HAZEN AND SAWYER
Environmental Engineers & Scientists

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March 12, 2013

Mr. Sydney Paul Miller, P.E.
Water Resources Engineer
Department of Public Works and Utilities
Town of Cary
400 James Jackson Ave.
Cary, NC 27513

Re: Jordan Lake Partnership
Potable Water Interconnection Study
Phase 2: Hydraulic Modeling Proposal

Dear Mr. Miller:

Hazen and Sawyer is pleased to submit this updated proposal for hydraulic modeling of potable water interconnections among the Jordan Lake Partners. This version of the proposal responds to our discussions with Orange County and the Town of Holly Springs.

The purpose of this study is to develop a regional approach for planning interconnections that increase the reliability and sustainability of drinking water by using resources cooperatively.

Our December 1, 2011, technical memorandum summarized Phase 1 of the project. This summary tabulated each partner's water facilities, documented existing interconnections and evaluated opportunities for improved interconnections. The key deliverable was a map showing all the partners' water systems, pressure zone boundaries and the interconnection locations.

Our December 20, 2011, technical memorandum outlined the next steps for evaluating interconnections by providing a modeling overview; an explanation of issues involved with combining and updating models; and recommendations for moving forward.

This updated proposal for the project's second phase integrates interconnection modeling requests by the partners and their feedback on the scope and cost estimates from previous proposals.

Interconnections will be evaluated for sustained transfers using multi-day extended period simulations. Each evaluation will include flow in both directions, where feasible. Predicted hydraulic performance will be compared with design criteria for velocities, pressures and tank water levels. Calibration tasks will focus on existing interconnections; broader calibration will be recommended if a partner's model is unable to match field measurements.

The following pages outline the requested modeling projects. Part 2 builds on Part 1 so that tasks are not repeated. Projects that involve wheeling water through an intermediate system may involve the same interconnections as direct transfer projects, but these are separate modeling scenarios that produce different flows and pressures. The numbers included in each project description refer to the interconnection IDs on the map from our December 1, 2011, technical memorandum. Each project includes initial meetings with the partners involved, to review and update model scenarios.

Scope of Services

Part	Project	Task	Description	Hours	Fee
1			**Build core model of Cary and Durham, then add OWASA-Hillsborough Model**		
1.	**1**		**Analyze Cary-Durham Interconnections (#6, 7, 9)**	**368**	**$ 57,280**
		1	Gather information and interview Partners' staff		
		2	Update Cary model infrastructure		
		3	Update Durham model infrastructure		
		4	Combine Durham and Cary models & add interconnection details		
		5	Check model calibration near interconnections		
		6	Determine sustainable flow from Cary to Durham with existing interconnections (EPS)		
		7	Identify improvements for sustained flow of 10 mgd from Cary to Durham (EPS)		
		8	Determine sustainable flow from Durham to Cary with existing interconnections (EPS)		
		9	Identify improvements for sustained flow of 7 mgd from Durham to Cary (EPS)		
		10	Present preliminary results		
		11	Prepare report chapter that incorporates review comments		
		12	QC		
1.	**2**		**Analyze Durham-OWASA Interconnections (#25, 26, 27)**	**368**	**$ 51,840**
		1	Gather information and interview Partners' staff		
		2	Combine OWASA-Hillsborough model with Durham-Cary model and add interconnection details		
		3	Check model calibration near interconnections		
		4	Determine sustainable flow from Durham to OWASA with no flow to Chatham (EPS)		
		5	Determine flow from Durham to OWASA with 4 mgd point load to Chatham (at #10)		
		6	Identify improvements for 7 mgd from Durham to OWASA + 4 mgd to Chatham (at #10)		
		7	Identify improvements for 9 mgd from Durham to OWASA inc 2 mgd to Orange + 4 mgd to Chatham		
		8	Determine sustainable flow from OWASA to Durham with no flow to Chatham		
		9	Present preliminary results		
		10	Prepare report chapter that incorporates review comments		
		11	QC		
1.	**3**		**Analyze Flow between Cary and OWASA through Durham (#6, 7, 9, 25, 26, 27)**	**256**	**$ 39,360**
		1	Gather information and interview Partners' staff		
		2	Identify improvements for sustained 5 mgd from Cary through Durham to OWASA off peak		
		3	Determine sustainable flow from OWASA through Durham to Cary		
		4	Present preliminary results		
		5	Prepare report chapter that incorporates review comments		
		6	QC		

Part	Project	Task	Description	Hours	Fee
1.	**4**		**Analyze Hillsborough-Durham Interconnection (#16)**	**248**	**$ 37,840**
		1	Gather information and interview Partners' staff		
		2	Test three pumps and check model calibration at connection point		
		3	Identify improvements for 2 mgd from Durham to Hillsborough		
		4	Identify improvements for 4 mgd from Durham to Hillsborough inc 2 mgd to Orange Co (Eno EDD)		
		5	Identify improvements for 1 mgd to Durham		
		6	Present preliminary results		
		7	Prepare report chapter that incorporates review comments		
		8	QC		
1.	**5**		**Analyze flow from Hillsborough to Orange County (#17,22)**	**208**	**$ 28,960**
		1	Gather information and interview Partners' staff		
		2	Update Orange Alamance model and add to combined model		
		3	Check model calibration near interconnections		
		4	Identify improvements for 0.75 mgd from Hillsborough through Orange Alamance to Buckhorn EDD		
		5	Map fire flows in Orange Alamance system with Buckhorn EDD supplied from Hillsborough		
		6	Identify improvements for 0.75 mgd from Hillsborough directly to Buckhorn EDD		
		7	Present preliminary results		
		8	Prepare report chapter that incorporates review comments		
		9	QC		
Part 1 Totals				**1,448**	**$ 215,280**

Part	Project	Task	Description	Hours	Fee
2	**Add Raleigh, Apex, Holly Springs and North Chatham to model from Part 1**				
	2. 1		**Analyze Cary emergency interconnections (#9, 6, 7, 47, 43, 32, 42, 44, 44, 45, 46, 50, 4, 3, 2, & 1)**	**400**	**$ 58,000**
		1	Gather information and interview Partners' staff		
		2	Update Apex model infrastructure		
		3	Add Raleigh and Apex to model from Part 1 and add details at interconnections		
		4	Check model calibration at interconnections		
		5	Analyze Cary emergency interconnections with 42" pipe out of service		
		6	Analyze Cary emergency interconnections with CAWTF out of service		
		7	Present preliminary results		
		8	Prepare report chapter that incorporates review comments		
		9	QC		
	2. 2		**Analyze Apex-Holly Springs interconnection (#21, 5, 1, 2, 3, 4, 50)**	**240**	**$ 35,280**
		1	Gather information and interview Partners' staff		
		2	Add new Holly Springs model to core model and add details at interconnections		
		3	Identify improvements for 2 mgd to Holly Springs + 3 mgd to Apex + 7 mgd to Cary from Harnett		
		4	Determine sustainable flow from Apex to Holly Springs		
		5	Identify improvements needed to supply average demand in Holly Springs from Cary and Apex		
		6	Present preliminary results		
		7	Prepare report chapter that incorporates review comments		
		8	QC		
	2. 3		**Analyze flow between Cary and Chatham County (#48, 1, 2, 3, 4)**	**240**	**$ 35,280**
		1	Gather information and interview Partners' staff		
		2	Add North Chatham County model to core model and add details for connecting pipes		
		3	Determine flow from Cary through Apex to Chatham County		
		4	Determine flow from Chatham County through Apex to Cary		
		5	Present preliminary results		
		6	Prepare report chapter that incorporates review comments		
		7	QC		

Part	Project	Task	Description	Hours	Fee
2.	**4**		**Analyze flow from Raleigh through Cary to Holly Springs and Apex (#46, 50, 4, 5)**	**232**	**$ 34,160**
		1	Gather information and interview Partners' staff		
		2	Update model at Cary's proposed connections to Holly Springs transmission main		
		3	Determine flow from Raleigh through Cary to Holly Springs		
		4	Determine flow from Raleigh through Cary to Apex		
		5	Identify improvements to increase above flows		
		6	Present preliminary results		
		7	Prepare report chapter that incorporates review comments		
		8	QC		
2.	**5**		**Analyze flow from Durham to Apex and Holly Springs (1, 2, 3, 4, 5, 6, 7, 9)**	**196**	**$ 30,600**
		1	Gather information and interview Partners' staff		
		2	Determine flow from Durham through Cary to Apex and Holly Springs		
		3	Identify improvements to increase above flows		
		4	Present preliminary results		
		5	Prepare report chapter that incorporates review comments		
		6	QC		
2.	**6**		**Analyze Cary-Durham-Raleigh interconnections in 2060 (#9, 6, 7, 47, 43, 32, 42, 44, 45, 46, 25, 26, 27)**	**496**	**$ 72,720**
		1	Gather information and interview Partners' staff		
		2	Adjust core models to 2060 demand from Triangle Regional Water Supply Plan		
		3	Identify improvements for 10 mgd from Durham to Cary/Apex/Holly Springs		
		4	Identify improvements for 10 mgd from Raleigh to Cary/Apex/Holly Springs		
		5	Identify improvements for 10 mgd from Durham and Raleigh to Cary/Apex/Holly Springs		
		6	Identify improvements for 17 mgd from Durham to Cary/Apex/Holly Springs		
		7	Identify improvements for 17 mgd from Raleigh to Cary/Apex/Holly Springs		
		8	Identify improvements for 17 mgd from Durham and Raleigh to Cary/Apex/Holly Springs		
		9	Determine flow from Harnett County through Holly Springs to Cary/Apex/Holly Springs		
		10	Determine flow from Harnett County through Holly Springs and Cary/Apex to Raleigh		
		11	Determine flow from Harnett County through Holly Springs and Cary/Apex to Durham		
		12	Determine flow from Harnett County through Holly Springs, Cary/Apex and Durham to OWASA		
		13	Present preliminary results		
		14	Prepare report chapter that incorporates review comments		
		15	QC		
Part 2 Totals				**1,804**	**$266,040**
GRAND TOTALS				**3,252**	**$481,320**

Deliverables

The deliverable for this project will be a single report with chapters describing findings for each interconnection project. The report will be provided in electronic format.

Project Team

The Hazen and Sawyer team for this project will include:

Project Director: Michael Wang, PhD, P.E.

Project Manager: Jeffrey R. Cruickshank, P.E.

Modelers:

Crystal Broadbent, P.E
Todd Davis, P.E.
Ricardo Espinosa, P.E.
Megan Roberts, P.E.
Wayne Zhang, PhD, P.E.

Field Coordinator:

Kevin Widderich, E.I.

Compensation:

Compensation for services rendered shall be based on a Direct Labor Multiplier of 3.15 applied to labor costs of the cumulative hours charged to the project by each employee providing services.

Table 1 depicts current direct salary rates for various staff positions expected to be involved with this project. Actual rates will be based upon labor costs for the individuals working on the project at the time services are rendered, and may differ from those shown in the table.

Table 1 – Direct Salary Rates

Position	Direct Salary Rates
Vice President	$75
Senior Associate	$67
Associate	$48
Principal Engineer	$44
Engineer/Field Coordinator	$40

The Direct Labor Multiplier will be applied to actual labor costs and will include all overhead, profit, travel, modeling software and computer costs, word processing, secretarial, telephones, faxes, etc.

It shall be understood the aggregate cost ceiling established for this project shall not be exceeded. If a project takes fewer hours than estimated, the fee will be less than that shown. If the costs for another project overrun that project's cost ceiling, remaining fees from other projects may be used.

Schedule:

We estimate completion within 12 months of authorization to proceed. Invoicing will not begin before July 1, 2013.

Please call me at (336) 292-7490 x81720 if you have any questions regarding this proposal, or email me at jcruickshank@hazenandsawyer.com.

Sincerely,

HAZEN AND SAWYER, P.C.

Jeffrey R. Cruickshank, P.E.
Senior Associate

CC: Michael Wang, P.E.
Christopher Belk, P.E.