

# Next Version of CAST: Data Updates and Effects on Loads

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CAST TEAM

FEBRUARY 14, 2022

# Errors and Omissions

- The Chesapeake Bay Program office staff alerted states that the agricultural fertilizer sales data had been erroneous in CAST-19 and was corrected in the review version of CAST-21 prior to the review period.
- When it became evident that there could be data that was not updated, the Bay Program put a hold on releasing CAST-21 until the extent of omissions were identified.
- We now have identified the extent of errors and omissions and are ready to make a new version available for review.
- New procedures are in place to prevent these errors and omissions in the future.

# CAST-21 Release

## Error identified by the Bay Program Office

- The **missing agricultural fertilizer data** for 2013 and 2014 was corrected.
  - ✓ Data was missing in CAST-19 (current version) and put in for the CAST-21 version that is out for review.

## Missing data

- **Broilers and turkeys** from the 2020 NASS Survey
- **Crop yields** from NASS Surveys for post calibration period
  - ✓ Data are not yet in the CAST-21 version available for review

# Jurisdictional Comments

- Jurisdictions conducted a thorough review following the timeline and provided well articulated comments, even while staff were focusing on preparing annual progress submissions.

**Thank you!**

- Most common comment: **Non-farm (urban) fertilizer sales data** corrections adversely shifting loads for some states
- Other comments are state specific or related to functionality in the user interface

# Change in Nutrient Loads to the Chesapeake Bay

Differences between CAST versions with each update: 6.2M lbs TN, -0.6M lbs TP  
By source sector; 2020 Progress scenario

Nitrogen									
Jurisdiction	Source	CAST19 - CAST21 (Reviewed)		CAST21 Effect of Broiler Data		CAST21 Effect of Yield Data		CAST19 - CAST21 (All Effects)	
		(M lbs)	(%)	(M lbs)	(%)	(M lbs)	(%)	(M lbs)	(%)
CBW	Agriculture	4.056	3.4%	0.024	0.02%	1.863	1.5%	5.943	5.0%
CBW	Developed	0.177	0.4%	0	0	0	0	0.177	0.4%
CBW	Wastewater	0	0	0	0	0	0	0	0
CBW	Septic	-0.080	-1.0%	0	0	0	0	-0.080	-1.0%
CBW	Natural	0.120	0.3%	0.001	0.00%	0.094	0.2%	0.215	0.5%
CBW	AllSources	4.273	1.8%	0.025	0.01%	1.957	0.8%	6.255	2.6%

Phosphorus									
Jurisdiction	Source	CAST19 - CAST21 (Reviewed)		CAST21 Effect of Broiler Data		CAST21 Effect of Yield Data		CAST19 - CAST21 (All Effects)	
		(M lbs)	(%)	(M lbs)	(%)	(M lbs)	(%)	(M lbs)	(%)
CBW	Agriculture	0.086	2.1%	0.001	0.03%	-0.029	-0.7%	0.058	1.4%
CBW	Developed	-0.454	-17.4%	0	0	0	0	-0.454	-17.4%
CBW	Wastewater	0	0	0	0	0	0	0	0
CBW	Septic	-0.003	-60.6%	0	0	0	0	-0.003	-60.6%
CBW	Natural	-0.127	-2.2%	0.000	-0.01%	-0.006	-0.1%	-0.134	-2.4%
CBW	AllSources	-0.498	-3.7%	0.001	0.01%	-0.036	-0.3%	-0.533	-4.0%

# Change in Nutrient Loads to the Chesapeake Bay

Differences between CAST versions with each update: 6.2M lbs TN, -0.6M lbs TP

By source sector; 2020 Progress scenario

<b>Nitrogen</b>									
		CAST19 - CAST21 (Reviewed)		CAST21 Effect of Broiler Data		CAST21 Effect of Yield Data		CAST19 - CAST21 (All Effects)	
Jurisdiction	Source	(M lbs)	(%)	(M lbs)	(%)	(M lbs)	(%)	(M lbs)	(%)
NY	AllSources	0.697	5.3%	0.000	0.00%	-0.042	-0.3%	0.655	4.9%
PA	AllSources	1.772	1.6%	0.124	0.11%	0.868	0.8%	2.764	2.6%
MD	AllSources	1.017	2.1%	-0.016	-0.03%	0.482	1.0%	1.483	3.1%
VA	AllSources	0.566	1.0%	-0.015	-0.03%	0.434	0.7%	0.985	1.7%
WV	AllSources	-0.153	-1.4%	-0.016	-0.20%	-0.005	-0.1%	-0.173	-1.7%
DE	AllSources	0.374	5.4%	-0.052	-0.71%	0.220	3.0%	0.542	7.9%
DC	AllSources	-0.002	-0.1%	0	0	0	0	-0.002	-0.1%
CBW	AllSources	4.273	1.8%	0.025	0.01%	1.957	0.8%	6.255	2.6%

<b>Phosphorus</b>									
		CAST19 - CAST21 (Reviewed)		CAST21 Effect of Broiler Data		CAST21 Effect of Yield Data		CAST19 - CAST21 (All Effects)	
Jurisdiction	Source	(M lbs)	(%)	(M lbs)	(%)	(M lbs)	(%)	(M lbs)	(%)
NY	AllSources	0.004	0.7%	0.000	0.02%	-0.002	-0.4%	0.002	0.3%
PA	AllSources	-0.027	-0.8%	0.004	0.11%	-0.014	-0.4%	-0.036	-1.0%
MD	AllSources	-0.392	-10.6%	0.000	0.00%	-0.014	-0.4%	-0.406	-11.0%
VA	AllSources	-0.159	-3.5%	0.001	0.01%	-0.004	-0.1%	-0.163	-3.5%
WV	AllSources	0.067	15.6%	0.000	-0.04%	0.000	-0.1%	0.067	15.4%
DE	AllSources	0.013	10.7%	-0.004	-2.86%	-0.001	-1.0%	0.008	6.5%
DC	AllSources	-0.003	-5.4%	0	0	0	0	-0.003	-5.4%
CBW	AllSources	-0.498	-3.7%	0.001	0.01%	-0.036	-0.3%	-0.533	-4.0%

# USDA NASS Corn for Grain Yields (2010-2021)

← → ↻ 🏠 <https://quickstats.nass.usda.gov/results/22518199-8A05-3923-9006-7BC375910F78>

USDA United States Department of Agriculture  
National Agricultural Statistics Service

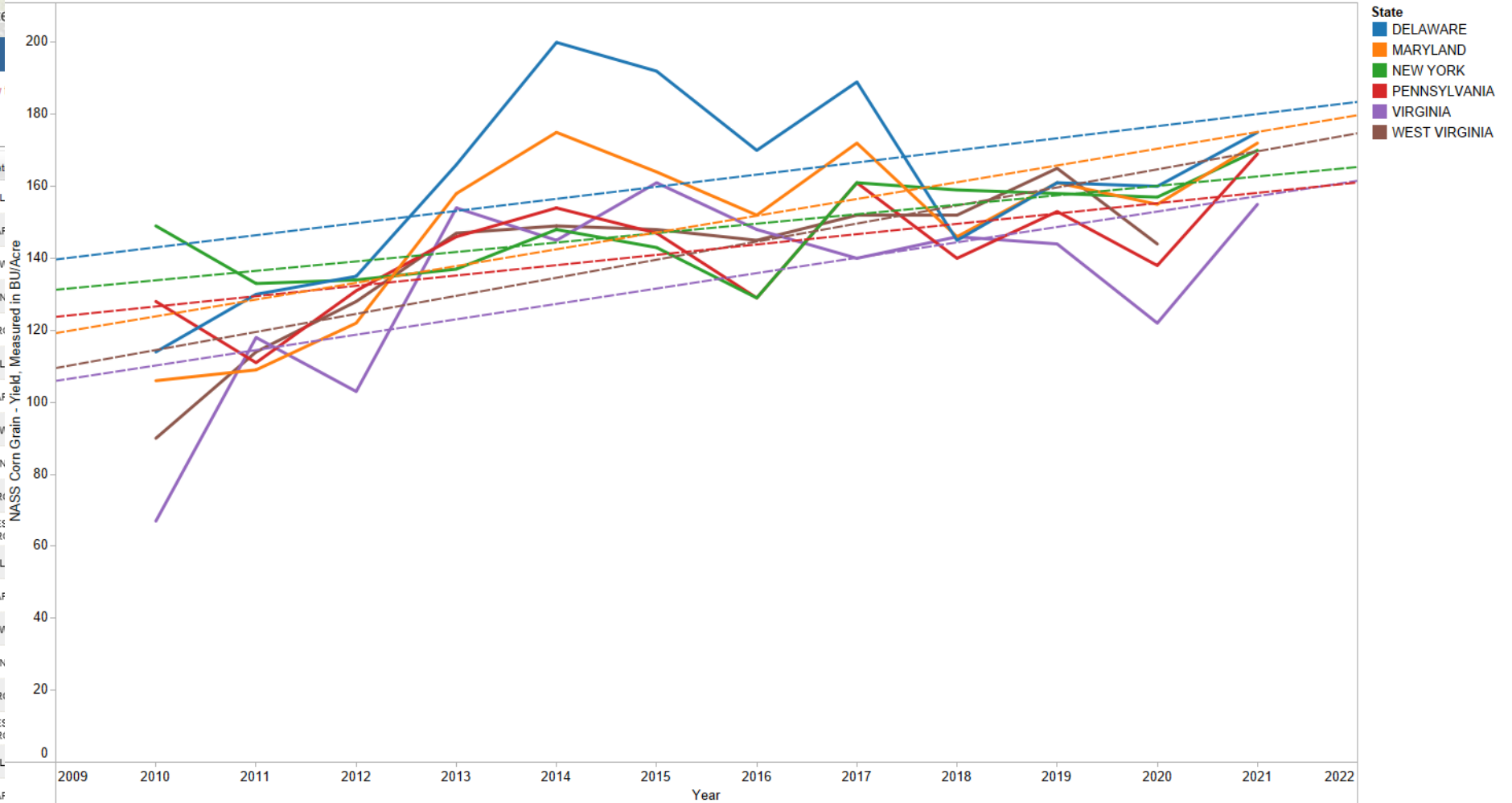
## Quick Stats

Navigation History: Data

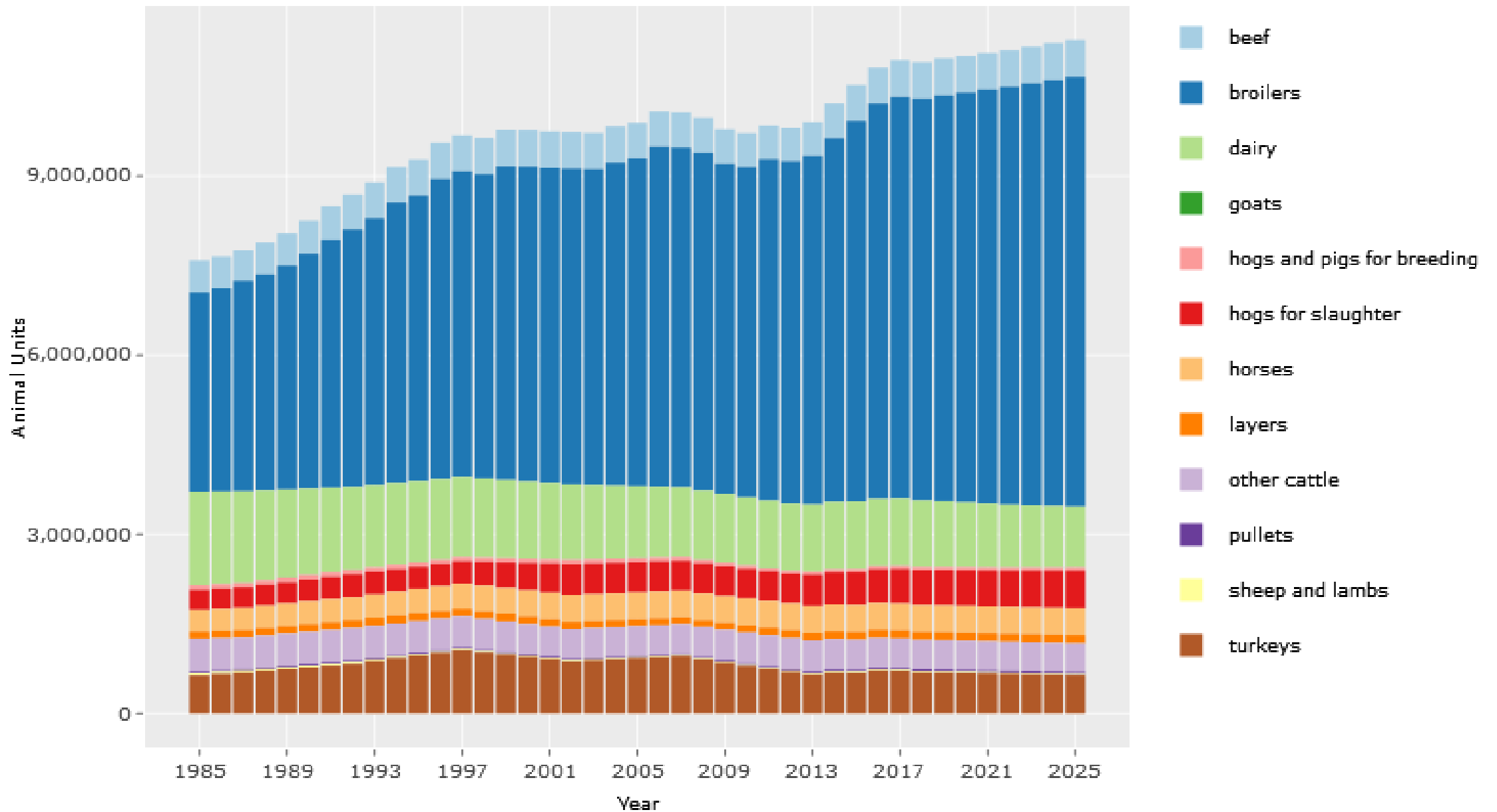
Double click any cell below!

Program	Year	Period	Geo Level	Stat							
SURVEY	2021	YEAR	STATE	DEL							
SURVEY	2021	YEAR	STATE	MAF							
SURVEY	2021	YEAR	STATE	NEV							
SURVEY	2021	YEAR	STATE	PEN							
SURVEY	2021	YEAR	STATE	VIRI							
SURVEY	2020	YEAR	STATE	DEL							
SURVEY	2020	YEAR	STATE	MAF							
SURVEY	2020	YEAR	STATE	NEV							
SURVEY	2020	YEAR	STATE	PEN							
SURVEY	2020	YEAR	STATE	VIRI							
SURVEY	2020	YEAR	STATE	WES VIRI							
SURVEY	2019	YEAR	STATE	DEL							
SURVEY	2019	YEAR	STATE	MAF							
SURVEY	2019	YEAR	STATE	NEV							
SURVEY	2019	YEAR	STATE	PEN							
SURVEY	2019	YEAR	STATE	VIRI							
SURVEY	2019	YEAR	STATE	WES VIRI							
SURVEY	2018	YEAR	STATE	DEL							
SURVEY	2018	YEAR	STATE	MAF							
SURVEY	2018	YEAR	STATE	NEW YORK	36	00000000	CORN	CORN, GRAIN - YIELD, MEASURED IN BU / ACRE	TOTAL	NOT SPECIFIED	159
SURVEY	2018	YEAR	STATE	PENNSYLVAN	42	00000000	CORN	CORN, GRAIN - YIELD, MEASURED IN BU / ACRE	TOTAL	NOT SPECIFIED	140

NASS Trends



Animal Units by Year and Animal







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Contact: Jim Barrett, (202) 690-8124 [Jim.Barrett@usda.gov](mailto:Jim.Barrett@usda.gov)

### US corn and soybean production up from September

WASHINGTON, Oct. 12, 2021 – Corn and soybean production is up from September 2021, according to the Crop Production report issued today by USDA's National Agricultural Statistics Service (NASS). Corn production is up 3% from last year, forecast at 15.0 billion bushels; soybean growers are expected to increase their production 5% from 2020, forecast at 4.45 billion bushels.

As is done every year in October, planted and harvested acreage estimates were reviewed for corn, sorghum, soybeans, sunflower, canola, sugarbeets, and dry edible beans. These estimates were updated as needed based on all available data, including the latest certified acreage data from the Farm Service Agency. All states in the estimating program for these crops were subject to review and updating. NASS previously reviewed corn, sorghum, soybeans, and sugarbeets in September, due to the completeness of this season's data for these crops, and published updates at that time. No additional changes were made for corn, sorghum, or soybeans this month.

Based on conditions as of Oct. 1, corn yields are expected to average 176.5 bushels per harvested acre, up 0.2 bushel from the previous forecast and up 5.1 bushels from 2020. Area harvested for grain is forecast at 85.1 million acres, unchanged from the previous forecast.

Also based on conditions as of Oct. 1, soybean yields are expected to average 51.5 bushels per acre, up 0.9 bushel

# ▶ CBW Change in Nutrient Applications to the Land

(2012 – 2016)

Nitrogen							
	Manure Applied	Biosolids Applied	Fertilizer Applied	Legume Fixed	Pasture Manure	Total Agriculture Applied/Fixed	Urban Fertilizer
<b>2012-2016 Change (lbs)</b>	14,460,000	-3,389,000	64,886,000	29,263,000	1,449,000	106,668,000	4,086,000
<b>2012-2016 Change (%)</b>	7%	-17%	16%	7%	1%	9%	6%
Phosphorus							
	Manure Applied	Biosolids Applied	Fertilizer Applied		Pasture Manure	Total Agriculture Applied	Urban Fertilizer
<b>2012-2016 Change (lbs)</b>	5,453,000	-1,616,000	5,581,000		681,000	10,098,000	6,643,000
<b>2012-2016 Change (%)</b>	9%	-15%	9%		2%	6%	62%

# CAST-19 → CAST-21 Updates

- 1) Agricultural and urban fertilizer sales data are updated to include data reported to AAPFCO through 2016. The missing agricultural fertilizer for 2013 and 2014 was corrected but new 2015 and 2016 data affects inputs to the land from 2016 forward
  - Missing VA 2013-2014 fertilizer data in CAST-19 resulted in underestimation of nutrients to the land and loads in CAST-19
  - Jurisdictional issues with urban turf grass application rates and non-farm fertilizer sales could be addressed at the USWG, WTWG, and WQGIT. Topic will begin to be covered at the 1/18/22 USWG meeting.

- 2) Broiler and turkey populations (not in CAST-21 currently out for review)
  - Includes missing broiler and turkey populations from 2020 annual NASS survey which changes the projections + NY poultry fix

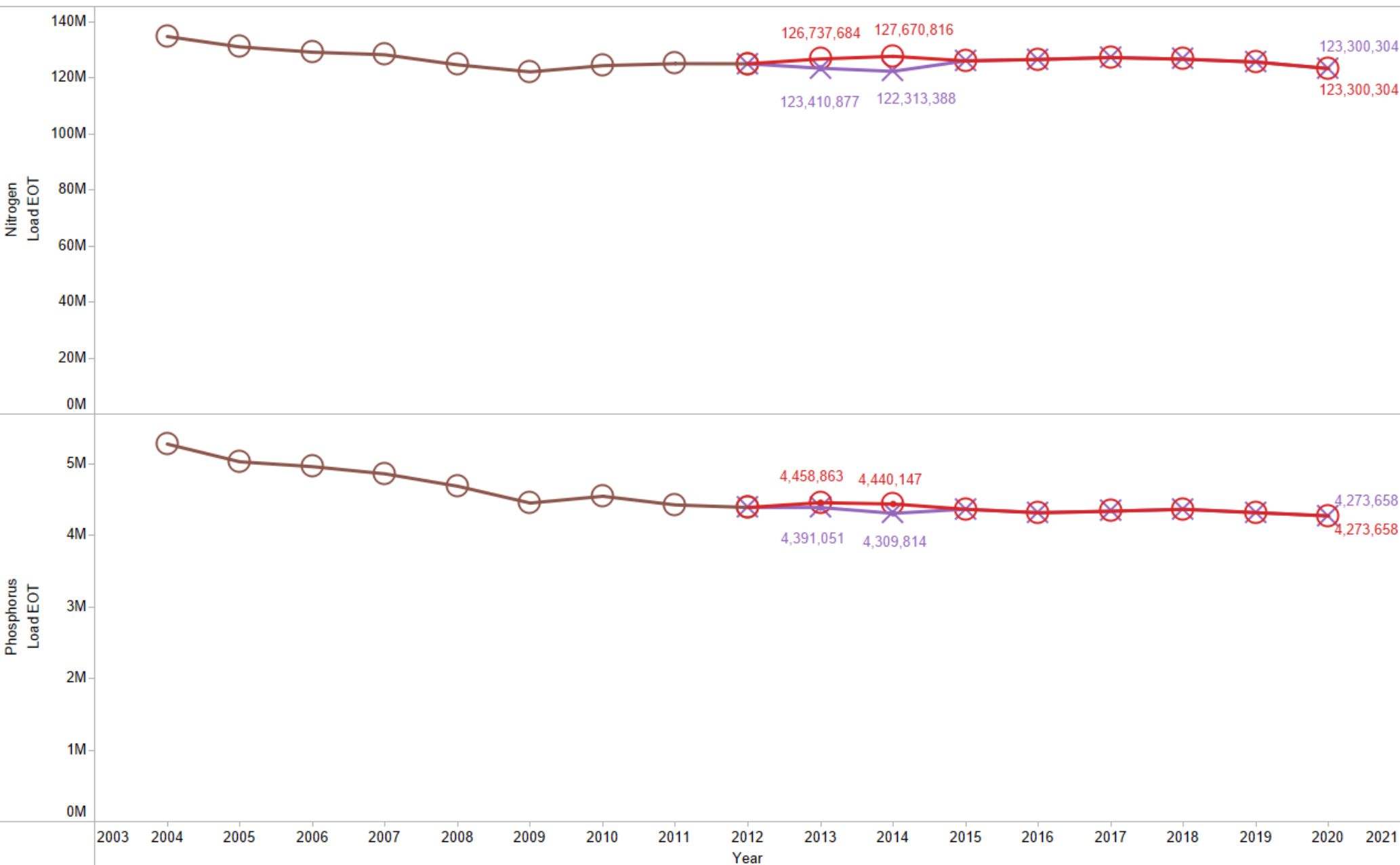
## 3) Crop Yields (not in CAST-21 currently out for review)

- Six major crops were missing most recent crop yield data from annual surveys (2017-2020 period). Updates made after the January CAST21 release.
- Affects fractions of crop need (and nutrient inputs to the land) for 2017 forward for the six crops.

# Other CAST-19 → CAST-21 Updates

- Jurisdictions updated the reported BMP history during Progress assessments - the most recent history will be in CAST-21
- The 2013 – 2025 land use acres, septic systems, and sewer service areas were updated
- The agricultural land use total acres are now determined by change product from 2013 rather than USDA Agricultural Census total acres
- MD biosolids, PA combined sewer overflow reductions, VA non-significant wastewater data for 2014-2020, WV 2020 wastewater data
- VA, WV, and MD harvested forest acres updated multiple years
- Construction acres are updated for most jurisdictions for multiple years
- PA permitted/nonpermitted feeding space split
- BMP updates for urban stream restoration, tree and forest planting, forest buffers, impervious disconnection, agricultural ditch management, water control structures, abandoned mine land reclamation, wetland creation and rehabilitation now available in progress scenarios

C21 Isolation Changes, Agriculture



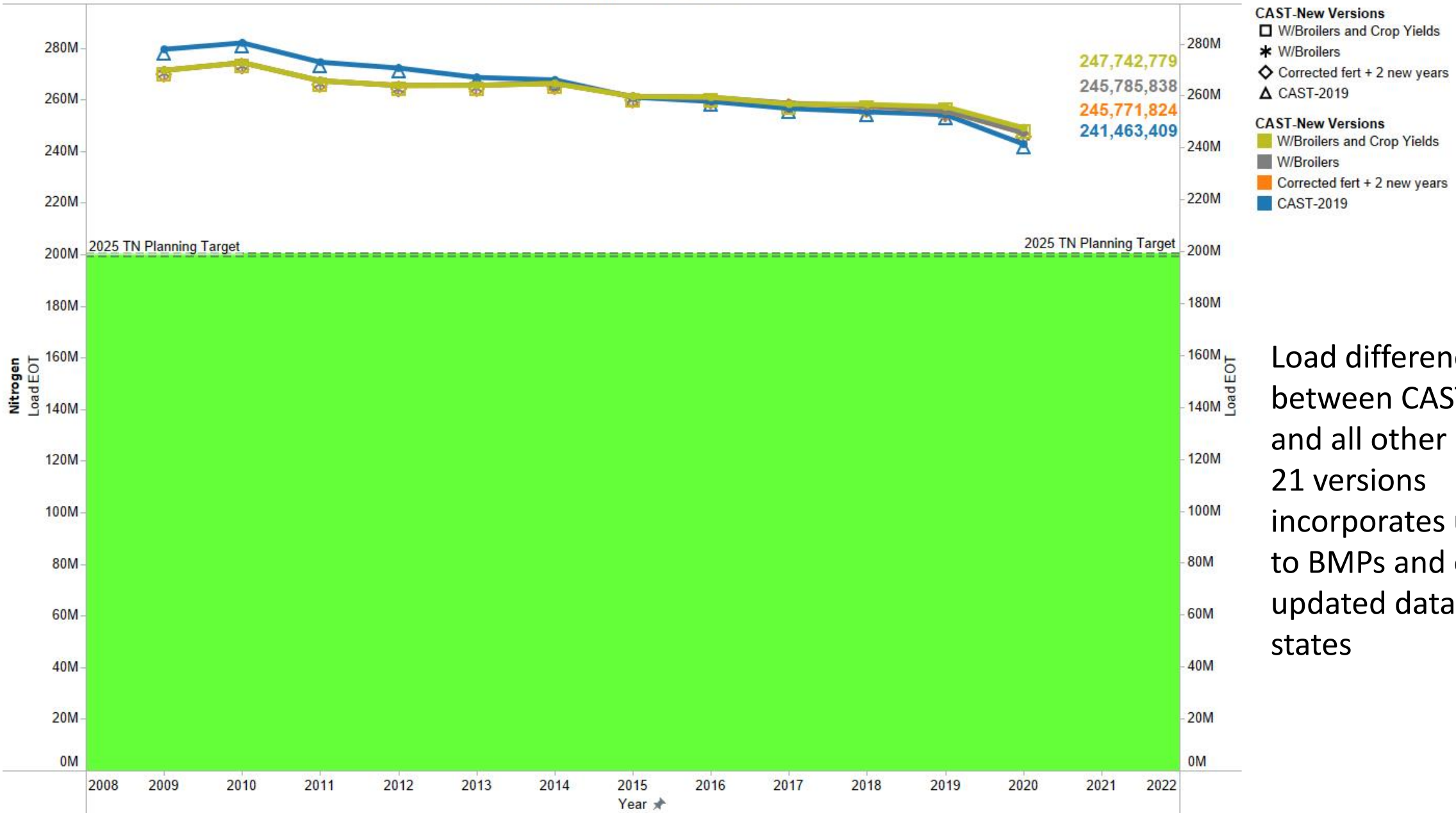
**Isolation Description**  
 ○ All good data  
 ○ Calibration years  
 × New years of data with Bad 2013-4

**Isolation Description**  
 ■ All good data  
 ■ Calibration years  
 ■ New years of data with Bad 2013-4

### Load difference

- The load is different for the two years where there was an error with inorganic fertilizer
- Once corrected, we still end up in the same place for 2015 forward

# CAST Comparisons, All Sectors



Load differences between CAST-2019 and all other CAST-21 versions incorporates updates to BMPs and other updated data from states



# Application Rate Calculation

Application rate is referenced in terms of **ratio applied**, the ratio of an estimate of the amount of nitrogen and phosphorus available to be applied with the amount that should be applied in typical situations. Sometimes, ratio applied is greater than 100%, indicating that more nitrogen and phosphorus are available than is necessary to achieve a crop yield in that typical situation.

- The amount of nitrogen available is derived from animal counts (manure sources) and fertilizer sales (inorganic sources).
- Example:
  - The amount of nitrogen available is 150 lbs
  - The typical amount needed is 100 lbs
  - The ratio applied is 150/100 or 150%
- Crop yield may be measured in bushels, tons, bales, etc. depending on the crop.
- Typical rate =  $\text{TN lbs} / \text{crop yield}$ 
  - Data provided by states typically drawn from land grant university recommendations + an increase for non-nutrient management amounts
- Actual rate =  $\text{Typical rate} * (\text{NASS yield} / \text{acre})$
- Actual rate =  $(\text{TN lbs} / \text{crop yield}) * (\text{NASS yield} / \text{acre})$
- Timing and specification of organic or inorganic are also factors

Table 34. Specified Crops Harvested - Yield per Acre Irrigated and Nonirrigated: 2017

[Totals may not add due to rounding. For meaning of abbreviations and symbols, see introductory text.]

Crop	Entire crop irrigated			Part of crop irrigated			None of crop irrigated			Average yield per acre
	Farms	Acres	Average yield per acre	Farms	Acres irrigated	Acres not irrigated	Average yield per acre	Farms	Acres	
Barley for grain (bushels)	2,638	602,296	110.6	463	131,049	125,695	75.2	8,087	1,347,788	56.2
Corn for grain (bushels)	14,786	4,995,223	193.0	20,560	7,372,651	7,811,690	175.3	269,455	64,558,998	17.8
Corn for silage or greenchop (tons)	6,360	1,356,605	25.6	1,248	204,704	219,902	20.6	51,892	4,328,203	1.7
Cotton, all (bales)	3,442	1,932,082	2.3	4,283	2,194,642	2,637,493	1.7	8,424	4,587,748	1.7
Upland cotton (bales)	3,138	1,680,384	2.3	4,279	2,193,806	2,633,888	1.7	8,428	4,591,353	1.7
Pima cotton (bales)	453	252,534	2.7	-	-	-	-	-	-	-
Dry edible beans, excluding chickpeas and limas (cvt) (see text)	1,964	351,228	25.0	251	74,800	57,505	21.7	3,193	986,603	19.2
Oats for grain (bushels)	496	31,902	77.2	117	10,205	7,587	56.2	19,229	764,446	61.2
Peanuts for nuts (pounds)	1,287	352,543	4,147.5	1,405	320,314	303,150	4,116.2	3,687	810,760	3,806.9
Rice (cvt)	4,637	2,395,054	73.6	-	-	-	-	-	-	-
Sorghum for grain (bushels)	753	145,916	85.5	939	164,488	448,964	76.4	13,647	4,310,791	68.5
Soybeans for beans (bushels)	8,328	3,624,435	56.3	16,574	5,730,230	6,038,583	52.3	278,289	74,756,132	47.3
Sugarbeets for sugar (tons)	1,259	372,174	35.5	52	9,061	25,568	28.5	2,185	743,879	28.6
Sugarcane for sugar (tons)	197	(D)	40.7	7	(D)	(D)	(D)	423	(D)	(D)
Tobacco (pounds)	419	22,836	2,393.7	407	20,806	28,438	2,238.0	5,411	259,473	2,121.9
Wheat for grain, all (bushels)	5,218	1,335,074	88.2	4,183	1,054,111	2,414,501	52.4	95,391	34,007,934	43.8
Winter wheat for grain (bushels)	3,563	831,920	84.1	3,611	859,851	2,011,146	52.1	79,402	22,483,500	47.4
Durum wheat for grain (bushels)	509	168,066	93.3	49	14,704	25,067	49.0	2,535	1,998,332	22.8
Other spring wheat for grain (bushels)	1,735	394,255	94.2	486	120,389	195,134	52.1	17,855	9,709,255	39.9
Forage - land used for all hay and haylage, grass silage, and greenchop (tons, dry equivalent) (see text)	71,795	8,880,567	(X)	12,687	1,348,771	1,903,734	(X)	715,145	44,725,550	(X)
Alfalfa hay (tons, dry)	47,971	5,595,393	4.6	5,368	572,095	645,290	3.0	205,477	11,057,171	2.3
Other dry hay (tons, dry) (see text)	28,511	2,828,924	2.5	4,921	322,019	558,958	2.2	495,537	28,886,607	1.9
Haylage or greenchop from alfalfa or alfalfa mixtures (tons, green)	3,150	419,231	6.6	613	50,637	88,714	8.2	34,760	2,714,908	7.0
All other haylage, grass silage, and greenchop (tons, green)	6,721	631,076	9.9	936	60,254	78,846	8.2	78,607	3,472,054	4.0
Land in vegetables (see text)	28,458	2,574,006	(X)	8,139	375,959	222,185	(X)	37,679	793,471	(X)
Land in orchards (see text)	61,964	4,772,593	(X)	2,436	152,240	116,756	(X)	47,555	624,001	(X)
Land in berries (see text)	15,191	202,881	(X)	795	32,449	15,305	(X)	17,933	51,563	(X)

These data are available for each county

# Application Rate Calculation (cont.)

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## Beyond 2016

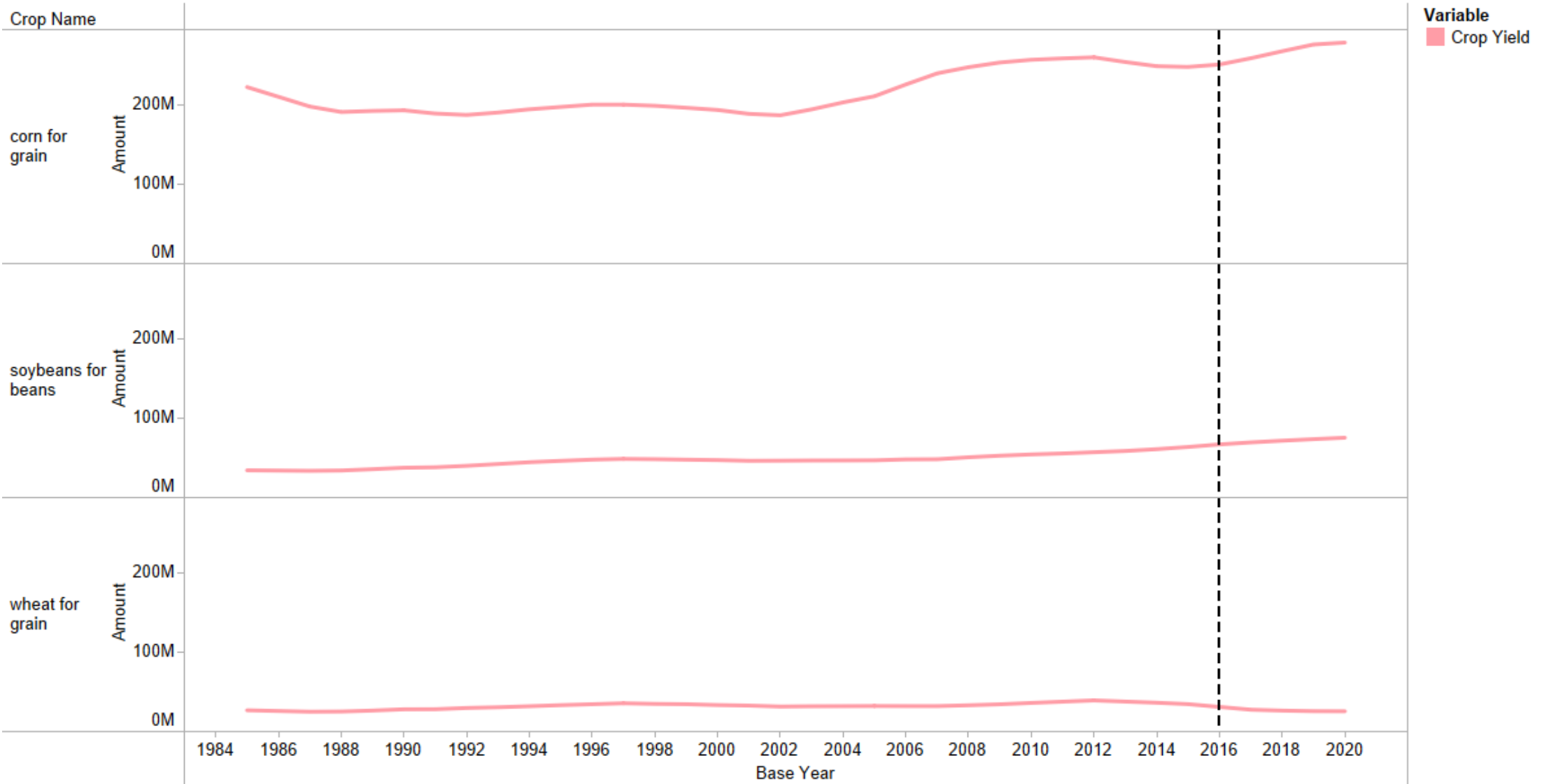
- Based on animal numbers and fertilizer sales, the amount applied in 2016 is used.
- If the amount applied in 2016 was 150% of ratio applied, then 150% will be applied in 2017 and later years.
- The same ratio is used even though the pounds vary with yields.

## 2016 and Prior

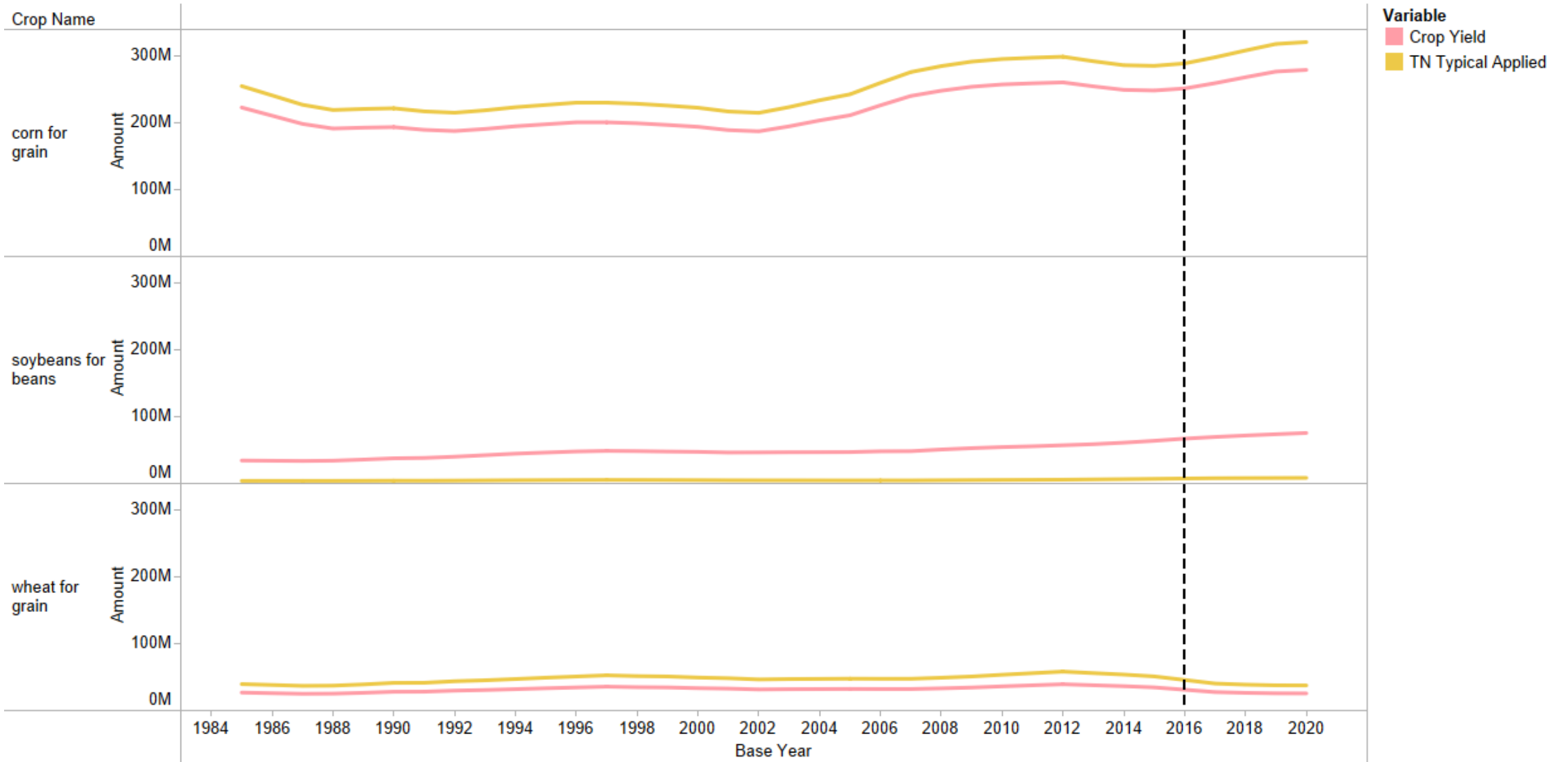
- The ratio applied is calculated based on manure, fertilizer sales data, and NASS yields for the progress scenario, for that year.

Timing and specification of organic or inorganic are also factors

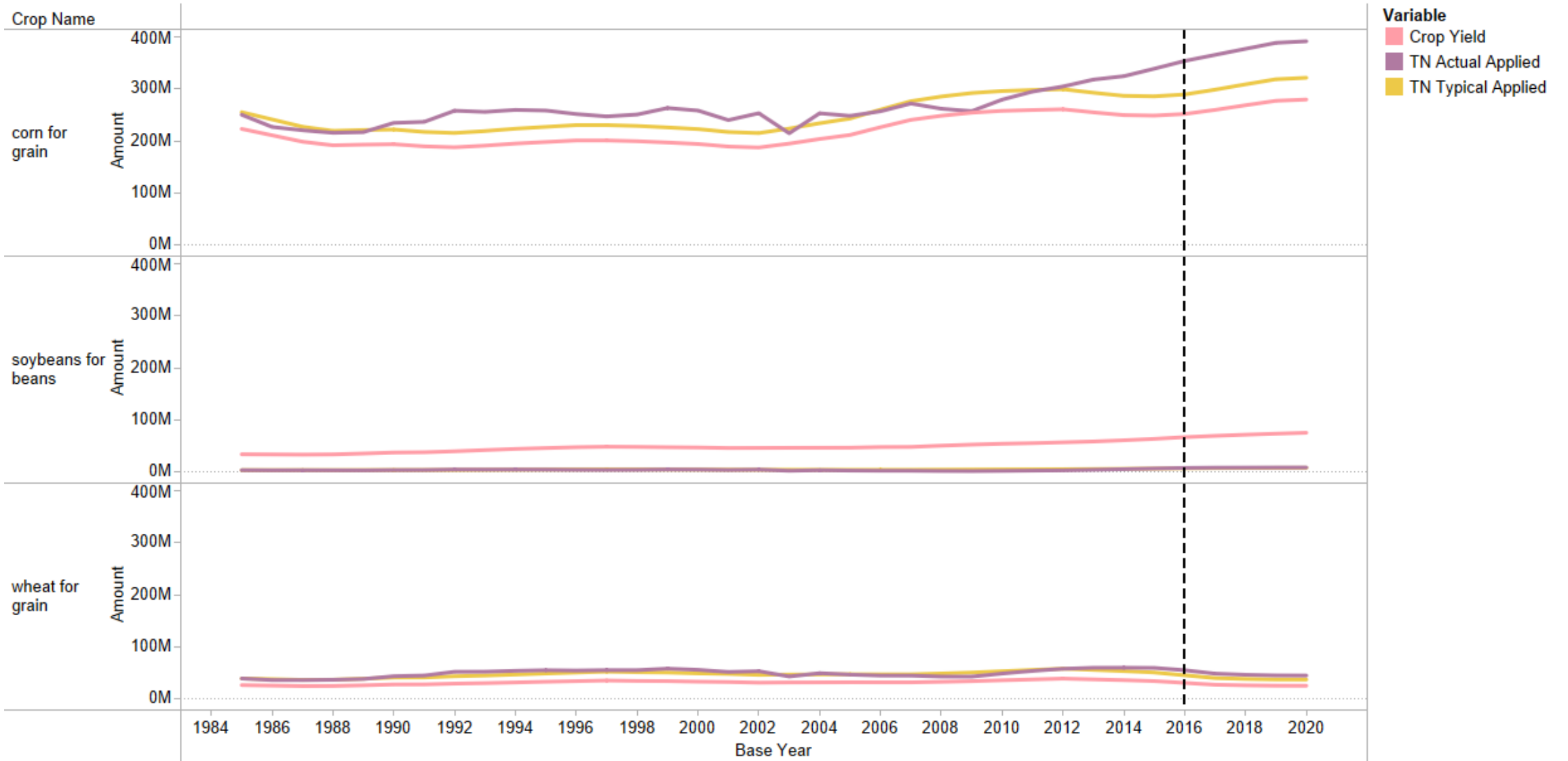
# Nitrogen Application



# Nitrogen Application



# Nitrogen Application



$$\text{Actual rate} = (\text{TN lbs} / \text{crop yield}) * (\text{NASS yield} / \text{acre})$$

Friday, 2/18 - Release of revised CAST-21 with updated poultry, crop yields



Friday, 3/18 - Comments due from states



Thursday, 3/31 - Response to comments, both those provided in November and those provided most recently.



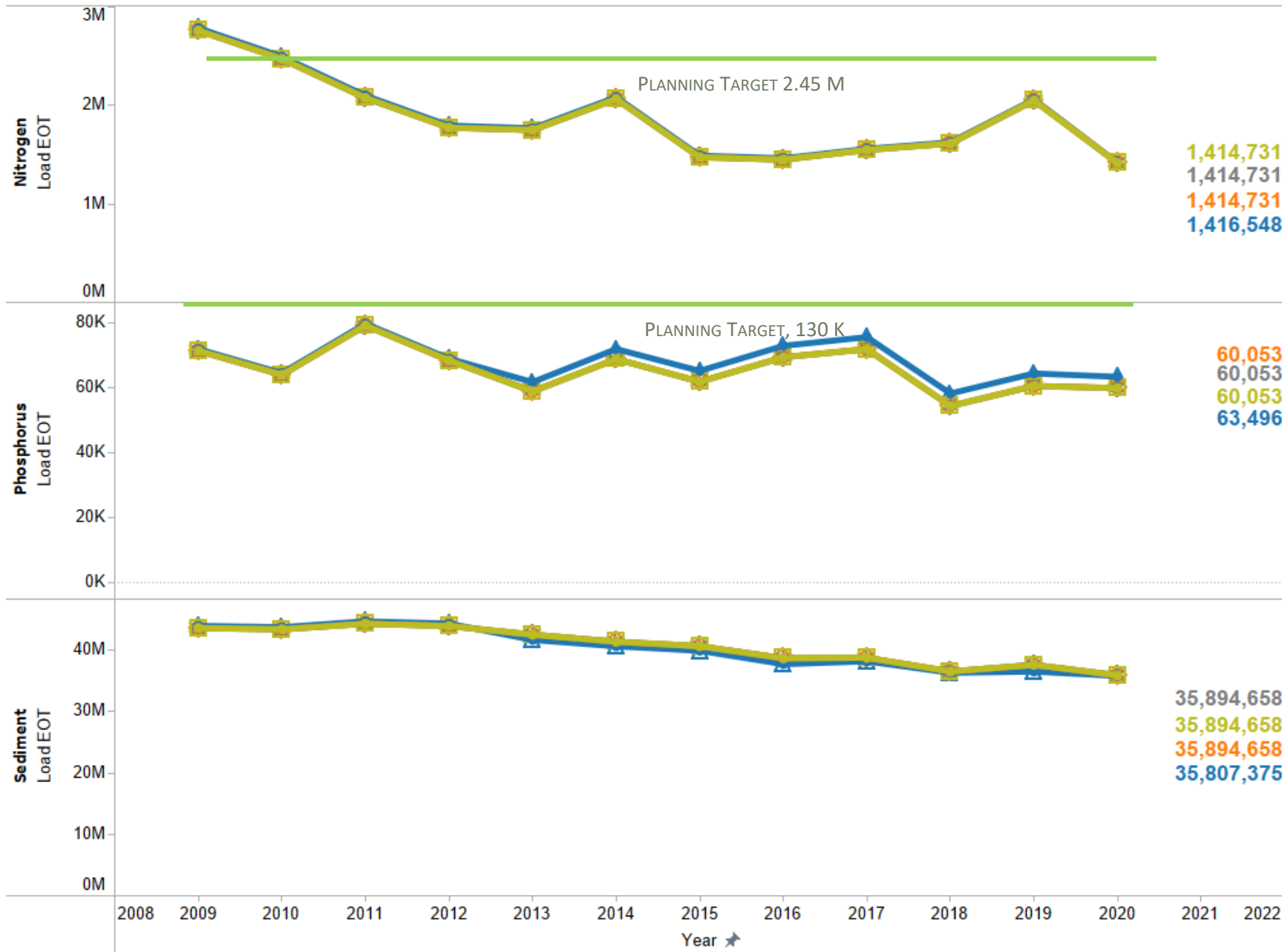
Release of CAST-21 to occur soon after response to comments

## Draft Schedule for Deliberative Purposes

# Jurisdiction-Specific Data

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# CAST Comparisons, DC, All Sectors



- CAST-New Versions**
- W/Broilers and Crop Yields
  - \* W/Broilers
  - ◇ Corrected fert + 2 new years
  - △ CAST-2019
- CAST-New Versions**
- W/Broilers and Crop Yields
  - W/Broilers
  - Corrected fert + 2 new years
  - CAST-2019

Load differences between CAST-2019 and all other CAST-21 versions incorporates updates to BMPs and other updated data from states

1,414,731  
1,414,731  
1,414,731  
1,416,548

60,053  
60,053  
60,053  
63,496

35,894,658  
35,894,658  
35,894,658  
35,807,375



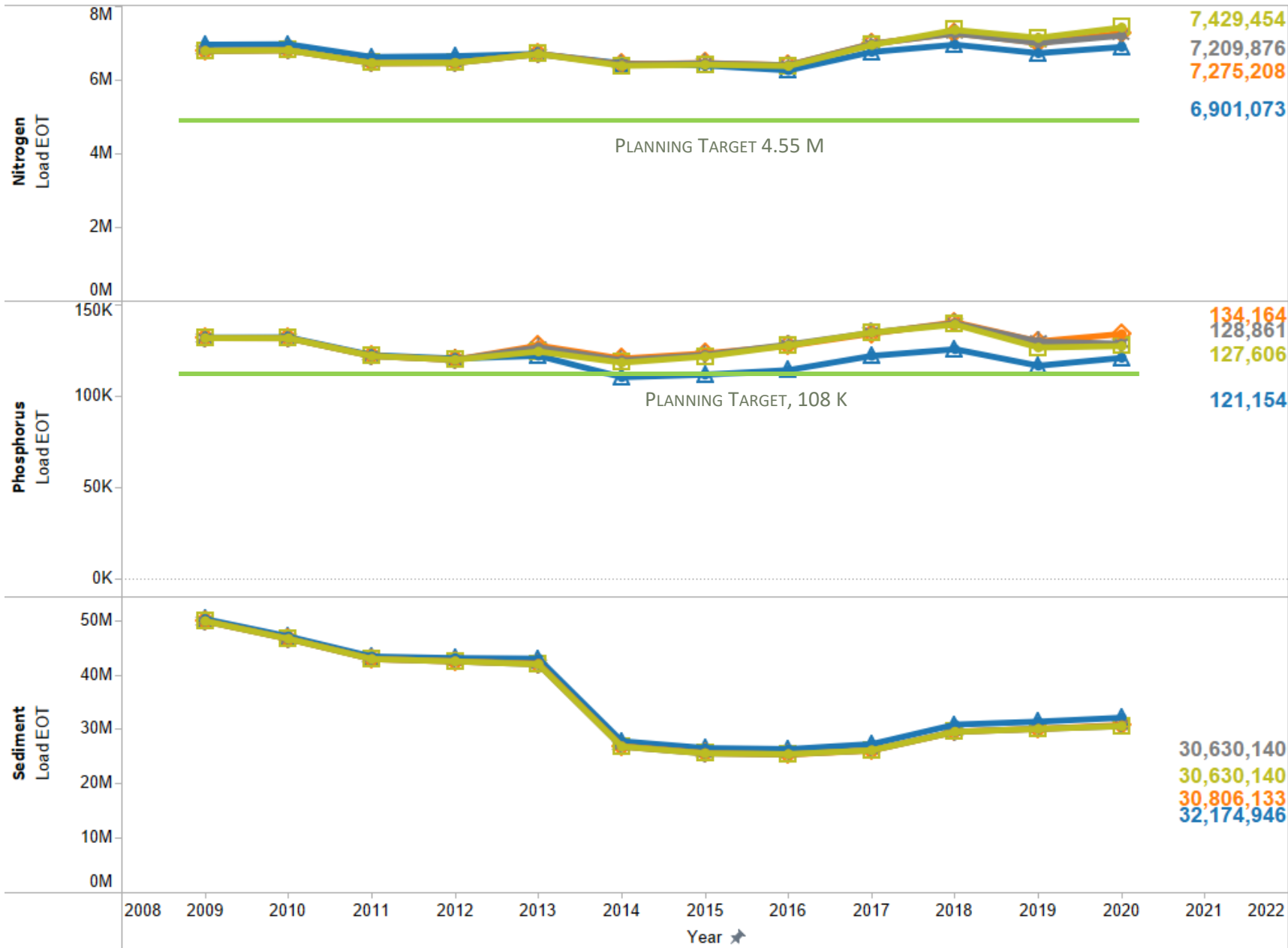
# District of Columbia Change in Nutrient Loads

Differences between CAST versions with each update: -2,000 lbs TN  
By source sector; 2020 Progress scenario

<b>Nitrogen</b>									
Jurisdiction	Source	CAST19 - CAST21 (Reviewed)		CAST21 Effect of Broiler Data		CAST21 Effect of Yield Data		CAST19 - CAST21 (All Effects)	
		(M lbs)	(%)	(M lbs)	(%)	(M lbs)	(%)	(M lbs)	(%)
DC	Agriculture	0	0	0	0	0	0	0	0
DC	Developed	-0.002	-1.1%	0	0	0	0	-0.002	-1.1%
DC	Wastewater	0	0	0	0	0	0	0	0
DC	Septic	0	0	0	0	0	0	0	0
DC	Natural	0.000	0.1%	0	0	0	0	0.000	0.1%
DC	AllSources	-0.002	-0.1%	0	0	0	0	-0.002	-0.1%

<b>Phosphorus</b>									
Jurisdiction	Source	CAST19 - CAST21 (Reviewed)		CAST21 Effect of Broiler Data		CAST21 Effect of Yield Data		CAST19 - CAST21 (All Effects)	
		(M lbs)	(%)	(M lbs)	(%)	(M lbs)	(%)	(M lbs)	(%)
DC	Agriculture	0	0	0	0	0	0	0	0
DC	Developed	-0.003	-22.8%	0	0	0	0	-0.003	-22.8%
DC	Wastewater	0	0	0	0	0	0	0	0
DC	Septic	0	0	0	0	0	0	0	0
DC	Natural	0.000	-14.7%	0	0	0	0	0.000	-14.7%
DC	AllSources	-0.003	-5.4%	0	0	0	0	-0.003	-5.4%

### CAST Comparisons, DE, All Sectors



Load differences between CAST-2019 and all other CAST-21 versions incorporates updates to BMPs and other updated data from states

# Delaware Change in Nutrient Loads

Differences between CAST versions with each update: 0.5M lbs TN  
By source sector; 2020 Progress scenario

<b>Nitrogen</b>									
Jurisdiction	Source	CAST19 - CAST21 (Reviewed)		CAST21 Effect of Broiler Data		CAST21 Effect of Yield Data		CAST19 - CAST21 (All Effects)	
		(M lbs)	(%)	(M lbs)	(%)	(M lbs)	(%)	(M lbs)	(%)
DE	Agriculture	0.303	5.6%	-0.049	-0.86%	0.213	3.7%	0.466	8.5%
DE	Developed	0.055	8.1%	0	0	0	0	0.055	8.1%
DE	Wastewater	0	0	0	0	0	0	0	0
DE	Septic	-0.007	-3.6%	0	0	0	0	-0.007	-3.6%
DE	Natural	0.023	4.3%	-0.002	-0.36%	0.007	1.3%	0.028	5.2%
DE	AllSources	0.374	5.4%	-0.052	-0.71%	0.220	3.0%	0.542	7.9%

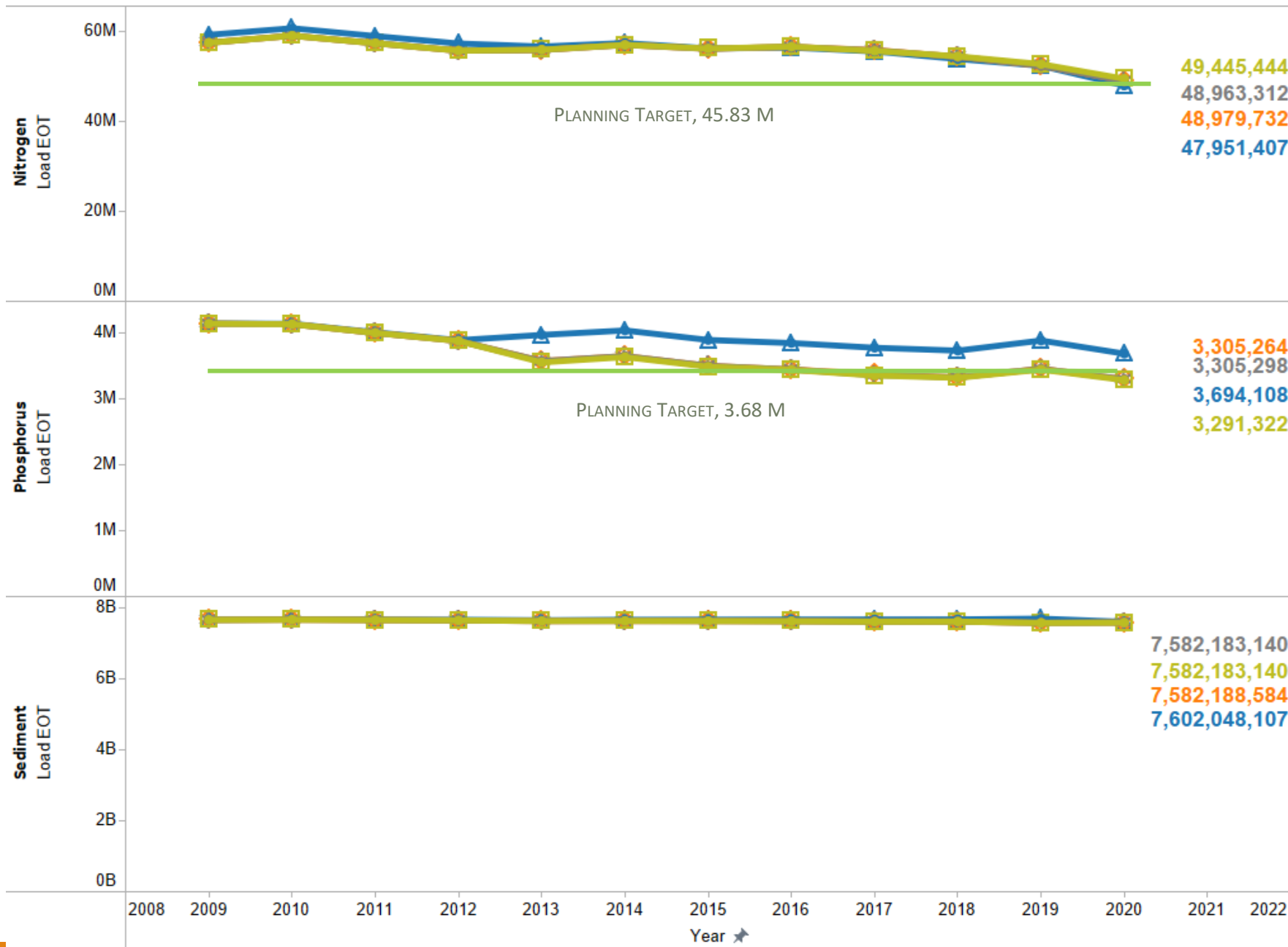
<b>Phosphorus</b>									
Jurisdiction	Source	CAST19 - CAST21 (Reviewed)		CAST21 Effect of Broiler Data		CAST21 Effect of Yield Data		CAST19 - CAST21 (All Effects)	
		(M lbs)	(%)	(M lbs)	(%)	(M lbs)	(%)	(M lbs)	(%)
DE	Agriculture	-0.003	-5.4%	-0.002	-4.96%	-0.001	-1.9%	-0.006	-11.8%
DE	Developed	0.012	46.2%	0	0	0	0	0.012	46.2%
DE	Wastewater	0	0	0	0	0	0	0	0
DE	Septic	0	0	0	0	0	0	0	0
DE	Natural	0.004	9.5%	-0.001	-3.23%	0.000	-0.9%	0.002	5.0%
DE	AllSources	0.013	10.7%	-0.004	-2.86%	-0.001	-1.0%	0.008	6.5%

# DE Change in Nutrient Applications to the Land

(2012 – 2016)

Nitrogen							
	Manure Applied	Biosolids Applied	Fertilizer Applied	Legume Fixed	Pasture Manure	Total Agriculture Applied/Fixed	Urban Fertilizer
2012-2016 Change (lbs)	4,014,000	-1,000	2,454,000	3,522,000	-165,000	9,824,000	1,857,000
2012-2016 Change (%)	23%	-2%	9%	15%	-12%	14%	43%
Phosphorus							
	Manure Applied	Biosolids Applied	Fertilizer Applied		Pasture Manure	Total Agriculture Applied	Urban Fertilizer
2012-2016 Change (lbs)	1,302,000	0	-729,000		-54,000	518,000	787,000
2012-2016 Change (%)	20%	-7%	-22%		-14%	5%	190%

# CAST Comparisons, MD, All Sectors



- CAST-New Versions**
- W/Broilers and Crop Yields
  - \* W/Broilers
  - ◇ Corrected fert + 2 new years
  - △ CAST-2019
- CAST-New Versions**
- W/Broilers and Crop Yields
  - W/Broilers
  - Corrected fert + 2 new years
  - CAST-2019

Load differences between CAST-2019 and all other CAST-21 versions incorporates updates to BMPs and other updated data from states

# Maryland Change in Nutrient Loads

Differences between CAST versions with each update: 1.5M lbs TN  
By source sector; 2020 Progress scenario

<b>Nitrogen</b>									
Jurisdiction	Source	CAST19 - CAST21 (Reviewed)		CAST21 Effect of Broiler Data		CAST21 Effect of Yield Data		CAST19 - CAST21 (All Effects)	
		(M lbs)	(%)	(M lbs)	(%)	(M lbs)	(%)	(M lbs)	(%)
MD	Agriculture	1.202	5.5%	-0.016	-0.07%	0.462	2.0%	1.648	7.5%
MD	Developed	-0.099	-1.1%	0	0	0	0	-0.099	-1.1%
MD	Wastewater	0	0	0	0	0	0	0	0
MD	Septic	-0.005	-0.2%	0	0	0	0	-0.005	-0.2%
MD	Natural	-0.081	-1.0%	-0.001	-0.01%	0.020	0.3%	-0.061	-0.8%
MD	AllSources	1.017	2.1%	-0.016	-0.03%	0.482	1.0%	1.483	3.1%

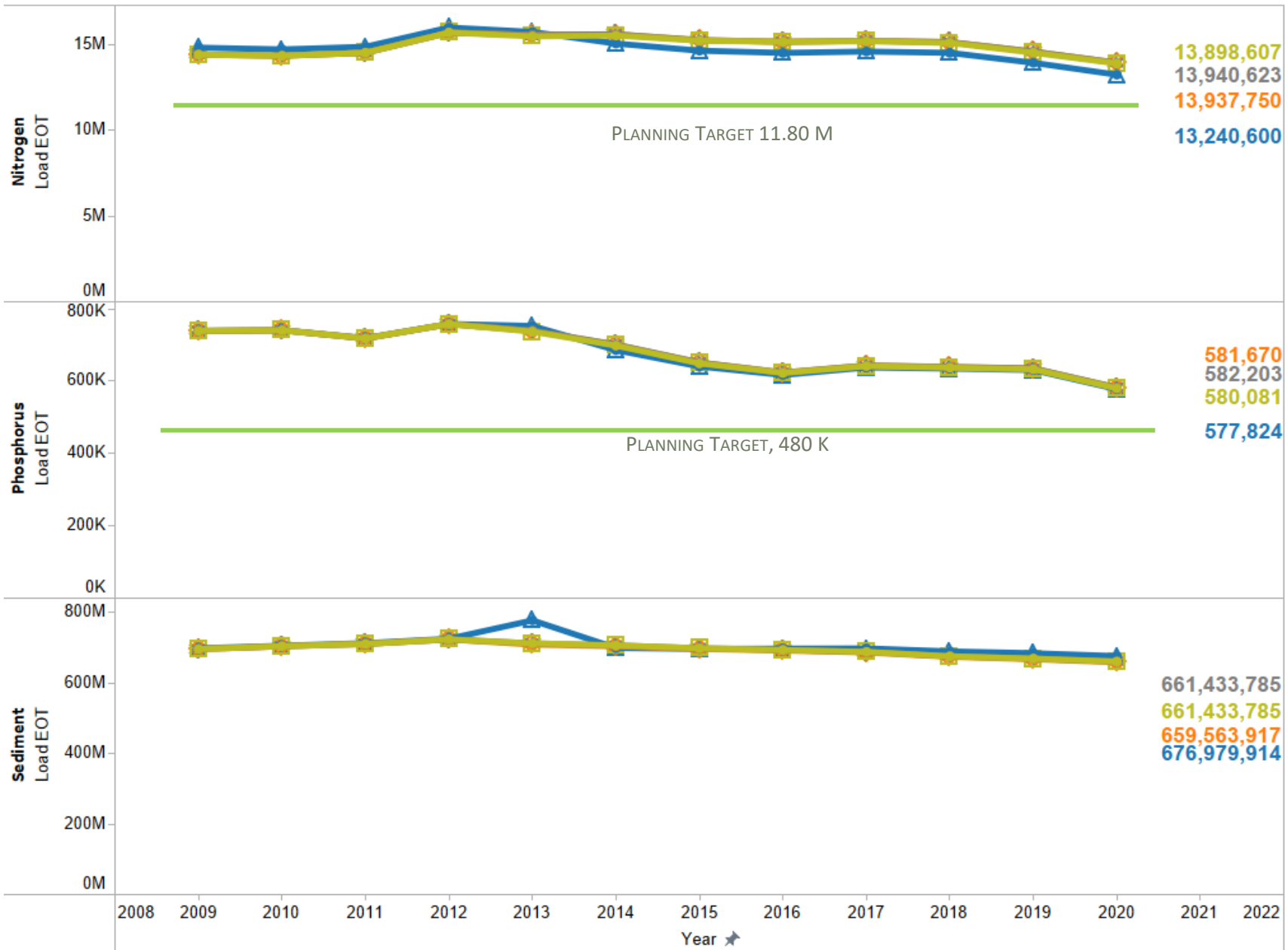
<b>Phosphorus</b>									
Jurisdiction	Source	CAST19 - CAST21 (Reviewed)		CAST21 Effect of Broiler Data		CAST21 Effect of Yield Data		CAST19 - CAST21 (All Effects)	
		(M lbs)	(%)	(M lbs)	(%)	(M lbs)	(%)	(M lbs)	(%)
MD	Agriculture	0.015	2.1%	0.000	0.00%	-0.012	-1.6%	0.003	0.5%
MD	Developed	-0.308	-45.3%	0	0	0	0	-0.308	-45.3%
MD	Wastewater	0	0	0	0	0	0	0	0
MD	Septic	-0.003	-93.8%	0	0	0	0	-0.003	-93.8%
MD	Natural	-0.096	-5.2%	0.000	0.00%	-0.002	-0.1%	-0.099	-5.4%
MD	AllSources	-0.392	-10.6%	0.000	0.00%	-0.014	-0.4%	-0.406	-11.0%

# ▶ MD Change in Nutrient Applications to the Land

(2012 – 2016)

Nitrogen							
	Manure Applied	Biosolids Applied	Fertilizer Applied	Legume Fixed	Pasture Manure	Total Agriculture Applied/Fixed	Urban Fertilizer
2012-2016 Change (lbs)	2,247,000	-1,201,000	11,325,000	9,902,000	176,000	22,449,000	-5,479,000
2012-2016 Change (%)	9%	-45%	15%	12%	1%	11%	-35%
Phosphorus							
	Manure Applied	Biosolids Applied	Fertilizer Applied		Pasture Manure	Total Agriculture Applied	Urban Fertilizer
2012-2016 Change (lbs)	658,000	-465,000	700,000		100,000	993,000	0
2012-2016 Change (%)	7%	-42%	7%		3%	4%	0%

### CAST Comparisons, NY, All Sectors



- CAST-New Versions**
- W/Broilers and Crop Yields
  - \* W/Broilers
  - ◇ Corrected fert + 2 new years
  - △ CAST-2019
- CAST-New Versions**
- W/Broilers and Crop Yields
  - W/Broilers
  - Corrected fert + 2 new years
  - CAST-2019

Load differences between CAST-2019 and all other CAST-21 versions incorporates updates to BMPs and other updated data from states



# New York Change in Nutrient Loads

Differences between CAST versions with each update: 0.7M lbs TN  
By source sector; 2020 Progress scenario

<b>Nitrogen</b>									
Jurisdiction	Source	CAST19 - CAST21 (Reviewed)		CAST21 Effect of Broiler Data		CAST21 Effect of Yield Data		CAST19 - CAST21 (All Effects)	
		(M lbs)	(%)	(M lbs)	(%)	(M lbs)	(%)	(M lbs)	(%)
NY	Agriculture	0.825	13.4%	0.000	0.00%	-0.039	-0.6%	0.786	12.7%
NY	Developed	-0.091	-4.4%	0	0	0	0	-0.091	-4.4%
NY	Wastewater	0	0	0	0	0	0	0	0
NY	Septic	-0.017	-8.9%	0	0	0	0	-0.017	-8.9%
NY	Natural	-0.020	-0.6%	0.000	0.01%	-0.003	-0.1%	-0.023	-0.7%
NY	AllSources	0.697	5.3%	0.000	0.00%	-0.042	-0.3%	0.655	4.9%

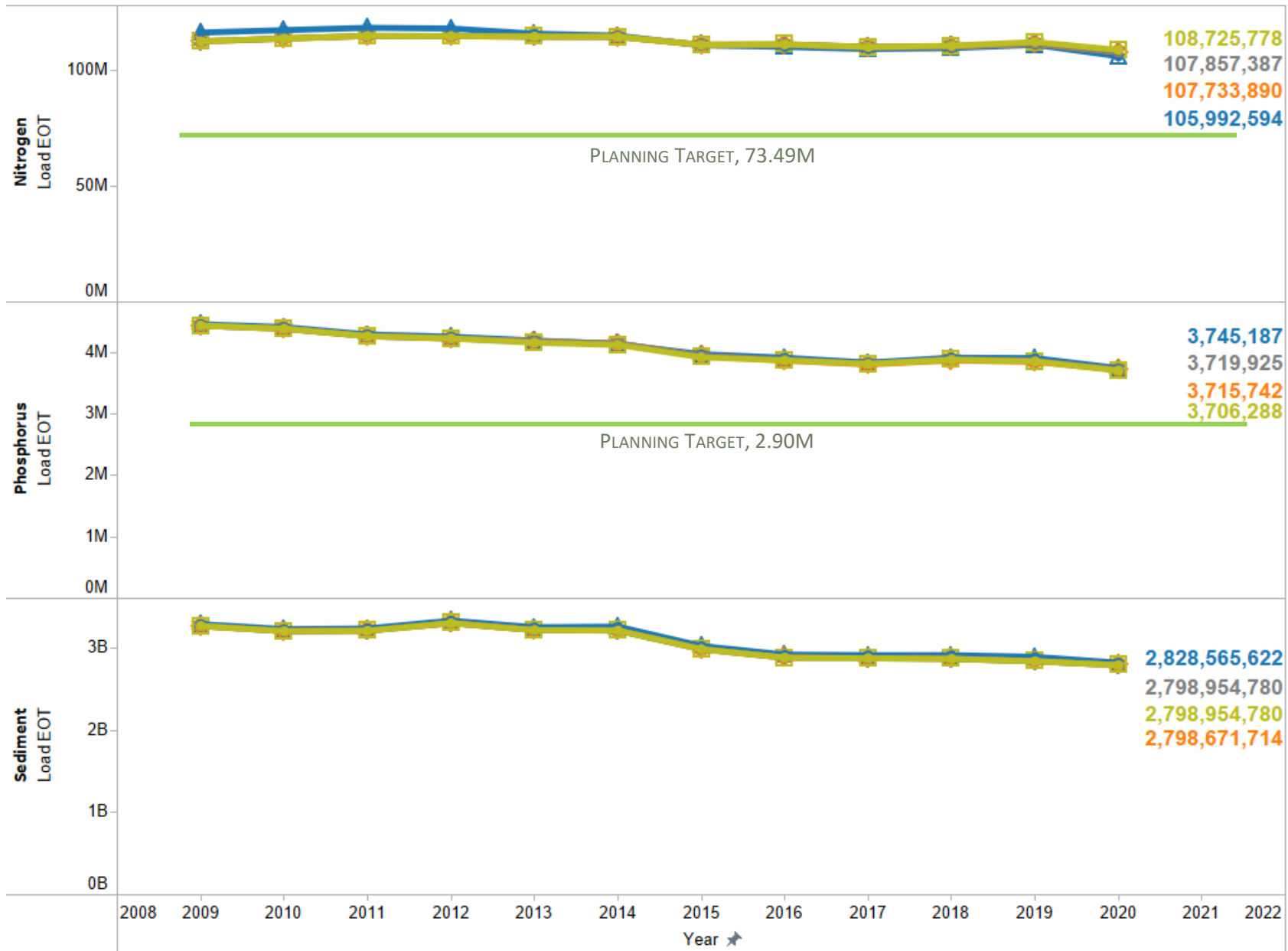
<b>Phosphorus</b>									
Jurisdiction	Source	CAST19 - CAST21 (Reviewed)		CAST21 Effect of Broiler Data		CAST21 Effect of Yield Data		CAST19 - CAST21 (All Effects)	
		(M lbs)	(%)	(M lbs)	(%)	(M lbs)	(%)	(M lbs)	(%)
NY	Agriculture	0.022	13.4%	0.000	0.00%	-0.002	-0.8%	0.021	12.5%
NY	Developed	-0.017	-22.0%	0	0	0	0	-0.017	-22.0%
NY	Wastewater	0	0	0	0	0	0	0	0
NY	Septic	0	0	0	0	0	0	0	0
NY	Natural	-0.002	-0.7%	0.000	0.06%	-0.001	-0.3%	-0.002	-0.9%
NY	AllSources	0.004	0.7%	0.000	0.02%	-0.002	-0.4%	0.002	0.3%

# NY Change in Nutrient Applications to the Land

(2012 – 2016)

Nitrogen							
	Manure Applied	Biosolids Applied	Fertilizer Applied	Legume Fixed	Pasture Manure	Total Agriculture Applied/Fixed	Urban Fertilizer
2012-2016 Change (lbs)	1,846,000	-9,000	17,980,000	-1,572,000	1,038,000	19,282,000	-630,000
2012-2016 Change (%)	7%	-59%	23%	-2%	10%	10%	-14%
Phosphorus							
	Manure Applied	Biosolids Applied	Fertilizer Applied		Pasture Manure	Total Agriculture Applied	Urban Fertilizer
2012-2016 Change (lbs)	514,000	-6,000	2,132,000		322,000	2,962,000	0
2012-2016 Change (%)	8%	-59%	16%		11%	13%	0%

### CAST Comparisons, PA, All Sectors



Load differences between CAST-2019 and all other CAST-21 versions incorporates updates to BMPs and other updated data from states

# Pennsylvania Change in Nutrient Loads

Differences between CAST versions with each update: 2.7M lbs TN  
By source sector; 2020 Progress scenario

<b>Nitrogen</b>									
Jurisdiction	Source	CAST19 - CAST21 (Reviewed)		CAST21 Effect of Broiler Data		CAST21 Effect of Yield Data		CAST19 - CAST21 (All Effects)	
		(M lbs)	(%)	(M lbs)	(%)	(M lbs)	(%)	(M lbs)	(%)
PA	Agriculture	1.345	2.2%	0.120	0.19%	0.832	1.3%	2.297	3.7%
PA	Developed	0.343	2.2%	0	0	0	0	0.343	2.2%
PA	Wastewater	0	0	0	0	0	0	0	0
PA	Septic	-0.022	-1.1%	0	0	0	0	-0.022	-1.1%
PA	Natural	0.106	0.6%	0.003	0.02%	0.036	0.2%	0.145	0.8%
PA	AllSources	1.772	1.6%	0.124	0.11%	0.868	0.8%	2.764	2.6%

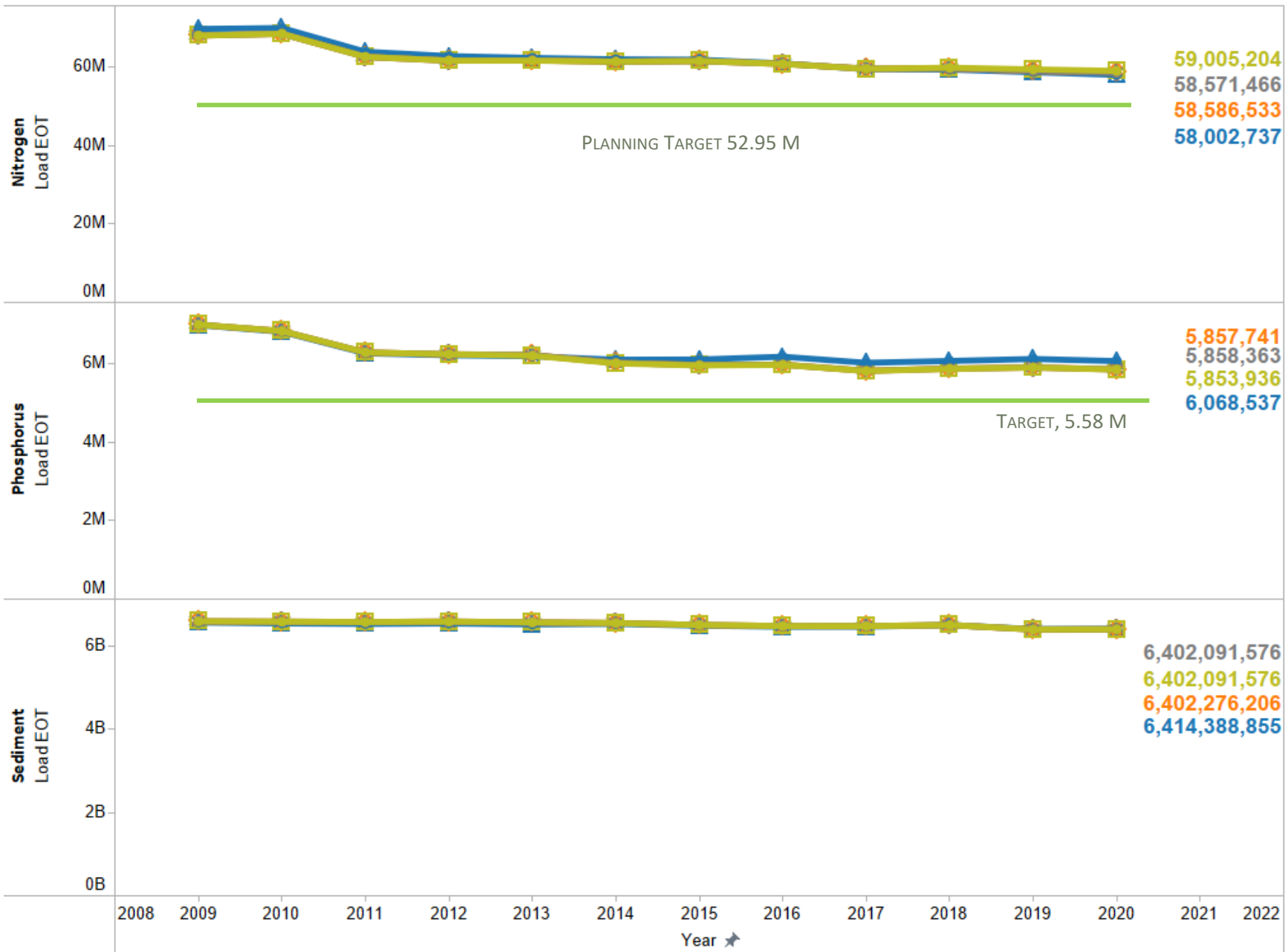
<b>Phosphorus</b>									
Jurisdiction	Source	CAST19 - CAST21 (Reviewed)		CAST21 Effect of Broiler Data		CAST21 Effect of Yield Data		CAST19 - CAST21 (All Effects)	
		(M lbs)	(%)	(M lbs)	(%)	(M lbs)	(%)	(M lbs)	(%)
PA	Agriculture	0.014	0.9%	0.004	0.22%	-0.011	-0.7%	0.006	0.4%
PA	Developed	-0.038	-8.5%	0	0	0	0	-0.038	-8.5%
PA	Wastewater	0	0	0	0	0	0	0	0
PA	Septic	0	0	0	0	0	0	0.000	0.0%
PA	Natural	-0.003	-0.3%	0.001	0.06%	-0.002	-0.2%	-0.005	-0.5%
PA	AllSources	-0.027	-0.8%	0.004	0.11%	-0.014	-0.4%	-0.036	-1.0%

# PA Change in Nutrient Applications to the Land

(2012 – 2016)

Nitrogen							
	Manure Applied	Biosolids Applied	Fertilizer Applied	Legume Fixed	Pasture Manure	Total Agriculture Applied/Fixed	Urban Fertilizer
2012-2016 Change (lbs)	5,477,000	3,000	22,827,000	12,667,000	1,633,000	42,606,000	11,633,000
2012-2016 Change (%)	6%	0%	15%	8%	4%	10%	77%
Phosphorus							
	Manure Applied	Biosolids Applied	Fertilizer Applied		Pasture Manure	Total Agriculture Applied	Urban Fertilizer
2012-2016 Change (lbs)	2,103,000	2,000	4,595,000		645,000	7,345,000	1,240,000
2012-2016 Change (%)	7%	0%	22%		5%	11%	67%

### CAST Comparisons, VA, All Sectors



- CAST-New Versions**
- W/Broilers and Crop Yields
  - \* W/Broilers
  - ◇ Corrected fert + 2 new years
  - △ CAST-2019
- CAST-New Versions**
- W/Broilers and Crop Yields
  - W/Broilers
  - Corrected fert + 2 new years
  - CAST-2019

Load differences between CAST-2019 and all other CAST-21 versions incorporates updates to BMPs and other updated data from states

# Virginia Change in Nutrient Loads

Differences between CAST versions with each update: 1M lbs TN  
By source sector; 2020 Progress scenario

<b>Nitrogen</b>									
Jurisdiction	Source	CAST19 - CAST21 (Reviewed)		CAST21 Effect of Broiler Data		CAST21 Effect of Yield Data		CAST19 - CAST21 (All Effects)	
		(M lbs)	(%)	(M lbs)	(%)	(M lbs)	(%)	(M lbs)	(%)
VA	Agriculture	0.567	2.9%	-0.014	-0.07%	0.400	2.0%	0.953	4.9%
VA	Developed	-0.058	-0.5%	0	0	0	0	-0.058	-0.5%
VA	Wastewater	0	0	0	0	0	0	0	0
VA	Septic	-0.029	-1.4%	0	0	0	0	-0.029	-1.4%
VA	Natural	0.087	0.7%	-0.001	-0.01%	0.033	0.3%	0.119	0.9%
VA	AllSources	0.566	1.0%	-0.015	-0.03%	0.434	0.7%	0.985	1.7%

<b>Phosphorus</b>									
Jurisdiction	Source	CAST19 - CAST21 (Reviewed)		CAST21 Effect of Broiler Data		CAST21 Effect of Yield Data		CAST19 - CAST21 (All Effects)	
		(M lbs)	(%)	(M lbs)	(%)	(M lbs)	(%)	(M lbs)	(%)
VA	Agriculture	0.045	3.0%	0.001	0.04%	-0.004	-0.3%	0.042	2.8%
VA	Developed	-0.155	-11.8%	0	0	0	0	-0.155	-11.8%
VA	Wastewater	0	0	0	0	0	0	0	0
VA	Septic	0	0	0	0	0	0	0	0
VA	Natural	-0.050	-2.2%	0.000	0.00%	0.000	0.0%	-0.051	-2.2%
VA	AllSources	-0.159	-3.5%	0.001	0.01%	-0.004	-0.1%	-0.163	-3.5%

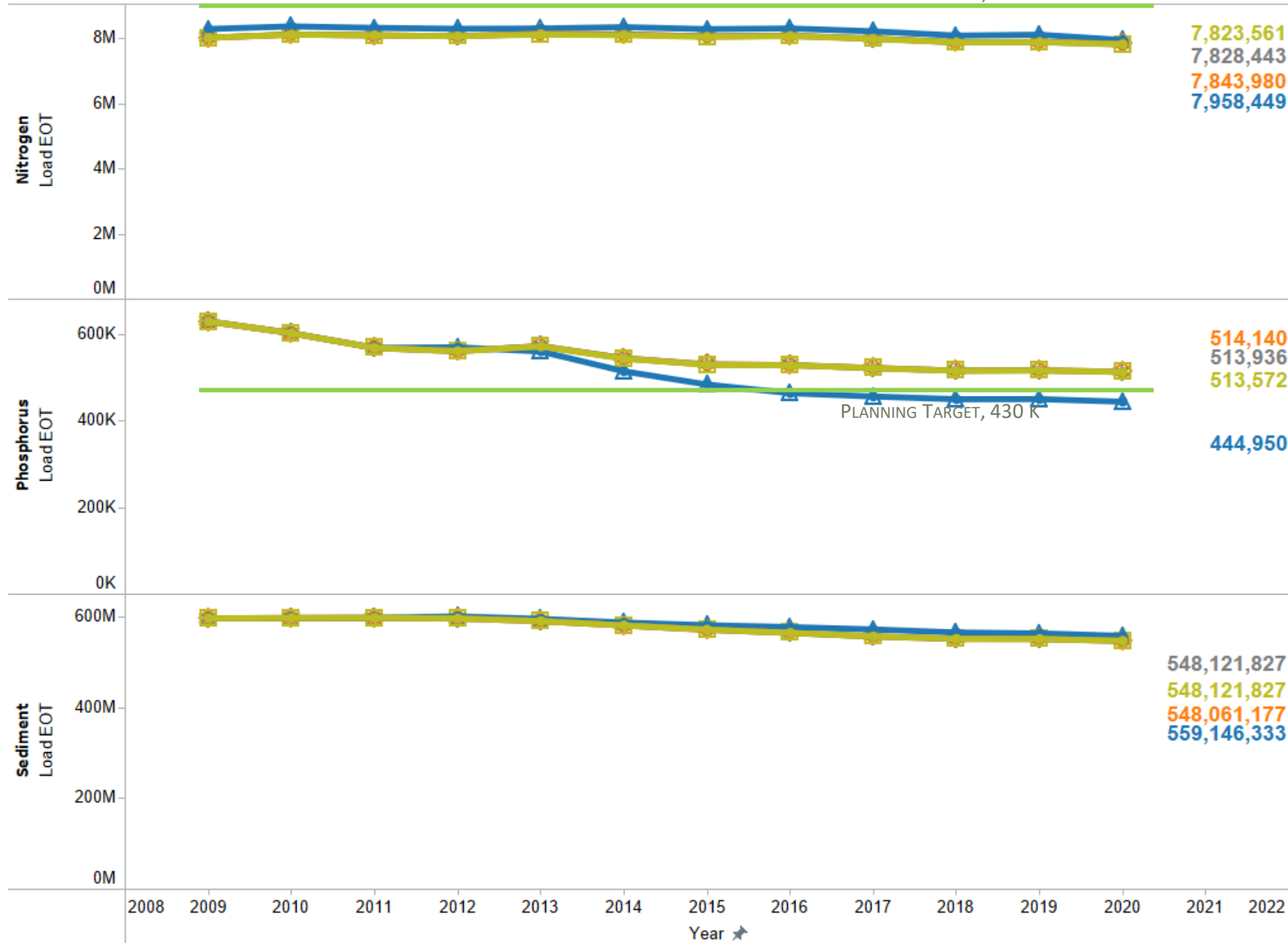
# VA Change in Nutrient Applications to the Land

(2012 – 2016)

Nitrogen							
	Manure Applied	Biosolids Applied	Fertilizer Applied	Legume Fixed	Pasture Manure	Total Agriculture Applied/Fixed	Urban Fertilizer
2012-2016 Change (lbs)	2,120,000	-2,173,000	7,200,000	5,060,000	-1,577,000	10,630,000	-3,591,000
2012-2016 Change (%)	6%	-15%	10%	6%	-3%	4%	-13%
Phosphorus							
	Manure Applied	Biosolids Applied	Fertilizer Applied		Pasture Manure	Total Agriculture Applied	Urban Fertilizer
2012-2016 Change (lbs)	1,085,000	-1,146,000	-1,351,000		-482,000	-1,894,000	4,022,000
2012-2016 Change (%)	11%	-15%	-11%		-2%	-4%	73%



# CAST Comparisons, WV, All Sectors



- CAST-New Versions**
- W/Broilers and Crop Yields
  - \* W/Broilers
  - ◇ Corrected fert + 2 new years
  - △ CAST-2019
- CAST-New Versions**
- W/Broilers and Crop Yields
  - W/Broilers
  - Corrected fert + 2 new years
  - CAST-2019

Load differences between CAST-2019 and all other CAST-21 versions incorporates updates to BMPs and other updated data from states

# West Virginia Change in Nutrient Loads

Differences between CAST versions with each update: -0.1M lbs TN  
By source sector; 2020 Progress scenario

<b>Nitrogen</b>									
Jurisdiction	Source	CAST19 - CAST21 (Reviewed)		CAST21 Effect of Broiler Data		CAST21 Effect of Yield Data		CAST19 - CAST21 (All Effects)	
		(M lbs)	(%)	(M lbs)	(%)	(M lbs)	(%)	(M lbs)	(%)
WV	Agriculture	-0.187	-5.5%	-0.016	-0.51%	-0.004	-0.1%	-0.208	-6.1%
WV	Developed	0.029	2.4%	0	0	0	0	0.029	2.4%
WV	Wastewater	0	0	0	0	0	0	0	0
WV	Septic	-0.001	-0.2%	0	0	0	0	-0.001	-0.2%
WV	Natural	0.006	0.2%	0.001	0.03%	0.000	0.0%	0.006	0.2%
WV	AllSources	-0.153	-1.4%	-0.016	-0.20%	-0.005	-0.1%	-0.173	-1.7%

<b>Phosphorus</b>									
Jurisdiction	Source	CAST19 - CAST21 (Reviewed)		CAST21 Effect of Broiler Data		CAST21 Effect of Yield Data		CAST19 - CAST21 (All Effects)	
		(M lbs)	(%)	(M lbs)	(%)	(M lbs)	(%)	(M lbs)	(%)
WV	Agriculture	-0.008	-5.7%	-0.001	-0.43%	0.000	-0.2%	-0.009	-6.3%
WV	Developed	0.054	90.1%	0	0	0	0	0.054	90.1%
WV	Wastewater	0	0	0	0	0	0	0	0
WV	Septic	0	0	0	0	0	0	0	0
WV	Natural	0.021	9.9%	0.000	0.15%	0.000	0.0%	0.021	10.0%
WV	AllSources	0.067	15.6%	0.000	-0.04%	0.000	-0.1%	0.067	15.4%

# WV Change in Nutrient Applications to the Land

(2012 – 2016)

Nitrogen							
	Manure Applied	Biosolids Applied	Fertilizer Applied	Legume Fixed	Pasture Manure	Total Agriculture Applied/Fixed	Urban Fertilizer
2012-2016 Change (lbs)	-1,244,000	-8,000	3,099,000	-315,000	344,000	1,876,000	366,000
2012-2016 Change (%)	-15%	-10%	35%	-3%	3%	5%	69%
Phosphorus							
	Manure Applied	Biosolids Applied	Fertilizer Applied		Pasture Manure	Total Agriculture Applied	Urban Fertilizer
2012-2016 Change (lbs)	-209,000	0	234,000		149,000	175,000	577,000
2012-2016 Change (%)	-9%	0%	19%		5%	3%	883%