Conowingo Activity 1 Pilot BMP Opportunity Datasets

To support the Conowingo WIP Milestone development, Chesapeake Conservancy has gathered data and developed methods to perform a BMP Opportunity Analysis. This analysis is meant to map specific locations where BMPs could *potentially* be implemented to reduce nutrient and sediment pollution. When paired with data or knowledge about already existing practices, this information can inform planning future projects. These data were developed as a reference resource and are not prescriptive ground-truthed methods; all sitings are meant to be validated with local expert knowledge and/or field visits.

These methods were piloted on a single watershed (HUC12 scale) in Lancaster County, Pennsylvania. Metadata for this pilot are shown as part of the methods to provide transparency.

Conowingo Activity 1 Pilot Dataset Web Viewer

User: Conowingo_Viewer
PW: Conowingo21

BMPs Covered in the Analysis (linked reference to CAST BMP Guide):

- Manure Incorporation
- Barnyard Runoff Control
- Prescribed Grazing
- Wetland Restoration
- Grass Buffers / Forest Buffers
- Urban Forest Buffers / Planting

Overview of BMP Opportunity Analysis

BMP Name	What does the analysis tell us?			What are the features in the Web Viewer?	
	Locations that are potentially suitable for new BMP implementation	Locations where the BMP is potentially already implemented[2]	Locations that may be suitable for BMP, no distinction between whether the BMP has or has not been implemented	BMP footprint. Displayed in the Web Viewer under the "Opportunities" group.	Parcels that potentially contain BMP opportunities. Displayed in the Web Viewer under the "Parcels with Opportunities" group.
Agricultural Practices					
Prescribed Grazing (cumulative)	N/A	N/A	Lands identified as pasture in 2017/2018 LU classification.	Footprints not included. Auxiliary datasets provided for pasture.	Layer name: Prescribed Grazing
Forest Buffers Grass Buffers (cumulative)	Areas of turf, low vegetation[1], or wetlands on ag lands within 35 ft or 100ft. of a waterway. *See note.*	Areas on ag lands within 35ft or 100ft. of a waterway that are classified as forest[1]. *See note.*	All areas within 100ft. of a waterway fall into one of the other two categories.	Footprints included. Layer name: Vegetative Buffers	Layer name: Vegetative Buffers (35 ft and 100 ft, Ag)
Wetland Restoration (cumulative)	N/A	N/A.	Depressions on agricultural land meeting minimum conditions for hydric soils, depth, and area.	Footprints included. Layer name: Wetland Restoration	Layer name: Wetland Restoration
Manure Incorporation (annual)	N/A	N/A	Any contiguous cropland of at least 10,000 square feet.	Footprints not included.	Layer name: Manure incorporation

Barnyard Runoff Control (cumulative)	N/A.	*CAFO structures are highly likely to have this BMP already implemented, but may not be in all cases.*	All agricultural areas that contain structures.	Footprints not included. Auxiliary datasets provided for the CAFO and other structures on agricultural lands.	Layer name: Barnyard Runoff Control
Non-Agricultural Practices					
Urban Forest Planting	Areas of contiguous turf greater than 1-acre not on agricultural lands that are farther than 30 feet from non-road impervious land cover classes.	Areas on non-ag lands within that are classified as forest[1].	N/A	Footprints included. Layer name: Urban Forest Planting	Layer name: Urban Forest Planting
Urban Forest Buffers	Areas of turf, low vegetation[1], or wetlands on non-ag lands within 35ft or 100ft. of a waterway. See note.	Areas on non-ag lands within 35ft or 100ft. of a waterway that are classified as forest[1]. *See note.*	N/A	Footprints included. Layer name: Vegetative Buffers (35ft and 100ft, Non-Ag)	Layer name: Vegetative Buffers

1. All analyses that use land cover rely on a 1-meter dataset using 2017/2018 imagery that was produced by Chesapeake Conservancy in partnership with the University of Vermont (UVM). Note: Areas identified for new Grass or Forest Buffers or new Urban Forest Planting may in some cases incorrectly identify areas where trees have been planted up to 5-10 years before 2017 as a new opportunity for BMP implementation. This is because new opportunities were defined in part as areas not classified as forest in the 2017/2018 land cover data. Because the forest land cover class was defined as vegetation cover starting at 3-5 meters in height, newly planted buffers with seedlings and small trees will not be identified as forest until the trees mature.
2. The potentially implemented BMP area datasets summarize areas that may have these BMPs implemented already. These datasets can potentially be utilized as a resource to compare reported BMP numbers against to get a sense of whether there are BMPs that may have been implemented and remain unreported. These datasets can serve as an additional resource to summarize potential geographic areas for further local field investigation

Disclaimer: Scaling this analysis up to the entire CWIP geography is dependent on availability of input datasets (i.e. quality lidar DEMs, parcel datasets from individual counties, etc.)

Detailed methodologies:

Agricultural Practices

Prescribed Grazing (cumulative)

Description	Lands identified as pasture in 2017/2018 LU classification.
Data Layer Name	PrescribedGrazing_Opportunities_020503061105 (feature class)
Input Data Layers	● Draft 2017/18 high resolution land use ● Parcels
Methodology	Extract all pasture land use for area of interest. Summarize pasture area within each parcel. Identify all parcels with at least 1 acre of contiguous pasture.

Ideas for further methodologies:

- Identify parcels with pasture that also have barren land cover to find potential opportunities for new implementation.
- Identify parcels with pasture where there was a change from barren to low vegetation to find potential sites of previous implementation.

Metadata:

- Chesapeake Bay watershed 2017/2018 High-resolution Land Use Draft Data. 2021. Chesapeake Bay Program Partnership.
  - The Chesapeake Bay watershed 2017/2018 High-resolution Land Use Data has been funded wholly or in part by the United States Environmental Protection Agency under assistance agreement CB96363001 Chesapeake Conservancy Geospatial Support.
- Lancaster County, PA Parcel data. 2020. Accessed through the Chesapeake Bay Program Partnership.

Manure Incorporation

Description	Any contiguous cropland of at least 10,000 square feet.
Data Layer Name	ManureIncorporation_Opportunity_Parcels (feature class) DRAFT201718HRLU_CroplandOnly.tif (raster)
Input Data Layers	● Draft 2017/18 high resolution land use ● Parcels
Methodology	Extract all cropland land use for area of interest. Filter cropland to contiguous areas of at least 10,000 sq meter. Summarize cropland area within each parcel.

Ideas for further methodologies:

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Metadata:

- Chesapeake Bay watershed 2017/2018 High-resolution Land Cover and Land Use Data. 2021. Chesapeake Bay Program Partnership.
  - The Chesapeake Bay watershed 2017/2018 High-resolution Land Use Data has been funded wholly or in part by the United States Environmental Protection Agency under assistance agreement CB96363001 Chesapeake Conservancy Geospatial Support.
- Lancaster County, PA Parcel data. 2020. Accessed through the Chesapeake Bay Program Partnership.

Barnyard Runoff Control

Description	All agricultural parcels containing CAFO buildings or other structures.
Data Layer Name	● BRC_Opportunity_Parcels (feature class) ● CAFO_Buildings_201718HRLU_onAgparcels (feature class) ● All_Buildings_onAgparcels (feature class)
Input Data Layers	● Draft 2017/18 high resolution land use ● Draft 2017/18 high resolution land cover ● CAFO dataset (Microsoft AI) ● Parcels
Methodology	Extract all agricultural land use for area of interest. Filter agricultural lands to contiguous areas of at least 10,000 sq meter. Identify parcels containing agricultural lands. Extract all buildings/structures within agricultural parcels. Summarize buildings/structures within each agricultural parcel.

Ideas for further methodologies:

- Within the identified parcels, filter with those intersecting a stream (especially agriculturally imparired streams). Prioritize areas that have significant areas of barren land cover within 300 ft of the stream.

Metadata:

- Chesapeake Bay watershed 2017/2018 High-resolution Land Cover and Land Use Data. 2021. Chesapeake Bay Program Partnership.
  - The Chesapeake Bay watershed 2017/2018 High-resolution Land Use Data has been funded wholly or in part by the United States Environmental Protection Agency under assistance agreement CB96363001 Chesapeake Conservancy Geospatial Support.
- Microsoft AI Concentrated Animal Feeding Operation (CAFO) dataset. (Citation pending).
- Lancaster County, PA Parcel data. 2020. Accessed through the Chesapeake Bay Program Partnership.

Riparian Forest & Grass Buffer (agricultural)

Description	Areas of turf, low vegetation, or wetlands on agricultural lands within 35ft or 100ft. of a waterway.
Data Layer Name	• VBOA_35ft_ag_poly_020503061105 (feature class) • VBOA_100ft_ag_poly_020503061105 (feature class)
Input Data Layers	• Draft 2017/18 high resolution land use • Draft 2017/18 high resolution land cover • Enhanced Flowpaths • Parcels
Methodology	Identify all areas of low vegetation, barren, or wetland land cover within 35 ft and 100ft of an enhanced flowpath waterway. Filter this data by only what intersects with agricultural land use.

Ideas for further methodologies:

- Identify areas to prioritize forest versus grass plantings.

Metadata:

- Chesapeake Bay watershed High-resolution Land Use and Land Cover Data. 2016. Chesapeake Bay Program Partnership. Accessed from https://www.chesapeakeconservancy.org/conservation-innovation-center/high-resolution-data/ on 06/22/2021.
- Susquehanna watershed Enhanced Flow Path data. 2018. National Fish and Wildlife Foundation. Accessed from

https://www.chesapeakeconservancy.org/conservation-innovation-center/high-resolution-data/enhanced-flow-paths/ on 06/22/2021.

- Lancaster County, PA Parcel data. 2020. Accessed through the Chesapeake Bay Program Partnership.

Wetland Restoration

Description	All depressions on agricultural land meeting minimum conditions for hydric soils, depth, and area as potential opportunities for wetland restoration
Data Layer Name	• WOA_020503061105 (feature class) • Wetland_Restoration_Opportunity_Parcels (feature class)
Input Data Layers	• Draft 2017/18 high resolution land use • Draft 2017/18 high resolution land cover • Enhanced Flowpaths • Parcels
Methodology	Follows USDA ACPF methodology: Identification of depression areas through a subtraction of a filled DEM from an unfilled DEM (preprocessed for noise). Filter these results to remove false depressions (i.e. areas where culvert crossings have impacted the DEM accuracy). Further filter results to remove areas that intersect with waterbodies, forested lands, impervious surfaces/structures, etc.

- From the USDA ACPF methodology:
  - 1) The mean percent hydric soils within each depression must be greater than a user-specified value.
    - Default value: 60%
  - 2) Depressions must be centered on agricultural fields (including pasture).
  - 3) Depressions cannot intersect the stream reach.
  - 4) Depressions cannot be centered within water bodies.
  - 5) Depressions must have a minimum depth of (x) cm.
    - Default: 30cm
  - 6) Depressions must have a minimum surface area of (y) acres.
    - Default: 0.25acres
- Metadata:
  - User manual:
    - Porter, S.A., M.D. Tomer, D.E. James, J.D. Van Horn, and K.M.B. Boomer. 2018. Agricultural Conservation Planning Framework: ArcGIS®Toolbox User's Manual, Ver. 3. USDA Agricultural Research Service, National Laboratory for Agriculture and the Environment, Ames Iowa. Available: http://northcentralwater.org/acpf/ (6/29/21).
  - Development of specific practice siting tools:

        - Tomer, M.D., S.A. Porter, K.M.B. Boomer, D.E. James, J.A. Kostel, M.J. Helmers, T.M. Isenhart, and E. McLellan. 2015. Agricultural Conservation Planning Framework: 1. Developing multi-practice watershed planning scenarios and assessing nutrient reduction potential. J. Environ. Qual. 44(3):754-767. https://dl.sciencesocieties.org/publications/jeq/articles/44/3/754
    - Chesapeake Bay watershed High-resolution Land Use and Land Cover Data. 2016. Chesapeake Bay Program Partnership. Accessed from https://www.chesapeakeconservancy.org/conservation-innovation-center/high-resolution-data/ on 06/22/2021.
    - Draft Chesapeake Bay watershed 2017/2018 High-resolution Land Use Data. 2021. Chesapeake Bay Program Partnership.
        - The Chesapeake Bay watershed 2017/2018 High-resolution Land Use Data has been funded wholly or in part by the United States Environmental Protection Agency under assistance agreement CB96363001 Chesapeake Conservancy Geospatial Support.
    - Lancaster County, PA Parcel data. 2020. Accessed through the Chesapeake Bay Program Partnership.

Non-Agricultural Practices

Urban Forest Buffer

Description	Areas of turf, low vegetation, or wetlands on agricultural lands within 35ft or 100ft. of a waterway.
Data Layer Name	• VBOA_35ft_urban_poly_020503061105 (feature class) • VBOA_100ft_urban_poly_020503061105 (feature class)
Input Data Layers	• Draft 2017/18 high resolution land use • Draft 2017/18 high resolution land cover • Enhanced Flowpaths • Parcels
Methodology	Identify all areas of low vegetation, barren, or wetland land cover within 35 ft and 100ft of an enhanced flowpath waterway. Filter this data by only what does not intersect with agricultural land use.

- Metadata:
    - Chesapeake Bay watershed High-resolution Land Use and Land Cover Data. 2016. Chesapeake Bay Program Partnership. Accessed from

https://www.chesapeakeconservancy.org/conservation-innovation-center/high-resolution-data/ on 06/22/2021.
    - Susquehanna watershed Enhanced Flow Path data. 2018. National Fish and Wildlife Foundation. Accessed from https://www.chesapeakeconservancy.org/conservation-innovation-center/high-resolution-data/enhanced-flow-paths/ on 06/22/2021.
    - Lancaster County, PA Parcel data. 2020. Accessed through the Chesapeake Bay Program Partnership.

Urban Forest Planting

Description	Areas of turf, low vegetation, or wetlands on agricultural lands within 35ft or 100ft. of a waterway.
Data Layer Name	ForestPlantingOpportunities_020503061105 (feature class)
Input Data Layers	• Draft 2017/18 high resolution land use • Draft 2017/18 high resolution land cover • Enhanced Flowpaths • Parcels
Methodology	Identify all areas of turf within the area of interest. Filter out areas that are not at least 1-acre of contiguous extend. Further filter out areas are at least 30' from non-road impervious surfaces.

- Ideas for further methodologies:
    - Further filter this dataset to remove recreational-use turf (i.e. sports fields and open space parks).
- Metadata:
    - Chesapeake Bay watershed High-resolution Land Use and Land Cover Data. 2016. Chesapeake Bay Program Partnership. Accessed from https://www.chesapeakeconservancy.org/conservation-innovation-center/high-resolution-data/ on 06/22/2021.
    - Susquehanna watershed Enhanced Flow Path data. 2018. National Fish and Wildlife Foundation. Accessed from https://www.chesapeakeconservancy.org/conservation-innovation-center/high-resolution-data/enhanced-flow-paths/ on 06/22/2021.
    - Lancaster County, PA Parcel data. 2020. Accessed through the Chesapeake Bay Program Partnership.