Initial Analysis on the SSO and Bypass Issues For Future Model

A Presentation to the CBP Wastewater Workgroup
April 4, 2017

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SSO and Bypass Issues For Future Model

Background: SSO is considered as illegal discharge and has traditionally been avoided in the Bay Models. Bypass has been permitted mainly as storm driven bypass of partially treated wastewater but not included in the reported DMR data for many plants.

Problems:

A. The phase 6 model has the same issue that the previous versions had:
   - the model underestimates during storm events in many major river basins.

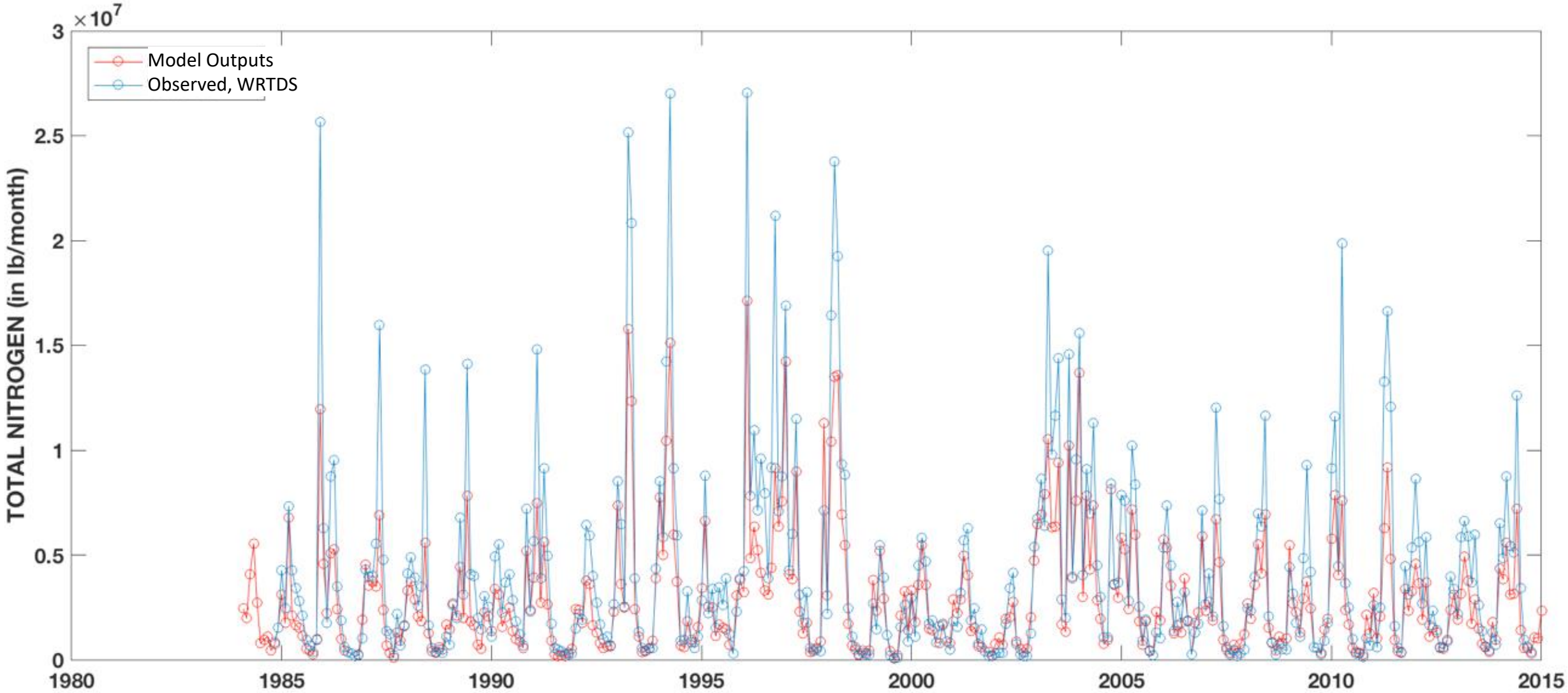
B. Many NGOs, such as Blue Water Baltimore, have asked about how the Bay models handle the sewage spills.

Data Analysis: Maryland SSO and Bypass data (2005-2016) are summarized and compared with MD CSO data to show the magnitude of SSO and Bypass contributions.

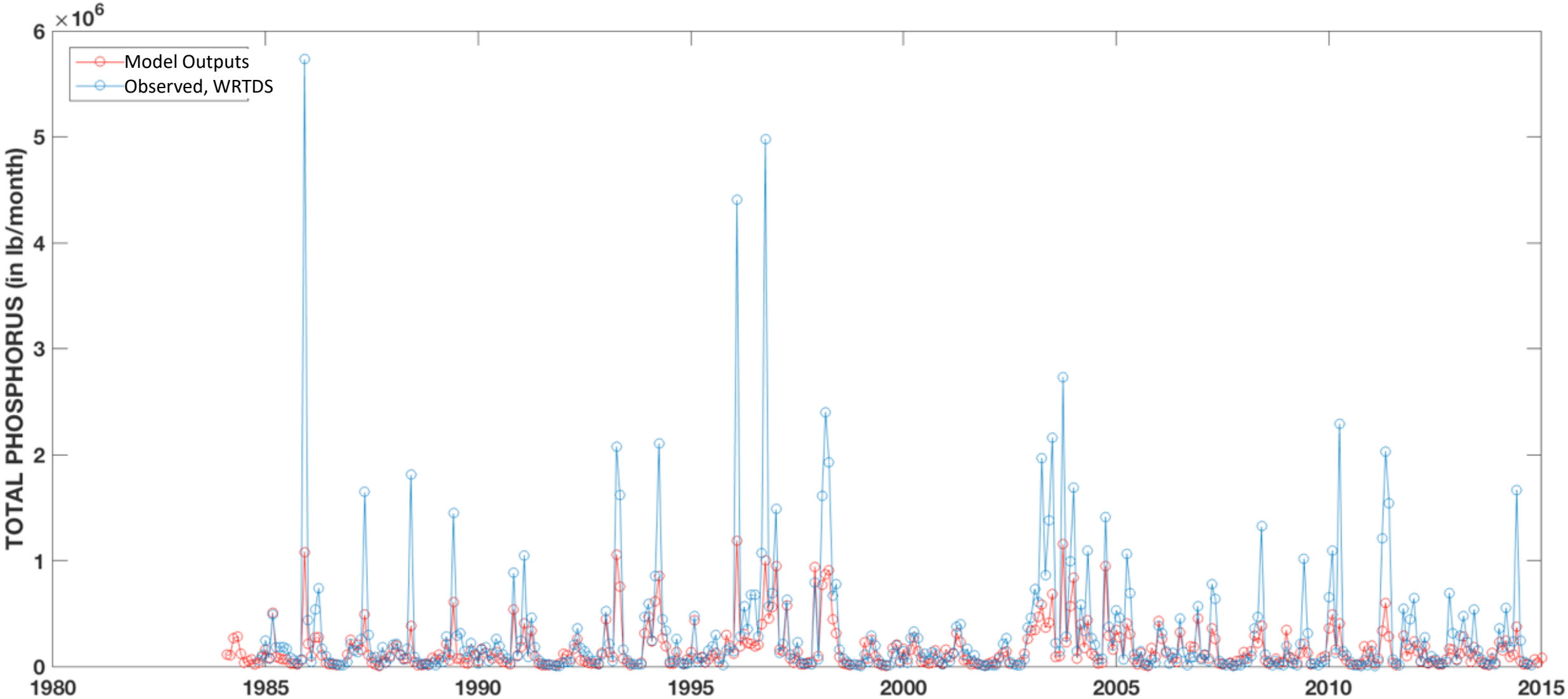
Options:

1. Workgroup provides a recommendation to WQGIT to include SSO and Bypass in future model (phase 7?) and starts to check the availabilities of the SSO and Bypass data.
2. Workgroup continues to investigate these issues.

Potomac River TN Loads– model output vs observed



Potomac River TP Loads– model output vs observed



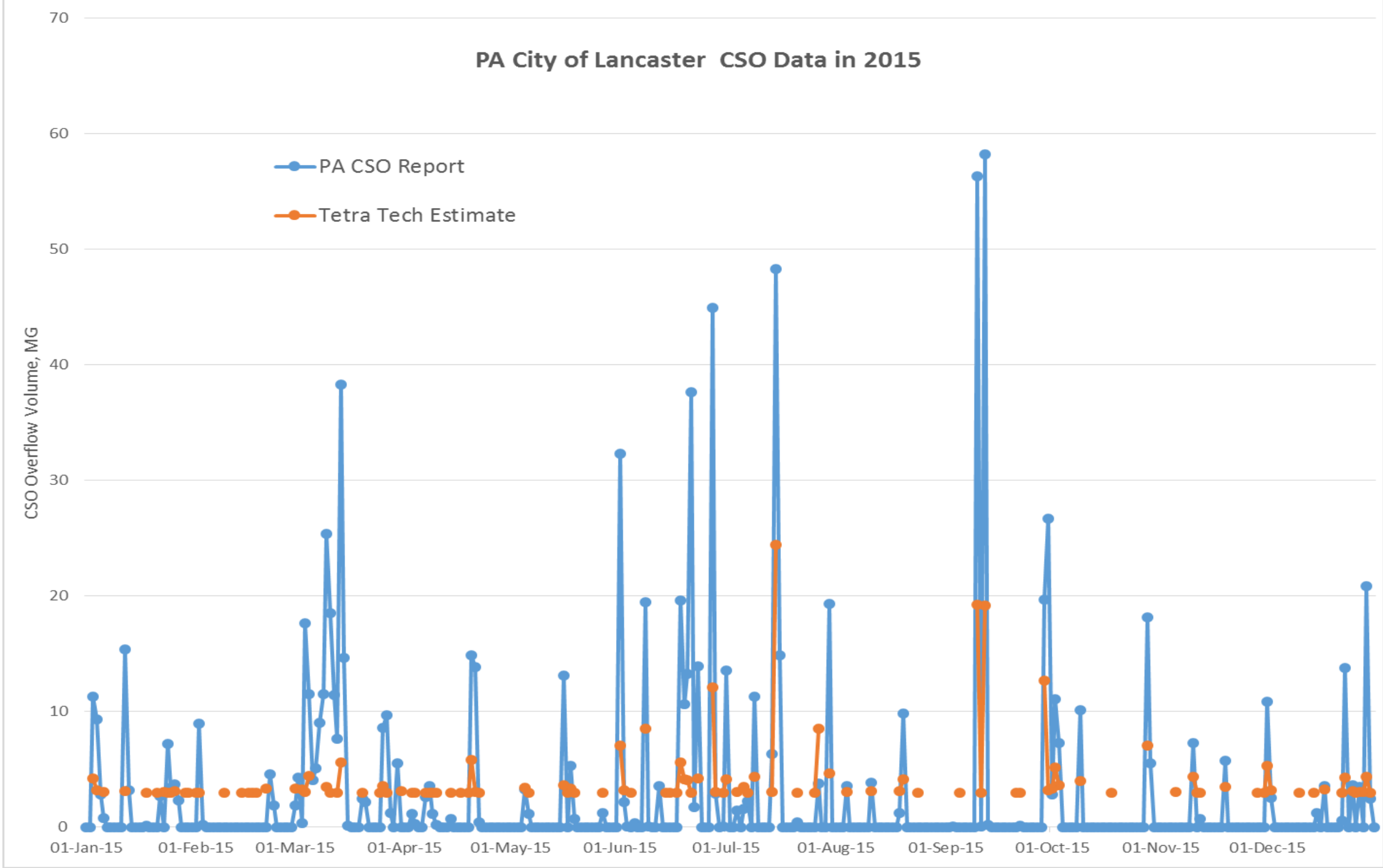
SSO and Bypass Issues For Future Model

The underestimation could be caused by many storm related event inputs, such as urban runoff, ag land runoff, CSO, SSO, Bypass, and etc. Further research is needed to study the causes to improve the model.

CSO, SSO and Bypass are in the domain of WWTWG. We know SSO and Bypass are missing in the models.

We decided to use a hybrid approach to handle CSO data before we can collect more reported CSO data. Example CSO data from Lancaster PA is presented on next slides to show the differences between the state reported CSO data and the Tetra Tech estimates.

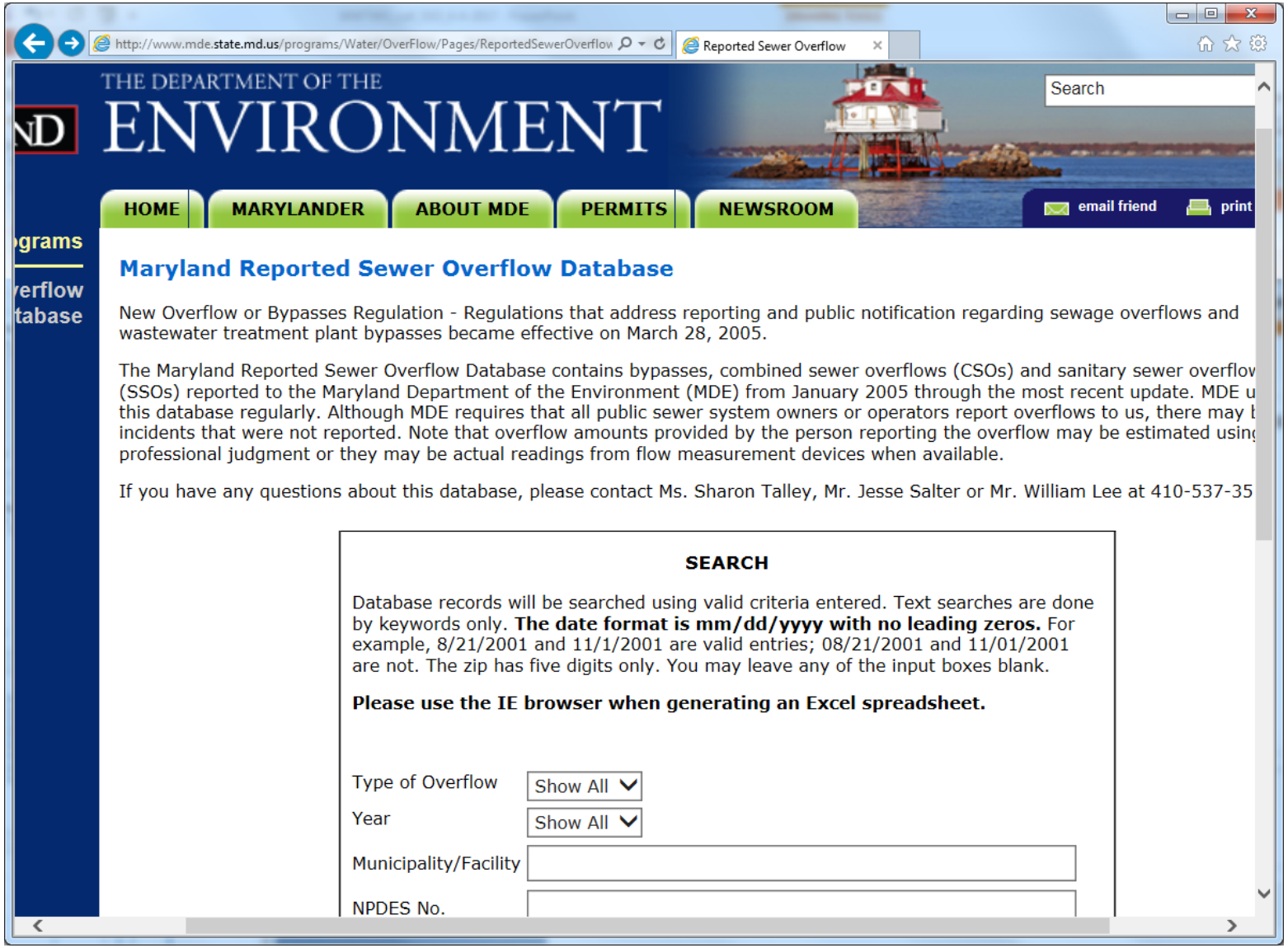
Are SSO and Bypass significant enough to contribute the model underestimation during storm event?

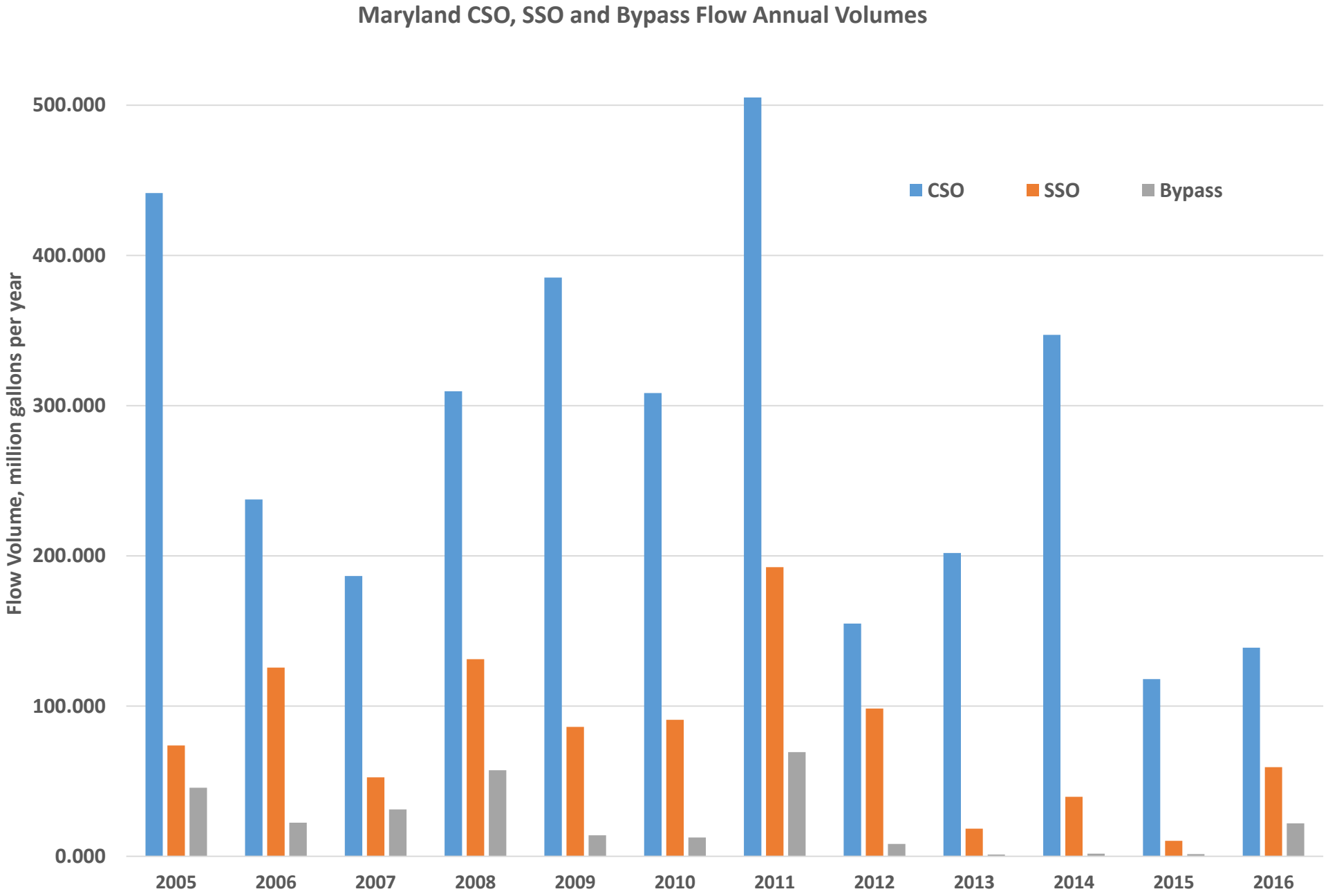

PA City of Lancaster CSO Data in 2015
PA CSO Report
Tetra Tech Estimate
CSO Overflow Volume, MG
70
60
50
40
30
20
10
0
01-Jan-15
01-Feb-15
01-Mar-15
01-Apr-15
01-May-15
01-Jun-15
01-Jul-15
01-Aug-15
01-Sep-15
01-Oct-15
01-Nov-15
01-Dec-15

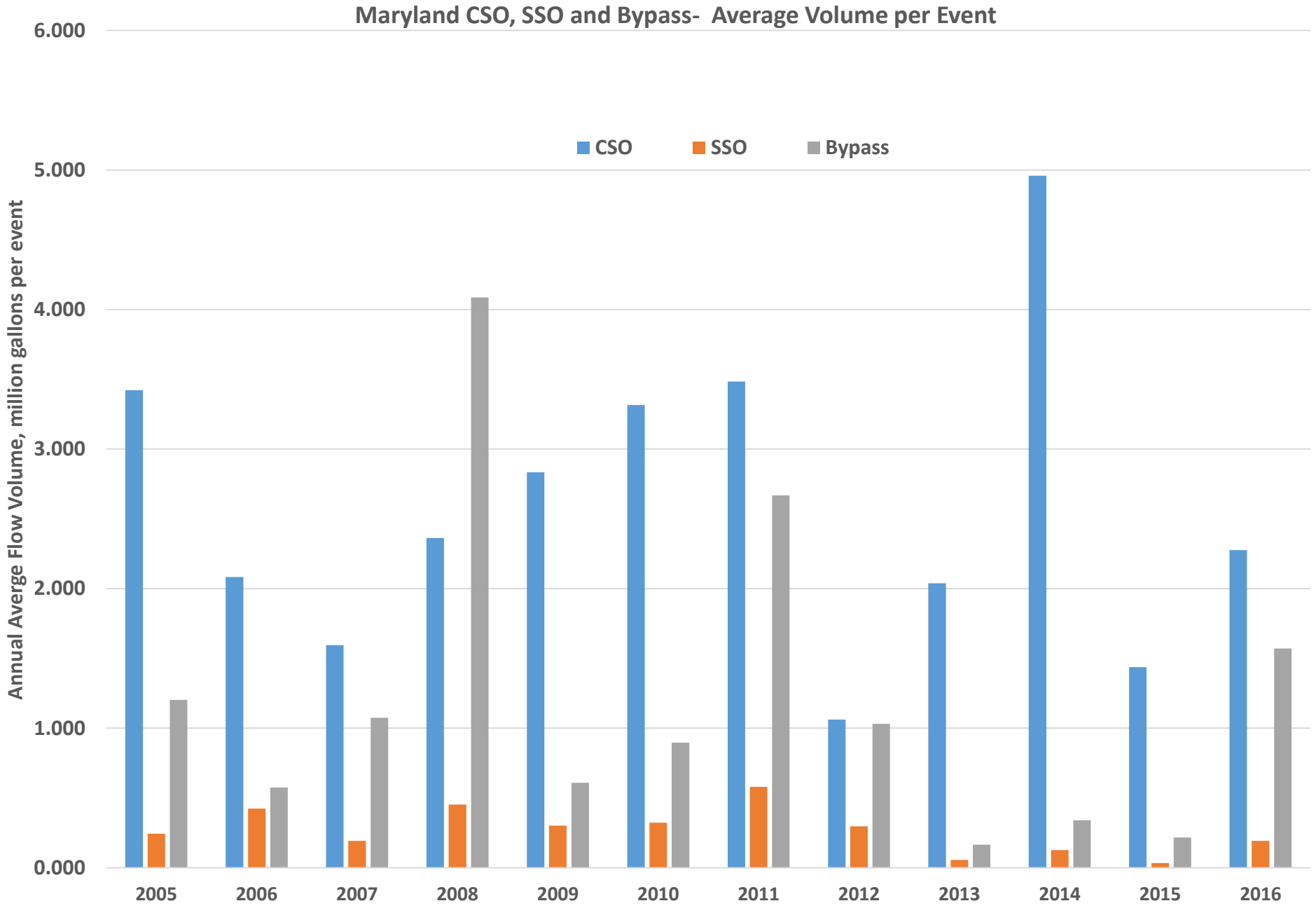
SSO and Bypass Issues For Future Model

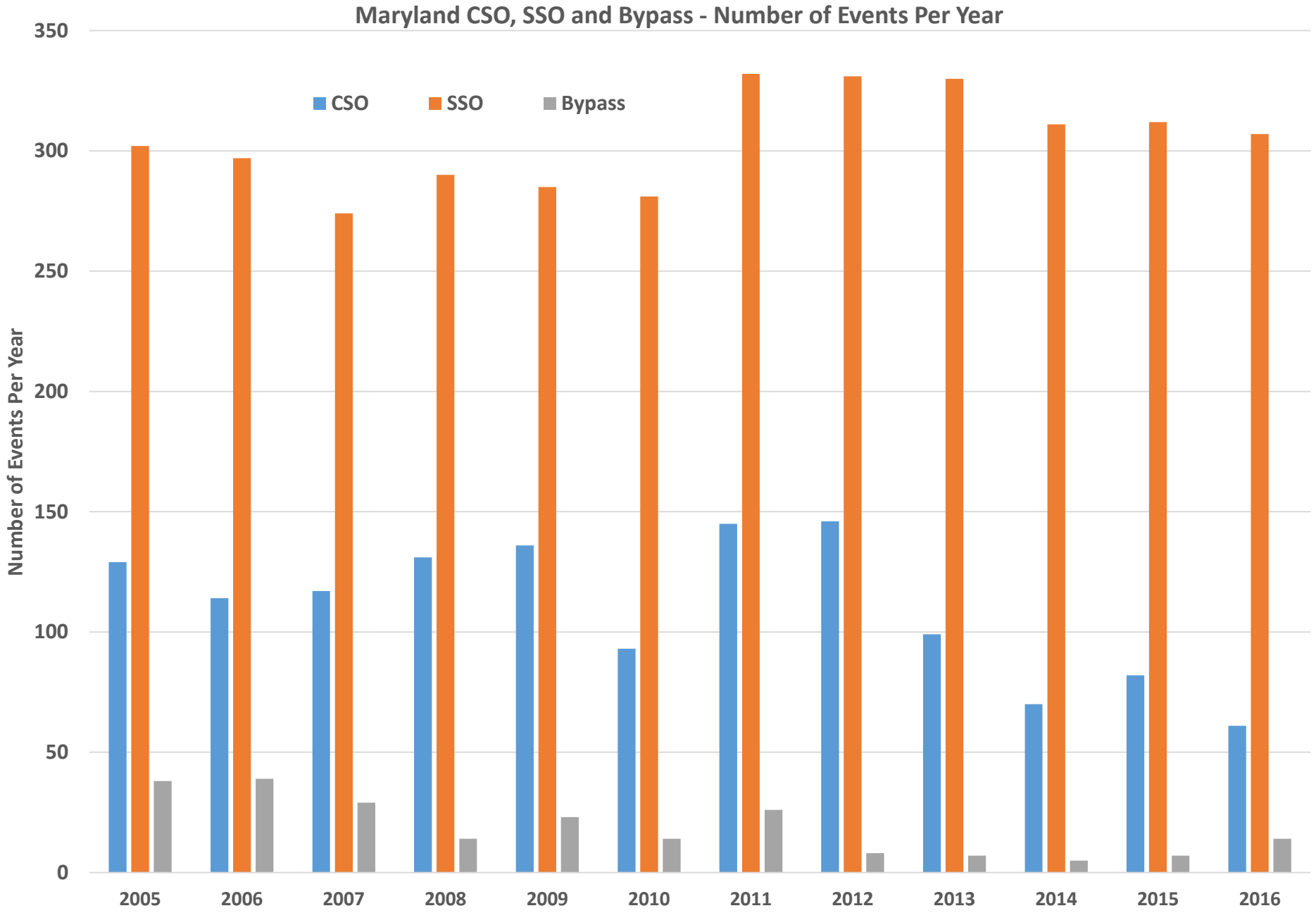
Are SSO and Bypass significant enough to contribute to the model underestimation during storm events?

Let us take a look at the Maryland SSO and Bypass data.




Maryland CSO, SSO and Bypass Flow Annual Volumes
Flow Volume, million gallons per year
500.000
400.000
300.000
200.000
100.000
0.000
CSO
SSO
Bypass
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016


Maryland CSO, SSO and Bypass- Average Volume per Event
CSO
SSO
Bypass
Annual Averge Flow Volume, million gallons per event
6.000
5.000
4.000
3.000
2.000
1.000
0.000
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016

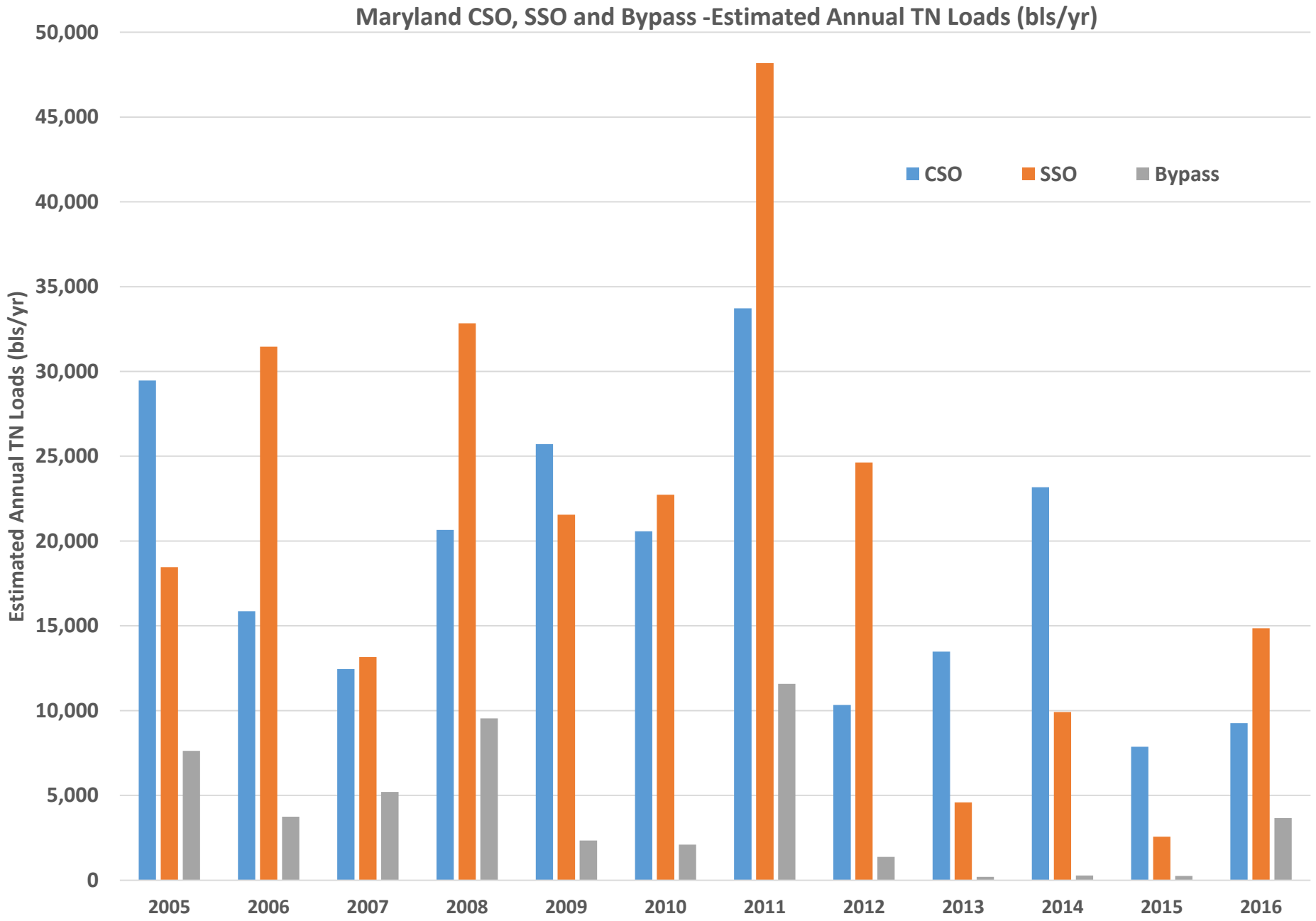

Maryland CSO, SSO and Bypass - Number of Events Per Year
CSO
SSO
Bypass
Number of Events Per Year
350
300
250
200
150
100
50
0
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016

Maryland Reported CSO, SSO and Bypass Data

	CSO			SSO			Bypass		
Year	# Events	Annual Total FLOW (MG)	Avg Flow per event (MG)	# Events	Annual Total FLOW (MG)	Avg Flow per event (MG)	# Events	Annual Total FLOW (MG)	Avg Flow per event (MG)
2005	129	441.477	3.422	302	73.761	0.244	38	45.701	1.203
2006	114	237.591	2.084	297	125.669	0.423	39	22.414	0.575
2007	117	186.593	1.595	274	52.582	0.192	29	31.175	1.075
2008	131	309.496	2.363	290	131.166	0.452	14	57.210	4.086
2009	136	385.290	2.833	285	86.114	0.302	23	13.998	0.609
2010	93	308.320	3.315	281	90.783	0.323	14	12.547	0.896
2011	145	505.174	3.484	332	192.476	0.580	26	69.370	2.668
2012	146	154.902	1.061	331	98.386	0.297	8	8.248	1.031
2013	99	201.873	2.039	330	18.342	0.056	7	1.154	0.165
2014	70	347.102	4.959	311	39.649	0.127	5	1.704	0.341
2015	82	117.867	1.437	312	10.262	0.033	7	1.515	0.216
2016	61	138.818	2.276	307	59.360	0.193	14	21.984	1.570

To convert the flow volumes to TN loads, we need to assume some draft TN concentrations for the calculation purpose. These draft concentrations are picked only for testing in this analysis and not citable.

	Draft TN		Justification
CSO	8	mg/l	Default value recommended for CSO by Tetra Tech
Bypass	20	mg/l	Based on the flow weighted average of Blue Plains bypass outfall TN values in 2015 and 2016.
SSO	30	mg/l	Considered with both wet and dry weather events


Maryland CSO, SSO and Bypass -Estimated Annual TN Loads (bls/yr)
Estimated Annual TN Loads (bls/yr)
50,000
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
CSO
SSO
Bypass
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016

CSO was eliminated, but SSO is still running

Municipality	Year	# SSO Events	Annaul SSO (Gallons)	Avg SSO (Gallons) per event	# CSO Events	CSO (Gallons)	Avg CSO (Gallons) per event
City of Baltimore	2005	84	4,749,943	56,547	4	4,885	1,221
City of Baltimore	2006	61	69,483,139	1,139,068	2	22,255	11,128
City of Baltimore	2007	61	549,564	9,009	CSO Eliminated		
City of Baltimore	2008	104	1,620,464	15,581	0	0	0
City of Baltimore	2009	152	2,167,752	14,262	0	0	0
City of Baltimore	2010	136	1,578,754	11,608	0	0	0
City of Baltimore	2011	240	10,857,511	45,240	0	0	0
City of Baltimore	2012	287	259,440	904	0	0	0
City of Baltimore	2013	279	963,690	3,454	0	0	0
City of Baltimore	2014	238	13,586,924	57,088	0	0	0
City of Baltimore	2015	260	968,168	3,724	0	0	0
City of Baltimore	2016	172	8,444,691	49,097	0	0	0

Baltimore County has no CSO, but it has SSO

Municipality	Year	# SSO Evens	Annaul SSO (Gallons)	Avg SSO (Gallons) per event
Baltimore County DPW	2005	73	11,450,966	156,863
Baltimore County DPW	2006	68	13,675,408	201,109
Baltimore County DPW	2007	51	3,107,394	60,929
Baltimore County DPW	2008	54	15,626,542	289,380
Baltimore County DPW	2009	40	24,064,011	601,600
Baltimore County DPW	2010	44	36,994,319	840,780
Baltimore County DPW	2011	57	120,765,533	2,118,694
Baltimore County DPW	2012	39	63,458,808	1,627,149
Baltimore County DPW	2013	46	2,908,692	63,232
Baltimore County DPW	2014	45	10,951,409	243,365
Baltimore County DPW	2015	37	1,864,382	50,389
Baltimore County DPW	2016	19	2,612,258	137,487

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