

ArcNLET Checklist Instructions

ArcNLET is an ArcGIS add-on modeling tool developed for the Florida Department of Environmental Protection (DEP) and the Institute of Energy Systems, Economics, and Sustainability (IESES) by Florida State University that can be used to estimate nitrogen loading to surface waters from septic systems. Several versions of the model along with user and technical manuals are available at <https://people.sc.fsu.edu/~mye/ArcNLET/>. Version 1 is compatible with older ArcGIS versions back to 9.3, followed by Versions 2 and 3 which are compatible with the most current version of Arc GIS 10.3.1. Version 2 provides the ability to perform uncertainty analyses while Version 3 allows analysis of both nitrate and ammonium transport.

The information in this document is intended to provide guidance for filling out the ArcNLET checklist. The checklist instructions provided below describe the specific ArcNLET input and output data items that are required to be submitted to DEP for verification of BMAP nutrient reduction credits for septic to sewer conversions. All of the light green cells in the spreadsheet need to be completed.

A. General Information (Tab A, ArcNLET checklist spreadsheet)

General Project Figure: Check the box to indicate that a project figure is provided. Add reference to the project figure if it is provided as a part of an attachment or other documentation. The project figure should be at least 8.5"X11" and should indicate location of nitrogen loading source (septic tanks) area of interest, the area simulated in the ArcNLET model, and water bodies of interest (both stream and lakes). The figure should be drawn at a scale where individual onsite water treatment systems (source locations) are visible. Additionally, the water bodies of interest should be labeled with corresponding water body IDs.

GIS Projection: Select the GIS projection used for the ArcNLET project from the drop-down menu. All input shapefiles used for an ArcNLET project must be in the same GIS projection.

Vertical Datum: Select the vertical datum for the DEM elevation values from the drop-down menu. Options can be North American Datum of 1988 (NAVD88) or National Geodetic Vertical Datum of 1929 (NGVD29).

Linear Unit: Select the linear unit used for the ArcNLET model (feet, meters, etc.) from the drop-down menu. The specified linear units should be same as the linear unit of the GIS projection used for the project.

Time Unit: Select the time unit used for the ArcNLET model (day, seconds, etc.) from the drop-down menu.

Mass Unit: Select the mass unit used for the ArcNLET model (milligram, pounds, etc.) from the drop-down menu.

Number of Septic Tanks Removed: Enter the number of onsite water treatment systems that are proposed to be removed. Nitrogen load reductions can be computed by subtracting the simulated nitrogen loading under proposed conditions from the existing conditions.

Alternatively, ArcNLET model can be run using only the septic tanks that are proposed to be removed to arrive at the nutrient reduction credits.

Decay Allowed: Specify whether the ArcNLET model was setup to simulate the denitrification process. Type in “Yes” or “No” in the space provided.

All rasters are square-celled: Confirm that the rasters specified in the ArcNLET model are square-celled. Inaccuracies are introduced in ArcNLET calculations if the rasters are not square-celled

Raster Cell-Size: Specify cell-size of the rasters used in the ArcNLET model. ArcNLET requires that all input rasters should have the same cell-size.

A1. Available Regional Data

Provide details of regional data available and the respective data sources in the vicinity of the project area. This allows the model results to be put into perspective.

Obs./Simulated WT Elevations: Provide range of water table (WT) elevation values in the general vicinity of the project area based on either observed data or simulated values derived from a regional or sub-regional groundwater model in the space provided.

Meas./Calibrated Hyd. Conductivity: Provide range of hydraulic conductivity values in the general vicinity of the project area based on either measured data or calibrated values derived from the regional or sub-regional groundwater model in the space provided.

Meas./Calibrated Porosity: Provide range of porosity values in the general vicinity of the project area based on either measured data or calibrated values derived from a regional or sub-regional groundwater model in the space provided.

Meas./Calibrated Dispersivity: Provide range of dispersivity values in the general vicinity of the project area based on either measured data or calibrated values derived from a regional or sub-regional groundwater model in the space provided.

B. Groundwater Flow Module (Tab B, ArcNLET checklist spreadsheet)

INPUTS

1. DEM

DEM Data Source: Provide the link or reference to the base topographic data that was used as a starting point in the space provided. If the observed or model-simulated water table was used skip this step and provide relevant external water table data.

DEM Original Size: Provide the cell size (in the project-specific linear units) of the base DEM used in the ArcNLET model in the space provided.

DEM Elevation Range: For the area simulated in the ArcNLET model provide the maximum and minimum elevations from the base DEM in the space provided.

2. Water Bodies

Linear Water Bodies: Provide data source for the linear water bodies (narrow streams and channels) and the buffer used to convert line features to polygon features in the space provided.

Water Body Polygon: Provide data source for the water body polygons in the space provided.

3. Hydraulic Conductivity

Hydraulic Conductivity: Provide data source and the range of hydraulic conductivity values for the area simulated in the ArcNLET model in the space provided. For heterogeneous distribution, please provide an 8.5X11 figure showing the spatial distribution of the specified hydraulic conductivity.

4. Porosity

Porosity: Provide data source and the range of porosity values for the area simulated in the ArcNLET model in the space provided. For heterogeneous distribution please provide an 8.5X11 figure showing the spatial distribution of the specified porosity values.

5. External water table elevation

External water table elevation: Provide data sources (model-simulated or observed) that were used to develop the water table elevation surface and specified in-lieu of DEM in the space provided. Please ensure that that DEM smoothing factor is set to “0” to avoid modification of specified water table values. Additionally, provide an 8.5X11 figure indicating the water table elevation distribution.

6. DEM Smoothing Factor

DEM Smoothing Factor: Provide the smoothing factor that was used to convert the base DEM to smoothed DEM used for computing hydraulic gradients in the space provided.

DEM Smoothing Cells: Provide the number of smoothing cells that were specified to determine the smoothing window in the space provided.

DEM Smoothing- Fill Sinks: Specify if the fill sink option was utilized for DEM smoothing. Type in “Yes” or “No” in the space provided.

Z-Factor Used: Provide value of Z-factor that was specified to convert base DEM vertical units to project linear units in the space provided.

7. Smooth Elevation

Smooth Elevation: Provide the range of elevation values after DEM smoothing is completed in the space provided.

OUTPUTS

Provide minimum and maximum computed values for velocity magnitude, velocity direction, and hydraulic gradient simulated subsequent to the execution of the Groundwater Flow module in the spaces provided.

C. Particle Tracking Module (Tab C, ArcNLET checklist spreadsheet)

INPUTS

Number of Points: Specify the number of septic systems being simulated in the space provided.

Data Source: Provide data source of the location information for the septic systems being simulated in the ArcNLET model in the space provided.

W.B. Raster Res: Provide value of the water body raster resolution (W.B.Raster Res.) used for the ArcNLET model in the space provided.

Step Size: Specify the step size used in the ArcNLET model in the space provided.

Optimized Step Size: Specify if the step size was optimized to ensure that the particle tracks were getting appropriately terminated. Type in “Yes” or “No” in the space provided.

Max. Steps: Specify maximum number of model steps that were taken before terminating any particle path in the space provided.

OUTPUTS

Min. And Max. Travel Time: Using the attribute table of the particle path output polyline shapefile provide the maximum and minimum travel times from all of the simulated flow paths in the space provided.

Additionally, provide the pathID and water body ID (WBID) for two tracks with minimum and maximum travel times.

D. Transport Module (Tab D, ArcNLET checklist spreadsheet)

INPUTS

Site-Specific Transport Parameters: Specify whether the transport parameters vary within individual (or group) on-site wastewater treatment systems with the drop-down menu. If “Yes” is selected, provide a table with all site-specific transport parameter datasets as a separate attachment.

Uniform C0: Provide the uniform concentration value of the source plane used in the ArcNLET model in the space provided. Note that the units of the specified C0 values can be converted to the project units using the Volume conversion factor.

Uniform Longitudinal Dispersivity (α_L): Provide the uniform longitudinal dispersivity value used in the ArcNLET model in the space provided.

Uniform Longitudinal Dispersivity (α_{TH}): Provide the uniform transverse dispersivity value used in the ArcNLET model in the space provided.

Uniform Decay Constant: If denitrification decay is simulated provide the decay constant used in the ArcNLET model in the space provided.

Volume Conversion Factor: Provide the volume correction factor used in the ArcNLET model in the space provided. The volume correction factor is used to convert volumes calculated from the units of lengths to the volume units used for concentration (C0).

Domenico Bdy. Parameter: Specify the Domenico boundary parameter chosen for the ArcNLET model setup with the drop-down menu. The available options are "Specified_Input_Mass_Rate" or "Specified_Z" Mass Inflow (Min): If the Domenico Bdy. Parameter is set to "Specified_Input_Mass_Rate" provide the value of mass inflow rate from the concentration source plane.

Source Dim. Y: Provide the value of Y (width of drainfield) use in the ArcNLET model in the space provided.

Source Dim. Z: If the Domenico Bdy. Parameter is set to "Specified_Z" provide the value of Z (measured/estimated plume thickness value) used in the ArcNLET model in the space provided.

Plume Cell Size: Provide the plume cell size (resolution of the plume grid) specified for the ArcNLET model in the space provided.

Solution Type Used: Provide the Domenico solution type used in the ArcNLET model setup with the drop-down menu. The available options are "Domenico Robbins SS 2D" or "Domenico Robbins SS Decay 2D"

Control Point Spacing: Provide the control point spacing (number of cells) used to warp the plume to specific flow paths in the space provided.

Warping Method: Provide the specific plume warping method used in the ArcNLET model with the drop-down menu. The available options are Spline, Polynomial2, and Polynomial1.

Approx. Method: Specify (Yes or No) if the use of approximate warp method was allowed with the drop-down menu.

Threshold Conc.: Provide the value of threshold concentration used for discarding portions of plume where the concentration falls below the specified threshold concentration with the drop-down menu.

Post-Processing: Specify the post-processing option selected in the ArcNLET model with the drop-down menu. The available options are None, Medium, and Full.

OUTPUTS

From the plume information ("info") shapefile generated upon execution of transport module provide the following:

Maximum and Minimum Path Time: These values should be determined from the output shapefile attribute "pathTime". Provide the values in the space provided.

Minimum and Maximum Path Length: These values should be determined from the output shapefile attribute “pathLen”. Provide the values in the space provided.

E. Load Estimation Module (Tab E, ArcNLET checklist spreadsheet)

INPUTS

Risk Factor: Specify the risk factor values used in the ArcNLET model to develop conservative estimates of the mass loading rates in the space provided.

OUTPUT

Upon execution of the load estimation module save the output data table. Append water body names to the table based on water body IDs and provide it as an attachment to the checklist.

SUMMARY OUTPUT TABLE

Using the tabular output from ArcNLET GUI, fill in the details regarding Waterbody ID and Name, and simulated nitrogen loading (Mass Output Load times Risk Factor) by ArcNLET. Also provide the number of septic tanks contributing to each waterbody. The expected load reduction per septic tank is computed automatically in the table.