Alternative Futures: Testing the Impact of Land Use and Conservation Policy BMPs on Pennsylvania Water Quality

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All land use change and nutrient load estimates provided by the Chesapeake Bay Program Partnership’s Phase 6 Watershed Model approved for use by the Principals’ Staff Committee on July 9, 2018.
Chesapeake Bay Land Change Model v4

- County-level Population Projections
- County-level Employment Projections
- Historic Infill Patterns
- Historic Development Patterns

Total Housing Demand

Potential Infill Development

- Land Conservation Demand
  - Unprotected
    - Conservation Probability
    - Road Gravity
  - Land Conservation
- Housing Land Demand
  - Unprotected and Developable
    - Residential Probability
    - Road Gravity
    - Housing Density
  - Residential Development
- Employment Land Demand
  - Unprotected and Developable
    - Commercial Probability
    - Road Gravity
    - Job Density
  - Commercial Development

Future Land Cover

- Present Land Cover
- Future Development Statistics

Summary Units (P6 modeling segments)

Iterative & Stochastic
How Does the CBLCM Work?

- **Housing Land Demand**: 3 new housing units needed
- **Employment Land Demand**: 3 new employment units needed
- **Land Conservation Demand**:
How Does the CBLCM Work?

- Housing Land Demand
  - 3 new housing units needed

- Employment Land Demand
  - 3 new employment units needed

- Land Conservation Demand

101 simulations per county
How Does the CBLCM Work?

Housing Land Demand
3 new housing units needed

Employment Land Demand
3 new employment units needed

Land Conservation Demand

101 simulations per county
How Does the CBLCM Work?

Housing Land Demand

3 new housing units needed

Employment Land Demand

3 new employment units needed

Land Conservation Demand

101 simulations per county
PA “Current Zoning” Scenario
Forestry Workgroup’s Land Policy BMP Approach

• Receive “credit” for land conservation actions
  • Supports investments made
  • Provides a holistic tool to watershed restoration beyond individual BMP or landowner actions

• Help to “offset” growth in nutrient and sediment loads that may occur in the future

• Create scenarios that are aggressive, yet practical
Forestry Workgroup’s Land Policy BMP Approach cont’d

• Forest Conservation
  • Conserve/protect wetlands
  • Limit commercial or residential development within 100 ft of streams
  • Forecast continual forest conservation based on agency (DCNR, PGC, etc.) and local conservation efforts (approx. 15,000 acres annually)
  • Forecast conservation of smaller, privately-owned forests based on participation in Clean and Green Forest Reserve Program (approx. 12,000 acres annually)

• Growth Management
  • Increase infill/redevelopment (+10% each decade)
  • Increase density of urban growth (+10% each decade)
  • Increase proportion of growth that is “urban” rather than “rural” (+10% each decade)
  • Expand sewer service areas (+1 mile in all directions)

• Agriculture
  • Forecast continual conservation of farmland based upon participation in PA’s Farmland Preservation Program
Estimated Change in PA Land Use Acres from 2017 through 2025

- 7,900 fewer acres of Development
- 2,700 more acres of Agriculture
- 4,600 more acres of Forests/Wetlands

Developed
Other Ag
Pasture
Hay
Crop
Open Space
Forest/Wetland

[-80,000, -60,000, -40,000, -20,000, 0, 20,000, 40,000]
Overall Estimated Changes in PA Nitrogen Loads

• **2017 Progress:**
  161.94 M lbs

• **2017 Progress BMPs on 2025 Default:**
  161.91 M lbs
  PA is projected to lose 0.03 M lbs of N by 2025 mainly due to losses in pasture and dairy animals.

• **2017 Progress BMPs on 2025 PA Land Policy:**
  161.88 M lbs
  Draft Land Policy BMP reduces 0.03 M lbs
Estimated Changes in Nitrogen Delivered to PA Streams 2017 through 2025

- 800,000 lbs from Wastewater (should be analyzed)
+ 5,600 lbs from Septic
- 131,000 lbs from developed
+ 86,000 lbs from agriculture
+ 10,000 lbs from forests/wetlands

Wastewater
Septic
Developed
Other Ag
Pasture
Hay
Crop
Open Space
Forest/Wetland
Estimated Lbs of N/Acre of Land Use Delivered to PA Local Streams

From a strictly average water quality perspective:

- Developing forest will result in more nutrient runoff
- Developing pasture and hay may result in more nutrient runoff
- Developing cropland will result in less nutrient runoff
Estimated Lbs of N/Acre of Land Use Delivered to PA Local Streams

From a strictly average water quality perspective:

- Developing forest will result in more nutrient runoff.
- Developing pasture and hay may result in more nutrient runoff.
- Developing cropland will result in less nutrient runoff.
- However, development of well-managed cropland, pasture and hay land may result in more nutrient runoff.
- Additionally, wastewater and septic increases must be considered as an impact of development.
Potential Paths Forward

- Agricultural preservation could be prioritized on lands meeting or exceeding implementation goals set by PA.

- Agricultural preservation could also be prioritized on lands outside of an area served by sewer.

- Development could be prioritized on sewer rather than septic.

- Infill/Redevelopment could be encouraged at the municipal level within urbanized areas served by sewer.

- Forest conservation could be prioritized outside of areas served by sewer.
Land Policy BMP Production Schedule

October 19, 2018:
PA’s Land Policy BMP will be available in CAST

November through March, 2019:
PA works with CBPO to revise Land Policy BMP outside of CAST.
Any officially approved revisions may be posted on CAST on an as-needed basis.

April, 2019:
PA’s Land Policy BMP Due Along with Draft Phase III WIP Submission