Approaches to Account for the Effects of Climate Change

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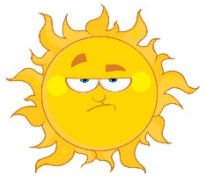
CBPO

Presentation to MWG 1/7/20

Major climate change forcing by 2025

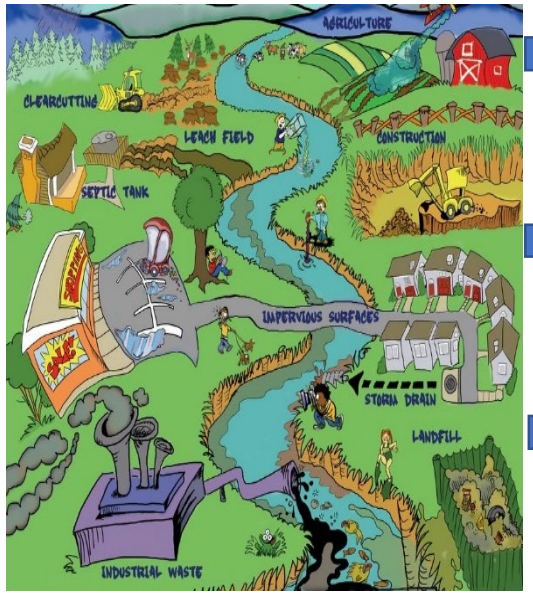
Rain

Warming



Air-temperature increase: 1.06 °C

Watershed



Flow

+2.4%

TN

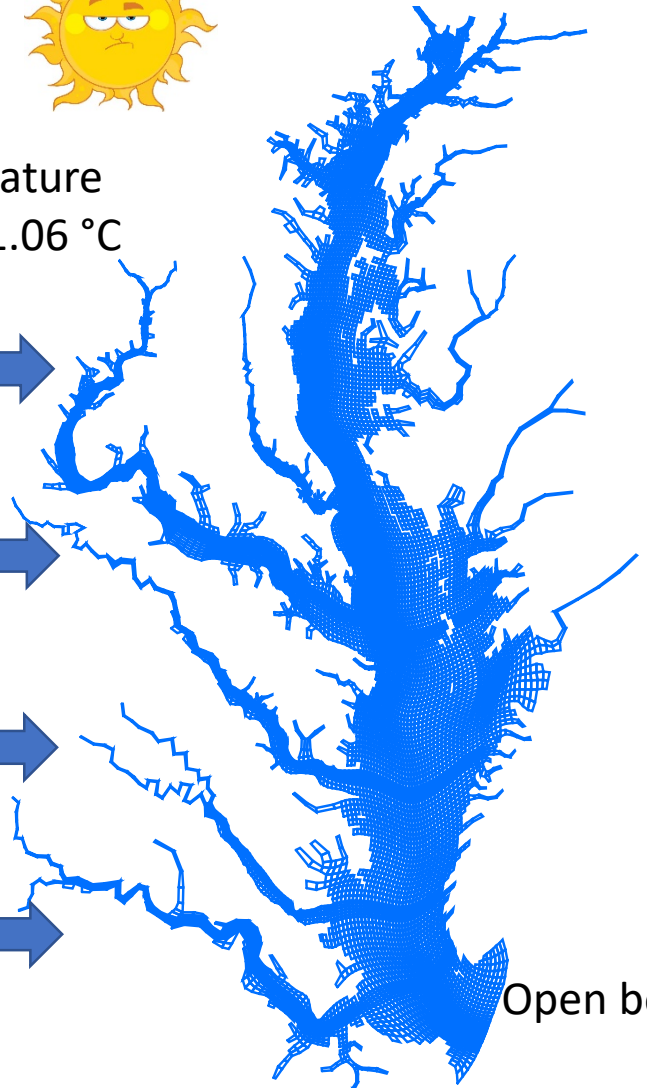
+2.6%

TP

+4.5%

Sediment

+3.8



Sea Level Rise: 0.22m

Open boundary T: + 0.95 °C; S: + 0.18 psu (Thomas et al., 2017)

From Gopal Bhatt

Approaches (policy decision)

- Suggested method from December 2017
  - Move up the ‘non-WWTP’ planning target curve
- Modify both lines in the hockey stick
- Same thing, but with a better modeling method
- All state-basins maintain PT load and then account for bay change using a method from above
- Proportional to Greenhouse Gas Emissions or some other climate-relevant metric?
- Bring in open water?
- …

Climate Model System – relative change only

- PSC voted to not change planning targets until 2025
  - Still need to use CAST-2017 and CAST-2019
- PSC asked to evaluate climate change

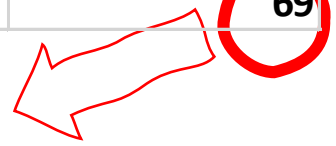
- Climate change assessment models will be used to evaluate the ***change*** in attainability of standards due to climate change effects

Method

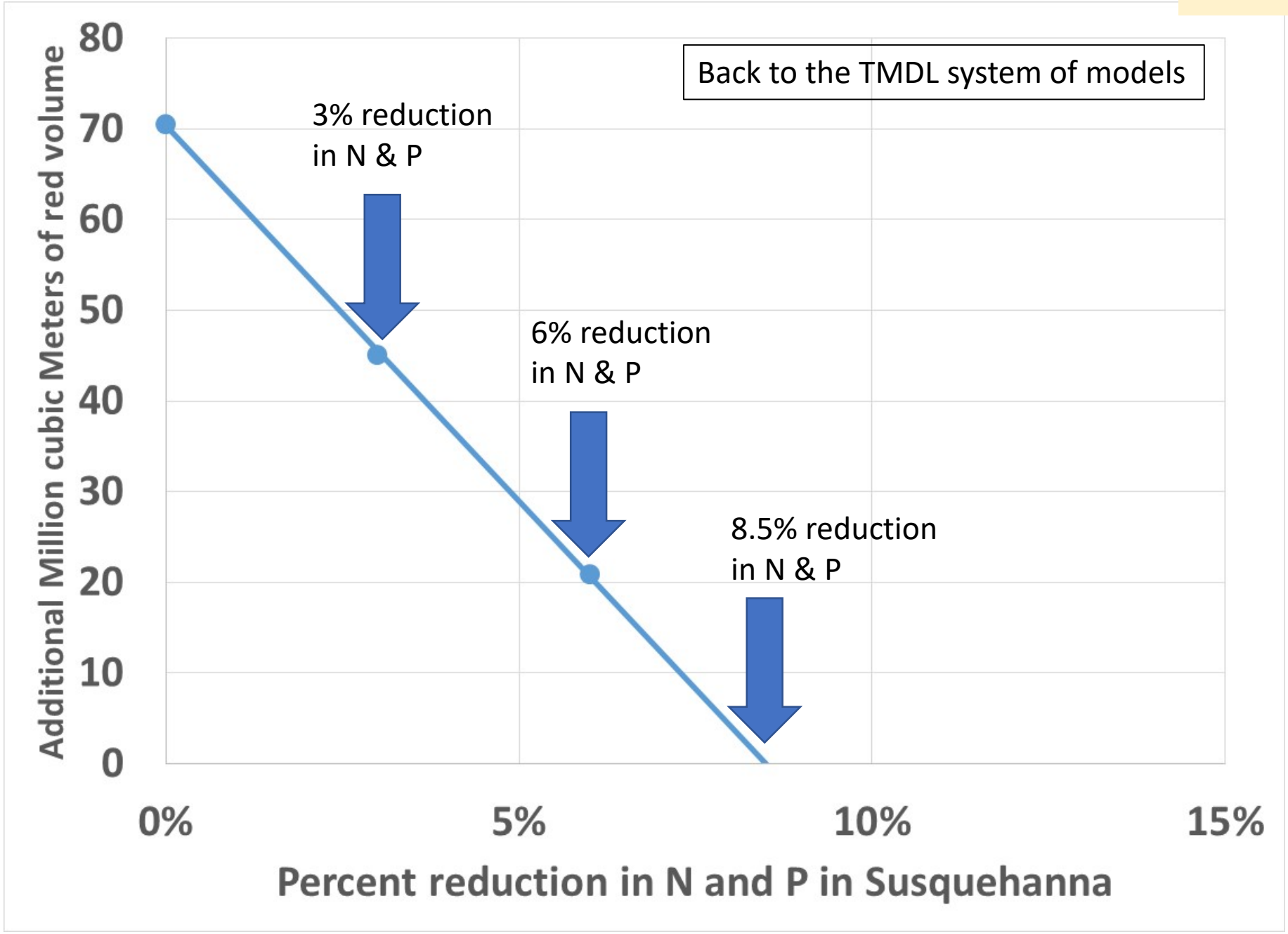
- Using the Climate Model System, estimate the change in attainment due to all climate change effects
- Using the TMDL Model System, estimate the change in load necessary to counteract that change

Climate increase in violation

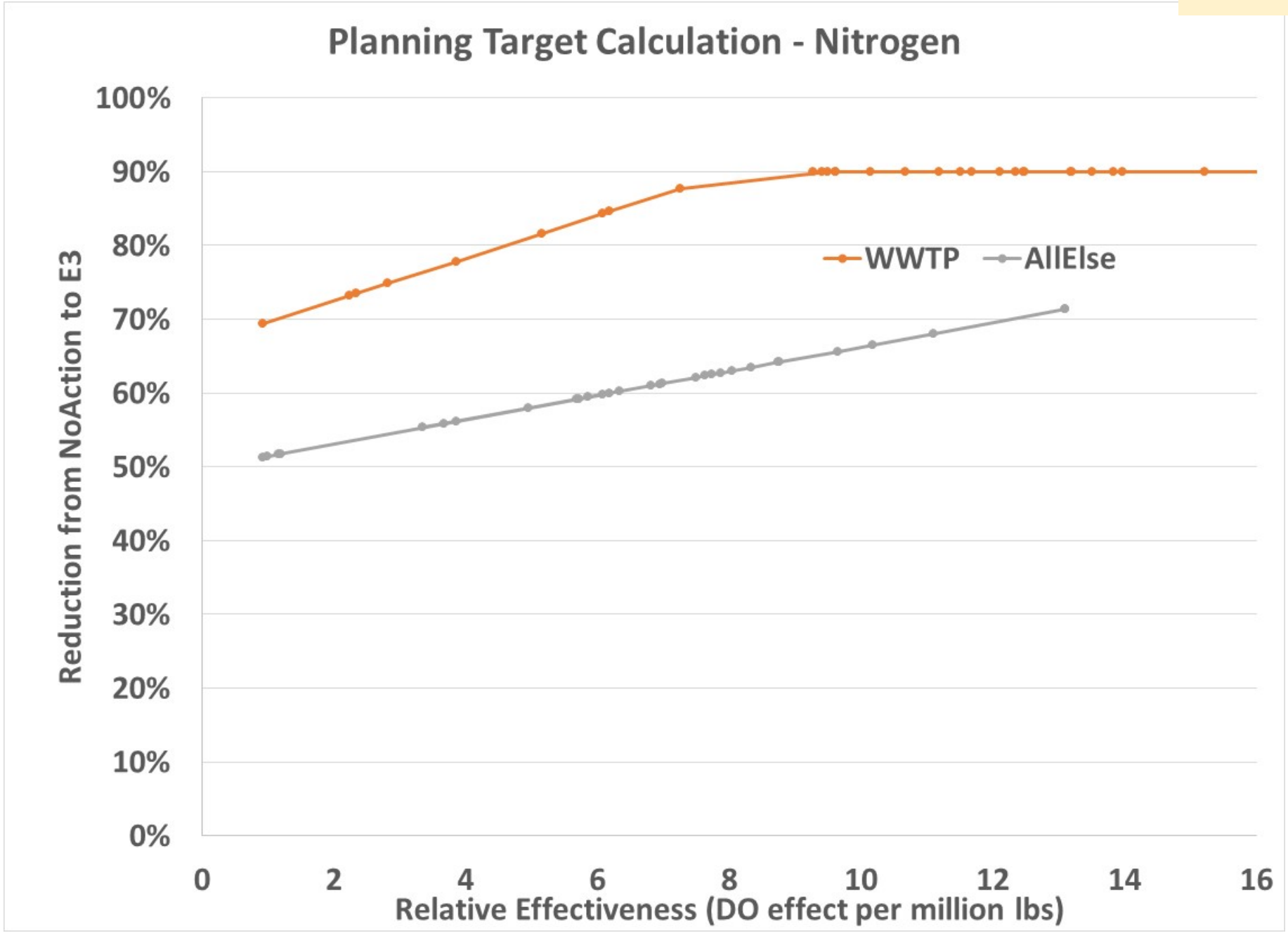
CB Seg	Designated Use	Designated Use Total Volume	Red Percent Planning Target	Red Volume Planning Target	Red Percent Planning target + CC	Red Volume Planning target + CC
CB3MH	DW	864	0.05%	0	0.06%	1
CB4MH	DW	2854	5.74%	164	6.67%	190
MD5MH	DW	2097	1.27%	27	1.79%	38
VA5MH	DW	1605	0.00%	0	0.00%	0
POMMH	DW	1839	0.03%	1	0.06%	1
CB3MH	DC	390	0.00%	0	0.00%	0
CB4MH	DC	2126	6.59%	140	8.06%	171
MD5MH	DC	2875	0.00%	0	0.00%	0
VA5MH	DC	1848	0.00%	0	0.00%	0
				332		401
					CC Difference	**69**



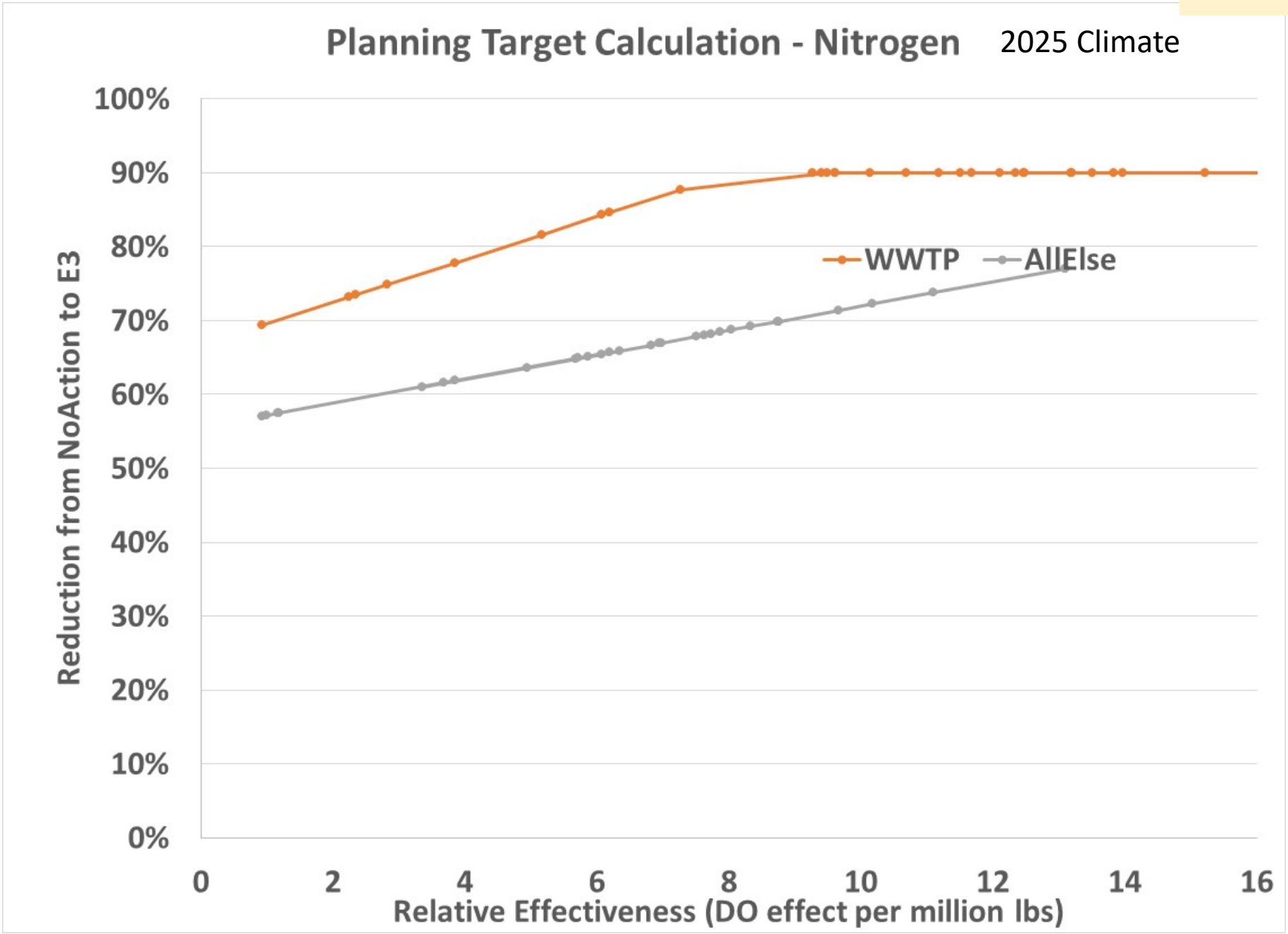
69 million cubic meters is the final result from the climate modeling
December 2017 number was 80


Back to the TMDL system of models
3% reduction in N & P
6% reduction in N & P
8.5% reduction in N & P
Additional Million cubic Meters of red volume
80
70
60
50
40
30
20
10
0
0%
5%
10%
15%
Percent reduction in N and P in Susquehanna

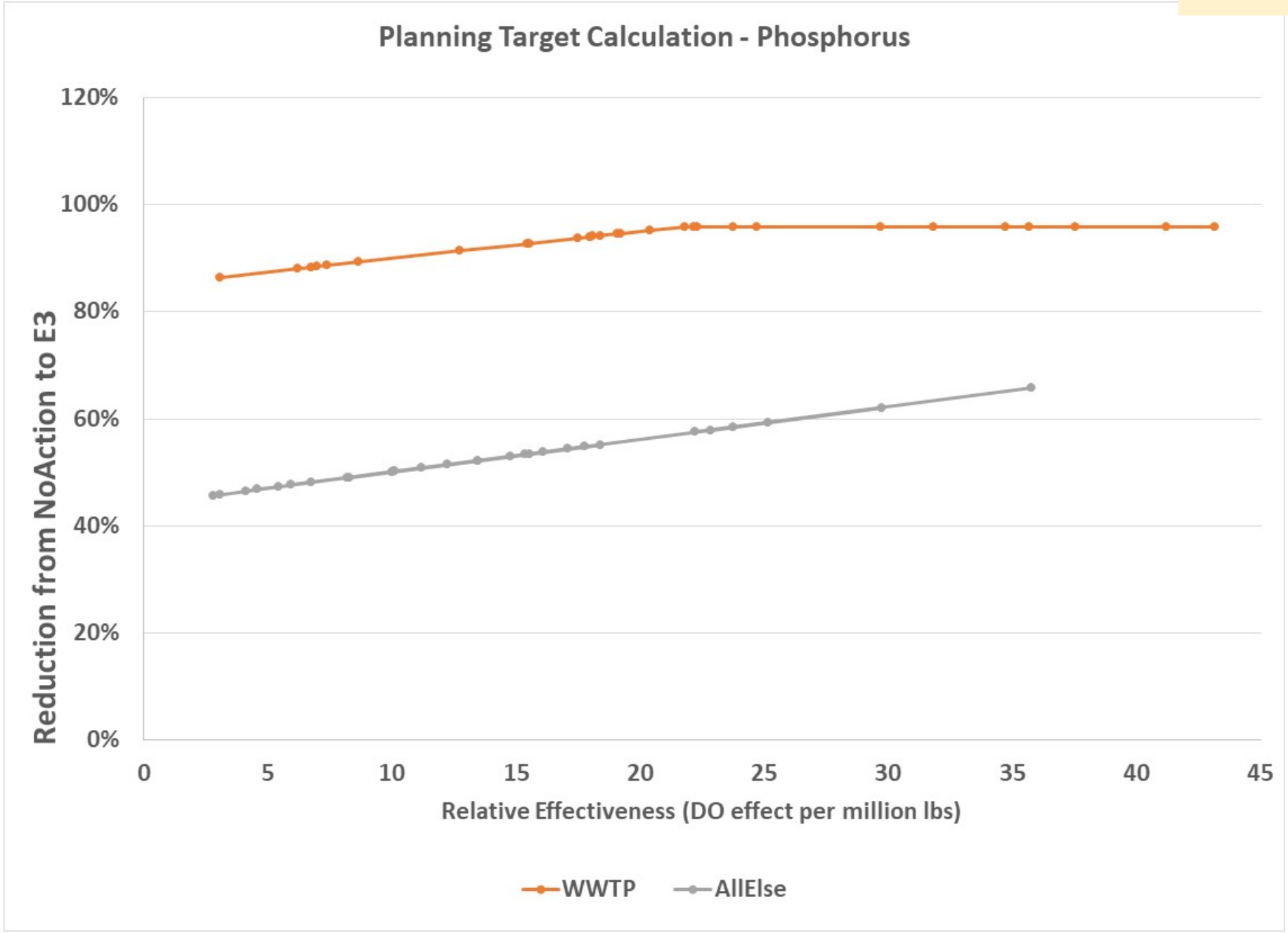
December 2017 method



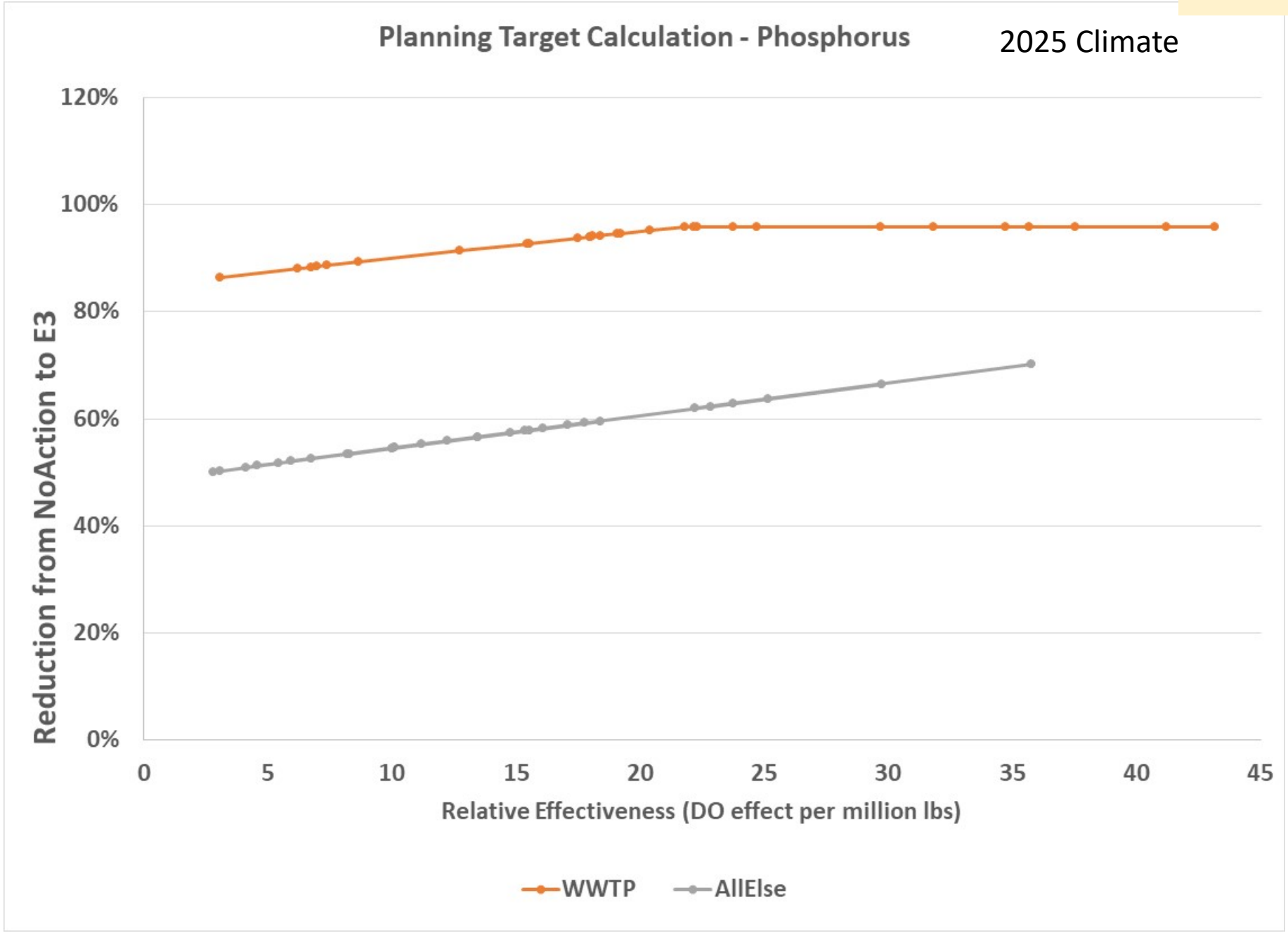
December 2017 method



December 2017 method



December 2017 method



December 2017 method

November 2019 calculation

Additional Reductions for Climate Change

	N	N	P	P
Jurisdiction	December 2017	December 2019	December 2017	December 2019
DC	0.006	0.005	0.001	0.001
DE	0.397	0.337	0.006	0.006
MD	2.194	1.850	0.117	0.097
NY	0.400	0.384	0.015	0.016
PA	4.135	3.652	0.143	0.126
VA	1.722	1.521	0.187	0.168
WV	0.236	0.220	0.017	0.015
BasinWide	9.089	7.970	0.485	0.428

Make reductions in climate modeling system

Climate increase in violation

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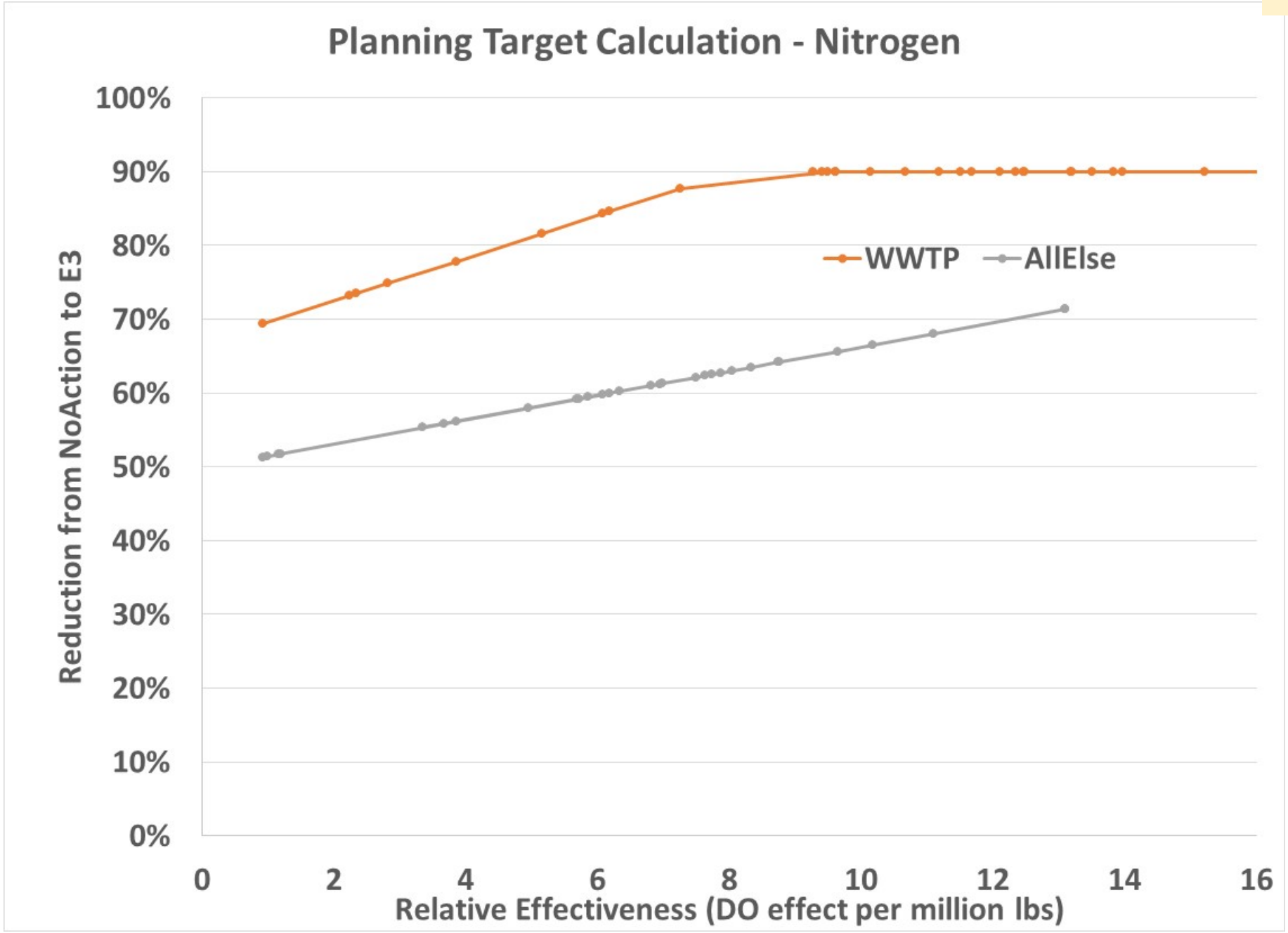
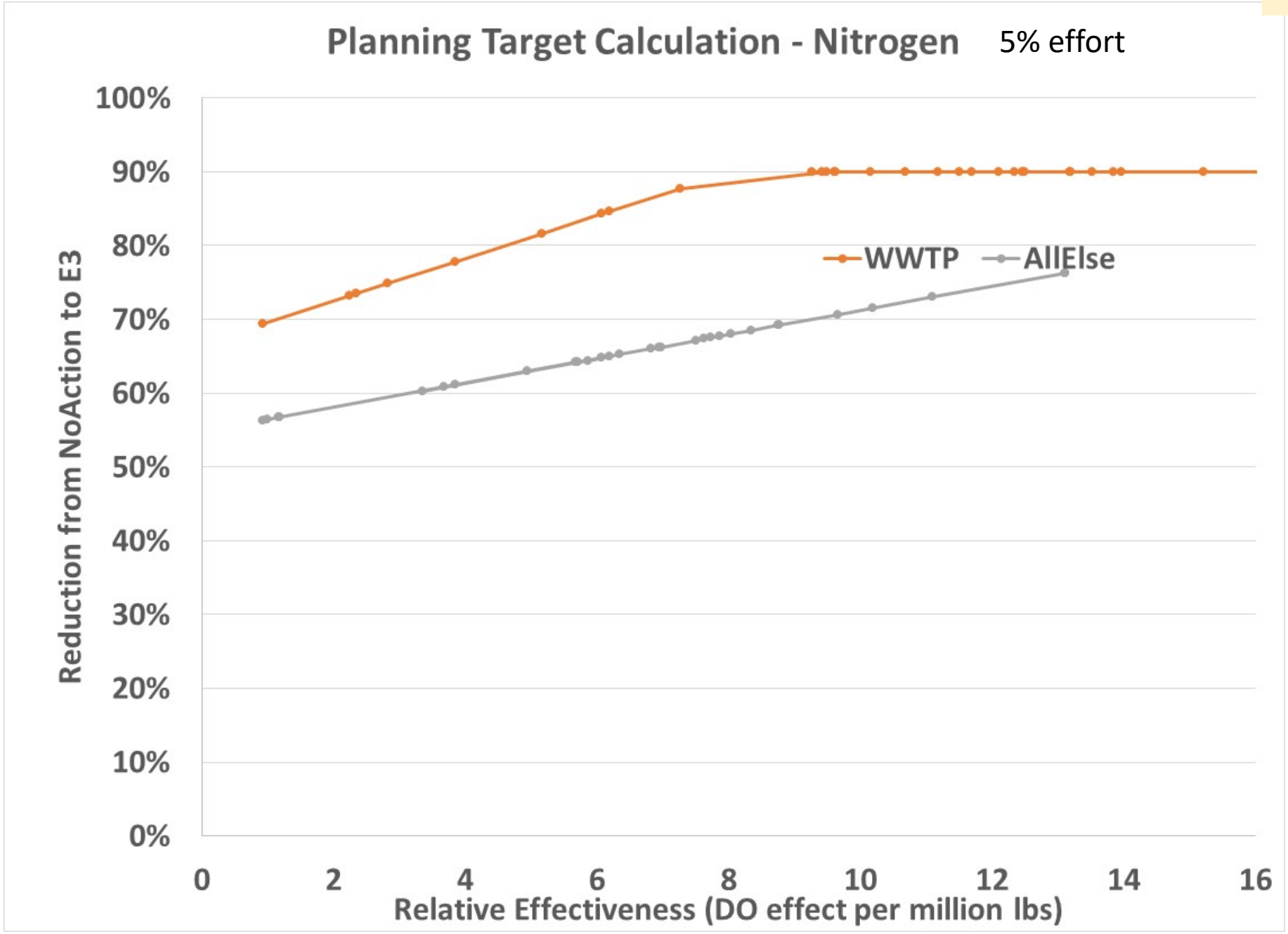
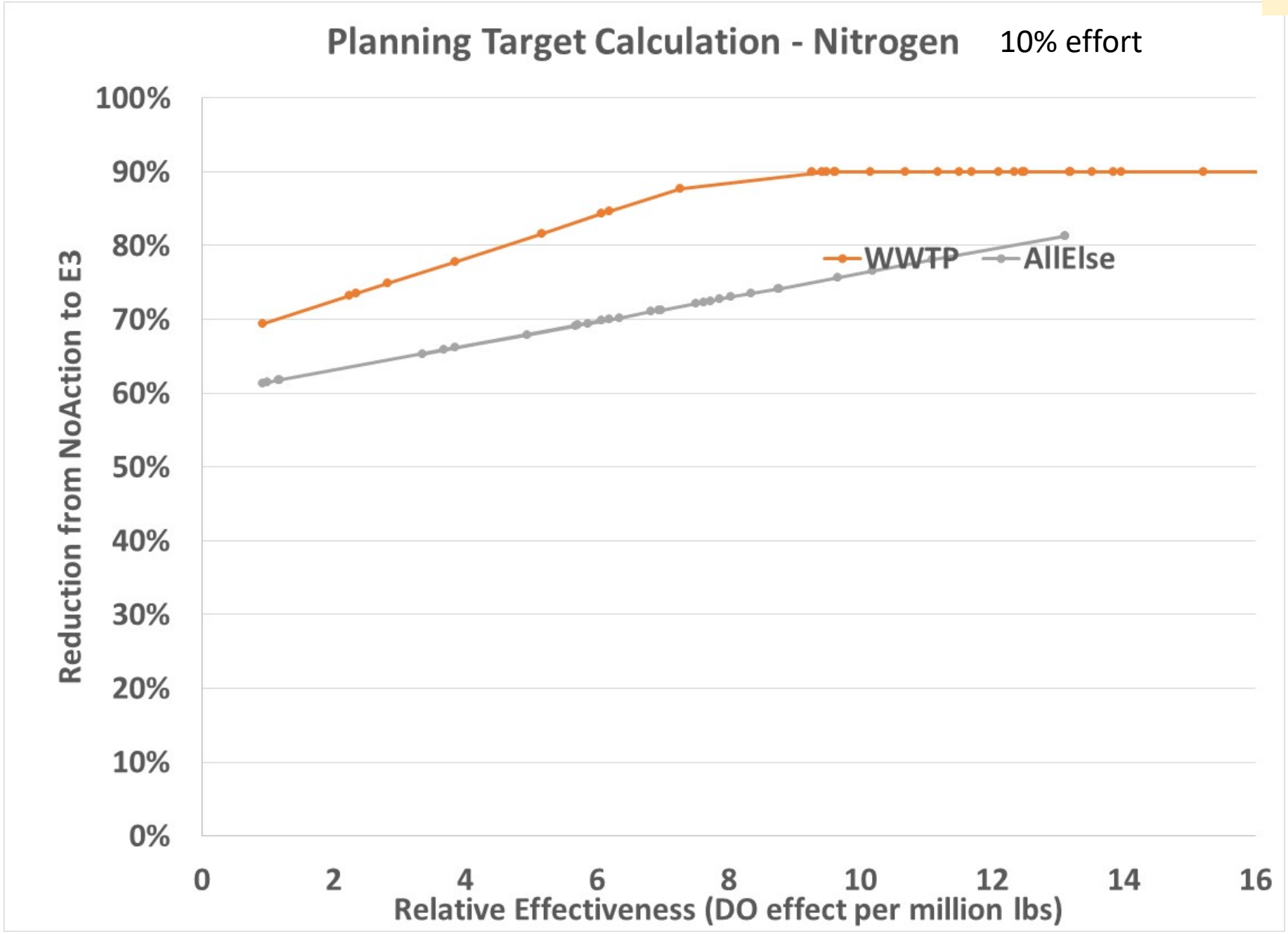
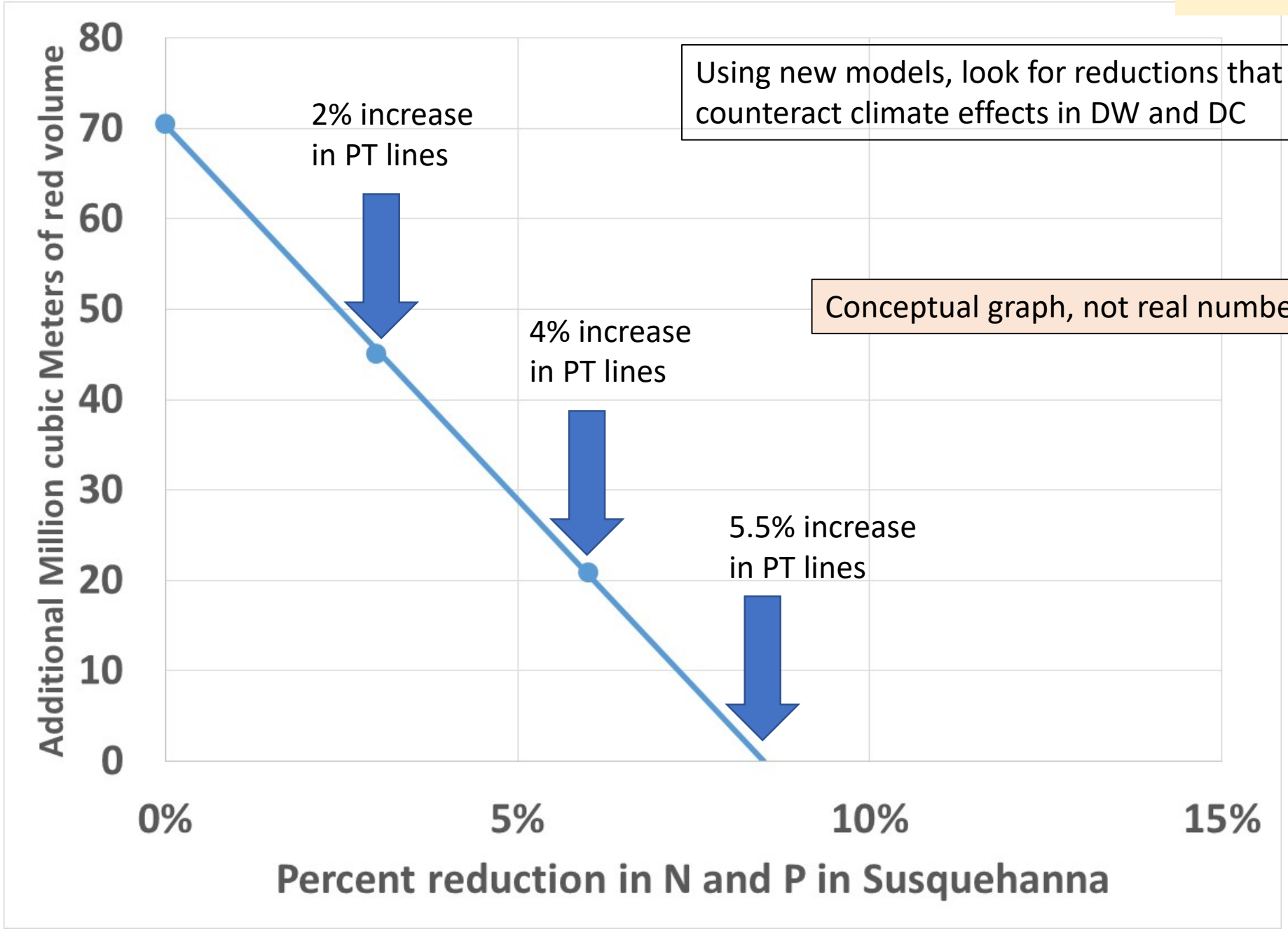
POMMH	DW	1839	0.03%	1	0.06%	1
CB3MH	DC	390	0.00%	0	0.00%	0
CB4MH	DC	2126	6.59%	140	8.06%	171
MD5MH	DC	2875	0.00%	0	0.00%	0
VA5MH	DC	1848	0.00%	0	0.00%	0
				332		401
					CC Difference	**69**

- Make reductions in climate modeling system
- Use scoping runs in the new system rather than the 2017 system.


Planning Target Calculation - Nitrogen
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Reduction from NoAction to E3
WWTP
AllElse
0
2
4
6
8
10
12
14
16
Relative Effectiveness (DO effect per million lbs)


Planning Target Calculation - Nitrogen
5% effort
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Reduction from NoAction to E3
WWTP
AllElse
0
2
4
6
8
10
12
14
16
Relative Effectiveness (DO effect per million lbs)


Planning Target Calculation - Nitrogen
10% effort
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Reduction from NoAction to E3
WWTP
AllElse
0
2
4
6
8
10
12
14
16
Relative Effectiveness (DO effect per million lbs)


Additional Million cubic Meters of red volume
80
70
60
50
40
30
20
10
0
0%
5%
10%
15%
Percent reduction in N and P in Susquehanna
2% increase in PT lines
4% increase in PT lines
5.5% increase in PT lines
Using new models, look for reductions that counteract climate effects in DW and DC
Conceptual graph, not real numbers

Use WWTP line

Climate increase in violation

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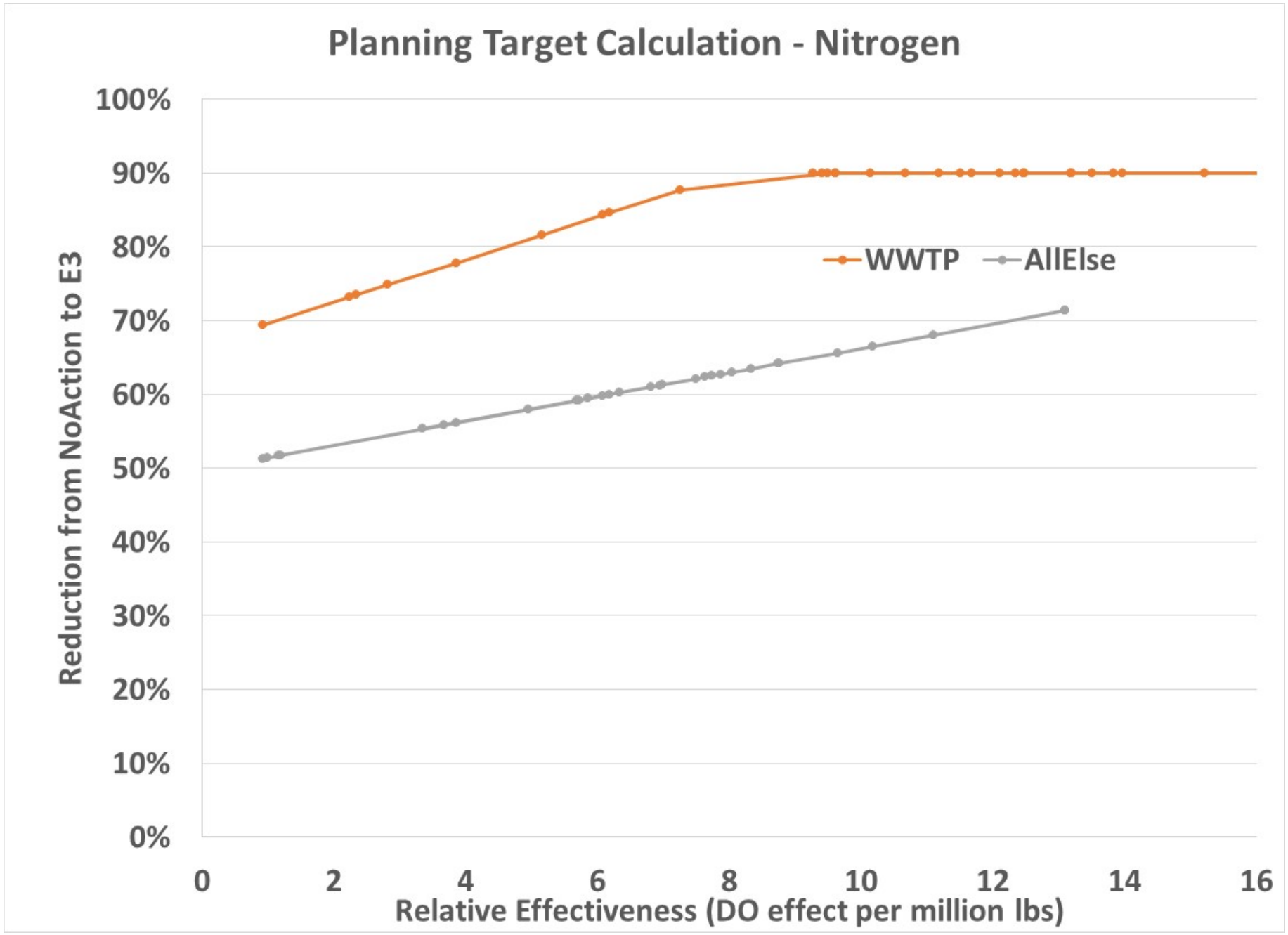
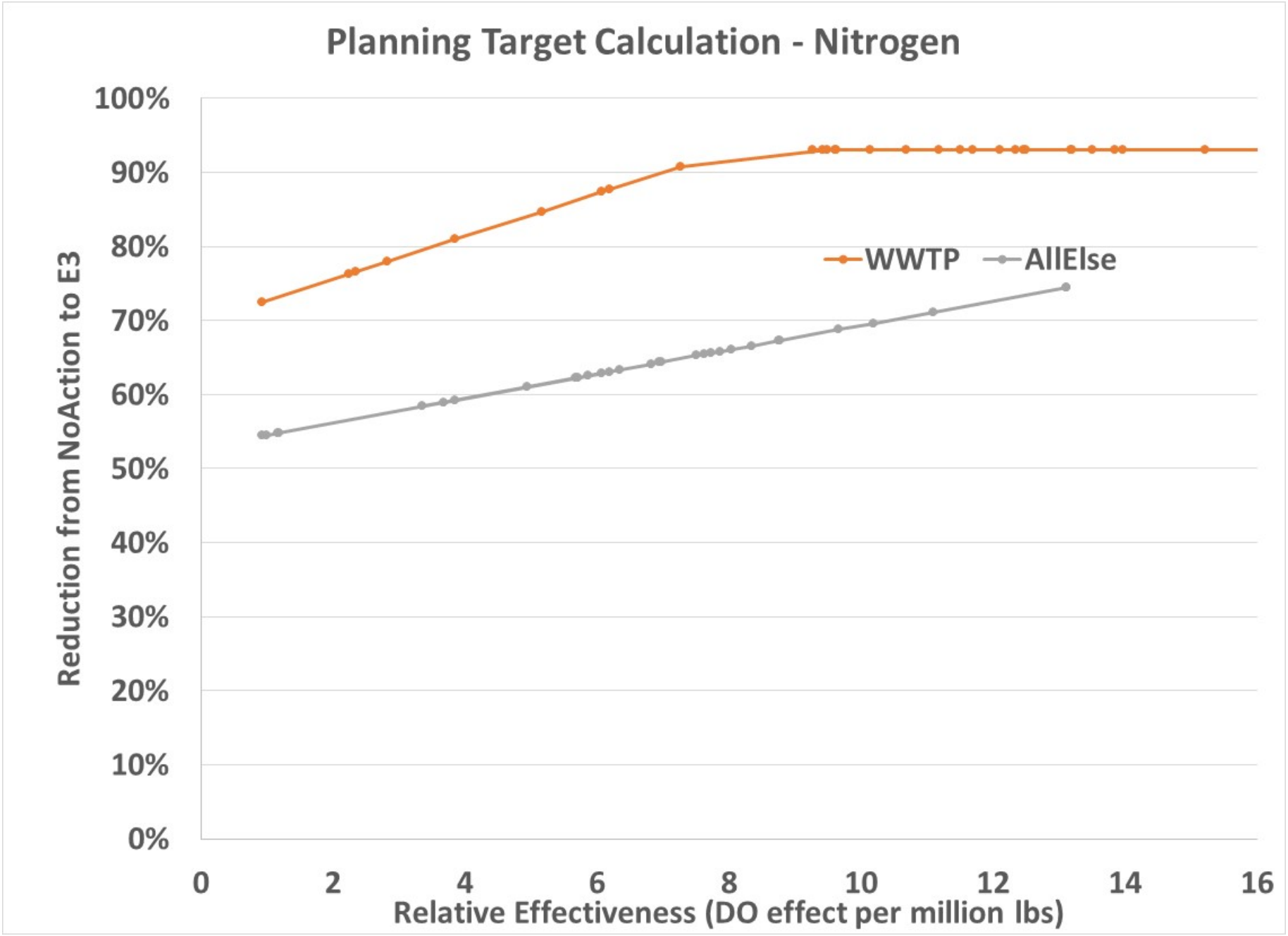
				332		401
					CC Difference	**69**

- Using either previous method, bring in WWTPs

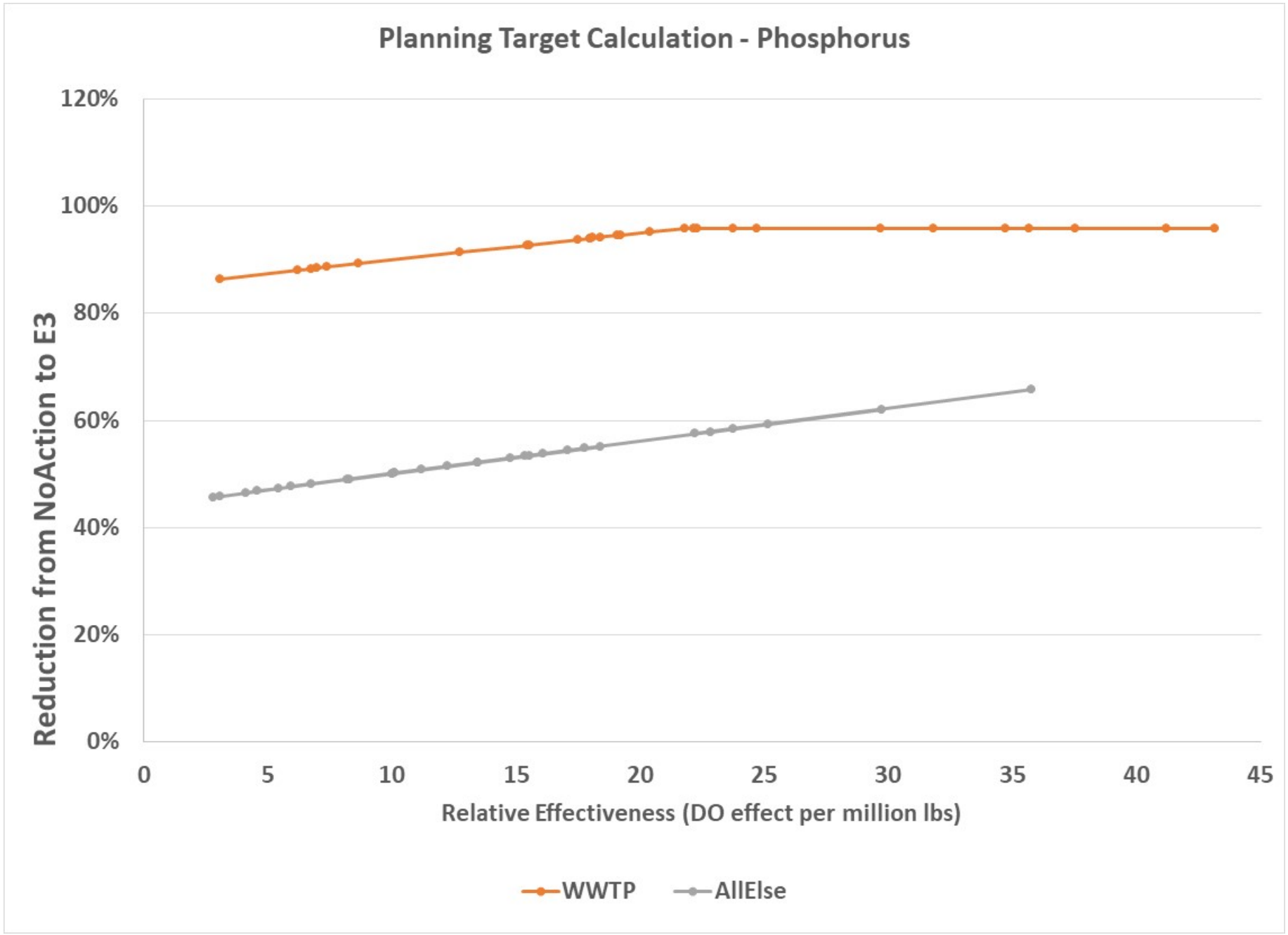
Both lines


Planning Target Calculation - Nitrogen
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Reduction from NoAction to E3
WWTP
AllElse
0
2
4
6
8
10
12
14
16
Relative Effectiveness (DO effect per million lbs)

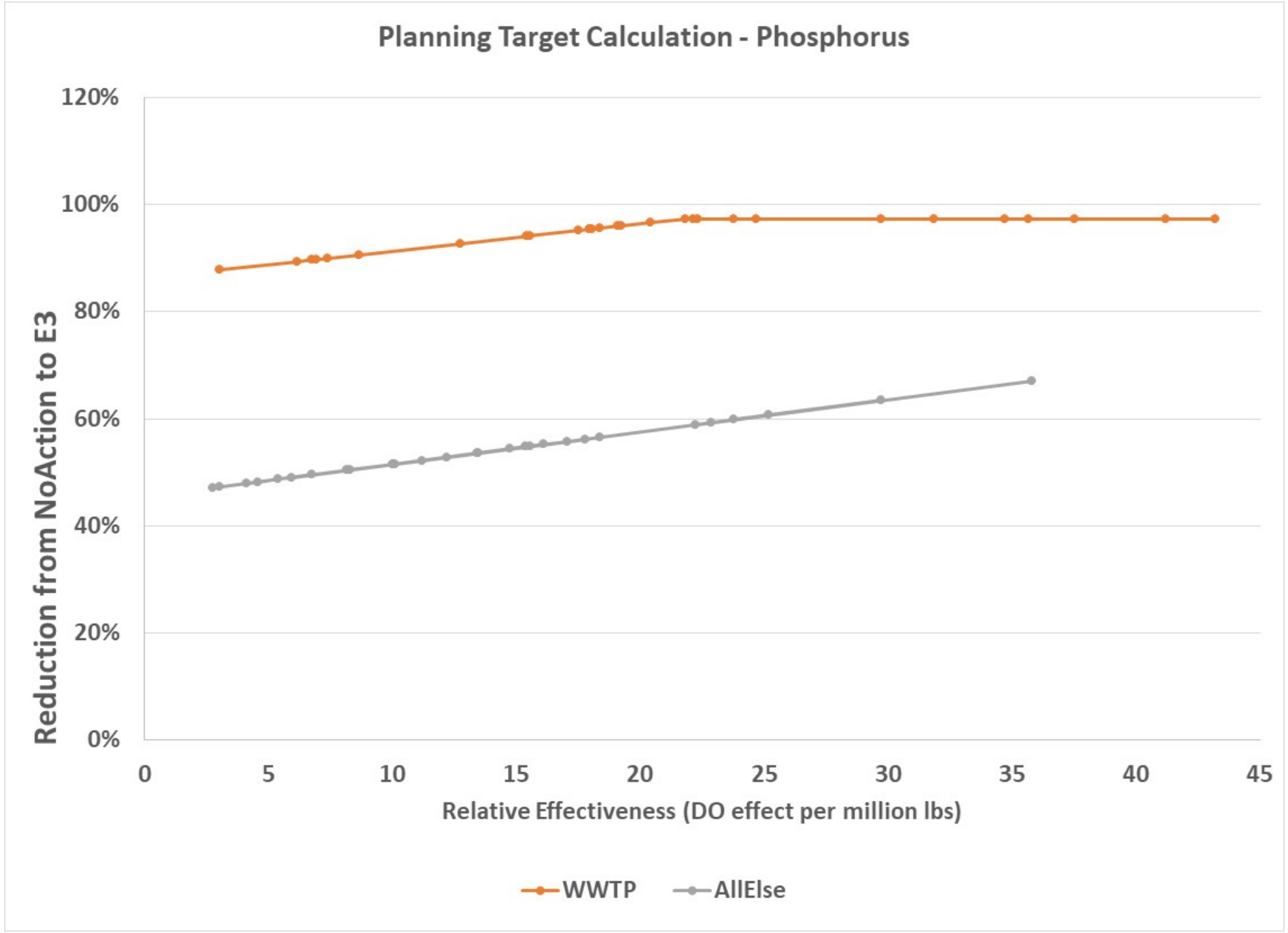
Both lines


Planning Target Calculation - Nitrogen
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Reduction from NoAction to E3
WWTP
AllElse
0
2
4
6
8
10
12
14
16
Relative Effectiveness (DO effect per million lbs)

Both lines


Planning Target Calculation - Phosphorus
120%
100%
80%
60%
40%
20%
0%
Reduction from NoAction to E3
0
5
10
15
20
25
30
35
40
45
Relative Effectiveness (DO effect per million lbs)
WWTP
AllElse

Both lines


Planning Target Calculation - Phosphorus
120%
100%
80%
60%
40%
20%
0%
Reduction from NoAction to E3
0
5
10
15
20
25
30
35
40
45
Relative Effectiveness (DO effect per million lbs)
WWTP
AllElse

Make up difference in load first

- Climate affects both watershed loading and bay assimilation capacity
- Possible method:
  - States responsible for increase in load
  - Bay assimilation distributed by planning target curves

Nitrogen Example – *calculations not exact*

	Dec 2017 method	Watershed Load	Bay Load	Total reduction
DC	0.01	0.01	0.00	0.01
DE	0.34	0.04	0.15	0.19
MD	1.85	0.72	0.81	1.54
NY	0.38	0.80	0.17	0.97
PA	3.65	1.90	1.61	3.51
VA	1.52	1.06	0.67	1.73
WV	0.22	-0.07	0.10	0.03
Total	7.97	4.46	3.50	7.97

Approaches (policy decision)

- Suggested method from December 2017
  - Move up the ‘non-WWTP’ planning target curve
- Modify both lines in the hockey stick
- Same thing, but with a better modeling method
- All state-basins maintain PT load and then account for bay change using a method from above
- Proportional to Greenhouse Gas Emissions or some other climate-relevant metric?
- Bring in open water?
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