COLORADO
Colorado Water Conservation Board
Department of Natural Resources

1313 Sherman Street, Room 718
Denver, CO 80203

April 11, 2017

Colorado River Water Conservation District
Attn: Eric Kuhn, General Manager
P.O. Box 1120
Glenwood Springs, CO 81602

RE: Notice to Proceed – WSRF Grant – **POGG1 2017-878 – CO River Development and Curtailment Risk Study in the Colorado, Gunnison, Southwest & Y/W/G River Basins**

Dear Eric,

This letter is to inform you that purchase order/contract to assist in the above WSRF grant project has been approved. The original contract documents in the email serve as your copy.

With the executed agreement, you are now able to proceed with the project and invoice the State of Colorado for costs incurred through December 31, 2017 according to the schedule in Exhibit A. Please provide the project name, contract/**PO number**, and basin(s) when corresponding with or invoicing for your project along with back-up documentation of cost incurred for the WSRF portion of the grant according to Exhibit A tasks. Upon receipt of your invoice(s), the State of Colorado will provide payment no later than 30 days after review and signed approval of the project manager.

Please refer to the WSRF Criteria & Guidelines for reporting requirements for the six month progress reports and final deliverable requirements in order to avoid a delay in payment. A 30-day advance notice is required in the event you are seeking an amendment to the term of the contract and will require an official letter of request to the CWCB project manager briefly describing the need for the extension, updated insurance certificates and updated schedule.

If you have any questions or concerns regarding this project, please contact Megan Holcomb, Project Manager at 303-866-3441 x3222 or at Megan.holcomb@state.co.us and/or Carlee Brown, Project Manager at 303-866-3441 x3220 or at Carlee.brown@state.co.us. When submitting invoices and progress reports, send to the PM and cc me at dori.vigil@state.co.us. You can contact me at 303-866-3441 x. 3250 for additional invoicing and payment disbursement questions.

Thank you.

Sincerely,

//s//

Doriann Vigil
Program Assistant II
O 303-866-3441 ext. 3250
1313 Sherman Street, Rm. 719, Denver, CO 80203
Dori.vigil@state.co.us / cwcb.state.co.com
Attachments
Cc: Alesha Frederick, Business Support Specialist

STATE OF COLORADO
Department of Natural Resources

ORDER
Number: POGG1 PDAA 201700000878
Date: 04/06/17
Description:
PDAA 2500 WSRF CRWCD to fund Phase 2 Risk Study
Effective Date: 04/01/17 Expiration Date: 12/31/17

BUYER
Buyer:
Email:

VENDOR
COLORADO RIVER WATER CONSERVE DIST
PO BOX 1120
GLENWOOD SPRINGS, CO 81602-1120

Contact: .
Phone: .

**** IMPORTANT ****
The order number and line number must appear on all invoices, packing slips, cartons and correspondence

BILL TO
COLORADO WATER BOARD CONSERVATION
1313 SHERMAN STREET, ROOM 718
DENVER, CO 80203

SHIP TO
COLORADO WATER BOARD CONSERVATION
1313 SHERMAN STREET, ROOM 718
DENVER, CO 80203

SHIPPING INSTRUCTIONS
Delivery/Install Date:
F.O.B: FOB Dest, Freight Allowed
VENDOR INSTRUCTIONS:

Line Item	Commodity/Item Code	UOM	QTY	Unit Cost	Total Cost	MSDS Req.
1	G1000		0	0.00	$10,000.00	☐
Description: PDAA 2500 WSRF CRWCD to fund Phase 2 Risk Study						
Service From: 04/01/17 Service To: 12/31/17						
Line Item	**Commodity/Item Code**	**UOM**	**QTY**	**Unit Cost**	**Total Cost**	**MSDS Req.**
2	G1000		0	0.00	$10,000.00	☐
Description: PDAA 2500 WSRF CRWCD to fund Phase 2 Risk Study						
Service From: 04/01/17 Service To: 12/31/17						
Line Item	**Commodity/Item Code**	**UOM**	**QTY**	**Unit Cost**	**Total Cost**	**MSDS Req.**
3	G1000		0	0.00	$10,000.00	☐
Description: PDAA 2500 WSRF CRWCD to fund Phase 2 Risk Study						
Service From: 04/01/17 Service To: 12/31/17						
Line Item	**Commodity/Item Code**	**UOM**	**QTY**	**Unit Cost**	**Total Cost**	**MSDS Req.**
4	G1000		0	0.00	$10,000.00	☐
Description: PDAA 2500 WSRF CRWCD to fund Phase 2 Risk Study						
Service From: 04/01/17 Service To: 12/31/17						

TERMS AND CONDITIONS
https://www.colorado.gov/osc/purchase-order-terms-conditions

DOCUMENT TOTAL = $40,000.00

Exhibit A
Phase II(a) Basin Roundtable Technical Study on Colorado River Risk Response Options

Statement of Work
Date: March 7, 2017

WATER ACTIVITY NAME: Basin Roundtable Technical Study on Colorado River Risk Response Options - Phase II

GRANT RECIPIENT: Colorado River Water Conservation District

FUNDING SOURCE: Gunnison BRT Basin Funds ($10,000.00), Southwest BRT Basin Funds ($10,000.00), Colorado BRT Basin Funds ($10,000.00), Yampa-White-Green BRT Basin Funds ($10,000.00).

INTRODUCTION AND BACKGROUND

At the December 18, 2014 meeting of the four West Slope Basin Roundtables (BRTs), attendees cited the need for more technical data and modeling so that the four roundtables could better understand and discuss issues surrounding future Colorado River development, the risk to existing water users and implementation of the framework principles included in Colorado's Water Plan. Results from Phase I validated previous work (Contingency Planning, Basin Study, etc.) that illustrate real risks to Lake Powell and quantify a range of possible deficit volumes that Colorado could be asked to supplement to maintain Powell elevations above critical thresholds.

Given that citizens and water users across the state have a stake in the challenges on the Colorado River, the Colorado Water Conservation Board (CWCB) envisions the next step of this study as a statewide effort. With input from all BRTs, CWCB has defined a Phase II that will help inform how Colorado can help protect critical elevations in Lake Powell through voluntary demand management and other water management activities. As such, the CWCB will continue to exercise its leadership and oversight responsibilities with regard to this study and all future efforts to address interstate water issues.

The intent of Phase II is to explore potential voluntary preemptive actions— and associated risks— that Colorado water users could take as short term measures (1-5 years in duration) to protect critical reservoir elevations. The study will evaluate a number of scenarios with a variety of assumptions regarding voluntary demand management and reservoir operation scenarios that were developed based on feedback from the BRTs and other stakeholders.

Two different technical approaches will be used in Phase II. The first set of analyses will build upon the Colorado River Simulation System (CRSS) modeling from Phase I, and will include additional modeling runs with CRSS to evaluate alternative model assumptions (hydrology, demand, etc.). The second piece of Phase II will investigate opportunities to use CRSS in conjunction with StateMod in order to model demand management allocation schemes. This work will allow for an exploratory analysis of the strengths and weaknesses of both tools in answering demand management questions both together and separately.

All phases of the Study will help planning for eventual implementation of Principle 4 of Colorado's Conceptual Framework contained in Chapter 8 of Colorado's Water Plan.

> **Principle 4: A collaborative program that protects against involuntary curtailment is needed for existing uses and some reasonable increment of future development in the Colorado River System, but it will not cover a new TMD.**
>
> A collaborative program that protects existing uses and an increment of future development is a necessary element of Colorado's water planning, regardless of whether a new TMD is developed. The Framework includes this principle to make clear that a collaborative program would not protect a new TMD.
>
> The collaborative program should provide a programmatic approach to managing Upper Division consumptive uses, thus avoiding a Compact deficit and ensuring that system reservoir storage remains above critical levels, such as the minimum storage level necessary to produce hydroelectric power reliably at Glen Canyon Dam (minimum power pool). A goal of the collaborative program is that it would be voluntary and compensated, like a water bank, to protect Colorado River system water users, projects and flows. Such protection would NOT cover uses associated with a new TMD.
>
> *A second goal of the collaborative program should be that it protects the yield of the water supply systems in place in the Colorado River Basin from involuntary curtailment. To achieve this goal, the program would need to expand to accommodate future West Slope growth and growth of existing water supply systems, the pace of which is not now known. Protecting additional consumptive uses will increase the program's scope and challenges. Some basins, such as the less-developed Southwest and Yampa/White/Green, anticipate the need for future development and will seek terms to accommodate it in the collaborative program. Regardless of when a use develops, the program would strive to protect uses at the time of shortage, except a new TMD.* (Emphasis added.) By adapting to accommodate increased uses at any given time, the program should not lead to a rush to develop water rights. Section 9.1 of Colorado's Water Plan provides additional discussion of the collaborative program.
>
> The collaborative program will develop in concert with intra- and interstate water policies. The IBCC and roundtables can provide an important forum for sharing the work of on-going interstate negotiations, scoping technical analyses, and identifying issues of concern at the stakeholder level, as well as providing input to the CWCB as it manages and conducts the technical, legal, economic, and other studies necessary for implementation.

The Study will be supported by two committees:

An Outreach Committee. This committee will be made up of the contractor (Hydros), representatives from each sponsoring roundtable, representatives of the funding sponsors, CWCB staff, and other interested parties. Participation in this committee is not limited. This

committee will operate in the same manner as a similar committee during Phase I of the Study. Hydros will conduct webinars with this committee to report progress under the Scope of Work and seek input regarding work accomplished and future tasks within the Scope of Work. This committee will inform the sponsoring roundtables regarding progress of the study and seek their input.

A Technical Advisory Committee. This committee will be a smaller group consisting of Hydros, a representative of each sponsoring roundtable that wishes to participate, the funding sponsors, CWCB staff, and others with special expertise as appropriate. There will not be an absolute limit on the number of participants, but keeping the group small enough to function effectively is important. This committee will work closely with Hydros regarding refinement of model details, coupling of CRSS and StateMod, and possible improvements to StateMod within the Scope of Work.

OBJECTIVES

Phase II will address the following questions:

1. Refinement and further analysis of scenarios using CRSS:
    a. Water Banking scenarios that include various levels of preemptive demand management and storage in a hypothetical reservoir not subject to equalization under the 2007 Colorado River Interim Guidelines, together with different assumptions about future demand growth.
    b. Additional model runs utilizing paleo-hydrology sequences to understand sensitivity to paleo-events and where those events fit within the spectrum of historical gaged data and climate change (predicted) hydrology.
    c. Evaluation of historic and possible future hydrologic variability and the impacts of that variability on critical reservoir elevations. Comparison of the magnitude of the hydrologic variability to other factors such as demands (as represented by both the Scenario A and 90% of Scenario D1 ("90%D1") demand schedules, as defined in the 2012 Colorado River Basin Supply and Demand Study).

2. Evaluate the utility of StateMod in addressing questions related to voluntary demand management. The goal will be to understand the capabilities and limitations in StateMod under various assumptions. Questions that we hope to eventually be able to ask of StateMod include (but are not limited to):
    a. How would different approaches to demand management impact water users, reservoir storage, and sub-basins?
        i. If a water banking mechanism were in place to preemptively conserve water to help protect critical reservoir elevations in Lake Powell.
        ii. Volumes that may need to be conserved in order to address risks identified in Phase I of the study, and duration of that storage.
            1. Evaluation of conditions within Colorado during drought periods that could prompt preemptive actions.
            2. Comparison of possible volumes to current consumptive use (average, dry-year, wet-year)

iii. Which reservoirs are best situated to provide cumulative water banking storage over several years.
    1. Strategies for maximum utilization of existing storage.
    2. Evaluation of exchange potential throughout basins that might improve utilization of existing storage.
iv. Scenarios in each basin for providing temporary (1-5 year duration) voluntary demand management to protect critical reservoir elevations in Lake Powell.

3. Review results with the sponsoring BRTs; discuss implications and lessons for implementation of a preemptive water banking storage account.
4. As approved by CWCB and permitted by budgetary constraints, expand or refine scenarios to address follow-on questions.

TASKS

TASK 1 - Ongoing CRSS Evaluation

Description of Task

Based on feedback from the BRTs and other stakeholders, a set of follow-on questions have been developed that leverage the initial set of runs from Phase I. These include investigation of system risks with different hydrologic sequences, with different preemptive voluntary demand management and water banking mechanisms, and with different demand and growth assumptions. A preliminary set of questions is provided in the introduction above, and we anticipate additional feedback and scenario requests from the participants that will be included in this task.

Method/Procedure

Continued use of CRSS for additional model runs, and extraction of additional data from scenarios that were already run as part of Phase I.

Deliverable

Model reports, memos, and presentations to stakeholders as needed.

TASK 2 - StateMod Evaluation and CRSS Integration Testing

Description of Task

Phase I of this work utilized CRSS to evaluate basin-wide risks. It is too coarse for use in evaluating local water use and non-CRSP reservoir operations. Ideally we could use StateMod to address more detailed questions on water banking. However, StateMod itself may have limitations in its ability to accurately reflect these components. The first task, therefore, will be an evaluation of the capabilities and limitations of StateMod in addressing these questions. We will use this budget to perform initial model simulations for the Phase II Study, to better understand any limitations, to identify and possibly implement model enhancements necessary for the study, and to test the StateMod/CRSS "coupling" that would be necessary to allow for feedback and data flow between the two models.

We will also evaluate different options for hydrologic traces. StateMod traditionally uses a single-trace historical period of record, whereas CRSS utilizes a hydrologic ensemble approach for simulating multiple possible events. It may be necessary to develop one or more hydrologic sequences that can be utilized by both models. As part of this task, we will also evaluate the usefulness of Paleo-hydrologic data and whether or not it adds information to the evaluation of risk.

The long-term objective (Phase IIb) in enhancing and coupling these tools is to be able to simulate water use and demand management across the sub-basins including:

1. Single-year versus multi-year actions to protect critical elevations in Lake Powell.
2. Water banking scenarios wherein the State and individual sub-basins may proactively create a water bank to mitigate against a call or other "mandatory" actions.
3. Strategies for maximum utilization of existing storage for water banking purposes.

Method/Procedure

Network modifications and testing of CRSS and StateMod; development of simple data conversion tool for moving data between the models. Written report on the strengths, limitations, and additional needs for partnering CRSS and StateMod.

Deliverable

Model files and ancillary tools and memo describing integrated use of the two models.

TASK 3- Final Report(s) and Meetings (Phase Ila)

Description of Task

One objective of this work is to provide a foundation of knowledge to BRT participants in order to foster informed discussions on management of risk. Phase I included over a dozen webinar events, as well as numerous in-person meetings. We anticipate a similar level of effort in this next Phase as well, and include budget in this task for conducting these meetings.

Additionally, we anticipate numerous interim reports, presentations, and as a final deliverable two separate reports, one for each of the above tasks:

1. Write a report documenting model work, scenario results, and recommendations moving forward, based on items from Task 1.
2. Write a report or memorandum of findings related to the use of StateMod, presenting initial modeling results and making recommendations for incorporation of StateMod results into Phase IIb analyses (Task 2).

Method/Procedure

Draft reports to be reviewed by participant committees. Meetings and workshops will be held to present findings and solicit input for additional studies.

Deliverable

Final Reports and associated model files, results, and other analyses.

REPORTING AND FINAL DELIVERABLE

Reporting: The applicant shall provide a progress report to the CWCB Director every 2 months, beginning from the date of the executed contract. The progress report shall describe the completion or partial completion of the tasks identified in the statement of work including a description of any major issues that have occurred and any corrective action taken to address these issues.

Any changes or additions to the scope of work must be approved by the CWCB Director. Interpretations of the Scope of Work that affect sensitive water policy matters must be approved by the CWCB Director. CWCB staff will be invited to participate in all meetings regarding the project and will be included in the review of drafts of the final deliverables.

Final Deliverable: At completion of the project, the applicant shall provide the CWCB a final report that summarizes the project and documents how the project was completed. This work product is solely that of the applicants and the applicants do not claim that it represents the views or interest of the State of Colorado. This report may contain photographs, summaries of meetings and engineering reports/designs.

BUDGET

Task	WSRF Funds	Matching Funds (cash & in-kind)	Total Costs	Hydros Budget Estimate
1: Ongoing CRSS Evaluation		$26,560	$26,5600	$ 26,560
2: StateMod Evaluation and CRSS Integration Testing	$20,000	$10,560	$30,5600	$ 30,560
3: Final Reporting and Meetings	$15,000	$20,920	$35,9200	$ 35,920
Travel Expenses (mileage, meals, hotel, etc.)	$5,000	$0	$5,000	$ 5,000
TOTAL	$40,0000	$58,040	$98,040	$ 98,040