Background and Concepts Introduction

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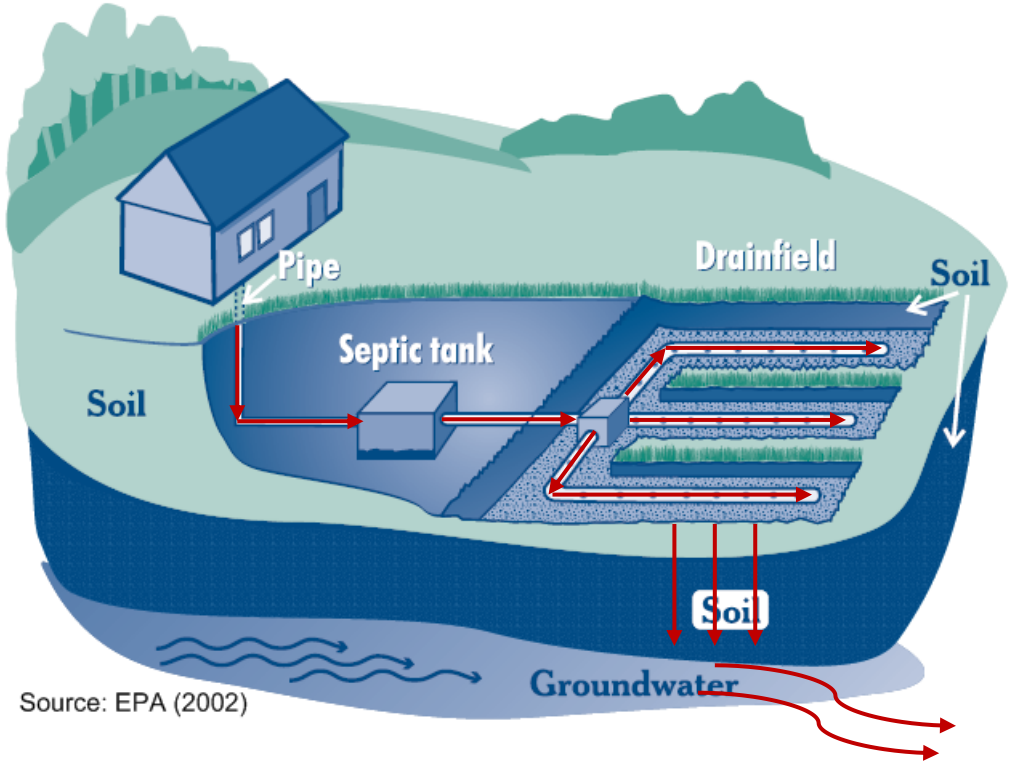
OSTDS introduction



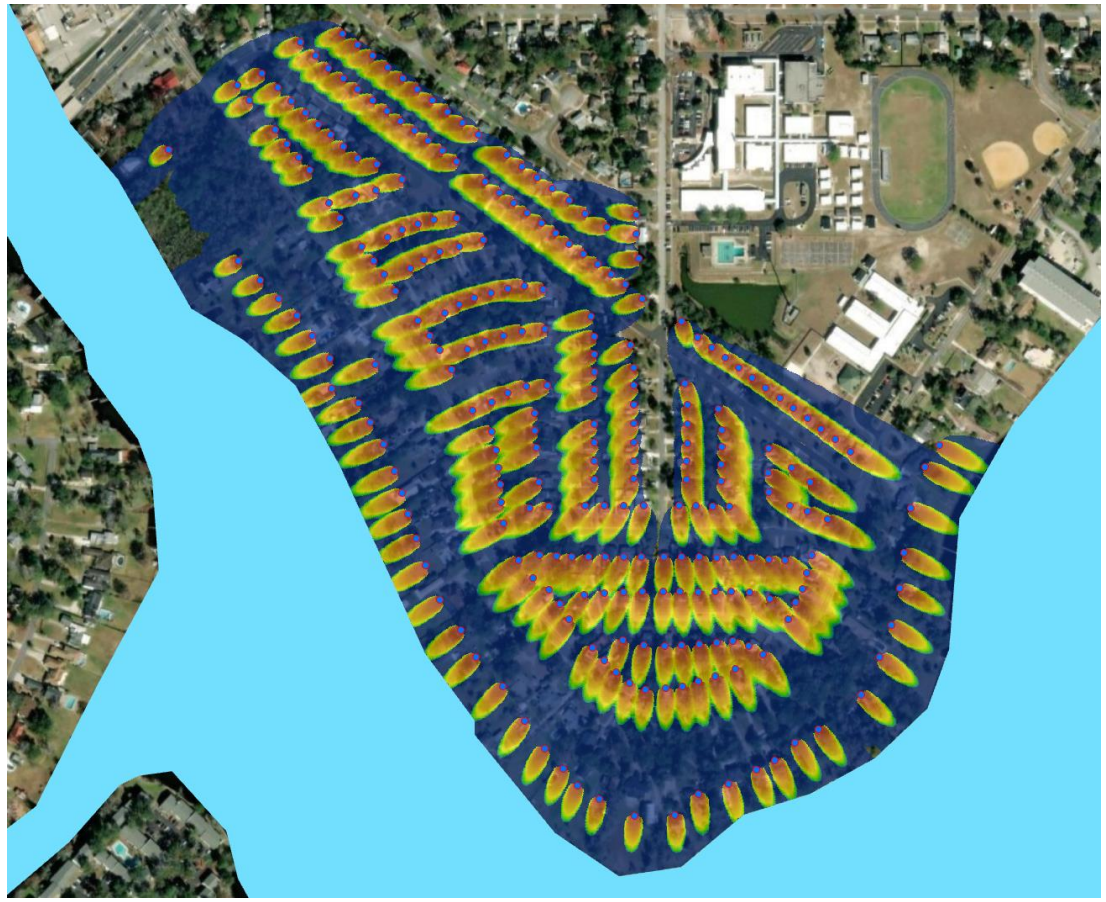
Source: EPA (2002)

- OSTDS (Onsite Sewage Treatment and Disposal Systems) are currently used by over 20% of the U.S. population (EPA).
- Wastewater treated with OSTDS is considered as the second largest source of groundwater nitrogen contamination in Florida (De and Toor, 2016).

- ArcNLET is developed to estimate OSTDS nutrient load to groundwater and surface water

ArcNLET introduction

- ArcNLET, an ArcGIS-based Nutrient Load Estimation Toolbox.
- The development of ArcNLET lasts more than 10 years by Dr. Ye, Dr. Rios, Dr. Wang, Dr. Zhu, and others.
- Since 2023, we have developed a new version called ArcNLET-Py, which is rewritten in Python and coupled into ArcGIS Pro.



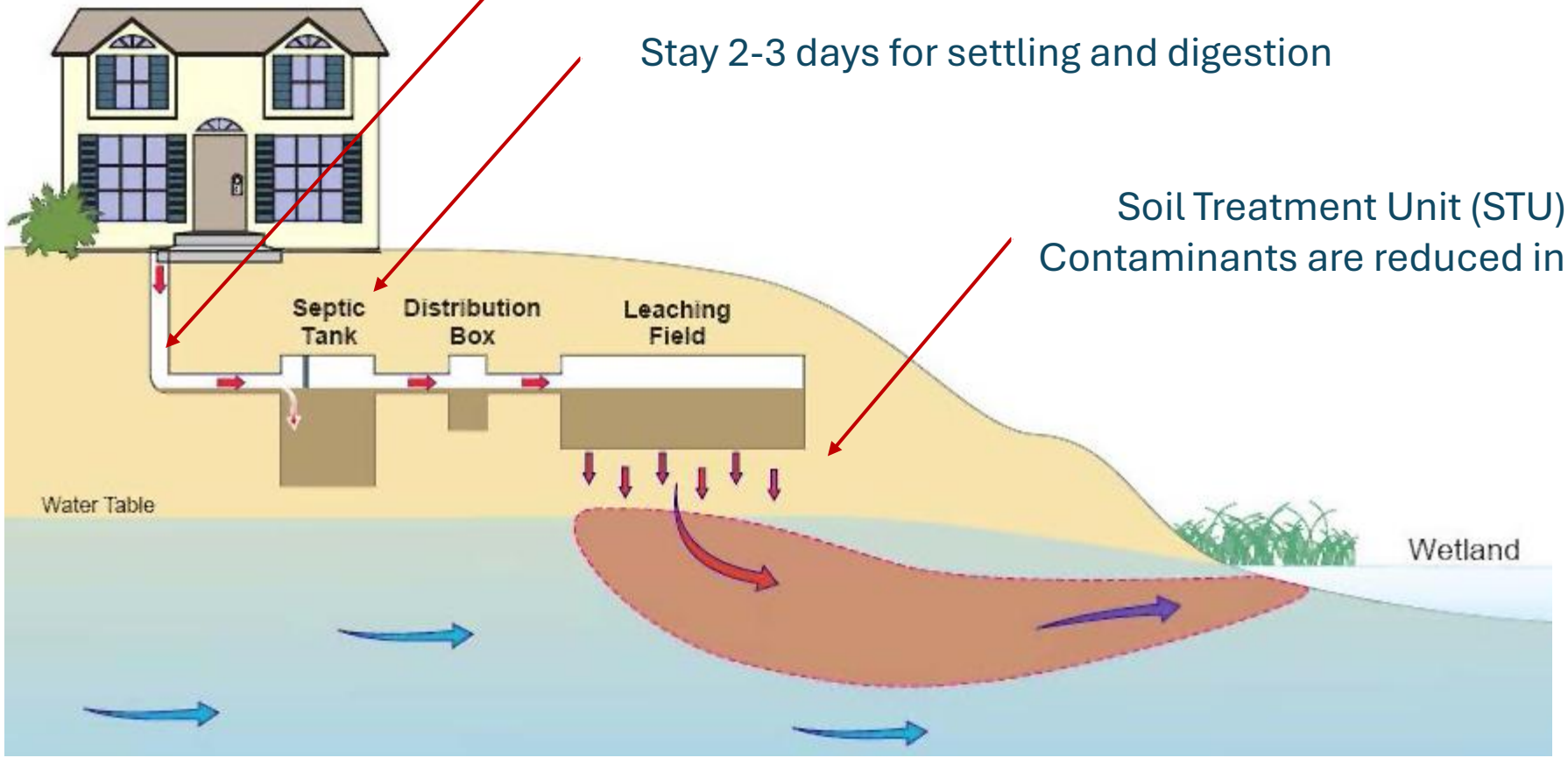
Concepts

Steady-state assumption

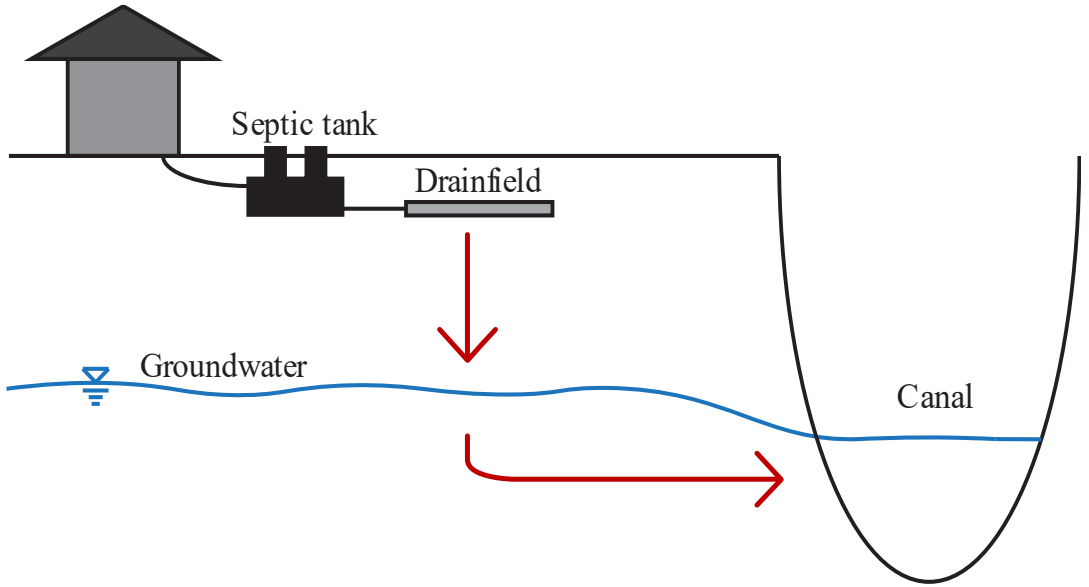
Wastewater containing nitrogen, phosphorus, and other substances

Stay 2-3 days for settling and digestion

Soil Treatment Unit (STU)
Contaminants are reduced in STU



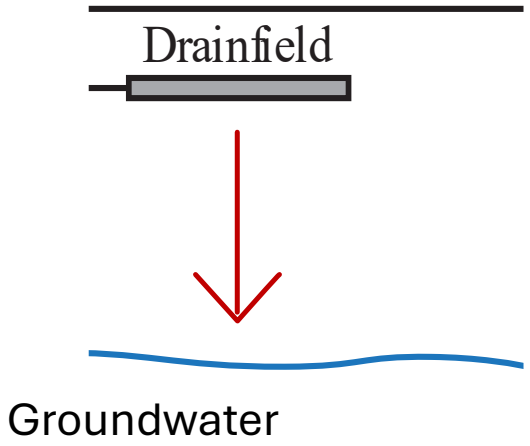
Conceptual model



Vadose zone
- Soil water movement
- Pollutant reactive transport

Groundwater
- Groundwater movement
- Pollutant reactive transport

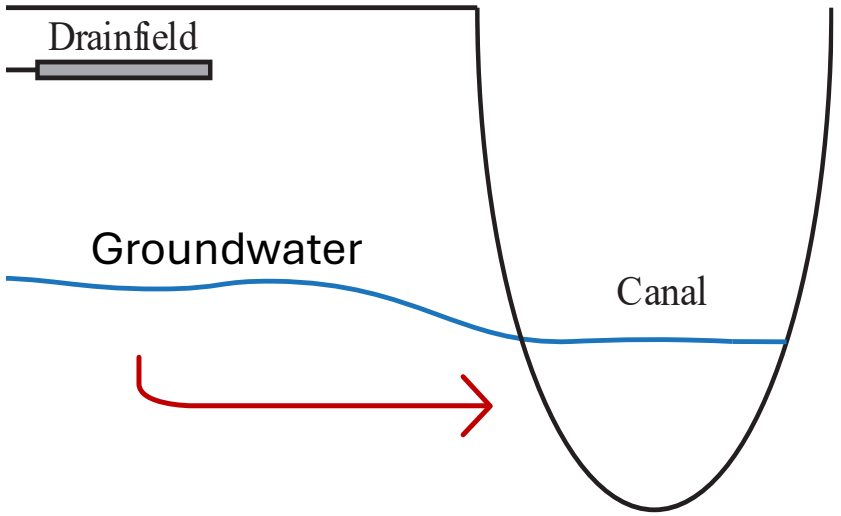
Conceptual model



Vadose zone

- The water flow and solute transport are simulated one dimensional (vertical) in the vadose zone.
- Soil water movement is solved by Richards' equation.
- Pollutant reactive transport is solved by advection-dispersion equation.

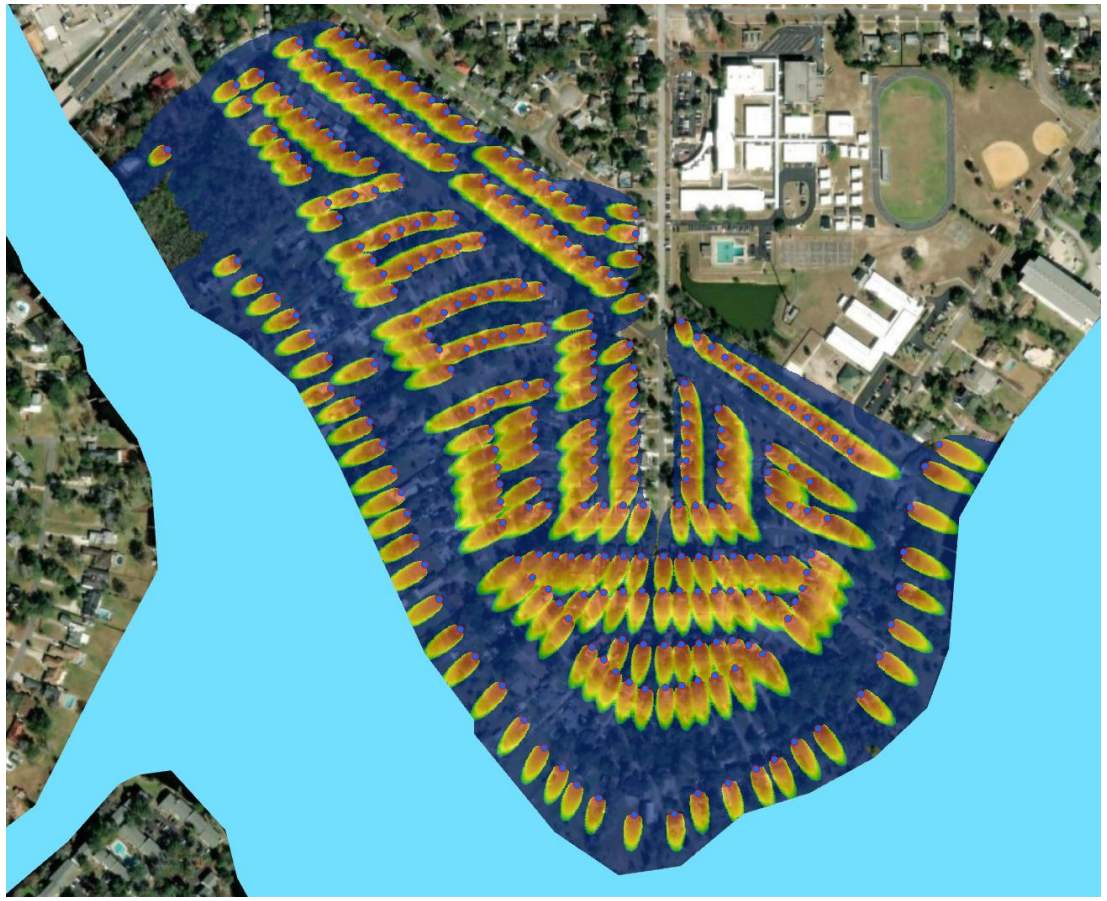
Conceptual model



Groundwater

- The water flow and solute transport are simulated 2-dimensional (horizontal) in groundwater.
- Groundwater table is assumed to be a subdued replica of topography.
- Pollutant reactive transport is solved by advection-dispersion equation.

Spatial variability



- The model is developed within ArcGIS Pro Python environment and is naturally well-suited for regional scale cases with multiple OSTDS.

1.3 ArcNLET-Py resources

- Source code on GitHub and online User's manual:

  https://github.com/ArcNLET-Py/ArcNLET-Py

- Training videos on YouTube:

  https://www.youtube.com/@mingye9168/videos
  https://www.youtube.com/@ArcNLET/videos

- FSU Website:

  https://atmos.eoas.fsu.edu/~mye/ArcNLET/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Thank you!