

Title Page

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Proposed Project Title

“Feasibility of Water Recovery from Filter Backwashing and Re-washing Operations”.

Funding Group I; Project Proposed under U. S. Bureau of Reclamation (USBR) Funding Opportunity Announcement No. R16-FOA-DO-011, referred to as “WaterSMART: Water Reclamation and Reuse Research under the Title XVI Water Reclamation and Reuse Program for Fiscal Year 2016”.

Project Summary Description:

This project will investigate the feasibility of recovering water that is used for filter backwashing and filter re-washing operations at EPWU’s surface water treatment plants. At the W. E. Robertson and Elwood Umbenhauer Plants, (also collectively called the Canal Plant), approximately 800,000 gallons of backwash water and 520,000 gallons of re-wash water are lost every day through these operations, a total of approximately 1.3 MGD, or 700 acre feet/year (AFY). The main concern regarding recycling of these waters to the head end of the treatment plants is the number of Giardia and Cryptosporidium parasitic cysts that may be present in the water. This project will collect and analyze weekly samples from these streams during a two-month operating period. In addition to analyses for Giardia and Cryptosporidium, other parameters of interest will be measured, including turbidity and suspended solids.

After the sampling is completed, an economic evaluation will be conducted of the options available for treating the recovered water, including recycling to the head end of the treatment plant, membrane treatment via ultrafiltration or microfiltration, disinfection via UV light and/or chlorine dioxide, etc.

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- Appendix 1: EPWU Public Service Board Resolution
- Appendix 2: Proof of SAM Registration
- Appendix 3: Proposed Project Budget
- Appendix 3a: Contractual Budget
- Appendix 4: State Review Letter: Upper Rio Grande Council of Governments
- Appendix 5: Dr. G. Di Giovanni's Résumé and References
- Appendix 6: Dr. A. Tarquin's Résumé and References
- Appendix 7: Dr. G. Delgado's Résumé
- Appendix 8: Laboratory Testing Price Quotes

Executive Summary

Date: April 20, 2016
Applicant Name: El Paso Water Utilities Public Service Board
El Paso, Texas

Project Summary:

El Paso Water Utilities (EPWU) is applying for funding under the U. S. Bureau of Reclamation (USBR) Funding Opportunity Announcement No. R16-FOA-DO-011 referred to as "WaterSMART: Water Reclamation and Reuse Research under the Title XVI Water Reclamation and Reuse Program for Fiscal Year 2016".

This project will investigate the feasibility of recovering water that is used for filter backwashing and filter re-washing operations at EPWU's surface water treatment plants. At the W. E. Robertson and Elwood Umbenhauer Plants, approximately 800,000 gallons of backwash water and 520,000 gallons of re-wash water are lost every day through these operations, a total of approximately 1.3 MGD, or 700 AFY. The main concern regarding recycling of these waters to the head end of the treatment plants is the number of Giardia and Cryptosporidium parasitic cysts that might be present in them. This project will collect and analyze weekly samples from these streams during a two-month operating period. In addition to analyses for Giardia and Cryptosporidium, other parameters of interest will be measured, including turbidity and suspended solids.

TECHNICAL PROPOSAL

Technical Research Study Description: Background Data

El Paso Water Utilities (EPWU)/Public Service Board operates the Water, Wastewater, Reclaimed Water and Stormwater utilities in El Paso, Texas. The entire service territory is located within El Paso County, and primarily operates within the boundaries of the City of El Paso.

EPWU is nationally recognized as a leader in the implementation of water management programs, including water conservation, reclaimed water, stormwater protection, and water desalination.

The Public Service Board (El Paso Water Utilities) was established in 1952, by City Ordinance No. 752 to completely manage and operate the water and wastewater system for the City of El Paso. The seven-member board of trustees, which consists of the Mayor of the City of El Paso and six residents of El Paso County, Texas, who are appointed by the City Council.

EPWU serves the city of El Paso, located in El Paso County, Texas. Figure 1 below shows the geographical location. Interstate 10 crosses the city of El Paso from West to East.

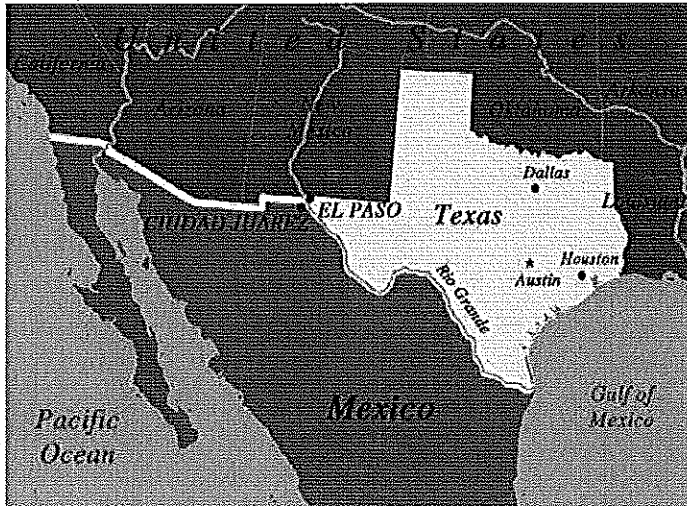


Figure 1 – Location of EPWU (El Paso, Texas)

The sources of water for EPWU are:

- Ground water from the Hueco Bolson (Hueco Bolson provides 70% of groundwater demand);
- Ground water from the Mesilla Bolson (provides the remainder of ground water demand, or 23% of total demand)
- Surface water from the Rio Grande (49% of demand)
- Reclaimed water used for non-potable uses (7% of demand)

The Utilities' instantaneous demand is approximately 170 MGD, or 190,424 AFY, including groundwater, desalinated brackish groundwater and surface water treatment. The surface water treatment plants have a combined capacity of 100 MGD, and together with wells, EPWU currently processes an average of 120,000 AFY of surface and ground water, or about 40 billion gallons per normal year. The utility owns land in the County of El Paso for the purposes of water rights, and currently leases additional acres for water rights. Furthermore, the Utility has Third Party agreements with El Paso County Water Improvement District #1 and the Bureau of Reclamation that allows for the purchase of additional surface water to supply the Jonathan Rogers Water Treatment Plant. In addition, the Utility built a desalination plant in east El Paso referred to as the Kay Bailey Hutchison Desalination Plant. This plant was designed to produce a maximum capacity of 27.5 MGD (30,804 AFY) of potable water. The water sources for the desalination plant are large brackish ground water areas in the Hueco Bolson estimated to hold 20 million acre-feet of water. Figure 2 below shows the location of the current and potential future sources of water for EPWU.

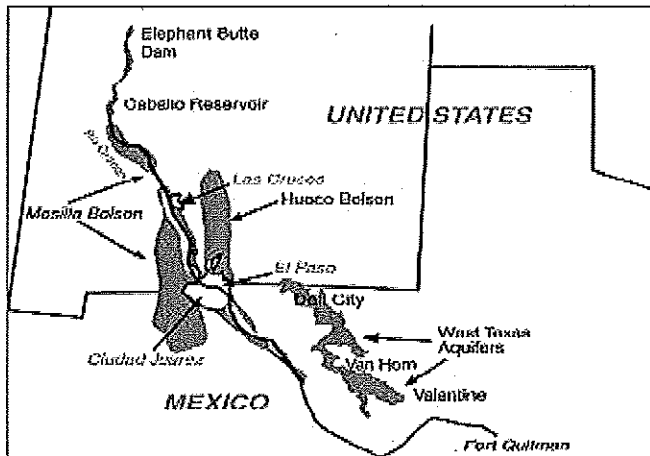


Figure 2 - Sources of Water for EPWU

The primary water uses for EPWU customers are municipal, residential, commercial and industrial. The Bureau of Reclamation and Irrigation districts in the area are responsible for the supply and distribution of surface water for irrigation purposes.

In 2007, in partnership with Fort Bliss, EPWU constructed a maximum capacity of 27.5 MGD desalination plant which it owns and operates on Fort Bliss property in east El Paso. The Kay Bailey Hutchison (KBH) Desalination Plant started production in July 2007. This plant is the largest inland desalination plant in the world and the largest desalination plant of any type in the United States. The plant has won numerous awards. (For more information about EPWU, please see <http://www.epwu.org/water>.)

Technical Research Study Description

General

One of the largest sources of water loss in surface water treatment plant operations is associated with filter backwashing and filter re-washing (i.e. placing filters back in service) operations. Filter backwashing in conventional surface water treatment plants typically occurs after 24 to 100 hours of filter operation, depending on head loss, turbidity breakthrough, or operating time (El Paso Water Utilities has a goal of no more than 100 hours of operation between backwashing the filters). During backwashing, treated water is passed upward through the filters at a high flow rate to dislodge suspended solids, chemical precipitation residuals, and microorganisms that are trapped in the filtration media. When backwashing is complete, the filters undergo a ripening process wherein treated water is passed through the filters and discharged to waste (for up to three hours) until the quality of the water (as measured by turbidity) is suitable for human consumption. This project will investigate certain physical and biological characteristics of the water that is discharged through backwashing and re-washing operations, in order to determine its suitability for recovery via recycling to the head end of the treatment plant.

Filter Backwashing

There are two—20 MGD surface water treatment plants at EPWU's Canal street location. Their formal names are W. E. Robertson (Plant 1) and Elwood Umbenhauer (Plant 2) Water Treatment Plants. The 20 MGD Robertson plant was the first, constructed in 1943. The 20 MGD Umbenhauer plant was built 24 years later in 1967. Both plants have the same types of treatment processes (primary settling, chemical coagulation, secondary settling and filtration) but the sizes of some of the treatment units are different. For example, the Robertson plant has six granular activated carbon filters while the Umbenhauer plant has only 3; however, the Umbenhauer filters are twice as large. All operational aspects of the filters are the same, including air scouring, backwashing, and filter-to-waste procedures, but the flow rates are proportionately different.

In both Plants 1 and 2, the filters are backwashed for between 10 and 16 minutes. The backwash water flow rate in Plant 1 is about 8,000 GPM and in plant 2, 22,000 GPM. Plant records indicate that the average filter backwash times are 14 minutes and 10 minutes in plants 1 and 2, respectively. Thus, for plant 1, the volume of water used per backwash cycle is 112,000 gallons. Since an average of 3.6 filters are washed every day in Plant 1, the total volume of water used is 403,000 gallons per day. In Plant 2, the backwash flow rate is 22,000 GPM, with an average of 1.8 filters washed each day. This results in a daily volume of 396,000 gallons. The combined water use for filter backwashing amounts to 800,000 gallons per day at the W. E. Robertson and Elwood Umbenhauer plants.

In 2001, a study was conducted to explore the quality of the backwash water exiting the filters. Samples were collected at one-minute intervals and checked for turbidity (Tarquin, 2001). The results in Table 1 show that most of the turbidity was removed within the first few minutes of the backwash, with 94% of it gone within 4 minutes. Thus, one operating scenario might be to discharge the water for the first 4 minutes and recycle the rest.

Table 1 - Turbidity of Backwash Water vs Time

<u>Time, Min</u>	<u>Turbidity, NTU</u>
1	487
2	336
3	159
4	33
5	20
6	13
7	10
8	7
9	6
10	5

One of the main concerns associated with recycling filtered water in a surface water treatment plant is that *Giardia* and/or *Cryptosporidium* cysts might be present in the water, and could be concentrating in the filters. Therefore, one objective of this project will be to determine the

extent to which protozoan cysts are present (if at all) in the filter backwash water after the first 4 minutes of the backwash cycle. This will be accomplished by collecting and analyzing weekly samples from the backwash water (after 4 minutes of backwash) over a two-month period of time. In addition to analyses for *Giardia* and *Cryptosporidium*, other parameters of interest will be measured, including turbidity and suspended solids.

Filter Re-washing

Filter re-washing, also known as filter-to-waste, is the operation wherein the first water that passes through a backwashed filter is wasted until the turbidity of the filtered water drops to a predetermined value (<0.10 NTU in EPWU plants). This operation can take anywhere from 25 minutes to 3 hours, with typical times in the 50-60 minute range. The re-washing rate for Plant 1 filters is estimated to be 1200 GPM, with a rate twice as high for Plant 2, or 2400 GPM. If a conservatively average time of only 60 minutes is assumed for each of the re-wash cycles in Plants 1 and 2 (3.6 re-washes per day in Plant 1 and 1.8 in Plant 2), the volume of water lost per day amounts to 260,000 gallons in each plant, for a total of about 520,000 gallons per day. Similar to backwash water testing, the re-wash water will be sampled immediately after the filter re-washing process begins and analyzed for *Giardia* and *Cryptosporidium* every week for two months.

If this project shows that capturing and recycling the backwash and re-wash waters would be safe and economically feasible, implementation of a full-scale project would result in capture of 800,000 gallons of backwash water and 520,000 of re-wash water every day, for a total of 1.3 MGD.

Scope of Work

The proposed project will be carried out through execution of the following three tasks:

Task 1 - Collect and analyze samples from backwash and re-wash water in Plant 1

Task 2 - Conduct an economic analysis of collection and treatment alternatives

Task 3 - Prepare monthly and final reports

Task 1 - Collect and analyze samples from backwash and re-wash water in Plant 1

Task 1 will involve collecting samples from the backwash water and re-wash water and determining the physical, chemical, and microbiological characteristics of each one. For this project, the most important characterization is microbiological, because if protozoans are present in the raw water, they can be trapped and concentrated in the filters. Recycling of highly-concentrated protozoan-laden backwash water to the head end of the plant could increase the protozoa load on all of the treatment processes, increasing the risk of a protozoan breakthrough. Other microbiological analyses will be conducted, such as total plate counts, to see if other microorganisms are concentrated in the filters. The microbiological analyses will be conducted by George Di Giovanni of the University of Texas Health Science Center in El Paso because he has direct experience in analyzing filter backwash water for *Giardia* and *Cryptosporidium* (Di Giovanni, 1999; Arora, 2001). Typical physical and chemical parameters of the raw water will be compared with the same parameters of the backwash and re-wash waters to see if there would be a significant increase in any of them (unlikely) through recycling of the backwash and re-wash waters.

Task 2 – Conduct an economic analysis of collection and treatment alternatives

Task 2 will be an economic analysis of all alternatives that would satisfy the goal of recovering most of the water that is lost through filter backwashing and re-washing operations with minimal risk of degradation (chemically or biologically) of the produced water. The analysis will consider all costs associated with the project (capital and operating) so that an accurate unit cost of the water (i.e. \$/kgal) will be obtained. The outcome of this task will determine the feasibility of moving forward with a full-scale project.

Task 3 – Prepare monthly and final reports

Task 3 will be completed as the monthly and final reports become due. The monthly reports will be submitted within two weeks after the end of the month. The draft final report will be submitted and finalized after all reviewer comments have been received.

IV.D.5 Environmental and Cultural Resources Compliance

To allow Reclamation to assess the probable environmental impacts and costs associated with each application, all applicants must respond to the following list of questions focusing on the requirements of NEPA, ESA, and NHPA. Please answer the following questions to the best of your knowledge. If any question is not applicable to the Project Activities, or if necessary environmental compliance has been completed, please explain.

1. Will the Research study activities impact the surrounding environment (i.e., soil, [dust], air, water [quality and quantity], animal habitat, etc.)?

- Please briefly describe all earth-disturbing work and any work that will affect the air, water, or animal habitat in the project area.
- Please also explain the impacts of such work on the surrounding environment and any steps that could be taken to minimize the impacts.

The research study that we propose will not involve any earth-disturbing work nor any work that will affect the air, water, or animal habitat. The research that we propose here will be conducted at a facility located entirely inside of the EPWU W. E. Robertson Water Treatment Plant campus.

2. Are you aware of any species listed, or proposed to be listed as a Federal endangered or threatened species, or designated Critical Habitat in the project area? If so, how would they be affected by activities associated with the proposed project Activities?

Please see response to question 1.

3. Are there wetlands or other surface waters inside the project boundaries that potentially fall under Federal Clean Water Act jurisdiction as "waters of the United States?" If so, please describe and estimate any impacts the research study activities may have.

There are no wetlands or other surface waters inside the project boundaries that fall under the Federal Clean Water Act jurisdiction as "waters of the United States".

4. Are there any known archeological sites in the research study activities area? If so, please describe and estimate any impacts the research study may have.

Please see response to question 1.

5. Will the proposed research study activities have a disproportionately high and adverse effect on low income or minority populations? If so, please describe and estimate any impacts the research study may have.

The research study should have no adverse effect on the population in general, or low income or minority populations in particular; nor will the activities affect any population disproportionately.

6. Will the research study activities limit access to and ceremonial use of Indian sacred sites or result in other impacts on tribal lands? If so, please describe and estimate any impacts the research study activities may have.

Research study activities will not affect, limit access to, nor result in any impact on tribal lands.

7. Will the research study activities contribute to the introduction, continued existence, or spread of noxious weeds or non-native invasive species known to occur in the area? If so, please describe and estimate any impacts the research study activities may have.

This research project's activities will not contribute to the introduction, continued existence, or spread of noxious weeds or non-native invasive species known to occur in any areas.

IV.D.6 Required Permits or Approvals

No permits are required for conducting this study. For the state agency review, please see Rio Grande Council of Governments letter, Appendix 4.

IV.D.7 Official Resolution

Please find a copy of the agenda item listing the resolution (Appendix 1), which will go to the Public Service Board on May 11, 2016. This signed resolution will be sent to USBR within 30 days of the date of this application.

IV.D.8 Research Study Budget

Description of expenditures planned through **December 31, 2016.**

Applicants also must provide a cost estimate for the Project Activities.

Funding Plan, Letter of Commitment

- (1) **How will you make your contribution to the cost share requirement, such as monetary and/or in-kind contributions and source funds contributed by the applicant (e.g., reserve account, tax revenue, and/or assessments)?**

EPWU's cash and in-kind contributions will be provided from revenues currently approved in its 2016-17 fiscal year budget.

- (2) **Describe any in-kind costs incurred before the anticipated research study start date that you seek to include as research study costs.**

None.

- (3) **What research study expenses have been incurred?**

None

- (4) **Provide the identity and amount of funding to be provided by funding partners, as well as the required letters of commitment.**

El Paso Water Utilities PSB is the only funding partner. Please see

Table 2 for more information.

- (5) Describe any funding requested or received from other Federal partners.
 Note: other sources of Federal funding may not be counted towards our 75 percent cost share unless otherwise allowed by statute.

None.

- (6) Describe any pending funding requests that have not yet been approved, and explain how the research study will be affected if such funding is denied.

None.

Please include the following chart (table 2) to summarize your non-Federal and other Federal funding sources. Denote in-kind contributions with an asterisk (*). Please ensure that the total Federal funding (Reclamation and all other Federal sources) does not exceed 25 percent of the total estimated research study cost.

Table 2. Summary of non-Federal and Federal funding sources.

Funding Sources	Funding Amount
Non-Federal Entities	
El Paso Water Utilities	\$ 28,305
El Paso Water Utilities *	\$ 4,838
<i>Non-Federal Subtotal:</i>	\$ 33,143
Other Federal Entities	
None	0
<i>Other Federal Subtotal:</i>	-0-
Requested Reclamation Funding:	\$ 10,600
<i>Total research study funding:</i>	\$ 43,743

*In-Kind Contributions (\$)

Table 3.—Funding sources

Funding sources	Percent of total project cost	Total cost by source
Recipient funding	75.8%	\$ 33,143
Reclamation funding	24.2%	\$ 10,600
Other Federal funding	0%	\$ 0
Totals	100%	\$ 43,743

Table 3 (above) summarizes the respective proposed non-Federal and Federal (USBR) funding source components. Review of this table reveals that the total Federal funding component (Bureau of Reclamation) does not exceed 25 percent of the total estimated project cost. On a Total Project Cost Basis, EPWU is proposing to pay for 75.8% of the project expenses in terms of both cash and in-kind services.

Table 4 – Project Budget

Budget Item	\$ per unit	EPWU quantity	Type	EPWU cost	TOTAL COST
Salaries & Wages					
M. Fahy*	75.00	20	hours	1500.00	1500.00*
Other					
Reporting, postage	varies	varies		varies	234.00
EPWU sample analyses* (see appendix 8)	376.00	4	sample	1504.00	1504.00*
EPWU Giardia/Cryptosporidium analyses* (see appendix 8)	400.00	4	sample	1600.00	1600.00*
Contractual – UTEP (see Appendices 3,3a, 8)	38905.00			38905.00	38905.00 [†]
Total direct costs				43743.00	43743.00
Indirect costs				0	0
TOTAL PROJECT COSTS				43743.00	43743.00

*In-kind

† This amount to be paid through an EPWU contract with UTEP. See Appendix 3 and Appendix 3a.

Budget Narrative

El Paso Water Utilities will contribute \$28,305 in cash and \$4,838 in-kind. The in-kind contribution will be (1) for service provided by Mr. Mike Fahy (\$1500); (2) for the cost of Giardia and Cryptosporidium analyses conducted by EPWU and Biovir Laboratories (\$1600); (3) for water sample analyses conducted at EPWU's certified International Water Quality Laboratory (\$1504); and (4) reporting and postage (\$234).

Contractual

The details associated with the contractual budget items in the budget table follow here:

El Paso Water Utilities will enter into a contract with the University of Texas at El Paso for \$38,905.00. Mike Fahy and other Utility personnel will meet with Drs. Tarquin and Delgado regularly and on an as-needed basis. This contract will cover the following expenses:

Salaries and Wages

Dr. Tarquin will serve as the project manager, for 195 hours. Dr. Tarquin will be responsible for all aspects of the project. Dr. Guillermo Delgado will be employed 214 hours and will assist Dr. Tarquin in all aspects of the project except report writing. Additionally, he will be responsible for managing the laboratory and all sample and data collection activities.

Fringe Benefits

Average medical benefits and fringe benefits for faculty at The University of Texas at El Paso are based on annually published rates and are based proportionally to effort charged. Dr. Tarquin's hourly fringe benefits rate is \$15.74 per hour.

Travel

Travel costs are for 1400 local miles at a mileage compensation rate of 50 cents per mile. The local travel will be for 5-mile round trips from UTEP to the W. E. Robertson Water Treatment Plant and for 22-mile round trips from UTEP to EPWU's main office (which is where Mr. Fahy is located). All travel costs will be charged/expensed in accordance with the State of Texas Travel regulations governing airfare, per diem, mileage, etc.

Supplies

The \$1,600 budgeted for materials and supplies will be used for purchasing laboratory consumable supplies (such as pH & conductivity electrodes, chemicals, standard solutions, gases, chemicals, batteries, safety items like glasses, gloves, & ear plugs, tubing, etc.). All materials and supplies needs are based on pricing of purchases of similar items, catalog pricing, and experience by the PI with respect to materials needed for laboratory analyses of water samples.

Other Expenses

Microbiological analyses will be conducted by George Di Giovanni of the University of Texas Health Science Center in El Paso at a fixed rate of \$500 per sample. A total of 18 have been budgeted for this project.

Indirect

Indirect costs at UTEP are based on a negotiated rate of 10% of Modified Total Direct Costs between UTEP and EPWU.

Total Costs

The total cost of the project is \$43,743. The Federal share is \$10,600 (24.2%) and the non-Federal share is \$33,143 (75.8%).

Funding Restrictions

There are no funding restrictions.

System for Award Management

EPWU is registered on the System for Awards Management (SAM); EPWU renewed its SAM registration on 3/10/2016 and a copy of this registration notice is attached as Appendix 2 of this Proposal.

Section V. Application Review Information

V.A. Technical Proposal: Evaluation Criteria

V.A.1 Statement of Problems and Needs

- (1) If the proposed research study aims to address the needs of a specific applicant or locale, describe in detail the water resource management**

problems and needs in the local area and explain how water reclamation and reuse may address those problems and needs.

The W. E. Robertson and Elwood Umbenhauer Water Treatment Plants now discharge up to 5% of their annual diversions from the Rio Grande back into the Franklin Canal during normal operations in the form of routine filter backwash and filter-to-waste water returns, which equates to approximately 700 Acre-Feet per Year (AFY) of unused water.

EPWU is familiar with the equipment designs, engineering consultants, treatment processes, vendors, and manufacturers of conventional water treatment systems that are required to capture and recycle these discharges for treatment and distribution to the public as additional potable water supply. In addition, EPWU has worked for several years with Dr. Anthony Tarquin of the Civil Engineering Department at the University of Texas at El Paso on research projects to produce potable water using water recycling and re-treatment techniques to reduce the overall volumes of water discharged and lost from EPWU's water supply. This research has shown that this proposed recycling can provide up to 700 Acre-Feet per Year (AFY) of additional potable water for sale to the customer.

In this desert area, still suffering from drought as El Paso County is, it is important to scrutinize all processes on a regular basis to ensure that optimal water conservation methods are in practice. In this case, EPWU observed that a sizeable amount of water may be available for reclamation and recycling; EPWU uses 1.3 MGD of water to backwash and re-wash granular active carbon filters. This water is lost to this process. This research will show that it is possible to recover 700 AFY of this lost supply of water.

The water used to backwash and re-wash filters could carry a level of the Giardia and Cryptosporidium parasites too great to make treatment practical and cost effective. However, some recent testing shows that the presence of these two parasites in the water, as well as the water's turbidity and suspended solids, is not as concentrated as originally thought. After sample testing to get an accurate measure of the presence of the parasites, turbidity, etc., an economic analysis will be performed; this analysis could show that treatment of this water, using current methods, makes recycling feasible and cost effective.

- (2) Identify the water supply imbalance that the research study will address for the area of responsibility of the applicant. Additional consideration will be given to proposals that explain how water supply imbalances in the area may be impacted by climate change, and/or if the research study will attempt to address projected climate change impacts in the area.**

This project addresses water supply shortages due to climate variability in the upper Rio Grande Basin, and in particular in the area of the USBR-Rio Grande Project. El Paso gets up to 50% of its water supply from the Rio Grande when water is available in the Elephant Butte Dam from runoff in southern Colorado and northern New Mexico. When the water supply from the Rio Grande is limited (as has been the case in recent years), El Paso must rely on groundwater to make up for the shortage. For example, during the 2014 calendar year, surface water from the Rio Grande was only available for approximately three months of the normal seven month summer irrigation season.

EPWU's surface water treatment plants are used only during the irrigation months, which normally extend from March through September (or seven months) during a normal, or wet year. However, during severe drought conditions (as currently exist), they may only be used for three to four months. The extra water that would be available through implementation of this project will be critical during periods of high demand. Use of this water conservation and recycling process may preclude the requirement for invoking Stage 2 water restrictions at various times during the high-demand periods of May through August.

- (3) If the proposed research study aims to address broader needs of the industry in terms of technology or practices, describe these needs as they occur on a watershed, regional, and/or national scale.**

If proven successful at this proposed level of operation, the concept could be expanded to increase the potable water productive capacity of multiple surface water treatment plants nationwide where the state regulations permit this process, and at locations where the same treatment train discharges are currently made back to the river-source supply where they cannot be recovered, and where limited replacement water is available or is extremely costly.

V.A.2 Water Reclamation and Reuse Opportunities

- (1) **Describe the source(s) of water that will be investigated for potential reclamation, including impaired surface or ground waters.**

The W. E. Robertson and Elwood Umbenhauer Water Treatment Plants now discharge up to 5% of their annual diversions from the Rio Grande back into the Franklin Canal during normal operations in the form of routine filter backwash and filter-to-waste water returns, which equates to approximately 700 Acre-Feet per Year (AFY) of unused water. This water is now being handled as reject water going to discharge as waste. Therefore, treating this water for supply to the public should be considered equivalent to water reclamation or reuse. The 700 AFY of water generated by this project translates into an equal volume of water per year that will not have to be diverted from surface water from the Rio Grande Project. This equates to 700 AFY in terms of water left in storage in either the Elephant Butte or in Caballo Reservoir.

- (2) **Describe how the research study will help to eliminate obstacles for using reclaimed water as a supply within and/or outside the area of responsibility of the applicant.**

Due to the simplicity and transportability of this technology, it is eminently transferrable to any location exhibiting similar river source water conditions and conventional surface water treatment techniques that traditionally require discharges during filter washing and conditioning, especially in the case where the raw water is purchased from a federal, state or private agency at a substantial cost (due to water rights or similar restrictions), and the discharges are released downstream where the utility cannot recover them in any fashion.

- (3) **Describe how the research study will expand a water market and promote implementation of new uses or expand existing uses for reclaimed water (e.g., environmental restoration, fish and wildlife, groundwater recharge, municipal, domestic, industrial, agricultural, power generation, and recreation).**

The 700 AFY of water generated by this project translates into an equal volume of water per year that will not have to be diverted from surface water from the Rio Grande Project. This will equate to 700 AFY in terms of water left either in Elephant Butte or Caballo Reservoirs, or available within the river or canal system as "in-stream" flows. This water is potentially available for benefits to the environment and potentially endangered species.

- (4) Describe how the research study will help establish or expand a water market to use reclaimed water outside your specific locale, including providing regional or West-wide benefits.**

The 700 AFY of water generated by this project translates into an equal volume of water per year that will not have to be diverted from surface water from the Rio Grande Project. This equates to 700 AFY in terms of water left in storage in either the Elephant Butte or in Caballo Reservoir. This 700 AFY of water is potentially available for marketing among the agricultural and municipal communities. Under the current Operating Agreement among the Bureau of Reclamation, El Paso County Water Improvement District No.1, and Elephant Butte Irrigation District, this 700 AFY will be classified as carry-over storage and will either be carried over proportionally according to the users' water rights into the following year, or be available for purchase by a willing buyer according to the wishes of a willing seller. On a regional scale, this concept could be applied in other communities exhibiting similar project operating agreements for carryover storage.

V.A.3 Description of Potential Alternatives

- (1) Describe objectives of the proposed research study and how the proposed research is innovative in advancing water reclamation knowledge and/or practices relative to existing knowledge and/or standard practices.**

References and literature citations should be provided, as applicable.

One of the major concerns for Operations staff at EPWU, with respect to implementing this technology, has been the concern that cysts such as Giardia and Cryptosporidium would concentrate over time in the filter media and ultimately reach critical "breakthrough" levels. This sampling and testing program will provide real information to identify whether there is a realistic basis for concern, and if so, what precautions need to be taken to protect the public.

- (2) If applicable, describe alternative water reclamation measures or technologies that will be investigated as part of the research study.**

If significant amounts of Giardia and Cryptosporidium are found in the backwash and/or in the re-wash waters, then the cost effectiveness of well-established processes for removing or inhibiting them will be investigated, including but not limited to ultrafiltration/microfiltration and uv/chlorine dioxide disinfection.

- (3) **Describe any collaborators involved with the research and their respective roles.**

Please refer to the attached resume and list of references for Dr. DiGiovanni, Appendix 5.

- (4) **Please describe the credentials, experience, and past performance of the research team. Alternatively, describe the process and criteria that will be used to select an appropriate, experienced research team.**

Please refer to the attached resume and list of references for Dr. Anthony Tarquin, Appendix 6, and Dr. Guillermo Delgado, Appendix 7.

V.A.4 Stretching Water Supplies

- (1) **At your specific locale and/or on a regional or West-wide scale, if applicable, describe how the research study could promote the establishment or expansion of a market for water reclamation and reuse that will reduce, postpone, or eliminate the development of new or expanded water supplies.**

The water to be reused using this proposed technique has already been diverted from the irrigation system associated with the Rio Grande Project from Elephant Butte and Caballo Reservoirs. In essence, since this water (approx. 700 AFY) will become available to the public from the existing supply, this will essentially decrease the demand from the Project by an equivalent amount. In this manner, postponing or eliminating expanded water supplies will be accomplished.

- (2) **Describe how the research study could or will streamline the implementation of a project that will reduce or eliminate the use of existing diversions from natural watercourses or withdrawals from aquifers and improve available supplies during droughts.**

The water to be reused using this proposed technique has already been diverted from the irrigation system associated with the Rio Grande Project from Elephant Butte and Caballo Reservoirs. In essence, because this water (approx. 700 AFY) will become available to the public from the existing supply, this will essentially decrease the demand from the Rio Grande Project by an equivalent amount. In this manner, reducing the use of existing diversions and aquifer withdrawals during drought will be accomplished. The extra water that would be available through implementation of this concept will be critical during periods of high demand. Use of this water conservation and recycling process may preclude the requirement for

invoking Stage 2 water restrictions at various times during the high-demand periods of May through August.

- (3) **Describe how the research study could or will streamline the implementation of a project that will reduce the demand on existing Federal water supply facilities.**

Please refer to response for Question V.A. 4. (1).

Also, if this project demonstrates that backwash and re-wash water could safely be recycled, similar projects could be instituted at many other surface water treatment plants in the west and southwestern United States.

V.A.5 Environment and Water Quality

- (1) **Describe the potential for the research study to identify methods or produce results that improve the quality of surface or groundwater, including description of any specific issues that will be investigated or information that will be developed as part of the research study.**

Since this water (approx. 700 AFY) will become available to the public from the existing surface water supply, this will essentially decrease the demand from the Rio Grande Project by an equivalent amount. This condition will permit an equivalent volume of water per year to remain in the upstream reservoirs or within the Rio Grande as in-stream flows, thus, improving the water quality and volume for environmental improvement and habitat purposes.

- (2) **Describe the potential for the research study to identify methods or produce results that improve flow conditions in a natural stream channel that benefit the environment, including a description of any specific issues that will be investigated or information that will be developed as part of the research study.**

Full deployment of this concept will permit an equivalent volume of water per year to remain in the upstream reservoirs or within the Rio Grande as in-stream flows, thus, improving the water quality and volume for environmental improvement and habitat purposes. On a regional scale, this concept could be applied at other water treatment plants at other communities exhibiting similar project operating agreements for carryover storage.

- (3) **Describe the potential for the research study to identify methods or produce results that provide water or habitat for non-listed, sensitive, or federally-listed threatened or endangered species, including description**

of any specific issues that will be investigated or information that will be developed as part of the research study.

The 700 AFY of water generated by this project translates into an equal volume of water per year that will not have to be diverted from surface water from the Rio Grande Project. This equates to 700 AFY in terms of water left in storage in either the Elephant Butte or in Caballo Reservoir, or surface water allowed to be released for in-stream flows to benefit sensitive, threatened or endangered species, or improve their habitat. Use of this technique will of course depend on the outcomes of the research to determine whether the build-up of Giardia and Cryptosporidium is critical to process implementation, and/or whether solutions can be developed.

V.A.6 Legal and Institutional Requirements

- (1) For planning related research, describe how the research study will be used to identify methods or produce results that help to eliminate obstacles for using reclaimed water as a supply in the research study area.**

One of the major concerns for Operations staff at EPWU, with respect to implementing this technology, has been the concern that cysts such as Giardia and Cryptosporidium would concentrate over time in the filter media and ultimately reach critical "breakthrough" levels. This sampling and testing program will provide real information to identify whether there is a realistic basis for concern, and if so, what precautions need to be taken to protect the public.

Also, this 700 AFY of water is potentially available for marketing among the agricultural and municipal communities. Under the current Operating Agreement among the Bureau of Reclamation, El Paso County Water Improvement District No.1, and Elephant Butte Irrigation District, this 700 AFY will be classified as carry-over storage and will either be carried over proportionally according to the users' water rights into the following year, or be available for purchase by a willing buyer according to the wishes of a willing seller.

- (2) For field research studies focused on state of the art technology deployment, describe the readiness to proceed in terms of:**
- a. The type and level of preliminary research investigations that have been completed. Dr. Tarquin and Dr. DiGiovanni, along with the EPWU staff at EPWU's International Water Quality Lab are properly trained and certified for this type of testing. Some testing has been performed on the raw water at

EPWU's surface water treatment plants for the presence of Giardia and Cryptosporidium.

b. The type and level of preliminary research plans or testing designs that have completed.

Dr. Tarquin and the Engineering staff have already calculated preliminary construction costs to execute this water recycling process at the Robertson and Umbenhauer (Canal) Plants. The estimated costs for engineering design and construction is approximately \$1.5 to \$2.0 million, for an estimated equivalent amortized cost of approximately \$250.00 per acre-foot (\$/AF) for the water produced in this manner for public consumption.

c. Uncertainties that could affect the timing of research completion associated with environmental compliance, permitting, etc. as applicable to the research study?

There are no uncertainties associated with environmental compliance or permitting that could affect the completion of the research project.

d. How will the testing of new state of the art technology aid in producing results that help address institutional requirements to implement a project?

There is no new state of the art technology involved in this project.

V.A.7 Renewable Energy and Energy Efficiency

- (1) **For research studies that include evaluation or incorporation of renewable energy, please describe the proposed or existing renewable energy system and the research objectives proposed to evaluate the integration of renewable energy into the research study area or project.**

Should EPWU decide to pursue this technology for a full-scale development project, then solar electric power will be evaluated for operation of basic flow monitoring and related equipment. Also, EPWU staff are aware of energy recovery and generation alternatives potentially available through the use of in-pipe turbines, which may show some feasibility for this process. Further evaluation would be needed, in the event that this technology is further developed.

- (2) **For research studies focused on improving energy efficiency, describe the full scale plant energy requirements, if applicable, proposed efficiency improvements, and reduced carbon footprint. Provide calculations and describe assumptions and methodology.**

The primary energy savings afforded to this technology, compared to the alternative of diverting additional water from the Rio Grande surface water supply, will be the avoided cost of energy to divert and pump the

equivalent volume of water from the adjacent water delivery canal. Since this subject water has already, previously been diverted and lifted into the initial treatment basin, this step will not be needed a second time, for the water being recycled.

- (3) Please quantify the energy savings that are expected to be identified in the research study through renewable energy or improved facility efficiencies. Include support for how energy savings were calculated.**

As mentioned previously, above, the primary energy savings afforded to this technology will be the avoided cost of energy to divert and pump the equivalent volume of water from the adjacent water delivery canal. While this calculation has not specifically been made, it is safe to estimate that this electrical savings would be on the order of 1-3% of the overall electricity cost per AF for water treatment.

V.A.8 Watershed Perspective

- (1) Describe whether or the extent to which the research study is based off of recommendations from an existing plan that is sponsored or otherwise recommends research needs on a regional or national scale.**

This concept of recovering and treating filter backwash and re-wash waters from conventional surface water treatment plants, is consistent with the purpose and directives of the USBR-Title XVI program. This process represents converting to potable use, those water streams targeted for discharge to waste. The process is easily transferrable to any location exhibiting similar river source water conditions and conventional surface water treatment techniques that traditionally require discharges during filter washing and conditioning.

- (2) Explain any additional benefits of, or specific need for, the proposed research study within the sponsors watershed, regional area, and nationally.**

El Paso obtains, during an average year, 50% of its municipal water supply from the surface water source of the USBR Rio Grande Project. This Project is located in an area of the Southwest that is prone to droughts, and consequently, the allocation from the Rio Grande Project to its customers can vary considerably from year to year. For example, during the current river drought in the El Paso area, the USBR allocation has often been below 50% of normal.

- (3) Describe how the research objectives will benefit other locations and the technical, economic, or institutional questions that will be answered by the research study.**

Due to the simplicity and transportability of this technology, it is eminently transferrable to any location exhibiting similar river source water conditions and conventional surface water treatment techniques that traditionally require discharges during filter washing and conditioning. This is especially true in the case where the raw water is purchased from a federal, state or private agency at a substantial cost (due to water rights or similar restrictions), and the discharges are released downstream where the utility cannot recover them in any fashion. At an estimated, amortized finished water cost of approximately \$250/AF, this process should be economically competitive at many locations throughout the country.

- (4) Explain how the research study includes or promotes and encourages collaboration among parties. Identify if there is widespread support for the research study.**

Please refer to previous answer above, to Question No. V.A. 8 (3).

ATTACHMENTS FORM

Instructions: On this form, you will attach the various files that make up your grant application. Please consult with the appropriate Agency Guidelines for more information about each needed file. Please remember that any files you attach must be in the document format and named as specified in the Guidelines.

Important: Please attach your files in the proper sequence. See the appropriate Agency Guidelines for details.

1) Please attach Attachment 1	USBR_Proposal&Application_pac	Add Attachment	Delete Attachment	View Attachment
2) Please attach Attachment 2	Appendix 1_May_2016_EPWU_Boar	Add Attachment	Delete Attachment	View Attachment
3) Please attach Attachment 3	Appendix 2 SAM_registration.p	Add Attachment	Delete Attachment	View Attachment
4) Please attach Attachment 4	Appendix 3 Budget Information	Add Attachment	Delete Attachment	View Attachment
5) Please attach Attachment 5	Appendix 3a_Table_5Contractua	Add Attachment	Delete Attachment	View Attachment
6) Please attach Attachment 6	Appendix 4_RIOCOG_letter.pdf	Add Attachment	Delete Attachment	View Attachment
7) Please attach Attachment 7	Appendix 5 Cv Brief Di Giovan	Add Attachment	Delete Attachment	View Attachment
8) Please attach Attachment 8	Appendix 6_ATarquin_Resume_ab	Add Attachment	Delete Attachment	View Attachment
9) Please attach Attachment 9	Appendix 7_G_Delgado_Resume.p	Add Attachment	Delete Attachment	View Attachment
10) Please attach Attachment 10	Appendix 8 Quote for lab anal	Add Attachment	Delete Attachment	View Attachment
11) Please attach Attachment 11		Add Attachment	Delete Attachment	View Attachment
12) Please attach Attachment 12		Add Attachment	Delete Attachment	View Attachment
13) Please attach Attachment 13		Add Attachment	Delete Attachment	View Attachment
14) Please attach Attachment 14		Add Attachment	Delete Attachment	View Attachment
15) Please attach Attachment 15		Add Attachment	Delete Attachment	View Attachment

DRAFT #1

NOTICE: The regular meeting of the Public Service Board will be held at **8:00 a.m.**, Wednesday, May 11, 2016, at the Public Service Board Meeting Room, 1154 Hawkins Boulevard, El Paso, Texas.

**CITY OF EL PASO
PUBLIC SERVICE BOARD**

May 11, 2016

8:00 a.m.

NOTICE TO THE PUBLIC

All matters listed under the CONSENT AGENDA will be considered by the Public Service Board to be routine and will be enacted by one motion in the form listed below. There will be no separate discussion of these items unless members of the Board or persons in the audience request specific items be removed from the CONSENT AGENDA to the REGULAR AGENDA for discussion prior to the time the Public Service Board votes on the motion to adopt the CONSENT AGENDA. The Public Service Board may reconsider an agenda item at any time prior to adjournment. Comment as to any regular agenda item may be allowed by the Chair at its discretion. Reasonable time limits may be imposed by the Chair.

CALL TO ORDER
ESTABLISHMENT OF A QUORUM
MOMENT OF SILENT PRAYER
PLEDGE OF ALLEGIANCE

CONSENT AGENDA

ITEM OWNER

- | | |
|--|-------------------------|
| 1. Consider and approve the minutes of the regularly scheduled meeting held on April 13, 2016. | Georgette Webber |
|--|-------------------------|

REGULAR AGENDA

- | | |
|--|--------------------------------------|
| 2. Presentation of the Safest Section of the Quarter Awards (4 th Quarter 2015) | Robert Leyva |
| 3. Consider and authorize the President/CEO to sign a developer participation agreement with River Oaks Properties, Limited for the construction of a lift station in an amount not to exceed \$120,000.00. | Amy Castner |
| 4. Consider and award a professional services contract for the Jackson Ground Water Storage Tank Replacement, to Freese & Nichols, Incorporated, in the amount of \$_____. | Felipe Lopez |
| 5. Consider and adopt a resolution authorizing the President/CEO to submit an application to the U.S. Bureau of Reclamation (USBR) for \$10,000 in 2016 WaterSmart, Title XVI Research Program grant funds to study a water recycling system at the Canal Plant. | Mike Fahy |
| 6. Management Report <ul style="list-style-type: none">• Update on EPWU Actions regarding the Zika and West Nile viruses. | John Balliew
Alan Shubert |
| 7. Public Comment: The PSB will permit public comment on any item not on the agenda. The Chair may impose reasonable time limits for each speaker. | |

Entity Dashboard

EL PASO WATER UTILITIES PUBLIC SERVICE BOARD
DUNS: 148678837 CAGE Code: 585F1
Status: Active
Expiration Date: 03/10/2017
Purpose of Registration: All Awards

1154 HAWKINS BLVD
EL PASO, TX, 79925-6436,
UNITED STATES

- Entity Overview
- Entity Record
 - Core Data
 - Assertions
 - Reps & Certs
 - POCs
- Reports
 - Service Contract Report
 - BioPreferred Report
- Exclusions
 - Active Exclusions
 - Inactive Exclusions
 - Excluded Family Members

Entity Overview

Entity Information
DUNS: 148678837
Name: EL PASO WATER UTILITIES PUBLIC SERVICE BOARD
Business Type: US Local Government
POC Name: JEFF TEPSICK
Registration Status: Active
Activation Date: 03/10/2016
Expiration Date: 03/10/2017

Exclusions
Active Exclusion Records? No

BUDGET INFORMATION - Non-Construction Programs

OMB Number: 4040-0006
Expiration Date: 01/31/2019

SECTION A - BUDGET SUMMARY

Grant Program Function or Activity (a)	Catalog of Federal Domestic Assistance Number (b)	Estimated Unobligated Funds		New or Revised Budget		
		Federal (c)	Non-Federal (d)	Federal (e)	Non-Federal (f)	Total (g)
1. WaterSMART: Water Reclamation Research under the Title XVI Water Reclamation and Reuse Program for Fiscal Year 2016	15.504	\$ 10,600.00	\$ 33,143.00	\$ 0.00	\$ 0.00	\$ 43,743.00
2.						
3.						
4.						
5. Totals		\$ 10,600.00	\$ 33,143.00	\$	\$	\$ 43,743.00

SECTION B - BUDGET CATEGORIES

6. Object Class Categories	GRANT PROGRAM, FUNCTION OR ACTIVITY				Total (5)
	(1)	(2)	(3)	(4)	
	WaterSMART: Water Reclamation Research under the Title XVI Water Reclamation and Reuse Program for Fiscal Year 2016				
a. Personnel	\$ 1,500.00	\$	\$	\$	\$ 1,500.00
b. Fringe Benefits	0.00				
c. Travel	0.00				
d. Equipment	0.00				
e. Supplies	3,104.00				3,104.00
f. Contractual	38,905.00				38,905.00
g. Construction	0.00				
h. Other	234.00				234.00
I. Total Direct Charges (sum of 6a-6h)	43,743.00				\$ 43,743.00
J. Indirect Charges	0.00				\$
k. TOTALS (sum of 6i and 6j)	\$ 43,743.00	\$	\$	\$	\$ 43,743.00
7. Program Income	\$ 0.00	\$	\$	\$	\$

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Prescribed by OMB (Circular A-102) Page 1A

SECTION C - NON-FEDERAL RESOURCES					
(a) Grant Program	(b) Applicant	(c) State	(d) Other Sources	(e) TOTALS	
8. WaterSMART: Water Reclamation Research under the Title XVI Water Reclamation and Reuse Program for Fiscal Year 2016	\$ 33,143.00	\$	\$	\$ 33,143.00	
9.					
10.					
11.					
12. TOTAL (sum of lines 8-11)	\$ 33,143.00	\$	\$	\$ 33,143.00	
SECTION D - FORECASTED CASH NEEDS					
	Total for 1st Year	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
13. Federal	\$ 10,600.00	\$ 10,600.00			
14. Non-Federal	\$ 33,143.00	\$ 33,143.00			
15. TOTAL (sum of lines 13 and 14)	\$ 43,743.00	\$ 43,743.00			
SECTION E - BUDGET ESTIMATES OF FEDERAL FUNDS NEEDED FOR BALANCE OF THE PROJECT					
(a) Grant Program	FUTURE FUNDING PERIODS (YEARS)				
	(b) First	(c) Second	(d) Third	(e) Fourth	
16. NA	\$	\$	\$	\$	
17.					
18.					
19.					
20. TOTAL (sum of lines 16 - 19)	\$	\$	\$	\$	
SECTION F - OTHER BUDGET INFORMATION					
21. Direct Charges: 43743		22. Indirect Charges: 0			
23. Remarks:					

Table 5

Appendix 3a

Contractual - UTEP - \$38905	Unit Cost	Quantity	Type	TOTAL COST
Salaries -- A. Tarquin	69.22	195	hour	13498.00
-- G. Delgado	35.05	214	hour	7501.00
Fringe -- A. Tarquin	15.74	195	hour	3069.00
Travel -- Local	0.50	1400	mile	700.00
Equipment - supplies		0		0
Other -- supplies	varies	varies	Total amount for supplies	1600.00
-- Giardia and Cryptosporidium analysis (UT Houston)	500.00	18	sample	9000.00
Reporting -- included in indirect				
Total direct costs				35368.00
Indirect costs	10%			3537.00
TOTAL PROJECT COSTS				38,905.00

Annette Gutierrez - Executive Director
8037 Lockheed, Ste. 100
El Paso, Texas 79925



Phone: (915) 533-0998
Fax (915) 532-9385
www.riocog.org

April 12, 2016

U.S. Bureau of Reclamation
Acquisition Operations Branch
Attn: Mike Dieterich
Mail code: 84-27810
PO Box 25007
Denver, CO 80225

Dear Mr. Dieterich:

El Paso Water Utilities Public Service Board (EPWU) is applying for funding under the U.S. Bureau of Reclamation Research Title XVI Water Reclamation and Reuse Program for Fiscal Year 2016 funding opportunity. They are seeking funding for researching the Feasibility of Water Recovery from Filter Backwashing and Rewashing Operations, for a project titled, "Feasibility of Water Recovery from Filter Backwashing and Rewashing Operations."

The amount of water used and lost for these operations is 1.3 million gallons per day (MGD). However, the main concern of recycling this water is the presence of Giardia and the Cryptosporidium Parasites. With this requested funding, EPWU will be able to collect and analyze water samples over a two-month operating period to determine the effect of filter membranes on the two parasites. As well, two other items will be measured: turbidity and suspended solids. Following sampling, an economic evaluation will be conducted of the options available for treating the recovered water.

As the administrator of the Far West Texas Water Planning Group, we are keenly aware that water is a precious commodity in the Southwest and is vital to our communities as an important component in quality of life and economic development issues. The El Paso Water Utilities PSB has always been a strong proponent of water issue solutions that benefit our citizens and community. They are a leader in water conservation throughout our region, the State of Texas and for the rest of the country.

Sincerely,

Annette Gutierrez
Executive Director



GEORGE D. DI GIOVANNI

Professor, Environmental and Occupational Health Sciences and Center for Infectious Diseases
University of Texas Health Science Center at Houston, School of Public Health, El Paso Regional Campus
1101 N. Campbell CH 412, El Paso, Texas 79902
Phone: 915-747-8509 Fax: 915-747-8512
E-mail: george.d.digiovanni@uth.tmc.edu

EXPERTISE

Dr. George D. Di Giovanni is Professor, University of Texas Health Science Center at Houston, School of Public Health, El Paso Regional Campus. His research program specializes in the detection, infectivity determination, and molecular analysis of waterborne pathogens. Current research includes the quantitative molecular detection of protozoan, viral and bacterial pathogens; assessment of the efficacy of ultraviolet light disinfection of drinking water and wastewater; microbiological safety of reclaimed water; and microbial source tracking to determine the human and animal sources of fecal pollution of water supplies. He has received United States and European patents for methods and kits for the molecular detection of the parasite *Cryptosporidium* in water. He has served as Technical Laboratory Auditor for Environmental Protection Agency Method 1623, Detection of *Cryptosporidium* and *Giardia* in Water, in support of the Safe Drinking Water Act. His research has been funded by the Water Research Foundation (formerly the American Water Works Association Research Foundation); Environmental Protection Agency; United Kingdom Drinking Water Inspectorate; Drinking Water Quality Regulator for Scotland; Ecowise Environmental (Australia); Texas Department of Agriculture; U.S. Department of Agriculture; U.S. Bureau of Reclamation; Texas State Soil and Water Conservation Board; Texas Commission on Environmental Quality; Brazos River Authority; and the Paso del Norte Health Foundation – Center for Border Health Research. He and his research team are recipients of the Texas Environmental Excellence Award, Texas' highest environmental honor. Dr. Di Giovanni has received over 25 grants and awards from federal, state and local agencies. Funding to his research program totals \$4.9 million, with total project funding of over \$9.2 million. He has published a total of 52 peer-reviewed journal articles and reports, 4 editor-reviewed journal articles, 117 proceedings and abstracts, and 11 book chapters. He has given 78 invited lectures, including 18 at international meetings.

EDUCATION

Doctor of Philosophy, Microbiology and Immunology. The University of Arizona, December 1994.
Bachelor of Science (*Cum Laude*), Microbiology and Immunology. The University of Arizona, December 1990.

PROFESSIONAL EXPERIENCE

Professor, Environmental and Occupational Health Sciences, 10/11 – present. University of Texas Health Science Center at Houston School of Public Health, El Paso Regional Campus.
Professor and Faculty Fellow, Environmental Microbiology, 9/08 – 09/11. Texas AgriLife Research Center at El Paso, Texas AgriLife Research, Texas A&M University System and Department of Plant Pathology and Microbiology.
Associate Professor, Environmental Microbiology, 9/01 – 8/08. Texas AgriLife Research Center at El Paso, Texas AgriLife Research (formerly Texas Agricultural Experiment Station), Texas A&M University System and Department of Plant Pathology and Microbiology.
Senior Environmental Scientist, 12/99 – 8/01. American Water Works Service Co., Inc., Belleville, IL.
Environmental Scientist, 6/97 – 11/99. American Water Works Service Co., Inc., Belleville, IL.
National Research Council Research Associate, 1/95 – 6/97. Environmental Protection Agency, Corvallis, OR.

ACTIVITIES AND HONORS

- Texas Environmental Excellence Award, Buck Creek Partnership Team for control of nonpoint source pollution. Presented by the Texas Commission on Environmental Quality, 2013
- US Environmental Protection Agency Section 319 Nonpoint Source Program Success Story – Buck Creek Watershed Protection Plan Team Member, 2012
- University of Arizona Alumni Professional Achievement Award, 2011
- Awarded Faculty Fellow distinction, Texas AgriLife Research, Texas A&M University System, 2009
- Texas Environmental Excellence Award for bacterial source tracking research. Presented by the Texas Commission on Environmental Quality, 2007

- Appointed Member, State of Texas Bacterial TMDL Task Force, 2006 – 2007
- Chair, Microbiological Contaminants Research Committee, American Water Works Association (2006 – 2010)
- Technical Laboratory Auditor, USEPA Method 1623 “Detection of *Cryptosporidium* and *Giardia* in Water by Filtration/IMS/FA” (2002 – 2007)
- Co-author of the first USEPA “Quality Assurance/Quality Control Guidance Manual for Laboratories Performing PCR Analyses on Environmental Samples” (2004)
- Member of the American Water Works Association Organisms in Water Committee (2002 – present)
- Member of the Centers for Disease Control and Prevention (CDC) Working Group on Waterborne Cryptosporidiosis (1999 – 2001)

PATENTS

- U.S. Patent 6,153,411 “Methods and Kits for Detection of *Cryptosporidium parvum* Using Immunomagnetic Separation and Amplification,” M. Abbaszadegan, G. D. Di Giovanni and M. W. LeChevallier, November 28, 2000; European Patent EP1127162, August 29, 2001
- U.S. Patent 6,395,517 “Methods and Kits for Detection of *Cryptosporidium parvum*,” M. Abbaszadegan, G. D. Di Giovanni and M. W. LeChevallier, May 28, 2002
- Hong Kong Patent 1039965 “Methods and Kits for Detection of *Cryptosporidium parvum*,” M. Abbaszadegan, G. D. Di Giovanni and M. W. LeChevallier, May 31, 2002

SELECTED PUBLICATIONS (Selected from 52 peer-reviewed publications)

- Zhou, P., **G. D. Di Giovanni**, J. S. Meschke and M. C. Dodd. 2014. Enhanced inactivation of *Cryptosporidium parvum* oocysts during solar photolysis of free available chlorine. *Environmental Science & Technology Letters* 1:453-458
- Lalancette, C., I. Papineau, P. Payment, S. Dorner, P. Servais, B. Barbeau, **G. D. Di Giovanni** and M. Prévost. 2014. Changes in *E. coli* to *Cryptosporidium* ratios for various fecal pollution sources and drinking water intakes. *Water Research* 55:150-161.
- Rochelle, P. A., A. M. Johnson, R. De Leon and **G. D. Di Giovanni**. 2012. Assessing the risk of infectious *Cryptosporidium* in drinking water. *Journal of the American Water Works Association* 104:E325-E336.
- Lalancette, C., M. Généreux, J. Mailly, P. Servais, C. Côté, A. Michaud, **G. D. Di Giovanni** and M. Prévost. 2012. Total and infectious *Cryptosporidium* oocyst and total *Giardia* cyst concentrations from distinct agricultural and urban contamination sources in Eastern Canada. *Journal of Water and Health* 10:147-160.
- Johnson, A. M., **G. D. Di Giovanni** and P. R. Rochelle. 2012. Comparison of assays for sensitive and reproducible detection of cell culture-infectious *Cryptosporidium parvum* and *Cryptosporidium hominis* in drinking water. *Applied and Environmental Microbiology* 78:156-162.
- Besner, M-C, R. Broséus, J. Lavoie, **G. Di Giovanni**, P. Payment, M. Prévost. 2010. Pressure monitoring and characterization of intrusion pathways at the site of the Payment drinking water epidemiological studies. *Environmental Science & Technology* 44:269-277.
- Lalancette, C., **G. D. Di Giovanni**, M. Prévost. 2010. Dual direct detection of total and infectious *Cryptosporidium* oocysts on cell culture with immunofluorescent assay (3D-CC-IFA): A method to improve risk analysis. *Applied and Environmental Microbiology* 76:566-577.
- Lamendella, R., J. W. Santo Domingo, A. C. Yannarell, S. Ghosh, **G. D. Di Giovanni**, R. I. Mackie, D. B. Oerther. 2009. Evaluation of swine-specific PCR assays used for fecal source tracking and analysis of molecular diversity of *Bacteroidales*-swine specific populations. *Applied and Environmental Microbiology* 75:5507-5513.
- Sifuentes, L. Y. and **G. D. Di Giovanni**. 2007. Aged HCT-8 cell monolayers support *Cryptosporidium parvum* infection. *Applied and Environmental Microbiology* 73:7548-7551.
- Casarez, E. A., S. D. Pillai and **G. D. Di Giovanni**. 2007. Genotype diversity of *Escherichia coli* isolates in natural waters determined by PFGE and ERIC-PCR. *Water Research* 41:3643-3648.
- Casarez, E. A., S. D. Pillai, J. Mott, M. Vargas, K. Dean and **G. D. Di Giovanni**. 2007. Direct comparison of four bacterial source tracking methods and a novel use of composite data sets. *Journal of Applied Microbiology* 103(2):350-364.
- Di Giovanni, G. D.**, W. Q. Betancourt, J. Hernandez, N. W. Assadian, J. P. Flores Margez and E. Jaramillo Lopez. 2006. Investigation of potential zoonotic transmission of cryptosporidiosis and giardiasis through agricultural use of reclaimed wastewater. *International Journal of Environmental Health Research* 16(6): 405-418.
- Assadian, N. W., **G. D. Di Giovanni**, J. Enciso, J. Iglesias and W. Lindemann. 2005. The transport of waterborne solutes and bacteriophage in soil subirrigated with a wastewater blend. *Agriculture, Ecosystems and Environment* 111:279-291.
- Di Giovanni, G. D.** and M. W. LeChevallier. 2005. Quantitative PCR assessment of *Cryptosporidium parvum* cell culture infection. *Applied and Environmental Microbiology* 71 (3):1495-1500.

Anthony Joseph Tarquin
The University of Texas at El Paso
Department of Civil Engineering
El Paso, Texas 79968
Telephone (915) 747-6915

PERSONAL DATA:

Marital Status: Unmarried
Place of Birth: Follansbee, W. Virginia

EDUCATION

West Virginia University, Morgantown, W. Va., 1959-1964 BSIE (Industrial Eng.)
West Virginia University, Morgantown, W. Va., 1964-1965 MSE (Air Pollution)
West Virginia University, Morgantown, W. Va., 1965-1969 PhD (Environmental)

PROFESSIONAL REGISTRATION AND LICENSES:

P.E. Texas #38690
P.E. West Virginia #5626 (Inactive)
State of Texas Class C Wastewater Treatment Plant Operator's License (inactive)
State of Texas Grade D Water Plant Operator's License (inactive)

EMPLOYMENT

September 1969 – Present
The University of Texas at El Paso, Civil Engineering Department as
Assistant Professor (1969), Associate Professor (1973), and Professor (1991)

December 1976 - August 1979; and December 1987 - August 1989
Assistant Dean, College of Engineering

September 1989 - August 1990
Interim Chairman, Dept. of Civil Engineering

January 1991 – December 1994
Adjunct Professor at New Mexico State University

RESEARCH

Received 65 grants totaling over \$2.9 million, most in the areas of water and wastewater treatment and a few related to teaching effectiveness.

PUBLICATIONS

Have over 100 professional publications in all types of journals (research, teaching, refereed, non-refereed, proceedings). Currently have 3 books in print, one in five different languages.

AWARDS

Received University's highest teaching award (distinguished achievement) in 1993.

One patent pending (in area of water recovery from RO concentrate).

HONORS

Permanent endowment established at UTEP in my name (by former students & others) in 1994

Contracts and Grants

1. "Effects of High Concentrations of Waste Paper on Aerobic Sludge Digestion," University Research Institute, 1969-70, \$900.
2. "Pilot Studies on Aerobic Sludge Digestion," Parkhill, Smith & Cooper Consulting Engineers, 1970-71, \$600.
3. "Use of Waste Paper as Carbon Source for Biological Denitrification," University Research Institute, 1971-72, \$1,880.
4. "Reclamation of Wastewater from Meatpacking Industry by Soil Treatment," Environmental Protection Agency, 1972-76, \$220,924
5. "Chemical Analysis of Water from Elephant Butte Reservoir," U.S. Bureau of Reclamation, 1972-73, \$1,000.
6. "Chemical Analysis of Water from Elephant Butte Reservoir," U.S. Bureau of Reclamation, 1973-74, \$500.
7. "Undergraduate Research Participation," with Jack Dowdy, National Science Foundation, 1974-75, \$7,800.
8. "Evaluation of Low Cost Solar Energy Systems," with Jack Dowdy, URI, 1976-77, \$1,500.
9. "Texas Energy Extension Service," proposal prepared with Scott Edwards was funded by ERDA through Texas A & M University, January 1978-June 1979, \$99,000.
10. "Acid Hydrolysis of Cellulosic Biomass," with Gary Hawkins, Southwest Resource Center for Science and Engineering, June 1980-August 1982, \$11,336.

Guillermo G. Delgado
1524 Upson Dr. Apt. 3, El Paso, TX 79902
(915)-219-6614 Email: ggdelgado@miners.utep.edu

Research Interests

Environmental Engineering
Water Resources Management
Water Treatment

Concentrate Management
Water Chemistry
Desalination systems

Teaching Interests

Environmental Engineering
Water and Wastewater Treatment
Advanced Water Treatment Processes

Environmental Engineering Chemistry
Environmental Processes,
Advanced Phy-Chem, Water Treatment
Processes

Education

Ph.D. in Civil Engineering, University of Texas at El Paso, 2013
Dissertation title: "An Evaluation of the CERRO Process as an Efficient RO Concentrate Management System".

M.S. in Environmental Science and Engineering, University of Texas at El Paso, 2009
Thesis Title: "Treatment of RO Concentrate using VSEP Technology".

B.S. in Chemical Engineering, Parral Institute of Technology, 2005
Minor in Environmental Engineering
Overall GPA: 87/100

Research Experience

Research Assistant, University of Texas at El Paso, 2008-present

- Application of VSEP technology to reduce the volume of RO Concentrate produced by the KBH desalination plant located at El Paso, Texas.
- Testing of batch processing desalination systems to treat concentrate with high concentrations of silica.
- Testing of batch processes to treat RO concentrate with high concentrations of calcium sulfate.
- Evaluation of different antiscalants in brackish water with supersaturation of calcium sulfate.
- Precipitation and removal of calcium sulfate from RO concentrate.
- Optimization of Batch processing desalination systems.

Teaching Experience

Teaching Assistant, University of Texas at El Paso, 2008-2013

- Leading the laboratory section of the Water and Wastewater Treatment Class.
- Preparation of experimental procedures and instrumentation.
- Evaluation of reports and exams.

Teaching Assistant, University of Texas at El Paso, 2009, 2011, 2013

- Leading the laboratory section of the Hydraulic Engineering class.
- Preparation of experimental procedures and instrumentation.
- Evaluation of reports and exams.

Awards

- Research Assistantship, University of Texas at El Paso, 2010-2012
- Teaching Assistantship, University of Texas at El Paso, 2008-2009, 2013
- Anita Mochen Loya Innovation Fund in Engineering, 2012

Publications and Presentations

1. Delgado, Guillermo; Tarquin, Anthony, "Concentrate Enhanced Recovery Reverse Osmosis: A New Process for RO Concentrate and Brackish Water Treatment", AICHE Annual Meeting, Conference Proceedings, 2012.
2. Delgado, Guillermo, Tarquin Anthony, "A Detail Analysis of Different Antiscalants in CaSO₄ Supersaturated Brackish Water", AICHE Annual Meeting, Conference Proceedings, 2012.
3. Delgado, Guillermo, "Treatment of RO Concentrate using VSEP Technology", ETD Collection for University of Texas, El Paso. Paper AAI1473859, 2009.
4. Ning, Robert, Delgado, Guillermo, and Tarquin, Anthony, "Tunneling Through Scaling Barriers with Tandem RO Process for Silica and Calcium Sulfate Super-saturation", Proceedings IDA World Conference, San Diego, CA, Aug 30-Sept 4, 2015

April 16, 2016

Michael P. Fahy
El Paso Water Utilities
1154 Hawkins Blvd
El Paso, Texas 79961

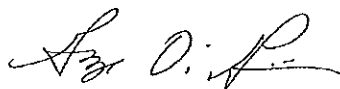
Re: WaterSMART: Water Reclamation Research Proposal under the Title XVI Water Reclamation and Reuse Program for FY 2016

Dear Mr. Fahy,

I am writing to confirm my support for the USBR WaterSMART: Water Reclamation Research proposal. I am pleased to contribute to the project team and can provide the necessary analytical microbiology support needed. My laboratory has extensive experience in the detection and characterization of waterborne *Cryptosporidium* and *Giardia*. In addition, I have prior experience in the detection of these parasites in drinking water treatment plant filter backwash waters. My laboratory is conveniently located on the University of Texas at El Paso campus which will help conserve project funds by avoiding costly shipping. In support of the project my laboratory can analyze water samples at a cost of \$500 per sample as needed.

I am quite excited to take part in this project as I clearly understand the importance of effectively utilizing and conserving our available water resources. If I can be of any further assistance, please do not hesitate to let me know.

Best regards,



Dr. George D. Di Giovanni
Professor, Environmental Microbiology



Quote# RAW-4/15/2016-1582

Quote Date: 4/15/2016

To: UTEP-Tarquin
 University of Texas at El Paso
 Attn: Anthony Tarquin
 UTEP Engineering Sciences
 500 W. University Ave.
 El Paso, Te 79968

Date Printed: Friday, April 15, 2016

Quote Expires: Thursday, July 14, 2016

Phone: (915) 747-6915 Ext:

email Addr: atarquin@utep.edu

FAX:

ClientProject#:

Test Name	Matrix	Unit Price	Quantity	Discount	Extended Price
Alkalinity, Total		\$12.00	1	0.00%	\$12.00
Total Hardness (as CaCO3)		\$10.00	1	0.00%	\$10.00
Electrical Conductivity		\$8.00	1	0.00%	\$8.00
Total Dissolved Solids		\$7.00	1	0.00%	\$7.00
pH		\$5.00	1	0.00%	\$5.00
Br/NO3/PO4/F by Ion Chromatography		\$40.00	1	0.00%	\$40.00
Chloride/Sulfate by Ion Chromatography		\$20.00	1	0.00%	\$20.00
Ca, Mg, Na, K by ICP		\$48.00	1	0.00%	\$48.00
Water Metals ICP (total)		\$120.00	1	0.00%	\$120.00
Trace Metals, total (ICP/MS)		\$96.00	1	0.00%	\$96.00
Silica		\$10.00	1	0.00%	\$10.00

Quote Terms: Net 30

Analytical Subtotal: \$376.00

Turn Around Time (Working Days): 21

Rush Multiplier: 1

QA/QC Level: 1

Total Analytical Fees: \$376.00

Other Charges:

QA/QC Charge: \$0.00

Sampling Charge: \$0.00

Other Charge: \$0.00

Quote Total: \$376.00

Comments:

PRICE LIST

(APPENDIX B WORKSHEET)

Parameter	Water	Wastewater	Sludge/Soil	Foot- notes
Table II		\$470.00	\$470.00	
Table II Volatiles		\$100.00	\$100.00	
Table II Acids		\$125.00	\$125.00	A
Table II Base Neutrals		\$125.00	\$125.00	A
Table II Pesticides		\$120.00	\$120.00	
Table III		\$211.50	\$258.50	
Table III Conventional Parameters		\$63.00	\$63.00	
Table III Metals		\$127.50	\$195.50	
Table IV (exclude radioactivity)		\$342.50	\$314.75	
Table IV Conventional Parameters		\$262.50	\$234.75	
Table IV Metals		\$80.00	\$80.00	
Table IV Organics		no listing	no listing	
Table V		\$684.00	\$684.00	B
Table V Metals		\$84.00	\$84.00	
Table V Organics		\$600.00	\$600.00	B
Texas Administrative Code Chapter 307		\$500.00		I Added by CAS
Total Toxic Organics - 40 CFR part 433		\$995.00		S-Dioxin
Total Toxic Organics - 40 CFR part 467		\$410.00		
Total Toxic Organics - 40 CFR part 468		\$202.50		
Total Toxic Organics - 40 CFR part 467 & 468 (combined)		\$410.00		
TCLP		\$641.75	\$641.75	
TCLP Metals		\$75.50	\$75.50	C
TCLP Organics		\$566.25	\$566.25	
TCEQ Permit Renewal List		\$1,200.00		
Drinking Water - Minerals	\$92.75			
Drinking Water - Metals	\$171.50			
Drinking Water - Disinfecton By Products	\$250.00			S
Drinking Water - Haloacetic Acids	\$150.00			
Drinking Water - Total Trihalomethaness	\$60.00			
Drinking Water - SOCs	\$500.00			S
Drinking Water - VOCs	\$120.00			
PCBs	\$150.00	\$75.00	\$75.00	S (Drinking Water)
EPA Method 507 Pesticides	\$75.00			
FH Permit Herbicides and Pesticides	\$450.00			S
Radionuclides	\$625.00			
Digester Gas Analysis			\$550.00	S,K
Giardia	\$585.00			S,D
Cryptosporidium	\$0.00			S,G
Virus	\$1,230.00			S
Chlorophyll A	\$125.00			S
Phaeophytin	\$0.00			S, H
Aluminum	\$8.00	\$8.00	\$8.00	
Antimony	\$8.00	\$8.00	\$8.00	
Arsenic	\$8.00	\$8.00	\$8.00	
Barium	\$8.00	\$8.00	\$8.00	
Beryllium	\$8.00	\$8.00	\$8.00	
Boron	\$8.00	\$8.00	\$8.00	
Cadmium	\$8.00	\$8.00	\$8.00	
Calcium	\$8.00	\$8.00	\$8.00	