


WATER QUALITY SUMMARY OF THE SOUTH PLATTE RIVER URBAN CORRIDOR: 2007-2016

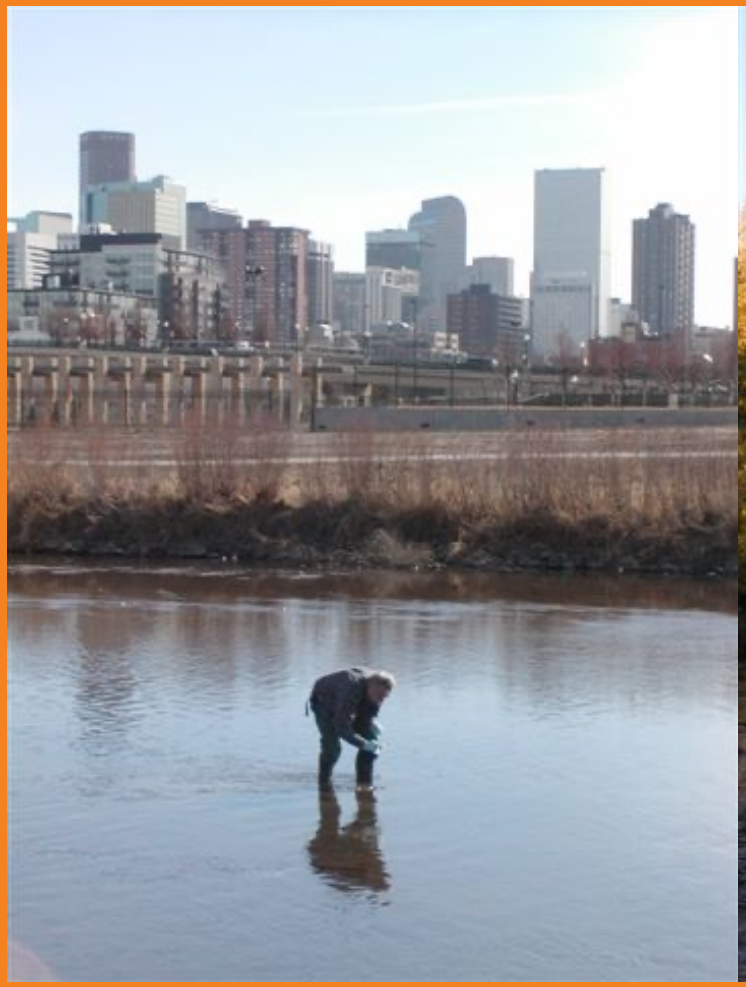
October 19, 2018

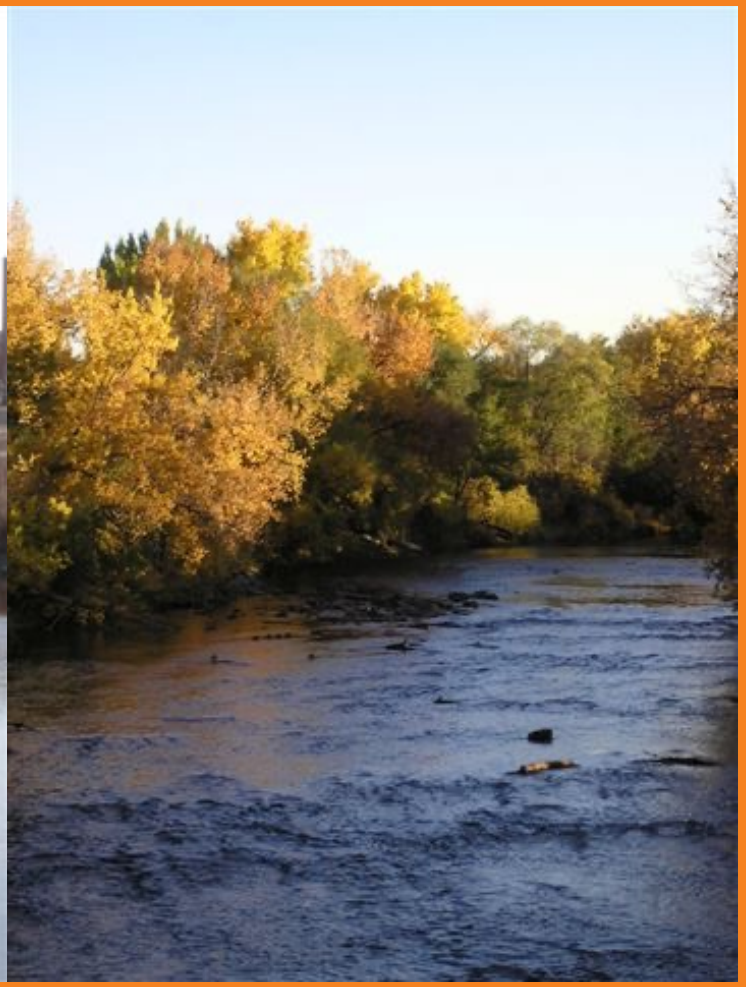
Confluence at the Confluence



South Platte CURE

Introduction



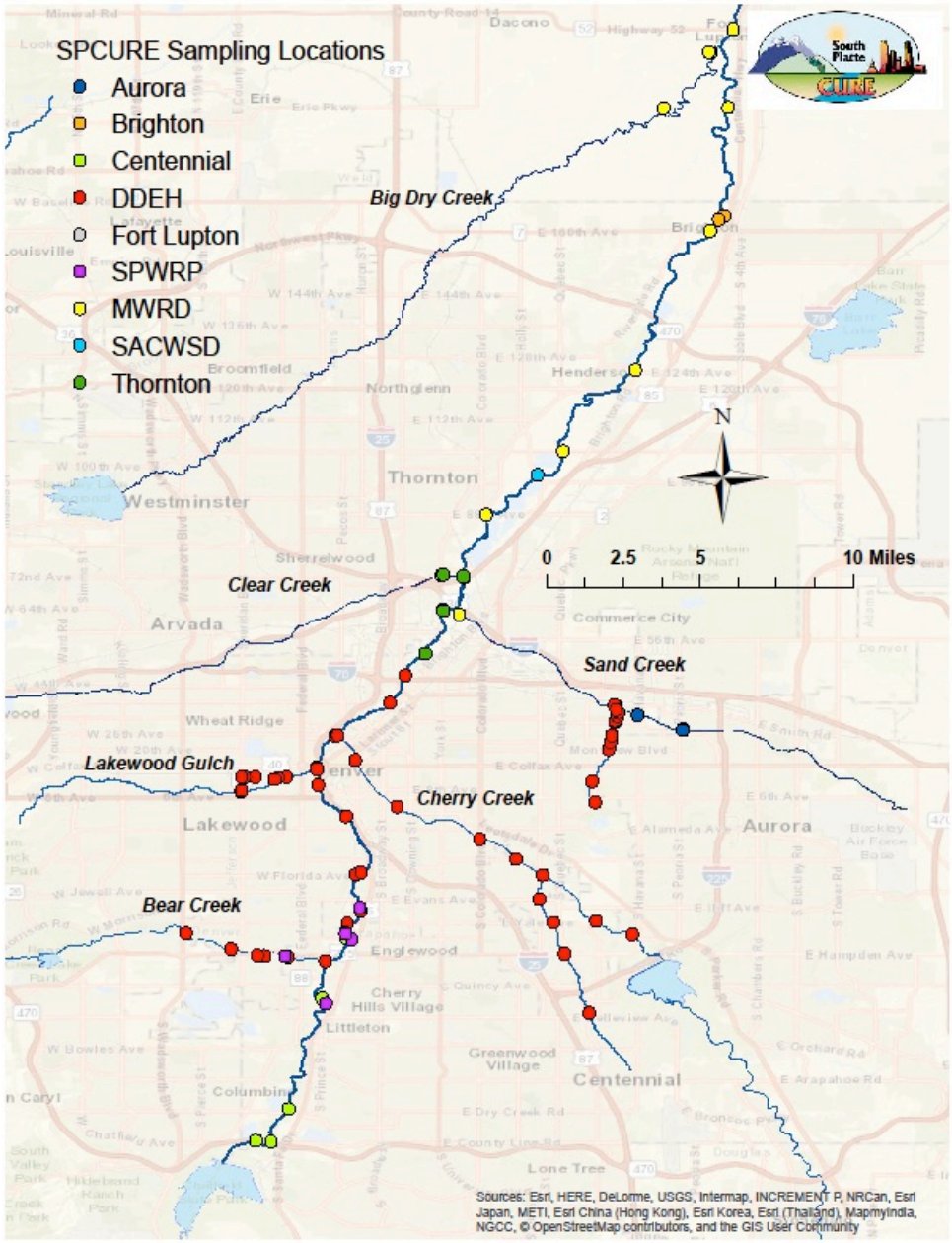


Objective

- Comprehensive evaluation of key water quality parameters to characterize the status of the watershed
- Identify any long-term trends in water quality
- Identify monitoring gaps
- Document to share with interested parties and stakeholders

Methods

- Water quality samples are collected on a bi-monthly basis as described in SPCURE Quality Assurance Project Plan (QAPP).
- Each entity also follows an individual Sampling and Analysis Plan



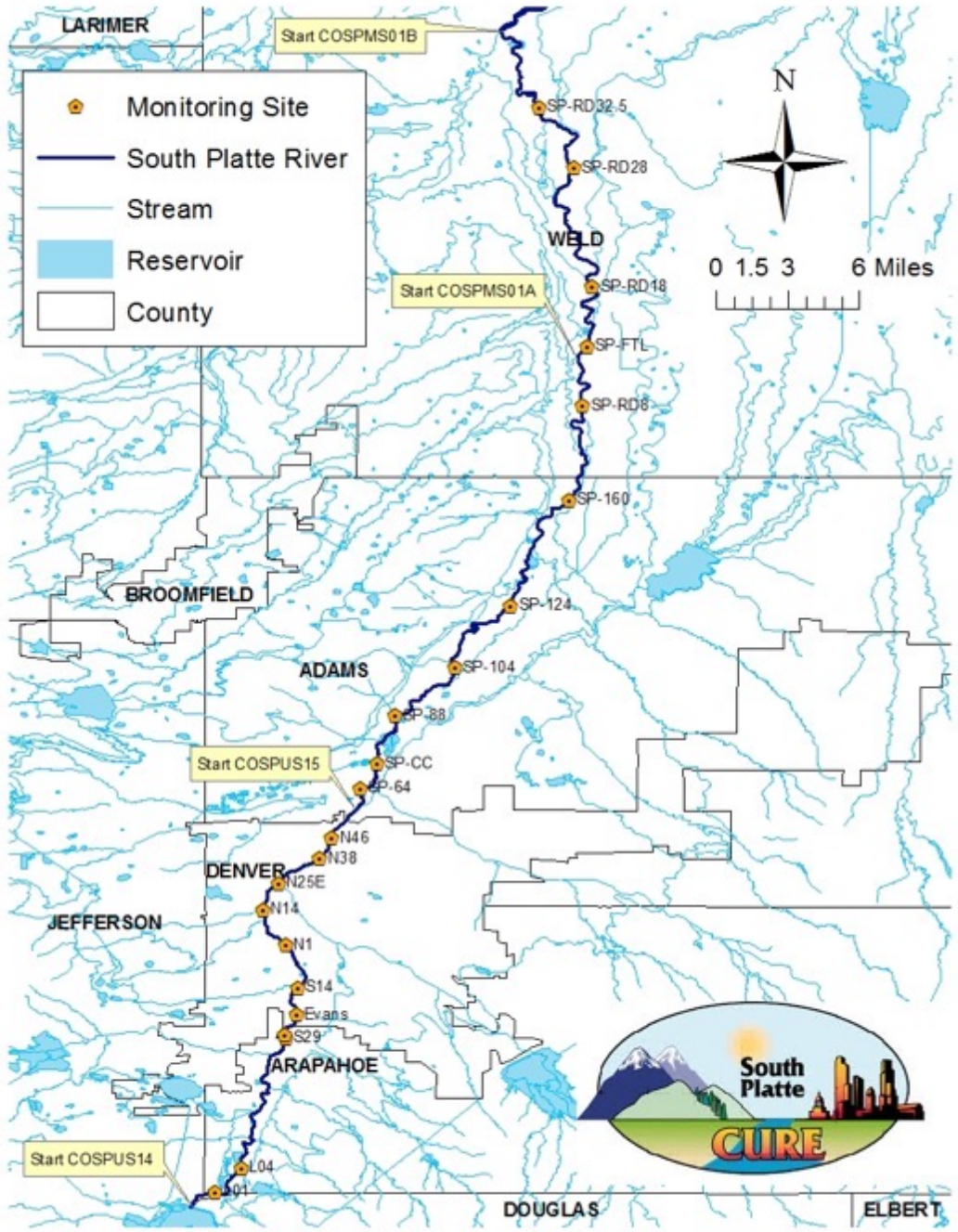
Parameters for Evaluation

Parameter	Rationale
Chloride	USGS study of urban areas; potential aquatic life standards
E. Coli	TMDL on Segment 14 and 15
Nutrients	Regulation 85 and 31
Selenium	Pending EPA criteria
Specific conductivity	Pending EPA criteria
Temperature	Regulation 31

All parameters were evaluated for spatial (longitudinal), seasonal and temporal (i.e. long-term) trends.

Sampling Sites

- While SPCURE samples a total of 57 sites on a biweekly basis, a subset of 21 sites were chosen based on the completeness of each of these sites' datasets
- Mainstem sites only
- Chatfield to the St. Vrain



Results

South Platte River Chloride Concentrations (2007-2016)

mg/L

0
100
200
300
400
500
600
700
800

L01
L04
Dartmouth
S29
Evans
S14
N1
N14
N25E
N38
N46
SP-64
SP-CC
SP-88
SP-104
SP-124
SP-160
SP-RD8
SP-FTL
SP-RD18
SP-RD28
SP-RD32.5

Site (Upstream to Downstream)

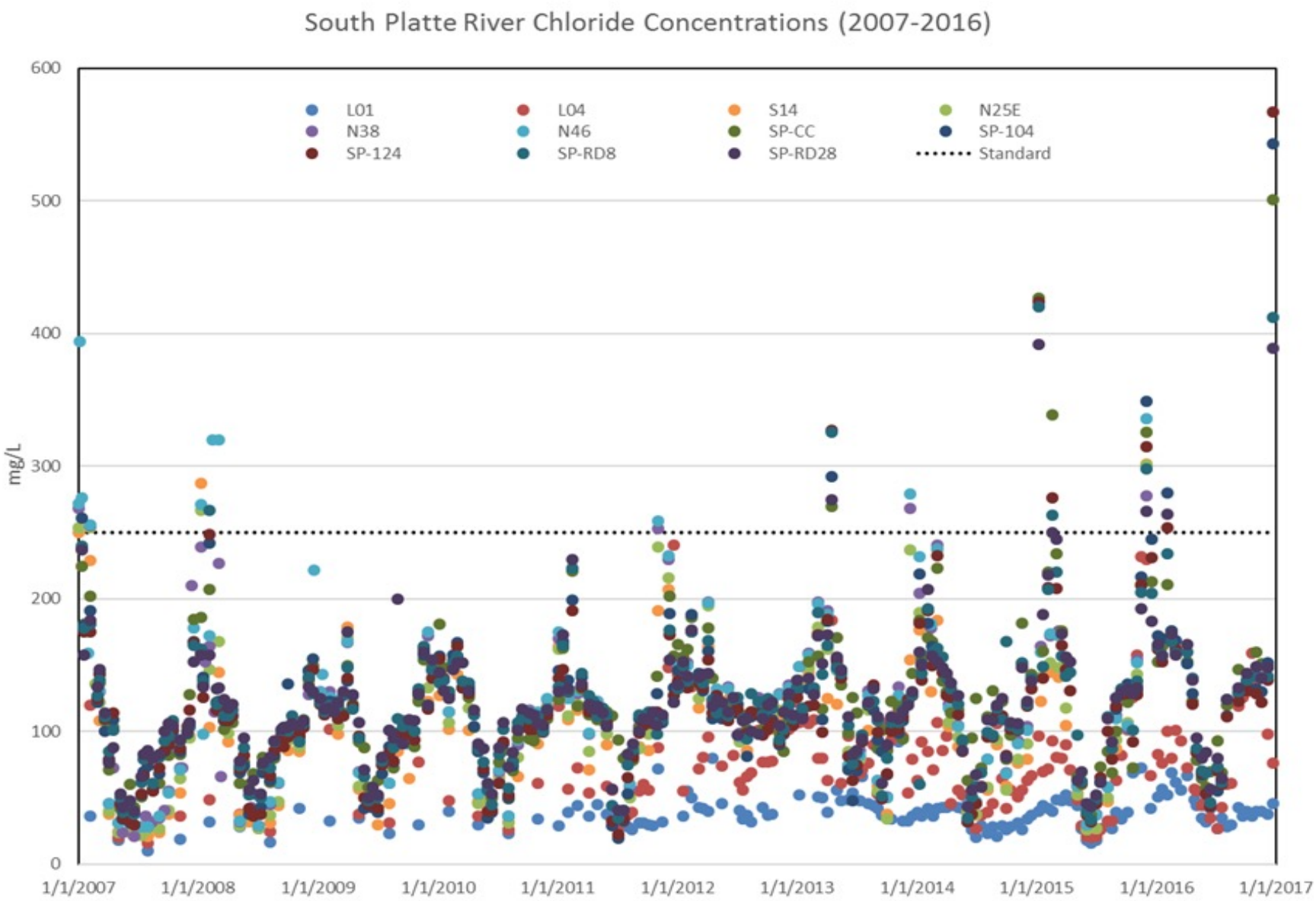
South Platte River Chloride Concentrations by Month (2007-2016)

mg/L

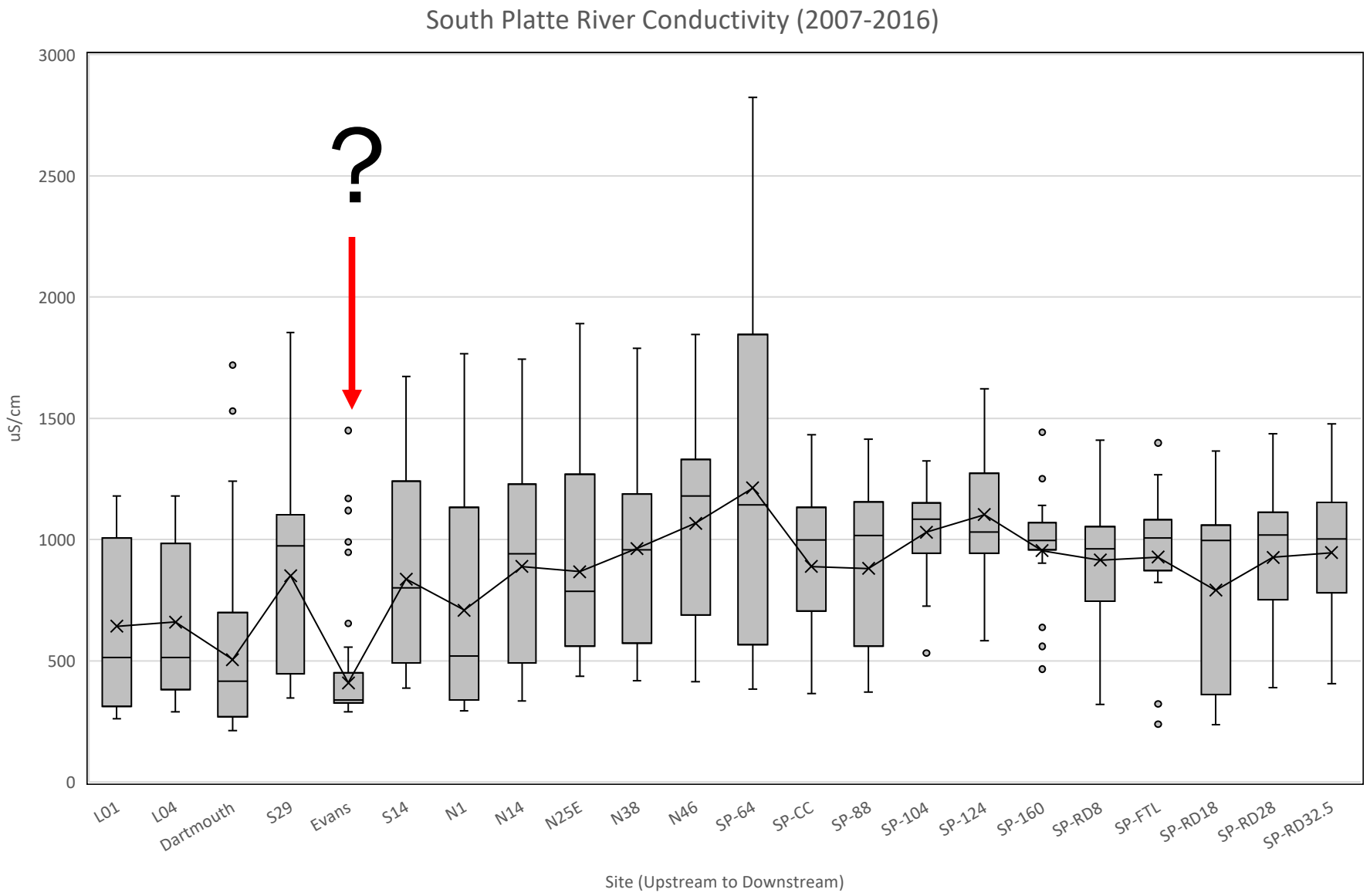
800
700
600
500
400
300
200
100
0

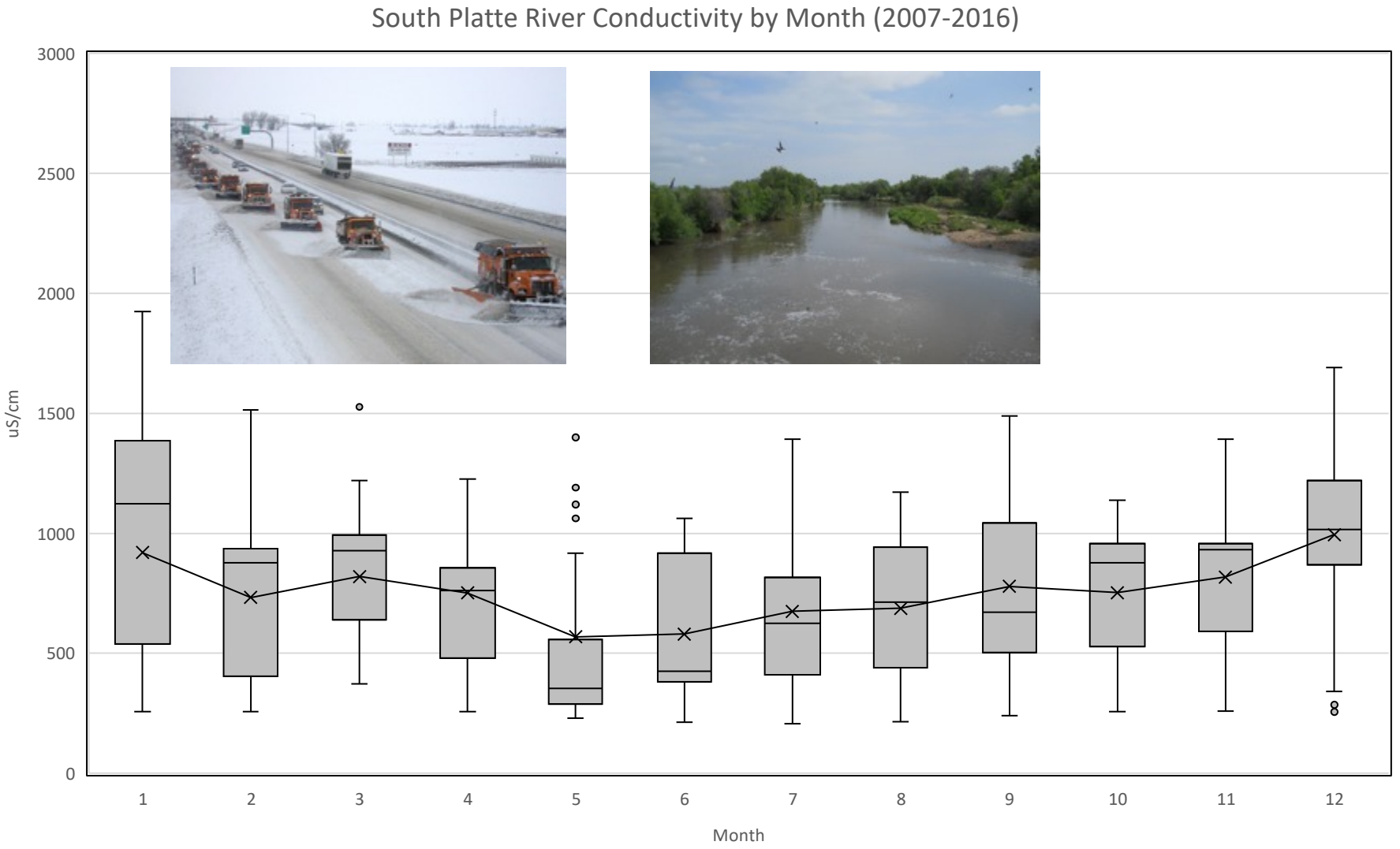
1 2 3 4 5 6 7 8 9 10 11 12

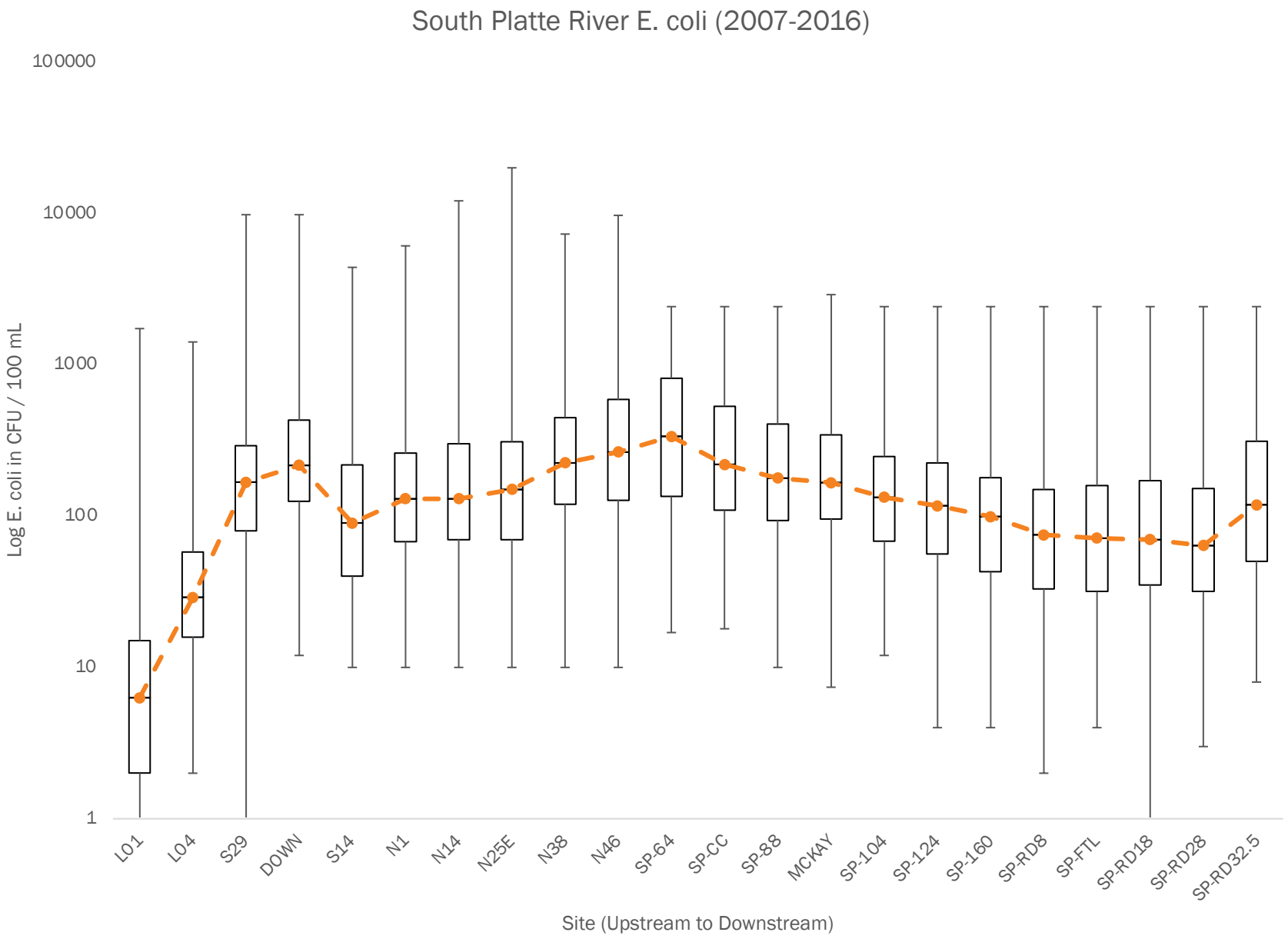
Month

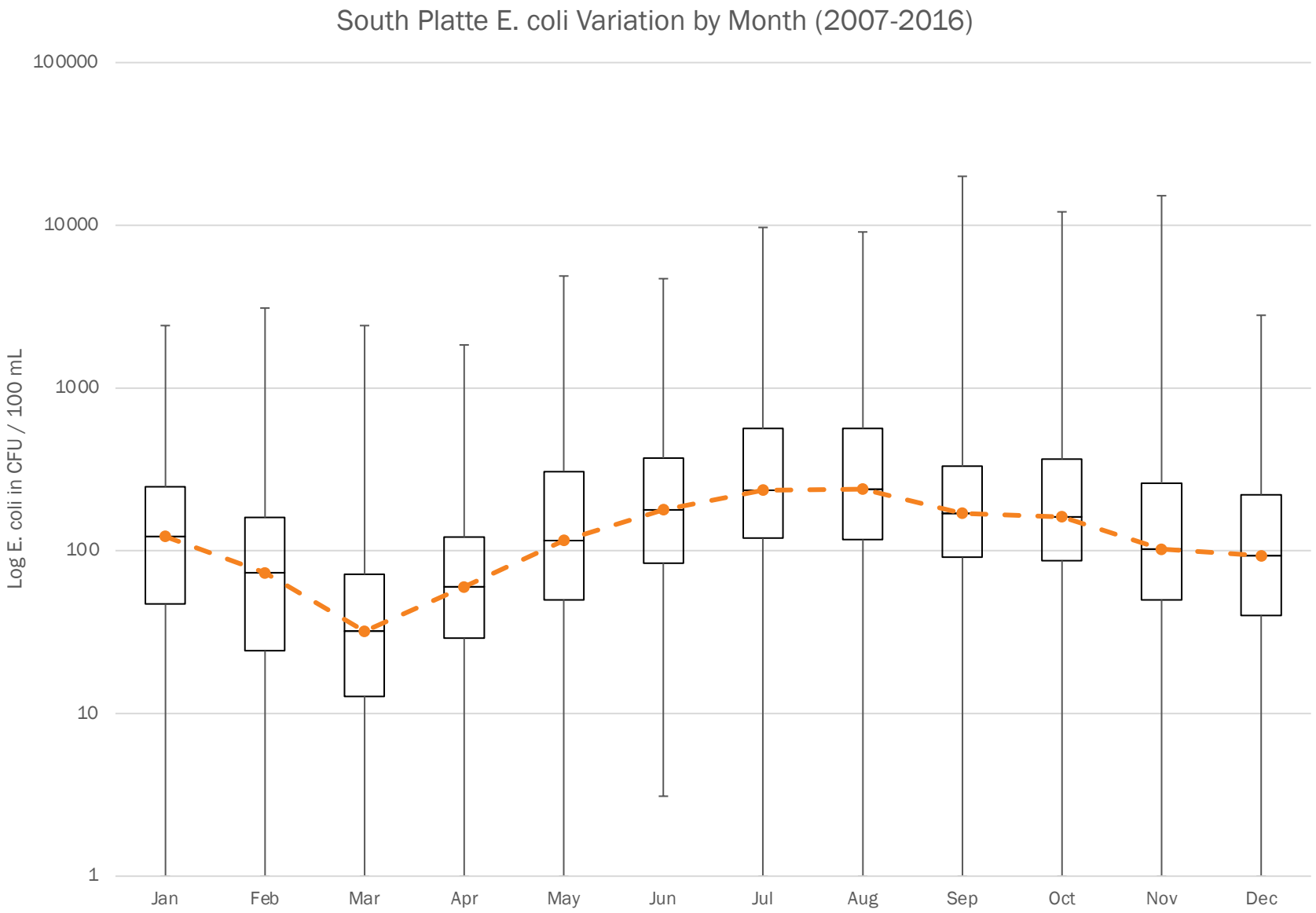

South Platte River Chloride Concentrations (2007-2016)
L01
L04
S14
N25E
N38
N46
SP-CC
SP-104
SP-124
SP-RD8
SP-RD28
Standard
mg/L
600
500
400
300
200
100
0
1/1/2007
1/1/2008
1/1/2009
1/1/2010
1/1/2011
1/1/2012
1/1/2013
1/1/2014
1/1/2015
1/1/2016
1/1/2017

Results of Chloride Trend Analysis (2007–2016)						
Sampling Location	Kendall's Tau	S Statistic	Sen's Slope	p	Alpha	Trend
L01	0.156	102	1.000	**0.023**	0.05	Increasing
L04	-0.033	-26	-0.575	0.620	0.05	None
S14	0.284	122	5.101	**0.000**	0.05	Increasing
N25E	0.334	179	5.611	**< 0.0001**	0.05	Increasing
N38	0.293	193	5.750	**< 0.0001**	0.05	Increasing
N46	0.078	42	0.300	0.289	0.05	None
SP-CC	0.157	321	1.900	**0.001**	0.05	Increasing
SP-104	0.167	239	1.219	**0.002**	0.05	Increasing
SP-124	0.122	249	0.823	**0.012**	0.05	Increasing
SP-RD8	0.151	308	2.388	**0.002**	0.05	Increasing
SP-RD28	0.169	346	1.964	**0.000**	0.05	Increasing

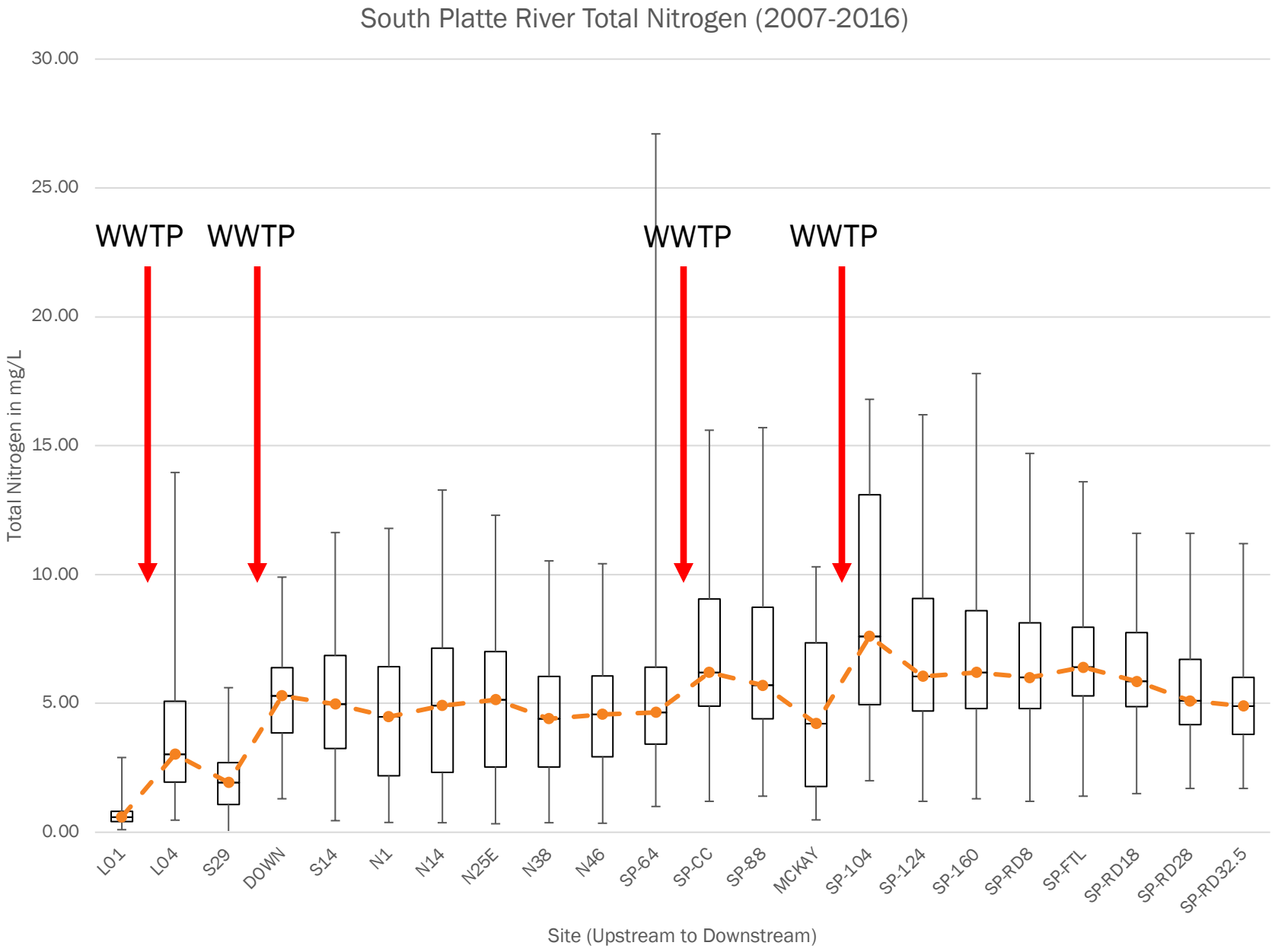

South Platte River Conductivity (2007-2016)
uS/cm
3000
2500
2000
1500
1000
500
0
?
L01
L04
Dartmouth
S29
Evans
S14
N1
N14
N25E
N38
N46
SP-64
SP-CC
SP-88
SP-104
SP-124
SP-160
SP-RD8
SP-FTL
SP-RD18
SP-RD28
SP-RD32.5
Site (Upstream to Downstream)

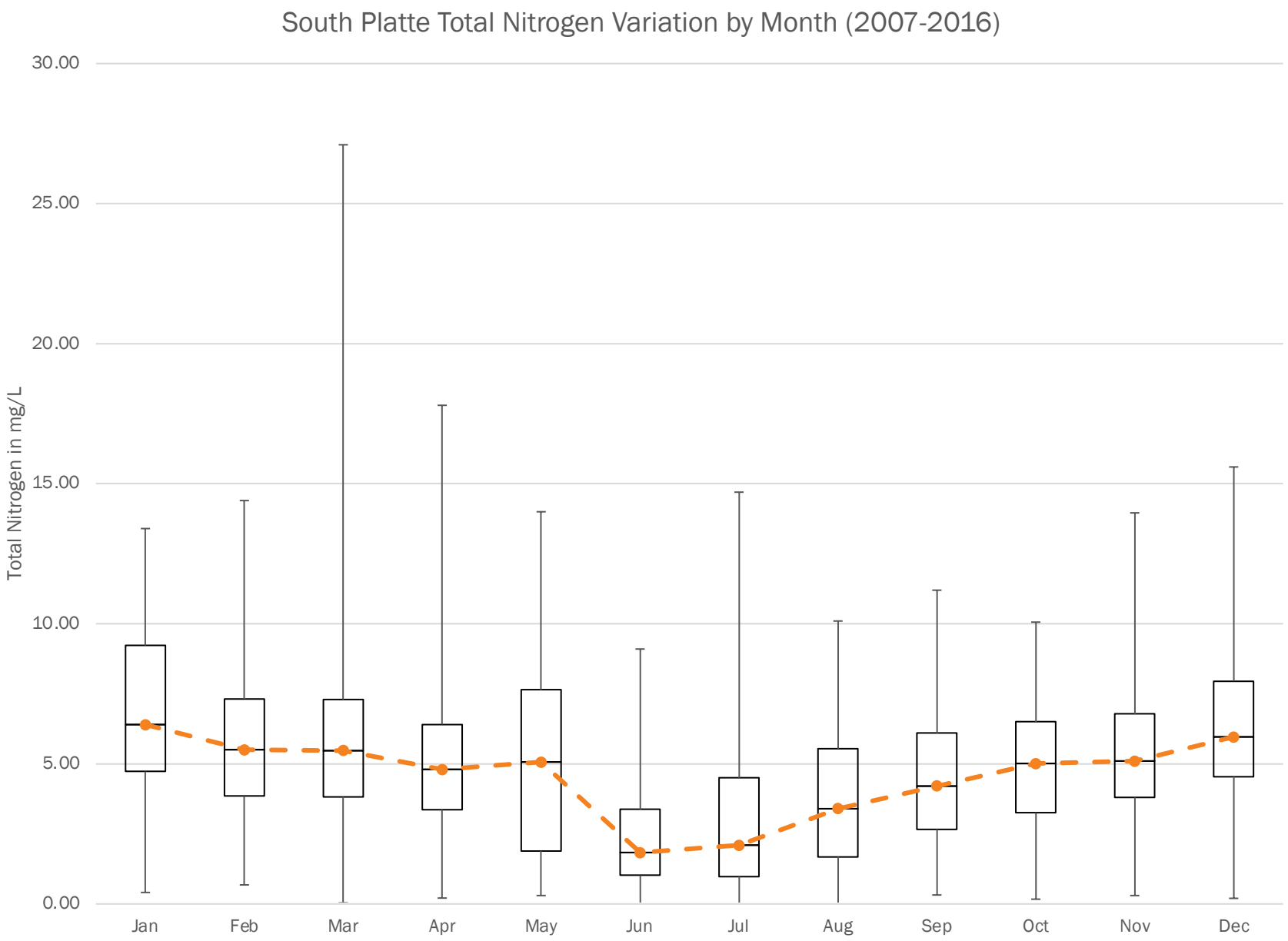

South Platte River Conductivity by Month (2007-2016)
3000
2500
2000
1500
1000
500
0
uS/cm
1
2
3
4
5
6
7
8
9
10
11
12
Month


South Platte River E. coli (2007-2016)
100000
10000
1000
100
10
1
Log E. coli in CFU / 100 mL
L01
L04
S29
DOWN
S14
N1
N14
N25E
N38
N46
SP-64
SP-CC
SP-88
MCKAY
SP-104
SP-124
SP-160
SP-RD8
SP-FTL
SP-RD18
SP-RD28
SP-RD32.5
Site (Upstream to Downstream)


South Platte E. coli Variation by Month (2007-2016)
Log E. coli in CFU / 100 mL
100000
10000
1000
100
10
1
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

Results of E. coli Trend Analysis (2007–2016)						
Sampling Location	Kendall's Tau	S Statistic	Sen's slope	p	Alpha	Trend
L01	0.051	90	0.000	0.324	0.05	None
L04	0.103	210	0.692	**0.035**	0.05	Increasing
S14	-0.074	-31	-5.833	0.360	0.05	None
N25E	0.164	791	4.124	**< 0.0001**	0.05	Increasing
N38	0.125	82	10.625	0.068	0.05	None
N46	0.200	107	11.500	**0.006**	0.05	Increasing
SP-CC	0.022	41	1.767	0.662	0.05	None
SP-104	-0.012	-15	-1.339	0.841	0.05	None
SP-124	0.048	99	1.386	0.322	0.05	None
SP-RD8	0.055	138	1.167	0.232	0.05	None
SP-RD28	0.028	52	-0.091	0.577	0.05	None


South Platte River Total Nitrogen (2007-2016)
30.00
25.00
20.00
15.00
10.00
5.00
0.00
Total Nitrogen in mg/L
WWTP
WWTP
WWTP
WWTP
L01
L04
S29
DOWN
S14
N1
N14
N25E
N38
N46
SP-64
SP-CC
SP-88
MCKAY
SP-104
SP-124
SP-160
SP-RD8
SP-FTL
SP-RD18
SP-RD28
SP-RD32.5
Site (Upstream to Downstream)


South Platte Total Nitrogen Variation by Month (2007-2016)
Total Nitrogen in mg/L
30.00
25.00
20.00
15.00
10.00
5.00
0.00
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

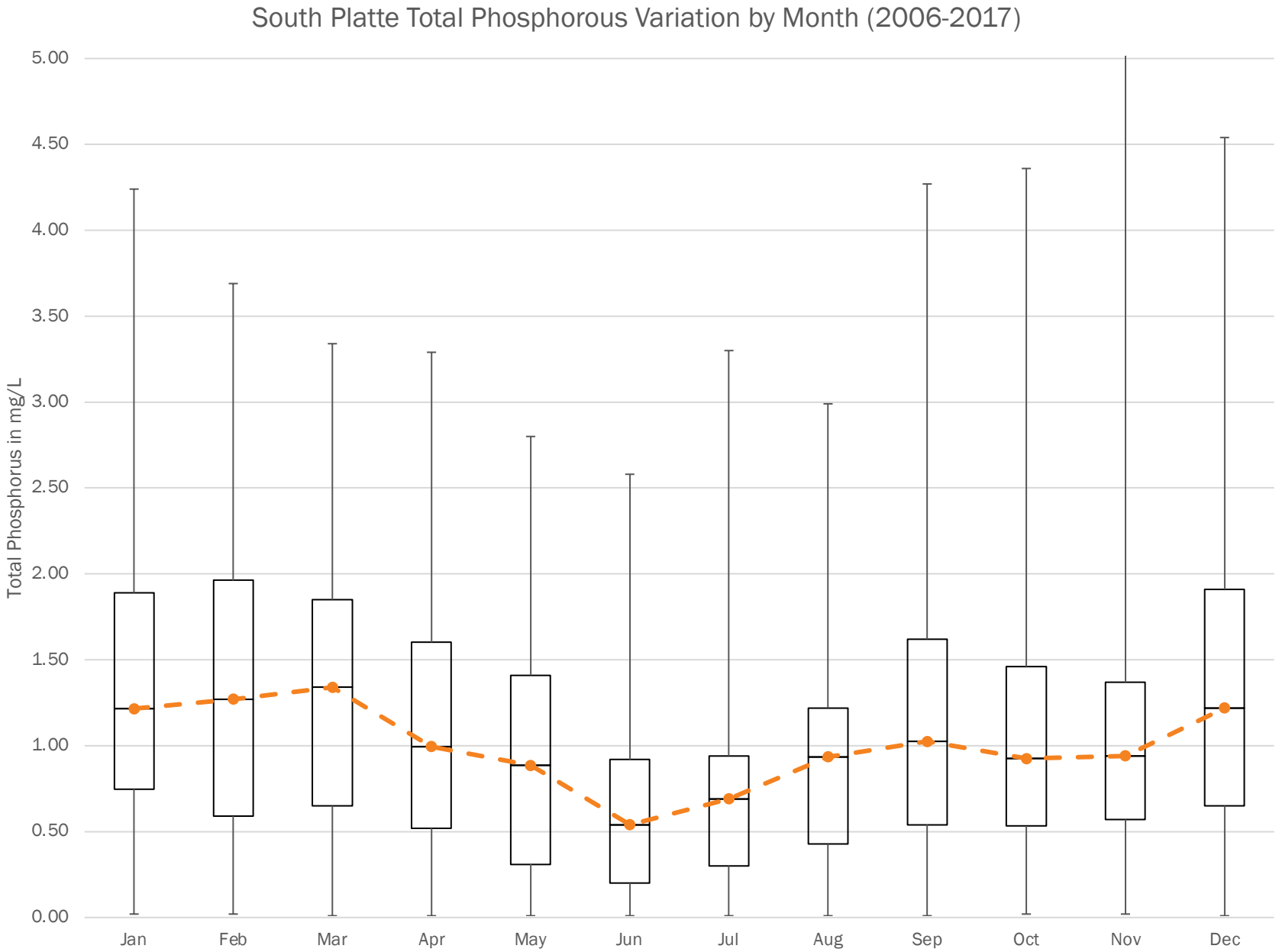
South Platte River Total Phosphorus (2007-2016)

Total Phosphorus in mg/L

5.00
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00

L01 L04 L05 S29 DOWN S14 N1 N14 N25E N38 N46 SP-64 SP-CC SP-88 MCKAY SP-104 SP-124 SP-160 SP-RD8 SP-FTL SP-RD18 SP-RD28 SP-RD32.5

Site (Upstream to Downstream)


South Platte Total Phosphorous Variation by Month (2006-2017)
Total Phosphorus in mg/L
5.00
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

Results of Total Phosphorus Trend Analysis (2007–2016) [a]						
Sampling Location	Kendall's Tau	S Statistic	Sen's Slope	p[b]	Alpha	Trend
L01	-0.133	-67	-0.001	0.079	0.05	None
L04	-0.038	-25	0.000	0.588	0.05	None
S14	0.028	12	-0.005	0.740	0.05	None
N25E	-0.095	-51	-0.007	0.196	0.05	None
N38	-0.052	-34	-0.006	0.457	0.05	None
N46	-0.091	12	-0.013	0.214	0.05	None
SP-CC	-0.289	-529	-0.055	**< 0.0001**	0.05	Decreasing
SP-104	-0.141	-321	-0.006	**0.003**	0.05	Decreasing
SP-124	-0.221	-859	-0.032	**< 0.0001**	0.05	Decreasing
SP-RD8	-0.277	-1442	-0.027	**< 0.0001**	0.05	Decreasing
SP-RD28	-0.288	-1122	-0.023	**< 0.0001**	0.05	Decreasing

a. Except L01 and L04, period of record is 2009–2016.
b. Bold values are statistically significant.

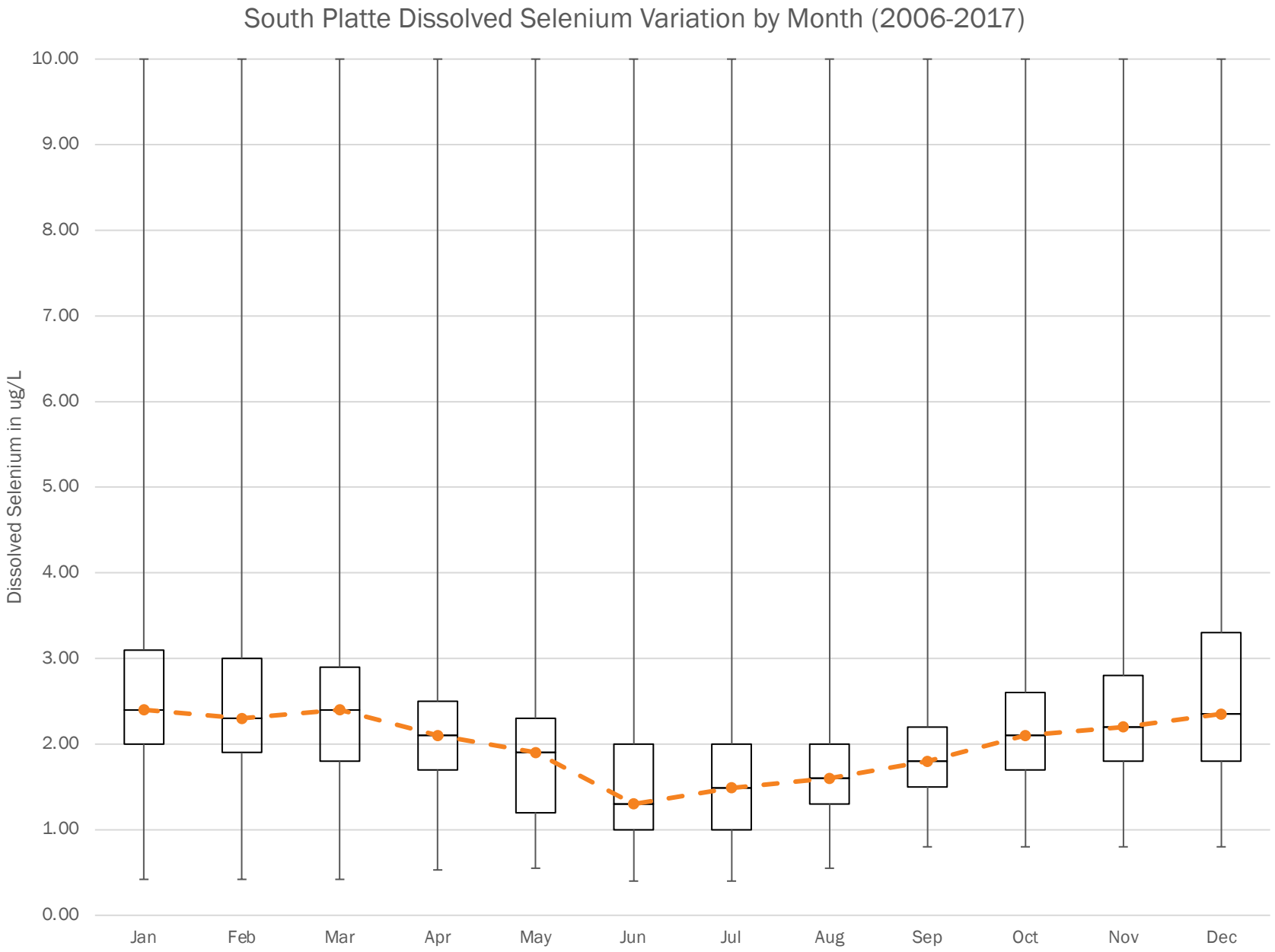
South Platte River Dissolved Selenium (2007-2016)

Dissolved Selenium in ug/L

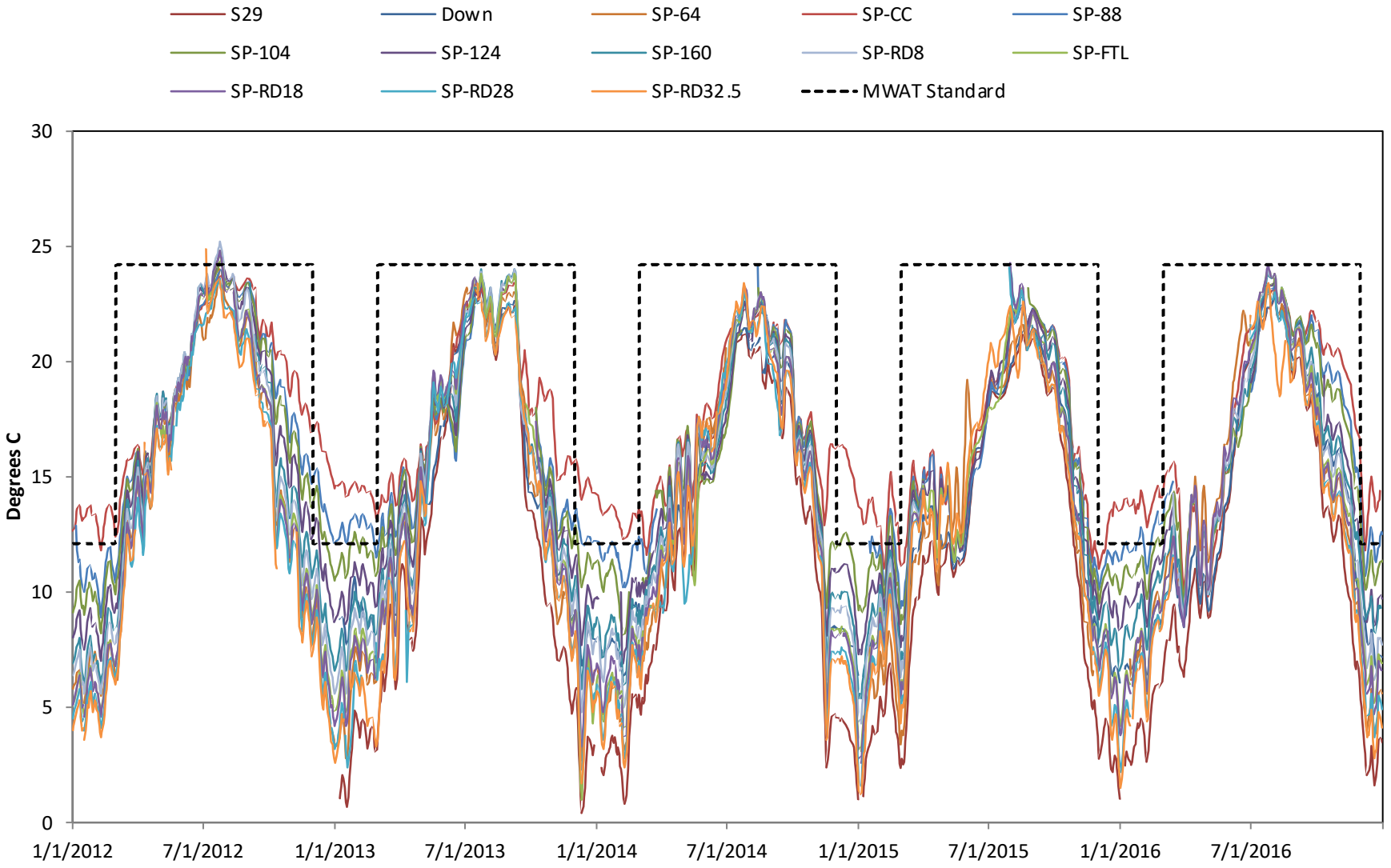
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00

L01 L04 S29 DOWN S14 N1 N14 N25E N38 N46 SP-64 SP-CC SP-88 MCKAY SP-104 SP-124 SP-160 SP-RD8 SP-FTL SP-RD18 SP-RD28 SP-RD32.5

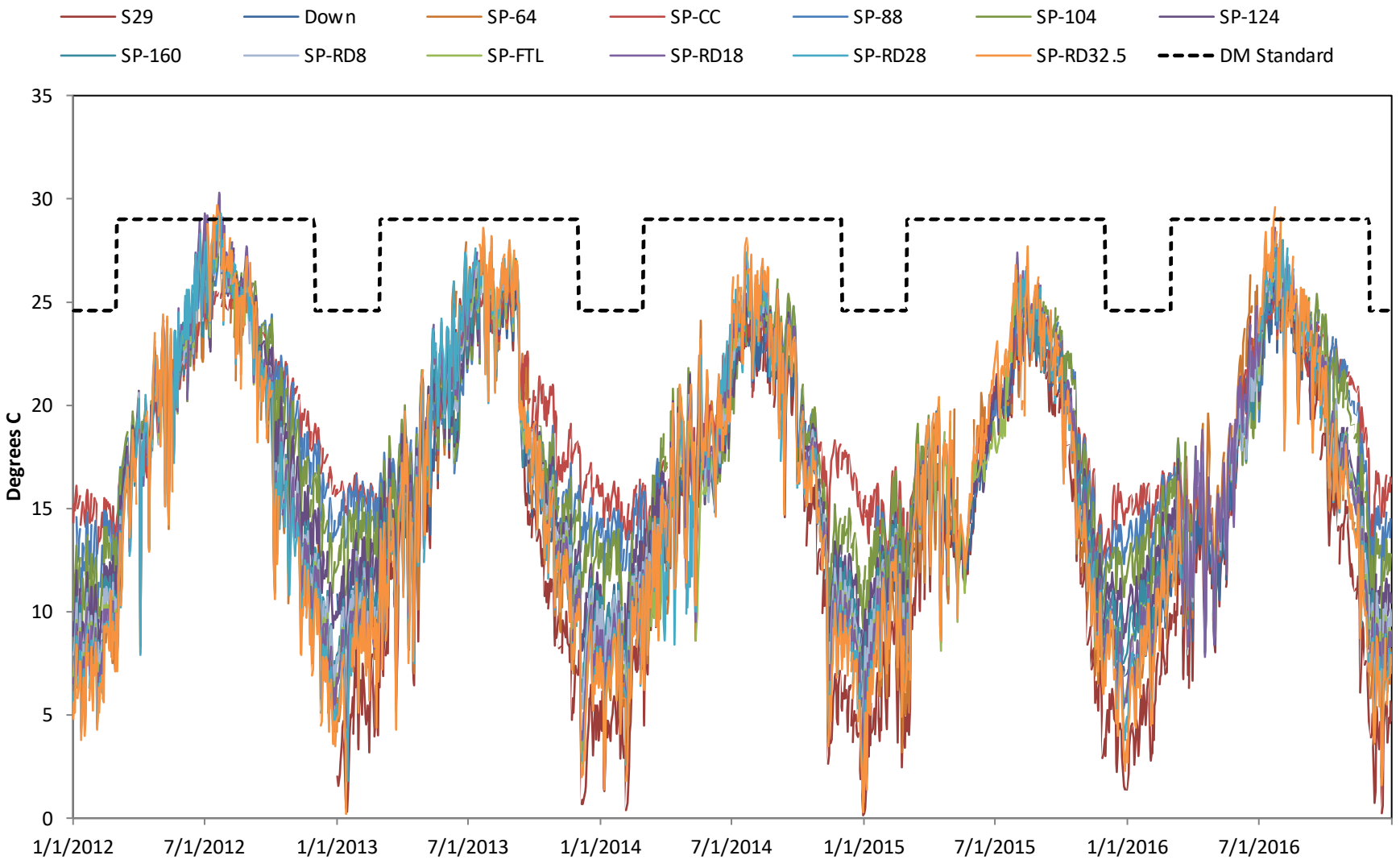
Site (Upstream to Downstream)


South Platte Dissolved Selenium Variation by Month (2006-2017)
Dissolved Selenium in ug/L
10.00
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

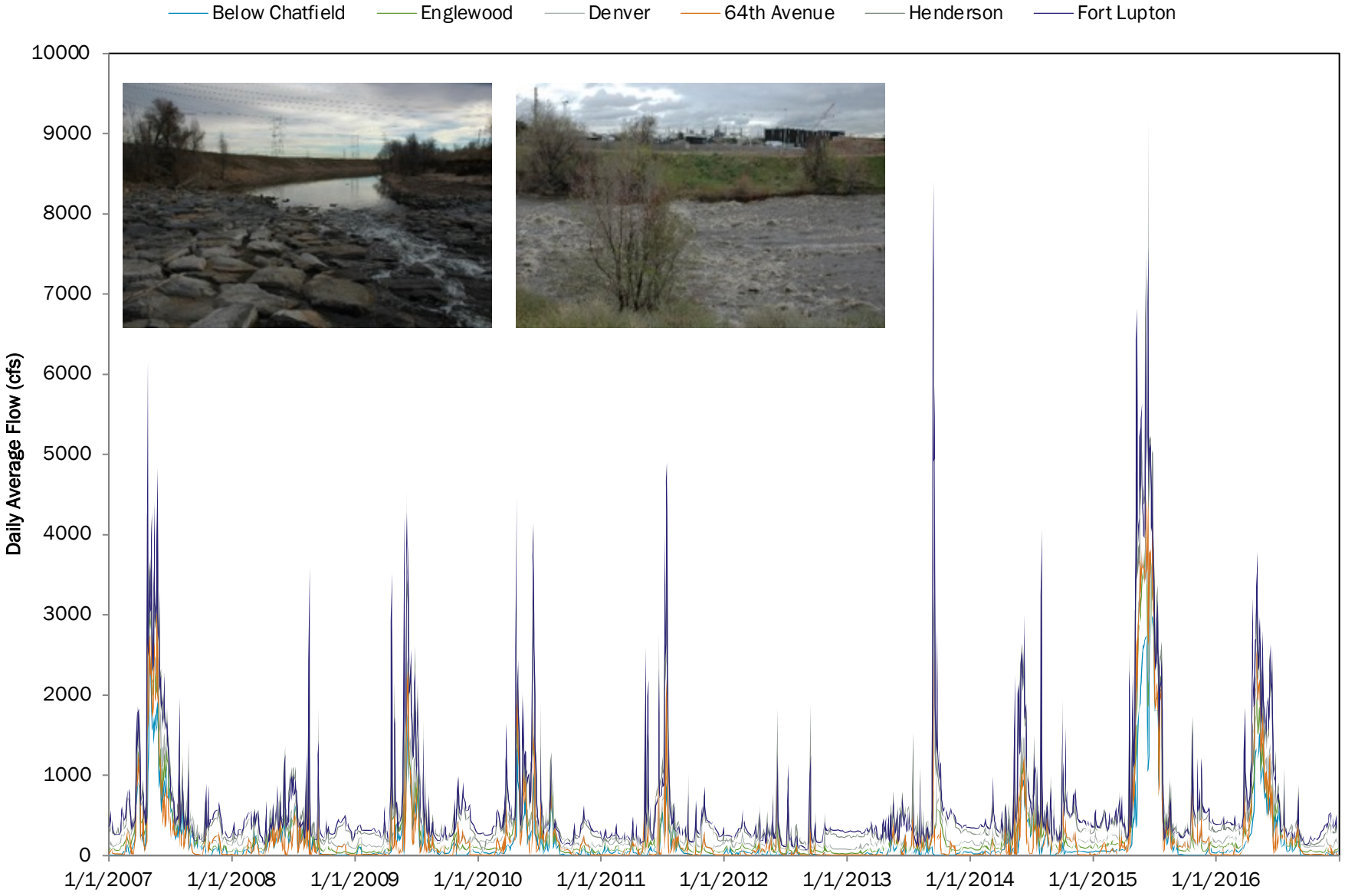
South Platte River Maximum Weekly Average Temperature (MWAT)



South Platte River 2-Hour Daily Maximum Temperature



South Platte River Segments 14 and 15 Daily Average Flow



Discussion and Next Steps

Discussion

- Denver urban and natural environments contribute mineral and biological contaminants to the South Platte River
- Seasonally, mineral and nutrient concentrations are highest in the winter months and lower in the summer months
- Chloride shows strong long-term increasing trend, other parameters no trends or less definitive

River chloride trends in snow-affected urban watersheds: increasing concentrations outpace urban growth rate and are common among all seasons

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[b] U.S. Geological Survey, 432 National Center, Reston, VA 20192, United States

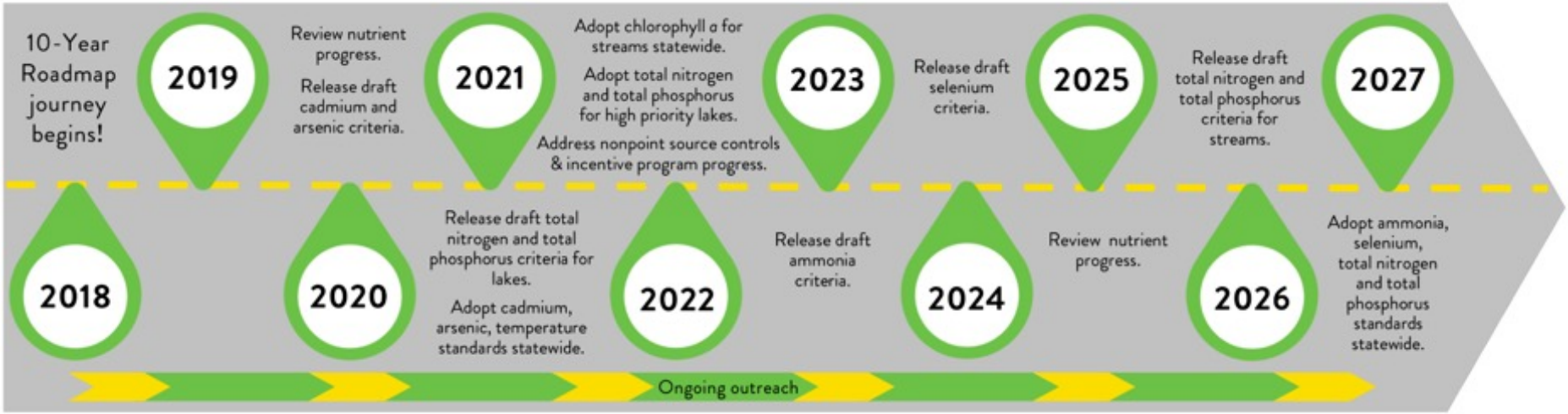
HIGHLIGHTS

- Chloride trends in northern U.S. urban streams are computed.
- The rate of chloride concentration increase outpaced urbanization from 1990 to 2011.
- The greatest chloride concentration increase was during the winter.
- Increasing chloride concentration trends were observed in all seasons.
- Chronic water quality criteria for chloride were exceeded for extended durations.

GRAPHICAL ABSTRACT

Next Steps

- Align report with WQCD's "Water Quality Roadmap"
- Closer look at tributaries
- Incorporate flow and loading
- Potential parameters for evaluation (ammonia, cadmium, arsenic, chlorophyll-a, etc…)



Questions?