

WATER QUALITY MODELING AND REGULATORY SUPPORT

Exhibit A- Scope of Work, September 21, 2016 through September 30, 2017

Introduction

The Upper Neuse River Basin Association (UNRBA) has selected Cardno, Inc., and their team of partners, to provide water quality modeling, cost benefit analysis, and regulatory support as described in its Request for Qualifications - Water Quality Modeling and Regulatory Support issued in April 2016 (Exhibit C).

The primary purposes of this Scope of Services under the contract resulting from the RFQ is to develop a Quality Assurance Project Plan (QAPP) that includes the lake and watershed models and to develop a two year work plan (for approximately October 2017 to September 2019) for the modeling, cost benefit analysis, and regulatory support project. Significant input on this Scope of Work has been provided by the Path Forward Committee's (PFC), Modeling and Regulatory Support Workgroup (MRSW), the PFC, the UNRBA Executive Director, and technical advisors. Separate scopes of work will be developed with the UNRBA for each fiscal year of the overall project.

Phase 1: Develop a QAPP for the Falls Lake Response Models and the Falls Lake Watershed Model(s)

The goal of Phase 1 of the project is to develop the lake and watershed Modeling QAPP that will guide development of the models used to support the UNRBA reexamination of Stage II of the Falls Lake Nutrient Management Strategy. The Modeling QAPP will include both the lake and watershed models. While the main deliverable associated with Phase 1 is the modeling QAPP, several preliminary activities are needed to define the specific objectives of each type of model and select the best models to meet the chosen objectives. A conceptual modeling plan will be developed to summarize the modeling objectives and identify the models the UNRBA has selected for the lake modeling, watershed modeling, and empirical/probabilistic/Bayesian modeling. Elements of this conceptual plan will be incorporated into the Modeling QAPP. Depending on the selected models and the QAPP, the previously submitted, DWR-approved Description of the Model Framework may need to be revised for consistency relevant to the lake modeling and the watershed modeling approach.

Cardno and its teaming partners (the Team) will develop in consultation with the UNRBA a conceptual plan for conducting the lake and watershed modeling using a multi-modeling approach. Development of the conceptual plan will include the following tasks:

- Discussion of the UNRBA goals for the lake modeling effort during a Kickoff Meeting expected to be held in conjunction with the September 28, 2016 PFC meeting. This meeting will include additional watershed stakeholders including DWR, DOT, Neuse River Keeper, land conservation trusts, environmental groups, WOC, Health and Human Services Onsite Wastewater (county reps also), watershed associations, soil and water conservation. This meeting will be an extension of the PFC meeting and will occur in the afternoon following the meeting.

- Review and evaluation of potential lake model packages (e.g., EFDC, BATHTUB, CE-QUAL-W2, WASP, WARMF-lake, WARMF-CE-QUAL-W2, and stochastic modeling; addressing 1D/2D/3D models and capabilities) that will support a recommendation to the UNRBA of the modeling packages or combination of packages that will provide accurate and appropriate simulation of nutrients, algae, and total organic carbon to support the UNRBA's Falls Lake Nutrient Management Strategy reexamination. Comparison of models will be provided in tabular format with preliminary recommendations in the form of a slide presentation developed by the Team for discussion with the MRSW and PFC. A brief description of why each model was selected will be included in the QAPP.
- Review and evaluation of potential watershed model packages (e.g., WARMF, SWAT, SPARROW, PC-SWMM, RHYSS, and stochastic modeling) with the MRSW and PFC to develop a recommendation on the package or combination of packages can provide accurate and appropriate simulation of watershed nutrient and total organic carbon loading given the monitoring data and modeling objectives defined by the UNRBA to support reexamination of the Falls Lake Nutrient Management Strategy. Comparison of models will be provided in tabular format with preliminary recommendations in the form of a slide presentation developed by the Team for discussion with the MRSW and PFC. A brief description of why each model was selected will be included in the QAPP.
- Development of supporting materials that describe the conceptual modeling plan. These materials will be distributed prior to the UNRBA PFC meeting or meetings that will discuss and make decisions on the conceptual modeling plan. These supporting materials may include slides, handouts, figures, and tables. Relevant information from these materials will be incorporated into the Modeling QAPP and its appendices.

The conceptual model plan and evaluation of models will be used to develop the Modeling QAPP. Decisions regarding the model selection and conceptual model plan will be documented in the form of meeting notes during MRSW and PFC meetings by Cardno. The Team will develop the Modeling QAPP in accordance with the Falls Lake Rules (15A NCAC 02B .0275 (5) (f)) and will use EPA's (2002) Guidance for Quality Assurance Project Plans for Modeling (QA/G-5M) EPA/240/R-02/007.

A draft of the Modeling QAPP will be provided iteratively to the UNRBA MRSW and PFC for review and editing, and then to the NC Division of Water Resources (DWR) for review prior to formal submittal. The Team will be responsible for finalizing the QAPP for submittal to the agency and assisting the UNRBA in responding to any agency comments or issues.

Communications

The Team will coordinate communications throughout the project with the Executive Director, the MRSW and the PFC through a series of meetings, calls, or webinars. The UNRBA Board will be briefed and updated as appropriate based on guidance from the PFC.

The scope of work for the development of the lake and watershed modeling QAPP assumes the following communications (additional communications are included in Phase 5):

- Twice per year in person meetings between active modeling task leads and the UNRBA. It is anticipated that these meetings will coincide with PFC meetings and may extend beyond the regularly scheduled meeting time. The first meeting is planned for September 28, 2016 to kickoff Phase 1.
- Bi-monthly calls (every other month) with the MRSW beginning in November or December. An agenda will be developed for these calls and the sessions will last approximately 1.5 hour, providing sufficient opportunity to discuss status and technical issues for the project.

Phase 1, First Year Deliverables:

The schedule for deliverables associated with Phase 1 is presented in Figure 1. This prospective schedule is based on meeting the UNRBA objectives and time frames for this project. Based on review and input by the MRSW, PFC, UNRBA, and DWR, this schedule may need to be revised.

1. Slides and handout materials (electronic copies in native format) to facilitate discussion of a) model evaluation and selection and b) development of the conceptual modeling plan. Key elements of these materials will be included in the Modeling QAPP to formally document why specific models were selected and how multiple models may be used to support the reexamination.
2. Draft and final Falls Lake nutrient response and watershed Modeling QAPP.
3. Presentations to the UNRBA Path Forward committee or UNRBA Board of Directors as appropriate and needed (see Phase 5), and
4. Revisions to the previously submitted Description of the Model Framework that was approved by DWR for consistency with the revised modeling QAPP.

Phase 2: Develop the Two-Year Work Plan

The Team will develop, in consultation with the UNRBA, a two-year work plan (approximately October 2017 to September 2019) for the modeling project including implementation of the watershed and lake modeling conceptual plans from Phase 1 and the development of the cost-benefit model that effectively supports the UNRBA's goal of providing a successful reexamination of the Falls Lake Nutrient Management Strategy, including additional regulatory options. The work plan will include detailed task breakdown structures and cost estimates for the two year period based on the local government fiscal year. The Team will seek input and direction from the MRSW and Path Forward Committee regarding the development of the work plan.

Communications

Throughout this project, the Team will coordinate with the Executive Director, the MRSW and the PFC through a series of meetings, calls, or webinars. The UNRBA Board will be briefed and updated as appropriate based on guidance from the PFC. The scope of work for the development of the two year work plan assumes the following communications continued from Phase 1 (additional communications are included in Phase 5):

- Twice per year in person meetings between active modeling task leads and the UNRBA. It is anticipated that these meetings will coincide with PFC meetings and may extend beyond the regularly scheduled meeting time. The second meeting is planned for March 22, 2017 to kickoff Phase 2.
- Continued bi-monthly calls (every other month) with the MRSW. An agenda will be developed for these calls and the sessions will last approximately 1.5 hour, providing sufficient opportunity to discuss status and technical issues for the project.

Phase 2, First Year Deliverables:

The schedule for deliverables associated with Phase 2 is presented in Figure 1. These include:

1. Draft and final, two-year work plan (approximately October 2017 to September 2019) with a cost estimate for each year. A draft of the work plan will be presented to the PFC at its June 2017 meeting.
2. Draft and final scope of work and budget for Modeling and Regulatory Support for October 2017 to September 2018 will be presented to the PFC at its August 2017 meeting for requested approval by the UNRBA Board of Directors during the September BOD meeting.
2. Status presentation and discussion of this phase with the UNRBA Path Forward Committee (see Phase 5).

Phase 3: Cost Benefit Analysis

There are no first-year deliverables anticipated for this component of the Modeling and Regulatory Support effort. A majority of this work will be conducted in subsequent years and will be described in the two-year work plan (See Task 2). The Team is prepared to adapt the schedule and budget to initiate work on this phase earlier than anticipated, if requested by the UNRBA.

Phase 4: Regulatory Options Support

There are no first-year deliverables within this service area. A majority of this work will be conducted in subsequent years and will be addressed in the two-year work plan (See Task 2). The Team is prepared to adapt the schedule and budget to initiate work on this phase earlier than anticipated, if requested by the UNRBA.

Phase 5: Project Management and General Meetings

Cardno will provide general program management for these efforts and will generate monthly invoices and supporting documentation for submittal to the UNRBA.

Cardno will facilitate scope and contract development for subsequent fiscal years.

Cardno will participate in the routine general UNRBA meetings with the Path Forward Committee (PFC) and Board of Directors (BOD) with the following assumptions:

- The Cardno Project Manager will provide status reports at BOD meetings.
- The Cardno Project Manager will provide status reports at the monthly PFC meetings beginning in October. The Cardno Project Manager will participate in these monthly meetings, with modeling leads participating remotely on an as needed basis.
- The Cardno Project Manager will participate in weekly status calls with the Executive Director.

Project Schedule

The prospective project schedule is provided in Figure 1.

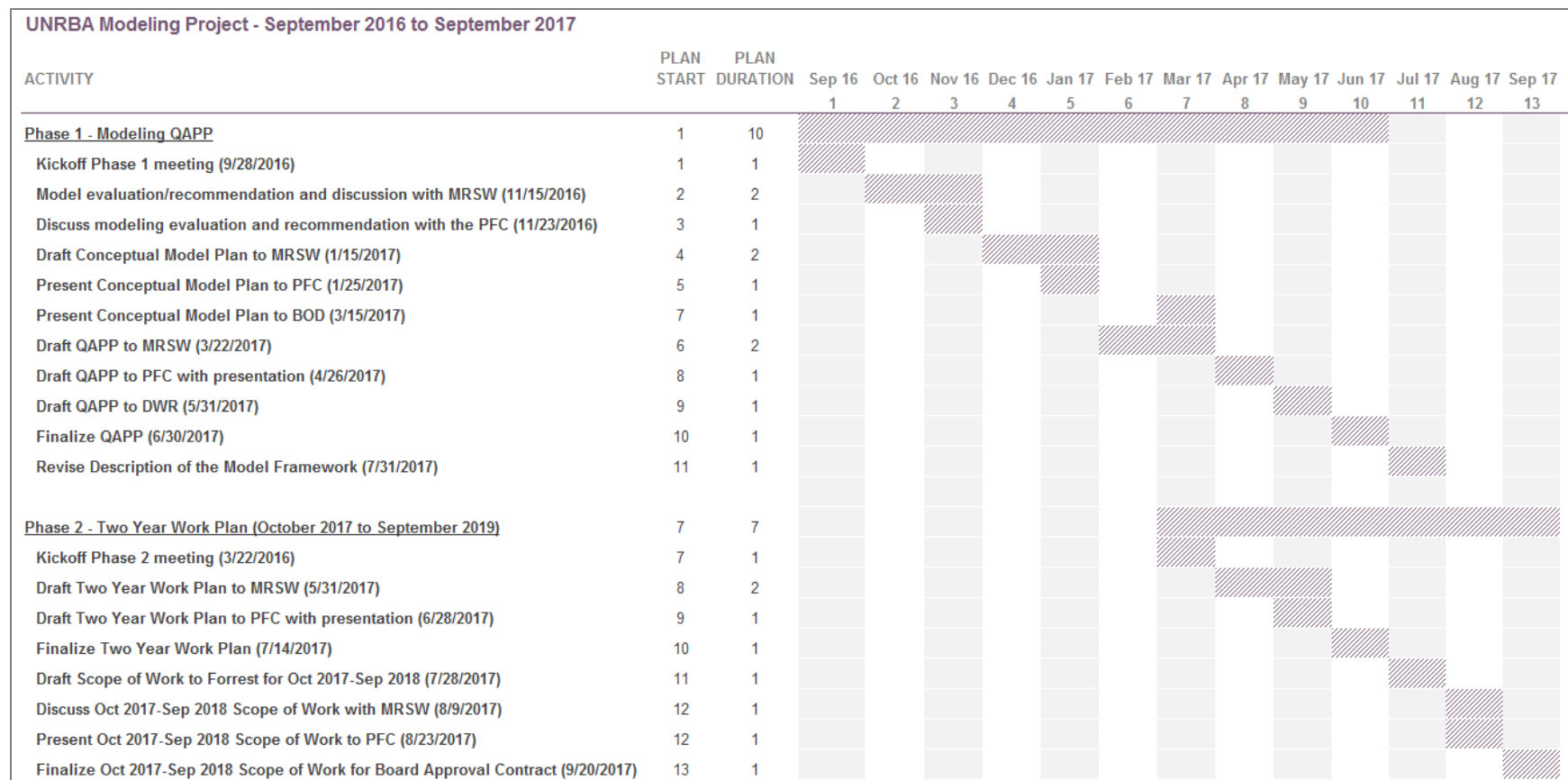


Figure 1. Schedule for September 2016 to September 2017 of the UNRBA Modeling Project (This prospective schedule is based on meeting the UNRBA objectives and time frames for this project. Based on review and input by the MRSW, PFC, UNRBA, and DWR, this schedule may need to be revised.)