STATE OF TEXAS

TWDB Contract No. 1600012027

COUNTY OF TRAVIS

General Revenue

Aqua Strategies Inc.

This Contract, (hereinafter "CONTRACT"), between the Texas Water Development Board (hereinafter "TWDB") and Aqua Strategies Inc. (hereinafter "CONTRACTOR"), is composed of two parts, SECTION I. SPECIFIC CONDITIONS AND EXCEPTIONS TO THE STANDARD AGREEMENT and SECTION II. STANDARD AGREEMENT. The terms and conditions set forth in SECTION I will take precedence over terms and conditions in SECTION II.

SECTION I. SPECIFIC CONDITIONS AND EXCEPTIONS TO STANDARD AGREEMENT

ARTICLE I. DEFINITIONS

For the purposes of this CONTRACT, the following terms or phrases shall have the meaning ascribed therewith:

1. TWDB – The Texas Water Development Board, or its designated representative

2. CONTRACTOR – Aqua Strategies Inc.

3. EXECUTIVE ADMINISTRATOR – The Executive Administrator of the TWDB or a designated representative

4. PARTICIPANT(S) – Aqua Strategies Inc.

5. REQUIRED INTERLOCAL AGREEMENT(S) – n/a

6. RESEARCH PROJECT – to study stream gage and weather station placement requirements to improve hydrometeorological flood forecasting in Texas

7. TWDB APPROVAL DATE – August 25, 2016

8. DEADLINE FOR CONTRACT EXECUTION – October 25, 2016

9. CONTRACT INITIATION DATE – August 25, 2016

10. STUDY COMPLETION DATE – December 31, 2016

11. CONTRACT EXPIRATION DATE – August 31, 2017

12. TOTAL STUDY COSTS – $150,000.00

13. TWDB SHARE OF THE TOTAL STUDY COSTS – the lesser of $150,000.00 or 100 percent of the total study costs or individual payment submission

14. LOCAL SHARE OF THE TOTAL STUDY COSTS – $0.00 in cash or 0 percent of the total study costs or individual payment submission

15. PAYMENT SUBMISSION SCHEDULE – Monthly

16. OTHER SPECIAL CONDITIONS AND EXCEPTIONS TO STANDARD AGREEMENT OF THIS CONTRACT – n/a

SECTION II. STANDARD AGREEMENT

ARTICLE I. RECITALS

Whereas, on TWDB APPROVAL DATE, the TWDB considered providing the CONTRACTOR a grant to conduct a RESEARCH PROJECT;

Whereas, the CONTRACTOR and PARTICIPANT will commit the LOCAL SHARE OF THE TOTAL STUDY COSTS, if applicable, in cash and/or in-kind services to pay for the LOCAL SHARE OF THE TOTAL STUDY COSTS of this RESEARCH PROJECT;

Whereas, the CONTRACTOR is the entity who will act as administrator of the TWDB's research grant and will be responsible for the execution of this contract;

Whereas, on the TWDB APPROVAL DATE, the TWDB approved a research grant to CONTRACTOR;

Now, therefore, the TWDB and the CONTRACTOR, agree as follows:

ARTICLE II. PROJECT DESCRIPTION AND SERVICES TO BE PERFORMED

1. The TWDB enters into this CONTRACT pursuant to Water Code §16.058 as appropriate; Exhibit A, the original grant application, which is incorporated herein and made a permanent part of this CONTRACT; and this CONTRACT.

2. The CONTRACTOR will conduct a RESEARCH PROJECT, as delineated and described in Exhibit A, according to the Scope of Work contained in Exhibit B.

3. A progress report, including results to date, will be provided to the EXECUTIVE ADMINISTRATOR monthly, throughout the project. Special interim reports on special topics and/or results will be provided as appropriate. Instructions for the progress report are shown in Exhibit E, TWDB Guidelines for a Progress Report.

4. Within the first 60 days of the commencement of this CONTRACT, CONTRACTOR will consult with TWDB staff to prepare a list of entities that potentially may be affected by the results of this RESEARCH PROJECT. On the STUDY COMPLETION DATE, this list will be reviewed and updated by the CONTRACTOR and submitted to the TWDB with the draft final report.

ARTICLE III. CONTRACT TERM, SCHEDULE, REPORTS, AND OTHER PRODUCTS

1. The CONTRACTOR has until the DEADLINE FOR CONTRACT EXECUTION to execute this CONTRACT and to provide acceptable evidence of any

REQUIRED INTERLOCAL AGREEMENT(S) and the Contractors' ability to provide the LOCAL SHARE OF THE TOTAL STUDY COSTS, if applicable, to the EXECUTIVE ADMINISTRATOR for approval or the TWDB's SHARE OF THE TOTAL STUDY COSTS will be rescinded.

2. The term of this CONTRACT shall begin and the CONTRACTOR shall begin performing its obligations hereunder on the CONTRACT INITIATION DATE and shall expire on the CONTRACT EXPIRATION DATE. Delivery of an acceptable final report prior to the CONTRACT EXPIRATION DATE shall constitute completion of the terms of this CONTRACT.

3. The CONTRACTOR will complete the Scope of Work and will deliver four (4) double- sided copies of a draft final report to the EXECUTIVE ADMINISTRATOR no later than the STUDY COMPLETION DATE. The draft final report will include the scope of work; a description of the research performed; the methodology and materials used; any diagrams or graphics used to explain the procedures related to the study; any data collected; an electronic copy of any computer programs, maps, or models along with an operations manual and any sample data set(s) developed under the terms of this CONTRACT; analysis of the research results; conclusions and recommendations; a list of references, a Table of Contents, List of Figures, List of Tables, an Executive Summary, and any other pertinent information. All final reports should be prepared according to Exhibit D, Guidelines for Authors Submitting Contract Reports to the Texas Water Development Board. After a 30-day review period, the EXECUTIVE ADMINISTRATOR will return review comments to the CONTRACTOR.

4. The CONTRACTOR will consider incorporating comments from the EXECUTIVE ADMINISTRATOR and other commentors on the draft final report into a final report. The CONTRACTOR will include a copy of the EXECUTIVE ADMINISTRATOR's comments in the final report. The CONTRACTOR will submit one (1) electronic copy of the entire final report in Portable Document Format (PDF) and five (5) bound double- sided copies of the final report to the EXECUTIVE ADMINISTRATOR no later than the sixty days (60) after the STUDY COMPLETION DATE.

5. The CONTRACTOR will submit one (1) electronic copy of any computer programs or models and an operations manual developed under the terms of this CONTRACT. In compliance with Texas Administrative Code Chapters 206 and 213 (related to Accessibility and Usability of State Web Sites), the digital copy of the final report will comply with the requirements and standards specified in statute. After a 30-day review period, the EXECUTIVE ADMINISTRATOR will either accept or reject the final report. If the final report is rejected, the rejection letter sent to the CONTRACTOR shall state the reasons for rejection and the steps the CONTRACTOR need to take to have the final report accepted and the retainage released.

6. The CONTRACTOR will submit the most recent progress report with submittal of payments according to the PAYMENT SUBMISSION SCHEDULE. Progress reports shall be in written form and shall include a brief statement of the overall progress

made since the last status report; a brief description of any problems that have been encountered during the previous reporting period that will affect the study, delay the timely completion of any portion of this CONTRACT, inhibit the completion of or cause a change in any of the study's products or objectives; and a description of any action the CONTRACTOR plans to take to correct any problems that have been encountered.

7. The EXECUTIVE ADMINISTRATOR can extend the STUDY COMPLETION DATE and the CONTRACT EXPIRATION DATE upon written approval. The CONTRACTOR should notify the EXECUTIVE ADMINISTRATOR in writing within ten (10) working days prior to the STUDY COMPLETION DATE or thirty (30) days prior to the CONTRACT EXPIRATION DATE that the CONTRACTOR is requesting an extension to the respective dates.

ARTICLE IV. COMPENSATION AND REIMBURSEMENT

1. The TWDB agrees to compensate and reimburse the CONTRACTOR in a total amount not to exceed the TWDB's SHARE OF THE TOTAL STUDY COSTS for costs incurred and paid by the CONTRACTOR pursuant to performance of this CONTRACT. The CONTRACTOR will contribute local matching funds, if applicable, in sources and amounts defined as the LOCAL SHARE OF THE TOTAL STUDY COSTS. The TWDB shall reimburse the CONTRACTOR for one hundred percent (100%) of the TWDB's share of each invoice pending the CONTRACTOR's performance up to ninety percent (90%) of the total funding costs. Upon completion of a Final Report, and written acceptance of said Final Report by the EXECUTIVE ADMINISTRATOR, the TWDB shall pay the remaining ten percent (10%) to the CONTRACTOR upon submission of a final invoice.

2. The CONTRACTOR shall submit payments and documentation for reimbursement billing according to the PAYMENT SUBMISSION SCHEDULE and in accordance with the approved task and expense budgets contained in Exhibit C to this CONTRACT. The CONTRACTOR has budget flexibility within task and expense budget categories to the extent that the resulting change in amount in any one task or expense category does not exceed 35% of the total authorized amount by this CONTRACT for the task or category. Larger deviations shall require approval by EXECUTIVE ADMINISTRATOR or designee which will be documented through an Approved Budget Memorandum to the TWDB contract file. The CONTRACTOR will be required to provide written explanation for the overage and reallocation of the task and expense amount.

   For all reimbursement billings including any subcontractor's expenses, the EXECUTIVE ADMINISTRATOR must have determined that the REQUIRED INTERLOCAL AGREEMENT(S) and contracts or agreements between the CONTRACTOR and the subcontractor are consistent with the terms of this CONTRACT. The CONTRACTOR is fully responsible for paying all charges by subcontractors prior to reimbursement by the TWDB.

3. The CONTRACTOR and its subcontractors shall maintain satisfactory financial accounting documents and records, including copies of invoices and receipts, and shall make them available for examination and audit by the EXECUTIVE ADMINISTRATOR. Accounting by the CONTRACTOR and its subcontractors shall be in a manner consistent with Generally Accepted Accounting Principles.

4. By executing this CONTRACT, the CONTRACTOR accepts the authority of the State Auditor's Office, under direction of the legislative audit committee, to conduct audits and investigations in connection with any and all state funds received pursuant to this contract. The CONTRACTOR shall comply with and cooperate in any such investigation or audit. The CONTRACTOR agrees to provide the State Auditor with access to any information the State Auditor considers relevant to the investigation or audit. The CONTRACTOR also agrees to include a provision in any subcontract related to this CONTRACT that requires the subcontractor to submit to audits and investigation by the State Auditor's Office in connection with any and all state funds received pursuant to the subcontract.

5. The CONTRACTOR shall submit a progress report as described in Article II, Item 3 and the following documentation which documents the TOTAL STUDY COSTS for the reporting period even if the TOTAL STUDY COSTS is zero for reimbursement by the TWDB to the CONTRACTOR for the TWDB's SHARE OF THE TOTAL STUDY COSTS shall be submitted by the CONTRACTOR to the EXECUTIVE ADMINISTRATOR for reimbursement billing:

   A. Completed and Signed Payment Request Checklist which includes the following:
   (1) TWDB CONTRACT Number;
   (2) Billing period; beginning (date) to ending date;
   (3) Total Expenses for this period;
   (4) Total In-kind services;
   (5) Less LOCAL SHARE OF THE TOTAL STUDY COSTS for the billing period;
   (6) Total TWDB's SHARE OF THE TOTAL STUDY COSTS for the billing period;
   (7) Amount of retainage to be withheld for the billing period;
   (8) Total costs to be reimbursed by the TWDB for the billing period; and
   (9) Certification, signed by the CONTRACTOR's authorized representative, that the expenses submitted for the billing period are a true and correct representation of amounts paid for work performed directly related to this contract.

   B. For direct expenses incurred by the CONTRACTOR other than subcontracted work:
   (1) A spreadsheet showing the tasks that were performed; the percent and cost of each task completed; a total cost figure for each direct expense category including labor, fringe, overhead, travel, and other expenses such as

communication and postage, technical and computer services, expendable supplies, printing and reproduction; and
(2) Copies of detailed, itemized invoices/receipts for other expenses (credit card summary receipts or statements are not acceptable).

C. For direct expenses incurred by the CONTRACTOR for subcontracted work:
(1) Copies of invoices from the subcontractors to the CONTRACTOR;
(2) A spreadsheet showing the tasks that were performed; the percent and cost of each task completed; a total cost figure for each direct expense category including labor, fringe, overhead, travel, and other expenses such as communication and postage, technical and computer services, expendable supplies, printing and reproduction; and the total dollar amount due to the consultant; and
(3) Copies of detailed, itemized invoices/receipts for other expenses (credit card summary receipts or statements are not acceptable).

D. For travel expenses for the CONTRACTOR and/or subcontractor(s) –
(1) Names, dates, work locations, time periods at work locations, itemization of subsistence expenses of each employee, limited, however, to travel expenses authorized for state employees by the General Appropriations Act, Tex. Leg. Regular Session, 2015, Article IX, Part 5, as amended or superceded. Receipts required for lodging;
(2) Copies of invoices or tickets for transportation costs or, if not available, names, dates, and points of travel of individuals; and
(3) All other reimbursable travel expenses -- invoices or purchase vouchers showing reason for expense with receipts to evidence the amount incurred.

6. Incomplete requests will be returned to the CONTRACTOR if deficiencies are not resolved within ten (10) business days.

7. If for some reason the reimbursement request cannot be processed due to the need for an amendment to the CONTRACT, the CONTRACTOR will be required to resubmit the Payment Request Checklist dated after the execution of the amendment.

8. The CONTRACTOR is responsible for any food or entertainment expenses incurred by its own organization or that of its subcontractors, outside that of the travel expenses authorized and approved by the State of Texas under this CONTRACT.

9. A compliance report in accordance with Texas Administrative Code (TAC) Title 1, Part 5, Chapter 111, Subchapter B, Rule §111.14:, The CONTRACTOR shall maintain business records documenting its compliance with the approved Historically Underutilized Business subcontracting plan in the format prescribed by the Texas Procurement and Support Services (Exhibit F). The compliance reports must include payment information on all HUB and non-HUB subcontractors. Submittal of these monthly compliance reports is required as a condition of payment.

The TWDB will monitor the HUB subcontracting plan monthly to ensure the value of the subcontracts meets or exceeds the HUB subcontracting provisions specified in the contract. CONTRACTOR who fails to implement the HUB subcontracting plan in good faith will be reported to Texas Procurement and Support Services. The TWDB may revoke the contract for breach of contract and make a claim against the contractor.

ARTICLE V. INTELLECTUAL PROPERTY: OWNERSHIP, PUBLICATION, AND ACKNOWLEDGMENT

1. "Use" of a work product, whether a CONTRACTOR Works, a Subcontractor Works or otherwise, shall mean and include, without limitation hereby, any lawful use, copying or dissemination of the work product, or any lawful development, use, copying or dissemination of derivative works of the work product, in any media or forms, whether now known or later existing.

2. "No Compensation Obligation" shall mean there is no obligation on the part of one co-owner or licensee of a work, whether a CONTRACTOR Works, a Subcontractor Works or otherwise, to compensate other co-owners, licensees or licensors of the work for any use of the work by the using co-owner or licensee, including but not limited to compensation for or in the form of: royalties; co-owner or licensee accounting; sharing of revenues or profits among co-owners, licensees or licensors; or any other form of compensation to the other co-owners, licensees or licensors on account of any use of the work.

3. "Dissemination" shall include, without limitation hereby, any and all manner of: physical distribution; publication; broadcast; electronic transmission; internet streaming; posting on the Internet or world wide web; or any other form of communication, transmission, distribution, sending or providing, in any forms or formats, and in or using any media, whether now known or later existing.

4. The TWDB shall have an unlimited, unrestricted, perpetual, irrevocable, non-exclusive royalty-free right to access and receive in usable form and format, and to use all technical or other data or information developed by CONTRACTOR and Subcontractor in, or otherwise resulting from, the performance of services under this CONTRACT.

5. For purposes of this Article, "CONTRACTOR Works" are work products developed by CONTRACTOR and Subcontractor using funds provided under this CONTRACT or otherwise rendered in or related to the performance in whole or part of this CONTRACT, including but not limited to reports, drafts of reports, or other material, data, drawings, studies, analyses, notes, plans, computer programs and codes, or other work products, whether final or intermediate.

    a. It is agreed that all CONTRACTOR Works shall be the joint property of the TWDB and CONTRACTOR.

b. The parties hereby agree that, if recognized as such by applicable law, the CONTRACTOR Works are intended to and shall be works-made-for-hire with joint ownership between the TWDB and CONTRACTOR as such works are created in whole or part.

c. If the CONTRACTOR Works do not qualify as works-made-for-hire under applicable law, CONTRACTOR hereby conveys co-ownership of such works to the TWDB as they are created in whole or part. If present conveyance is ineffective under applicable law, CONTRACTOR agree to convey a co-ownership interest of the CONTRACTOR Works to the TWDB after creation in whole or part of such works, and to provide written documentation of such conveyance upon request by the TWDB.

d. The TWDB and CONTRACTOR acknowledge that the copyright in and to a copyrightable CONTRACTOR Work subsists upon creation of the CONTRACTOR Work and its fixing in any tangible medium. CONTRACTOR or the TWDB may register the copyrights to such Works jointly in the names of the CONTRACTOR and the TWDB.

e. The TWDB and CONTRACTOR each shall have full and unrestricted rights to use a CONTRACTOR Work with No Compensation Obligation.

6. For purposes of this Article, "Subcontractor Works" include all work product developed in whole or part by or on behalf of Subcontractors engaged by CONTRACTOR to perform work for or on behalf of any CONTRACTOR under this CONTRACT (or by the Subcontractors' Subcontractors hereunder, and so on). CONTRACTOR shall secure in writing from any Subcontractors so engaged:

a. unlimited, unrestricted, perpetual, irrevocable, royalty-free rights of the TWDB (and, if desired, of CONTRACTOR) to access and receive, and to use, any and all technical or other data or information developed in or resulting from the performance of services under such engagement, with No Compensation Obligation; and either

b. assignment by the Subcontractor to the TWDB (and, if desired by them, jointly to the CONTRACTOR) of ownership (or joint ownership with the Subcontractor) of all Subcontractor Works, with No Compensation Obligation; or

c. grant by Subcontractor of a non-exclusive, unrestricted, unlimited, perpetual, irrevocable, world-wide, royalty-free license to the TWDB (and, if desired by them, the CONTRACTOR) to use any and all Subcontractor Works, including the right to sublicense use to third parties, with No Compensation Obligation.

7. No unauthorized patents. CONTRACTOR Works and Subcontractor Works or other work product developed or created in the performance of this CONTRACT or

otherwise using funds provided hereunder shall not be patented by CONTRACTOR or their Subcontractor unless the EXECUTIVE ADMINISTRATOR consents in writing to submission of an application for patent on such works; and provided that, unless otherwise agreed in writing, any application made for patent shall include and name the TWDB (and, as applicable and desired by them, CONTRACTOR) as co-owners of the patented work:

a. no patent granted shall in any way limit, or be used by CONTRACTOR or Subcontractor to limit or bar the TWDB's rights hereunder to access and receive in useable form and format, and right to use, any and all technical or other data or information developed in or resulting from performance pursuant to this CONTRACT or the use of funds provided hereunder; and

b. the TWDB (and, if applicable, the CONTRACTOR) shall have No Compensation Obligation to any other co-owners or licensees of any such patented work, unless otherwise expressly agreed in writing.

8. CONTRACTOR shall include terms and conditions in all contracts or other engagement agreements with any Subcontractors as are necessary to secure these rights and protections for the TWDB; and shall require that their Subcontractors include similar such terms and conditions in any contracts or other engagements with their Subcontractors. For the purposes of this section, "Subcontractors" includes independent contractors (including consultants) and also employees working outside the course and scope of employment.

9. Any work products subject to a TWDB copyright or joint copyright and produced or developed by the CONTRACTOR or their Subcontractor pursuant to this CONTRACT or using any funding provided by the TWDB may be reproduced in any media, forms or formats by the TWDB or CONTRACTOR at their own cost, and be disseminated in any medium, format or form by any party at its sole cost and in its sole discretion. CONTRACTOR may utilize such work products as they may deem appropriate, including Dissemination of such work products or parts thereof under their own name, provided that any TWDB copyright is noted on the materials.

10. The CONTRACTOR agrees to acknowledge the TWDB in any news releases or other publications relating to the work performed under this CONTRACT.

ARTICLE VI. AMENDMENT, TERMINATION, AND STOP ORDERS

1. This CONTRACT may be altered or amended by mutual written consent or terminated by the EXECUTIVE ADMINISTRATOR at any time by written notice to the CONTRACTOR. Upon receipt of such termination notice, the CONTRACTOR shall, unless the notice directs otherwise, immediately discontinue all work in connection with the performance of this CONTRACT and shall proceed to cancel promptly all existing orders insofar as such orders are chargeable to this CONTRACT. The CONTRACTOR shall submit a statement showing in detail the work performed under this CONTRACT

to the date of termination. The TWDB shall then pay the CONTRACTOR promptly that proportion of the prescribed fee, which applies to the work, actually performed under this CONTRACT, less all payments that have been previously made. Thereupon, copies of all work accomplished under this CONTRACT shall be delivered to the TWDB.

2. The EXECUTIVE ADMINISTRATOR may issue a Stop Work Order to the CONTRACTOR at any time. Upon receipt of such order, the CONTRACTOR shall discontinue all work under this CONTRACT and cancel all orders pursuant to this CONTRACT, unless the order directs otherwise. If the EXECUTIVE ADMINISTRATOR does not issue a Restart Order within 60 days after receipt by the CONTRACTOR of the Stop Work Order, the CONTRACTOR shall regard this CONTRACT terminated in accordance with the foregoing provisions.

ARTICLE VII. SUBCONTRACTS

Each Subcontract entered into to perform required work under this CONTRACT shall contain the following provisions:

a. a detailed budget estimate with specific cost details for each task or specific item of work to be performed by the Subcontractor and for each category of reimbursable expenses;

b. a clause stating that the Subcontract is subject to audit by the Texas State Auditor's Office and requiring the Subcontractor to cooperate with any request for information from the Texas State Auditor, as further described in Article X, Section 1, Paragraph D hereof;

c. a clause stating that payments under the Subcontract are contingent upon the appropriation of funds by the Texas Legislature, as further described in Article X, Section 1, Paragraph A hereof;

d. a clause stating that ownership of data, materials and work papers, in any media, that is gathered, compiled, adapted for use, or generated by the Subcontractor or the CONTRACTOR shall become data, materials and work owned by the TWDB and that Subcontractor shall have no proprietary rights in such data, materials and work papers, except as further described in Article V hereof;

e. a clause stating that Subcontractor shall keep timely and accurate books and records of accounts according to generally acceptable accounting principles as further described in Article X, Section 2, Paragraph G;

f. a clause stating that Subcontractor is solely responsible for securing all required licenses and permits from local, state and federal governmental entities and that Subcontractor is solely responsible for obtaining sufficient insurance in accordance with the general standards and practices of the industry or governmental entity; and

g. a clause stating that Subcontractor is an independent contractor and that the TWDB shall have no liability resulting from any failure of Subcontractor that results in breach of CONTRACT, property damage, personal injury or death.

ARTICLE VIII. LICENSES, PERMIT, AND INSURANCE

1. For the purpose of this CONTRACT, the CONTRACTOR will be considered an independent contractor and therefore solely responsible for liability resulting from negligent acts or omissions. The CONTRACTOR shall obtain all necessary insurance, in the judgment of the CONTRACTOR, to protect themselves, the TWDB, and employees and officials of the TWDB from liability arising out of this CONTRACT.

2. The CONTRACTOR shall be solely and entirely responsible for procuring all appropriate licenses and permits, which may be required by any competent authority for the CONTRACTOR to perform the subject work.

3. Indemnification. The CONTRACTOR shall indemnify and hold the TWDB and the State of Texas harmless, to the extent the CONTRACTOR may do so in accordance with state law, from any and all losses, damages, liability, or claims therefore, on account of personal injury, death, or property damage of any nature whatsoever caused by the CONTRACTOR, arising out of the activities and work conducted pursuant to this CONTRACT. The CONTRACTOR is solely responsible for liability arising out of its negligent acts or omissions during the performance of this CONTRACT.

ARTICLE IX. SEVERANCE PROVISIONS

Should any one or more provisions of this CONTRACT be held to be null, void, voidable, or for any reason whatsoever, of no force and effect, such provision(s) shall be construed as severable from the remainder of this CONTRACT and shall not affect the validity of all other provisions of this CONTRACT which shall remain of full force and effect.

ARTICLE X. GENERAL TERMS AND CONDITIONS

1. GENERAL TERMS.

   a. No Debt Against the State. This CONTRACT does not create any debt by or on behalf of the State of Texas and the TWDB. The TWDB's obligations under this CONTRACT are contingent upon the availability of appropriated funds and the continued legal authority of the TWDB to enter into this CONTRACT.

   b. Independent Contractor. Both parties hereto, in the performance of this contract, shall act in an individual capacity and not as agents, employees, partners, joint ventures or associates of one another. The employees or agents of one party shall not be deemed or construed to be the employees or agents of the other party for any purposes whatsoever.

c. Procurement Laws. The CONTRACTOR shall comply with applicable State of Texas procurement laws, rules and policies, including but not limited to competitive bidding and the Professional Services Procurement Act, Government Code, Chapter 2254, relating to contracting with persons whose services are within the scope of practice of: accountants, architects, landscape architects, land surveyors, medical doctors, optometrists, professional engineers, real estate appraisers, professional nurses, and certified public accountants.

d. Right to Audit. The CONTRACTOR and its Subcontractors shall maintain all financial accounting documents and records, including copies of all invoices and receipts for expenditures, relating to the work under this CONTRACT. CONTRACTOR shall make such documents and records available for examination and audit by the EXECUTIVE ADMINISTRATOR or any other authorized entity of the State of Texas. CONTRACTOR'S financial accounting documents and records shall be kept and maintained in accordance with generally accepted accounting principles. By executing this CONTRACT, the CONTRACTOR accepts the authority of the Texas State Auditor's Office to conduct audits and investigations in connection with all state funds received pursuant to this CONTRACT. The CONTRACTOR shall comply with directives from the Texas State Auditor and shall cooperate in any such investigation or audit. The CONTRACTOR agrees to provide the Texas State Auditor with access to any information the Texas State Auditor considers relevant to the investigation or audit. The CONTRACTOR also agrees to include a provision in any Subcontract related to this CONTRACT that requires the Subcontractor to submit to audits and investigation by the State Auditor's Office in connection with all state funds received pursuant to the Subcontract.

e. Force Majeure. Unless otherwise provided, neither CONTRACTOR nor the TWDB nor any agency of the State of Texas, shall be liable to the other for any delay in, or failure of performance, of a requirement contained in this CONTRACT caused by force majeure. The existence of such causes of delay or failure shall extend the period of performance until after the causes of delay or failure have been removed provided the non-performing party exercises all reasonable due diligence to perform. Force majeure is defined as acts of God, war, strike, fires, explosions, or other causes that are beyond the reasonable control of either party and that by exercise of due foresight such party could not reasonably have been expected to avoid, and which, by the exercise of all reasonable due diligence, such party is unable to overcome. Each party must inform the other in writing with proof of receipt within two (2) business days of the existence of such force majeure or otherwise waive this right as a defense.

2. STANDARDS OF PERFORMANCE.

a. Personnel. CONTRACTOR shall assign only qualified personnel to perform the services required under this CONTRACT. CONTRACTOR shall be responsible for ensuring that any Subcontractor utilized shall also assign only qualified personnel. Qualified personnel are persons who are properly licensed to perform the work and who have sufficient knowledge, skills and ability to perform the tasks and services required herein according to the standards of performance and care for their trade or profession.

b. Professional Standards. CONTRACTOR shall provide the services and deliverables in accordance with applicable professional standards. CONTRACTOR represents and warrants that he is authorized to acquire Subcontractors with the requisite qualifications, experience, personnel and other resources to perform in the manner required by this CONTRACT.

c. Antitrust. CONTRACTOR represents and warrants that neither CONTRACTOR nor any firm, corporation, partnership, or institution represented by CONTRACTOR, or anyone acting for such firm, corporation, partnership, or institution has (1) violated the antitrust laws of the State of Texas under the Texas Business & Commerce Code, Chapter 15, of the federal antitrust laws; or (2) communicated directly or indirectly the proposal resulting in this CONTRACT to any competitor or other person engaged in such line of business during the procurement process for this CONTRACT.

d. Conflict of Interest. CONTRACTOR represents and warrants that CONTRACTOR has no actual or potential conflicts of interest in providing the deliverables required by this CONTRACT to the State of Texas and the TWDB. CONTRACTOR represents that the provision of services under this CONTRACT will not create an appearance of impropriety. CONTRACTOR also represents and warrants that, during the term of this CONTRACT, CONTRACTOR will immediately notify the TWDB, in writing, of any potential conflict of interest that could adversely affect the TWDB by creating the appearance of a conflict of interest.
CONTRACTOR represents and warrants that neither CONTRACTOR nor any person or entity that will participate financially in this CONTRACT has received compensation from the TWDB or any agency of the State of Texas for participation in the preparation of specifications for this CONTRACT. CONTRACTOR represents and warrants that he has not given, offered to give, and does not intend to give at any time hereafter, any economic opportunity, future employment, gift, loan, gratuity, special discount, trip, favor or service to any public servant in connection with this CONTRACT.

e. Interested Parties. All non-governmental CONTRACTORS are required to submit a Certificate of Interested Parties at the time the signed contract is submitted to the TWDB. The Certificate of Interested Parties (Form 1295) is a

sworn statement by the contracting business entity and must be submitted even if there is no interested party in the transaction. The Form 1295 and instructions for completing and submitting the form are available at: https://www.ethics.state.tx.us/tec/1295-Info.htm. The TWDB is prohibited from executing a contract unless the contracting business entity submits a completed Form 1295.

f. Proprietary and Confidential Information. CONTRACTOR warrants and represents that any information that is proprietary or confidential, and is received by CONTRACTOR from the TWDB or any governmental entity, shall not be disclosed to third parties without the written consent of the TWDB or applicable governmental entity, whose consent shall not be unreasonably withheld.

g. Public Information Act. CONTRACTOR acknowledges and agrees that all documents, in any media, generated in the performance of work conducted under this CONTRACT are subject to public disclosure under the Public Information Act, Government Code, Chapter 552. CONTRACTOR shall produce all documents upon request of the TWDB within two (2) business days when the documents are required to comply with a request for information under the Public Information Act.

h. Accurate and Timely Record Keeping. CONTRACTOR warrants and represents that he will keep timely, accurate and honest books and records relating to the work performed and the payments received under this CONTRACT according to generally accepted accounting standards. Further, CONTRACTOR agrees that he will create such books and records at or about the time the transaction reflected in the books and records occurs.

i. Dispute Resolution. The CONTRACTOR and the TWDB agree to make a good faith effort to resolve any dispute relating to the work required under this CONTRACT through negotiation and mediation as provided by Government Code, Chapter 2260 relating to resolution of certain contract claims against the state. The CONTRACTOR and the TWDB further agree that they shall attempt to use any method of alternative dispute resolution mutually agreed upon to resolve any dispute arising under this CONTRACT if this CONTRACT is not subject to Chapter 2260.

j. Contract Administration. The TWDB shall designate a project manager for this CONTRACT. The project manager will serve as the point of contact between the TWDB and CONTRACTOR. The TWDB's project manager shall supervise the TWDB's review of CONTRACTOR's technical work, deliverables, draft reports, the final report, payment requests, schedules, financial and budget administration, and similar matters. The project manager does not have any express or implied authority to vary the terms of the

ARTICLE XI. CORRESPONDENCE

All correspondence between the parties shall be made to the following addresses:

For the **TWDB**:

Contract Issues:
Texas Water Development Board
Attention: Contract Administration P.O.
P.O. Box 13231
Austin, Texas 78711-3231
Email: contracts@twdb.texas.gov

Payment Request Submission: Texas Water Development Board Attention:
Accounts Payable
P.O. Box 13231
Austin, Texas 78711-3231
Email: invoice@twdb.texas.gov

Physical Address:
Stephen F. Austin State Office Building
1700 N. Congress Avenue
Austin, Texas 78701

For the **CONTRACTOR:**

Contract Issues:
Aqua Strategies Inc.
14101 Hwy 290 West, Suite 1400B
Austin, TX 78737
Attention: Barney Austin, Ph.D., P.E.
Email: info@aquastrategies.com

Payment Request Submission:
Aqua Strategies Inc.
14101 Hwy 290 West, Suite 1400B
Austin, TX 78737
Attention: Barney Austin, Ph.D., P.E.
Email: info@aquastrategies.com

Physical Address:
Aqua Strategies Inc.
14101 Hwy 290 West, Suite 1400B
Austin, TX 78737

IN WITNESS WHEREOF, the parties have caused this CONTRACT to be duly executed in multiple originals.

TEXAS WATER DEVELOPMENT BOARD

Jeff Walker
Executive Administrator

Date: 11-1-16

AQUA STRATEGIES INC.

Barney Austin, Ph.D., P.E.
President and CEO

Date: 10/7/16

EXHIBIT A

ORIGINAL GRANT APPLICATION

AquaStrategies

vieux & ASSOCIATES

May 31, 2016

Texas Water Development Board
6th Floor Reception Desk
1700 North Congress Avenue
Austin, TX 78701

RE: Transmittal letter for response to 580-16-RFQ0023

Dear Texas Water Development Board:

The joint venture, Aqua-Strategies and Vieux & Associates, Inc., is pleased to present our statement of qualifications for the above referenced RFQ. The team expertise and unique capabilities complement one another. Our team excels in understanding of the problem, and with providing solutions involving weather and stream gauge monitoring networks, hydro-meteorological conditions and flood-prone areas in Texas, and flood forecasting systems.

The strengths brought to the team by Aqua Strategies are four Texas water resources engineers, an engineer in training, as well as administrative support. Projects have taken us across the State of Texas involving stream gage installation, hydrologic field work, and subsequent water resources modeling. Vieux & Associates Inc. developed the real-time IT software infrastructure to integrate sensor and model information and provided operational flood forecasting that has supported the City of Austin Flood Early Warning System, since 2004. In Houston, a similar radar-based forecasting system for the Texas Medical Center/Rice University has been operated by Vieux, since 1997. They bring to the team a wealth of experience in flood forecasting, which relies on floodplain mapping, stream gage monitoring, and analysis of radar and raingage data for Texas communities.

We have outlined an analytical framework that will provide a defensible prioritization for needed stream gages and weather stations. A comprehensive distributed model of the stream network affecting the State will be applied across the entire state, helping to assess site suitability and achieve flood warning lead time. Through application of requested criteria and the analytical framework, TWDB will gain confidence in the proposed stream gage location, and its ability to help warn downstream residences and businesses in communities subjected to flood threats. Accomplishing this task will necessarily involve key agencies, namely the Texas Water Development Board, National Weather Service, and the US Geological Survey. Coordination with the NWS forecasters, who will utilize real-time stream gage data for warning purposes, helps ensure that the new locations will be efficiently integrated and used beneficially to warn communities not currently served with adequate flood warning services.

The team is excited to apply our experience, knowledge, and abilities to meet or exceed TWDB expectations. We are confident that our qualifications and the proposed approach will lead to efficient development of enhanced stream gaging and flood warning services in the State of Texas, and help alleviate flood impacts that plague the state, even as we write this letter.

Sincerely,

Barney Austin

Texas Water Development Board

COPY

RESPONSE TO RFQ NO. 580-16-RFQ0023

IMPROVING HYDRO-METEOROLOGICAL FLOOD FORECASTING IN TEXAS

Tuesday May 31, 2016

AquaStrategies – vieux
Water Planning, Science & Engineering

Joint Venture

Table of Contents

Page

Content Item 1……..1

Content Item 2……..2

Content Item 3……..4

Content Item 4……..5

Content Item 5……..6

Content Item 6……..7

Appendix A: Individual resumes

Appendix B: HUB subcontracting plan

Appendix C: RFQ addendums

CONTENT ITEM 1

EXECUTION OF STATEMENT OF QUALIFICATIONS
to the
REQUEST FOR QUALIFICATIONS

Company Name: Aqua Strategies – Vieux & Associates Joint Venture

Address: 14101 Hwy 290 W, Suite 1400-B

Austin, TX 78737

Phone Number: (512) 826-2604

E-Mail: baustin@aquastrategies.com

I, Barney Austin, am the above-referenced company's representative and I am authorized to submit this response and sign future contract documents. By signing below, the representative certifies that if a Texas address is shown as the address, the respondent qualifies as a Texas Bidder as defined in 34 TAC Rule 20.32(68).

Authorized Signature

May 30, 2016
Date

President/CEO
Title:

CONTENT ITEM 2
COMPANY PROFILE SUMMARY AND HISTORY

I, Barney Austin, am pleased to present to the TWDB our Aqua Strategies – Vieux and Associates **Joint Venture**. I have authority to bind the company. Our expertise and capabilities complement one another well and our familiarity with the current monitoring network, hydro-meteorologic conditions in Texas, and flood forecasting systems enables us to be well qualified to perform the work described in the RFQ. Bios are presented below; short representative project descriptions are presented on the next page. My contact details are listed below, if you have any questions.

Aqua Strategies Inc. is a Texas-based water resources engineering corporation with headquarters in Austin, TX. Founded just over two years ago, we specialize in hydrology, open-channel hydraulics, environmental flows and water resources planning. Composed of four experienced Texas water resources engineers and one engineer in training as well as administrative support, our projects have taken us all over the state, through field work and subsequent numerical modeling. Furthermore, our staff have experience more specifically related to flood forecasting and floodplain mapping, stream gage installation and operation, and analysis of radar and raingage data. Our office is located within a few yards of Dripping Springs, some 15 miles from Wimberley where our staff and their families volunteered in post-flood cleanup efforts last year and where we saw first-hand the devastation that can be caused by severe flooding events.

AquaStrategies
Water Planning, Science & Engineering

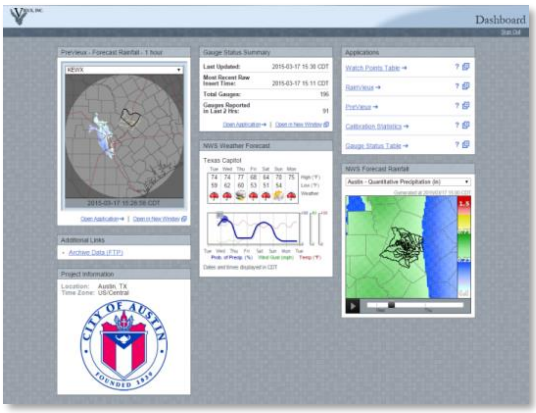
14101 Hwy 290 W, Suite 1400-B
Austin, TX 78737
www.aquastrategies.com
Phone: (512) 826-2604
Contact email: baustin@aquastrategies.com

Vieux & Associates, Inc. is an engineering and technology firm specialized in flood forecasting with high-resolution radar rainfall products and physics-based hydrologic modeling software and information services. Established in 1992, the firm is a woman-owned Oklahoma corporation with offices in Texas and Oklahoma. Vieux, Inc. builds and applies software that provides value-added US National Weather Service-based rainfall information that supports the understanding of rainfall distribution. Our web-based services are supported by software that simulates how much runoff will occur based on current and forecast rainfall. With 10 employees, Vieux, Inc. is composed of four hydro-meteorologists, four software developers, a hydrologic/hydraulic engineer, and an environmental scientist/project manager. We specialize in radar rainfall estimation, modeling rainfall-runoff with physics-based distributed hydrologic model design, development of design storms from period of record, and provision of real-time flood warning and hydrologic information services. Vieux & Associates, Inc. has three contracts with the City of Austin, providing real-time radar rainfall and rainfall forecast data (our products and NWS products), mapping and modeling of runoff, and developing a portal (also called a graphical user interface and common operating system).

vieux

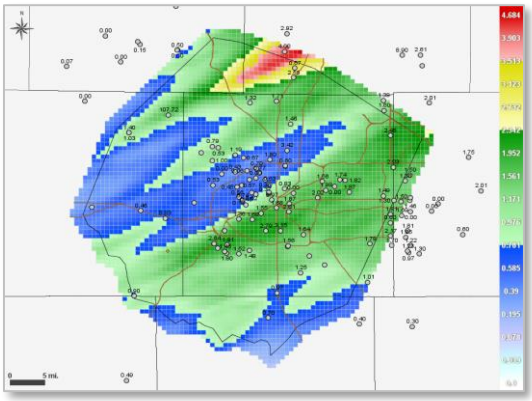
Vieux & Associates, Inc.
301 David L. Boren Blvd. Suite 3050
Norman, OK 73072
www.vieuxinc.com
Phone: (405) 325-1818
Contact Email: jean.vieux@vieuxinc.com

City of Austin Radar Rainfall and Hydrologic Services. 2004 – present. Vieux Inc. began providing Gauge Adjusted Radar Rainfall (GARR) to the City of Austin FEWS in 2004. This rainfall data was accessed for display, query and download using a graphical user interface called RainVieux that maps rainfall between gauges. Forecast rainfall was added by our service called PreVieux, a radar-based nowcasting algorithm used to alert FEWS staff when a basin is likely to receive 1.0 inch or more of rainfall. In 2007, we began delivering real-time hydrologic model simulations as a web-service using V*flo*®. Expanded basin modeling was added where we provide the maximum forecast depth of flooding and its time via XML to map 599 points of inundation. Because of the growing number of applications provided, there was a need for enhancements to web access. In 2016, Vieux began delivering forecast stage using *forecast rainfall*.



Advisory Committee on Water Information (ACWI). 2005-2008. Aqua Strategies Inc. During his tenure as Director of the Surface Water Resources Division at the TWDB, Dr. Austin represented the Western States Water Council on the USGS Advisory Committee on Water Information (ACWI). In addition to serving as main author and editor on the final report, Dr. Austin participated in many discussions related to the funding, prioritization and operation of stream gages across the nation.

Fort Worth Flood Warning System Study. 2010-2011. Vieux & Assoc, Inc. For 16 selected rainfall events, radar rainfall estimates at 1x1-km and 5-minute increments were generated using NWS level 2 radar rain gauge data. Vieux, Inc. calculated, analyzed and delivered storm return periods for each event in relation to flooded areas and rainfall depth and intensity distribution by stream/watershed and gridded rainfall maps for each event for use in hydrologic modeling. Results were delivered for use in stormwater modeling and for characterization of the NWS MPE. A separate report detailed data improvements and differences compared to the NWS Stage 3/MPE data achieved by careful QA/QC. Findings included the effects of using hourly NWS multi-sensor rainfall, which tended to reduce the more intense storm depths, and contain artifacts associated with improper or no QA/QC of rain gauge data included in MPE production by the NWS.



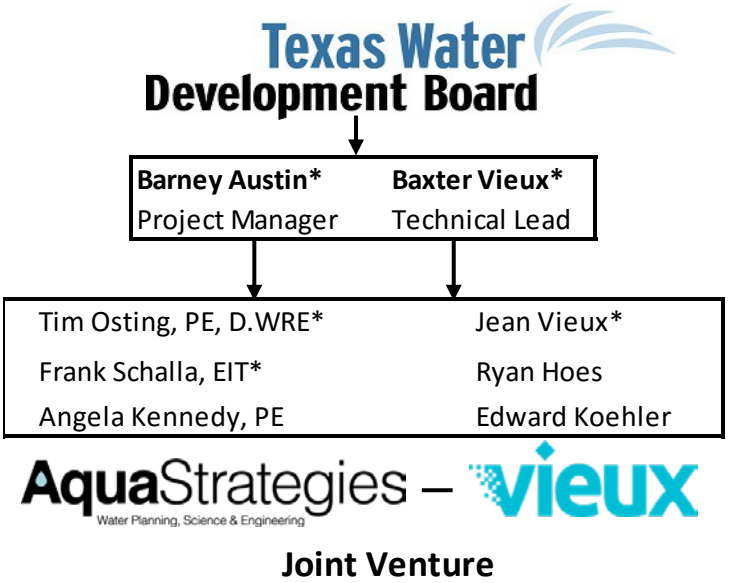
Radar-Based Estimation of Probable Maximum Precipitation and Flood. 1990-1995. Aqua Strategies Inc. In the UK, extreme flooding events usually involve a large-scale thunderstorm remaining stationary over a watershed for at least the Time to Peak (*Tp*). For this project a storm-tracking algorithm was developed for accumulating rainfall in the Lagrangian frame of reference, the assumption being that the observed moving rainfall event could have remained stationary under slightly different meteorologic conditions. These synthetic storms were applied over the watersheds of interest and routed through hydrologic and hydraulic models. Results of the study were summarized in Dr. Austin's PhD thesis and subsequently published in the form of a book and the approach is recommended in the latest UK Flood Estimation Handbook – a guide to engineers.

CONTENT ITEM 3
RESUMES OF INDIVIDUALS

For this Joint Venture, we have assembled a team of competent scientists, hydrologists, and engineers. The proposed Project Manager is Dr. Barney Austin; the Technical Lead offered is Dr. Baxter Vieux (see proposed organizational chart, below). Together we bring almost 60 years of experience to the table in rainfall-runoff modeling and remote sensing. Short biographies for the two project leaders are presented below; one-page résumés for the key team members (those highlighted with asterisks in the organizational chart) are presented in **Appendix A**. Although we present only eight names below, the company has access to other technical staff, as needed.

Barney Austin, PhD, PE, **[Project Manager]** has worked in the area of water resources for more than 24 years, specializing in water supply planning, hydrology, hydraulics, and environmental flows. He has actively participated in the development of state water plans in Texas, Oklahoma and California. In addition to directing a large and diverse group of scientists and engineers, Dr. Austin has managed many large projects and is the former director of the Surface Water Division of the Texas Water Development Board. His PhD thesis was on use of radar for estimating the Probable Maximum Precipitation for flood design – work that was published as a book by the UK Met Office. Dr. Austin has worked for government, academia and consulting firms, successfully bridging the gap between technical and non-technical stakeholders as well as the private and public sectors.

Baxter Vieux, PhD, PE, [Technical Lead] has been active in the fields of remote sensing and runoff forecasting for 35 years. He is experienced in the application of high-resolution rainfall monitoring to hydrologic forecasting, and hydraulic modeling. He oversees technology development for rainfall and runoff monitoring software and services. Dr. Vieux developed the first commercially available distributed hydrologic model, V*flo*™, US Patent No. 7,136,756-Method for determining runoff. He is co-author of the textbook, *Hydrology and Floodplain Analysis* in its 5th edition. Professional experience includes ten years in Kansas and Michigan with the USDA NRCS (formerly Soil Conservation Service) where he served as PL-566 Small Watershed Dam Project Engineer, Assistant State Engineer, and in his highest position as Acting State Engineer for NRCS in Michigan.



Joint Venture

CONTENT ITEM 4
HISTORICALLY UNDERUTILIZED BUSINESS SUBCONTRACTING PLAN

For this Statement of Qualifications, we have assembled a Joint Venture, composed of two firms: Aqua Strategies Inc. and Vieux & Associates, Inc. Aqua Strategies is a registered small business in Texas, operating out of South-West Austin, near Dripping Springs. Vieux & Associates is a woman-owned business, certified through the Women's Business Council and operating out of Norman, Oklahoma. Vieux has been certified as a Women Business Enterprise recently through several Texas-based organizations, including the City of Houston and the South Central Texas Regional Certification Agency, Vieux & Associates, Inc.

As assembled, the Aqua Strategies Inc. – Vieux & Associates, Inc. Joint Venture has the skills, expertise and capabilities to perform the describe scope of work without the need for subcontractors.

The HUB Subcontracting Plan Can be found in **Appendix B**.

CONTENT ITEM 5
OWNERSHIP OF BUSINESS ENTITY
Name(s) and Social Security Number(s) of Each Person with at least 25 Percent Ownership of the Business Entity Submitting the RFQ
(if applicable)

Barney Austin
Name

640-66-3281
Social Security Number

Jean Vieux
Name

511-62-4674
Social Security Number

Name

Social Security Number

Name

Social Security Number

CONTENT ITEM 6
TECHNICAL APPROACH

In the Technical Approach described below we propose an objective, analytical framework for identifying communities with the most pressing need for additional stream gages and weather stations, leading to improved flood forecasting services. The communities identified will be those that are not currently served or inadequately served by existing forecasting services. The approach described below, in Tasks A through D, will allow the TWDB to choose and justify recommendations for additional monitoring, with quantitative information provided on improved lead time that each monitoring station would provide for the identified communities. In addressing these tasks, we anticipate holding regular progress meetings with TWDB staff to seek guidance and input, and coordinate with the National Weather Service (NWS) and United States Geological Survey (USGS) in the decision process.

Task A. Identify communities with inadequate flood warning

The Advanced Hydrologic Prediction Service (AHPS), operated by NWS River Forecast Centers (RFCs), serves to mitigate economic losses by providing flood and drought forecasts at over 7,800 points across the United States. The NWS-AHPS system provides flow forecasts and flood warnings for needs including emergency response, flood control, reservoir operation and more. Forecasts may include how high a river might rise, when it will reach its peak, where property will be flooded, and how long the flooding will continue. Information provided to water managers and city officials supports decisions regarding evacuation of people and safeguarding goods, or using reservoir storage capacity and operations to reduce flood impacts. Unfortunately, there is insufficient coverage across Texas, leaving some communities vulnerable to flood as exemplified by the Memorial Day floods in Wimberley last year.

The location of NWS-AHPS monitoring and forecast points in Texas (Figure 1) will be used to identify communities near streams and rivers that have non-existent or poorly located stream monitoring and forecast points. We will also make use of the National Land Cover Database, satellite imagery, US Census maps of urban areas, and FEMA Insurance Rate Maps. We will exclude communities already covered by municipal flood warning systems, such as the City of Austin Flood Early Warning System, San Antonio River Authority, and Harris County Flood Control District. The vulnerable communities identified may include both unincorporated and incorporated areas. Areas in the peri-urban area or watersheds adjacent to existing flood forecasting services will be considered within the proposed analytical framework. Areas experiencing high development pressure, such as Hays, Travis and Williamson Counties, may not be served and could benefit from additional stream gage or weather station resources.

FEMA floodplain delineations are established for the majority of the state and serves as a guide for locating vulnerable communities. The extent of mapped flood hazard zones are static maps based on approximate methods or detailed hydraulic studies. While these zones do provide the extent of the flood elevation, they do not convey information about the lead time that could be achieved from addition of an upstream stream gage or flood forecasting. Existing HAZUS flood maps (Q3/DFIRM)

and repetitive loss properties from the RLP database information will be integrated within the analysis framework as geographic overlays.

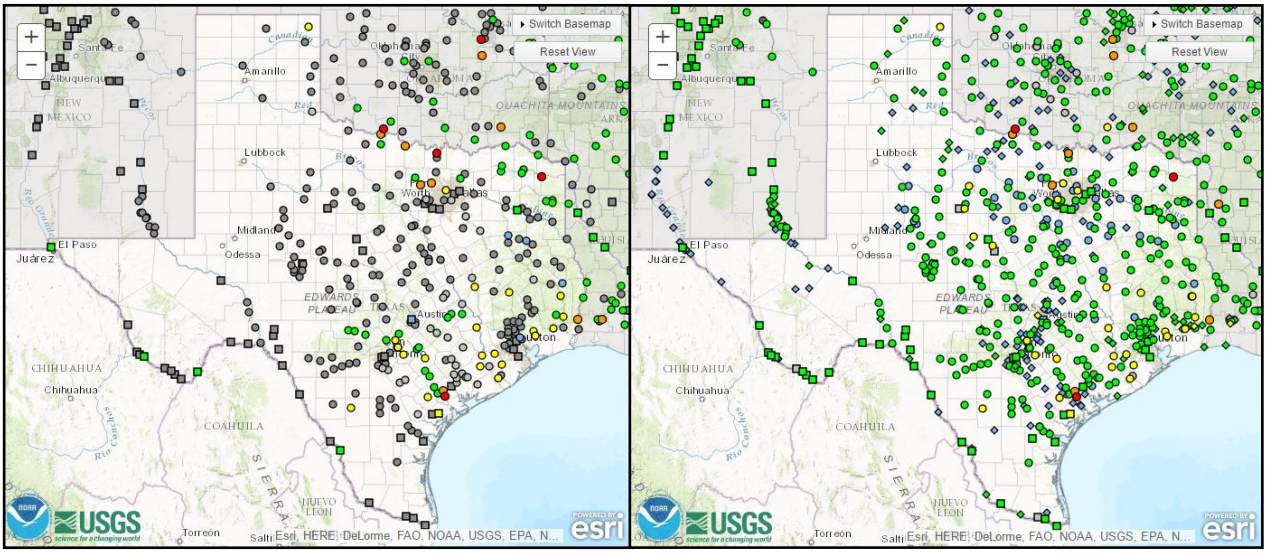


Figure 1. Current NWS-AHPS forecasting (left) and monitoring (right) locations in Texas.

Task B. Prioritize communities needing additional monitoring

Floods occur throughout Texas, but mostly in a region bounded by the Texas Hill Country to North Texas, and then East Texas, and south to the Gulf Coast. Along the border in the Rio Grande Valley, communities can receive prolonged and intense rainfall from remnants of tropical storms traveling inland (see Figure 2, for example). Eagle Pass and Maverick County are prime examples. In low-lying coastal areas, flooding can be influenced by storm surge from the Gulf as well as river flooding from the landward side, where low gradient rivers spill over, flooding areas of low-relief topography. Convergence of Gulf moisture with synoptic scale frontal systems or localized daytime heating can generate copious amounts of rainfall exemplified in Tropical Storm Allison in 2001, or during October, 1994, when heavy rainfall placed 34 counties in Presidential Disaster status.

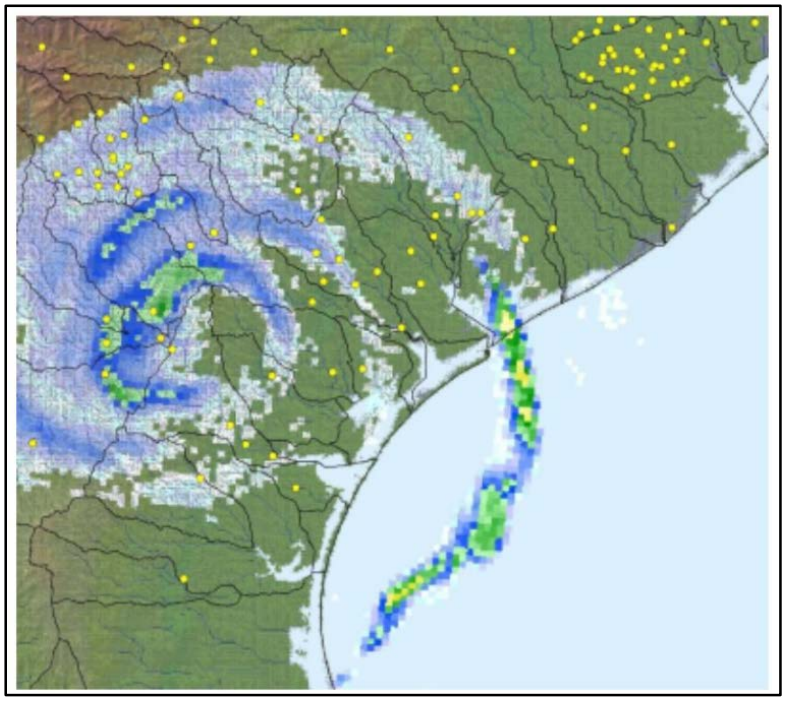


Figure 2. The remnants of Hurricane Claudette, July 14-15, 2003.

To prioritize the communities identified in Task A for new monitoring stations, we will consider factors such as propensity for flash floods, historical number of fatalities due to flooding, severe and

repetitive economic losses due to flooding, and population temporarily or permanently residing within designated Federal Emergency Management Agency flood hazard areas. Special attention will be given to communities or incorporated areas in Texas that experience repetitive losses based on FEMA 497 data. The Extreme Events database from the NOAA National Climatic Data Center will be also consulted.

Flood hazard areas will be overlaid with census tracks to identify populations at most risk. Because floods occur throughout Texas, special care will be taken to give each area its due consideration within a consistent framework. This will be accomplished by considering a range of information not limited to flood hazard areas already mapped, but taking into account comprehensive information to target areas in most need of enhanced flood forecasting resources. Communities at risk from dam breach or coastal flooding from storm surge represent flood hazards that may not improve from having additional stream gaging stations. Such risks will rank lower in terms of setting priorities, but will be addressed.

Task C. Identify where additional monitoring would improve flood forecasting

We believe the approach for identifying locations for additional stream gages should be different from that used to identify new locations for weather stations. As such we have divided this task into two parts.

Stream gages

The proposed analytical framework for prioritizing communities will utilize a rainfall-runoff model built on existing geospatial datasets. The model will help identify areas with short lag times between when heavy precipitation events occur and when flood crests inundate the communities being investigated. For the purposes of this proposal, an initial configuration will be implemented for all of Texas that combines GIS functions and geospatial data for measuring drainage area and streamflow routing with historic flood producing hydro-meteorological inputs. This physics-based conservation of mass modeling approach, is used by the City of Austin Flood Early Warning System to produce stage forecasts, but at much higher resolution. The model covers the entire state at a 1-km resolution, and uses National Hydrographic Database (NHDplus) flowlines to represent all segments of the stream network. To understand the lead time and improved forecast resulting from addition of an upstream stream gage, the use of a standard design storm or transposition of historic rainfall, such as the Wimberley, Texas storm event on May 23-24, 2015, will be applied across all the watersheds prioritized in Task B, individually. This analysis will help the team understand the potential benefits in terms of lead time associated with a proposed stream gage location. This model and the hydrometeorological input used in the analysis will be a deliverable to the TWDB.

To demonstrate the effectiveness of this approach, we developed a model for the Blanco River watershed. In the application of this approach, described in Figure 3, analysis shows that a 1 hour and 40-minute lead time is gained by installing a new stream gage in the Blanco River upstream of Wimberley, TX. The simulated hydrographs are produced using rain gage-adjusted radar rainfall from May 23-24, 2015. At the trial location (FM32 near Fisher), a boundary condition was set and then used to forecast downstream river conditions at Wimberley. The simulated upstream peak flow was 107,000 cfs at the proposed location, while the downstream peak was estimated at 159,000 cfs at the

USGS stream gage (08171000) with a flood wave exceeding 40 ft. The increase in flow is due to precipitation and inflow between the upstream and downstream stream gages. With the new lead time and proper warning there would be sufficient time to protect life and property and for the NWS to issue a flood warning, and emergency managers to mobilize and help protect residents in the path of the impending disaster. This approach will guide the selection and prioritization of new stream gage locations for communities vulnerable to flooding. We recognize that a new stream gage has already been installed at FM32 on the Blanco River (and two other locations in the Blanco watershed) and that is has been operational since January 2016. Our approach shows the benefits of that particular stream gage and that our approach can be used to facilitate placement and understanding the potential benefits gained from other sites across the state.

Appropriate locations for stream gages (typically bridges and other areas with easy access to the river) in each prioritized watershed will be identified and flows at these points will be simulated using the rainfall-runoff model. The simulated flows at each proposed monitoring site will then be compared to the flows simulated at the vulnerable community. The relative magnitude of the peak flows, the volume of water produced by the event, and the lead time provided by each possible stream gage location will be considered in determining the optimum location for the stream gage in each watershed. In the example described above, a stream gage much further up in the watershed would have provided more lead time to the citizens of Wimberley, but may not have helped determine the extreme magnitude of the flood.

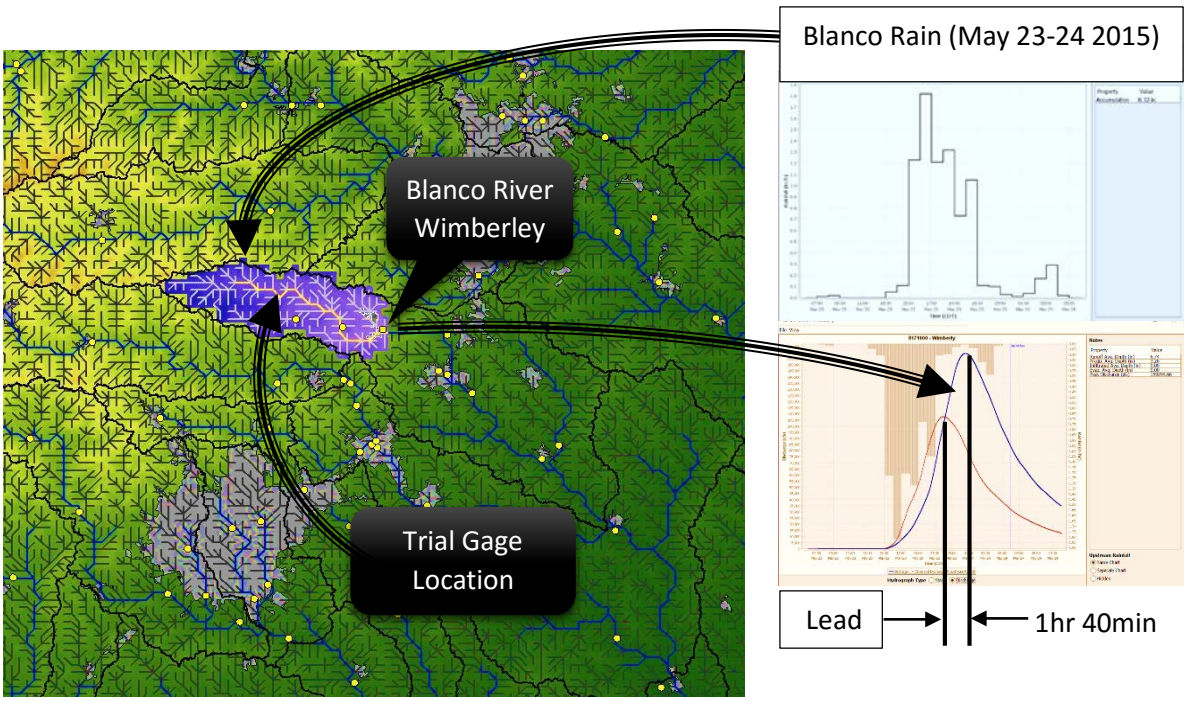


Figure 3. Analytical approach showing lead time gained by installing a new stream gage in the Blanco River at the FM32 crossing. Drainage network connections for each grid cell covering the State shown as dark gray; mapped locations of Census urban areas are shown in light gray, and AHPS stream gage locations in yellow.

It is important to note that the NWS only uses about 60 percent of the USGS real-time stream gages for flood forecasting purposes [Mark Null, Hydrologist-in-Charge, NWS River West Gulf River Forecast Center, Fort Worth, pers. comm.], so approximately 40 percent of active USGS stream gages are in locations that are not helpful for flood forecasting.

We will coordinate with the NWS West Gulf River Forecast Center forecasters to develop and prioritize possible locations additional stream gages that would beneficial. We understand that the NWS has already collaborated with the TWDB on prioritizing additional monitoring, however the focus of that effort was on identifying gaps in the network, rather than on identifying vulnerable communities and working backwards from there. We anticipate focusing our attention on urban areas and locations that pose significant potential for flood hazards, but we also want to make sure that the locations chosen have the potential to improve the NWS-AHPS, providing advanced flood warning to those vulnerable communities. This effort will build on the work done by the USGS, NWS, TWDB and others on prioritizing additional monitoring for improved flood forecasting.

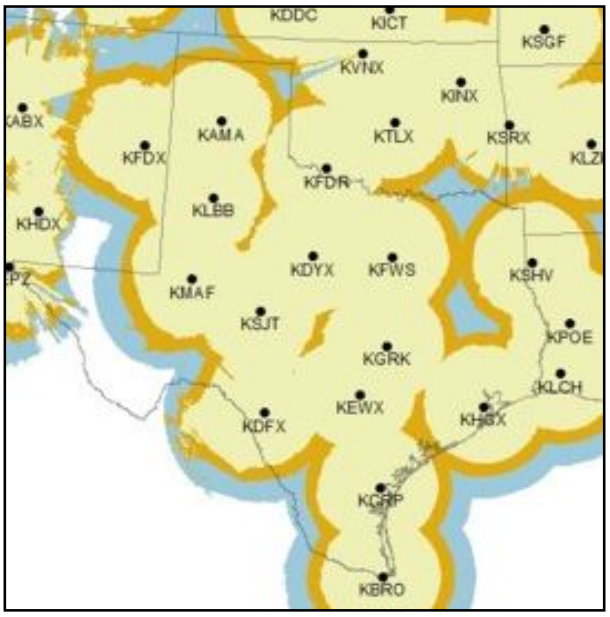
There are limited funds for new stream gages and the state appropriation will likely have to cover both installation of the stream gages and a least a portion of the ensuing operation and maintenance costs.

The USGS has a list of stream gage locations it considers high priority, developed through the National Streamflow Information Program (NSIP). Its criteria differs from those laid out in this RFQ, however there are two good reasons for at least considering this list of sites: a) the USGS has already investigated these sites and know they are suitable for installation of stream gages; and b) streamflow monitoring at these sites would serve other useful purposes. The criteria used by the USGS for choice of these sites include:

- Streamflow forecasting (including flood forecasting)
- Compacts and Decrees (interstate and international boundaries)
- Major River Basin outflows
- Sentinel Watersheds
- Water Quality Monitoring

Rain Gages

Unlike the situation with stream gages, precipitation coverage for the state of Texas is almost complete, courtesy of the NEXRAD radar network. Apart from small gaps in parts of North, East and West Texas (see Figure 4), the 160 S-Band radars deployed across the United States offer high resolution data (spatial: 1km, temporal: approximately 5 minute) that are highly suitable for real-time flood forecasting. The NWS-AHPS relies heavily on these data for their flood prediction services, however the radar data are verified and adjusted using on-the-ground rain gage measurements. Rain gages provide redundancy in case the radar data stream is interrupted, and are used in conjunction with weather radar measurements by the NWS to issue flood warnings and watches.



There are 336 real-time rain gage sites operated by the USGS in Texas. Other organizations also operate rain gages, such as the NWS, LCRA, City of Austin, and more recently, the TWDB TexMesonet, among others. In addition to considering the list of priority basins and locations of proposed new stream gages, we will identify obvious gaps in the current real-time rain gage network and consult with NWS-AHPS staff on where they feel additional rain gages would improve their ability to provide accurate flood forecasting across the state, but especially for communities prioritized in Task B. We will consider gaps in coverage by rain gages and NEXRAD radar, with preference given to watershed areas not served by existing real-time telemetered rain gages.

Figure 4. NEXRAD radar coverage in Texas.

While the analytical framework will be refined with inputs from the relevant agencies including USGS, NWS, and TWDB, the initial approach is outlined as follows. Locations of new stream gages and weather stations will be optimized to provide adequate lead times for flood warnings. Focusing on the priority communities and their associated watersheds will help keep overall costs low, and thus increase the number of communities that can be supported. Analysis and prioritization of new stream gages and weather stations will follow a hierarchical process:

1. Delineate watersheds above prioritized communities, with 50 – 1,000 sq. mi., consistent with NWS forecast modeling at 1 to 6 hour updates.
2. Identify likely candidates for stream gage sites in these watersheds, upstream of communities, starting with bridges or low water crossings.
3. Simulate by transposition of historic storms using the Memorial Day event or a synthetic temporal distribution based on the 100-yr rainfall event.
4. Create a short list of locations for stream gages by modeling where the lead time is more or less one hour, and application of other criteria, as identified in consultation with TWDB, USGS and NWS.
5. Develop list of recommended locations for stream gages and weather stations in each prioritized community/watershed.

Task D. Alterations to Existing Data Collection Infrastructure

To maximize the effectiveness of the monitoring network upgrade with the funds available, identifying existing weather stations and stream gages in the watersheds of priority communities that do not currently report in real time offers the potential for network enhancement with less of a financial burden. Interestingly, the USGS operates 556 real-time stream gages in Texas, and there are only 20 that do not report in real-time, those being on small culverts in West Texas that rarely flow.

The opportunity for real-time upgrade of stream gages seems therefore somewhat limited. However, the USGS also operates over 300 real-time rain gages (most of them at streamflow monitoring sites) that are not regularly maintained or thoroughly QA/QC'd [pers. comm. Robert Joseph, Texas District Chief, USGS]. The data produced by this network, while used by the NWS, is treated with caution [pers. comm. Mark Null, NWS] due to its lack of QA/QC, and are not archived by the USGS. According to the USGS, upgrades to the USGS rain gages would cost about $2,000 per site. Upgrading rain gages is an attractive alternative to establishing and maintaining a new site, if they are in appropriate locations, providing benefits to flood forecasting operations by the NWS.

There is also the opportunity to co-locate rain gages at new stream gage sites, therefore reducing the overall cost of installation and operation the monitoring stations. However, for any particular basin, the ideal location for each type of monitoring device may be different, so that should not be a constraint on selection of sites.

Summary of Technical Approach

We have outlined an analytical framework that has sufficient flexibility to identify suitable locations for stream gages in areas that are in need of improved forecasting services. By estimating lead time gained from extreme flood-producing storms of record, the dynamic modeling approach will improve what can be accomplished with static maps. A consistent framework based on a physics-based distributed model will be applied across the entire state, helping to site and test proposed stream gage locations in advance. Through this process, we will gain confidence in its ability to help warn downstream residences and businesses in communities subjected to flood threats. Coordination with the NWS forecasters, who will utilize real-time stream gage data for warning purposes, will help ensure that the new locations will be efficiently integrated and used beneficially to warn communities that are not currently served with adequate flood warning services. Consultation with USGS will take into account the suitability of stream gaging locations, for which they will likely be tasked in establishing rating curves, and performing operation and maintenance.

For weather monitoring stations, we will identify gaps in the existing network, consider upgrading USGS and other existing rain gages, and seek locations near the geometric center of upstream watershed areas affecting the communities prioritized.

The experience, knowledge and background of the team will help ensure that TWDB expectations are met or exceeded. We are confident that our qualifications and the proposed approach will lead to efficient development of enhanced stream gaging and flood warning services in the State of Texas.

Barney Austin

AquaStrategies
Water Planning, Science & Engineering

OVERVIEW

Barney Austin has 23 years of experience in hydrology, hydraulics and water resources planning. He obtained his BS in Agricultural Engineering in Canada in 1989 and his PhD in Civil Engineering (Water Resources) in England in 1995. His PhD dissertation was on Probable Maximum Floods and Probable Maximum Precipitation from which he published a book on the subject in 1995 and which is still used for dam safety analyses in the UK. Dr. Austin is a professional engineer, serving as hydrologist and project engineer before becoming director of the Surface Water Resources Division of the TWDB in 2004. Prior to accepting the Division Director role, he served as the Surface Water Section Chief, which included the Water Availability Modeling and Coastal Hydrology programs, amongst others. He also participated in fieldwork across the state, through the hydrographic survey, instream flows and bays and estuaries programs. While at the TWDB, Dr. Austin also advised the USGS on prioritization of streamgage locations through the Advisory Committee on Water Information (ACWI). Dr. Austin is now President and CEO of Aqua Strategies Inc - a company that specializes in hydrology, hydraulics and water resources planning.

EDUCATION

University of Salford, PhD in Civil Engineering (1995)
McGill University, BSc in Agricultural Engineering (1990)

PROFESSIONAL HISTORY

2014 – Present. President and CEO of Aqua Strategies Inc. Austin, TX.
2009 – 2014. Director, Hydrology and Water Resources Planning, INTERA, Inc. Austin, TX.
1999 – 2009. Director, Surface Water Resources Division. Texas Water Development Board.
1997 – 1999. Team Leader, Metering and Special Projects. Générale des Eaux. London, UK.
1994 – 1997. Hydrologist, Water Resources Division. Institute of Hydrology. Wallingford, UK.

PROFESSIONAL REGISTRATIONS AND AFFILIATIONS

Professional Engineer, Texas, No. 100370
Fellow of the Royal Meteorological Society
Fellow of the University of Texas Center for Public Policy Dispute Resolution

REPRESENTATIVE PUBLICATIONS

M. R. Duncan, B. Austin, F. Fabry, and G. L. Austin, "The effect of gauge sampling density on the accuracy of streamflow prediction for rural catchments," J of H, vol. 142, no. 1-4, pp. 445–476, 1993.

AUSTIN, B.N., CLUCKIE, I.D., COLLIER, C.G., HARDAKER, P.J. 1995. Radar-based estimation of Probable Maximum Precipitation and flood. Met.Office, Bracknell, UK. ISBN 0 86180 3132. 123pp.

YANG, Y., AUSTIN, B.N., PI, Z., and Lu, Q. 2009 Assessing the Effects of Water Management Strategies on Streamflow using Water Availability Models. Water International, V. 34, No. 3, pp. 335-344.

AquaStrategies
Water Planning, Science & Engineering

Tim Osting

OVERVIEW

Tim Osting, PE, D.WRE, has 18 years of experience in drainage, site development, watershed, river, lake and coastal studies, environmental flows, modeling, water quality and water resources planning. Mr. Osting participated in the review of the FEMA Texas Hurricane Surge models, completed wave runup and coastal flooding analyses, inland river water surface profile modeling and inundation mapping for over 50 local drainage, site development and subdivision projects. Mr. Osting has completed basin-wide unsteady/dynamic water surface profile models, calibrated roughness values for riparian and urban floodplains, evaluated flood wave travel times and used those models for mapping of inundated areas using available raster topographic datasets (generally, LiDAR-generated terrains) and (San Antonio, Trinity, Brazos and Guadalupe Rivers). Mr. Osting has completed modeling assessments of flood model predictions, comparing 1-D HEC-RAS models to 2D models like RMA2 and River2D for 0.1 percent chance events (Walnut Creek, Austin, TX). Mr. Osting has developed an automated flow and water quality forecast model using NOAA River Forecast Center (RFC) flow predictions (Brazos River TDS and Chloride Forecast). Mr. Osting has conducted flow measurements, installed water level meters and conducted elevation surveying to develop flow rating curves in natural channels where stream gauges do not exist (Sulphur, Trinity, Brazos, Guadalupe, San Antonio, Cibolo Rivers, and other streams).

EDUCATION

University of Texas at Austin, MSE in Environmental and Water Resources Engineering (2007)
University of Texas at Austin, BSE in Civil Engineering (1998)

PROFESSIONAL HISTORY

2014 – Present. Principal Engineer, Aqua Strategies Inc. Austin, TX.
2005 – 2014. Managing Engineer, Water Resources, Espey Consultants, Inc., dba RPS, Austin, TX.
2001 – 2005. Instream Flow Team Lead, Texas Water Development Board, Austin, TX.
1998 – 2001. Designer, Steger & Bizzell Engineering, Inc., Georgetown, TX.
1996 – 1998. Technician, Texas Water Development Board, Austin, TX.

PROFESSIONAL REGISTRATIONS AND AFFILIATIONS

Professional Engineer, Texas, No. 91931
Diplomate Water Resources Engineer (D.WRE) 564, American Academy of Water Resources Engineers
American Society of Civil Engineering

Frank Schalla

AquaStrategies
Water Planning, Science & Engineering

OVERVIEW

Frank Schalla has over 6 years of experience in water supply planning, hydrology and hydraulics. He has experience working with the US Geological Survey (USGS) Water Science Center in Fort Worth, analyzing base flow and streamflow gain and loss, and conducting water related studies. He has experience installing and maintaining USGS real-time water quality and streamgage stations and management of these data. His experience with the USGS also involved raingage and evaporation station maintenance. Additionally, he has experience in flood forecasting techniques and emergency response techniques through his graduate studies at The University of Texas at Austin, which focused on identifying socially vulnerable populations in flood prone areas. Frank has lead water supply projects and planning including water system optimization, operation and maintenance manual creation, and developing and implementing water monitoring tools for rural household rainwater catchment systems.

EDUCATION

University of Texas at Austin, MSE in Environmental and Water Resources Engineering (2016)
University of Texas at Arlington, BS in Civil Engineering (2010)

PROFESSIONAL HISTORY

2016 – Present. Hydrologist / Graduate Engineer, Aqua Strategies Inc., Austin, TX.
2015 – 2016. Graduate Research Assistant, Center for Research in Water Resources, Austin, TX.
2014. Water Resources Professional, School Yoga Institute, Guatemala.
2011 – 2013. Water Program Developer & Water Program Advisor, Global Brigades, Fresno, CA.
2010 – 2011. Hydrologic Technician, US Geological Survey, Fort Worth, TX.

PROFESSIONAL REGISTRATIONS

Engineer in Training, Texas, No. 44805

REPRESENTATIVE PUBLICATIONS

Baldys, Stanley, III, and Schalla, F.E., Base flow (1966–2009) and streamflow gain and loss (2010) of the Brazos River from the New Mexico – Texas State line to Waco. Texas: U.S. Geological Survey.

Schalla, F.E., Ashraf, M.. "Analysis of Flush Structural Supports and Design Equations for TxDOT Curb Inlets." Center for Transportation Research Symposium. The University of Texas at Austin. Austin, TX. 13 Apr. 2016. Poster Presentation.

Baxter Vieux

OVERVIEW

Baxter E. Vieux's professional focus is in flood forecasting with specialties in radar rainfall and distributed hydrologic modeling. He is experienced in the application of high-resolution rainfall monitoring to hydrologic forecasting, and hydraulic modeling. He oversees technology development for rainfall and runoff monitoring software and services. Dr. Vieux developed the first commercially available distributed hydrologic model, V*flo*™, US Patent No. 7,136,756-Method for determining runoff. He is co-author of the textbook, *Hydrology and Floodplain Analysis* in its 5th edition. Professional experience includes ten years in Kansas and Michigan with the USDA NRCS (formerly Soil Conservation Service) where he served as PL-566 Small Watershed Dam Project Engineer, Assistant State Engineer, and in his highest position as Acting State Engineer for NRCS in Michigan.

EDUCATION

Ph.D. Agricultural Engineering, Michigan State University (1988)
MSCE, Kansas State University (1982)
BSCE, Water Resources Engineering, University of Kansas (1978)

PROFESSIONAL HISTORY

Principal/Chief Technology Officer, Vieux & Associates, Inc., 1992-Present
Adjunct Professor, Rice University, Houston TX, 2008-present
Associate Scientist-III, University Corporation for Atmospheric Research (UCAR), 2016-present
Professor Emeritus, University of Oklahoma, 2013-present
University of Oklahoma Full Professor, 2000-2013; Assoc. Prof., 1995-2000; Assist. Prof., 1990-1995
USDA Soil Conservation Service (now NRCS), various positions in Kansas and Michigan, 1977-1988

PROFESSIONAL REGISTRATIONS AND AFFILIATIONS

Professional Engineering Registration: Texas PE, and OK, KS, CO
American Meteorological Society, Member, 1997
American Geophysical Union, Member, 1994
American Society of Civil Engineers, Member, 1978

RELEVANT PROJECT EXPERIENCE

Flood Protection Plan City of San Marcos TX – Hydrometeorological processing for flood event analysis.
Ameren Reservoir Inflow System Lake of the Ozarks – As senior engineer provided project conceptualization and oversight in the development and deployment of a real-time system forecasting of reservoir operations and notifications and alerts, and project management.
Trinity River Authority, CAC-11 Flood Forecasting System. As senior engineer, responsible for development and configuration of forecasting flooding during construction, Trinity River, Texas.
Dam Safety and PMP/PMF Training - Oklahoma Water Resources Board, 2014. Developed and conducted Dam Safety Hydrology/ PMP/PMF training with USACE HEC software.

REPRESENTATIVE PUBLICATIONS

Stormwater Forecasting: When Predictive Hydrographs Are Golden, 2015. BE Vieux, JE Vieux, T Rodriguez, City of Austin, TX S Janek, City of Austin, TX. In Conf. Proc. (P33) Storm Con, Austin TX, Aug 2-6, 2015.
Distributed Hydrologic Forecast Reliability Using Next-Generation Radar. Looper, J.P., and Vieux, B.E., 2013. J. Hydrol. Eng., 18(2), pp. 260-268.
An Assessment of Distributed Flash Flood Forecasting Accuracy using Radar and Rain Gauge Input for a Physics-based Distributed Hydrologic Model. Looper, J.P., and Vieux, B.E., 2012. J. of Hydrology, 412, pp. 114-132.

Jean Vieux

OVERVIEW

Ms. Vieux is a co-founder, President and CEO of Vieux & Associates, Inc. She is responsible for project management, client communications and coordination/management of the firm's interdisciplinary team. She is project manager for all real-time NEXRAD radar rainfall systems, real-time hydrologic information systems, and retrospective rainfall analysis projects. She is involved in the hydrologic, weather and environmental communities through participation in professional societies and service on steering committees and board of directors. Ms. Vieux excels in growing and sustaining a firm of 10 employees. She actively manages human resources, purchasing and business development, as well as project management since the company's inception.

EDUCATION

MS Environmental Science (1995) - University of Oklahoma, School of Civil Engineering and Environmental Science, Norman, Oklahoma.
BSN Nursing (1978) – University of Kansas, Lawrence Kansas.

PROFESSIONAL HISTORY

President and Co-Founder of Vieux, Inc., 1992-present

PROFESSIONAL REGISTRATIONS AND AFFILIATIONS

- Member of CRAFT (2000-2002) steering committee that supported the real-time delivery and centralized archiving of NWS Level II NEXRAD data.
- Member of the Environmental Information Systems Working Group (EISWG), serving NOAA and the National Weather Service (2014-present)
- Board Member of the National Hydrologic Warning Council 2013-2015
- American Society of Civil Engineers Affiliate, 2005-present
- American Meteorological Society, 2005-present

RELEVANT PROJECT EXPERIENCE

City of Austin, Texas, Flood Early Warning System (FEWS) – Radar Rainfall and Hydrologic Services. Ms. Vieux initiated this project and is project manager for hydrologic services in support of the City of Austin, Flood Early Warning System.

Texas Medical Center/Rice University Flood Alert System for Brays Bayou – Project management in support of continuous flood forecasting services based on radar, rain gauge and stream gauge information.

Harris County Flood Control District – Project manager, flood forecasting for operational flood forecasting of HCFCD watersheds relied on our operational system for gauge adjusted radar rainfall.

Ft. Worth Flood Warning System Study – Project manager, analysis of radar rainfall for model input used to simulate key flood events.

Trinity River Authority, CAC-11 Flood Forecasting System – Project manager, coordination project with the Trinity River Authority and the RPS Group engaged in construction management. The award-winning project received distinction from the National Hydrologic Warning Council in 2013. System components included reservoir releases and riverine flood stage response with inputs from gauge-adjusted radar rainfall and probabilistic rainfall inputs.

REPRESENTATIVE PUBLICATIONS

Vieux, B.E. and J.E. Vieux, 2005b. Statistical evaluation of a radar rainfall system for sewer system management. *J. of Atmospheric Research*, 77, pp. 322– 336.

Vieux, B.E., and J.E. Vieux, 2010. Real-time Stormwater Modeling. AWRA, Philadelphia, November 1-4, 2010.

Rev. 09/15

HUB Subcontracting Plan (HSP)

QUICK CHECKLIST

While this HSP Quick Checklist is being provided to merely assist you in readily identifying the sections of the HSP form that you will need to complete, it is very important that you adhere to the instructions in the HSP form and instructions provided by the contracting agency.

➤ **If you will be awarding all of the subcontracting work you have to offer under the contract to only Texas certified HUB vendors, complete:**

- ☐ Section 1 - Respondent and Requisition Information
- ☐ Section 2 a. - Yes, I will be subcontracting portions of the contract.
- ☐ Section 2 b. - List all the portions of work you will subcontract, and indicate the percentage of the contract you expect to award to Texas certified HUB vendors.
- ☐ Section 2 c. - Yes
- ☐ Section 4 - Affirmation
- ☐ GFE Method A (Attachment A) - Complete an Attachment A for each of the subcontracting opportunities you listed in Section 2 b.

➤ **If you will be subcontracting any portion of the contract to Texas certified HUB vendors and Non-HUB vendors, and the aggregate percentage of all the subcontracting work you will be awarding to the Texas certified HUB vendors with which you do not have a *continuous contract** in place for more than five (5) years *meets or exceeds* the HUB Goal the contracting agency identified in the "Agency Special Instructions/Additional Requirements", complete:**

- ☐ Section 1 - Respondent and Requisition Information
- ☐ Section 2 a. - Yes, I will be subcontracting portions of the contract.
- ☐ Section 2 b. - List all the portions of work you will subcontract, and indicate the percentage of the contract you expect to award to Texas certified HUB vendors and Non-HUB vendors.
- ☐ Section 2 c. - No
- ☐ Section 2 d. - Yes
- ☐ Section 4 - Affirmation
- ☐ GFE Method A (Attachment A) - Complete an Attachment A for each of the subcontracting opportunities you listed in Section 2 b.

➤ **If you will be subcontracting any portion of the contract to Texas certified HUB vendors and Non-HUB vendors or only to Non-HUB vendors, and the aggregate percentage of all the subcontracting work you will be awarding to the Texas certified HUB vendors with which you do not have a *continuous contract** in place for more than five (5) years *does not meet or exceed* the HUB Goal the contracting agency identified in the "Agency Special Instructions/Additional Requirements", complete:**

- ☐ Section 1 - Respondent and Requisition Information
- ☐ Section 2 a. - Yes, I will be subcontracting portions of the contract.
- ☐ Section 2 b. - List all the portions of work you will subcontract, and indicate the percentage of the contract you expect to award to Texas certified HUB vendors and Non-HUB vendors.
- ☐ Section 2 c. - No
- ☐ Section 2 d. - No
- ☐ Section 4 - Affirmation
- ☐ GFE Method B (Attachment B) - Complete an Attachment B for each of the subcontracting opportunities you listed in Section 2 b.

➤ **If you will not be subcontracting any portion of the contract and will be fulfilling the entire contract with your own resources (i.e., employees, supplies, materials and/or equipment, including transportation and delivery), complete:**

- ☒ Section 1 - Respondent and Requisition Information
- ☒ Section 2 a. - No, I will not be subcontracting any portion of the contract, and I will be fulfilling the entire contract with my own resources.
- ☒ Section 3 - Self Performing Justification
- ☒ Section 4 - Affirmation

***Continuous Contract**: Any existing written agreement (including any renewals that are exercised) between a prime contractor and a HUB vendor, where the HUB vendor provides the prime contractor with goods or service, to include transportation and delivery under the same contract for a specified period of time. The frequency the HUB vendor is utilized or paid during the term of the contract is not relevant to whether the contract is considered continuous. Two or more contracts that run concurrently or overlap one another for different periods of time are considered by CPA to be individual contracts rather than renewals or extensions to the original contract. In such situations the prime contractor and HUB vendor are entering (have entered) into "new" contracts.*

Rev. 09/15

HUB Subcontracting Plan (HSP)

In accordance with Texas Gov't Code §2161.252, the contracting agency has determined that subcontracting opportunities are probable under this contract. Therefore, all respondents, including State of Texas certified Historically Underutilized Businesses (HUBs) must complete and submit this State of Texas HUB Subcontracting Plan (HSP) with their response to the bid requisition (solicitation).

NOTE: Responses that do not include a completed HSP shall be rejected pursuant to Texas Gov't Code §2161.252(b).

The HUB Program promotes equal business opportunities for economically disadvantaged persons to contract with the State of Texas in accordance with the goals specified in the 2009 State of Texas Disparity Study. The statewide HUB goals defined in 34 Texas Administrative Code (TAC) §20.13 are:

- ***11.2 percent for heavy construction other than building contracts,***
- ***21.1 percent for all building construction, including general contractors and operative builders' contracts,***
- ***32.9 percent for all special trade construction contracts,***
- ***23.7 percent for professional services contracts,***
- ***26.0 percent for all other services contracts, and***
- ***21.1 percent for commodities contracts.***

- - Agency Special Instructions/Additional Requirements - -

*In accordance with 34 TAC §20.14(d)(1)(D)(iii), a respondent (prime contractor) may demonstrate good faith effort to utilize Texas certified HUBs for its subcontracting opportunities if the total value of the respondent's subcontracts with Texas certified HUBs meets or exceeds the statewide HUB goal or the agency specific HUB goal, whichever is higher. When a respondent uses this method to demonstrate good faith effort, the respondent must identify the HUBs with which it will subcontract. If using existing contracts with Texas certified HUBs to satisfy this requirement, only the aggregate percentage of the contracts expected to be subcontracted to HUBs with which the respondent **does not** have a **continuous contract*** in place for **more than five (5) years** shall qualify for meeting the HUB goal. This limitation is designed to encourage vendor rotation as recommended by the 2009 Texas Disparity Study.*

SECTION-1 RESPONDENT AND REQUISITION INFORMATION

a. Respondent (Company) Name: Aqua Strategies Inc. - Vieux & Associates, Inc. Joint Venture — State of Texas VID #: 32053104892

Point of Contact: Barney Austin — Phone #: (512) 826-2604

E-mail Address: baustin@aquastrategies.com — Fax #: n/a

b. Is your company a State of Texas certified HUB? ☐ - Yes ☑ - No

c. Requisition #: 580-16-RFQ0023 — Bid Open Date: 05/31/2016 (mm/dd/yyyy)

Enter your company's name here: Aqua Strategies Inc. - Vieux & Associates, Inc. Joint Venture Requisition #: 580-16-RFQ0023

SECTION-2: RESPONDENT's SUBCONTRACTING INTENTIONS

After dividing the contract work into reasonable lots or portions to the extent consistent with prudent industry practices, and taking into consideration the scope of work to be performed under the proposed contract, including all potential subcontracting opportunities, the respondent must determine what portions of work, **including contracted staffing, goods, services, transportation and delivery will be subcontracted**. Note: In accordance with 34 TAC §20.11, a "Subcontractor" means a person who contracts with a prime contractor to work, to supply commodities, or to contribute toward completing work for a governmental entity.

a. Check the appropriate box (Yes or No) that identifies your subcontracting intentions:

☐ - ***Yes***, I will be subcontracting portions of the contract. (If ***Yes***, complete Item b of this SECTION and continue to Item c of this SECTION.)

☑ - ***No***, I will not be subcontracting any portion of the contract, and I will be fulfilling the entire contract with my own resources, including employees, goods, services, transportation and delivery. (If ***No***, continue to SECTION 3 and SECTION 4.)

b. List all the portions of work (subcontracting opportunities) you will subcontract. Also, based on the total value of the contract, identify the percentages of the contract you expect to award to Texas certified HUBs, and the percentage of the contract you expect to award to vendors that are not a Texas certified HUB (i.e., Non-HUB).

Item #	Subcontracting Opportunity Description	HUBs		Non-HUBs
		Percentage of the contract expected to be subcontracted to HUBs with which you do not have a continuous contract* in place for more than five (5) years.	Percentage of the contract expected to be subcontracted to HUBs with which you have a continuous contract* in place for more than five (5) years.	Percentage of the contract expected to be subcontracted to non-HUBs.
1		%	%	%
2		%	%	%
3		%	%	%
4		%	%	%
5		%	%	%
6		%	%	%
7		%	%	%
8		%	%	%
9		%	%	%
10		%	%	%
11		%	%	%
12		%	%	%
13		%	%	%
14		%	%	%
15		%	%	%
	Aggregate percentages of the contract expected to be subcontracted:	**%**	**%**	**%**

(Note: If you have more than fifteen subcontracting opportunities, a continuation sheet is available online at http://window.state.tx.us/procurement/prog/hub/hub-subcontracting-plan/).

c. Check the appropriate box (Yes or No) that indicates whether you will be using **only** Texas certified HUBs to perform **all** of the subcontracting opportunities you listed in SECTION 2, Item b.

☐ - ***Yes*** (If ***Yes***, continue to SECTION 4 and complete an "HSP Good Faith Effort - Method A (Attachment A)" for **each** of the subcontracting opportunities you listed.)

☐ - ***No*** (If ***No***, continue to Item d, of this SECTION.)

d. Check the appropriate box (Yes or No) that indicates whether the aggregate expected percentage of the contract you will subcontract **with Texas certified HUBs** with which you **do not** have a **continuous contract*** in place with for **more than five (5) years**, **meets or exceeds** the HUB goal the contracting agency identified on page 1 in the "**Agency Special Instructions/Additional Requirements**."

☐ - ***Yes*** (If ***Yes***, continue to SECTION 4 and complete an "HSP Good Faith Effort - Method A (Attachment A)" for **each** of the subcontracting opportunities you listed.)

☐ - ***No*** (If ***No***, continue to SECTION 4 and complete an "HSP Good Faith Effort - Method B (Attachment B)" for **each** of the subcontracting opportunities you listed.)

***Continuous Contract**: Any existing written agreement (including any renewals that are exercised) between a prime contractor and a HUB vendor, where the HUB vendor provides the prime contractor with goods or service, to include transportation and delivery under the same contract for a specified period of time. The frequency the HUB vendor is utilized or paid during the term of the contract is not relevant to whether the contract is considered continuous. Two or more contracts that run concurrently or overlap one another for different periods of time are considered by CPA to be individual contracts rather than renewals or extensions to the original contract. In such situations the prime contractor and HUB vendor are entering (have entered) into "new" contracts.*

Enter your company's name here: Aqua Strategies Inc. - Vieux & Associates, Inc. Joint Venture Requisition #: 580-16-RFQ0023

SECTION-2 RESPONDENT's SUBCONTRACTING INTENTIONS (CONTINUATION SHEET)

This page can be used as a continuation sheet to the HSP Form's page 2, Section 2, Item b. Continue listing the portions of work (subcontracting opportunities) you will subcontract. Also, based on the total value of the contract, identify the percentages of the contract you expect to award to Texas certified HUBs, and the percentage of the contract you expect to award to vendors that are not a Texas certified HUB (i.e., Non-HUB).

Item #	Subcontracting Opportunity Description	HUBs		Non-HUBs
		Percentage of the contract expected to be subcontracted to HUBs with which you do not have a continuous contract* in place for more than five (5) years.	Percentage of the contract expected to be subcontracted to HUBs with which you have a continuous contract* in place for more than five (5) years.	Percentage of the contract expected to be subcontracted to non-HUBs.
16		%	%	%
17		%	%	%
18		%	%	%
19		%	%	%
20		%	%	%
21		%	%	%
22		%	%	%
23		%	%	%
24		%	%	%
25		%	%	%
26		%	%	%
27		%	%	%
28		%	%	%
29		%	%	%
30		%	%	%
31		%	%	%
32		%	%	%
33		%	%	%
34		%	%	%
35		%	%	%
36		%	%	%
37		%	%	%
38		%	%	%
39		%	%	%
40		%	%	%
41		%	%	%
42		%	%	%
43		%	%	%
	Aggregate percentages of the contract expected to be subcontracted:	**%**	**%**	**%**

**Continuous Contract: Any existing written agreement (including any renewals that are exercised) between a prime contractor and a HUB vendor, where the HUB vendor provides the prime contractor with goods or service, to include transportation and delivery under the same contract for a specified period of time. The frequency the HUB vendor is utilized or paid during the term of the contract is not relevant to whether the contract is considered continuous. Two or more contracts that run concurrently or overlap one another for different periods of time are considered by CPA to be individual contracts rather than renewals or extensions to the original contract. In such situations the prime contractor and HUB vendor are entering (have entered) into "new" contracts.*

Enter your company's name here: Aqua Strategies Inc. - Vieux & Associates, Inc. Joint Venture Requisition #: 580-16-RFQ0023

SECTION-3 SELF PERFORMING JUSTIFICATION (If you responded "No" to SECTION 2, Item a, you must complete this SECTION and continue to SECTION 4.)

If you responded "No" to SECTION 2, Item a, in the space provided below **explain how** your company will perform the entire contract with its own employees, supplies, materials and/or equipment, to include transportation and delivery.

The scope of work presented in this RFQ is technical in nature, requiring professional services and little or no materials or equipment, other than the computers we own. Our company has the technical expertise to perform this work without assistance from subcontractors.

SECTION-4: AFFIRMATION

As evidenced by my signature below, I affirm that I am an authorized representative of the respondent listed in SECTION 1, and that the information and supporting documentation submitted with the HSP is true and correct. Respondent understands and agrees that, if awarded any portion of the requisition:

- The respondent will provide notice as soon as practical to all the subcontractors (HUBs and Non-HUBs) of their selection as a subcontractor for the awarded contract. The notice must specify at a minimum the contracting agency's name and its point of contact for the contract, the contract award number, the subcontracting opportunity they (the subcontractor) will perform, the approximate dollar value of the subcontracting opportunity and the expected percentage of the total contract that the subcontracting opportunity represents. A copy of the notice required by this section must also be provided to the contracting agency's point of contact for the contract no later than ten (10) working days after the contract is awarded.
- The respondent must submit monthly compliance reports (Prime Contractor Progress Assessment Report – PAR) to the contracting agency, verifying its compliance with the HSP, including the use of and expenditures made to its subcontractors (HUBs and Non-HUBs). (The PAR is available at http://www.window.state.tx.us/procurement/prog/hub/hub-forms/progressassessmentrpt.xls).
- The respondent must seek approval from the contracting agency prior to making any modifications to its HSP, including the hiring of additional or different subcontractors and the termination of a subcontractor the respondent identified in its HSP. If the HSP is modified without the contracting agency's prior approval, respondent may be subject to any and all enforcement remedies available under the contract or otherwise available by law, up to and including debarment from all state contracting.
- The respondent must, upon request, allow the contracting agency to perform on-site reviews of the company's headquarters and/or work-site where services are being performed and must provide documentation regarding staffing and other resources.

Signature	Printed Name	Title	Date (mm/dd/yyyy)
	Barney Austin	President	05/27/2016

Reminder:

- If you responded "**Yes**" to **SECTION 2, Items c or d**, you must complete an "HSP Good Faith Effort - Method A (Attachment A)" for **each** of the subcontracting opportunities you listed in SECTION 2, Item b.
- If you responded "**No**" **SECTION 2, Items c and d,** you must complete an "HSP Good Faith Effort - Method B (Attachment B)" for **each** of the subcontracting opportunities you listed in SECTION 2, Item b.

Texas Water Development Board

P.O. Box 13231, 1700 N. Congress Ave.
Austin, TX 78711-3231, www.twdb.texas.gov
Phone (512) 463-7847, Fax (512) 475-2053

ADDENDUM to RFQ NO. 580-16-RFQ0023

THE STUDY OF STREAM GAGE AND WEATHER STATION PLACEMENT TO IMPROVE HYDRO-METEOROLOGICAL FLOOD FORECASTING IN TEXAS IN ORDER TO PROTECT COMMUNITIES AT RISK FROM FLOODS

RFP NO:	580-16-RFQ0023	**ADDENDUM NO. :**	1
Deadline for Submission for RFQ:	2:00 PM, Friday, May 31, 2016		
Contact: Angela Wallace	Phone: 512-463-7979 Email: angela.wallace@twdb.texas.gov		

PURPOSE OF ADDENDUM

CLARIFICATION ONLY:

Content Item 3: Resumes of Individuals – Resumes do NOT count towards the response limit of 14 pages.

End of Addendum No. 1

IN THE SUBMISSION OF RFQ, RESPONDENT SHOULD ACKNOWLEDGE RECEIPT OF THIS ADDENDUM; OTHERWISE THE SUBMISSION MAY NOT BE GIVEN CONSIDERATION. RESPONDENT MAY ACKNOWLEDGE RECEIPT BY RETURNING A SIGNED COPY WITH THEIR SUBMISSION.

BARNEY AUSTIN
RESPONDENT NAME

AUTHORIZED SIGNATURE

Our Mission

To provide leadership, information, education, and support for planning, financial assistance, and outreach for the conservation and responsible development of water for Texas

Board Members

Bech Bruun, Chairman | Kathleen Jackson, Board Member | Peter Lake, Board Member

Texas Water Development Board

P.O. Box 13231, 1700 N. Congress Ave.
Austin, TX 78711-3231, www.twdb.texas.gov
Phone (512) 463-7847, Fax (512) 475-2053

ADDENDUM to RFQ NO. 580-16-RFQ0023

THE STUDY OF STREAM GAGE AND WEATHER STATION PLACEMENT TO IMPROVE HYDRO-METEOROLOGICAL FLOOD FORECASTING IN TEXAS IN ORDER TO PROTECT COMMUNITIES AT RISK FROM FLOODS

RFP NO:	580-16-RFQ0023	**ADDENDUM NO. :**	2
Deadline for Submission for RFQ:	2:00 PM, Friday, May 31, 2016		
Contact: Angela Wallace	Phone: 512-463-7979 Email: angela.wallace@twdb.texas.gov		

PURPOSE OF ADDENDUM

CLARIFICATION ONLY:

RFQ Deadline for Submission is 2:00 PM, TUESDAY, May 31, 2016.

End of Addendum No. 2

IN THE SUBMISSION OF RFQ, RESPONDENT SHOULD ACKNOWLEDGE RECEIPT OF THIS ADDENDUM; OTHERWISE THE SUBMISSION MAY NOT BE GIVEN CONSIDERATION. RESPONDENT MAY ACKNOWLEDGE RECEIPT BY RETURNING A SIGNED COPY WITH THEIR SUBMISSION.

BARNEY AUSTIN
RESPONDENT NAME

AUTHORIZED SIGNATURE

Our Mission

To provide leadership, information, education, and support for planning, financial assistance, and outreach for the conservation and responsible development of water for Texas

Board Members

Bech Bruun, Chairman | Kathleen Jackson, Board Member | Peter Lake, Board Member

AquaStrategies

Exhibit B
Scope of Work

Overview

An analytical framework for identifying communities with the most pressing need for additional stream gages and weather stations for improved flood forecasting services is described herein. The communities identified will be those that are not currently served or inadequately served by existing forecasting services. The approach laid out below, in Tasks A through C, will allow the Texas Water Development Board (TWDB) to choose and justify recommendations for additional monitoring, with quantitative information provided on improved lead time each monitoring station would provide for the identified communities.

Locations of new stream gages and weather stations will be optimized to provide adequate lead times for flood warnings. Focusing on the priority communities and their associated watersheds will help keep overall costs low, and thus increase the number of communities that can be supported. Analysis and prioritization of new stream gages and weather stations will follow a hierarchical process:

1. Delineate watersheds above prioritized communities, with 50 – 1,000 square miles, consistent with National Weather Service forecast modeling at 1 to 6 hour updates.
2. Identify likely candidates for stream gage sites in these watersheds, upstream of communities, starting with bridges or low water crossings.
3. Simulate lead time gained by transposition of historic storms using the Memorial Day event or a synthetic temporal distribution based on the 100-yr rainfall event.
4. Create a short list of locations for stream gages by modeling where the lead time is more or less one hour, and application of other criteria, as identified in consultation with TWDB, United States Geological Survey and National Weather Service.
5. Develop list of recommended locations for stream gages and weather stations in each prioritized community/watershed.

Specifics of each task are described below. Although not explicitly stated, we anticipate considerable coordination with TWDB staff throughout the project.

Task 1. Identifying and prioritizing communities with inadequate flood warning

We will identify, obtain and map all sources of data that will help identify communities at risk from flooding, including census tracts, Federal Emergency Management Administration maps and information generated by the National Weather Service, United States Geological Survey, TWDB and others. In the process of identifying and obtaining these data, we will meet in person with employees of these organizations to describe the project and ensure that we have identified all relevant data and that they understand the importance of the activity. Using this information, we will identify all communities across that state that are at risk of flooding,

excluding those that already have advanced flood warning systems in place and those not near streams, or near streams where the magnitude of flooding is deemed too small to cause risk of loss of life. All data will be pulled into a Geographic Information System database, containing the watershed delineations described in the introduction.

To prioritize the communities identified in Task 1 for new monitoring stations, we will consider factors such as propensity for flash floods, historical number of fatalities due to flooding, severe and repetitive economic losses due to flooding, and population temporarily or permanently residing within designated Federal Emergency Management Agency flood hazard areas. Special attention will be given to communities or incorporated areas in Texas that experience repetitive losses based on the Federal Emergency Management Administration's National Flood Mitigation Data Collection Tool (FEMA 497 data). The Extreme Events database from the National Oceanic and Atmospheric Administration's National Climatic Data Center will also be consulted.

Flood hazard areas will be overlaid with census tracks to identify populations at most risk. Because floods occur throughout Texas, special care will be taken to give each area its due consideration within a consistent framework. This will be accomplished by considering a range of information not limited to flood hazard areas already mapped, to be discussed with National Weather Service and TWDB staff.

Task 2. Identify where additional monitoring would improve flood forecasting

The approach for identifying locations for additional stream gages is different from that used to identify new locations for weather stations. As such we have divided this task into two parts.

Stream gages

The analytical framework for prioritizing communities will utilize a rainfall-runoff model built on existing geospatial datasets. The model will help identify areas with short lag times between when heavy precipitation events occur and when flood crests inundate the communities being investigated. The model will cover the entire state at a 1-km resolution, and use National Hydrographic Database (NHDplus) flowlines to represent all segments of the stream network. To understand the lead time and improved forecast resulting from addition of an upstream stream gage, the use of a standard design storm or transposition of historic rainfall, such as the Wimberley, Texas storm event on May 23-24, 2015, will be applied across all the watersheds prioritized in Task 1, individually. This analysis will help the team understand the potential benefits in terms of lead time associated with a proposed stream gage location.

Appropriate locations for stream gages (typically bridges and other areas with easy access to the river) in each prioritized watershed will be identified and flows at these points will be simulated using the rainfall-runoff model. The simulated flows at each proposed monitoring

site will then be compared to the flows simulated at the vulnerable community. The relative magnitude of the peak flows, the volume of water produced by the event, and the lead time provided by each possible stream gage location will be considered in determining the optimum location for the stream gage in each watershed.

We will coordinate with the National Weather Service's West Gulf River Forecast Center forecasters to develop and prioritize possible locations of additional stream gages that would be beneficial. We anticipate focusing our attention on urban areas and locations that pose significant potential for flood hazards, but we also want to make sure that the locations chosen have the potential to improve the National Weather Service's Advanced Hydrologic Prediction Service, providing advanced flood warning to those vulnerable communities. This effort will build on the work done by the United States Geological Survey, National Weather Service, TWDB and others on prioritizing additional monitoring for improved flood forecasting.

At the conclusion of this task we will meet with United States Geological Survey staff to confirm the feasibility of installing streamgages at the proposed locations.

Rain Gages

For weather monitoring stations, we will identify gaps in the existing network, consider upgrading United States Geological Survey and other existing rain gages, and seek locations near the geometric center of the watersheds of the communities prioritized. There are 336 real-time rain gage sites operated by the United States Geological Survey in Texas. Other organizations also operate rain gages, such as the National Weather Service, Lower Colorado River Authority, City of Austin, and more recently, the TWDB TexMesonet, among others. In addition to considering the list of priority basins and locations of proposed new stream gages, we will identify obvious gaps in the current real-time rain gage network and consult with National Weather Service-Advanced Hydrologic Prediction Service staff on where they feel additional rain gages would improve their ability to provide accurate flood forecasting across the state, but especially for communities prioritized in Task 1. We will consider gaps in coverage by rain gages and Next Generation Weather Radar, with preference given to watershed areas not served by existing real-time telemetered rain gages.

To maximize the effectiveness of the monitoring network upgrade with the funds available, identifying existing weather stations and stream gages in the watersheds of priority communities that do not currently report in real time offers the potential for network enhancement with less of a financial burden. The opportunity for real-time upgrade of stream gages may be somewhat limited, however the United States Geological Survey also operates over 300 real-time rain gages (most of them at streamflow monitoring sites) that are not regularly maintained or their data evaluated thoroughly with Quality Assurance/Quality Control procedures. The data produced by this network, while used by the National Weather Service, is treated with caution due to its lack of Quality Assurance/Quality Control, and are not archived by the United States Geological Survey. According to the United States

Geological Survey, upgrades to the United States Geological Survey rain gages would cost about $2,000 per site. Upgrading rain gages is an attractive alternative to establishing and maintaining a new site, if they are in appropriate locations, providing benefits to flood forecasting operations by the National Weather Service.

There is also the opportunity to co-locate rain gages at new stream gage sites, therefore reducing the overall cost of installing and operating the monitoring stations. However, for any particular basin, the ideal location for each type of monitoring device may be different, so that should not be a constraint on selection of sites.

Task 3: Reporting and deliverable

At the conclusion of this study we will develop and deliver a report describing the methodology utilized and a list of priority sites for new stream and rain gages.

EXHIBIT C
TASK AND EXPENSE BUDGETS

TASK BUDGET

TASK	DESCRIPTION	TWDB AMOUNT
TASK 1	Identifying and prioritizing communities	$46,292.00
TASK 2	Identifying additional monitoring sites	74,250.00
TASK 3	Reporting	29,458.00
Total		**$150,000.00**

EXPENSE BUDGET

CATEGORY	TWDB AMOUNT
Salaries and Wages[1]	$124,276.00
Fringe[2]	22,622.00
Travel[3]	3,102.00
Other Expenses[4]	0.00
Subcontract Expenses	0.00
Overhead[5]	0.00
Profit	**0.00**
TOTAL	**$150,000.00**

[1] Salaries and Wages is defined as the cost of salaries of engineers, draftsmen, stenographers, surveymen, clerks, laborers, etc., for time directly chargeable to this CONTRACT.
[2] Fringe is defined as the cost of social security contributions, unemployment, excise, and payroll taxes, workers' compensation insurance, retirement benefits, medical and insurance benefits, sick leave, vacation, and holiday pay applicable thereto.
[3] Travel is limited to the maximum amounts authorized for state employees by the General Appropriations Act, Tex. Leg. Regular Session, 2015, Article IX, Part 5, as amended or superseded
[4] Other Expenses is defined to include expendable supplies, communications, reproduction, postage, and costs of public meetings directly chargeable to this CONTRACT.
[5] Overhead is defined as the costs incurred in maintaining a place of business and performing professional services similar to those specified in this CONTRACT.

EXHIBIT D

GUIDELINES FOR AUTHORS SUBMITTING CONTRACT REPORTS TO THE TEXAS WATER DEVELOPMENT BOARD

1.0 Introduction

The purpose of this document is to describe the required format of contract reports submitted to the Texas Water Development Board (TWDB). Our reason for standardizing the format of contract reports is to provide our customers a consistent, and therefore familiar, format for contract reports (which we post online for public access). Another reason for standardizing the format is so that we can more easily turn a contract report into a TWDB numbered report if we so choose. Remember that your report will not only be seen by TWDB staff, but also by any person interested in the results of your study. A professional and high quality report will reflect well on you, your employer, and the TWDB.

Available upon request, we will provide a Microsoft Word template (used to write these instructions) that gives the fonts, spacing, and other specifications for the headings and text of the report. Please follow this template as closely as possible.

2.0 Formatting your report

The TWDB format is designed for simplicity. For example, we use Times New Roman for all text. We use 12 point, single-spaced text, left justification for paragraph text, 18 point bold for first-level headings, and 14 point bold for second-level headings. Page numbers are centered at the bottom of the page. Other than page numbers, please refrain from adding content to the document header or footer. Page setup should use one-inch margins on all four sides.

2.1 Text

The best way to format your document is to use the styles described and embedded in the template document (Authors_Template.dot) that is available on request from the TWDB. To use the Authors_Template.dot file, open it in Word (make sure *.dot is listed under Files of type) and save it as a .doc file. Advanced users can add the .dot file to their computers as a template. Make sure the formatting bar is on the desktop (to open, go to View→Toolbars→Formatting) or, to view all of the formatting at once, go to Format→Styles and Formatting and select Available Styles from the dropdown box at the bottom of the window. The formatting in the template document provides styles (such as font type, spacing, and indents) for each piece of your report. Each style is named to describe what it should be used for (for example, style names include Chapter Title, Body Text, Heading 1, References, and Figure or Table Caption). As you add to your report, use the dropdown list on the Formatting Toolbar or the list in the Styles and Formatting window to adjust the text to the correct style. The Authors_Template.dot file shows and lists the specifications for each style.

2.1.1 Title

Give your report a title that gives the reader an idea of the topic of your report but is not terribly long. In addition to the general subject (for example, “Droughts”), you may include a few additional words to describe a place, methodology, or other detail focused on throughout the paper (for example, “Droughts in the High Plains of Texas” or “Evaluating the effects of drought using groundwater flow modeling”). Please capitalize only the first letter of each word except ‘minor’ words such as ‘and’ and ‘of’. Never use all caps.

Use headings to help the reader follow you through the main sections of your report and to make it easier for readers to skim through your report to find sections that might be the most interesting or useful to them. The text of the report should include an executive summary and sections outlined in 4.4 of Attachment 1. Headings for up to five levels of subdivision are provided in the template; however, we suggest not using more than three or four levels of subdivision except where absolutely necessary. Please avoid stacked headings (for example, a Heading 1 followed immediately by a Heading 2), and capitalize only the first letter of headings or words where appropriate—never use all caps.

2.2 Figures and photographs

To publish professional-looking graphics, **we need all originals to be saved at 300 dots-per-inch** (dpi) and in grayscale, if possible, or in the CMYK color format if color is necessary. Excessive use of color, especially color graphics that do not also work in grayscale, will prevent us from publishing your report as a TWDB numbered report (color reproduction costs can be prohibitive). Preferred file formats for your original graphics are Adobe Illustrator (.ai), Photoshop (.psd), EPS with .tiff preview, .jpg, .png, or .tiff files. Refrain from using low resolution .jpg or .gif files. Internet images at 72 dpi are unacceptable for use in reports.

All graphics shall be submitted in two forms:

1. Inserted into the Microsoft Word document before you submit your report. Ideally, inserted graphics should be centered on the page. Format the picture to downsize to 6 inches wide if necessary. Please do not upsize a graphic in Word.
2. Saved in one of the formats listed above.

2.2.1 Other graphics specifications

It is easiest to design your figures separately and add them in after the text of your report is more or less complete. Graphics should remain within the 1-inch page margins of the template (6.5 inches maximum graphic width). Be sure that the graphics (as well as tables) are numbered in the same order that they are mentioned in the text. Figures should appear embedded in the report after being called out in the text. Also, remember to include a caption for each graphic in Word, not as part of the graphic. We are not able to edit or format figure captions that are part of the figure. For figures and photographs, the caption should appear below the graphic. For tables, the caption should appear above.

2.2.2 Creating publication-quality graphics

When designing a graphic, make sure that the graphic (1) emphasizes the important information and does not show unnecessary data, lines, or labels; (2) includes the needed support material for the reader to understand what you are showing; and (3) is readable (see Figures 1 and 2 for examples). Edward R. Tufte's books on presenting information (Tufte, 1983; 1990; 1997) are great references on good graphic design. Figures 1 through 3 are examples of properly formatted, easy to understand graphics. Do not include fonts that are less than 6 points.

For good-looking graphics, the resolution needs to be high enough to provide a clear image at the size you make them within the report. In general, 300 dpi will make a clear image—200 dpi is a minimum. Try to create your figures at the same size they will be in the report, as resizing them in Word greatly reduces image quality. Photographs taken with at least a two-megapixel camera (if using digital) and with good contrast will make the best images. Save the original, and then adjust color levels and size in a renamed image copy. Print a draft copy of your report to double-check that your figures and photographs have clear lines and show all the features that you want them to have.

Figures and photographs should be in grayscale. Color greatly adds to the cost of printing, so we are trying to keep it to a minimum. Also remember that your report may be photocopied, scanned, or downloaded and printed in black and white. For this reason, you should use symbols or patterns, or make sure that colors print as different shades in black and white. All interval or ratio data (data measuring continuous phenomena, with each color representing an equal interval) need to be displayed in a graded scale of a single color (Figure 3). This way your figures will be useful even as a photocopy.

If you need help with your graphics or have questions, please contact the TWDB graphics department at (512) 936-0129.

2.2.3 Using other people's graphics

Figures and photographs (and tables) need to be your own unless you have written permission from the publisher that allows us to reprint them (we will need a copy of this permission for our records). Avoid using any figures or photographs taken off the Internet or from newspapers or magazines—these sources are difficult to cite, and it is often time-consuming and expensive to gain permission to reproduce them.

2.3 Tables

Tables should be created in Microsoft Word (see Table 1). Tables should include a minimal amount of outlining or bold font to emphasize headings, totals, or other important points. Tables should be numbered separately from figures, and captions should appear above the text of the table.

Table 1: A sample table. Note caption above table.

Table text heading*

Table text	1940	1950	1960	1970	1980	1990	2000	%GW
Table text	15	441	340	926	196	522	83	97.4
Table text	64	944	626	173	356	171	516	99.9
Total	79	1385	966	1099	552	693	599	

* A footnote should look like this using 10 point Times New Roman.
%GW = percent groundwater
Be sure to describe any abbreviations or symbols, and, unlike in this table, be sure to note the units!

3.0 Units

Measurements should be in English units. Metric units may be included in parentheses after the English units.

All units of geologic time should conform to the most recent geologic timescale (Gradstein and others, 2004). A summary of this timescale is available from the International Commission on Stratigraphy's website at http://stratigraphy.org/chus.pdf.

4.0 Citations and references

It is important to give credit where credit is due. Therefore, be sure to use the appropriate citations and include references in your paper.

4.1 In-text citations

Each piece of information you use in your report that comes from an outside source must be cited within the text using the author's last name and the year of publication. If there are two authors, list the last

name of each followed by the year, and if there are more than two authors, list the last name of the first author followed by "and others" and the year. For example: the end of the Jurassic Period occurred approximately 145.5 million years ago (Gradstein and others, 2004).

4.2 References

All sources that are cited within the report should be listed at the end of the paper under the heading References. The references should follow the guidelines in "Suggestions to Authors of the Reports of the United States Geological Survey" (Hansen, 1991). These are available online at http://www.nwrc.usgs.gov/lib/lib_sta.html (a link to the chapter "Preparing references for Survey reports," p. 234-241, is found here). Several examples of complete reference citations are listed at the end of these guidelines. Be sure that any citations that appear in tables or figures are included in the reference list. Also, before submitting the report, please check that all the citations in the report are included in the reference list and all references in the reference list are cited in the report. If at all possible, avoid web-based citations. These materials are often transient and therefore useless to future readers.

5.0 Submitting your report

Before you submit your report, proofread it. Look for spelling and grammatical errors. Also, check to see that you have structured the headings, paragraphs, and sentences in your paper so that it is easy to follow and understand (imagine you are a reader who does not already know the information you are presenting!).

6.0 Conclusions

Following the instructions above and providing accurate and readable text, tables, figures, and citations will help to make your report useful to readers. Scientists may read your report, as well as water planners, utility providers, and interested citizens. If your report successfully conveys accurate scientific information and explanations to these readers, we can help to create more informed decisions about the use, development, and management of water in the state.

7.0 Acknowledgments

Be sure to acknowledge the people and entities that assisted you in your study and report. For example: We would like to thank the Keck Geology Consortium, the American Society of Civil Engineers, and the Texas Bar CLE for providing examples to use in developing these guidelines. In addition, we appreciate Mike Parcher for providing information on how to create publication-quality graphics, Shirley Wade for creating the data used in sample Figure 1, and Ian Jones for providing sample Figure 3.

8.0 References

Gradstein, F.M., J.G. Ogg, and A.G. Smith, eds., 2005, A geologic time scale 2004: Cambridge, Cambridge University Press, 610 p.

Hansen, W.R., ed., 1991, Suggestions to authors of the reports of the United States Geological Survey (7th ed.): Washington, D.C., U.S. Government Printing Office, 289 p.

Tufte, E. R., 1983, The visual display of quantitative information: Cheshire, C.T., Graphics Press, 197 p.

Tufte, E. R., 1990, Envisioning information: Cheshire, C.T., Graphics Press, 126 p.

Tufte, E. R., 1997, Visual explanations: Cheshire, C.T., Graphics Press, 156 p.

9.0 Examples of references

Arroyo, J. A., and Mullican, III, W. F., 2004, Desalination: *in* Mace, R. E., Angle, E. S., and Mullican, W. F., III, editors, Aquifers of the Edwards Plateau: Texas Water Development Board Report 360, p. 293-302.

Bates, R. L., and Jackson, J. A., 1984, Dictionary of geological terms: Anchor Press/Doubleday, Garden City, New York, 571 p.

Blandford, T. N., Blazer, D. J., Calhoun, K. C., Dutton, A. R., Naing, T., Reedy, R. C., and Scanlon, B. R., 2003, Groundwater availability of the southern Ogallala aquifer in Texas and New Mexico–Numerical simulations through 2050: contract report by Daniel B. Stephens and Associates, Inc., and the Bureau of Economic Geology, The University of Texas at Austin to the Texas Water Development Board, variably paginated.

Fenneman, N. M., 1931, Physiography of Western United States (1st edition): New York, McGraw-Hill, 534 p.

Hubert, M., 1999, Senate Bill 1–The first big bold step toward meeting Texas's future water needs: Texas Tech Law Review, v. 30, no. 1, p. 53-70.

Kunianski, E. L., 1989, Precipitation, streamflow, and baseflow in West-Central Texas, December 1974 through March 1977: U. S. Geological Survey Water-Resources Investigations Report 89-4208, 2 sheets.

Mace, R. E., Chowdhury, A. H., Anaya, R., and Way, S.-C., 2000, A numerical groundwater flow model of the Upper and Middle Trinity aquifer, Hill Country area: Texas Water Development Board Open File Report 00-02, 62 p.

Maclay, R. W., and Land, L. F., 1988, Simulation of flow in the Edwards aquifer, San Antonio Region, Texas, and refinements of storage and flow concepts: U. S. Geological Survey Water-Supply Paper 2336, 48 p.

For more examples of references, see p. 239-241 of "Suggestions to Authors of the Reports of the United States Geological Survey" at http://www.nwrc.usgs.gov/lib/lib_sta.html.

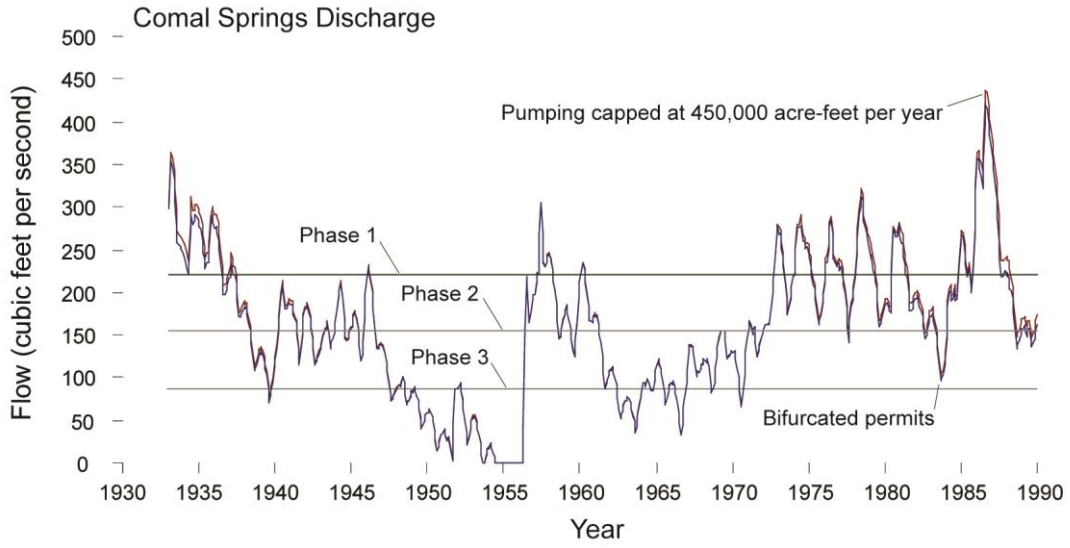


Figure 1. A sample figure showing only the information needed to help the reader understand the data. Font size for figure callouts or labels should never be less than 6 point.

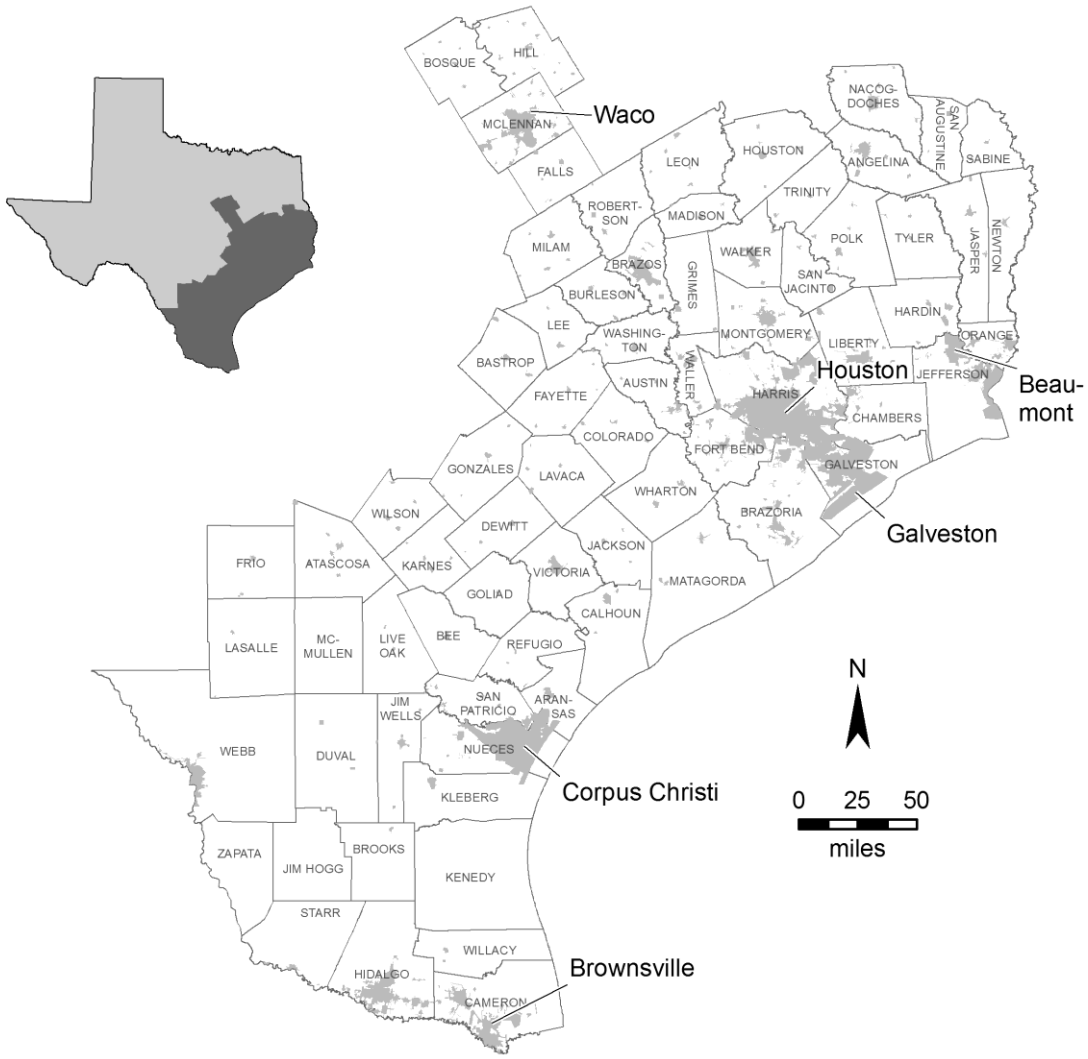


Figure 2. A sample subject area map, giving the reader enough information to understand the location being discussed in this conference. For map figures, be sure to include a north arrow to orient the reader, a scale, and, if needed, a submap that places the figure in greater geographic context. Be sure that text is readable and that any citations listed on the figure or in the figure caption are included in the reference list. Font size should never be less than 6 pt.

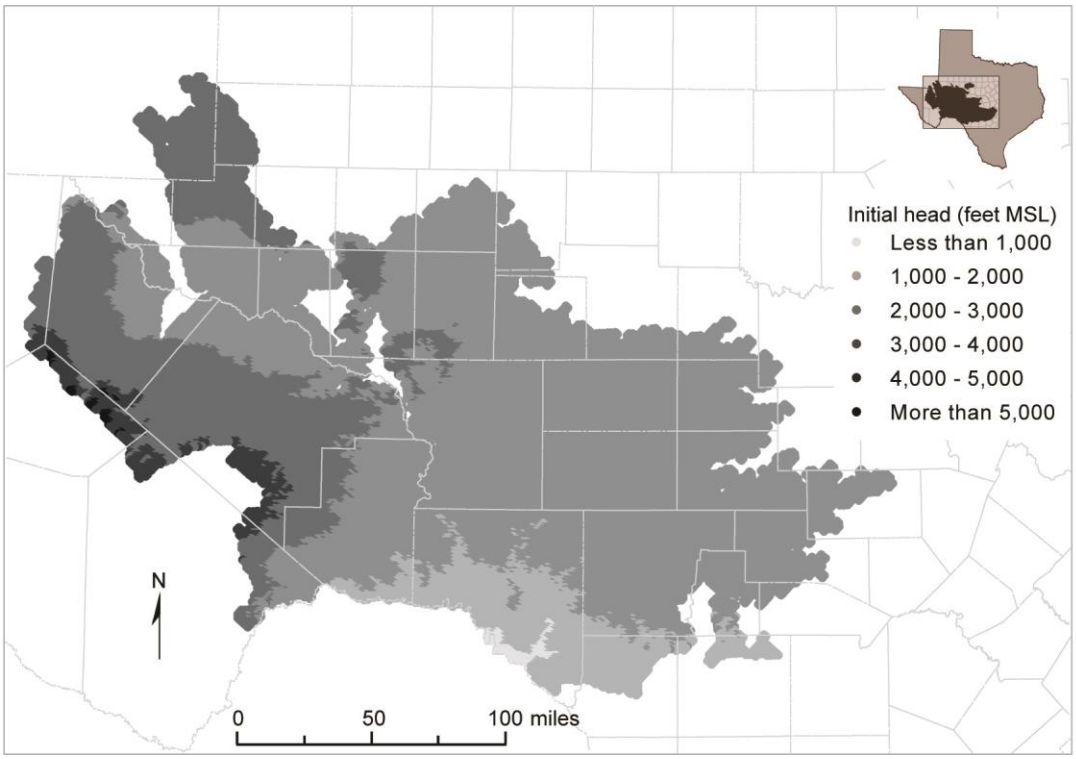


Figure 3. Initial hydraulic heads used in model simulations for layer 1. Note the use of grayscale shading to show differences.

EXHIBIT E
TWDB Guidelines for a Progress Report

Texas Water Development Board Contractors are required by their contracts to provide Progress Reports usually with the submission of an invoice/payment request.

The progress report should contain the following standard elements:

- Date: Date the memo is sent
- To: Name and position of the reader
- From: Name and position of the writer

Subject: TWDB Contract Number and a clear phrase that focuses the reader's attention on the subject of the memo

Work Completed: *(The next section of a progress report explains what work has been done during the reporting period. Specify the dates of the reporting period and use active voice verbs to give the impression that you or you and your team have been busy) For Example:*

Task 1: Completed 3 draft chapters and all appendices. Met with sub consultants on their chapters.
Task 2: Completed sample collection throughout river reach.
Task 3: No work completed in reporting period.

Problems:
If the reader is likely to be interested in the glitches you have encountered along the way, mention the problems you have encountered and explain how you have solved them. If there are problems you have not yet been able to solve, explain your strategy for solving them and give tell the reader when you think you will have them solved.

EXHIBIT F

HUB SUBCONRACTING PLAN PROGRESS ASSESSMENT REPORT

Use current form located at:
http:*I*/www.window.state.tx.us/procurement/pro
g/hub/hub-forms/