Response to Request for Proposal

Central Regional Wastewater System

Nutrient Improvements - Post Aerobic Digestion

Dallas, TX

January 13, 2021

Jacobs

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Reinventing tomorrow.

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January 13, 2021

Trinity River Authority of Texas
Attn: Dusty D. Brannum
Planning, Design and Construction Administration 5300 South Collins
Arlington, TX 76018-1710

Re: Central Regional Wastewater System Nutrient Improvements-Post Aerobic Digestion

The Trinity River Authority (TRA) CRWS Nutrient Improvements- Post Aerobic Digestion (PAD) project will be an essential part of the facility's nutrient management and biosolids processes. Jacobs is pleased to provide our proposal in response to TRA's request for qualifications.

There are currently three operating PAD systems in the United States. They are located at the Spokane County Regional Water Reclamation Facility (Spokane, WA), Metro Water Reclamation District Northern Treatment Plant (Denver, CO), and the Boulder Wastewater Treatment Plant (Boulder, Colorado).

- Jacobs, with Bruce Johnson as process lead, played an essential role in the success of all three PAD facilities. Jacobs provided engineering, design and startup for the Spokane and Denver facilities, and startup consulting for the Boulder facility.
- Jacobs currently provides contract operations for the Spokane facility, giving us unmatched knowledge of day-to-day operations and optimization of PAD.
- Bruce Johnson is one of the few demonstrated PAD experts worldwide, and is who the sole PAD license holder (Ovivo) contacts for technical advice regarding these systems.

With Jacobs as TRA's engineer, a vendor-driven design by the sole-source supplier will be avoided. Our project approach within this Statement of Qualifications identifies unique challenges and also opportunities for TRA to maximize additional benefits from the PAD process, and combine the primary nitrogen removal function of the system with:

- more simplified O&M,
- struvite control,
- phosphorous uptake and integration into the plant's long-term nutrient control plan,
- consideration of uncertainty, and
- benefits to dewatering.

Further, Jacobs' knowledge of the CRWS facility through our process modeling and design of the Phase V improvements will maximize use of the existing infrastructure, and ensure that the PAD system integrates seamlessly into the plant's unique solids and liquid treatment processes. We look forward to the opportunity to be of service to TRA and support your efforts to meet the demands of this critical project. If you have any questions, please contact Matt Berg at 512.314.3180 or matt.berg@jacobs.com or Raj Mehta at 972.603.6653 or raj.mehta@jacobs.com.

Sincerely,

Matthew L. Berg

Matt Berg, PE
Project Manager

Raj Mehta, PE
Principal-in-Charge
Vice President

Local, Experienced & Committed To Your Success.

1 Firm Information

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ENR April 2019 Engineering News-Record
Overall Design
Sanitary & Storm Sewers
Sewer & Waste
Wastewater Treatment Plants
#1

Jacobs

948 DFW Staff

232 Local Licensed Engineers

8 Texas Offices

2 Organization Chart

The following organizational chart shows our proposed personnel and structure for the Post Aerobic Digestion (PAD) project. In addition to our team, our subconsultants are Dallas-based HUB firms.

PROJECT MANAGER SPOTLIGHT:

Matt Berg, PE
PROJECT MANAGER

With 23 years of experience, **Matt Berg, PE** is regarded as an industry leader for wastewater and biosolids treatment in Texas. Matt has served as Project Manager/Project Engineer for 19 treatment process projects, 13 of which have had a biosolids digestion/storage component. Matt currently serves as Chair of the Water Environment Association of Texas (WEAT) Biosolids Committee, *where he works to educate the Texas wastewater community on the latest biosolids industry trends and technology innovations.*

Matt will leverage his holistic understanding of wastewater and biosolids treatment processes to ensure that the PAD process will be well integrated with TRA's thermal hydrolysis, anaerobic digestion, and activated sludge processes. With Matt serving as Project Manager, TRA can be confident that the PAD improvements will meet TRA's biosolids handling goals, and also improve the overall effectiveness of the larger treatment process.

Trinity River Authority of Texas

Raj Mehta, PE
Principal-in-Charge

Matt Berg, PE
Project Manager

QA/QC

Joel Rife, PE
QA/QC Manager and Process /Mechanical

Sai Ho, PE
Electrical

Michael Montoya, PE
Instrumentation and Conrol

Alex Firth, PE
Structural

Vihbuti Pandey, PhD, PE
Civil

Bruce Johnson, PE*, BCEE
Process Lead

George Luke, PE
Electrical Lead
gluke@gaiconsulting.com
(972) 490-7661
Gupta & Associates

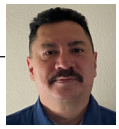
Louis Hund, PE
Civil Lead
lhund@jqieng.com
@jqieng.com
(817) 505-4311
JQ Infrastructure

Colin Fitzgerald, PE*
Mechanical Lead

Joe Foley, PE*
Instrumentation and Control Lead

Murali Kariyarveedu, PE
Structural Lead
mkariyarveedu@jqieng.com
(214) 623-5814
JQ Infrastructure

Alex Yoffie, EIT
Process Engineer



Josue Escobar
Automation/ SCADA Lead

Anthony Benavidez
PAD Operations Specialist

Mark Keeton, RPLS
Survey

Chris Quigley, PhD, PE
Odor Control Lead

(resources as needed)

LTRA
Subsurface Utility

HVJ
Geotech

PE* = PE in State other than Texas

3 Prior Experience of Project Team, Project Manager and Subconsultants

For this project we have assembled a highly specialized team with extensive wastewater treatment plant experience, along with the industry's leading technical expert in Post Aerobic Digestion (PAD) technology. **To this day, Jacobs continues to manage or support 2 of the 3 existing PADs in the United States making Jacobs the leader in Post Aerobic Digestion systems.**

In 2009, Jacobs became a Pioneer in PAD by building the very first North American full-scale system in Spokane, Washington. Leading the design and implementation of the nation's first system was **Bruce Johnson (Process Lead)**, who is regarded as the leading authority on Post Aerobic Digestion Technology and who serves as a senior technical advisor to the technology's license holder, Ovivo. Bruce went on to design the second PAD system in Denver, Colorado and continues to oversee our efforts at those facilities. In addition to these two facilities, Bruce is leading our consulting efforts on the 3rd PAD system in Boulder, Colorado. As your partner on this project, you will have a team that provides you with a high level of certainty through their leading experience in PAD technology and extensive TRA/CRWS projects.

Completed PAD Projects	
Spokane County Regional Water Reclamation Facility (Design, Build, Operate)	• First in nation • Proven nitrogen and vs reduction • Lessons learned brought to CRWS
Metro Water Reclamation District (MWRD) Northern Treatment Plant (Design, Build)	• Second in nation • Bringing same technical team to CRWS
City of Boulder PAD Start-up Support and Optimization	• Leveraged Jacobs PAD experience to optimize performance

In this section, we have included four (4) projects that demonstrate our team's proven experience and capabilities of ensuring a successful implementation of a new Post Aerobic Digestion (PAD) system. Our team brings direct experience from every operating full-scale PAD system in North America. Our experience and lessons learned on past projects will provide you with a high level of certainty in helping you achieve your goals at the CRWS facility.

1 Spokane County Regional Water Reclamation Facility Design-Build-Operate Project *Spokane, WA*

Responsibilities/Role:
- Design
- Builder
- Operator

Contract Duration:
2009 - Ongoing

Client Name:
Spokane County Division of Utilities

Point of Contact:
Rob Lindsay
Water and Wastewater Manager
(509) 477.7576

Jacobs Project Staff:
Bruce Johnson, Anthony Benavidez, Joe Foley, Colin Fitzgerald

Description:
This project was the first full-scale post aerobic digester in North America. It was designed for nitrogen load and volatile suspended solids reductions. Jacobs is currently contracted for operations and maintenance responsibility for 20 years. This innovative, state-of-the-art facility's PAD system was designed and set up by Jacobs, at our own financial risk, without piloting or bench testing based on Jacobs' deep understanding of the biological principles underlying it.

Project Approach:
The scope of work for the Spokane County Regional Water Reclamation Facility (SCRWRF) encompassed the design, permitting, construction, commissioning, and long-term operations of the new treatment facility. Facilities constructed on the 20 acre (8 hectare) site include:

- **Anaerobic and post aerobic digestion (PAD) plus dewatering facilities to produce Class B biosolids for land application**
- Headworks facility to screen influent, remove grit, and receive septage deliveries
- Primary clarifiers featuring a chemically-enhanced treatment process with step-feed membrane bioreactor technology to achieve low phosphorous effluent levels of 50 ppb.
- Digester gas cogeneration facilities to generate power and recover heat for use in treatment processes.

2 Metro Water Reclamation District (MWRD) Northern Treatment Plant *Denver, CO*

Responsibilities/Role:
- Progressive Design-Build Contractor
- Design, engineering, permitting, cost estimating, construction, startup and commissioning

Contract Duration:
2011 - 2016

Client Name:
Metro Wastewater Reclamation District

Point of Contact:
Matt Duncan, PE
Project Manager
(303) 286-3422

Jacobs Project Staff:
Bruce Johnson, Joe Foley, Joel Rife, Colin Fitgerald, Josue Escobar

Description: The Northern Treatment Plant is one of the most advanced treatment facilities in the Western U.S. and includes one of the first post-aerobic digesters in North America. In 2011, Jacobs (then CH2M Hill) was selected by the Metro Wastewater Reclamation District (Denver CO) to be their progressive design builder for the 24 MGD greenfield Northern Treatment Plant. The $255 million facility meets very stringent current effluent limits of 10 mg/L for total nitrogen and a projected future 0.1 mg/L for total phosphorus. Liquids processes include preliminary, primary, advanced secondary BNR, and tertiary treatment. Solids processes include unified primary sludge fermentation and thickening, WAS thickening, anaerobic digestion, **Post Aerobic Digestion (PAD)**, and dewatering.

Project Approach: One of the key themes implemented throughout the design was to provide a flexible solution that could adapt to changing influent characteristics, mitigate carbon limitations, and consistently achieve effluent nutrient performance goals with a minimum of chemical usage. Bruce Johnson was the wastewater process lead for this effort, and amongst several other items was directly responsible for the adoption of the PAD process as part of the plant design to reduce sidestream nitrogen loading and mitigate struvite deposition within dewatering. ***This PAD system was the second operating PAD in the world and has since been optimized by staff for both nitrogen and phosphorus removal.***

3 Solids Handling Study, Design, and Construction Services for Phase I Expansion and Improvements Project *Fort Collins, CO*

Responsibilities/ Role:
- Prime
- Design, Start-up support

Construction:
2017 - Ongoing

Client Name:
South Fort Collins Sanitation District, Colorado

Point of Contact:
Chris Matkins
General Manager
(970) 226-3104 ext. 101

Jacobs Project Staff:
Bruce Johnson

Description: Jacobs provided engineering and construction phase services to expand this water reclamation facility (WRF) from 4.5 mgd to 9 mgd. Design work included wet stream and solids handling treatment processes with chemical phosphorus removal facilities, step-feed aeration basins, UV disinfection, an aeration blower building, secondary clarifier, yard piping, and miscellaneous mechanical and electrical equipment. Biosolids improvements included **Autothermal Thermophilic Aerobic Digestion (ATAD), an advanced form of aerobic digestion** that operates at higher (thermophilic) temperatures to produce Class A biosolids. Other solids improvements included **Storage Nitrification/Denitrification Reactor (SNDR) Tanks**, rotary drum thickening, an ATAD building, odor control facilities, numerous sludge pumps, and ferric chloride storage/feed facilities for dewatering. It is important to note that the **SNDR tanks are essentially PAD tanks**, other than following ATAD rather than anerobic digestion.

Project Approach: Jacobs evaluated multiple technologies to select the ATAD and SNDR systems, and during the subsequent design evaluated multiple aerobic digestion mixing systems including coarse and fine bubble diffusers, and jet aeration. The resulting design selected advanced jet aeration with 7,300 gpm recirculation pumps, 1,350 scfm positive displacement blowers and jet mixing nozzles in the ATAD tanks and SNDR Tanks, with process control by pH, temperature and oxidation reduction potential probes. ***Jacobs' design optimized the use of existing assets to reduce overall costs, including repurposing existing tanks and buildings to save approximately $4 million. During construction, Jacobs supervised the ATAD and SNDR mixing performance testing and startup to ensure that treatment targets were achieved.***

4 City of Midland Water Pollution Control Plant (WPCP) Secondary Treatment Upgrades *Midland, TX*

Responsibilities/Role:
- Design, SCADA Integration, Startup Support, Commissioning, Operator Training

Contract Duration:
2017 - Ongoing

Client Name:
City of Midland;
Pioneer Water Management

Point of Contact:
Cory Moose
Assistant Utilities Director
(432) 685-7937

Jacobs Project Staff:
Bruce Johnson, Alex Yoffie, Josue Escobar

Description: Ongoing design-build project for a new 15 MGD WWTP, currently in startup. Treatment process includes secondary activated sludge, tertiary treatment, and solids processing facilities including two aerobic sludge holding tanks that are similar to the proposed CRWS PAD system. Uncertainty in future growth trends for the City of Midland required a cost efficient approach to increase digestion capacity beyond the three existing anaerobic digesters, while maximizing operational flexibility, by using the aerated sludge tanks.

Project Approach: Jacobs designed two new 0.4 MG aerobic digesters including associated positive displacement blowers, coarse bubble diffusers, floating decanters, transfer and decant pumps. The tanks were designed to maximize operational flexibility by allowing an adjustable sludge feed rate to either the existing anaerobic digesters or new aerobic digesters. The aerobic digester effluent can be pumped directly to the dewatering screw presses or to the anerobic digesters for additional digestion. Similar to intermittent PAD aeration, the aerobic digester controls were programmed and tuned to allow for intermittent aeration, adding the flexibility to cycle between aerobic and anoxic environments that promote nitrification and denitrification.

4 - 5 Anticipated Subconsultant Tasks and Historically Underutilized Business (HUB) Subconsultants

HUB Subconsultants	Project Role/Task	%'s
Gupta & Associates, Inc.	Electrical	10%
JQ Infrastructure, LLC	Civil and Structural	10%
HVJ	Geotech	2%
LTRA	Subsurface Utility	3%

Jacobs is committed to meeting or exceeding your goal of **25% HUB participation**, as proven from our past performance. We have a long history of working with our selected subcontractor partners on multiple projects and have consistently met or exceeded your expectations for both quality and timeline deliverables as a cohesive team.

6 Prior Experience With Construction Administration Engineering Services, Start-up, Commissioning, and Acceptance Testing

1 Metro Water Reclamation District (MWRD) Northern Treatment Plant *Denver, CO*

Responsibilities/Role:
- Progressive Design-Build Contractor
- Design, engineering, permitting, cost estimating, construction, startup and commissioning

Contract Duration:
2011 - 2016

Client Name:
Metro Wastewater Reclamation District

Point of Contact:
Matt Duncan, PE
Project Manager
(303) 286-3422

Jacobs Project Staff:
Bruce Johnson, Joe Foley, Joel Rife, Colin Fitzgerald, Josue Escobar

As the progressive design builder Jacobs (then CH2M Hill) was responsible for detailed design, construction, and commissioning activities. The Jacobs process team remained involved through the entire project to ensure the process design was maintained from concept through support during start up and commissioning activities. As lead process designer, Bruce Johnson leveraged his intimate knowledge of the process concepts to support startup activities and process acceptance with specific focus on the post-aerobic digestion (PAD) and tertiary systems. Bruce was assisted in his commissioning efforts by several on-site Jacobs staff. To manage the complexity of NTP's commissioning, Jacobs used senior process technologists to provide the requisite onsite expertise. Joel Rife helped provide onsite startup support with other Jacobs staff, while Colin Fitzgerald assisted with process modeling to troubleshoot and optimize processes throughout start up. Given the complex nature of PAD implementation with high strength feed at CRWS, Jacobs plans to use a similar approach for TRA.

The 24 MGD Northern Treatment Plant facility is one of the most advanced treatment facilities in the Western U.S. The facility meets very stringent effluent limits for total nitrogen total phosphorus, and it uses advanced solids processes that include unified primary sludge fermentation and thickening, WAS thickening, anerobic digestion, post aerobic digestion (PAD), and dewatering. **It is one of the first plants with post-aerobic digesters in North America.**

2 Walnut Creek Secondary Process Improvements *Austin, TX*

Responsibilities/Role:
- Condition assessment
- Process Modeling
- Design, Bid Services, Local Permitting
- SCADA Integration, Startup Support, Commissioning, Operator Training

Contract Duration:
2012 - Ongoing

Point of Contact:
Erik Kunkel, PE, SE, CPEng
Capital Delivery Project Manager
(512) 974-7027

Client Name:
City of Austin

Jacobs Project Staff:
Matt Berg, Joel Rife, Michael Montoya, Alex Yoffie, Chris Quigley

Jacobs provides engineering services during construction for this ongoing project (total construction cost of $23M). Matt Berg serves as the Jacobs PM, with Joel Rife as senior treatment process technology lead. The project includes upgrade and replacement of all aeration diffuser systems, blower/air system analysis and repair of underground air piping, major electrical and control system upgrades, replacement of secondary clarifier mechanisms, upgrades to flow control weirs, gates, and valves, and replacement of sludge and scum pumps. Jacobs also recommended improvements to maximize nitrification and denitrification in the activated sludge process, using the same treatment mechanism that will occur in the CRWS PAD reactor to balance aerobic and anoxic conditions for optimal nitrogen removal.

Jacobs' work includes on-site resident engineering, construction administration, and support of startup, commissioning, and acceptance testing. The project will upgrade all six of the WWTP activated sludge trains one by one to ensure continued operations, and the first of the six upgraded trains has been started as of this date. For these trains, Jacobs supports the City by inspecting Contractor work in the field, providing technical advice to the ensure that construction is performed in accordance with the design, and responding to unforeseen field conditions. Jacobs coordinates extensively between the Contractor and plant operations staff to ensure that startup meets performance requirements and does not place any other plant processes at risk.

3 City of Boulder - PAD Start-up Support and Optimization *Boulder, CO*

Responsibilities/Role:
- Startup and Process Optimizationr

Contract Duration:
2011 - 2016

Client Name:
City of Boulder Utilities

Point of Contact:
Cole Sigmon, PE
Engineer Project Manager
(303) 441-3279

Jacobs Project Staff:
Bruce Johnson,
Colin Fitzgerald

The City of Boulder, CO started up their PAD process (designed by another firm) in an existing sludge storage tank, and only treating a portion of the digested sludge flow, similar to what is being proposed for TRA CRWS.

The city hired Jacobs (Bruce Johnson) to help advise them on the startup and operation of their new PAD system. The city's PAD system has subsequently been optimized by their staff based on the knowledge transfer that happened and their ongoing operational experience. Since that time Jacobs was again hired by the city (Colin Fitzgerald and Bruce Johnson) to conduct an evaluation around the nitrogen removal pathways occurring within PAD, specifically concerning the generation of N2O. The study focused on refining our understanding of nitrogen transformations through specialized sampling and innovative process modeling that incorporated enhanced nitrogen transformations.

Start-up and commissioning, including process and equipment training, are key elements in effective transition from construction to normal operations that are often overlooked.

For this CRWS PAD project, startup and commissioning are critical to a successful project. PAD will be an entirely new process for the CRWS staff and some of its operational and process basis is counter-intuitive to conventional wastewater experience, as discussed below. Jacobs will draw upon our experience as the single firm that **performed start-up of the Spokane WRF and Northern Treatment Plant PAD systems, and advised on the PAD start-up for City of Boulder**. These three plants have the only current operational PAD systems in the country. Our position as technical advisor to PAD Process license holder Ovivo will help Jacobs integrate PAD into the CRWS process to achieve TRA's treatment goals. Additionally, we have been responsible for operating the Spokane PAD, proving PAD performance during acceptance testing at multiple facilities, and developing the acceptance testing approaches for PAD systems. Thus, we will have the greatest leverage with Ovivo towards achieving their guaranteed performance goals.

Key elements to effectively transition to operations are planning and deep integration with the CRWS operation staff in the start-up & commissioning phase. Too often, the design process engineer is not engaged actively in the start-up and commissioning activities. Our engagement in this phase offers great benefit to TRA because Jacobs will:

1. Initiate Commissioning Planning During Design
Our experience to date has shown that every PAD system has unique issues related to startup and operation, primarily concerning appropriate pH control, heat management, and ammonia toxicity. Thus, it is critical that the design engineer understand the fundamentals of the PAD process to efficiently navigate these items. Process modeling will be the key tool we use to plan out startup and contingencies. Jacobs was the first to develop the concepts used in all the major process models and simulators for PAD performance, giving us unique expertise in this area and a deep understanding of the strengths and weaknesses of each simulator's approach. This experience will provide TRA with the highest levels of confidence in the start-up of the new PAD process, which is even more unique being fed from THP digestion.

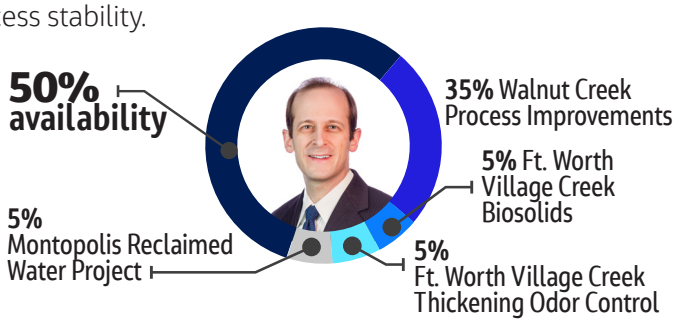
2. Integrate Operator Training Prior to Start-Up with Flight-Simulator Approach
A deep integration between CRWS operation staff and Jacobs will ensure that the PAD process has a successful startup, while providing staff with the tools and knowledge they need to succeed long-term with this new process. Jacobs suggests developing a "flight simulator" of the PAD process (including two important parameters not currently included in any commercial simulator; ammonia toxicity and heat generation) that Operations can use for training prior to startup; this would provide a high level of return on investment. Jacobs can do this by modifying the existing model that we used for the overall CRWS Master Plan and later updated for the CRWS Phase V improvements.

3. Start-Up Challenges Anticipated and Mitigated by our Experience

- PAD will be initially seeded with mixed liquor. These solids will not be stabilized but are necessary to grow nitrifying (ammonia removal) organisms, so appropriate feed routines must be developed to minimize the impact on the Class A biosolids produced by the THP process. This will likely entail enhanced sampling and analysis of the Class A biosolids during this phase.
- The high strength THP digester discharge will be another critical parameter to balance during this period. Enough feed has to be provided to the PAD to increase capacity, while not feeding so much that ammonia toxicity or high/low pH causes process instabilities.
- This will also be a period of heavy growth and heat release due to the biological reaction, especially with the thick biosolids from THP digestion. Appropriate temperature control and monitoring will be critical to avoid the high temperature inhibition of nitrifying organisms as temperature approaches 40° C.
- Once operating, there will then be two challenges: 1) Finding the appropriate loading rate to maximize the treatment goals at CRWS, while balancing operational needs and equipment capacity, and 2) Optimizing aeration control for both performance and overall process stability.

7 Project Manager's Workload

Matt's current workload capacity will allow him to lead our team on this project. At this moment, Matt has 4 ongoing projects that will still allow him 50% availablity to oversee our efforts in implementing the PAD system at your facility.



8 Project Team Commitment

The table below exhibits our key staff's current workload and their time committed to this project.

KEY POSITION	TEAM MEMBER	% Time on Current Commitments	% Time Committed to Post Aerobic Digestion
Project Manager	Matt Berg	50%	50%
Principal-In-Charge	Raj Mehta	70%	30%
QA/QC Manager and Process QC	Joel Rife	70%	30%
Process Lead	Bruce Johnson	60%	40%
Mechanical Lead	Colin Fitzgerald	60%	40%
Process Engineer	Alex Yoffie	20%	80%
Electrical Lead	George Luke	75%	25%
Structural Lead	Murali Kariyarveedu	70%	30%
Civil Lead	Louis Hund	70%	30%
Instrumentation & Control Lead	Joe Foley	70%	30%

9 Team Resumes

A big part of our success comes from our approach of working as your "trusted partner". We are highly committed to your success and strive to always work in your best interests. For your project we have assembled a locally led and highly specialized team with extensive wastewater treatment plant experience that will ensure your facilities are always operating at optimal levels.

Please refer to the "Supplemental" section of our proposal for a compilation of individual resumes of our team members.

TEAM HIGHLIGHTS

Our proposed team brings significant advantages to helping you achieve your goals. Here are some highlights of our team's collective experience.

- **3** Only 3 Post Aerobic Digestion Systems in US. Jacobs Started Up ALL 3 *Spokane, Denver, Boulder
- **2** Jacobs Designed 2 of 3 PADs in North America *Spokane and Denver
- **$9B+** Combined Estimated Value of W/WWTP projects
- **400+** Combined # of W/WWTP projects
- **130+** Combined Projects with tra
- **200+** Combined years of experience on W/WWTP projects

10 Key Personnel Succession Plan

We are committed to providing you with continuous and seamless service from preliminary design through completion of construction. At Jacobs we understand that "life happens" and team members may have to leave the project for a variety of reasons. We are ready with a transition plan should a key team member leave the project.

Since the role of Project Manager is of primary importance and critical to project continuity:

- If the situation arises, Raj Mehta will immediately fill the PM role and act as both Principal-in-Charge and PM. He will serve as interim PM and will review Jacobs' resources to identify a replacement candidate. This candidate will be presented to TRA and will include resume review and an in-person interview with TRA staff.

KEY POSITION	TEAM MEMBER	SUCCESSOR
Project Manager	Matt Berg	Raj Mehta
Principal-In-Charge	Raj Mehta	Jennifer Henke*
QA/QC Manager	Joel Rife	Jennifer Henke*
Process Lead	Bruce Johnson	Colin Fitzgerald
Mechanical Lead	Colin Fitzgerald	Alex Yoffie
Electrical Lead	George Luke	Lance Price*
Structural Lead	Murali Kariyarveedu	Chris Story*
Civil Lead	Louis Hund	Chris Bitter*
Instrumentation & Control	Joe Foley	Michael Montoya

*Resumes for Successors are included in "Supplemental" section of our proposal.

  If approved, Raj will transition the project to the new PM. If this candidate is not approved by TRA, an alternative candidate will be proposed.

- Should a transition occur closer to the end of the project, Raj will serve as PM to completion.

11 History of Team Working on Similar Projects Together

We understand that close collaboration within our teams will be a key factor to helping you achieve your goals. Within our collective experience of past water and wastewater treatment plant projects, our proposed team members and subcontractor partners have shared multiple opportunities to collaborate.

Serving as Project Manager for various projects throughout Texas, **Matt Berg, PE** routinely leads teams comprised of our technical leaders such as **Bruce Johnson, PE** and **Colin Fitzgerald, PE**. His design teams for projects for other utilities have included **Joel Rife, PE, Josue Escobar, Raj Mehta, PE, Michael Montoya, PE, Alex Yoffie,** and **Chris Quigley, PE.**

Our key subconsultants, **Gupta and Associates** and **JQ** have partnered with Matt for projects for *Austin Water* and *Fort Worth Water Department*. Both firms are very well known to TRA, having completed multiple at the *CRWS facility*. JQ provided structural and civil design on Jacobs' team for the *CRWS Phase V improvements*. Jacobs is currently teaming with both firms on our *CRWS Headworks B project*.

12 Technical Approach

Charting a Course for Success

We have identified **10 Challenges and SOLUTIONS** that will result in the successful implementation of the new PAD system at the CRWS facility. In consideration of these challenges, the primary objective will be **providing the most capacity with the existing Digested Sludge Storage tank while minimizing operations and maintenance needs.** Through our proven experience and expertise on PAD systems, we will bring a high level of certainty in executing innovative solutions to overcome these challenges.

Challenge #1:
Aeration/Mixing Approach for THP Digested Solids

This will be the first full-scale PAD applied to the high solids produced by the THP process, treating an anticipated 5-6% digested solids. Oxygen transfer and the biological nutrient removal processes cannot be successful unless the PAD reactor is completely mixed and aerated to achieve the optimal balance between aerobic and anoxic conditions.

Solutions

Selecting the right aeration and mixing system equipment for TRA's unique solids will be crucial to project success. This will also be influenced by the selected operating scheme; the choice between intermittent versus continuous aeration has significant implications for both performance and air supply system design.

- Bench study to evaluate the effects of viscosity on aeration in the PAD
- Supplemental mixing during both aerated and unaerated phases may be required to overcome the effects of high solids concentrations and to maximize nitrogen removal
- Continuous low-level aeration is the simplest approach, but this also decreases overall TIN removal
- Advanced controls, up to and including model-based controls, may be warranted in intermittent aeration scenarios
- Blower control and operation is more complex with intermittent aeration. Overall power usage and blower life can be improved with continuous aeration
- A new blower system may be avoided if an alternate low-pressure air source can be tapped for the PAD. This is much more practical with continuous low-level aeration

Challenge #2: Heat Management

The PAD process is an exothermic (heat generating) process resulting from the biological reactions associated with volatile solids destruction. As we've seen in our pre-thickened and thermophilic aerobic digestion projects, the amount of heat generated is directly related to solids concentration. With the high solids concentrations resulting from THP, the CRWS PAD must have a proven and effective thermal management system.

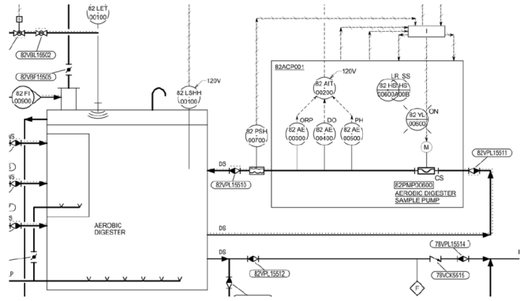
Solutions

First we need to understand the amount of cooling needed through detailed modeling, then we can adopt a range of cooling approaches as appropriate for CRWS.

- Process modeling integrated with a detailed thermal model of the system to be used to quantify cooling needs under various loading and climatic conditions
- Thermal management can involve a range of alternatives that can be combined as needed: 1) load control, 2) eliminate cover and consider surface aeration, 3) heat exchanger cooling
- Possible integration with heat recovery for THP and upstream digestion

Challenge #3: Simple Reliable Control

The PAD tank is a harsh environment, but also needs good control to optimize nitrogen removal without requiring excessive operation and maintenance attention.



Solutions

The primary control parameters for a PAD are loading rate, aeration intensity, and aeration duration. These impact pH, nitrogen removal, heat generation, and Volatile Solids Reduction (VSR).

- pH has been found to be a very good and reliable indicator of performance, and it can be used to make operating decisions regarding air flow rates to balance between ammonia and total inorganic nitrogen (TIN) removal. Higher air flow removes more ammonia, which lowers pH but also decreases removal of TIN; and vice versa (low DO and air rates raise the pH and increase TIN removal). This is perhaps the simplest control approach
- Temperature monitoring is a must and will be used in any thermal management system
- With the purpose of PAD being nitrogen removal, aeration control to maximize alkalinity recovery through denitrification is critical.
- In-Situ monitoring of Ammonia, Nitrate and Dissolved Oxygen should be considered to optimize capacity, but must be done in a way that is easy to maintain.
- Given that the PAD process will be installed in a single tank, it is a single point of failure. As such, it needs a robust control system to minimize failures and protect the secondary process.
- Any control system should be accurately simulated and tested in a variety of scenarios to maximize installed reliability

Challenge #4: Phosphorus Reduction

PAD will reduce downstream formation of precipitants/scaling in dewatering and centrate streams in multiple ways: By design, PAD removes ammonia, which is a key component in struvite formation. PAD also strips CO2, reducing the likelihood that pH increases and subsequent struvite deposition will occur during dewatering. Lastly, sidestream phosphorus mitigation can be improved by controlling aeration to achieve some phosphorus uptake in PAD. These factors will impact the design and adoption of the future sidestream phosphorus return system at CRWS. Thus, the PAD process approach must consider the whole plant phosphorus plan.

Solutions

The PAD process will impact the whole plant nutrient balance and the "outside the box" impacts should be considered. Appropriate control of the soluble phosphorus from the PAD should be addressed

- PAD will reduce downstream struvite formation at a minimum, but can also be used to remove additional phosphorus through the addition of lime (calcium phosphate precipitation) or metal salts such as ferric chloride. Lime increases pH while metal salts decrease pH, so these have very different impacts upon nitrogen removal performance
- Other commercial phosphorus removal technologies can be used with PAD, such as Ostara or Airprex. However the PAD interaction with them must be appropriately considered in light of the long term phosphorus plan at CRWS

Challenge #5: TIN vs Ammonia Removal

Every operating PAD has developed a different approach to balancing nitrogen and ammonia removal. Additionally, CRWS will have a unique consideration due to the very high influent ammonia levels expected after THP is running.

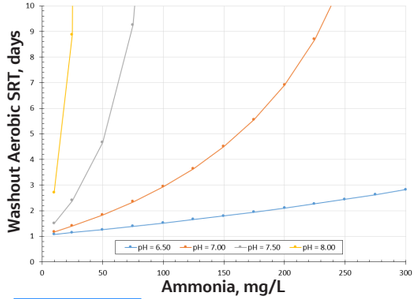
Solutions

Process modeling of the combined THP/Digestion/PAD system can be used to preemptively define the optimum operating modes and boundaries of this system

- The calibrated Sumo model developed by Jacobs for the CRWS Master Plan and Phase V Improvements can be updated and combined with Jacobs' PAD experience to provide the needed information
- Uncertainty analysis can be used to maximize the robustness of the process and the overall performance of the new PAD system

Challenge #6: pH Management and PAD Stability

High pH can result in ammonia toxicity, especially with THP inputs. Too low of a pH from inadequate denitrification can inhibit nitrification as well. Appropriate pH control is therefore needed both to improve overall reliability, and to enable smoother startups of the PAD should there be a nitrification failure.



Solutions

A robust pH control system, integrated with the phosphorus removal targets should be put in place

- Consideration of a high pH chemical, such as lime, can be integrated with improved phosphorus removal to ensure pH does not drop too low
- An acid can be added to lower pH during high ammonia periods. A metal salt, such as ferric chloride, can be also used for this, and would serve the dual function of reducing phosphorus.
- Use of pH to control aeration rates would also reduce this risk

Challenge #7: Volatile Solids Reduction (VSR)

The PAD process will improve overall VSR across the digestion system. Longer retention in the PAD improves VSR, but with the fixed available volume at CRWS, there will be a balance between VSR and nitrogen/ammonia removal that should be designed for in the controls.

Solutions

Nutrient management is the primary goal of the PAD process, but it should also be operated to maximize VSR

- Lower loading rates may result in a better balance of nitrogen removal and VSR
- It may be beneficial to recycle a portion of the PAD contents to the head of THP. This will provide much higher VSRs across the system and may have overall lifecycle cost savings. Jacobs will analyze costs and benefits of this unique approach

Challenge #8: Solids Storage

The PAD is currently envisioned to be installed in the sludge storage tank. The PAD process can be operated as variable level to provide more buffer capacity, but at the price of less operational stability. The challenge is to design a system that allows balance between the two.

Solutions

Provide flexibility in the design of the PAD and blower system to allow for variable volume operation

- Robust control system design is needed to maximize reliability
- Blower design should consider both variable air rates and variable pressures, and may warrant less efficient positive displacement blowers.

Challenge #9: Dewatering

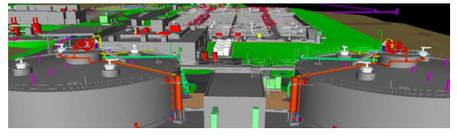
Frequently changing PAD operations may negatively impact dewatering. To optimize dewatering a stable mixture of PAD sludge and anaerobically digested sludge is required in the feed to the dewatering system

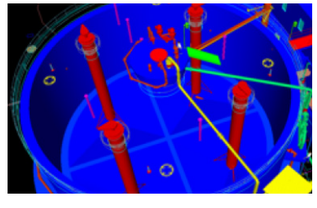
Solutions

Work closely with operations staff to understand dewatering operations at CRWS, and develop an approach that provides both a stable feed, and the ability to easily adapt to changing conditions.

Challenge #10: Training on New Process

The PAD process is relatively new to the industry, so is not familiar to operations staff and may in fact feel counterintuitive to them. It is critical to provide good training and support during the startup and operation of the PAD process.





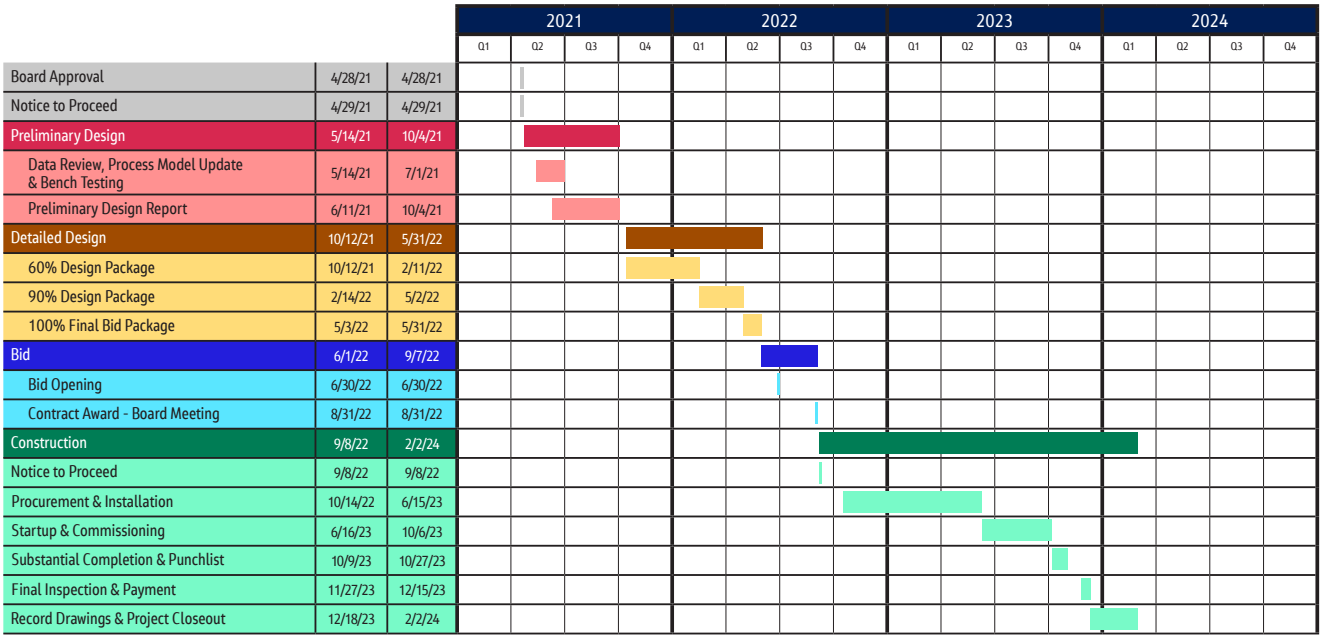
Solutions

A robust training program that occurs over a longer period.

- As Jacobs did with the Phase V Improvements, we will provide a computer based "flight simulator" of the THP/Digestion/PAD/Dewatering process that staff can use for training, understanding and operational scenario planning
- Develop a "champion" within the organization that feels ownership of the PAD process and can be used as a central source for internal information.

13 Project Schedule and Quality Assurance/Quality Control Process

Jacobs anticipates a 12-month design schedule and a 17-month construction schedule. Because every PAD startup is unique, the schedule also includes a 4-month startup period, during which time Jacobs can support and train CRWS staff as they fine tune the system's operation. No major shutdowns of other systems are anticipated during construction beyond short-duration tie-ins.



A full detailed schedule is included in the "Supplemental" section of our proposal. The full detailed schedule includes the allocated time for Jacobs internal QA/QC and time for TRA review. The QA/QC periods are embedded in the tasks above.

Joel Rife, PE will serve as our QC Team Manager (QCM). Our team is comprised of discipline team leads (DTLs) and subject matter experts (SMEs), applying continuous QA/QC procedures to ensure good decisions are made on key technical issues as the technical work progresses. Jacobs will thoroughly review all work products before providing them to TRA.

Our QA/QC Team will be lead by **Joel Rife, PE** Joel brings over 42 years of Design and QA/QC management experience.

QUALITY ASSURANCE/QUALITY CONTROL PROCESS

VALIDATION	CONCEPT	SYSTEMS	DEVELOPMENT	DOCUMENTATION
Project Program Validation Review	Executive Concept Review	Systems Coordination Review	Project Development Review	Inter-Discipline Coordination Review
	DISCIPLINE CHECK Occurs prior to any submission (interim and final) made to the Client and/or review agency. Lead by QCM and completed by DTLs and SMEs			
• Inception of Project • Reviews Scope • Validate tasks to meet Owner's expectations	• Review team progress • Fatal flaw analysis for technical approach	• Review at schematic phase (typically 30%) • Confirm decisions made during Concept Review can be carried through to production phase	• Review of 60% project deliverables • Ensure no technical errors in the project as scoped and understood by the project team	• Review of 90% and Final Deliverables • Conducted by discipline-specific professionals who haven't worked on the project for "second set of eyes from new point of view
5%	10%	30%	60%	70% 100%

14 Acknowledge Ability to Execute Contract

Acknowledged. We have contracted with TRA successfully on past pursuits and anticipate no issues at this time related to execution of the contract.

15 Corporate Authorization Resolution

Raj Mehta, is Principal-In-Charge in our Dallas office and is authorized to contractually bind Jacobs for this contract.

16 Respondent Questionnaire

Our completed Respondent Questionnaire is provided in the Appendix.

Resumes

Central Regional Wastewater System
Nutrient Improvements - Post Aerobic Digestion

Jacobs

Challenging today.
Reinventing tomorrow.

Jacobs

Matt Berg, PE

PROJECT MANAGER

Matt Berg, PE, will serve as Project Manager for the Jacobs team. He is a senior project manager, specializing in wastewater biosolids with over 23 years of experience. Matt leads multidisciplinary and complex teams through all phases of project work, from planning to design, construction, startup, and closeout. His biosolids projects have included screening, odor control, equalization, thickening, anaerobic digestion, dewatering, composting, sidestreams, process modeling, polymer and chemical feed systems, digester gas handling, pumping and conveyors, evaluations of thermal hydrolysis, and permitting. Matt is passionate about biosolids beneficial reuse, and he currently serves as the chair of the Water Environment Association of Texas' (WEAT) Biosolids Committee. Through WEAT, Matt has both presented and published technical papers on post aerobic digestion (PAD) technology.

Matt's Spotlight

- 23 Years of WWTP Experience
- 19 Water and Wastewater Treatment Plant Projects
- 13 Wastewater Solids Digestion/Storage Projects
- Chair of Water Environment Association of Texas (WEAT) Biosolids Committee
- Published and presented technical papers on Post Aerobic Digestion Technology

EDUCATION/ QUALIFICATIONS

- M.S., Civil/Environmental Engineering, The University of Texas at Austin;
- B.S., Civil Engineering, University of Illinois at Urbana-Champaign

REGISTRATIONS/ CERTIFICATIONS

- Professional Engineer: TX

Relevant Project Experience

Digester Improvements and Sustainability Project, Hornsby, Austin, TX; Facilities Engineer/ Assistant Project Manager. Project included a variety of improvements throughout the plant to improve performance and capacity. The project upgraded the existing plant headworks, equalization facilities, thickening, anaerobic digestion, dewatering, odor control, polymer feed, and digester gas/heating systems. The improvements significantly increased Hornsby's digestion capacity, methane production for use in power generation, and Class A compost production. Matt also provided engineering support during construction, and developed solutions to field challenges.

Secondary Process Improvements, Walnut Creek WWTP, Austin, TX; Project Manager/Project Engineer. Scope of work included a plant evaluation, and condition assessment, influent characterization, treatment and hydraulic evaluations, followed by design, permitting, bid services, and now services during construction including startup and commissioning. Major improvements include upgrades and changes to flow control weirs, gates, and valves throughout the process, upgrade and replacement of aeration diffuser systems, repair of underground air piping, major electrical and control system upgrades, replacement of secondary clarifier mechanisms, and replacement of sludge and scum pumps. Matt has also led additional design efforts to enhance denitrification resulting in savings of approximately $2M/year.

Miscellaneous Capital Improvements, San Marcos WWTP, San Marcos, TX; Project Manager. Matt served as Project Manager for the engineering team during the construction and startup phases, and he served as lead engineer on the solids improvements. These included improvements to sludge holding tanks, plus a new dewatering centrifuge, sludge feed pump, and polymer feed system. During construction, Matt managed the engineering team and worked with the plant and construction staff to address challenges that arose. He coordinated closely with the major equipment manufacturers and field staff to ensure that equipment would arrive on time and integrate seamlessly into the operating facility. The project also upgraded the non-potable water system with new pumps, yard piping, a liquid chlorine feed system, and new surge tank system.

Jacobs

Raj Mehta, PE

PRINCIPAL-IN-CHARGE

Raj's Spotlight

- Over $500 million in Water and Wastewater Treatment Plant Projects
- Over 25 Years of WWTP Experience
- 30 Water and Wastewater Treatment Plant Projects
- 7 Projects with TRA
- 4 Projects at CRWS Facility

EDUCATION/ QUALIFICATIONS

- M.S., Civil Engineering Texas Tech University
- BS, Microbiology Univ. of Texas El Paso

REGISTRATIONS/ CERTIFICATIONS

- Professional Engineer: TX

MEMBERSHIPS AND AFFILIATIONS

- Construction Management Association of America

Raj Mehta, PE will serve as the Principal-in-Charge. He is well known to TRA, having served as the Project Manager for a large diameter conveyance project and as the Engineer of Record for portions of numerous design projects at CRWS. He has 25 years of experience in civil and environmental project management and design with an emphasis in water and wastewater treatment and conveyance projects. He is certified in Risk Assessment Methodology for Water (RAM-W) and has completed multiple projects including vulnerability assessments, development of emergency response plans, risk management planning and design of safety and security improvements for treatment facilities.

Relevant Project Experience

Central Regional Wastewater System Headworks B Fine Screen Improvements, Trinity River Authority, Dallas, TX; Principal-In-Charge. Serving as Principal In Charge for the evaluation and design of new fine screens for this 124 MGD plant. Raj is overseeing all aspects of contract management, resource allocation, and project delivery. He also provides technical review and management advisory to the delivery team.

Central Wastewater Treatment Plant Aeration Improvements, Dallas Water Utilities, Dallas, TX; Principal-In-Charge. Serving as the Principal in Charge for the evaluation and design of a new blower facility to serve this 170 MGD plant. As Principal in Charge, Raj is overseeing all aspects of contract management and project delivery. He also serves in a technical review and management advisory role to the delivery team.

Central Regional Wastewater Treatment Plant Pump Station 13/13B Improvements, Trinity River Authority, Dallas, TX; Project Manager. As a sub-consultant to Freese and Nichols, Inc., Jacobs was responsible for detailed plans and specifications for 1200 LF of above and below grade wastewater piping to enable the plant to better process peak wet-weather flows. Piping ranges in diameter from 42-inch to 60-inch and crosses numerous existing utilities. Completed hydraulic analysis required to allow flow by gravity.

Central Regional Wastewater Treatment Plant Administration and Disinfection Improvements, Trinity River Authority, Dallas, TX; Project Manager. As a sub-consultant to Freese and Nichols, Inc., Jacobs was responsible for detailed plans and specifications for various mechanical improvements including influent sluice gates for the chlorine contact basin, and various mechanical improvements for the chlorine feed and rail car facility.

Emergency Response Plans, Trinity River Authority, TX; Project Manager. Developed emergency response plans as required under the EPA-mandated Risk Management Plan for two wastewater treatment facilities owned and operated by the Authority. Utilized the EPA approved VSAT Software Database to generate Emergency Response Plans for various naturally occurring threats such as tornados and severe weather, catastrophic power loss, disease pandemics, fire and winter storms.

Jacobs

Bruce Johnson, PE*, BCEE, IWA Fellow

PROCESS LEAD

Bruce's Spotlight

- 3 Post Aerobic Digestion Projects
- 30+ Years of WWTP Experience
- 100+ Water and Wastewater Treatment Plant Projects
- Developed the 1st PAD system in North America
- The leading expert in the design and utilization of PAD technology

EDUCATION/ QUALIFICATIONS

- M.S. Environmental Systems Engineering, Clemson University, South Carolina
- B.S. Chemical Engineering, University of Wyoming

REGISTRATIONS/ CERTIFICATIONS

- Professional Engineer: ID, UT
- *PE outside of Texas

MEMBERSHIPS/ AFFILIATIONS

- American Academy Environmental Engineers Board Certified Environmental Engineer
- International Water Association Fellow

In 2009, Jacobs became a Pioneer in PAD by building the very first North American system in Spokane, Washington. Leading the design and implementation of the nation's first full scale system was Bruce Johnson, who's technical expertise is regarded as the leading authority on Post Aerobic Digestion Technology. Bruce went on to design the second PAD system in Denver, Colorado and continues to advise at those facilities. In addition to these two facilities, Bruce led our consulting efforts on a 3rd PAD system start-up in Boulder, Colorado. Bruce is a wastewater technology fellow and process engineer, with over 30 years of experience specializing in municipal wastewater treatment, simulation, and process design. His specialty has been the design, modeling, and sizing of biological treatment systems, solid-liquid separation equipment, and waste sludge reduction.

Relevant Project Experience

Spokane County Regional Water Reclamation Facility Design-Build-Operate Project, Spokane, WA; Lead Technologist. This project was the first full-scale post aerobic digester in North America for nitrogen load and volatile suspended solids reductions. Jacobs is currently contracted for operations and maintenance responsibility for 20 years. The innovative, state-of-the-art membrane bioreactor (MBR) and nutrient removal achieve lowest phosphorus effluent levels in North America at 50 ppb to meet Class A reclaimed water requirements. Scope of work encompassed the design, permitting, construction, commissioning, and long-term operations of the new treatment facility that included anaerobic/aerobic digestion and dewatering facilities to produce Class B biosolids for beneficial land application reuse and headworks facility to screen influent, remove grit, and receive septage deliveries.

Northern Treatment Plant, Metro Sanitation District, Denver, CO; Lead Technologist. Bruce was the lead technologist on this project and worked with the District to design and build the new plant to achieve less than 0.1 mg/L TP and less than 6 mg/L total nitrogen. It also has the second post aerobic digester in North America. Jacobs was selected to deliver this 24 MGD Greenfield wastewater treatment plant using a progressive design build delivery platform. Bruce also oversaw the start-up, commissioning, and acceptance testing of the NTP Post Aerobic Digestion, as well as provided optimization advice after this period.

City of Boulder - PAD Startup Support and Optimization, Boulder, CO; Senior Process Advisor. Jacobs supported PAD operations and evaluations at this facility. The N_2O emission study evaluated and traced the nitrogen removal pathways in the PAD reactor, which were largely unknown in relation to N_2O production. We worked with the city's engineering and operations staff to install and calibrate a N_2O probe to measure the emissions in the reactor. Using this data, along with other special sampling data, we performed a complete nitrogen balance around the PAD reactor to evaluate how nitrogen is being transformed and removed throughout the reactor using a first-of-its-kind biokinetic modeling matrix for N_2O emissions (Sumo4N). Bruce also partnered with the city to support their startup and operation of the PAD process as it was being optimized by operations staff. Jacobs worked with the city to get the most out of the PAD process designed by another consultant.

Jacobs

Joel Rife, PE

QA/QC MANAGER AND PROCESS/MECHANICAL REVIEWER

Joel's Spotlight

- Lead Startup Engineer for Northern Treatment Plant PAD System in Denver, CO
- 42 Years of Water Resource Recovery Plant Experience
- Principal Technologist in Water Resource Recovery
- Expertise in biological nutrient removal (BNR)process

EDUCATION/ QUALIFICATIONS

- M.S., Environmental Engineering Kansas University
- B.S., Civil Engineering, Kansas University

REGISTRATIONS/ CERTIFICATIONS

- Professional Engineer: TX, NM

Mr. Rife has 42 years of experience in environmental engineering. He possesses a broad-based knowledge of Water Resource Recovery process engineering with an emphasis on plant capacity evaluations, activated sludge design including biological and chemical nutrient removal, treatment plant modeling, industrial waste treatment, membrane bioreactors, headworks design, effluent disinfection, primary and secondary sludge processing and Water Resource Recovery plant operations. Mr. Rife is highly regarded as a leading expert and continues to publish ground-breaking industry articles on a wide variety of topics related to wastewater facilities and systems.

Relevant Project Experience

Post-Aerobic Digestion (PAD) Process Startup, Northern Treatment Plant, Metro (Denver), CO; Lead Startup Engineer. Served as startup process engineer for this greenfield 25 MGD biological and tertiary nutrient removal plant, including troubleshooting of the startup of the post-aerobic digestion (PAD) process.

Oso Water Reclamation Plant, Corpus Christi, TX; Process Modeler. Provided process modeling and preliminary design for conversion of an existing 16 MGD contact-stabilization process to a nutrient removal process to allow compliance with effluent ammonia limits and decommissioning of a high operational cost breakpoint chlorination system. The work involved modeling of the existing aerobic digestion process and comparing conventional nitrifying/denitrifying activated sludge with integrated fixed film/activated sludge and membrane bioreactor technology.

Walnut Creek WWTP Nutrient Removal Upgrades, Austin, TX; Process Modeler. Developed various process configuration options to assist the city in lowering the cost of treating high nitrogen, low organics wastewater currently requiring the feeding of large quantities of magnesium hydroxide at a cost of over $2 million annually. The recommended option will improve the nitrification and denitrification kinetics in the existing complete mix aeration basins.

Central WWTP Aeration System Upgrades, Dallas, TX; Senior Technical Consultant and Process Modeler. Provided the process modeling to allow sizing of a new bioreactor aeration system for this 170 MGD treatment plant. The process modeling included evaluation of aeration loads for future biological nitrogen and phosphorus bioreactor configurations using innovative new Sumo modeling software that Jacobs assisted in the development of, allowing pairing of the process model with Jacobs' Replica operations model that simulates the aeration distribution system and various aeration control scenarios.

Aerobic Digestion Process, Hobbs, NM; Lead Designer. Designed and assisted in the construction and startup of an innovative pre-thickened aerobic digestion process that achieved up to 70% volatile solids destruction and biological nitrogen and phosphorus removal within the digestion process.

Colin Fitzgerald, PE*

MECHANICAL LEAD

Colin's Spotlight

- 7 projects evaluating the incorporation of PAD or PAD optimization
- 3 projects involving conventional aerobic digestion
- Experienced in the application of wastewater process modelling, working on 10+ process modeling projects in the last 2 years
- 8 years experience on WWTP projects

EDUCATION/ QUALIFICATIONS

- M.S., Environmental Engineering, University of Wisconsin-Madison
- B.S., Civil and Environmental Engineering, University of Wisconsin-Madison
- B.S., Physics, University of Wisconsin-Eau Claire

REGISTRATIONS/ CERTIFICATIONS

- Professional Engineer: MN, IL
- *PE outside of TX

Colin is a wastewater process/mechanical engineer with an emphasis on biological nutrient removal, sidestream treatment, and advanced aeration control strategies. He has direct experience with TRA: He supported the CRWS Master Plan and Modeling Project, assisted with modeling during Phase V commissioning, and assisted in modeling sulfur, iron, and phosphorus interactions surrounding THP and digestion. Colin is experienced in process engineering, detailed process mechanical design, and process commissioning. He is an expert in the area of process modeling and an industry leader incorporating uncertainty analysis to improve desings. Colin has evaluated the implementation of PAD on numerous projects and has focused on understanding the fundamental nitrogen transformations within PAD to identify optimal operating strategies. He will bring this experience to the TRA PAD system to maximize the benefit it brings to CRWS.

Relevant Project Experience

CRWS Master Plan and Modeling Project, Trinity River Authority, TX, Process Engineer. Colin was heavily involved in the Nutrient Management Plan portion of the CRWS Master Plan. He was responsible for the process modeling and economic evaluations of the secondary process improvements and the new sidestream treatment processes (including PAD). As part of the evaluations, Colin assessed the impact of future THP sidestream loads and the incorporation of sidestream treatment processes (PAD, anammox, Ostara, Airprex) on nutrient removal performance. Colin was also heavily involved in the model-based uncertainty analysis to evaluate the stability of alternate mainstream BNR and sidestream treatment processes. The results from the uncertainty analysis were used in a financial uncertainty analysis to compare the likely range of project costs, and then to prioritize future improvements at CRWS, including the selection PAD to mitigate sidestream nitrogen loads.

PAD Nitrogen Transformation Study, Boulder, CO; Lead Process Engineer. Colin led a team to assess the nitrogen transformation pathways and possible N_2O emissions within Boulder's PAD process. The study sampled nitrogen species around PAD and used an internal N_2O sensor to develop a detailed nitrogen mass balance around PAD. The team also developed a process model with improved nitrogen biokinetics to analyze the nitrogen transformation pathways. Subsequent phases of the study will evaluate the impact of alternate operational strategies (e.g. intermittent air vs. continuous aeration) on nitrogen transformations and the potential use of PAD for sidestream phosphorus mitigation when the City incorporates phosphorus removal into their secondary process.

Central WWTP Aeration System Upgrades, Dallas Water Utilities, TX, Process/ Mechanical Engineer. Design of a new 48,000 scfm blower building and aeration system including air distribution piping and flow controls valves. Colin was responsible for baseline process modeling, control methodology development and detailed design review. As part of the process modeling, Colin also assisted in the development of an integrated Relpica™-Sumo© aeration system model to assess blower alternatives and refine sizing of aeration system components.

Jacobs

Joe Foley, PE*

INSTRUMENTATION AND CONTROL LEAD

Joseph's Spotlight

- Over 40 years in lead control systems on wastewater and industrial projects
- Specialist in Instrumentation & Control (I&C) design integration with electrical systems and process mechanical systems
- Expertise in specifying plant networking system design and instrumentation, programmable controllers, human-machine interface (HMI) equipment, application software, and associated networking

EDUCATION/ QUALIFICATIONS

- B.S., Electrical Engineering, University of Vermont

REGISTRATIONS/ CERTIFICATIONS

- Professional Engineer: OR, CA
- *PE outside of TX

Joseph brings more than 40 years of experience, including as lead control systems engineer on a variety of wastewater and industrial projects. Joseph's experience includes expertise in specifying plant networking system design and selection of all field instrumentation, programmable controllers, human-machine interface (HMI) equipment, application software, and associated networking. Joseph is a specialist in Instrumentation & Control (I&C) design integration with electrical systems and process mechanical systems and seamlessly collaborates with startup managers during systems verifications, startup, and commissioning. Relevant construction phase work includes serving as ***Control System Integration Manager*** for **Metro Wastewater Reclamation District's Northern Treatment Plant in Denver, Colorado** and the **City of Spokane's Riverside Park Water Reclamation Facility in Washington**.

Relevant Project Experience

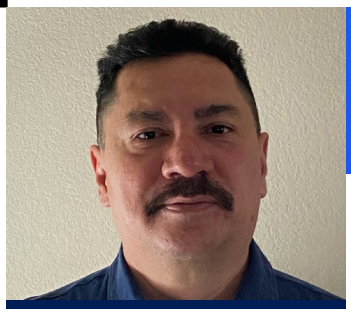
Spokane County Regional Water Reclamation Facility (WRF) Design-Build-Operate (DBO) Project; Spokane, Washington; I&C Design Lead. Lead control systems engineer for the 14 mgd advanced wastewater treatment plant and PAD system. Responsible for the design of the plant control system, including the process and instrumentation diagrams, specifying all field instrumentation, programmable controllers, HMI equipment, application software, and associated networking. The control system included redundant Allen-Bradley ControlLogix programmable logic controllers (PLCs), Factory Talk View HMI software, and Factory Talk Historian. The plant needed to be highly automated as it was staffed only 8 hours/day with a crew of six people.

Northern Wastewater Treatment Plant (WWTP) Design-Build Project; Denver Metro Wastewater Reclamation District; Denver, CO; I&C Design Lead and Integration Manager. Led I&C team that evaluated and designed modifications to aeration basins required to achieve reliable biological phosphorus removal. The evaluation included PAD, VFA requirements, impacts to digester gas, diffuser reconfiguration, baffle wall alternatives and anaerobic zone mixing. The final design included the PAD system, mixers, a baffle wall, struvite mitigation, dewatering, reconfigurating the diffuser grid and constructing a $10-million-dollar struvite recovery that reduced phosphorus recycle and provides $400,000 per year in revenue from struvite fertilizer production.

Metropolitan Water District; Los Angeles, CA; Control System Technology Expert. Metropolitan Water District is in the process of replacing their SCADA system that controls multiple water treatment plants ranging in size from 450 mgd to 750 mgd. We are in the process of developing the RFP for the project and will act as the Owner's Engineer for the duration of the 10 year project.

Sand Island WWTP; City and County of Honolulu; Honolulu, HI; Lead Control System Engineer. Responsible for the design, implementation, and commissioning of a replacement plant control system for the 200-mgd WWTP. The first phase of the I&C project, including the network backbone and control system, was brought online within 4-months after conceptual design. The entire plant control system was brought online within 1 year.

Jacobs



Josue Escobar

AUTOMATION / SCADA LEAD

Josue's Spotlight

- Supported startup of the Northern WWTP PAD project in Denver, CO
- Factory trained on major SCADA with years of successful SCADA projects delivery.
- Wonderware Certified Application Developer in Application Server 3.5
- Experience converting large-scale, complex SCADA systems upgrades
- Finds solutions that help clients meet technical and operational challenges
- Hands-on programming, testing, and commissioning expertise

EDUCATION/ QUALIFICATIONS

- Engineering Technology, Del-Mar College
- Corpus Christi, Texas Navy Electrician "A" School

Josue is a Senior SCADA Integrator / Programmer with 20 years of experience designing control systems for water and wastewater treatment plants, giving him a strong foundation in treatment systems integration, SCADA programming, systems networking, systems startup, and commissioning. His SCADA programming experience and knowledge includes the entire GE-iFIX SCADA package (SCADA, Historian, Web, Trending, Alarming, etc) and many Windows based SCADA systems. Mr. Escobar has expertise in large, medium, and small scale SCADA systems integration and field startup that has helped Jacobs' clients overcome technical and operational challenges at water and wastewater treatment plants.

Relevant Project Experience

Northern Wastewater Treatment Plant (WWTP) Design-Build Project; Denver Metro Wastewater Reclamation District; Denver, CO; System Integrator. On this project Josue was tasked in providing PLC programming, configuration and start up support services, including for the PAD system. His responsiblities included testing PLC programming for Allen Bradley PLCs, configuration of device net and profibus networks. Josue was heavily involved in field testing, and start-up phases of the project.

Design, Programming, and Implementation, Texas, City of Austin; SCADA Controls Task Manager. Project tasks include conversion of the city Water Distribution Control System (WDCS) SCADA displays, I/O driver and I/O database configuration to the new OASyS 7.2 DNA Windows based SCADA software. The city Lift Station Telemetry System (LSTS) Intellution SCADA software was also replaced with the new OASyS 7.2 DNA SCADA software. Both new systems display templates and display navigation were configured to look and feel the same in order to minimize operator training between the two city wide SCADA systems. The LSTS upgrades also included the replacement of physical dialling modems with Cisco router and virtual modems.

Water and Wastewater SCADA Improvements Project, Rio Rancho, NM; Lead SCADA Programmer. This city-wide upgrade is being done in several phases to accommodate the City financial needs and to make the transition to new and consolidated systems easier for Managers and Operators. Remote support and troubleshooting as needed for the past 6 years. Current project involves virtualization of SCADA servers, historian, iFIX clients and domain controllers. Project also included software upgrades to the SCADA supported latest OS (Windows 2012), iFIX 5.8, Webspace 4.7 and iHistorian 5.0. Josue was responsible for large GE-iFIX SCADA system improvements and consolidation, upgrade of the Telemetry and Networking systems for Water and Wastewater, implementation of enhanced distributed alarm system, including GE-iHistorian database development, and PLC and control systems programming upgrade.

Design, Programming, and Implementation, Hornsby Bend, Austin, TX; SCADA Controls Task Manager. Design and implementation of iFIX database, process graphics, historical trends, I/O drivers and SQL based historical database configuration for wastewater treatment plant upgrade and expansion project. Project also included QA/QC review of subcontractor PLC programs.

Jacobs

Anthony Benavidez

PAD OPERATIONS SPECIALIST

Anthony's Spotlight

- Anthony is the plant operations supervisor directly responsible the PAD system in Spokane, WA
- Over 17 years of experience in water and wastewater facilities.
- Extensive experience in leading operations on multiple facilities
- Extensive experience in developing startup plans, standing operating procedures, maintenance plans, compliance, permitting, and other various reports

REGISTRATIONS/ CERTIFICATIONS

- Current license: Washington state Group IV Wastewater treatment operator.
- Past licenses, NM Wastewater 3, NM Water 2, SC Wastewater Class B

Anthony brings over 17 years of experience in leadership roles in the operations of water and wastewater facilities, **and he is directly responsible for operation of the PAD system in Spokane, WA**. As an Operations Specialist, Anthony is highly experienced in managing day-to-day activities and has a thorough understanding in developing startup and control plans, Standard Operating Procedures and operations and maintenance manuals.

In addition to his extensive operator experience, Anthony has given several presentations at the section meetings for the Inland Empire Section of the Pacific Northwest Clean Water Association (PNCWA) and the Columbia Basin Section of the PNCWA Annual Conference. His expertise will be an asset to ensuring the successful startup and operation of your facility.

Relevant Project Experience

8 MGD Spokane County RWRF Post-Aerobic Digestion (PAD), Spokane, WA; Operations Supervisor/IPP Specialist. Anthony was heavily involved in the operational planning and training for the Post-Aerobic Digestion System. Prior to startup, Anthony maintained the training library and wrote several plans including Unit Process Control Plans, startup plans, and Standard Operating Procedures that are still in use to this day. Anthony operates all aspects of the plant including compliance testing in the lab. He serves as Operations Supervisor of the facility, overseeing all activities and developing proactive measures to maintain compliance with permitting regulations, submit monthly biosolids reports, annual reports, and Discharge Monitoring Reports.

Water and Wastewater Services Phosphorous Removal Pilot, Spokane, WA; Operator. Anthony operated 6 small tertiary systems in a phosphorus removal pilot study conducted by the City of Spokane. Responsible for ensuring proper operation of all plants, data entry, process control and testing.

Grand Strand Water & Sewer Authority, Conway, SC; Chief Operator. Anthony operated the 7 MGD Vereen Wastewater Treatment Facility, which is a triple oxidation ditch modified sequential batch reactor (SBR). He was involved in all process control decisions and change implementation and held a South Carolina level B wastewater license.

Village of Taos Ski Valley, Taos Ski Valley, NM; Public Works Operator/Shift Supervisor. Anthony served as lead plant operator and shift supervisor running all the lab tests and leading process decisions and implementing changes. Anthony acquired a New Mexico Level 3 wastewater certification and a Level 2 water certification.

Miscellaneous Operations Support, Various Locations in US; Operations Specialist. Anthony provide operational support on various projects throughout the United States. These have included startup and commissioning of pump stations and developing treatment plant operations and maintenance manuals. Anthony was also in charge of reviewing Operations and Maintenance manuals for new projects to ensure pertinent information is included in the manual, and reviewing the plans for operability.

Jacobs

Alex Yoffie, EIT

PROCESS ENGINEER

Alex is a trusted process engineer with invaluable experience supporting the TRA CRWS facility. Alex has developed a reputation as a trusted advisor and resource to TRA, and has been instrumental in many recent process improvements leading up to the PAD project.

Alex's Spotlight

- 15 Wastewater Treatment Plant Projects
- 4 Years Experience on Water Wastewater Treatment Plant Facilities
- 12 Projects involving Hydraulic Systems
- 4 TRA Projects
- 4 CRWS Projects

EDUCATION/ QUALIFICATIONS

- B.S., Chemical Engineering University of Texas at Austin

Relevant Project Experience

Phase V Aeration Rehabilitation Aeration Basin Improvements, Central Regional Wastewater System (CRWS), Trinity River Authority; Project Engineer. Reviewed process data for the aeration basin during startup to identify recommendations to optimize the airflow control systems. Developed and delivered a series of training presentations to operations staff to implement these controls recommendations to reduce the cost associated with running the aeration basins by minimizing airflow.

City of Midland Water Pollution Control Plant (WPCP) Secondary Treatment Upgrades; Midland, TX. Ongoing design/build project currently in startup that consists of new 15 MGD average day secondary, tertiary, and solids processing facilities including two aerobic digestion tanks. Alex was responsible for field commissioning and startup of the new facilities. This included facilitating testing and training on the positive displacement blowers, coarse bubble diffusers, floating decanters, transfer and decant pumps associated with the aerobic digestion tanks.

Master Plan and Modeling Project, Central Regional Wastewater System (CRWS), Trinity River Authority; Project Engineer. Responsible for a hydraulic assessment of three screening improvement alternatives using Replica software. The hydraulic model was used to assess the capability of each screening alternative to reduce backup into the collection system during wet weather events. Developed a wet weather training scenario for operations staff using Replica. Trained and provided ongoing support on Replica model for continued system optimization.

2017 Process Services, Central Regional Wastewater System (CRWS), Trinity River Authority. Responsible for helping design and carry out various bench scale lab tests to determine the rate of consumption of nitrite and nitrate in the CRWS aeration basins. This data was also used to further understand the digestion rates of the Comammox bacteria present at the CRWS facility. Alex carried out additional bench scale lab tests to help determine the cause of, and monitor, a sudden nitrite lock event at the CRWS plant.

Central WWTP Aeration System Upgrades, Dallas Water Utilities, TX, Process Mechanical Engineer. Design of a new 48,000 scfm blower building and aeration system including air distribution piping and flow controls valves. Alex was responsible for airflow and control system modeling, including the development of an integrated Relpica™-Sumo© aeration system model to assess blower alternatives and refine sizing of aeration system components. Alex was also responsible for blower system selection and the process mechanical design of the overall air delivery system.

GAI
Gupta & Associates, Inc
CONSULTING ENGINEERING

George Luke, PE

ELECTRICAL LEAD

George's Spotlight

- Extensive TRA project experience
- Extensive experience on multiple projects at CRWS Dallas facility
- Over 30 years experience specializing in Electrical and Instrumentation & Controls

EDUCATION/ QUALIFICATIONS

- B.S. Electrical Engineering, University of Texas, Austin

REGISTRATIONS/ CERTIFICATIONS

- Professional Engineer: TX, NE

Mr. Luke's professional engineering and project management experience extends over 30 years. His experience includes electrical and controls engineering with an extensive background in domestic and international projects. His areas of specialty include oil/gas operations, semiconductor manufacturing, and water/wastewater facilities. George is the engineering manager at GAI overseeing project staffing, schedule adherence, and quality reviews. In addition, George handles project management responsibilities for some electrical distribution and controls or instrumentation and controls design efforts.

Relevant Project Experience

TRA Central Regional Wastewater System Headworks A Fine Screen Facility, Dallas, TX. This project provides a new fine screen facility to be designed and constructed upstream of Headworks A. The screening facility will have an upper level containing screens and channels and a lower level for screening dumpsters. A Fine Screen Facility will house 6 fine screens, 4 waster/compactors, screening conveyance, 4 dumpsters, odor control, and associated switchgear. Redundant transformers are being installed to provide more operational reliability. Mr. Luke is providing electrical and I&C quality reviews for GAI.

TRA Central Regional Wastewater System Headworks B Fine Screen Facility, Dallas, TX. This project will provide eight new fine screens to replace the existing four coarse screens. Each of the four channels will be divided into two channels, each with a new fine screen. Also included are wash/compactors, odor control, and dumpster-veyors. A new electrical building is being provided to house a new motor control center and manufacturer control panels. Mr. Luke is writing the preliminary engineering report and providing quality reviews for GAI.

TRA Central Regional Wastewater System Phase IV-C Pump Station Improvements, Dallas, TX. This project installed new fine screens at TRA CRWS WWTP Influent Pump Station 6. This work included demolishing three sets of screens and washer/compactors. Two new perforated plate fine screens, two new washer/compactors, along with a new shaftless screw conveyor system for these two were then installed. A third set of screen and washer/compactor was not replaced, however, the conveyor system for that set was replaced. GAI provided both the electrical distribution and controls as well as the instrumentation and controls for this work. Mr. Luke served as the overall lead engineer for GAI.

TRA Central Regional Wastewater System Standby Generator, Dallas, TX. TRA CRWS is served by redundant 138kV transmission lines. However, to improve overall system reliability, new local emergency generation was installed. Options were evaluated that included multiple distributed standby generators throughout the Plant versus a single centralized generator. GAI designed the installation of a 2MW generator on the main switchgear at the point of electrical service into the Plant. Mr. Luke served as the overall project delivery manager for GAI.

Murali Kariyarveedu, PE, LEED AP

STRUCTURAL LEAD

Colin's Spotlight

- 31 years of structural engineering experience
- 17 years experience in working with Trinity River Authority
- Extensive experience on CRWS facility in Dallas, TX

EDUCATION/ QUALIFICATIONS

- M.S., Civil Engineering, Oklahoma State University
- B.S., Civil Engineering, Bangalore University, India

REGISTRATIONS/ CERTIFICATIONS

- Professional Engineer: TX
- US Green Building Council, LEED Accredited Professional

With 31 years of structural engineering experience, Murali focuses on conditions assessments and the evaluation and rehabilitation of various new and existing structures at water, wastewater and lake facilities. He designs new structures in the plants and structural modifications to various existing structures to accommodate process improvements and facility maintenance. He has extensive knowledge in structural design, project construction cost budgeting, feasibility studies, structural assessments, production of specifications, and construction management. Murali has worked with the Trinity River Authority for the past 17 years.

Relevant Project Experience

Mountain Creek Regional Wastewater System Plant Expansion, Trinity River Authority, Midlothian, TX; QA/QC Manager. The project consists of an evaluation of the existing 3 MGD wastewater treatment plant to develop a master plan for expanding the plant to its future 6 MGD capacity. JQ performed structural engineering design for a new aerobic digester, blower building, RAS/WAS pump station, UV channel and peak flow basin along with improvements to the existing influent pump station, aeration basin, dewatering facility and filter complex.

Phase V Rehabilitation Aeration Basin Improvements, Central Regional Wastewater System, Trinity River Authority, Dallas, TX; Structral Engineer. The project consisted of aeration system process improvements to the aeration process at AB 1-12. The scope involved a performing structural condition assessment of existing structures and aeration basins to identify required improvements to sustain proposed aeration improvements. Modifications include construction of new baffle wall systems considering O&M basin drainage methods, and provisions for access to gates and mixers.

Ten Mile Creek Regional Wastewater System Corrosion Management Plan, Trinity River Authority, Ferris, TX; Project Manager. The project included a structural assessment, in coordination with a multi-discipline evaluation, of all plant facilities to identify and prioritize corrosion mitigation and improvements based on facility importance and operations reliability. Murali served as Project Manager and used the recommended facility improvements to help prioritize capital planning development.

Primary Clarifiers 5-8 Rehabilitation, Central Regional Wastewater System, Trinity River Authority, Dallas, TX; Structural Designer. The project included structural engineering for the rehabilitation and modification to the existing PC 5-8 structure. Murali led the structural design for repairs of existing spalls, weir plates, wall cracks and floor cracks for the existing basins; repairs and replacement of the existing effluent troughs; coordination for replacement of the existing odor control covers; coordination for the site civil modifications; and coordination for replacement of the clarifier mechanisms.

Louis B. Hund, III, PE

CIVIL LEAD

Colin's Spotlight

- 34 years of Civil Engineering experience
- Multiple project experience on Trinity River Authority projects
- Direct experience on multiple projects at the CRWS facility

EDUCATION/ QUALIFICATIONS

- B.S., Civil Engineering, Texas Tech University
- Bachelor of Architecture, Texas Tech University

REGISTRATIONS/ CERTIFICATIONS

- Professional Engineer: TX

Louis brings 34 years of experience in civil engineering design to JQ. His experience encompasses designing all types of public works projects that involve paving, grading, drainage and utility design, as well as water and wastewater treatment facilities site design that includes all buried yard piping, paving, grading and drainage. Louis has worked on multiple water facilities projects for Trinity River Authority, Dallas Water Utilities and the Fort Worth Water Department.

Relevant Project Experience

EF-R3 Rehabilitation, Central Regional Wastewater System, Trinity River Authority, Dallas, TX; Quality Assurance/Quality Control Officer. This project consisted of the rehabilitation of a 12,000 LF section of 66-inch diameter wastewater main and associated junction structures and the replacement of seven manholes. The project included a physical evaluation of the pipe as well as calculations of the pipe capacity using future flow projections through the year 2060.

Collection System Building and Equipment Area Improvements, Central Regional Wastewater System, Trinity River Authority, Dallas, TX; Project Engineer. The project consisted of the rehabilitation and adaptive reuse of an existing annex building and the construction of a new remote storage facility. The scope involved performing topographic survey and site civil design. Improvements include paving, grading, drainage, utilities, and TAS compliant access.

Final Clarifier Walkways and Handrails, Red Oak Creek Regional Wastewater System, Trinity River Authority, Waxahachie, TX; Quality Assurance/Quality Control Officer. JQ served as Prime Consultant on this project that includes the design of circular walkway system around two existing final clarifiers at the Red Oak Creek Regional Wastewater System Treatment Plant to facilitate safe O&M access for cleaning algae from the launders.

Murphy Drive Pump Station Improvements, Trinity River Authority, Bedford, TX; Civil Engineer. JQ served as subconsultant providing structural and civil engineering and land surveying services for a comprehensive study to determine the combination of outdoor pad mounted switchgear and portable generators to provide power to the pump station. Louis led the civil engineering of the study, design, and construction administration phases.

Ten Mile Creek Relief Interceptor, Segment 11-40TM2, Trinity River Authority, Various, TX; Project Engineer. Project consisted of evaluation and study to replace an existing meter station on a 66-inch wastewater interceptor being upgraded to a 72-inch line. The scope involved reviewing historical data of as-built conditions and flow data for current minimum average and maximum flow conditions and determine design flow ranges. Tasks also included evaluating existing and proposed alternative meters for high and low flow velocities, hydraulic grade line of the sewer and possible submergence, and meter accuracy to meet requirements. Louis served as the Project Engineer for the civil scope of the study, as well as oversaw and coordinated electrical and instrumentation/control sub-consultants and structural project engineers.

Chris Quigley, PhD, PE

ODOR CONTROL LEAD

Chris has more than 25 years of design and construction experience, including extensive experience in wastewater upgrade and expansion projects, and leading odor control design efforts at more than 30 facilities. He is an expert in wastewater collection system modeling, odor emissions estimation, offsite odorous impacts assessment using odor dispersion modeling, odor control technology evaluation, and odor control design.

Christopher's Spotlight

- Over 25 years experience in design and construction on wastewater upgrade and expansion projects
- Extensive knowledge of various odor control systems
- Worked on over 30 wastewater facilities specializing in odor control
- Was a lead developer of Jacobs Interceptor Model

EDUCATION/ QUALIFICATIONS

- Ph.D., Civil Engineering, University of Texas at Austin
- M.S., Environmental Engineering, University of Guelph
- B.S., Environmental Engineering, University of Guelph
- B.S., Biology, Dalhousie University

REGISTRATIONS/ CERTIFICATIONS

- Professional Engineer: TX, NC

Relevant Project Experience

WWTP Odor Evaluations, City of Marco Island, FL; Lead Engineer. Lead engineer responsible for assessment of water treatment plant degasifier and scrubber system and wastewater treatment plant odor control scrubber system. Assessment involved sampling and determination of system performance under existing and design operating conditions. Recommendations included converting chemistry of WWTP scrubber system to first stage caustic and second stage caustic/hypochlorite. Recommendations for WTP scrubber included constructing a second stage and implementation of dual chemistry in second stage to reduce annual chemical costs and provide system flexibility.

North Texas Municipal Water District, Odor and Corrosion Master Plan, TX; Senior Technologist. Served as senior technologist for this odor control master plan project for the Upper East Fork Interceptor System. The plan consisted of sampling and modeling of more than 100 miles of conveyance system that contains 18 lift stations, seven liquid phase chemical dosing stations, several vaporphase odor control systems, and two receiving WWTPs. A total of 42 locations were sampled within the conveyance system to characterize the system and facilitate INTERCEPTOR model calibration.

Pima County Regional Wastewater Reclamation District, Odor Control Master Plan; Tucson, AZ; Senior Technologist. Responsible for the completion of a system-wide assessment of the wastewater conveyance system. The evaluation included sampling and modeling of more than 200 miles of pipe larger than 21 inches in diameter. Existing liquid phase chemical dosing stations were evaluated to determine performance in terms of chemical efficiency and sulfide removal. Recommendations were made to improve operation of the existing chemical dosing stations and included changes in both daily dose rates and method of injection.

Snyderville Basin Water Reclamation District, Odor Control, Park City, UT; Senior Technologist. Odor evaluation and designed the East Canyon Trunkline Support Facility to control odors from this new sewer line. The project is currently under construction. This project involved application of Jacobs' proprietary INTERCEPTOR model for assessing odor potential in the trunk sewer and evaluation of impacts from mitigation measures. The final facility includes an active odor control system on parts of the trunkline predicted to have significant outgassing problems in the Spring Creek Area and a passive system using manhole inserts in other areas predicted to have relatively minor outgassing problems.

Jacobs

Mark Keeton, RPLS

SURVEY

Mark's Spotlight

- Over 20 years geospatial and surveying experience
- Extensive Project Managing experience on various site civil and government installation including hydraulic modeling for watershed projects

EDUCATION/ QUALIFICATIONS

- B.S., Information Technology, University of Texas at Arlington
- Associate Degree, Applied Science in Drafting Technology, Howard Junior College
- Paralegal Certificate, University of North Texas in Denton
- Short Course, Survey I, Texas A&M University-Corpus Christi

EDUCATION/ QUALIFICATIONS

- Registered Professional Land Surveyor (RPLS)
- Texas Surveyor in Training (SIT)

Mark has over 20 years of geospatial and surveying experience with his current day to day responsibilities that include department, project, and personnel management over field crews and office technicians for the DFW and Austin areas. Project managing includes various transportation, railroad, land development, federal, aviation, site civil, buildings group, oil and gas, government installation projects, and water projects for hydraulic modeling. Day to day activities include scope of fee and compensation packages, preparing and calculating boundary analysis and resolution for Category 1A, 1B, ALTA surveys, along with platting services. Also included are mapping of topographic and cross-sectional surveys for civil design and hydraulic modeling, transportation responsibilities in design survey, right-of-way (ROW) mapping and resolution, along with oil and gas pipeline design and route surveys including transmission lines using state of the art Trimble GPS, robotic, and terrestrial scanning instruments and post processing with Trimble Business Center.

Relevant Project Experience

Natural Gas Liquids and Gas Pipeline Projects, Crestwood Midstream Partners and Quicksilver Resources, Malaga/Loving, NM; Project Manager. Natural gas liquids and gas pipeline projects for Crestwood Midstream Partners and Quicksilver Resources began in 2007 after the Barnett Shale was established in the North Texas region for distribution and production including salt water disposal wells and lift gas lines ranging from 4" to 20" steel including polyethylene lines. Quicksilver Resources was the exploration company for drilling while Crestwood Midstream Partners teamed with them on the gathering line systems.

Services for Crestwood Midstream Partners continued to Malaga / Loving, New Mexico just outside of Carlsbad once production seized in North Texas. The Client constructed a plant in New Mexico to connect their new pipelines to gas being extracted from other companies drilling in the area. Right of way acquisition; route determination and constructability; topographical surveys of the proposed routes, plat creation, alignment sheets for construction, Horizontal directional drill design / implementation with contractor support; construction staking of the proposed route and right of way; full as-built of pipeline design for the underground and above ground facilities including as-built plans upon completion.

North Texas Services Godley Ranch to West Johnson Plant, Godley, TX; Survey Lead. Pipeline design and P&ID's for pipe rack fitting and tie in locations, route determination and constructability, parcel plats and legal descriptions, construction staking, and as-built pans for approximately 5 miles.

North Texas Services, Alliance, TX, Quicksilver Resources Inc.; Survey Lead. Complete urban pipeline design and network, ROW acquisition with land department, various laterals of various pipe sizes, constructability, parcel plats, construction staking and as-built plans for approximately 40 miles bounded by many freeways, permitting, and various obstacles for HDD designs.

Sai Ho, PE

ELECTRICAL QA/QC

Sai's Spotlight

- Over 30 years of Electrical Engineering experience
- Lead Electrical Engineer on multiple water and wastewater projects
- Previous experience as Lead Electrical Engineer on CRWS Phase V Rehabilitation project

EDUCATION/ QUALIFICATIONS

- M.S., Electrical Engineering, University of Wisconsin
- B.S., Electrical Engineering, University of Wisconsin

REGISTRATIONS/ CERTIFICATIONS

- Professional Engineer: TX, AL, LA, FL

Sai brings over 30 years of electrical engineering experience in the design of power and control of major electrical systems involving distribution and control of heavy electrical loads in various heavy industrial facilities and municipal water and wastewater facilities. In water and wastewater projects, his role as Lead Electrical Engineer would typically include the electrical design for normal and redundant site power distribution systems with primary voltage ranged from 5 KV to 15 KV, underground conduit ductbank design, lighting design, and process control wiring systems. He also provides construction phase services.

Relevant Project Experience

CRWS Phase V Rehabilitation, Trinity River Authority, TX; Lead Electrical Engineer. Modification of the existing 480V electrical site power system to provide power distribution to new floating mixers located in all twelve (12) aeration basins. Design includes underground and exposed raceway systems to support new power and control circuits to the basins. All equipment specified complied with corrosion-resistance requirements.

Wilson Creek Regional WWTP Expansion, North Texas Regional Water District, Wyle, TX; Lead Electrical Engineer. This project included the expansion of a 48-mgd WWTP to a 56-mgd facility, and the addition of a 32-mgd ACTIFLO system for providing tertiary treatment of dry weather flows. Electrical design includes modification of the existing 480V service from 2-3750 KVA transformers to 4-3750 KVA transformers to service the additional loads. Engineering also included the design of switchgears and motor control centers for aeration blowers (high-speed and variable-speed blowers), ultraviolet systems, desk filters, pumps, clarifiers, and non-potable water pumps.

Loma Outfall to Wyle WTP Raw Water Pipeline, Wylie, TX, North Texas Regional Water District; Lead Electrical Engineer. Electrification of numerous underground flow meter vaults, including power, lighting, grounding and control, in all the four (4) WTPs at the Wylie plant. Design of underground conduit ductbank system to connect the flow meter vaults at each WTP to the associated power and control interface.

South Parkway 48-mgd Water Treatment Plant, Huntsville, AL; Lead Electrical Engineer. Responsible for modifying 2300V electrical power system at raw water pump station by adding three, 400-horsepower (hp) pumps and modifying the finished water pump station by replacing existing pumps with four 900-hp pumps to expand plant capacity to 56 mgd.

Water Quality and Quantity Improvements, Waco, TX; Lead Electrical Engineer. Responsible for electrical design of 5KV power distribution to three, 1,750-hp pumps with generator backup to one pump, and 480V power distribution to balance of plant with generator backup for critical loads. Project encompassed design of a new 90-mgd dissolved air flotation and ozonation facility and new clarified water pumping system.

Michael Montoya, PE

INSTRUMENTATION AND CONTROL QA/QC

Michael's Spotlight

- Over 34 years of Instrumentation and Control Experience
- 25 years of municipal water/ wastewater experience
- SCADA experience on the Austin Water Utility project

EDUCATION/ QUALIFICATIONS

- BSME from the University of Texas at El Paso

REGISTRATIONS/ CERTIFICATIONS

- Professional Engineer: TX

Michael is a registered Professional Engineer in the State of Texas and holds a BSME from the University of Texas at El Paso where he graduated from in 1986. He has over 34 years experience with Control and Instrumentation (C&I) for a variety of industries and processes. His experience includes over 25-years in municipal water/wastewater and 10 years in clean-room technology for the semi-conductor industry. His experience also includes design of turnkey projects that have provided Michael with unique experience in both process and I&C control design, and mechanical and electrical systems. Over the last 18 years, Michael has been involved in numerous projects involving Control Systems Automation targeted at optimizing process control. Prior to joining Jacobs, Michael spent the last five plus years with the Austin Water Utility in the Facility Engineering SCADA group.

Relevant Project Experience

Northeast Water Purification Plant (NEWPP), Houston, TX; Senior Project Manager. Technical lead for PLC programming for new 320 MGD at NE Water Purification Plant in Houston Texas. Responsible for PLC programming, startup and commissioning for twenty-four (24) ControLogix PLC's. Process systems include Post Treatment Chemical Systems, Transfer Pumps Station, Solids Handling and Filtration systems.

TDCJ Ferguson WTP; Senior Project Manager. I&C Design for new 2.6 MGD Water Treatment Plant for the Ferguson Facility operated by the Texas Department of Criminal Justice. The I&C design includes P&ID's, Wiring Diagrams, Instrument Details, specifications and control Narratives. The new water treatment facility includes and Air Stripper, Chemical Disinfection, Transfer Pump Station, Ground Storage Clearwell's and a High Service Pump Station.

El Paso Water JRWTP Raw Water Improvements Texas Medical Center; Senior Project Manager. I&C design for process improvements at the JR Water Treatment Plant in El Paso, Texas. The I&C design includes P&ID's, Wiring Diagrams, Instrument Details, specifications and Process Control Narratives. Improvements include a new intake flow meter, new fine screens as well as new screw pumps.

Hornsby Bend Biosolids Management – Thickener Complex Rehabilitation Project, Austin, TX; Project Manager. Project involved Systems Integration for the replacement of the existing Gravity Belt thickeners with Centrifuges for the facilities sludge thickening process at the HB BMP Plant in Austin Texas. Responsible for overseeing all PLC programming and HMI configuration on the Owners Top End System including integration with the new thickening centrifuges and ancillary support systems such as the sludge feed pumps and polymer systems.

Austin Water Utility, Austin, TX; Engineer C. Propose, design, develop, and manage high technology Supervisory Control and Data Acquisition (SCADA) and I&C system improvement projects from the preliminary engineering and design phases through construction and implementation phases for Capital Improvement Projects for various facilities owned and operating by the City of Austin. These facilities include, but are not limited to three (3) Water Treatment Plants, three (3) Wastewater Plants, Package Wastewater plants (under 1 MGD), Reservoirs, Pump Stations, Lift Stations and Pressure Points.

Jacobs

Vibhuti Pandey, PhD, PE

CIVIL QA/QC

Vibhuti's Spotlight

- Over 13 years experience on Water and Wastewater Plant projects
- Previous experience at CRWS facility

EDUCATION/ QUALIFICATIONS

- M.B.A., Executive Masters in Business Administration, Texas Tech University
- Ph.D., Agricultural and Biological Engineering (Water Resources), University of Florida
- M.S., Irrigation Engineering, Utah State University
- B.S., Agricultural Engineering, University of Allahabad, India

REGISTRATIONS/ CERTIFICATIONS

- Professional Engineer: TX

Dr. Vibhuti Pandey has worked on projects involving conveyance, design, wetlands, modeling, and permitting. Currently, Vibhuti is serving as Coordinating Manager for DWU's Lake Ray Hubbard Indirect Recycled Water Phase I Flows Transfer Project, which involves collection and review of data; river diversion, sediment control, and pump station alternatives; and use of multi-criteria decision analysis to select the best alternatives for the project.

Relevant Project Experience

Sanitary Sewer System Evaluation and Improvements, TX; Staff Engineer. Conducted an evaluation of three drainage areas that are integral to the City of Fort Worth's wastewater program to eliminate and prevent sanitary sewer overflows (SSO) and bypasses from the wastewater collection system in order to comply with U.S. EPA proposed Capacity, Management, Operations, and Maintenance (CMOM) regulations.

Hillside Terrace Estates Interceptor Project, Amarillo, TX; Project Engineer The project was designed and bid into two phases. The first phase included replacement of 2,860LF of existing 30-inch VCP sewer, which required detailed coordination for various electrical conflicts. The design and construction of the 1st phase is complete, during which engineering service during construction was provided. Design of the 2nd phase included a 5,629LF new 30-inch fiberglass-reinforced replacement pipe. Additional scopes included the design, removal, salvage, and/or replacement of existing manholes, new manholes, lateral connections, pavement replacement and surface restoration, bypass pumping, and existing pipe and manhole abandonment. Construction methods included open cut, Microtunnel, and Pilot Tube Auger Bore.

Red Oak Creek Interceptor Segments I and IIA Condition Assessment and Design Project; Project Engineer. The system consists of 24 miles of sewer interceptor to collect wastewater and treat it at the Red Oak Creek Regional Wastewater Treatment Plant. Segments I and IIA comprise one of the three major interceptors within the ROCRWS service area, which consists of 11,000 LF of 27-inch unlined reinforced concrete pipe. In 2009, TRA conducted an I&I assessment of the Red Oak System that indicated additional capacity was needed to convey projected 2040 flows. Additionally, in 2013 there was a pipe collapse near the treatment plant. Jacobs conducted a condition assessment to evaluate the two segments, including multiple siphons and aerial crossings. We used Multi-Criteria-Decision-Analysis and cost-benefit analysis to evaluate alternatives for rehab (CIPP or pipe-burst) and/or replacement (54- and 48-inch pipe). Options considered the use of existing easement vs. a new alignment location, with recommendations for phased design and construction packages to meet the owner's funding availability.

Jacobs

Alex Firth, PE, LEED AP

STRUCTURAL QA/QC

Alex's Spotlight

- Over $1 Billion in construction of Water and Wastewater Treatment Plant Projects
- 34 years experience on WWTP projects
- 34 Water plant projects

EDUCATION/ QUALIFICATIONS

- B.S., Civil Engineering, Oregon State University
- Graduate Studies, Structural Engineering, Oregon State University

REGISTRATIONS/ CERTIFICATIONS

- Professional Engineer: OR
- Structural Engineer: HI, AZ, TX
- U.S. Green Building Council (USGBC)
- LEED Accredited Professional (46999)

Alex is a senior structural engineer with Jacobs Water Business Group in Corvallis, Oregon. He has worked on a variety of structural projects, including water and wastewater treatment plants, Industrial facilities, resident construction inspection, and bridge inspection. He was previously the west regional technology director for water and wastewater structural engineering and also the staffing manager for structural engineering. He has developed and maintained the firm's master specifications and details for water and wastewater treatment design. He is also the firm's source matter expert in the structural engineering aspects of anti-terrorism and force protection (AT/FP) design.

Relevant Project Experience

North Texas Water District, Leonard, Texas Water Treatment Project; Lead Structural Engineer. Project involved a new greenfield 75 mgd water treatment project. Project included the design of multiple, large concrete treatment basins including pre-treatment, ozone, filtration, and chlorine contact/clearwell. The design also included all the supporting chemical and treatment buildings including operations, maintenance and a warehouse facility. Two of the facilities were designed for improved performance for tornado loads.

City of Goodyear, Goodyear Water Treatment Facility; Lead Structural Engineer. Lead structural engineer for a new, greenfield 8 mgd water treatment project. Project included multiple concrete treatment basins and the associated treatment facilities. The project also included the design of an operations building.

Corvallis Solids Handling Project Wastewater Reclamation Plant, Corvallis, OR; Design Manager. Design manager for the Corvallis Solids Handling Project for the City of Corvallis Wastewater Reclamation Plant. Led the design of a new prestressed concrete digester and solids handling building. The solids handling building is a single-story concrete masonry structure with a structural roof structure.

Rock Creek Advanced Wastewater Treatment Plant, Phase IV, Clean Water Services, Hillsboro, OR; Lead Structural Engineer. Design of two modified German, coned bottom digester tanks. The tank vertical walls were vertically and horizontally post-tensioned, and the cone bottom structure was a conventionally reinforced concrete. The digester complex was built integrally with the digester tanks.

Camp Pendleton Advanced Water Treatment Plant; NAVFAC; MCB Camp Pendleton; San Diego, California; Lead Structural Engineer. Led the structural design for a new, greenfield water treatment facility consisting of an operations building, chemical storage facility, reverse osmosis facility, iron removal facility, decarbonation, pump station, brine storage tanks, and clearwell. It is designed per the military's Unified Facilities Criteria and the International Building Code.

Pima County WRF DBO Project; Pima County, AZ; Lead Structural Engineer. Project includes design and construction of a new 24-mgd, $158-million water reclamation facility for seven separate facilities, as well as pipeline, basins, and tanks. Scope includes innovative treatment process uses DAF clarification and 5-stage Bardenpho, enhanced with step-feed capabilities.

Jacobs

Jennifer Henke, PE

SUCCESSION PLAN PROJECT PRINCIPAL AND QA/QC LEAD

Jennifer brings over 23 years of experience supporting clients by understanding and solving complex problems—from designing various water and wastewater system elements to hydraulic modeling to facility planning and prioritization. She brings global expertise in guiding clients through selecting the best options for facility improvements and the development of an executable improvement plan that balances growth and condition-driven requirements with risk and resiliency.

Jennifer's Spotlight

- 23 Years Design Experience on water and wastewater treatment plant facilities
- Global Expertise in Process Design and Hydraulic Modeling
- TRA Project Experience. Jennifer's previous experience working with TRA on several projects will provide familiarity, and ensure that Jacobs meets TRA's quality expectations.

EDUCATION/ QUALIFICATIONS

- M.S., Civil Engineering University of Texas at Austin
- B.S., Civil Engineering University of Texas at Austin

REGISTRATIONS/ CERTIFICATIONS

- Professional Engineer: TX

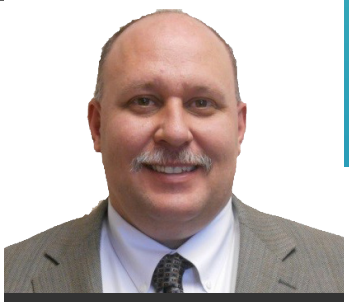
Relevant Project Experience

Phase V Aeration Basin Rehabilitation Project, Central Regional Wastewater System (CRWS), Trinity River Authority; Project Manager. Led the design of improvements to the aeration basins to incorporate BNR into the treatment process. As part of the design, simulated the biological process and control strategy to identify target operating parameters. Supported the evaluation and performance of each phase of basin construction to define and document basin performance, tuning parameters, and optimal setpoints for ammonia based aeration control (ABAC).

Treatment Plant Master Plan and Modeling Project, Central Regional Wastewater System (CRWS), Trinity River Authority; Project Manager. Project consisted of developing full CRWS plant dynamic models for process evaluation and hydraulic capacity using the Replica model. The project team developed the model with significant engagement and input from TRA staff, so that TRA staff can apply the model to evaluate operating scenarios and identify associated hydraulic impacts.

Control Strategy Documentation and Development, West Point Control System Replacement, King County Wastewater Treatment Division, WA; Task Lead. Led the effort to develop control strategies to document the operation and control of processes at the West Point Treatment Plant for replacement of the Supervisory Process Control System (SPCS) with Ovation® by Emerson. The operation of the West Point Treatment Plant varies from average flows of 90 mgd to peak flows of over 400 mgd during wet weather events. Development of the control strategies was accomplished through review of operations documentation, review of existing alarms and setpoints, conducting interviews with operators during night-time shifts, and through review of system performance information.

River Road Stormwater Basin and Primary Clarifier Rehab, City of Amarillo, TX; Project Manager. Jacobs evaluated rehabilitation options for the stormwater basin including liner technologies and concrete options. Based upon a comparison of liner options, Jacobs designed an XR-5 liner system with a concrete bottom for cleaning and maintenance access. The project also assessed flows for raw water piping reconfiguration design, and designed replacement primary clarifier equipment. Jacobs also supported Amarillo staff in the monitoring of construction progress and startup of the new facilities.



Lance Price

ELECTRICAL LEAD SUCCESSOR

Lance's Spotlight

- 10 Water Plant Projects
- 50 Wastewater Treatment Plant Projects
- 17 Years Experience on WWTP Projects
- 7 Projects involving Headworks/Screens
- 59 Projects with TRA
- 22 Projects at CRWS

EDUCATION/ QUALIFICATIONS

- Journeyman's License

Mr. Price has exceptional experience with construction and field operations in addition to his project design experience. He leads W/WW design projects, in particular projects for TRA, where he has earned a reputation for being a trusted and reliable resource. His design experience includes both 480V low voltage and 5kV medium voltage. It includes both the rehabilitation of existing facilities as well as new greenfield projects and it includes serving as a technical consultant for developing OPCCs, defining control strategies, and supervising design deliverable schedules.

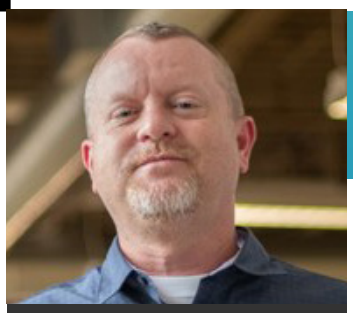
Relevant Project Experience

TRA CRWS Headworks A Fine Screen Facility, Dallas, TX; Lead Designer for Controls. This project will provide a new fine screen facility to be designed and constructed upstream of Headworks A. The screening facility will have an upper level containing screens and channels and a lower level for screening dumpsters. A Fine Screen Facility will house 6 fine screens, 4 waster/compactors, screening conveyance, 4 dumpsters, odor control, and associated switchgear. Redundant transformers are being installed to provide more operational reliability. Mr. Price is leading the electrical distribution and controls design for GAI.

TRA CRWS Phase IV Plant Rehab, Dallas, TX; Lead Electrical Designer. Mr. Price led much of the design of the electrical portion of this project. This project included the rehabilitation and process improvements for several areas throughout the plant. This includes the Primary Clarifiers 1 - 4, Influent Iron Salts Facility, Valve Vaults 1C and 1D, Final Clarifiers 1 - 12, Meter Vaults 6C and 6D, and roadway lighting. GAI provided the electrical distribution and controls design that included new influent gate actuators, new control panels, replacement flow meters, and motor control center maintenance. It also included a new manufacturer PLC to for each of the twelve final clarifiers.

TRA CRWS Solids Handling Phase III, Dallas, TX; Project Manager. All solids management improvements for the CRWS WWTP have been designed to provide adequate capacity through 2040. Planning and construction will be performed in four phases, with Phase III providing service from 2019 through 2023. GAI is providing the electrical distribution and controls design for the new THP, Boilers, Digestion, and related facilities. Preliminary design calls for redundant 3MVA transformers, four MCCs, and over two dozen VFDs. The project is being developed for CMAR construction.

TRA CRWS Primary Clarifiers 5-8, Dallas, TX; **Project Manager.** Project consisted of mechanical equipment replacement and the electrical infrastructure that served them. Three of the four clarifier drives are being replaced, four scum well blowers, and four scum pumps. All twelve controls are being replaced, along with all power and control wiring, conduit, and control stations. The instrumentation and controls consisted of disconnecting the existing I/O points, then reconnecting and recommissioning theme.



Chris Story, PE

STRUCTURAL LEAD SUCCESSOR

Colin's Spotlight

- 25+ years of structural engineering experience
- 20 years experience in working with Trinity River Authority
- Extensive experience on CRWS facility in Dallas, TX

EDUCATION/ QUALIFICATIONS

- Bachelor of Science in Civil Engineering Texas A&M University

REGISTRATIONS/ CERTIFICATIONS

- Professional Engineer: TX

Chris brings more than 25 years of experience in structural engineering design. His broad range of experience includes infrastructure, municipal, and heavy industrial with an emphasis in structural design at water and wastewater facilities. He has extensive knowledge in design, project construction cost budgeting, feasibility studies, facility assessments, production of specifications, and construction management. Chris has worked with the Trinity River Authority for the past 20 years. He has led teams delivering reliable engineering and project management services to TRA for a variety of complex process projects ranging in size from less than $1M to over $35M.

Relevant Project Experience

Mountain Creek Regional Wastewater System Plant Expansion, Trinity River Authority, Midlothian, TX; Principal-in-Charge. The project consists of an evaluation of the existing 3 MGD wastewater treatment plant to develop a master plan for expanding the plant to its future 6 MGD capacity. JQ performed structural engineering design for a new aerobic digester, blower building, RAS/WAS pump station, UV channel and peak flow basin along with improvements to the existing influent pump station, aeration basin, dewatering facility and filter complex.

Phase V Rehabilitation Aeration Basin Improvements, Central Regional Wastewater System, Trinity River Authority, Dallas, TX; Project Manager. The project consisted of aeration system process improvements to the aeration process at AB 1-12. The scope involved a performing structural condition assessment of existing structures and aeration basins to identify required improvements to sustain proposed aeration improvements. Modifications include construction of new baffle wall systems considering O&M basin drainage methods, and provisions for access to gates and mixers.

Phase I, II, III Plant Rehabilitation Replacement and Corrosion Remediation Project, Central Regional Wastewater System, Trinity River Authority, Dallas, TX; Project Manager. The phased construction project included extensive structural rehabilitation and improvements to correct deteriorated facilities. Improvements included complete rehabilitation of primary clarifiers 1-4, four digesters and associated aluminum geodesic dome improvements, grit influent, and various areas within the solids processing facilities.

Primary Clarifiers 6-8 Structural Evaluation, Central Regional Wastewater System, Trinity River Authority, Dallas, TX; Principal-in-Charge. JQ served as Prime Engineer on this project which consisted of a complete structural assessment of the existing Primary Clarifier 6-8 structures. Field assessments of the structures were performed in order to determine their anticipated remaining service life. Repair recommendations and associated costs were compiled for the observed deficiencies. JQ consulted with plant staff, TRA management and clarifier equipment manufacturers to establish a detailed cost estimate for the upcoming rehabilitation of the PC 5-8 clarifier complex.

Chris Bitter, PE, ENV SP

CIVIL LEAD SUCCESSOR

Colin's Spotlight

- 13 years of water and wastewater project experience
- Multiple project experience on Trinity River Authority projects
- Previous experience working with TRA and CRWS projects

EDUCATION/ QUALIFICATIONS

- B.S., Civil Engineering University of Oklahoma

REGISTRATIONS/ CERTIFICATIONS

- Professional Engineer: TX

Chris has over 13 years of experience in water and wastewater conveyance, treatment and general civil design. He provides comprehensive services to infrastructure clients throughout Texas. He has designed water, sanitary sewer and storm sewer pipelines using various pipe materials including PVC, HDPE, RCP, PCCP, steel, ductile iron and FRP. His experience also includes lift station and meter station design, alternative alignment analysis, pipeline rehabilitation design, odor control system design, permitting, traffic control and temporary bypass plans.

Relevant Project Experience

EF-R3 Rehabilitation, Central Regional Wastewater System, Trinity River Authority, Dallas, TX; Project Manager. This project consisted of the rehabilitation of a 12,000 LF section of 66-inch diameter wastewater main and associated junction structures and the replacement of seven manholes. The project included a physical evaluation of the pipe as well as calculations of the pipe capacity using future flow projections through the year 2060.

Final Clarifier Walkways and Handrails, Red Oak Creek Regional Wastewater System, Trinity River Authority, Waxahachie, TX; Civil Project Manager. JQ served as Prime Consultant on this project that includes the design of circular walkway system around two existing final clarifiers at the Red Oak Creek Regional Wastewater System Treatment Plant to facilitate safe O&M access for cleaning algae from the launders.

Influent Piping and Equipment Rehabilitation, Central Wastewater Treatment Plant, Dallas Water Utilities, Dallas, TX; Pipeline Design Lead. JQ performed condition assessments and implemented improvements to the 84-inch horseshoe influent piping between the Influent Pump Station and White Rock Raw Sewage Pump Station. Repairs include non-circular CCFRP slip-lining of the existing 84-inch horseshoe shaped influent piping – the first application of non-circular slip-lining in the state of Texas. Other improvements include the addition of the fourth screen at IPS, improvements to the existing sludge disposal station, and various critical sluice gate replacements at influent piping.

Cadiz Pump Station Decommissioning Evaluation and Y-Inlet Improvements, Dallas Water Utilities, Dallas, TX; Project Engineer. This project consisted of the structural rehabilitation of the Y-inlet structure at the Cadiz Street Pump Station. This included the refurbishment of five pumps and motors, electrical improvements, detailed flow diversion/bypass pumping plan for 150-MGD bypass through the Kay Bailey Hutchison Convention Center parking lot and across the I-30 Canyon, inspection, and repair of the 60-inch West Bank Force Main, and installation of instrumentation improvements at the East Bank-West Bank siphon interceptor.

Rolling Hills WTP Meter Stations, City of Fort Worth Water Department, Fort Worth, TX; Quality Assurance/Quality Control Officer. JQ provided the design of two new open-top meter vaults in support of the meter replacement of existing piping at Rolling Hills Water Treatment Plant. The existing piping had a 48-inch diameter and a 54-inch diameter at different locations.

Schedule

Central Regional Wastewater System
Nutrient Improvements - Post Aerobic Digestion

SCHEDULE

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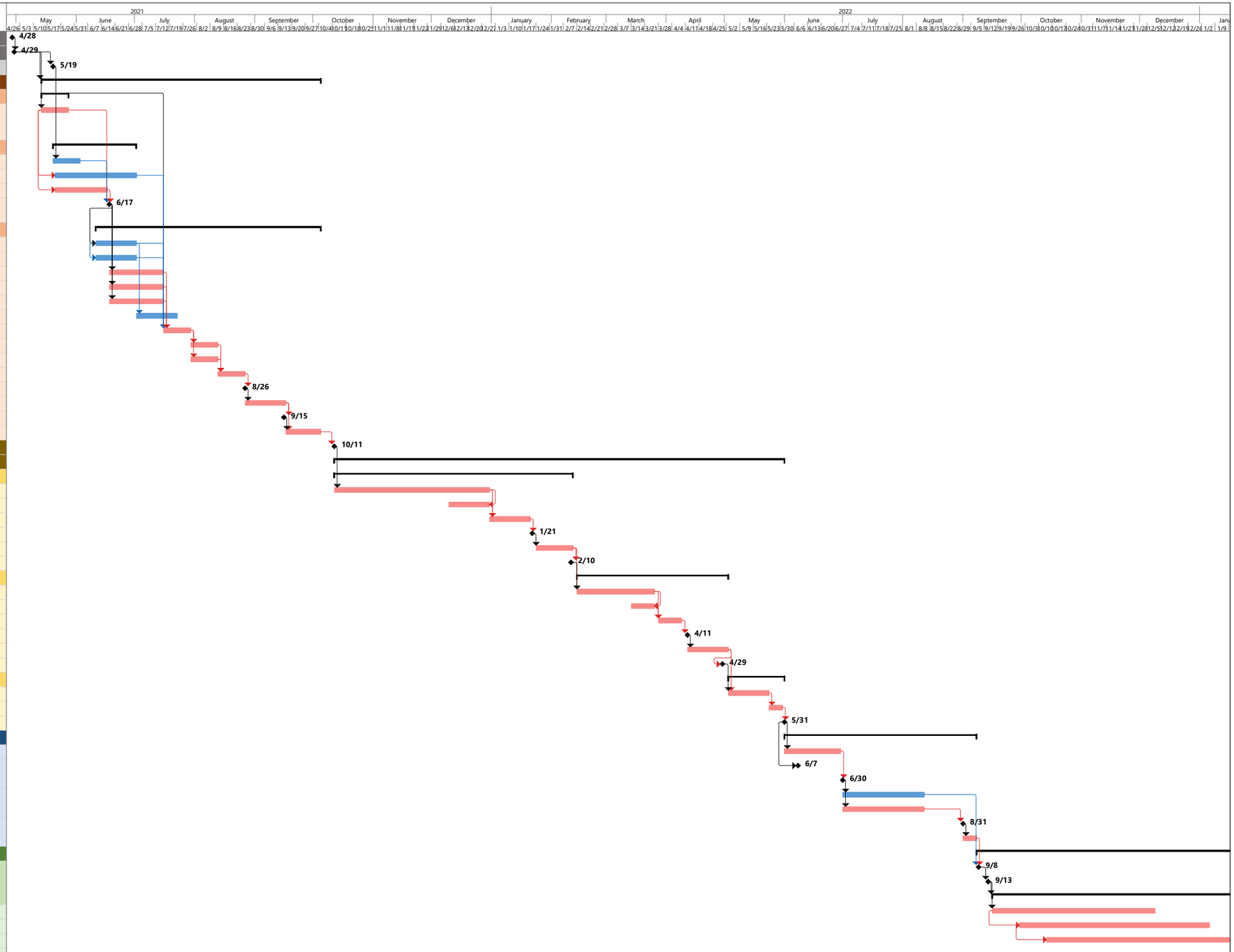
Central Regional Wastewater System Nutrient Improvements-Post Aerobic Digestion

ID	Task Name	Duration	Start	Finish
1	**Board Approval**	**1 day**	**Wed 4/28/21**	**Wed 4/28/21**
2	**Notice to Proceed**	**1 day**	**Thu 4/29/21**	**Thu 4/29/21**
3	Project Kick Off Meeting	1 day	Wed 5/19/21	Wed 5/19/21
4	**Preliminary Design**	**102 days**	**Fri 5/14/21**	**Mon 10/4/21**
5	**Data Review**	**10 days**	**Fri 5/14/21**	**Thu 5/27/21**
6	Review available Record Drawings, Design Reports, Existing Process Model, Existing Blower/Air System model, Literature on THP's Impact on sludge Rheology	10 days	Fri 5/14/21	Thu 5/27/21
7	**Process Model Update and Bench-Scale Testing**	**31 days**	**Thu 5/20/21**	**Thu 7/1/21**
8	Site Review and Assessment (one visit)	10 days	Thu 5/20/21	Wed 6/2/21
9	Bench Testing for Effects of Viscosity on Aeration in the PAD	30 days	Fri 5/21/21	Thu 7/1/21
10	Process/Blower Model Update (Replica)	19 days	Fri 5/21/21	Wed 6/16/21
11	Operational Evaluation Workshop (Present and discuss possible operations concepts)	1 day	Thu 6/17/21	Thu 6/17/21
12	**Preliminary Design Report (PDR)**	**82 days**	**Fri 6/11/21**	**Mon 10/4/21**
13	Finalize Operational Schemes	15 days	Fri 6/11/21	Thu 7/1/21
14	Survey/Geotech	15 days	Fri 6/11/21	Thu 7/1/21
15	New Blower/Electrical Building	20 days	Fri 6/18/21	Thu 7/15/21
16	Mechanical, Civil, and Structural Requirements	20 days	Fri 6/18/21	Thu 7/15/21
17	I&C/Control Requirements	20 days	Fri 6/18/21	Thu 7/15/21
18	Construction Sequencing and Operational Impact Mitigation Strategy	15 days	Fri 7/2/21	Thu 7/22/21
19	Finish Preliminary Design Alternatives	10 days	Fri 7/16/21	Thu 7/29/21
20	Develop 30% OPPC Estimate	10 days	Fri 7/30/21	Thu 8/12/21
21	Develop Preliminary Design Report (PDR)	10 days	Fri 7/30/21	Thu 8/12/21
22	PDR Internal QA/QC Review	10 days	Fri 8/13/21	Thu 8/26/21
23	Submit Draft PDR	0 days	Thu 8/26/21	Thu 8/26/21
24	TRA - PDR Review	15 days	Fri 8/27/21	Thu 9/16/21
25	Draft PDR Review Meeting	1 day	Wed 9/15/21	Wed 9/15/21
26	Issue Final PDR	12 days	Fri 9/17/21	Mon 10/4/21
27	Notice to Proceed for Detailed Design	1 day	Mon 10/11/21	Mon 10/11/21
28	**Detailed Design Phase**	**166 days**	**Tue 10/12/21**	**Tue 5/31/22**
29	**60% Design Package**	**89 days**	**Tue 10/12/21**	**Fri 2/11/22**
30	Develop 60% Drawings and Specs	58 days	Tue 10/12/21	Thu 12/30/21
31	Develop 60% OPCC	15 days	Fri 12/10/21	Thu 12/30/21
32	60% Design Package Internal QA/QC Review	15 days	Fri 12/31/21	Thu 1/20/22
33	Submit 60% Design Package	1 day	Fri 1/21/22	Fri 1/21/22
34	TRA - 60% Design Package Review	15 days	Mon 1/24/22	Fri 2/11/22
35	60% Design Review Workshop	1 day	Thu 2/10/22	Thu 2/10/22
36	**90% Design Package**	**56 days**	**Mon 2/14/22**	**Mon 5/2/22**
37	Update 90% Drawings and Specs	30 days	Mon 2/14/22	Fri 3/25/22
38	Update 90% OPCC	10 days	Mon 3/14/22	Fri 3/25/22
39	90% Design Package Internal QA/QC Review	10 days	Mon 3/28/22	Fri 4/8/22
40	Submit 90% Design Package	1 day	Mon 4/11/22	Mon 4/11/22
41	TRA - 90% Design Package Review	15 days	Tue 4/12/22	Mon 5/2/22
42	90% Design Review Workshop	1 day	Fri 4/29/22	Fri 4/29/22
43	**100% Final Bid Package**	**21 days**	**Tue 5/3/22**	**Tue 5/31/22**
44	Update Final Bid Package	15 days	Tue 5/3/22	Mon 5/23/22
45	Bid Package Internal QA/QC Review	5 days	Tue 5/24/22	Mon 5/30/22
46	Submit Final Bid Package to TRA	1 day	Tue 5/31/22	Tue 5/31/22
47	**Bid Phase**	**71 days**	**Wed 6/1/22**	**Wed 9/7/22**
48	Advertise & Bid (CivCast and Newspaper)	21 days	Wed 6/1/22	Wed 6/29/22
49	Prebid Meeting	1 day	Tue 6/7/22	Tue 6/7/22
50	Bid Opening	1 day	Thu 6/30/22	Thu 6/30/22
51	Issue Conformed for Construction Package	30 days	Fri 7/1/22	Thu 8/11/22
52	Bid Reviews, Evaulation and Recommendation to Award	30 days	Fri 7/1/22	Thu 8/11/22
53	Contract Award - Board Meeting (approximate date)	1 day	Wed 8/31/22	Wed 8/31/22
54	Notify Winning Contractor	5 days	Thu 9/1/22	Wed 9/7/22
55	**Construction Phase**	**367 days**	**Thu 9/8/22**	**Fri 2/2/24**
56	Notice to Proceed	1 day	Thu 9/8/22	Thu 9/8/22
57	Kick-off Meeting	1 day	Tue 9/13/22	Tue 9/13/22
58	**Project Construction**	**326 days**	**Fri 9/16/22**	**Fri 12/15/23**
59	Submittals Preparation	60 days	Fri 9/16/22	Thu 12/8/22
60	Submittals Review and Resubmits	70 days	Fri 9/30/22	Thu 1/5/23
61	Procurement and Installation	175 days	Fri 10/14/22	Thu 6/15/23
62	Start-up & Commissioning	81 days	Fri 6/16/23	Fri 10/6/23
63	Substantial Completion Walk-thru & Punchlist	15 days	Mon 10/9/23	Fri 10/27/23
64	Final Inspection & Payment Recommendation	15 days	Mon 11/27/23	Fri 12/15/23
65	Record Drawings	20 days	Mon 12/18/23	Fri 1/12/24
66	Project Closeout	15 days	Mon 1/15/24	Fri 2/2/24
67				



Respondent Questionnaire

Central Regional Wastewater System
Nutrient Improvements - Post Aerobic Digestion

RESPONDENT QUESTIONNAIRE

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RESPONDENT QUESTIONNAIRE

TRINITY RIVER AUTHORITY OF TEXAS
CENTRAL REGIONAL WASTEWATER SYSTEM

REQUEST FOR PROPOSAL (RFP)

Nutrient Improvements - Post Aerobic Digestion

Instructions: The Respondent Questionnaire is a required part of the RFP. Complete the questionnaire by inserting the requested information. Do not modify or delete the questions.

GENERAL INFORMATION

1. **Respondent Information:** Provide the following information regarding the Respondent. (NOTE: Co-Respondents are two or more entities proposing as a team or joint venture with each signing the contract, if awarded. Subcontractors are not Co-Respondents and should not be identified here. If this proposal includes Co-Respondents, provide the required information in this Item 1. for each Co-Respondent by copying and inserting an additional block(s) before Item 2.)

   Respondent Name: Jacobs Engineering Group Inc.
   (NOTE: Give exact legal name as it will appear on the contract, if awarded.)
   Principal Address: 1999 Bryan Street, Suite 1200
   City: Dallas State: TX Zip Code: 75201-3136
   Telephone No. 214.638.0145 Fax No: 214.638.0447
   Texas Board of Professional Engineers Firm Number: F-2966

2. **Contact Information:** List the one person who the Authority may contact concerning your proposal or setting dates for meetings.

   Name: Raj Mehta, PE
   Address: 1999 Bryan Street, Suite 1200
   City: Dallas State: TX Zip Code: 75201-3136
   Telephone No. 469.941.8917 Fax No: 214.638.0447
   Email: raj.mehta@jacobs.com

3. Identify the principal contact person authorized to commit the Respondent to a contractual agreement.
   Raj Mehta, PE

4. Does Respondent anticipate any mergers, transfer of organization ownership, management reorganization, or departure of key personnel within the next 12 months?

   Yes ☐ No ☒

The Jacobs organization has a talent force of more than 50,000, approximately $13 billion in revenue, and over 300 global operating entities, with approximately 100 operating entities in the United States and Canada. Jacobs provides a full spectrum of services including scientific, technical, professional, construction, and program management for business, industrial, commercial, government, and infrastructure sectors. Our corporate profile and public filings can be found at http://invest.jacobs.com/investors/default.aspx#corporate. Jacobs is a publicly traded company and its stock is purchased and traded daily by the general public. As such, disclosures regarding mergers, transfer or organization ownership, management reorganization or departure of key personnel are controlled and regulated by applicable federal law that restricts disclosure of such information except through certain government approved means.

5. **Debarment/Suspension Information:** Has the Respondent or any of its principals been debarred or suspended from contracting with any public entity?

   Yes ☐ No ☒ If "Yes", identify the public entity and the name and current phone number of a representative of the public entity familiar with the debarment or suspension, and state the reason for or circumstances surrounding the debarment or suspension, including but not limited to the period of time for such debarment or suspension.

   To the best of its actual knowledge, Jacobs Engineering Group Inc. is not currently debarred by any State or Federal agency of the United States of America. On information and belief, without independent investigation, no elected officer or director of Jacobs Engineering Group Inc. has been debarred by any State or Federal agency of the United States of America.

6. Provide any other names under which Respondent has operated within the last ten years.

   Jacobs Engineering Group Inc. incorporated under the laws of the State of Delaware on January 8, 1987. On March 4, 1987, the corporation succeeded by merger to the business and assets of Jacobs Engineering Group Inc., a California corporation that, in 1974, had succeeded to a business organized originally by our founder, Dr. Joseph J. Jacobs, in 1947. Currently Jacobs Engineering Group Inc. and its related companies form an organization that is comprised of over 300 global operating entities, with approximately 100 operating entities in the United States and Canada.

7. **Litigation Disclosure**: Respond to each of the questions below by checking the appropriate box. Failure to fully and truthfully disclose the information required in the Litigation Disclosure questions may result in the disqualification of your proposal from consideration or termination of the contract, once awarded.

   (a) Have you or any member of your Firm or Team to be assigned to this engagement been terminated (for cause or otherwise) from any work being performed for any Federal, State or Local Government during the last ten (10) years?

   Yes ☐ No ☐

   (b) Have you or any member of your Firm or Team to be assigned to this engagement been involved in any claim or litigation with any Federal, State or Local Government during the last ten (10) years?

   Yes ☐ No ☐

   If you have answered "Yes" to any of the above questions, please indicate the name(s) of the person(s), the nature, and the status and/or outcome of the information, indictment, conviction, termination, claim or litigation, as applicable. Any such information should be provided on a separate page, attached to this form and submitted with your proposal.

* The Jacobs organization has a talent force of more than 50,000, approximately $13 billion in revenue, and over 300 global operating entities, with approximately 100 operating entities in the United States and Canada. Jacobs provides a full spectrum of services including scientific, technical, professional, construction, and program management for business, industrial, commercial, government, and infrastructure sectors. Our corporate profile and public filings can be found at: http://invest.jacobs.com/investors/default.aspx#corporate. From time to time and in the ordinary course of its business, the Company is subject to various claims, disputes, terminations, arbitrations, and other legal proceedings. It is the Company's practice to defend itself in such actions, many of which are generally subject to insurance and none of which are expected to have a materially adverse effect on the Company's consolidated financial statements.

8. **Compliance Agreement:** No Lobbying and Compliance with Law. During the selection process for the project named in this RFP, Prospective Consultant agrees to comply with all applicable laws and regulations**, including but not limited to restrictions against direct or indirect lobbying of public officials. Prospective Consultant agrees not to** make or permit to be made any improper payments, or to perform any unlawful acts.

   This agreement shall be construed to be enforceable to the maximum extent permitted by law.

   Failure to complete this question or comply with its terms may subject this firm to elimination from the selection process at any time.

   Does the Respondent agree to the above?

   Yes ☒ No ☐

9. **Security Procedures:** Respondent is prepared to perform at their own expense background security checks on their employees, or the employees of their consultants or subconsultants if requested by the Authority.

   Yes ☒ No ☐

10. **Addenda:** Each Respondent is required to acknowledge receipt of all addenda.

    None ☒ Yes ☐ If "Yes", Identify.

    _____

11. **Verification Required:** Be prepared to execute the verification required by Texas Government Code Chapter 2270 located in sample engineering services agreement of this document.

The information provided above is true and accurate to the best of my knowledge. Furthermore, we understand that failure to complete the Respondent Questionnaire may subject this firm to elimination from the selection process.

_____ January 8, 2021
Signature Date

C. Raj Mehta, PE
Printed Name

Vice President – Client Account Manager
Title

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