

Sampling Method Comparison Study

Project Summary

Bimonthly Sampling Program

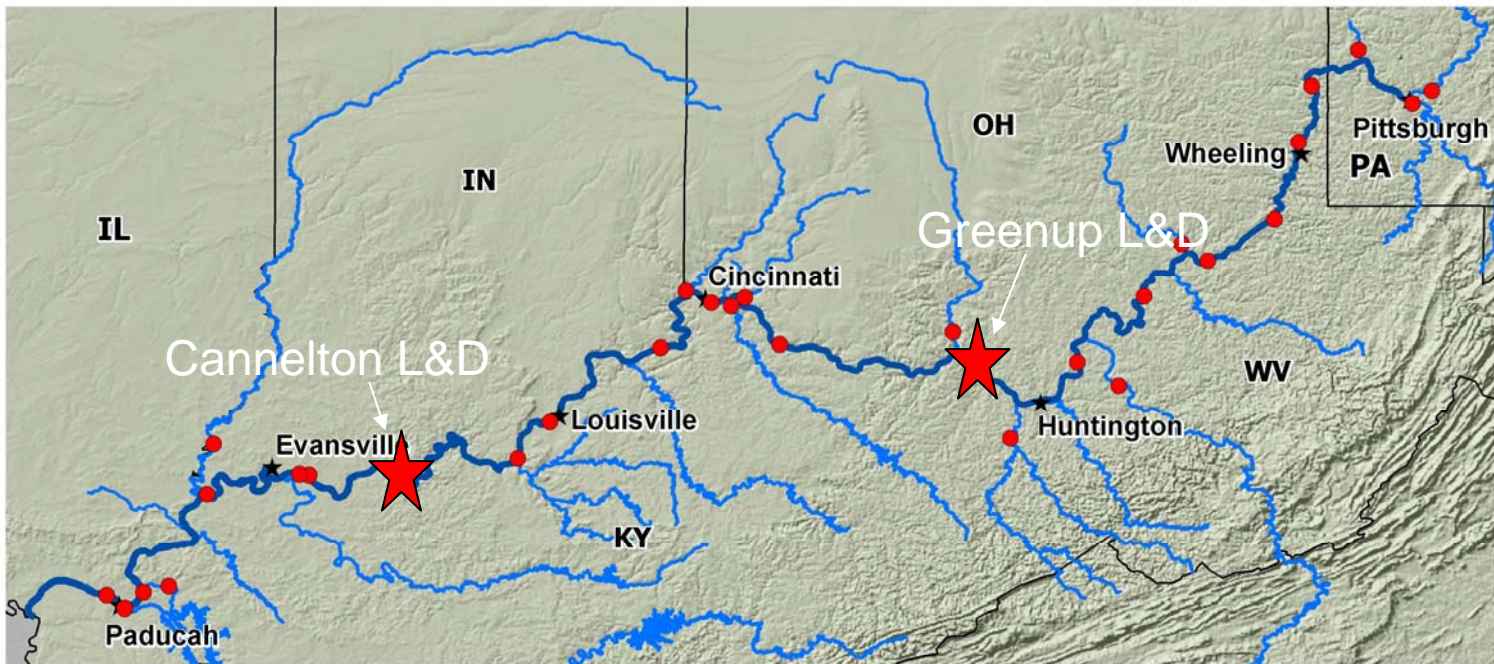


Ohio River Bimonthly Sampling Stations

- Ohio River
- ★ Major cities
- Bimonthly Stations lat longs Events



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Purpose of Bimonthly Sampling

- Long-term Trends, 305b Assessment: Aquatic Life and Human Health (water + organism)
- Period of record 1975-Present at most stations

Mile Point	Location	Monthly Sampling*						Monthly Sampling										Bimonthly Sampling																		
		1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	
0.0	Pittsburgh											3	12	12	12	12	9	3	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6		
0.0	South Pittsburgh	6	31	36	30	34	25	18	13	12	12	12	12	12	12	12	12	9	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6		
25.4	Beaver Falls	3	31	36	32	35	28	20	12	12	12	12	12	12	12	12	12	9	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6		
54.4	New Cumberland																	3	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6		
84.2	Pike Island																	3	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6		
126.4	Hannibal			10	33	33	27	19	12	12	12	12	13	12	12	12	11	12	9	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	
161.8	Willow Island	4	28	35	31	31	20	18	12	12	12	12	12	12	12	12	11	12	9	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6		
172.2	Marietta	4	29	35	32	30	20	18	12	12	12	12	12	12	12	12	12	12	9	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6		
203.9	Belleville	5	27	35	29	12	16	12	12	12	12	12	12	12	12	12	11	12	9	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6		
265.7	Winfield	5	31	31	23	18	12	16	12	12	12	12	12	12	12	12	12	12	9	6	6	6	6	6	6	6	6	5	6	6	6	6	6	6		
279.2	R.C. Byrd	5	30	32	24	17	15	14	13	12	12	12	12	12	12	12	12	12	9	6	6	6	6	6	6	6	5	6	6	6	6	6	6	6		
317.1	Louisa	5	36	31	24	14	15	16	13	12	12	12	12	12	12	12	12	12	9	6	6	6	6	6	6	6	6	5	6	6	6	6	6	6		
341.0	Greenup																	3	6	6	6	6	6	6	6	6	6	6	6	6	6	9	12	9	6	
356.5	Lucasville	3	32	28	21	13	12	12	12	11	11	12	12	12	12	12	12	12	9	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6		
436.2	Meldahl																	3	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6		
464.1	Newtown		14	30	20	12	12	11	13	12	12	12	12	12	12	12	12	12	9	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6		
470.2	Covington	5	30	41	23	16	13	15	12	11	12	12	12	12	12	12	12	12	8	5	6	6	4	4	5	5	6	6	6	6	6	6	6	6		
477.5	Anderson Ferry																	3	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6		
491.1	Elizabethtown	5	29	42	24	16	17	12	12	12	12	11	12	12	12	12	12	12	9	6	6	6	6	6	6	6	6	5	6	6	6	6	6	6		
531.5	Markland	5	29	35	24	17	18	17	12	12	12	13	12	12	12	12	11	12	12	9	6	6	6	6	6	6	5	6	6	6	6	6	6	6		
600.6	Louisville	3	27	35	26	20	19	17	12	12	12	12	12	12	12	12	11	11	6					3	5	4	6	6	6	6	6	6	6	6	6	
625.9	West Point	3	26	34	23	18	18	16	12	12	12	12	11	12	12	12	11	12	9	6	6	6	6	4	6	5	4	6	6	6	6	6	6	6	6	
720.7	Cannelton	5	32	40	27	21	17	16	12	12	12	12	12	12	12	12	12	12	9	6	6	4	4	6	6	6	6	6	6	6	6	6	9	12	9	6
776.0	Newburgh																	3	6	6	4	4	6	6	6	6	6	6	6	6	6	6	6	6		
784.2	Sebree	4	26	35	23	12	12	13	12	12	12	12	12	12	12	12	12	12	9	6	6	4	4	6	6	6	6	6	6	6	6	6	6	6	6	
846.0	J.T. Myers	5	30	33	27	12	12	12	12	12	12	12	12	12	12	12	12	12	9	6	6	4	4	6	6	6	6	6	6	6	6	6	6	6	6	
848.0	Route 62 Bridge																									6	6	6	6	6	6	6	6	6	6	
918.5	Smithland								12	12	12	12	12	12	12	12	12	12	9	6	6	6	6	6	6	5	6	6	6	6	6	6	6	6	6	
920.4	Pinkneyville															9	12	12	9	6	6	6	6	6	6	5	6	6	6	6	6	6	6	6	6	
934.5	Paducah																				3	6	6	6	6	5	6	6	6	6	6	6	6	6	6	
938.9	L&D 52																			3	6	6	6	6	6	5	6	6	6	6	6	6	6	6	6	

* Monthly sampling with more frequent observations of non-metal parameters

Note: Greenup and Cannelton part of a sub-study requiring monthly sampling in 2005, 2006, 2007

ORSANCO Bimonthly Parameters

(WQC shown where applicable)

● 11 non-metals

- NH₃-N (23 mg/L *)
- Cl⁻ (250 mg/L)
- Hardness
- NO₂-NO₃-N (10 mg/L)
- Phenols (5 ug/L)
- SO₄ (250 mg/L)
- TKN
- TOC
- TP
- TSS
- CN (5.2 (ug/L)

● 18 Metals

- Ag (50 ug/L)
- Al
- As (10 ug/L)
- Ba (1000 ug/L)
- Ca
- Cd (2.24** (ug/L)
- Cr (74.1** ug/L)
- Cu (8.96** ug/L)
- Fe
- Hg (12 ng/L)
- Mg
- Mn
- Ni (52** ug/L)
- Pb (2.52 ug/L)
- Sb
- Se (5 ug/L)
- Tl
- Zn (118** ug/L)

*Acute ammonia criterion shown at pH 7.4 (median all Ohio River stations)

** Hardness dependant metals criteria shown at Hardness 100mg/L as CaCo₃

Sampling Comparison

22 Coordinated Sample Events from June 2004 through June 2007

- Two ORSANCO locations shared with USGS NASQAN program:

- Greenup Lock and Dam mile 341.5
- Cannelton Lock and Dam mile 720.8

- 12 WQ Parameters in common used to make comparison (of 29 from ORSANCO and >90 NASQAN)



Comparison Study Parameters

● 7 non-metals

- NH₃-N
- Cl⁻
- Hardness
- NO₂-NO₃-N
- Phenols
- SO₄
- TKN
- TOC
- TP
- TSS
- CN

● 5 Metals

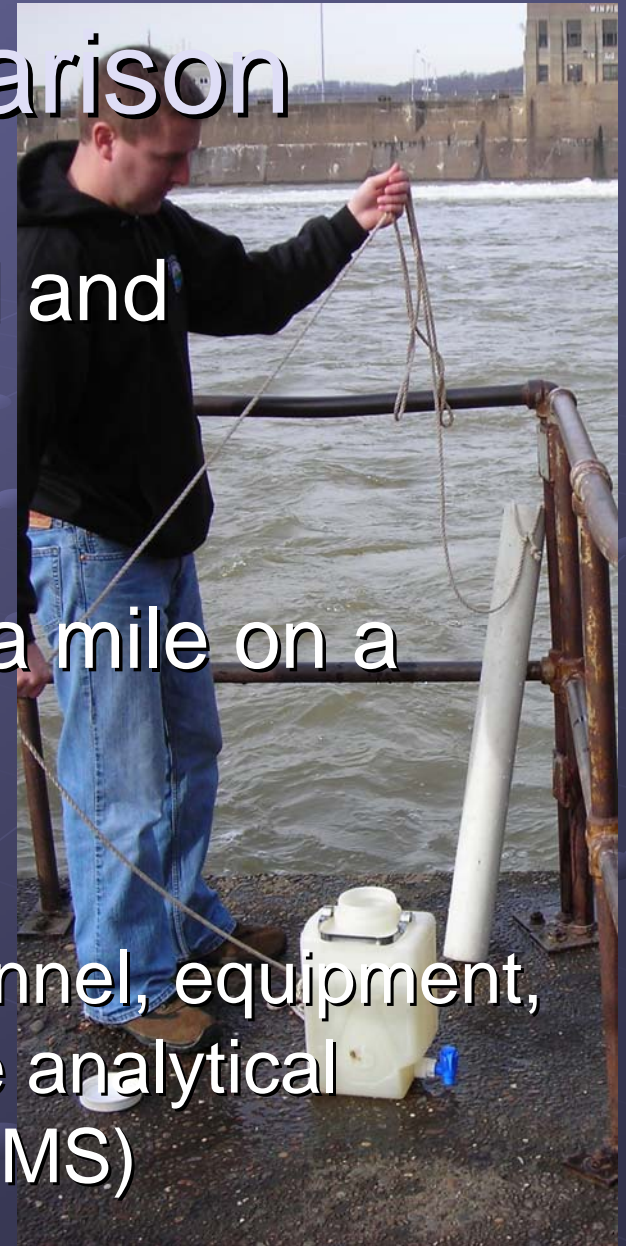
- Ag
- Al
- As
- Ba
- Ca
- Cd
- Cr
- Cu
- Fe
- Hg
- Mg
- Mn
- Ni
- Pb
- Sb
- Se
- Tl
- Zn

12 Parameters used for comparison are highlighted

17 of the Bimonthly parameters not included in NASQAN

Sampling Comparison

- Analysis of USGS NASQAN and ORSANCO Bimonthly data
- The shared sites are within a mile on a 981-mile river
- Many differences also:
 - Laboratories, sampling personnel, equipment, location about the dam, some analytical differences (ICP-AES vs ICP-MS)



Sampling Methods

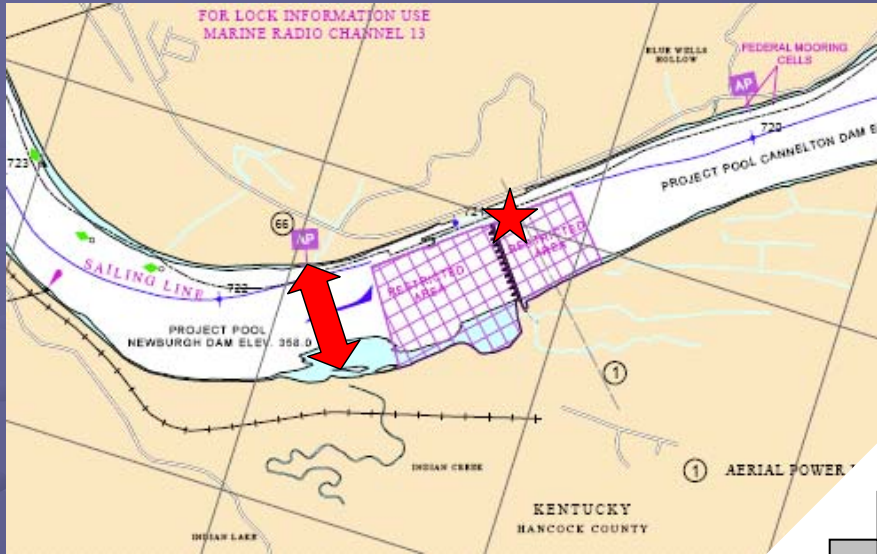
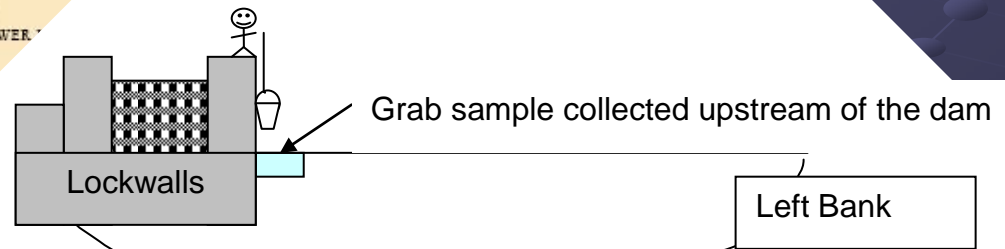
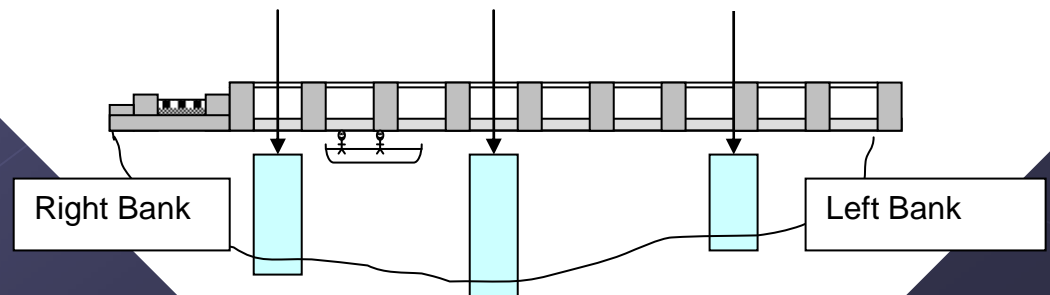


Illustration from US Army Corps of Engineers Navigation Charts (USACE, 1989)

Bimonthly Sampling Program grab sample is collected from the upstream lockwall



NASQAN cross-section collected downstream of the dam



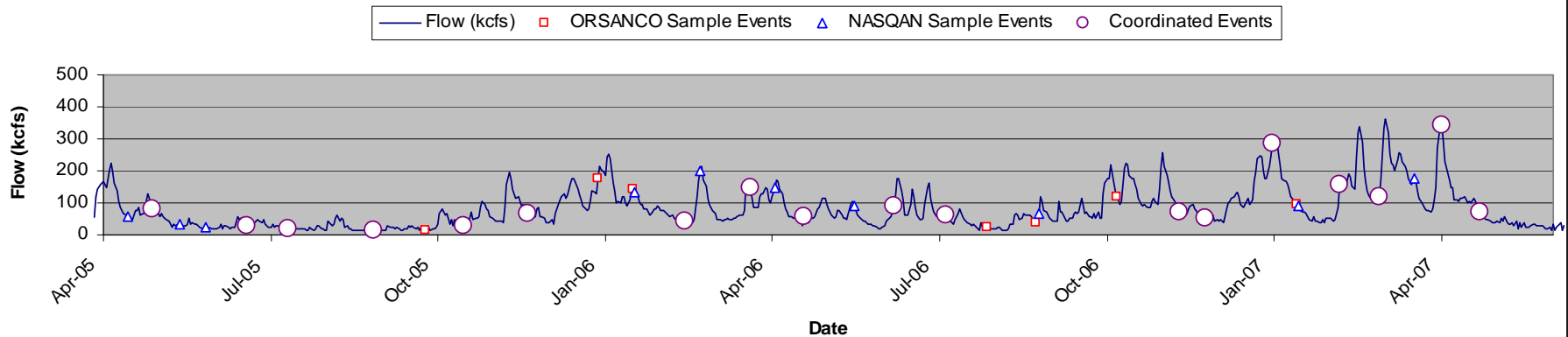
NASQAN sample is depth and width-integrated collected by boat downstream of dam

Project Design

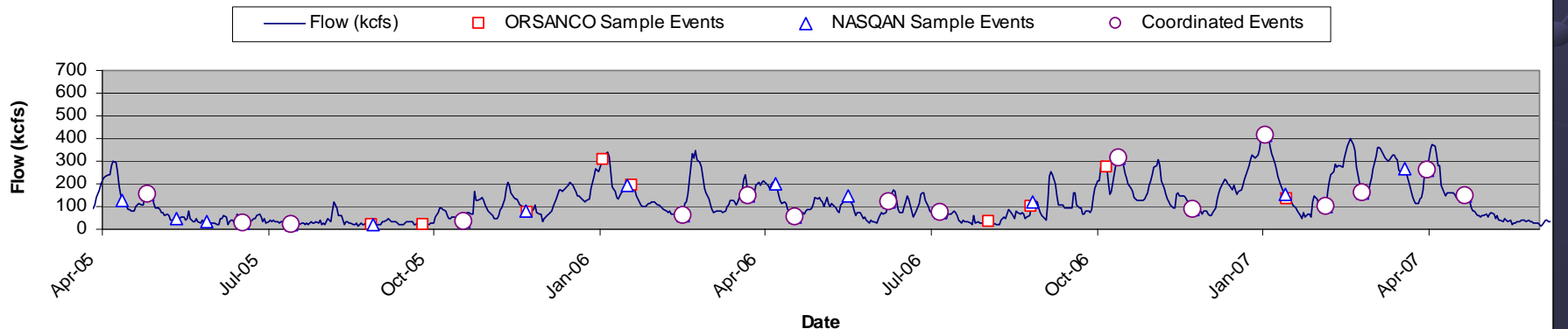
- Low cost project - no changes to either program to control variables
- But cannot assign error due to different laboratories, location differences

Sample Events August 2005 through August 2007

Ohio River Flow and Sample Events at Greenup L&D 2005-2007

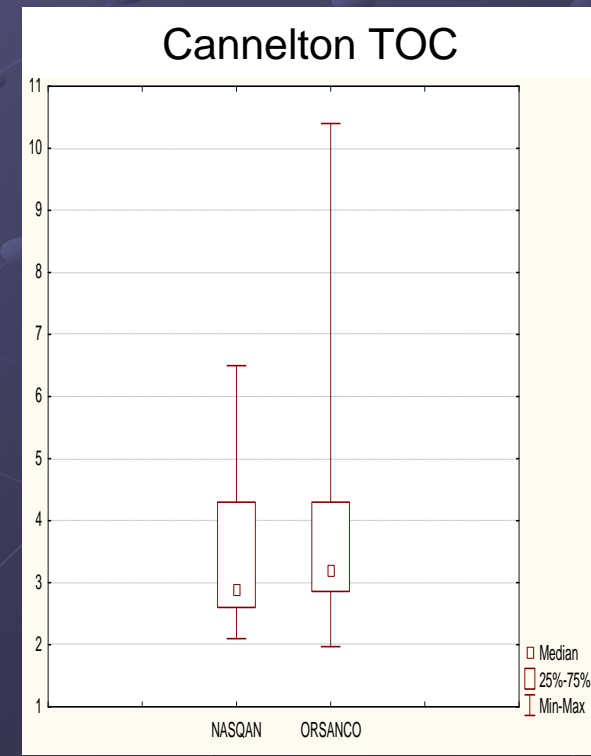
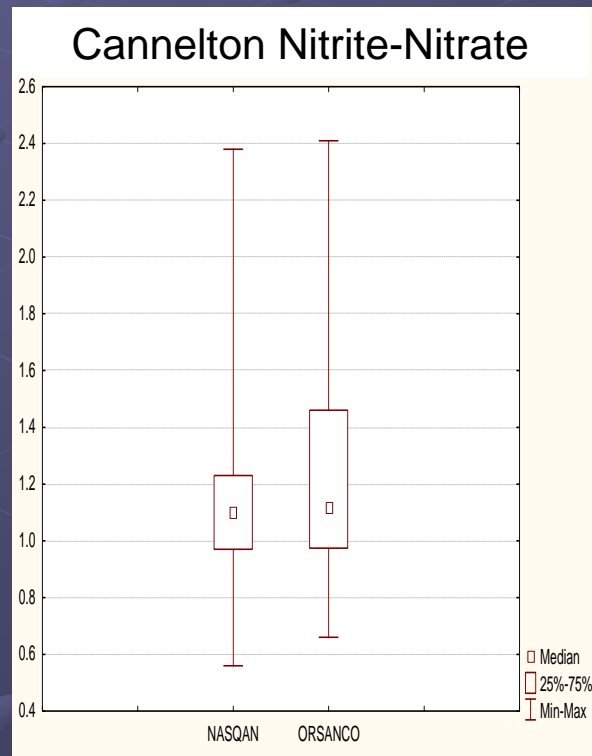
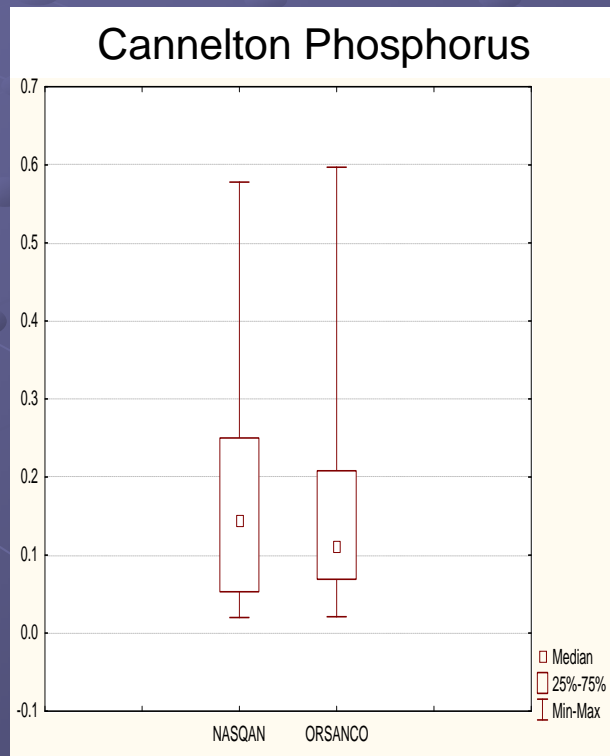


Ohio River Flow and Sample Events at Cannelton L&D 2005-2007



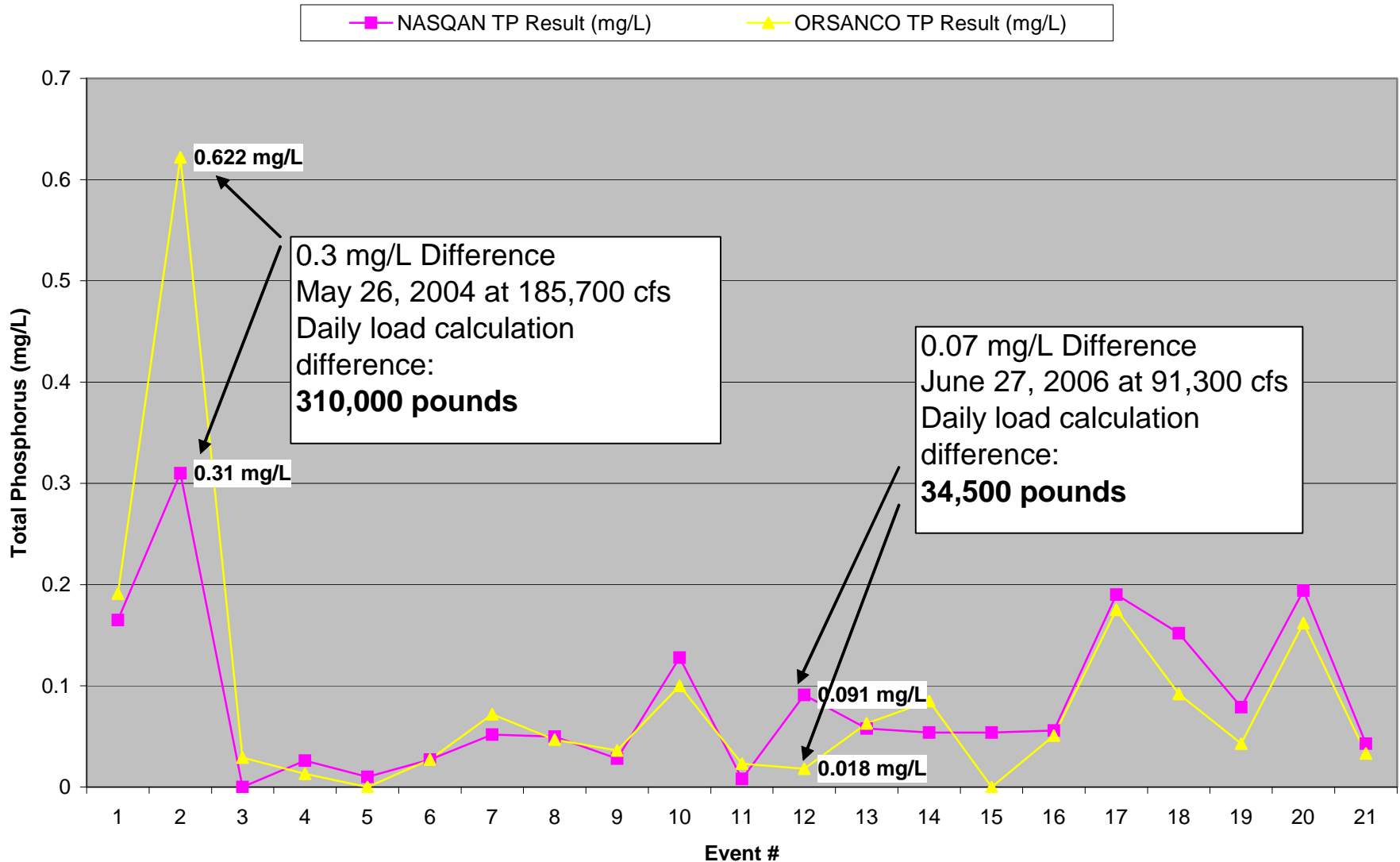
3 of 12 Parameters Showed No Significant Differences

- Total Phosphorus, Nitrate/Nitrite Nitrogen and Total Organic Carbon
- No significant difference at either station ($p < 0.05$)



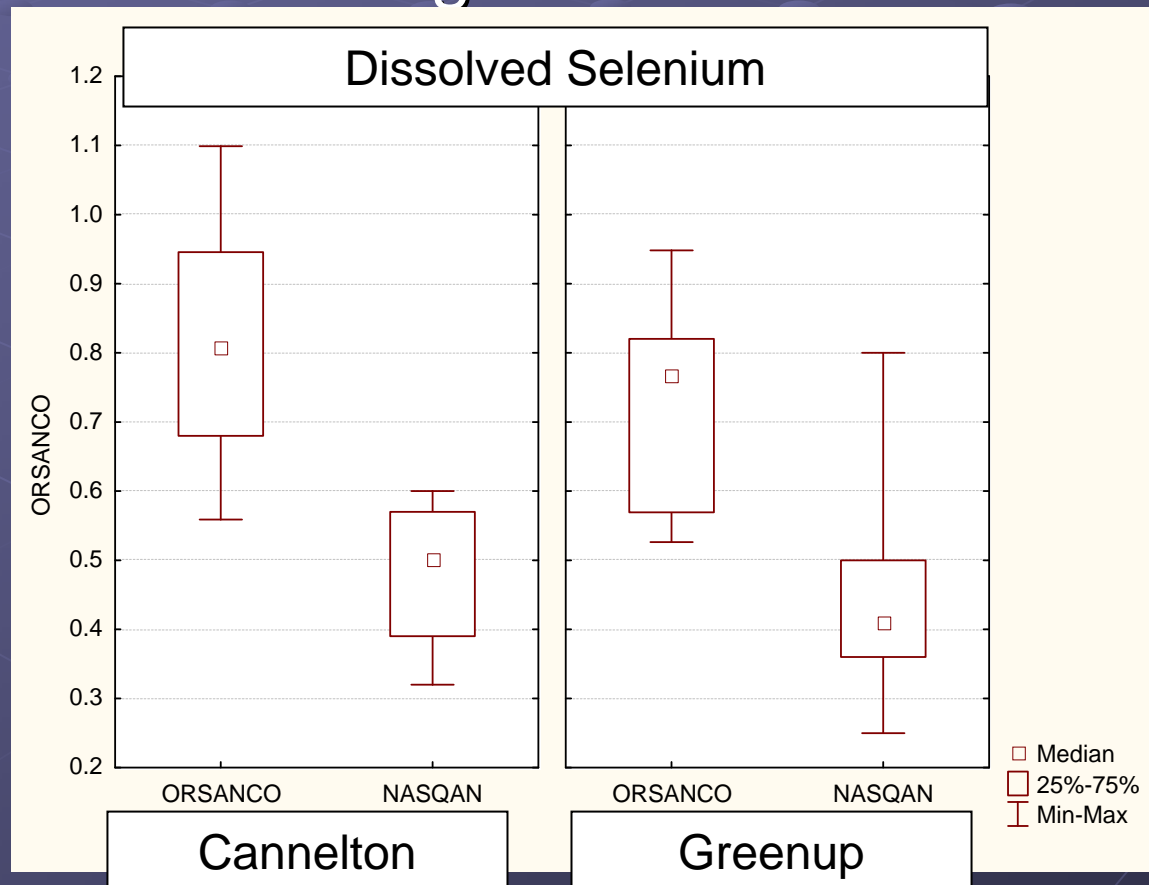
Total Phosphorus

Greenup L&D Largest Observed Differences in Total Phosphorus



Significant Differences

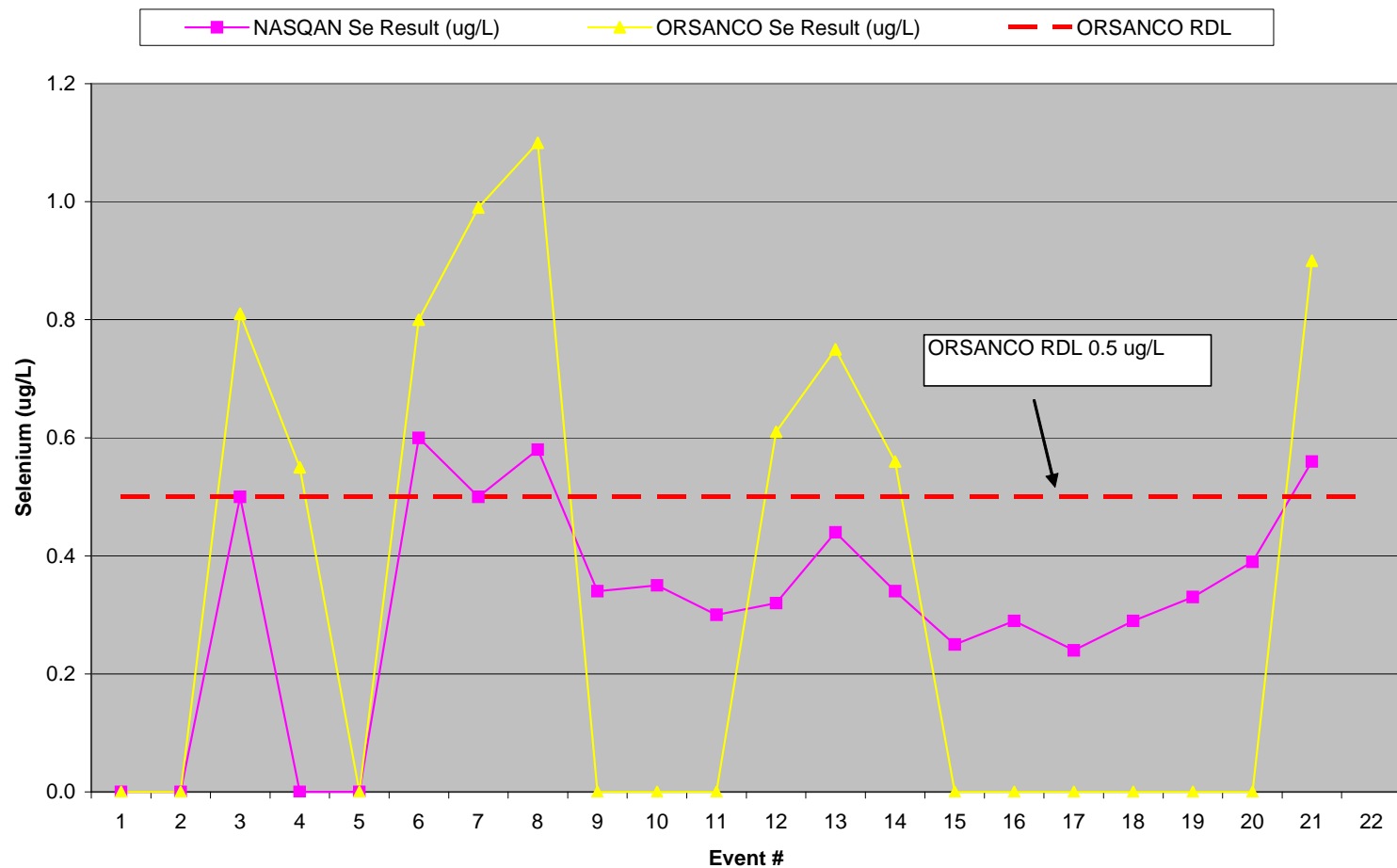
- Chloride, Selenium, Sulfate, and TKN
- All tests showed significant differences



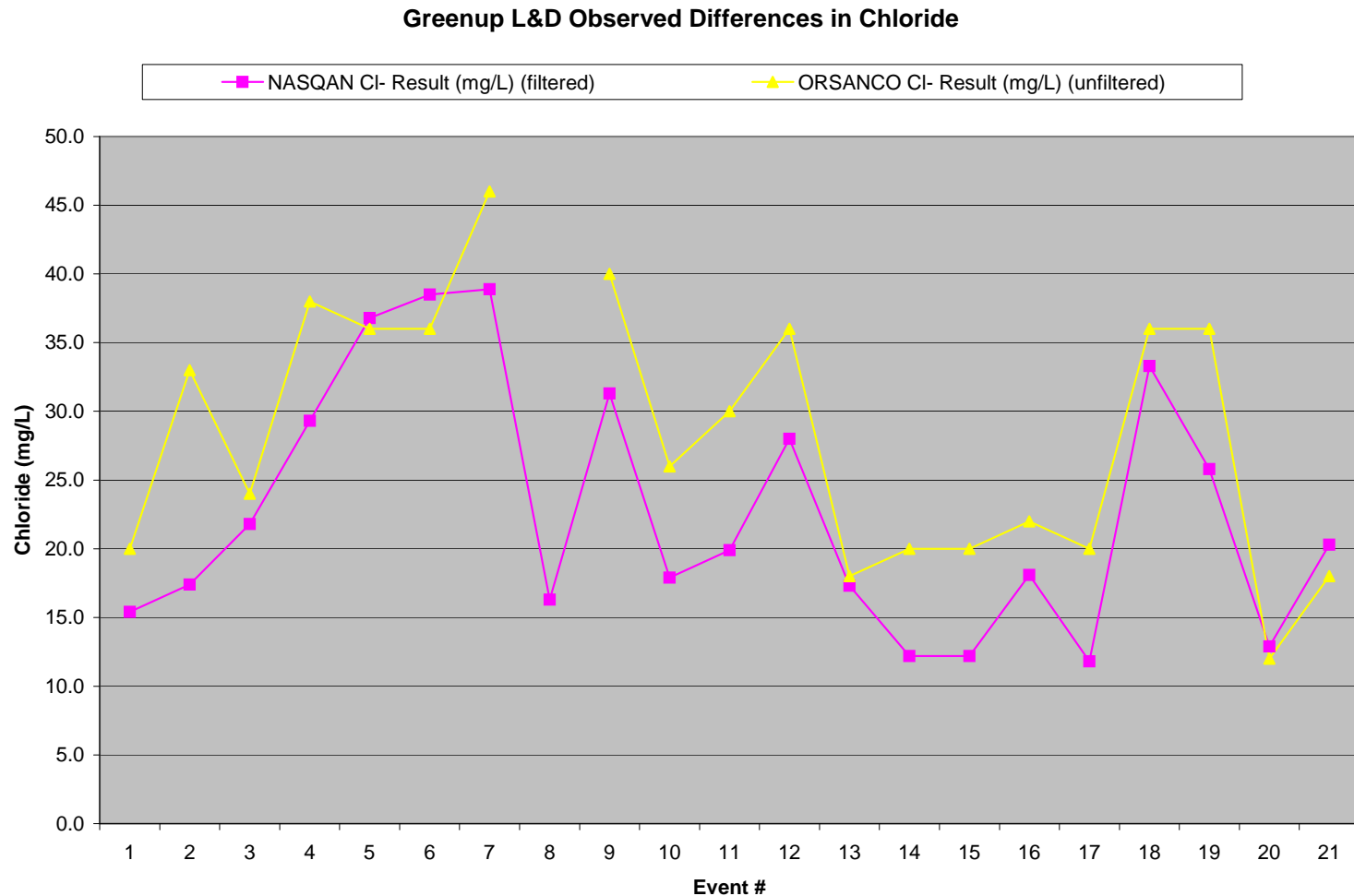
Significant Differences in Selenium Results

ORSANCO result always higher, 12 ND's vs 4 in NASQAN data

Cannelton L&D Observed Differences in Selenium



Significant Differences in Chloride Results



Conclusions

- 3 pollutants no significant differences, 4 with consistent differences, and 5 with mixed results
- Study done for the Monitoring Strategy Committee
- Inquiry has been made about lowering our Selenium reporting limit