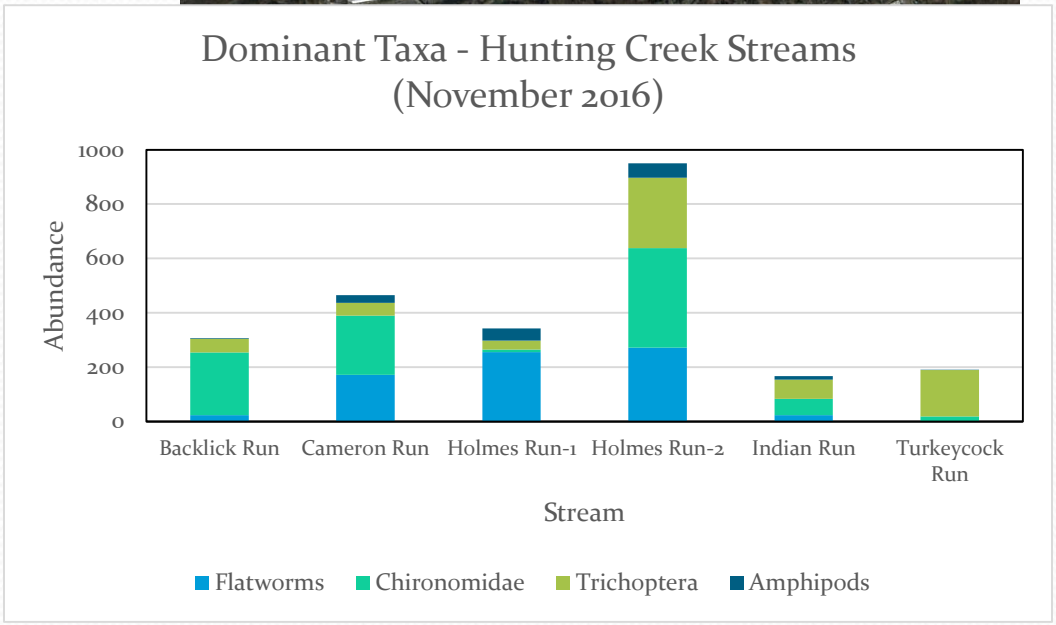


Figure 3. Micropollutant concentrations in white perch and killifish for 2014 sampling in Lower Hunting Creek.

Tributary Macroinvertebrate Sampling

- Initiated in 2016 as a way of assessing upstream impacts on Hunting Creek





Some General Conclusions

- Water quality in Hunting Creek reflects its shallow nature and inputs from the Cameron Watershed, Alex Renew, combined sewers, and Potomac mainstem
- Being a more open system that Gunston Cove, Hunting Creek is more strongly influenced by these external forces than Gunston Cove
- That said, the biological communities in Hunting Creek are similar to those found in Gunston Cove and reflect a generally healthy ecosystem
- Excess phytoplankton growths have not been observed and submersed aquatic vegetation carpets most of the Hunting Creek embayment by late summer
- River herring are spawning at the head of tide in Cameron Run!!
- Numerous micropollutants are found at elevated levels throughout the study area consistent with the location of Hunting Creek in an area influenced by publicly owned treatment works, urban nonpoint pollution, and upstream sources including agriculture.

Thank YOU!

- The Potomac Environmental Research and Education Center (PEREC) at George Mason University thanks you for the opportunity to collaborate on this important work
- R. Christian Jones, Project Director, Water Quality, Plankton, Benthos
  - Director, PEREC & Professor, Environmental Science and Policy (ESP)
- Kim De Mutsert, Fish Biology
  - Faculty Fellow, PEREC & Assistant Professor, ESP
- Greg Foster, Micropollutant Studies
  - Senior Faculty Fellow, PEREC & Professor, Chemistry
- Robert Jonas, E. coli Studies
  - Senior Faculty Fellow, PEREC & Associate Professor, ESP
- Tom Huff, Micropollutant Studies
  - Research Fellow, PEREC