Overview
- Basic watershed water quality.
- What are water quality models?
- Why are they needed?
- How are they used?
- Types of water quality models.

Water Quality Parameters
- pH
- Total Suspended Solids (TSS)
- Temperature
- Nutrients (N, P, Ammonium)
- Bacteria (e-coli)
- Algae

What are water quality models?
- Water quality models are mathematical representation or approximations of real-world conditions.
- Mathematical tools/equations to study:
  - Transportation
  - Distribution
  - Chemical Reaction
  - Ecological Impact of sediments and chemicals on water quality

Why do we need models?
- Sampling and monitoring is very costly
  - It is unrealistic to sample and monitor each field or stream segment in a large-watershed.
- To understand and learn from the events of past and plan for the future
  - Protection and sustainable use of water resources.
- To evaluate how changes in watershed, stream or reservoir characteristics change water quality
  - Assist in improving or preventing water quality problems.
How are these models used?

- **Status**: assess environmental conditions and reporting
- **Trend**: evaluate historical change
- **Prediction**: evaluate impact as a result of change
- **Decisions**: evaluate alternative management plans

Status

- What is the background (natural) loading from the watershed?
  - Important especially for TMDL’s
- Identifying and quantifying sources of pollution
  - What is the contribution of non-point and point sources?

Trend

- Is there long-term accumulation of chemicals and nutrients in the watershed?
  - Natural degradation slower than accumulation or loading rate to the water body?
- Has the sediment or nutrient loading rate increased due to changes in climatic patterns (Dry and wet year cycles)?

Prediction

- Can the water quality be maintained 50 years from now with projected population growth?
- What is the impact of additional Waste Water Treatment Plant at a particular location in the watershed?
- What is the impact of land use change on water quality?

Decision

- What is the impact of management practices?
  - Converting pasture lands into improved pasture lands
  - Crop rotation and nutrient management practices
  - Urban sprawl, street cleaning, lawn fertilization improved sewage treatment etc.,
- Environmental laws and policies
  - E.g. Impact of Clean Water Act

Types of water quality models

- Watershed water quality
- Stream water quality
- Reservoir water quality
- Ground Water Quality (MODFLOW)
- Field-scale Vs Watershed-scale
Watershed Water Quality Models
- Overland processes (SWAT)
- HSPF
- Others

Stream Water Quality Models
- Channel processes - River/In-Stream Water Quality (Qual2E, QualTX)
- HSPF
- Others

Reservoir Water Quality Models
- Lake Processes - Lake water quality (WASP)
- Bathtub
- CE-Qual-W2
- Others

Questions?