Delaware River Basin Commission

Point-Discharge 2018-2019 Nutrient Monitoring Data Summary

Water Quality Advisory Committee Meeting

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Delaware River Basin Commission
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Background

- 71 point-discharge facilities within Zones 3 through upper 5 monitored during the first round of nutrient monitoring initiated in 2011
  - All facilities monitored for 2-yr period
  - Characterized point-discharger nutrient loads
- **32 facilities** identified for second round of monitoring conducted 2018 – 2019
  - Eutrophication Model calibration period
    - **Tier 1 Facilities (12)** → Weekly monitoring
    - **Tier 2 Facilities (20)** → Monthly monitoring
- Model incorporates Tiers 1 – 3 facilities
  - This presentation and data summary covers Tiers 1 & 2

2018 - 2019 Additional Monitoring

(12) Tier 1 facilities monitored weekly

Tier 1 Facilities (12)	
Facility Name	NPDES Permit No.
City of Wilmington	DE0020320-001
City of Trenton	NJ0020923-001A
Willingboro Municipal Utilities Authority	NJ0023361-001A
Gloucester County Utilities Authority	NJ0024686-001A
Camden County MUA	NJ0026182-001A
Hamilton Township - Wastewater Utility	NJ0026301-001A
Lower Bucks County JMA	PA0026468-001
Philadelphia Water Department Southeast	PA0026662-001
Philadelphia Water Department Southwest	PA0026671-001
Philadelphia Water Department Northeast	PA0026689-001
Morrisville Borough Municipal Authority	PA0026701-201
DELCORA	PA0027103-001

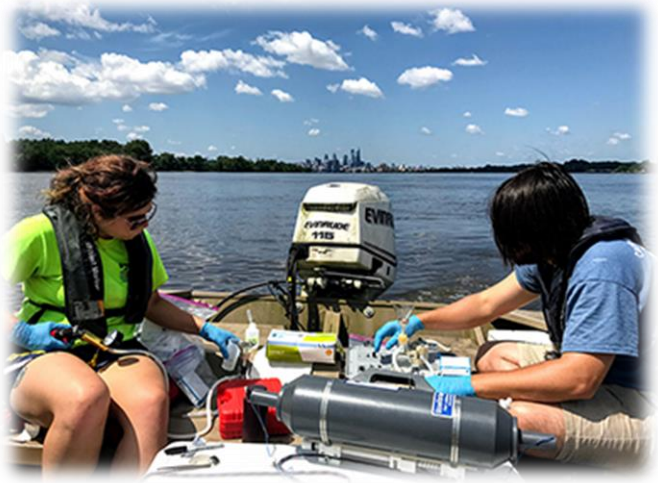
32 total point-discharge facilities

(20) Tier 2 facilities monitored monthly

Tier 2 Facilities (20)	
Facility Name	NPDES Permit No.
Delaware City Refinery	DE0000256-601
Kent County Dept of Public Works	DE0020338-001
Paulsboro Refining	NJ0005029-001A
Valtris Specialty Chemicals (previously Ferro)	NJ0005045-001A
Chemours Chambers Works	NJ0005100-662A
Pennsville Sewerage Authority	NJ0021598-001A
Burlington Township Public Works	NJ0021709-002A
Riverside Water Reclamation Authority	NJ0022519-001A
Delran Sewerage Authority	NJ0023507-001A
Florence Township STP	NJ0023701-001A
Cinnaminson Sewerage Authority	NJ0024007-001A
Mt Holly Municipal Utilities Authority	NJ0024015-001A
Cumberland County Utilities Authority	NJ0024651-001A
Burlington City STP	NJ0024660-002A
Bordentown Sewerage Authority	NJ0024678-001A
Moorestown Twp WWTP	NJ0024996-001
Mt Laurel Municipal Utilities Authority	NJ0025178-001A
City of Millville STP	NJ0029467-001A
Bristol Borough Water & Sewer Authority	PA0027294-001
GROWS Landfill, Waste Management	PA0043818-001

Eutrophication Model Calibration and Development

- Resolution 2017-4 “Analysis of Attainability”
  - Study element: development of loading conditions
- Nutrients and related data collected for eutrophication model
- **2018 – 2019** selected as model calibration period
  - DRBC staff conducted intensive Tributary Nutrient Monitoring during the same period to account for tributary loads
    - The purpose of this presentation is to summarize the Point-Discharge Nutrient data



Point Discharge Nutrient Monitoring Data Collection and Estimated Loadings

- **39,608** datapoints of monitoring results were utilized in this assessment and as model input data (this total includes additional data that facilities submitted)
- Loads assessed in this summary calculated prior to model development
  - Concentration multiplied by flow for each record (typically 104 records for Tier 1 facilities and 24 records for Tier 2 facilities)
- Non-detected results replaced with half of the Method Detection Limits

Analytical Parameter	Units	Filtration	Sample Type
Total Phosphorus (TP)	mg/L as P	Unfiltered	24-hour composite
Total Kjeldahl Nitrogen (TKN)	mg/L as N	Unfiltered	24-hour composite
Nitrate Nitrogen (NO_3-N)	mg/L as N	Unfiltered	24-hour composite
Nitrite (NO_2-N)	mg/L as N	Unfiltered	24-hour composite
20-day BOD (BOD_{20})	mg/L	Unfiltered	24-hour composite
5-day Carbonaceous BOD ($CBOD_5$)	mg/L	Unfiltered	24-hour composite
Chemical Oxygen Demand (COD)	mg/L	Unfiltered	24-hour composite
Dissolved Organic Carbon (DOC)*	mg/L	Filtered	24-hour composite
Total Organic Carbon (TOC)	mg/L	Unfiltered	24-hour composite
Total Suspended Solid (TSS)	mg/L	Unfiltered	24-hour composite
Soluble Reactive Phosphorus (SRP)	mg/L as P	0.45 µm membrane filter	24-hour composite
Soluble Kjeldahl Nitrogen (SKN)	mg/L as N	0.45 µm membrane filter	24-hour composite
Ammonia Nitrogen (NH_3-N)	mg/L as N	0.45 µm membrane filter	24-hour composite
Discharge Flow (*or higher frequency)	MGD	N/A	24-hour mean*
Water Temperature	°C	N/A	24-hour mean
Dissolved Oxygen	mg/L	N/A	24-hour mean
pH	1-14	N/A	24-hour mean
Specific Conductance or TDS	µS/cm or mg/L	N/A	24-hour mean

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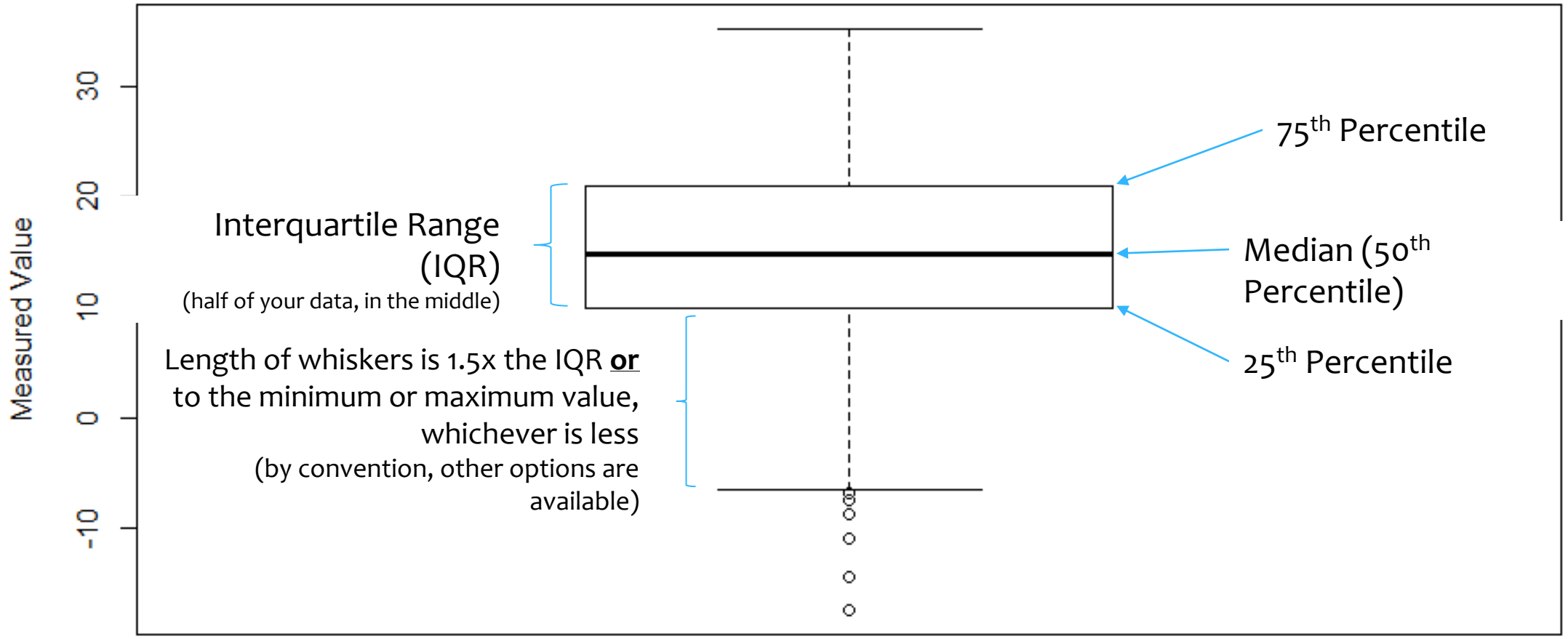
Parameters Monitored 2018 - 2019

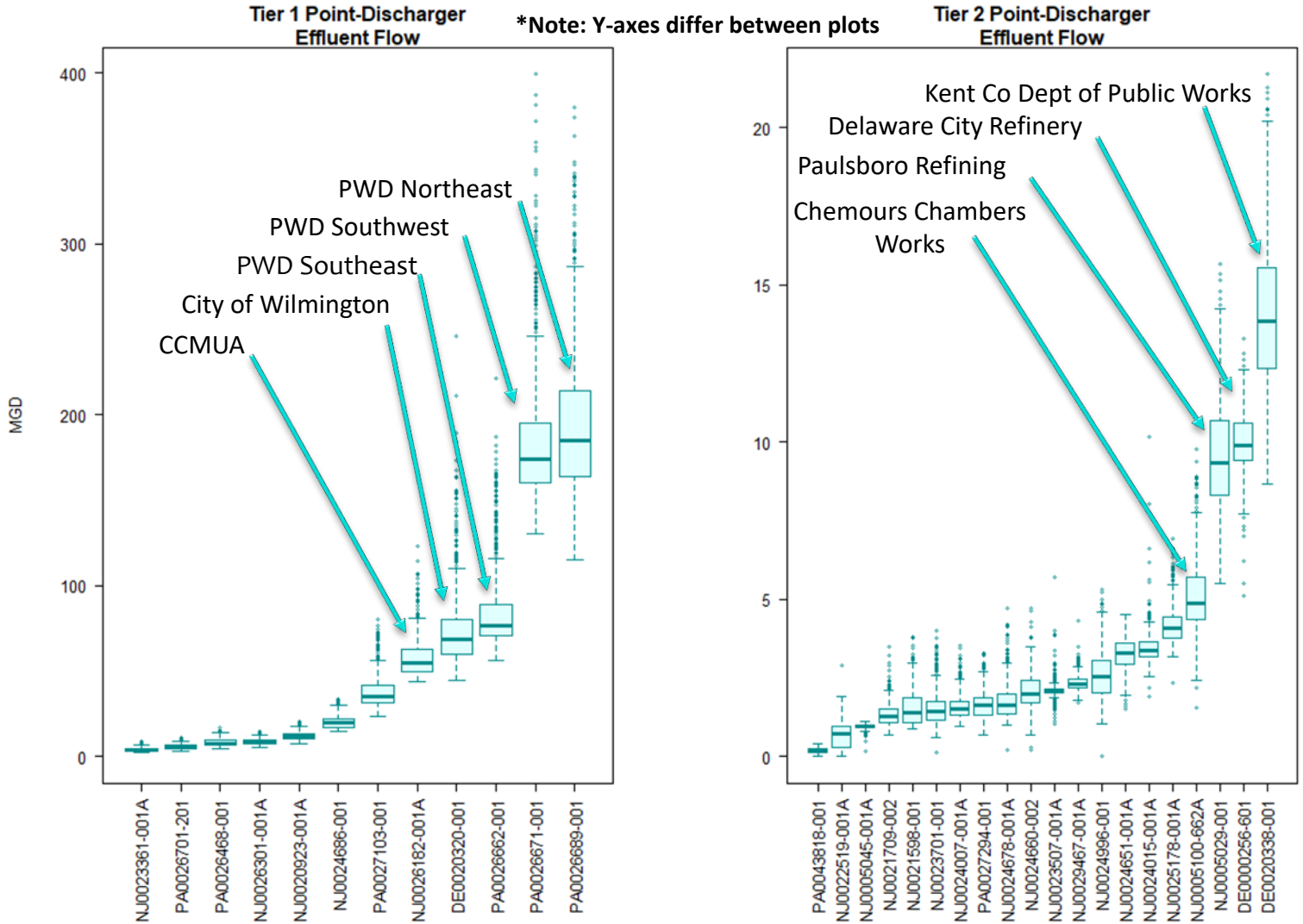
- Parameters summarized
  - Discharge flow
  - Ammonia
  - Nitrate
  - Total Phosphorus
  - Soluble Reactive Phosphorus
  - CBOD-5
  - Total Organic Carbon
- Summaries of other parameters included in data summary report (in progress)

What is a Boxplot?



Discharge Flow, MGD

Tier 1 Range:
3.87 – 185 MGD



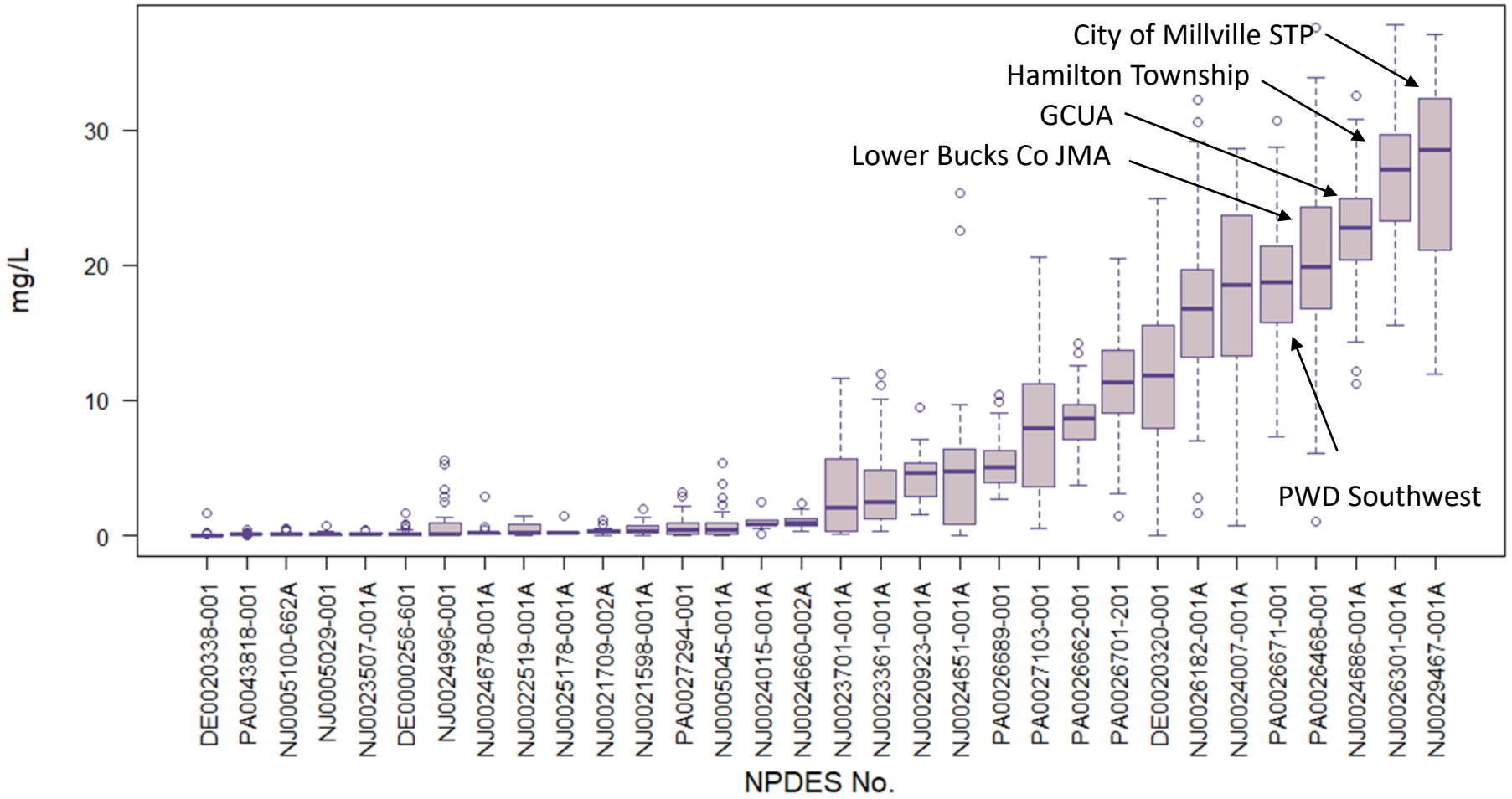
Tier 2 Range:
0.19 – 13.8 MGD

Ammonia Concentration Boxplots

2018 – 2019
Tier 1 & Tier 2 Facilities

Ranked Point Discharger
Ammonia Concentration Data

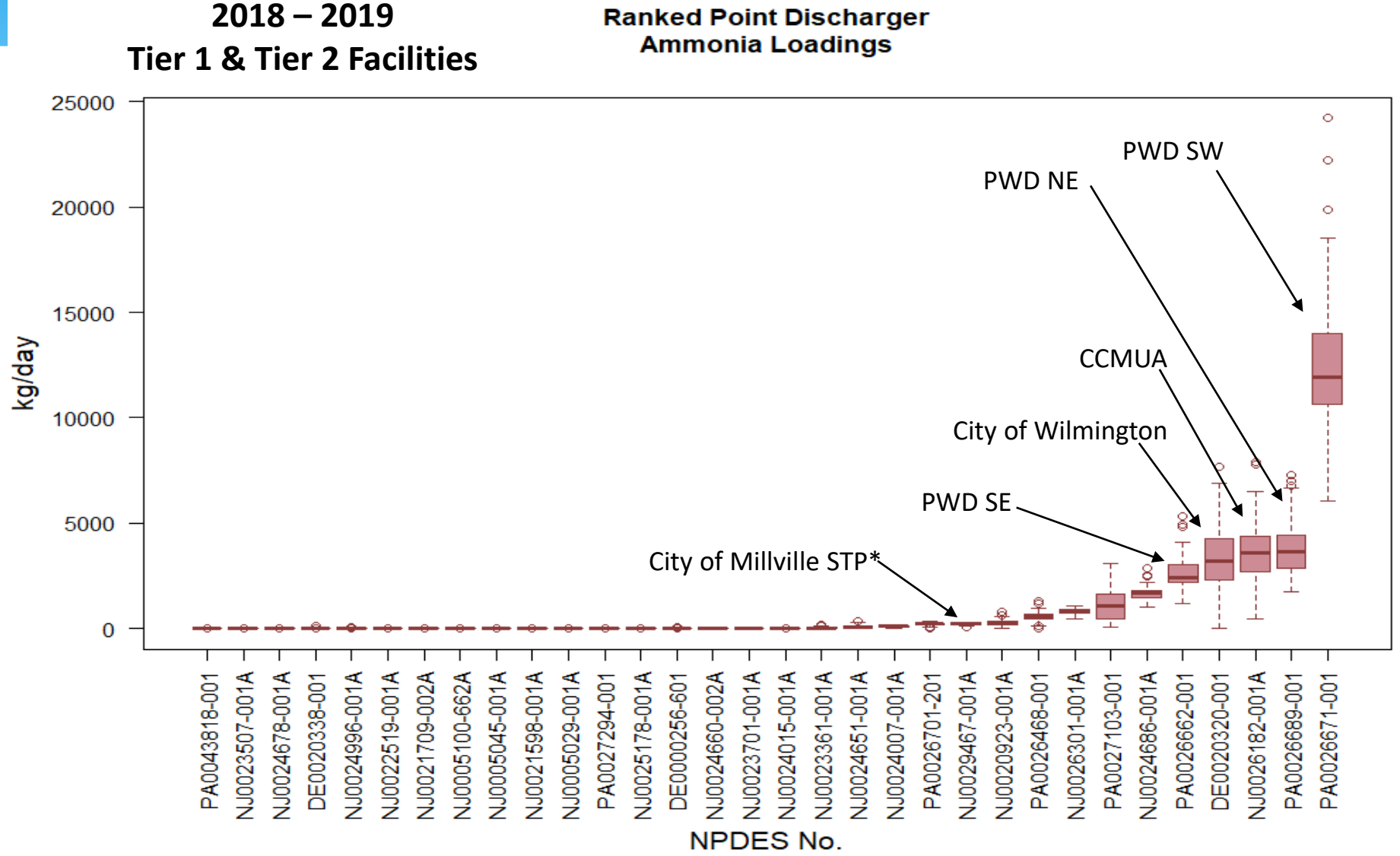
Range of medians:
0.025 – 28.5 mg/L



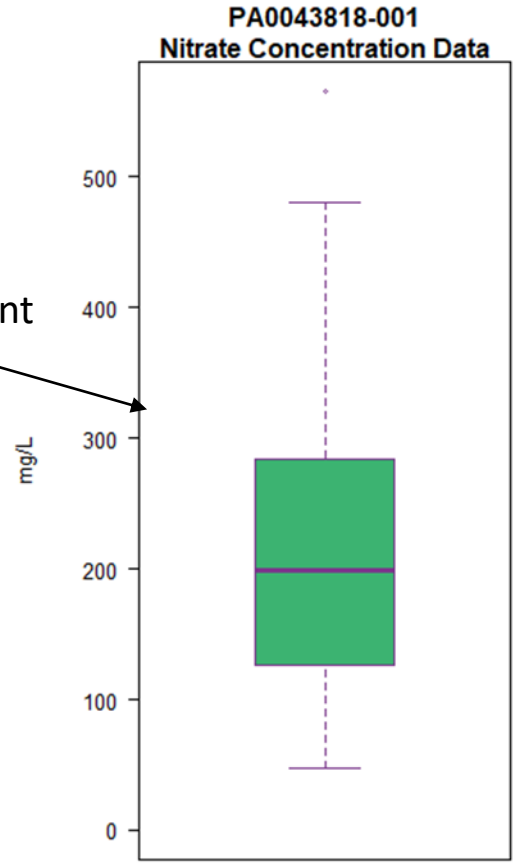
Ammonia Loading Boxplots

Range of medians:
3.48 – 11,745 kg/day

2018 – 2019
Tier 1 & Tier 2 Facilities



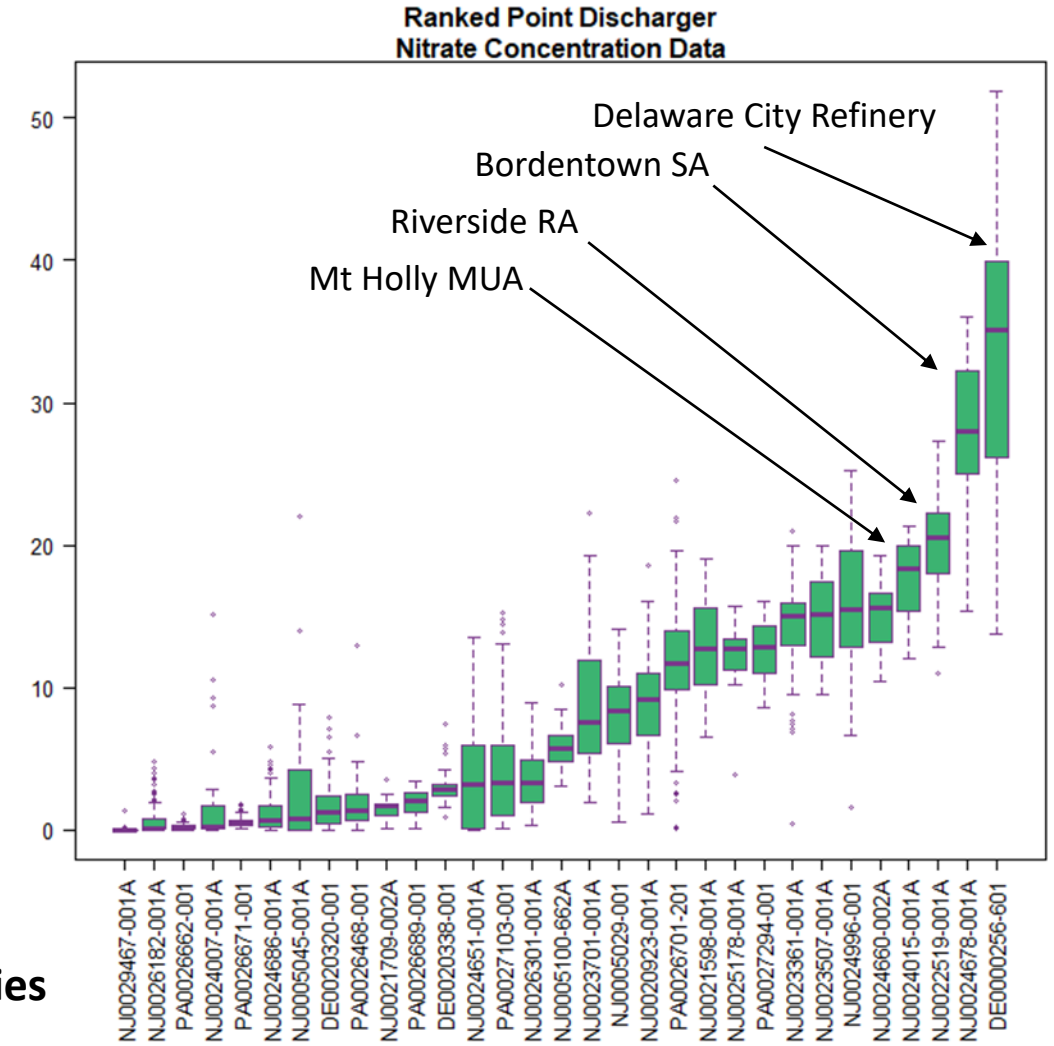
Nitrate Concentration Boxplots



GROWS Landfill
Waste Management

Range of medians:
0.02 – 199 mg/L

***Excluding GROWS*:**
0.02 – 35.1 mg/L



2018 – 2019
Tier 1 & Tier 2 Facilities

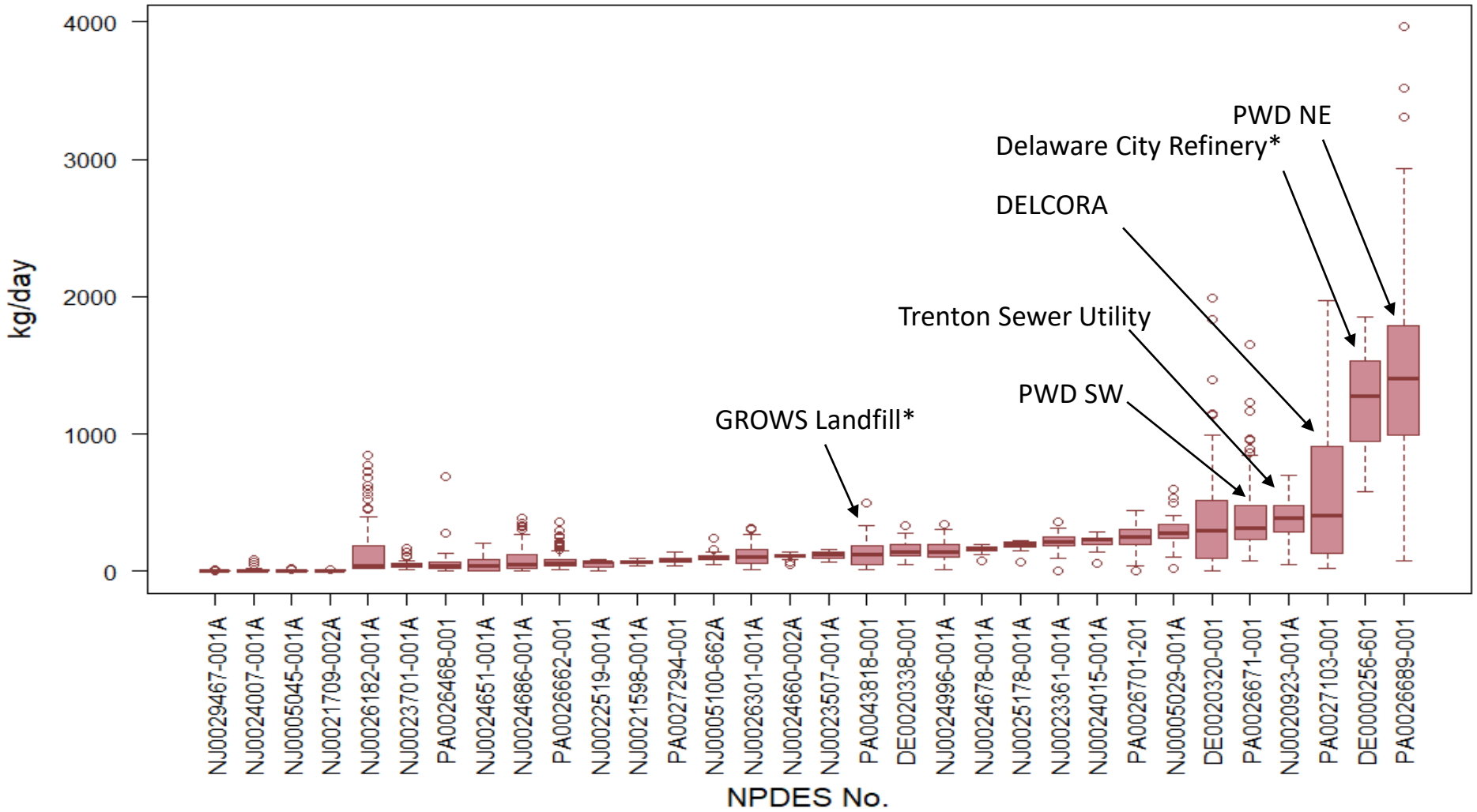
Nitrate Loading Boxplots

Range of medians:
2.22 – 1,400 kg/day

GROWS Landfill:
~90 kg/day

2018 – 2019
Tier 1 & Tier 2 Facilities

Ranked Point Discharger Nitrate (NO3) Loadings

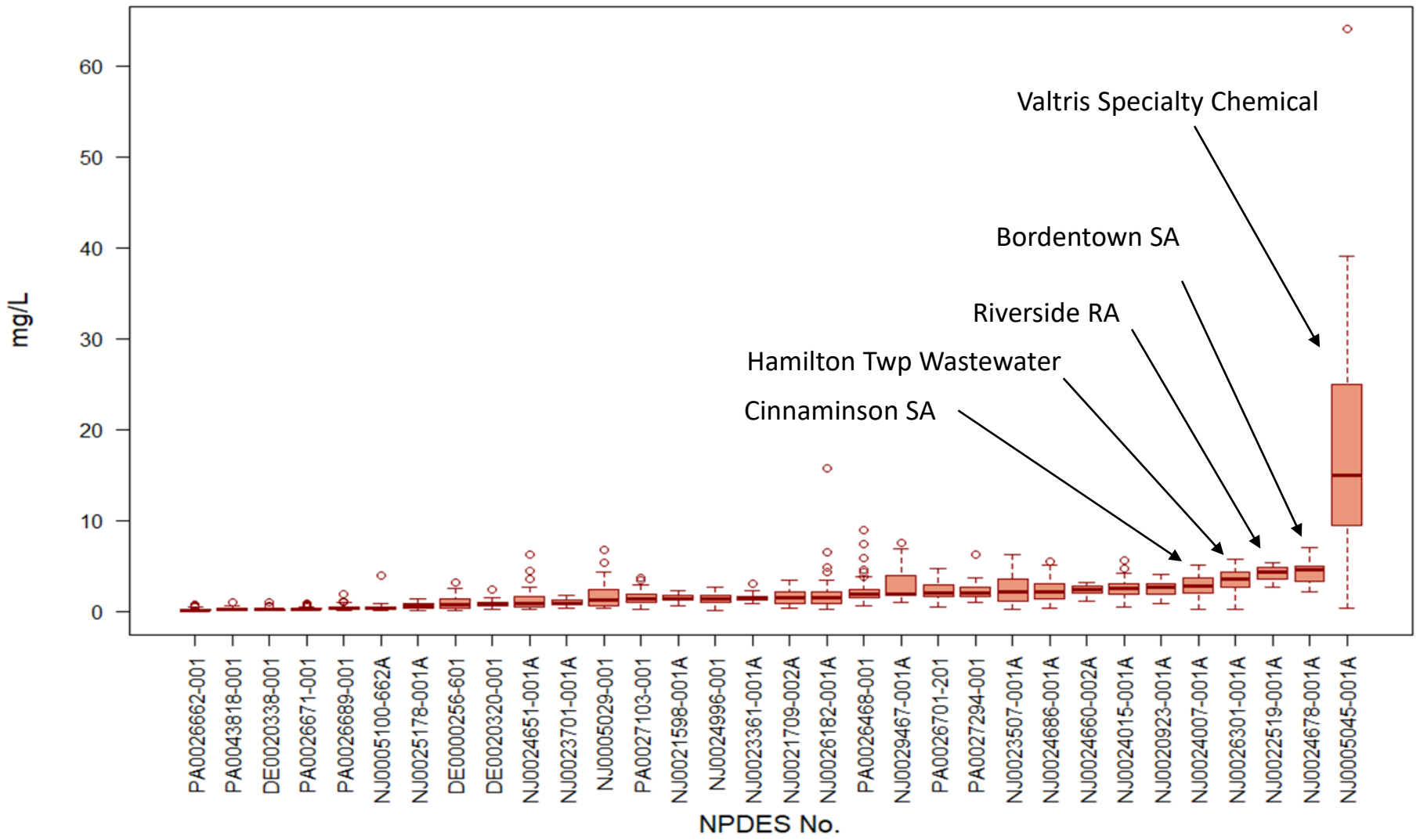


Total Phosphorus Concentration Boxplots

2018 – 2019
Tier 1 & Tier 2 Facilities

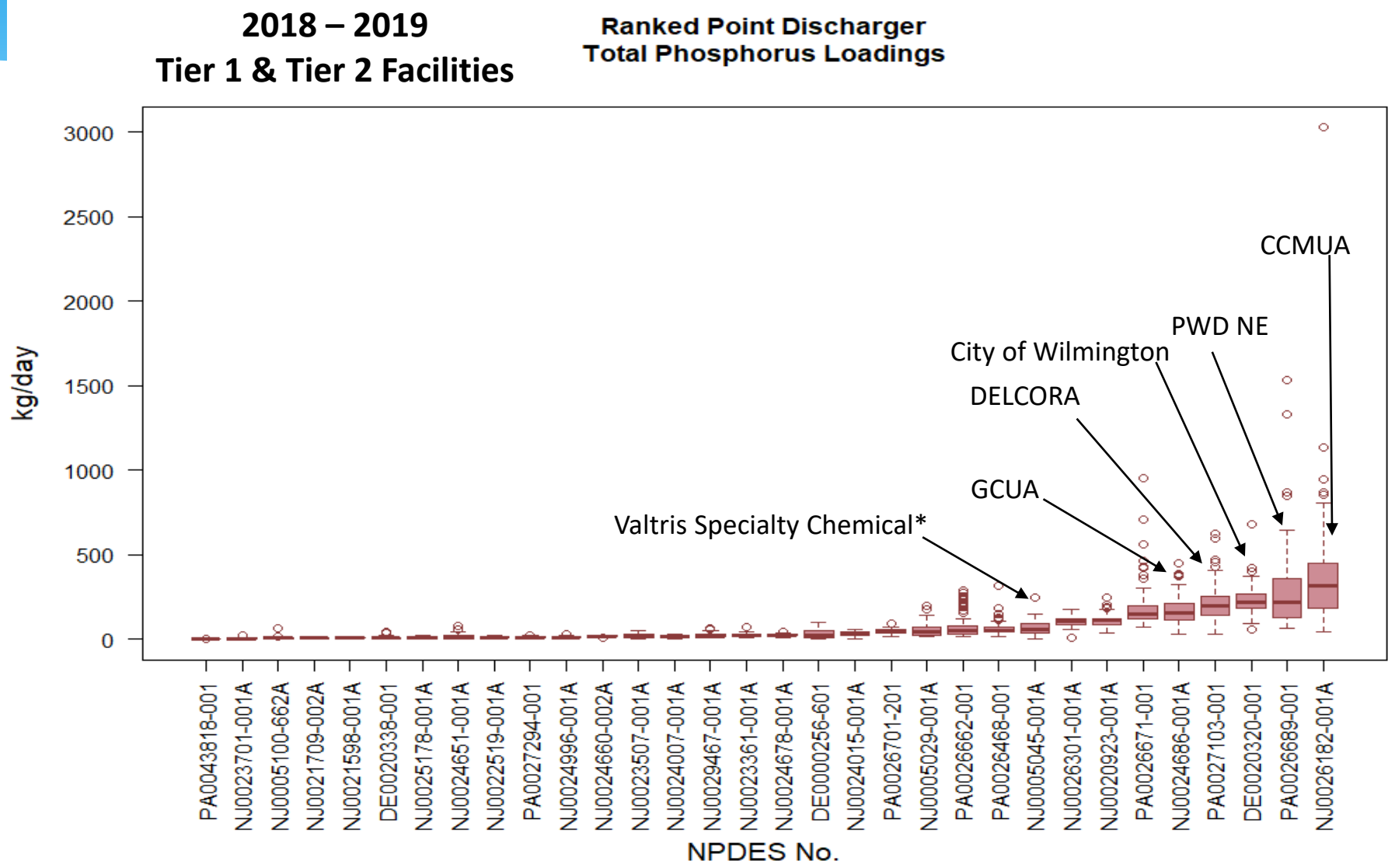
Range of medians:
0.05 – 15.0 mg/L

Excluding Valtris:
0.05 – 4.57 mg/L



Total Phosphorus Loading Boxplots

Range of medians: 13.3 – 286 kg/day



Soluble Reactive Phosphorus Concentration Boxplots

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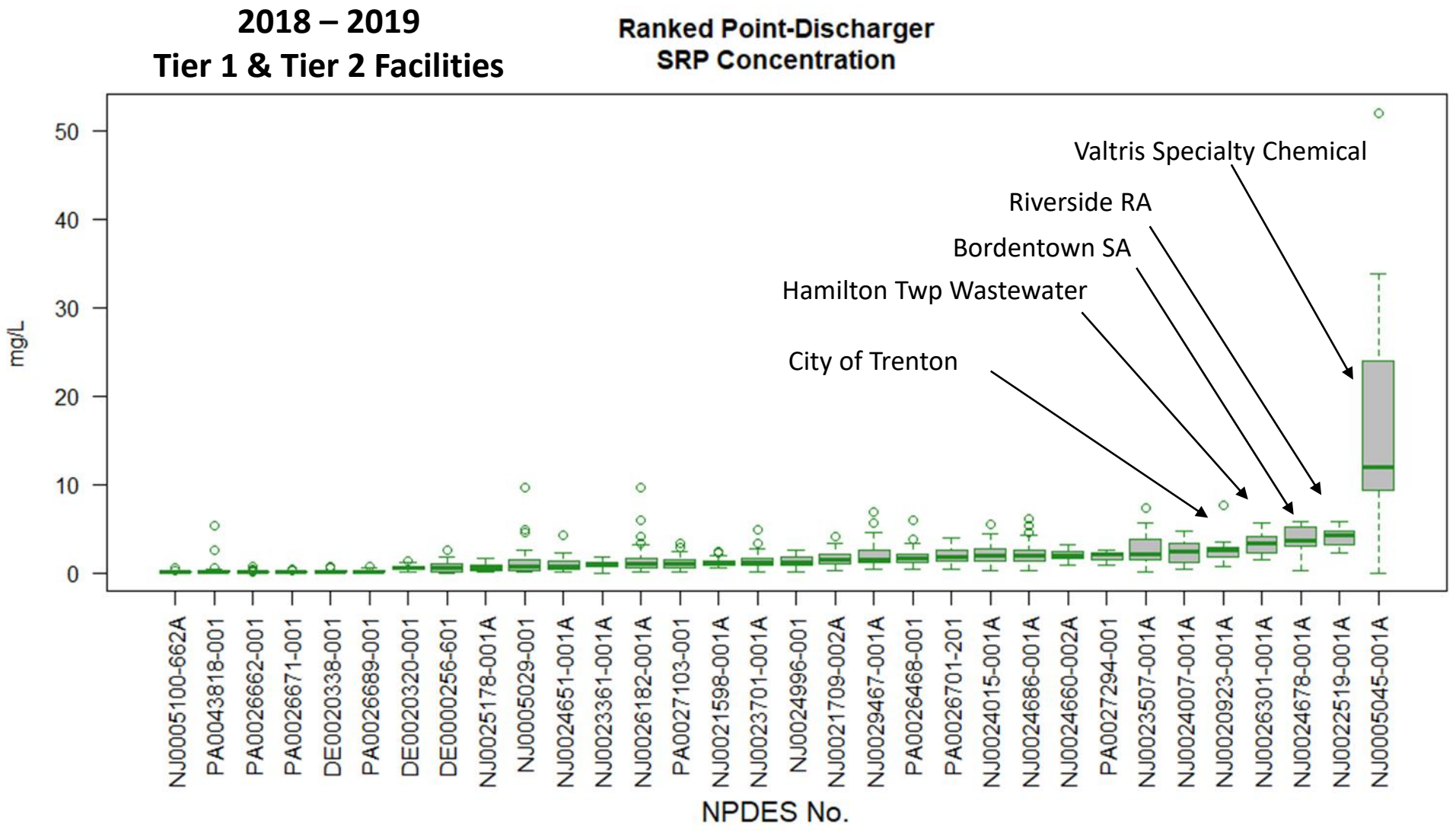
Range of medians:
0.04 – 12.0 mg/L

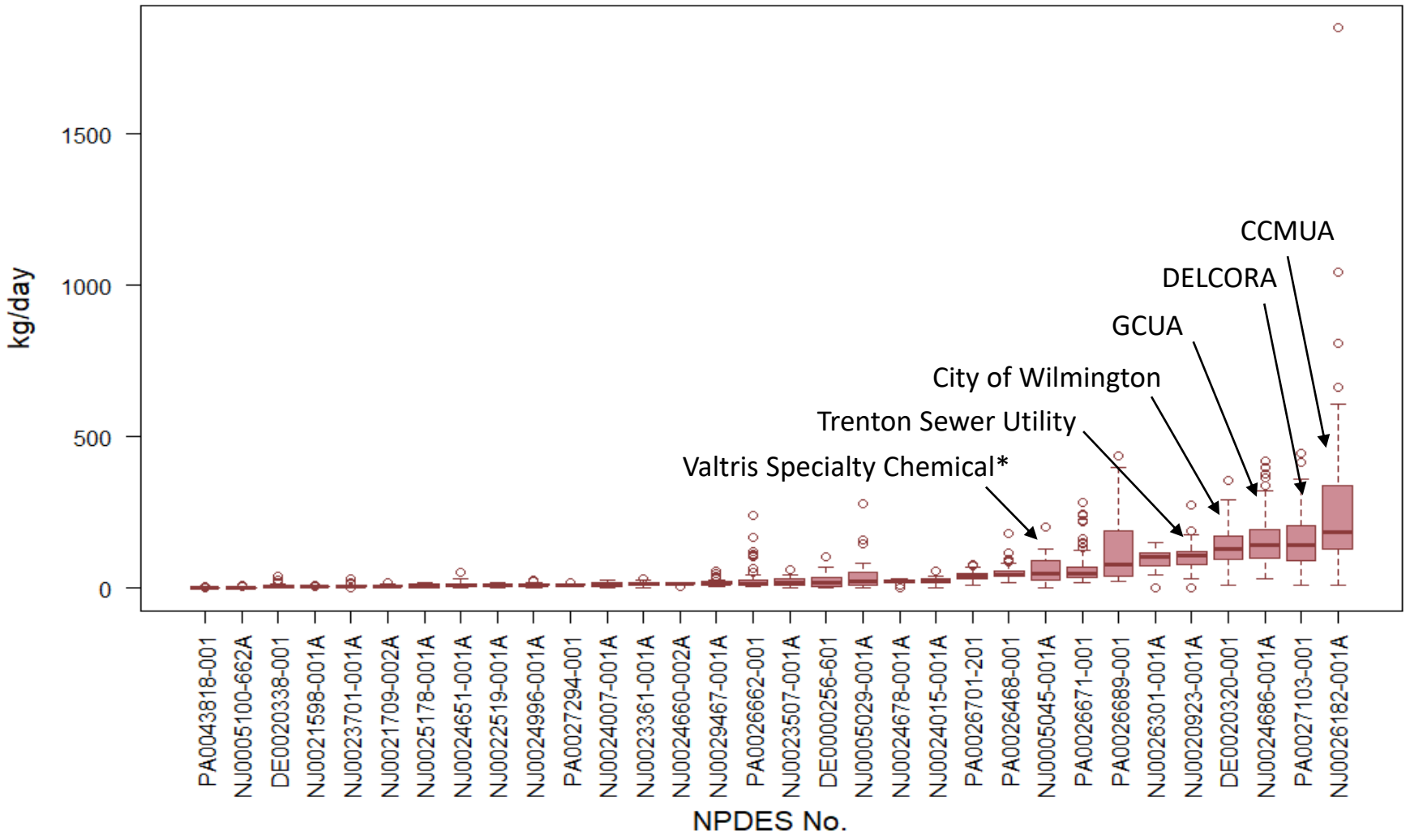
Excluding Valtris:
0.04 – 4.20 mg/L



Soluble Reactive Phosphorus Loading Boxplots

2018 – 2019
Tier 1 & Tier 2 Facilities

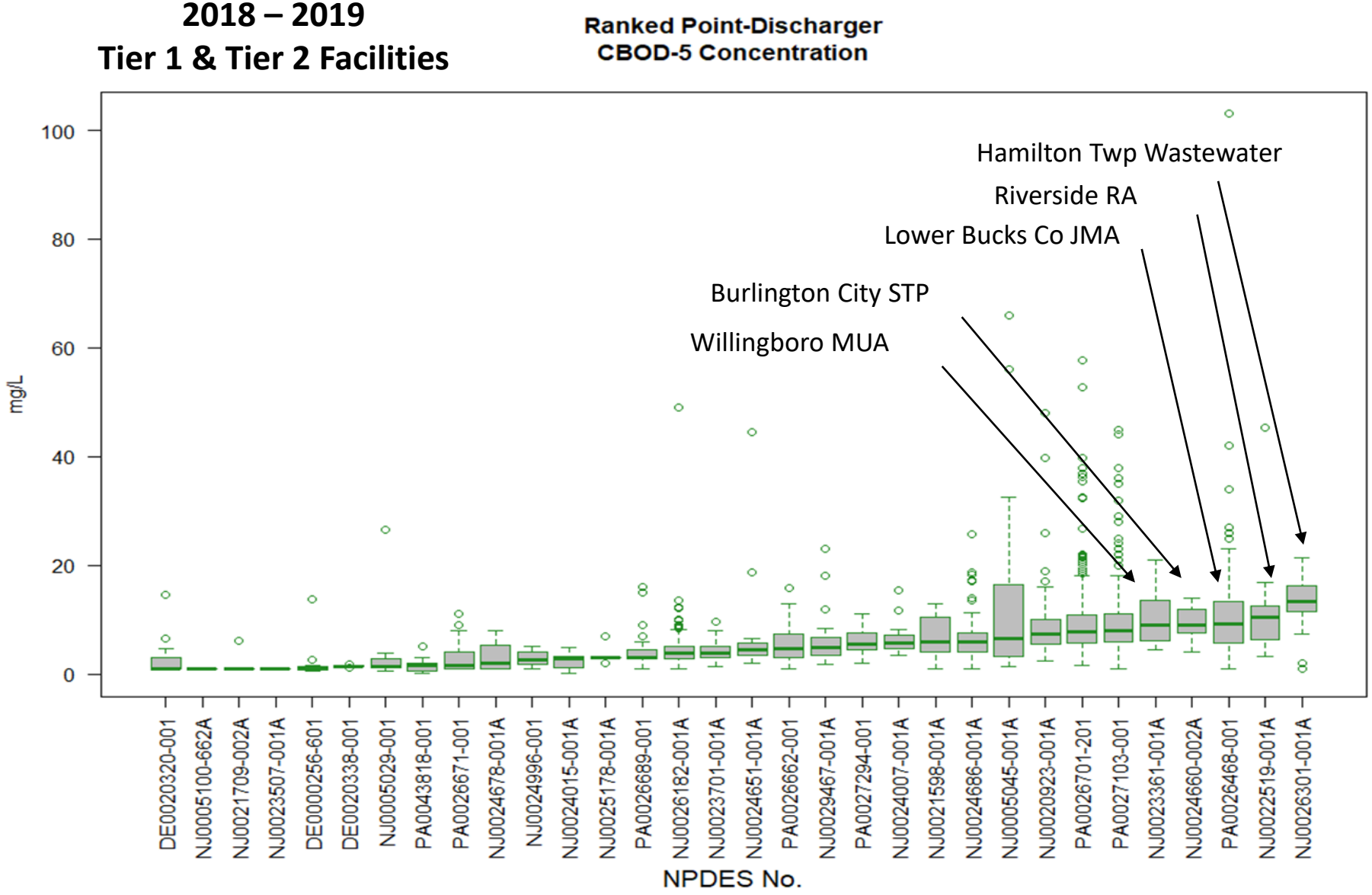
Range of medians:
0.90 – 178 kg/day



CBOD5 Concentration Boxplots

Range of medians:
1.00 – 13.4 mg/L

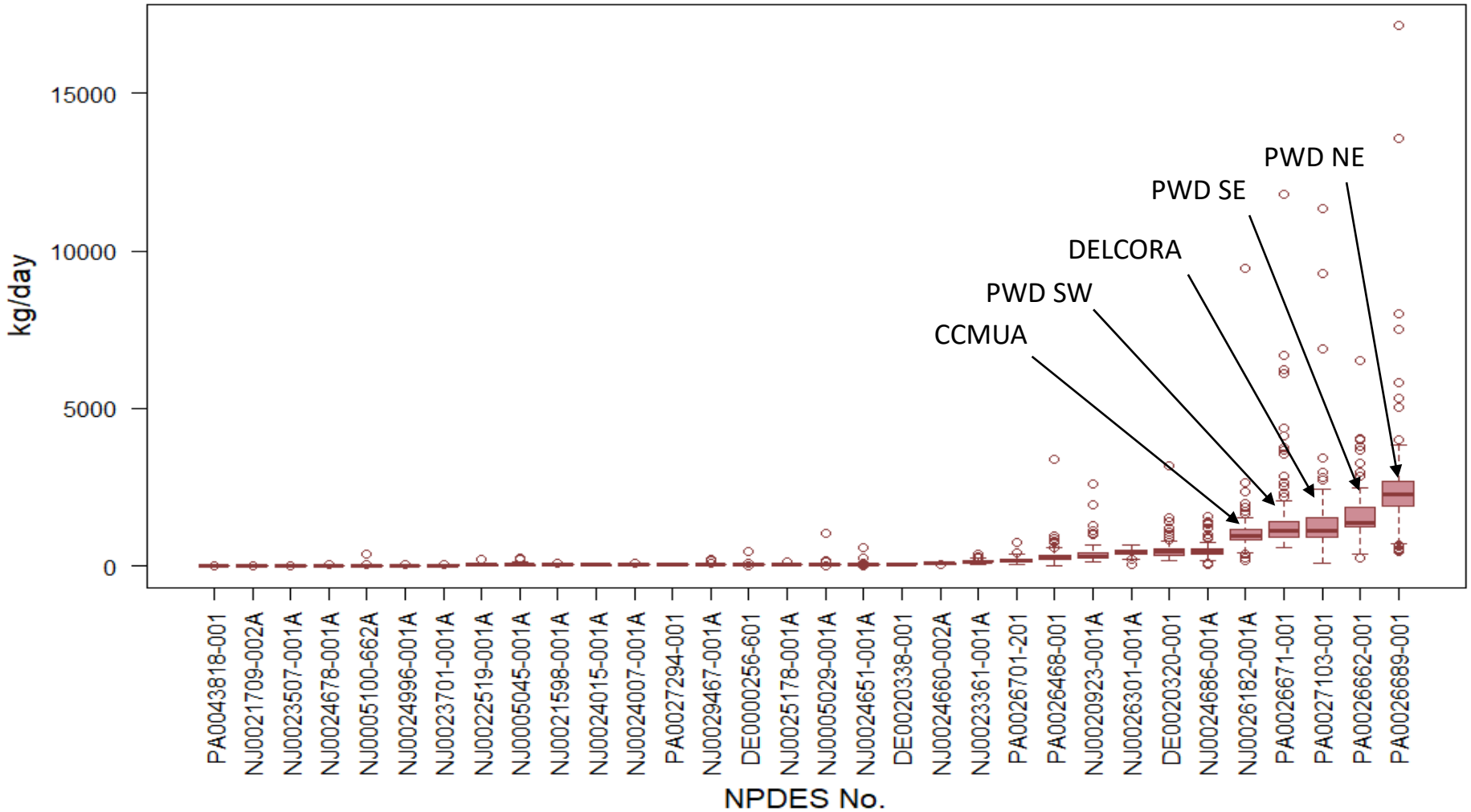
2018 – 2019
Tier 1 & Tier 2 Facilities



CBOD5 Loading Boxplots

2018 – 2019
Tier 1 & Tier 2 Facilities

Range of medians:
5.00 – 2,237 kg/day



Total Organic Carbon Concentration Boxplots

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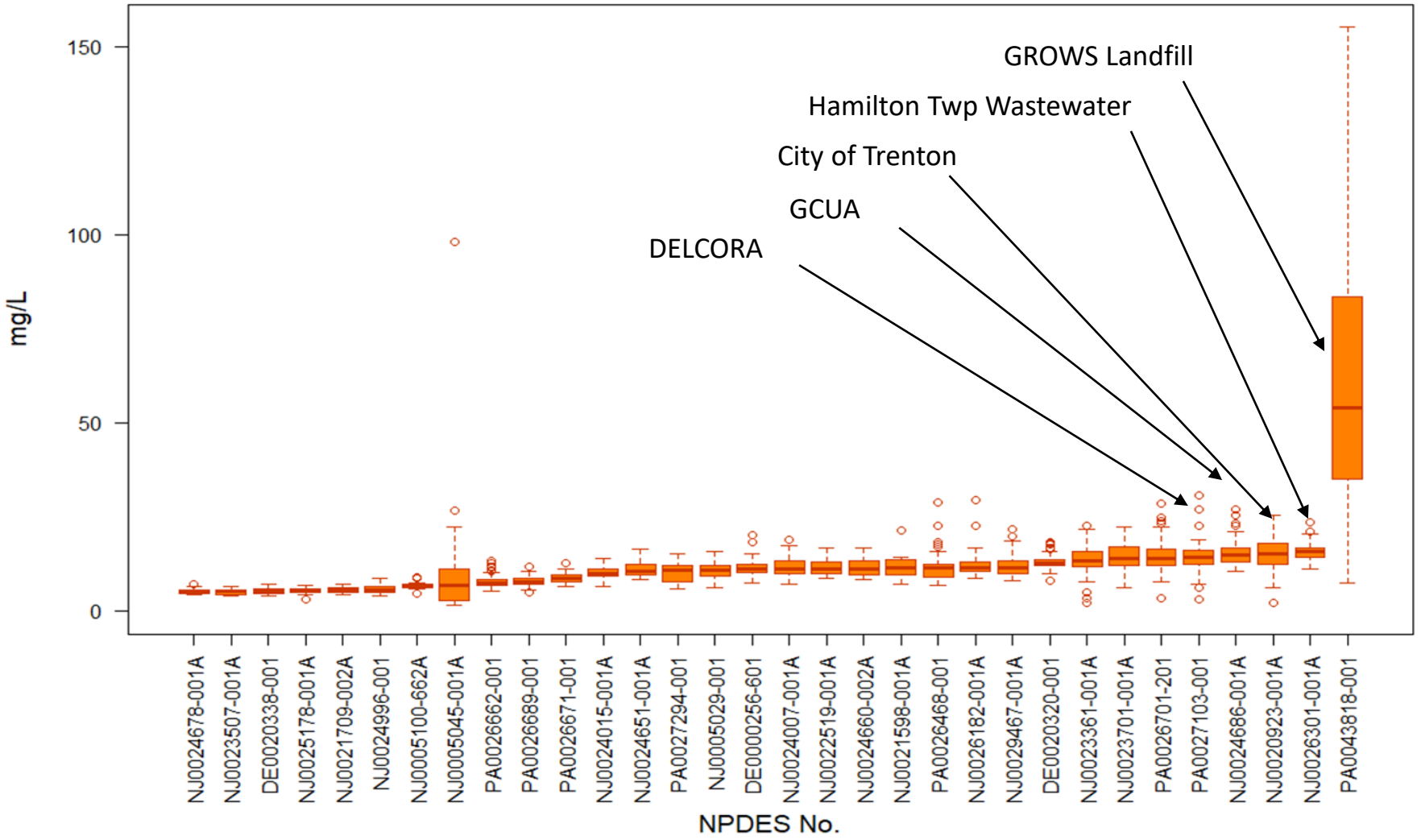
2018 – 2019
Tier 1 & Tier 2 Facilities

Range of medians: 4.95 – 54.0 mg/L

Excluding GROWS Landfill:
4.95 – 15.7 mg/L



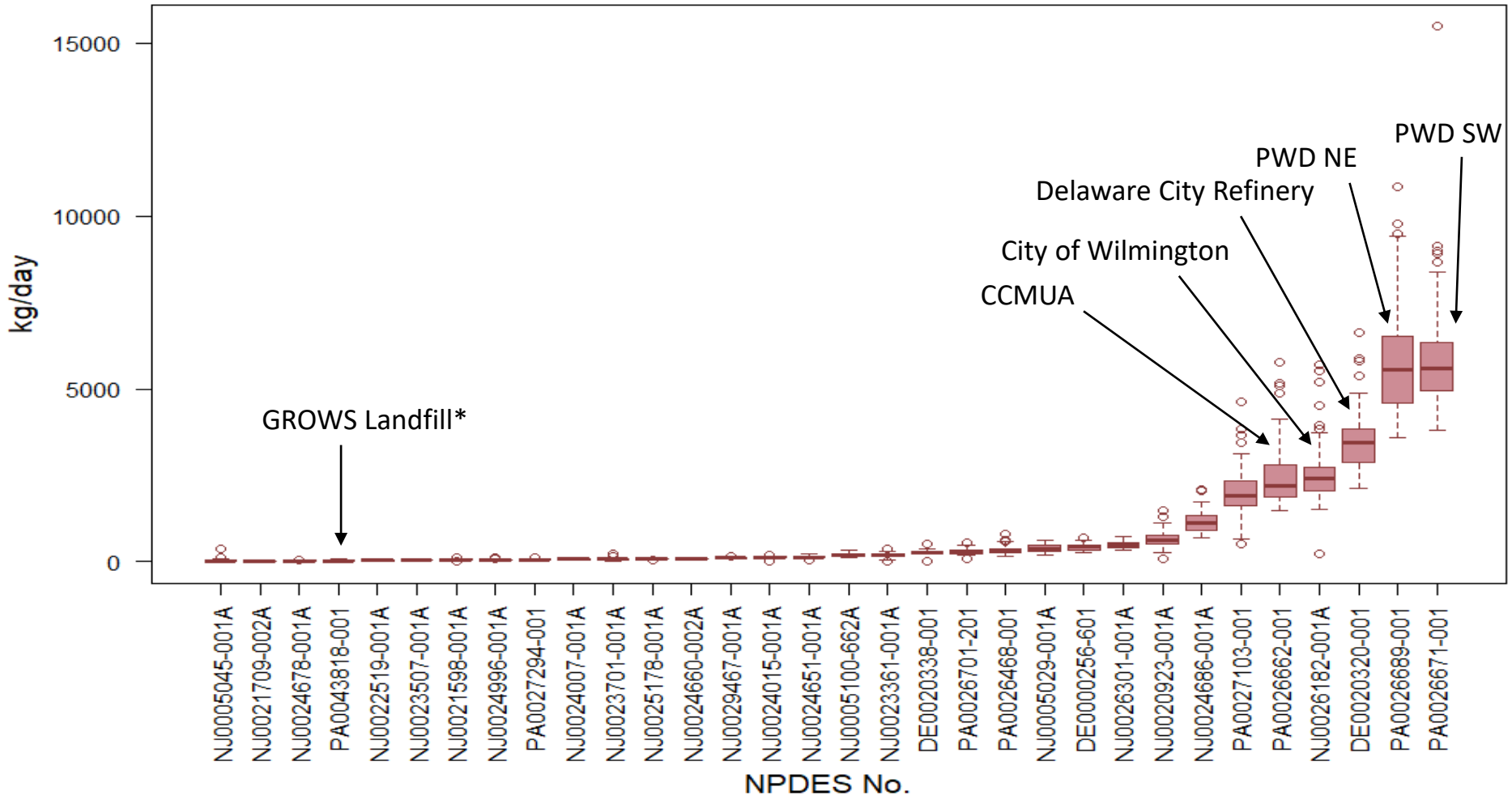
Total Organic Carbon Loading Boxplots

Range of medians:

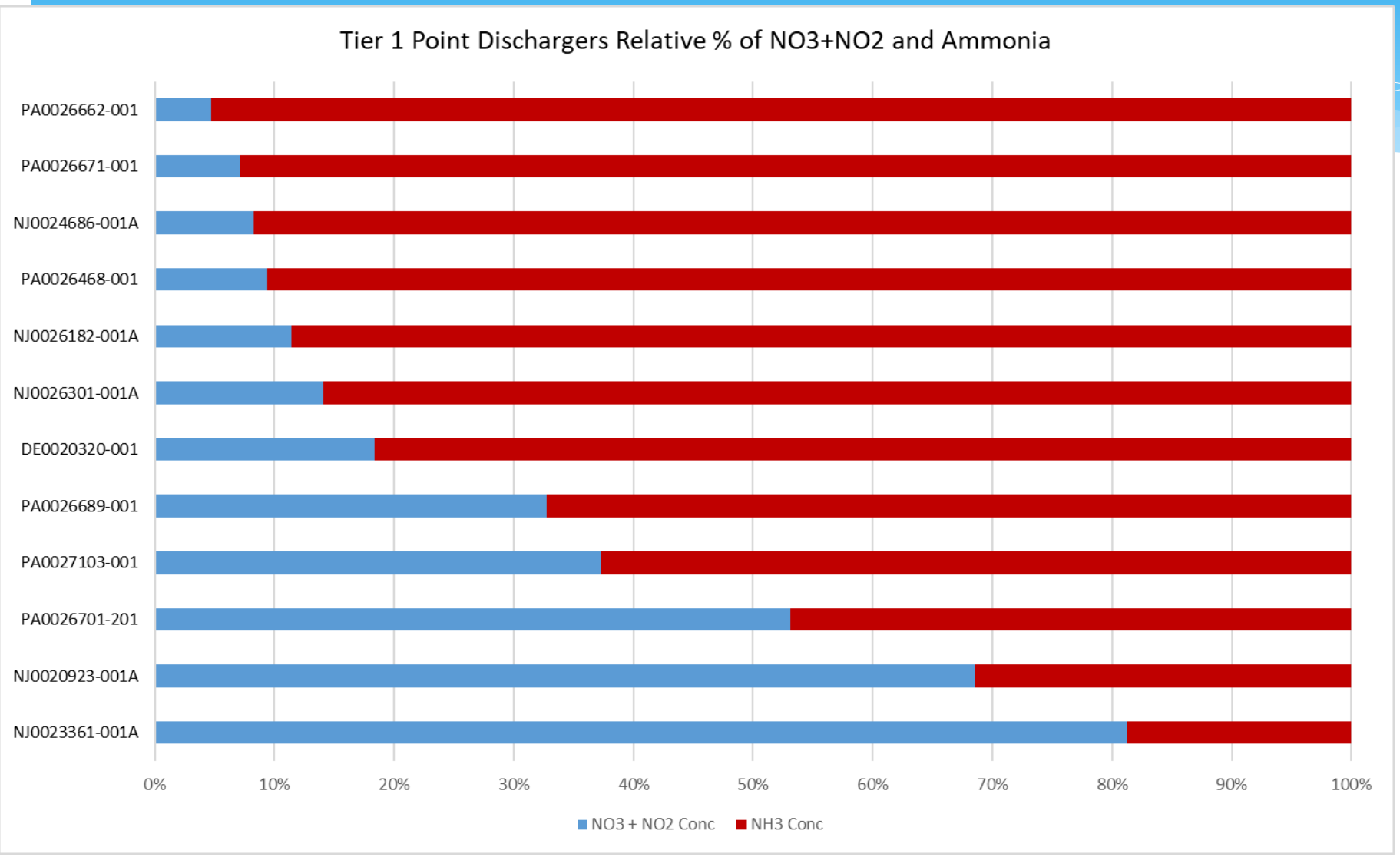
33.0 – 5,586 kg/day

2018 – 2019
Tier 1 & Tier 2 Facilities

Ranked Point Discharger
Total Organic Carbon Loadings

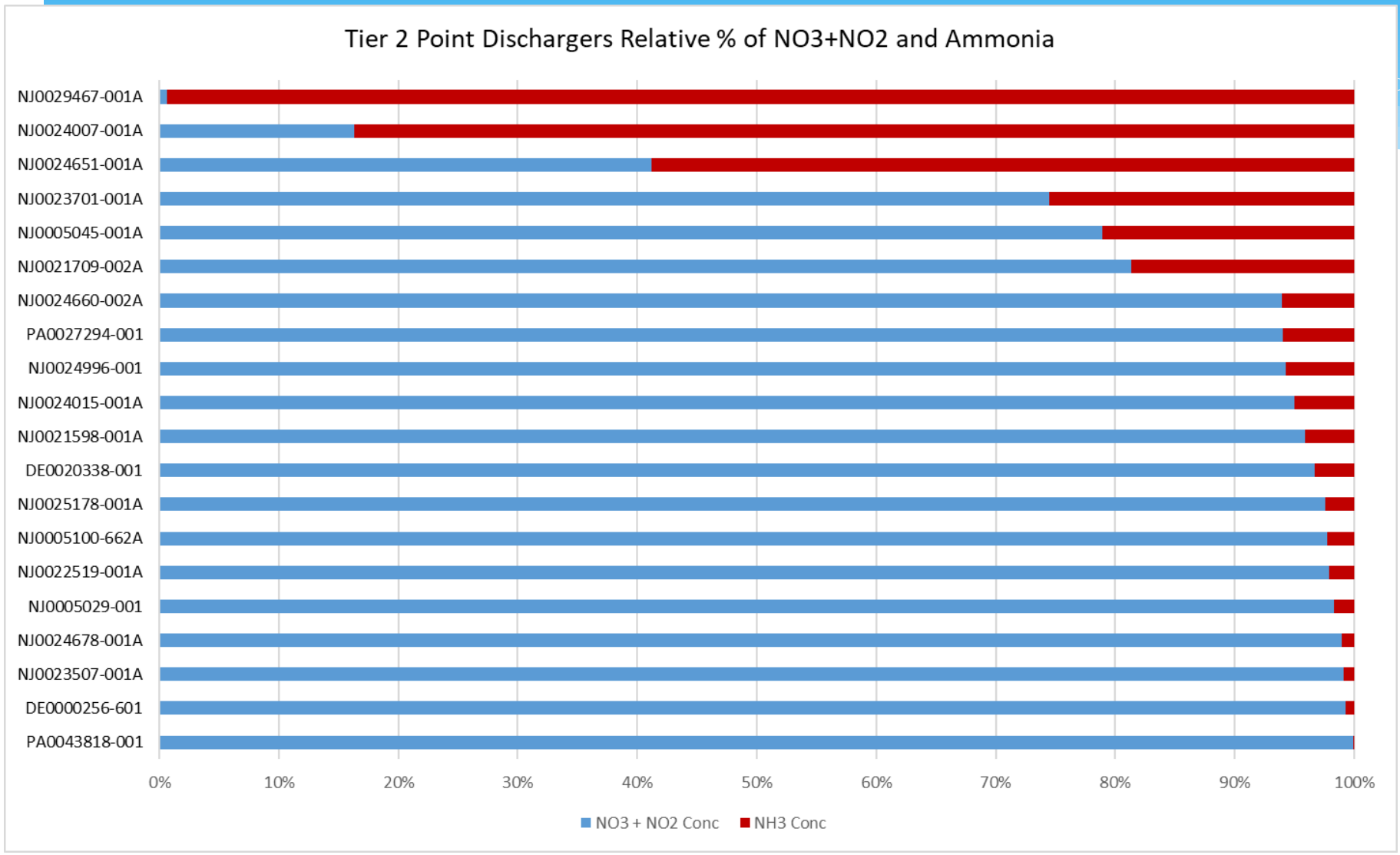


Ratios of Nitrate-N : Ammonia-N
Tier 1



- A majority of Tier 1 facilities, which include the largest municipal facilities, discharge relatively **more ammonia** compared to nitrate
- Indicates less oxidation of reduced forms of nitrogen
- Impacts oxygen demand of receiving waterbody

Ratios of Nitrate-N : Ammonia-N
Tier 2

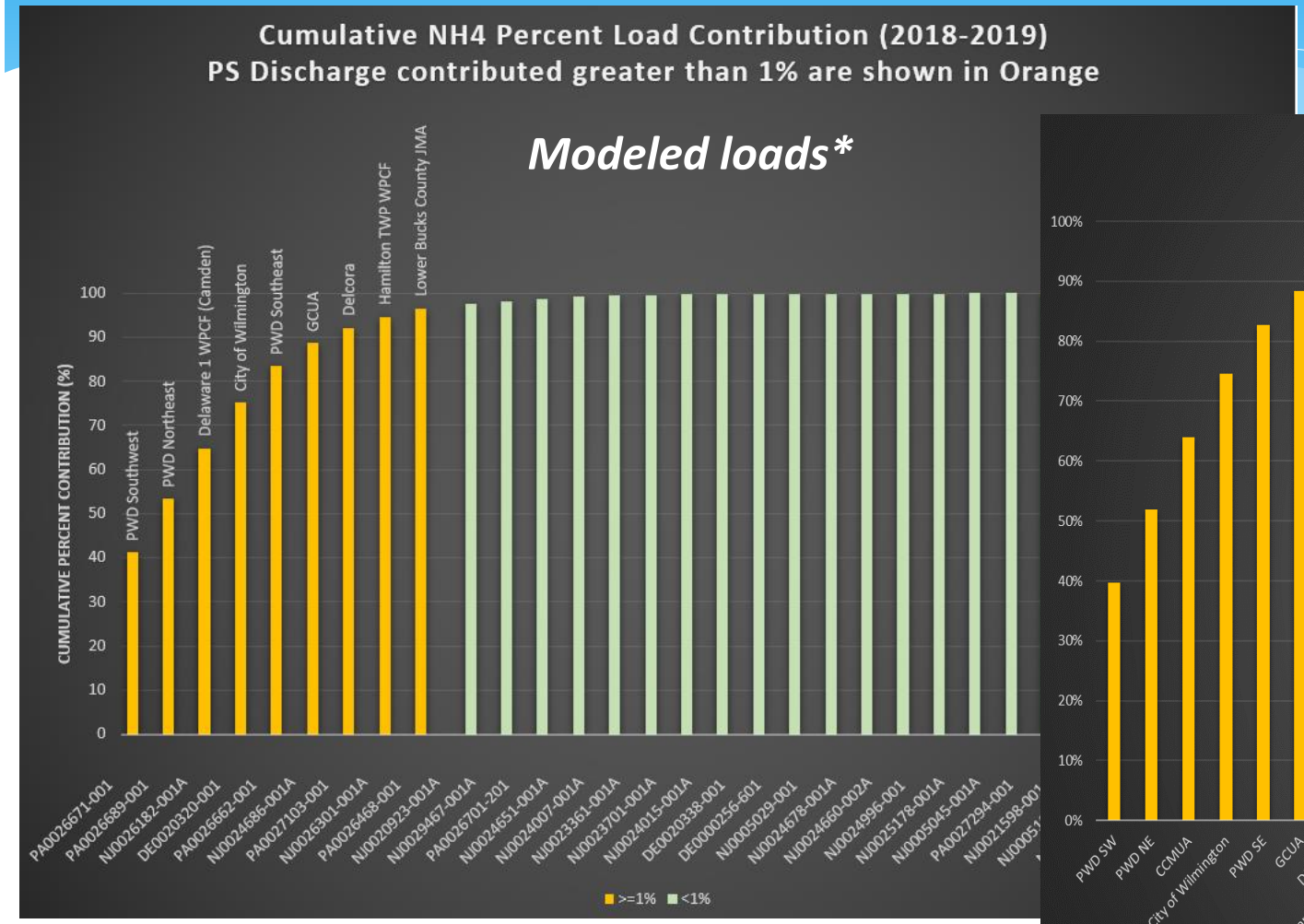


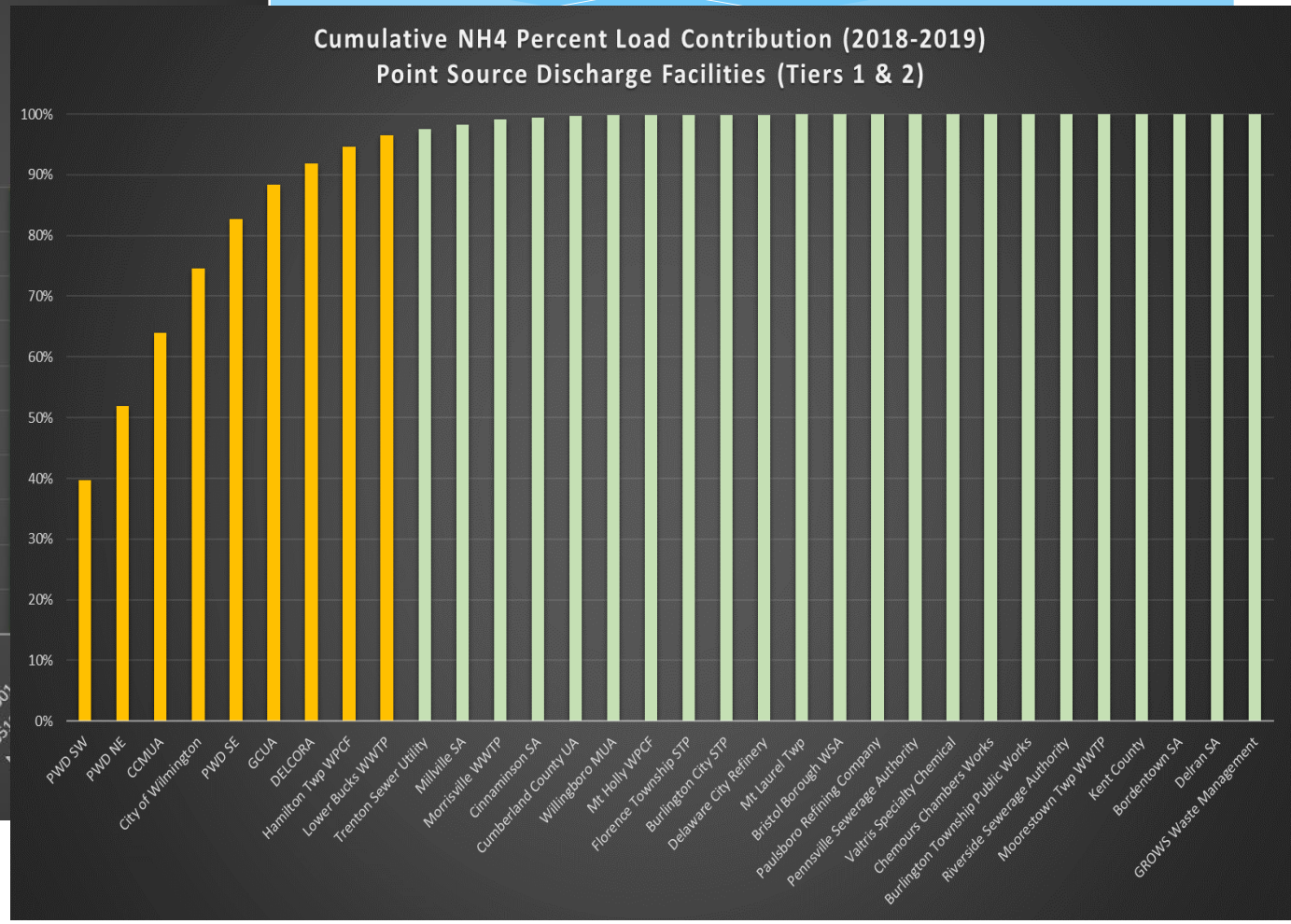
- Comparatively, a majority of Tier 2 facilities discharge a greater portion of oxidized forms of nitrogen (less oxygen demand in the receiving water body)
- Exceptions:
  - City of Millville STP
  - Cumberland County UA
  - Cinnaminson SA

Caveats and Additional Information

- This summary and subsequent report includes Tier 1 & Tier 2 facilities
- Some facilities submitted additional/more frequent data when available
- Data presented during this meeting covers concentration data results and loadings based on the data submitted
  - This is not the same as modeled inputs, which are continuous

Modeled Loads vs. Loads Estimated in Summary (Example: Ammonia)





Summary

- Monitoring effort completed successfully
- Data were fully utilized for model development and calibration
- High concentrations do not always indicate high loading facilities
- Ammonia – smaller facilities undergo more nitrification of effluent compared to larger municipalities

Report in Progress

- Technical summary report of point discharge 2018 – 2019 data
  - Draft currently under internal review
- Includes statistical summaries, data tables, and more nutrients and parameters

Data Summary Tables in Appendices

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		City of Wilmington	Trenton Sewer Utility [2]	Willingboro MUA	GCUA	CCMUA DE WPCP	Hamilton Twp	Lower Bucks County JMA	PWD SE	PWD SW	PWD NE	Morrisville Borough MA	DELCORA WRTP
NPDES No.		DE0020320-001	NJ0020923-001A	NJ0023361-001A	NJ0024686-001A	NJ0026182-001A	NJ0026301-001A	PA0026468-001	PA0026662-001	PA0026671-001	PA0026689-001	PA0026701-201	PA0027103-001
Permitted Flow (MGD)		134	20	5.22	27	80	16	10	110	200	210	8.7	50
Flow (MGD)													
Effluent Annual Average (CV%)	2019 [1]	71.8 (28.5)	12.1 (19.0)	4.00 (23.4)	19.7 (18.3)	57.0 (19.0)	7.83 (14.5)	7.88 (27.4)	82.4 (27.0)	184.5 (20.2)	189.5 (22.7)	5.30 (20.5)	37.2 (23.8)
	2018 [1]	76.4 (33.0)	12.4 (20.0)	4.09 (24.3)	20.4 (18.9)	58.6 (21.1)	9.00 (19.2)	8.41 (28.0)	88.3 (28.8)	188.3 (25.4)	200.2 (23.0)	5.97 (22.8)	38.0 (25.8)
Max Monthly Average		146.0 (29.5)	18.1 (12.0)	6.16 (23.9)	28.2 (17.7)	91.0 (20.7)	10.6 (19.9)	12.7 (23.7)	166.1 (17.3)	324.3 (15.9)	318.9 (15.3)	7.57 (22.9)	64.6 (19.8)
Max Day		245.6	20.4	8.95	33.9	122.9	14.8	17.0	223.0	426.0	380.0	11.1	82.7
Ammonia (mg/L)													
Effluent Annual Average (CV%)	2019 [1]	11.2 (39.4)	6.42 (48.2)	4.43 (67.7)	22.3 (18.2)	15.6 (28.2)	27.2 (18.7)	20.6 (32.4)	8.70 (22.6)	18.4 (23.8)	5.08 (30.8)	12.5 (23.5)	9.70 (44.4)
	2018 [1]	11.5 (61.9)	4.18 (40.9)	1.83 (64.0)	22.4 (18.6)	18.7 (37.4)	25.9 (14.4)	19.6 (25.7)	8.15 (26.6)	18.8 (25.0)	5.50 (31.7)	9.46 (39.3)	5.14 (72.7)
Average Summer (May - Oct)		10.2 (59.5)	4.72 (49.5)	1.95 (90.6)	24.1 (13.3)	16.9 (40.7)	26.9 (16.1)	20.0 (13.3)	8.56 (21.6)	18.5 (24.0)	4.76 (30.1)	10.7 (33.8)	5.43 (74.2)
Average Winter (Nov - April)		12.5 (41.6)	7.36 (41.5)	4.83 (58.0)	20.7 (20.2)	16.8 (26.4)	26.5 (18.6)	20.4 (31.1)	8.38 (27.2)	18.7 (24.6)	5.79 (29.5)	11.8 (29.5)	10.2 (39.0)
2018-2019 Avg Ammonia Load		1,194,968	100,422	18,277	605,902	1,336,152	302,262	215,194	961,807	4,543,891	1,391,245	83,603	417,335
% Ammonia Contribution		10.7%	0.9%	0.2%	5.4%	12.0%	2.7%	1.9%	8.6%	40.7%	12.5%	0.7%	3.7%
Total Kjeldahl Nitrogen (mg/L)													
Effluent Annual Average (CV%)	2019 [1]	16.0 (27.4)	9.60 (42.3)	7.64 (56.0)	28.2 (16.8)	19.3 (22.7)	25.5 (30.8)	24.5 (30.5)	10.3 (16.3)	21.3 (24.5)	6.63 (24.7)	14.6 (24.5)	13.5 (36.4)
	2018 [1]	16.1 (25.4)	5.66 (39.9)	4.46 (53.7)	24.5 (17.5)	20.8 (21.8)	25.5 (17.6)	19.2 (22.7)	9.3 (21.6)	18.5 (23.9)	7.23 (31.3)	11.5 (37.4)	7.89 (54.7)
Average Summer (May - Oct)		14.4 (29.2)	7.92 (44.4)	4.98 (65.2)	28.1 (16.9)	19.8 (23.3)	25.2 (31.7)	21.2 (29.7)	10.0 (17.8)	19.4 (26.0)	6.32 (29.6)	13.1 (32.6)	8.43 (57.3)
Average Winter (Nov - April)		17.8 (20.1)	11.3 (36.5)	7.76 (53.3)	25.2 (18.4)	20.0 (21.9)	25.8 (19.1)	23.6 (31.2)	9.7 (20.1)	20.9 (24.0)	7.48 (24.5)	13.6 (29.8)	14.0 (32.6)
2018-2019 Avg TKN Load (kg/day)		1,533,131	149,330	34,369	72,873	1,549,819	288,558	242,618	1,122,483	4,924,459	1,842,354	100,176	598,792
% TKN Contribution		12.3%	1.2%	0.3%	0.6%	12.4%	2.3%	1.9%	9.0%	39.5%	14.8%	0.8%	4.8%
Total Organic Carbon (mg/L)													
Effluent Annual Average (CV%)	2019 [1]	12.9 (11.4)	15.8 (24.8)	14.5 (18.8)	14.8 (16.5)	12.3 (24.3)	16.3 (17.1)	11.6 (33.9)	7.52 (20.0)	8.58 (13.2)	8.05 (12.6)	14.4 (21.6)	15.5 (10.2)
	2018 [1]	13.0 (14.2)	10.3 (32.5)	12.9 (26.4)	15.6 (22.1)	11.4 (22.5)	15.2 (10.1)	10.7 (15.4)	7.87 (18.8)	8.75 (15.9)	7.87 (18.6)	14.5 (29.5)	13.2 (27.8)
Average Summer (May - Oct)		12.6 (11.0)	14.7 (25.1)	12.3 (22.2)	14.8 (22.0)	11.4 (20.4)	15.8 (13.3)	10.6 (30.7)	7.84 (20.5)	8.57 (12.4)	8.13 (14.3)	15.6 (23.9)	13.4 (20.4)
Average Winter (Nov - April)		13.3 (14.1)	15.0 (34.9)	15.0 (20.2)	15.7 (17.4)	12.4 (25.6)	15.6 (15.6)	11.7 (24.3)	7.57 (18.0)	8.77 (16.9)	7.77 (17.7)	13.3 (25.8)	15.1 (26.6)
2018-2019 Avg TOC Load (kg/day)		1,261,849	237,488	73,538	418,878	929,507	179,413	121,215	891,596	2,150,534	2,130,296	110,907	747,702
% TOC Contribution		13.6%	2.6%	0.8%	4.5%	10.0%	1.9%	1.3%	9.6%	23.2%	23.0%	1.2%	8.1%

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Questions?