Long Term Control Plan (LTCP) Citywide Modeling Meeting
Summary of Meeting and Comments Received

On February 28, 2013 New York City Department of Environmental Protection (DEP) co-hosted the LTCP Citywide Modeling Meeting with the New York State Department of Environmental Conservation (DEC) to support the water quality evaluation efforts for DEP's combined sewer overflow (CSO) LTCP Program. The two hour event was held at the U.S. Custom House in lower Manhattan and included poster displays, presentations given by DEP and DEC staff and public question and answer sessions. Approximately 55 stakeholders representing over 30 different non-profit, community planning, environmental, economic development, governmental organizations and the general public attended the event. Below is a summary of the meeting and specific questions asked during the meeting and responses provided by DEP.

Welcome and Introductions

- Keith Mahoney (DEP) welcomed the audience and introduced the speakers. He noted DEP's long history of investment in wastewater treatment and sewer system infrastructure to reduce CSOs.

- Gary Kline (DEC) discussed the Amended Consent Order (ACO) between DEP and DEC, which was signed on March 8, 2012, and three important characteristics of the ACO:
    - The ACO has a set timetable for completion of LTCPs for control of CSOs in New York City's sewersheds, which have been grouped into 10 receiving waterbodies, all of which require a separate LTCP.
    - The ACO represents an agreement between EPA Region 2, the State and City on how best to approach the water quality endpoint, or final proposed condition, of the 10 receiving waterbodies impacted by CSOs.
    - The ACO allows integration of green infrastructure (GI) into DEP's LTCPs.

Long Term Control Plan Process

- Linda Allen (New England Interstate Water Pollution Control Commission) presented an overview of the regulatory requirements for CSO planning (slides 2 through 6). She outlined the process that DEP is required to follow and federal guidance used for the CSO control planning process. Finally, Linda discussed the water quality goals of each LTCP and the options available to achieve them in accordance with the Clean Water Act.

Mathematical Modeling for LTCP Alternatives Evaluations

- Sri Rangarajan (DEP) presented a brief overview of the components included in hydrologic and hydraulics land-based and receiving water-based mathematical models (slide 8). Sri then provided an overview of DEP's integrated modeling framework (slide 9) and presented details on DEP's watershed models (slides 10 through 24).
    - Details presented included the components and status of the InfoWorks models, which are used to develop flows and pollutant loads caused by CSOs and stormwater. The models have been developed over many years and were peer

reviewed by independent academics and practitioners. Finally, Sri presented the model sizes and characteristics (slides 11 through 14).

- Recent and ongoing (2012) model refinements were also presented (slides 15 through 19). Refinements include site-scale (localized) and area-wide data collected for calibration of the models. Updated satellite imagery is also being used to refine model parameters, including impervious and pervious surface areas, which helps to inform stormwater runoff calculations. Twenty site-scale upland monitoring sites were used to characterize detailed runoff flows in various types of land use areas. Radar rainfall data was also used to refine rainfall intensity for storm events.

- The new data and assessments were used to improve calibration of the InfoWorks models for various sewersheds. Calibration metrics, examples of results and example scatter plots with acceptable error bands for rain event volume, peak flow and water depth in the sewer were also presented (slides 20 through 24). Also, time series analyses for water depth and flow comparing measured data vs. model predictions were shown. Overall, calibrated model predictions appear to reasonably match observed measurements and DEC will review calibration results as LTCP planning and development continues.

Question and Answer Session #1

- What is measured for model calibration – both for quantity and quality?
  - *For quantity, model results are compared to depth, velocity and flow at different spatial scales. For quality, pathogens (fecal coliform and enterococci), dissolved oxygen, nutrients and toxics are measured at end-of-pipe to get representative values, or event mean concentrations, and are associated with flows.*

- Is the water table measured or accounted for in the modeling?
  - *Water table is accounted for by including the infiltration component of the flow in the sewers.*

- What is an acceptable margin of error for the model calibration?
  - *DEP uses international standards, which state that model results should be within +20% to -10% for flow volumes and +25% to -15% for flow rates when compared to measured data.*

- Since DEP has been improving the models over many years, has the margin of calibration error improved?
  - *The margin of calibration error has improved, since the increased speed of computers allow long term simulations using multiple rain events. This calibration process improves the number and accuracy of predictions over many different types of storms and over different spatial scales within a sewershed.*

- How accurate is the land use estimates as converted to impervious area from the Columbia University study?

- *DEP used an approximation procedure to calculate impervious area, but Columbia University estimates have improved this calculation significantly. In general, the research guidance on remote sensing data is within +/- 5%. DEP is currently testing this by comparing satellite estimates to actual ground-truthed values for a GI demonstration area.*

- How effective have the GI pilot projects been?
  - *We are evaluating the results of these GI pilots using post-construction monitoring in three demonstration projects (26th Ward, Newtown Creek and Hutchinson River), which will be compared to pre-construction monitoring data previously collected. Pilot projects have generally shown successful results in terms of managing one inch of stormwater from their catchment areas.*

- Do the models discharge coefficients or parameters change with larger storms or higher flows?
  - *In general, for larger storms, the pervious areas become saturated and then behave like impervious areas. This effect is included in the models.*

- What is the impact of tree canopy; how is it accounted for?
  - *Evapotranspiration is included in the model. Impervious areas under tree canopies are modeled with no interception due to the canopies, so the runoff estimates will be conservatively higher than what they are in reality.*

- What is the impact of sediment on pipe capacity; does the model account for it?
  - *The model can account for sediment accumulation if needed. The effects may vary depending on various factors such as pipe size, amount of sediment and velocity and flow rate of sewage. Cleaning of interceptor sewers has benefited in conveying additional flows to treatment plants in some drainage areas and reducing CSO discharges accordingly.*

- How consistent are the model volume and flow predictions for different types of storms?
  - *In general, calibration results may vary at individual sites but tend to be consistent at each site no matter what types of storms are modeled. In other words, model results compare well with measurements.*

Water Quality Model Description

- Thomas Newman (DEP Consultant) presented information on DEP's receiving waterbody models (slides 25 through 30). Thomas explained that as computer and modeling technology has evolved, more accurate calculations can be performed both spatially and over longer time periods. An example was shown for Alley Creek. A calibration example over space (along the East River) and over time (a full year at different locations) was also presented. The various types of water quality models used – pathogens (bacteria), eutrophication (dissolved oxygen and nutrients) and toxics – were also discussed.

Assumptions Used for LTCP Baseline Conditions in 2040

- Sri Rangarajan (DEP) presented the assumptions that are planned for LTCP baseline runs (slides 31 through 41). Assumptions include long-term rainfall conditions annually and at different gauging stations, the use of 2008 rainfall data as an average year (i.e., representing typical rainfall conditions), and a 10-year period to assess compliance with pathogen water quality standards. Another assumption presented is the future projected sanitary flows based on water consumption and population projections. Capacities at the DEP's wastewater treatment plants (WWTPs) are assumed to be two times design dry weather flow however this assumption is still being discussed with the DEC. The interceptor sewers are assumed to contain sediment levels subsequent to the recent cleaning efforts and the combined sewers were assumed to be clear of sediments and this assumption is also still being discussed with the DEC. The City has committed to implementation of GI projects in future years. A table showing the percentages and types of projects (public vs. private) in the various sewersheds was also presented. Also included in the baseline are recently completed and ongoing "grey infrastructure" projects, including storage tanks, improved pumping stations and other system improvements. Finally, details about how InfoWorks would be used to model site-scale and subcatchment-scale areas were presented.

Citywide Baseline Model Projections and Next Steps

- Sri Rangarajan (DEP) continued with a presentation of model projections using the citywide baseline models (slides 42 through 44). Tabulations of CSO volumes by WWTP service area and by waterbody were presented, in addition to a summary of underlying assumptions.

- Sri briefly presented next steps (slide 45 through 48), which will include further model refinements and developments, post-construction monitoring to test the efficacy of CSO reduction projects, and a sensitivity analysis to be performed on baseline model results to climate change.

Question and Answer Session #2

- Has the added GI flow capture been proven through monitoring?
    - *DEP is still evaluating this as part of post-construction monitoring of each GI installation. The results included in the "NYC Green Infrastructure Plan: 2011 Preliminary Pilot Monitoring Results" report (available at http://www.nyc.gov/html/dep/pdf/green_infrastructure/gi_annual_report_update_supplement_2012.pdf) indicate that most pilot installations are managing at least one inch of stormwater from their respective catchment areas.*

- Is one inch the correct design criterion for rainfall capture by GI, especially due to climate change?
    - *One inch generally represents the 90th percentile storm volume in the metropolitan area and is a widely accepted number currently used in many locations around the country.*

- Are standard GI designs being used to maximize rainfall capture?
    - *Yes, DEP has detailed standards which are being implemented and upgraded as more projects are built and more experience is gained. These specifications can be found on DEP's website: http://www.nyc.gov/html/dep/pdf/green_infrastructure/bioswales-standard-designs.pdf.*

- How is climate change incorporated into the LTCP baseline?
    - *Changes in water level have been projected to future conditions and will be included as a sensitivity analysis to assess the potential impacts of climate change on the baseline results.*

- What is the expected public involvement process – one way (DEP "telling") or two way back and forth discussion?
    - *A two-way (back and forth) community involvement process will be conducted. DEP will present preliminary information and solicit feedback and input as we undertake each LTCP. A public meeting for Alley Creek is coming up soon.*