Evaluation of green infrastructure using hydrologic modeling and high performance computing

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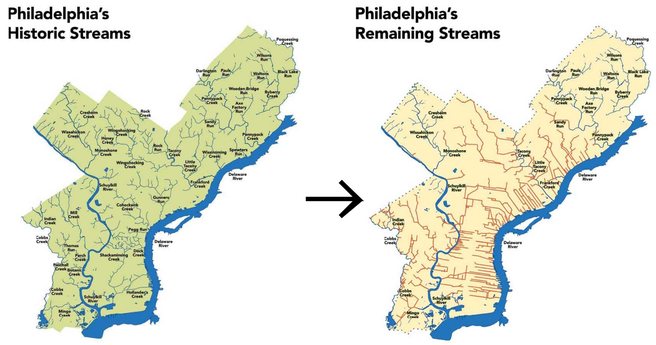
1. Objective

- To develop a coupled groundwater-surface water model to evaluate the impacts of green infrastructure on groundwater resources in Philadelphia.

2. Background

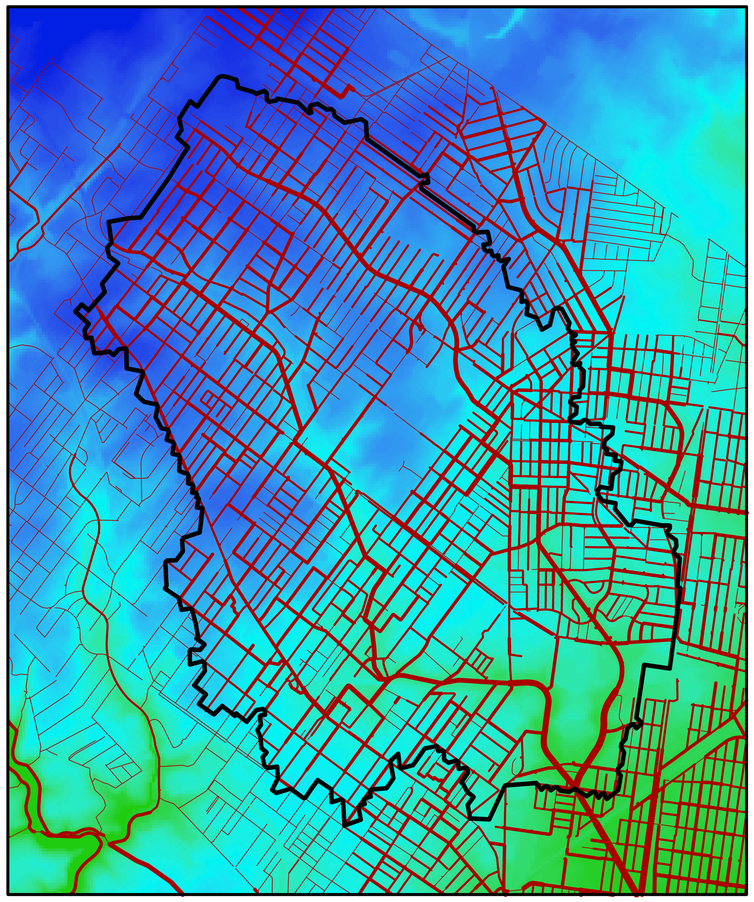
- 60% of the City of Philadelphia's sanitary sewer system is served by combined sewers.
- The City has commited to reducing the number of combined sewer overflows by installing green infrastructure to promote infiltration.
- The City's goal is to replace 40% of its impervious surface area.
- Most of the City's streams have been piped and integrated into the combined sewer system.



(Philadelphia Water Department)

3. Area of Interest

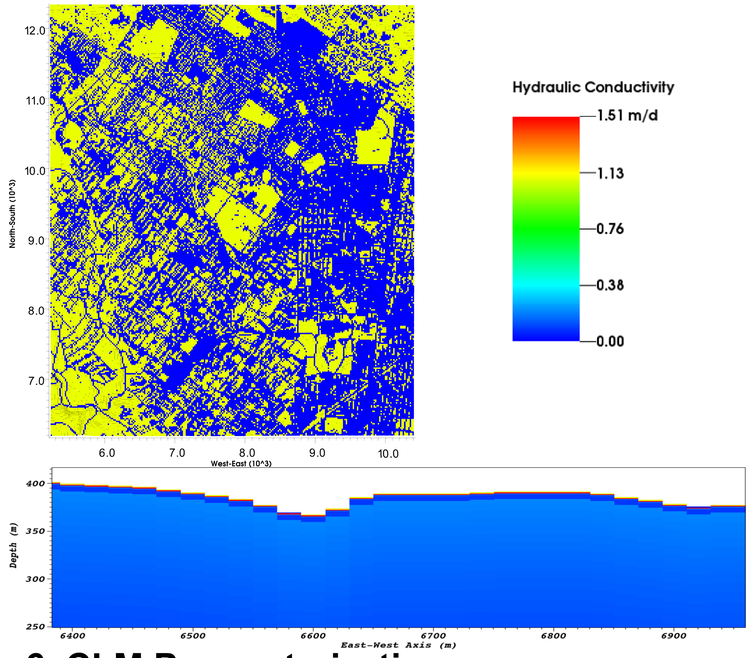
- A 32-km^2 area that contains 13.5-km^2 sewershed
- Encompasses historic Wingohocking Creek at Germantown
- Contains 43 planned and implemented GI facilities
- Located in the Piedmont physiographic province



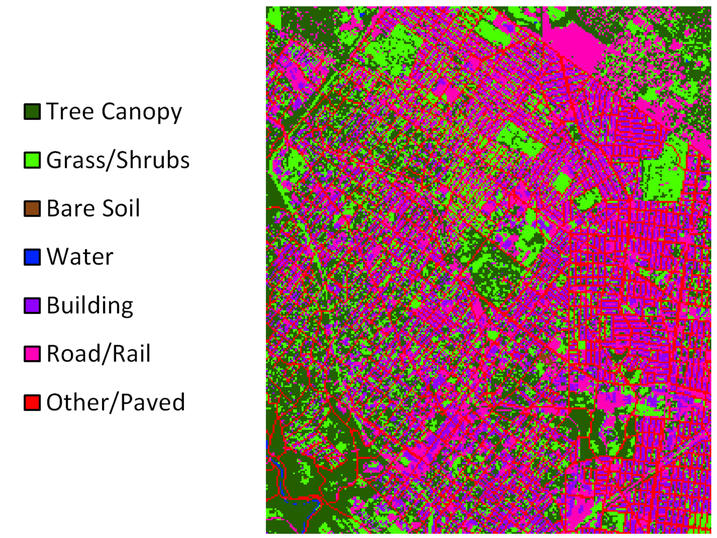
4. Model Development

- Using Parflow-CLM, a 3D integrated land-atmosphere-surface-subsurface hydrologic model
- 40 m x 40 m x 1 m grid resolution; 4 million model cells
- Used a resampled Digital Elevation Model from PA; City of Philadelphia LiDAR Project Spring 2010
- Burned DEM at the locations of the sewer pipes, provided by Philadelphia Water Department
- Used a mosaic of land cover data from City of Philadelphia, Delaware River Basin Commission and National Land Cover Database
- Assigned literature hydraulic conductivity values to surface and subsurface layers
  - Surface: Pervious vs impervious
  - Surface: Soil-saprolite-fractured bedrock system

5. Hydraulic Conductivity



6. CLM Parameterization



7. Achievements and Future Goals

- The model was spun up and run using meterological forcing from January 2004 to February 2015.
- Future work includes:
  (1) Running the model with and without GIs and
  (2) Evaluating impacts on subsurface flow paths and travel times.