Analyzing Chain Bridge Loads

Some Recent Developments

Presentation to Water Resources Technical Committee

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Metropolitan Washington Council of Governments

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Outline

- Basic Load Data from COG-Occoquan Watershed Monitoring Laboratory Database
  - Analysis possibilities
    - comparing the impact of wastewater loads to other sources
    - flow-load relationships
- Issues
  - Monitoring vs. modeling discrepancies
  - What is driving negative load trends in Potomac?
- Next Steps

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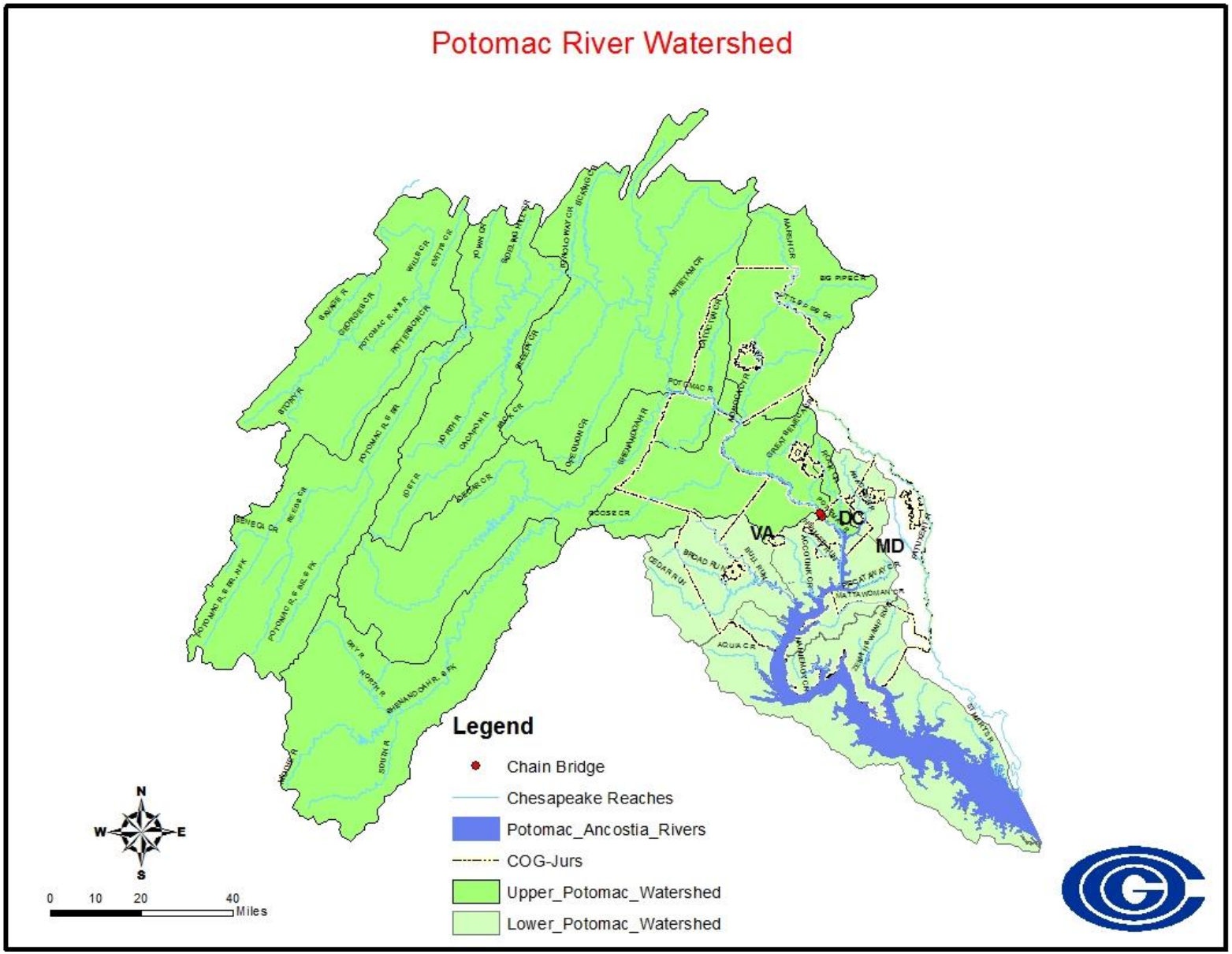
Notes on Slides

- Data for slides 4 – 13 derived from COG's OWML Chain Bridge data base.
- Nutrient data shown either as total nitrogen (TN) and total phosphorus (TP) or as dissolved forms:
  - OXN = nitrate and nitrite for nitrogen
  - TDP = total dissolved phosphorus, including both PO4 and dissolved organic P
- Below fall-line wastewater plant data in slides 10-13 is still preliminary
- Data in slides 14-16 show results for weighted regression on time, discharge and season (WRTDS) trend analysis (USGS) or Chesapeake Bay Program watershed model (WSM) Version 5.3.2


Potomac River Watershed
DC
VA
MD
Legend
Chain Bridge
Chesapeake Reaches
Potomac_Ancostia_Rivers
COG-Jurs
Upper_Potomac_Watershed
Lower_Potomac_Watershed
N
W
E
S
0
10
20
40
Miles

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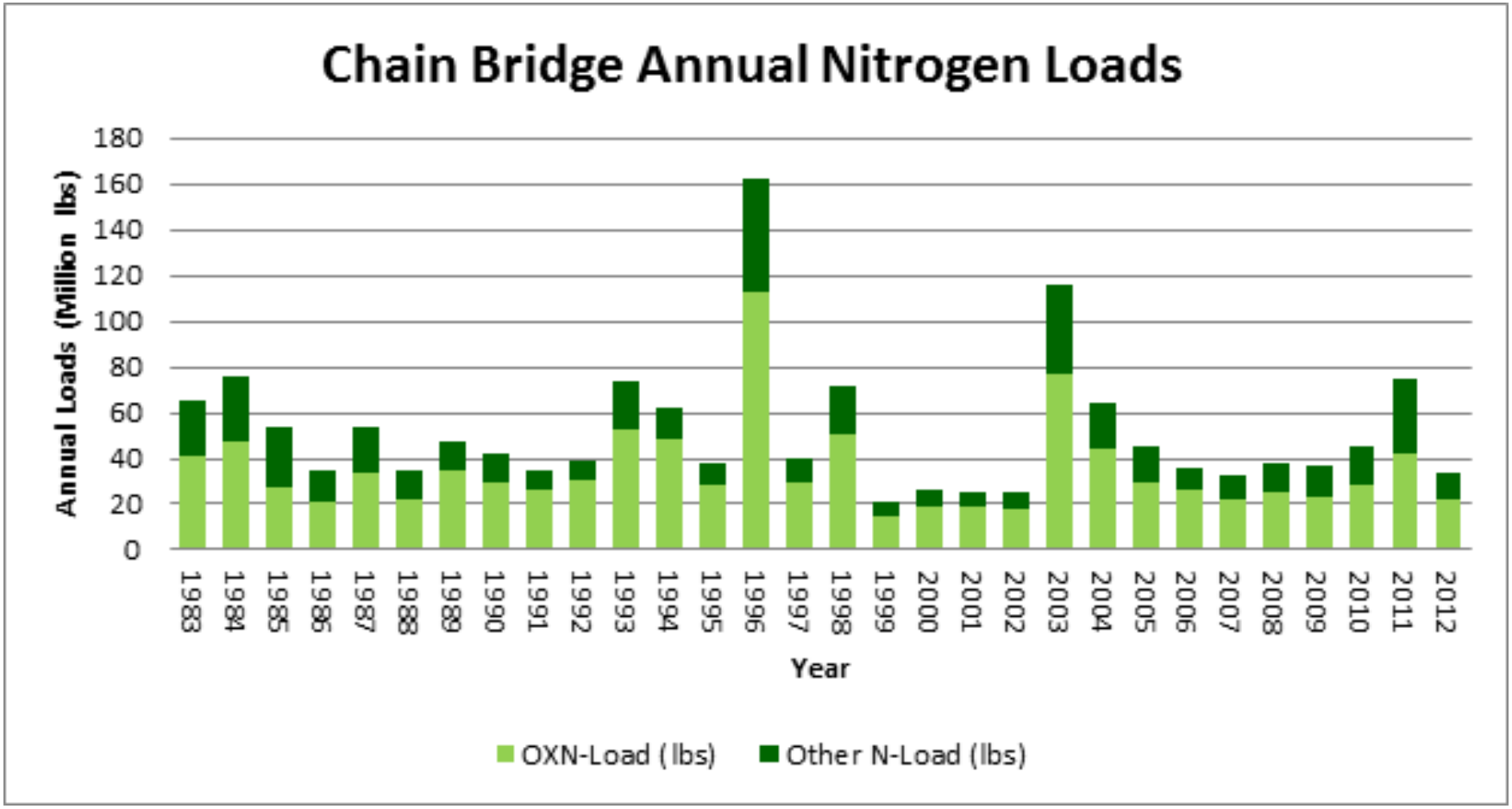

OXN = nitrate and nitrite nitrogen

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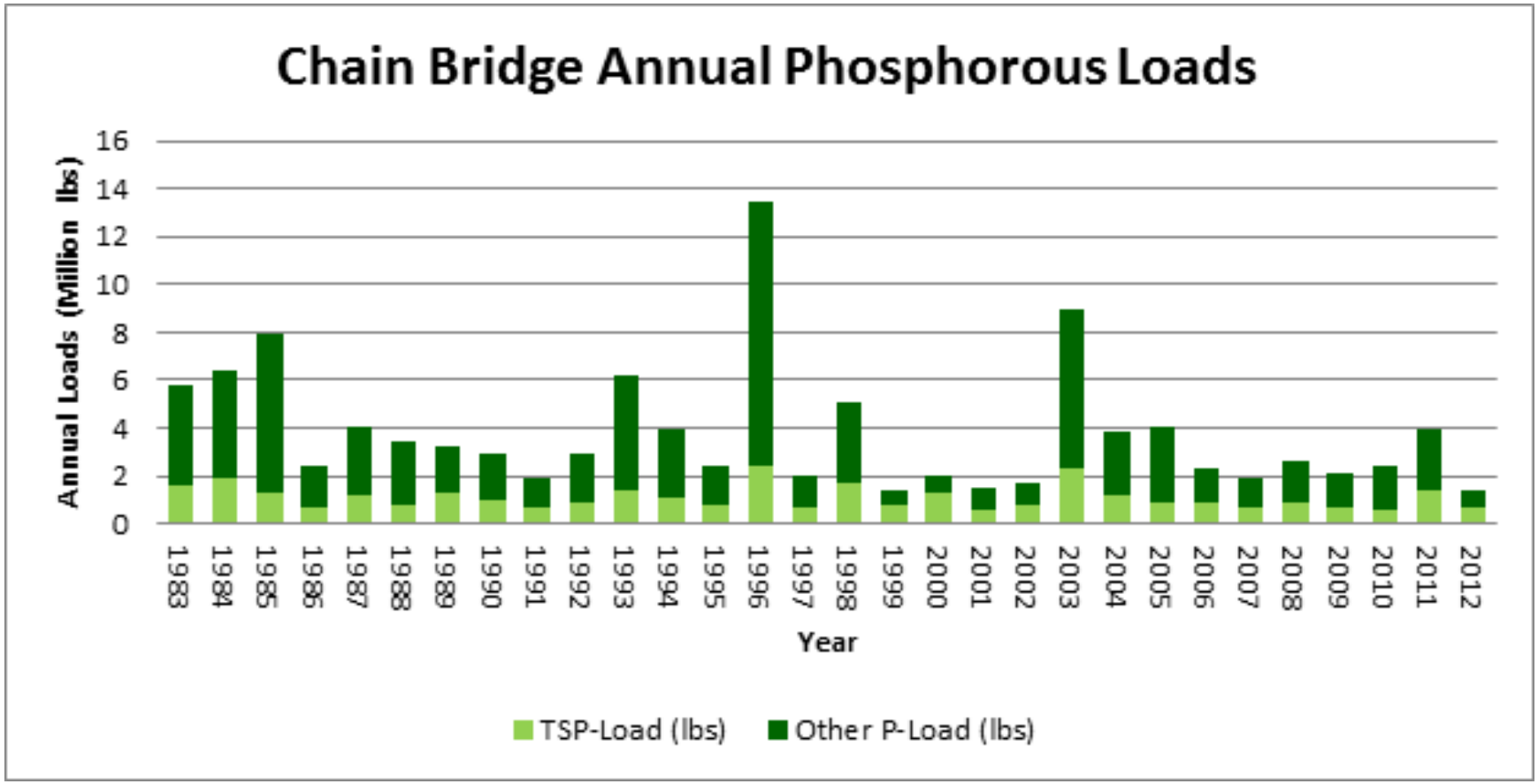

TSP = total soluble phosphorus

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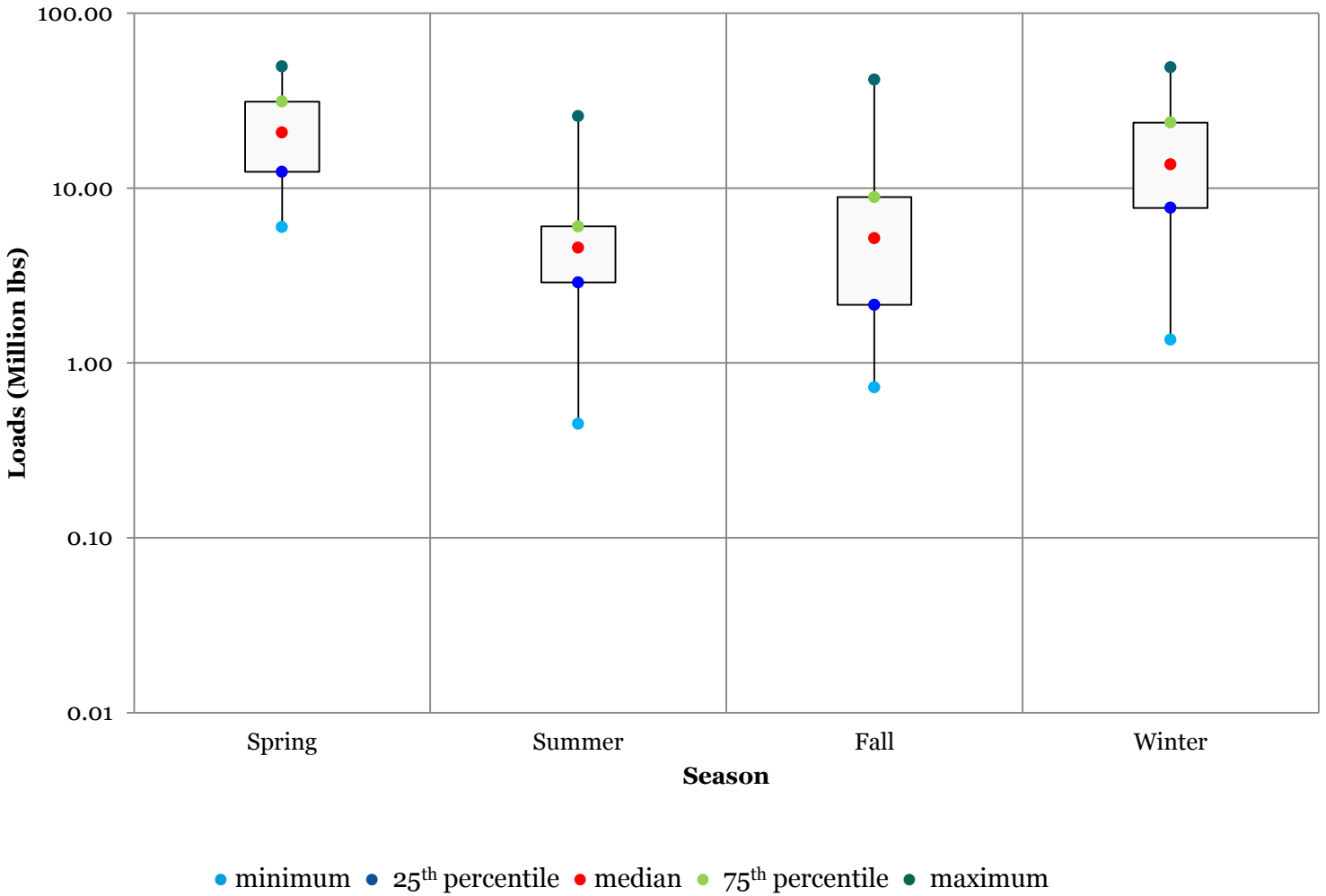
Chain Bridge TN Seasonal Load Parameters



Note: seasonal loads are based on Dec. – Feb = winter; March – May = spring; June – August = summer; Sept. – Nov. = fall

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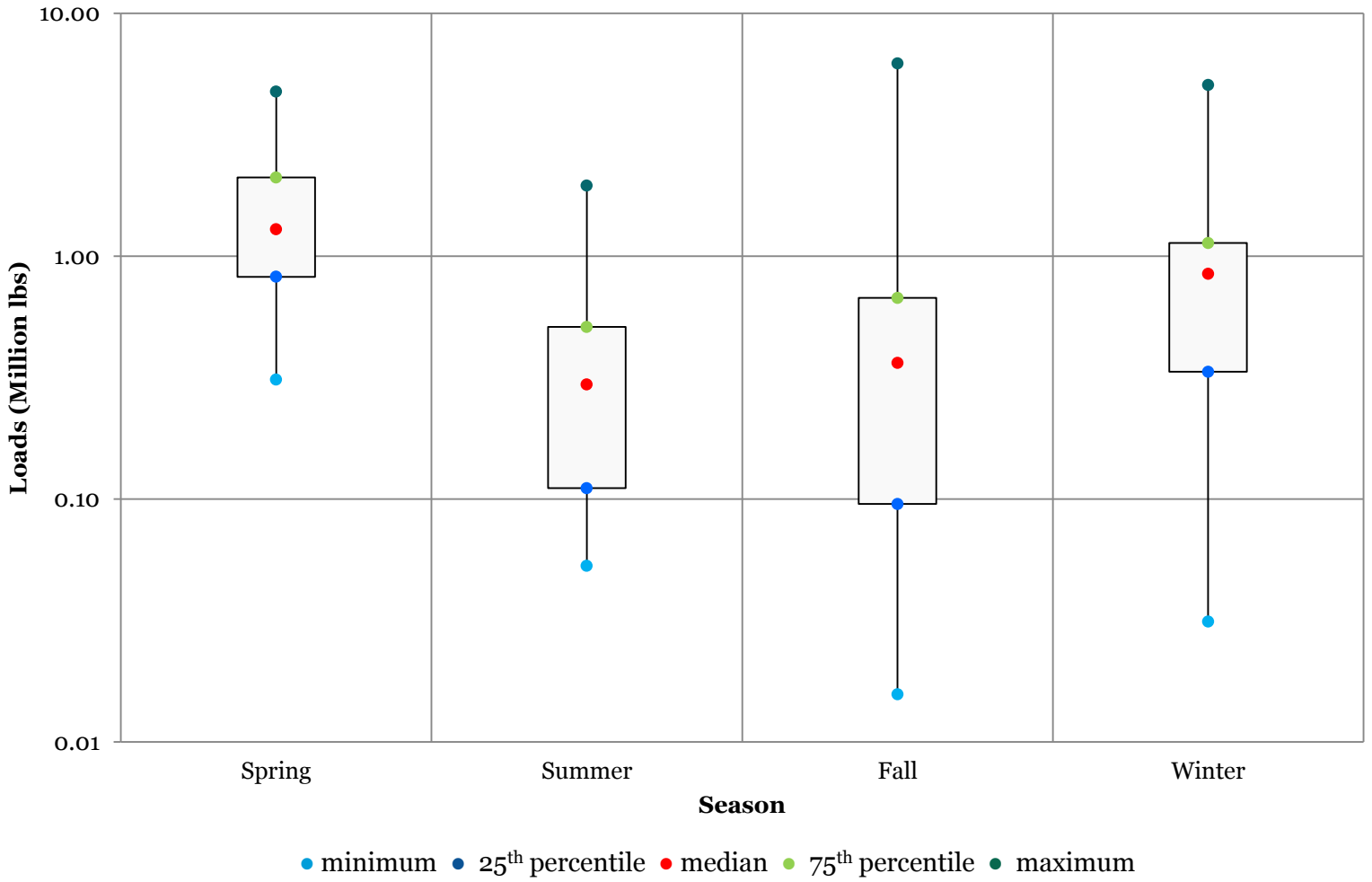
Chain Bridge TP Seasonal Load Parameters



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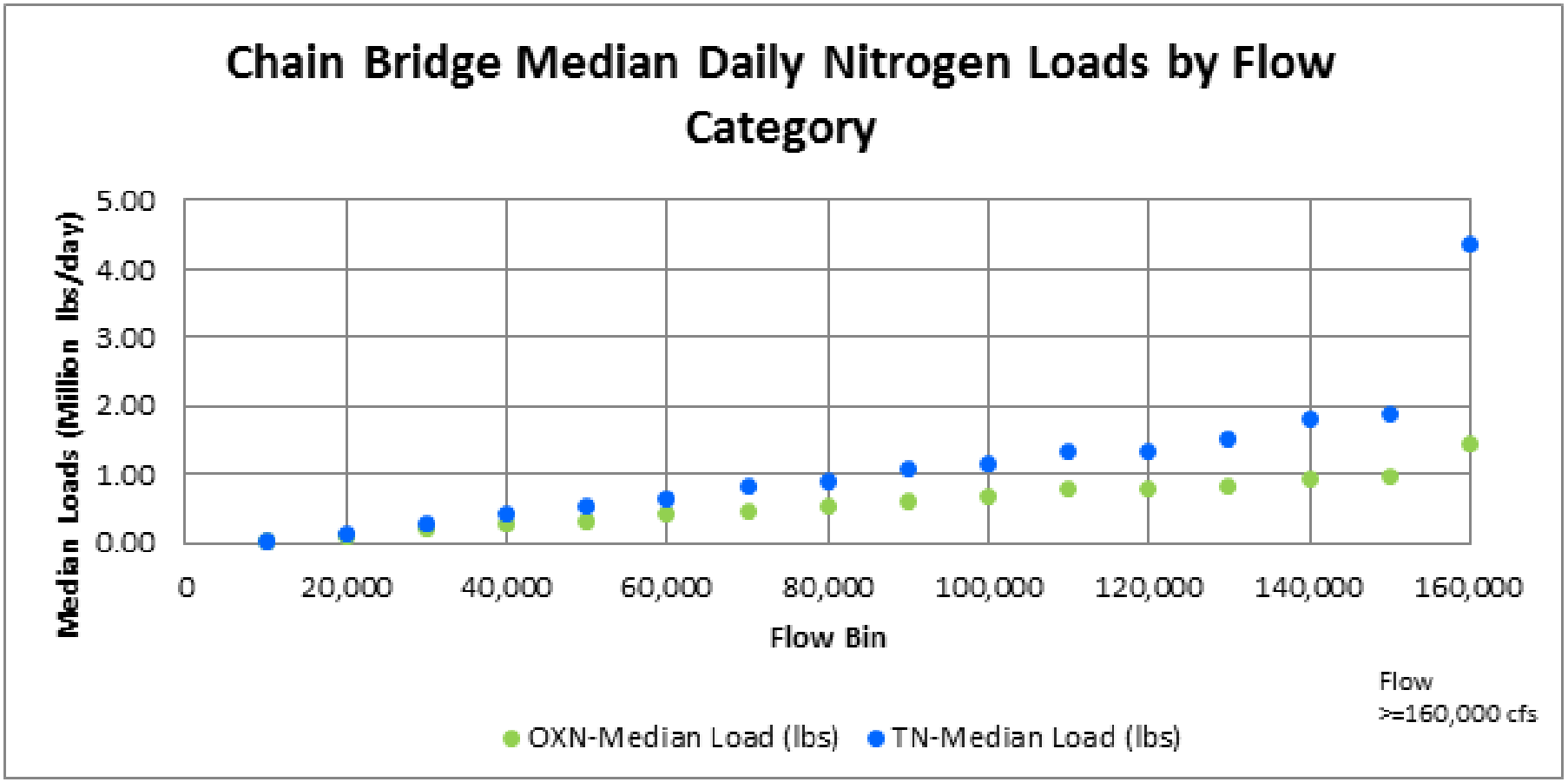
Chain Bridge Median Daily Nitrogen Loads by Flow Category
Median Loads (Million lbs/day)
5.00
4.00
3.00
2.00
1.00
0.00
0
20,000
40,000
60,000
80,000
100,000
120,000
140,000
160,000
Flow Bin
Flow >=160,000 cfs
OXN-Median Load (lbs)
TN-Median Load (lbs)

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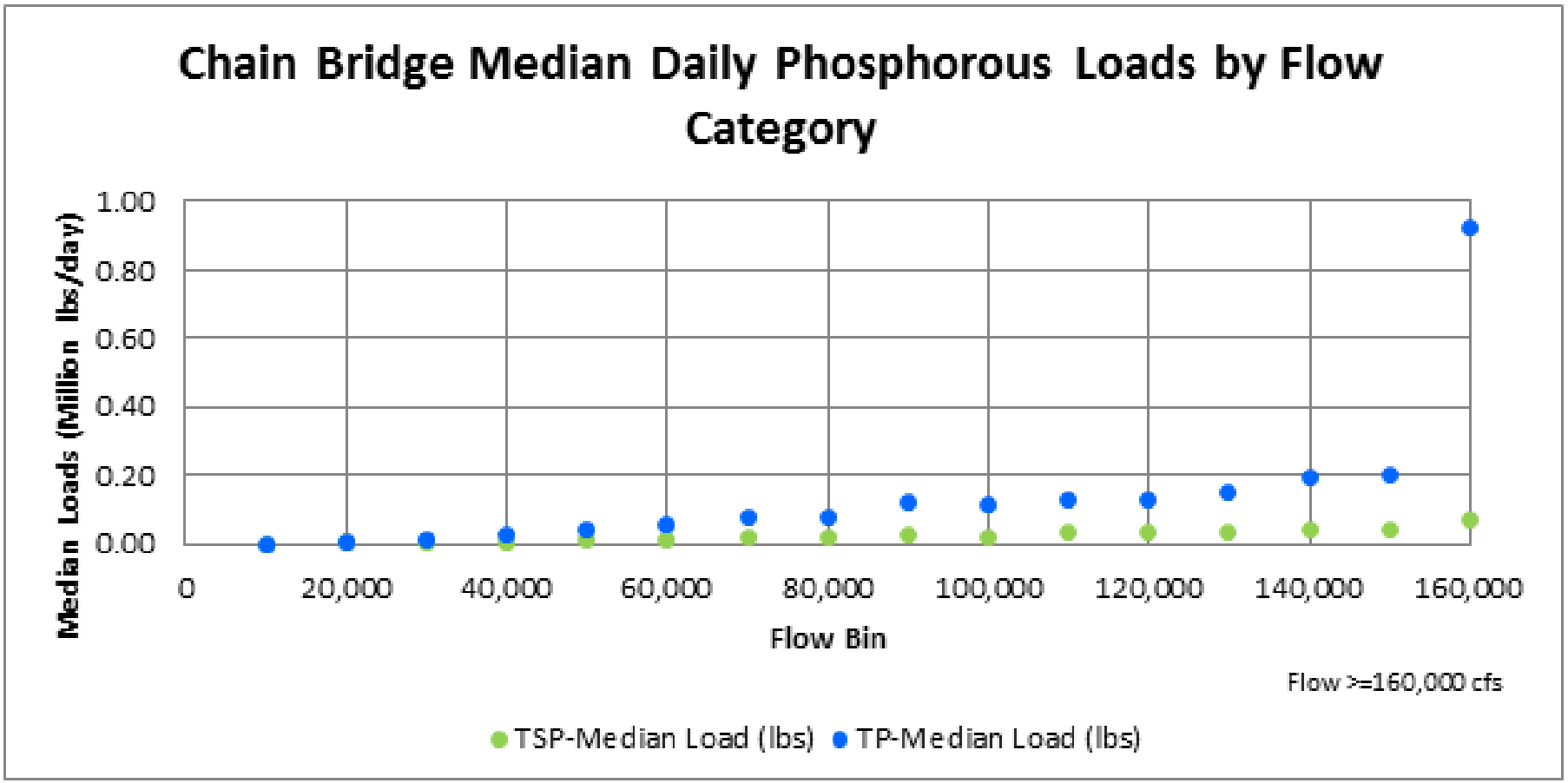
Chain Bridge Median Daily Phosphorous Loads by Flow Category
Median Loads (Million lbs/day)
1.00
0.80
0.60
0.40
0.20
0.00
0
20,000
40,000
60,000
80,000
100,000
120,000
140,000
160,000
Flow Bin
Flow >=160,000 cfs
TSP-Median Load (lbs)
TP-Median Load (lbs)

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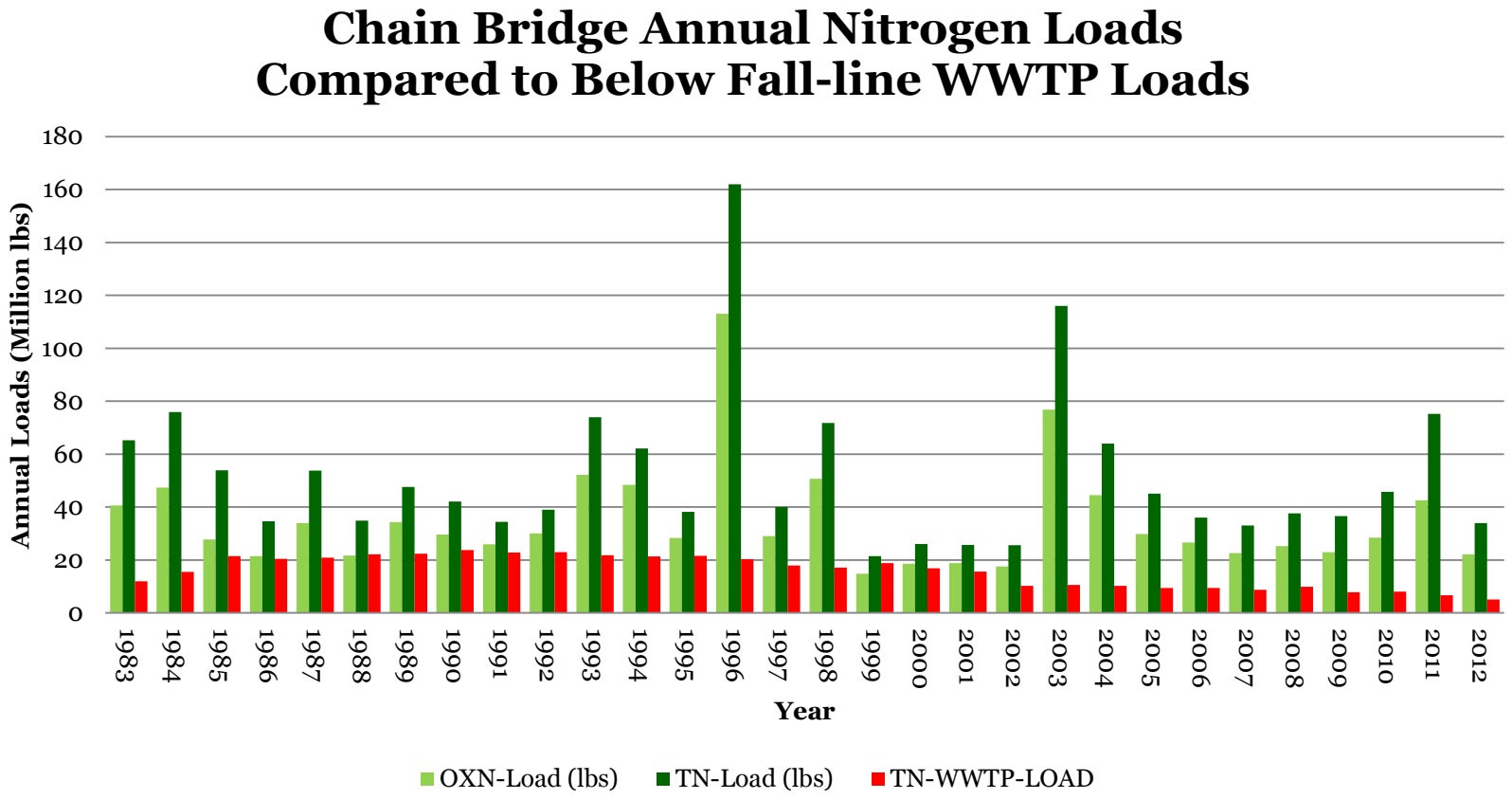
Chain Bridge Annual Nitrogen Loads
Compared to Below Fall-line WWTP Loads
Annual Loads (Million lbs)
180
160
140
120
100
80
60
40
20
0
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Year
OXN-Load (lbs)
TN-Load (lbs)
TN-WWTP-LOAD

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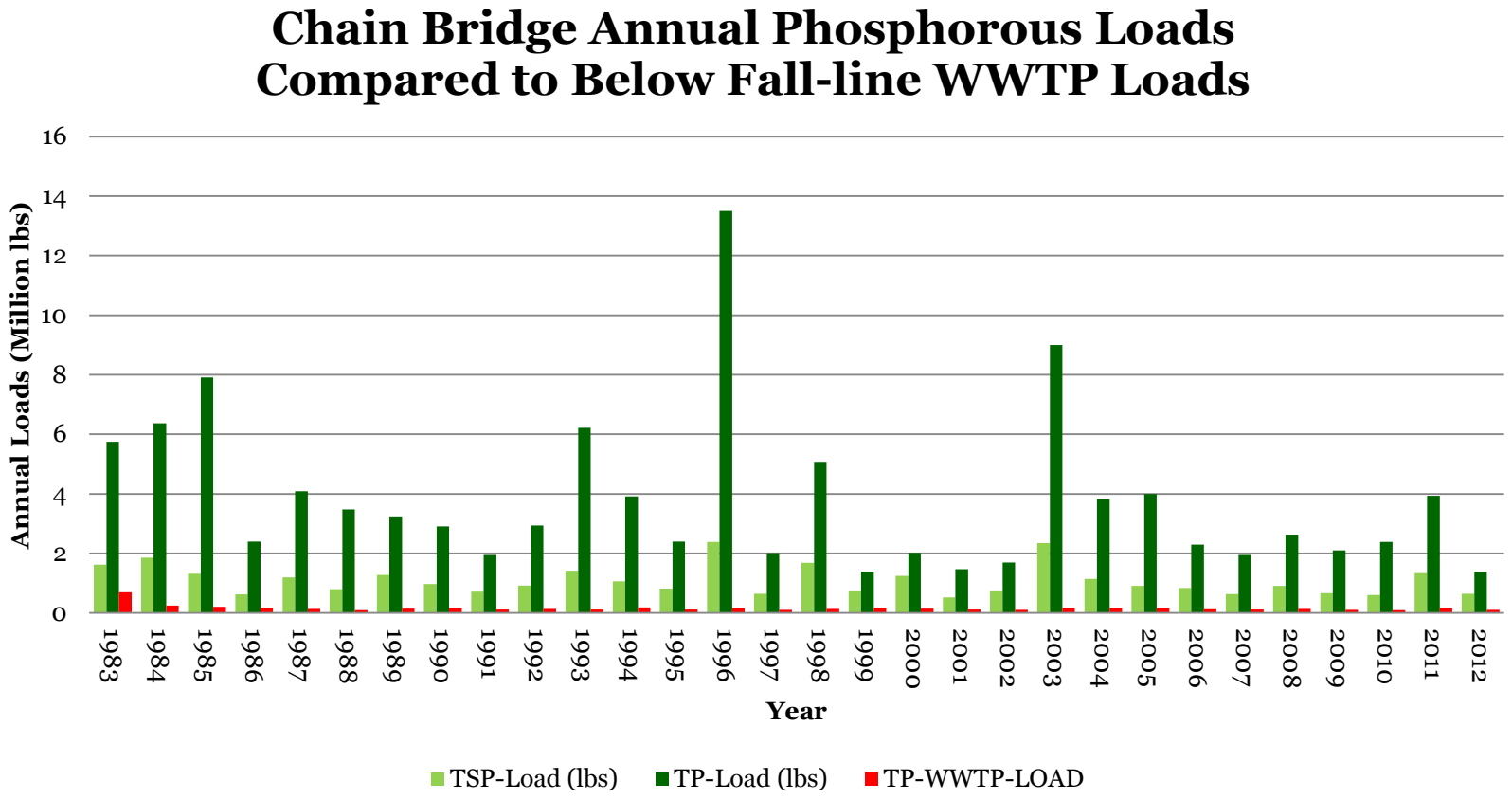
Chain Bridge Annual Phosphorous Loads
Compared to Below Fall-line WWTP Loads
Annual Loads (Million lbs)
16
14
12
10
8
6
4
2
0
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Year
TSP-Load (lbs)
TP-Load (lbs)
TP-WWTP-LOAD

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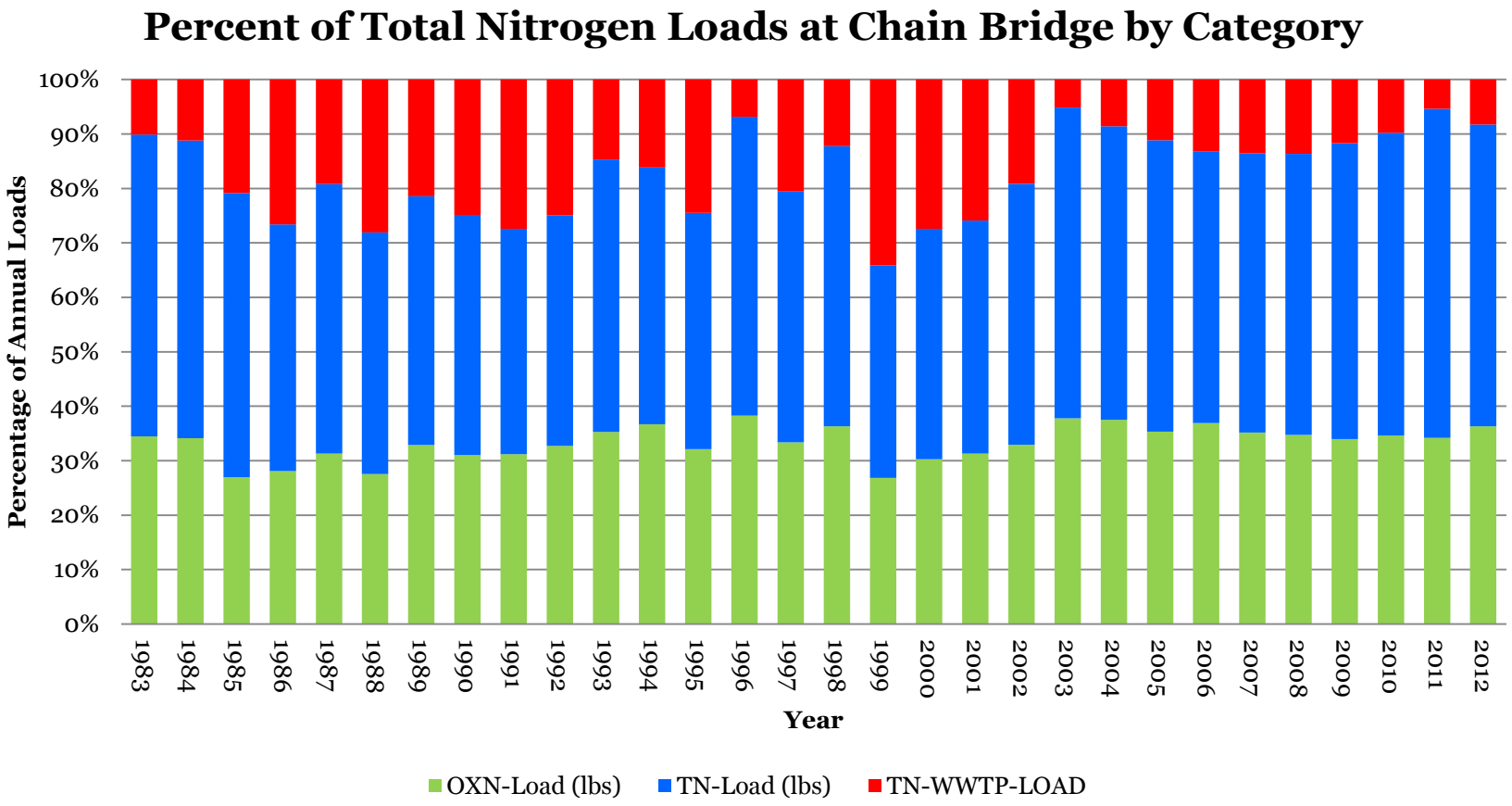
Percent of Total Nitrogen Loads at Chain Bridge by Category
Percentage of Annual Loads
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Year
OXN-Load (lbs)
TN-Load (lbs)
TN-WWTP-LOAD

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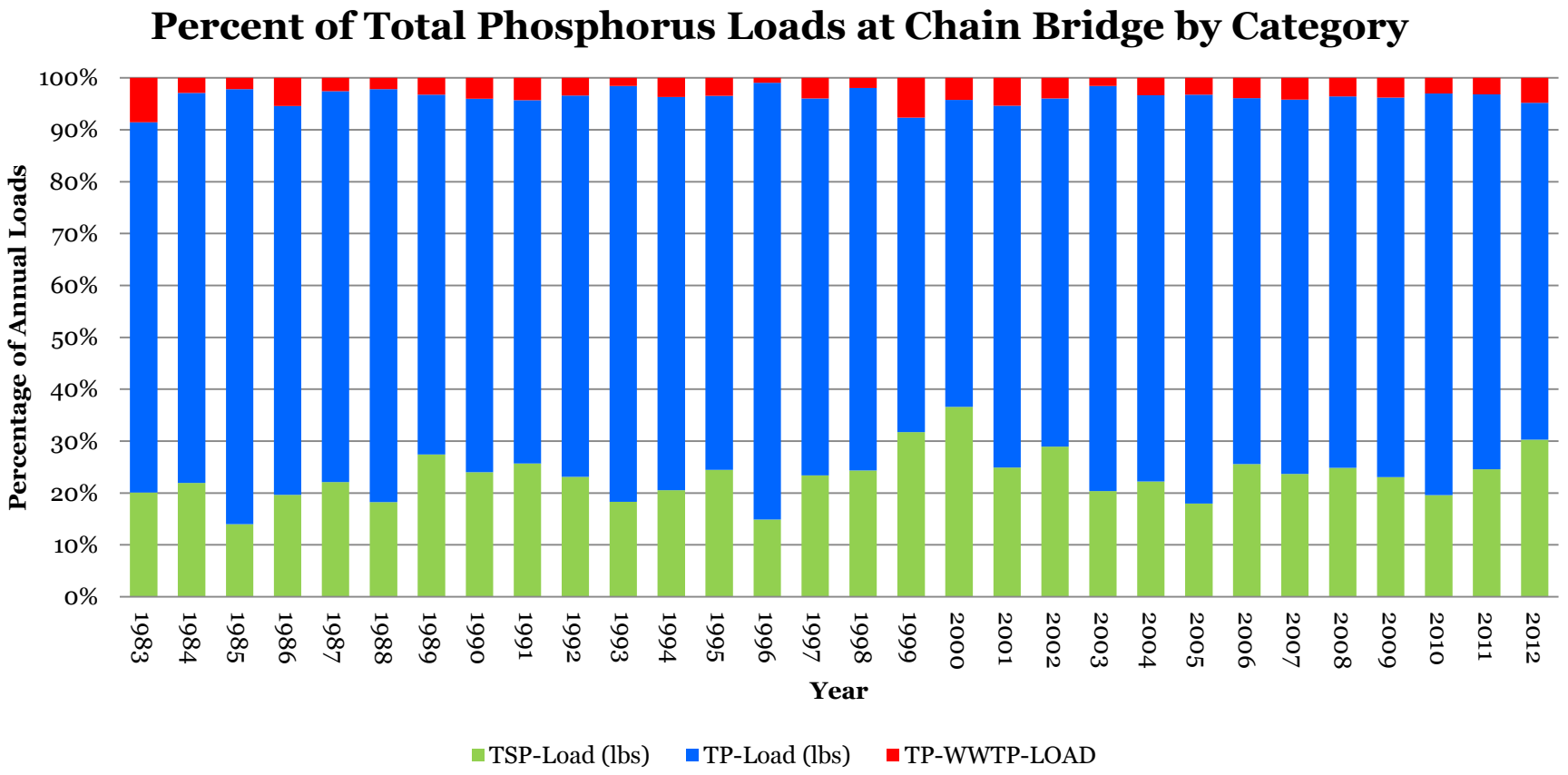
Percent of Total Phosphorus Loads at Chain Bridge by Category
Percentage of Annual Loads
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Year
TSP-Load (lbs)
TP-Load (lbs)
TP-WWTP-LOAD

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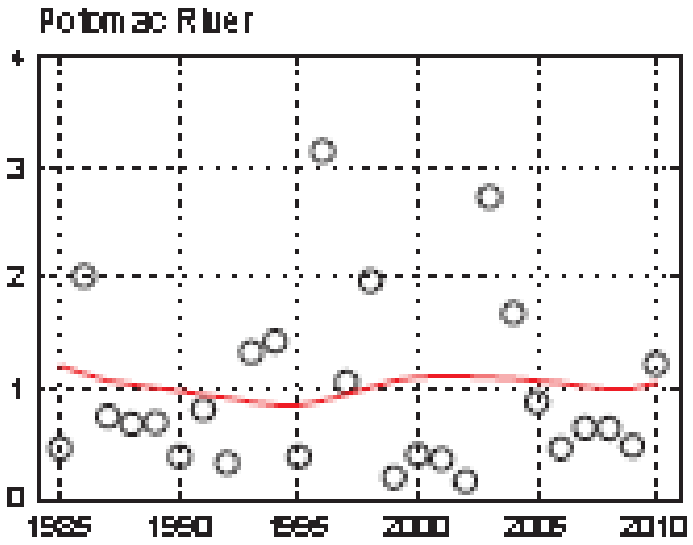
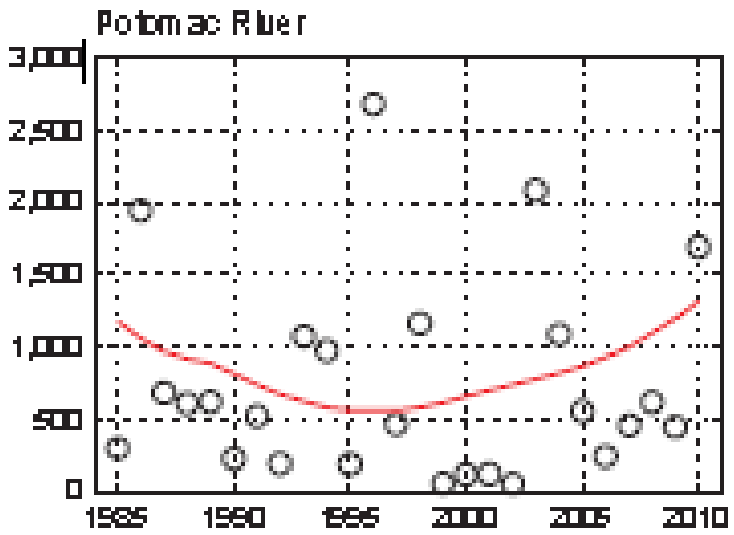
WRTDS Results for Potomac at Chain Bridge

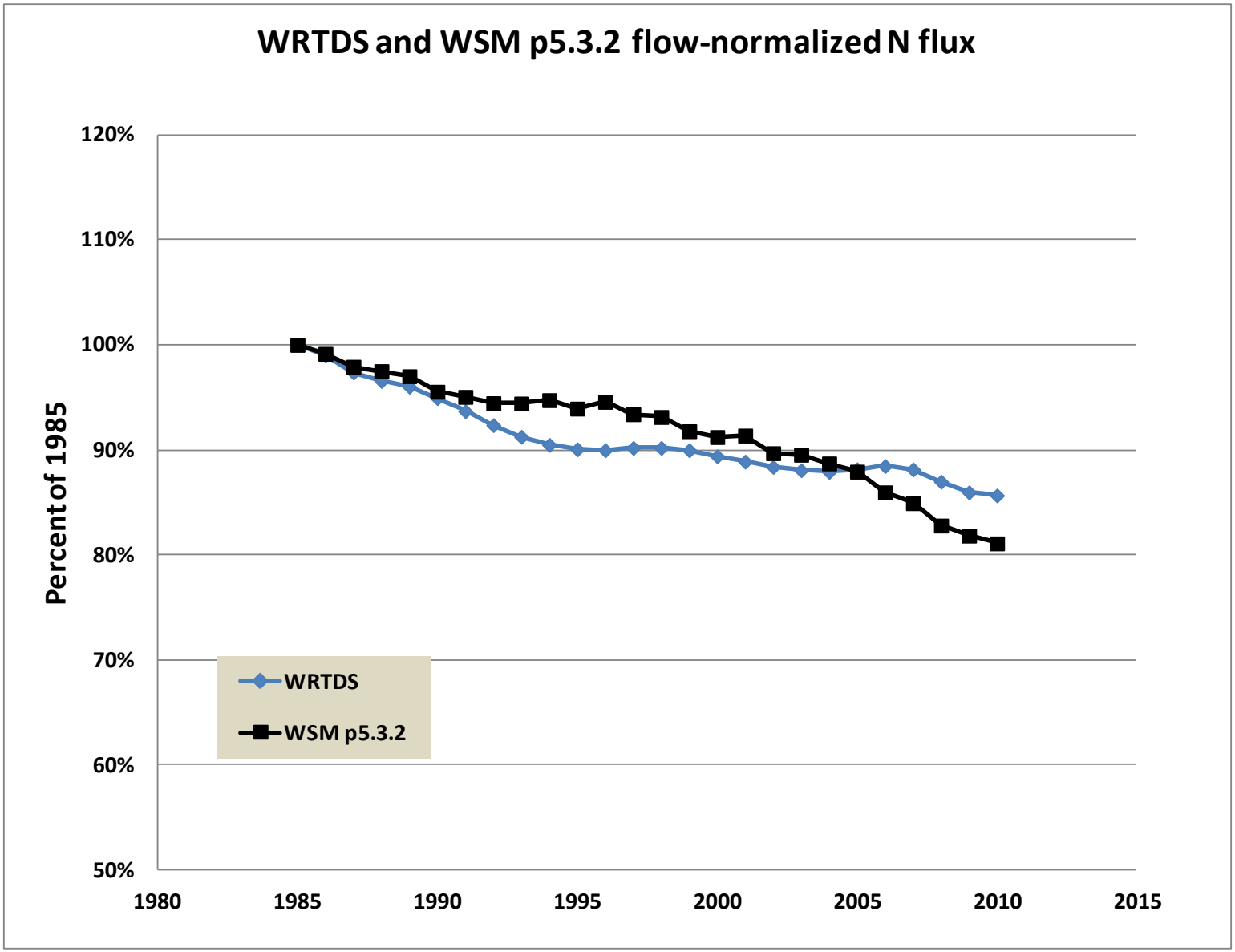




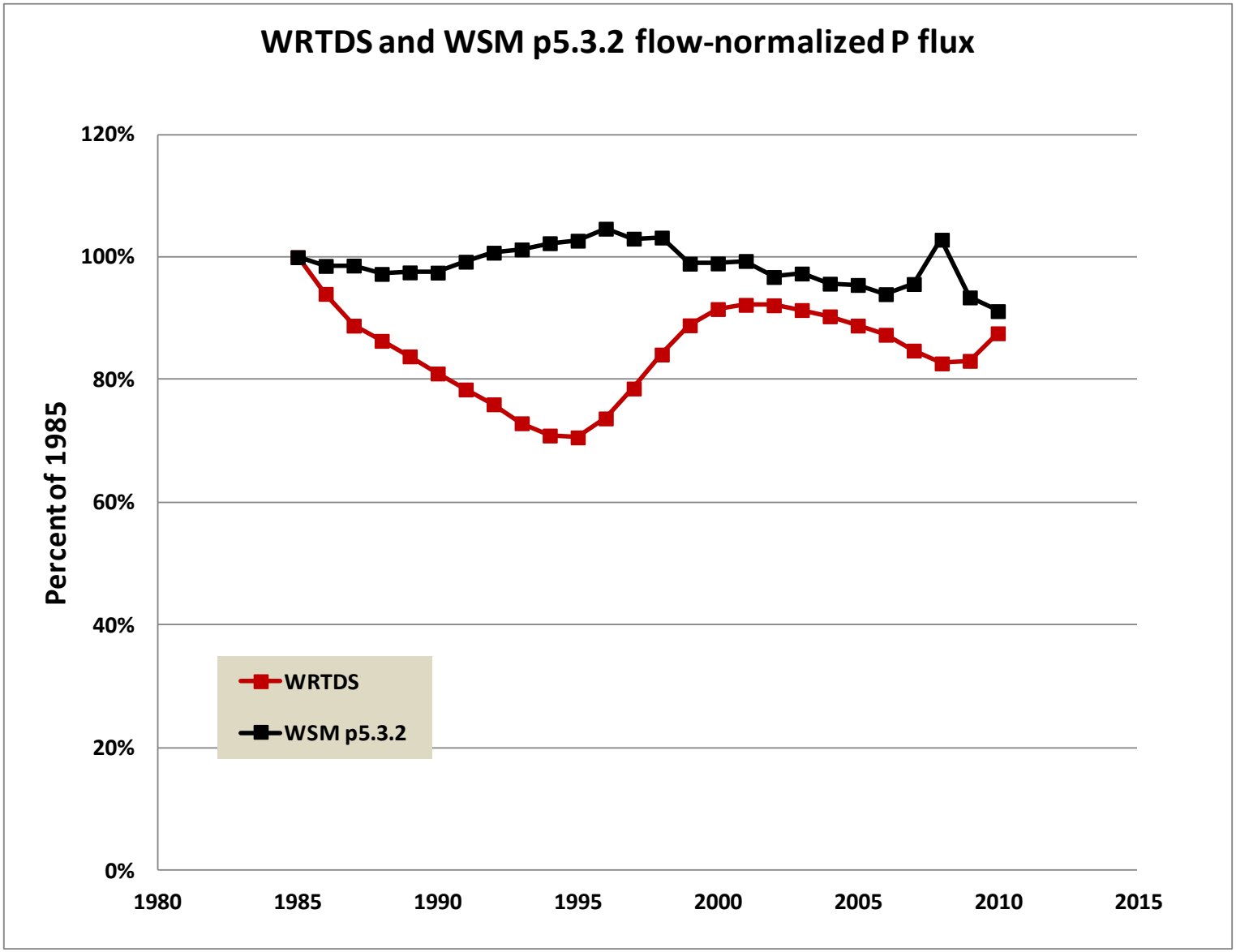
Flow adjusted trends for TP yield: 12.4% decrease from 1985 – 2010; 5 % decrease from 2000 - 2010

Flow adjusted trends for TSS yield: 12.2% increase from 1985 – 2010; 89.1 % increase from 2000-2010

Results derived from Science Summary—Determining Nutrient and Sediment Loads and Trends in the Chesapeake Bay Watershed by Using an Enhanced Statistical Technique. Hirsch, Robert, et al. USGS 2013.



Slide courtesy of Gary Shenk, CBPO



Slide courtesy of Gary Shenk, CBPO

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Next Steps by Bay Program

- Bay Program working with various partners (USGS, potentially others) to investigate discrepancies between modeling and monitoring results; reasons for observed trends
  - Looking at data from upriver stations
  - Looking for data to isolate possible source and geographic signals
    - Acid rain => alkalinity => pH => P release from sediments (?)

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Next Steps by COG

Short-term

- Address Chain Bridge loads in more detail in addition to overall Potomac Water Quality Fact Sheet
  - Discuss at COG monitoring workshop
- Provide easier access to OWML Chain Bridge data set

Long-term

- COG funding OWML to do additional Potomac water quality analysis
  - Partner with USGS on further trend analysis using OWML's Chain Bridge data (WRTDS and other methods)
  - Partner with CBP, others on explanations for trends, modeling-monitoring discrepancy
  - Check accuracy of USGS loads for the Potomac (used in WSM calibration)