SOQ NO. 090511

RIO GRANDE REGIONAL WATER AUTHORITY (RGRWA)

REQUEST FOR STATEMENT OF QUALIFICATIONS
TO PREPARE LOWER RIO GRANDE VALLEY BASIN AND REGIONAL WATER SUPPLY FEASIBILITY STUDY
AS DEFINED BY 31 TAC CHAPTERS 355,357 & 358

The Rio Grande Regional Water Authority (RGRWA) invites all qualified parties to submit a statement of qualifications for preparing a **LOWER RIO GRANDE VALLEY BASIN AND REGIONAL WATER SUPPLY FEASIBILITY STUDY**, as defined by 31 TAC Chapters 355, 357 & 358.

BACKGROUND

The Rio Grande Regional Water Authority (RGRWA) was created by the 78th Legislature, which enacted SB 1902 in 2003. SB 707 (80th Legislature) amended the powers and duties of the RGRWA.

The RGRWA covers six counties in the Middle and Lower Rio Grande Valley: Willacy, Cameron, Hidalgo, Starr, Zapata, and Webb.

The Authority was specifically created to supplement—not replace—the services, regulatory powers, and authority of irrigation districts, water development supply corporations, counties, municipalities, and other political subdivisions within its borders. It has assumed the functions of the former Lower Rio Grande Authority (LRGA).

As a conservation and reclamation district established under the Texas Constitution, the RGRWA has broad powers, rights, privileges, and responsibilities.

The RGRWA's enabling legislation also gives it specific authority to "investigate, plan, acquire, construct, maintain, or operate any property the authority considers necessary or proper for the accomplishment of the purposes of the authority, including water treatment, wastewater treatment, water conveyance, and desalination of water.".

ADDITIONAL INFORMATION

The purpose of this request for statements of qualifications is to permit the evaluation of the relative professional and technical qualifications of respondents, see Exhibit A.
The statement of qualifications should be no more than 20 pages in length, excluding cover letter and resumes of project team members. Responses should address the following:

1. Describe your firm's approach to executing the work associated with this project.

2. Describe your firm's experience and involvement in State and Regional Water Studies related to regional approaches, utilizing non-traditional resources that would include brackish and seawater desalination and reclaimed water

3. Describe your firm's experience with the Bureau of Reclamation and your approach to joint document preparation.

4. Provide the location, size and description of your firm and services offered and the location, size and description of any sub-consultants that may be employed as part of the project team.

5. Identify the person proposed by the Firm to serve as the point of contact for the scope of services development and negotiations.

6. A list of at least five (5) projects similar to the scope of work discussed herein, with descriptions of the projects, members of the project teams, time schedule, and contact persons who are able to certify the information presented. All projects must have been completed within the past ten (10) years. Demonstrate the following types of recent work experience:
   - Regional and state water studies for various size regions and states;
   - Work with alternative water resource development;
   - Facilitating consensus-building and conflict resolution among stakeholders with diverse and potentially-conflicting interests;
   - Ability to collect and manage data and information available from relevant sources;
   - Familiarity with Bureau of Reclamation administration and invoicing requirements;
   - Knowledge of statutory and regulatory policies affecting water supply, water quality, water conservation, and drought management issues for both surface and groundwater; and
   - Experience with environmental issues and analyses related to water supply development.

7. Identify the project manager and team members with their professional licenses and qualifications to perform the proposed professional services. The Project Manager must be licensed in the State of Texas. Include an organizational chart identifying the specific individuals (by name) and their role(s) within this project.

8. Your firm's resources and capabilities: including location, staffing size, and length of local office's existence in Texas;

9. The capability of your firm to commit necessary resources to the project in order to meet the project schedule;

10. A description of the Firm's ability to complete projects without significant cost escalations or overrun.

11. Resumes for team members associated with the project (Submitted as an appendix; not counted towards page limit).

Any additional information you would like RGRWA to be aware of or which you feel might have a direct bearing on your firm's qualifications to perform on the project.

COMMUNICATION DURING THE BIDDING PROCESS

It is not appropriate for you or your team members to have direct communication with any members of the RGRWA and/or LRGVDC staff outside of the formal in-session communications arranged by the Procurement Director.

Any attempt by one of the respondents to have direct or indirect communication with the RGRWA and/or LRGVDC staff outside of a committee session must be avoided and reported immediately to the Procurement Director.

SCHEDULE

Aug 03, 2011	Approve to advertise and mail notices for Request for Statement of Qualifications
Aug 07, 2011	Advertisement/and release of mail notices
Sep 09, 2011	Statement of Qualifications Due
Sep 21, 2011	RGRWA review of RFQ's and preparation of recommendation; RGRWA may recommend that short-listed firms make a presentation
Oct 05, 2011	Fifteen (15) minute presentations including Q&A sessions by short-listed consultants.

The schedule is subject to change

ACKNOWLEDGEMENTS

The submittal either as part of the Statement of Qualifications or the cover letter shall provide the following acknowledgments:

- Acknowledgment that, if requested, you will prepare and make a presentation to RGRWA.
- Acknowledgment that, if selected, the key individuals of the proposed team will not be changed without the written approval of RGRWA; and
- Acknowledgment that, if selected, you **must** be thoroughly familiar with USBOR Rules and requirements for grant funding and invoicing.

Any revisions to the RFQ will be posted on the following web sites: lrgvdc.org and riograndewaterplan.org, is the responsibility of the respondent to check periodically these sites. The deadline for responses to this request is 2:00 p.m. on **Friday, September 09, 2011**. One (1) electronic copy in Word format and fifteen (15) hard copies of each submittal shall be delivered to Victor Morales, LRGVDC's Director of Procurement, at the following address:

Lower Rio Grande Valley Development Council
Procurement Department
Attn: Victor Morales
301 West Railroad
Weslaco, TX 78596
Phone: 956-682-3481
Fax: 956-682-3295

LOWER RIO GRANDE VALLEY BASIN AND REGIONAL WATER SUPPLY FEASIBILITY STUDY
Rio Grande Regional Water Authority

The primary objective of the Study is to identify the feasibility and cost effectiveness of creating a regionalized approach to a long- term alternative supply in the three county area that includes Cameron, Hidalgo, and Willacy counties. Alternative regional supply would include local brackish groundwater desalination, seawater desalination and importation of fresh groundwater from sources outside the regional area described.

The RGRWA has partnered with the US Bureau of Reclamation (Reclamation) for this study. Reclamation will provide in-kind contribution to the project, performing work as outlined in.

The Rio Grande Regional Water Authority (RGRWA) is interested in looking at the feasibility of one or more of the options mentioned to reduce the dependency on the Rio Grande in the future. There are currently several brackish groundwater desalination facilities in the area that are successfully operating. These range in size from 0.25 MGD to 7.5 MGD and there are plants located in each county. It is recognized that the Rio Grande is limited and subject to drought with increasing demands, as witnessed in 2002 where reservoir capacities reached critical capacity.

The existing brackish facilities have shown an investment in alternative supplies by various entities. One of the key portions of this study is to generally determine the availability of brackish groundwater, based on the most recent data, on a long-term basis. Once the availability of the groundwater is determined, the 25% of the 2050 demands will be projected, and if inadequate, seawater desalination and/or importation of fresh groundwater from outside the area will be evaluated.

Brackish groundwater treatment and distribution along with local participation will be evaluated to determine cost of the new supply and determine if the construction of regional brackish plants and a regional distribution system is the most practical option. This evaluation will include initial capital and operational cost projections. A review of potential operational scenarios would be included.

One of the main goals is to protect and manage the groundwater resources in the area. Any withdrawal of significance from the aquifer(s) has impact on other suppliers in the area and the benefit of all water providers in the area working together on the same source should be beneficial.

Another key in the long-term supply is the impact of irrigation systems in the Valley. Part of this study would be to look at the impact on irrigation districts relative to water rights conversion, urbanization and water sales to municipalities.

The scope of services is proposed as follows:

Phase 1a: Preliminary Data Gathering
The Engineer will compile the following data for the RGRWA and each of its member service providers, including but not limited to, the following:

1. Topographic map (to determine water source(s), and designated jurisdictional boundaries for each service provider.
2. Existing water quantity and quality studies and data prepared by State, Federal , and academic institutions;

Phase 1 b: Assess Water Availability

Assess groundwater availability

1. Assess the groundwater availability in the area to include: quantities and qualities of groundwater, pumping tests of existing wells, maximum pumping rates and total capacities available for treatment.
2. Evaluate the ground water productions potential and water quality from the proposed will field location.

Assess other water resources

3. Seawater desalination
4. Imported fresh groundwater (Dimmit County, or others)

Phase 2: Develop Alternatives

The engineer will continue data gathering to develop the following:

1. The water supply and treatment capacity for each service provider over 10,000 population within the study area;
2. The water distribution interconnection infrastructure between service providers within the study area (as detailed as possible);

Assess municipal water supply needs in 2050

3. Determine the most appropriate location and size of the facility to provide 25% of the municipal needs in 2050 and the impact of this location and well field on existing active wells in the study area.

Based on the results of Phase 1b, the following will be developed for a proposed groundwater desalination facility:

<u>Environmental</u>

4. Determine most appropriate means of disposal of concentrate generated from the brackish/seawater treatment facility.

<u>Operations</u>

5. Determine whether the operational aspects of the proposed facility deliver the service effectively and efficiently.
6. Clearly define what aspects of the facility and the service provided will remain the responsibility of the individual utilities.
7. Describe the engineering-related benefits to be gained by the construction of regionalized brackish water treatment facility, including but not limited to:
    a. Improved level of service
    b. Establishment of previously unavailable water source
    c. Greater efficiency of service operations
    d. Compliance with local, state and federal requirements
8. Describe how the facility could be organized and administered.
9. Identify how treated water from the regionalized water facility could be provided to the residents of the participating local units.
10. Determine the staffing level required, the number of employees, supervisors, clerical, support staff, etc.
11. Present recommendations for the size, design, structure, and location of the proposed facility.
12. Identify whether any existing facilities become surplus or available for other use.
13. Identify potential problem areas.

Phase 3: Cost Analysis of Alternatives

The engineer will continue data gathering to determine the following:

1. The cost for each service provider within the study area to treat drinking water on a per 1,000 gallon basis;

In terms of the anticipated groundwater desalination facility, the following cost analysis will be performed:

2. Estimate capital and operational costs of the proposed well field(s).

3. Prepare a cost estimate for the proposed facility/facilities. Capital cost estimates will be prepared by taking into consideration potential site development, process equipment, yard piping, electrical, ancillary equipment, and distribution.

Phase 4: Financial Model

The engineer will identify the following:

1. The total cost of providing treated water on a joint basis including all direct and indirect costs.
2. Projected cost of the treated water to each participant.
3. The service level provided to each participant, including the development of an objective, quantifiable basis for calculating the annual cost of service for each participant.
4. If participants will provide existing facilities, equipment or material to the regionalized facility, include the costs of these "in-kind" contributions.
5. A ten-year forecast of the expected annual cost of providing treated water from the brackish water treatment facility.
6. A comparison of each participant's individual cost of providing the same level of treated water under an alternative, more conventional means to the anticipated cost of a regionalized brackish water facility.
7. Prepare an assessment of the financial impact on alternative supplies on local irrigation districts providing water to municipalities.

Phase 5: Analyze Potential Groundwater Conservation Districts(s)

The engineer will develop a comprehensive description of groundwater conservation districts (GCDs). This task should include the following:

1. Description of GCDs in terms of the legal responsibility associated with developing desired future conditions, enforcement of groundwater withdrawals, role in future water planning of the regional/State level, and the steps necessary to develop a GCD.
2. Identify potential GCD boundaries

Phase 6: Draft and Final Reports

The Engineer will prepare detailed draft and final reports summarizing all findings and conclusions. A draft report will be completed and presented to the RGRWA's Board of Directors for review and comment. A final report will then be completed which incorporates all recommendations for changes and revisions.

Twenty (20) copies of the final report will be provided to the RGRWA. The Engineer will provide a presentation to the RGRWA's Board of Directors to present the results of the Study. Presentation to the individual members Boards of Directors are beyond the scope of this initial study, but will be completed by the Engineer at standard reimbursement rates for professional time and expenses. An electronic file version of the summary report (MS Word, Excel or as otherwise mutually agreed) will also be supplied to the RGRWA.

Lower Rio Grande Basin Study

Location of Study Area

The basin study area encompasses 122,400 square miles along the U.S./Mexico border and includes the Lower Rio Grande River basin from Fort Quitman, Texas to the Gulf of Mexico. Water supply/demand projections and water management recommendations will focus on eight counties in South Texas area known as Region M (Figure 1).

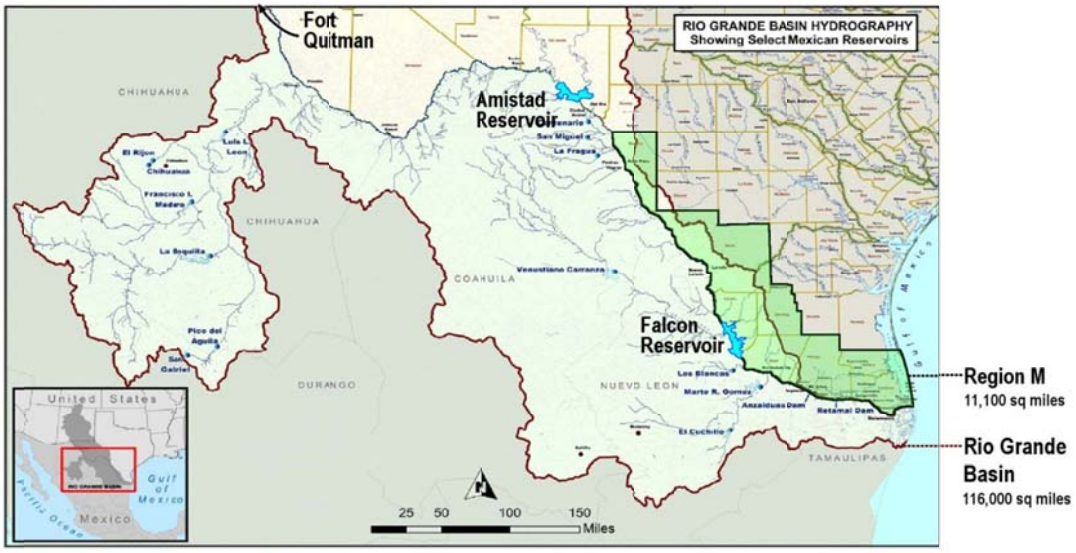

Figure 1: Lower Rio Grande Basin (adapted from IBWC)

Total study cost:	**Reclamation Share**	**Non-Federal Share**	**Total Project Cost**
	$ 198,948	**$ 213,850**	**$412,798**

Cost-share partners contact information:	**Rio Grande Regional Water Authority (RGRWA)** 301 W Railroad , Weslaco TX 78596	956.682.3481
	Ken Jones, Executive Director	knjones@lrgvdc.org

Basin Study partners contact information:

Basin Study Partners are the same as the cost share partners.

Reclamation contacts:	Kip Gjerde, Great Plains Regional Planning Officer	gjerde@usbr.gov
	Thomas Michalewicz, Special Projects Director – OTAO	tmichalewicz@usbr.gov
	Collins Balcombe, Program Coordinator – OTAO	cbalcombe@usbr.gov
	Jeff Gerber, Study Manager - OTAO	jgerber@usbr.gov
	Subhrendu Gangopadhyay, Technical Lead - TSC	sgangopadhyay@usbr.gov

Table of Contents

ABSTRACT

An **urgent need exists** to reduce dependence on the Rio Grande River and address a current and projected water supply deficit within the Lower Rio Grande Basin, Texas, which is one of the fastest growing and most economically depressed areas in the U.S. The Rio Grande Regional Water Authority (RGRWA) and its member entities, in collaboration with the Texas Region M Planning Group, Bureau of Reclamation (Reclamation), Texas Water Development Board, Texas Commission on Environmental Quality (TCEQ), and International Boundary and Water Commission, is proposing a basin study to **evaluate the impacts of climate variability and change** on water supply imbalances within an **eight county region along the U.S./Mexico border** in south Texas (Cameron, Willacy, Hidalgo, Starr, Zapata, Jim Hogg, Webb and Maverick Counties). This information will build upon existing, well recognized data/models to perform a systems reliability analysis and formulate a range of alternatives to meet short, mid, and long-term planning objectives, particularly during times of drought. Of notable interest are **regional supply options**, including seawater and brackish groundwater desalination, as well as importation of fresh groundwater from sources outside the study area. Alternatives will then be evaluated and compared using screening criteria developed in collaboration with project partners. Results of this analysis will be used to make recommendations on preferred alternatives to meet established planning objectives. Furthermore, the methodology used in this study could serve as a template for other regional planning groups in Texas to follow as they search for ways to develop sustainable water supplies and manage risk associated with a changing climate.

STUDY PROPOSAL SELECTION CRITERIA

The extent and consequences of existing or anticipated imbalances in water supply and demand

Magnitude and frequency of water shortages

The magnitude and frequency of water supply shortages within the study area continues to be severe. According to the Region M Water Plan[1], the population in the eight county region is expected to grow from **1.7 million in 2010 to 4 million in 2060**. This represents a growth rate of 2.8 percent per year, which is seven times faster than the state's average growth rate of 0.4 percent per year.

Over the past hundred years, Texas has experienced severe water shortages/droughts in 1925, 1953-1956, 1971, 1988, 1999-2000, 2008-2009, and 2010-2011.[2] The increasing frequency of shortages, along with complications surrounding the shared international management of the drainage basin, has greatly reduced the dependency of surface water in the Rio Grande River. According the 2010 Region M Water Plan, the current **net water supply shortage totals 368,356 acre feet per year (af/yr)**, resulting in 25 percent of water demands being unmet in 2010. This shortage is expected to reach a staggering **592,084 af/yr by 2060**, which would result in 35 percent of water demands being unmet. Figure 2 provides a summary of supply and demand imbalances from 2010 through 2060. These deficits are expected to be exacerbated by drier conditions, reduced run-off, and increased temperature resulting from climate change.[3]

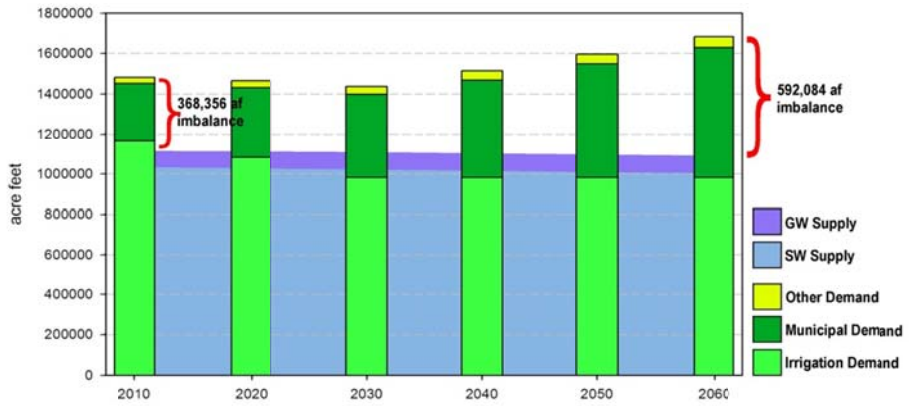

Figure 2: Existing and Projected Water Supplies and Demand in Region M[4]

Known and projected demands for all types of water uses

Figure 2 above provides a summary of current and projected demands by water use sectors from 2010 to 2060. The two largest uses of water are **irrigation and municipal supply**. Current **irrigation demands total 1,163,634 af/yr**, which account for almost 80 percent of all demands in the region. Current **municipal demands total 288,323 af/yr**, which account for most of the remaining 20 percent of uses. Municipal demands are expected to significantly thwart irrigation demands in the future, with irrigation demands experiencing a 20 percent decline and municipal demands experiencing a 20 percent increase by 2060.

Nature of imbalances - water quantity and water quality

The water supply in the study area is severely limited in **both quantity and quality**. The extent to which supplies are limited from a quantitative standpoint is discussed above. The extent to which supplies are limited from a quality standpoint are driven primarily by discharges from upstream sources, surface run-off, and seasonal pumping rates in the Rio Grande River. Because the river flows through intensively farmed and urbanized areas, it is subject to a number of water quality challenges. As required under Sections 303(d) and 304(a) of the federal Clean Water Act, the TCEQ identifies impaired water bodies. According to the draft **2010 Texas 303(d) List** (February 5, 2010), the Rio Grande within the study area below both Falcon Dam and Amistad Reservoir has been listed for bacterial contamination. The Lower Rio Grande Valley is actually a delta that gently slopes away from the Rio Grande River, beginning approximately 85 miles upstream of the mouth of the Rio Grande, and fanning out to include approximately 100 miles of the Gulf Coast. The Arroyo-Colorado River watershed is situated within the delta of the Rio Grande, comprising a large portion of the study area along the lower Rio Grande. The Arroyo-Colorado Watershed Partnership, a coalition of public and private organizations and concerned individuals, developed the **Arroyo Colorado Watershed (ACW) Protection Plan**, a comprehensive watershed-based strategy to improve water quality and aquatic and riparian habitat in the Arroyo-Colorado. The ACW Protection Plan is designed to address impairments and concerns identified in the Texas Water Quality Inventory and 303(d) List. The implementation period for Phase I of the ACW Protection Plan is 2006-2015, subject to revision and modification every five years in coordination with revisions made to the Rio Grande (Region M) Regional Water Plan. An evaluation of regional water supply options as part of this basin study would consider watershed protection plans and, to the extent that regional options are implemented in the future, help **alleviate stressors on the quality** of both the Rio Grande and Arroyo-Colorado river systems.

Severity of potential consequences for not addressing imbalances in supply and demand

The impacts of not addressing the staggering water supply and demand imbalances, both current and future, in the Lower Rio Grande River basin are severe. The study area is home to 27 **irrigation districts and a multi-million dollar crop and citrus industry** that drives both the local and national economy. The annual value of crops and citrus grown in the study area is estimated at $**50 million and $200 million**, respectively. Texas is the third largest citrus producer and fourth largest sugarcane producer in the U.S., most of which is grown in the study area. Other prominent crops include cotton, sorghum, and corn. Irrigation water rights in the study area are junior to municipal and industrial rights (M&I), and as such are subject to proration during supply shortages. This can have devastating impacts on agricultural uses and the local economy when shortages occur. For instance, the 2009 drought resulted in interrupted water diversions for some irrigation districts with junior water rights, which resulted in a 49 percent loss of acreage and $**19 million in losses** for farmers in parts of the study area[5]. In general, when agricultural shortages occur, costs to the local economy have been estimated to be about **$135 million and a loss of 4,130 jobs annually**. [6] These adverse economic impacts would have **environmental justice** implications as well. The study area contains a disproportionate number of persons living below the poverty level when compared to the rest of Texas (35.7 percent vs. 15.4 percent). In addition, the median household income in the area is $23,489, well below the state average of $39,927.

The consequences of water supply imbalances extend well beyond adverse impacts on the economy of the region. Imbalances are and will continue to have adverse impacts on the sensitive ecological communities that depend on the Rio Grande River and associated riparian habitat. The **Lower Rio Grande Valley National Wildlife Refuge and Wildlife Corridor**, administered by the U.S. Fish and Wildlife Service and Texas Parks and Wildlife, respectively, cover 91,000 acres in the region, with plans to expand to 132,000 acres. The study area is located within a major confluence of two flyways for migratory birds and waterfowl and is home to the **World Birding Center**, which is a top worldwide destination for bird watching. Furthermore, **sixty-nine rare, threatened, or endangered species** are supported by these protected areas. All of these sensitive resources will be subject to increased stressors in the future as water supplies become more constrained by increased demand and climate change.

The extent to which Federal involvement is needed due to the nature and complexity of the issues involved

The issues facing the Lower Rio Grande River basin are extremely complex, ranging from a multi-national to local scale. First, because the study area is shared by both the **U.S. and Mexico**, numerous issues are presented both politically and technically. Flows within the Lower Rio Grande River are dependent upon reservoir operations and run-off emanating from *both* the U.S. and Mexico, which is complicated by issues relating to required reservoir releases pursuant to stipulations set forth in the 1944 U.S.-Mexico Water Treaty. Therefore, **Federal involvement is needed to collaborate with entities from both countries** to collect data necessary for climate variability modeling. Reclamation will solicit assistance on this issue from the International Boundary and Water Commission, and their counterpart agency, la Comisión Internacional de Límites y Aguas, which make up the bi-national commission that manages operations and usage of the shared Rio Grande Reservoir system.

Complex and controversial issues also exist on a more local scale between the M&I and agricultural users. Because the agricultural sector holds about 90 percent of the region's water rights and can account for up to 80 percent of total withdrawals from the river, future M&I demands will need to be met through allowances from the agricultural sector. This increased competition for water recently manifested itself in April 2011 when a Texas Senate committee recommended that lawmakers allow the City of McAllen to

dissolve Hidalgo County Water Improvement District 3, one of the 27 irrigation districts in the study area. Climate change will likely exacerbate this competition by making less water available for agricultural uses, thereby placing even more pressure on proposed reallocations from agricultural to M&I uses. This situation provides a **unique opportunity for Federal involvement as a neutral 3rd party** to help evaluate the extent to which climate change could affect the reliability of existing infrastructure, and to formulate, screen, and recommend regional solutions that hopefully garner support from both sectors.

The Government Accountability Office (GAO) completed an evaluation in 2009 on water issues facing rural communities within regions along the entire U.S.-Mexico border, including the study area[7]. The GAO Report focused on whether water and wastewater systems are adequate to meet the needs of economically distressed communities in the border region, namely colonias. According to the GAO Report, Federal efforts to meet drinking water and wastewater needs have been ineffective, in part due to lack of a comprehensive needs assessment in the border region and a lack of coordinated policies and processes between Federal agencies. Based on this information, it is clear that a unique opportunity exists for **Reclamation to do its part in addressing concerns outlined in the GAO Report**. This basin study proposes to (1) engage all Federal agencies that have a nexus to water issues within the study area; (2) perform a system reliability analysis on infrastructure to deliver water to both big and small communities; and (3) conduct an evaluation on regional supply alternatives. The goal is to conduct a basin-wide study on the lower reaches of the Rio Grande River that serves as a template by which other regions along the border can follow. Reclamation alone, with its expertise in climate science and water resources planning and management, is best suited to get involved and facilitate this effort.

Finally, the issue of climate change has been very contentious in Texas, and few entities have taken strides to account for climate variability in their water resources planning efforts. In addition to politics, this is partly due to a lack of understanding about the complex and seemingly disjointed and inaccurate nature of climate variability models and projection data. **Reclamation is a recognized leader in evaluating the climate/water management nexus** and is thus situated to provide unique expertise in this area. Reclamation was a principle contributor on key publications on the climate/water nexus including *Circular 1331 – Climate Change and Water Resources Management: A Federal Perspective (2009)* and *Climate Research Needs for Long-Term Water Resources Planning and Management (2011)*. Furthermore, as part of its mandate under Secretarial Order 3289 and Section 9503c of the SECURE Water Act, Reclamation is undertaking a *West Wide Climate Risk Assessment* initiative and recently published *Reclamation Climate Change and Water 2011*, a report submitted to Congress on the status of climate science and climate change impacts on major river basins across the West, including the Rio Grande. Finally, Reclamation is already applying the latest climate science to several prominent basin studies across the West that include evaluations on the impacts of climate variability and change on water resources management. As a whole, the above activities demonstrate Reclamation's ability to incorporate the **best available science and state of the art tools** into water resource planning activities for climate change adaptation planning and thus provide strong **justification for Federal involvement** on an issue that remains contentious in Texas.

The existence and quality of data and models available and applicable to the proposed study

The extent and quality of existing data and models in the study area is exceptional. The state of Texas is comprised of **16 regional planning groups**, one for each major river basin, including **Region M** (Rio Grande River). Each planning group is required to submit regional **water plans** to the Texas Water Development Board (TWDB) every five years. The TWDB then roles up each regional plan into a

statewide comprehensive water plan. The most recent round of regional water plans were completed in 2010, so **baseline data** considered critical to conducting a basin-wide water management assessment (i.e., population projections, existing versus 2060 supplies/demands by sector, water management strategies, cost estimates, financial capability, etc.) **are all new and based on latest modeling trend**s **as of 2010**. The existence of high quality data is not limited to the U.S. The Region M Plan contains an **abundance of data on the Mexico** drainage area including reservoirs, pool elevations, yield allocations, operations, current inflow/outflow records, etc., all of which will be useful in basin study modeling efforts.

The Texas Commission on Environmental Quality (TCEQ) has created **Water Rights Analysis Package (WRAP) software to develop a Water Availability Model (WAM)** for all Texas basins to help it adjudicate water rights in the state. The Rio Grande WAM, for instance, uses a monthly time-step under the 1940-2000 period of record to make predictions about the availability of river flows for future water rights using a variety of different data sources. The WAM incorporates operational constraints set by international agreements between the U.S. and Mexico, and it includes expected sedimentation and evaporation rates in Amistad and Falcon Reservoirs. One of the objectives of this basin study would be to enhance the Rio Grande WAM by integrating the effects of climate variability and evaluating impacts on water rights. This will be done by developing **monthly bias-corrected streamflow time-series using the Variable Infiltration Capacity (VIC)** model for the Rio Grande WRAP/WAM.

Furthermore, TWDB has developed a standardized three dimensional **Groundwater Availability Model (GAM)** for several aquifers across the state in an effort help ensure sustainable groundwater development. Each respective GAM is based on MODFLOW-96 code with grid dimensions of 1-mile by 1-mile. The Gulf Coast Aquifer GAM was built in 2003, in part for quantifying brackish groundwater, and has several layers - the Chicot, Evangeline, and Jasper aquifers, as well as the Burkeville and Catahoula confining systems. The model includes information on recharge, geology, water levels, aquifer properties, and pumping, and has already been calibrated to ensure that the model can reasonably reproduce past water levels and groundwater flows. With regards to a basin study, the Gulf Coast Aquifer GAM will provide an excellent tool for assessing **brackish groundwater** and incorporating impacts of climate change and assessing the **effects of pumping and droughts on groundwater availability** in the study area, and impacts on capacities of currently existing active wells.

The amount of data available in the study area extends well beyond state regional water plans and surface/groundwater models. A countless number of local studies have been prepared by individual RGRWA member municipalities, irrigation districts, and other water purveyors. These include **drought contingency plans, system optimization reviews, water and wastewater master plans, feasibility studies, etc**. It is clear that an abundance of current, relevant data and well recognized models exist in the study area that can be drawn upon to conduct this basin study in the most efficient manner possible well within a two-year timeframe.

The strength of any nexus between the Basin Study and a Reclamation project or activity

A strong nexus exists between ongoing Reclamation activities and the proposed basin study. The **Lower Rio Grande Water Conservation and Improvement Act of 2002**, as amended (P.L. 107-351), provided Reclamation with the authority to fund 50 percent of the costs, up to **$55 million**, to plan, design, and construct **water conservation improvements on 19 irrigation districts** within the study area. Twelve of the nineteen projects executed cost-share agreements - eight are complete and under operation; four are under construction. The remaining seven districts elected to postpone construction until additional funding becomes available for the program. New legislation (H.R. 550) has been introduced into the 112th Congress to authorize an additional **19 projects with a $42 million** Federal cost-share. Reclamation also provides financial assistance to several irrigation districts and municipalities within the

study area through the **WaterSMART Program** – a total of **13 grants** have been awarded, totaling about $11 million ($**3.5 million Federal cost-share**). The amount of Federal funds flowing into the study area over the last decade is a testament to the urgent need that currently exists in this region to better manage and conserve water. One of the benefits of conducting a basin study on this region is that it would include a **comprehensive evaluation of regional water supply options** to meet the needs of entities that otherwise would continue to pursue "piece-meal" solutions to their individual water needs. This is not to detract from the value of implementing water conservation and improving water delivery efficiencies, but more needs to be done if the region hopes to address the existing 368,356 af/yr and projected 592,084 af/yr water supply deficits in the study area.

The level of Stakeholders interest in and support for the Basin Study

RGRWA members include 29 municipalities, 25 irrigation districts, 9 water supply corporations, and 10 other water supply entities. A number of letters expressing their support for the proposed project. These members actively participate on several planning committees aimed at addressing water issues in the region. Assessing the future needs of the region, the limits of existing water sources, and how climate change can affect planning efforts is considered a vital step to a more secure water supply for all users in the region.

Whether the non-Federal cost-share contribution exceeds the required 50 percent

RGRWA proposes to fund 51.6 percent of the project costs through member contributions and RGRWA operating funds.

STUDY OUTLINE

Task 1. The first task will consist of **data collection and coordination** among stakeholders to **refine planning objectives**, review the project and clarify roles and responsibilities. Results of this effort will be documented through execution of a **Memorandum of Agreement** between Reclamation and non-Federal partners. A **Plan of Study** will be developed jointly between cost-share partners that outlines study tasks and procedures to execute each task. Project Management is included under the cost estimates for each task. ***Task 1 Deliverable:*** (1) Signed Memorandum of Agreement and (2) Final Plan of Study

Task 1 Summary		**Reclamation**	**RGRWA**
1.1	Inform stakeholders of planning tasks, solicit data requests, refine planning objectives	$5,616	$3,564
1.2	Identify, obtain, review, and synthesize existing data sources	$6,552	$14,455
1.3	Establish collaboration and data-sharing procedures – execute Memorandum of Agreement	$2,808	$1,782
1.4	Develop draft and Final Plan of Study	$9,360	$9,360

Task 2. This task will include **hydrologic projections of water supply and demand**, building upon existing data within the Region M Water Plan and relevant data sources. Future water supply projections will be made using the Climate Model Inter-comparison Project Phase 3 (**CMIP-3**) and the **Variable Infiltration Capacity** (VIC) model. The CMIP-3 archive provides a 12 kilometer resolution grid on a monthly time-series of precipitation and temperature from 1950-2099 for 112 climate projections. The VIC model is a spatially distributed hydrology model that solves the water balance at each model grid cell. In addition to simulating runoff response, VIC simulated water balance results will be used to estimate changes in snowpack and changes in the timing and quantity of runoff. Because VIC does not simulate groundwater-surface water interaction, changes in groundwater recharge and discharge estimates due to climate change will not be estimated using VIC. The area is currently not affected by groundwater recharge as it relates to runoff from snowpack in the Rio Grande headwaters. However, the middle and

lower reaches of the Rio Grande are rainfall dominated regions, and changes in precipitation patterns could affect groundwater recharge events in the region. As part of this effort, temporal trends in precipitation and temperature and spatial distribution of precipitation and temperature across the study region will also be analyzed for all the 112 climate projections. The monthly-bias corrected stream flows will constitute the final set of future water supply projections that would be used in the water allocation model WRAP for Task 3. ***Task 2 Deliverable:*** Technical Memorandum that includes the monthly bias-corrected streamflow time-series for the Rio Grande WRAP/WAM.

Task 2 Summary		**Reclamation**	**RGRWA**
2.1	Analyze of Existing Supplies	$1,404	$21,705
2.2	Projections of Future Water Supplies	-	-
2.2.1	*Develop daily VIC forcings for 112 climate projections, 1950-2099*	$14,040	$0
2.2.2	*Run VIC hydrology model to develop gridded monthly runoff time-series*	$18,864	$0
2.2.3	*Develop basin contribution areas for TCEQ control locations*	$12,576	$0
2.2.4	*Set up the VIC hydraulic routing model - flow fraction, flow direction and station location files for TCEQ control points*	$14,040	$0
2.2.5	*Run the hydraulic model for 112 projections to develop monthly routed flow*	$8,856	$0
2.2.6	*Hydroclimate data analysis for Region-M - changes in precipitation, temperature, snowpack, runoff volumes and timing*	$1,404	$0
2.2.7	*Develop monthly bias-corrected streamflow time-series for incorporation into the Rio Grande WRAP/WAM*	$14,040	$0
2.3	Analysis of Existing Water Demands	$1,404	$8,705
2.4	Projections of Future Water Demands	$9,360	$8,705

Task 3. This task will include an analysis of **how existing water and power infrastructure will perform** in the face of changing water realities. This will involve characterizing baseline **system reliability** and making updates by estimating the probability of inflows into reservoir systems under different climate change scenarios. Also, **firm yield estimates** generated by the WAM will be updated to account for climate change impacts on hydrology, such as reservoir evaporation. These results will be in integrated with Region M Plan projections and account for decreased reservoir storage due to sedimentation. Sensitivity analysis of ET estimates obtained from the VIC model would be used to guide analysis of agricultural water demand impacts from changing climate. ***Task 3 Deliverable:*** Technical memorandum combined with Task 2 – includes reservoir yield, agricultural demands, WAM simulations.

Task 3 Summary		**Reclamation**	**RGRWA**
3.1	Baseline System Reliability Analysis	-	-
3.1.1	*Probabilistic risk estimation*	$11,232	$1,934
3.2	Projections of Future System Reliability	-	-
3.2.1	*Estimation of changes in reservoir yield due to climate change*	$14,040	$0
3.2.2	*ET sensitivity analysis not including adjustment of irrigation demands*	$9,360	$0
3.2.3	*Adjustment of irrigation demands*	$2,808	$7,738
3.2.4	*WAM simulations*	$5,616	$15,475

Task 4. This task includes soliciting stakeholder input and **formulation of a range of alternative water management options** to meet short, medium, and long-term needs in 2060. Alternatives identified in the Region M Water Plan will be considered, as well as other options that meet planning objectives. **Non-structural options** would be evaluated including water conservation, conversion of water rights, water rights leases, rate adjustments, usage rules, water markets, and efficiency gains through improved operations and management. **Structural options** also would be formulated, including irrigation delivery

improvement projects, additional reservoir capacity, construction of new infrastructure, and development of alternative water resources such as seawater, brackish groundwater, and fresh groundwater from outside the basin. The needs of both **large *and* rural communities** will be addressed. Engineering will be reconnaissance level. Based on the information in the Region M Water Plan, it is assumed that brackish groundwater will be one of many options evaluated as a potential regional supply source. Evaluation of this alternative will require using well logs to modify the existing Gulf Coast Aquifer GAM to better quantify the distribution of brackish groundwater. ***Task 4 Deliverable:*** A technical memorandum that includes a brief description of all alternatives, including major infrastructure components, reconnaissance-level cost estimates, environmental considerations, and legal, regulatory, and public acceptance factors.

Task 4 Summary		**Reclamation**	**RGRWA**
4.1	Formulate non-structural alternatives – reconnaissance	$2,808	$5,158
4.2	Formulate structural alternatives – reconnaissance	$2,808	$5,158
4.3	Modify Gulf Coast GAM	$1,872	$74,471

Task 5. This task includes soliciting stakeholder input on the development of **screening criteria** and an evaluation/comparison of alternatives through a **two-phased "trade-off" analysis**. Phase I will include a preliminary screening based on reconnaissance-level engineering, and Phase II will include a detailed screening based appraisal-level engineering. Screening criteria will include (but are not limited to) capital and O&M costs; local, regional, and national economic benefits; legal and regulatory issues; environmental constraints/benefits; risk; completeness; and public acceptance. Special weighting factors will be given to options that **improve environmental sustainability and incorporate renewable energy**. Alternatives considered but eliminated will be documented. ***Task 5 Deliverable*****:** (1) A technical memorandum that includes a detailed description of Phase II alternatives, including major infrastructure components, appraisal-level cost estimates, environmental considerations, and legal, regulatory, and public acceptance factors; (2) matrix that includes screening criteria, weighting factors, and ranked alternatives.

Task 5 Summary		**Reclamation**	**RGRWA**
5.1	Develop screening criteria – stakeholder input	$3,744	$9,448
5.2	Phase I screening analysis	$3,120	$5,373
5.3	Phase II appraisal-level engineering	$3,120	$5,373
5.4	Phase II screening analysis	$3,120	$5,373

Task 6. This task includes making findings and recommendations based on the results of the screening analysis in Task 5. It includes compilation of all deliverables into a draft Basin Study Report for Quality Assurance/Quality Control (QA/QC) review by cost-share partners. ***Task 6 Deliverable:*** Final Report on the Lower Rio Grande River Basin

Task 6 Summary		**Reclamation**	**RGRWA**
6.1	Make findings and recommendations	$1,872	$1,222
6.2	Prepare Draft Basin Study Report for QA/QC	$4,680	$3,508
6.3	Incorporate comments/make revisions	$4,680	$3,508
6.4	Prepare Final Draft and Final Reports	$3,744	$1,834

Budget Total	**Reclamation**	**RGRWA**
Total Cost Shares	**$ 198,948**	**$ 213,850**

Proposed Schedule