Mercury Cycling in Seasonal Wetlands of the Los Banos Wildlife Area

Danielle Jones, UC Merced

Andrew Gordus, California Department of Fish and Wildlife

Nigel Quinn, Lawrence Berkeley National Laboratory

Marc Beutel, UC Merced

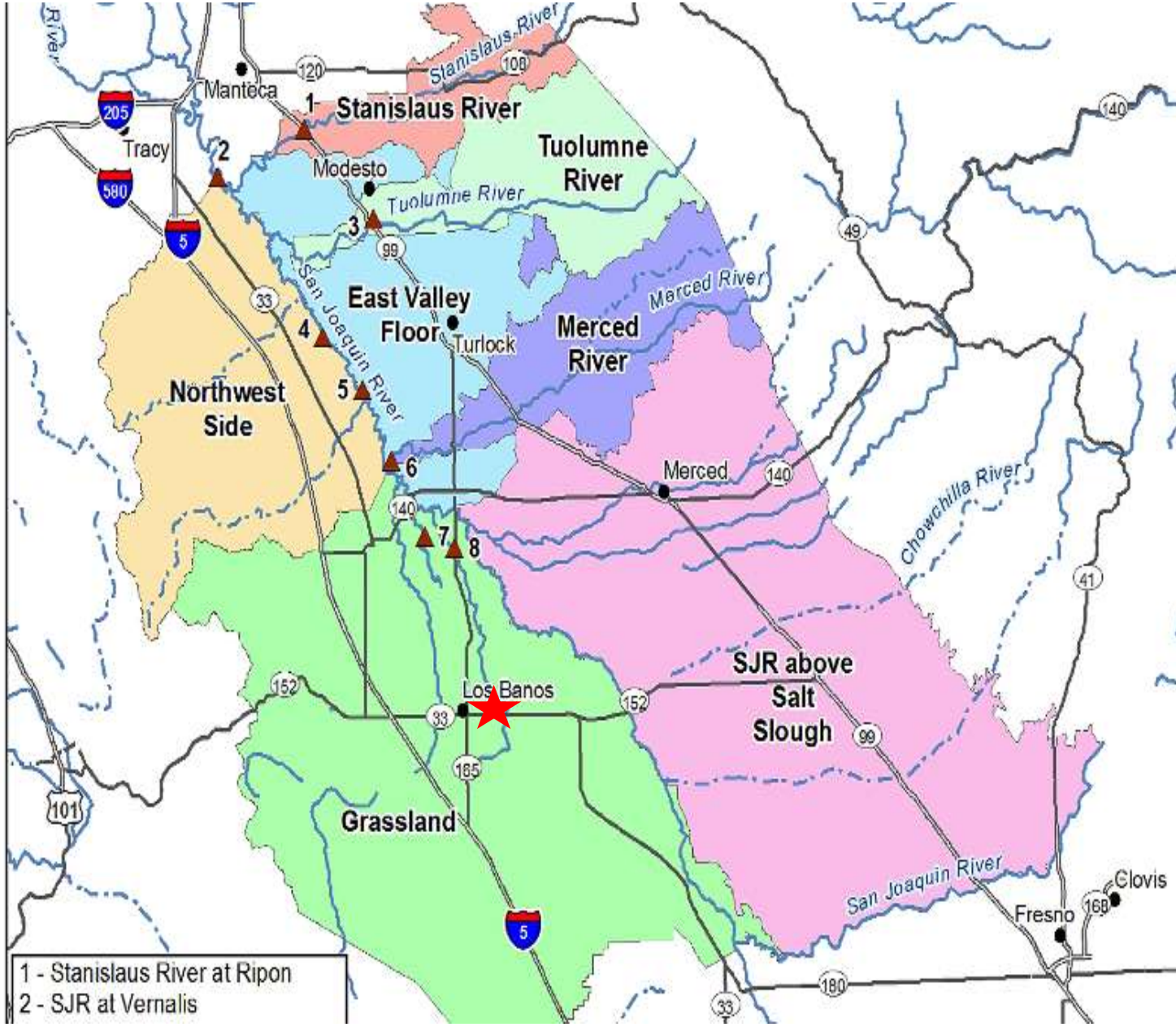
Peggy O'Day, UC Merced

Funded by:

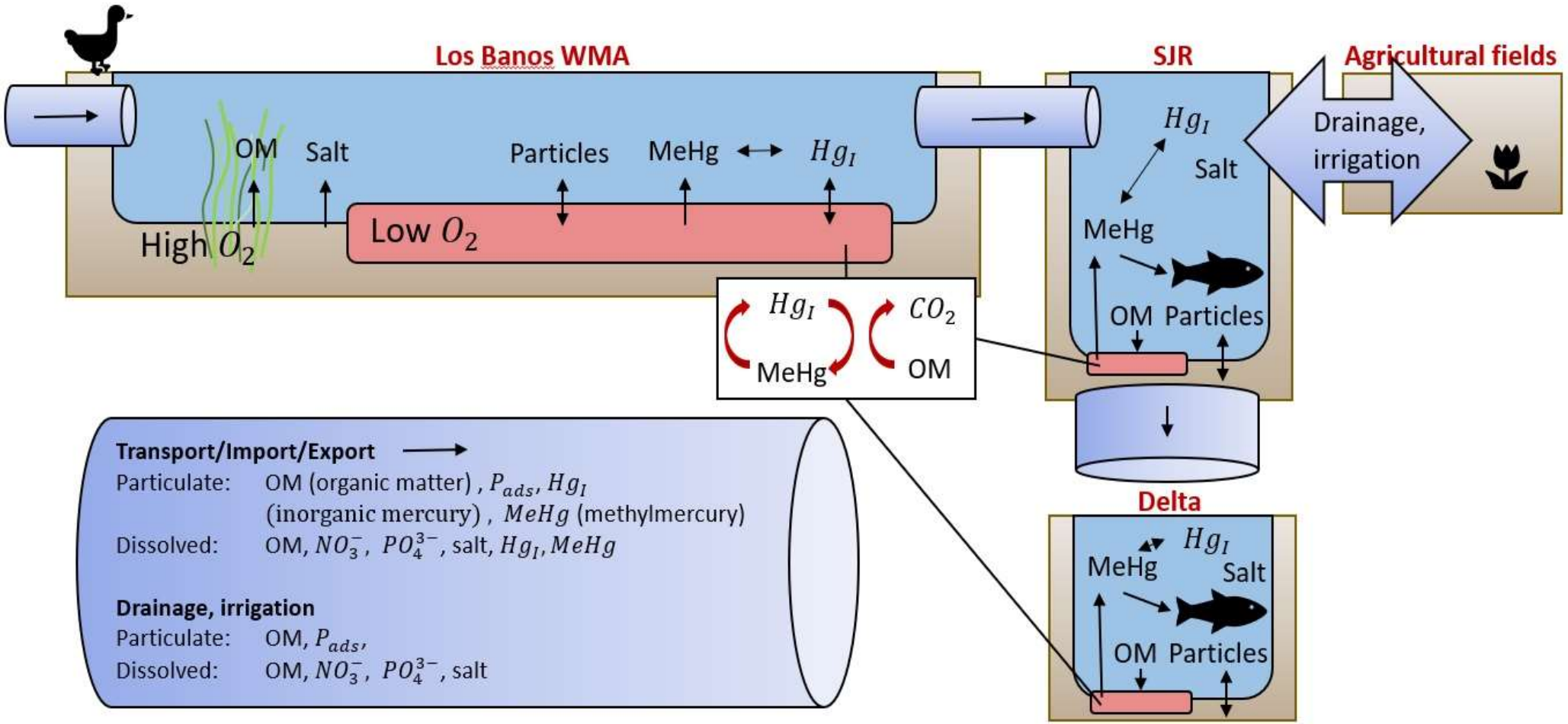
Delta Stewardship Council through CDFW Proposition 1 and US Bureau of Reclamation

Introduction

- San Joaquin River basin (SJRB), a major tributary to the San Joaquin Delta, provides drinking water and recreational water activities to the central valley
- Important to consider impairments to water quality, such as salt and methylmercury, however, there is no point source for mercury impairment
- Wetlands in the Grasslands Ecological Area, including the Los Banos Wildlife Area (LBWA), may contribute mercury (Hg) and methylmercury (MeHg), in addition to salts and nutrients to the SJR, and potentially act as sites for mercury methylation



Conceptual Mercury Model



Conceptual model courtesy of S. Helmrich

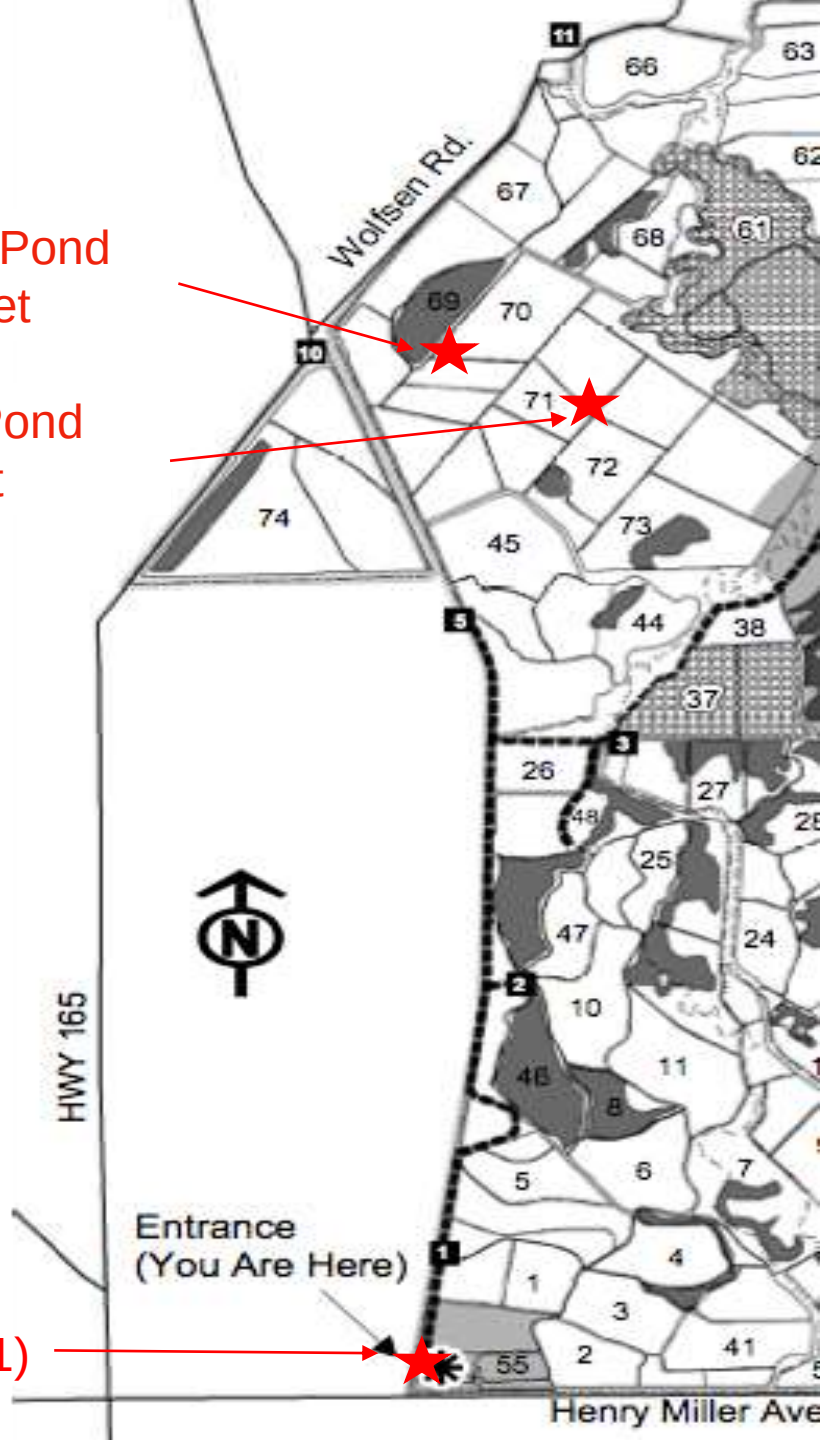
Project Objectives

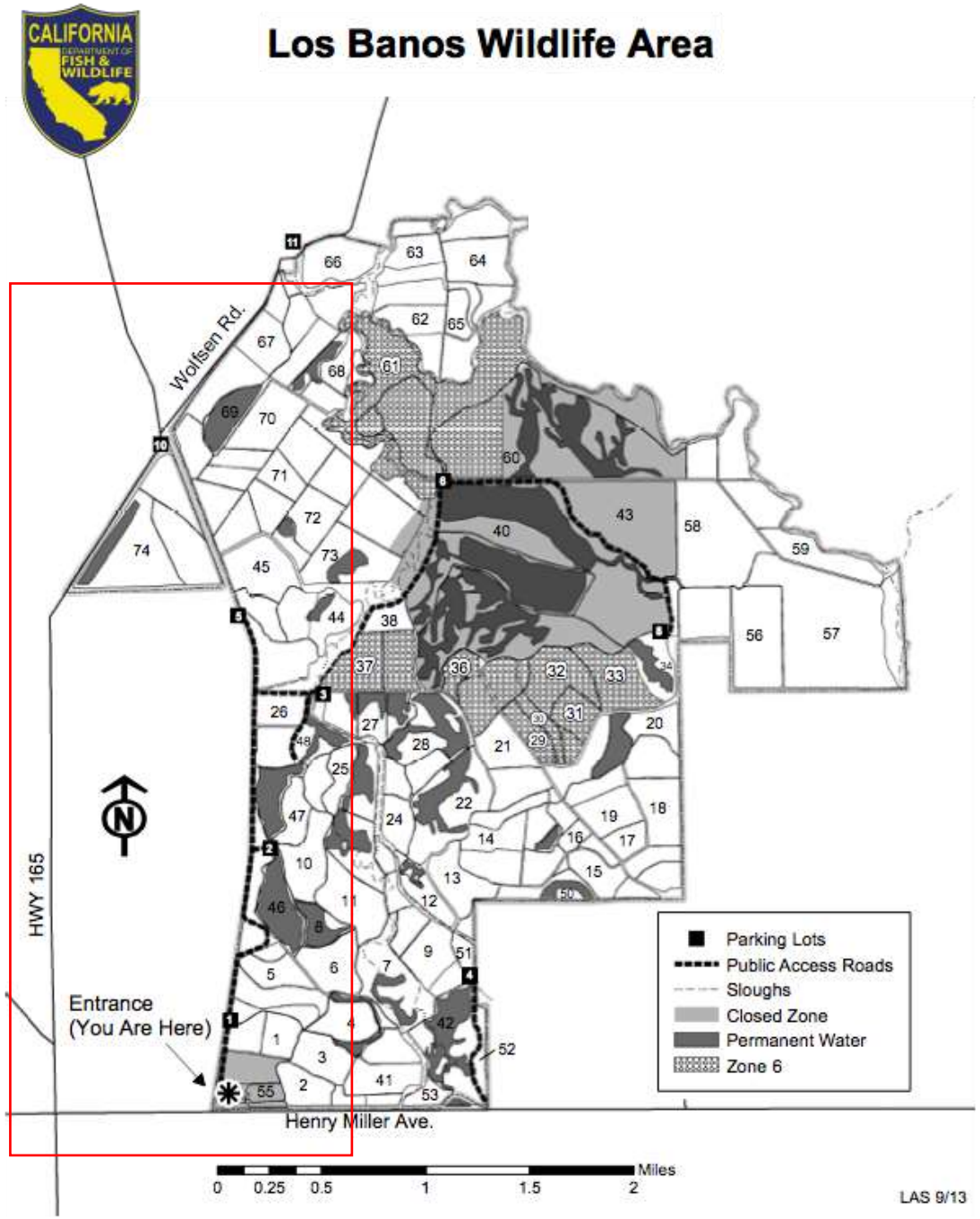
- **Improve understanding of seasonal variation, export, and transport of Hg, MeHg from managed wetlands in LBWA to the SJR**
- Fill a knowledge gap regarding the composition and character of dissolved and suspended particulate matter exported from wetlands
- Develop and test proxy relationships or indicators for measured concentrations of Hg, MeHg and nutrients using statistical correlations with current real-time and historical data
- Develop management practices and guidelines to help reduce salt, nutrient, and mercury loads from the GEA to the SJR and Delta

70A Pond Outlet

71A Pond Outlet

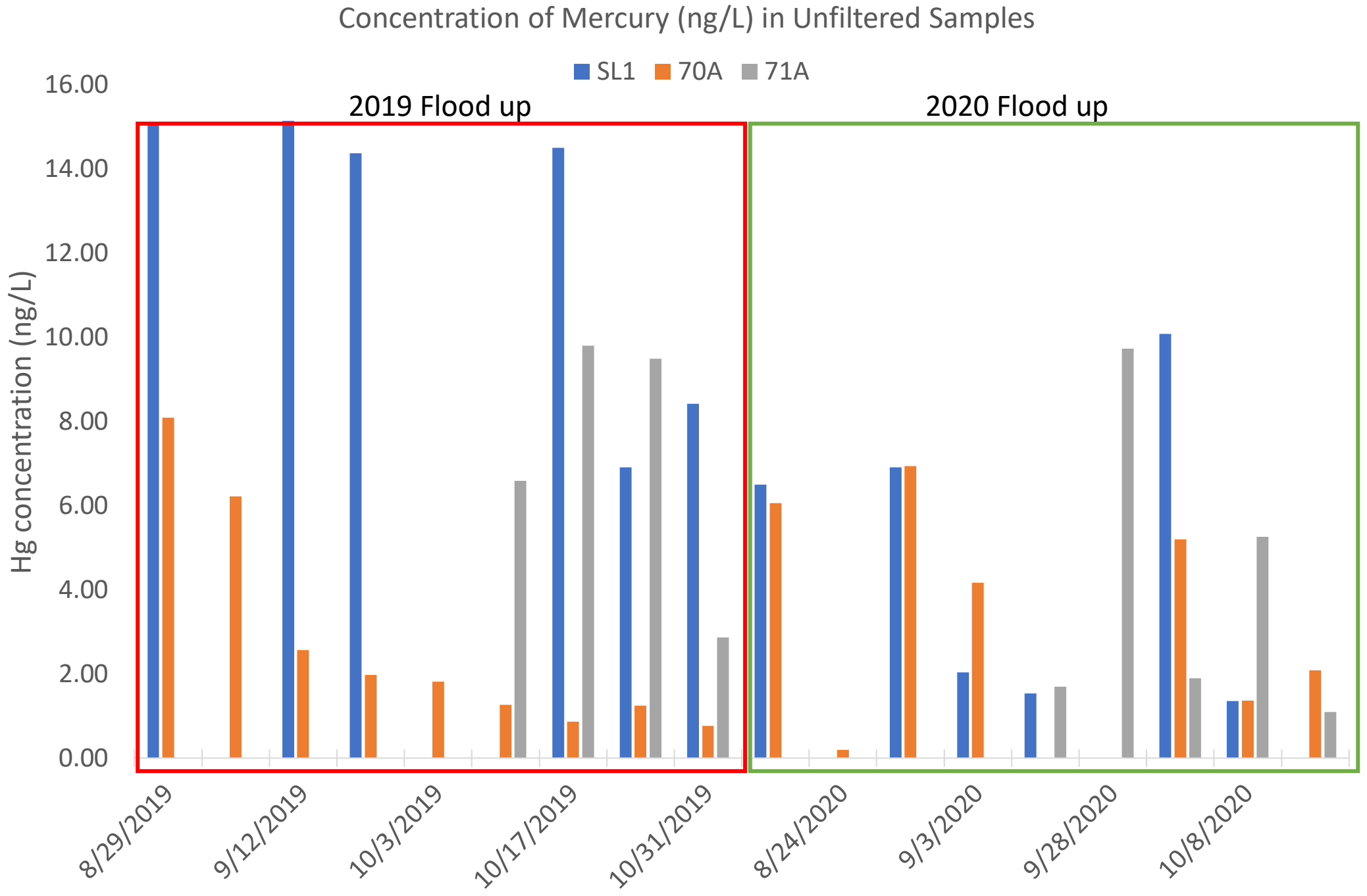
San Luis Canal (SL1)

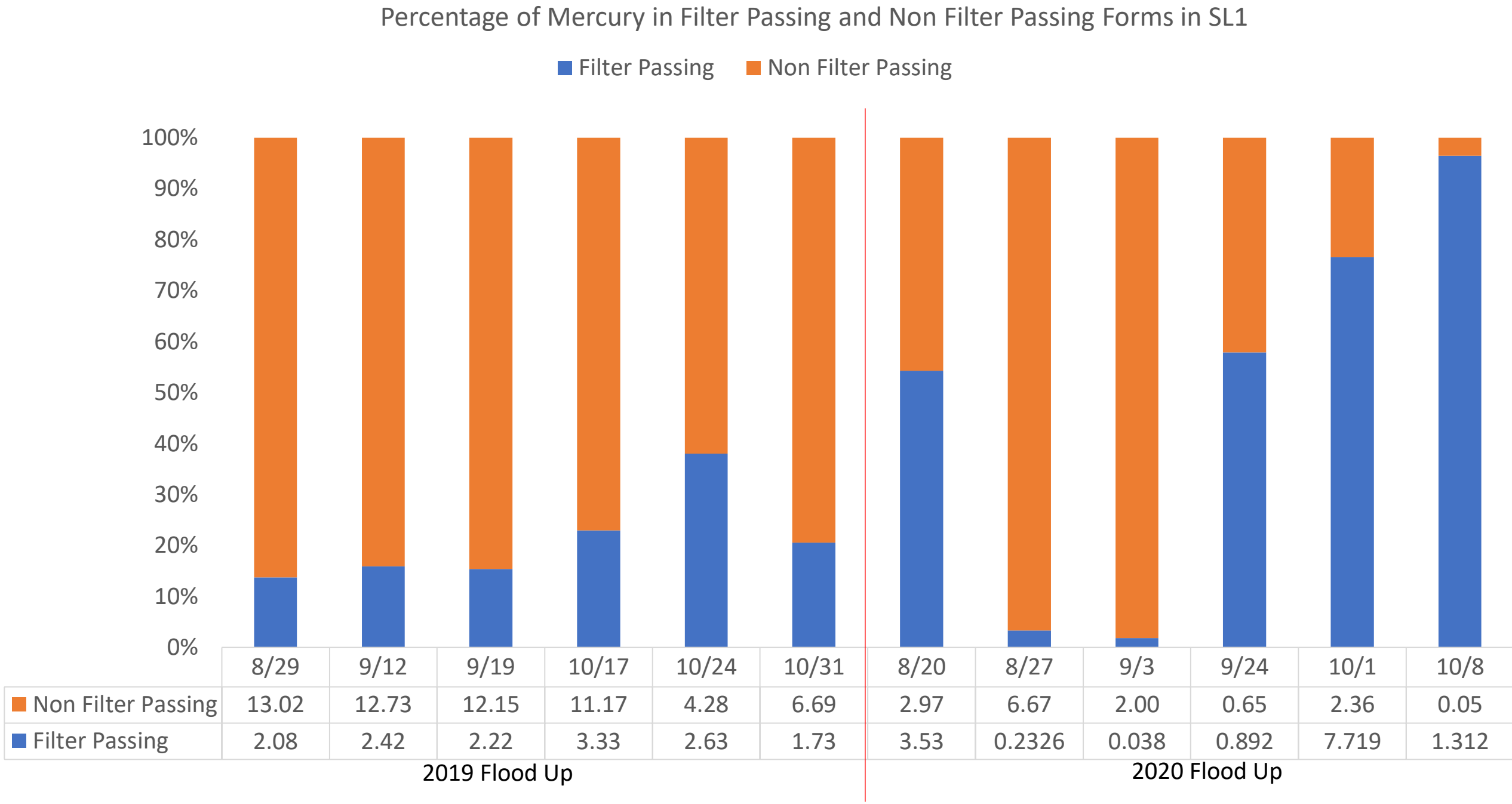




Methods

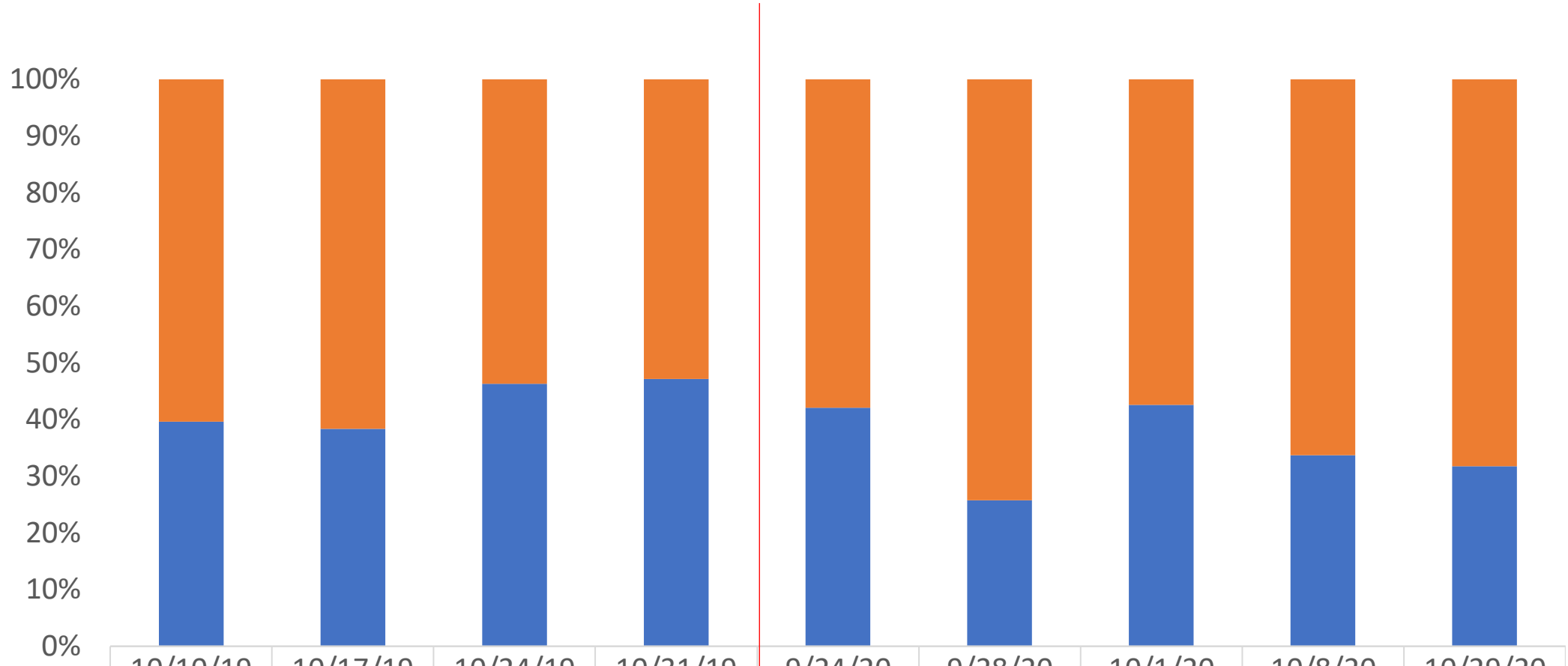
- Collect water weekly during flood-up (end of August through October) in 2019 and 2020
- Collect discrete measurements of conductivity (EC), dissolved oxygen (DO), pH and oxidation-reduction potential (ORP) using HACH meter
- Collect continuous data using Aquatroll 600
- Analyze data
  - Total Hg and MeHg (filtered and unfiltered) by cold vapor atomic fluorescence spectroscopy (CVAFS)
  - Nutrients (nitrate, ammonia, orthophosphate) by automated flow injection analysis
  - Anions (sulfate, chloride) by ion chromatography
  - Total element analysis by inductively coupled plasma – Optical Emission Spectrometry (ICP-OES)


Concentration of Mercury (ng/L) in Unfiltered Samples
SL1
70A
71A
2019 Flood up
2020 Flood up
Hg concentration (ng/L)
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
8/29/2019
9/12/2019
10/3/2019
10/17/2019
10/31/2019
8/24/2020
9/3/2020
9/28/2020
10/8/2020



	8/29	9/12	9/19	10/17	10/24	10/31	8/20	8/27	9/3	9/24	10/1	10/8
Non Filter Passing	13.02	12.73	12.15	11.17	4.28	6.69	2.97	6.67	2.00	0.65	2.36	0.05
Filter Passing	2.08	2.42	2.22	3.33	2.63	1.73	3.53	0.2326	0.038	0.892	7.719	1.312

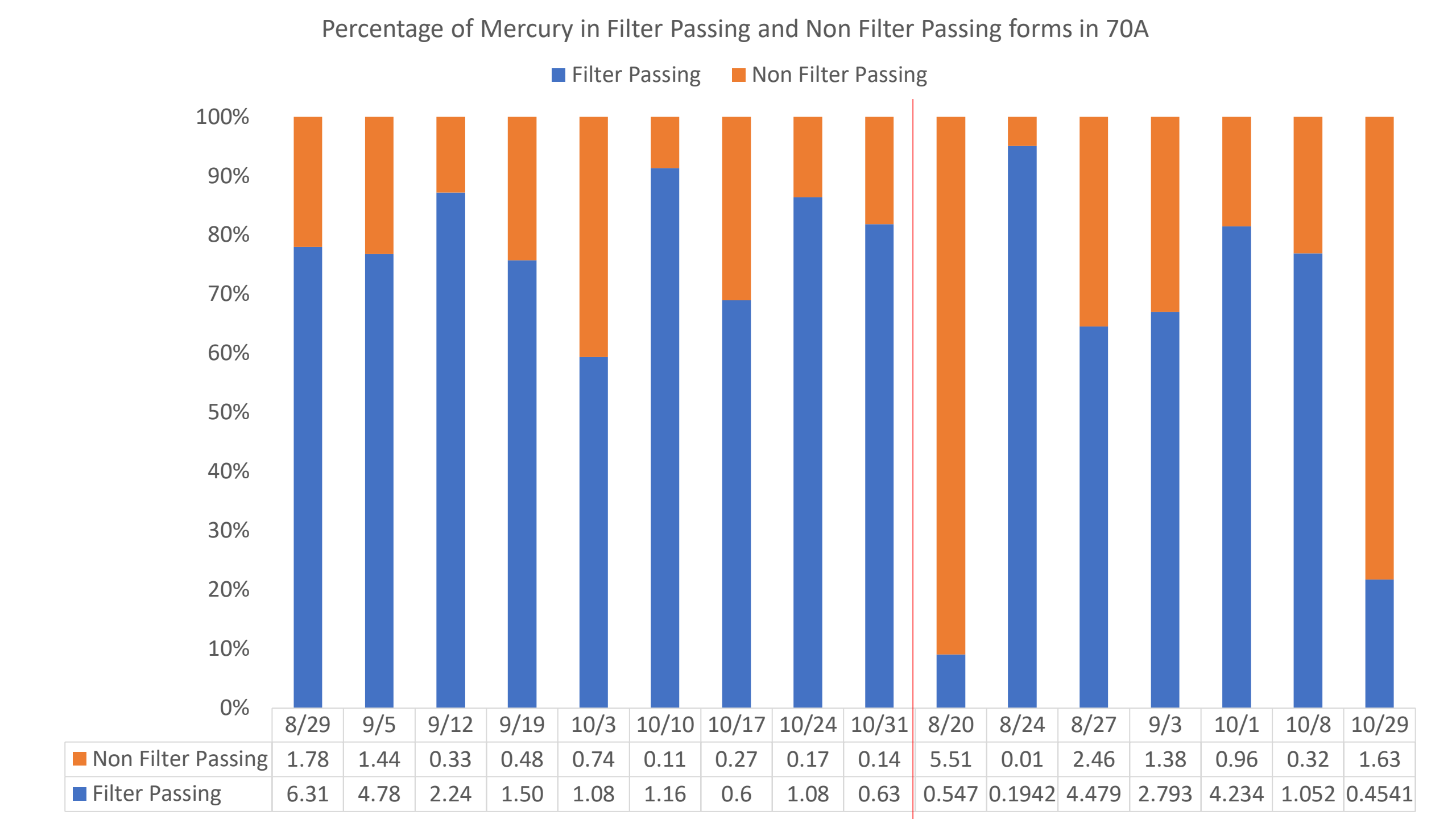
Percentage of Mercury in Filter Passing and Non Filter Passing forms in 71A



	10/10/19	10/17/19	10/24/19	10/31/19	9/24/20	9/28/20	10/1/20	10/8/20	10/29/20
Non Filter Passing	6.59	9.8	9.49	2.87	1.696	9.734	1.899	5.255	1.099
Filter Passing	4.33	6.09	8.19	2.56	1.231	3.371	1.41	2.673	0.5108

2019 Flood Up

2020 Flood Up



	8/29	9/5	9/12	9/19	10/3	10/10	10/17	10/24	10/31	8/20	8/24	8/27	9/3	10/1	10/8	10/29
Non Filter Passing	1.78	1.44	0.33	0.48	0.74	0.11	0.27	0.17	0.14	5.51	0.01	2.46	1.38	0.96	0.32	1.63
Filter Passing	6.31	4.78	2.24	1.50	1.08	1.16	0.6	1.08	0.63	0.547	0.1942	4.479	2.793	4.234	1.052	0.4541

Observations and Conclusions

- Total mercury in SL1 varies regardless of season
- Mercury in both ponds spike during flood-up then decrease in concentration
  - Concentration of mercury in filtered samples exceeds the concentrations found in SL1 during flood-up
- Mercury in 70A is dominated by dissolved mercury
  - Difference potentially due to plants in ponds and management

- Future studies could include sediment sampling
- This study could help influence management practices such and Hg monitoring and sensing