UNRBA Modeling and Regulatory Support

Year 2 Kickoff Meeting

WARMF Data Presentation

October 25, 2017

Brown AND Caldwell

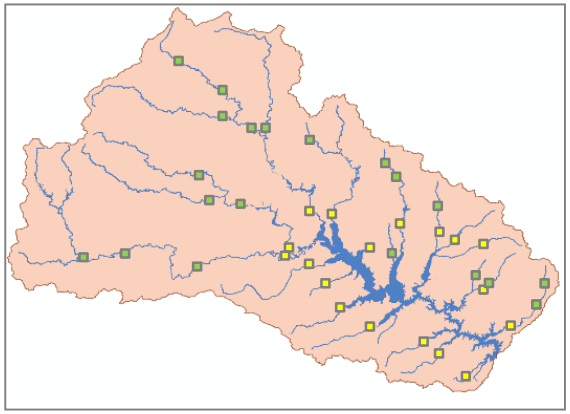
SYSTECH WATER RESOURCES

Dynamic Solutions LLC

Watershed Modeling Overview

Existing Falls Lake Watershed Model

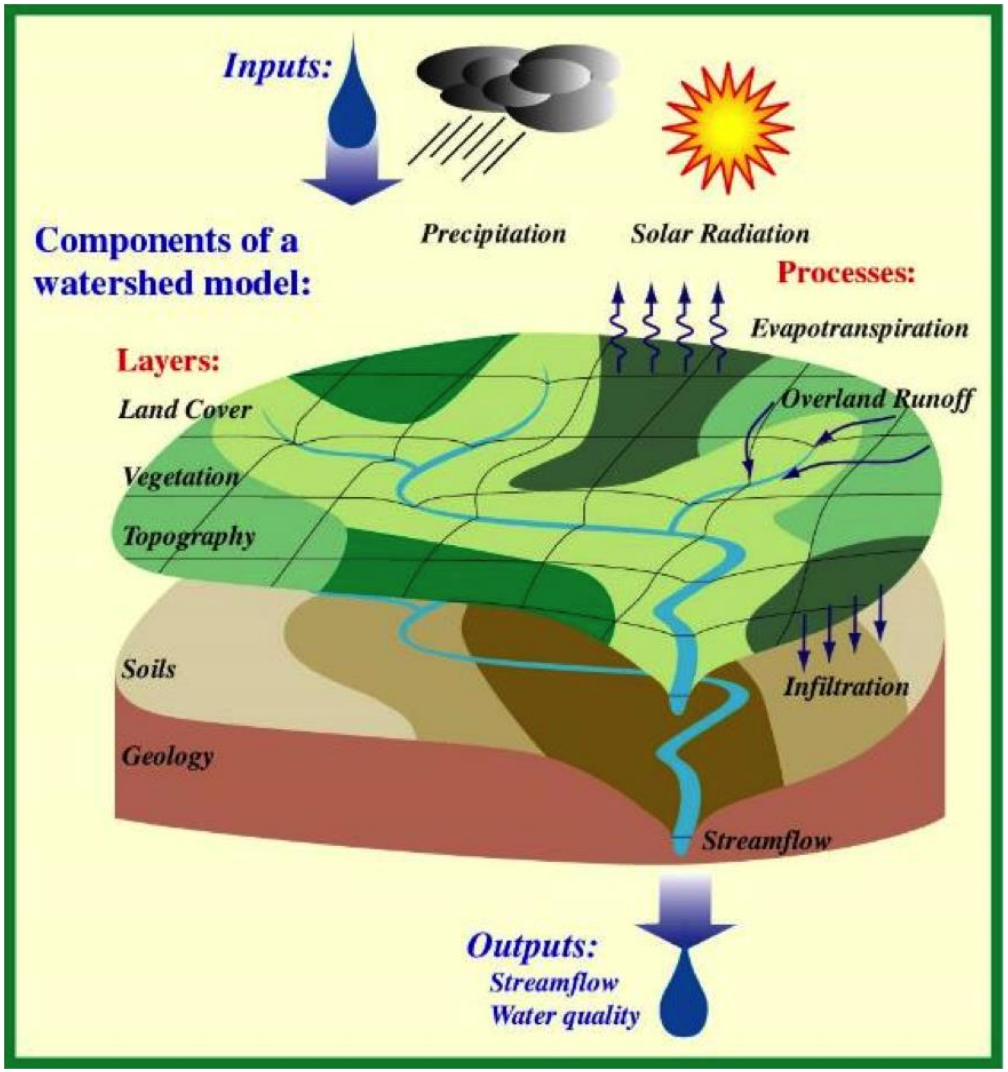
- In 2009, DWR developed a watershed model using WARMF
- Additional data have been collected
  - Routine water quality monitoring at 38 stations since August 2014
  - Storm event and high flow sampling
- Need data and information to build the watershed model
- The UNRBA has begun its process to acquire local data



UNRBA Watershed Monitoring Stations

How Watershed Models Work

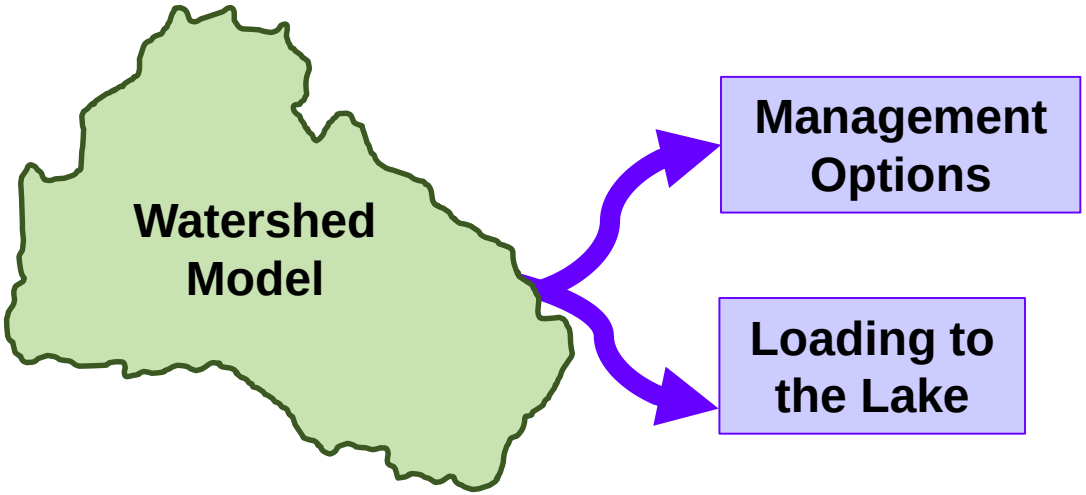
- Mathematical representation of watershed processes
- Inputs: Model forcing
- Catchment processes
- Stream/reservoir processes
- Model output



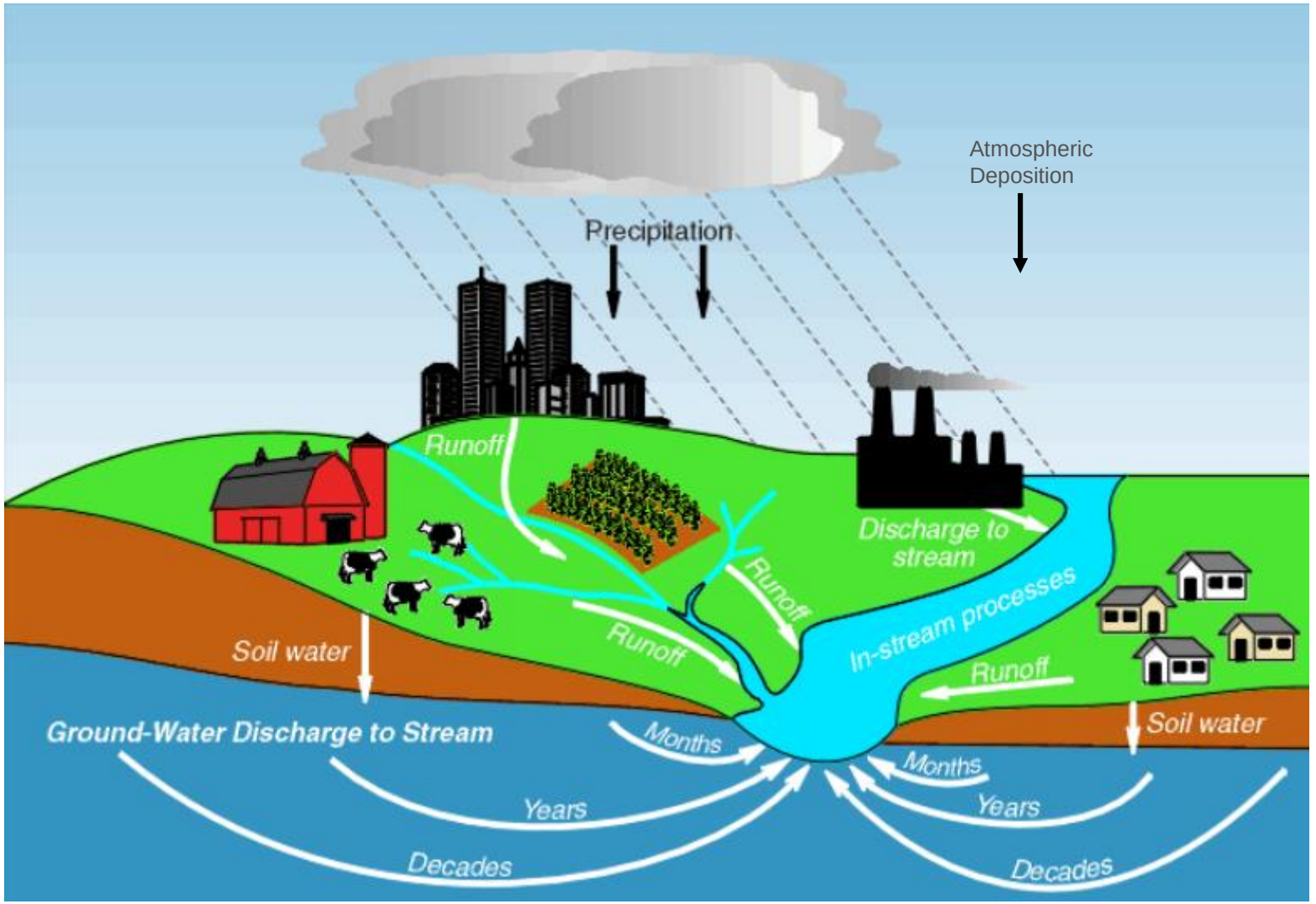
https://scwrs.files.wordpress.com/2016/04/model-components.png

Goals of Watershed Modeling

- Identify major sources contributing loads going to the lake
- Simulate loads to the lake to drive the lake water quality model
- Predict how management activities affect loading
- Provide information for the cost benefit analyses

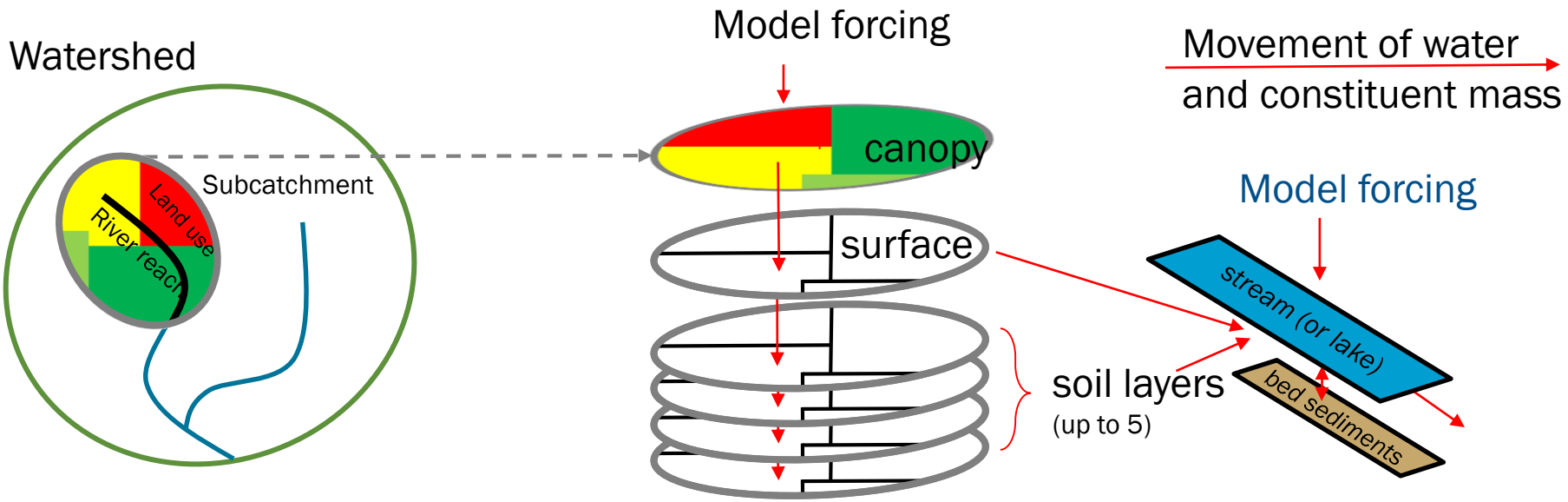


Sources of Loading



https://pubs.usgs.gov/fs/fs15099/

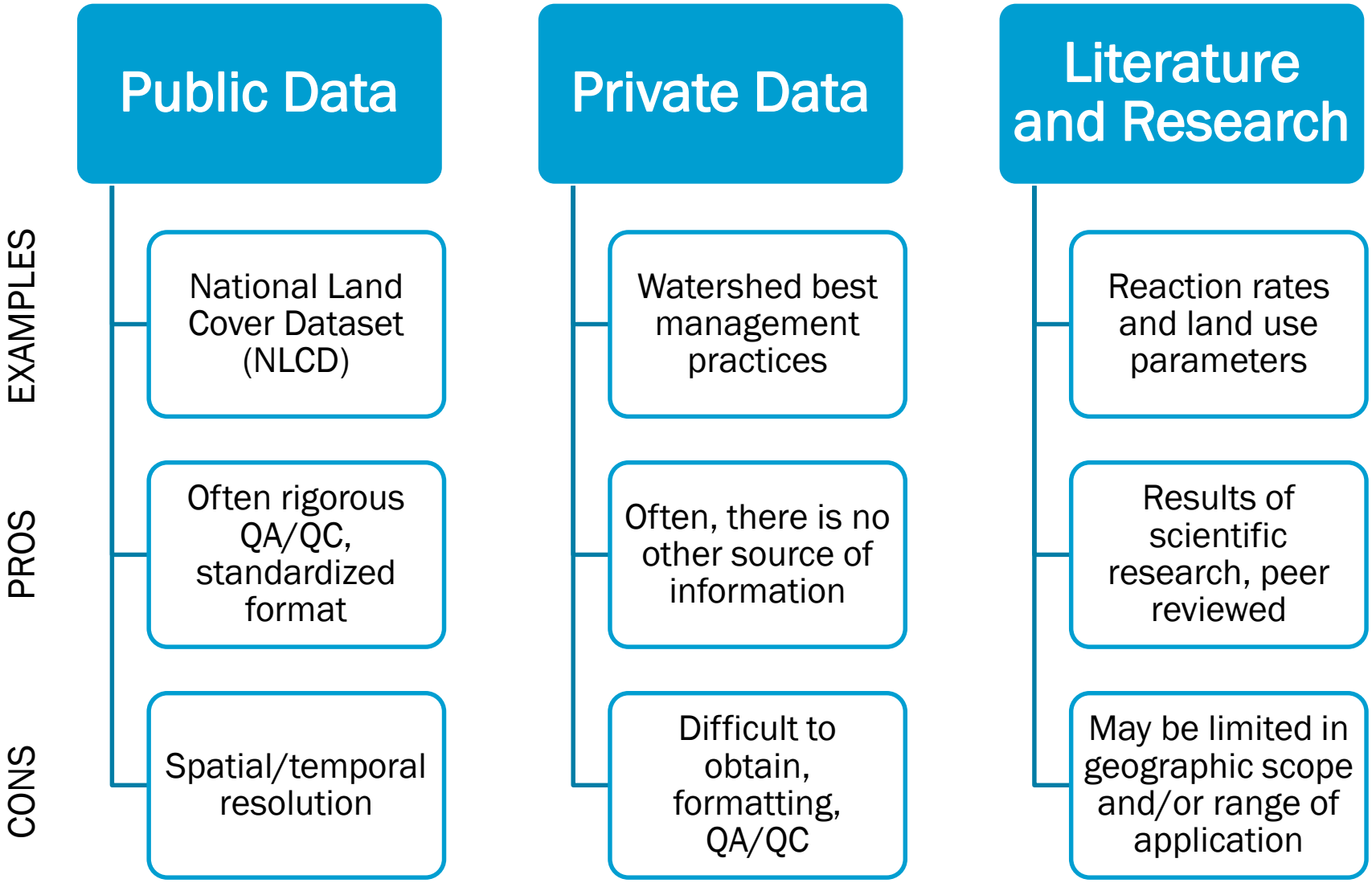
How WARMF Handles Loading Sources



- For finer spatial resolution → delineate more subcatchments and/or rivers

- Each component (e.g. river, soil layer) is simulated as a CSTR
- Completely mixed within each time step
- Time steps from 24 hours down to 1 minute

Data Sources



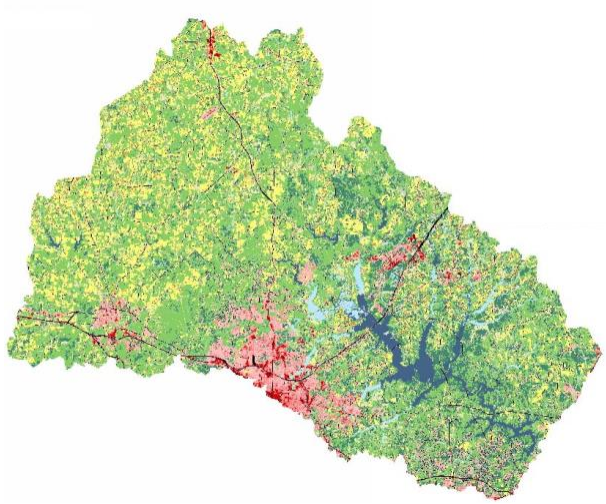
Spatial Data for the Watershed Model

Topographic Data

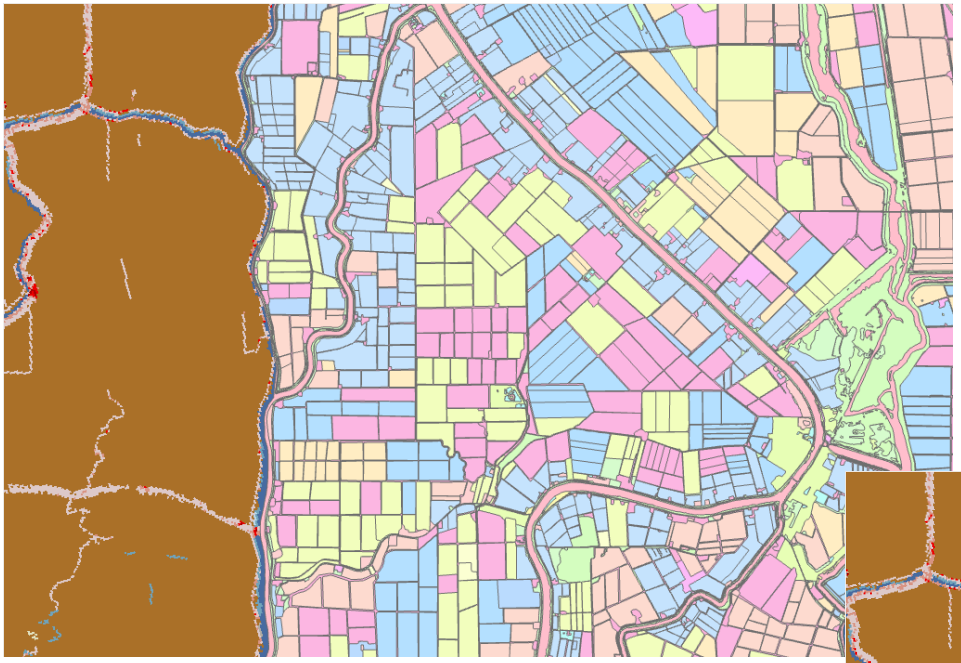
- Examples:
  - Digital elevation models (DEM)
  - LIDAR
- Sources:
  - USGS
  - Local governments
  - State agencies
- Purpose:
  - Delineate the watershed and river network
  - Provide:
    - Catchment and stream slope
    - Catchment aspect

Land Use Data

- Sources: USGS, state agencies, local governments, researchers, agricultural representatives
- Purpose: Differentiate how land uses and land covers affect
  - Hydrologic response
  - Soil detachment
  - Vegetative processes
  - Management practices
- Note: Greater number of land uses may provide more detail, but information on the hydrologic response of each land use is required

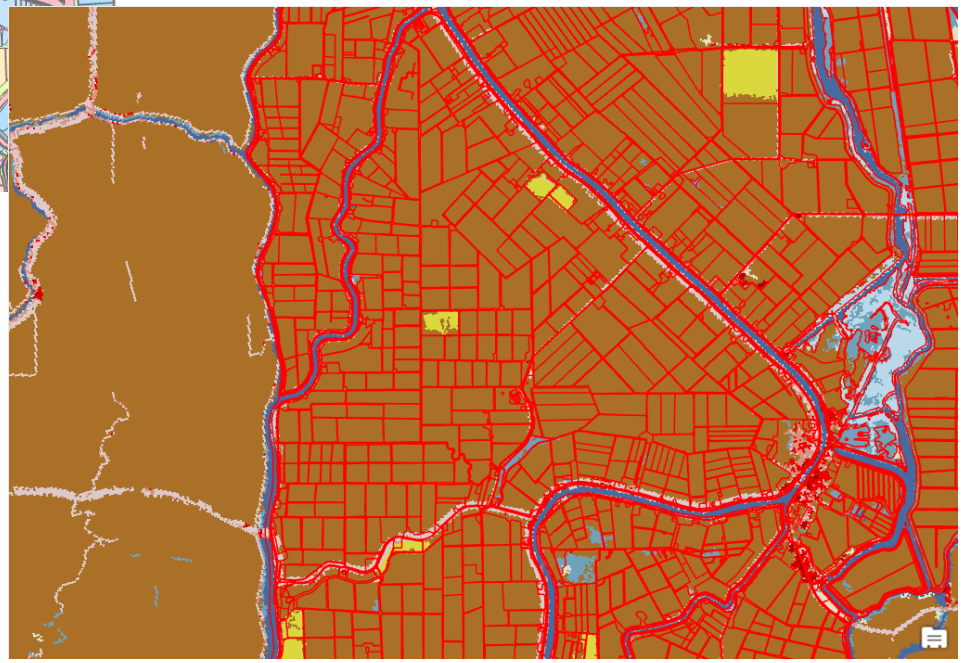


Land Use Data



Differences:

- Level of detail
- Specificity of land use classification
- Data type (grid vs polygon)



Choose carefully!!

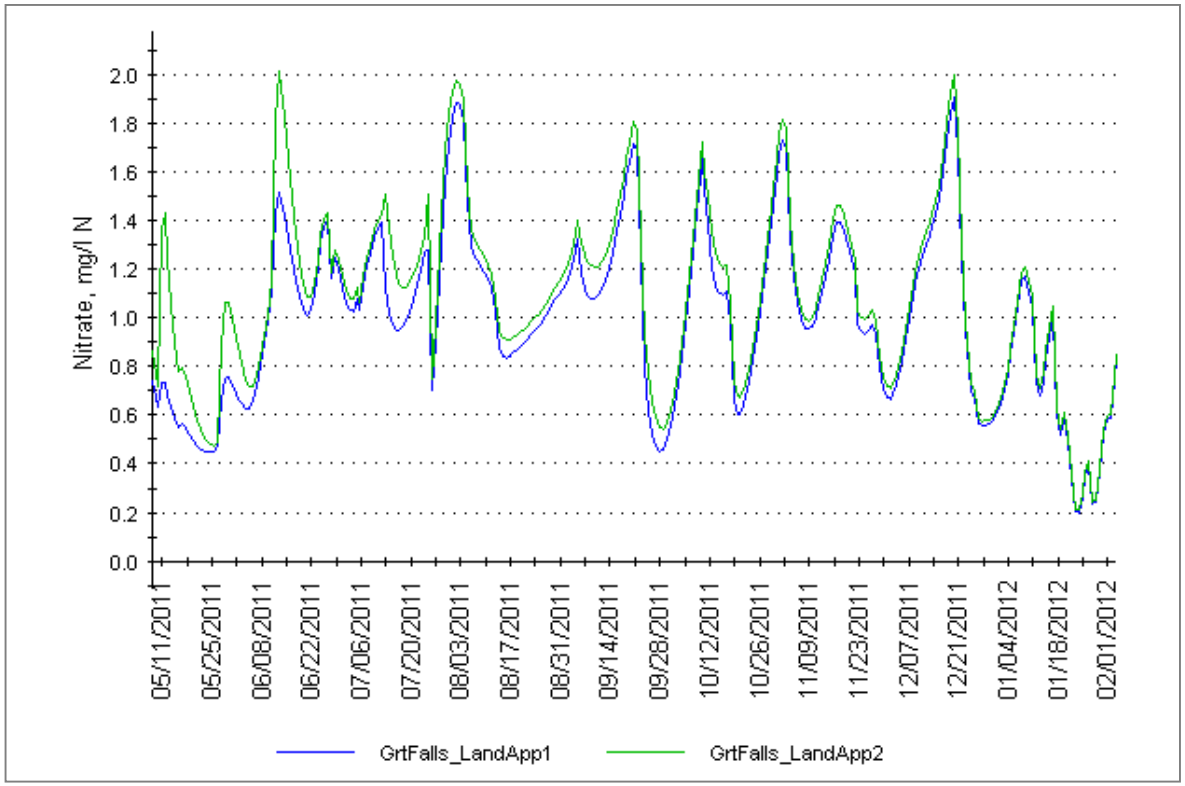
Added complexity does not always lead to added accuracy…

Land Application of Nutrients

- Examples: fertilizer, manure, and biosolids composition and application rates
- Source: USDA, state agencies, local governments, researchers, agricultural representatives, literature
- Purpose: Quantify the loads applied to each land use by month
- Values can vary spatially across the watershed, or can be uniform, based on available data
- WARMF also accounts for nutrient uptake by plants

Land Application of Nutrients

- Useful information that affects model simulations
  - Application rates (load/area/time)
  - Timing of application
  - composition
  - Timing of harvest



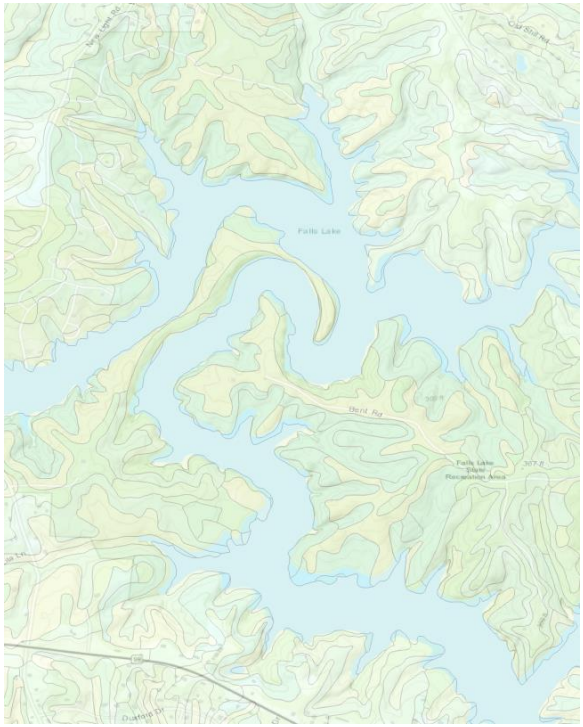
Water Withdrawal/Irrigation

- Examples:
  - Water can be removed from a water source
  - Water can be applied to a land use as irrigation water
  - Interbasin transfers can also be simulated
- Sources: Local governments, utilities, agricultural representatives, hydrologic models

Source: City of Durham Teer Quarry

Soils

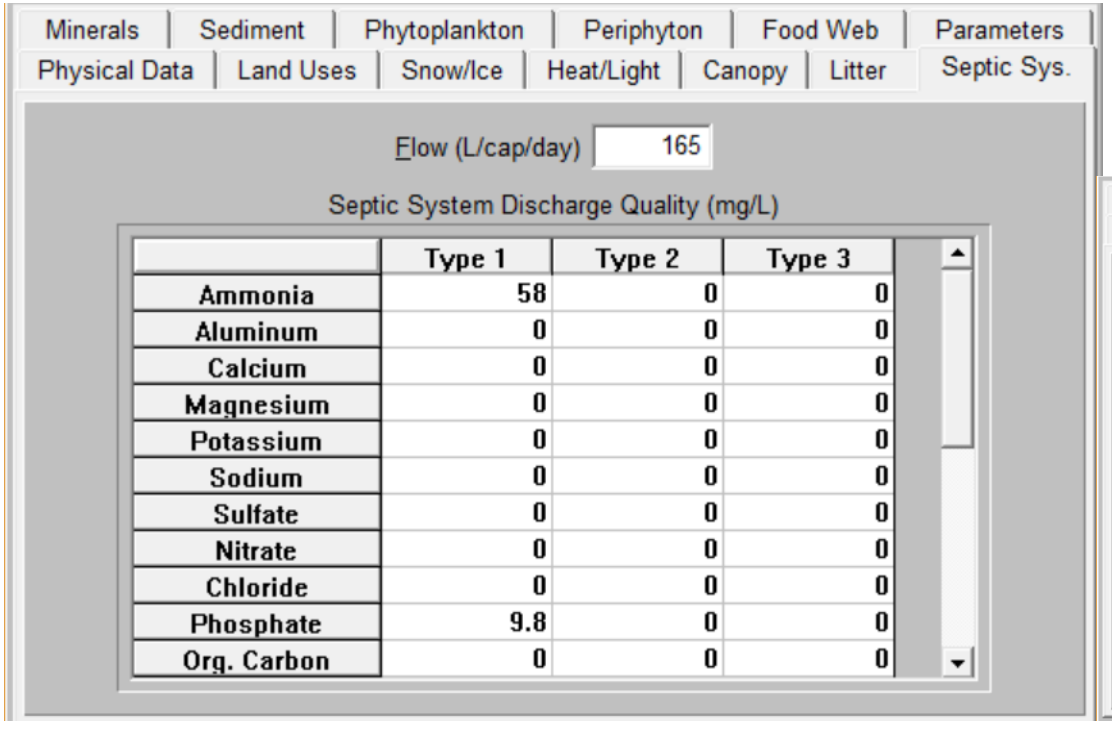
- Sources: NRCS, agricultural representatives, researchers, local governments
- Purpose: describe soil erosivity, soil fractions, **chemistry**, infiltration rates
- Key hydrology parameters:
  - Hydrologic soil group
  - Depth to bedrock
  - Drainage class
  - Hydric classification
- Most of this data is publicly available
- Additional soil chemistry data would be helpful

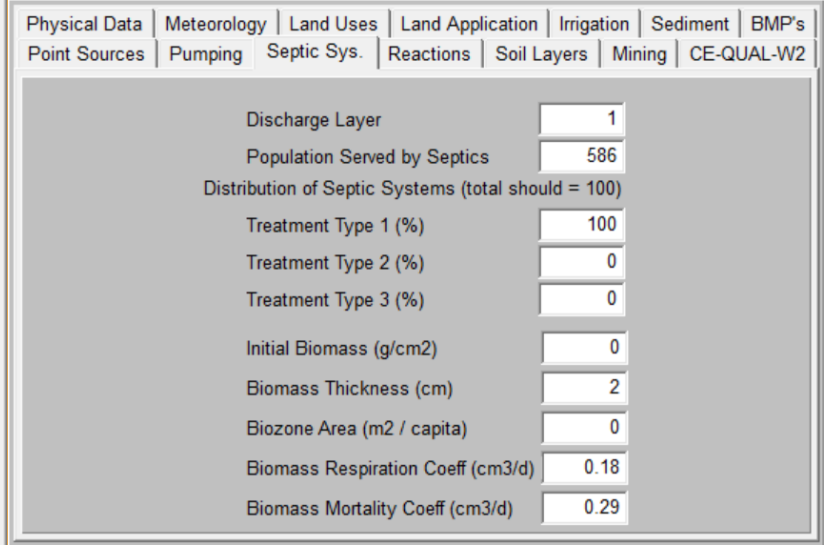


Soil mapping units in the Falls Lake watershed

Onsite Wastewater (Septic) Systems

- Source: Local governments, state agencies, census data/drinking water well correlations
- Information: Location, density, failure rates, complaints
- Alternative to local data: Assumptions, US Census (1990)





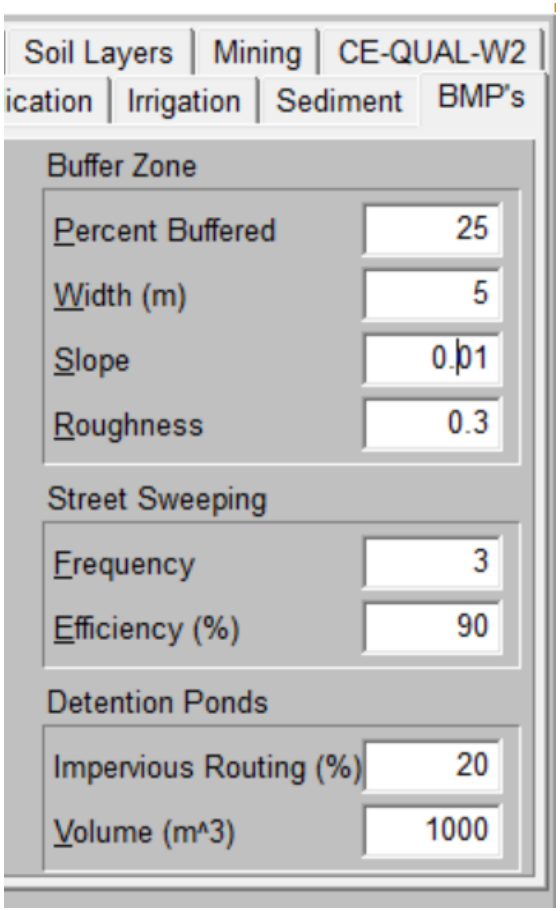
Animal Operations

- Examples: Horses, kennels, livestock operations
- Source: State agencies, agricultural representatives, USDA, local governments
- Information: location, type, number of animals, permits
- Practices: waste management, carcass disposal

Source: Scott Eaton, Kings Mountain NC

Best Management Practices

- Attenuate pollutant loads
- Examples:
  - Livestock exclusion
  - Buffer zones
  - Street sweeping
  - Detention ponds
- Sources of information:
  - Local governments
  - Agricultural representatives
  - Agencies
  - Large land owners



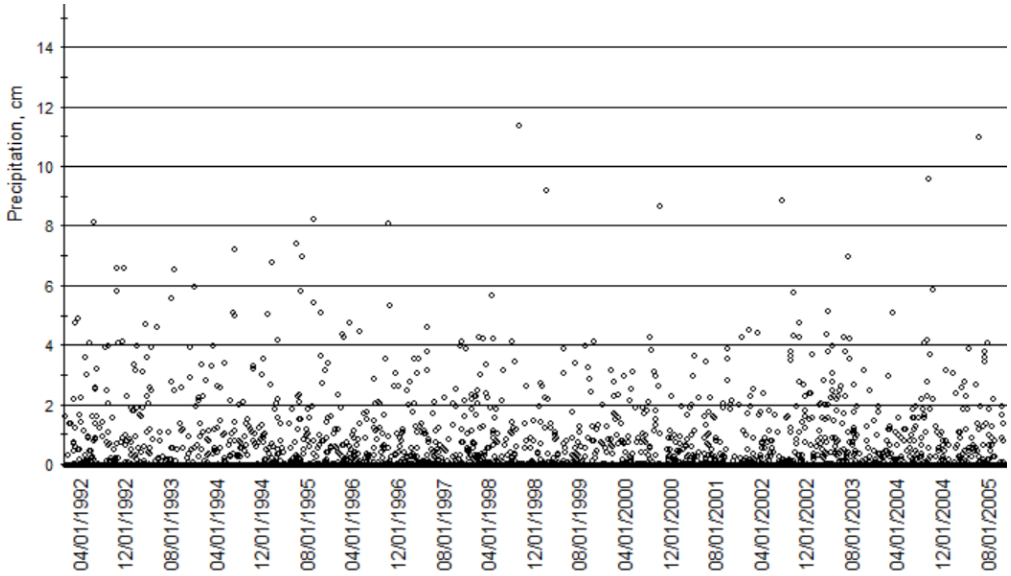
Time Series Data

Time Series Data

- Specifies inputs to the model that vary with time or provides data to compare model output
- Examples of data include meteorology, air quality, point sources, managed flow, hydrology, and observed water quality
- Data are entered into WARMF in spreadsheet format

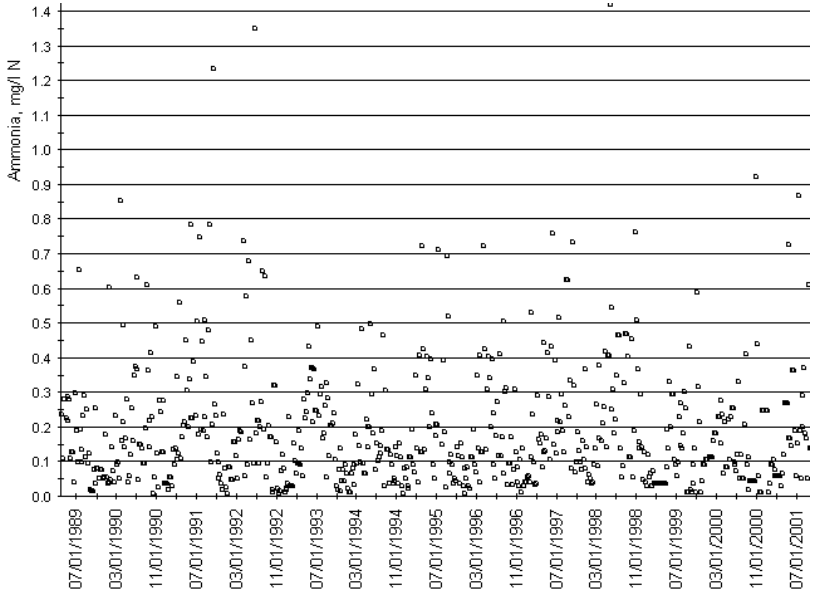
Sources of Meteorology Data

- NOAA National Climatic Data Center (NCDC)
- NOAA North American Land Data Assimilation System (NLDAS)
- NC Climate Retrieval and Observations Network of the Southeast (CRONOS) database
- USGS National Water Information System (NWIS)
- Local data



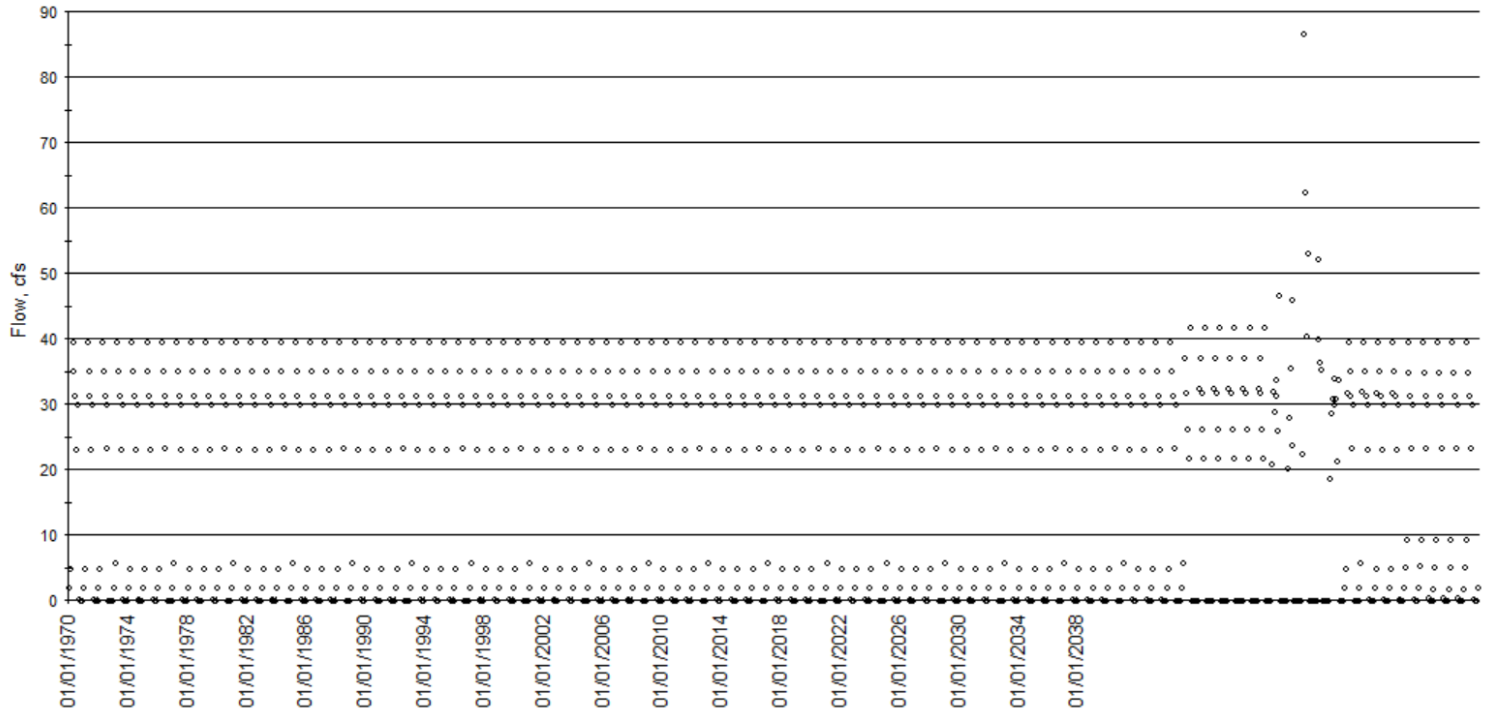
Sources of Air Quality Data

- National Atmospheric Deposition Program (NADP)
- Clean Air Status and Trends Network (CASTNET)
- Community Multi-Scale Air Quality (CMAQ) Modeling System for Air Quality Management
- City of Durham Atmospheric Deposition Monitoring Study
- Research



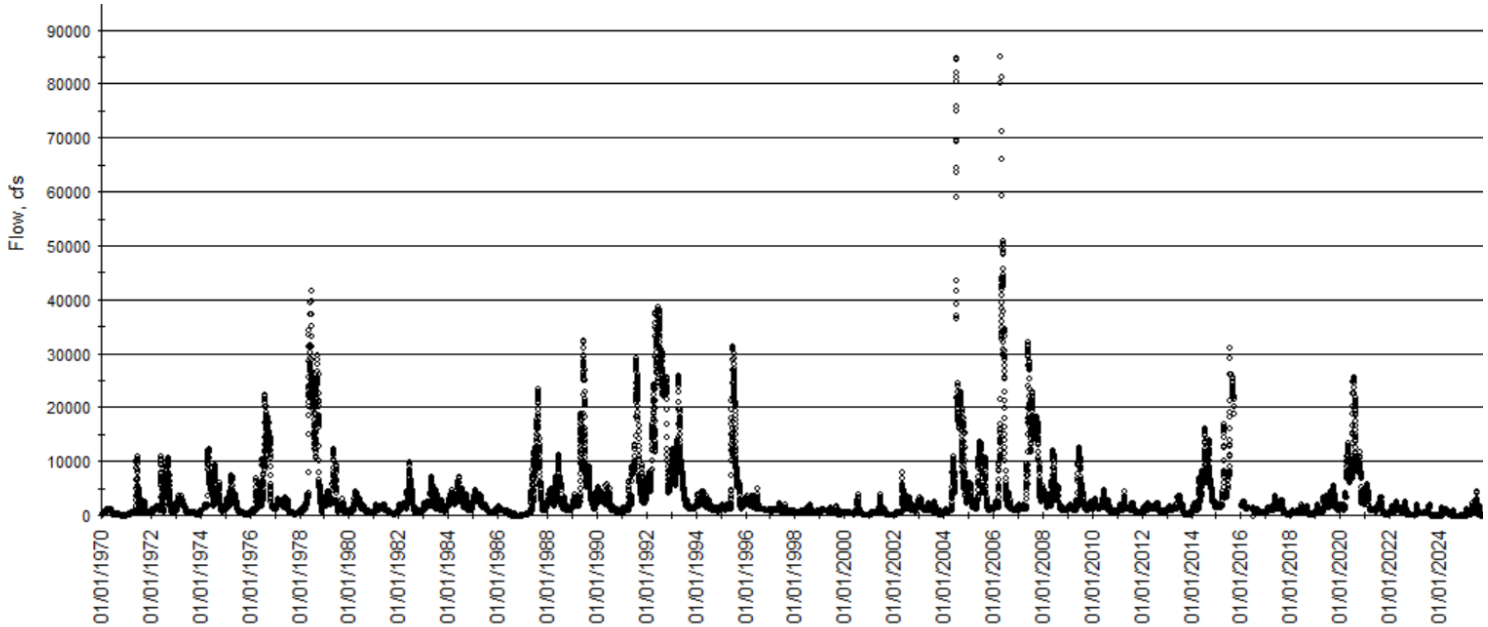
Sources of Point Source Data

- EPA Pollution Control System (PCS) Database
- DEQ Database
- Dischargers' Records



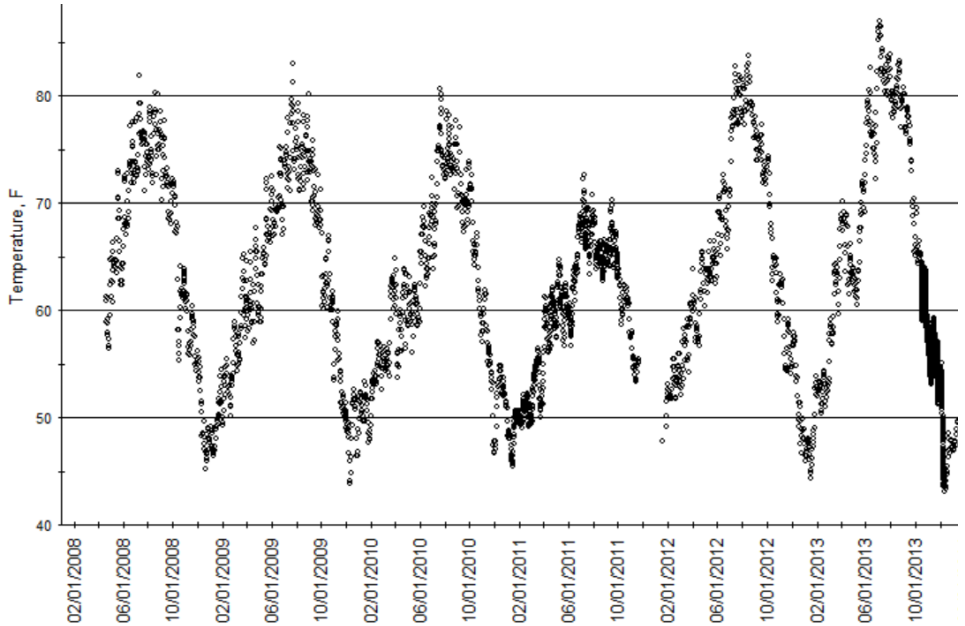
Sources of Hydrology and Managed Flow Data

- USGS gages
- US Army Corp of Engineers
- Operators of reservoir release structures



Sources of Water Quality Data

- UNRBA Monitoring Program and individual members
- Federal and state agencies (e.g., USGS, DEQ, EPA)
- Universities and researchers (e.g., Center for Applied Aquatic Ecology)
- Dischargers/utilities



UNRBA Data Acquisition to Support Modeling

October 2017

UNRBA Process for Acquiring Local Data

- Distributed Data Acquisition Form on 10/17/2017
  - Please return forms 11/8/2017
- UNRBA will provide instructions for data transmittal to organizations that indicate ownership of data
  - Please submit data by the end of 2017

Small Group Session

- What obstacles are you facing or do you anticipate regarding getting the requested data sets to the UNRBA in a timely manner?
- What advice can people at the table provide that will help the others overcome those obstacles?
- What help would you like from UNRBA or others, as follow-up to this meeting, to help you in getting the requested data sets to the UNRBA in a timely manner?
- What are the concerns about use of the data?
- Do you have any lessons learned from similar projects where these types of data were used?