

WORK AUTHORIZATION NO. 2

PROJECT: Groundwater Services Relating to the Trinity Aquifer Within Williamson County East of I-35

This Work Authorization is made pursuant to the terms and conditions of the Williamson County Contract for Engineering Services, being dated **December 20, 2023** and entered into by and between Williamson County, Texas, a political subdivision of the State of Texas, (the "County") and **LRE Water, LLC** (the "Engineer").

Part 1. The Engineer will provide the following Engineering Services set forth in Attachment "B" of this Work Authorization.

Part 2. The maximum amount payable for services under this Work Authorization without modification is **\$185,940.00.**

Part 3. Payment to the Engineer for the services established under this Work Authorization shall be made in accordance with the Contract.

Part 4. This Work Authorization shall become effective on the date of final acceptance and full execution of the parties hereto and shall terminate on **December 31, 2024.** The Engineering Services set forth in Attachment "B" of this Work Authorization shall be fully completed on or before said date unless extended by a Supplemental Work Authorization.

Part 5. This Work Authorization does not waive the parties' responsibilities and obligations provided under the Contract.

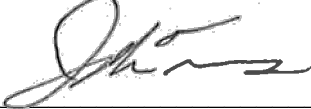
Part 6. County believes it has sufficient funds currently available and authorized for expenditure to finance the costs of this Work Authorization. Engineer understands and agrees that County's payment of amounts under this Work Authorization is contingent on the County receiving appropriations or other expenditure authority sufficient to allow the County, in the exercise of reasonable administrative discretion, to continue to make payments under this Contract. It is further understood and agreed by Engineer that County shall have the right to terminate this Contract at the end of any County fiscal year if the governing body of County does not appropriate sufficient funds as determined by County's budget for the fiscal year in question. County may effect such termination by giving written notice of termination to Engineer.

Part 7. This Work Authorization is hereby accepted and acknowledged below.

EXECUTED this ____ day of _____, 2024

FIRM:

LRE Water, LLC

By:  8/1/24

Signature

Jordan Furnans, PhD, PE, PG

Printed Name

Vice President - TX Operations

Title

COUNTY:

Williamson County, Texas

By: _____
Signature

Printed Name

Title

LIST OF ATTACHMENTS

Attachment A - Services to be Provided by County

Attachment B - Services to be Provided by Firm

Attachment C - Work Schedule

Attachment D - Fee Schedule

ATTACHMENT A

WORK AUTHORIZATION No. 2

PROJECT: 23RFSQ79

Services to be Provided by County:

None

ATTACHMENT B

WORK AUTHORIZATION No. 2

PROJECT: 23RFSQ79

Services to be Provided by Firm:

LRE Water, LLC (“The Firm”) will provide the following Professional Services, consisting of tasks that will collectively convert the hydrogeologic conceptual model (created under Work Authorization 1) to a complete computational numerical model using industry standard modeling software. The first part of this process is to translate the real-world, conceptual-model data into the MODFLOW input file format and files which we will use for calibration of the model parameters. During the construction and calibration of the model, we will use an open-source scripting-based approach. The workflow approach will ensure that the model is developed with transparency, efficiency, and reproducibility. The model will be developed using MODFLOW 6, which is the latest version of MODFLOW. The model will be designed, constructed, and documented to TWDB standards. The model, along with the dashboard and analytical tools (to be developed under future Work Authorization 3), will aid the County in effectively planning water supplies for proposed and future developments. Individual subtasks include:

TASK 2A – GRID DISCRETIZATION AND STRUCTURE

The first task in model development is determining the model area. Since the area of interest is Williamson County, the model area will need to extend beyond the county to avoid potential issues when simulating pumping near the Williamson County line. The extension of the area beyond the county will either coincide with natural geologic boundaries, utilize the current (or in process of being updated) Region 8 GAM (Developed by TWDB) to determine groundwater inflows or outflows, or be assigned as time-variant water level elevations. We will develop the grid for the model using the unstructured approach which will allow for stratigraphic pinch outs or other structures identified in the hydrogeologic conceptual model. In addition, the use of an unstructured grid will allow for nodes to represent varying amounts of aquifer area; for example, a node can represent a smaller area where the density of real-world data is greater. For the aquifer discretization, we will assign the bottom of each layer to each cell using the stratigraphic layer elevations from the hydrogeologic conceptual model phase. Once the model parameters and boundary conditions have been developed (Task 2B and Task 2C), we will refine the grid where necessary to improve the numerical representation of local conditions.

TASK 2B – PREPARE MODEL PARAMETERS FILES

For this task, the model parameter files refer to the input files associated with the hydraulic properties of the model or items associated with the observations of aquifer conditions. In addition, as part of this task we will compile and/or format observations of water level and spring flow that may be used during calibration of the model. As applicable, water level and spring flow data will be incorporated into the model dataset to aid in the calibration of the Edwards Aquifer layer of the model. We will incorporate the representation of faults within the model to reflect observations and mapping. We will also

investigate the potential for monthly time discretization for the model. However, if available data are insufficient for meaningful calibration at the monthly time period level, we will focus on developing the model to reflect annual aquifer conditions.

TASK 2C – PREPARE MODEL BOUNDARY CONDITION FILES

The model boundary conditions refer to items where the flow, water level, or a combination of the flow and water level are defined for the aquifer. For example, pumping is a flow boundary condition where the groundwater withdrawals are prescribed for the aquifer. Preparation of these files will include general head or constant head boundaries along the edge of the model. We will evaluate the choice of boundary type through preparation and testing of the model. We will incorporate the transient recharge to the Edwards and Trinity aquifers developed from the conceptual model. Our evaluation will be limited to the estimated potential for recharge across the outcrop area. Pumping volumes from the well locations and corresponding pumping estimates will be incorporated into the model. Drains will be used to represent spring locations and evaluate outflow from the aquifer. We will evaluate the explicit incorporation and simulation of streams within the model.

TASK 2D – CALIBRATION AND PREDICTIVE EVALUATION

Model calibration and predictive evaluation will involve conducting multiple simulations and adjusting parameters to minimize the difference between simulation results and field observations. In addition, the approach will seek to also minimize predictive uncertainty where it is reasonable and justified by observations to do so. Our approach will involve both manual and automated methods.

Manual testing will involve performing one simulation at a time and assessing the results. This step will help us identify potential errors in the input files, observation files, computation of results, or other issues that may interfere with automated calibration.

Automated calibration will involve the application of the PEST++ software to conduct multiple simulations simultaneously to evaluate possible parameter values. Application of this approach will allow us to achieve calibration of the model much faster than through manual calibration alone. In addition, we anticipate applying the approach to create an ensemble of parameters that will aid in informing the uncertainty in the predictions.

The model purpose will guide our approach to calibration and predictive uncertainty evaluation. We will work with County leaders and staff to weight the calibration and predictive uncertainty such that model reliability may be clearly understood with regard to the ability of the formations to provide sufficient groundwater to meet projected needs.

TASK 2E – PREDICTIVE SIMULATIONS

Once the model is calibrated, we will perform three predictive simulations. We will work with County leaders and staff to define the scope of these predictive simulations. Possible simulations may involve potential developments that may use groundwater, potential aquifer storage and recovery projects, or

areas of existing groundwater use. Results for the simulations will illustrate the predicted effect on aquifer conditions based on the simulation parameters and constraints.

TASK 2F – REPORT

We will prepare a draft and final report documenting the data, model construction, model calibration, and predictive simulation results. Model development and reporting will follow the TWDB's Groundwater Availability Model Standards.

Work Authorization 2 Deliverables:

Groundwater Flow Model Files

Volumetric estimates for the availability of water for each subunit of the Trinity Aquifer within Williamson County

Maps of available drawdown for all subunits of the Trinity Aquifer

Groundwater Flow Model Report

- Summarizes the project with relevant items discussed in Task 2A – 2E according to the TWDB numerical model report checklist.
- Provided in electronic format (PDF)

ATTACHMENT C

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Work Schedule

Tasks performed under Work Authorization 2 will commence immediately upon receipt of notice to proceed. All task efforts shall be completed no later than December 31, 2024, with a draft report provided to the County no later than October 31, 2024.

ATTACHMENT D

WORK AUTHORIZATION No. 2

PROJECT: 23RFSQ79

Fee Schedule

The project budget for Work Authorization No 2. is \$185,940.

Expenses will be based on hours worked by project staff, per the hourly rates listed below.

Note: LRE Water Staff listed below are those most likely to work on the Williamson County Groundwater Services Project. We will utilize other staff (as needed), possibly including staff not hired as of 4/21/2024, and will provide such staff names, classifications, and hourly rates as needed.

Primary LRE Water Staff – TX Operations		
<u>Name</u>	<u>Classification</u>	<u>Rate (\$/hr)</u>
Furnans, Jordan	Project Manager	\$225
Clause, Vince	Senior Project Geologist	\$200
Budd, Theresa	Staff Geologist III	\$185
Darling, Wallace	Staff Geologist I	\$143
Schellhorn, Alex	Project Geologist	\$176
Standen, Allan	Senior Project Geologist	\$220
Swientek, Lauren	Staff Geologist I	\$143
Wade, Kacey	Staff Geologist I	\$137
Wong, Stephanie	Staff Geologist II	\$153
Project Support Staff – TX Operations		
<u>Name</u>	<u>Classification</u>	<u>Rate (\$/hr)</u>
Gilliom, Ryan	Project Geologist	\$169
D’ Ambra, Lauren	Staff Geologist I	\$135
Fullmer, Tucker	Technology Specialist II	\$141
Salazar, Tim	Data Scientist II	\$169
Barry, Michael	Project Developer	\$183
Anderson, Hanna	Project Engineer	\$185
Weil, Page	Project Manager	\$220
Bauer, Jacob	Project Geologist	\$220
Barber, Joel	Project Engineer	\$215
Stokes, Scott	Staff Geologist II	\$142

Subcontractor Staff – Staff Rates

<u>Name</u>	<u>Firm/Affiliation</u>	<u>Classification</u>	<u>Rate (\$/hr)</u>
Keester, Mike	KT Groundwater	Senior Geologist	\$250
Webster, Paul	KT Groundwater	Geologist	\$150
Joe Yelderman	Baylor University	Technical Advisor	\$250
Hunt, Brian	UT BEG	Technical Advisor	\$250
Scanlon, Bridget	UT BEG	Technical Advisor	\$250
Nicot, Jean-Phillippe	UT BEG	Technical Advisor	\$250
Flaig, Peter	UT BEG	Technical Advisor	\$250