

COMPLETING MODELING WORK SUPPORTING NITROGEN AND CARBON TMDL DEVELOPMENT IN THE NY/NJ HARBOR, CONTRACT II

SCOPE OF WORK FOR HYDROQUAL, INC. UNDER CONTRACT AGREEMENT BETWEEN NEW ENGLAND INTERSTATE WATER POLLUTION CONTROL COMMISSION AND HYDROQUAL, INC.

The full context and justification for this scope of work are largely provided in Attachment A. Attachment A also includes a description of related work which was included in a separate contract previously (i.e., Tasks 1,2,3, and 8 in Attachment A), but is not included in this scope of work. This scope of work specifically includes effort not to exceed \$240,000 over a period of performance of up to twelve months following date of contract execution. Work to be performed in this scope of work consists of:

Perform Subregional SWEM Simulations to Identify Dissolved Oxygen Standards Attainment Requirements

HydroQual shall perform up to four SWEM simulations for each subregion (i.e., Hackensack River, Passaic River, Newark Bay, Raritan River/Bay, Arthur Kill, Hudson River/Upper Bay). The purpose of these simulations is to illustrate:

- The reductions of nitrogen and carbon point and non-point source loadings within a subregion, (i.e., bounded by LOT), necessary to attain current water quality standards. For downstream subregions, the more upstream subregions will be set at compliance loadings. For New York Class SA, SB, and SC waters, the proposed New York marine DO standards will be considered as the current standard.
- If current standards are attainable with possible loading reductions (i.e., bounded by LOT), the loading reductions necessary to meet the proposed New York marine DO standards, if more stringent.
- If current standards are non-attainable with possible loading reductions (i.e., bounded by LOT), the loading reductions necessary to meet the proposed New York marine DO standards, if more relaxed.

Model simulations may also consider other actions such as standards revisions, bathymetric changes, in-stream aeration, and other non-abatement related actions, etc., to meet the proposed New York marine DO standards or other current standards, if LOT loading reductions are not sufficient.

Results from this task shall be incorporated into subregion specific narrative documents as described in “Assist Stakeholder Optimization and Implementation Planning.”

Assist Stakeholder Optimization and Implementation Planning

At EPA’s discretion, if a workshop is necessary to develop a “working plan” for a given subregion, HydroQual shall participate as EPA’s contractor in a workshop with EPA, the State/States, and impacted permittees and their consultants. To facilitate each subregion planning workshop needed, HydroQual shall prepare a narrative fact sheet that will aid EPA, the State, and permittees. During the workshops, permittees may request that HydroQual perform additional SWEM simulations to

confirm the receiving water quality benefits attained by alternative management actions identified in the workshops. As part of this contract, an allocation of twenty SWEM simulations for all subregions is available for this purpose. If SWEM simulations are requested by the permittees during a subregion workshop, a technical memorandum summarizing the results of the simulations for that subregion shall be prepared. This task also includes two meetings/conference calls with the NWG and/or OG to report results from all workshops.

Additional SWEM Simulations to Illustrate/Confirm All Subregion “Working Plans” Simultaneously

Once “working plans” have been agreed to for each subregion, three global SWEM simulations shall be performed which consider milestones elements of “working plans” across subregions:

- Run 1 - Milestone 1 actions in all subregions
- Run 2 - Milestone 2 actions in all subregions
- Run 3 - Milestone 3/final actions in all subregions

This task includes two meetings or conference calls and a technical memorandum for reporting to the NWG and the OG. In addition, at the request of the OG, three additional global SWEM simulations are included in the scope as may be needed.

Assist EPA and the States in Preparing a TMDL Document

As directed by EPA, HydroQual shall furnish text and graphics to support a public TMDL document. Assistance with both proposed and final documents is anticipated. Up to three additional SWEM simulations may be required (i.e., based on public comments) between proposed and final TMDL documents.



ATTACHMENT A
PROPOSED APPROACH FOR COMPLETING MODELING WORK SUPPORTING
NITROGEN AND CARBON TMDL DEVELOPMENT IN THE NY/NJ HARBOR

November 2007

Background Information and Scope Justification

The NY/NJ Harbor Estuary Program (HEP) through the TMDL Oversight Group (OG) and the Nutrient Workgroup (NWG) completed a regional-scale analysis of what it would take to meet dissolved oxygen standards in various portions of the NY/NJ Harbor estuary. The results of this analysis suggest that, for the majority of the Harbor, fairly robust reductions of both nitrogen and carbon from both point and non-point sources may be required to attain or approach attainment of water quality criteria and standards for dissolved oxygen.

The analysis did not consider the feasibility of the required loading reductions. Accordingly, a more targeted analysis, at the subregional or management zone scale, has been requested to further pinpoint specific loading reductions and management actions that may be required for nutrient TMDL/WLA/LA purposes, taking into consideration what may be feasible. The targeted loading reduction analysis will involve conducting modeling scenarios using SWEM. Described below is a proposed approach for completing such a modeling analysis. This proposed approach, in concept, had been presented previously to the OG on October 16, 2006 and the NWG on November 20, 2006. A detailed version of the approach was presented to the NWG on January 18, 2007 and to the OG on February 2, 2007. Preliminary feedback from the OG and the NWG and comments submitted to EPA have been incorporated into the proposed approach presented below.

Further in March 2007, the OG and NWG authorized a series of modeling runs which define the impact of carbon from each of nineteen STP's discharging to the Harbor. Since the dissolved oxygen response to reductions in carbon loadings is linear, it will not be necessary in the future to model all of the possible carbon effluent levels at these facilities. Rather, for each facility, the entire effluent carbon was simulated at full removal with SWEM and a resultant time-varying dissolved oxygen response systemwide calculated. The calculated dissolved oxygen response can then be scaled accordingly based on realistic carbon removals which may be required. For example, consider a specific facility run in the model with the full removal of an effluent BOD₅ of 10 mg/L and the calculated dissolved oxygen response at a given place and time in the receiving water was an improvement of 1 mg/L. If a potential

upgrade considered for that facility involved achieving an anticipated BOD₅ of 7 mg/L (i.e., a removal of 3 mg/L rather than 10 mg/L), the dissolved oxygen benefit in the receiving water expected for the potential upgrade would be 0.3 mg/L (i.e., $3/10 \times 1 = 0.3$). Similarly, DO responses to infinitely many possible carbon effluent conditions for each facility can be generated with the single run for each facility already performed as described because the carbon/oxygen kinetics are linear. The 19 STPs considered in the carbon component simulations include 3 Hackensack River facilities, 2 Raritan Bay facilities, 4 Kill van Kull/Arthur Kill facilities, and 10 Hudson River facilities.

Other sources of information already available to inform the proposed subregional modeling work include:

- The on-going costing analysis undertaken by the permitted point source discharges to the Harbor in New York and New Jersey
- Results of the SWEM 1988 and 1989 baseline simulation, i.e., a representation of conditions in the Harbor now. The results answer, “Where are we now?”
- Results of the SWEM baseline plus selected major mandated programs (i.e., CAIR, the Long Island Sound TMDL, and the Jamaica Bay Consent Order) simulation serve as a representation of the conditions already planned for the Harbor. As described below, an improved version of this simulation is anticipated. The results begin to answer, “Where will we be based on what is planned?”
- Results of the SWEM pastoral simulation represent the upper limit on attainability of conditions in the Harbor. The results answer, “Where were we prior to development?”

Sources of information to inform the subregional modeling evaluations proposed for development in this work scope include:

- Defining levels of nitrogen and carbon loading reductions from 1994-95 runoff, independent of CAIR, that may be associated with MS4 requirements and other management practices. For this purpose, EPA experts and the literature will be consulted.
- Performing a SWEM simulation which not only accounts for CAIR, the Long Island Sound TMDL, and the Jamaica Bay Consent Order but also includes other planned actions to be identified by the NWG such as the relocation of the North Bergen WPCP outfall outside of the Hackensack River, changes to inputs from the Dundee Dam as a result of the phosphorus TMDL for the Upper Passaic River, etc.. Previously, these other planned actions were going to be addressed with numerous individual SWEM simulations that would track separately the benefits associated with each individual planned action. A streamlined approach is being proposed that will allow for an understanding of the benefits associated with all of the planned actions collectively using a single SWEM simulation. With the single SWEM simulation it will be possible for subsequent subregional TMDL analyses to consider the attendant benefits

associated with the planned actions in all subregions. Results will answer better than already existing runs, “Where will we be after implementation of planned action?”

- Perform a SWEM simulation of Limit of Technology (LOT) for both point and non-point sources for both nitrogen and carbon. This SWEM simulation, although not yet contracted for, was authorized by the NWG on July 27, 2007 and the OG on September 13, 2007. Results will answer, “Where could we be after implementation of LOT reductions?”

Ultimately, the proposed approach will include a sequential (i.e., from upstream and working downstream) consideration of loading reductions in various management zones of the Harbor such that the benefits of upstream measures needed to attain water quality standards there can be considered in deciding upon more downstream measures to attain water quality standards locally. In the proposed approach, shared waters are addressed last. In the proposed approach, loading reductions will be considered by modifying the loadings in the “baseline plus all planned improvements” SWEM simulation.

Anticipated elements of the approach that would be common to each subregion include:

- Evaluations at the subregional level will start with all of the planned improvements system-wide. Attendant benefits from CAIR and management plans in Long Island Sound and Jamaica Bay and other already planned or in-progress loading reduction actions, to be determined by the NWG, will be included in subregional evaluations. This may include actions above head-of-tide.
- Attendant benefits from reduction plans to attain water quality standards selected for more upstream subregions shall be included.
- Loading reductions considered for each sub-region will be bounded by LOT. This will include a consideration of the “Where could we be after implementation of LOT reductions?”/LOT results across regions.
- New model simulations for reductions, bounded by LOT, to subregional point and non-point sources to attain current water quality standards.
- If current standards are attainable with possible loading reductions (i.e., bounded by LOT), a consideration of the loading reductions necessary to meet the proposed New York marine dissolved oxygen standards, if more stringent than the current standard.
- If current standards are non-attainable with possible loading reductions (i.e., bounded by LOT), a consideration of the loading reductions necessary to meet the proposed New York marine DO standards, if less stringent than the current standard. Model simulations may consider other actions such as in-stream aeration to meet the proposed New York marine DO standards.
- Planning workshop

The order in which SWEM simulations involving subregional loading reductions will be performed and a “working plan” to meet water quality standards will be selected for each subregion includes:

Hackensack River, Passaic River, Newark Bay, Raritan River/Bay, Arthur Kill, and Hudson River/Upper Bay. It is noted that a “working plan” will be selected for the first subregion before proceeding with planning work in the second region, etc..

The “working plan” for each subregion will be developed in coordination with EPA, the State/States, and the impacted permittees. For development of the “working plan” for each subregion, SWEM results illustrating the required loading reductions and other actions necessary to attain the dissolved oxygen standard will serve as a blueprint for what the TMDL must ultimately accomplish. For each subregion, a workshop will be held with EPA, the State/States, the impacted permittees and their consultants, and HydroQual as EPA’s consultant. During each workshop, discussions will be held to outline the interim steps that are most cost effective and the implementation schedules necessary to attain the dissolved oxygen standard. At this time, the permittees may request additional SWEM simulations to be performed to define the receiving water quality benefits associated with various site-specific alternative options for loading reductions.

Considerations to be explored during each workshop include: DO benefits and costs associated with nitrogen vs. carbon removal, DO standards considerations vs. nutrient standards/other eutrophication issues, and seasonal vs. annual treatment considerations. The workshop discussions will be facilitated by a subregional narrative fact sheet to be prepared by HydroQual, summarizing results to date from all of the modeling work. The goal of the workshop is to optimize lowest cost actions that could be committed to in the short-term. Once short-term actions are agreed to, this will allow more time for exploration of longer-term questions such as additional data collection, equity issues, potentially better science for standards and models, the permitting process, changes to bypass restrictions, use attainability analyses, etc.

Proposed Scope

Task 1 - Development of Loadings Tabulations

For purposes of the NWG and OG to ultimately develop a TMDL baseline and to assess the adequacy of the 1994-95 loading conditions with 1988 and 1989 rainfall conditions as a reflection of current conditions (i.e., existing effluent quality, EEQ), HydroQual shall prepare detailed tabulations of loadings included in SWEM. The format for each subregional area loadings tabulation will be analogous to the format used previously for the Hackensack River. HydroQual will provide the tabulations in a pdf format.

Task 2 - Estimates of MS4 Load Reductions

HydroQual shall consult existing literature reviews that examine the range of nitrogen and carbon runoff reductions associated with implementation of various programs and practices (e.g., the *National Pollutant Removal Performance Database* developed by the Center for Watershed Protection

(Sept 2007) and O'Shea, M. L., Borst, M., and C. Nietch, The Role of Stormwater BMPs in Mitigating the Effects of Nutrient Overenrichment in the Urban Watershed. In: Proceedings of the 9th Triennial International Conference on Urban Storm Drainage, September 8-13th, 2002, Portland, OR, etc.). HydroQual shall also consult with experts (including Mike Borst at EPA ORD's National Risk Management Research Laboratory, Urban Watershed Management Branch, Edison, NJ (732-321-6631)) who can provide some insight into the questions being asked. Based on an analysis of the existing literature reviews and the expert opinions, HydroQual shall prepare a technical memorandum recommending 1) the level of nitrogen and carbon reduction expected from the current MS4 requirements that should be incorporated into the modeling analysis and 2) the plausible upper and lower limits of reduction for carbon and nitrogen for targeted BMPs that could occur in the future. Up to two meetings or conference calls with the NWG or OG have been allocated to report on Task 1 and 2 results.

Task 3 - Perform Regional SWEM Simulations to Inform Subregional Analyses

HydroQual shall perform two SWEM simulations. The first SWEM simulation will include a more robust representation of planned improvements than was represented in the SWEM simulation which included CAIR related loading reductions, the LISS TMDL, and the Jamaica Bay Consent Order. Additional loading reductions/changes, such as those associated with the North Bergen STP outfall relocation, the Upper Passaic River phosphorus TMDL, MS4 requirements, CSO control, etc., shall be incorporated in this simulation. The second simulation, also known as Limit of Technology (LOT), will include the loading conditions of the first simulation as well as all STP's at the lowest level of paired effluent nitrogen and carbon concentrations considered in the dischargers' costing analyses and runoff related loadings with the higher end of nitrogen and carbon reductions identified in Task 2. HydroQual shall prepare a technical memorandum summarizing the results of these simulations before SWEM simulations are performed supporting specific subregional evaluations. Up to three meetings or conference calls with the NWG or OG have been allocated to confirm SWEM simulation input specifications and to report on Task 3 results.

Task 4 - Perform Subregional SWEM Simulations to Identify Dissolved Oxygen Standards Attainment Requirements

HydroQual shall perform up to four SWEM simulations for each subregion (i.e., Hackensack River, Passaic River, Newark Bay, Raritan River/Bay, Arthur Kill, Hudson River/Upper Bay). The purpose of these simulations is to illustrate:

- The reductions of nitrogen and carbon point and non-point source loadings within a subregion, (i.e., bounded by LOT), necessary to attain current water quality standards. For downstream subregions, the more upstream subregions will be set at compliance loadings. For New York Class SA, SB, and SC waters, the proposed New York marine DO standards will be considered as the current standard.

- If current standards are attainable with possible loading reductions (i.e., bounded by LOT), the loading reductions necessary to meet the proposed New York marine DO standards, if more stringent.
- If current standards are non-attainable with possible loading reductions (i.e., bounded by LOT), the loading reductions necessary to meet the proposed New York marine DO standards, if more relaxed.

Model simulations may also consider other actions such as in-stream aeration to meet the proposed New York marine DO standards or other current standards, if LOT loading reductions are not sufficient.

Results from this task shall be incorporated into subregion specific narrative documents as described in Task 5.

Task 5 - Assist Stakeholder Optimization and Implementation Planning

At EPA's discretion, if a workshop is necessary to develop a phased "working plan" for a given subregion, HydroQual shall participate as EPA's contractor in a workshop with EPA, the State/States, and impacted permittees and their consultants. To facilitate each subregion planning workshop needed, HydroQual shall prepare a narrative fact sheet that will aid EPA, the State, and permittees. During the workshops, permittees may request that HydroQual perform additional SWEM simulations to confirm the receiving water quality benefits attained by interim management actions identified in the workshops. As part of this contract, an allocation of twenty SWEM simulations for all subregions is available for this purpose. If SWEM simulations are requested by the permittees during a subregion workshop, a technical memorandum summarizing the results of the simulations for that subregion shall be prepared. This task also includes two meetings/conference calls with the NWG and/or OG to report results from all workshops.

Task 6 - Additional SWEM Simulations to Illustrate/Confirm All Subregion "Working Plans" Simultaneously

Once phased reduction "working plans" including early management actions have been agreed to for each subregion, three global SWEM simulations shall be performed which consider each of the phases of loadings across subregions:

- Run 1 - Phase 1 actions in all subregions
- Run 2 - Phase 2 actions in all subregions
- Run 3 - Phase 3/final actions in all subregions

This task includes two meetings or conference calls and a technical memorandum for reporting to the NWG and the OG.

Task 7 - Assist EPA and the States in Preparing a TMDL Document

As directed by EPA, HydroQual shall furnish text and graphics to support a public TMDL document.

Task 8 - Project Control

The purpose of this task is to allow for both internal and external project communications, beyond usual technical reports and presentations. This task includes up to five meetings to be used as EPA deems necessary. These meetings could include internal working sessions with EPA staff, additional NWG or OG meetings, HEP Management Committee Meetings, HEP Policy Committee Meetings, or meetings to achieve coordination on work elements common to pathogens and toxics TMDLs. As part of project control, the presentations, technical memoranda, etc., produced in Tasks 1 to 8 shall be made available to New York Sea Grant for posting to the HEP website.

In addition, this task will facilitate web-based access to key final work products, analogous to <http://www.carpweb.org> which is used for distribution of representative CARP final work products. Completion of this task will involve coordinating with New York Sea Grant regarding HEP website space availability and/or capabilities for handling registrations, consent forms, and information request orders. Web-based informational requests may be filled by any or all of (to be determined based on file sizes and space availability): web-site downloads, free distribution of CD's, preset downloads to requester-provider storage devices at a fixed labor-cost price, or individually negotiated custom information requests. The OG and NWG will be involved in prioritizing which work products need to be most readily accessible given practical and budgetary limitations. In addition to reports and presentations, work products may include source codes for the models and selected sample model input and output files.

Proposed Budget

The scope presented above is responsive to the EPA's request for a complete scope for the remaining modeling-related work needed to support TMDL development. For purposes of the cost proposal, Tasks 1, 2, 3, and 8 have been grouped together and Tasks 4, 5, 6, and 7 have been grouped together. The logic is that information generated and managed under Tasks 1, 2, 3, and 8 will inform decisions necessary for the completion of Tasks 4, 5, 6, and 7. From a scheduling perspective, if the scope for Tasks 1, 2, 3, and 8 is accepted, work could commence immediately while the scope for Tasks 4, 5, 6, and 7 is further contemplated. Costs reflect that much of the work shall be completed in 2008 rather than in 2007. The estimated budget for Tasks 1, 2, 3, and 8 is \$72,000. The estimated budget for Tasks 4, 5, 6, and 7 is \$203,000. 1754 manhours are included across various staffing levels for all tasks.