

## AGREEMENT FOR PROFESSIONAL SERVICES

Project No. \_\_\_\_\_

This AGREEMENT made and entered into this 14<sup>th</sup> day of June, 2016 by and between Norman Utilities Authority, (hereinafter "OWNER"), and Carollo Engineers, Inc., (hereinafter "ENGINEER").

WITNESSETH:

WHEREAS, the OWNER and the ENGINEER wish to enter into an Agreement (hereinafter "Agreement") for the furnishing of Engineering Services in connection with the:

Norman Utilities Authority Groundwater Well Field Development Project

(hereinafter "Project"), and

WHEREAS, ENGINEER is qualified and prepared to perform the necessary professional services in connection with the Project.

NOW THEREFORE, in consideration of the mutual promises and covenants of the parties hereto, it is agreed as follows:

### SECTION 1 - PROFESSIONAL SERVICES

- 1.1 ENGINEER shall provide professional engineering services in all phases of the Project to which this Agreement applies. The services furnished by the ENGINEER will be defined by Task Orders which will set forth the Engineer's Services, Time of Performance, and Payment.
- 1.2 It is intended that each Task Order, after execution by both parties shall become a supplement to and a part of this Agreement.

basis to be established in the Task Order for Services.

- 2.2 The ENGINEER is not responsible for damage or delay in performance caused by events beyond the control of ENGINEER. In the event ENGINEER's services are suspended, delayed or interrupted for the convenience of the OWNER or delays occur beyond the control of ENGINEER, an equitable adjustment in ENGINEER's time of performance and cost of ENGINEER's personnel and subcontractors shall be made.

### SECTION 2 - PAYMENT TO ENGINEER

- 2.1 As consideration for providing the services referred to in Section 1, the OWNER shall pay ENGINEER on the

- 2.3 OWNER reserves the right to direct revision of ENGINEER's services as may be necessary. When ENGINEER is directed to make revisions under this section of the agreement, ENGINEER shall advise OWNER of

the probable costs involved in completing engineering services and the time of performance for such completion. Extra services also include those that are required for defense of claims, in which event ENGINEER shall bill OWNER on an hourly basis together with cost of material.

2.4 In the event OWNER and ENGINEER cannot agree on equitable compensation for services rendered in making revisions, then, at OWNER's option, ENGINEER shall either continue performance under the revised Agreement and an equitable adjustment in ENGINEER's time of performance and cost of ENGINEER's personnel shall be made at completion of the revised work or ENGINEER shall not be obligated to continue performance under this Agreement.

2.5 If ENGINEER's work products require revisions prior to construction bidding due to ENGINEER's errors or omissions, the exclusive remedy will be limited to revisions made by ENGINEER without compensation.

2.6 The ENGINEER shall bill the OWNER monthly indicating the services performed and the cost of such services.

OWNER agrees to pay invoices within 45 days of their date. Payments not received by ENGINEER within 45 days shall be considered delinquent and subject to a finance charge of 1 percent per month for each month unpaid after the date of invoice. ENGINEER may suspend services should an invoice remain delinquent for 75 days from date of invoice.

2.7 All notices shall be made in writing and may be given by personal delivery or by mail. Notices sent by mail shall be addressed to the designated responsible person or office:

TO OWNER:

Chris Mattingly, P.E.

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201 W. Gray, Bldg. C

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Norman, OK 73069

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TO ENGINEER:

Thomas Crowley, P.E.

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100 N.E. 5th Street

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Oklahoma City, OK 73104

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and when so addressed, shall be deemed given upon deposit in the United States Mail, postage prepaid. In all other instances, notices and invoices shall be deemed given at the time of actual delivery.

All payments are to be mailed to:

Carollo Engineers, Inc.  
P.O. Box 4932  
Houston, TX 77210-4932

unless otherwise informed on the face of the invoice.

### SECTION 3 - MISCELLANEOUS

3.1 The OWNER shall furnish the ENGINEER available studies, reports and other data pertinent to ENGINEER's services; obtain or authorize ENGINEER to obtain or provide additional reports and data as required; furnish to ENGINEER services of others required for the

performance of ENGINEER's services hereunder, and ENGINEER shall be entitled to use and rely upon all such information and services provided by OWNER or others in performing ENGINEER's services under this Agreement.

- 3.2 The OWNER shall arrange for access to and make all provisions for ENGINEER to enter upon public and private property as required for ENGINEER to perform services hereunder.
- 3.3 Documents, including drawings and specifications, prepared by ENGINEER pursuant to this Agreement are not intended or represented to be suitable for reuse by OWNER or others for this Project or on any other project. Any reuse of completed documents or use of partially completed documents without written verification or concurrence by ENGINEER for the specific purpose intended will be at OWNER's sole risk and without liability or legal exposure to ENGINEER; and OWNER shall indemnify and hold harmless ENGINEER from all claims, damages, losses and expenses, including attorney's fees arising out of or resulting therefrom.
- 3.4 The ENGINEER maintains, at its own expense, Worker's Compensation and Employers Liability, Comprehensive General Liability, Automobile Liability and Professional Liability policies with limits at or above that which is reasonably required of other engineering firms and will, upon request, furnish insurance certificates to OWNER.

## SECTION 4 - LEGAL RELATIONS

- 4.1 The ENGINEER shall be responsible for professional negligence, which is failure to exercise skill and ability as ordinarily required of engineers under the same or similar circumstances. The ENGINEER shall not be responsible for warranties, guarantees, fitness for a particular purpose or breach of fiduciary duty and shall only indemnify for failure to perform in accordance with the generally accepted engineering and consulting standards.
- 4.2 OWNER and ENGINEER shall each defend, indemnify and hold harmless the other and their respective principals, directors, officers and employees from and against claims, loss, liability, suits and damages, including attorney's fees, caused in whole or in part by either party's negligent acts, errors or omissions, willful misconduct or OWNER's lawful responsibility respectively or, anyone directly or indirectly employed by either of them or anyone for whose acts they may be liable regardless of whether or not such claim, loss, liability or damage is caused in part by a party indemnified hereunder.

In the event that both OWNER's and ENGINEER's wrongful act or lawful responsibility is the proximate cause of any liability or damages, then in such event, each party shall be liable for a portion of the damages and claim costs resulting therefrom equal to such party's comparative share of the total negligence or lawful responsibility for such damages and claim costs. Notwithstanding the foregoing, a party's defense obligation hereunder shall be limited to reimbursement of the other party's reasonable defense

costs which are judicially determined to have been incurred as a result of the first party's negligence.

- 4.3 Hazardous materials or asbestos may exist at a site where there is no reason to believe they could or should be present. The ENGINEER and OWNER agree that the discovery of unanticipated hazardous materials or asbestos constitutes a changed condition mandating a renegotiation of ENGINEER's services.
- 4.4 The ENGINEER has no control over the cost of labor, materials, equipment or services furnished by others, or over Contractor's methods of determining prices, or other competitive bidding or market conditions, practices or bidding strategies. Cost estimates are based on ENGINEER's opinion based on experience and judgment. ENGINEER cannot and does not guarantee that proposals, bids or actual Project construction costs will not vary from cost estimates prepared by ENGINEER.
- 4.5 If the project involves construction of any kind, the parties agree that OWNER and ENGINEER shall be indemnified to the fullest extent permitted by law for all claims, damages, losses and expense including attorney's fees arising out of or resulting from Contractor's performance of work including injury to any worker on the job site except for the sole negligence of OWNER or ENGINEER. Both OWNER and ENGINEER shall be named as additional primary insured(s) by Contractor's General Liability and Builders All Risk insurance policies without offset and all Construction Documents and insurance certificates shall include wording acceptable to the parties herein with reference to such provisions.
- 4.6 ENGINEER shall not be responsible for the means, methods, techniques, sequences, or procedures of construction selected by contractors or the safety precautions and programs incident to the work of contractors and will not be responsible for Contractor's failure to carry out work in accordance with the Contract Documents.
- 4.7 The services to be performed by ENGINEER are intended solely for the benefit of the OWNER. No person or entity not a signatory to this Agreement shall be entitled to rely on the ENGINEER's performance of its services hereunder, and no right to assert a claim against the ENGINEER by assignment of indemnity rights or otherwise shall accrue to a third party as a result of this Agreement or the performance of the ENGINEER's services hereunder.
- 4.8 The ENGINEER's instruments of service hereunder are the printed hard copy drawings and specifications issued for the Project, whereas electronic media, including CADD files, are tools for their preparation. As a convenience to the OWNER, the ENGINEER shall furnish to the OWNER both printed hard copies and electronic media. In the event of a conflict in their content, the printed hard copies shall take precedence over the electronic media.
- Because data stored in electronic media form can be altered, inadvertently, it is agreed that the OWNER shall hold ENGINEER harmless from liability arising out of

changes or modifications to ENGINEER's data in electronic media form in the OWNER's possession or released to others by the OWNER.

disputes through meetings and negotiations required to resolve the dispute before any other forms of dispute resolution.

**SECTION 5 - TERMINATION OF AGREEMENT**

- 5.1 If this Agreement is terminated with or without cause, in either event, OWNER shall provide:
  - a. not less than five (5) working days' written notice of intent to terminate, and
  - b. an opportunity for good faith consultation prior to termination.

**SECTION 6 - DISPUTE RESOLUTION**

- 6.1 Disputes arising during the course of this Agreement shall be promptly addressed at completion of construction when professional services, together with construction evaluation, can be reasonably and fully assessed. The parties shall use best efforts to reach final resolution of

**SECTION 7 - ENTIRE AGREEMENT**

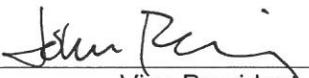
- 7.1 This Agreement, including attachments incorporated herein by reference, represents the entire Agreement and understanding between the parties and any negotiations, proposals or oral agreements are intended to be integrated herein and to be superseded by this written Agreement. Any supplement or amendment to this Agreement to be effective shall be in writing and signed by the OWNER and ENGINEER.

**SECTION 8 - GOVERNING LAW**

- 8.1 This Agreement is to be governed by and construed in accordance with the laws of the State of Oklahoma.

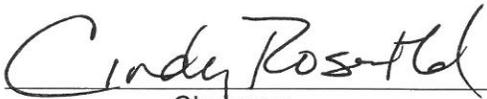
IN WITNESS WHEREOF, duly authorized representatives of the parties have signed in confirmation of this Agreement, with effective date the day and year first above written.

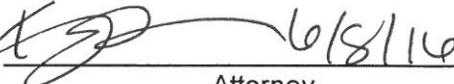
CAROLLO ENGINEERS, INC.

By:   
 Vice President  
 PE# 27605

By:   
 Vice President  
 PE# 0034164

NORMAN UTILITIES AUTHORITY

By:   
 Chairman

By:  6/8/14  
 Attorney

TASK ORDER NO. 1

NORMAN UTILITIES AUTHORITY  
OWNER

AND

CAROLLO ENGINEERS, INC.

This Task Order is issued by the OWNER and accepted by ENGINEER pursuant to the mutual promises, covenants and conditions contained in the Agreement between the above named parties dated the 14th day of June, 2016, in connection with:

Norman Utilities Authority Groundwater Well Field Development Project.  
(Project)

PURPOSE

The purpose of this Task Order is to:

Complete Phase 1 of the services for the Project, as described in Exhibit 1 to this Task Order No. 1.

ENGINEER'S SERVICES

ENGINEER shall provide the services described in Exhibit 1 to this Task Order No. 1.

TIME OF PERFORMANCE

Task 3 (Hydrogeological Investigations) shall be completed within 2 months of receipt of all final data and calibrated groundwater model from ACOG.

Task 4 (Infrastructure Optimization and Well/WTP Siting) shall be completed within 4 months of receipt of the final updated and calibrated distribution system hydraulic model..

Task 5 (Test Well Drilling Procurement Documents) shall be completed within 3 months of completion of Task 4 and receipt of supplemental data from NUA, contingent on timely reviews by NUA.

PAYMENT

Total payment for services rendered under this Task Order No. 1 shall not exceed \$228,384.00 inclusive of all labor, overhead and profit, subconsultant expenses, and other direct costs unless this Task Order No. 1 is modified in writing and approved by OWNER and ENGINEER.

Payment shall be made on a lump sum basis, based on monthly invoices submitted by ENGINEER indicating percent complete of each major task in the Scope of Services as shown in Exhibit 2 to this Task Order No. 1.

EFFECTIVE DATE

This Task Order No. 1 is effective as of the 14<sup>th</sup> day of June, 2016.

IN WITNESS WHEREOF, duly authorized representatives of the OWNER and of the ENGINEER have executed this Task Order No. 1 evidencing its issuance by OWNER and acceptance by ENGINEER.

CAROLLO ENGINEERS, INC.

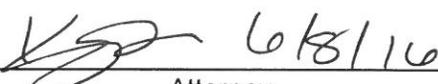
NORMAN UTILITIES AUTHORITY

Accepted this 14<sup>th</sup> day of June, 2016

By:   
Vice President

By:   
Chairman

By:   
Vice President

By:  6/8/16  
Attorney

## EXHIBIT 1 TO TASK ORDER 1

City of Norman / Norman Utilities Authority (NUA)

Groundwater Well Field Development

Scope of Work

Carollo Engineers, Inc.

May 20, 2016

The scope of work will be conducted in three phases, with each phase providing the details necessary to proceed with the subsequent phase:

- Phase 1: Aquifer Investigations and Well/WTP Siting
- Phase 2: Design Infrastructure To Blend Existing Wells / Test Well Support, Land Acquisition, and Production Well Design
- Phase 3: Production Well Construction Management Support

Accordingly, an outline for tasks and subtasks for all three phases of the work is provided below, and a detailed scope of work and fee has been developed for the initial contract. The detailed scope of work and fee for Phase 2 services will be developed and amended to the contract based on Phase 1, and the detailed scope of work and fee for Phase 3 services will be developed and amended to the contract based on Phase 2.

### Task Outline

#### PHASE 1: AQUIFER INVESTIGATIONS AND WELL/WTP SITING

##### **TASK 1: PHASE 1 PROJECT COORDINATION AND COMMUNICATION**

- Task 1.1: Kickoff Meeting and Project Plan
- Task 1.2: Biweekly Coordination Calls
- Task 1.3: Monthly Progress Reporting
- Task 1.4: Coordination with Other Project Elements & Consultants

##### **TASK 2: SELECT EXISTING WELLS TO REACTIVATE THROUGH WTP BLENDING**

- Task 2.1: Identify Existing Wells for Potential WTP Blending; Inventory Water Quality and Yield
- Task 2.2: Assess Blend Ratios for Range of WTP Operating Conditions
- Task 2.3: Existing Well Blending Decision Workshop
- Task 2.4: Existing Well Blending Technical Memorandum

##### **TASK 3: HYDROGEOLOGICAL INVESTIGATIONS**

- Task 3.1: Data Coordination with City and ACOG
- Task 3.2: Review ACOG Aquifer Mapping
- Task 3.3: Review ACOG Groundwater Model
- Task 3.4: Groundwater Modeling to Assess Well Interference and Potential New Well Yields
- Task 3.5: Analyze Potential Well Siting Areas Based on Aquifer Mapping and Groundwater Modeling Results
- Task 3.6: Well Siting Workshop 1

Task 3.7: Task 3 Summary TM

**TASK 4: INFRASTRUCTURE OPTIMIZATION AND WELL/WTP SITING**

- Task 4.1: Identify Potential Groundwater WTP Sites & Blending Stations
- Task 4.2: Identify Candidate Well Sites
- Task 4.3: Construct Raw & Treated Water Optimization Model
- Task 4.4: Optimize Infrastructure for Wells, WTP, and Blending
- Task 4.5: Workshop 2 - Well / GWTP Site Selection
- Task 4.6: Siting Refinements Analysis
- Task 4.7: Task 4 Summary TM

**TASK 5: TEST WELL DRILLING PROCUREMENT DOCUMENTS**

- Task 5.1: Well Testing and Development Plan
- Task 5.2: Prepare Test Well Driller Minimum Qualifications
- Task 5.3: Support NUA Test Well Driller Prequalification Solicitation
- Task 5.4: Review SOQs and Recommend Prequalified Contractors
- Task 5.5: Prepare Test Well Program Bid Package

**PHASE 2A: DESIGN INFRASTRUCTURE TO BLEND EXISTING WELLS**

*Phase 2A will be authorized under a separate amendment. The exact tasks and fees will be determined at a later date, based on the results of Phase 1.*

**TASK 6: DESIGN INFRASTRUCTURE TO BLEND EXISTING WELLS**

- Task 6.1: Basis of Design Memorandum
- Task 6.2: CFD Modeling of WTP Clearwell Blending
- Task 6.3: 30 Percent Design Documents
- Task 6.4: 60 Percent Design Documents
- Task 6.5: 90 Percent Design Documents
- Task 6.6: 100 Percent Design Documents
- Task 6.7: Permitting Support
- Task 6.8: Bidding Support
- Task 6.9: Engineering Services During Construction and Discipline Inspections

**PHASE 2B: TEST WELL DRILLING, LAND ACQUISITION, AND PRODUCTION WELL DESIGN:**

*Phase 2B will be authorized under a separate amendment. The exact tasks and fees will be determined at a later date, based on the results of Phase 1.*

**TASK 7: PHASE 2 PROJECT COORDINATION AND COMMUNICATION**

- Task 7.1: Biweekly Coordination Calls
- Task 7.2: Monthly Progress Reporting
- Task 7.3: Public and City Council Meeting Support

**TASK 8: ACQUIRE LEASES FOR WATER RIGHTS OR LAND PURCHASE**

- Task 8.1: Parcel/Landownership Analysis and Alternatives Assessment for Identified Test Well Sites

- Task 8.2: Land Valuation Assessment/Water Rights Valuation Assessment
- Task 8.3: Acquire & Negotiate Water Rights Leases
- Task 8.4: Acquire & Negotiate Land Purchases
- Task 8.5: Request Lien Waivers/Sub-ordination Agreements
- Task 8.6: Landowner Negotiations for Test Wells with Option for Production Wells
- Task 8.7: Recommendations and Summary Report

**TASK 9: TEST WELL DRILLING SUPPORT**

- Task 9.1: Test Well Drilling Bidding and Recommendation of Award
- Task 9.2: Preconstruction Planning and Coordination
- Task 9.3: Field Support
- Task 9.4: Analyze Test Well Yield and Water Quality Data
- Task 9.5: Production Wells Siting Recommendation
- Task 9.6: Production Well Recommendations Workshop
- Task 9.7: Test Well Program Summary Report

**TASK 10: PRODUCTION WELL DESIGN**

- Task 10.1: Well Perforation/Screening Analysis
- Task 10.2: Well Screening Design for Each Well (up to 10 Wells)
- Task 10.3: Radio and Communication Technology Review and Equipment Technical Memorandum (Existing and New Wells)
- Task 10.3: Monitoring Well Siting Analysis
- Task 10.4: Monitoring Well Design (up to 3 Monitoring Wells)
- Task 10.5: Standard Well House Design (30/60/90/100% submittals)
- Task 10.6: Site Grading, Paving, and Access Design (up to 10 Well Sites) (60/90/100% submittals)
- Task 10.7: Permitting Support (Building Permit and ODEQ Permit; OWRB permit provided by others)

**Task 11: BIDDING SUPPORT**

- Task 11.1: Contractor Bidding Support and Recommendation of Award
- Task 11.2: Preconstruction Planning and Coordination

**PHASE 3: PRODUCTION WELL CONSTRUCTION MANAGEMENT SUPPORT**

***Phase 3 will be authorized under a separate amendment. Scope of work and fee will be determined based on Final Design of Test Wells and availability of NUA staff to provide construction management support functions.***

## **Detailed Scope of Work – PHASE 1: AQUIFER INVESTIGATIONS AND WELL/WTP SITING**

### **TASK 1: PROJECT COORDINATION AND COMMUNICATION**

#### **Goals**

- Manage project execution to maintain compliance with agreed-upon scope, schedule, and budget.

#### **Scope of Work Elements**

##### Task 1.1: Kickoff Meeting and Project Plan

- Prepare for and facilitate project kickoff meeting with ACOG and NUA staff in Norman; prepare and submit meeting minutes.
- Prepare Project Plan documenting project scope, roles and responsibilities, project file management, communication protocol, and QA/QC protocol.

##### Task 1.2: Biweekly Coordination Calls

- Conduct biweekly project coordination conference calls with NUA Project Management team, Engineer's Project Manager, and select members of the Engineer's project team (determined as needed based on project phases and progress, assuming two project team members per call).
- Submit brief email summary of action items from each biweekly coordination call.

##### Task 1.3: Monthly Progress Reporting

- Prepare and submit monthly progress reports via e-mail documenting work performed during the month and work anticipated in the upcoming month; reports will accompany monthly invoices.
- Maintain updated project decision, data, and action logs.

##### Task 1.4: Coordination with Other Project Elements & Consultants

- Coordinate and communicate as needed with NUA staff and consultants conducting directly-related project work that will affect the well siting analyses and modeling (e.g., consultants conducting distribution system hydraulic modeling).

#### **Assumptions**

- 11 month period assumed for Phase 1 project management activities (i.e., 11 monthly progress reports, 11 months of biweekly coordination calls).

#### **Deliverables**

- Kickoff meeting materials and meeting summary.
- Project Plan in electronic (PDF) format and hard copies.
- Email summary of biweekly coordination calls.
- Monthly progress report in electronic (PDF) format.

### **TASK 2: SELECT EXISTING WELLS TO REACTIVATE THROUGH WTP BLENDING**

#### **Goals**

- Identify wells that are currently offline due to water quality considerations that can and should be brought back online by blending their production with finished water produced at the Vernon Campbell Water Treatment Plant (WTP).
- Identify constraints on the ability of Vernon Campbell WTP to provide the necessary blending under a range of conditions.
- Identify preliminary collection pipeline routing for conveying water from the selected wells to a common point of blending with finished water produced at the Vernon Campbell WTP, to allow design of the collection piping to proceed in Phase 2A as the initial phase of increasing groundwater production in the NUA system.

### **Scope of Work Elements**

#### **Task 2.1: Identify Existing Wells for Potential WTP Blending; Inventory Water Quality and Yield**

- Compile/review historical water quality (arsenic and gross alphas) and yield data for inactivated wells within an approximate 2-mile radius of the Vernon Campbell WTP
- Summarize water quality data (arsenic and gross alphas) for those wells in comparison to Safe Drinking Water Act standards.

#### **Task 2.2: Assess Blend Ratios for Range of WTP Operating Conditions**

- Compile/review historical water quality (arsenic and gross alphas) for finished water from the Vernon Campbell WTP. Obtain 10-year projection of minimum, maximum, and average daily WTP production (with seasonal variability) from NUA staff.
- Set up a blend ratio spreadsheet to determine blended water quality (arsenic and gross alphas), providing the ability to assess different WTP flow scenarios in combination with reactivation of any combination of one or more wells operating at each well's anticipated yield. Include an ability to sort the wells by distance and direction from the WTP.

#### **Task 2.3: Existing Well Blending Decision Workshop**

- Conduct an interactive Well Blending Decision Workshop at NUA's offices to assess different blending scenarios, considering ranges of well and WTP production conditions and distances from the WTP. Use the blend ratio spreadsheet to identify maximum blend capabilities of the WTP production and prioritize and select wells to blend.
- Discuss potential routing for collection piping to convey water from selected wells to common point of blending with finished water from the Vernon Campbell WTP.

#### **Task 2.4: Existing Well Blending Technical Memorandum**

- Develop a brief draft and final Technical Memorandum documenting the basis for the selection of existing wells to be blended with finished water from the Vernon Campbell WTP (as decided at the Existing Well Blending Decision Workshop) and showing Conceptual Routing of collection piping to convey water from the selected wells to the identified common point of blending with finished water from the Vernon Campbell WTP.

### **Assumptions**

- NUA will provide all necessary historical water quality and production data for wells and Vernon Campbell WTP.

- Existing wells to be blended with Vernon Campbell WTP finished water will be selected based on water quality blending constraints and proximity to Vernon Campbell WTP; no detailed cost/benefit analysis will be performed.
- Wells that can be blended with Vernon Campbell WTP finished water should be prioritized for such blending. Existing deactivated wells' production beyond the Vernon Campbell WTP's blending capacity will be considered for blending with Oklahoma City supplies and/or treatment at the future groundwater treatment facility under subsequent tasks.
- Technical Memorandum will document workshop discussions/decisions in lieu of separate workshop minutes.
- Technical Memorandum will provide brief summary of rationale for selection of existing wells to be blended, and a conceptual routing of collection piping sufficient for initiation of design activities in Phase 2A.

#### **Deliverables**

- Blend ratio spreadsheet.
- Workshop agenda and discussion materials.
- Draft and final Existing Well Blending Technical Memorandum.

### **TASK 3: HYDROGEOLOGICAL INVESTIGATIONS**

#### **Goals**

- Determine the relationship between aquifer hydraulic characteristics and well yield based on data from existing production wells and aquifer data to provide a basis for estimating the potential yields of candidate wells.
- Develop a prioritized list of apparently viable candidate sites for production wells with acceptable water quality and yield, based on aquifer mapping and modeling tools developed by ACOG.
- Under separate agreement with NUA, ACOG will be responsible for creating a Garber-Wellington model for the Norman area, developing updated geological maps and cross-sections, and incorporating the updated geologic information into the model. The first three sub-tasks describe Engineer's quality assurance role in supporting ACOG.

#### **Scope of Work Elements**

##### Task 3.1: Data Coordination with City and ACOG

- Participate in discussion of available well data with City and ACOG.
- Review database of well information to ensure all available data is incorporated.

##### Task 3.2: Review ACOG Aquifer Mapping

- Participate in discussions with ACOG during review of well logs.
- Review cross-sections of focus area.
- Review mapping of sand zones developed from cross-sections and well data.

##### Task 3.3: Review ACOG Groundwater Model

- Coordinate with ACOG during model development to ensure the model is suitable for subsequent well field modeling.
- Review selection of model boundaries and grid refinement.
- Review integration of updated geology into the model.

- Review model calibration.
- Review future model assumptions and input data.

#### Task 3.4: Groundwater Modeling to Assess Well Interference and Potential New Well Yields

- Assess aquifer transmissivity and other characteristics including As and Cr6 data and well production and testing data including drawdown and yield to estimate potential yield of candidate wells for input to the model.
- Determine areas and approximate sites for candidate production wells based on aquifer mapping completed by ACOG.
- Develop a 30-year predictive scenario for the Norman-area model provided by ACOG.
- Evaluate well interference and drawdown for up to 5 scenarios to supply 2 mgd using different combinations of new candidate wells and existing shut-in wells. Initial input yields for new wells will be based on estimates derived from existing well data. NUA's production wells will be simulated using the MODFLOW MNW package to simulate potential yield reduction
- Process output for each scenario to evaluate drawdown, interference, and yield for candidate wells as well as long-term reliability of the well field and regional impacts to the aquifer.

#### Task 3.5: Analyze Potential Well Siting Areas Based on Aquifer Mapping and Groundwater Modeling Results

- Based on model results from the various pumping scenarios, prioritize the potential well sites based on hydraulic considerations only (predicted yield and well interference). Develop a table and map showing the prioritized wells and their anticipated yield; show potential blending stations (Vernon Campbell Water Treatment Plant and Oklahoma City supply connection).

#### Task 3.6: Well Siting Workshop 1

- A workshop will be conducted between Engineer, ACOG, and NUA staff to present the findings developed in the above tasks. Powerpoint slides and maps will be used to explain the assumptions, methods, and results.
- Workshop minutes will be compiled after the meeting and provided to NUA within two weeks of workshop.

#### Task 3.7: Task 3 Summary TM

- A draft technical memorandum (TM) will be developed to document the assumptions, methods, results, and conclusions/recommendations from the aquifer analysis and modeling efforts. The TM will not document geologic mapping or local model development by ACOG.
- Once NUA compiles comments and delivers these comments in a single document to Engineer, a final TM will be completed within 3 weeks and delivered to NUA in PDF format and hard copies.

#### Assumptions

- ACOG has primary responsibility for assembling data on existing wells for use in geologic mapping and analysis of potential well yields. The assembled well data will be made available to Engineer for analysis of production well yields.
- ACOG will provide a calibrated groundwater model suitable for use in modeling analyses with no further modification.
- Engineer's staff will meet with ACOG two times during geologic mapping and model development.

### Deliverables

- A PDF document and hard copies of the Powerpoint presentation and notes compiled from Well Siting Workshop 1 will be provided as meeting minutes.
- A draft TM will be provided in PDF format to NUA for comments. The comments received from NUA will be integrated into a Final TM that will be delivered as a PDF document and in hard copies.
- The updated MODFLOW groundwater model of the Garber-Wellington Aquifer in the Norman area will be delivered.

## **TASK 4: INFRASTRUCTURE OPTIMIZATION AND WELL/WTP SITING**

### Goals

- Within the viable areas identified in Task 3, identify sites for production wells and a potential future groundwater water treatment plant (WTP) that are optimized to reduce the need to make capital improvements to the City's treated water distribution system and reduce the necessary raw groundwater collection infrastructure feeding the WTP.
- Evaluate blending raw groundwater with other potable water sources in the City's transmission and distribution system as an alternative to the groundwater WTP as part of optimization analyses.

### Scope of Work Elements

#### Task 4.1: Identify Potential Groundwater WTP Sites & Blending Stations

- Engineer will work with NUA to identify select candidate areas for a new Groundwater Water Treatment Plant (GWTP). As an option to (or in concert with) the GWTP, potential blending stations will also be identified, which will be used to blend treated water and raw groundwater to meet water quality objectives.
- Candidate GWTP areas will be identified based on a visual assessment of mapping of existing transmission and distribution infrastructure and existing and potential future sites of production wells, in an effort to limit the need for transmission and distribution system improvements. Land ownership considerations identified by NUA will also be used in the GWTP siting. For each GWTP candidate area, a specific representative site will be assumed for modeling. The actual specific site to be acquired will be determined as part of subsequent land acquisition activities for the selected GWTP area. The two blending stations to be evaluated will be the Oklahoma City treated water point of entry into NUA's water distribution system and a point at or near NUA's Vernon Campbell Water Treatment Plant (WTP) treated water point of entry into NUA's water distribution system. However, if the WTP's production capacity has been fully allocated to blending the initial wells identified through the Task 2 analyses, it will not be considered further under this task.
- It is envisioned that up to three GWTP areas and 2 blending stations will identified for further exploration during Task 4.3 and 4.4.

#### Task 4.2: Identify Candidate Well Sites

- Identify deactivated well sites that can be reactivated. Choosing potential sites for reactivation will be based on available historical information on these wells including yields, water quality, operational issues, and remaining useful life estimates provided by NUA. These sites will also be

investigated as to locational issues to existing infrastructure and also potential new infrastructure (pipes).

- Identify potential new general well sites based on groundwater mapping analyses and modeling from Task 3. Sites for first and second phases of new well construction will be selected based on Level of Service (LOS) requirements such as yield and water quality constraints. These sites will also be selected based on proximity to existing infrastructure, and general information readily available from NUA or public sources regarding land ownership. Specific well sites (e.g., land parcels) for test wells and/or production wells will be identified for the selected well sites as part of subsequent project tasks.
- Siting these facilities will also depend on reactivation of existing wells and when new wells will be necessary. Therefore, scheduling of these new facilities will depend on growth patterns and replacement needs (of existing infrastructure) identified by NUA.
- Upon preliminary identification of GWTP sites and blending station sites (Task 4.1) and well sites (Task 4.2), conduct Well Siting Workshop 1 (Alternative GWTP and Well Siting) in Norman with NUA staff to review, discuss, and refine/revise preliminary siting and select sites to be used for optimization modeling.

#### Task 4.3: Construct Raw & Treated Water Optimization Model

- NUA's updated InfoWorks WS model of the transmission and distribution system will be used for this analysis.
- It is assumed that this model will be updated and calibrated by others to existing conditions using a steady state solution (no extended period simulations are budgeted). It is also assumed that all future scenarios necessary for this analysis (e.g., 2025 demands and any known future infrastructure improvements) will be provided to Engineer with the updated model to represent additional future flows and infrastructure needed to meet LOS criteria within the existing service area.
- It is assumed that these flows will be finalized and will not change for each select period during this optimization analysis. It is also assumed that the proposed CIP infrastructure within the existing service area models will not need major modification based on this expanded system analysis.
- The final InfoWorks WS models of existing and future scenarios will be exported to an EPANET format and imported into the Optimizer WDS software. Additional facilities will be added in the Optimizer WDS software.
- The model construction effort assumes that up to 10 inactive/reactivated wells, and 10 new candidate well sites will be added during construction of the model. Necessary pipelines and valves that are needed to connect the new facilities to the existing facilities will also be constructed in the Optimizer WDS model.
- The Optimizer WDS modeling software requires additional input beyond the InfoWorks WS software. This input includes unit costs (for wells, piping, treatment and blending facilities, valves, tanks, etc.), LOS decision constraints (minimum and maximum flows, pressures, velocities), along with other "soft constraints" that may be needed to direct the optimized solutions.

#### Task 4.4: Optimize Infrastructure for Wells, WTP, and Blending

- The Optimizer WDS models (existing and future scenarios) will be run to develop optimized solutions. The Optimizer will be run for hundreds to thousands of iterations to identify optimized locations of facilities (wells, blending stations, and WTP), based on lowest overall

costs, as well as minimized pipeline infrastructure to connect the facilities while meeting the LOS criteria.

- To expedite the optimization runs, the new facilities may be run independent of the existing system model, but include necessary information at the proposed connection points to the existing model (e.g. flows and pressures). This will expedite the run times involved and provide a more efficient analysis.
- For budgeting purposes, it is estimated that up to nine (9) viable scenarios will be identified through the optimization process. These include up to three (3) scenarios for each planning period (first phase of new well construction at approximately 1 mgd of additional capacity, second phase of new well construction at a second additional 1 mgd of capacity, and future scenario with implementation of Cr6 regulation requiring treatment or blending of all existing and new wells and reactivation of currently-inactive arsenic wells). If NUA wants to expand the number of scenarios during the course of the project, additional budget may be needed to complete additional scenarios depending on the complexity of the additions.
- The results of the optimization runs, if run separately from the existing system, will be reconnected to the existing system to verify the overall system responds as expected.
- The entire model for each designated scenario will then be input back into the InfoWorks WS model and rerun to verify that any resulting differences between the Optimizer WDS and InfoWorks WS outputs are insignificant.
- Water quality constituents, such as the conservative pollutants (arsenic and Cr6) will be analyzed during optimization of the scenarios in order to identify necessary blending or treatment options related to these pollutants. Meeting water quality requirements for these two metals will act as a constraint within the optimization process. The resulting concentrations of these metals will be identified within each of the viable scenarios.

#### Task 4.5: Workshop 2 - Well / GWTP Site Selection

- A workshop will be conducted between Engineer and NUA staff to present the findings developed in the above tasks. Powerpoint slides and maps will be used to explain the assumptions, methods, and results.
- Workshop minutes will be compiled after the meeting and provided to NUA within two weeks of workshop.

#### Task 4.6: Siting Refinements Analysis

- Based on the input received from NUA during Workshop #2, additional runs may be made with the Optimizer model to refine the proposed CIP improvements.
- It is not envisioned that significant changes or additions will be made to the above 9 scenarios.

#### Task 4.7: Task 4 Summary TM

- A draft technical memorandum (TM) will be developed to document the assumptions, methods, results, and conclusions/recommendations from the above effort.
- Once NUA compiles comments and delivers these comments in a single document to Engineer, a final TM will be completed within 3 weeks and delivered to NUA in PDF format and in hard copies.

#### Assumptions

- NUA will provide significant input to Engineer to identify select Groundwater Treatment and Blending Station sites. NUA will also work closely with Engineer to define new well sites and

provide timely input to questions raised by Engineer, and documentation provided by Engineer that requires NUA's input.

- NUA will need to provide growth projections that will affect the siting and scheduling of new WTP sites, blending sites, wells, and other infrastructure (pipes). NUA will also need to provide information on the age and useful life of existing facilities so that this information can be incorporated into the scheduling of new facilities.
- Additional assumptions are detailed in the above tasks.

#### **Deliverables**

- A PDF document and hard copies of the PowerPoint presentation and notes compiled from Workshop #2 will be provided as meeting minutes.
- A draft TM will be provided in PDF format to NUA for comments. The comments received from NUA will be integrated into a Final TM that will be delivered as a PDF document and in hard copies.
- The updated InfoWorks WS model, including proposed new facilities, will be delivered.

### **TASK 5: TEST WELL DRILLING PROCUREMENT DOCUMENTS**

#### **Goals**

- Develop and document a prioritized plan for well field development; specify a plan for test well drilling to confirm anticipated water quality and yield from hydrogeological investigations and using results of well and WTP siting optimization to prioritize sites for test well drilling.
- Develop bid specifications for the test well drilling program.
- Prequalify approximately three well drilling contractors to bid the test well drilling program in Phase 2 of the project.

#### **Scope of Work Elements**

##### Task 5.1: Well Testing and Development Plan

- Based on TMs and well siting conclusions from analyses in Tasks 2 and 3, develop a synthesized and prioritized plan for well testing and development. Wells will be prioritized for development such that wells identified as viable production sites can be implemented in prioritized succession at NUA's chosen pace to achieve the desired cumulative new well yield over time.
- Document the Well Testing and Development Plan in an executive summary-style document summarizing the conclusions from previous analysis and the basis for and resulting recommendations for prioritizing well sites for test well development. Provide summary tables and maps documenting recommendations in the Well Testing and Development Plan. This document should be maintained as a strictly confidential, non-public document until such time as the landowner agreements are negotiated (see separate scope of work tasks in Phase 2B).

##### Task 5.2: Prepare Test Well Driller Minimum Qualifications

- Prepare a set of minimum qualifications for test well drillers, based on ENGINEER's experience in specifying, bidding, and working with test well drilling projects and contractors on similar projects in Oklahoma. Examples of the types of minimum qualifications that may be included are: ODEQ/OWRB certified well driller; Garber-Wellington municipal water well experience; familiar with oilfield logging techniques; zone isolation testing experience; ODEQ water sampling and submittal experience; OWRB well abandonment knowledge and experience.

**Task 5.3: Support NUA Test Well Driller Prequalification Solicitation**

- Support NUA's development and issuance of a Request for Qualifications (RFQ) to solicit qualified well drillers by identifying potentially qualified contractors, reviewing and providing comments on draft RFQ, and fielding respondents' questions.

**Task 5.4: Review SOQs and Recommend Prequalified Contractors**

- Support NUA's review of statements of qualifications (SOQs) received in response to NUA's issuance of the RFQ. Review SOQs for respondents' compliance with minimum qualification requirements as specified in the RFQ.
- Provide recommendation for qualified well drillers based on review of SOQs.

**Task 5.5: Prepare Test Well Program Bid Package**

- Prepare draft standard bid documents for NUA's use in soliciting bids for the test well drilling program. Bid documents will include NUA-provided standard front end specifications (Division 0 and Division 1), technical specifications, and maps of prioritized test well sites (based on Well Testing and Development Plan).
- Meet with NUA to review draft bid package and receive comments.
- Revise and finalize bid package; submit final bid package for NUA's use in test well program bidding under Phase 2B of this scope of work.

**Assumptions**

- RFQ process for test well drilling prequalification, including development of RFQ, advertisement, and notification of qualified contractors, will be conducted by NUA, with support as described herein by ENGINEER.
- Division 0 and Division 1 specifications will be provided by NUA with only minor editorial changes required by ENGINEER to conform them to this project.

**Deliverables**

- Draft and Final Executive Summary-style Well Testing and Development Plan (PDF and 10 hard copies)
- Description of Test Well Driller minimum qualifications
- Recommendation of qualified test well drilling contractors letter
- Draft and Final Test Well Program Bid Package (MS Word and PDF format; City will be responsible for producing bidders' hard copies)

Norman Utilities Authority Groundwater Well Field Development Carollo Engineers May 20, 2016						
ID	DESCRIPTION	Carollo + Subs Labor Hours	Carollo Labor	Carollo Expenses	Sub-Consultant	TOTAL FEE
<b>Phase 1: Tasks 1 through 5</b>						
<b>Task 1</b>	<b>Phase 1 Project Coordination and Communication</b>					
1.1	Kickoff Meeting and Project Plan	56	\$8,054	\$2,591	\$2,152	\$12,797
1.2	Biweekly Coordination Calls	55	\$9,317	\$515	\$1,452	\$11,284
1.3	Monthly Progress Reporting	44	\$8,052	\$515	\$0	\$8,567
1.4	Coordination with Other Project Elements & Consultants	24	\$4,884	\$281	\$0	\$5,165
	<i>SUBTOTAL</i>	<b>179</b>	<b>\$30,307</b>	<b>\$3,902</b>	<b>\$3,604</b>	<b>\$37,812</b>
<b>Task 2</b>	<b>Select Existing Wells to Reactivate Through WTP Blending</b>					
2.1	Identify Existing Wells for Potential WTP Blending; Inventory WQ & Yield	22	\$3,408	\$257	\$0	\$3,665
2.2	Assess Blend Ratios for Range of WTP Operating Conditions	34	\$5,236	\$398	\$0	\$5,634
2.3	Existing Well Blending Decision Workshop	28	\$3,886	\$1,307	\$792	\$5,985
2.4	Existing Well Blending Technical Memorandum	64	\$9,528	\$902	\$517	\$10,947
	<i>SUBTOTAL</i>	<b>148</b>	<b>\$22,058</b>	<b>\$2,865</b>	<b>\$1,309</b>	<b>\$26,232</b>
<b>Task 3</b>	<b>Hydrogeological Investigations</b>					
3.1	Data Coordination with City and ACOG	8	\$1,680	\$94	\$0	\$1,774
3.2	Review ACOG Aquifer Mapping	30	\$4,024	\$607	\$1,056	\$5,687
3.3	Review ACOG Groundwater Model	22	\$4,024	\$607	\$0	\$4,631
3.4	GW Modeling to Assess Well Interference and Potential New Well Yields	84	\$14,752	\$983	\$0	\$15,735
3.5	Analyze Potential Well Siting Areas	32	\$5,112	\$328	\$528	\$5,968
3.6	Well Siting Workshop 1	38	\$5,470	\$1,751	\$1,606	\$8,827
3.7	Task 3 Summary TM	76	\$11,532	\$996	\$1,058	\$13,586
	<i>SUBTOTAL</i>	<b>290</b>	<b>\$46,594</b>	<b>\$5,365</b>	<b>\$4,248</b>	<b>\$56,208</b>
<b>Task 4</b>	<b>Infrastructure Optimization and Well/WTP Siting</b>					
4.1	Identify Potential Groundwater WTP Sites & Blending Stations	14	\$2,556	\$164	\$0	\$2,720
4.2	Identify Candidate Well Sites	30	\$4,252	\$304	\$528	\$5,084
4.3	Construct Raw & Treated Water Optimization Model	56	\$9,640	\$655	\$0	\$10,295
4.4	Optimize Infrastructure for Wells, WTP, and Blending	84	\$14,460	\$5,983	\$0	\$20,443
4.5	Workshop 2 - Well / GWTP Site Selection	46	\$6,874	\$2,045	\$1,606	\$10,525
4.6	Siting Refinements Analysis	56	\$8,928	\$608	\$528	\$10,064
4.7	Task 4 Summary TM	86	\$12,200	\$1,089	\$1,036	\$14,325
	<i>SUBTOTAL</i>	<b>372</b>	<b>\$58,910</b>	<b>\$10,848</b>	<b>\$3,698</b>	<b>\$73,456</b>
<b>Task 5</b>	<b>Test Well Drilling Procurement Documents</b>					
5.1	Well Testing and Development Plan	64	\$3,254	\$234	\$6,789	\$10,277
5.2	Prepare Test Well Driller Minimum Qualifications	48	\$420	\$23	\$6,591	\$7,035
5.3	Support NUA Test Well Driller Prequalification Solicitation	20	\$0	\$0	\$2,422	\$2,422
5.4	Review SOQs and Recommend Prequalified Contractors	12	\$0	\$0	\$1,672	\$1,672
5.5	Prepare Test Well Program Bid Package	100	\$1,574	\$94	\$11,603	\$13,270
	<i>SUBTOTAL</i>	<b>244</b>	<b>\$5,248</b>	<b>\$351</b>	<b>\$29,077</b>	<b>\$34,676</b>
<b>Task 6</b>	<b>Design Infrastructure to Blend Existing Wells (Phase 2A)</b>					
<b>Task 7</b>	<b>Phase 2 Project Coordination and Communication (Phase 2B)</b>					
<b>Task 8</b>	<b>Acquire Leases for Water Rights or Land Purchase (Phase 2B)</b>					
<b>Task 9</b>	<b>Test Well Drilling Support (Phase 2B)</b>					
<b>Task 10</b>	<b>Production Well Design (Phase 2B)</b>					
<b>Task 11</b>	<b>Bidding Support (Phase 2B)</b>					
	<b>Construction Phase Services (Phase 3)</b>					
<b>TOTAL FEE: PHASE 1 SERVICES</b>		<b>1,233</b>	<b>\$163,117</b>	<b>\$23,331</b>	<b>\$41,936</b>	<b>\$228,384</b>
<b>TOTAL FEE: PHASE 2A SERVICES - TO BE NEGOTIATED BASED ON SCOPE</b>						
<b>TOTAL FEE: PHASE 2B SERVICES - TO BE NEGOTIATED BASED ON SCOPE</b>						
<b>TOTAL FEE: PHASE 3 SERVICES - TO BE NEGOTIATED BASED ON SCOPE</b>						