REQUEST FOR PROPOSAL (RFP)

COCONINO AND REDWALL-MUAV AQUIFER MODELING PROJECT (CARAMP), PHASE 2

COCONINO PLATEAU WATERSHED PARTNERSHIP
9833 E. PRESERVE WAY
SCOTTSDALE, AZ 85262

MARCH 22, 2023

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1. SUMMARY AND BACKGROUND

The Coconino Plateau Watershed Partnership (Partnership) is currently accepting proposals for groundwater modeling work that will evaluate groundwater withdrawal scenarios and provide information to assist its participants in evaluating possible rule changes by the State of Arizona that will affect the determination of adequate water supplies outside of Active Management Areas for users of the Coconino (C) and the Redwall-Muav (R) Aquifers. Given the mission of the Partnership to facilitate and implement sound water resource management and conservation strategies on the Coconino Plateau, the results of the modeling work will be used by the participants to evaluate the impacts on surface water flows in rivers, springs and riparian areas over a 100-yesr time period.

Through this scope of work, the Partnership is seeking a respondent to complete the groundwater modeling scenario runs and generate a report using the Coconino and Redwall-Muav Aquifer Modeling Project (CARAMP) version of the Northern Arizona Regional Groundwater Flow Model.

The purpose of this Request for Proposal (RFP) is to solicit proposals from various candidate organizations, conduct a fair and extensive evaluation based on criteria listed herein, and select the candidate who is best qualified to complete the groundwater modeling in a manner that provides a useful tool for water related decisions to be made by the stakeholders.

The Partnership is diverse group of stakeholders that has formed a non-profit organization intended to provide a forum for cooperative, sustainable water development and use on the Coconino Plateau. Stakeholders include water providers, State and Federal agencies, Native American Tribes, environmental organizations, academia and interested citizens. The Partnership has a Technical Advisory Committee (TAC) and Public Outreach Committee (POC) staffed by volunteers representing participating organizations. Monthly meetings take place virtually or at the U.S. Geological Survey facility at 2255 N. Gemini Drive, Flagstaff, Arizona.

The Partnership is administered by an independent contractor, Ron Doba Management Services. Ron Doba is the Coordinator for the Partnership and, as the project manager for the groundwater modeling project, will coordinate the project with the TAC and Partnership as necessary through its duration. Ron Doba's office is located at 9833 E. Preserve Way, Scottsdale, AZ 85262 and his phone number is 480-299-5764. Questions regarding this RFP should be directed to Mr. Doba by email at rdoba@cox.net.

2. PROPOSAL GUIDELINES PROPOSAL

This Request for Proposal represents the requirements for an open and competitive process. Proposals will be accepted until 5pm Mountain Time, April 24, 2023. Any proposals received after this date and time will be returned to the sender. All proposals must be signed by an official agent or representative of the company or agency submitting the proposal.

Proposals shall not exceed 10 pages in length. The page limitation is all inclusive. Do not submit company brochures or other marketing material not relevant to this particular project.

If the organization submitting a proposal must outsource or contract any work to meet the requirements contained herein, this must be clearly stated in the proposal. Additionally, all costs included in proposals must be all-inclusive to include any outsourced or contracted work. Any proposals which call for outsourcing or contracting work must include a name and description of the organizations being contracted.

All costs must be itemized to include an explanation of all fees and costs.

Contract terms and conditions will be negotiated upon selection of the proposal for this RFP. All contractual terms and conditions will be subject to review by the Partnership and will include scope, budget, schedule, and other necessary items pertaining to the Assessment.

3. MODELING PROJECT OBJECTIVE

The Coconino Plateau Watershed Partnership (CPWP) Technical Advisory Committee (TAC) seeks to retain a groundwater modeling consultant to complete an evaluation of scenarios designed to explore alternative physical availability criteria to demonstrate water adequacy for developments pumping groundwater from the "C" and "R" aquifers in northern Arizona. A modified version of the Northern Arizona Regional Groundwater Flow Model (NARGFM) developed by the U.S. Geological Survey will be used to complete the work (USGS, 2011). The modified version, CARAMP will be used to address the scope of work identified in this RFP

The issue for northern Arizona is that the starting 100-year depth-to-static water level in some existing or proposed municipal well fields exceeds the 1,200-foot, depth-to-static water level criteria[1]. Recognizing the many issues and challenges that confront the development of sustainable municipal and domestic rural water supplies, legislation was passed in 2007 (Senate Bill 1575) that required ADWR to develop additional criteria for establishing physical availability in areas outside AMAs that may include depth-to-static water level or limits based on other aquifer characteristics that affect the physical availability of water for a proposed use that are appropriate for a specific groundwater basin or sub-basin (ADWR, 2008).

Following on potential alternative physical availability criteria initially proposed in 2008, the CPWP TAC is concerned whether a percent reduction in saturated thickness of the "C" and "R" aquifers at municipal pumping centers would meet current and projected future water demands, and also not negatively impact other municipal water providers or rivers, springs and riparian areas within a 100-year time period. The TAC is also concerned about climate change and how it may impact future natural recharge.

[1] The ADWR 100-year, depth-to-static water level physical availability criteria for demonstrating water adequacy for developments outside AMAs is R12-15-716(B)(2)(c).

4. BACKGROUND ON THE NARGFM

The NARGFM model was developed by the USGS using the MODFLOW-2005 (Harbaugh, 2005) source code to simulate the impacts of groundwater withdrawals and the interactions between the aquifers, perennial streams, and springs for predevelopment and transient conditions from 1910 through 2005. The model domain spans a very large geographical area and includes multiple aquifers, rivers and springs. The model grid includes 600 rows, 400 columns, and three layers (Figure 1). Model cell sizes are one square kilometer. The NARGFM model is the most comprehensive and all-encompassing numerical model that exists for northern Arizona.

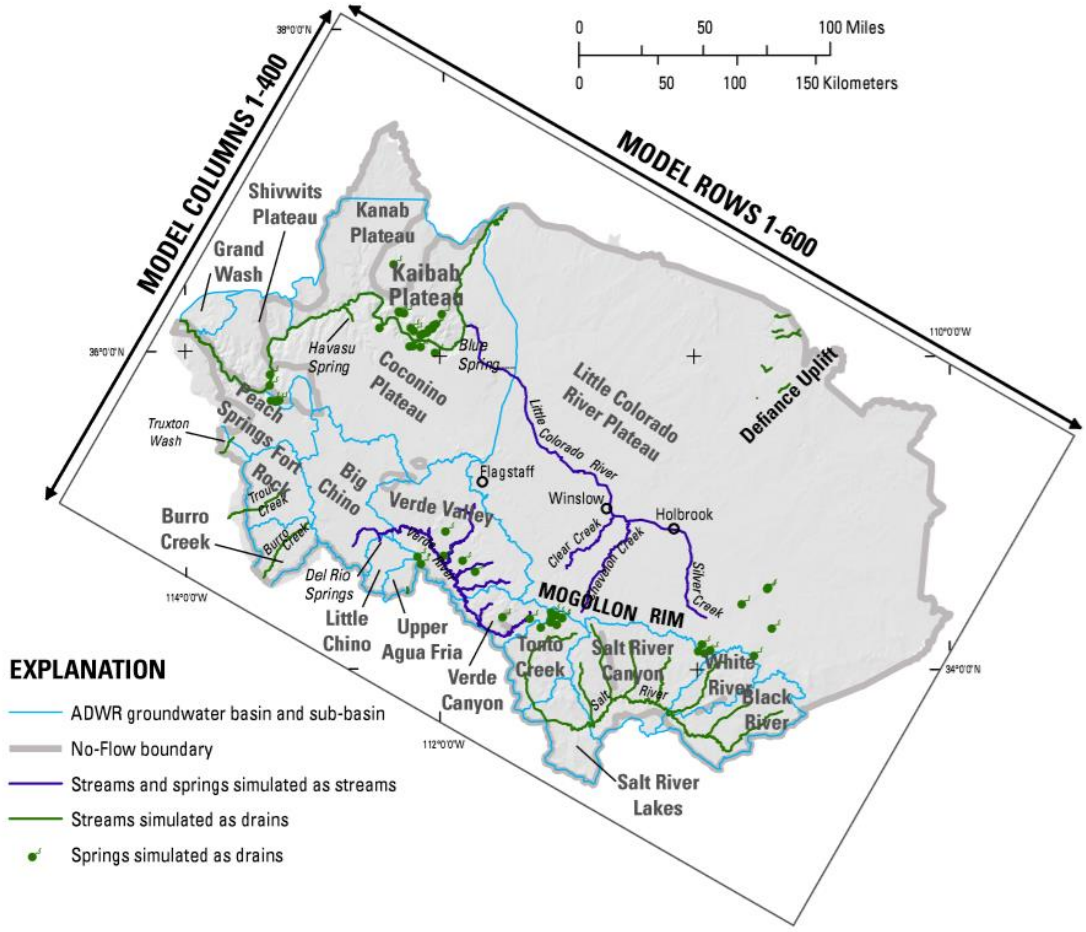

Figure 1 Boundary conditions for NARGFM (Source: USGS, 2011)

5. NARGFM UPDATES AND RELATED MODELING STUDIES

The NARGFM model was originally updated and used in a study for the City of Flagstaff by AMEC (2012) for purposes of submitting a Physical Availability Demonstration for the City's Designation of Adequate Water Supply (known as the Flagstaff Model). This first iteration of the City's updates to the NARGFM included an updated model-calibration period from 1910 through 2010 with 100-year predictive simulations from 2011 through 2110. Modifications to the model included refinements to the model grid in the vicinity of Flagstaff and Red Gap Ranch.

The NARGFM model was used in 2015 as an interpretive model by a group of researchers from Northern Arizona University (NAU) to evaluate semi-arid aquifer responses to forest restoration treatments and climate change (Wyatt, and others, 2015). Several scenarios were run in this study that evaluated theoretical impacts to natural recharge from planned tree basal area reductions and climate change.

A revised version of the NARGFM model was recently used to simulate the effects of groundwater withdrawal scenarios for the Redwall-Mauv (R-aquifer) and Coconino (C-Aquifer) systems of northern and central Arizona (USGS, 2016). That study was conducted for the Coconino Plateau Water Advisory Council to evaluate the impacts of three future water use scenarios (simulating future groundwater conditions from 2006 to 2105) that included:

Scenario 1 – no major changes in groundwater use except for increased demand based on population projections.

Scenario 2 – a pipeline that would provide a source of surface water from Lake Powell to areas near Moenkopi and Cameron that would replace local groundwater withdrawals.

Scenario 3 – the pipeline extends to the Flagstaff and Williams and reduce groundwater withdrawals in those areas.

Results of that study focused on projected impacts to regional water levels and water levels at local pumping centers, and to impacts on groundwater discharge at rivers, springs and riparian areas.

The most recent use of the NARGFM model by the City of Flagstaff involved the update of model pumping and recharge inputs and other refinements to the Flagstaff Model to complete the version of the model known as the Red Gap Ranch–Leupp Groundwater Flow Model (RGRLGFM) (Southwest Groundwater Consultants, 2015). The focus of that modeling effort was to assess the impact of proposed groundwater withdrawals from the C aquifer by the City of Flagstaff at its current well fields, at the City's Red Gap Ranch, and by the Navajo Nation at Leupp. Of particular interest in the study were projected 100-year impacts to static water levels at the Red Gap Ranch and Leupp well fields, and impacts to the projected baseflow of the Little Colorado River, Clear Creek, and Chevelon Creek. Substantial updates

and refinements were made to the model, within the areas shown in Figure 2. The most significant updates included:

- Reducing the model grid size in key areas (Clear Creek, Chevelon Creek, Red Gap Ranch (RGR) and Navajo Nation Leupp (NNL) well fields, the Flagstaff area; utilizing the Unstructured Grid (USG) version of MODFLOW.

- Changing from MODFLOW's River Package to the Stream Package for simulation of selected rivers, streams, and creeks in the Study Area.

- Reviewing well records and geologic information and modifying the extent of Layer 1 (Coconino Sandstone) to encompass all the RGR and NNL well field areas and the depth of the contact between Layer 1 and Layer 2 north of Holbrook.

- Updating the Basin Characterization Model (BC-NT) natural recharge data sets obtained from the USGS.

- Updating groundwater pumping files with pumping for municipalities, INAs, Community Water Systems (CWS), major industries and others.

- Calibrating the model to 2015 water levels in the C aquifer, including water level data provided by Arizona Public Service (APS) for the region east of Chevelon Creek.

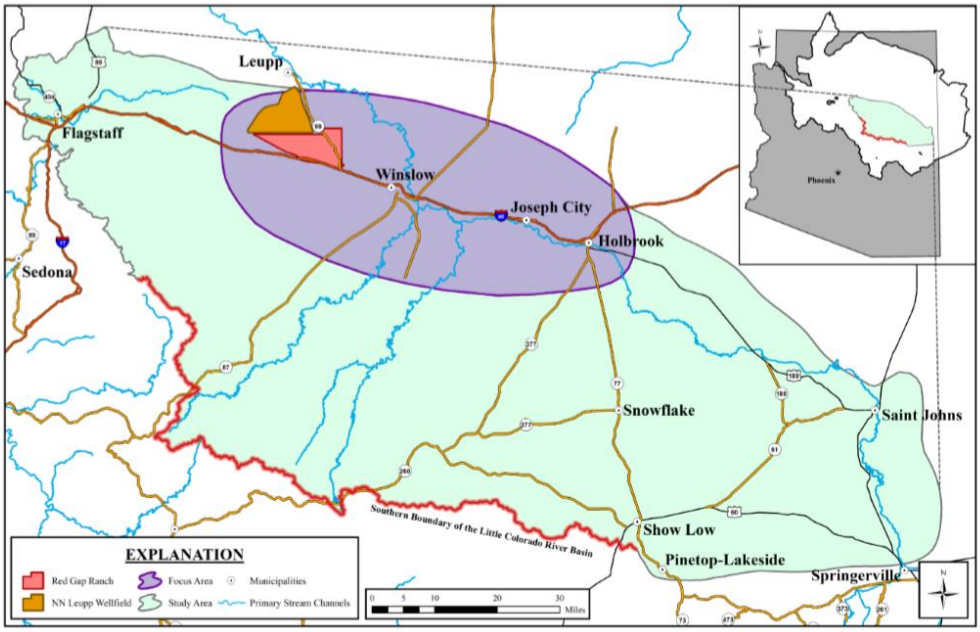

Figure 2 RGRLGFM Model Area and Focus Study Area

The CARAMP version of the model was developed by Matrix New World Engineering for Phase1 of this project. Phase 2 consist of tasks identified in this Scope of Services.

6. General Requirements and Recommendations for Scenario Development

The selected consultant should be familiar with the geology and hydrogeology of northern Arizona, and have demonstrated experience working with the NARGFM or a modified version of that model. The consultant will utilize the CARAMP version of the NARGFM to conduct the proposed model study. The consultant will work with representatives of the CPWP TAC to develop future pumping and recharge scenarios for the project.

7. General Requirements for all Model Scenarios

1. All 100-year scenarios will begin at the end of the last stress period simulated in the current version of the RGRLGFM.

2. The future change in aquifer saturated thickness and change in groundwater discharge calculations will be made relative to the beginning of the 100-year projection period.

3. The future projected depth-to-static water level and remaining aquifer saturated thickness will be calculated at the end of the 100-year projection period.

4. Projected percent remaining saturated thickness will be calculated for the C and R aquifers at specific well(s) and/or pumping centers. Wells and pumping centers where the remaining saturated thickness will be calculated include existing or proposed municipal or community water system providers where the current or projected 100-year, depth-to-static water level exceeds 1,200 feet BLS (unless otherwise specified by the TAC). The method used to calculate the remaining saturated thickness will be specified by the TAC.

5. Projected future groundwater discharge and change in groundwater discharge will be calculated for the Little Colorado River, Upper Verde River, Clear Creek, Chevelon Creek, Oak Creek, and for springs listed in Table 1.

6. Any areas that have dewatered model cells after the 100-year projection period will be identified on applicable maps and in the project report.

Specific Scenario Requirements

Two additional model scenarios (with and without climate change) to the original scenarios (below) shall be developed and run. The scenarios will require the following estimates and assumptions (unless otherwise specified by the TAC).

Baseline Conditions (Scenario 1)

1. Future groundwater withdrawals for municipal providers will be based on current rates of withdrawal and population growth assumptions to be specified by the TAC. Future groundwater withdrawals for other uses will be based on current rates of withdrawals simulated in RGRLGFM or otherwise specified by the TAC.

2. Future recharge and other model inputs will be left unchanged from one of the existing RGRLGFM scenarios.

50 % Remaining Saturated Thickness (Scenario 2)

1. Increased pumping rates at wells in specified pumping centers until 50 percent saturated thickness is achieved. Future groundwater withdrawals for other uses will be the same as in Scenario 1.

2. Future recharge rates will be the same as in Scenario 1.

75 % Remaining Saturated Thickness (Scenario 3)

1. Increased pumping rates at wells in specified pumping centers until 75 percent saturated thickness is achieved[2]. Future groundwater withdrawals for other uses will be the same as in Scenario 1.

2. Future recharge rates will be the same as in Scenario 1.

[2] The proposed 75 or 50 percent remaining saturated thickness criteria are strictly initial evaluation thresholds. Ultimately, minimum remaining saturated thickness criterion will be proposed that are based on projected pumping rates that do not cause unacceptable impacts at existing or proposed municipal pumping centers and environmental areas of concern.

50 % Remaining Saturated Thickness, With Climate Change (Scenario 4)

1. In this scenario natural recharge is less than rates simulated in Scenarios 1-3. The amount of decrease in natural recharge may be based on rates discussed in (Wyatt, and others, 2015) or otherwise specified by the TAC.

2. Like Scenario 2, municipal pumping rates would be varied to an extent necessary to lower the projected 100-year depth-to-static water level to approximately 50 percent of the aquifer's current saturated thickness.

3. All other recharge rates and model inputs be the same as simulated in Scenarios 1-3.

75 % Remaining Saturated Thickness, With Climate Change (Scenario 5)

1. In this scenario natural recharge is less than rates simulated in Scenarios 1-3. The amount of decrease in natural recharge may be based on rates discussed in (Wyatt, and others, 2015) or otherwise specified by the TAC.

2. Like Scenario 3, municipal pumping rates would be varied to an extent necessary to lower the projected 100-year depth-to-static water level to approximately 75 percent of the aquifer's current saturated thickness.

3. All other recharge rates and model inputs be the same as simulated in Scenarios 1-3.

Additional Scenario 6, Simulation of 5' per year Reduction to Water Level:

1. Consultant shall run a model scenario that simulates pumping resulting in a 5' per year reduction to water level below land surface for 100-years for determination of impact to adjacent wellfields and surface water flows, including springs.

Additional Scenario 7, Simulation of 5' per year Reduction to Water Level with Climate Change:

1. Consultant shall run a model scenario that simulates pumping resulting in a 5' per year reduction to water level below land surface for 100-years for determination of impact to adjacent wellfields and surface water flows, including springs taking into account climate change.

8. MODEL REPORT

A model report will be prepared by the consultant that documents model scenario assumptions and results. Items documenting model results such as maps, tables and narrative in the report include:

- Total withdrawal rates for each well field for each scenario
- Initial and percent remaining saturated thickness of the R and C aquifers at municipal pumping centers
- Simulated 100-year depths-to-static water level
- Simulated potentiometric surface and drawdown at the end of the 100-year projection period.
- Any simulated negative impacts to existing municipal water users
- Simulated groundwater discharge and evapotranspiration at environmental areas of concern
- Simulated change in groundwater discharge and evapotranspiration
- Dry cells
- Simulated water budgets with mass balance errors for each model run
- Any un-simulated pumping due to model cell dewatering

- Summary of findings and recommendations
- Any other information required by the TAC

References

ADWR, 2008. Hydrologic Data and Draft Recommendations Related to the Review of 100-Year Physical Availability Depth Criteria for Demonstrating Adequate Water Supplies (Study in support of the requirements of SB 1575). Public Comment Draft Report, 5/9/08.

AMEC, 2012. Final Groundwater Modeling Impact Analysis, City of Flagstaff – Water Resources Sustainability Study Coconino County, Arizona (Volume 1 of 2).

Harbaugh, 2005. MODFLOW-2005, The U.S. Geological Survey Modular Ground-Water Model – the Ground-Water Flow Process. U.S. Geological Survey Techniques and Methods 6-A16.

Southwest Groundwater Consultants, 2015. Red Gap Ranch – Leupp Water Resources Environmental Assessment Groundwater Flow Model. Prepared for The City of Flagstaff Utilities Division.

USGS, 2011. Regional Groundwater-Flow Model of the Redwall-Muav, Coconino, and Alluvial Basin Aquifer Systems of Northern and Central Arizona. USGS Scientific Investigations Report 2010–5180, v. 1.1.

USGS, 2016. Simulation of Groundwater Withdrawal Scenarios for the Redwall-Muav and Coconino Aquifer Systems of Northern and Central Arizona. USGS Scientific Investigations Report 2016–5115.

Wyatt, and others, 2015. Semi-Arid Aquifer Responses to Forest Restoration Treatments and Climate Change. Groundwater. Vol. 53, No. 2 March-April 2015, Pages 207-216.

Table 1 Selected Spring and River Flux Targets (Source: AMEC, 2012)

TABLE 3.6.3-1

SIMULATED VERSUS OBSERVED SPRING AND RIVER FLUX TARGETS (1910-2010)

City of Flagstaff
Flagstaff, Arizona

Target Location (Relative to Focused Study Area)	Common Spring, River, or Wash Name	Model Layer	Simulated Flow Rate (Range) (af/yr)	Observed Flow Rate (af/yr)	Observed Flow Rate (gpm)	Observed Data Source (Date Range)	Observed Data Source
Inside Focused Study Area	Beaverhead	2	131 - 142	137	85	1974	Hart et. al., 2002
	Blue Spring	3	190,604 - 195,116	164,000	101,604	1950 - 1993	Hart et. al., 2002
	Cold Spring	3	3,923 - 10,964	6,779	4,200	1952	Hart et. al., 2002
	Diamond	3	635 - 694	405	251	5/19/1993	ADWR, 2012b
	Fossil	3	23,051 - 28,515	30,000	18,600	1952	Hart et. al., 2002
	Henturkey	3	41 - 113	97	60	1952	Hart et. al., 2002
	Horton	3	364 - 646	633	392	10/2/2002	ADWR, 2012b
	Ind Gardens	3	185 - 586	161	100	5/17/1952	ADWR, 2012b
	Nappa	3	53 - 92	113	70	1966	Hart et. al., 2002
	Page Springs	2	44,182 - 46,722	22,400	13,913	1968	Hart et. al., 2002
	R-C	3	877 - 1,692	1,291	800	5/14/1952	ADWR, 2012b
	See	3	947 - 1,633	1,450	900	1966	Hart et. al., 2002
	Sheepshead Canyon	2	151 - 156	179	111	3/1/1974	ADWR, 2012b
	Sterling	2	348 - 362	468	291	1949	Hart et. al., 2002
	Sterling	2	0 - 0	34	21	1949	Hart et. al., 2002
	Tonto	3	836 - 1,512	1,450	900	1952	Hart et. al., 2002
	Walker Creek	2	88 - 97	121	75	1959	Hart et. al., 2002
	Wet Beaver	2	2,631 - 2,694	2,180	1,350	1959	Hart et. al., 2002
	Wildcat	3	0 - 0	94	59	10/20/1952	ADWR, 2012b
		Totals (af/yr)	269,047 291,736	241,249			
		Average (af/yr)	280,391				

% Difference between Average Observed vs. Model Simulated Flow	16%

9. REQUEST FOR PROPOSAL TIMELINE

All proposals in response to this RFP are due no later than 5pm Mountain Time, April 24, 2023.

Evaluation of proposals will be conducted from April 24, 2023 until May 8, 2023. If additional information or discussions are needed with any bidders during this two-week window, the bidder(s) will be notified.

Depending on the number of proposals received and the quality of submitted proposals, it may be necessary for the TAC to conduct interviews of respondents that are "short listed." Interviews (if necessary) will be scheduled from May 8, 2023 thru May 25, 2023 and will be held in Flagstaff, AZ or virtually.

The selection decision for the successful proposal will be made no later than May 26, 2023.

Upon notification, the contract negotiation with the winning bidder will begin immediately. Contract negotiations will be completed by June 29, 2023 and shall be submitted to the Coconino Plateau Watershed Partnership Board of Directors for approval at the June 30, 2023 meeting.

Notifications to bidders who were not selected will be sent July 3, 2023.

Project Timeline:
The Project is to be completed by June 30, 2024. A schedule for completion of the individual Project tasks shall be included in the respondent's proposal.

10. BUDGET

All proposals must include proposed costs to complete the tasks described in the *Project Scope*.

NOTE: All costs and fees must be clearly described in each proposal. The budgeted amount the Partnership has for the completion of the groundwater modeling project is $111,000.

11. BIDDER QUALIFICATIONS

Bidders should provide the following items as part of their proposal for consideration:

- Description of experience in groundwater modeling
- List of how many full-time, part-time, and contractor staff in your organization
- Anticipated staff resources you will assign to this project (total number, role, title, experience)
- Timeframe for completion of the project
- Project management methodology

12. PROPOSAL EVALUATION CRITERIA

The TAC will evaluate all proposals based on the following criteria and make a recommendation for award to the Partnership Board of Directors. To ensure consideration for this Request for Proposal, your proposal should be complete and include all of the following criteria:

- Overall proposal suitability: proposed solution(s) must meet the scope and needs included herein and be presented in a clear and organized manner
- Overall systematic approach for the completion of the modeling effort
- Organizational Experience: Bidders will be evaluated on their experience as it pertains to the scope of this project
- Value and cost: Bidders will be evaluated on the cost of their solution(s) based on the work to be performed in accordance with the scope of this project
- Technical expertise and experience: Bidders must provide descriptions and documentation of staff technical expertise and experience

Each bidder shall email one electronic copy of their proposal to the Coconino Plateau Watershed Partnership Coordinator, Ron Doba, at rdoba@cox.net by 5pm Mountain Time, April 24, 2023. If submitted by hard copy the due date remains the same and the address is:

Coconino Plateau Watershed Partnership
C/O Ron Doba Management Services
9833 E. Preserve Way
Scottsdale, AZ 85262

13. SCOPE OF SERVICES

1. Update pumping, ET, stream, and spring flow data in the Red Gap Ranch-Leupp Groundwater Flow Model (RGRLGFM) to include any new data available since 2015.
    a. Pumping data will be provided by the CPWP Technical Advisory Committee (CPTAC) from the recent Water Demand date update completed in 2020.
    b. The CPTAC and consultant will identify springs that will be addressed for flow updating and be represented in the model. It is understood that the Upper Verde River above the Paulden gage will not be included.

2. Recalibrate the CARAMP PHASE I model with river package inputs converted to stream package by inputting targets focused for improvements to the selected stream discharges.

3. The unrealistically high pumping rates for some of the wellfields may be resulting in overestimating model computed impacts, particularly on stream and spring flows. The CPWP TAC shall analyze the wellfields to determine a likely maximum groundwater pumping demand for each. The model scenarios will be run to evaluate the results with more realistic projected demand limits in place.

4. Consultant shall identify springs in the model that require more detailed analysis of their hydrogeology and provide the list to the TAC for consultation with the Springs Institute. The consultant shall make limited modifications as appropriate to the CARAMP Phase I model.

5. The CPTAC will provide climate multipliers to apply to the climate change model scenarios that vary over time.

6. Consultant shall run an additional model scenario that simulates pumping resulting in a 5’ per year reduction to water level below land surface for 100-years for determination of impact to adjacent wellfields and surface water flows, including springs (two new scenarios, with and without climate change).

    a. The CPTAC will work with the consultant to determine adjacent wellfields.
    b. One point per wellfield will be used for running scenarios.

7. Consultant shall determine the individual impact of each wellfield utilizing one selected model scenario. The selected scenario will be determined after consultation with the TAC.

8. The Partnership would like to make the model available from its website for the benefit of other users for the Little Colorado River Basin. Model files shall be provided. Weaknesses of the model shall be identified that should be considered by the model user along with pertinent instructions for the use of the model.