1. Background

- The NYC water supply system supplies 1.1 BGD to over 9 million people. To meet the challenges of operating this 19-reservoir, unfiltered water supply system, NYCEP is developing the Operations Support Tool.
- OST is a decision support system that integrates near-real time data and ensemble inflow forecasts with reservoir system operating rules and simulation modeling.
- OST allows system managers to conduct look-ahead simulations to support near-real time reservoir operations decisions. These simulations provide a robust probabilistic assessment of near term water quality conditions, as well as storage levels/drought risk over the coming year.
- OST also provides a platform for long-term supply planning analyses and development of efficient system operating rules that balance competing objectives:
  - Drought Planning
  - Operating costs
  - Drinking Water Quality
  - Flood Control
  - Ecological Flows
  - Climate Assessment

2. System Operations Model

- At the core of OST is an OASIS (HydroLogics, Inc) model that simulates daily reservoir system operations throughout the NYC water supply system and the Delaware River Basin – including all reservoir diversion and release decisions.
- The OASIS model is dynamically linked to CE-QUAL-W2 water quality models of key reservoirs to simulate temperature and turbidity levels and support water-quality-based operational decisions. This linkage accounts for the feedback between reservoir operations and water quality, thus allowing for explicit simulation of water-quality based operations decisions.

3. Operations Support Tool

- OST integrates near-real time data and hydrologic forecasts with powerful look-ahead simulation modeling.
- Automated acquisition of near-real time hydrologic, meteorologic, operations data
- In-reservoir water quality profiling
- Automated and human-approved data QA-QC checks with full audit trail
- Model simulations initialized with today’s flows and elevations
- Ensemble forecasts to assess drought risk
- Fast, daily timestep simulation (60 sec/year)
- Integrated visualization and animation tools

4. One Tool for Planning and Operations

- OST can execute long-term simulations driven by historical or synthetic inflows, or short-term look-ahead (“Position Analysis”) simulations driven by ensemble inflow forecasts.
- Using the same underlying model and operating rules ensures that planning analyses are based on realistic operations, and reduces model maintenance requirements.

5. Ensemble Forecast Sources

- An ~80-member ensemble inflow forecast represents the expected range of potential reservoir inflows over the coming weeks and months.
- OST allows users to drive simulations with two types of ensemble forecasts:
  1. Statistical forecasts: These are based on historical inflow climatology conditioned on antecedent flows using the Hirsch method, an autoregressive lag-1 model that reflects the serial correlation in streamflows.
  2. Meteorological forecasts: These are based on predictions from the National Weather Service Hydrologic Ensemble Forecast Service (HEFS). HEFS forecasts are derived from climate and rainfall-runoff models, and offer greater near-term forecast skill than the Hirsch forecasts.
- OST provides system managers with the analytical tools necessary to quickly characterize system status and performance over the coming weeks and months.

6. OST for Near Real Time Operations

- For each member of the inflow ensemble, OST conducts a simulation for the entire system, starting at today’s storage levels. Operational simulations typically cover a horizon of 1–12 months. Output is often aggregated based on percentiles and interpreted probabilistically (e.g. likelihood of drought, system refill, or meeting stream release targets).
- OST provides system managers with robust probabilistic basis for quantifying the performance of alternative reservoir operations decisions.