Chesapeake Bay Program
A Watershed Partnership

Milestone Land Use Recommendations
&
Tree Canopy Change Comparison

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Land Use Workgroup Call

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2019 Milestone Land Use

Updated Data

Population Estimates (from 2016 ed. to 2018 ed.)

Population Projections (VA, NY, DE, MWCOG, and BMC)

Protected Lands (from 2016 ed. to 2018 ed.)

Sewer Service Areas (51 counties/cities)

MS4 Boundaries (VA only)

High-resolution (1m) land use change "hot spots", 2013 - 2017 (DC, DE, MD, NY, PA, WV)

Moderate-resolution (30m) land use change from NLCD, 2011/13 - 2016 (VA)

Milestone vs Phase III WIP Land Use Change (acres in CBW)

Land Use Change in CBW from 2013 - 2017	Development	Natural	Agriculture
2019 Milestones	45,621	(67,562)	21,942
WIPS	79,801	(49,913)	(29,888)

Land Use Change in CBW from 2017 - 2025	Development	Natural	Agriculture
2019 Milestones	173,316	(109,014)	(64,302)
WIPS	159,602	(99,827)	(59,775)

Land Use Change in CBW from 2013 - 2025	Development	Natural	Agriculture
2019 Milestones	218,937	(176,576)	(42,360)
WIPS	239,402	(149,740)	(89,663)

- Data in black is from the updated Milestone Land Use and reprsent change in acres from 2013 – 2025.
- Data in red is from the Phase III WIP Land Use developed for the 2017 mid-point assessment and represent change in acres from 2013 – 2025.

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Interpolated vs Mapped 2017 Land Use (acres in CBW)

WIP 2017 Land Use (Interpolated between 2013 and 2025)

Jurisdiction	DEV_17	NAT_17	AG_17
DC	32,582	7,083	50
DE	64,734	210,688	176,868
MD	1,382,818	2,826,532	1,393,326
NY	324,983	2,551,092	1,133,940
PA	1,669,140	9,616,424	3,184,922
VA	1,949,344	9,543,622	2,216,234
WV	194,796	1,734,120	359,993
Total	5,618,398	26,489,561	8,465,334

Milestone 2017 Land Use (mapped with High-res hot spots and NLCD)

Jurisdiction	DEV_17	NAT_17	AG_17
DC	32,590	7,075	50
DE	63,857	210,710	177,722
MD	1,384,528	2,821,535	1,396,612
NY	325,108	2,550,843	1,134,064
PA	1,656,331	9,615,797	3,198,359
VA	1,934,816	9,540,876	2,233,508
WV	193,809	1,734,020	361,079
Total	5,591,039	26,480,857	8,501,395

Milestone vs WIP 2017 Land Use

Jurisdiction	DEV_17	NAT_17	AG_17
DC	8	(8)	(0)
DE	(877)	23	854
MD	1,710	(4,997)	3,286
NY	125	(249)	124
PA	(12,810)	(626)	13,436
VA	(14,528)	(2,746)	17,274
WV	(987)	(100)	1,087
Total	(27,358)	(8,704)	36,062

All jurisdictions except for DC and MD appear to be developing less or more slowly than forecast in the WIP Current Zoning scenario. Mapped 2017 land use data show less development and forests and more agriculture compared to the 2017 interpolated land use data. The effect of this difference on loads is not yet known. Less development results in lower loads but less forest and more agriculture contribute to higher loads.

See P6LU_2013_2025_cz2019.xlsx

USGS

2017 - 2025 Land Use Change: WIP vs Milestone versions (acres in CBW)

WIP Land Use Change (2017 - 2025)

Jurisdiction	DEV_17_25	NAT_17_25	AG_17_25
DC	69	(69)	-
DE	3,974	(1,091)	(2,882)
MD	24,764	(15,632)	(9,132)
NY	603	(306)	(297)
PA	38,814	(18,480)	(20,335)
VA	86,120	(61,887)	(24,232)
WV	5,259	(2,361)	(2,897)
Total	159,602	(99,827)	(59,775)

Milestone Land Use Change (2017 - 2025)

Jurisdiction	DEV_17_25	NAT_17_25	AG_17_25
DC	160	(160)	-
DE	4,217	(1,315)	(2,902)
MD	23,854	(14,375)	(9,480)
NY	94	(56)	(38)
PA	53,267	(27,494)	(25,774)
VA	86,132	(63,106)	(23,025)
WV	5,592	(2,507)	(3,084)
Total	173,316	(109,014)	(64,302)

Mileston vs WIP Land Use Change (2017 - 2025)

Jurisdiction	DEV_17_25	NAT_17_25	AG_17_25
DC	91	(91)	-
DE	243	(224)	(19)
MD	(910)	1,257	(348)
NY	(509)	250	259
PA	14,453	(9,014)	(5,439)
VA	12	(1,219)	1,207
WV	333	(146)	(187)
Total	13,714	(9,187)	(4,527)

Projected Population Change

	chng_2017	chng_2025	POP17_25
DC	816	(76)	740
DE	(319)	4,221	4,539
MD	(18,704)	(14,682)	4,022
NY	(14,519)	(13,225)	1,294
PA	(38,294)	48	38,342
VA	(7,816)	(21,307)	(13,491)
WV	(1,001)	(29)	972

Differences between the Current Zoning scenarios produced for the 2017 WIPs and 2019 Milestones are minimal except in Pennsylvania. While the demographic projections produced by Pennsylvania are identical for the WIP and Milestone land uses, the updated Census Population Estimates for 2011-2018 indicate a reduced demand for housing in 2017 and an increased vacancy ratio which slightly increased the demand for housing in 2025. Both changes compounded to produce an overall increase in housing change from 2017-2025 resulting in more development in Pennsylvania. The updated population estimates impacted all states to some degree but impacted Pennsylvania the most (see table bottom right).

See P6LU_2013_2025_cz2019.xlsx, P6LU_2013_2025_cz2017.xlsx, POPv17_POPv19.xlsx

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Comparison of NLCD, HotSpot, and Wall-To-Wall Estimates of Tree Canopy Change (2013/14 – 2016/18)

Dorchester

NLCD	Gain	Loss	Net	Ratio (L/G)
5-class	2,733	(1,981)	752	-0.7:1
4-class	2,316	(1,508)	809	-0.7:1
3-class	494	(518)	(24)	-1:1

HR-HotSpot	Gain	Loss	Net	Ratio (L/G)
Trees	589	(1,177)	(588)	-2:1

Allegany

NLCD	Gain	Loss	Net	Ratio (L/G)
5-class	3,139	(2,934)	204	-0.9:1
4-class	2,166	(1,029)	1,137	-0.5:1
3-class	2,164	(1,025)	1,139	-0.5:1

HR-HotSpot	Gain	Loss	Net	Ratio (L/G)
Trees	57	(224)	(167)	-4:1

Anne Arundel

NLCD	Gain	Loss	Net	Ratio (L/G)
5-class	482	(1,339)	(857)	-2.8:1
4-class	308	(1,194)	(887)	-3.9:1
3-class	141	(993)	(852)	-7.1:1

HR-HotSpot	Gain	Loss	Net	Ratio (L/G)
Trees	1	(708)	(707)	-708:1

HR-WallToWall	Gain	Loss	Net	Ratio (L/G)
Trees	188	(2,544)	(2,356)	-13.5:1

Prince George's

NLCD	Gain	Loss	Net	Ratio (L/G)
5-class	1,120	(1,771)	(651)	-1.6:1
4-class	600	(1,335)	(735)	-2.2:1
3-class	437	(1,213)	(776)	-2.8:1

HR-HotSpot	Gain	Loss	Net	Ratio (L/G)
Trees	89	(1,469)	(1,379)	-16.5:1

HR-WallToWall	Gain	Loss	Net	Ratio (L/G)
Trees	518	(7,673)	(7,155)	-14.8:1

NLCD "Forest" classifications:

5-class: Deciduous, Evergreen, Mixed, Woody Wetlands, Shrub/scrub

4-class: Deciduous, Evergreen, Mixed, Woody Wetlands

3-class: Deciduous, Evergreen, Mixed

To compare 30m NLCD-based assessments of tree canopy change with 1m assessments, three different classifications of tree canopy are presented for consideration. Tree canopy is present in all three forest classes (41-43) and the woody wetland class (90), although the latter is sometimes omitted in estimates of forest cover. Shrub/scrub (52) typically represents mid-successional forest and may or may not be mapped as tree canopy at high-resolution. These data indicate that there are substantial differences in estimates of tree canopy change between the NLCD, Hot-Spots, and Wall-to-Wall mapping approaches. This is because the average size of tree canopy change patches is much smaller than the 900m^2 size of a Landsat E-TM cell used to create the NLCD and to identify hot spots (within which change at 1m-resolution was mapped). Agreement between change detected in the NLCD and from high-resolution imagery is dependent on the average size of change patches and consistency between the image dates and temporal range represented by both products.

USGS

See LUWG_MilestoneUpdate2019_v3.xlsx

Tree Canopy Change, Prince George's County, Maryland: 2014 – 2018 Wall-to-Wall Data

TC Change (acres)

BaseClass	NoChange	Gain	pGain	Loss	pLoss
IR	81	2	0.4%	5	0.1%
INR	220	6	1.2%	16	0.2%
TCI	4,030	2	0.4%	648	8.4%
WAT	447	6	1.1%	30	0.4%
WLT	2,164	8	1.5%	154	2.0%
WLF	11,447	16	3.2%	382	5.0%
WLO	1,236	3	0.5%	41	0.5%
FOR	113,399	56	10.8%	3,908	50.9%
TCT	21,427	9	1.8%	2,097	27.3%
MO	3,918	110	21.3%	343	4.5%
FracTurf_1	177	26	5.1%	7	0.1%
FracTurf_2	70	24	4.6%	2	0.0%
FracTurf_3	72	19	3.6%	2	0.0%
FracImp	39	4	0.9%	1	0.0%
TG	958	74	14.3%	26	0.3%
AG	367	152	29.4%	10	0.1%
Total	160,053	518		7,673	

TC Loss:

- 59% of loss change occurred within forest or wetlands
- 41% of loss occurred in developed areas

TC Gain:

- 16% of gain occurred within forest or wetlands
  - shrub/scrub; edge of forest
- 54% of gain occurred in developed areas
- 29% of gain occurred on agricultural lands

TC Change Patch Size Statistics High-Res (m^2)

Change	Count	Min	Median	Max	Mean
Loss	256,864	1	48	170,114	121
Gain	42,831	1	6	24,828	49

TC Change Patch Size Statistics NLCD (m^2)

Change	Count	Min	Median	Max	Mean
Loss	877	900	900	132,300	5,642
Gain	674	900	900	46,800	2,711

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Tree Canopy Change, Anne Arundel County, Maryland: 2014 – 2018
Wall-to-Wall Data

TC Change (acres)

BaseClass	NoChange	Gain	pGain	Loss	pLoss
IR	9,232	2	1%	7	0%
INR	23,335	6	3%	23	1%
TCI	9,277	5	2%	254	10%
WAT	3,060	1	0%	6	0%
WLT	7,886	2	1%	16	1%
WLF	9,130	1	1%	24	1%
WLO	1,325	2	1%	13	1%
FOR	99,478	13	7%	1,397	55%
TCT	31,221	16	8%	607	24%
MO	7,855	12	6%	105	4%
FracTurf_1	13,919	26	14%	43	2%
FracTurf_2	2,799	2	1%	0	0%
FracTurf_3	1,054	0	0%	0	0%
FracImp	410	0	0%	1	0%
TG	23,966	34	18%	37	1%
AG	18,672	66	35%	11	0%
Total	262,618	188		2,544	

TC Loss:

- 57% of loss change occurred within forest or wetlands
- 42% of loss occurred in developed areas

TC Gain:

- 9% of gain occurred within forest or wetlands
  - shrub/scrub; edge of forest
- 55% of gain occurred in developed areas
- 35% of gain occurred on agricultural lands

TC Change Patch Size Statistics High-Res (m^2)

Change	Count	Min	Med	Max	Mean
Loss	22,394	1	127	471,775	460
Gain	2,807	1	101	53,035	271

TC Change Patch Size Statistics NLCD (m^2)

Change	Count	Min	Median	Max	Mean
Loss	850	900	900	297,900	5,093
Gain	391	900	900	18,900	1,800

USGS


Tree Canopy over Impervious Change
2014 – 2018 Prince George's County
Google Earth


10/2018
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Google Earth

Options for updating Phase III WIP land use (2014 – 2025):

1. Update with 2017 Ag Census only

2. Same as #1 with added updates to Sewer Service Areas (SSAs) and MS4s

3. Same as #2 with added updates to 2025 Population Projections and 2014 - 2017 Population Estimates
   a) Population Estimates updated for all counties; or
   b) Population Estimates updated for counties with new projections; or
   c) Population updated for all counties with 2025 projections adjusted: * (v2019 / v2017)

4. Same as #3 with added update of 2016 land use based on NLCD everywhere

5. Same as #3 with added update of 2016 land use based on NLCD in Virginia and 2017/18 land use based on High-res Hot Spots elsewhere

Recommendation:

1. Update with 2017 Ag Census only

2. Same as #1 with added updates to Sewer Service Areas (SSAs) and MS4s

3. **Same as #2 with added updates to 2025 Population Projections and 2014 - 2017 Population Estimates**
   a) Population Estimates updated for all counties; or
   b) Population Estimates updated for counties with new projections; or
   c) Population updated for all counties with 2025 projections adjusted: * (v2019 / v2017)

4. Same as #3 with added update of 2016 land use based on NLCD everywhere

5. Same as #3 with added update of 2016 land use based on NLCD in Virginia and 2017/18 land use based on High-res Hot Spots elsewhere