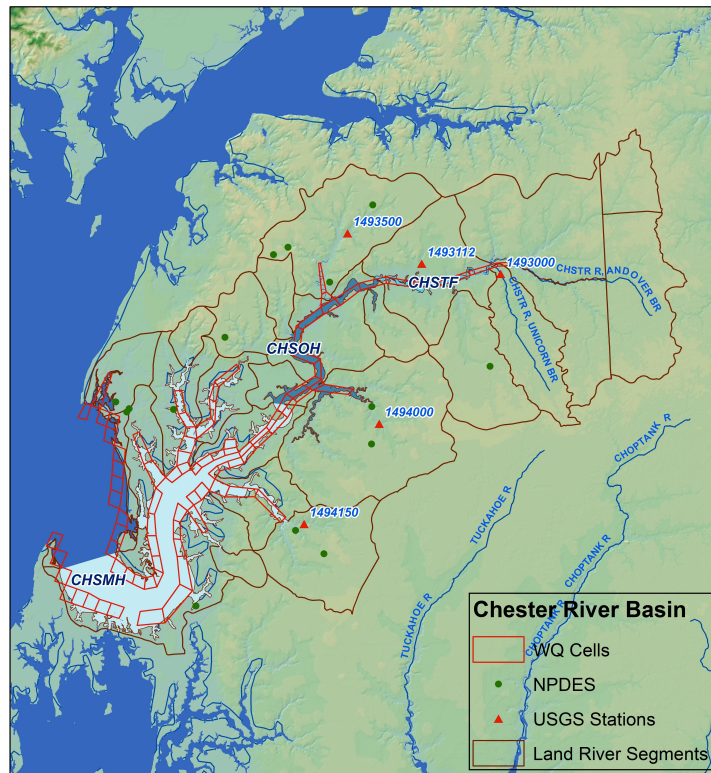


1. Delivered Loads from the Watershed Model

Watershed model was calibrated over a period of 2002-2011 to provide best estimates of loading rates to the Bay. Model calibration using the observations for the year 2002-2011 showed improvements in the multiple model performance statistics as compared to calibration over the period of 1985-2005. Model performance statistics that were examined for flow include Bias, Nash-Sutcliffe Efficiency (NSE), and log-NSE. R-squared statistics, slope of the best-fit line, and goodness of fit of cumulative frequency distributions of observed and simulated total nitrogen, total phosphorous and total suspended sediment at daily time scale were compared. In contrast to the Phase 5.3.2 model, NLDAS-2 based precipitation and meteorological parameters (temperature, solar radiation, wind speed, dew point temperature) were used for climate forcing dataset. Daily potential evapotranspiration rate were derived using Hamon method. Solar radiation data were used for temporal segregation of daily potential evapotranspiration to hourly time scale. Additionally, HSPF-PQUAL was used to simulate the fate and transport of nutrients replacing HSPF-AGCHEM based simulation. Sediment calibration was refined to attain a-priori estimates of edge of field sediment yields from National Resources Inventory. This research was presented and reviewed by the modeling workgroup in July 2013 quarterly meeting (Event 18875 URL).

Delivered loads from the watershed model for the Chester River have been summarized separately from point and non-point sources using two different approaches. These two

approaches differ in terms of spatial aggregation at which loads were summarized. The first approach provides loading rates for a subset Phase 5.3.2 Water Quality and Sediment Transport Model (WQSTM) grids of the Chesapeake Bay estuary that interface with the Chester River shoreline/boundary (see Figure 1). In another approach, the loading rates were summarized at the Land-River segments of the Phase 5.3.2 watershed model (see Figure 1). GIS layers for these spatial units have been provided



(Chester_WQcell and Chester_segments) as shapefiles.

Loading rates for the both approaches have been summarized at daily, monthly and annual time scales for the years 2002 to 2011. Table below provides a quick overview of the output files. File naming convention used below replaces SRC for either point sources (ps) or non-point sources (nps), and YY as last two digits of the corresponding year.

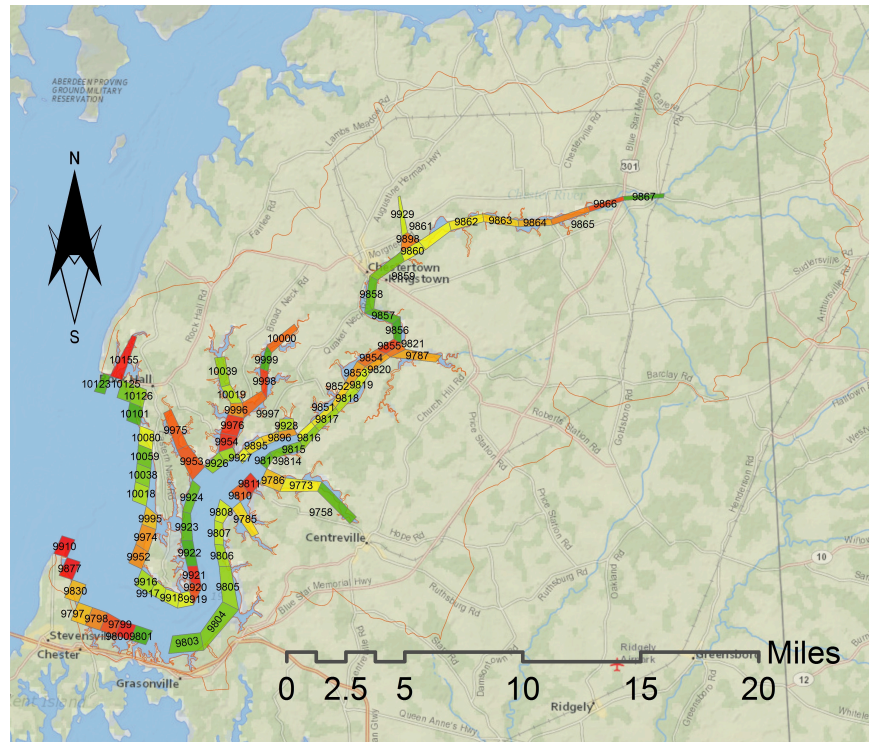
| File Name | Overview |
|----------------------|--|
| wsm57k_wsm_SRC.YY | Daily loading rates at individual boundary element |
| wsm57k_wsm_SRC.YY_DT | Net daily loading rates to the Chester River |
| wsm57k_wsm_SRC.YY_MC | Monthly loading rates at individual boundary element |
| wsm57k_wsm_SRC.YY_MT | Net monthly loading rates to the Chester River |
| wsm57k_wsm_SRC.YY_YC | Annual loading rates at individual boundary element |
| wsm57k_wsm_SRC.YY_YT | Net annual loading rates to the Chester River |

SRC = point source (ps) or non-point source (nps), YY = Year

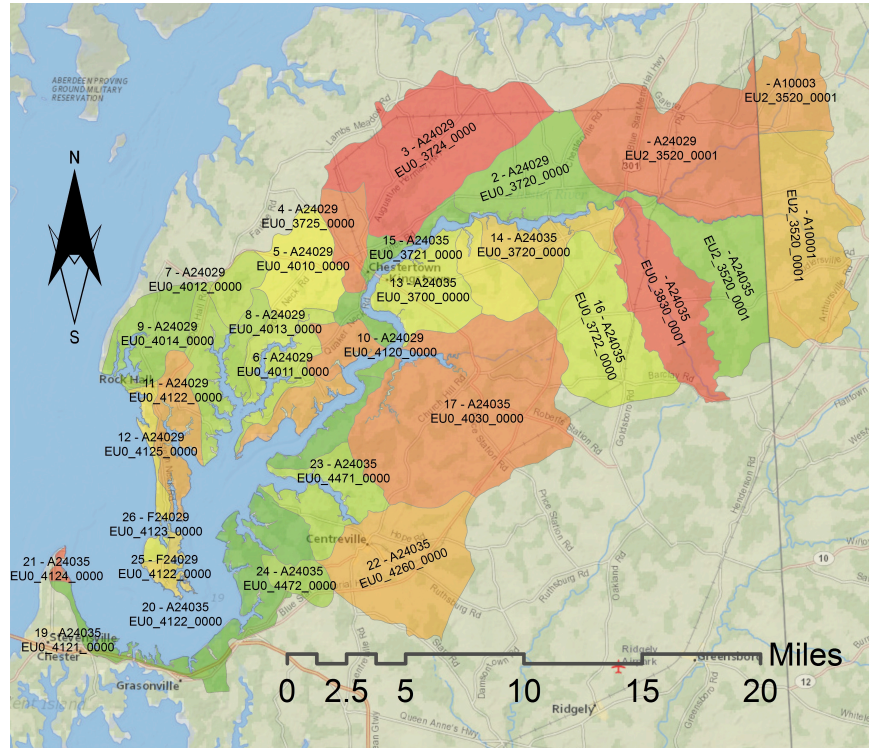
These files provide data that are either loading rates or concentration. It is noted that units corresponding concentration is sufficient however for loading rates time intervals changes with the file. For e.g., total nitrogen (totn) loading rates are expressed in unit of lb/month in wsm57k_wsm_nps.02_MT, and lb/year in wsm57k_wsm_nps.02_YT.

Chester_WQSTM contains loading rates data at WQSTM grid. Whereas,

Chester_LRSEGS has land-river segment scale loading rates. *Chester_WQSTM* uses the cell numbers of the WQSTM grid that can be identified in GIS using *Chester_WQcell* layer (see Figure 2). In *Chester_LRSEGS*, land-river segments were assigned unit identification numbers that



range from 1 to 28 (see Figure 3). A relational table describing mapping between unit identification numbers and land-river segment names is provided separately as SEGMENT_CELLS_MAPPING.txt with Chester_LRSEGS.



Data Download URLs:

- (a) Loading rates for Chester_WQSTM
- (b) Loading rates for Chester_LRSEGS
- (c) GIS layer of Chester_WQSTM
- (d) GIS layer of Chester_LRSEGS
- (e) GIS layer of Chester Tidal Segments

2. Point Source Data

Flow and nutrient data corresponding to the point source facilities are added to an associated stream reach and the river simulation module of HSPF simulates their fate and transport. Loads from point sources facilities that are located on tidal land segments that do not have an explicit river simulation, are delivered directly to the associated estuary cell. Particularly at the Chester river watershed, two none of the point sources are associated with river simulation and therefore are transported directly to the Bay.

Data corresponding to the National Pollutant Discharge Elimination System facilities (see Figure) are provided in a spreadsheet (Chester_Point_Source). The spreadsheet contains point source data corresponding to municipal and industrial facilities. Combined sewer overflows that are also used in the model were not available for this sub-watershed. Point source files provide FLOW (millions of gallons/day), BOD5 (pounds/day), DO (pounds/day), NH3 (pounds/day), NO23 (pounds/day), TON (pounds/day), TN (pounds/day), PO4 (pounds/day), TOP (pounds/day), TP (pounds/day), TSS (pounds/day).

GIS layer for the point source facilities is provided as shapefile (Chester_NPDES).

Data Download URLs:

- (a) *Point Source Loads Spreadsheet*
- (b) *GIS layer of NPDES*

3. Monitoring Station Observed Data

Observation data for the five USGS stream gage stations (see Figure, Table 2) that are located in the Chester River watershed were archived for the years 2000 to 2013. Out of these five stations, station 01494000 did not have any data during this period and station 01494150 has data available from late December 2006. It is noted that out of these observation stations only one (01493000) was used in the watershed model calibration, whereas rest did not meet the mean annual flow threshold of 100cfs used in the development of river simulations in Phase 5.3.2 model.

| USGS Gage Station | Description |
|--------------------------|---|
| USGS 01493000 | Unicorn Branch near Millington, MD |
| USGS 01493112 | Chesterville Branch near Crumpton, MD |
| USGS 01493500 | Morgan Creek near Kennedyville, MD |
| USGS 01494000 | Southeast Creek at Church Hill, MD |
| USGS 01494150 | Three Bridges branch at Centreville, MD |

GIS layer for these USGS stream gage stations is provided as shapefile (Chester_USGS).

Data Download URLs:

(a) *USGS Gage Station Observations*

(b) *GIS layer of USGS Gages*