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**TASK ORDER (TO) FORM, TO No. 2014-01**  
**Water System Modeling and Planning**  
**City of Griffin, GA**

January 6, 2014  
Revised May 28, 2014

**Background**

The City of Griffin (City) maintains and operates a water distribution system serving the cities of Griffin, Williamson, Zebulon, and Concord, Pike and Spalding County, and parts of Coweta and Meriwether County. The source water is the Upper Flint River, including one withdrawal point north of the City of Griffin for the Heads Creek Reservoir and Harry Simmons Water Treatment Plant (WTP), and a second withdraw point downstream for the Still Branch Reservoir and WTP. The system serves approximately 80,000 customers.

The City is in need of a hydraulic model for use as a decision making tool in maintaining, improving, and expanding the water distribution system. This project will provide the City with a calibrated model, constructed to evaluate scenarios for key future demand conditions, and to prioritize hydraulic improvements for those scenarios.

**Project Team Members**

We propose Rebecca Clay as your Project Manager. Rebecca has over 10 years of experience managing water infrastructure projects for Georgia utilities. Other key team members will include:

- Matt Bracewell: Matt has 17 years of experience in all aspects of water system design, including planning level reports, cost estimates, and pipeline construction, and will lead the quality control for this project. Matt also serves on the Legislative Committee of GAWP, and has an in-depth knowledge of the water quality and supply challenges facing our region.
- Imran Khan: Imran has over 25 years of experience in hydraulics/hydrology modeling and master planning. Imran brings value to the City of Griffin with a deep understanding of adaptive planning and of the synergies between water and wastewater modeling, to help position the City for future decision making.
- Ryan Scott: Ryan has over 10 years of specialized water system modeling, planning, and design experience. Ryan will lead the development and calibration of your hydraulic model.

Resumes of these individuals have been attached to this Scope of Services.

**Scope of Services**

This Scope of Services includes collection of field data necessary to calibrate the hydraulic model (Task 1), followed by development of the calibrated model in Task 2. Current and future water demand scenarios will be evaluated using the calibrated model in Task 3, and these results and recommendations will be documented in a Final Presentation and Report (Task 4). Task 5 is reserved for

services that we will provide at the City's option, at no charge, to better assist you in your future planning goals.

- Task 1: Data Collection and Analysis;
- Task 2: Hydraulic Model Development;
- Task 3: Scenario Development and Infrastructure Planning;
- Task 4: Final Presentation and Report;
- Task 5: No-Cost Services.

A description of these services is provided in the following paragraphs.

#### TASK 1 – DATA COLLECTION AND ANALYSIS

We will collect and examine the below data in Task 1, and advise the City of Griffin of any data manipulation required prior to incorporation of the data in the Task 2 geocoding effort.

##### **Future Demand Projections Data**

Burns & McDonnell will review previous reports provided by the City, related to the City's distribution and collection system, population projections, and water use projections, and land use data. Griffin's current GIS database includes current and future land use layers. We will use this information along with boundaries and population projections for future growth areas for the distribution system, as identified by the City, to estimate the distribution of future water system demands.

##### **Water System Operating Data**

The City of Griffin will provide Burns & McDonnell with system operating records and parameters including pump curves, water treatment plant high service flow records, historical tank operating levels, data on pressure zone delineation (or map of closed valves that form pressure zone boundaries), high service system layout drawings with pipe sizes, and point-of-entry and distribution system water quality data. The City will also provide operational descriptions for high service pumping (e.g. distribution system tank level, system demand, pressure, etc.).

##### **Flow and Pressure Data**

We have included an allowance of \$20,070 for hydrant logger devices in our fee for this task, to be purchased by Burns & McDonnell for data collection efforts in this project, and turned over to the City. Burns & McDonnell will coordinate with the City of Griffin in the preparation of a field testing plan that will encompass the City and the surrounding cities and counties within the water service area. City staff and Burns & McDonnell will strategically place the pressure loggers on fire hydrants throughout the water distribution system and conduct fire hydrant tests. Since the water service area covers a large area, it is anticipated that each of the City's ten loggers along with Burns & McDonnell data loggers will be used and rotated within the system over a summer period of approximately two weeks.

The field testing plan will be developed from the available GIS data on the water system with respect to pipe material, pipe diameter, location, fire hydrant availability and accessibility, heavy demand areas, and input from City staff. All of this information will be used to strategically conduct the field testing plan as expediently as possible to collect the information for model calibration; but, as indicated previously, the size and complexity of the City of Griffin's water service area warrants a slightly longer



field testing plan. Our review of the GIS data indicates that the pressurized mains layer totals over 700 miles of pipe.

During this testing period, Burns & McDonnell will also coordinate with the City to observe field flow testing (C-value testing) at strategic locations within the distribution system. This will allow us to verify the Hazen-Williams coefficients employed in the water model in Task 2, providing the City with a more confidently calibrated model. This effort will include isolating sections, or certain water mains, in the distribution system to allow flow in one direction, and conducting a hydrant test for additional data collection.

*Deliverable: We will provide the City of Griffin with the hydrant loggers upon delivery. The City will maintain ownership and possession of the loggers. We will provide the City with the raw data output retrieved from the loggers during the field effort, for record purposes.*

*We anticipate two routine progress meetings during execution of Task 1. These will be conducted at the City's offices by Rebecca Clay, your Project Manager. We anticipate that other key Burns & McDonnell staff may also attend via teleconference as relevant to the project status.*

#### **Water System Demand Data**

The City of Griffin will provide historical (peak month desired) billing data for population of the water distribution model current condition demands. Billing data will include Parcel Identification Number, total water use in billing period, and physical address. For data that does not include Parcel Identification Number, we anticipate that the physical address can be readily correlated to the GIS database addresses, for geocoding of the demands.

### **TASK 2 – HYDRAULIC MODEL DEVELOPMENT**

#### **Model Demonstration Workshop**

Selection of the modeling software that best meets the City of Griffin's current and future needs is critical. We will conduct an interactive Model Demonstration Workshop with your key staff, to explore modeling software options prior to purchase. This Scope of Services anticipates purchase of a WaterGEMs unlimited government rate license at a value of \$28,000; this allowance has been included in our fee for this Task. If the City selects a different software option as a result of the Model Demonstration Workshop, we will adjust our fee accordingly to account for the variation in software cost and model complexity.

The Model Demonstration Workshop will provide an overview of leading options in water/wastewater modeling softwares. Wastewater modeling softwares will be presented because the platforms for water/wastewater are related and should be selected with the ultimate use in mind. The water distribution models to be examined in this Workshop are Bentley products - WaterCAD V8i (standalone) and WaterGEMs (GIS-based), and Innovyze products - H2OMap (standalone) and InfoWATER (GIS-based). Bentley and Innovyze offer popular, corresponding choices for wastewater collection system models (e.g. InfoWorksCS and SewerGEMS). The purpose of this effort is to demonstrate the model's

features using different softwares and to highlight the synergy between water/wastewater models, not to obtain or project flows or pressures. This Workshop is expected to be conducted through a web interface, with some Burns & McDonnell modeling experts attending remotely, using available Burns & McDonnell or trial software licenses.

Based on the workshop, Burns & McDonnell will purchase the selected distribution system modeling software on behalf of the City, for use by Burns & McDonnell on this project and by the City after the scope of work is complete.

### **Model Development**

The water distribution model will be a full pipe network for all pipe sizes greater than or equal to 4-inch diameter. It will include the full extent of the water distribution system operated and maintained by the City of Griffin, as extracted from the GIS. Smaller diameter piping is excluded to make the model more manageable, improving the efficiency and speed at which it operates.

Prior to importing the pipe network from the GIS into the model, we will provide the City with a verification list highlighting data that warrants closer examination (such as pipe diameters that appears to be in mismatched units, pipes missing attributes such as material/diameter, and areas in which connectivity is unclear). These discrepancies can be corrected within the model as part of the calibration effort, however we recommend resolving identified discrepancies within the GIS in advance for a more consistent, accurate database.

### **Demand Geocoding**

Using the billing data provided by the City and the Parcel Identification Numbers in the GIS, Burns & McDonnell will geocode current peak day system demands within the hydraulic model.

Then, we will develop the population data obtained in Task 1 into a spatial population projection database, for use in examining future demand scenarios. We anticipate that four demand scenarios will be developed, estimated at approximately 12 MGD (current day), 18 MGD, 24 MGD, and 60 MGD (build-out). These demand milestones correlate to potential expansions of the Still Branch WTP.

*Deliverable: We will provide the City of Griffin with the spatial population projections and accompanying demand projection database developed in this task, for future use in adapting the demand distribution and model as projections are refined.*

*We anticipate two routine progress meetings during execution of Task 2. These will be conducted at the City's offices by Rebecca Clay, your Project Manager. We anticipate that other key Burns & McDonnell staff may also attend via teleconference as relevant to the project status.*

### **Model Calibration**

Burns & McDonnell will calibrate the water system model from data collected in Task 1, to mimic the actual operation of the existing system. This is an interactive process and will require close collaboration with the City, particularly where model results deviate from actual conditions. This is



often caused by unknown partially closed valves, unknown pipes, or unknown connectivity in the water system. We propose the following Coordination Workshop to review these areas.

#### **Coordination Workshop**

Burns & McDonnell will conduct this Coordination Workshop with the City of Griffin after development of the model structure, to demonstrate the operational status of the model, and to review connectivity at main intersections and other questionable areas. This is estimated to be a 2-hour interactive meeting involving the City's field representatives knowledgeable in the system. Following the Workshop, the City will field-verify connectivity at key points where conditions are unknown, if possible, to refine the model structure.

#### **Training Workshop**

Burns & McDonnell will conduct a training workshop with the City of Griffin using the calibrated hydraulic model, to illustrate the functionality of the model and how to run specific scenarios. This is expected to be an open-forum style 2-hour workshop, with the model displayed from a projector screen, so that your staff can observe how scenarios are run and how basic operations such as adding pipes are achieved in the modeling environment. To reduce project expenses, we have assumed that this Workshop will be conducted in the same day as the Coordination Workshop, as each meeting will engage different City staff.

During the Training Workshop, we will also explore future demand scenarios and obtain input from the City on growth patterns, pipeline routes, and other factors that may affect the practicality of supply scenarios developed in Task 3.

### **TASK 3 – SCENARIO DEVELOPMENT AND INFRASTRUCTURE PLANNING**

The objective in this project is to provide the City of Griffin with a calibrated and adaptable tool that can be used in water system planning for years ahead, not just for today's conditions. Accordingly, it is important to note that the proposed model construction will not only include a current day scenario, but it will also be loaded with demands for future milestones. Task 3 will explore the four demand milestones noted previously, creating hydraulic scenarios to meet each demand condition.

#### **Scenario Modeling**

Modeling scenarios will consist of the existing demand and future demand conditions (four total) under maximum day, peak hour, and minimum hour water demands to evaluate system hydraulics as relates to supply, pumping, storage, transmission, and water mains. A fire flow analysis will be conducted under the maximum day demand as well, for each of the scenarios.

Scenario output will include graphical results such as color-coded pipe networks, with pipe/node colors matching a legend for pressure or other parameters. It will also include tabular output.

### **Water Age Modeling – *OPTIONAL, INCLUDED***

Water age modeling requires extended period simulation analysis. It is included in this Scope of Services but is distinct from the remainder of the scenario modeling, and can be deleted at the City's option for a cost reduction.

Burns & McDonnell will use the calibrated model to perform an extended period simulation, as needed to conduct a water age analysis for the City of Griffin, identifying areas that could benefit from automatic flushing devices. If this optional task is retained in the Scope, the findings and recommendations from the water age analysis will be included in the Final Report as with the other scenario output. Scenario output will include graphical results such as color-coded pipe networks, with pipe/node colors matching a legend for water age. It will also include tabular output.

### **Infrastructure Planning Meeting**

We will conduct a planning Meeting with the City to review the output from the Scenario Modeling. In this Meeting we will review the output from each scenario, highlighting infrastructure deficiencies such as areas with insufficient fire flow capacity. We will also present options for resolving these deficiencies; for example, illustrating the impact of a new pipeline in a capacity-limited area.

The purpose of this Meeting is to demonstrate the value of the model as a planning tool, identify areas where the City should closely evaluate infrastructure improvements, and develop feasibility-level scenarios for maintaining the hydraulic capacity of the system through the demand horizon.

*Deliverable: Graphical and tabular output from the model scenarios will be provided to the City of Griffin during this Meeting, as an intermediate deliverable to refine options prior to cost estimating.*

*We anticipate two routine progress meetings during execution of Task 3. These will be conducted at the City's offices by Rebecca Clay, your Project Manager. We anticipate that other key Burns & McDonnell staff may also attend via teleconference as relevant to the project status.*

### **Conceptual Phasing and Costing**

Burns & McDonnell will prepare opinions of probable construction cost for the supply, pumping, storage, transmission, and water main improvements identified in this Task, as selected in the Infrastructure Planning Meeting. These will be feasibility level estimates ( $\pm 30$ -50%) as typical for an extended planning horizon. We will also devise an implementation sequence that is prioritized according to hydraulic related improvements, fire flow related improvements, and developer driven/system growth improvements. The sequence and improvements will be correlated to demands (rather than years) to make it independent of the rate of growth.

### **TASK 4 – FINAL PRESENTATION AND REPORT**

Task 4 will provide the City with the formal deliverables of the model development and planning efforts from Tasks 1 through 3.



### **Final Report**

Burns & McDonnell will prepare a draft report of the water model development and infrastructure plan, summarizing the results of the tasks indicated above for review. The report will describe how the model was developed and calibrated, and how demands were distributed. It will also present the results of the infrastructure planning, documenting the various demand scenarios and associated recommendations, costs, and priorities for needed improvements.

Burns & McDonnell will provide the draft report to the City for review and comment. After we address all review comments and, upon approval from City staff, we will deliver five copies of the final report and a copy of the hydraulic model on a CD.

*Deliverable: We will provide the City of Griffin with the Final Report and the calibrated hydraulic model. The model will include the four demand scenarios. We will also relinquish use of the model software upon submittal of the Final Report.*

### **Final Presentation**

We will conduct a final presentation for the water model, reviewing the planning scenarios run. The presentation will summarize our findings and conclusions, and will be prepared for a 1-hour powerpoint overview to the City, to supplement the Final Report. The objective of the Presentation is to provide the City of Griffin's stakeholders, who may not be aware of the full content of the Final Report, with an overview of the results specifically as relates to future infrastructure needs. We can conduct this Presentation after submittal of the draft report (prior to the Final Report), or as the culmination of the project, at the City's option.

*Deliverable: We will provide the City with the Final Presentation in native format (ppt).*

### **TASK 5 – NO-COST SERVICES**

During development of this Scope of Services, we identified three services that will provide added value to the City, and which we can provide in this project at no cost, as follows:

#### **Flow Metering Plan**

Wastewater modeling is excluded from the current scope, but the City anticipates development of a collection system model in the future. In the Model Demonstration Workshop, Burns & McDonnell is exploring the City's sewer system GIS as needed to illustrate the synergies of water and wastewater modeling. As part of this task, we will provide the City with a Flow Metering Plan, identifying key locations where we would desire wastewater flow data during model development. The Flow Metering Plan will assist the City of Griffin in positioning for the future wastewater modeling.

#### **Asset Management Workshop**

Asset management, like hydraulic modeling, is very closely tied to master planning. Burns & McDonnell understands that the City is beginning implementation of an Asset Management Program, using Hiperweb software. We propose to conduct an Asset Management Workshop with the City (approximately 1 hour), before or after the Infrastructure Planning Meeting, to discuss asset management cataloguing and how that relates to model development and master planning.

We will introduce asset management concepts in the context of how these could affect the Infrastructure Planning in the future. Specifically, we will provide the City with an overview of:

- how to define distribution and collection system level of service (LoS) goals and triple bottom line LoS measures;
- concepts for modeling Probability of Failure (PoF) and Consequence of Failure (CoF) for linear assets; and
- how to determine an assets' residual life (e.g. Remaining Useful Life) using available work management data.

Ultimately these concepts define a process for identifying and documenting asset management metrics and performance data, which the City of Griffin can track and monitor for more stable infrastructure planning.

#### **UDF Feasibility Review**

We recommend that Unidirectional Flushing (UDF) be evaluated for feasibility, after model calibration is complete. It is possible that many areas of the water system may not be able to sustain a unidirectional flush, and we will be able to provide better guidance on the feasibility and extent of the Plan after model development. In this task, we will advise the City on the feasibility of implementing UDF and provide you with a budgetary cost for preparing the UDF Plan. The City will be undertaking a one-year valve assessment project beginning July 1, 2014, and implementation of a UDF Plan would be most successful after valve operation is confirmed.

#### **Assumptions and Exclusions**

Our Scope of Services has been developed under the following assumptions and our understandings of the City of Griffin's needs on this project.

- No licensing fees are included for the Model Demonstration Workshop. It is anticipated that this Workshop will be conducted using the licenses that Burns & McDonnell has available, through a remote interface.
- We anticipated that population and/or demand projections will extend through the City's desired planning horizon/demand. Development of population projections are excluded from this Scope.
- We anticipate that the population projection/land use data will be provided by the City on the finest disaggregate level available and in a format which relates the population to discrete areas identified in an electronic map format (polygonal geodatabase, shapefile, or ArcInfo coverage).
- We anticipate that the population projection/land use database encompasses the study area for the water modeling, e.g. that it overlaps the build-out demand scenario.
- The water model will be constructed from the City's existing GIS database. Refinement is anticipated for connectivity and for limited attribute corrections, as described in this Scope, however it is assumed that the pipe network is complete. No digitizing of the existing pipe network is proposed.
- System elevations will be extracted from the GIS topography, for pipes, and from as-built drawings for tanks/pump stations. No survey is proposed.



- Burns & McDonnell understands that the City is implementing a valve assessment program. Valve modeling is therefore excluded from this Scope. These can be readily added to the model in the future, particularly as part of a future Unidirectional Flushing Plan development, if pursued.
- We have assumed that customer service connections will be readily geocoded according to Parcel ID. Burns & McDonnell will attempt to reconcile mismatch data using customer address, but assistance from the City's GIS department may be required to manipulate the data where service locations are unclear or where customer address formatting is inconsistent (not a direct match to the parcel database).
- Construction opinions of cost will be based on examination of aerial routes within right-of-ways. Inspection of potential routes on the ground is excluded at this planning level phase.

We will gladly expand this Scope, for commensurate compensation, upon your request.

### Schedule

BMCD is available to begin with Task 1 in the summer of 2014, upon your authorization to proceed. We recommend completing the field testing portion of Task 1 during the summer months (July 2014-August 2014). We anticipate an overall project duration of 8 months, assuming data is available at the start of Task 1, and prompt coordination of reviews/workshops in remaining tasks. We will include progress reports with a narrative addressing work completed and the status of the project budget and schedule, as part of monthly invoicing.

### Supplemental Terms

This Scope of Services anticipates execution of a Master Services Agreement with the City (attached; pending full execution by City). In addition to the terms stated in that Agreement, during the course of performance of these services, Burns & McDonnell will maintain (in United States Dollars) the following minimum insurance coverages:

<u>Type of Coverage</u>	<u>Limits of Liability</u>
Workers' Compensation Employers' Liability	Statutory \$500,000 Each Accident
Commercial General Liability Bodily Injury and Property Damage	\$1,000,000 Combined Single Limit
Automobile Liability: Bodily Injury and Property Damage	\$1,000,000 Combined Single Limit
Professional Liability:	\$1,000,000 Per Claim and Annual Aggregate

If requested, Burns & McDonnell will provide to the City certificates as evidence of the specified insurance. City and Burns & McDonnell agree to waive all rights against each other and their officers, directors, agents, or employees for damage covered by property insurance (including deductibles) during and after the completion of these services. If these services result in a construction phase, we anticipate that a provision similar to this will be incorporated into all construction contracts entered into by the City, and all construction contractors will be required to provide waivers of subrogation in favor of the City and Burns & McDonnell for damage or liability covered by any construction contractor's policy of insurance.

### Compensation

BMCD proposes to provide these services under the Master Services Agreement with the City of Griffin, on a lump sum basis for \$251,900.00. This value includes labor and direct expenses.

The estimated breakdown for the tasks is as follows:

Task	Labor	Expenses	Total
Task 1: Data Collection and Analysis.	\$22,020	\$20,835 <sup>a</sup>	\$42,855
Task 2: Hydraulic Model Development.	\$70,580	\$31,060 <sup>b</sup>	\$101,640
Task 3: Scenario Development and Infrastructure Planning.	\$59,750	\$1,650	\$61,400
Task 4: Final Presentation and Report.	\$44,540	\$1,465	\$46,005
Task 5: No-Cost Services.	0	0	0
<b>Total =</b>			<b>\$251,900</b>

<sup>a</sup>This value includes \$20,070 for purchase of hydrant loggers.

<sup>b</sup>This value includes \$28,000 for purchase of WaterGEMS.

The above breakdown represents an estimate only; actual progress will be invoiced as a percent of completion distinct from these estimates per task.





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The parties hereto have accepted and executed this Task Order according to the terms of the Master Services Agreement dated \_\_\_\_\_:

OWNER:

City of Griffin, Georgia

ENGINEER:

Burns & McDonnell

By: \_\_\_\_\_

By: \_\_\_\_\_

Title: \_\_\_\_\_

Title: \_\_\_\_\_

Date: \_\_\_\_\_

Date: \_\_\_\_\_